VAL AVIONICS LTD

COM 2KR

Remote VHF Transceiver

Installation and Operator's Manual

Revision 3
March 2013

P/N 172201-3

Revision History:

September 2012 – Initial Printing

December 2012 – Updated Appendix B wiring diagram to show RS-232 connection.
Added dimensional drawings of COM 2KR case.
Figure 1 updated to current design.
Figure 3 & 4 Removed, as they are no longer accurate.
March 2013-   corrected typographical errors.
Corrected Table 4
Corrected Figure 3

Table of Contents

1   SECTION I - GENERAL INFORMATION

1.1   INTRODUCTION

Thank you for purchasing our COM 2KR – *Remote VHF Transceiver*. Here at Val Avionics Ltd., our core design philosophy is based on the ease of installation and use. The COM 2KR represents 20 years of refinement in that process, based on the feedback of customers that have used the COM 760. The COM 2KR takes the original idea of the COM 760: a simple-to-use, reliable unit without the frills of other radios, and overhauls that idea with new and exciting features.

That design philosophy translates into ease of installation and integration that makes the COM 2KR – *VHF Transceiver* a communication solution specialized for operating with the latest EFIS system technology. The COM 2KR satisfies the need for compact, fully integrated, quality radio that can be counted on to provide years of maintenance-free, reliable service.

Before installing and/or using your new COM 2KR please read this manual completely. This will ensure proper installation and familiarize you with all of the features your COM has to offer.

1.2   SCOPE

This manual will provide detailed information about the installation and operation of the COM 2KR – *Remote VHF Transceiver*. It will also provide equipment limitation information and instructions for continued airworthiness.

1.3   EQUIPMENT DESCRIPTION

The COM 2KR has been designed for integration with most major EFIS systems. Using the NEMA-0187 communications standard, the interface is compatible with the Garmin SL-30 command stack. Using state-of-the-art technology Val Avionics Ltd. has created a radio that will provide the pilot with seamless and easy-to-operate communications.

The COM 2KR simplifies installation into an aircraft by allowing installation anywhere. Using a standard RS-232 serial connection, the COM 2KR can connect to many available EFIS systems available today.

The COM 2KR has one internal receiver. The internal receiver operates from 118.00 MHz to 137.975 MHz. This receiver is capable of receiving down to 2μV with a 6dB signal-to-noise ratio.

The COM 2KR has many audio inputs and outputs to facilitate any installation. The unit has two capacitively coupled audio inputs for adding a Nav receiver audio output or other such audio device. The COM also has a 5W speaker output and 50mW headphone output.

1.4   FCC

The COM 2KR transceiver is a voice-modulated communications device utilizing amplitude modulation, with a maximum power of 10W, operating in the **6K00A3E** emission designator, with a 25kHz channel spacing.

This unit has been tested and found to comply with the limits for a Class B receiver, pursuant to Part 15 of the FCC rules, as well as the emission requirements set forth in Part 87 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when it is operated in an aircraft environment. The unit generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions manual, may cause harmful interference to radio communications. Operation of the unit in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC ID: EZN5PRCOM2KR

1.5 SPECIFICATIONS

Table 1: Specifications

SPECIFICATIONS	CHARACTERISTICS
Environmental:	(RTCA/DO160D)
Minimum Performance Standard	(RTCA/DO-186B)
Physical Dimensions:	
Height	.86 inches (2.54 cm)
Width	5.9 inches (15.88 cm)
Depth	10.1 inches (22.86 cm)
Weight:	2.0 pounds (1.5 kg)
Mounting:	Ridged mounting, no shock mounting required
Temperature Range:	-30 to +55 Celsius with short time operations at +70 Celsius
Power Requirements:	
Voltage	11.0 to 30.0 VDC
Current	0.5 Amp Rec. 3 Amp max transmit
Receiver:	
VHF Frequency	118.00 to 136.975 MHz
Sensitivity	2 µV to provide a 6dB S+N:N
Channel Spacing	25 kHz
Stability	±.002%
Selectivity	≥60dB
Audio output	5W to 4Ω Spk 50mW to 600Ω Phone
AGC Characteristics	From 10 µV to 200 µV the audio level will not vary more than 3db.
Transmitter:	
Carrier Power	8W nom. RMS
Duty Cycle	50%
Interface:	RS-232
Baud Rate	9600
Manufacturer's Model Number	**COM 2KR**
Part Number	VPN 0800106

1.6   EQUIPMENT SUPPLIED

Table 2: Equipment Supplied

QTY	DESCRIPTION	PART NUMBER
1	COM 2KR – 760 Channel Radio	**0800106**
1	INSTALLATION KIT	**651008**

1.7   EQUIPMENT REQUIRED BUT NOT SUPPLIED

Table 3: Equipment Not Supplied

QTY	DESCRIPTION	PART NUMBER
1	Circuit Breaker 5 amp	Potter & Brumsfield PB W23
1	Aircraft Cabin Speaker	Ref aircraft parts manual for specific part number
1	Contact Crimping Tool w/ Positioning Tool	AMP P/N 601966-1 AMP P/N 601699-5

1.8   LICENSE REQUIREMENTS

There is no licensing requirement to operate the COM 2KR when installed and operated in accordance with this manual.

2   **SECTION II -** INSTALLATION

2.1   GENERAL INFORMATION

2.1.1   Scope

This section of the manual will provide the needed information to successfully complete the installation of your new COM 2KR – *Remote VHF Transceiver*. Please read this section completely before proceeding with the installation process. Although the COM 2KR installation procedures are designed with the do-it-yourselfer in mind, we at Val Avionics Ltd. strongly suggest that you seek the advice of a qualified avionics installation facility before beginning this or any other installation project. Qualified avionics installation technicians can offer good advice as to time-tested installation practices and techniques that can save you many hours of time and frustration.

2.2   UNPACKING AND INSPECTION

Use care when unpacking the equipment. Inspect the unit and supplied parts for visual signs of damage during shipment. Examine the unit for loose screws, dents, broken buttons and other signs of damage that may have occurred during shipment. Verify the contents of the container with the list in section 1.5. If any damaged or missing parts are discovered during the inspection save the shipping material and contact the freight carrier to file a claim. If it is suspected that parts were omitted from the container please feel free to contact Val Avionics Ltd., to acquire the missing items.

2.3   EQUIPMENT INSTALLATION PROCEDURES

2.3.1   Cooling Requirements

Forced air-cooling is not required for the COM 2K – *VHF Transceiver*. However, when planning the location for mounting, ensure adequate spacing from heat producing sources such as heating or defrosting ducts.

2.3.2   Mounting Requirements

The COM 2KR should be rigidly mounted in the aircraft cabin using the hardware provided in the installation kit. Ensure that the mounting location will provide easy access for future maintenance. Ensure that the mounting position will provide adequate clearance between the unit and the associated wire harness and the aircraft controls. Consult FAA Advisory Circular AC 43.13-2B for acceptable practices and techniques.

2.3.3   Wire Harness Fabrication

Val Avionics Ltd. Strongly recommends the use of a factory fabricated wire harness (VPN 751028) with your new COM 2KR – *Remote VHF Transceiver*. Use of the factory fabricated wire harness will ensure proper operation of the COM 2KR, reduction in the occurrence of interfering signals and ground loops, greatly reduced installation time, and provide prolonged trouble-free performance of your new equipment.

Although strongly recommended, it is not required to use the factory fabricated wire harness when installing the COM 2KR. A wiring harness can be fabricated in the field. Refer to appendix B of this manual for a complete wiring diagram. The COM 2KR is connected to the aircrafts avionics bus via a 5 AMP circuit breaker. All wires must be 22 AWG MIL-SPEC, unless otherwise noted in accordance with current regulations. Two and three

conductor shielded MIL-C-27500 or equivalent wire must be used where indicated. Use AMP Contact Crimping Tool (AMP P/N 601966-1) with Positioning Tool (AMP P/N 601699-5) or equivalent to ensure good quality contacts. Refer to FAA Advisory Circular AC 43.13-2A for acceptable practices and techniques.

2.3.4 COM 2KR Installation

2.3.4.1 Mounting

The COM 2KR is rigidly mounted in the aircraft cabin or avionics bay. Once a location has been selected, a visual inspection should be made of the area, which will be occupied by the COM 2KR and harness assembly for obvious obstructions such as heater ducts, control cables, fuel and oil lines or any other obstruction. Pay particular attention to any control systems. They should be moved to the full limit of travel and verified that sufficient clearance exists prior to beginning installation. Mark and drill the mounting holes as required.

With the unit held in place, insert the four supplied 6-32 X 3/8" screws from the front and tighten as appropriate.

2.3.4.2 Antennas

One antenna is required for the COM 2KR installation. A standard COM antenna can be used with the unit such as a COMANT CI-121 or equivalent. Follow the antenna manufacture's installation Manual to ensure proper installation of the antenna.

2.3.4.3 Audio

The COM 2KR has two auxiliary audio inputs and two audio outputs, Speaker audio and Headset audio. In installations with two radio and/or more audio devices, it is strongly recommended that these audios be coupled to a quality audio selector panel.

2.4 POST INSTALLATION CHECK

2.4.1 Operational Check

Refer to section three of this manual. Check all functions of the COM 2KR for proper operation. Check the operational functions of other equipment installed in the aircraft in accordance with the individual manufacture's operation manuals to insure that no cross interference exists as a result of this installation.

2.4.2 Final Inspection

Verify that the wiring is bundled away from all controls and that no part of the installation interferes with the movement of the aircraft controls. Move all of the aircraft controls through their full range of movement while visually verifying that the installation does not mechanically interfere with the control movement. Verify that the wiring harnesses are properly secured to the aircraft structure in accordance with accepted practices as described in AC 43.13 and that adequate strain relief and service loops have been provided. Ensure that there are no kinks or sharp bends in the wire harnesses. Verify that the wire bundles are not exposed to any sharp or abrasive surfaces. Complete log book entries, weight and balance computations and other documentations as required.

2.5 LIMITATIONS

There are no known limitations to the operation of the COM 2KR. Instructions for Continued Airworthiness and Return to Service Instructions can be found in Appendix C.

3 **SECTION III -** OPERATION

3.1 **GENERAL INFORMATION**

3.1.1 **Scope**

This section will provide detailed operating instructions for your new COM 2KR – *Remote VHF Transceiver*.

All user interface functions are controlled by an external EFIS system over RS-232. Refer to your EFIS Systems manufacture's installation and operations manuals for complete installation and operation information.

4 **SECTION IV -** WARRANTY AND SERVICE

4.1 LIMITED WARRANTY

The equipment delivered with this Standard Factory Warranty is manufactured by Val Avionics, Ltd. and is guaranteed against defective materials and workmanship for two years from date of original retail purchase. Any unit found to be defective due to material and workmanship during the warranty period will be repaired or replaced at the sole discretion of Val Avionics Ltd.

Val Avionics, LTD liability under this warranty is limited to servicing, repairing or adjusting any equipment returned prepaid to the Val Avionics' factory by express written or verbal authorization for that purpose and to repair or replace defective parts thereof.

If, upon examination, it is determined that a malfunction has been caused by misuse of the equipment, installation or operation not in accordance with factory instructions, accident or negligent damage, alterations of any manner, and repair by other than the factory, the repairs will not be covered under the warranty. In such cases, an estimate will be submitted for approval before repair is initiated. In most cases, Val avionics, Ltd. will provide one week turn around on its warranty and repair service. We recommend that contact be made with the FACTORY CUSTOMER SERVICE DEPARTMENT prior to any unit return and obtain RETURN AUTHORIZATION AND INSTRUCTIONS. This will provide proper control and expedite service.

Val Avionics, Ltd. reserves the right of continuous product development without obligation to install changes in previously manufactured products.

Installation of Val Avionics, Ltd. products must conform to methods acceptable by the Federal Aviation Administration as described in the appropriate Federal Aviation Regulations (FAR's) and Advisory Circulars (AC's).

4.2 SERVICE

Repair service for the COM 2KR – *Remote VHF Transceiver* is available at our manufacturing facility. Units in need of servicing should be returned prepaid to Val Avionics Ltd at the following address.

Val Avionics
2950 Pringle Roasd SE
Salem, OR 97302

5 **Appendix A** – INSTALLATION DRAWINGS AND CONNECTOR LAYOUT

Figure 1: Physical Dimensions
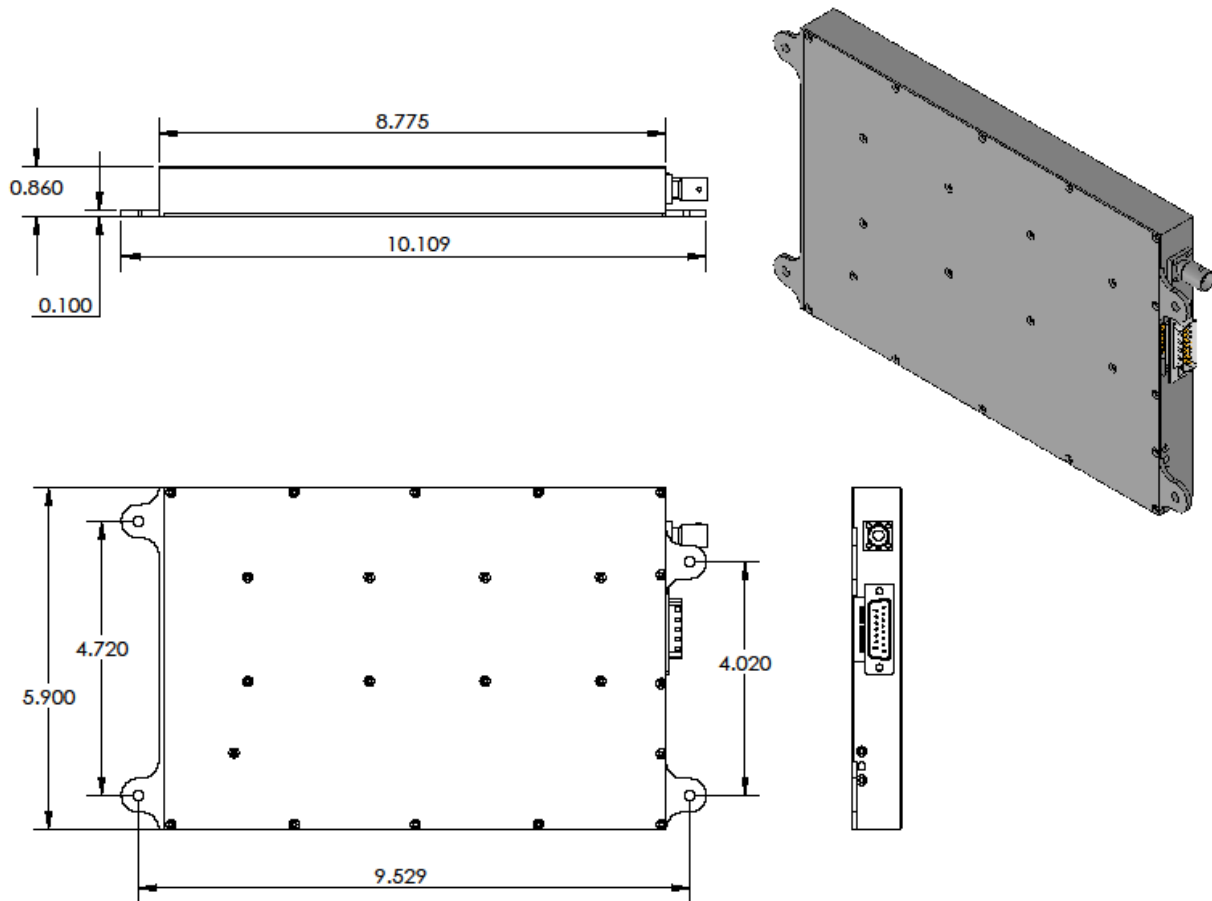
Figure 2: P1 Connector Pin Out
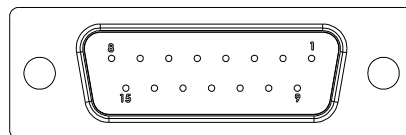
Table 4: Rear Connector Pin Functions

Pin	Functoin	I/O
1	RS-232 In	Input
2	Aux In 2	Input
3	Speaker Ground	
4	Headphone Ground	
5	Mic Ground	
6	Key	Input
7	Main Ground	Input
8	Main Power	Input
9	RS-232 Out	Output
10	Aux In 1	Input
11	Speaker	Output
12	Headphone	Output
13	Mic Audio	Input
14	NC	
15	NC	

6 Appendix B – WIRING DIAGRAMS
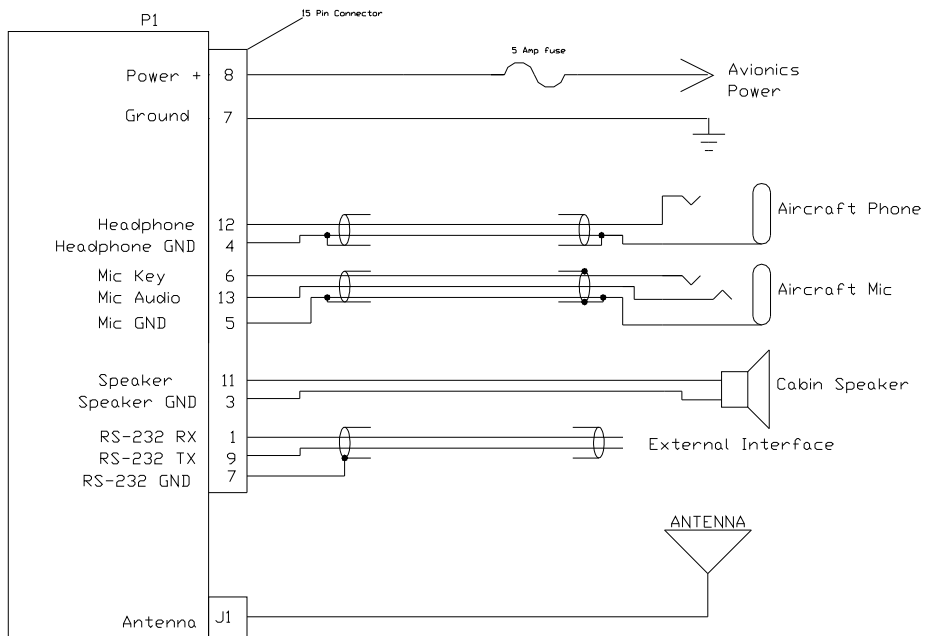
Figure 3: COM 2K Basic Wiring Diagram

7 **Appendix C –** Certifications

7.1 FAA Acceptability:

This device has been tested and found to meet the specification of TSO-C169a (RTCA; DO-186B, DO-160E, DO-178B DO-254).

8 **Appendix D** – INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

8.1 MAINTENANCE INSTRUCTIONS

Maintenance of the COM 2KR – *Remote VHF Transceiver* is on condition only. **No periodic maintenance is required**. If unit is found to be out of calibration, send unit in for service. If unit is removed for service, upon re-installation perform Post Installation check as described in section 2.4 of this manual.

9   **Appendix E –** RS-232 Command Interface

This appendix includes the interface specifications for the RS-232 serial port. The RS-232 port can be used to input active and standby frequencies as well as using an external serial resolver such as an EFIS system. The interface format conforms to NMEA 0183 message format specifications. For improved compatibility, the COM 2000 / COM 2KR accepts all commands for the INS 429 / NAV 2000 / NAV 2KR

9.1   **Input Commands**

The following input command messages are supported:
- Request data output
- Set active COM frequency data from a remote source
- Set standby COM frequency data from a remote source
- Set COM Volume and Squelch Level
- Set COM Mic Gain and Sidetone

9.2   **Output Messages**

The COM 2000 / COM 2KR output messages include:
- Reset status
- Communications Error
- COM Receiver status
- COM audio mode
- COM microcontroller software version
- COM Volume and Squelch Level
- COM Mic Gain and Sidetone

9.3   **Data Format**

The data format for serial communication is:
- Baud rate   9600
- Data bits   8
- Stop bits   1
- Parity   none

9.4   **Default Message Output**

At system start when the COM 2000 / COM 2KR is configured to operate in normal mode, the following messages will be configured for output and the specified rates:
- COM Receiver status at 1 Hz (low rate)

These default rates can be changed by using the Request Data Output message.

9.5 Message Formats

All messages will conform to the NMEA 0183 proprietary message format as follows. All characters will be standard ASCII characters. No binary data characters will be used.

"$".....................................Start of message character, ASCII "$" (024h)
"P"....................................Proprietary message identifier
"MRR" ....II Morrow company identifier
c..Message class identifier. Used to identify a message as either a COMM of VHF NAV message. Those message types, which are also supported by the VAL COM 2000 VHF Transceiver, will use the "C" identifier to allow the INS 429 to accept COMM radio commands from existing products. All other messages will use the "V" identifier to indicate that they relate to a VHF NAV receiver.
nn ....Message identifier, two-digit number in ASCII characters.
d…d ....Message data characters defined for each message.
chksum ....Message checksum, including message identifier through data characters. The two-digit checksum is generated by adding all values of valid characters together, ignoring carry (if any).   This value is converted into two encoded hex[1] characters (30h-3Fh).
<CR>................................ASCII carriage return (0Dh)
<LF> ....ASCII line feed (0Ah)

The maximum message length, including the start of message character ("$") and the end of message <CR><LF> sequence, is 25 bytes.

This message format is the same as is used in the INS 429 / NAV 2000 / NAV 2KR. The COM 2000 / COM 2KR will be able to accept all messages intended for a INS 429 / NAV 2000 / NAV 2KR without generating a serial communications error. It will ignore all of those messages. Those messages have been included for completeness.

---

[1] Encoded Hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value of 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters "5" and "?" respectively.

9.6   Message Definitions

9.6.1   Input Messages

REQUEST DATA OUTPUT

This input is used to request an output message to be sent by the INS 429 / COM 2000.

Message format:
"V" ....Message class. This is a VHF NAV message.
"24" ....Message identifier.
ii ....Output identifier of requested message, two ASCII characters.
dd.................................Message data, two encoded hex[2] characters (30h-3Fh), used for specific output
request. Set to "00" if not needed. These characters are used for such items as
selecting a specific EEPROM address to output.
A...................................Request type: (ASCII) "0"= output repeatedly at low speed (1 Hz); "H" = output
repeatedly at high speed (10 Hz).

ii	Output	Dd	Data Description	a
"20"	Reset Status	"00"		"0"
"21"	CDI, GSI, and Flags	"00"		"0", "L", "H"
"22"	Decoded OBS Setting	"00"		"0", "L", "H"
"23"	Radial from Active VOR	"00"		"0", "L"
"28"	Receiver Status	"00"		"0"
"30"	NAV Microntroller Software Version	"00"		"0"
"32"	ADC Data Output	cc	ADC channel: "00" to "08"	"0"
"35"	Comm Transceiver Status	"00"		"0"
"36"	Comm Software Version	"00"		"0"
"71"	Comm Volume and Squelch	"00"		"0", "L"
"72"	Comm Mic Gain and Sidetone	"00"		"0"

Table 5 - Data Output Requests

Example messages:

        $PMRRV242100L<chksm><CR><LF>
Request periodic output of CDI, GSI, and related flags at low (1Hz) rate.

        $PMRRV2432050<chksm><CR><LF>
Request a single output of ADC data from channel 5.

---

[2] Encoded Hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value of 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters "5" and "?" respectively.

SET ACTIVE VOR/LOC FREQUENCY AND RECEIVER FUNCTION

This message is used to set the standby VOR or Localizer frequency as well as the receiver operating function. The INS 429 can detect if the supplied frequency corresponds to a VOR or a Localizer channel, so this command will work for both types of NAV aids.

Message format:
```
$PMRV27E4N<chksm><CR><CR><LF>
```

This example command would set the active VOR frequency to 117.100 MHz. This can be interpreted by noting that the ASCII 'E' corresponds with 45h, + 30h = 75h, converted to decimal equals 117 for the MHz portion of the command. The kHz portion converts ASCII '4' to 34h, - 30h = 4h, x 25 kHz steps = 100 kHz. This command would also set the receiver function to normal, leaving the standby channel inactive.

Note: The INS 429 will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

SET STANDBY VOR/LOC FREQUENCY AND RECEIVER FUNCTION

This message is used to set the standby VOR or Localizer frequency as well as the receiver operating function. The INS 429 can detect if the supplied frequency corresponds to a VOR or a Localizer channel, so this command will work for both types of NAV aids.

Message format:
"V"………..Message class. This is a VHF NAV message.
"28"………Message identifier.
mk………..Standby VOR/LOC frequency:
> m = desired frequency in MHz in hexadecimal, where m = desired frequency – 30h, with desired frequency in range of 108 to 117 MHz.
> k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, desired frequency in range of 000 to 975 kHz in 50 kHz steps, or the even numbers from 30h to 56h.

a………….Receiver function: N = normal, 0 = unchanged.

Example message:
```
$PMRRV28?PN<chksm><CR><LF>
```

This example command would set the standby VOR frequency to 111.800 MHz. This is interpreted by noting that the ASCII '?' corresponds with 3Fh, + 30h = 7Bh, converted to decimal equals 111 for the MHz portion. The kHz portion converts ASCII 'P' to 50h, -30h, -30h yields 20h, x 25 kHz steps = 800 kHz portion. This command would also set the receiver function to normal, so the receiver would receive only the active VOR channel.

Note: The INS 429 will check input frequencies for validity. An RS-232 serial message output will be generated if the frequency is invalid.

SET STANDBY COMM FREQUENCY AND TRANSRECEIVER FUNCTION

This message is issued to set the standby COM frequency.

Message format:

"V" .... Message class. This is a VHF NAV message.
"29" .... Message identifier.
Mk .... Standby COM frequency:

m = desired frequency in MHz in hexadecimal, where m = desired frequency - 30h, with desired frequency in range of 118 to 136 MHz, or 162 MHz.
k = desired frequency in kHz, where k = (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 975 kHz in 25 kHz steps.

a……………..Transceiver function: N = normal, 0 = unchanged.

Example message:

$PMRRV29G4M<chksm><CR><LF>

This example command would set the standby VOR frequency to 119.100 MHz. This is interpreted by noting that the ASCII 'G' corresponds with 47h, + 30h = 77h, converted to decimal equals 119 for the MHz portions. The kHz portion converts ASCII '4' to 34h, - 30h yields 4h x 25 kHz steps = 100 kHz.

Note: The COM 2000 will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

SET ACTIVE COMM FREQUENCY AND TRANSCEIVER FUNCTION

This message is used to set the Active COMM frequency as well as he COMM transceiver function.

This message is only available in normal mode.

Message format:

"V" .... Message class. This is a VHF NAV message.
"42" .... Message identifier.
mk .... Active COMM frequency:

  m = desired frequency in MHz in hexadecimal, where m = desired frequency – 30h, with desired frequency in range of 118 to 136MHz, or 162MHz.
  k = desired frequency in kHz, where k = (desired frequency / 25kHz steps.)
  a = Transceiver function: N = normal, 0 = unchanged.

Example message:

$PMRRV42G4N<chksm><CR><LF>

This example command would set the active VOR frequency to 119.100MHz and place the COMM radio in Normal receive mode. This is interpreted by noting that the ASCII 'G' corresponds with 47h, + 30h = 77h, converted to decimal equals 119 for the MHz portion. The KHz portion converts ASCII '4' to 34h, - 30h yields 4h, x 25KHz steps = 100 kHz.

Note: The COM 2000 will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

SET OMNI-BEARING SELECT (OBS) VALUE

This message is used to set the OBS value used by the INS 429 as the elected radial for computing the course deviation from a VOR. This message will have no effect unless the INS 429 is configured to use the internal OBS source, or a serial OBS source.

Message format:

"V" .... Message class. This is a VHF NAV message.
"34" .... Message identifier.
vvv .... OBS Value in degrees, ranging from "000" to "359".

Example message:

```
$PMRRV34310<chksm><CR><LF>
```

Set the OBS value to 310 degrees.

VOLUME AND SQUELCH CONTROL

This message is used to adjust the volume and squelch levels of the COM unit

Message format:

"V" .... Message class - VHF NAV Message
"71" .... Message Identifier
"vs" .... Volume level and Squelch Level:

v = Desired volume level in encoded hexadecimal, where v = desired level + 0x30 with a range between 0 - 20, 0 being muted
s = Desired squelch level in encoded hexadecimal, where s = desired level + 0x30 with a range between 0 - 20, 0 being off

Example Message:

$PMRRV71;?<chksum><CR><LF>

This example command would set the volume level at 11 and the squelch at 15.

MIC GAIN AND SIDETONE CONTROL

This message is used to adjust the volume and squelch levels of the COM unit

Message format:

"V" .... Message class - VHF NAV Message
"72" .... Message Identifier
"ms" .... Volume level and Squelch Level:

m = Desired mic gain level in encoded hexadecimal, where m = desired level + 0x30 with a range between 1 - 20
s = Desired sidetone level in encoded hexadecimal, where s = desired level + 0x30 with a range between 1 - 20.

Example Message:

$PMRRV72;?<chksum><CR><LF>

This example command would set the mic gain level at 11 and the sidetone at 15.

9.6.2   OUTPUT MESSAGES

RESET STATUS

This message is sent to indicate to the host that the INS 429 / COM 2000 is running and ready to accept data on the serial port. It will be sent once upon startup and when requested by the host.

Message format:

"V"………..Message class. This is a VHF NAV message.\
"20"………Message identifier.

Example message:

$PMRRV20<chksm><CR><LF>

INS 429 is running and ready to accept serial input.

CDI, GSI, AND RELATED FLAGS

This message outputs the current values of the CDI, GSI, and their related flags. After power up this message will be output at a 10 Hz rate.

Message format:

"V"..................... Message class. This is a VHF NAV message.
"21"................... Message identifier.
cc....................... CDI deflection. An eight-bit value indicating the amount of deflection of the CDI needle, represented as two encoded hex[3] digits. The CDI deflection is a twos complements signed integer in the range of –100 to 100. –100 indicates full left deflection, 0 indicates no deflection, and 100 indicates full right deflection.
gg .... GSI deflection. An eight-bit value indicating the amount of deflection of the GSI needle, represented as two encoded hex^{XX} digits. The CDI deflection is a twos complement signed integer in the range of –100 to 100. –100 indicates full deflection upwards, 0 indicates no reflection, and 100 indicates full deflection downwards.
ff........................ Flags. Eight bits for HNAV and VNAV related flags, represented as two encoded hex digits.

Bit 1 (1sb)	Back Course enable (1 = enabled)
Bit 2	Localizer detect (1 = using localizer)
Bit 3	FROM flag (1 = From)[4]
Bit 4	TO flag (1 = To)
Bit 5	GSI superflag (1 = valid)
Bit 6	GSI valid (1 = valid)\
Bit 7	NAV superflag (1 = valid)
Bit 8 (msb)	NAV valid (1 = valid)

Example message:

$PMRRV21817??:<chksm><CR><LF>

---

[3] Encoded Hex: each character consists of 4 bits of data placed in the low order nibble +30h. For example, the 8-bit value of 5Fh would be encoded as two characters with values of 35h and 3Fh, which map to the ASCII characters "5" and "?" respectively.

[4] The TO and From flag can not both be 1, indicating that they are both valid. They can both be zero, indicating that neither is valid. This situation will occur whenever the receiver determines that it is within the "cone of confusion" directly over the VOR, or when no signal is being received.

This message indicates a full left CDI deflection (-127), a full up GSI deflection (127), both the GSI and NAV flags/superflags are valid, TO flag set, FROM flag not set, using a localizer, with no back course enable.

DECODED OBS SETTING

This message outputs the current OBS setting, which may be read from an external resolver or from user input to the front panel. After power up this message will be sent at a 10 Hz rate.

Message format:

"V" .... Message class. This is a VHF NAV message.
"22" .... Message identifier.
v .... Valid flag. "0" = OBS invalid/not present, "V" = OBS setting is valid.
ddd .... Three digit OBS setting, in degrees. Values are in the range of "000" to "359".

Example message:

```
$PMRRV22V170<chksm><CR><LF>
```

A valid OBS setting of 170 degrees.

RADIAL FROM ACTIVE VOR

This message outputs the current bearing from the active VOR station. This message will be output even when a localizer is being tracked by the NAV receiver. In this case, the bearing will be marked as invalid. After power up this message will be sent at a 10 Hz rate.

Message format:

"V" .... Message class. This is a VHF NAV message.
"23" .... Message identifier.
v .... Valid flag. "0" = bearing not valid, "V" = bearing is valid.
dddf .... Bearing to a resolution of $1/10^{th}$ of a degree. ddd = three digit bearing in degrees, ranging from "000" to "359". f = $1/10^{th}$ of a degree.

Example message:

```
$PMRRV23V1654<chksm><CR><LF>
```

A valid bearing of 165.4 degrees FROM the active VOR station.

COMMUNICATIONS ERROR

This message is used to indicate a communication error.

Message format:

"V".....................Message class. This is a VHF NAV message.
"27"....................Message identifier.
e..........................Error code: (ASCII)
> "0" = input message checksum error.
> "1" = unknown message.
> "2" = error or mismatch in message data.

Example message:

```
$PMRRV271<chksm><CR><LF>
```

Received an unknown message.

NAV RECEIVER STATUS

This message is used to output the current status of the NAV receiver. It will be output upon request or whenever the status changes.

Message format:

"V".....................Message class. This is a VHF NAV message
"28"....................Message identifier
mk ....Standby NAV frequency: m = MHz, where m + 30h = desired MHz frequency in the range of 108 to 117 MHz. k= (desired frequency / 25 kHz) + 30h, with desired frequency in range of 000 to 975 kHz in 50 kHz steps.
s..........................Status: "N" = Normal mode, "M" = Monitor mode

Example message:

```
$PMRRV28E4?PM<chksm><CR><LF>
```

Active NAV frequency is 117.100 MHz, Standby NAV frequency is 111.800 MHz, receiver is in monitor mode.

NAV MICROCONTROLLER SOFTWARE VERSION

This message is used to output the version string for the NAV microcontroller software.

Message format:

"V".....................Message class. This is a VHF NAV message.
"30"....................Message identifier.
vvvv ....Software version in ASCII
e..........................Engineering version flag:
> "R" = Released version.
> "E" = Engineering version.

Example message:

```
$PMRRV300103E<chksm><CR><LF>
```

NAV Microcontroller software is version 1.03. It is an engineering version.

COM TRANSCEIVER STATUS

This message outputs the result of a specific system test.

Message format:

"V".....................Message class. This is a VHF NAV message.

"35".................... Message identifier.
mk .... Active frequency: m = MHz, where m = desired MHz frequency – 30h, ranging from 118 to 136 MHz, 162 (i.e., 76h to 88h, A2h); k = (kHz offset / 25 kHz) + 30h, ranging from 000 to 975 kHz steps.
mk .... Standby frequency: m = MHz, where m = desired MHz frequency – 30h, ranging from 118 to 136 MHz, 162 (i.e., 76h to 88h, A2h); k = (kHz offset / 25 kHz) + 30h, ranging from 000 to 975 kHz steps.
a........................ Transceiver status:
      R = Normal receive
      T = Transmit enabled
      S = Stuck mic
      F = Comm failure
s........................ Squelch test setting: (ASCII) 0 = automatic; 1 = test

Example message:
$PMRRV35G4LFR0<chksm><LF>

Active frequency is 119.100 MHz, the standby frequency is 124.550 MHz, receiver function, squelch is automatic.

COM SOFTWARE VERSION
This message is used to output the version string for the VHF COM receiver software.

Message format:
"V"..................... Message class. This is a VHF NAV message.
"36".................... Message identifier.
vvvv .... Software version in ASCII

Example message:
$PMRRV300103<chksm><CR><LF>

COM software is version 1.03.

VOLUME AND SQUELCH SETTING
This command is sent anytime there is a change in either the volume or squelch settings, or is requested by using a Request Data Output "24" command.

Message format:
"V" .... Message class - VHF NAV Message
"71" .... Message Identifier
"vs"................. Volume level and Squelch Level:
      v = Desired volume level in encoded hexadecimal, where v = desired level + 0x30 with a range between 0 - 20, 0 being muted
      s = Desired squelch level in encoded hexadecimal, where s = desired level + 0x30 with a range between 0 - 20, 0 being off

Example Message:
$PMRRV71;?<chksum><CR><LF>

This example command shows the volume level at 11 and the squelch at 15.

MIC GAIN AND SIDETONE
This command is sent anytime there is a change in either the volume or squelch settings, or is requested by using a Request Data Output "24" command.

Message format:

"V" .... Message class - VHF NAV Message
"72" .... Message Identifier
"ms" .... Volume level and Squelch Level:

m = mic gain level in encoded hexadecimal, where m = desired level + 0x30
with a range between 1 - 20

s = sidetone level in encoded hexadecimal, where s = desired level + 0x30
with a range between 1 - 20.

Example Message:

$PMRRV72;?<chksum><CR><LF>

This example command shows the mic gain level at 11 and the sidetone at 15.