

# ComNav®

## TS-202 FFU Lever Remote Part Number 20310020 & 20310029



### Operation & Installation Instructions Version 2.1



## Introduction

The TS-202 Full Follow Up (FFU) Lever Remote is designed to work with the ComNav Marine 1001, 1101, 1201, 2001, and 5001 Autopilot Systems. The TS-202 allows the vessel operator to control the tiller steering and autopilot course functions from a workstation, flying bridge or any other remote location on the vessel.

### Features included in the TS-202:

- Standard cable length of 12 meters (40 feet) – PN20310020
- Optional cable length of 18.3 meters (60 feet) – PN20310029
- Watertight case complete with sealed openings.
- High impact material with excellent resistance to most chemicals.
- Vertical or horizontal surface mount, option.
- Flush or straight mount cable wiring routed through or on surface panels, decks and bulkheads.
- “Positive feedback” (detent) in center position tiller handle.
- User adjustable helm bias.

## Installation

The following pages describe how to install the TS-202 FFU Lever Remote on your vessel.

For information regarding the installation of the complete Autopilot System, consult your Autopilot Operation and Installation Manual.

# Mounting the TS-202 FFU Lever Remote

### Tools required:

- Drill and drill bit selection
- Screw driver
- Small wrench (depending on hardware used).

### Fasteners:

- Customer Supplied - Stainless Steel screws, washers and nuts (used to secure the FFU).

### Mounting Considerations:

Note: See Figure 1 for Detail Dimensions of FFU

### Before mounting the TS-202 FFU, take the following into consideration:

- Is the FFU to be mounted vertically or horizontally?
- Will the cabling go through a bulkhead or deck, or will it be routed along the surface? See figures 2 and 3, next page.
- Is there adequate mounting space to ensure all that all 4 mounting holes are used?
- Is there sufficient clearance for cable routing through bulkhead (if applicable)?
- Is there sufficient clearance for the cable plug?
- Will the switches and buttons be easily accessible?
- Will the lever be free to swing from one end to the other without obstruction?

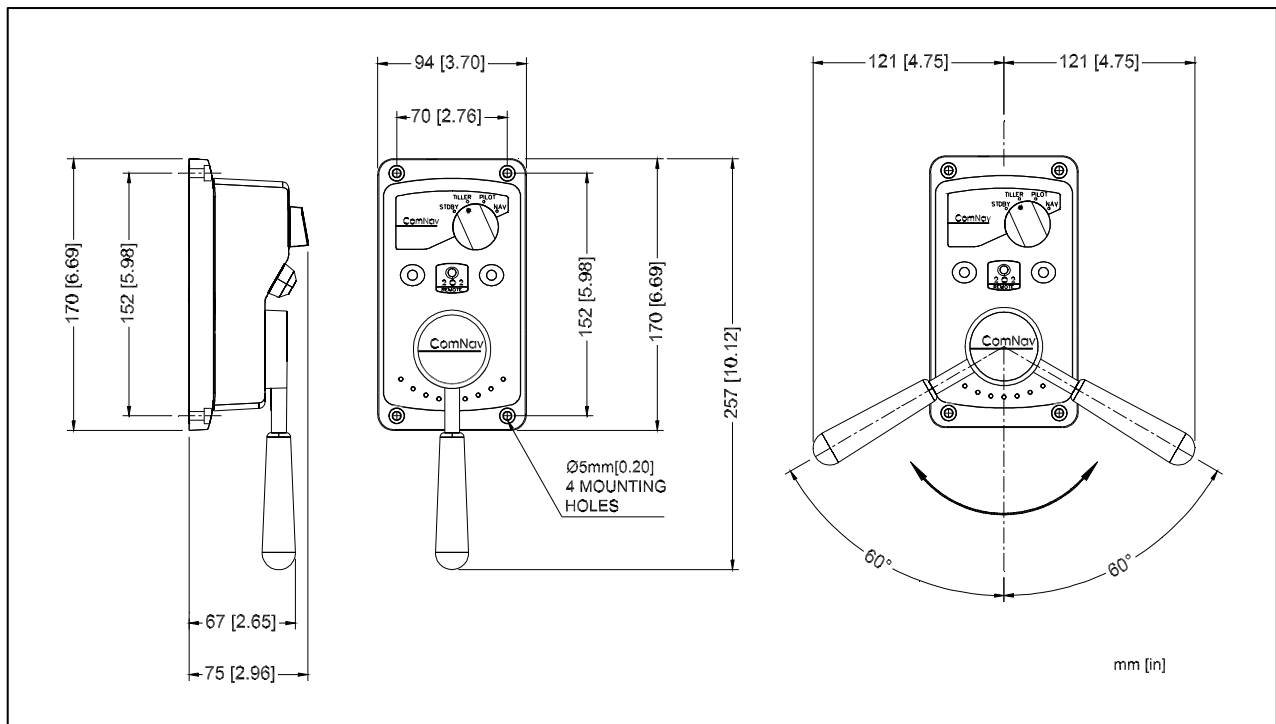


Figure 1 – Detail Dimensions for TS-202 FFU Lever Remote

## OPTION 1 – Cable Through Bulkhead or Deck

1. Place the FFU in the desired location. Mark the center position of the four mounting holes and approximate location for the cable through panel (see Figure 1 for Detail Dimensions).
2. Drill the four mounting holes (using a drill bit appropriate to the mounting hardware you are using). The TS-202 FFU Remote will accept mounting hardware up to 5mm (just over 3/16") in diameter. Be sure to check that you will not be drilling through wires or plumbing that may be hidden in bulkhead walls or underneath decks.
3. Drill through surface panel or bulkheads using an 18mm (11/16") drill bit to allow sufficient clearance for the cable plug.
4. Route the cable through the panel.
5. Using customer supplied fasteners, fasten the FFU to the bulkhead or deck.

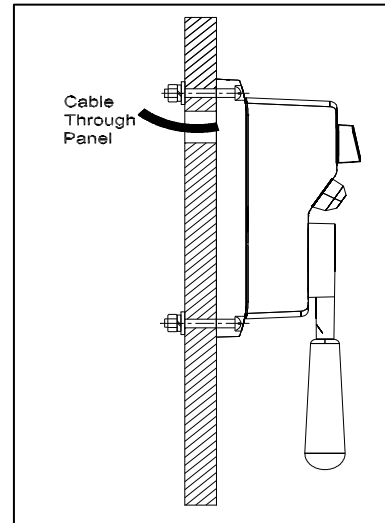


Figure 2 - Cable Through Bulkhead or Deck

## OPTION 2 – Cable On Surface of Bulkhead or Deck

1. Place the FFU in the desired location. Mark the center position of the four mounting holes. (See Figure 1 for Detail Dimensions).
2. Drill the four mounting holes (using a drill bit appropriate to the mounting hardware you are using). The TS-202 FFU Remote will accept mounting hardware up to 5mm (just over 3/16") in diameter. Be sure to check that you will not be drilling through wires or plumbing that may be hidden in bulkhead walls or underneath decks.
3. Route the cable along the channel located in the bottom of the unit.
4. Using customer supplied screws, fasten the FFU to the bulkhead or deck.

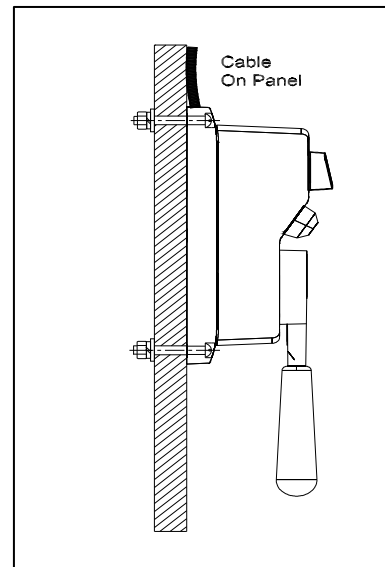


Figure 3 - Cable on Surface of Bulkhead or Deck

## Electrical Connections for 1001 Autopilot

1. Route the TS-202 FFU cable to the rear of the 1001 Autopilot Head and plug it into the receptacle labeled "REMOTE".

## Electrical Connections for 1101, and 1201 Autopilot

1. Route the TS-202 FFU cable to the rear of the Signal Processing Unit (SPU) and plug it into the receptacle labeled "AUXILIARY STATION".

## Electrical Connections for 2001 Autopilot

### Tools required:

- Large Philips screwdriver
- Small wrench depending on hardware used.

There are two receptacles on the rear of the 2001 where the TS-202 FFU may be plugged in. These are labeled "REMOTE 1" and "REMOTE 2". The TS-202 FFU can be plugged into either one, but some configuration of the 2001 Autopilot and the TS-202 is necessary to ensure proper operation. To properly configure the 2001 Autopilot, the Autopilot Head must be opened up. The configuration procedure is given below:

1. Disconnect all cables from the Autopilot Head and remove the Head from its mounting bracket(s).
2. Remove the rear chassis cover by removing the two large screws at the rear of the unit.
3. Locate the control circuit board that has a series of DIP Switches. These switches typically have one side marked "ON" or "CLOSED".
4. If the TS-202 is going to be plugged into "REMOTE 1", then DIP Switch 5 must be in the "ON" or "CLOSED" position. If the TS-202 is going to be plugged into "REMOTE 2", DIP Switch 6 must be in the "ON" or "CLOSED" position.
5. After setting the appropriate DIP Switch, re-assemble the unit taking care to seat all gaskets correctly and to properly tighten all fasteners.
6. Fix the Autopilot Head back into its mounting position and tighten the mounting bracket(s).
7. Re-connect all cables onto the rear of the Autopilot Head.
8. Connect the TS-202 FFU cable onto the appropriate "REMOTE" connector as per the DIP Switch setting performed in step 4.
9. See also **Setup For 2001 Autopilot** to properly configure the TS-202 FFU.

# Electrical Connections for 5001 Autopilot

## Recommended Method:

### Tools Required:

- Small slot screwdriver
- Medium Philips screwdriver

### Other:

- “Remote to 5001 Interface Cable” (ComNav PN 83783)
1. Remove the cover from the 5001 SPU and connect the “Remote to 5001 Interface Cable” to the 12-position Remote Connector on the Compass Interface Card as per the instructions supplied with the Interface Cable.
  2. Plug the TS-202 cable into the Interface cable until an audible “snap” is heard.
  3. Replace the cover on the 5001 SPU.

## Alternative Method:

Use this method if you do not have a “Remote to 5001 Interface Cable” (PN 83783). You may wish to obtain the services of a competent technician or an authorized ComNav dealer to make these modifications for you.

### Tools required:

- Wire cutters
- Wire strippers
- Small sharp utility knife
- Medium size Philips screwdriver
- Small size screwdriver
- Small adjustable wrench
- Soldering iron and solder (recommended)

### Other:

- Electrical quality insulating tape or heat-shrink tubing

The 5000 Series SPU used in 5001 Autopilot Systems utilizes a wiring terminal block on the Compass Interface Card for connection to various Remotes. Therefore, it is necessary to remove the small circular connector on the end of the TS-202 FFU and connect the cable wires directly to the Autopilot terminal block. Follow these steps to accomplish this:

1. With a pair of wire cutters, cut the connector off of the end of the TS-202 FFU cable.
2. Note that the cable is shielded (there is fine wire braiding wrapped around the wire conductor bundle). This braiding can be seen just inside the plastic outer jacket of the cable. Just inside the braiding is a group of bare (non-insulated) wire strands lightly twisted together that make up a “drain wire.” It is imperative that this drain wire not be damaged in subsequent steps.

3. Trim the plastic outer jacket back from the end of the cable to a distance of about 5 cm (2").
4. Gently unbraid the exposed shielding, and separate the drain wire from it. Trim off the braiding, being sure to leave the drain wire intact.
5. Insulate the drain wire, leaving only about 5 mm (1/4") at the end exposed by wrapping it with tape or covering it with heat-shrink tubing.
6. Trim the insulation off of all of the other conductors to a length of 5 mm (1/4"). Note that each conductor is made up of several fine strands of wire. Lightly twist these together after trimming the insulation to prevent them from splaying out.
7. If possible, "tin" the ends of the conductors, including the drain wire, with solder to permanently prevent them from splaying out.
8. Remove the cover from the 5001 SPU.
9. Feed the end of the TS-202 FFU cable through a spare gland on the right-hand side of the 5000 Series SPU.
10. Wire each conductor of the cable into the 12-position Remote connector (J2 on the Compass Interface Card) as per the following table:

J2 connector number	ComNav Function	Wire Colour
1	Power Positive	Brown
2	Rotary Switch 0	Violet
3	Rotary Switch 1	Grey
4	Starboard	Green
5	Port	Red
6	Dodge	Yellow
7	U-Turn	Black
8	Tiller	Blue
9	Serial Data	White
10	Serial Clock	Pink
11	Power Negative	Shield Drain wire
12	Chassis Shield **	

\*\* Chassis Shield is AC coupled to chassis.

Table 1 - TS-202 FFU Wiring for 5000 Series SPU

11. Check the wiring to be sure there is no possibility of shorts between the wire conductors, and that all connections are secure.
12. Tighten the cable gland on the end of the SPU.
13. Replace the cover on the SPU.

# Operation

## Set Up

The TS-202 FFU contains a small micro-processor chip which controls the output of the unit. Once your TS-202 is installed and wired according to the Installation instructions, you will need to “Set Up” or configure this micro-processor so that you can obtain the best performance from your TS-202 FFU. Once the initial setup is performed, you will not have to redo it unless the TS-202 requires repair or re-installation.

***Do not perform either the Initial Setup or the General Setup while the vessel is underway.***

During the Set Up procedure, the TS-202 will be moving the vessel's rudder. This rudder movement may result in unexpected changes to the vessels heading causing injury to personnel or damage to the vessel.

***Setup should only be performed when the vessel is not underway.***

## Initial Set Up (For 2001 Autopilot Only)

### Tools required:

- None

### Other:

- 2001 Autopilot Operation & Installation Manual

Since there are two “REMOTE” receptacles provided on the 2001 Autopilot, the TS-202 needs to know which one of those receptacles it is connected to. If you are not using the TS-202 with a 2001 Autopilot, proceed to **General Setup, for all Autopilots**, below. Perform the following steps to configure the TS-202 for proper operation with 2001 Autopilot:

1. Turn on the Autopilot and leave it in **STANDBY** Mode.
2. The blue LED lamp on the TS-202 FFU should not be on.
3. Center the tiller handle on the TS-202. Turn the selector knob on the TS-202 to the “TILLER” position.
4. Press and hold the PORT and STARBOARD buttons, then move the selector knob to the “STANDBY” position. The LED lamp should start flashing at a rate of about once per second.
5. If the TS-202 is connected to the “REMOTE 1” receptacle on the 2001 Autopilot Head, press the STARBOARD button once. The flashing LED lamp will stop flashing.
6. If the TS-202 is connected to the “REMOTE 2” receptacle on the 2001 Autopilot Head, press the PORT button once. The flashing LED lamp will stop flashing.
7. Proceed with the **General Setup, (Applies to All Autopilot Models)**, as detailed below.

### **Warning:**

*Without proper Initial Setup, TS-202 FFU on REMOTE 2 will be in control after System Transfer. However, the blue LED lamp on the FFU will not turn on since the Default of FFU is REMOTE 1.*



## General Setup (Applies to All Autopilot Models)

### Tools required:

- None

### Other:

- Applicable Autopilot Operation & Installation Manual

If you are using the TS-202 FFU with a 2001 Autopilot, be sure that you have performed the **Initial Setup (For 2001 Autopilot Only)** before proceeding.

- 1) Turn the Autopilot on, and leave it in **STANDBY** Mode.
- 2) Place the TS-202 into **STANDBY** Mode.
- 3) Ensure that the lever is at the center (detent) position.
- 4) Press and hold the PORT and STARBOARD buttons, LED comes on and while holding the push buttons move the Mode selector to "TILLER". The TS-202 should respond by rapidly blinking the LED lamp 4 times. Then it will continue to flash the LED lamp at a much slower pace of about once per second. This indicates that the unit has successfully been placed into SETUP Mode.
- 5) Pressing the PORT or STBD button will cause the Autopilot to move the rudder as if you were in **POWER STEER** Mode. Use these buttons to move the rudder to the "dead-ahead" (which is not necessarily mid-ships) position.
- 6) Switch the Mode selector to "STANDBY". The LED lamp should blink rapidly 4 times in response. Then it will revert to blinking about once per second.
- 7) Swing the FFU lever to hard-over Starboard.
- 8) Turn the selector knob back to the "TILLER" position.
- 9) Use the PORT and STARBOARD buttons to move the rudder to the position that represents the maximum starboard angle that the FFU will command the rudder to go to. Note that this does not have to be as far as the vessel's physical rudder limits.
- 10) Switch the selector knob to "STANDBY". The LED will blink rapidly 4 times in response, and then revert to blinking about once per second.
- 11) Swing the FFU lever to hard-over Port.
- 12) Turn the selector knob back to the "TILLER" position.
- 13) Use the PORT and STARBOARD buttons to move the rudder to the position that represents the maximum port angle that the FFU will command the rudder to go to. Note that this does not have to be as far as the vessel's physical rudder limits, nor does it have to be symmetrical with the starboard angle set in steps 6 through 9.
- 14) Once the rudder is at the desired position, switch the selector knob to "STANDBY". The LED will blink rapidly 6 times in response, the new parameters will be stored in non-volatile memory, and the unit will automatically switch to normal operating Mode. The LED will be on continuously to indicate this.

**If an error has occurred during the SETUP script:**

The LED will begin to blink in a distinctive pattern: one long, one short, one long. This pattern will repeat itself until you take control away from the FFU by pressing the two dodge buttons on the Autopilot. Once this is done, you may take control with the FFU again, but you must begin the SETUP process all over again. If you do not complete the Setup process all the way through to step 14, the TS-202 will retain its factory default settings.

## **Normal Usage (Applies to All Autopilot Models)**

### **Taking Command:**

In order to use the TS-202 FFU, it is first necessary to “take command” away from the main Autopilot Head. This is accomplished by pressing and holding both PORT and STARBOARD buttons until the blue LED lamp is illuminated. The Autopilot display will show that a Remote is in command (how this is displayed varies from model to model; consult your Autopilot manual for more detail).

The TS-202 FFU is in command any time the blue LED lamp is lit.

To take command away from the TS-202, go back to the Autopilot head (or another Remote) and press the PORT and STARBOARD DODGE buttons. The display on the Autopilot Head (or Remote) will show that it is now in command, and the blue LED lamp on the TS-202 will be off.

### **LAMP BRIGHTNESS:**

The blue LED lamp is designed to be visible in most daylight conditions. At nighttime, however, it may be that the lamp causes interference because it is too bright. To adjust the brightness to a more suitable level, perform the following steps:

- Move the SELECTOR KNOB to “STANDBY”.
- Take command by pressing and holding the PORT and STARBOARD buttons. Release the PORT and STARBOARD buttons once the blue LED lamp is lit.
- Press the PORT and STARBOARD buttons together twice. The second press must be within about  $\frac{3}{4}$  of a second from the first, or the TS-202 will not understand that you want to adjust the brightness. If done properly, the LED lamp will momentarily go out, then come back on again.
- Move the TILLER HANDLE and you will see the brightness of the LED lamp vary in proportion to the position of the TILLER HANDLE. Moving the handle to port reduces the lamp intensity, while movement in the starboard direction increases the intensity.
- Once the LED lamp is at the desired brightness, press and hold the PORT and STARBOARD buttons for approximately  $\frac{3}{4}$  of a second. The LED lamp will momentarily go out, then come back on again at the new level. The brightness level is stored in non-volatile memory inside the TS-202 FFU, so the LED will stay at the level you set it to until you change it to another level.

## Modes of Operation

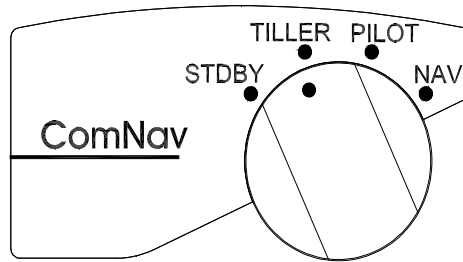


Figure 4 - TS-202 FFU Modes

### **STANDBY (STDBY) Mode:**

If the TS-202 is in command (blue LED lamp lit) and the SELECTOR KNOB is in the “STANDBY” position, then the entire Autopilot System will be in **STANDBY** Mode. No controls on the TS-202 will have any effect on the vessel’s rudder.

### **TILLER Mode:**

If the TS-202 is in command (blue LED lamp lit) and the SELECTOR KNOB is moved to the “TILLER” position, then the Autopilot will immediately begin moving the vessel’s rudder to a position that is proportional to the position of the TS-202’s TILLER HANDLE. Thereafter, the Autopilot will move the vessel’s rudder so as to follow the relative position of the Tiller Handle on the TS-202.

The PORT and STARBOARD buttons have no effect in **TILLER** Mode.

### **PILOT Mode:**

If the TS-202 is in command (blue LED lamp lit) and the SELECTOR KNOB is moved to the “PILOT” position, the Autopilot will lock on to the present course and maintain it.

The PORT and STARBOARD buttons on the TS-202 can be used to make course changes in one-degree increments for every push of the button. Pressing and holding either the PORT or STARBOARD button will cause the commanded course to change at a rate of 10 degrees per second.

The TILLER HANDLE has no effect in **PILOT** Mode.

### **NAV Mode:**

If the TS-202 is in command (blue LED lamp lit) and the SELECTOR KNOB is moved to the “NAV” position, the Autopilot will lock on to the commanded course given by the NMEA Navigation device connected to the Autopilot. For more information on **NAV** Mode, refer to the appropriate section in your Autopilot manual

The TILLER HANDLE has no effect in **NAV** Mode.

The PORT and STARBOARD buttons have no effect in **NAV** Mode.

## Care & Maintenance

There are no user-serviceable parts or adjustments inside the TS-202 FFU Lever Remote enclosure. Should the unit become damaged in any way, return it to an authorized ComNav Marine dealer.

A few precautions will keep the unit in prime condition and result in years of trouble-free service:

- The TS-202 housing does not require any special maintenance other than an occasional cleaning.
- Avoid exposing the TS-202 housing to solvents, acids, and bases as some of these may weaken the casing.
- Although the TS-202 is watertight, it is not designed for submersion under water.

## Specifications\*\*\*

### TS-202 FFU Lever Remote (PN 20310020 & PN20310029)

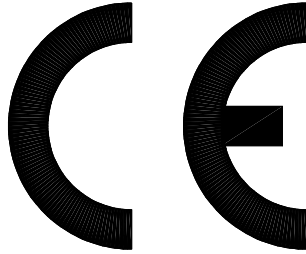
Supply Voltage	4 to 14 VDC
Supply Current	40 mA nominal
Operating Temperature	-40°C to +85°C
Storage Temperature	-40°C to +100°C
Mounting	Deck or Bulkhead Surface
Dimensions (maximum, without cable)	257 mm X 94 mm X 75 mm (10.12" X 3.70" X 2.96")
Weight (without cable)	690 grams (24 ounces)
Safe Distance To Compass	30 cm (12 inches)

Table 2 - TS-202 FFU Lever Remote Specifications

\*\*\* Specifications subject to change without notice.

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This product has been tested and is in compliance with the Electro-Magnetic Compatibility (EMC) standards of the European Community and bears the CE label. It has been tested according to the applicable sections outlined under;

Technical standard #IEC945/EN60945  
Marine Navigation Equipment  
General Requirements

Applicable sections for methods of testing and required test results are;

Section 4.5.4: Radiated Interference

Section 4.5.4: Immunity to Electro-magnetic Environment

Annex A, Section A.3: Immunity to conducted audio frequencies

Annex A, Section A.4: Immunity to earth lead coupling

Annex A, Section A.6: Immunity to radiated interference

Test results and a declaration of conformity are on file at the ComNav plant;

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