VAL AVIONICS LTD.

NAV 2KR

REMOTE NAVIGATION RECEIVER

Installation and Operator's Manual

Original Issue
June 2013

P/N 172202

This Page Intentionally
Left Blank

Table of Contents

SECTION I - GENERAL INFORMATION 3
INTRODUCTION 3
SCOPE 3
EQUIPMENT DESCRIPTION 3
SPECIFICATIONS 3
EQUIPMENT SUPPLIED 3
EQUIPMENT REQUIRED BUT NOT SUPPLIED 3
LICENSE REQUIREMENTS 3
SECTION II - INSTALLATION 3
GENERAL INFORMATION 3
Scope 3
UNPACKING AND INSPECTION 3
EQUIPMENT INSTALLATION PROCEDURES 3
Cooling Requirements 3
Mounting Requirements 3
Wire Harness Fabrication 3
NAV 2KR Installation 3
POST-INSTALLATION CHECK 3
Operational Check 3
Final Inspection 3
LIMITATIONS 3
SECTION III - OPERATION 3
GENERAL INFORMATION 3
Scope 3
User Controls 3
System Configuration 3
SECTION IV - WARRANTY AND SERVICE 3
LIMITED WARRANTY 3
SERVICE 3
Appendix A – INSTALLATION DRAWINGS AND CONNECTOR LAYOUT 3
Appendix B – WIRING DIAGRAMS 3
Appendix C – INSTRUCTIONS FOR CONTINUED AIRWORTHINESS 3
MAINTENANCE INSTRUCTIONS 3
Appendix D – RS-232 Instruction Listing 3
Input Commands 3
Output Messages 3
Data Format 3
Default Message Output 3
Message Formats 3
Message Definitions 3

Table 1: Specifications 6
Table 2: Equipment Supplied 7
Table 3: Equipment Not Supplied 7
Table 4: Rear Connector Pin Functions 14
Table 5 - Data Output Requests 20

Figure 1: Physical Dimensions 13
Figure 2: P1 Connector Pin Out 13
Figure 3: NAV 2KR Basic Wiring Diagram 15
Figure 4: NAV 2KR RS-232 Connection 15

SECTION I - GENERAL INFORMATION

1.1 INTRODUCTION

Thank you for purchasing our NAV 2KR Remote Navigation Receiver. Here at Val Avionics Ltd., our core design philosophy is based on ease of installation and use. The NAV 2KR represents a new direction and continued improvement of our product line. The NAV 2KR contains continuing improvements from the INS 429, based on the feedback of customers. The NAV 2KR is a continuation of our remote avionics series, designed with new and exciting features.

The Val Avionics design philosophy translates into the ease of installation and simple operation the makes the NAV 2KR a navigation solution for a wide variety of aircraft panels, from homebuilts through light twins. The NAV 2KR satisfies the need for compact, fully integrated, quality navigational aid that can be counted on to provide years of reliable service.

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

1.2 SCOPE

This manual will provide detailed information about the installation and operation of the NAV 2KR Remote
Navigation Receiver. It will also provide equipment limitation information and instructions for continued airworthiness.

1.3 EQUIPMENT DESCRIPTION

The NAV 2KR has been designed for simplicity. It is straightforward to install and operate. Using state-of-the-art technology, Val Avionics Ltd. has created a navigation receiver that will provide the pilot with simple, easy-to-interpret navigation information for in-route VOR navigation and ILS approaches.

The NAV 2KR also has an enhanced display that features both active and standby frequency displays.

The NAV 2KR has two internal receivers. The VOR/LOC receiver operating from 108.00 MHz to 117.95 MHz and the Glide Slope receiver, which operates from 329.15 MHz to 335.0 MHz.

1.4 SPECIFICATIONS

Table 1: Specifications

SPECIFICATIONS	CHARACTERISTICS
Environmental	RTCA/DO160D
VOR	RTCA/DO-196
Localizer	RTCA/DO-195
Glide slope	RTCA/DO-192
Physical Dimensions:	
Height	1.0 inches (2.54 cm)
Width	6.25 inches (15.88 cm)
Depth	9.0 inches (22.86 cm)
Weight:	3.00 pounds (1.36 kg)
Mounting:	Panel mounted, no shock mounting required
Temperature Range:	-30 to +55 Celsius with short time operations at +70 Celsius
Power Requirements:	
Voltage	10.0 to 30.0 VDC
Current	0.50 Amp @ 14V, 0.30 Amp @ 28V
Receiver:	
VHF Frequency (VOR/LOC)	108.00 to 117.95 MHz
Sensitivity	2 µV to provide 50% Standard Deflection
Channel Spacing (VOR/LOC)	50 KHz
UHF Frequency (Glide slope)	329.15 to 335.0 MHz
Sensitivity	20 µV to provide 50% Standard Deflection
Channel Spacing (Glide slope)	150 KHz
External Outputs:	
Audio Output	10mv into a 600 ohm load
CDI Left/Right	150mV into 1K Load
CDI Up/Down	150mV into 1K Load
CDI Glide slope Flag	250mV into 1K Load
CDI VOR/LOC Flag	250mV into 1K Load

Composite Output	500mV into 1K Load
Manufacturer's Model Number	**NAV 2KR**
Part Number	VPN 0800125-0
FCC ID	EZNNAV2KR

1.5 EQUIPMENT SUPPLIED

Table 2: Equipment Supplied

PART NUMBER	QTY	DESCRIPTION
0800125	1	NAV 2KR NAVIGATION SYSTEM
0651025	1	INSTALLATION KIT

1.6 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Table 3: Equipment Not Supplied

QTY	DESCRIPTION	PART NUMBER
1	Interconnect Wire Harness	VPN 0751020 or field fabricated
1	Headphone Jack	Switchcraft P/N 11 (Ref VPN 550017)
1	Circuit Breaker 2 amp	Potter & Brumsfield W58-2 or equivalant
1	Contact Crimping Tool w/ Positioning Tool	AMP P/N 601966-1 AMP P/N 601699-5

1.7 LICENSE REQUIREMENTS

There are no licensing requirements to operate the NAV 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 NAV 2KR Remote Navigation Receiver. Please read this section completely before proceeding with the installation process. Although the NAV 2KR installation procedures are designed with the do-it-yourself 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 any damage sustained 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 of this manual. 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 NAV 2KR Remote Navigation Receiver. 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 NAV 2KR should be rigidly mounted in the aircraft cabin using appropriately sized aircraft-grade hardware. Suitable surfaces include the firewall, sub-panel, avionics tray, avionics bay or any other flat surfaces that provide adequate structural integrity. 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. Bracing at the rear of the unit should be installed to ensure rigidity in the panel. Consult FAA Advisory Circular 43.13-2B for acceptable practices and techniques

2.3.3 Wire Harness Fabrication

Val Avionics Ltd. recommends that a factory-fabricated wire harness (VPN 0751020) be used for the installation of the NAV 2KR Remote Navigation Receiver. Use of the factory-fabricated wire harness will ensure proper operation of the NAV 2KR, reduction in the occurrence of interfering signals and ground loops and greatly reduced installation time, as well as provide prolonged trouble-free performance of your new equipment. Contact Val Avionics Ltd. or your local avionics distribution center for NAV 2KR Wire Harness ordering information.

Although strongly recommended, the factory-fabricated wire harness is not required to install the NAV 2KR. A wiring harness can be fabricated in the field. Refer to Appendix B of this manual for a complete wiring diagram. The NAV 2KR is connected to the aircraft's avionics bus via a 2 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 43.13-2B for acceptable practices and techniques.

2.3.4 NAV 2KR Installation

2.3.4.1 Mounting

The NAV 2KR is designed to be rigidly mounted within the cockpit. Once a location has been selected, a visual inspection should be made of the area that will be occupied by the NAV 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 the control yoke assembly. It should be moved to the full limit of travel to verify that sufficient clearance exists prior to beginning installation.

2.3.4.2 Antennas

One antenna is required for the NAV 2KR installation. A standard VOR/Localizer/Glide Slope antenna can be used with the unit such as a COMANT CI-157 or equivalent. The most common location for the antenna is on top of the vertical stabilizer. The VOR/localizer/glide slope antenna can be coupled to the unit's NAV-in port directly.

2.3.4.3 Audio

The NAV 2KR has one audio output, navigation audio. Although the audio output levels of the receivers are capable of driving a standard headset directly, it is strongly recommended that these audios be coupled to a quality audio selector panel. For complete details, refer to the interconnect wiring diagrams in Appendix B.

2.4 POST-INSTALLATION CHECK

2.4.1 Operational Check

Refer to Section 3 of this manual. Using calibrated VOR, localizer and glide slope signals, check all functions of the NAV 2KR for proper operation. Check the operational functions of other equipment installed in the aircraft in accordance with the individual manufacturers' 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 FAA Advisory Circular 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 documentation as required.

2.5 LIMITATIONS

There are no known limitations to the operation of the NAV 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 NAV 2KR Remote Navigation Receiver. Please read this section completely to become familiar with all of the features of the unit.

3.1.2 User Controls

As the NAV 2KR does not have any direct user controls, please refer to your controlling device manual for instructions on performing functions.

3.2 System Configuration

As the NAV 2KR does not have any direct controls and is calibrated at the factory, there are no functions for configuration.

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.

The liability of Val Avionics Ltd. 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, or repairs executed by any other than the Val Avionics 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 a one-week turnaround on its warranty and repair service. We recommend that contact be made with the FACTORY CUSTOMER SERVICE DEPARTMENT prior to any unit return and that the RETURN AUTHORIZATION AND INSTRUCTIONS are obtained beforehand. 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).

To ensure proper warranty registration, type or print clearly the application information on the enclosed PRODUCTS WARRANTY REGISTRATION FORM and return to Val Avionics, Ltd.

4.2 SERVICE

Repair service for the NAV 2KR Remote Navigation Receiver 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 Ltd.
2950 Pringle Road SE
Salem, OR 97302

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

Figure 1: Physical Dimensions

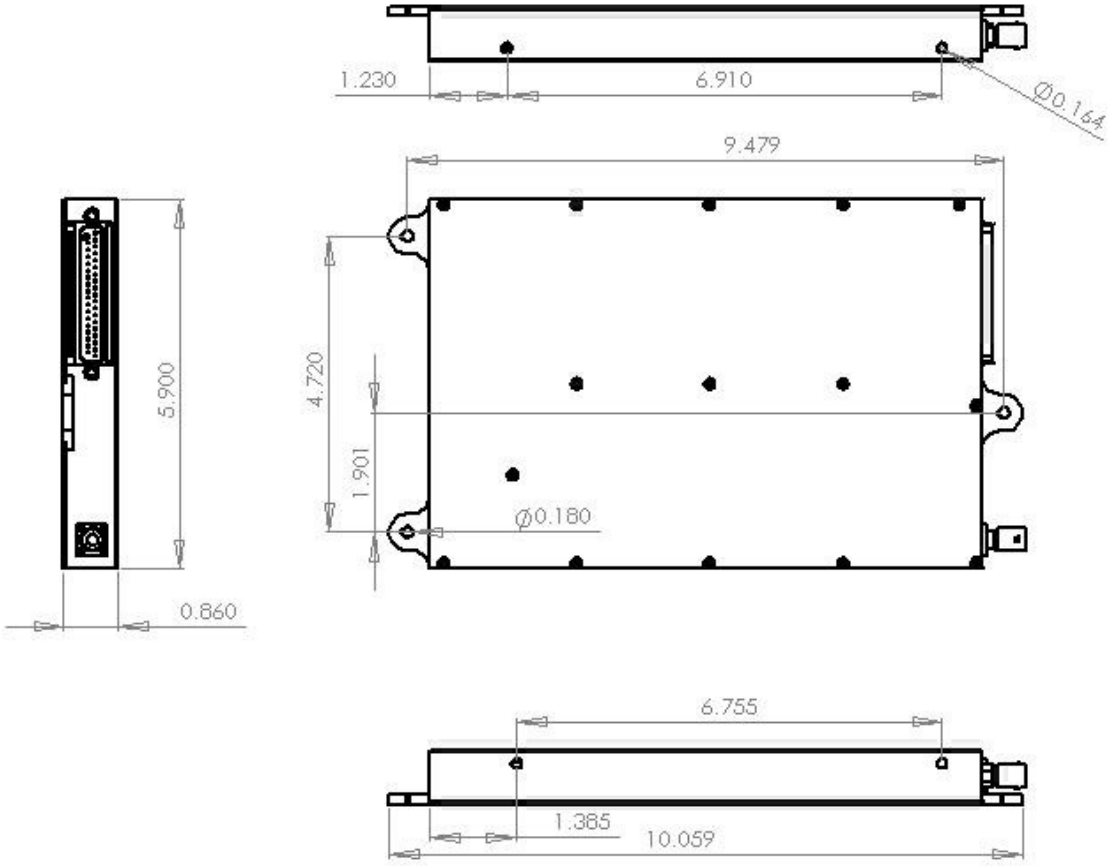


Figure 2: P1 Connector Pin Out

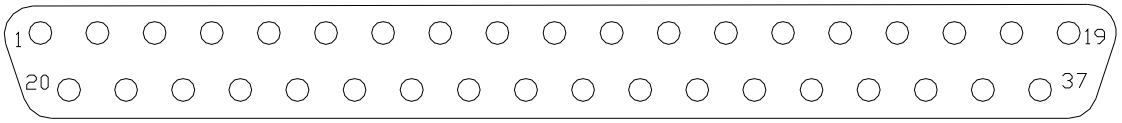


Table 4: Rear Connector Pin Functions

Pin	Functoin	I/O
1	Main Power	Input
2	Airframe Ground	
3	Serial Ground	
4	RS-232 Input	Input
5	RS-232 Output	Output
6	Reserved	
7	OBS_D (COS)	Input
8	Reserved	Input
9	Reserved	
10	CDI +Flag	Output
11	+ From	Output
12	+ To	Output
13	CDI +Right	Output
14	CDI + Left	Output
15	Backcourse	Output
16	OBS_F (SINE)	Input
17	Reserved	
18	Reserved	
19	Composite Output	Output
20	Audio Ground	
21	Reserved	
22	Reserved	
23	Audio Output	Output
24	OBS_H (Reference)	Output
25	OBS_C	Output
26	OBS_E	Input
27	Reserved	
28	VDI +Flag	Output
29	CDI -Flag	Output
30	VDI +Up	Output
31	VDI + Down	Output
32	VDI - Flag	Output
33	ILS Energize	Output
34	OBS_G	Output
35	Reserved	
36	Reserved	
37	Ground (composite)	

6 **Appendix B** – WIRING DIAGRAMS

Figure 3: NAV 2KR Basic Wiring Diagram

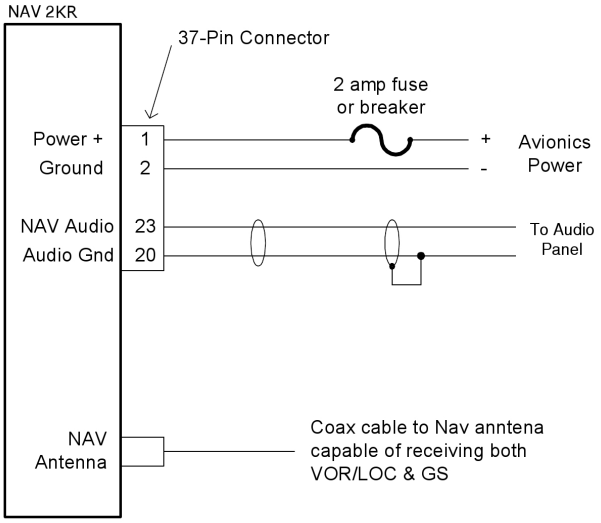
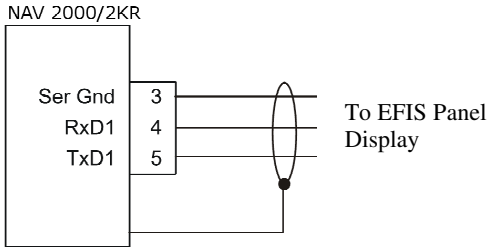


Figure 4: NAV 2KR RS-232 Connection



Notes: 1. Connect cable shields to the mounting frame, pigtails < 1.25 inches.
2. Connect cable shields to the chassis ground at both ends.

This Page Intentionally
Left Blank

7 **Appendix C** – INSTRUCTIONS FOR CONTINUED AIRWORTHINESS

7.1 MAINTENANCE INSTRUCTIONS

Maintenance of the NAV 2KR Remote Navigation Receiver is on condition only. **No periodic maintenance is required**. VOR calibration, in accordance with 14 CFR 91.171, is required to be checked every 30 days. If the unit is found to be out of calibration, send the unit in for service. If the unit is removed for service, upon reinstallation perform the post-installation check as described in Section 2.4 of this manual.

8 Appendix D – RS-232 Instruction Listing

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 to use an external serial resolver such as an EFIS system. The interface format conforms to NMEA 0183 message format specifications.

8.1 Input Commands

The following input command messages are supported:

- Input VOR frequency data from a remote source
- Input Localizer frequency data from a remote source
- Request data output
- Set active VOR/LOC frequency data from a remote source
- Set standby VOR/LOC frequency data from a remote source
- Set Omni-Bering Select (OBS) value from remote source

8.2 Output Messages

The NAV 2KR output messages include:

- Reset status
- CDI, GSI and flags
- Decoded OBS setting
- Radial from active VOR
- Communications Error
- NAV Receiver status
- NAV audio mode
- NAV microcontroller software version

8.3 Data Format

The data format for serial communication is:

- Baud rate 9600
- Data bits 8
- Stop bits 1
- Parity none

8.4 Default Message Output

At system start when the NAV 2KR is configured to operate in normal mode, the following messages will be configured for output and the specified rates:

- CDI, VDI and Flags at 10 Hz (high rate)
- Decoded OBS Setting at 10 Hz (high rate)
- Radial from Active VOR at 10 Hz (high rate)
- NAV Receiver status at 1 Hz (low rate)

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

8.5 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 COM 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 NAV 2KR to accept COM 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 VAL COM 2000 VHF Transceiver, the INS 429 Integrated Navigation System and the COM 2KR Remote VHF Transceiver. The NAV 2KR will be able to accept all messages intended for a COM 2000 without generating a serial communications error. It will ignore all of those messages.

[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.

8.6 Message Definitions

Input Messages

REQUEST DATA OUTPUT

This input is used to request an output message to be sent by the NAV 2KR.

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"	COM Transceiver Status	"00"		"0"
"36"	COM Software Version	"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.

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 NAV 2KR 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.

[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.

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 NAV 2KR 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 NAV 2KR 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 NAV 2KR will check input frequencies for validity. An RS-232 serial message output will be generated if the frequency is invalid.

SET STANDBY COM 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 NAV 2KR will check input frequencies for validity. An RS-232 serial error message output will be generated if the frequency is invalid.

SET ACTIVE COM FREQUENCY AND TRANSCEIVER FUNCTION

This message is used to set the active COM frequency as well as the COM 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 COM 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 NAV 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 NAV 2KR 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 NAV 2KR as the elected radial for computing the course deviation from a VOR. This message will have no effect unless the NAV 2KR 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.

OUTPUT MESSAGES

RESET STATUS

This message is sent to indicate to the host that the NAV 2KR 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>
```

NAV 2KR 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:

[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 cannot 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.

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

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 = COM 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.