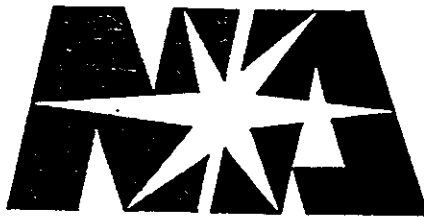


NORTHSTAR C1 COMM TRANSCEIVER INSTALLATION MANUAL

August 25, 1994



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REVISION HISTORY

Date	Page	Revision
25 AUG 94		Initial release

SECTION 1

TECHNICAL INFORMATION

This manual contains information about the physical, mechanical and electrical characteristics of the Northstar C1 Communications Transceiver. Carefully follow the installation procedures described in this manual to obtain maximum performance from the C1. Information for operating this unit is contained in the Reference Manual for the Northstar navigation product used with the C1, and in the Northstar C1 Operator's Manual.

The C1 is designed to operate on a 12-Volt system. A 24-Volt-to-12-Volt converter (similar to the Narco MP10, King KA39, or Collins/STEC PWR-150) is suggested for operation on a 24-Volt system.

Equipment Description

The Northstar C1 Communications Transceiver is a 760-channel, remote-mounted comm module, which connects to a comm antenna and to a Northstar "SmartComm ready" M2, M2V, GPS-60 or GPS-600 navigator. All Northstar navigators manufactured after Summer 1994, are SmartComm-ready, and older units (excluding the M1) can be upgraded to this capability. A SmartComm-ready unit can be identified by the COMM function next to the right-hand control knob, and by the combination power switch and volume control marked VOL.

The Northstar navigator unit serves as the control and display unit for the comm module.

General Description

The VHF Transceiver uses a single superheterodyne receiver. A squelch (muting) circuit suppresses transmissions or disturbances below a certain field strength. The squelch threshold can be modified by the user through the navigator (control unit). The squelch function can also be switched off.

The transmitter is designed to be wideband over the 118.000 to 136.975 MHz range. The transmitter output power is a minimum of 5 Watts. The sidetone is automatically switched to the headphone output during transmission.

The oscillator frequency of the receiver and the transmitting frequency of the transmitter are generated by a VCO (voltage controlled oscillator). This is monitored by a digital frequency evaluation circuit. This digital frequency processing operates in conjunction with a microprocessor.

The microphone inputs are designed for both dynamic and electret/condenser microphones. The inputs are connected to a dynamic volume compressor that keeps the modulation constant over a wide input volume range.

The C1 is interfaced to the navigator unit using an RS-232 serial data link. All commands to the C1 are provided over this link.

Power switching of the C1 is performed by an internal relay that is energized by +5 VDC supplied by the navigator whenever it is turned on. Properly wired, the C1 turns on and off fully automatically.

Technical Specifications

Nominal supply voltage	13.75 VDC (use adapter for 28-Volt operation)
Supply voltage range	12.4 VDC to 15.1 VDC
Emergency operation	to 10.0 VDC at reduced transmitter power
Power consumption at 13.75 V	
Standby reception mode	≤ 70 mA
Reception	≤ 500 mA
Transmission mode	≤ 2.5 Amp
Frequency range	118.000 MHz to 136.975 MHz
Number of channels	760
Channel spacing	25 kHz
Storage temperature range	-55°C to +85°C
Operating temperature	-20°C to +55°C (short time +70°C)
Maximum operating altitude	50,000 feet
Vibration	Category NM
Humidity	Category A/+50°C: 95%, 48 hours
Dimensions (max. overall):	9.3 inches long 2.75 inches high 2.9 inches wide
Weight	1.60 pounds
Fuse	5A

Receiver Data

Type of receiver	Single superheterodyne receiver
Sensitivity	≤ 5 μV EMF for 6dB
IF bandwidth	≥ ± 8 kHz at 6 dB attenuation
Selectivity	≥ 40 dB at 17 kHz ≥ 60 dB at 25 kHz
Squelch	Can be adjusted or switched off
AGC control for 5 to 100 mV input	≤ 6dB
Distortion m=85%	≤ 15%
Audio frequency response relative to 1000 Hz	≤ 6dB, 350 Hz to 2500 Hz ≥ 18dB at 4000 Hz
Intermediate frequency	21.4 MHz
Audio output	
for speaker operation	at 13.75 V input: ≥ 3 W into 4 Ohms at 10.0 V input: ≥ 1.5W into 4 Ohms
for headphone operation	at 13.75 V input: ≥ 100 mW into 600 Ohms at 10.0 V input: ≥ 30 mW into 600 Ohms

Transmitter data

Transmitter output into 50 Ohms	≥ 5 W with 13.75 V input ≥ 2 W with 10.0 V input
Frequency tolerance	≤ 15 ppm
Duty cycle	1:4 (min)
Type of modulation	A3E amplitude modulation AM
Modulation factor	$\geq 70\%$ to $\leq 99\%$ (dynamic compressor)
Distortion at 70% modulation	$\leq 15\%$
Modulation bandwidth	350Hz to 2500 Hz
Frequency response	-6 dB (relative to 1 kHz/0 dB)
Input voltage (M=70%)	
Dynamic microphone	≤ 2 mV symmetrical 150 Ohms
Carbon microphone	≤ 100 mV 100 Ohms
FM deviation with modulation	
m = 70% f = 1.25 kHz	≤ 3 kHz
Sidetone	true, adjustable
Automatic shutdown on stuck mike	after 2 minutes of continuous transmission

SECTION 2

INSTALLATION

General

Since the installation of the VHF transceiver depends on the type of aircraft and its equipment, only general information can be given in this section.

Before installing the VHF transceiver in an aircraft, inspect the unit for signs of shipping damage. Pay particular attention to the following:

1. Dirt, dents, scratches, corrosion or broken parts
2. Dirt or scratches on the identification plate
3. Dirt, bent or broken pins, displaced inserts of plugs and sockets

Mechanical Installation of C1 Remote-Mount Transceiver

Choose a mounting location that provides easy access for service, reasonable cabling to the navigator unit, comm antenna, and power wiring, and meets environmental requirements specified in the technical data section. A mounting bracket is supplied with the unit.

Wiring

Notes:

1. Use only cable which is suitable for use in aircraft (self extinguishing): Use AWG 20 for power wiring and AWG 22 for other cables
2. Fit rubber sleeves/heat shrink tubing over the solder joints on the unit connector.
3. Protect the power wiring with a trip-free, resettable circuit breaker. (The unit is also protected internally by a 5-Amp fuse.)
4. No high frequency cables should be included in the cable harnesses of the system and the routing of connecting cables alongside cables that carry audio power or pulses should also be avoided.
5. Carefully check the wiring before switching on the unit and check particularly that the (+) and (-) connections have not been reversed.

Microphone connection

The VHF transceiver allows a maximum of two non-amplified dynamic microphones and two electret/condenser microphones (DC supply) to be connected at the same time. A symmetrical input transformer with an impedance of 150 Ohms is included at the input of the dynamic microphone. If a non-amplified dynamic microphone is used, it must be connected between pins 5 and 6 as shown in Figure 1. Note that most aviation handsets which incorporate a dynamic mike also contain a preamplifier, and should be connected to the C1 via the "electret mike" input.

Speaker connection

A 4- to 8-Ohm speaker may be connected to the audio output pins of the comm module.

Caution: A speaker's magnetic field will influence your on-board magnetic compass. When choosing the mounting point for the speaker, maintain the minimum distance specified by the manufacturers of the speaker and the compass.

Headphone connection

Up to two headphones with an impedance of 600 Ohms can be connected to the audio output of the comm module.

Power control connection

Power for the Northstar C1 is controlled by an internal relay. It is energized by +5 VDC from the Northstar navigator, to which the C1 is interfaced. The C1 will turn on and off automatically as the navigator is turned on and off. As shown in Figure 1, two power control wires are run from the C1 to the navigator.

Control link connection

The Northstar C1 is controlled from the Northstar navigator by means of a bi-directional RS-232 serial data link. Each command to the C1 is echoed back to the navigator to check that it was received correctly. Wiring for this channel is shown in Figure 2 for the GPS-60 navigator, and in Figure 3 for the GPS-600, the M2 and M2V, and for the M3.

The Push-To-Talk (PTT) signal is also sent to the navigator, as shown in Figures 2 and 3.

(Note that the pin connections for the GPS-60 are different from the pin connections for the other units.)

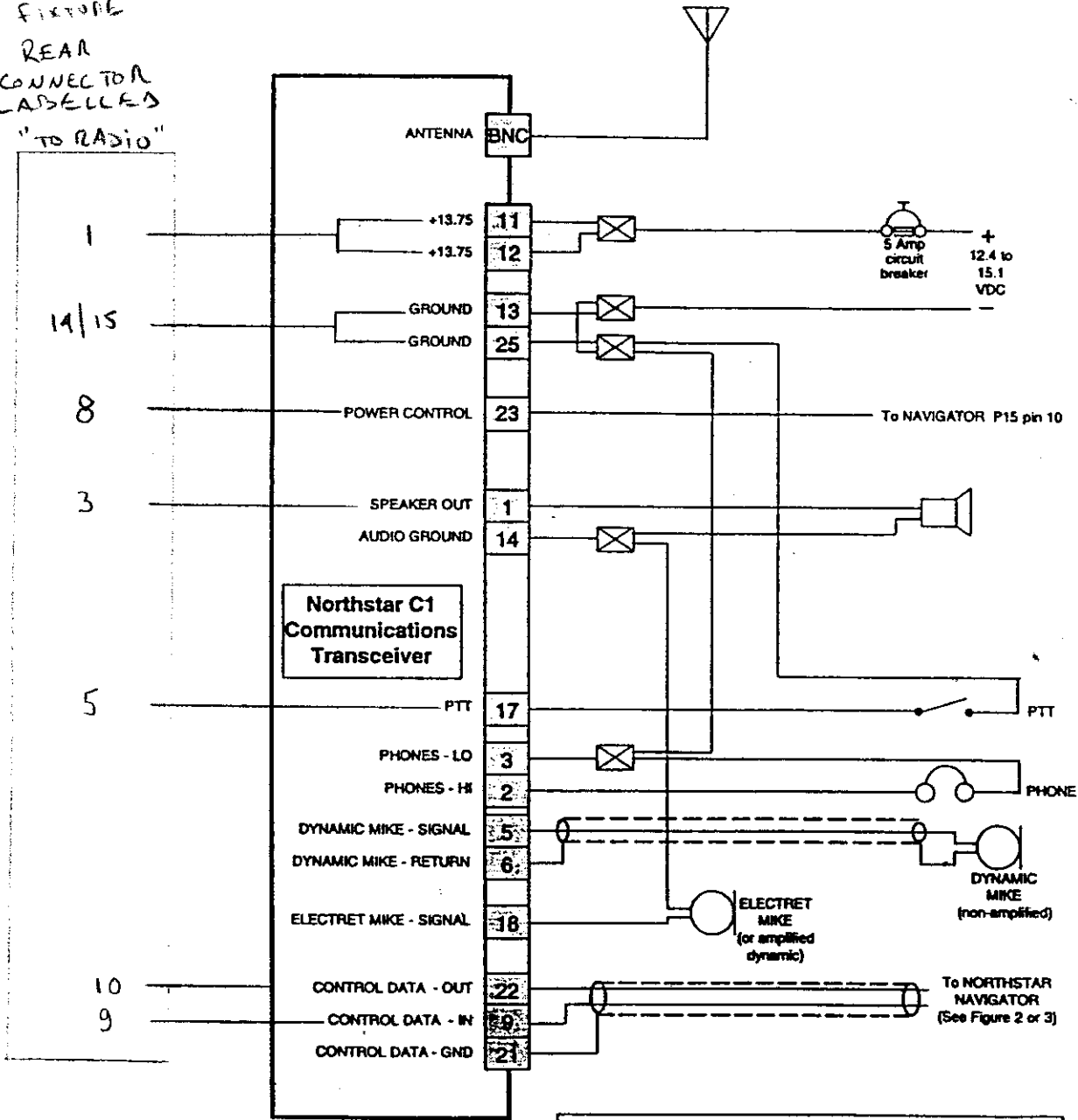
Replacement of the internal equipment fuse

The C1 Transceiver is fitted with an internal 5-Amp equipment fuse. If the C1 Transceiver ever fails to operate, first check the equipment fuse. It is mounted on the left sidewall (rear) and is accessible from the outside without opening the unit. A pair of small, long-nosed pliers is required to withdraw the fuse (fuse is plugged into a quick-release socket).

Installation of Volume Control label

The SmartComm-ready navigator to which the C1 transceiver is being interfaced has a control which serves as a combination push-pull ON/OFF switch and volume control for the audio level from the C1. A small round label marked "VOL" is included with the C1. Rotate the knob to near its center position. Remove the backing paper from the label to expose its self-adhesive layer, and apply the label to the center of the navigator's volume control knob. Press firmly to set the adhesive.

TO
C01 TEST
FIXTURE
REAR
CONNECTOR
LABELLED
"TO RADIO"



Note: All undesignated pins on Northstar C1 must be left unconnected at all times.

Note: Microphones must be wired as shown.

Figure 1—Northstar C1 Connector Wiring

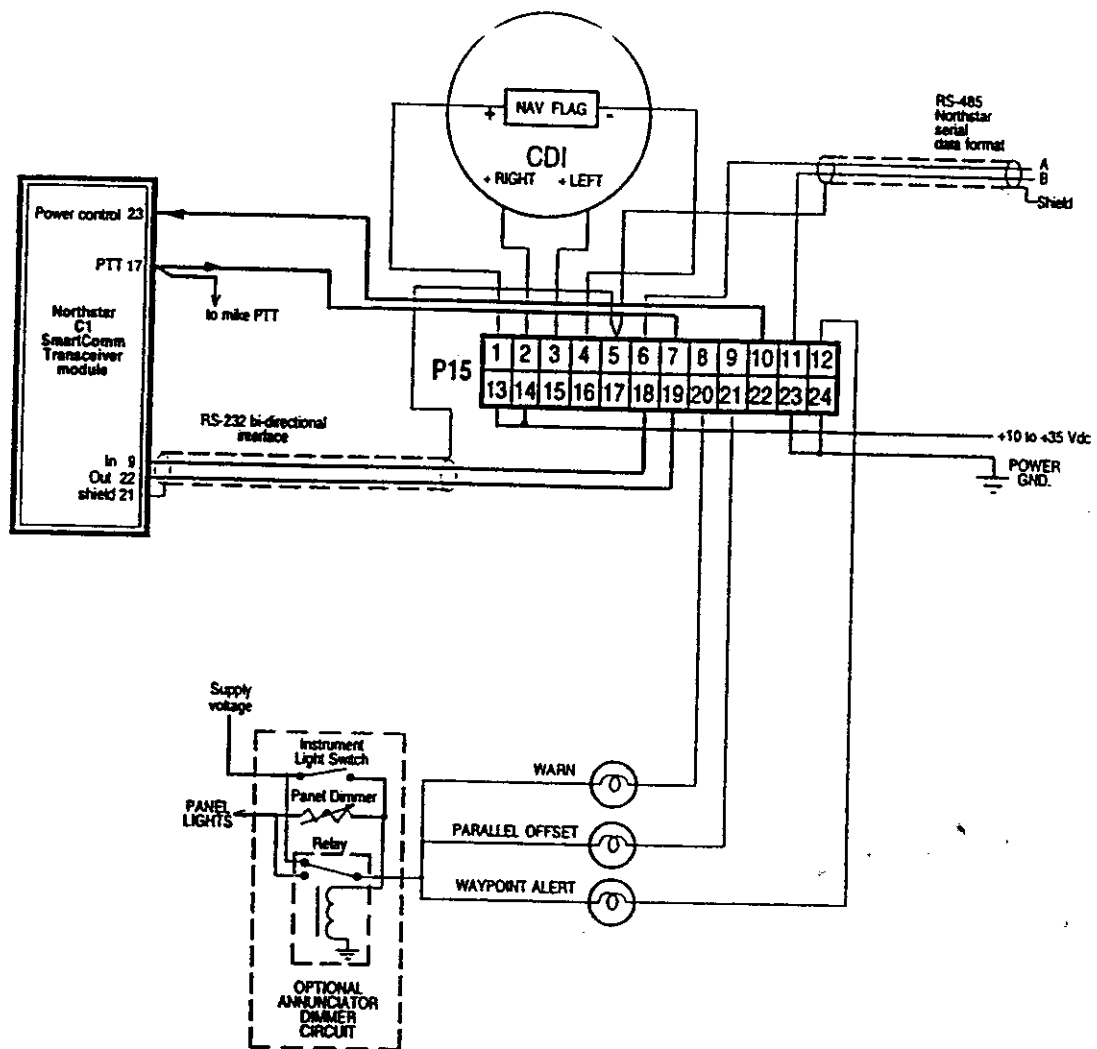


Figure 2—Northstar C1 Wiring for Northstar GPS-60

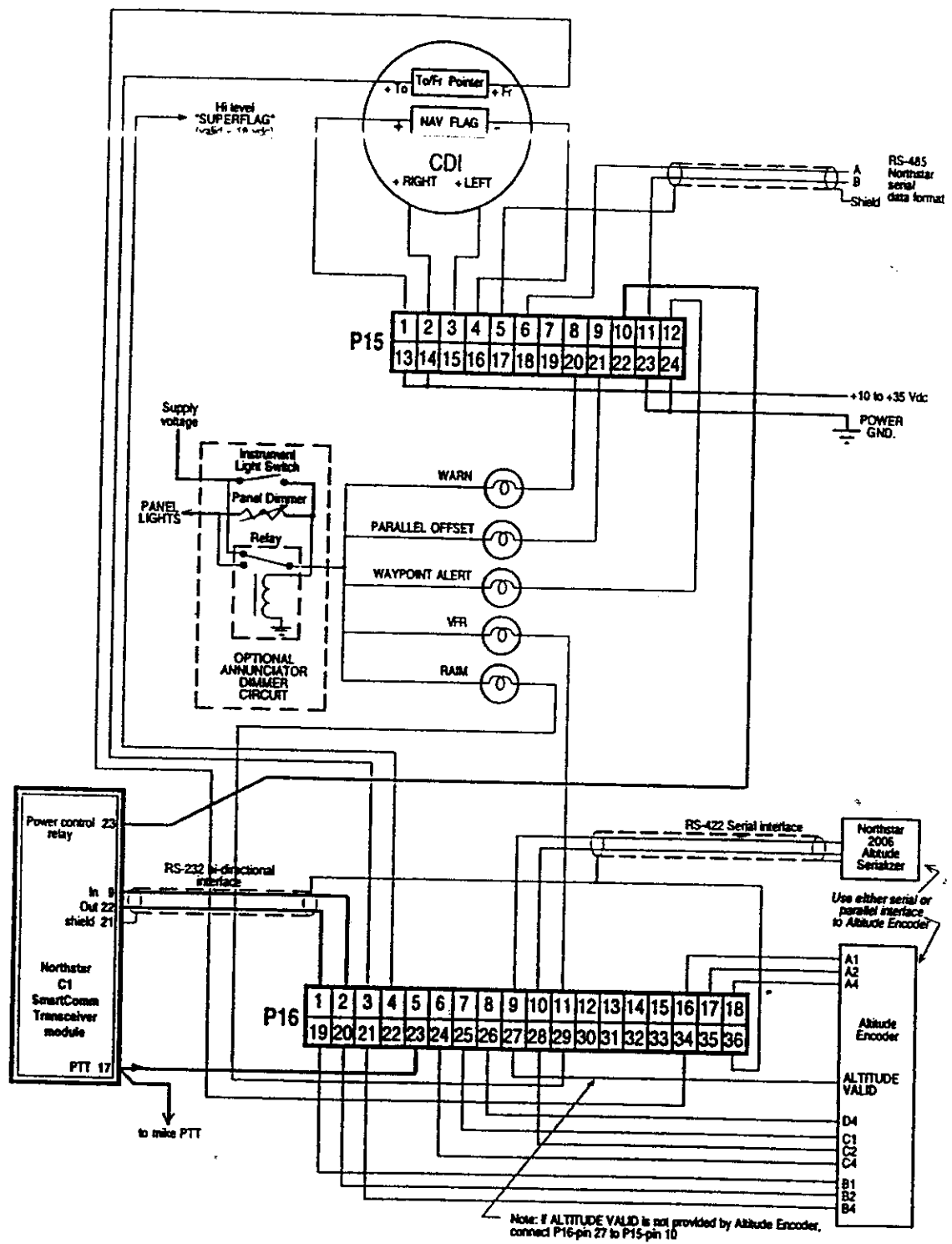


Figure 3—Northstar CI Wiring for Northstar GPS-600, M2 and M3

Do not connect Altitude Encoder, SUPERFLAG, or VFR or RAIM annunciators to GPS-600.
 Do not connect Altitude Encoder, SUPERFLAG, or RAIM annunciator to M2.

SECTION 3

Testing after installation

Configuring the Navigator to control the C1

Perform the following procedure to allow the navigator to control the C1 module:

1. Turn the navigator on.
2. Turn the large secondary knob to **SETUP**.
3. Turn the small secondary knob all the way to the right to display **END OF FUNCTIONS**. Press both **CRSR** buttons simultaneously. Press the right **CRSR** button, and use the small and large secondary knobs to spell out the service code **RADIO**. Press the **CRSR** button again to turn it off.

Interface test

To assure proper communication between the navigator and the C1 transceiver after the installation is completed:

1. Apply power to both units and turn the navigator's power switch to **ON**.
2. The navigator's red **WARN** button may flash. If it does, press it (several times if necessary) to read the diagnostic warning messages. These messages may include warnings about lack of an antenna, or outdated FliteCard, as well as other messages not related to the C1. The one warning message which indicates a problem with the C1 is the following:

NO RESPONSE FROM RADIO MODULE

This means that the navigator has sent a command to the C1, but the C1 has not responded to this command correctly by sending data back to the navigator. Likely causes are miswiring of the connections between the navigator and the C1, lack of power being supplied to the C1, or a defective navigator or C1.

If the above message is not displayed, the two units are communicating together.

Sidetone level adjustment

To set the sidetone level of the C1 unit, perform the following steps using the navigator unit:

1. Turn the large secondary knob to **SETUP**.
2. Turn the small secondary knob all the way to the right to display **END OF FUNCTIONS**. Press both **CRSR** buttons simultaneously. Press the right **CRSR** button, and use the small and large secondary knobs to spell out the service code **SIDE**. Press the **CRSR** button again to turn it off.
3. Turn the small primary knob to adjust the sidetone to the desired level.
4. Press **ACK** to store the new value.

Squelch level adjustment

1. Turn the large secondary knob to **SETUP**.
2. Turn the small secondary knob to display **SQUELCH LEVEL**.
3. Turn the small primary knob to adjust the squelch level, as required.

Ground test with engine shut down

1. After installation of the unit, measure the antenna tuning between the base of the antenna and the antenna connecting cable using a VHF reflection coefficient meter (voltage standing wave meter).
2. The VSWR (voltage standing wave ratio) over the complete frequency range for the unit must be within 3:1. If this matching value is incorrect, this indicates a mismatch, caused for example by an incorrect or unsatisfactory counterpoise, a cable with an impedance that deviates significantly from 50 Ohms or an incorrectly tuned antenna.
3. After the antenna measurement, check the readability by carrying out a speech test with a ground station.

Ground test with engine running

With the engine running at cruising speed check that the aircraft power supply is within the permissible tolerances at approximately 14 Volts.

When performing the following speech test, ensure that the distance from the ground station is as great as possible, at least 100 meters (approx. 300 feet).

With the engine at cruising speed, the cabin noise of the aircraft should be only slightly transmitted and communication should be clear and distinct. Hold the microphone close to the lips when speaking.

Operating Instructions

The following instructions must be followed for safe operation of the Northstar C1 transceiver:

1. Switch off the unit when starting or shutting down engines.
2. A speech test should be performed after startup. Note that, if a speech test is carried out close to a ground station, the results may appear to be positive, even if the antenna cable is broken or short-circuited.
3. Use a normal voice for speech communication and hold the microphone close to the lips; otherwise, cabin noise can be intrusive and make your transmissions difficult to understand.
4. Use only microphones or headsets that are suitable for use in aircraft. In aircraft made of wood or synthetic materials, or in gliders or helicopters, radiation from the transceiver antenna can enter the microphone's integrated amplifier, causing feedback. This is noticeable at the ground station, and is characterized by whistling and/or heavy distortion. These disturbances can occur in different ways on different transmission frequencies

APPENDIX 1 - Environmental Specifications

Storage temperature	-55°C to + 85°C
Operating temperature range as per EUROCAE ED-14C/RTCA DO-160C	-20°C to +55°C (short time to +70°C)
Operating altitude as per EUROCAE ED-14C/RTCA DO-160C	50,000 feet
Vibration as per EUROCAE ED-14C/RTCA DO-160C	Category NM
Humidity as per EUROCAE ED-14C/RTCA DO-160C	Category A/+50C: 95%, 48h