Nucleus® Paging Station

Series: Wireless Messaging System

System Version: 1.06

Installation and Operation

Issue Date: December 1997

6881002F05-O

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Foreword

General Information

The information in this manual has been reviewed for accuracy. However, no responsibility is assumed for inaccuracies. Motorola® reserves the right to make changes to any products discussed herein. The information in this document is subject to change without notice. Motorola assumes no liability for hardware or software damage or loss of data because of errors or omissions in this manual. Motorola does not assume any liability arising from the application or use of any products or circuits described herein. Neither does Motorola convey any license under its patents or right of others.

Refer questions concerning the contents of this manual or requests for related circuit board information to the following location:

Motorola, Inc.
Paging Systems Group
Multimedia Publications Department
5401 North Beach St., MS E230-A
Fort Worth, TX 76137-2794

or telephone: **(817) 245-2823**

To access on-line electronic information (BBS) for service notices and the latest software releases, call the Paging One-Call-Support™ Center. To request additional manuals or parts, please contact the Motorola Americas Parts Division:

telephone: **(800) 422-4210**
facsimile: **(847) 538-8198**

To request a part number, contact the Parts Identification Group:

telephone: **(847) 538-0021**

For Motorola Infrastructure and communicator test equipment, contact the Motorola Test Equipment Center:

telephone: **(800) 505-8378**

Global Service Organization

Motorola provides Infrastructure and communicator technical support through authorized or company-owned Service Centers. Motorola also provides service for communicators on a contract basis. For contract service information, please contact your local Motorola representative or the Paging One-Call-Support Center:

Motorola, Inc.
Paging One-Call-Support Center
5401 North Beach St., MS E112
Fort Worth, TX 76137-2794

telephone: **(800) 520-7243** or
(817) 245-4663
facsimile: **(817) 245-2141**

Service Training

Motorola, through its Advanced Messaging Technical Training Group in Fort Worth, Texas, offers courses on communicators, messaging switches, transmitters, and receivers. These courses are taught on the site or at a customer's location.

Students learn to install, configure, and maintain Motorola messaging systems. The classrooms at Motorola are equipped to ensure hands-on experience in practical lab exercises.

Training courses range from a basic introduction to communicators and messaging systems to customized classes on specific systems and large system applications.

To obtain a course catalog or scheduling information, please call (817) 245-2184 or (800) 724-3588 and ask for the training coordinator.

Computer Software Copyrights

Trademarks

Motorola, the Motorola logo, and Nucleus, Reg. U.S. Pat. and TM. Off, Motorola, Inc.

FLEX, Paging One-Call-Support, RF-Baton!, and RF-B! are trademarks of Motorola, Inc.

Trademarks contained herein are the acknowledged property of their respective owners.

Important Safety Information

The installation, maintenance, and / or operation of this equipment may present potentially unsafe conditions, including, but not limited to, electrical shock, improper voltage to components, and improper operation that can cause personal injury, death or damage to property.

Read Instructions: Read all the safety instructions before operating the equipment. Retain these safety instructions for future reference. Specialized procedures and instructions are required and must be followed. Also, all applicable safety procedures, such as Occupational, Safety, and Health Administration (OSHA) requirements, National Electric Code Requirements, local code requirements, safe working practices, and good judgement must be used by personnel.

Heed Admonitions: Adhere to all warnings on the equipment and in the operating instructions. Follow all operating and use instructions. Two safety admonitions are used in this instruction manual to indicate:

- Equipment damage–

CAUTION

This safety admonition applies to an operating or maintenance procedure, practice or condition which, if not strictly observed, could result in damage to the equipment or database.

- Personal injury or injury that may result in death–

DANGER

This safety admonition applies to an operating or maintenance procedure, practice or condition which, if not strictly observed, could result in serious personal injury or death.

Mounting: Mount the equipment only as recommended by the manufacturer. Situate the equipment away from heat sources such as radiators, heat registers, stoves, or other equipment (including amplifiers) that produces heat.

Power Sources and Grounding: Connect the equipment to the type of power source described in the installation instructions or as marked on the equipment. Take precautions to avoid defeating the grounding or polarization provisions of the equipment. Disconnect the power to the equipment by a circuit breaker when left unused for long periods of time.

Cleaning: Clean the outside of the equipment by using only a damp cloth. Do not immerse the equipment in any type of liquid, including water. Do not use liquid cleaners or aerosol cleaners. Dirt or other foreign matter should not be allowed to accumulate in the interior of the enclosure.

Damage Requiring Service: Do not attempt to perform service functions that are not described in the operating instructions. All other servicing should be referred to qualified service personnel.

Telephone Line Installation: All telephone line connections to the equipment should be accomplished with the telephone lines disconnected from the network interface.

Motorola is not responsible for static damage to equipment not sold under the Motorola logo.

PSG Limited Equipment Warranty for Non-U.S. and Non-Canadian Markets

General Terms

1. Motorola Paging Systems Group (PSG) manufactured infrastructure equipment is warranted to be free from defects in material and workmanship to the original purchaser only as set forth herein.

2. This Warranty covers only that equipment identified in paragraph 1 that is used in the manner and for the purpose intended.

3. This Warranty specifically excludes any and all software products from any source. PSG software products are the subject of the PSG Software Maintenance Program, addressed separately.

4. This Warranty shall commence 30 days after the date of shipment of the PSG infrastructure equipment.

5. The term of Warranty for all PSG infrastructure equipment is one (1) year parts and labor.

Limitations And Qualifications of Warranty

6. LIMITATION—THE REMEDY UNDER THIS WARRANTY IS LIMITED TO MOTOROLA'S REPAIR OR REPLACEMENT OF DEFECTIVE EQUIPMENT. THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OR CONDITIONS, EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

7. This Warranty does not cover, nor include a remedy for, damages, defects or failure caused by:

   a. The equipment or any part of it NOT having been installed, modified, adapted, repaired, maintained, transported or relocated in accordance with Motorola technical specifications and instructions;

b. Storage not conforming to the Shipping, Receiving, and Installation section of the applicable Motorola Equipment Manual;

c. Environmental characteristics not conforming to the applicable Motorola Equipment Manual;

d. Nonconformance with the Equipment Operating Instructions in the applicable Motorola Equipment Manual;

e. External causes including, without limitation, use in conjunction with incompatible equipment, unless such use was with or under Motorola's prior written consent;

f. Cosmetic damages;

g. Damages caused by external electrical stress;

h. Lightning;

i. Accidental damage;

j. Negligence, neglect, mishandling, abuse, or misuse;

k. Force Majeure; and

l. Damage caused by Shipper(s).

Return of Equipment

8. If an item of PSG infrastructure equipment malfunctions or fails in normal use within the Warranty Period:

   a. The Customer shall promptly notify the nearest Motorola Area Customer Care Center (CCC) of the problem and provide the serial number of the defective item. Motorola shall then, at its option, either resolve the problem over the telephone or issue a Return Authorization Number to the Customer. The Customer shall, at its cost, ship the item to the Motorola Area CCC location designated at the time the Return Authorization Number is issued;

   b. The Return Authorization Number must be shown on the label attached to each returned item. A description of the fault must accompany each returned item. The returned item must be properly packed, and the insurance and shipping charges prepaid;

   c. Motorola shall either repair or replace the returned item. The replacement item may be new or refurbished. When refurbished, it shall be equivalent to new in operation. When a returned item is replaced by Motorola, the returned item shall become the property of Motorola;

d. Subject to all the terms of this Warranty, part availability and the clearance of Customs, Motorola shall complete the repair or exchange of Motorola-manufactured equipment returned under Warranty within fifteen (15) working days of receipt of the equipment;

e. Motorola shall, at its cost, ship the repaired or replaced item to the Customer. If the Customer has requested Express Shipping, the Customer shall pay Motorola an expedite fee; and

f. Equipment which is repaired or replaced by Motorola shall be free of defects in material and workmanship for the remainder of the original Warranty, or for 90 days from the date of repair or replacement, whichever is longer. All other terms of this Warranty shall apply to such repairs or replacements.

Advance Replacements

9. During the Warranty Period:

a. At the Customer's request and for the Customer's convenience, Motorola may supply the Customer with Advance Replacement Parts (parts furnished in advance of Motorola's receipt of defective items). Motorola's provision of such parts will be contingent on part availability and on the Customer's maintaining a satisfactory credit standing with Motorola.

b. Motorola shall ship the Advance Replacement Parts requested by the Customer within 48 hours of Motorola determining that such service is appropriate, if stock is available at the Motorola service location. If stock is not available, Motorola will make reasonable efforts to locate and provide it to the Customer within ten (10) working days.

c. The Customer shall return defective items to the Motorola Area Customer Care Center within thirty (30) days from the date of shipment of the Advance Replacement Parts; failing which, Motorola shall bill and the Customer shall pay the full current list price of the Advance Replacement Parts.

10. To secure payment of the list price of Advance Replacement Parts if the defective items are not returned to Motorola, the Customer hereby grants to Motorola a purchase money security interest in any Advance Replacement Parts.

Excluded Equipment

11. The following equipment is excluded from this Warranty and is covered instead by the Original Equipment Manufacturer's Warranty:

    a. Equipment which is not an integral part of a basic system configuration and which is not manufactured by Motorola, such as batteries and satellite dish LNBs;

    b. Peripheral equipment such as printers, modems, data loggers, video display terminals, and lightning and surge protectors; and

    c. Equipment which is not listed in Motorola's Price Book.

Force Majeure

12. Motorola shall not be responsible for failure to discharge its obligations under this Warranty due to delays by suppliers, material shortages; strikes, lockouts or other labor disputes; disturbances, government regulations, floods, lightning, fires, wars, accidents, acts of God, and any other causes beyond Motorola's reasonable control.

Default and Termination

13. Motorola shall have the right to immediately terminate this Warranty, and to suspend its performance under this Warranty, upon notification to the Customer if the Customer:

    a. Assigns or transfers the Customer's rights or obligations under this Warranty without the prior written consent of Motorola; or

    b. Within thirty (30) days of written demand by Motorola, fails to pay (1) any charge for Advance Replacement Parts supplied under this Warranty, if the Customer has not timely returned the defective items, or (2) any other amount that may be due.

14. Notwithstanding any such termination of the Warranty to the Customer, the Customer shall remain responsible for all amounts then due.

Limitation of Liability

15. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR ANY INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THIS WARRANTY, EVEN IF MOTOROLA HAS BEEN ADVISED OF THE POSSIBILITY THEREOF, INCLUDING, WITHOUT LIMITATION, LOST PROFITS AND REVENUES, FAILURE TO REALIZE EXPECTED SAVINGS, LOST DATA OR ANY CLAIMS AGAINST THE CUSTOMER BY A THIRD PARTY.

Contents

Figures

Tables

Introduction

This chapter briefly describes the contents of the manual, section by section, and includes the specifications for the Nucleus paging station and the Nucleus paging station with Advanced Control (NAC). This chapter contains the following information:

About this Manual

This section describes the intended audience for this manual, and lists the contents of the chapters and appendices in this manual.

Audience

This manual is intended for installers and configuration technicians who install and operate Nucleus and NAC paging stations.

Contents

This manual contains the following chapters and appendices:

- Chapter 2 describes the operation of the station briefly.
- Chapter 3 describes the basic requirements for a Nucleus paging station site. These requirements include power, ground, and antenna installation.
- Chapter 4 describes mechanical installation, including unpacking, drilling anchor holes in a concrete floor, and bolting Nucleus and NAC paging stations to the floor.
- Chapter 5 describes the backplane interfaces and the internal interfaces for special uses, such as alignment.
- Chapter 6 describes the front panels on the Nucleus and NAC paging stations, including use of the keypad, and interpreting the light emitting diodes (LEDs).
- Chapter 7 describes basic keypad procedures for the control panel. This chapter also describes the LEDs for the Exciter and the power supplies.
- Chapter 8 describes configuration for Nucleus paging stations.
- Chapter 9 describes status, alarms, troubleshooting, and alignment for the Nucleus paging station. These procedures align 2-level and 4-level output from the Nucleus paging station.
- Chapter 10 describesconfiguration for NAC paging stations.
- Chapter 11 describes alignment procedures for the NAC paging stations.
- Chapter 12 describes NAC alarm configuration and reporting.
- Chapter 13 describes module replacement procedures for modules in the Nucleus and NAC paging stations.
- Appendix A contains a list of acronyms and abbreviations used in this manual.
- Appendix B contains a configuration record for a Nucleus paging station and NAC paging station.
- Appendix C describes the internal Network Interface Unit (NIU) in sufficient detail to configure it during system installation.
- Appendix D describes the RF-Baton!™ (RF-B!) in sufficient detail to connect it during system installation.
- Appendix E describes the receivers used in the Nucleus paging station.

- Appendix F describes installation and repair of a Global Positioning System (GPS) antenna and GPS receiver.

Software Versions Supported

This section describes software compatibility in the Nucleus paging station or Nucleus paging station with Advanced Control (NAC). Each station contains four software entities:

- Station Control Module (SCM) or NAC application software
- Exciter electronically programmable read only memory (EPROM)
- Boot read only memory (ROM)
- Network Interface Unit (when used as a transmitter controller)

Boot software resides in the program single in-line memory module (SIMM). The program in SIMM corresponds to SCM or NAC software release. An upgrade from version 1.xxx to 2.xxx or 3.xxx software requires a new SCM board and does not cause a compatibility problem with the SIMM. Motorola always ships the correct version of the boot software with the SCM application version of the software.

Nucleus Software Compatibility

This manual supports the following software versions for the Nucleus paging station:

- Programmed Single In-line Memory Module (SIMM)–01V0880B061FXX
- SCM application version–3.320
- Boot version–2.000
- Exciter PROM–5170401CXX
- Exciter–7.110
- Release Date–4/08/97

Motorola tracks compatibility for Nucleus software and makes software updates as required (see Table 1-1, where C = compatible, X = incompatible, and a number references a note for the table).

Note: If the exciter accepts software download, the downloaded software is always the latest version, and compatibility is not an issue.

Exciter version 3.100 is only compatible with SCM version 1.520 and SCM version 1.550

Exciter version 4.050 is only compatible with SCM version 1.560.

All SCM and Exciter releases are backward compatible in a simulcast area with other releases of Nucleus software in other transmitters in the same area.

Table 1-1: Nucleus Software Compatibility Matrix

SCM Application SW Version	Boot ROM Version	Exciter EPROM 4.120	4.123	5.010	6.020	6.200	6.400	6.600	6.630	7.030	7.110
1.600	1.400	C	C	C	C	C	C	C	C	C	C
1.710	1.400	C[1]	C	C	C	C	C	C	C	C	C
2.340	2.000	C[1, 2]	C[1, 2]	C	X	X	X	X	X	X	X
2.410	2.000	C[1, 2, 3]	C[1, 2, 3]	C[2, 3]	C	C	C	C	C	C	C
2.600	2.000	C[1, 2, 3, 4]	C[2, 3, 4]	C[3, 4]	C[4]	C	C	C	C	C	C
2.700	2.000	C[1, 2, 3, 4, 5]	C[2, 3, 4, 5]	C[3, 4, 5]	C[4, 5]	C[5]	C	C	C	C	C
2.900	2.000	C[1, 2, 3, 4, 5, 6]	C[2, 3, 4, 5, 6]	C[3, 4, 5, 6]	C[4, 5, 6]	C[5, 6]	C[6]	C	C	C	C
2.910	2.000	C[1, 2, 3, 4, 5, 6]	C[2, 3, 4, 5, 6]	C[3, 4, 5, 6]	C[4, 5, 6]	C[5, 6]	C[6]	C	C	C	C
2.920	2.000	C[1, 2, 3, 4, 5, 6, 7]	C[2, 3, 4, 5, 6, 7]	C[3, 4, 5, 6, 7]	C[4, 5, 6, 7]	C[5, 6, 7]	C[6, 7]	C[7]	C	C	C
3.100	2.000	C[1, 2, 3, 4, 5, 6, 7]	C[2, 3, 4, 5, 6, 7]	C[3, 4, 5, 6, 7]	C[4, 5, 6, 7]	C[5, 6, 7]	C[6, 7]	C[7]	C[7]	C	C
3.210	2.000	C[1, 2, 3, 4, 5, 6, 7, 8]	C[2, 3, 4, 5, 6, 7, 8]	C[3, 4, 5, 6, 7, 8]	C[4, 5, 6, 7, 8]	C[5, 6, 7, 8]	C[6, 7, 8]	C[7,8]	C[7, 8]	C	C
3.320	2.000	C[1, 2, 3, 4, 5, 6, 7, 8, 9, 10]	C[2, 3, 4, 5, 6, 7, 8, 9, 10]	C[3, 4, 5, 6, 7, 8, 9, 10]	C[4, 5, 6, 7, 8, 9, 10]	C[5, 6, 7, 8, 9, 10]	C[6, 7, 8, 9, 10]	C[7,8, 9, 10]	C[7, 8, 9, 10]	C[9, 10]	C

1. This release does not support the 900 MHz power amplifier (PA).
2. This release supports 2-level modulation only. This release does not support exciter software download.
3. This release does not support channel-mapped power. This release does not support the 25 W and 350 W VHF PA.
4. This release does not support the 350 W VHF R1 and R2 features.
5. This release does not support 280 MHz.
6. This release does not support UHF.
7. This release does not support the complete low forward power feature.
8. This release does not support the antenna relay improvement. This release does not support the station dekeyed software fix.
9. This release does not support the 250 W 900 MHz PA with internal triple circulator.
10. This release does not support the high forward power alarm and the PA alignment alarm.

NAC Software Compatibility

This manual supports the following software versions in the NAC:

- Programmed SIMM–5170408B01
- NAC main processor EPROM application version–3.120

- NAC secondary processor EPROM application version–3.010
- Boot version–2.000
- Exciter PROM–5170401CXX
- Exciter–7.110
- Release Date–10/07/96

Motorola tracks compatibility for Nucleus software and makes software updates as required (see Table 1-1, where C = compatible, X = incompatible, and a number references a note for the table).

Table 1-2: NAC Software Compatibility Matrix

SCM Application SW Version	Exciter EPROM 5.010	6.020	6.2000	6.4000	6.6000	7.030
1.100	C[1]	C	C	C	C	C
1.110	C[1]	C	C	C	C	C
1.200	C[1, 2, 3]	C[2, 3]	C[3]	C	C	C
1.210	C[1, 2, 3]	C[2, 3]	C[3]	C	C	C
1.220	C[1, 2, 3]	C[2, 3]	C[3]	C	C	C
2.000	C[1, 2, 3]	C[2, 3]	C[3]	C	C	C
2.001	C[1, 2, 3]	C[2, 3]	C[3]	C	C	C
2.120	C[1, 2, 3, 4]	C[2, 3, 4]	C[3, 4]	C[4]	C	C
2.121	C[1, 2, 3, 4]	C[2, 3, 4]	C[3, 4]	C[4]	C	C
2.130	C[1, 2, 3, 4]	C[2, 3, 4]	C[3, 4]	C[4]	C	C
3.000	C[1, 2, 3, 4, 5]	C[2, 3, 4, 5]	C[3, 4, 5]	C[4, 5]	C[5]	C
3.120	C[1, 2, 3, 4, 5]	C[2, 3, 4, 5]	C[3, 4, 5]	C[4, 5]	C[5]	C

1. This release does not support the 25 W VHF PA or the 350 W VHF R3 PA.
2. This release does not support the VHF R1 350 W PA or the VHF R2 PA.
3. This release does not support 280 MHz.
4. This release does not support UHF R2.
5. This release does not support the software fix for spurious power cutback.

Related Publications

For further information, see the following publications:

- *RF-Baton!™ Transmitter Controller Installation and Operation Guide*, 6880497G05
- *C-NET External Network Interface Unit (NIU) Installation and Operation Guide*, 6880451F10.
- *External NIU Installation*, 6880497G10

Specifications

This section describes the Motorola Nucleus paging station specifications. The tables in this section describe the product in terms of dimensions, frequency, and power requirements. All specifications conform to TIA / EIA-603 test standards and are guaranteed at +25˚C. Specifications are subject to change without notice. The specifications are:

- Unit sizes (see Table 1-3).
- Cabinet capacity (see Table 1-4).
- Power consumption (see Table 1-5).
- Transmitter performance specifications (see Table 1-6).
- Internal link and monitor receiver specifications (see Table 1-7).

Table 1-3: Unit Sizes (Sheet 1 of 2)

Frequency (MHz)	Power Output (W)	New Model Number (Old Model Number)	Dimensions (Track and Mount) (H x W x D)	Weight
132–154 (VHF)	125 W (variable to 20 W)	PT1148A standard power (T5481 with X195AA)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
132–154 (VHF)	25 W (variable to 5 W)	PT1146A standard power (T5481 with X330AC)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
144–160 (VHF)	350 W (variable to 100 W)	PT1150A[1] high power (T5482 with X830AD)	14 x 19 x 20 in. 35 x 48 x 51 cm	105 lb 48 kg
150–174 (VHF)	125 W (variable to 20 W)	PT1149A standard power (X5481 with X195AB)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
150–174 (VHF)	25 W (variable to 5 W)	PT1147A standard power (T5481 with X330AC)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
158–174 (VHF)	350 W (variable to 100 W)	PT1151A[1] high power (T5482 with X830AE)	14 x 19 x 20 in. 35 x 48 x 51 cm	105 lb 48 kg
276–284	125 W (variable to 20 W)	PT1142A standard power (T5481 with X213AA)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
276–284	300 W (variable to 100 W)	PT1143A[1] high power (T5482 with X214AA)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lb 48 kg
438–470 (UHF)	100 W (variable to 25 W)	PT1158A standard power (T5481 with X640AH)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
927–941	100 W (variable to 20 W)	PT1161A standard power (T5481 with X660AB)	8.75 x 19 x 20 in. 23 x 48 x 51 cm	60 lb 27 kg
927–941	300 W (variable to 100 W)[2]	PT1104[1] high power (T5482 x/X201AA)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lb 48 kg
927–941	250 W[2]	PT1105 high power with triple circulator (PT1104 with X677)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lb 48 kg

Table 1-3: Unit Sizes (Sheet 2 of 2)

Frequency (MHz)	Power Output (W)	New Model Number (Old Model Number)	Dimensions (Track and Mount) (H x W x D)	Weight
927–941	300 W (variable to 100 W)[2]	PT1173[1] high power (42–72 Vdc power supply)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lb 48 kg
927–941	300 W (variable to 100 W)[2]	PT1174[1] high power (23–34 Vdc)	14 x 19 x 20 in. 36 x 48 x 51 cm	105 lb 48 kg

1. Not available in the Peoples Republic of China.
2. Measured at output of Power Amplifier (PA) cable.

Table 1-4: Cabinet Capacity

Cabinet Options	Cabinet Dimensions (H x W x D)	Cabinet Weight	Maximum Number of Stations
X92	25 x 22 x 21.25 in. 64 x 56 x 54 cm	59 lb. 27 kg	Two 8.75 in. standard power models One 14 in. high power model
X308	46 x 22 x 21.25 in. 117 x 56 x 54 cm	125 lb. 57 kg	Four 8.75 in. standard power models Two 14 in. high power models
C307 (indoor)	70 x 23.8 x 21.5 in. 178 x 60 x 55 cm	200 lb. 91 kg	Five 8.75 in. standard power models Three 14 in. high power models

Table 1-5: Power Consumption

Frequency (MHz)	Standard or High Power	Operating State	AC Power (120 V, 60 Hz)	AC with Battery Revert (24 Vdc)	DC Power (± 48/60 Vdc)
132–154	Standard	Transmit Standby	472 W 66 W	422 W 66 W	525 W 77 W
150–174	Standard	Transmit Standby	472 W 66 W	422 W 66 W	525 W 77 W
144–160	High	Transmit Standby	1180 W 133 W	NA	1270 W 85 W
158–174	High	Transmit Standby	1180 W 133 W	NA	1270 W 85 W
276–284	Standard	Transmit Standby	540 W 66 W	500 W 66 W	515 W 77 W
276–284	High	Transmit Standby	1245 W 133 W	NA	1200 W 89 W
438–470	Standard	Transmit Standby	593 W 66 W	550 W 66 W	605 W 77 W
927–941	Standard	Transmit Standby	593 W 66 W	550 W 66 W	605 W 77 W
927–941	High	Transmit Standby	1546 W 133 W	NA	1422 W 89 W

Table 1-6: Transmitter Performance Specifications (Sheet 1 of 2)

Specification	Requirement	Performance Capability
Input Power	Power supply type	Switching
	AC voltage	90–280 Vac, line-sensing
	AC frequency	47–63 Hz, line-sensing
	AC battery revert	24 Vdc
	DC power	±24 Vdc (21–34.5 Vdc, 40 A max.), or ±48/60 Vdc (41–72 Vdc, 18 A max.)
Transmit Frequency (Varies with Power)	Frequency generation	Synthesized, no multiplier stages
	Channel spacing	25 kHz standard or 12.5 kHz for special applications
	Multiple channel capability	8 [with synchronous local control (SyLC)]
	Conducted spurious and harmonic emissions	Better than -80 dBc
	Adjacent channel noise	Better than -70 dBc
	Frequency deviation (2-level)	±5000 Hz, programmable in 1 Hz steps
	Frequency deviation (4-level)	Per FLEX specifications
	Frequency offsets	±5000 Hz, programmable in 1 Hz steps
	Stability for UHSO	±0.005 ppm -30˚C to +60˚C ambient
	Stability for HSO	±0.03 ppm -30˚C to +60˚C ambient
	Stability for nonsimulcast station	±1 ppm -30˚C to +60˚C ambient
	External reference	Consult Motorola Systems Engineering
	C-NET reference stability	± 0.0015 ppm -30˚C to +60˚C ambient[1]
FM Hum and Noise	VHF FM hum and noise	300–3000 Hz bandwidth (audio) = -50 dB
	280 MHz FM hum and noise	300–3000 Hz bandwidth = -50 dB
	UHF FM hum and noise	300–3000 Hz bandwidth = -45 dB
	900 MHz FM hum and noise	300–3000 Hz bandwidth = -45 dB
	20 dB isolation	Standard single circulator
	40 dB isolation	Option X677 (double circulator) adds single circulator (not available with PT1105)
	60 dB isolation	Option X676 (triple circulator) adds double circulator (900 MHz only, not available with PT1105)

Table 1-6: Transmitter Performance Specifications (Sheet 2 of 2)

Specification	Requirement	Performance Capability
Transmitter Modulation	Message signaling	2-level and/or 4-level binary FSK-NRZ FLEX codes[1]
	Modulator	DSP-based
	Maximum paging data rates	2-level: 2400 or 3200 bps 4-level: 6400 bps
	Modulation rise time	2-level: 88/140/250 µs selectable 4-level (and 2-level 3200 bps FLEX): 88 µs fixed
	FCC emissions designators	16KOF1D
Transmitter Output Power	Power output	Continuous duty and selectable by front panel on a per-channel basis
	Antenna connector	N-type (50 ohms output impedance)
Control	Remote system control	Motorola Network Control (RF-Conductor!™ controller or C-NET Control Point)
Environmental Requirements	Operating temperature	-30˚C to +60˚C (-22˚F to +140˚F) full power +45˚C to +60˚C (1–3 dB reduced, model dependent)
	Operating humidity	0% to 95% relative at 50˚C

1. Not available for Nucleus with Advanced Control (NAC).

Table 1-7: Internal Link and Monitor Receiver Specifications (Sheet 1 of 2)

Requirement	Midband	VHF	280 MHz	UHF	900 MHz
Frequency (MHz)	72–76	132–154 150–174	276–284	403–433 438–470 470–494 494–520	922–941 941–962
Link Option	X209	X333	-----	X334	X336
Monitor Option	-----	X662	X01	X632	X630
Channel Spacing	20 kHz	25 kHz	25 kHz	25 kHz	12.5/25 kHz
Frequency Stability	See transmitter specifications				
Signal Displacement Bandwidth	±2 kHz minimum				
Sensitivity (12 dB SINAD)	0.35 µV	0.25 µV	0.35 µV	0.35 µV	0.35 µV
Sensitivity (20 dB Quieting)	0.50 µV	0.35 µV	0.50 µV	0.50 µV	0.50 µV
Adjacent Channel Rejection	80 dB	85 dB	80 dB	85 dB	70/75 dB
Intermodulation	85 dB	85 dB	80 dB	85 dB	80 dB
Spurious and Image Rejection	95 dB	95 dB	90 dB	95 dB	95 dB

Table 1-7: Internal Link and Monitor Receiver Specifications (Sheet 2 of 2)

Requirement	Midband	VHF	280 MHz	UHF	900 MHz
Audio Response	Front panel switchable: flat or EIA de-emphasis				
Flat Ratio	DC -3000 Hz ±1 dB[1]				
Audio Out Level	-5 dBm (±2 dB) single-ended)				
Line Audio Level	Adjustable -30 to +11 dBm at 600 ohms (with optional wireline module)				
FM Hum and Noise	-50 dB[1]	-50 dB[1]	-45 dB[1]	-50 dB[1]	-50 dB[1]

1. Measured at the Link Rx Audio signal or the Monitor Rx Audio signal, referenced to 1 kHz.

Options and Field Replaceable Units (FRUs)

This section lists the options and FRUs for the Nucleus paging station (see Table 1-8 and Table 1-9).

Table 1-8: Option Numbers and Descriptions (Sheet 1 of 2)

Option Category	Option Number	Description
Power Supply	X115	625 W AC power supply (90–280 Vac, 47–63 Hz)
	X30	625 W AC power supply with battery revert (high power station: control only)
	X43	625 W AC power supply with battery revert (station power, does not include battery)
	X342	625 W DC power supply (input Voltage 21–34.5 Vdc)
	X561	625 W DC power supply (input Voltage 41–72 Vdc)
Control	X151	SCM
	X621	External control (SCM with Wildcard Interface Board)
	X579	Simulcast NAC
	X644	Non-simulcast NAC
Reference Module and Frequency Stability	X576	Reference module with GPS receiver
	X206	Reference module with UHSO (5 ppb)
	X208	Reference module with HSO (30 ppb)
	X212	External frequency stability (no reference module)
Cabinet	X92	25 in. cabinet
	X308	46 in. cabinet
	C307	70 in. cabinet
	X362	Packing kit for station without cabinet
Accessories	X371	Antenna relay
	X676	Triple circulator (add two circulators, not available for PT1104)
	X677	Double circulator (add one circulator, not available for PT1105)
Link Receivers	X209	link receiver midband
	X333	Link receiver VHF 72–76 MHz (specify band)
	X334	Link receiver UHF 403–520 MHz (specify band)
	X336	Link receiver 900 MHz 922–960 MHz (specify band)

Table 1-8: Option Numbers and Descriptions (Sheet 2 of 2)

Option Category	Option Number	Description
Monitor Receivers	X662	Monitor receiver VHF 132–174 MHz (specify band)
	X632	Monitor receiver UHF 438–470 MHz (specify band)
	X630	Monitor receiver 900 MHz 927–931 MHz (specify band)
	X01	Monitor receiver 280 MHz 276–288 MHz (specify band)

Table 1-9: FRU Numbers (Sheet 1 of 2)

FRU Type	Model Number	Option Number	Description
Power Amplifier Decks (include PA and Front Panel with Fans)	TTD1811	X195AA	125 W VHF Range 1: 132–154 MHz
	TTD1812	X195AB	125 VHF Range 2: 150–174 MHz
	TTD2110	X830AD	350 W VHF Range 2: 144–160 MHz
	TTD2120	X830AE	350 W VHF Range 3: 158–174 MHz
	PTTE1001	X640AH	100 W UHF Range 2: 438–470 MHz
	TTF1620	X660AB	100 W 927–944 MHz
	TTF1610	X201AA	300 W 927–944 MHz
	TTD2070	X213	125 W 276–284 MHz
	TTD2080	X214	300 276–284 MHz
	TTD2090	X330A	25 W VHF range 1 and 2: 132–174 MHz
Power Supplies	TPN1290	X30	AC power supply with battery revert
	TPN1290	X43	AC power supply with battery revert
	TPN1290	X115	625 W AC power supply and hardware AC adapter
	TPN1293	X581	48 Vdc power supply
	TPN1294	X342	24 Vdc power supply
Line Cords (North America)	TRN7663	X187AC	2.5 m for standard power model (single)
	TTN5051	X188AA	6.1 m for standard power model (single)
	TRN7951	X187AD	2.5 m for high power model (dual)
	TTN4054	X188AB	6.1 m for high power model (dual)
Line Cords (United Kingdom)	TTN5049	X162AA	2.5 m for standard power model (single)
	TTN5050	X162AB	2.5 m for high power model (dual)
Line Cords (Europe)	TRN7755	X189AA	2.5 m for standard power model (single)
	TTN4055	X189AB	2.5 m for high power model (dual)

Table 1-9: FRU Numbers (Sheet 2 of 2)

FRU Type	Model Number	Option Number	Description
Line Cords (Australia and China)	TTN5103	X191AA	2.5 m for standard power model (single)
	TTN5104	X191AB	2.5 m for high power model (dual)
Matched Pair (SCM and Exciter)	TTD1821	X131AC, X158, X621	Matched at 132–154 MHz
	TTD1822	X131AD, X158, X621	Matched at 150–174 MHz
	TTD1980	X217, X158, X621	Matched at 276–284 MHz
	TTE1940	X132AH, X158, X621	Matched at 438–470 MHz
	TTF1630	X134AB, X158, X621	Matched at 927–944 MHz
Internal Link Receivers	TRC1100	X209AA	Midband FMK (72–76 MHz)
	TRD1900	X333AC	Internal VHF link receiver FMK (132–154 MHz)
	TRD1910	X333AD	Internal VHF link receiver FMK (150–174 MHz)
	TRE1410	X334AE	Internal UHF link receiver FMK (403–433 MHz)
	TRE1420	X334AF	Internal UHF link receiver FMK (438–470 MHz)
	TRE1430	X334AG	Internal UHF link receiver FMK (470–494 MHz)
	TRE1440	X334AE	Internal UHF link receiver FMK (403–433 MHz)
	TRF1470	X336AB	Internal 900 MHz link receiver FMK (922–941 MHz)
	TRF1480	X336AC	Internal 900 MHz link receiver FMK (941–960 MHz)
Diagnostic Receivers	TRF1470	X630AA	900 MHz FMK (927–931 MHz); does not include antenna relay
	TRF1480	X630AB	900 MHz FMK (941–960 MHz); does not include antenna relay
Ancillary Equipment	TLN3453	X621	Wildcard Interface Board (to C-NET Control Point or RF-Baton!™ transmitter controller)
	TLN3451	X621	Front panel and board with keypad
	TAX1002	X576	GPS receiver with antenna
	TLN3410	X371AE	Antenna relay
	TLF1910	X676AL	Additional circulators for 900 MHz 300 W system (quantity 2, not available for PT1105)
	-----	------	Wireline Interface Board to Advanced Simulcast Controller (ASC)

FCC Type Acceptance Data

This section describes FCC type acceptance documentation (see Table 1-10).

Table 1-10: FCC Type Acceptance

Frequency (MHz)	Power Output (W)	Chassis Model and Frequency Option	FCC Type Acceptance
132–154 (VHF)	125 W (variable to 20 W)	PT1148A standard power	ABZ89FC3783
132–154 (VHF)	25 W (variable to 5 W)	PT1146A	ABZ89FC3781
144–160 (VHF)	350 W (variable to 100 W)	PT1150A[1] high power	ABZ89FC3782
150–174 (VHF)	125 W (variable to 20 W)	PT1149A standard power	ABZ89FC3783
150–174 (VHF)	25 W (variable to 5 W)	PT1147A	ABZ89FC3781
158–174 (VHF)	350 W (variable to 100 W)	PT1151A[1] high power	ABZ89FC3782
276–284	125 W (variable to 20 W)	PT1142A standard power	----
276–284	300 W (variable to 100 W)	PT1143A[1] high power	----
438–470 (UHF)	100 W (variable to 25 W)	PT1158A standard power	ABZ89FC4806
927–941	100 W (variable to 20 W)	PT1161A	ABZ89FC5766
927–941	300 W (variable to 100 W)	PT1162A[1]	ABZ89FC5765

1. Not available in the Peoples Republic of China.

Nucleus Paging Station Description

This chapter briefly describes the operation of the Nucleus paging station and the Nucleus paging station with Advanced Control (NAC). This chapter contains the following information:

General Description

A Nucleus paging station consists of the following elements:

- Station Control Module (SCM)–controls the station, and processes inputs from and displays to the SCM front panel.
- Exciter–provides the carrier frequency for the transmitter.
- Power Amplifier (PA)–combines the messaging data stream with the carrier frequency, enhances the signal, and sends it to the antenna.
- Receiver–processes received RF signals for use by the SCM for a monitor receiver.
- Reference module–provides a known reference signal to stabilize transmitter output.
- Transmitter controller–provides an interface to the network control device. The transmitter controller is one of the following:
  – RF-Baton!™ (RF-B!) transmitter controller
  – Internal Network Interface Unit (NIU)
  – External NIU

A NAC paging station consists of the following elements:

- NAC Control Module–controls the station, and processes inputs from and displays to the NAC front panel.
- Exciter–provides the carrier frequency for the transmitter.
- PA–combines the messaging data stream with the carrier frequency, enhances the signal, and sends it to the antenna.
- Receiver–processes received RF signals for use by the SCM for a monitor receiver.
- Reference module–provides a known reference signal to stabilize transmitter output.
- Nucleus Advanced Control (NAC)–provides an interface to the network control device.

Note: The NAC uses a special mid-tier version of the SCM.

This chapter describes these elements.

SCM

This section describes the SCM. The SCM has two functions:

- Controls the transmitter
- Maintains communication with a receiver

This section describes both functions briefly.

Transmitter Control

The SCM consists of an SCM front panel and a Station Control Board (see Figure 2-1).

The NAC consists of a NAC front panel and a NAC board.

Each front panel consists of a 15–pushbutton keypad and a light-emitting diode (LED) display. An operator, technician, or installer enters commands and configuration data for the transmitter through the keypad and confirms data on the LED display.

Note: For a NAC station, the operator, technician, or installer can also use a terminal connected to the NAC.

SCM

The SCM contains a digital signal processor (DSP), a DSP application-specific integrated circuit (DSP ASIC), and an ASIC interface. This series of circuits translates messaging data from the transmitter controller into modulation signals.

The DSP ASIC receives reference signals from a 16.8 MHz reference oscillator. The reference signal passes to a buffer and then to an exciter. The digitized output signal passes to the audio interface circuitry (AIC). The AIC converts the digitized signal to analog, performs level-shifting, and amplifies the signal. The signal passes to a reconstruction filter. The output consists of two signals:

- VCO Mod, which controls the impulse response of the Exciter
- Ref Mod, which modulates the reference frequency for long-term deviation accuracy

The DSP also contains a splatter filter to prevent the transmit signal from interfering with adjacent transmit channels. This feature matches the output of the Nucleus paging station with other paging (or messaging) stations in a simulcast system. An option on the front panel selects the appropriate splatter filter (88 µs, 140 µs, 160 µs, or 250 µs).

The host microprocessor controls messaging. The host microprocessor reads Nucleus paging station software and configuration data from memory. It uses this information to manage messaging. An example is the power applied to the channel that carries the message. The microprocessor exchanges address and data with the host ASIC.

The host ASIC communicates with memory and the SCM front panel through a serial peripheral interface (SPI) bus. The SPI bus communicates with the other modules on the backplane.

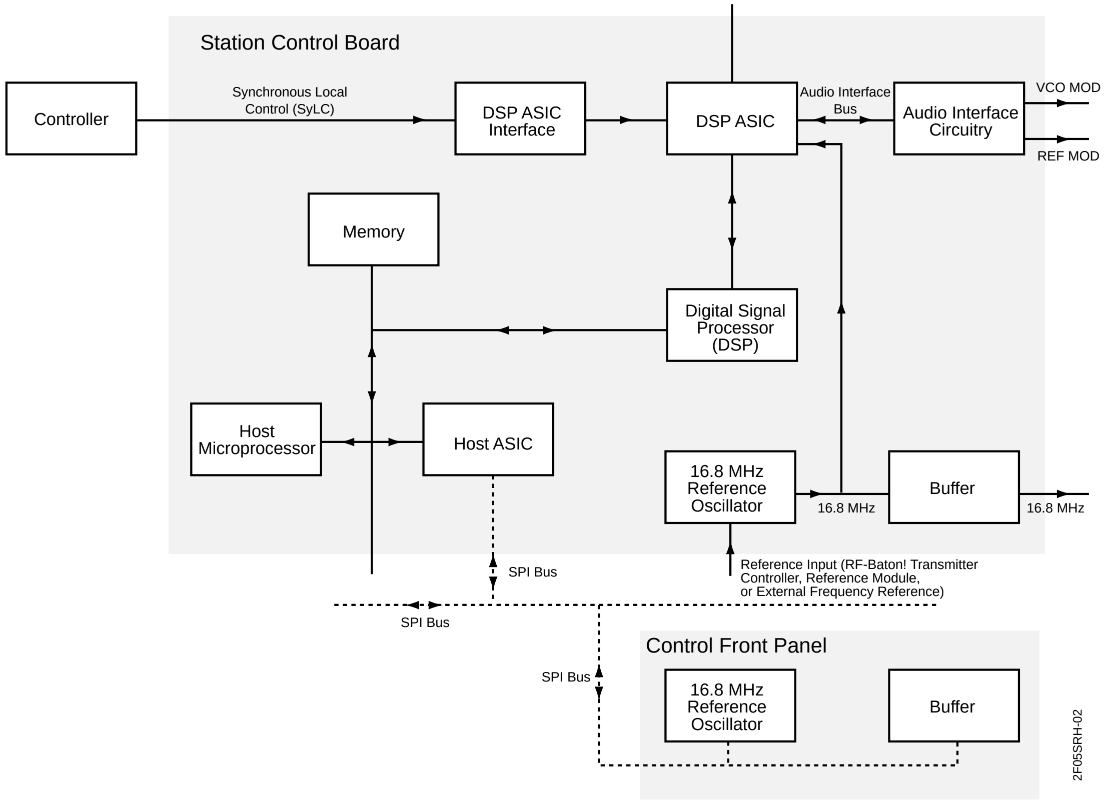


Figure 2-1: Station Control Board Block Diagram

NAC

The board has the same basic design as the SCM with some additional circuits:

- An input gain set controls the gain from the interface to the DSP.
- An MDC encoder controls a line 2 audio input to the interface.
- A data latch in the data line controls buffers inputs from the keypad and the data line to the display.
- A user audio circuit reads and controls audio inputs from the front panel.

Receiver Communication

An internal monitor receiver resides in a Nucleus paging station cabinet and monitors performance of transmitters in a maintenance group. In this configuration, the Station Control Board controls the receiver. The Station Control Board uses an interface board called a Controller / Receiver Interface Board (CRIB) as the interface to the receiver.

The receiver reads and decodes RF data from one or more transmitters under control of the Station Control Board.

The Station Control Board host microprocessor measures and controls various signals on the receiver (see Figure 2-2). To measure or adjust a signal, the Station Control Board sends board-select and chip-select data on the address bus to the receiver. When the receiver board-select circuit decodes the receiver's address, the board-select circuit enables the chip select circuit. The chip select circuit identifies the chip that the host microprocessor reads. These chips on the Receivers are the A/D converter and the phase lock loop (PLL) in the synthesizer circuit.

The Station Control Board uses the SPI bus to carry clock and data information to the A/D converter and the PLL. The selected chip reads the data from the SPI bus.

The receiver contains extensive circuitry for reading and processing an RF signal. The RF signal passes through a receiver front end that strips off the carrier frequency and filters the result. The receiver sends differential RF data to the Station Control Board through a pair of drivers. The Station Control Board compares the signals, selects one, and uses the signal as input for maintenance cycle data.

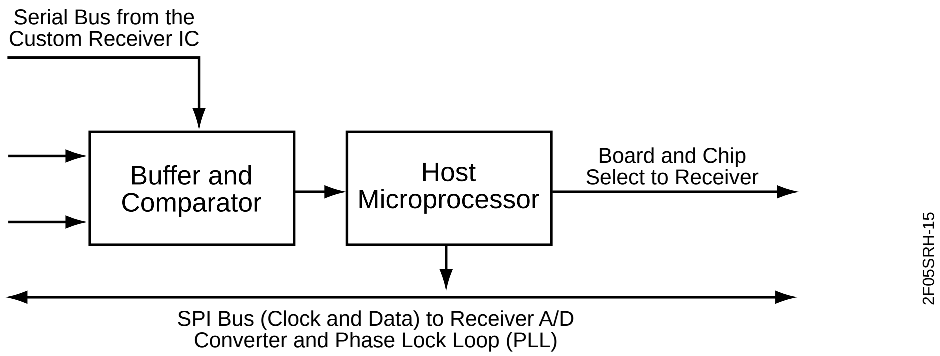


Figure 2-2: Station Control Board Relationship with Receiver

Note: An external monitor receiver also contains an Station Control Board, a CRIB, and a receiver board. The Station Control Board software capability is limited to controlling the receiver and does not have transmitter control enabled.

Exciter

The Exciter generates modulated RF messaging signals at the appropriate messaging frequency and sends the messaging signals to the PA. To do this, the Exciter mixes the messaging data with the carrier frequency. The Exciter is frequency-specific for the transmitter.

The Exciter consists of a reference modulator, a synthesizer, a voltage-controlled oscillator (VCO), an RF switch circuit, and a transmitter power circuit (see Figure 2-3). The Exciter runs under control of its own microprocessor. The Exciter synthesizer and microprocessor communicate with the host ASIC on the SCM through the SPI bus.

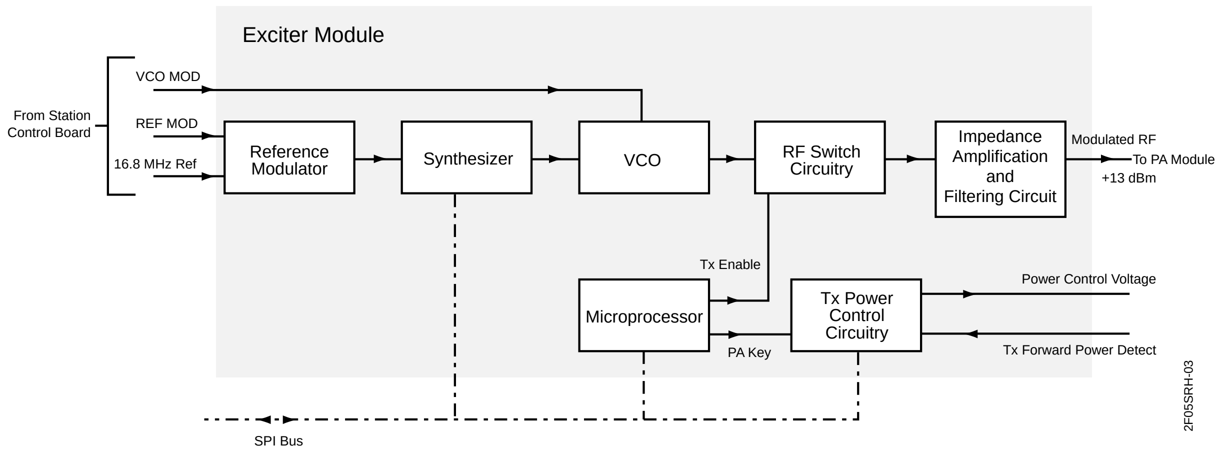


Figure 2-3: Exciter Block Diagram

The reference modulator receives the 16.8 MHz reference signal from the reference oscillator on the SCM. The reference modulator receives the reference modulation signal from the audio interface circuitry on the SCM. The reference modulator combines the two signals and sends the modulated reference signal to the synthesizer.

The synthesizer compares the modulated reference signal with the feedback sample from the VCO. The synthesizer increases or decreases the frequency by generating correction pulses. The synthesizer feeds the correction pulses to an internal charge pump. The charge pump creates a DC correction voltage. The synthesizer uses the correction voltage to correct the output to the RF switch circuit.

The corrected frequency passes to the VCO. The VCO also receives audio and data modulation (VCO MOD) from the audio interface circuit on the Control board. The VCO uses this information to create a modulated low-power RF carrier signal.

The modulated low power RF carrier signal passes through an impedance, amplification, and filtering circuit and then to the PA.

The Exciter microprocessor generates a Tx Enable signal and sends it to the RF switch circuit. The microprocessor also generates a PA Key signal and transmits it to the transmitter power control circuity.

The transmitter power control circuity generates the power control voltage. The transmitter power control circuity reads the Tx Forward Power Detect signal from the forward power detect in the harmonic filter coupler to modify the power control voltage.

Power Amplifier

The PA takes the modulated RF messaging signal and amplifies it in preparation for transmission. The structure of the PA depends on the station power level:

- Standard power Nucleus paging station (100 to 135 W)
- High power Nucleus paging station (250 to 300 W)

The output power level for the PA (at full power) varies with the frequency ranges for the PA, the Exciter, and the transmitter (see Table 2-1).

Table 2-1: Frequencies for PAs with Exciter and Transmit Frequencies

PA (Full Power)	PA Frequency Range	Exciter Frequency Range	Transmit Frequency Range
125 W (VHF)	132 to 154 MHz	132 to 154 MHz	132 to 154 MHz
	150 to 174 MHz	150 to 174 MHz	150 to 174 MHz
300 W (VHF)	144 to 160 MHz	132 to 154 MHz	144 to 154 MHz
	144 to 160 MHz	150 to 174 MHz	150 to 160 MHz
	157 to 174 MHz	150 to 174 MHz	157 to 174 MHz
125 W (280 MHz)	276 to 286 MHz	276 to 286 MHz	276 to 286 MHz
300 W (280 MHz)	276 to 286 MHz	276 to 286 MHz	276 to 286 MHz
100 W (UHF)	438 to 470 MHz	438 to 470 MHz	438 to 470 MHz
100 W (900 MHz)	927 to 941 MHz	927 to 941 MHz	927 to 941 MHz
300 W (900 MHz)	927 to 941 MHz	927 to 941 MHz	927 to 941 MHz

In addition to the standard circulator installed in all Nucleus paging stations, two types of optional circulators are also available:

- External circulators–installed over the backplane on the Nucleus paging station. Motorola offers two levels:
  - Double circulator, available for standard power and high power stations
  - Triple circulator, available for high power stations only
- Internal circulator–installed inside the high power Nucleus paging station PA.

PA for a Standard Power Nucleus Paging Station

The standard PA consists of the following elements (see Figure 2-4):

- Intermediate power amplifier
- Driver power amplifier
- Final power amplifier
- Standard circulator

- Harmonic filter / coupler
- Impedance matching, amplification, and filtering circuit

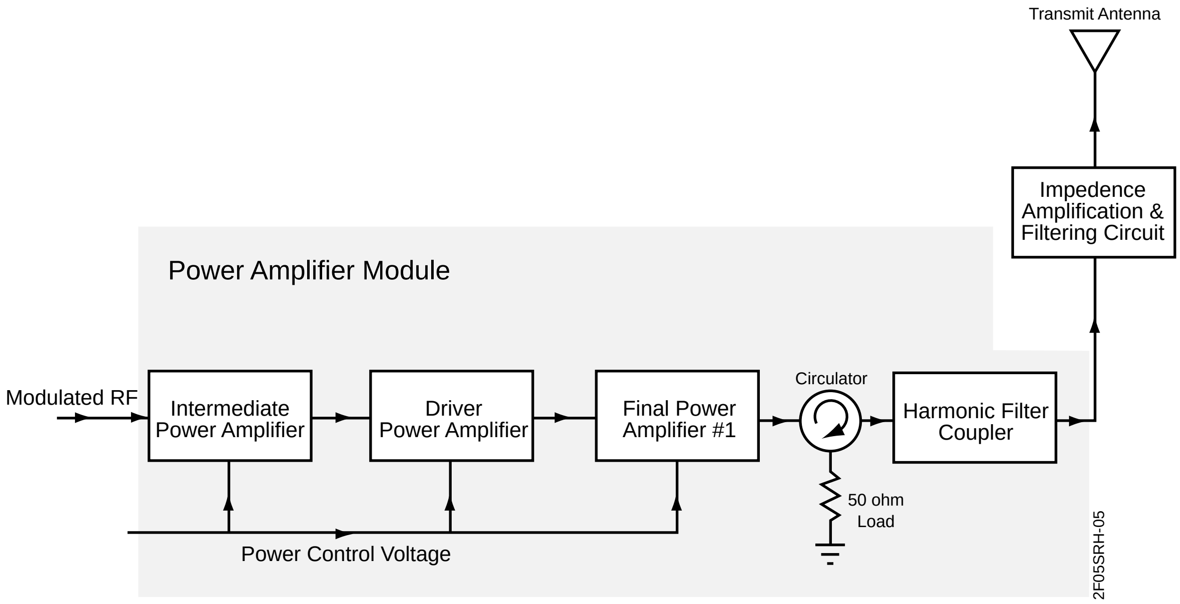


Figure 2-4: PA Block Diagram for a Standard Power Nucleus Paging Station

In the standard power system, the modulated RF passes through the intermediated power amplifier, the driver power amplifier, and the final amplifier number 1. A power control voltage signal modifies the performance of each chip to ensure the proper signal processing. The standard circulator provides 20 dB isolation between the power amplifier circuitry and the transmit antenna system. The circulator junction allows forward RF energy to pass through to the output and routes reflected RF energy to the 50-Ohm load.

The standard power Nucleus paging station has a double circulator option that provides a low loss path for RF signals from the combined output to the low-pass harmonics filter and Wattmeter. The double circulator absorbs high reflected RF signals from the antenna port. This arrangement prevents the power amplifier from being damaged.

The harmonic filter reduces circulator harmonics. The signal passes through an impedance amplification and filtering circuit on its way to the transmit antenna.

If the heat sink temperature exceeds a preset threshold, the PA reduces output. If overheating persists, the PA shut down completely. An internal Wattmeter sends RF power and voltage standing wave ratio (VSWR) to the front panel. The SPI bus transmits the Wattmeter reading.

PA for a High Power Nucleus Paging Station

The high power supply consists of the following elements (see Figure 2-5):

- Intermediate power amplifier
- Driver power amplifier

- Power splitter
- Three final power amplifiers
- Power combiner
- Standard circulator
- Harmonic filter / coupler
- Impedance matching, amplification, and filtering circuit

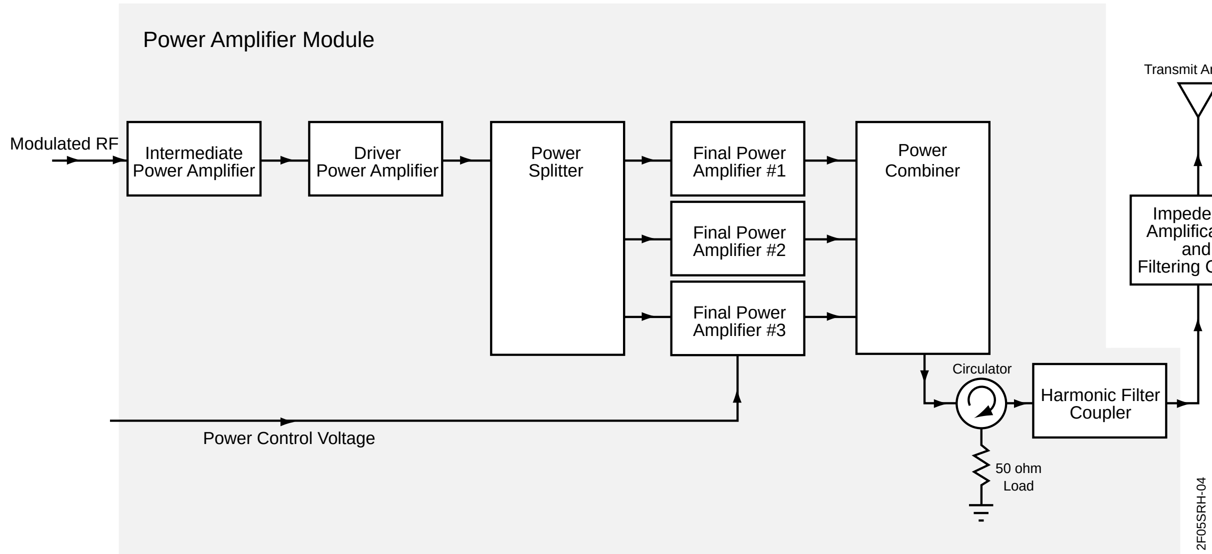


Figure 2-5: PA Block Diagram for a High Power Nucleus Paging Station

The modulated RF passes through the intermediate power amplifier and the driver power amplifier into a power splitter. The power splitter divides the power output into three and sends the three outputs the final power amplifiers. Each power amplifier sends its output to a power controller and then to a circulator.

The high power Nucleus paging station has a double or triple circulator option that provides a low loss path for RF signals from the combined output to the low-pass harmonics filter and Wattmeter. The double or triple circulator absorbs high reflected RF signals from the antenna port. This arrangement prevents the power amplifier from being damaged. The triple circulator has an output of 250 W, measured at the output of the circulator.

The standard circulator provides 20 dB isolation between the power amplifier circuitry and the transmit antenna system. The circulator junction allows forward RF energy to pass through to the output and routes reflected RF energy to the 50-Ohm load. If the heat sink temperature exceeds a preset threshold, the PA reduces output. If overheating persists, the PA shuts down completely.

The harmonic filter reduces circulator harmonics.

An internal Wattmeter sends RF power VSWR to the front panel. The Wattmeter reading is transmitted on the SPI bus to the SCM.

Power Supply

The power supplies provide DC voltages for the station modules (see Figure 2-6). The high-power station has two power supply modules. Each power supply uses the voltage available at the customer site. This voltage enters through a switching circuit that adjusts to the source. The regulator circuits creates three output voltages:

- +5 Vdc
- +14 Vdc
- +28 Vdc

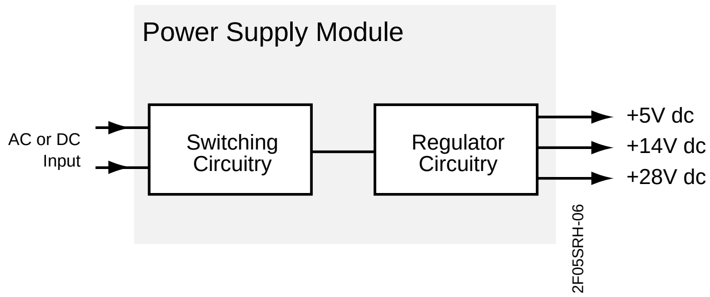


Figure 2-6: Power Supply Module

Receiver Module

The Nucleus paging station and the NAC paging station use a receiver in either of two ways:

- As a monitor receiver to monitor the transmissions of the transmitters in one or more maintenance groups
- As a link receiver, to receive messaging data and control from a link transmitter.

The installer configures the receiver module as a link receiver or a monitor receiver from the front panel. The receiver module is located in the paging station cage. It consists of the following items:

- Receiver board
- Preselector
- Receiver front panel
- CRIB mounted on the SCB

The receiver board consists of a preselector filter, a mixer, a bandpass filter, a custom receiver integrated circuit, and a differential driver (see Figure 2-7). These circuits take the RF signal, process it, and send it to the IC interface on the CRIB. The CRIB processes the differential signal to the appropriate output to be read at the SCM.

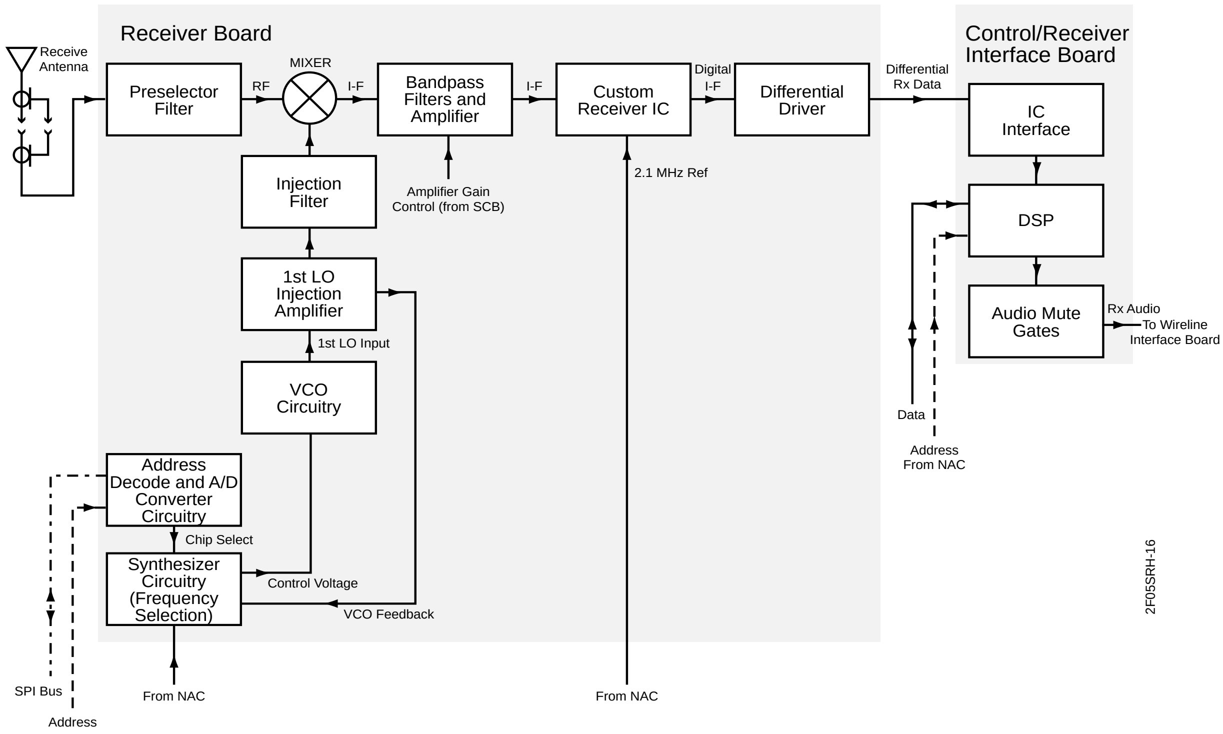


Figure 2-7: Receiver Module and CRIB Block Diagram

The SCM or NAC board controls processing at the mixer through the SPI bus and an address decode and A/D converter circuit. The address decode and A/D converter control a synthesizer to create a control voltage to the mixer. A VCO circuit, first low injection amplifier, and injection filter control the mixer. The first low injection amplifier provides feedback to the VCO.

The CRIB receives the differential Rx data at an IC interface and passes the signal to a DSP. The DSP receives address and data from the transmitter controller. When the SCM requests the data, the DSP sends the Rx audio to the SCM.

Reference Modules

This section describes reference modules. Nucleus and NAC paging stations use two reference modules:

- Reference module with GPS receiver (used only for stations with internal NIUs)
- Reference module with oscillator (used for stations without internal NIUs)

Reference Module with Global Positioning System (GPS) Receiver

Systems that use GPS synchronization require reference modules with a GPS receiver (option X576). The GPS signal arrives on a GPS antenna (see Figure 2-8). This is a 1.57542 GHz signal. The GPS receiver uses its location information and the timing signal from the satellites to set the timing pulse output (1 pps to the SCM) precisely.

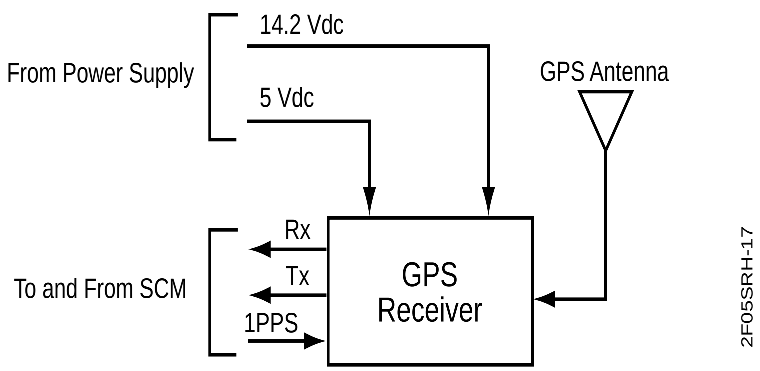


Figure 2-8: Reference Module with GPS Receiver

Reference Module with an Oscillator

Transmitters that do not use GPS signals and do not use internal NIUs require one of two oscillator-driven reference modules:

- The reference module with a high speed oscillator (HSO) is option X208 (5 ppb).
- The reference module with an ultra-high speed oscillator (UHSO) is option X206 (30 ppb).

Each reference module contains a D / A converter and an A / D converter and the oscillator itself (see Figure 2-9). The converters communicate with the SPI bus. The 5 MHz frequency generated by the oscillator goes to the SCM to stabilize the 16.8 MHz reference oscillator signal that passes to the Exciter.

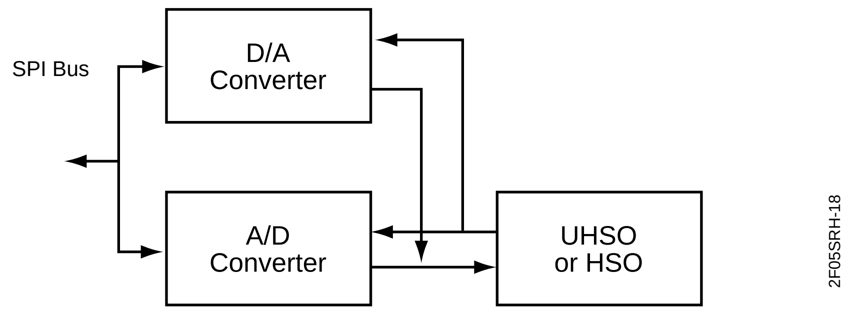


Figure 2-9: Reference Module with a UHSO or HSO

Transmitter Controllers

This section describes Nucleus and NAC paging stations transmitter controllers. The transmitter controllers and their interfaces include the following:

- The WIB, installed in Nucleus paging stations, use external RF-B! transmitter controllers or external NIUs.
- The internal NIU, installed in the Nucleus paging station, use a direct interconnect with the SCM.
- The Nucleus Advanced Control (NAC) and a WIB, installed in the NAC paging station, communicate with the Motorola Advanced Simulcast Controller (ASC).

Wildcard Interface Board for RF-B! Transmitter Controllers

Nucleus paging station that use RF-Baton!™ (RF-B!) transmitter controllers or external NIUs require the WIB. The RF-B! transmitter controller is used in systems with the RF-Conductor!™ (RF-C!) controller. The external NIU is used in systems with the C-NET Control Point controller.

In these systems, the transmitter controller defines all signals between the WIB and the Nucleus paging station in software. The WIB outputs are typically used for station operating status such as alarm information. WIB inputs include local control signals from peripheral equipment or status of on-site equipment (see Figure 2-10).

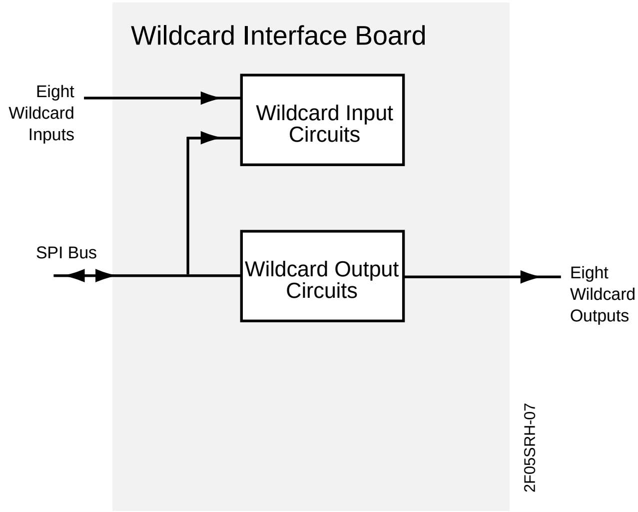


Figure 2-10: Wildcard Interface Board

Note: The WIB occupies the slot beside the Station Control Board (behind the SCM control panel) and communicates through the backplane to the rest of the Nucleus paging station.

This manual describes the WIB in sufficient detail to facilitate installation and configuration (see Appendix D). For a complete description of the RF-B! transmitter controller, see the *RF-Baton! Transmitter Controller Installation and Operation* manual, publication 6880497G05.

Internal Network Interface Unit (NIU)

The internal NIU replaces an external NIU for systems with C-NET Control Point controllers. The NIU defines all signals between the NIU and the Nucleus paging station in software. NIU signals to the Nucleus paging station consists of messaging data stream data as well as maintenance and configuration data. Nucleus paging station outputs to the NIU consists of alarms (see Figure 2-11).

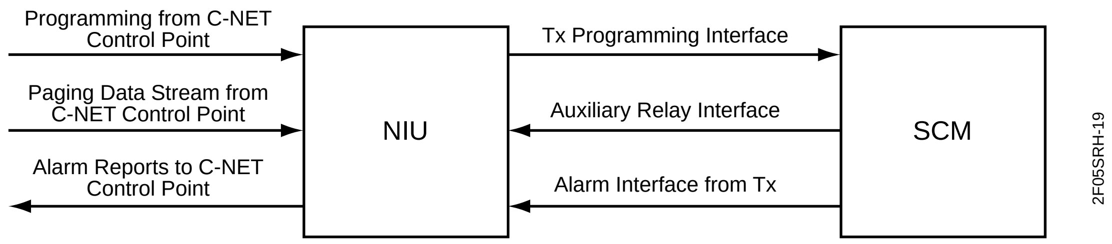


Figure 2-11: Inputs and Outputs to an Internal NIU

This manual describes the internal NIU interface in sufficient detail to facilitate Nucleus installation and configuration (see Appendix C).

Note: *An internal NIU occupies the slot next to the Station Control Board (behind the front panel) and communicates through the backplane with the rest of the Nucleus paging station.*

Wildcard Interface Board (WIB) for the NAC

The Wildcard Interface Board (WIB) for a NAC station is a slightly different design from the WIB used with the RF-Baton!. The NAC WIB interfaces customer telephone lines with the Nucleus paging station. The WIB processes and routes wireline audio signals between the station and land-line equipment such as consoles and modems. The WIB uses the 50-pin telephone connector (J17) or J61 on the station backplane (see Chapter 5, "Connectors and Interfaces", Figure 5-1, Figure 5-2, Table 5-4, and Table 5-5).

Installation Overview

This chapter describes overall site and clearance considerations when you install a Nucleus paging station or NAC station. This chapter contains the following information:

Purpose

Proper installation maximizes performance and reliability for Nucleus and NAC paging stations. Pre-installation planning is essential. Pre-installation planning includes the following considerations:

- FCC compliance
- Location in relation to input power
- Location in relation to antenna(s)
- Location in relation to telephone lines
- Grounding requirements
- Heat and humidity
- Availability of air conditioning
- Mounting method
- Availability of required tools and equipment

Note: Read this section completely before installing the equipment.

Procedure Overview

Installation includes the following steps:

- Plan the installation.
- Unpack and inspect the equipment.
- Perform mechanical installation at the site.
- Complete necessary electrical and cabling connections, including the following:
  - Site grounding
  - AC or DC input power cabling
  - Coaxial cables to transmit and receive antennas
  - Phone line connections
  - Site lightning protection
- Perform a post-installation functional test to verify proper installation.

FCC Compliance

FCC requirements state the following:

- The grantee of a license must ensure that all equipment operated under that license conforms to the specifications of the license.
- The RF power output of a radio transmitter must not exceed the level required for satisfactory technical operations considering the area to be covered and the local conditions.
- The frequency, deviation, and power of a radio transmitter must be maintained within specific limits. Check these three parameters before placing the station in service.

Note: Equipment efficiency depends on proper installation and service. Motorola recommends that this equipment be installed and serviced only by certified technicians.

Grounding, Protection, and Shielding

The conditions that make a site desirable for two-way radio communications are the same that make a site an excellent target for lightning strikes. Proper lightning protection methods can prevent equipment damage in all but the most severe strikes. Even then, equipment damage may be kept to a minimum. Lightning protection is intended to prevent the electrical energy from a strike from entering the equipment room, and then preventing damage to the equipment as a result of induced voltages on power, signal, and control lines to the equipment.

Although a comprehensive coverage of site grounding techniques and lightning protection is not within the scope of this manual, several industry sources provide rules and guidelines on grounding and lightning protection at communication sites. Motorola recommends Quality Standards–FNE Installation Manual R56 (Motorola part number 6881089E50). Order this manual from the Motorola Americas Parts Division (see the Foreword).

Site Grounding

Site grounding requires two types of ground connections:

- Electrical ground—This type of ground includes AC and DC electrical power ground, telephone line grounding, and low-voltage currents for alarms or sensors located at the site.
- Lightning ground—This type of ground protects against lightning strikes.

Ground Lug

The paging station cage is equipped with a single ground lug located on the backplane. Use this lug to connect the cage to the site ground point.

CAUTION

Do not use the ground lug for grounding of telephone lines, antenna cables, DC power, AC power or other earth ground applications. Ground all elements safely and adequately according to national, state, local, and industry standards.

Electrostatic Grounding

All Nucleus and NAC paging stations have provisions for electrostatic grounding. The formed tube at each side of the front of the card cage chassis is marked with the grounding symbol. When handling any module or circuit board, be sure to wear an antistatic wrist strap and plug the clip into the ground jack (formed tube) on the card cage (see Figure 3-1).

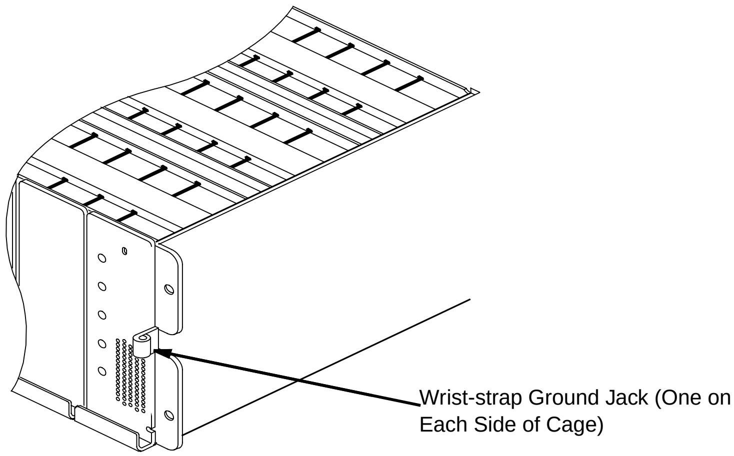


Figure 3-1: Location of Electrostatic Ground Jacks

RF Shielding

RF shielding minimizes or prevents leakage of unwanted RF transmissions from equipment and cables. Use special care in ordering and installing cables that carry RF data and cables that pass near RF circuits. Use shielded cables to minimize or prevent leakage, and contamination from unshielded AC or DC currents.

Environmental Conditions at the Site

CAUTION

To install the station in an environment that does not meet air quality requirements, cool and filter the air for station modules must to meet air quality standards. Dust or dirt that accumulate on the internal circuit boards and modules is difficult to remove. Dust and dirt cause malfunctions, such a as overheating and intermittent electrical failures.

Install the Nucleus paging station in any location suitable for electronic communications equipment (environmental conditions do not exceed equipment requirements for temperature, humidity, and air quality) (see Table 3-1).

Table 3-1: Required Environmental Conditions at the Site

Environmental Condition	Requirement
Operating temperature	-30^{o} to +60^{o}C (-22^{o} to +140^{o}F)
Humidity	Not to exceed 95% relative humidity at 50˚C
Air quality	If the area is environmentally controlled: Airborne particulates level must not exceed 25 mg/m3 If the area is not environmentally controlled: Airborne particulates level must not exceed 90 mg/m3

CAUTION

Failure to ensure proper ventilation and cooling voids the product warranty for a Nucleus or NAC paging station if it fails because of overheating.

The PA module and power supply module have thermistor-controlled cooling fans to provide forced convection cooling. The air flow is front to back, allowing several cages to be stacked within a rack or cabinet. When planning the installation, observe the following ventilation guidelines:

- The operating range of the equipment is -30°C to +60°C / -22°F to +140°F.
- Customer-supplied cabinets must have adequate ventilation slots or openings in the front (for air entry) and back (for air to exit).
- All cabinets must have at least 6 inches of open space between the air vents and walls or other cabinets.
- Separate the cabinets to ensure that the air intake of one cabinet does not take in exhaust an adjacent cabinet.
- Motorola recommends an air conditioning system where the climate or the proximity of other equipment threatens the temperature maximum.

Input Power Requirements

Nucleus and NAC paging stations have one or two AC power supplies (90 to 280 V rms, 50 Hz or 60 Hz) or a DC-to-DC power supply (21 to 34.5 Vdc or 41 to 72 Vdc). All AC power supplies have automatic range and line frequency selection.

Motorola recommends a standard 3-wire grounded electrical outlet as the AC source. For a 125 W station and a nominal 110 Vac input, the AC source must supply 5 A. The AC source should be protected by a circuit breaker rated at 15 A. For a nominal 220 Vac input, the AC source must supply approximately 2.5 A.

The high power (250 and 300 W) stations use two power supplies. These power supplies draw a total of 13 A at 110 Vac, 60 Hz. They require a circuit breaker rated at 20 A.

For a 24 Vdc or 48/60 Vdc source, Motorola provides appropriate cabling from the DC power source to the backplane (located at rear of the station).

Equipment Mounting Methods

Motorola supplies four mounting options for Nucleus and NAC paging stations:

- Installed in 25-in. cabinet (option X92)–this is a formed cabinet with front and rear vented doors.
- Installed in 46-in. cabinet (option X308)–this is a formed cabinet with front and rear vented doors.
- Installed in 70-in. cabinet (option C307)–this is a formed cabinet with front and rear vented doors.
- Shipped without rack or cabinet (option X362)–the customer can install the station in a rack or cabinet. The station is designed to fit standard EIA 19-in. rack configuration. For rack mounting, order option X153 mounting brackets.

Physical Dimensions and Clearances

This section presents the physical dimensions and clearance requirements for Nucleus equipment installed in Nucleus cabinets or in cabinets with other equipment.

Nucleus Cage Without Cabinet

The dimensions and recommended clearances for a standard power or high-power station mounted without a cabinet appear in the figures listed below. The dimensions for standard and high power models are identical except for overall height.

- Side views of the standard power station and high power station (see Figure 3-2)
- Front view (see Figure 3-3)
- Clearance (see Figure 3-4)

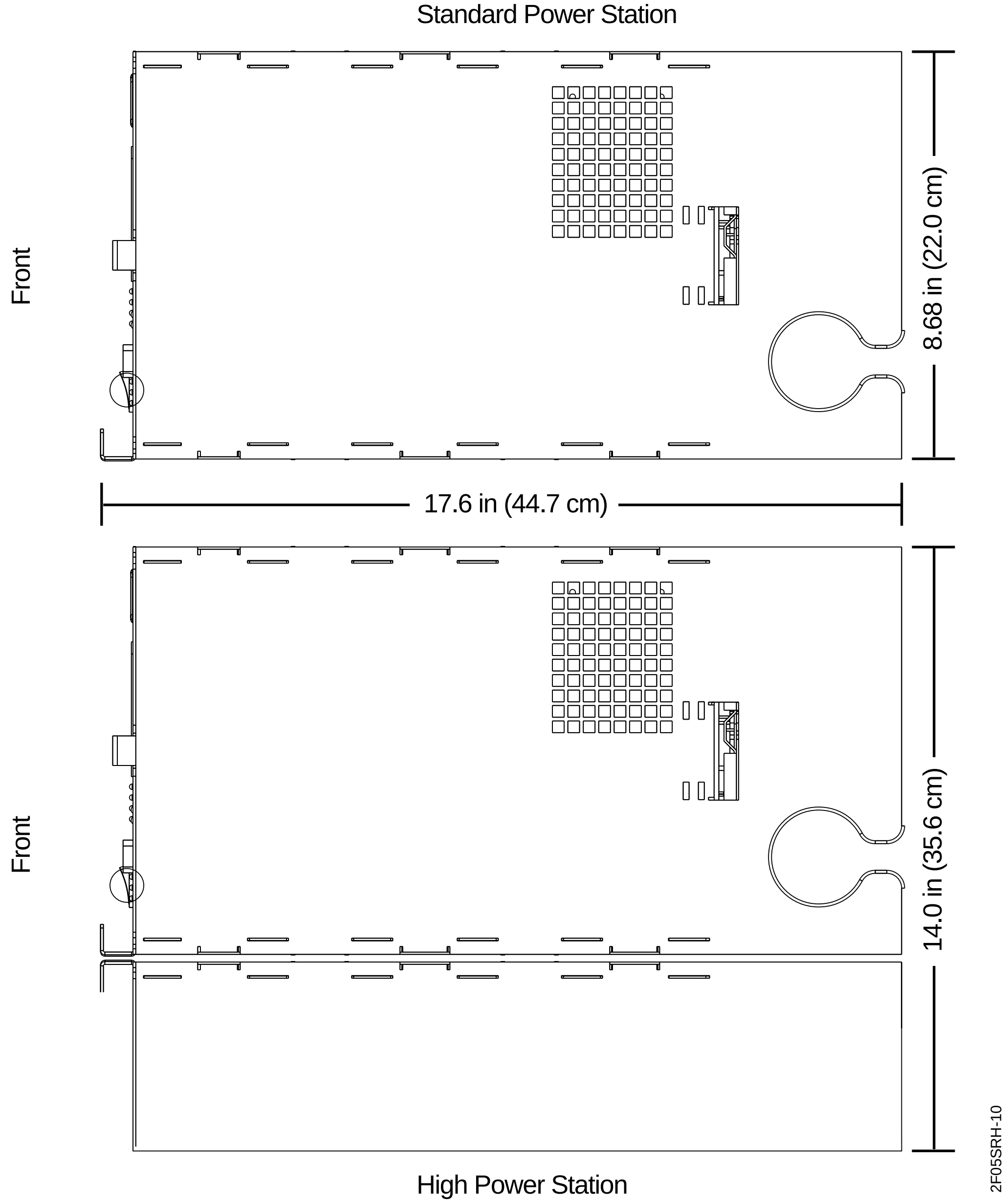


Figure 3-2: Side View of the Standard Power and High Power Stations Without a Cabinet

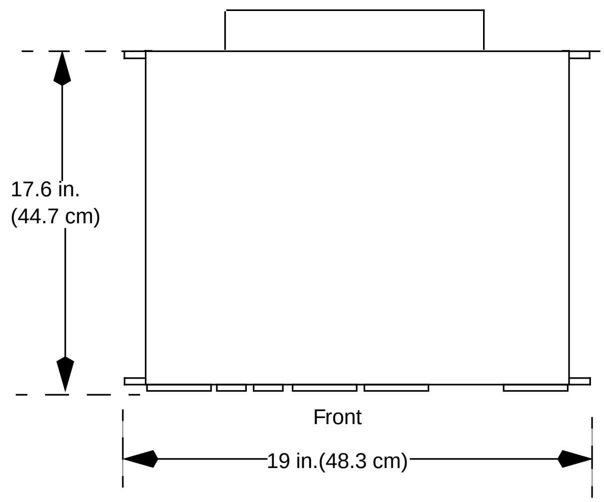


Figure 3-3: Top View of the Station Without a Cabinet

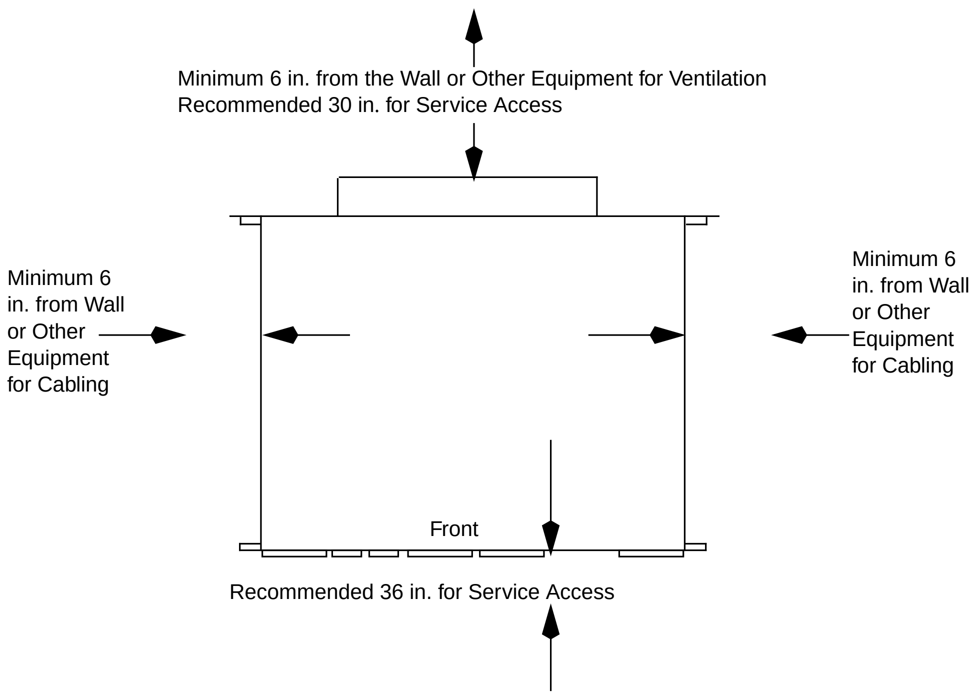


Figure 3-4: Clearance View of the Station Without a Cabinet

25-in. Indoor Cabinet

The figures listed below show the physical dimensions for a 25-in. cabinet (option X92). The minimum recommended clearances are 36 in. (front) and 30 in. (rear) for installation access.

- Front view (see Figure 3-5)
- Side view (see Figure 3-6)
- Base mounting (see Figure 3-7)

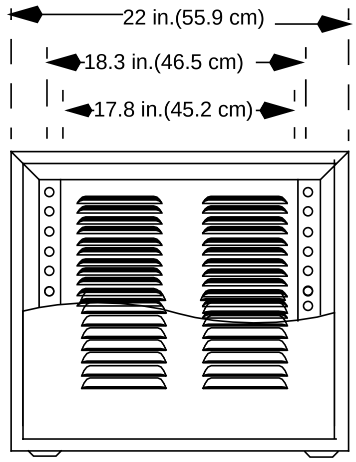


Figure 3-5: Front View of the 25-in. Station Cabinet

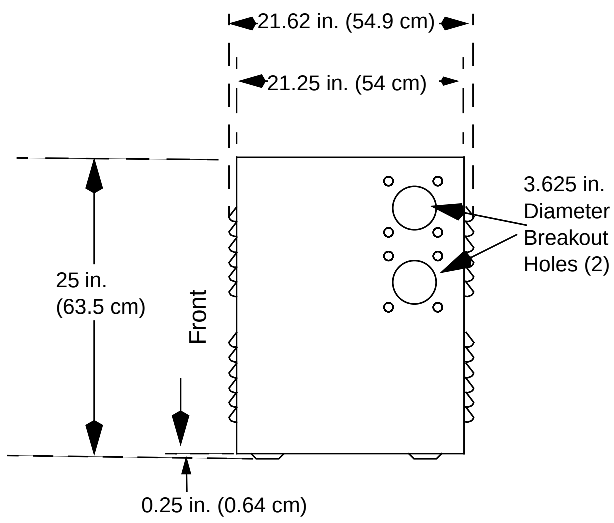


Figure 3-6: Side View of the 25-in. Station Cabinet

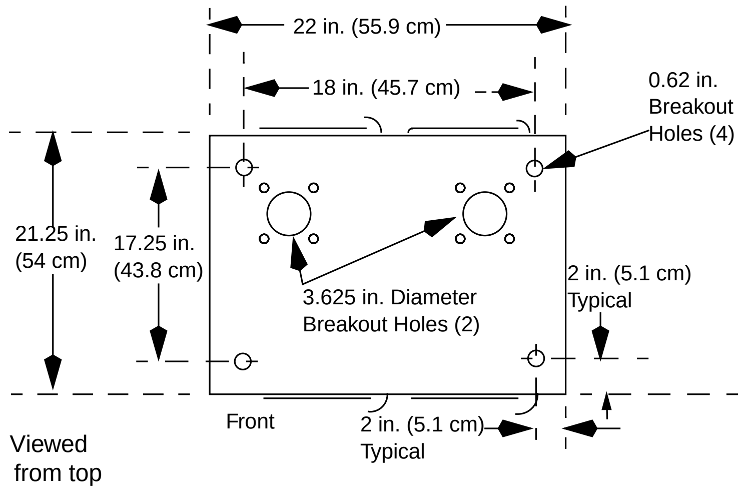


Figure 3-7: Drilling Template for a 25-in. Station Cabinet

46-in. Indoor Cabinet

The figures listed below show the physical dimensions for a 46-in. cabinet (option X308). The minimum recommended clearances are 36 in. (front) and 30 in. (rear) for installation access.

- Front view (see Figure 3-8)
- Side view (see Figure 3-9)
- Base mounting (see Figure 3-10)

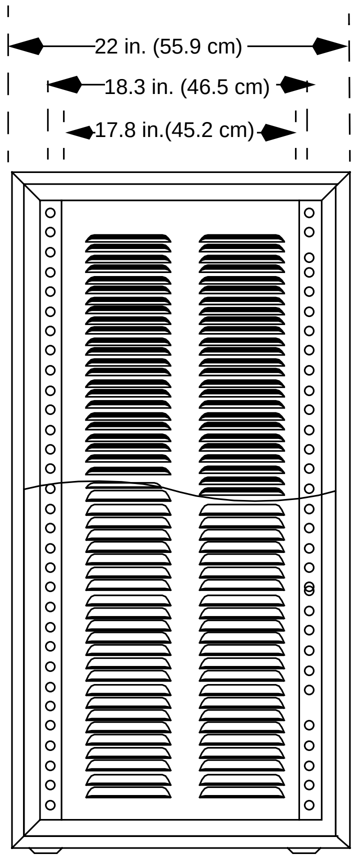


Figure 3-8: Front View of the 46-in. Station Cabinet

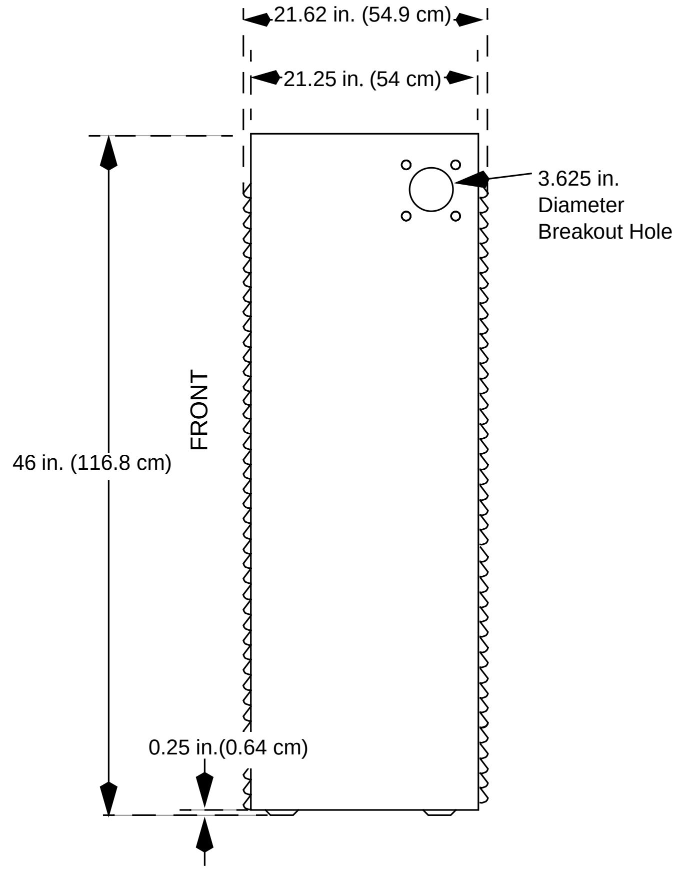


Figure 3-9: Side View of the 46-in. Station Cabinet

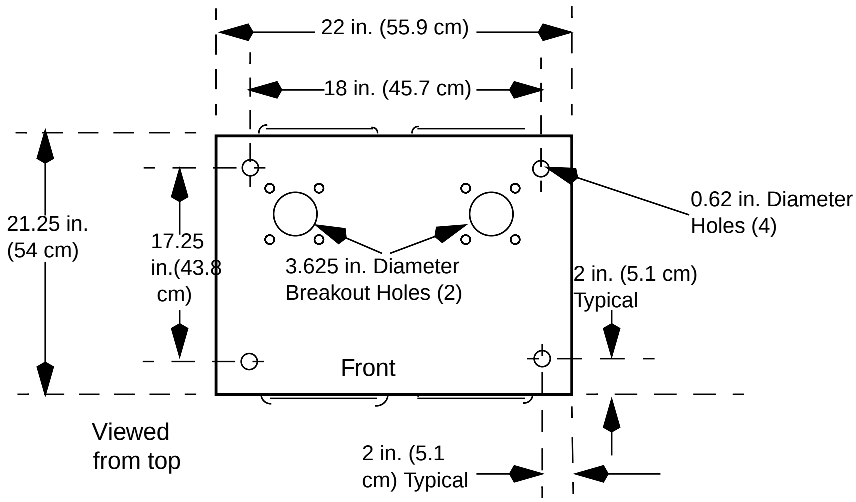


Figure 3-10: Drilling Template for a 46-in. Station Cabinet

70-in. Indoor Cabinet

The figures listed below show the dimensions for a 70-in. indoor cabinet (option X36). The minimum recommended clearances are 36 in. (front) and 30 in. (rear) for installation access.

- Front view (see Figure 3-11)
- Side view (see Figure 3-12)
- Base mounting (see Figure 3-13)

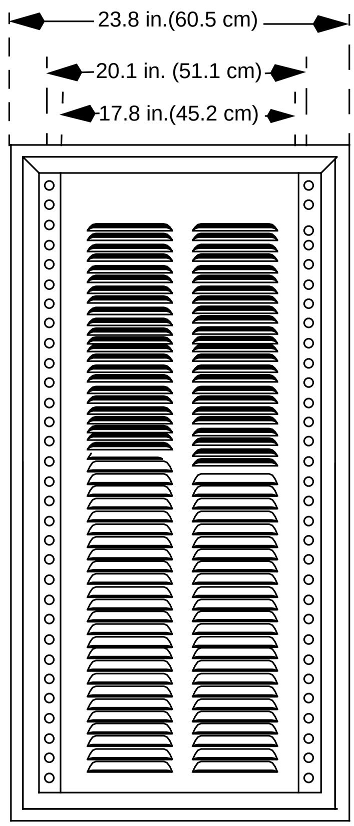


Figure 3-11: Front View of the 70-in. Station Cabinet

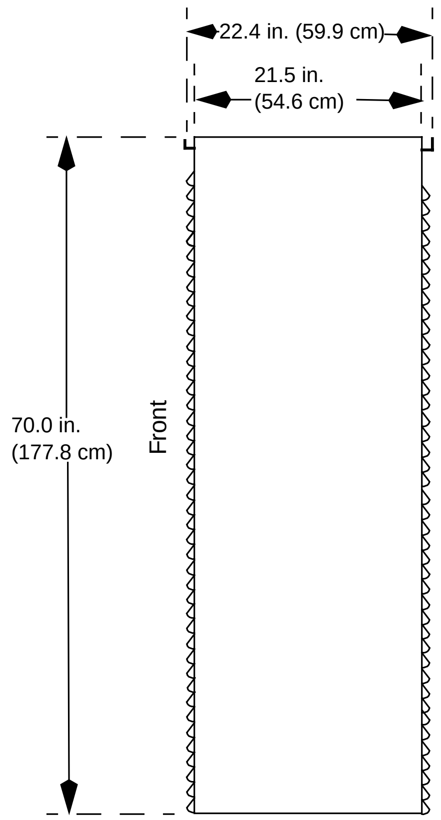


Figure 3-12: Side View of the 70-in. Station Cabinet

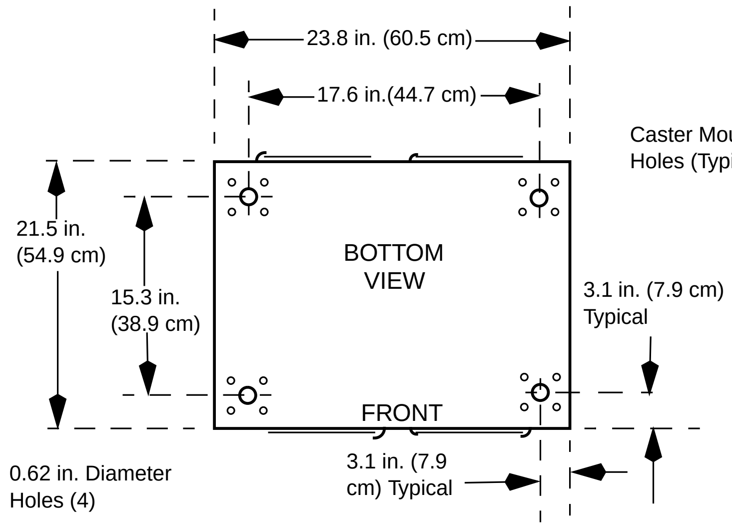


Figure 3-13: Drilling Template for a 70-in. Station Cabinet

Recommended Tools and Equipment

DANGER

Use a fiberglass or wooden stepladder. Do not use a metal stepladder. Accidental contact with electrical wires could cause electrocution or serious injury.

Installation requires the following tools and equipment:

- Standard electrician's tool box (should contain a variety of hand tools appropriate for working with electrical circuits and associated equipment), including the following:
  - TORX™ screwdriver, with TX15 and TX30 bits
  - Small adjustable wrench or gas pliers
  - Wire cutters (for cutting tie-wraps)
- Fiberglass or wooden stepladder, six to eight feet (used to access the top of the 70-in. cabinet).
- Block-and-tackle or suitable hoist to lift cabinets equipped with multiple stations

Note: Each fully equipped standard power station weighs approximately 60 lb. Each fully equipped high power station weighs 105 lb.

- Power drill and appropriate boring bits for drilling concrete (for drilling anchor holes in concrete flooring)
- Tarpaulin or large plastic drop cloth to cover surrounding equipment while drilling concrete anchor holes (for installations where cabinet or rack is being anchored to concrete flooring)
- Vacuum cleaner for removing concrete dust (for installations where cabinet or rack is being anchored to concrete flooring)
- ESD grounding strap

Motorola supplies the following materials with each station:

- Black M6 thread-cutting screws, part no. 0383498N08 (quantity 8)
- Power supply power cables (AC and DC)

GPS Antenna Installation

GPS synchronization requires attention to the following items:

- Sky visibility
- Mounting
- RF connectors
- Interconnecting cable
- Multiple receivers per antenna
- Cabling system loss

Sky Visibility

GPS requires sky visibility in an arc from directly overhead to within 10^{o} of the horizon for optimum performance. Obstructions such as adjacent buildings or towers may not block more than 20% of the circumference of the sky visibility ring from 10^{o} to 30^{o} above the horizon. Consult Motorola for site planning advice.

Mounting

The disc-shaped GPS antenna should be mounted in the horizontal position (see Figure 3-14). The post-mounted L-shaped mounting bracket accepts a maximum diameter 30-mm post or bar.

DANGER

Do not mount the GPS antenna on a tower (lightning strikes to the tower damage the GPS antenna or GPS receiver).

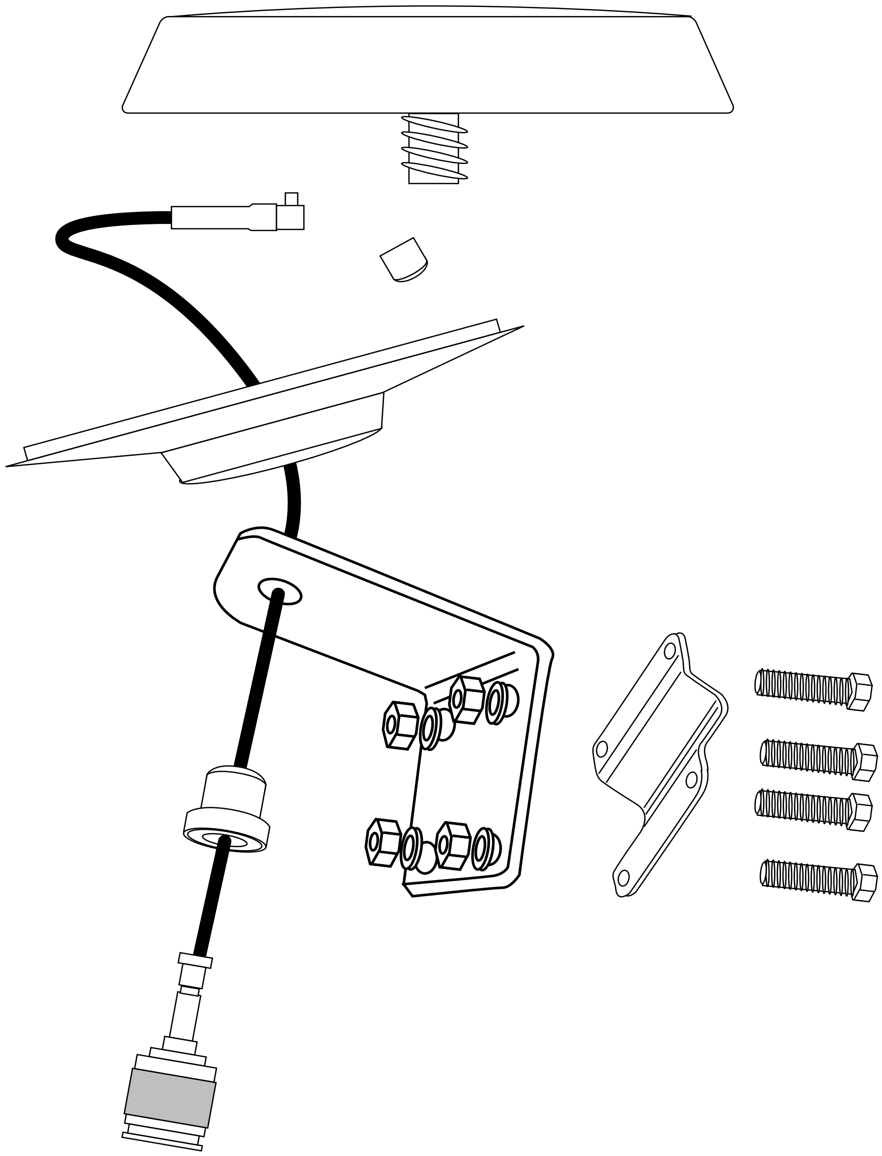


Figure 3-14: GPS Antenna Mounting

Motorola recommends a lightning arrestor that redirects DC voltage past the entrance to the building, but this arrester does not completely prevent damage.

On a rooftop, mount the receiver at a height or location that minimizes snow coverage and physical damage from other obstructions. Avoid multipath reception from large reflective surfaces other than those in the plane of the antenna base. Maintain at least ten feet separation from transmitter antennas (to provide at least 38 dB path loss from a 1-W isotropic radiator).

RF Connectors

The GPS connector is a N-type male (requires N-type female mating connector). The station connector is an N-type female and requires N-type male mating connector. The connector center contacts are gold-plated. Weatherproof the connector at the GPS antenna; Motorola recommends part number TDN9289A or its equivalent.

Interconnecting Cable

Motorola recommends a 50-Ohm low-loss outdoor coaxial cable with a solid copper outer conductor to minimize interference. The cable loss at 1.57542 GHz must be no more than 6 dB of gain.

An in-line amplifier may be used if it passes 5 V and uses no more than 25 mA at 5 V. Do not provide more than 6 dB of gain (including cable losses). The cabling system noise figure must be less than 15 dB. The system noise figure must not exceed 4 dB. Motorola provides site engineering or system installation to assist in achieving these requirements.

Single Receiver per Antenna

The GPS receiver provides 5 V to the active GPS antenna. The output is not reverse-polarity protected; multiple receivers cannot be connected directly from one antenna. Only one GPS receiver may power the GPS antenna; all other ports to other receivers must be DC-blocked to prevent damage.

Cabling System Loss

The maximum allowed voltage drop for the antenna is 0.25 V at 22 mA plus in-line amplifier current drain. This maximum voltage drop includes losses of the in-line amplifier(s) and bias tees; antenna-loss only is 11-Ohm maximum. Test delivered voltage by placing a 200-Ohm source at the antenna connection point. The minimum voltage delivered should be 4.5 V. The required supply input voltage to the GPS antenna is 5.5 V to 4.5 V.

Mechanical Installation

This chapter describes the procedures necessary to unpack and mechanically install a Nucleus paging station or a Nucleus paging station with Advanced Control (NAC). This chapter contains the following information:

Equipment Unpacking and Inspection

The packing for a Nucleus paging station equipment depends on the rack or cabinet type. Nucleus paging station cages can also be packed and shipped without a cabinet. This chapter describes unpacking procedures for stations packed in cabinets or shipped without cabinets. The packing is based on the following criteria:

- If shipping without a cabinet or rack, Motorola ships the Nucleus paging station in a cardboard container with interior packing supports.
- If shipping in an indoor cabinet, Motorola ships the cabinet bolted to a wooden skid and covered with a cardboard box with corrugated interior corner braces.

Motorola ships the Nucleus paging station by air freight or van (specified by customer).

Note: Thoroughly inspect the equipment as soon as possible after delivery. If any part of the equipment was damaged in transit, immediately report the extent of the damage to the transportation company.

Unpacking Nucleus Paging Stations Without Cabinets

Nucleus paging stations without cabinets (ordered with Option X362, omit cabinet) are packed in a cardboard box with styrofoam interior spacers and cardboard stiffeners. Use the following procedure to unpack the equipment:

1. Cut and remove the band around cardboard base.
2. Unfold the sides of the base to release the flaps at the bottom of the cardboard cover (see Figure 4-1).
3. Lift and remove the cardboard cover.
4. Remove the foam spacers. The line cord and plastic bag containing mounting hardware are located in the back of the station.

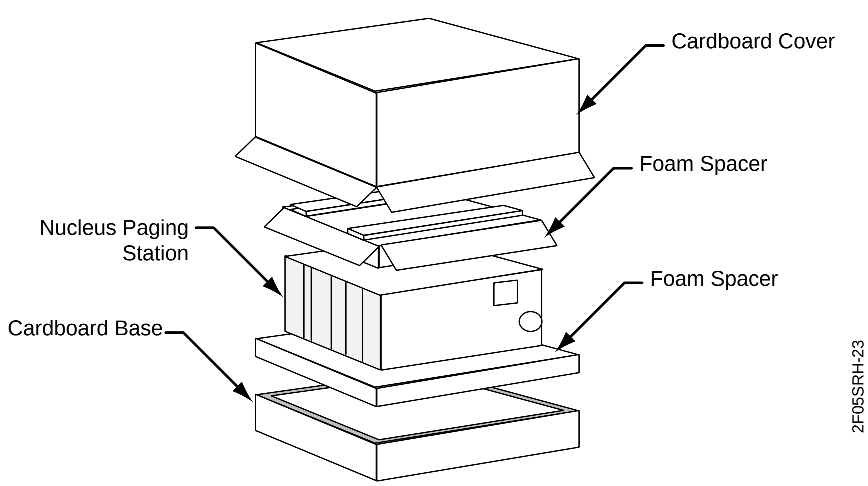


Figure 4-1: Unpacking the Station Shipped Without a Cabinet

Unpacking 25-in., 46-in., and 70-in. Indoor Cabinets

Motorola ships the 25-in., 46-in., and 70-in. cabinets mounted on a wooden skid, secured with corrugated corner braces held by a plastic strap, and covered with a cardboard cover.

1. Remove the staples that hold the cardboard cover to the wooden skid.

2. Remove the cardboard cover from the base station (see Figure 4-2).

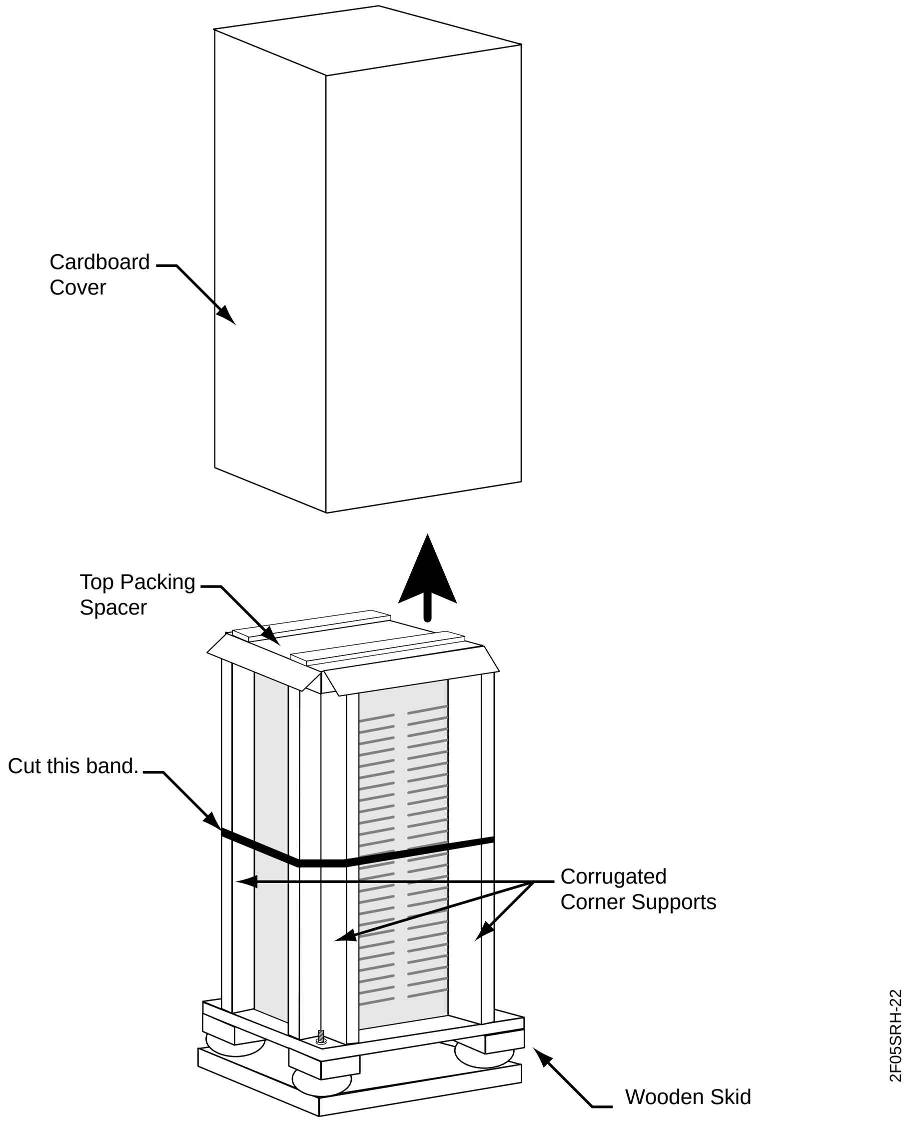


Figure 4-2: Removing the Cardboard Cover

3. Cut the metal band.

4. Remove the top packing spacer and corrugated corner supports.

5. Remove the antistatic bag (see Figure 4-3). Do not discard the bag. Use it to protect equipment during installation.

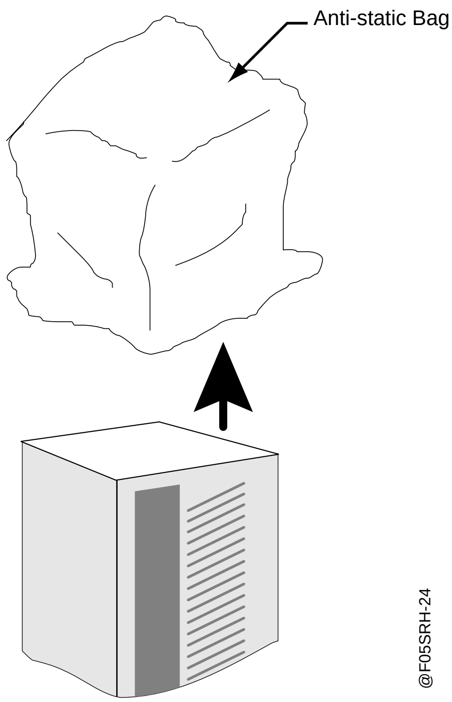


Figure 4-3: Removing the Antistatic Bag

6. The unit has a door on the front and one on the rear. Remove the doors.

7. Locate the four (4) bolts that secure the station to the wooden skid. Remove the bolts and nuts (see Figure 4-4).

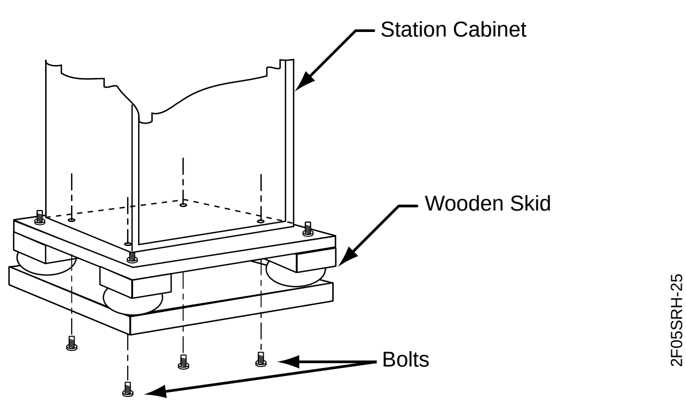


Figure 4-4: Removing the Bolts and Nuts

8. The station cabinet has lifting rings on the top front and top back. Attach these lift rings to a hoist to lift raise the station from the skid.

9. Remove the skid and return the station to the floor.

10. Replace the antistatic bag over the unit to protect it during installation.

Installing 25-in., 46-in., and 70-in. Cabinets

The 25-in., 46-in., and 70-in. cabinets have four (4) mounting holes in their bottom plates. The installer uses these holes to anchor the station to the site floor. This type of mounting requires a drilling template.

The bottom view and drilling template for each cabinet appears in Chapter 3, "Installation Overview". Use the following procedure to drill the mounting holes:

CAUTION

Cement dust is harmful to electronic equipment and wiring. Cover the cabinet and other collocated equipment to protect the equipment before drilling holes in the concrete floor. Use a tarpaulin, cloth, or plastic sheeting to cover exposed equipment. Cover the cabinet with an antistatic bag. Use a vacuum cleaner while drilling the holes to minimize the spread of concrete dust. Carefully clean up any accumulated dust and debris from the anchor installation before uncovering the equipment.

Note: Verify with local authorities that this procedure conforms to local building codes and regulations before permanently installing the cabinet.

CAUTION

A fully equipped cabinet requires extreme care to avoid dropping the equipment or causing serious injury.

1. Locate the drilling template for the cabinet.
2. Cut a large piece of cardboard from the side of the shipping carton.
3. Copy the dimensions from the drilling template onto the cardboard to make a drilling template. Verify that the template faces in the same direction and has the same left-right orientation as the station. The templates are:
   – 25-in. cabinet (see Figure 3-7)
   – 46-in. cabinet (see Figure 3-10)
   – 70-in. cabinet (see Figure 3-13)
4. Use the template and mark the location of the six, 3/4 in. (1.9 cm) diameter mounting holes.
5. Drill these holes.

Note: Use all six anchoring positions.

6. If the installation is on a wooden floor, use lag bolts and washers (customer-supplied) to secure the cabinet to the floor.
7. If the installation is on concrete floor, inspect the holes to verify that the anchors do not contact the wire mesh or rebar in the floor.

CAUTION

Isolate the cabinet electrically from any other equipment or materials at the site.

8. Install the mounting anchors (RAM RD-56 anchors recommended) using the instructions provided with the anchors.

9. Align the cabinet with the installed anchors.

10. Lower the cabinet to the floor and lightly secure the cabinet with the proper mounting hardware.

Note: Do not tighten the mounting hardware at this time.

11. Verify that the cabinet is plumb in the vertical direction. Verify that the top of the cabinet is level. Use shims (flat washers or flat aluminum plates) under the cabinet mounting foot to achieve vertical plumb and horizontal level.

12. Tightly secure the cabinet to the floor anchors, while maintaining vertical plumb and horizontal level.

13. Remove all debris and vacuum all dust. Remove protective coverings from the equipment and the antistatic bag from the cabinet.

Mounting Procedures

This procedure applies to mechanical installation in standard Electrical Industries Association (EIA) cabinets. The standard power and high power stations have different mounting procedures. Refer to the mounting procedures for your type of station.

Mounting all Stations in EIA Cabinets

Note: Do not begin this procedure until the EIA cabinet is securely fastened to the floor at its base.

Stations in EIA racks require stand-off brackets to center the cage within the rack mounting rails. Order option X153, which includes mounting brackets and slotted screws.

CAUTION

In a multiple-unit rack install equipment at the lowest possible position in the rack. Continue installing equipment, building toward the top of the rack. This procedure ensures that the rack is not top-heavy.

Motorola provides mounting screws (M6x1.0 tapping) with each station to secure the cage flanges to the stand-off brackets. Installing multiple cages one above the other is permitted as long as proper ventilation is maintained (see Chapter 3, "Installation Overview").

Mounting the Standard Power Station

This procedure describes installation of a standard power station in a standard EIA 19-in. cabinet.

Note: Perform the procedures in sequence.

CAUTION

Each standard power station weights approximately 60 lb. The unit requires two people to lift and handle it.

1. Remove the station from the packing kit. If the station is too heavy to lift from the packing carton, lighten the station by removing the power supply and power amplifier (PA) from the front of the station as follows:
   a. Remove the two TORX® screws holding the power supply using a TORX screwdriver and TX15 bit. Remove the power supply and set it aside in a safe location.
   b. Remove the two TORX screws holding the PA in the cage. Remove the PA from the cage and set it aside in a safe location.

2. Remove the fan door located at the back of the cage:
   a. Rotate the quarter-turn fasteners on right side of the fan door counterclockwise to unlock the fan door.
   b. Open the fan door and disconnect the fan cable connector.
   c. Lift the fan door off its hinge pins. Set the fan door aside in a safe place.
   d. If a peripheral bracket assembly is installed in the duct, disconnect the cables. Draw a diagram or tag the cables for reconnection. Set the screws and bracket aside for later reinstallation.
3. Prepare the equipment cabinet rails for installation:
   a. Determine where to insert the station in the rack.
   b. Mark the screw holes for the stand-off brackets.
   c. Install the brackets on the rails using four M6x1.0 tapping screws (see Figure 4-5).

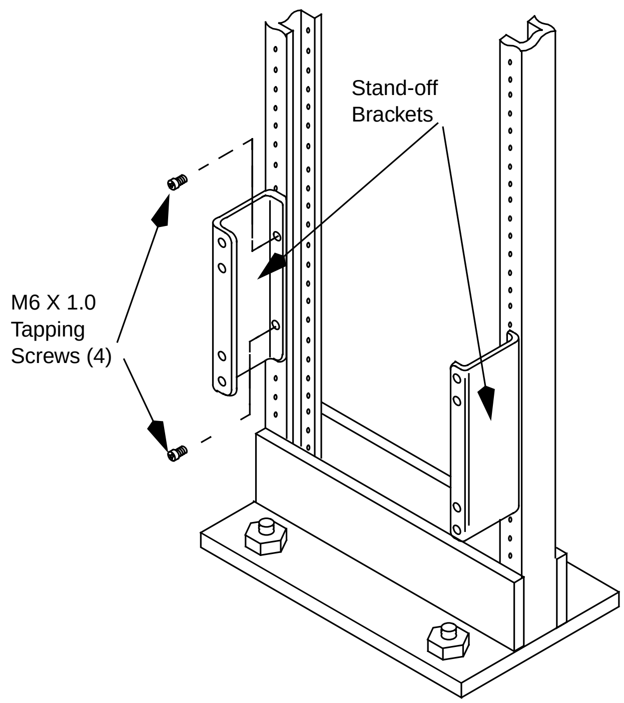


Figure 4-5: Attaching the Brackets to the Rails

d. Insert an M6x1.0 tapping screw (supplied) into each front rail at the lower of the two holes for each stand-off bracket (see Figure 4-6). The screw head is approximately 1/8 in. from the rail surface. These screws assist in positioning and holding the station for mounting.

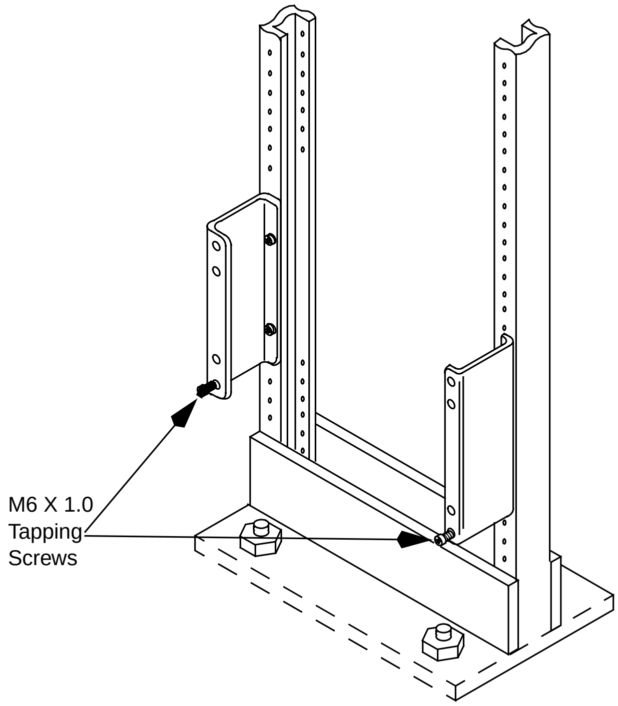


Figure 4-6: Attaching Screws to the Brackets&

4. Install the station in the cabinet:

   a. Carefully lift the station and position it in the cabinet so it rests on the two screws installed in Step 3 (see Figure 4-7).

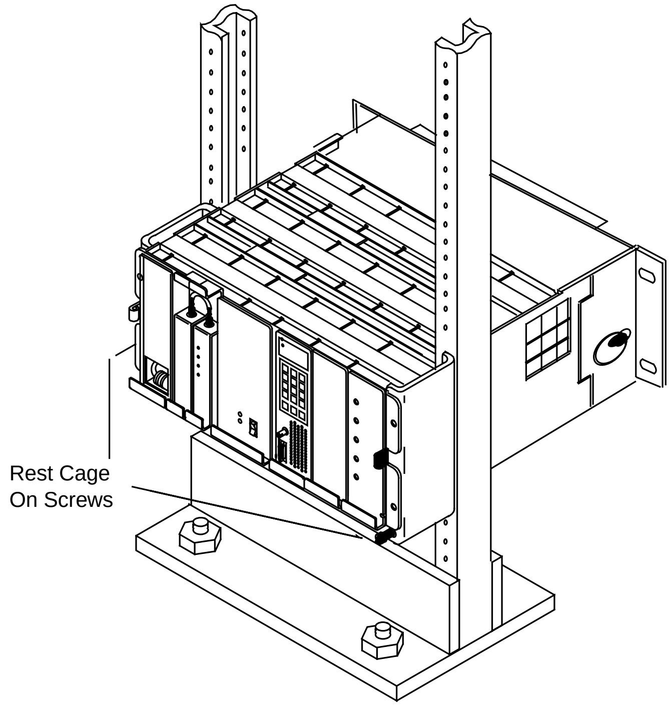


Figure 4-7: Resting the Standard Power Station on the Two Screws

b. Insert four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-8).

c. Do not install any screws in the area where the PA will be reinstalled.

d. Tighten all mounting screws securely.

5. Reinstall the fan door. Clear all cables before seating the door.

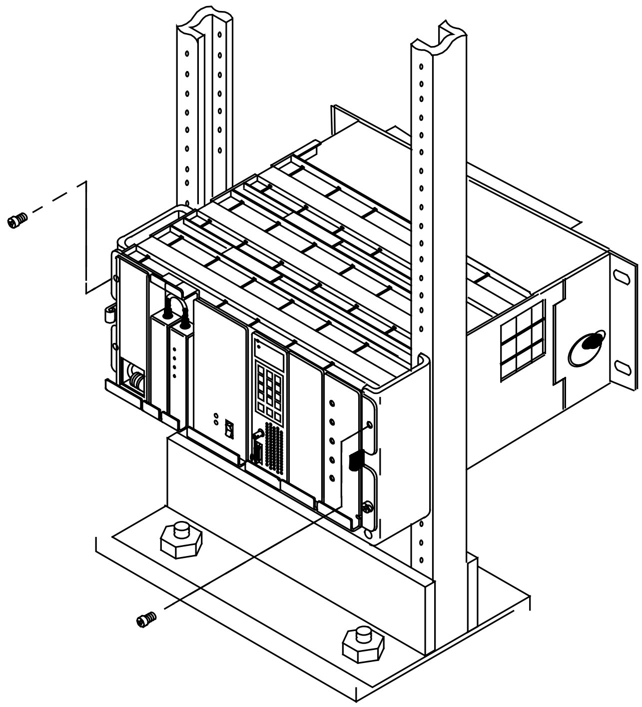


Figure 4-8: Attaching the Screws to the Standard Power Cabinet

6. Route the supplied power supply cables through the right side (viewed from rear) wiring access hole. Connect the power cables to the power supply AC power connectors.

7. Route the RF antenna cable from the RF output connector through the left side wiring access hole.

8. Reinstall the peripheral bracket and reconnect any cables which were disconnected.

9. Secure the bracket.

10. Close the fan door and secure it by pushing inward on the two quarter-turn fasteners while rotating clockwise.

11. Reinstall the power supply in the original location and secure with original TORX screws.

12. Remove the two screws that the cage is resting on.

13. This portion of the installation procedure is complete.

Mounting the High Power Station

This procedure describes installation of a high power station in a standard EIA 19-in. cabinet.

Note: Perform the procedures in sequence.

CAUTION

Each high power station weights approximately 105 lb. The unit requires two people to lift and handle it.

1. Remove the station from the packing kit. If the station is too heavy to lift from the packing carton, lighten the station by removing the two power supplies and the PA from the front of the unit:
   a. Remove the two TORX screws holding each power supply using a TORX screwdriver and TX 15 bit.
   b. Remove the power supplies from the chassis and set them aside in a safe location.
   c. Place the station on a clean work surface.
   d. Remove and discard the two shipping screws that secure the PA assembly. Use a TORX screwdriver with TX 30 bit and a small wrench or pliers.
   e. Pull the PA out from the chassis approximately 5 in. (see Figure 4-9).

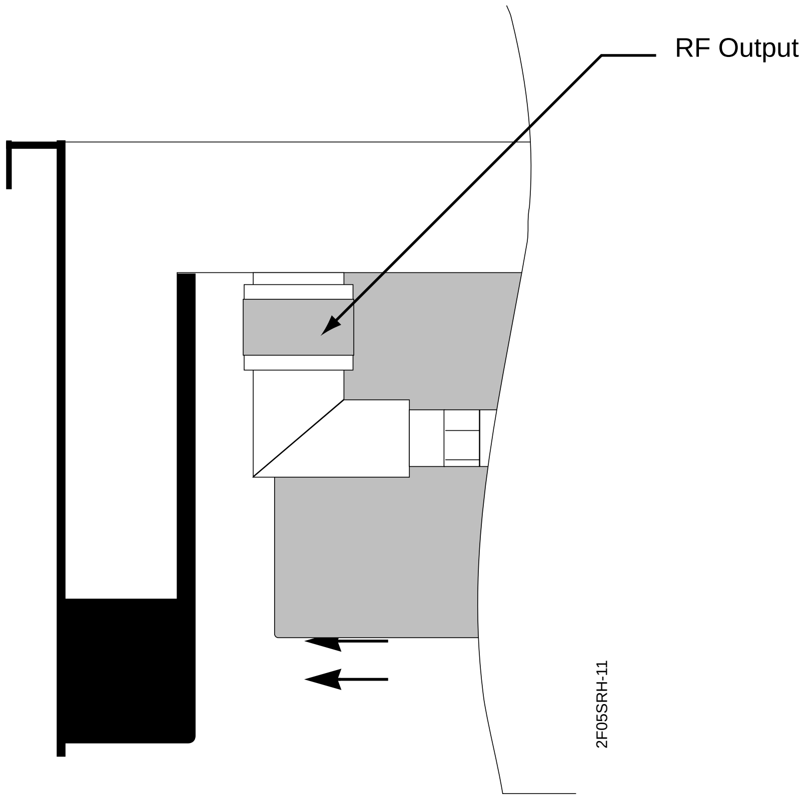


Figure 4-9: Pulling the PA from the Chassis

f. Disconnect the RF cable located at the right front of the PA.

g. Pull the PA completely away from the chassis and set it aside in a safe location.

2. Remove the fan door:

   a. Rotate the two quarter-turn fasteners on the rear of the fan door counterclockwise to unlock the fan door.

   b. Open the fan door and disconnect the fan cable connector.

   c. Remove the fan door by lifting upward until it clears the hinge pins. Set the fan door aside in a safe place.

   d. If a peripheral bracket assembly is installed, disconnect the cables. Draw a diagram or tag the cables for later reconnection. Set the screws and the bracket aside for later reinstallation.

Note: To ensure proper cooling in a Motorola cabinet, install the station so the louvers in the cabinet rear door align with the exhaust fans on the fan door.

To ensure proper cooling in a non-Motorola cabinet, install the station so the exhaust fans are aligned with adequate louvers to ensure proper cooling.

3. Install the high power station in the cabinet.
   a. Determine where to install the station in the rack. Allow space for the PA module below the cage.
   b. Mark the screw holes for the stand-off brackets.
   c. Install the brackets on the rails using four M6x1.0 tapping screws (see Figure 4-10).

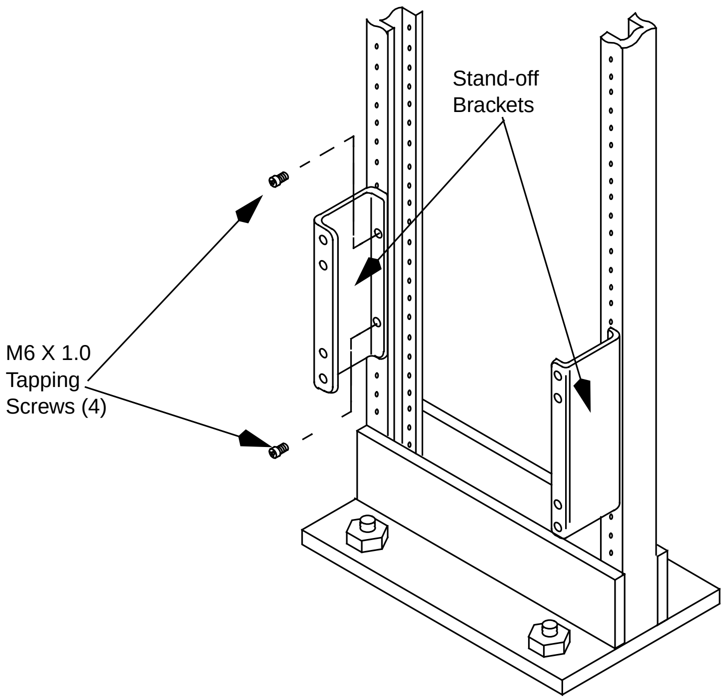


Figure 4-10: Attaching the Brackets to the Rails for a High Power Station

d. Insert an M6x1.0 tapping screw (supplied) into each front rail at the lower of the two holes for each stand-off bracket (see Figure 4-11). The screw head is approximately 1/8 in. from the rail surface. These screws assist in positioning and holding the station for mounting.

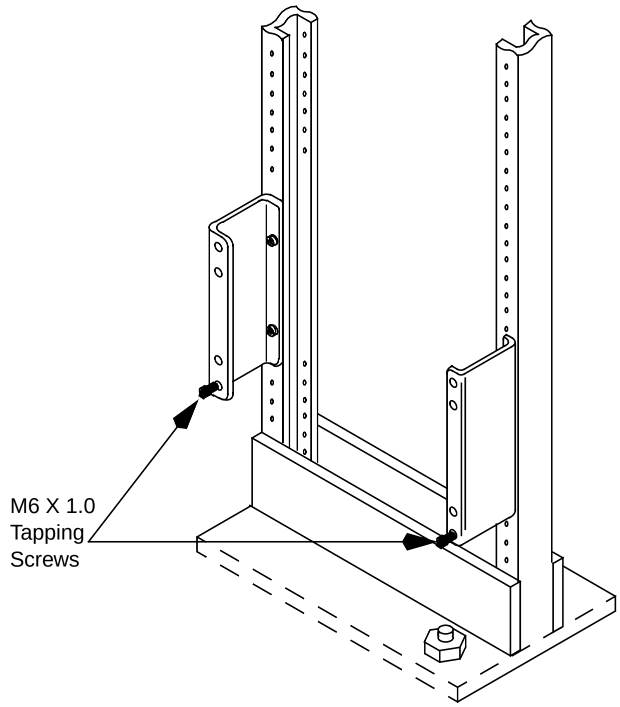


Figure 4-11: Attaching Screws to the Brackets for a High Power Station

4. Install the high power station in the cabinet:

   a. Carefully lift the station and position it in the cabinet so it rests on the two screws installed in Step 3 (see Figure 4-12).

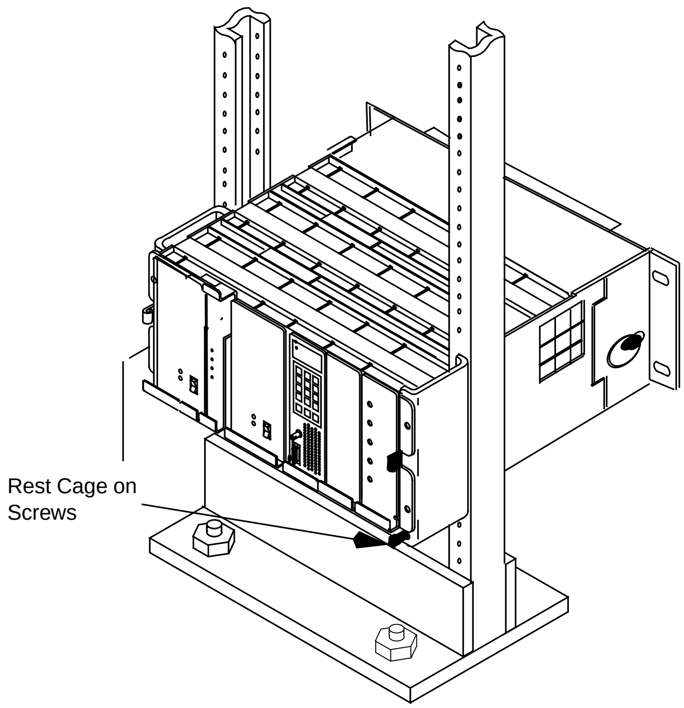


Figure 4-12: Resting the Cage on the Two Screws

b. Insert four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-13).

c. Do not install any screws in the area where the PA will be reinstalled.

d. Tighten all mounting screws securely.

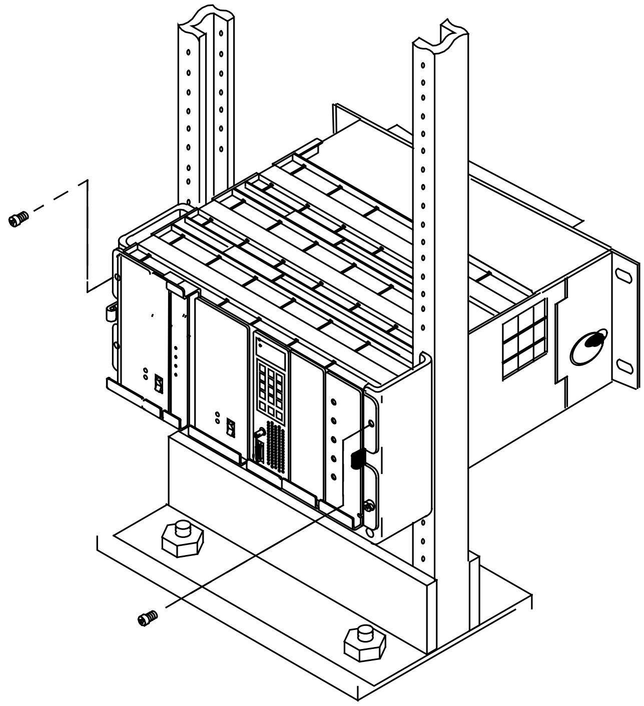


Figure 4-13: Attaching the Screws to the Cabinet

5. Reinstall the rear fan door.

6. Reconnect the fan wiring.

7. Clear all cables before seating the door.

8. Install the high power PA directly under the station.

CAUTION

The PA weights 25.65 lb (11.65 kg).

9. Route the RF and power supply cables through the right side (viewed from rear) wiring access hole.

10. Connect the power cables to the power supply AC power connectors.

11. Route the RF antenna cable from the RF output connector through the left side wiring access hole.

12. Reinstall the peripheral bracket and reconnect any cables which were disconnected.

13. Secure the bracket.

14. Reinstall fan door on hinge pins and reconnect fan cable.

15. Verify that all internal connections are completed.

16. Close the fan door and secure it by pushing inward on the two quarter-turn fasteners while rotating clockwise.

17. Reinstall the power supply in the original location and secure with original TORX screws.

18. Remove the two screws that the rack was resting on.

19. Use mounting procedure described in Step 3 through Step 4 to mount the PA.

20. This portion of the installation procedure is complete.

Stacking Cabinets

The 25-in. and 46-in. cabinets can be stacked to maximize the use of space (see Table 4-1). Motorola provides a stacking kit (TRN7750) that contains the bolts, nuts, and washers required to stack one cabinet on another.

Table 4-1: Stacking Limits for 25-in. and 46-in. Cabinets

Cabinet Size	Number of Units	Maximum Height
25 in.	3	75 in.
46 in.	2	92 in.

Connectors and Interfaces

The Nucleus paging station supports a variety of interfaces. Most interfaces connect through the Nucleus paging station backplane. This chapter describes these interfaces. This chapter contains the following information:

Backplane Interfaces

The Nucleus paging station backplane provides the station interface connectors for power, messaging data, radio frequency (RF) connections, and diagnostic interfaces. Each backplane connector has an identification number, Jxx, where x is the number of the connector. The assigned number is stamped (without the J prefix) into the metal shield covering the backplane.

Note: The backplane of the high power station and the standard power station are slightly different. Use care in installing interfaces to ensure all interfaces are correct for the station power.

The numbers and type of connectors used depends on the power level of the station:

- High power station (see Figure 5-1 and Table 5-1)
- Standard power station (see Figure 5-2 and Table 5-1)

Note: J61 Wireline Connector is identical to the following punchblock pairs in J17: pair 3, pair 4, pair 5, and pair 6.

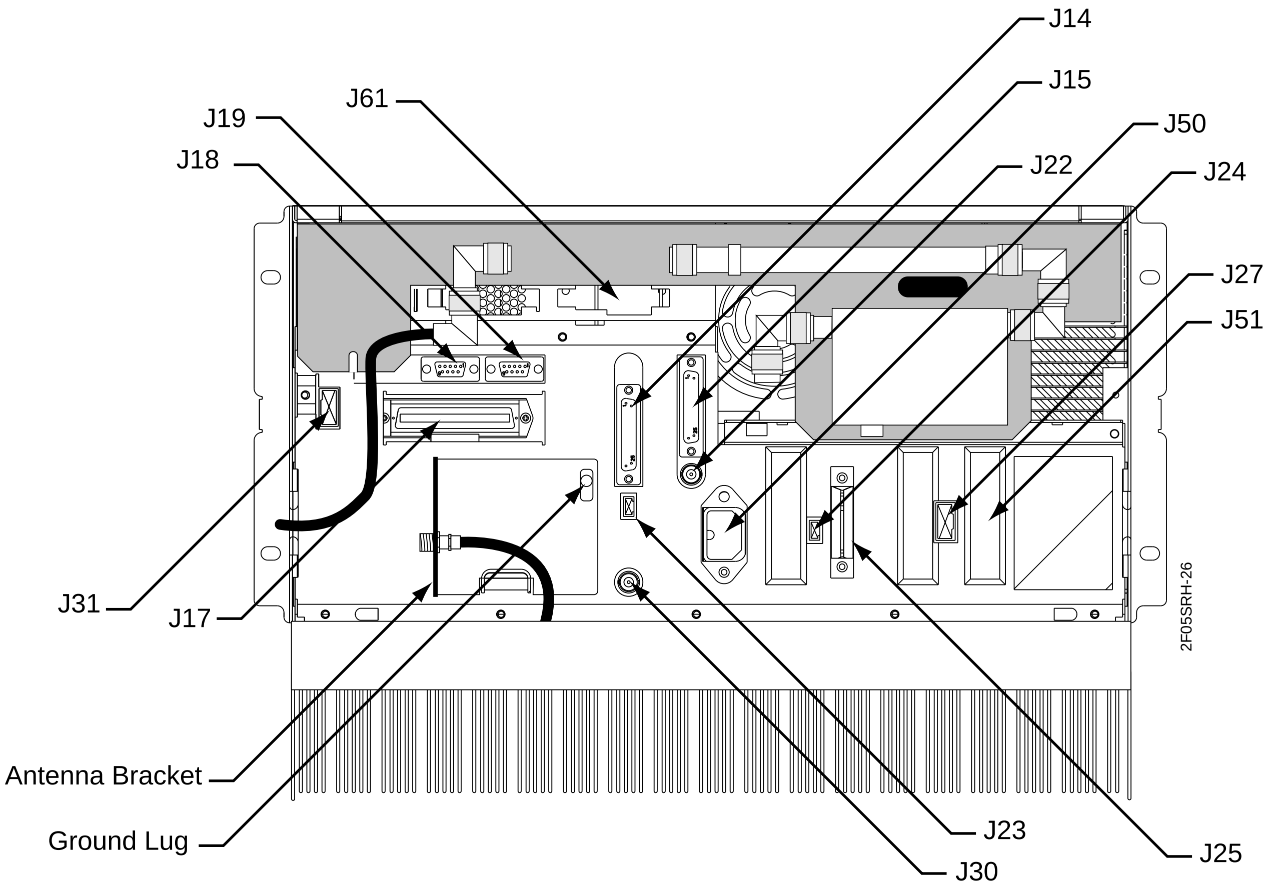


Figure 5-1: Backplane Connectors for a High Power Station (with Circulator Option)

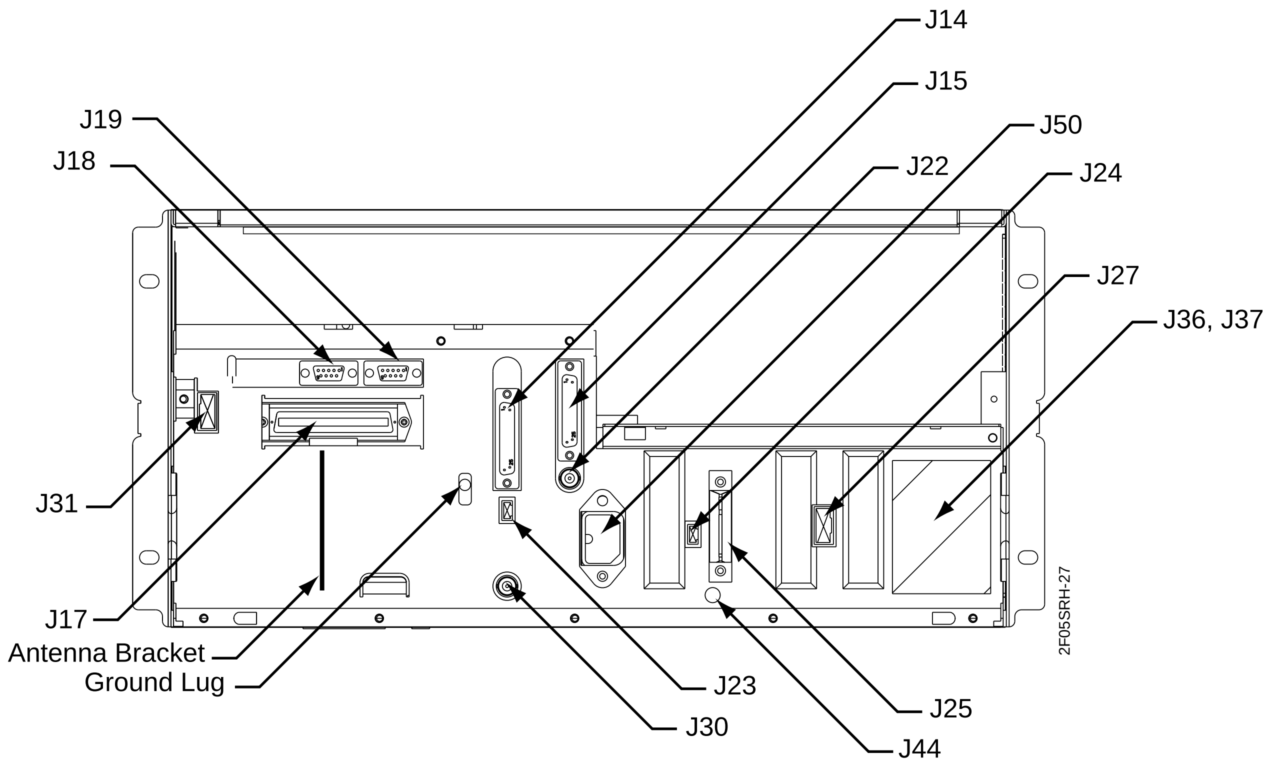


Figure 5-2: Backplane Connectors for a Standard Power Station

Table 5-1: Backplane Connectors (Sheet 1 of 2)

General Type	Connector	Name	Connector Type	Function in Standard Station	Function in High Power Station
Communication	J14	Public Switched Telephone System (PSTN) modem channel	DB25, RS232	PSTN modem channel	PSTN modem channel
	J15	Paging distribution channel	DB25, RS232	Paging distribution channel	Paging distribution channel
	J17	Multipurpose connector	50-pin	External transmitter controller interface	External transmitter controller interface
	J61	Wireline connector	8-pin	NAC wireline interface	NAC wireline interface
Synchronization	J19	Receiver link	DB9	Link receiver	Link receiver
	J22	1 pps reference port	BNC	GPS	GPS
	J30	5 MHz input	BNC	To J11 on RF-Baton!™ (RF-B!) transmitter controller backplane	To J11 on RF-B! transmitter controller backplane

Table 5-1: Backplane Connectors (Sheet 2 of 2)

General Type	Connector	Name	Connector Type	Function in Standard Station	Function in High Power Station
RF	J23	Antenna relay	AMP-MODU	Output antenna	Output antenna
	J44	RF input to PA	Blindmate SMA	Not used	RF from Exciter to Power Amplifier (PA)
Power	J24	Battery temperature	AMP-MODU	Battery thermistor	Battery thermistor
	J25	Battery revert	4-pin modular	Not used	Battery connection
	J26	Battery revert	4-pin modular	Battery connection	Not used
	J31	DC power to fan(s) and external devices	4-wire	Fan door and RF-B! transmitter controller	Fan door and RF-B! transmitter controller
	J50	AC input	3-prong receptacle	AC power	AC power
	J51	AC input	3-prong receptacle	Not populated	AC power
Circulator Option	J27	Peripheral interface	AMP-MODU		Double or triple circulator option

Installing Communication Peripherals

This section describes the installation of communication peripherals. The communication connectors are the following:

- J14—the PSTN modem channel connector. J14 provides a direct telephone connection with a computer terminal (see Table 5-2).
- J15—the paging distribution connector (see Table 5-3). J15 is used when the Nucleus paging station is used as a link transmitter.
- J17—the external control and communication connector used for several options. Options include the RF-B! transmitter controller, an external Network Interface Unit (NIU) or the internal modem on the internal NIU (see Table 5-4).
- J61—the wireline connector (see Table 5-5).

Note: Nucleus paging stations with internal NIUs do not use J14. Make connections to an optional dial modem on the internal NIU through J17, pins 5 and 30.

Table 5-2: J14 PSTN Modem Channel Connector Pins and Signals (Sheet 1 of 2)

Pin Number	Signal	Input	Output	Function
1	Gnd		X	Ground
2	PSTN TXD		X	PSTN transmit data
3	PSTN RXD	X		PSTN receive data
4	PSTN RTS		X	PSTN request to send
5	PSTN CTS	X		PSTN clear to send
6	PSTN DSR	X		PSTN data set ready
7	Gnd		X	Ground
8	PSTN DCD	X		PSTN Data Carrier Detect
9	Open			Not used
10	Open			Not used
11	Open			Not used
12	Open			Not used
13	Open			Not used
14	Open			Not used
15	PSTN TCLK		X	PSTN transmit clock
16	Open			Not used
17	PSTN RCLK	X		PSTN receive clock
18	Open			Not used
19	Open			Not used

Table 5-2: J14 PSTN Modem Channel Connector Pins and Signals (Sheet 2 of 2)

Pin Number	Signal	Input	Output	Function
20	PSTN DTR		X	PSTN data terminal ready
21	Open			Not used
22	PSTN RI	X		PSTN ring indicator
23	Open			Not used
24	Open			Not used
25	Open			Not used

Table 5-3: J15 Paging Distribution Channel Connector Pins and Signals (Sheet 1 of 2)

Pin Number	Signal	Input	Output	Function
1	Gnd		X	Ground
2	Dist TXDA		X	Distribution transmit data A
3	Dist RXDA	X		Distribution receive data A
4	Dist RTS		X	Distribution Request to send
5	Dist CTS	X		Distribution clear to send
6	Dist DSR	X		Distribution data set ready
7	Gnd		X	Ground
8	Dist DCD	X		Distribution data carrier detect
9	Open			Not used
10	Open			Not used
11	Open			Not used
12	Open			Not used
13	Dist RCLKB	X		Distribution receive clock B
14	Dist TXDB		X	Distribution transmit data B
15	Dist TCLKA		X	Distribution transmit clock A
16	Dist RXDB	X		Distribution receive data B
17	Dist RCLKA	X		Distribution receive clock A
18	Open			Not used
19	Dist TCLKB		X	Distribution transmit clock B
20	Dist DTR		X	Distribution data terminal ready
21	Open			Not used
22	Open			Not used
23	Open			Not used

Table 5-3: J15 Paging Distribution Channel Connector Pins and Signals (Sheet 2 of 2)

Pin Number	Signal	Input	Output	Function
24	Open			Not used
25	Open			Not used

Table 5-4: J17 50-pin Multipurpose Connector Pins and Signals (Sheet 1 of 2)

Signal	Pin Number	Wire Color (Main/Trace)	Signal	Function
Ring	1	Blue/White	Aux Audio In	Auxiliary audio input
Ring	2	Orange/White	Relay Normally Closed	Relay 1
Ring	3	Green/ White	Line 1 (+)	Line 1 positive input
Ring	4	Brown/White	Line 2 (+)	Line 2 positive input
Ring	5	Slate/White	Dial Modem (+)	Dial-up PSTN modem connection
Ring	6	Blue/Red	Open	Open
Ring	7	Orange/Red	Gnd	Ground
Ring	8	Green/Red	+5 Vdc	+5 Vdc from power supply
Ring	9	Brown/Red	Buf Audio Out	Buffered audio out
Ring	10	Slate/Red	Ext Key Req	External key response
Ring	11	Blue/Black	WIB In 1	External alarm 1 to WIB
Ring	12	Orange/Black	WIB In 2	External alarm 2 to WIB
Ring	13	Green/Black	Open	Open
Ring	14	Brown/Black	Line (+)	Wireline messaging input positive input
Ring	15	Slack/Black	Line (-)	Wireline messaging input negative input
Ring	16	Blue/Yellow	WIB In 6	External alarm 6 to WIB
Ring	17	Orange/Yellow	Open	Open
Ring	18	Green/Yellow	FLEX Sel	FLEX select
Ring	19	Brown/Yellow	Tx Baud Clk	Transmit baud clock to Synchronous Local Control (SyLC) interface
Ring	20	Slate/Yellow	Tx Data Clk	Transmit data clock to SyLC interface
Ring	21	Blue/Violet	Tx Data	Transmit data to SyLC interface
Ring	22	Orange/Violet	WIB in 4	External alarm 2 negative input to WIB
Ring	23	Green/Violet	WIB in 3	External alarm 2 positive input to WIB
Ring	24	Brown/Violet	Ext Mon Rec Dis	Disable external monitor receiver
Ring	25	Slate/Violet	WIB In 7	External alarm 7 to WIB
Tip	26	White/Blue	Open	Open

Table 5-4: J17 50-pin Multipurpose Connector Pins and Signals (Sheet 2 of 2)

Signal	Pin Number	Wire Color (Main/Trace)	Signal	Function
Tip	27	White/Orange	Relay Norm Open	Relay 1
Tip	28	White/Green	Line 1 (-)	Line 1 negative input
Tip	29	White/Brown	Line 2 (-)	Line 2 negative output
Tip	30	White/Slate	Dial Modem (-)	Dial-up PSTN modem connection
Tip	31	Red/Blue	Open	Open
Tip	32	Red/Orange	Gnd	Ground
Tip	33	Red/Green	+13.8 Vdc	+13.8 Vdc from power supply
Tip	34	Red/Brown	Gnd	Ground
Tip	35	Red/Slate	Ext Mode Req	External mode request
Tip	36	Black/Blue	WIB Out 1	WIB output 1
Tip	37	Black/Orange	WIB Out 2	WIB output 2
Tip	38	Black/Green	WIB Out 3	WIB output 3
Tip	39	Black/Brown	WIB Out 4	WIB output 4
Tip	40	Black Slate	WIB Out 5	WIB output 5
Tip	41	Yellow/Blue	WIB In 6	WIB input 6
Tip	42	Yellow/Orange	WIB In 8	WIB input 8
Tip	43	Yellow/Green	WIB Out 7	WIB output 7
Tip	44	Yellow/Brown	WIB Out	WIB output 8
Tip	45	Yellow/Slate	WIB In 5	WIB input 5
Tip	46	Violet/Blue	Ext Mon Rx Sq Req	External monitor receiver squelch request
Tip	47	Violet/Orange	Mon Rec Audio	External or internal monitor request audio
Tip	48	Violet/Green	Open	Open
Tip	49	Violet/Brown	Com Relay 1	Relay 1 common
Tip	50	Violet/Slate	WIB In 7	WIB input 7

Table 5-5: J61 Wireline Connector Pins and Signals (Sheet 1 of 2)

Old Wireline Connector (Part Number 0185057U01)		New Wireline Connector (Part Number 3082739X01)	
Pin Number	**Signal**	**Pin Number**	**Signal**
1	Modem-	**1**	Line 1+
2	Modem+	**2**	Line 1-
3	Not used	**3**	Line 2+

Table 5-5: J61 Wireline Connector Pins and Signals (Sheet 2 of 2)

Old Wireline Connector (Part Number 0185057U01)		New Wireline Connector (Part Number 3082739X01)	
Pin Number	**Signal**	**Pin Number**	**Signal**
4	Not used	**4**	Line 2-
5	Line 2-	**5**	Not used
6	Line 2+	**6**	Not used
7	Line 1-	**7**	Modem+
8	Line 1+	**8**	Modem-

Installing Synchronization Peripherals

This section describes installation procedures for synchronization peripherals. The synchronization connectors are the following:

- J19—the link receiver connector (see Table 5-6).
- J22—the 1 pps reference port connector for a GPS receiver. J22 is a 1-pin BNC connector.
- J30—the 5 MHz input from the RF-B! transmitter controller. J30 is a 1-pin BNC connector.

Table 5-6: J19 Link Receiver Connector Pins and Signals

Pin Number	Signal	Input	Output	Function
1	Gnd		X	Ground
2	Ext Link Rx DPL En	X		External link Rx DPL enable
3	Ext Link Rx Sq Ind	X		External link Rx squelch indicator
4	Ext Link Rx DPL Ind	X		External link Rx DPL detect indicator
5	Link Rx Audio[1]			Internal or external link Rx audio
6	Open			Not used
7	Open			Not used
8	Open			Not used
9	13.8 Vdc		X	13.8 Vdc from power supply

1. Link Rx Audio is an input for a the monitor receiver or a Nucleus paging station configured as no internal. This signal is an output signal for a link receiver.

Installing RF Interfaces and Antenna Options

This section describes RF installation procedures. The RF connectors are the following:

- J23—the antenna relay for an output antenna (see Table 5-7).
- J44—the RF input connector to the power amplifier (PA). J44 is a 1-pin blindmate connector.

This section also describes the antenna relay options:

- Single antenna transmit and receive (antenna relay option X371)
- Separate transmit and receive antenna

Table 5-7: J23 Antenna Relay Connector Pins and Signals

Pin Number	Signal	Output	Function
1	Gnd	X	Ground
2	Ant Rly Keyed A+	X	Switched +14.2 Vdc to energize the antenna relay
3	Gnd	X	Ground

Single Antenna Transmit and Receive (Antenna Relay Option X371)

The antenna relay option enables a single antenna to transmit and receive for the station. Nucleus paging stations with the antenna relay option are shipped with:

- Antenna relay module installed in the antenna bracket on the station backplane
- RF cables from the PA to the Receiver already connected (see Figure 5-3)

Note: If the Nucleus paging station has SCM software 3.000 or later, Exciter software 7.000 or later, and internal NIU software 3.18 or later, the antenna relay remains in the Tx position until a maintenance cycle occurs. At this point, the NIU communicates the position of the relay to the SCM and Exciter. This feature greatly increases the life expectancy of the antenna relay.

Use the following procedure to install or verify installation of the cables:

1. Inspect the antenna relay control cable. Ensure that the antenna relay control cable is securely attached to the J23, the antenna relay connector.

2. The antenna bracket has two rows of three holes each. Connect the station receive input cable from the Receiver to the top outside opening in the antenna bracket.

3. Attach the single transmit and receiver cable to the middle outside opening in the antenna bracket.

4. Attach the transmit output cable from the PA to the lower outside opening in the antenna bracket.

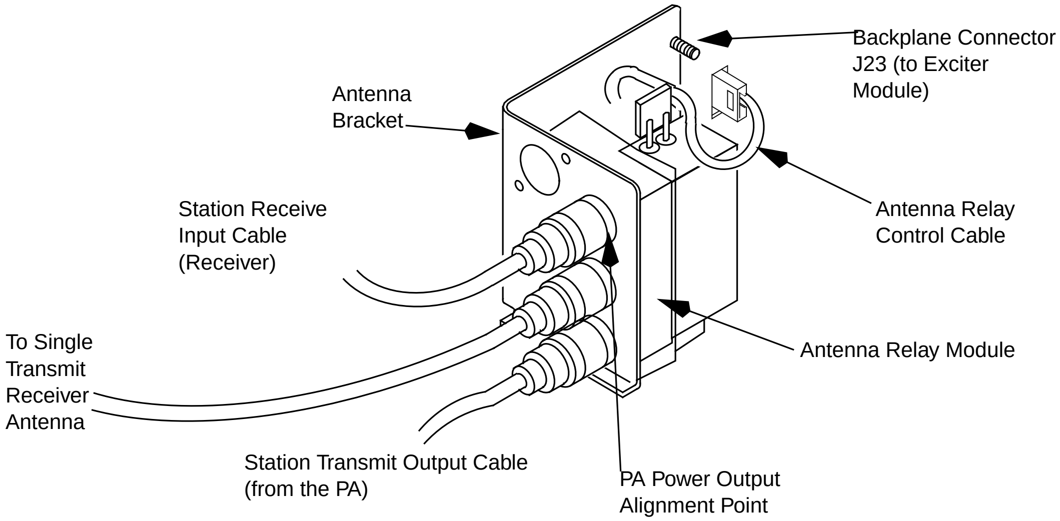


Figure 5-3: Backplane Connections for an Antenna Relay Module

Separate Transmit and Receive Antenna

A Nucleus paging station without an antenna relay option requires a separate transmit antenna receive antenna. A stations that uses separate transmit and receive antennas is shipped with:

- A coaxial cable from the PA connected to the antenna bracket on the backplane.
- A Receiver connected to the antenna bracket on the backplane.

The internal transmit and receive cables meet and mate with the external transmit and receive cables through the antenna bracket (see Figure 5-4).

Note: Detach the PA power output alignment point from the antenna relay module and attach it directly to the power meter during station power alignment.

1. The antenna bracket has two rows of three holes each. The row closer to the backplane provides receive-antenna connections. Connect the receive antenna cable through the top inside opening in the antenna bracket.

2. Connect the station receiver input cable to the receive antenna cable through the antenna bracket.

3. Connect the transmit antenna cable through the middle outside opening in the antenna bracket.

4. Connect the station transmit output cable from the PA to the transmit cable through the antenna bracket.

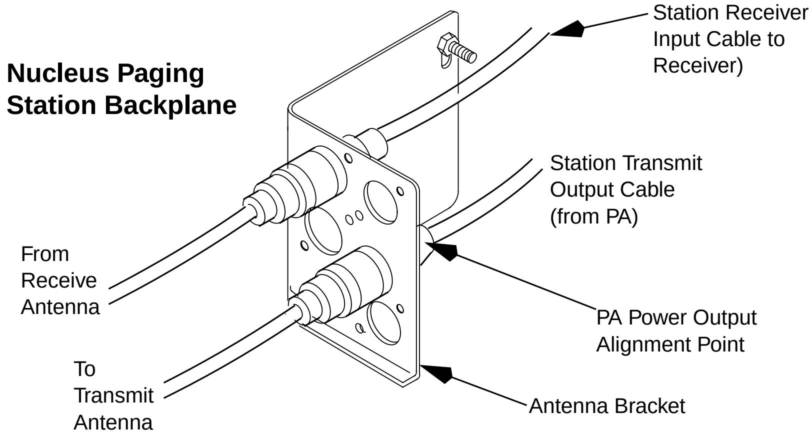


Figure 5-4: Backplane Connections for Separate Transmit and Receive Antennas

Installing Power

This section describes power installation procedures. The power connectors include the following:

- Ground at the ground lug on the antenna bracket.
- J31—the DC power to fan(s) and external devices (see Table 5-8).
- J50—the AC input to all stations. J50 is a 3-prong receptacle suitable to the site country, and designated during the ordering procedure.
- J51—the AC input high power stations. J51 is a 3-prong receptacle suitable to the site country, and designated during the ordering procedure.
- J24—the battery temperature measurement to the station (Table 5-9).
- J25—the battery revert during AC power failures for standard power stations. See paragraph, "Standard Power Station Battery Revert".
- J26—the battery revert during AC power failures for high power stations. See paragraph, "High Power Station Battery Revert".

Note: Always install battery options after installing AC power.

Table 5-8: J31 DC Power Connector Pins and Signals

Pin Number	Signal	Input	Output	Function
1	Gnd		X	Ground
2	Gnd		X	Ground
3	5 Vdc		X	5 Vdc from power supply
4	5 Vdc		X	5 Vdc from power supply
5	13.8 Vdc		X	13.8 Vdc from power supply
6	13.8 Vdc		X	13.8 Vdc from power supply
7	28 Vdc		X	28 Vdc from power supply
8	Gnd		X	Ground
9	28 Vdc		X	28 Vdc from power supply
10	Gnd		X	Ground

Table 5-9: J24 Battery Temperature Connector Pins and Signals

Pin Number	Signal	Input	Output	Function
1	Gnd		X	Ground
2	Batt Temp	X		Variable resistance proportional to battery temperature
3	Gnd		X	Ground

Ground at the Ground Lug

The Nucleus station cage has a single ground lug located on the rear panel of the cage. Connect this lug to the site ground point (see Figure 5-5).

Use the following procedure to install the ground lug:

1. Connect a #10 gauge (or larger) coated wire to the site ground point.

2. Connect the other end of the wire to the Nucleus paging station at the earth ground lug on the upper right-hand corner of the antenna bracket on the backplane.

3. Tighten the nut on the antenna bracket securely.

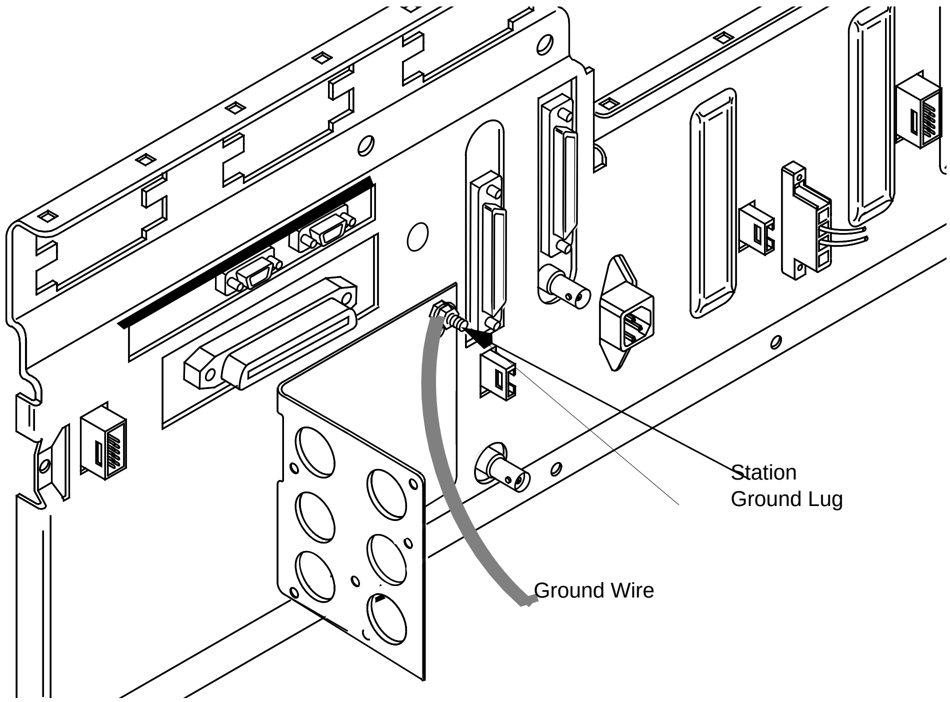


Figure 5-5: Ground Lug to Site Ground

DC Power to Fans and External Devices

J31 provides DC power to fans and the RF-B! transmitter controller. Use the following procedure to route the power to the fans and external devices:

1. Locate the black and red wire assembly for the door fans. Motorola installs this assembly on the fan door during manufacturing.

2. If the RF-B! transmitter controller also uses power from J31, clip the white tie-wraps that constrain the cable assembly.

3. Route the white / black (main color / trace color) connector to J31 on the backplane.

4. Route the black / white connector to J14 on the RF-B! transmitter controller (see Figure 5-6). This connection uses four pins. The cable termination at J14 on the RF-B! transmitter controller is a four-pin connector.

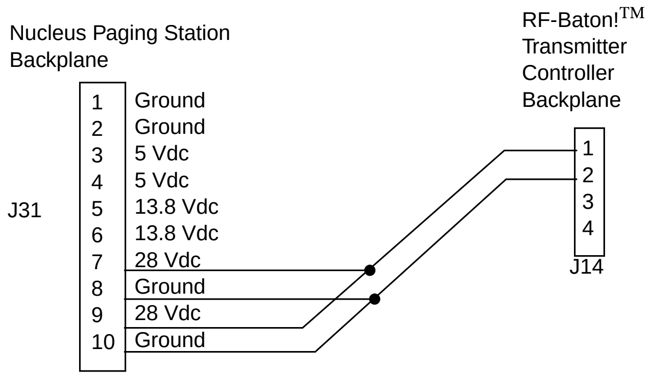


Figure 5-6: Connector J31 Output to an RF-B! Transmitter Controller

AC Power

Each Nucleus paging station with AC power ships with a customer-specified line cord. Occasionally, in response to a customer request, Motorola ships the cord in the unterminated state (no plug).

Standard power Nucleus paging stations have one power supply and one line cord. High power Nucleus paging stations have two power supplies and two line cords. The Motorola factory installs the receptacle end of the cord(s) in J50 and J51 (if required).

CAUTION

Do not apply power after connection. Turn off the Power Supply Module On and Off switch located on the front panel to the 0 or off position (switch position down). Turn off the circuit breaker for the AC outlet.

Use this procedure to connect AC power:

1. If the Nucleus paging station was shipped with the unterminated cord option, obtain the correct terminator from an electrical parts supplier and connect it to the power cord using manufacturer's instructions.

2. Connect the plug end of each cord to a grounded outlet (see Figure 5-7).

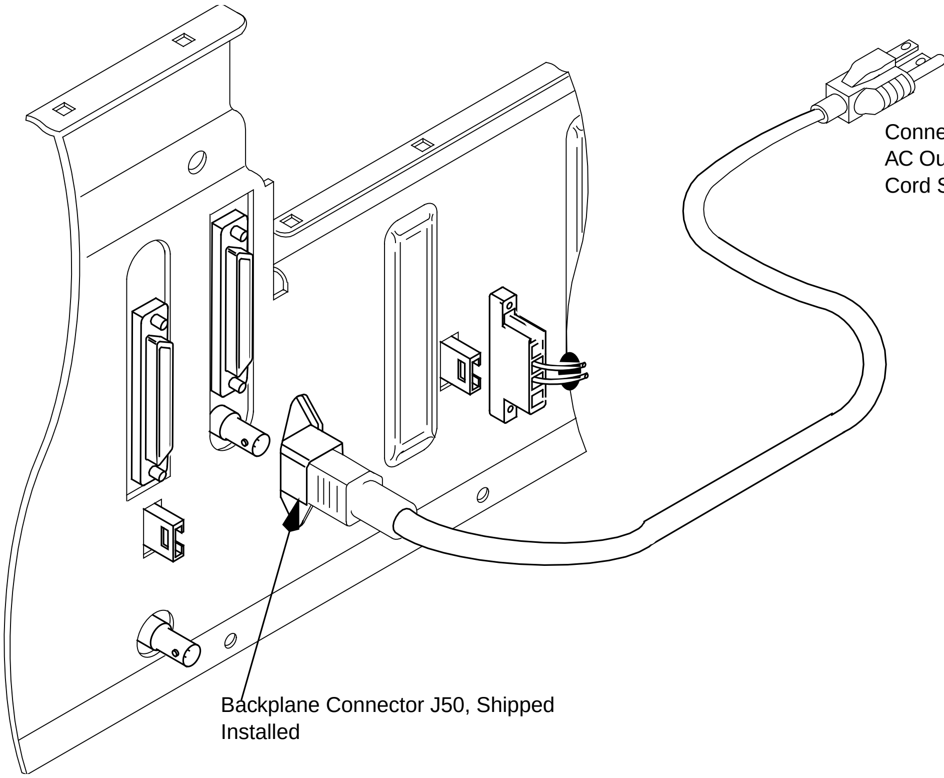


Figure 5-7: AC Power (US 120 Vac Shown)

DC Power from a Power Supply

The DC power options for battery revert are X342 and X581 (see Table 5-10).

Table 5-10: Nucleus DC Power Options

Option	Input Voltage	Input Current	Recommended Circuit Breakers or Fuses
X342	21–34.5 Vdc	40 A maximum	50 A
X581	41–72 Vdc	18 A maximum	25 A

Note: Motorola installs the cable connectors to J25 on the backplane during manufacturing. Connect a battery after this procedure.

The cable assembly has a snap connector at one end, a red-coated wire and a black coated wire. Each wire terminates in an eyelet terminal (see Figure 5-8). The cable assembly provides 10 ft lengths of black- and red-coated wire. If the DC power connection exceeds 10 ft, use thicker wire to compensate for the increased distance.

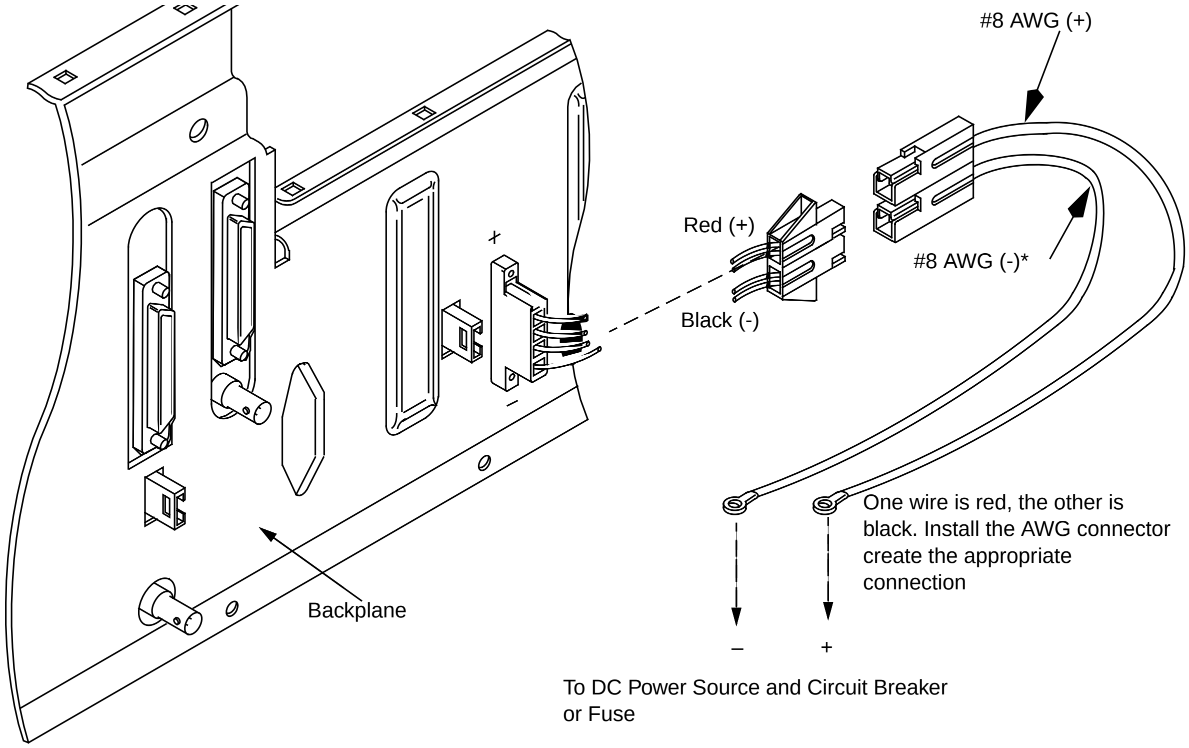


Figure 5-8: DC Power Supply Option

Installing a Negative Voltage DC Power Supply

Note: The shipping package contains a 10-ft length of #8 AWG wire. If the distance is longer than 10 feet, use thicker wire to compensate for increased wire length.

Use the following procedure to install a negative voltage DC power supply:

1. Connect the black-coated wire to earth ground (see Figure 5-9).

CAUTION

Do not connect the black coated wire to the same ground as the ground lug connection. Use a separate earth ground to ensure the safety of the system.

2. Connect the black-coated positive (+) side of the DC power source.

3. Connect the red-coated wire to the circuit breaker or fuse connector.

4. Connect a red-coated wire from the circuit breaker or fuse connector to the negative side of the DC power source.

5. Orient the cable to connect the red-coated wire to the negative side of the cable from J25. Snap the connectors together.

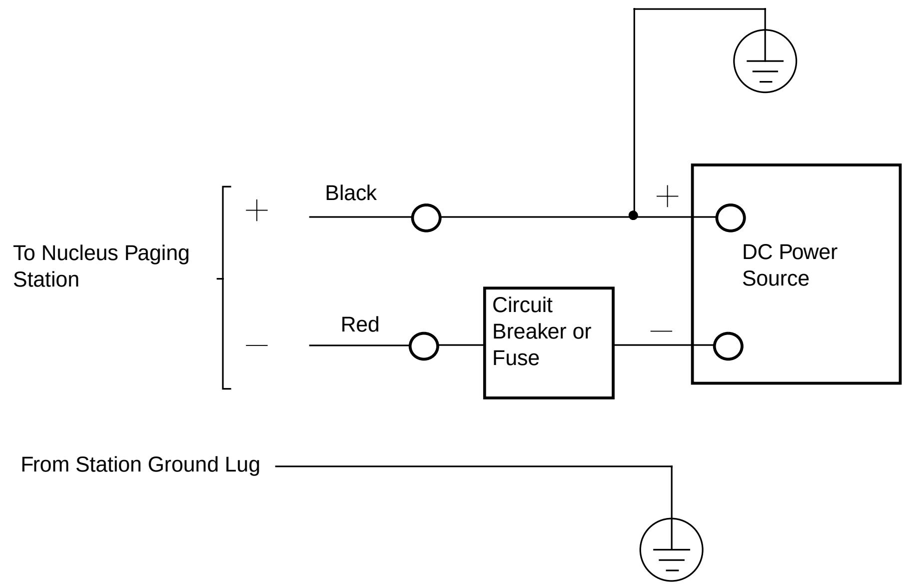


Figure 5-9: Negative Voltage DC Power Supply

Installing a Positive Voltage DC Power Supply

Note: The shipping package contains a 10-ft length of #8 AWG wire. If the distance is longer than 10 feet, use thicker wire to compensate for increased wire length.

Use the following procedure to install a negative voltage DC power supply:

1. Connect the black-coated wire to earth ground (see Figure 5-10).

CAUTION

Do not connect the black coated wire to the same ground as the ground lug connection. Use a separate earth ground to ensure the safety of the system.

2. Connect the black-coated wire to the negative (-) side of the DC power source.

3. Connect the red-coated wire to the circuit breaker or fuse circuit.

4. Connect a red-coated wire from the circuit breaker or fuse circuit the DC power source.

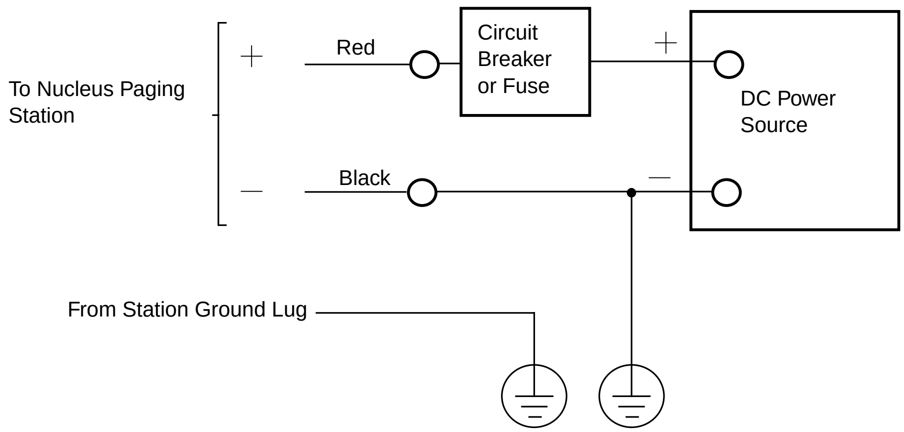


Figure 5-10: Positive Voltage DC Power Supply

High Power Station Battery Revert

High power Nucleus paging station use the X30 battery revert option. The X30 battery revert option uses battery backup to maintain power if the AC power fails. Battery revert maintains data and software stored in memory and communication with the control. Motorola does not provide batteries in the shipment.

A Nucleus paging station ordered with the battery revert option is shipped with a 2-wire assembly already installed on the backplane. This assembly has two 10-ft lengths of red and black #12 AWG gauge wire and a fuse block with a 20 A fuse.

Note: If the Nucleus paging station power is on at this point, turn it off. If a power failure occurs during installation, the Nucleus paging station attempts to revert to battery power and drains the battery.

Use the following procedure to complete the connections:

1. Arrange the batteries to facilitate connection (- to +) and place them together to form a deck (see Figure 5-11).

2. Connect the black #12 AWG wire to the negative pole on the battery at one end of the battery deck.

3. Connect the red #12 AWG wire from the fuse box to the positive side of the battery deck at the opposite side from the negative connection.

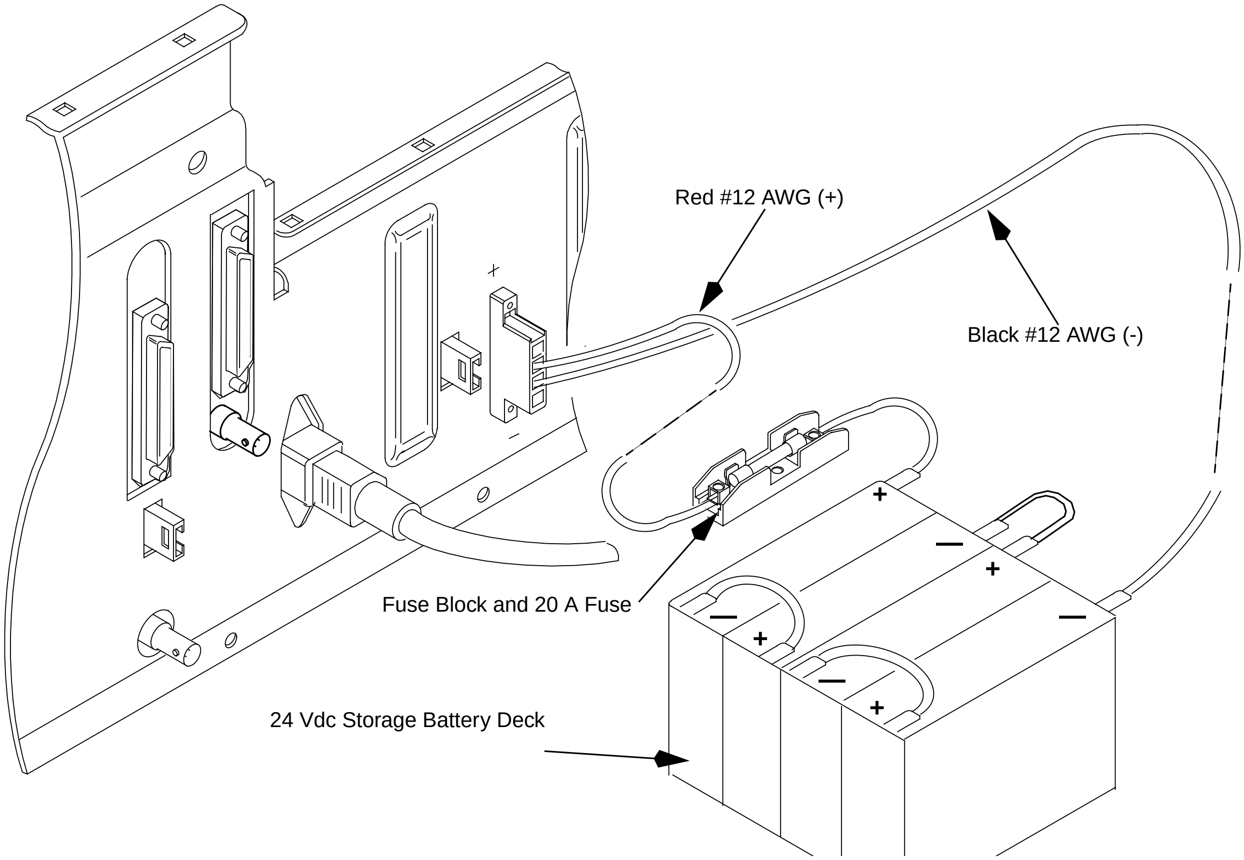


Figure 5-11: Battery Revert in a High Power Station

Standard Power Station Battery Revert

Standard power Nucleus paging stations use the X43 battery revert option. The X43 battery revert option uses battery backup to maintain power if the AC power fails. The station continues to key during battery revert. However, the Nucleus paging station reduces power output. Motorola does not provide a battery in the shipment.

Motorola installs the 4-wire connector for the battery revert option on the backplane during manufacturing. The other end of the cable assembly snaps into the battery lead assembly. The leads are two 10-ft lengths of red and black #12 AWG gauge wire. The red wire has an in-line 60 A fuse box.

Note: The thermistor sensor, which is part of the battery temperature sensor option, attaches to the black-coated wire.

If Nucleus paging station power is turned on at this point, turn it off. If a power failure occurs during installation, the Nucleus paging station attempts to revert to battery power.

Use the following procedure to complete the connections:

1. Connect the black-coated (negative) #8 AWG wire to the negative terminal on the battery (see Figure 5-12).

2. Connect the red-coated (positive) #8 AWG wire to the positive terminal on the battery.

3. Snap the connector on the #8 AWG assembly into the installed connector from the backplane.

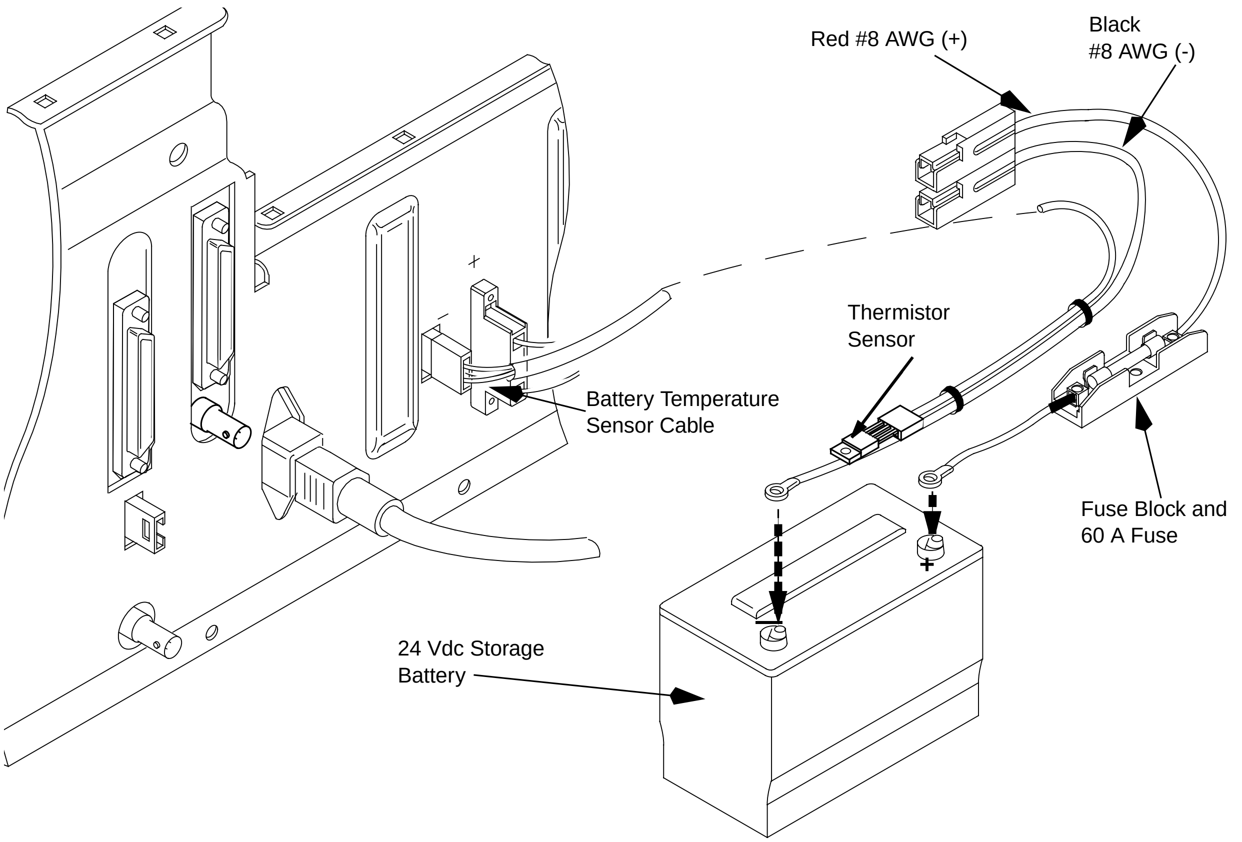


Figure 5-12: Battery Revert for a Standard Power Nucleus Paging Station

Battery Temperature Option

The Nucleus paging station with a battery revert option requires the battery temperature option if battery temperature is a critical issue. Use the following procedure to install the battery temperature option:

1. Connect the wire with the thermistor sensor (black wire) to the negative pole of a single battery or the first battery in the battery deck (see Figure 5-13).

2. Connect the wire with the fuse block (red wire) to the positive pole of a single battery or the last battery in the battery deck.

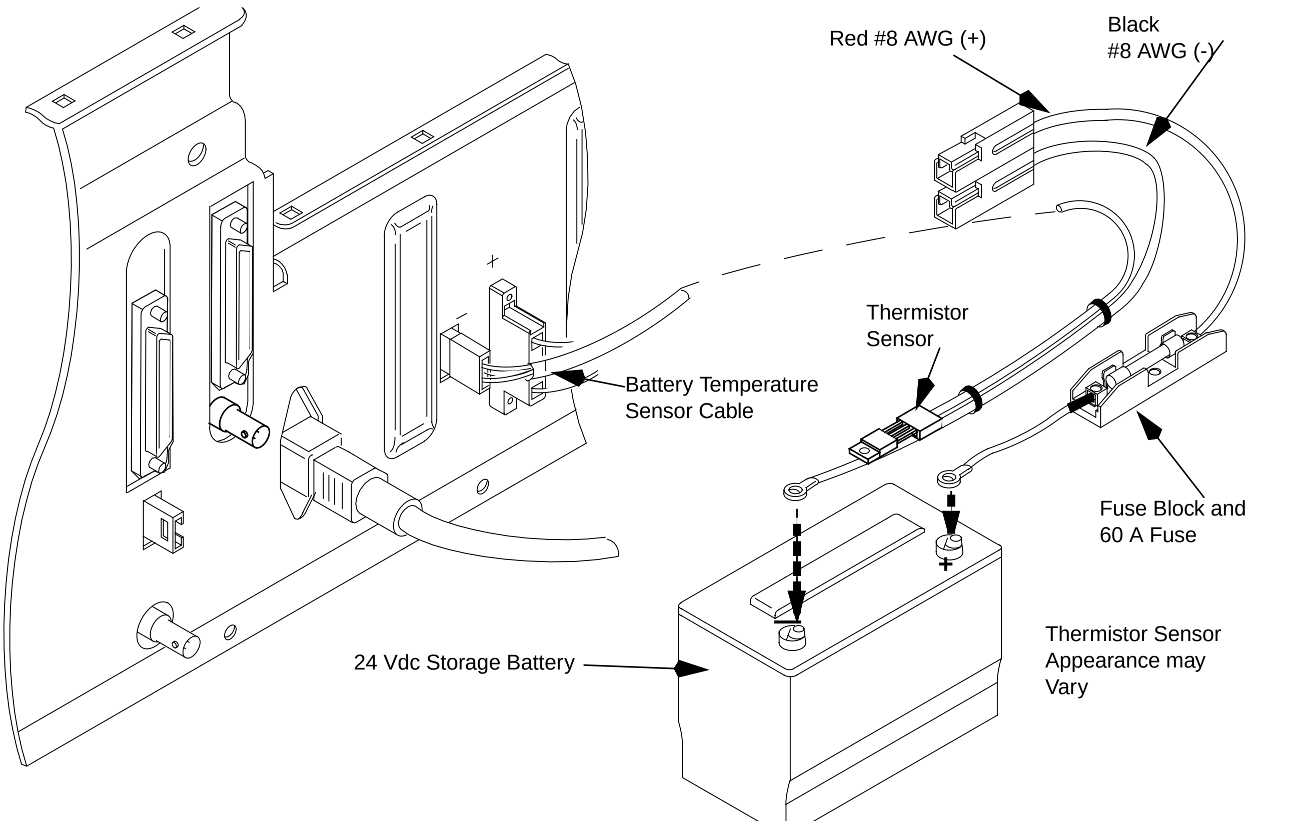


Figure 5-13: Battery Temperature Sensor

Connecting the RF-B! Transmitter Controller

The Nucleus paging station connectors are for the RF-B! transmitter controller are the following:

- J17—the 50-pin multiple-purpose connector at the Nucleus paging station (see Table 5-4). The cable that terminates at J17 splits and has two terminations at the RF-B! transmitter controller (see Figure 5-14).
- J30—the 5 MHz input from the RF-B! transmitter controller. J30 is a 1-pin BNC connector.
- J31—the 10-pin DC power cable to the RF-B! transmitter controller. This connector uses four pins for the RF-B! transmitter controller interface (see Figure 5-6).
- The RF-B! transmitter controller connects to the Nucleus paging station through connectors on the station backplane (see Figure 5-14).

Use the following procedure to connect the Nucleus paging station with the RF-B! transmitter controller:

1. Locate the special J17 cable in the cable kit if it has not already be installed. Install the 50-pin end of the cable to J17. Install the other connectors to J14 and J17. The connectors are keyed to eliminate errors.

2. Locate the BNC-to-BNC coaxial cable in the cable kit if it has not already be installed. Install one end of this cable at J30. Connect the other end of the cable to J11.

3. Locate the 10-pin DC power cable in the cable kit, if it has not already been installed. Install the 10-pin connector to J31. Install the 4-pin connector in J14.

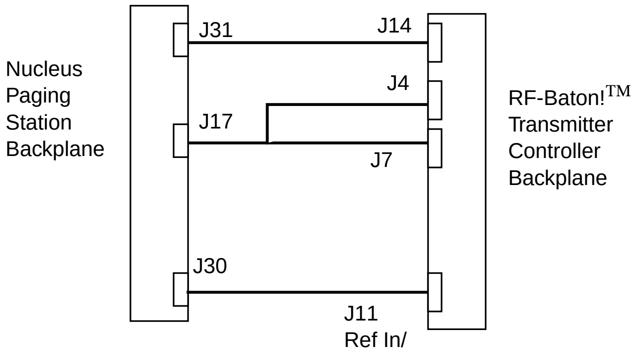


Figure 5-14: Nucleus Paging Station to the RF-B! Transmitter Controller

NAC Wireline Configuration

Motorola configures a NAC station for 4-wire operation on inbound traffic on Line 1 and outbound on Line 2. Some countries require 2-wire inbound and outbound operation on Line 2 (see Appendix Table 5-11:). Motorola configures the board during manufacturing. Do not reset the board unless the board is being replaced.

Table 5-11: Wireline Configuration for NAC Boards

Jumper Number	Description and Setting	Setting
JU801	Line 2 impedance matching	A. 600 Ohm matching network B. Belgium matching network C. FRG/Swiss matching network D. UK C1A matching network
JU802	Line 2 impedance matching	A. 600 Ohm matching network B. Belgium matching network C. FRG/Swiss matching network D. UK C1A matching network
JU803	Impedance matching jumper	A. Special matching (not used) B. Normal Operation
JU804	European line spacing	A. Spacing in B. Spacing out
JU805	European line spacing	A. Spacing in B. Spacing out
JU901	European line spacing	A. Spacing in B. Spacing out
JU902	European line spacing	A. Spacing in B. Spacing out
JU903	Impedance matching jumper	A. Special matching (not used) B. Normal Operation
JU904	Line 1impedance matching	A. 600 Ohm matching network B. Belgium matching network C. FRG/Swiss matching network D. UK C1A matching network
JU905	Line1 impedance matching	A. 600 Ohm matching network B. Belgium matching network C. FRG/Swiss matching network D. UK C1A matching network
JU906	2 ire or 4 wire operation on Line 2	A. 4 Wire B. 2 Wire

Front Panel Indicators and Controls

This chapter describes the front panel indicators and controls that provide maintenance control and operating information for the Nucleus paging station and Nucleus paging Station with Advanced Control (NAC). This chapter contains the following information:

Control Module Front Panel

This section describes the front panels for the Station Control Module (SCM) and the NAC board.

SCM Front Panel

The SCM front panel has several sections (see Figure 6-1).

- Light-emitting diode (LED) display
- Keypad
- Alarm LEDs
- Reference frequency port
- Serial port

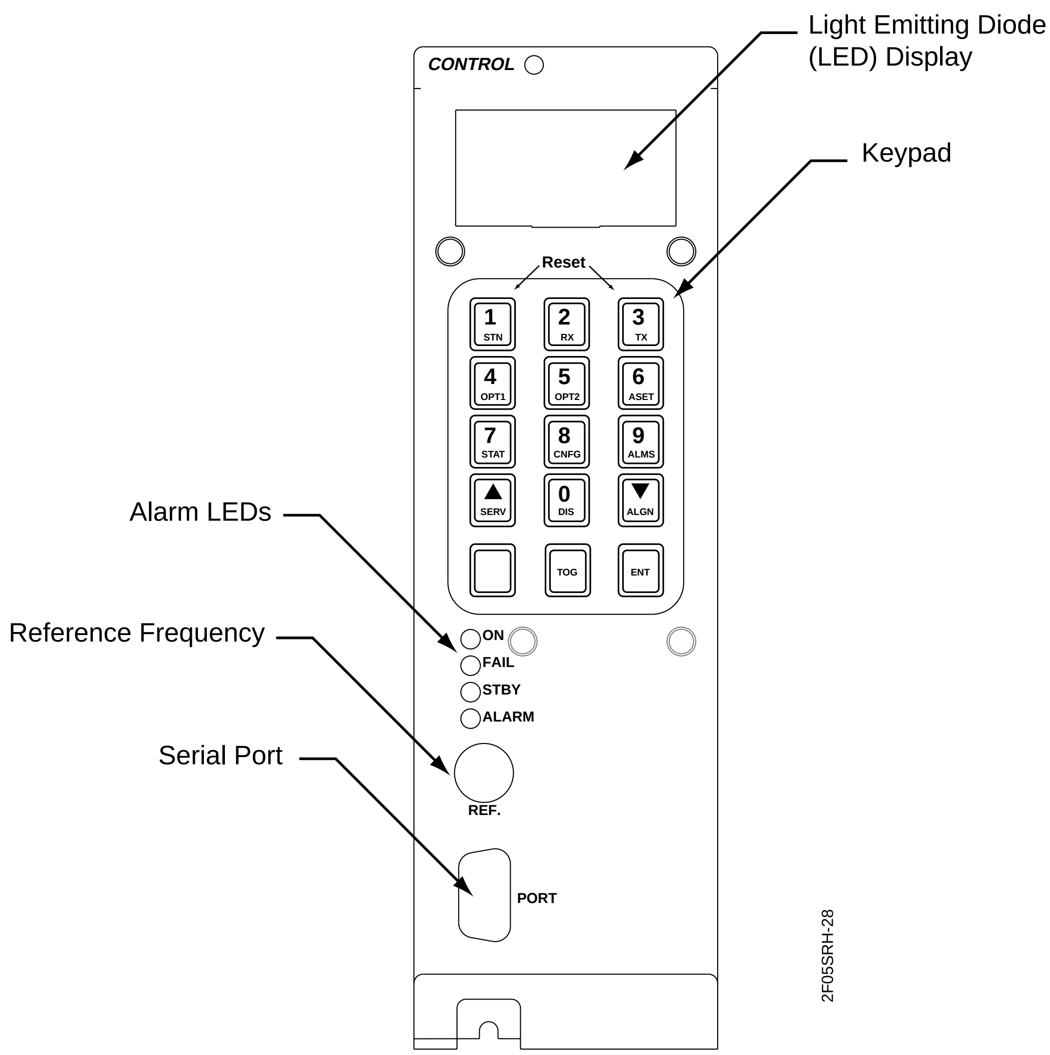


Figure 6-1: Nucleus CM Front Panel

NAC Front Panel

The NAC front panel has several sections (see Figure 6-2).

- Light-emitting diode (LED) display
- Keypad
- Alarm LEDs
- ________________

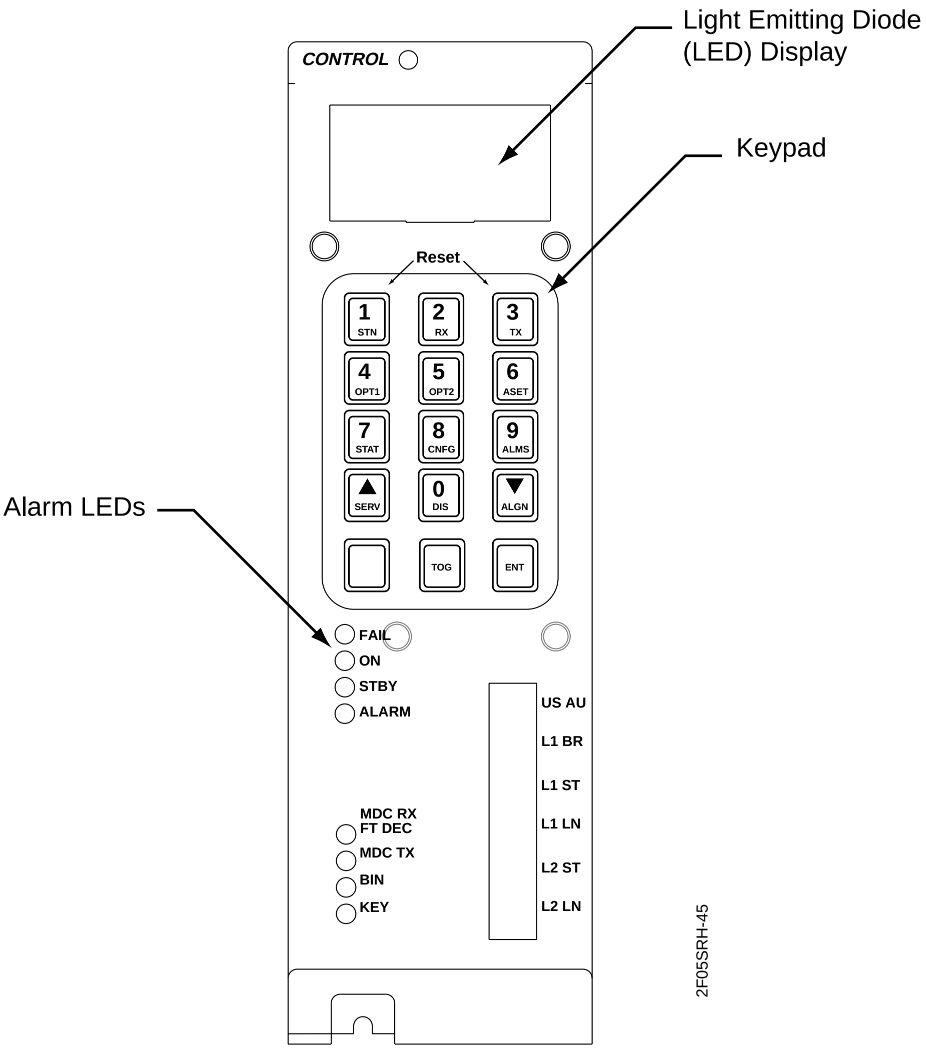


Figure 6-2: Nucleus with NAC Front Panel

Front Panel LED Display

The LED display scrolls to show messages, alarms, and field information for configuration. This display is the interface between the technician and the station.

Keypad Functions

The keypad has 15 keys (see Figure 6-3 and Table 6-1). The top 12 keys serve two functions:

- Menu functions (in the menu select mode)
- Date entry functions (in the edit mode)

Three keys at the bottom of the keypad provide additional control.

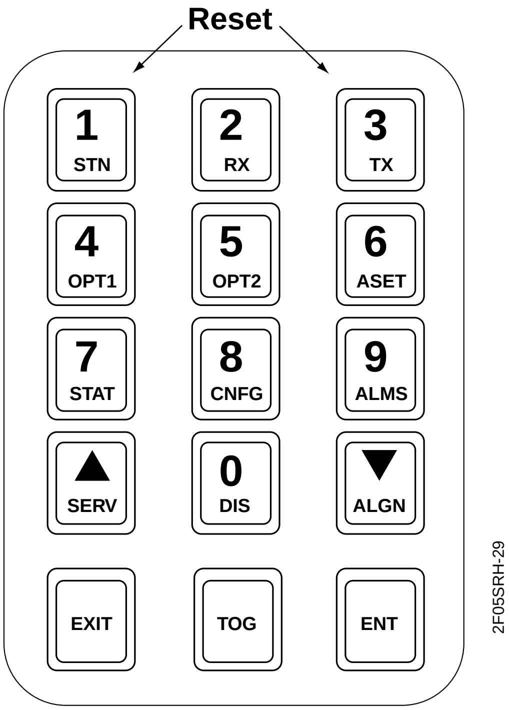


Figure 6-3: SCM and NAC Front Panel Keypad

Table 6-1: SCM Control Panel Keypad Functions (Sheet 1 of 2)

Key	Label	Edit Mode	Menu Select Mode
1 STN	Station	Type the value 1	View or configure a station parameters
2 RX	Receiver	Type the value 2	View or configure receiver parameters
3 TX	Transmitter	Type the value 3	View or configure transmitter parameters
4 OPT1	Option 1	Type the value 4	View or configure station options
5 OPT2	Option 2	Type the value 5	(NAC only) View or configure communication options
6 ASET	Alarm setup	Type the value 6	Configure alarms
7 STAT	Status	Type the value 7	View station status
8 CNFG	Configuration	Type the value 8	View and configure other parameters
9 ALMS	Alarms	Type the value 9	View or clear alarms
▲ SERV	Service	Move up one menu selection	Enter the service mode
0 DIS	Disable	Type the value 0	Disable remote keying during local control; view disable status

Table 6-1: SCM Control Panel Keypad Functions (Sheet 2 of 2)

Key	Label	Edit Mode	Menu Select Mode
▼ ALGN	Alignment	Move down one menu selection	Perform station alignment from the keypad and read power output
EXIT	Exit	Return to the menu select mode	Move one menu level, or abort an edit session
TOG	Toggle	Toggle between the edit mode and the menu select mode	
ENT	Enter	Store keyed-in values	Move in one menu level or begin an edit session
EXIT and ENT		Reset the station	Reset the station

Menu Select Mode

The menu select mode accesses a station menu or submenu (for a list of menus and submenus, see Table 7-1). The station is in the menu select mode when the LED display shows the READY prompt. In this mode, any key has the value of a menu option. Press a key to select a menu.

Press <**up arrow**>, <**down arrow**>, or <**TOG**> to move from one menu to another. Press <**EXIT**> to return to the previous menu level.

Edit Mode

The edit mode adds or modifies data in station memory. The station is in the edit mode when the LED display is flashing. In this mode any key has the value of the number on it. Enter values as appropriate. Press <**ENT**> to store a value.

Note: If you toggle to the menu select mode without storing the value, the system uses the previously entered value.

SCM Front Panel LEDs

The SCM font panel has four LEDs for the SCM (see Table 6-2). All LEDs momentarily light during power-up or reset.

Note: For a description of the internal Network Interface Unit (NIU) LEDs, see Appendix C.

Table 6-2: SCM Control Panel LED Functions and Definitions

LED Name	Color	On	Flashing	Off
On	Green	SCM fully functional	Not used	SCM failure
Fail	Red	SCM failure	Software checksum failure	SCM fully functional
Disable	Red	Disabled by remote keying (maintenance access or messaging access disabled)	Shorted dynamic random access memory (DRAM) address lines are open	Enabled and fully functional SCM
Alarm	Red	Active station alarm (see Alarms menu)	Shorted DRAM address lines	Fully functional SCM, no alarms

NAC Front Panel LEDs

The NAC font panel has eight LEDs (see Table 6-2). All LEDs momentarily light during power-up or reset.

Table 6-3: NAC Control Panel LED Functions and Definitions

LED Name	Color	On	Flashing	Off
Fail	Red	NAC failure	Software checksum failure	NAC fully functional
On	Green	NAC fully functional	Not used	NAC failure
Disable	Red	Disabled by remote keying (maintenance access or messaging access disabled)	Shorted dynamic random access memory (DRAM) address lines are open	Enabled and fully functional SCM
Alarm	Red	Active station alarm (see Alarms menu)	Shorted DRAM address lines	Fully functional SCM, no alarms
Mdc[1] Rx Ft Dec	Yellow	Receiving an MDC message or Decoding function tones	Not used	Not used
Mdc Rx	Yellow	Transmitting MDC	Not used	Not used
Bin	Yellow	Station keyed in binary mode	Not used	Not used
Key	Yellow	Station has a key request	Not used	Not used

1. Minimum Shift Keying (MSK) Digital Control (MDC) is another term for Digital Remote Control (DRC).

SCM Serial Port

The serial port is a 9-pin connector for serial access to the station from a laptop computer running an emulation program.

SCM Reference Frequency Port

The Ref. Freq. port is a 1-pin connector for injecting a reference frequency into the SCM.

LEDs on Other Modules

This section describes the light emitting diodes (LEDs) on the Exciter and the power supplies.

Exciter LEDs

The Exciter has four LEDs (see Figure 6-4 and Table 6-4).

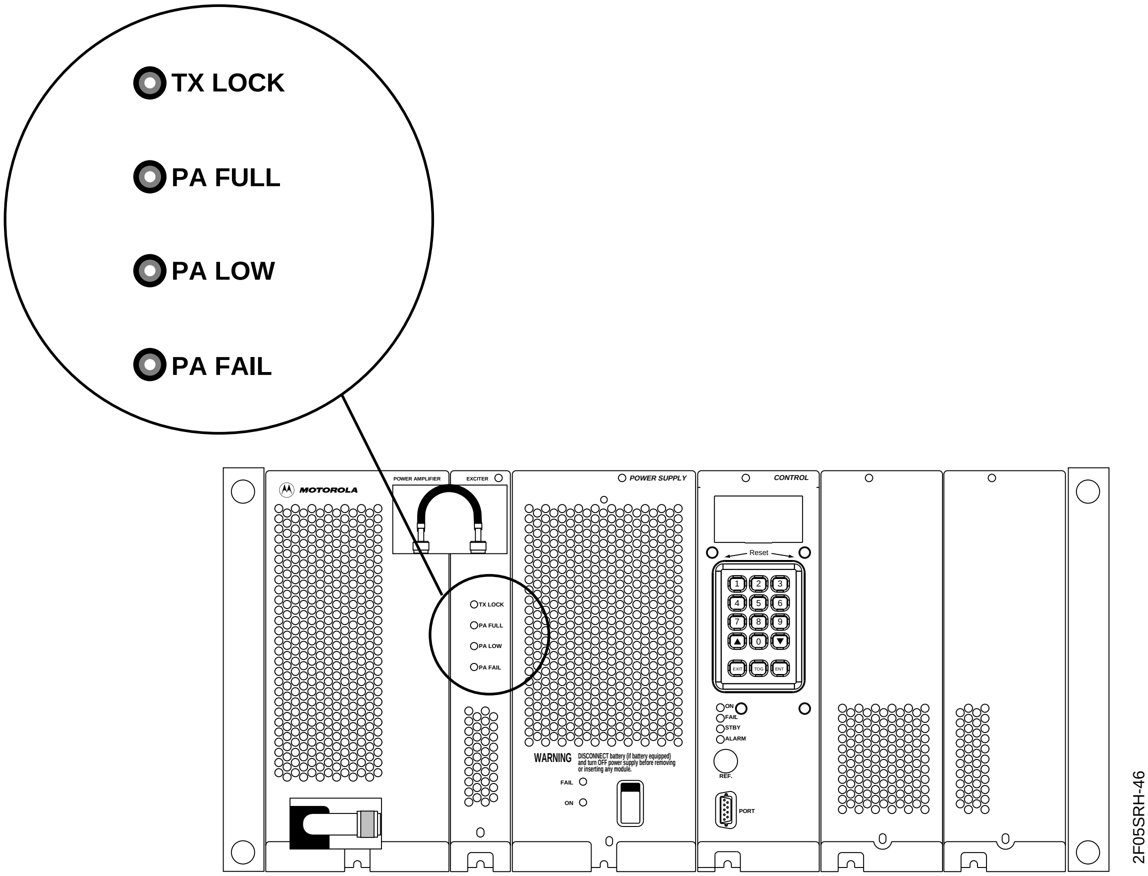


Figure 6-4: Exciter LEDs

Table 6-4: Exciter LED Functions and Definitions (Sheet 1 of 2)

LED Name	Color	Lighted	Off
TX Lock	Green	Exciter synthesizer is locked; Exciter is fully functional.	Synthesizer is out of lock or +5 V, +14.2 V, or both are absent
PA Full	Green	Transmitter is keyed and PA output power is at expected power level	PA not keyed or PA keyed but PA output power is more than 95% of expected power

Table 6-4: Exciter LED Functions and Definitions (Sheet 2 of 2)

LED Name	Color	Lighted	Off
PA Low	Yellow	Transmitter is keyed and PA output power is less than expected power level but not shut down	PA not keyed or PA keyed and PA output power is less than 95% of expected power
PA Fail	Red	(ON) No PA output power (example: PA shutdown mode) or LED status is latched (status during current key or for previous key) or Fault in one or more of the PA fans or Final PA VSWR Alarm is activated	PA output power is at expected level or at specific cutback levels (any level other than shutdown) or LED status is latched (status during current key or for previous key)
PA Fail	Red	(FLASHING) when PA Test Mode is active	PA is functioning normally

Power Supply LEDs

Each power supply has two LEDs (see Figure 6-5 and Table 6-5). The Module Fail LED on each power supply lights during start-up and then turns off.

Note: The high power station has two power supplies. Each power supply has the LEDs described here.

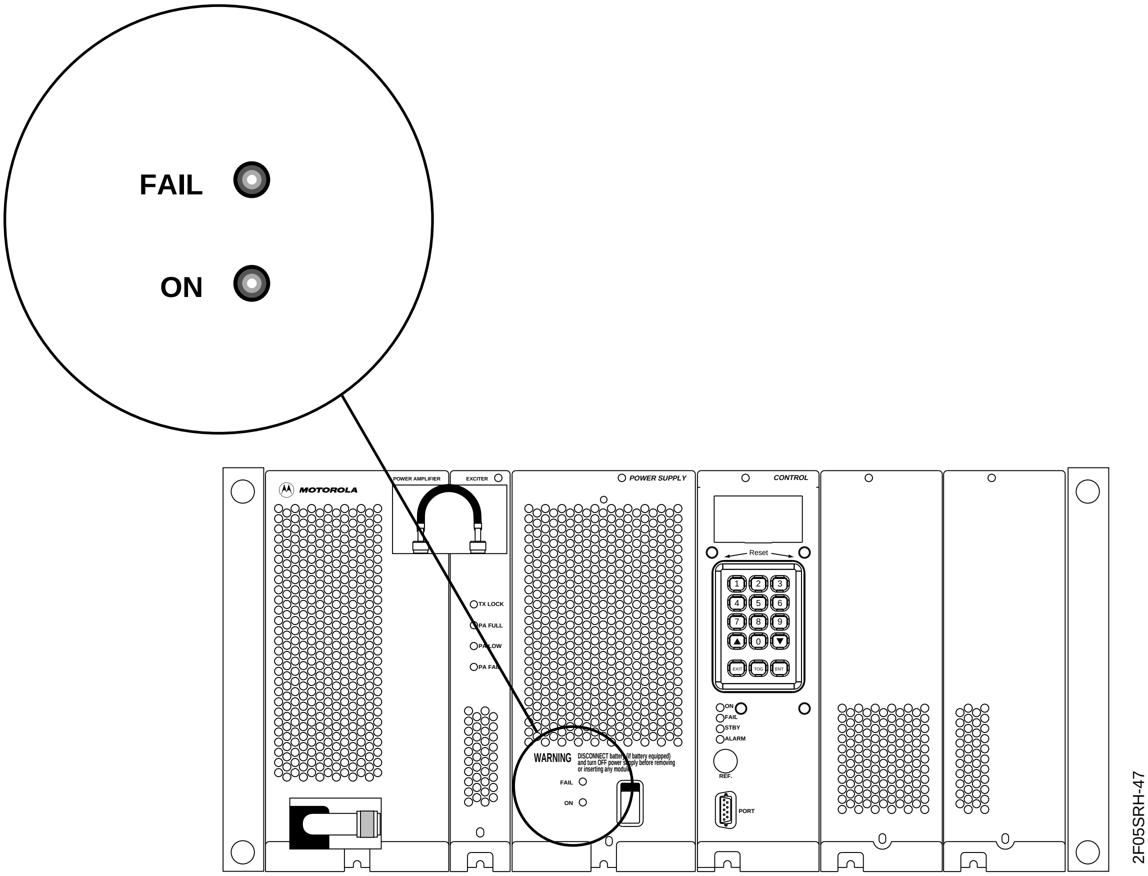


Figure 6-5: Power Supply LEDs (Low Power Station Shown)

Table 6-5: Power Supply LED Functions and Definitions (All Power Supplies)

LED name	Color	Lighted	Off
Module Fail	Red	Power supply malfunction, such as shorted output, current limit exceeded, or loss of communication with backplane and other modules	Normal operation
Power On	Green	AC input power present and system turned on	AC power not present, or system turned off

Basic Keypad Procedures

This chapter describes basic keyboard access for the Nucleus paging station. This chapter contains the following information:

Conventions

Several chapters that follow describe work with the menus and selections that appear in the light-emitting diode (LED) display on the keypad. These chapters are:

- SCM configuration (see Chapter 8, "SCM Station Configuration")
- SCM alarms, status, troubleshooting, and alignment (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment")
- NAC configuration (see Chapter 10, "NAC Configuration")
- NAC alignment and simulcast equalization (see Chapter 11, "NAC Alignment and Equalization")
- NAC alarm configuration and management (see Chapter 12, "NAC Alarm Configuration and Verification")
- Receivers (see Appendix E)

These chapters use the notational conventions to describe activities with the LED and the keypad (see Table 7-1).

Table 7-1: Notational Conventions for Presenting Software Procedures

Item	Enclosed in	Printed in	Examples
SCM or NAC front panel keys	Angle brackets (<>)	**9 point Palatino Bold**	**<TX>** **<STN>** **<down arrow>**
Station output	Not enclosed	9 point Helvetica	EXT CIRCULATOR: NOT PRESENT RX TYPE: INTERNAL MONITOR OPERATING POWER: yyy W
User input	Not enclosed	9 point Helvetica bold	**Enabled** **Disabled**
Starting point in a procedure	Not enclosed	9 point Helvetica	READY prompt
End point in a procedure	As required	As required	Press **<EXIT>** once to return to the TX CHN FREQS prompt. Press **<EXIT>** twice to return to the READY prompt.

Accessing the LED Display

After start-up, use this procedure to gain access to the LED display on the SCM or NAC panel:

1. From a blank display, press any key on the SCM or NAC front panel keypad.

   If the station has the password enabled, see Step . If the station has the password disabled, the LED display shows the READY prompt. Continue with other procedures.

Note: To enable the password feature, see paragraph, "Enabling the Password".

   If the station has the password enabled, the LED display shows the READY - ENTER PASSWORD prompt.

2. Type the password on the number keys.

3. Press **<ENT>**. (The default password is 6000.)

   The LED display shows the READY prompt.

   The LED display has a screen saver. After five minutes without input, the LED display goes blank. Perform the procedure again to regain access.

Note: If you change the password, display the value to confirm it before the LED display screen saver timer expires and the LED display goes blank.

If you forget your password, the Nucleus paging station denies access. Call Motorola One-Call-Support.

Changing the Password

Use the following procedure to change the password at the station.

1. From the READY prompt, press **<STN>**. The system accesses the Station menu.

2. At the TX FREQ RANGE prompt, press <**up arrow**> or <**down arrow**> to access the password:

   PASSWORD xxxx

   Where xxxx is the current password.

3. Press **<ENT>**.

   The text flashes to show the system is in the edit mode.

4. Type the new password (in the range 0000 through 9999). Press **<ENT>**.

   The LED display shows the new password:

   PASSWORD yyyy

   Where yyyy is the new password.

5. Press **<EXIT>** twice to return to the READY prompt.

Disabling or Enabling the Password

This section describes the procedures for controlling the password.

Disabling the Password

Use this procedure to disable the password:

1. From the READY prompt, press **<STN>**. The system accesses the Station menu.
2. At the TX FREQ RANGE prompt, press <**up arrow**> or <**down arrow**> to access the password:

   The display shows the current status of the password:

   FRONT PANEL PASSWORD: ENABLED
3. Press **<ENT>**. The message flashes to show the system is in the edit mode.
4. Press **<TOG>** to select **Disable**. The message continues to flash**.**
5. Press **<STN>**. The message stops flashing and shows the new password status:

   FRONT PANEL PASSWORD: DISABLED
6. Press **<EXIT>** twice to return to the READY prompt.

Enabling the Password

Use this procedure to enable the password:

1. From the READY prompt, press **<STN>**. The system accesses the Station menu.
2. At the TX FREQ RANGE prompt, press <**up arrow**> or <**down arrow**> to access the password:

   The display shows the current status of the password:

   FRONT PANEL PASSWORD: DISABLED
3. Press **<ENT>**. The message flashes to show the system is in the edit mode.
4. Press **<TOG>**. The message continues to flash.
5. Press **<ENT>**. The text stops flashing and shows the new password status:

   FRONT PANEL PASSWORD: ENABLED
6. Press **<EXIT>** twice to return to the READY prompt.

Changing Parameters from the Keypad

When the LED display shows the READY prompt, the system is in the menu select mode. The menus are organized in a hierarchy. All menus have submenus and many submenus have further selections (see Figure 7-1 for the SCM menus and Step 7-2 for the NAC menus). Use this general procedure to work with the menus.

Note: The system shows alignment channels from the Station menu. However, the values are set during alignment procedures from the Station Alignment menu. Do not attempt to set them from the Station menu.

All menus are structured hierarchically (see Figure 7-1, Table 7-2, and Table 7-2). Use the following procedure for working in these menus:

1. In Table 7-2, the first column, Menu Name, refers to the name of a key on the SCM front panel.
2. When you select the menu name, the display shows the first item in the second column. This is the first item in the column entitled Submenu Name.
3. When the display shows the first submenu name, press <**down arrow**> to scroll to the next submenu name in the menu.
4. As each submenu appears, the display shows the value that is currently stored in memory for the submenu item.
5. To change the value, press **<ENT>**.
6. If the value is a simple number, type the new value on the keypad. Press **<ENT>** to store the value. For example, in Figure 7-1, the value for the password is 6000. To replace this value, type the new value and press **<ENT>**.
7. If the value is one of a list, press <**down arrow**> to scroll through all the available values in the list. Press **<ENT>** to select and store the new value. For example, in Figure 7-1, the values for the CURRENT TX CHN are 1 through 8. Press <**down arrow**> to scroll through these values. Press **<ENT>** to select the correct one.
8. Occasionally, the selection has one more level of items imbedded in it. For example, the TX menu has a SPECIAL TX SETUP submenu. The SPECIAL TX SETUP submenu has a list of selections; TX DATA INVERT is one of them. An additional level of selection is ENABLED or DISABLED. Press <**down arrow**> to scroll to one of these values. Press **<ENT>** to store the value.
9. At the end of each procedure, press **<EXIT>** until the top level of the menu appears. Press **<EXIT>** again. The READY prompt appears.

Menu Name

Submenu Name

Press <up arrow> or <down arrow> to select a submenu

- STN - STATION
  - TX FREQ RANGE (read-only)
  - CURRENT TX CHN [select one]
    - 1
    - 2
    - 3
    - 4
    - 5
    - 6
    - 7
    - 8
    - ALIGN 1 VCO
    - ALIGN... ALIGN 4 DELAY
  - SYS TIMER ALRM
    - DISABLE
    - 2 MIN
    - 15 MIN
    - 30 MIN
    - 60 MIN
    - 90 MIN
    - 120 MIN
    - 180 MIN
  - FRONT PANEL PASSWORD
    - ENABLED
    - DISABLED
  - PASSWORD (DEFAULT = 6000)
  - SET STATION TIME
    - YEAR
    - MONTH
    - DAY
    - HOUR
    - MINUTE
    - SECONDS

Selection: press <up arrow> or <down arrow> to select a value, then press <ENT>

Type value

Figure 7-1: Nucleus Paging Station Menu Logic

The Menus

This section shows the menus for the Nucleus paging station with a System Control Module (SCM) (see Table 7-2) and a Nucleus paging station with Advanced Control (NAC) (see Table 7-2).

Table 7-2: Hierarchical SCM Menu Structure (Sheet 1 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
1 STN (station) **Use this menu to enter and read station values. These are general station parameters.**	TX FREQ RANGE (read-only)		Displays the frequency range for the transmitter
	CURRENT TX CHN	1 2 3 4 5 6 7 8 ALIGN 1 VCO ALIGN 2 VCO ALIGN 3 VCO ALIGN 4 VCO ALIGN 5 VCO ALIGN 6 VCO ALIGN 1 DELAY ALIGN 2 DELAY ALIGN 3 DELAY ALIGN 4 DELAY	Displays or selects the current transmitter channel (8 available) Also aligns the Voltage controlled oscillator (VCO) and the alignment delay
	SYS TIMER ALRM	DISABLE 2 MIN 15 MIN 30 MIN 60 MIN 90 MIN 120 MIN 180 MIN	Sets a timer to run from the time when the station keys to the time when it keys again
	FRONT PANEL PASSWORD	ENABLED DISABLED	Enables or disables the password
	PASSWORD (DEFAULT = 6000)		Displays or enters the password value
	SET STATION TIME	YEAR MONTH DAY HOUR MINUTE SECONDS	Displays or enters the date and time

Table 7-2: Hierarchical SCM Menu Structure (Sheet 2 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
2 RX (receiver) **Use this menu to define and display the receiver parameters.**	LINK/MONITOR RECEIVER	RX FREQ RANGE (read-only)	Displays the frequency range of the receiver
		RX CHN FREQ	Displays or enters the receiver channel frequency
		CHN SPACING	Displays or selects the channel spacing: 12.5 KHZ 20 KHZ 25 KHZ
		RX DEEMPHASIS	Selects receiver deemphasis during transmission: ENABLED DISABLED
		RX OUTPUT	Selects receiver date polarity: INVERTED NOT INVERTED
		MONITOR RX OUTPUT	Selects monitor output (when monitor receiver is selected): ANALOG TTL CNET

Table 7-2: Hierarchical SCM Menu Structure (Sheet 3 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
3 TX (transmit) **Use this menu to define and display transmitter characteristics.**	TX CHN FREQS	CHN 1 FREQ CHN 2 FREQ CHN 3 FREQ CHN 4 FREQ CHN 5 FREQ CHN 6 FREQ CHN 7 FREQ CHN 8 FREQ MEAN FREQ	Displays or enters the frequency for each channel
	TX CHN PWR (if CHN MAPPED PWR disabled)	OPERATING PWR	Displays or enters the operating power value for a system that uses one power value for all channels
	TX CHN PWR (if CHN MAPPED PWR enabled)	CHN 1 FREQ CHN 2 FREQ CHN 3 FREQ CHN 4 FREQ CHN 5 FREQ CHN 6 FREQ CHN 7 FREQ CHN 8 FREQ MEAN FREQ (if CHN n FREQ= 0)	Displays or enters the operating power for each channel
	TX CHN OFFSETS	HIGH SPEED OFFSET LOW SPEED OFFSET	Displays or enters the transmitter channel offsets
	REFLEX25 OFFSET		Not enabled on this release
	HIGH SPEED SPLATTER FILTER	88 US LOW PASS (µs) LOW PASS 160 US LOW PASS	Displays or enters the high speed splatter filter selection
	LOW SPEED SPLATTER FILTER	88 US 140 US LOW PASS 250 US LOW PASS 160 US LOW PASS	Displays or enters the low speed splatter filter selection
	NOMINAL BINARY DEVIATION		Displays or enters the nominal binary deviation for binary transmission

Table 7-2: Hierarchical SCM Menu Structure (Sheet 4 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
3 TX (continued)	SPECIAL TX SETUP	TX DATA INVERT	Displays or defines the data inversion on transmitted data: ENABLED DISABLED
		TX = RX	Displays or determines whether a transmitter channel is also used as a receiver channel: ENABLED DISABLED
		TX = RX CHANNEL	Displays or enters the number of the channel used for transmitting and receiving: 1 2 3 4 5 6 7 8
		IDLE DEVIATION	Displays or defines the signal sent during idle periods: NULL SPACE MARK
4 OPT 1 (station options 1) **Use this menu to define and display some special transmitter functions.**	ANTENNA RELAY	DISABLED ENABLED	Configures the transmitter for an antenna relay
	EXT CIRCULATOR	NOT PRESENT PRESENT	Configures the transmitter for an external circulator
	CHN MAPPED PWR	DISABLED ENABLED	Configures the transmitter for channel mapping
5 OPT 2	Not used		
6 ASET (alarm setup) If CHN MAPPED PWR disabled **Use this menu to define and display alarms for the entire transmitter.**	NON-CHAN MAPPED PWR ALARMS	FWD PWR ALM PT RFL PWR ALM PT EXT WM FWD PWR ALM PT EXT WM RFL PWR ALM PT	Displays or enters a single value for each of four transmitter alarms

Table 7-2: Hierarchical SCM Menu Structure (Sheet 5 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
6 ASET (alarm setup) if CHN MAPPED PWR enabled **Use this menu to define and display alarms for each channel individually.**	INT FWD CHN MAPPED ALMS	CHN 1 FWD ALM PT CHN 2 FWD ALM PT CHN 3 FWD ALM PT CHN 4 FWD ALM PT CHN 5 FWD ALM PT CHN 6 FWD ALM PT CHN 7 FWD ALM PT CHN 8 FWD ALM PT	Displays or configures the forward alarm value for each channel
	INT RFL CHN MAPPED ALMS	CHN 1 RFL ALM PT CHN 2 RFL ALM PT CHN 3 RFL ALM PT CHN 4 RFL ALM PT CHN 5 RFL ALM PT CHN 6 RFL ALM PT CHN 7 RFL ALM PT CHN 8 RFL ALM PT	Displays or configures the reflected alarm value for each channel
	EXT FWD CHN MAPPED ALMS (if EXT WATTMETER TYPE NONE)	CHN 1 EXT FWD ALM PT CHN 2 EXT FWD ALM PT CHN 3 EXT FWD ALM PT CHN 4 EXT FWD ALM PT CHN 5 EXT FWD ALM PT CHN 6 EXT FWD ALM PT CHN 7 EXT FWD ALM PT CHN 8 EXT FWD ALM PT	Displays or configures the forward alarm value for each channel measured at the external Wattmeter
	EXT RFL CHN MAPPED ALMS (if EXT WATTMETER TYPE NONE)	CHN 1 EXT FWD ALM PT CHN 2 EXT FWD ALM PT CHN 3 EXT FWD ALM PT CHN 4 EXT FWD ALM PT CHN 5 EXT FWD ALM PT CHN 6 EXT FWD ALM PT CHN 7 EXT FWD ALM PT CHN 8 EXT FWD ALM PT	Displays or configures the reflected alarm value for each channel measured at the external Wattmeter

Table 7-2: Hierarchical SCM Menu Structure (Sheet 6 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
7 STAT (station status) **Use this menu to display station status.**	FWD PWR		Displays the forward power at the transmitter
	RFL PWR		Displays the reflected power at the transmitter
	VSWR		Displays the Voltage standing wave ratio (VSWR) at the transmitter
	EXT WM FWD PWR		Displays the forward power measured at the Wattmeter
	EXT WM RFL PWR		Displays the reflected power measured at the Wattmeter
	EXT WM VSWR		Displays the VSWR measured at the Wattmeter
	SOFTWARE VERSIONS	APPLICATION	Displays the software version for the application software
		EXCITER	Displays the software version for the Exciter software
		BOOT	Displays the software version for the boot software
		ALIGNMENT ID	Displays the software version for the matched pair: SCM EXCITER

Table 7-2: Hierarchical SCM Menu Structure (Sheet 7 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
8 CNFG (station configuration) **Use this menu to display or configure some network and station parameters**	MAX PWR (read only)	NO PA (Power Amplifier) 20 W 25 W 100 W 125 W 250 W 300 W	Displays the maximum power for the station
	BATTERY REVERT SETUP	BATTERY TYPE	Selects one of two battery types: SEALED LEAD CALCIUM, or BATTERY REVERT DISABLED
		CHARGING	Enables or disables battery charging from the AC power input: ENABLED DISABLED
		BACKUP	Defines the control used during battery revert: BACKUP STATION BACKUP CONTROL
		FIXED CUTBK RED%	Not supported in this release
	EXTERANAL WATTMETER TYPE	NONE CLASS 1 EXT CLASS 2 EXT CLASS 3 3XT CLASS 4 EXT	Displays or defines the type of station external Wattmeter
	CONTROL	INTERNAL CNET EXT SYCH LOCAL CTROL	Displays or defines the type of transmitter controller used at the station
	RX TYPE	NO INTERNAL INTERNAL LINK INTERNAL MONITOR	Displays or defines the receiver used at the station
	SPECIAL KEY SELECT	NONE CD INT CD EXT SPCL KEY FAST LOW FAST HIGH EXT LOW EXT HIGH	Selects inverted or non-inverted messaging pattern

Table 7-2: Hierarchical SCM Menu Structure (Sheet 8 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
9 ALMS (station alarms) **Use this menu to read alarms.**	LOW FORWARD POWER HIGH REFLECTED POWER EXT LOW FORWARD POWER EXT HIGH REFLECTED POWER REDUNDANCY SWITCHOVER PA FAN SYNTH OUT OF LOCK BATTERY REVERT SYS TIMER EXPIRED PA FAIL STATION RESET HIGH STABILITY REF FAIL ALIGNMENT ID MISMATCHED HIGH FORWARD POWER PA NOT ALIGNED EXCITER STARTUP FAILURE		Displays alarms
<up arrow> SERV (service mode) **Use this menu to select the PA test and transmission mode.**	PA TEST MODE	ACTIVE INACTIVE	Enables or disables the PA test mode
	SELECT SYMBOL	STAIRCASE 01–10 00–11 10 11 01 00 CARRIER	Displays or defines the transmission signal used for testing
	KEY ON SYMBOL		Not used
0 DIS (disable access) **Use this menu to enable or disable access to the transmitter.**	MAINT ACCESS	DISABLED ENABLED	Enables or disables maintenance access to the transmitter
	PAGING ACCESS	DISABLED ENABLED	Enables or disables messaging at the transmitter
	DISABLE STATUS (read only)	DISABLE_1 DISABLE_2 DISABLE_3 DISABLE_4 DISABLE_5 DISABLE_6 DISABLE_7 DISABLE_8 DISABLE_n	

Table 7-2: Hierarchical SCM Menu Structure (Sheet 9 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
<down arrow> ALIGN (alignment) **Use this menu to control calibration.**	CAL STATION POWER	MANUAL PA CALIBRATION AUTO PA CALIBRATION	Selects calibration procedure
	CAL EXT WM		Calibrates external Wattmeter
	ALIGN UHSO	KEY START START	Aligns oscillators
	KEY AND READ POWER		Displays the power at the SCM front panel display
	KEY AND READ EXT WM POWER		Displays the power at the external Wattmeter

Table 7-3: Hierarchical NAC Menu Structure (Sheet 1 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
1 STN (station) **Use this menu to enter and read station values. These are general station parameters.**	STN TYPE	PAGE TX	
	TX RANGE (read-only)		Displays the frequency range for the transmitter
	TX RANGE CHECKING	ENABLED DISABLED	Controls range checking
	CHANNEL FREQS	1 2 3 4 5 6 7 8	Displays or selects the frequency for each channel
	STN ID		Creates the station ID
	STATION CONTROL SETUP	DRC SETUP	DRC Enabled or Disabled DRC System ID System ID Locked or Unlocked Poll Response via Line 2 or RF Paging Keyup Enabled or Disabled ATC ID
		TRC SETUP	TRC Enabled or Disabled TRC Tone Table Selection Guard Tone Frequency
	DROP OUT DELAY	Value	Creates a dropout delay
	KEY TIMEOUT	VALUE DELAY	Creates a key time-out
	SYSTEM TIMEOUT ALM	VALUE DISABLE	Sets a limit on time-out; at expiration sets an alarm
	FRONT PANEL PASSWORD	ENABLED DISABLED	Enables or disables the password
	PASSWORD	VALUE	Displays or enters the password value
	CURRENT CHANNEL	1 2 3 4 5 6 7 8	Selects a current channel to key (during testing)

Table 7-3: Hierarchical NAC Menu Structure (Sheet 2 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
	INPUT AUDIO FROM	LINE1 INT RX EXT RX	Selects an internal audio source
	LINE 2 ADUIO FROM	INT RX (none) EXT RX	Selects an external audio source
	EXTERNAL RX SETUP	LINK RX SQUELCH TYPE	Carrier DPL
		MONITOR RX	Enab Dis
		DPL	Enab Dis
2 RX (receive Audio) **Use this menu to define and display the receiver parameters.**	INTERNAL RX SETUP	MONITOR RX:	Enab Dis
		RX FREQ RANGE CHECKING	Enab Dis
		RX FREQ RANGE (read only)	
		RX FREQ RANGE	Value
		RX CHAN SPACING	
		SQUELCH TYPE	Carrier DPL
		DPL	Enab Dis
		INVERT RX DPL	Enab Dis
		DPL CODE	Value
		DPL HIGH PASS FILTER	Enab Dis
		AUDIO PHASE INVERT	Enab Dis
		STATUS TONE	Enab Dis
		STATUS TONE FREQ	Value
		STATUS TONE LEVEL	Value
	DELAY	ENAB DIS	Enables or disables a receiver delay
	DELAY	VALUE	Sets a value for the receiver delay
	GAIN	ENAB DIS	Enables or disables receiver gain
	GAIN	VALUE	Sets a value for receiver gain
	LINE 1 IMPEDANCE	600 OHM BRIDGE	Selects impedance for line 1

Table 7-3: Hierarchical NAC Menu Structure (Sheet 3 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Receive Audio (Continued)	LINE 2 AUDIO	FLAT DE-EMPHASIS	
3 TX (transmit) **Use this menu to define and display transmitter characteristics.**	FREQ ADJUST	STEPS	
	TX DEVIATION SETUP	MAXIMUM DEVIATION	
		NOMINAL DEVIATION	
		NOMINAL BINARY DEVIATION	
	CARRIER FREQ OFFSET	Value	
	BINARY SPLATTER FILTER	140 USEC 250 USEC	
	GT Notch	EN DIS	
	ANIG EQ FILTER	EN DIS	
	SPECIAL TX SETUP	AUDIO PHASE INVERT	En Dis
		BINARY TX DATA INVERT	En Dis
		TX=RX	En Dis

Table 7-3: Hierarchical NAC Menu Structure (Sheet 4 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
4 OPT 1 (Station Options) **Use this menu to display and define some special transmitter values.**	SPECIAL KEY SETUP	SPECIAL KEY DISABLED KEY ON INTERNAL CD KEY ON EXTERNAL DC KEY ON EXT KEY REQ LOW KEY ON EXT KEY REQ HIGH	
	WILDCARD INPUT SETUP	WILD CARD 1 ACTIVE	High Low
		WILD CARD 2 ACTIVE	High Low
		WILD CARD 3 ACTIVE	High Low
		WILD CARD 4 ACTIVE	High Low
		WILD CARD 5 ACTIVE	High Low
		WILD CARD 6 ACTIVE	High Low
		WILD CARD 7 ACTIVE	High Low
		WILD CARD 8 ACTIVE	High Low
	WILDCARD OUTPUT SETUP	WILD CARD 1	Active Inactive
		WILD CARD 2	Active Inactive
		WILD CARD 3	Active Inactive
		WILD CARD 4	Active Inactive
		WILD CARD 5	Active Inactive
		WILD CARD 6	Active Inactive
		WILD CARD 7	Active Inactive
		WILD CARD 8	Active Inactive

Table 7-3: Hierarchical NAC Menu Structure (Sheet 5 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
4 OPT 1 (Station Options) (Continued)	REDUNDANCY SETUP	REDUNDANCY	En Dis
		MASTER STATION SETUP ONLY	Number of Stns in System
			Prioritizing: En Dis
			Keyup: En Dis
			Force Switchover Setup: Switchover LAN ID Activate Switchover: Yes/No
	EXTERNAL PAGING DATA SETUP	DELAY	Analog Path Digital Path
		DRC BINARY DATA	Internal External;
		RECEIVE DATA	RS-232 Ext Modem
		DIRECT DIGITAL	En Dis
	PA SHUTDOWN ON HIGH VSWR	EN DIS	
	UNSOLICITED ALM REPORTING	UNSOLICITED ALM	En Dis
		UNSOLICITED ALARMS ON	All Major Minor
		REPORT VIA	Line 2 RS-232
	387 VERIFICATION TONE	EN DIS	

Table 7-3: Hierarchical NAC Menu Structure (Sheet 6 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
5 OPT 2 (Communication Options) **Use this menu to define and display RS-232 options and LAN options in a redundant transmitter group.**	RS-232 DIALIN SETUP	DIAL IN	En Dis
		ANSWER ON RING #	1 2 3 4
		AUTO BAUD DETECT	En Dis
		CONNECT	Smart Modem No Modem Connected
	RS-232 DIAL OUT SETUP	BAUD RATE	Value
		PHONE NUMBER	Value (18 digits)
		PAUSE AFTER 1ST DIGIT	En Dis
		DIAL OUT VIA	Tone Pulse
		NUMBER OF ATTEMPTS BEFORE ALARM	Value
	NAC LAN SETUP	NAC LAN	En Dis
		NAC LAN	Master Slave
		ALM ON # OF INV ATTEMPTS	Value
		NAC SLAVE LAN ID	Value

Table 7-3: Hierarchical NAC Menu Structure (Sheet 7 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
	FORWARD POWER ALM POINT	Value	
	REFLECTED POWER ALM POINT	Value	
	EXT FORWARD POWER ALM POINT	Value	
	EXXT REFLECTED POWER ALM POINT	Value	
	TRAY TEMP ALM POINT	Value	
	REDUN SWITCHOVER ALM	CRIT GEN NOT SEL	
		PA FAULT 1 PA FAULT 2 PA CUTBACK SYNTH OUT OF LOCK LOW FORWARD POWER HIGH REFLECTED POWER HIGH VSWR TX IN LIMIT HIGH TRAY TEMP BATTERY REVERT STN EXECUTED A RESET DIAG FAILURE SYSTEM TIMER	
6 ASET (Alarm Setup) **Use this menu to configure alarms.**	ALM VERIFICATION RELAY	RELAY	Disabled Alarm Mode Verify Mode
		OPT ALARM	Selected Not Selected
			Redundancy Switch Occurred
		STN ALARM	Selected Not Selected
			PA Fault 1 PA Fault 2 PA Cutback Synth Out of Lock Low Forward Power High Reflected Power High VSWR TX in Limit High Tray Temp Battery Revert Stn Executed a Reset Diag Failure Station timer

Table 7-3: Hierarchical NAC Menu Structure (Sheet 8 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
		SELECTED NOT SELECTED	
6 ASET (Alarm Setup) (Continued)	MISC ALRM	WILD CARD INPUT 1 . . . WILD CARD INPUT 8 PAGING KEYUP DISABLE NO MODEM RESPONSE MODEM DIAL OUT TIMER EXPIRED NO DIAL TONE OR CARRIER MODEM NAC LAN LINE FAILURE EE DATA MODIFIED	
7 STN (Station) **Use this menu to display or configure station status.**	PTT		
	DISABLE STATUS		Displays disable status
	FORWARD POWER		Displays forward power level
	REFLECTED POWER		Displays reflected power
	VSWR		Displays Voltage standing wave ratio
	EXT FORWARD POWER		Displays forward power measured at an external Wattmeter
	EXT REFLECTED POWER		Displays reflected power measured at an external Wattmeter
	EXT VSWR		Displays Voltage standing wave ratio measured at an external Wattmeter
	CURRENT CHAN		Displays the current channel
	TRAY TEMP		
	HARD/FIRMWARE VERSIONS	MAIN PROC FW VERSION CONTROL BOARD VERSION CNT RX INTFC BD SW VERSION SEC PROC VERSION EXCITER FIRMWARE VERSION MAIN DSP SW VERSION	Displays hardware versions of boards and software versions of code

Table 7-3: Hierarchical NAC Menu Structure (Sheet 9 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
7 STN (Station) (Continued)	REDUNDANCY STAT	REDUNDANCY	Enables or disables redundancy: En Dis
		SLAVE STAT	Enables or displays the status of an N group station in a redundancy group: Switched out of System: Yes No
		MASTER STAT	Switched for Slave: Yes No
			Switched LAN ID (Value)
			Switchover Upon Alm: Yes No
			Switchover Due to: Alarm Forced
		INTERNAL RX	Squelched Unsquelched
		INTERNAL DPL	Detected Not Detected
		EXTERNAL Rx	Squelched Unsquelched

Table 7-3: Hierarchical NAC Menu Structure (Sheet 10 of 14)

<table>
<tr><th>Menu Name</th><th>Submenu Name</th><th>Selection</th><th>Definition and Additional Selections</th></tr>
<tr><td rowspan="10">8 CNFG (Configuration)

Use this menu to configure or display some additional station parameters.</td><td>OPERATING PWR</td><td>OPERATING PWR</td><td>Read only value</td></tr>
<tr><td>PWR RATING</td><td>NO PA
25 W
125 W
350 W</td><td>Configures the power level</td></tr>
<tr><td rowspan="4">BATTERY REVERT SETUP</td><td>BATT REVERT</td><td>Configures the backup battery:
None
Sealed LD Calcium</td></tr>
<tr><td>BACKUP</td><td>Configures the source of control during revert:
Station
Control</td></tr>
<tr><td>FIXED CUTBK RED%</td><td>Configures the power cutback during revert:
Value</td></tr>
<tr><td>BATTERY BANK VOLTAGE</td><td></td></tr>
<tr><td rowspan="2">WATTMETER SETUP</td><td>WATTMETER POLL RESP</td><td>Configures the Wattmeter:
Internal
Secondary</td></tr>
<tr><td>EXTERNAL WATTMETER TYPE</td><td></td></tr>
<tr><td>EXTERNAL CIRCULATOR</td><td>PRESENT
NOT PRESENT</td><td>Configures the circulator:</td></tr>
<tr><td>REFERENCE TYPE</td><td>UHSO
HSO
EXT
NONE</td><td>Configures the source of the reference frequency</td></tr>
</table>

Table 7-3: Hierarchical NAC Menu Structure (Sheet 11 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
	OPTION ALARMS	BINARY AIRTIME OVERFLOW ANALOG AIRTIME OVERFLOW BINARY TIMEOUT DEKEY ANALOG TIMEOUT DEKEY BINARY KEYUP COUNTER OVERFLOW ANALOG KEYUP COUNTER OVERFLOW REDUNDANCY SWITCHOVER	
	STATION ALARMS	PA FAULT 1 PA FAULT 2 PA CUTBACK SYNTHESIZER OUT OF LOCK LOW FORWARD POWER HIGH REFLECTED POWER HIGH VSWR TX IN LIMIT LOW INPUT LEVEL HIGH INPUT LEVEL HIGH TRAY TEMPERATURE BATTERY REVERT STATION EXECUTED RESET DIAGNOSTICS FAILURE SYSTEM TIMER	
9 ALMS (Alarms) **Use this menu to display alarms.**	COMMUNICATION ALARMS	MDC COMM ALARMS	MDC Rx Wrong Sys ID MDC Rx Undefined Reg MDC Rx Undefined Cmd MDC RX Protected Reg MDC Rx Invalid Sequence MDC Rx System ID Access
		RS-232 COMM ALARMS	RS-232 Wrong Sys ID RS-232 Undefined Reg RS-232 Undefined Cmd RS-232 Protected Reg RS-232 Invalid Sequence RS-232 System ID Access RS-232 Dial-in Invalid Pswd RS-232 Hang Up/Timeout RS-232 Dial-Out Max Retries RS-232 No Dial-Out Ph #
		LAN COMM ALARMS	LAN Wrong Sys ID LAN Undefined Reg LAN Undefined Cmd LAN Protected Reg LAN Invalid Sequence LAN System ID Access LAN Master Failed to Respond LAN Slave Failed to Respond Minor/Momentary Alm on LAN Major Alm on LAN

Table 7-3: Hierarchical NAC Menu Structure (Sheet 12 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
9 ALMS (Alarms) (Continued)	MISC ALARMS	WILD CARD INPUT 1 . . . WILD CARD INPUT 8 PAGING KEYUP DISABLE NO MODEM RESPONSE MODEM DIAL OUT TIMER EXPIRED NO DIALTONE/CARRIER MODEM NAC LAN – LINE FAILURE EE DATA MODIFIED	
	MISC II ALARMS	INCOMPATIBLE HW/SW	
	MOMENTARY ALARMS	PA FAULT 1 PA FAULT 2 PA CUTBACK SYNTHESIZER OUT OF LOCK LOW FORWARD POWER HIGH REFLECTED POWER HIGH VSWR TX IN LIMIT HIGH TRAY TEMPERATURE BATTERY REVERT STATION EXECUTED RESET DIAGNOSTICS FAILURE SYSTEM TIMER	
	SWTICHOVER ALARMS	SWITCHOVER ALARM ON LAN ID 1 SWITCHOVER ALARM ON LAN ID 2 SWITCHOVER ALARM ON LAN ID 3 SWITCHOVER ALARM ON LAN ID 4 SWITCHOVER FOR LAN ID 1 SWITCHOVER FOR LAN ID 2 SWITCHOVER FOR LAN ID 3 SWITCHOVER FOR LAN ID 4 LAN FAILURE-NO RESP ON LAN ID 1 LAN FAILURE-NO RESP ON LAN ID 2 LAN FAILURE-NO RESP ON LAN ID 3 LAN FAILURE-NO RESP ON LAN ID 4 HOT STANDBY SAVE KEY FAILURE HOT STANDBY MASTER KEY FAILURE FRONT PANEL FORCED SWITCHOVER	

Table 7-3: Hierarchical NAC Menu Structure (Sheet 13 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
<up arrow> SERV (Service) **Use this menu to select the PA test and transmission mode.**	KEY AND READ POWER		
	KEY AND READ EXT POWER		
	KEY ANALOG PASS AUDIO		
	KEY ANALOG 1 KHZ		
	KEY BINARY PASS DATA		
	VCO STEERING LINE VOLTAGES	FREQ 1	Value
		FREQ 2	Value
		FREQ 3	Value
		FREQ 4	Value
	PA SERVICE MODE	ENA DIS	
	USER AUDIO	SOURCE	None Input Audio Gained Audio DSP Input Audio Exciter Audio Rx Audio F Plus Audio Transmit Audio Line 1 Audio Line 2 Audio
		PHONE LINE LOOP	Ena Dis
0 DIS (Disable Access) **Use this menu to enable or disable access to the transmitter.**	ACCESS	EN DIS	

Table 7-3: Hierarchical NAC Menu Structure (Sheet 14 of 14)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
<down arrow> Align (Alignment) **Use this menu to control calibration.**	DE-EMP RX LEVEL		
	INPUT AUDIO LEVEL	ENTER TO ADJUST EXIT TO CANCEL	
	OUTPUT RX AUDIO		
	OUTPUT AUDIO INTERNAL SOURCE		
	CALIBRATE STATION POWER	INITIALIZE POWER CALIBRATE	
		POWER CALIBRATE	Value
		CAL EXT WATTMETER	Value
	REFERENCE ALIGNMENT	PENDULUM	Value
		REFERENCE MODULE	Value
	VCO MODULATION FREQS	FREQ 1 DEV	Value
		FREQ 2 DEV	Value
		FREQ 3 DEV	Value
		FREQ 4 DEV	Value
	SRM ALIGNMENT	DELAY	Value
		GAIN	Value
	NOMINAL DEVIATION		
	BINARY INST		
	INTERNAL RX SQUELCH		
	INTERNAL RX TEST TONE SETUP	TEST TONE	En Dis
		TEST TONE FREQ	Value

SCM Station Configuration

The control front panel supports all configuration procedures for a Nucleus paging station. This chapter describes configuration for a first-time installation, or reconfiguration. Previous chapters describes the station front panel (see Chapter 6, "Front Panel Indicators and Controls") and keypad usage (see Chapter 7, "Basic Keypad Procedures").

The contents of this chapter include the following information:

First Time Installation

The procedures described in this chapter apply to a transmitter that is being installed for the first time, a transmitter that is being reinstalled, or a transmitter that has had extensive repairs and requires reconfiguration. The assumed starting point is a Nucleus paging station with all defaults set. This is the condition when Motorola ships the station from the factory, and when the station goes through a reset after power down. In this condition, the Nucleus paging station disables all options.

Note: The transmitter also requires reconfiguration if you enter a new password after the station display times out (see Chapter 7, "Basic Keypad Procedures").

This chapter describes installation, but does not describe all activities from the Station Control Module (SCM) keypad display (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

This manual also provides a method or recording configuration (see Table B-1). Use the table to create a permanent record of the configuration for the Nucleus paging station.

Station (STN) Configuration

This section describes the station configuration procedures available from the STN menu. These procedures include the following:

- Setting the current transmit channel
- Setting the system timer alarm
- Setting the station time

Current Transmit Channel

This procedure configures the current transmit channel for the Nucleus paging station. Use this procedure to select a channel for testing.

Note: The station displays the alignment channels from this menu. However, the station automatically selects the alignment values during the station alignment procedure.

Use the following procedure to set the current transmit channel:

1. From the READY prompt, press <**STN>.**

   The display briefly shows the STN menu, then displays the first submenu item:

   TX FREQ RANGE: xxx-yyy

   Where xxx is the lowest frequency and yyy is the highest frequency in the range.

2. Press **<down arrow>** to access the CURRENT TX CHN submenu.

   The display shows the default or current setting:

   CURRENT TX CHN: xx

   Where xx is the current channel.

3. Press **<ENT>**.

   The text flashes to show the system has entered the edit mode.

4. Press **<down arrow>** or <**up arrow**> to sequence through the channel numbers (1–8). Each number flashes as it appears. When the display shows the appropriate channel number, press **<ENT>**.

   The text stops flashing. The display shows the new channel number:

   CURRENT TX CHN: yy

   Where yy is the new channel.

   Press **<EXIT>** to return to the READY prompt.

Note: The ALIGN 1 VCO *through* ALIGN 6 VCO *values and the* ALIGN 1 DELAY *through* ALIGN 4 DELAY *values are read-only. The station calculates these values during the alignment procedure (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").*

Continue with the paragraph, "System Timer Alarm".

System Timer Alarm

This procedure sets the timer alarm threshold and enables the system timer. The Nucleus paging station resets the system timer each time the station keys. The timer runs until the station keys and resets the timer again. If the station fails to reset the timer before the timer expires, the station declares an alarm.

1. From the READY prompt, press <**STN**>.

   The system accesses the Station menu. The display briefly shows the STN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the SET STATION TIME submenu.

   The display shows the current time:

   SYS TIMER ALRM: DISABLED

   This is the default value.

3. Press **<ENT>**.

   The text flashes to show the system has entered the edit mode.

4. Press **<down arrow>** to sequence through the timer values:

   2 MIN

   15 MIN

   30 MIN

   60 MIN

   90 MIN

   120 MIN

   180 MIN

   DISABLED

   Each value flashes as it appears.

5. When the display shows the appropriate timer value, press **<ENT>**.

6. The text stops flashing and the display shows the new timer value:

   SYS TIMER ALRM: xxx MIN

   Where xxx is the timer value in minutes.

   Press **<EXIT>** to return to the READY prompt.

   Continue with the paragraph, "Station Time".

Note: The FRONT PANEL PASSWORD *submenu is described in Chapter 7, "Basic Keypad Procedures".*

Station Time

This procedure sets the Nucleus paging station date and time. The Nucleus paging station uses the date and time to stamp error log entries. An internal battery maintains date and time for as long as 48 hours after a complete power failure.

Use this procedure to set date and time:

1. From the READY prompt, press <**STN**>.

   The system accesses the Station menu. The display briefly shows the STN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the SET STATION TIME submenu:

   SET STATION TIME

3. Press **<ENT>**.

   The display shows the first value, the year:

   YEAR: 1993

4. Press **<ENT>**.

   The message flashes to show the system has entered the edit mode.

5. Type a new value for the year. Press **<ENT>**.

   The display stops flashing and shows the new value:

   YEAR: 1997

6. Press **<down arrow>** to access the month value. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

7. Type the new value for the month. Press **<ENT>**.

   The display stops flashing and shows the new value:

   MONTH: 2

8. Press **<down arrow>** to access the day value. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

9. Type the value for the day. Press **<ENT>**.

   The display stops flashing and shows the new value:

   DAY: 28

10. Press **<down arrow>** to access the hour value. Press **<ENT>**.

    The display flashes to show the system has entered the edit mode.

11. Type the new value for the hour.

12. Press **<ENT>**.

    The display stops flashing and shows the new value:

    HOUR: 13

13. Press **<down arrow>** to access the minute value.

14. Press **<ENT>**.

    The display flashes to show the system has entered the edit mode.

15. Type the new value for minutes.

16. Press **<ENT>**.

    The display stops flashing and shows the new value:

    MINUTE: 28

17. Press **<down arrow>** to access the seconds value.

18. Press **<ENT>**.

    The display flashes to show the system has entered the edit mode.

19. Type the new value for seconds.

20. Press **<ENT>**.

    The display stops flashing and shows the new value:

    SECOND: 00

    Press **<EXIT>** to return to the READY prompt.

    Continue with the paragraph, "Transmit (TX) Configuration".

Transmit (TX) Configuration

This section describes the transmit configuration procedures available from the TX menu. These procedures include the following:

- Setting transmitter channel frequencies
- Setting transmitter channel power
- Setting transmitter channel offsets
- Setting the low-speed splatter filter
- Setting the high-speed splatter filter
- Setting the nominal binary deviation
- Setting the transmitter data
- Setting idle deviation

Transmitter Channel Frequencies

Transmit frequencies are normally set at the factory. However, the station may require a frequency change after installation.

Note: The station calculates mean frequency from the frequency or frequencies set during this procedure. The station uses the mean frequency in three procedures:
- station power output alignment
- external wattmeter calibration
- UHSO/HSO alignment

Frequency Selection

Note: To select or set transmit frequencies from the front panel, you must configure pole 1 of the Station Control Board S751 DIP switch to the ON position. Reinstall the board and perform system reset.

Use the following procedure to change the frequency for each channel (1–8) in a channel mapped system.

1. From the READY prompt, press <**TX**> to enter the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu item:

   TRANSMIT: TX CHN FREQS

2. Press **<ENT>**.

   The display shows the first channel frequency:

   CHN 1 FREQ xxx.xxxx MHZ

   Where xxx.xxxx is the currently programmed frequency for channel 1.

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Type a new frequency value for the channel. The value is in MHz, with four places to the right of the decimal point.

Note: To deprogram a channel, type 0.

5. Press **<ENT>**.

   The display shows the new channel value:

   CHN 1 FREQ yyy.yyyy MHZ

   Where yyy.yyyy is the newly entered value.

6. Press **<down arrow>** to move to the next channel. Repeat Step 3 through Step 5 for each channel.

Note: This system displays all channels that have a non-zero frequency value.

   Press **<EXIT>** once to return to the TX CHN FREQS prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Mean Frequency".

Mean Frequency

The station keys on the mean frequency during the following procedures:

- Station power output alignment
- External Wattmeter calibration
- UHSO / HSO alignment procedure

Use the following procedure to display a mean frequency for all the channels:

1. From the READY prompt, press <**TX>** key to enter the Transmit menu.

   The display shows the Transmit menu text for the first menu item:

   TRANSMIT: TX CHN FREQS

2. Press **<ENT>**.

   The display shows the first channel frequency:

   CHN 1 FREQ: xxx.xxx

3. Press **<down arrow>** to access the MEAN FREQ option (after Channel 8).

   The system displays the current mean frequency:

   MEAN FREQ zzz.zzzz MHz

   Press **<EXIT>** once to return to the TX CHN FREQS prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Transmitter Channel Power".

Transmitter Channel Power

To set transmitter power, determine whether the transmitter is channel mapped or non-channel mapped. With channel mapping enabled, a Nucleus paging station transmit at a different, programmable power level on each channel. With channel mapping disabled, the Nucleus paging station transmits at the same power level on each channel. By default, the Nucleus paging station sets transmit power at the low end of the station's power amplifier range.

To set the transmitter channel power with channel mapping disabled, see paragraph, "Transmitter Channel Power (Channel Mapping Disabled)". To set the transmitter channel power for each channel, see paragraph, "Transmitter Channel Power (Channel Mapping Enabled)".

Transmitter Channel Power (Channel Mapping Disabled)

Use the following procedure if channel-mapped power is disabled.

1. From the READY prompt, press <**TX**> to access the Transmitter menu.

   The LED briefly displays the TX menu, then displays the first submenu item:

   TX CHN FREQS

2. Press **<down arrow>** to access the TX CHN PWR submenu.

   The display shows the current transmitter channel power:

   TX CHN PWR OPERATING PWR xxx W

   Where xxx is the currently programmed station transmit power.

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Type the power value in Watts.

5. Press **<ENT>**.

   The text stops flashing and shows the new power value:

   OPERATING PWR yyy W

   Where yyy is the new station power value.

   Press **<EXIT>** once to return to the TX CHN PWR prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Transmitter Channel Offsets".

Transmitter Channel Power (Channel Mapping Enabled)

Use the following procedure if channel-mapped power is enabled.

*Note: Motorola enables channel mapping during manufacturing. To enable channel mapping in the field, press <**OPT1**> to access the Option menu and select* ENABLE CHANNEL MAPPING *(see paragraph, "Channel Mapped Power").*

1. From the READY prompt, press the <**TX**> key to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu item.

   TX CHN FREQS

2. Press **<down arrow>** to access the TX CHN PWR submenu.

   The display shows the shows the power for the first channel:

   CHN 1 PWR xxx W

   Where xxx is the currently programmed station transmit power.

3. Press **<ENT>**.

   The text flashes to show the system has entered the edit mode.

4. Type the power value in Watts. The value flashes:

   yyy

5. Press **<ENT>**.

   The text stops flashing and shows the new power value:

   CHN 1 PWR yyy W

   Where yyy is the newly entered station power value.

6. Press **<down arrow>** to display the power setting for another channel:

   CHN n PWR xxx W

   Where n is the current channel number and xxx is the currently programmed station transmit power for the channel.

7. Perform Step 3 through Step 6 to change values for other channels.

   Press **<EXIT>** once to return to the TX CHN PWR prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Transmitter Channel Offsets".

Transmitter Channel Offsets

In a simulcast messaging system, one way to improve transmitter performance is to create offsets to the frequency deviations for adjacent messaging channels. Use the following procedure to configured offsets.

The messaging data type determines the offset (high or low) that maximizes performance for your system (see Table 8-1). Consult Motorola for additional information.

Table 8-1: Carrier Offset

Messaging Data Type	Carrier Offset
2-level 1600 FLEX	Low-speed
4-level 3200 FLEX	High-speed
4-level 6400 FLEX	High-speed

1. From the READY prompt, press <**TX**> to access the Transmit menu. The display briefly shows the TX menu, then shows the first submenu item:

   TX CHN FREQS

2. Press **<down arrow>** to access the TX CHN OFFSETS submenu.

3. Press **<ENT>**.

   The text scrolls to show the default:

   HIGH SPEED OFFSET xxx HZ

   Where xxx is the current high-speed carrier offset value.

4. To set the high-speed offset, see paragraph, "High-speed Carrier Offset".

   To set the low-speed offset, see paragraph, "Low-speed Carrier Offset".

High-speed Carrier Offset

Use the following procedure to change the high-speed carrier offset.

1. At the HIGH SPEED OFFSET display, press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

   Where xxx is the current high-speed carrier offset.

2. Type a new value for high-speed offset.

   yyy

   Where yyy is the new high-speed carrier offset. The range is -5000 to +5000 Hz.

   Press **<TOG>** to change the sign of the value.

Note: The display shows negative (-) sign, but does not show the positive (+) sign.

3. Press **<ENT>**.

   The display stops flashing and shows the new value:

   HIGH SPEED OFFSET yyyy HZ

   Press **<EXIT>** once to return to the TX CHN OFFSET prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "High-speed Splatter Filter" or paragraph, "Low-speed Splatter Filter".

Low-speed Carrier Offset

Use the following procedure to change the low-speed carrier offset.

1. At the HIGH SPEED OFFSET display, press **<down arrow>** to access the low-speed offset. The display shows the current value:

   LOW SPEED OFFSET xxx HZ

   Where xxx is the current low-speed carrier offset value.

2. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

3. Type a new value for low-speed offset. The range is -5000 to +5000 Hz.

   yyy

   Where yyy is the new high-speed carrier offset.

   Press **<TOG>** to change the sign of the value.

Note: The display shows negative (-) sign, but does not show the positive (+) sign.

4. Press **<ENT>**.

   The display stops flashing and shows the new value:

   LOW SPEED OFFSET yyyy HZ

   Where yyyy is the low-speed carrier offset value.

   Press **<EXIT>** once to return to the TX CHN OFFSETS prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "High-speed Splatter Filter" or paragraph, "Low-speed Splatter Filter".

High-speed Splatter Filter

The splatter filters configure the Nucleus paging station for compatibility with other transmitters in the system. A high-speed splatter filter configures the station for compatibility with other high-speed transmitters in the same system.

Use the following procedure to configure a Nucleus paging station for operation in a high-speed system.

Note: Most systems use the 88 µs splatter filter. However, when 20 kHz channel spacing is required, the 160 µs splatter filter is applied to meet adjacent channel power (ACP) specifications.

In GPS synchronized systems, all stations should use the same filter because each filter has a different delay value.

1. From the READY prompt, press <**TX**> to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu item.

   TX CHN FREQS

2. Press **<down arrow>** to access the HIGH SPEED SPLATTER FILTER submenu.

   The display shows the current value:

   HIGH SPEED SPLATTER FILTER: xxx US LOW PASS

   Where xxx is 88 or 160 µs.

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<down arrow>** to display the other value for high-speed splatter filter.

5. Press **<ENT>**.

   The text stops flashing. The text scrolls to show the splatter filter value:

   HIGH SPEED SPLATTER FILTER: yyy US LOW PASS

   Where yyy is the new value.

   Press **<EXIT>** to return to the READY prompt.

   Continue with the paragraph, "Nominal Binary Deviation".

Low-speed Splatter Filter

The splatter filters configure the Nucleus paging station for compatibility with other transmitters in the system (see Table 8-2). The low-speed splatter filter is used for low-speed FLEX paging. The low-speed splatter filter has no effect on high-speed messaging.

Note: For most applications, Motorola recommends the 88 µs low pass filter.

In GPS synchronized systems, all stations should use the same filter because each of the four filters has a different delay value.

Table 8-2: Recommended Splatter Filters

Messaging System	Recommended Splatter Filter
Nucleus paging stations only	88 µs low pass filter
Nucleus paging station in a system with 140 µs messaging stations	140 µs low pass filter
Nucleus paging station in a system with 250 µs messaging stations	250 µs low pass filter
Nucleus paging station in a system with 20 KHz channel spacing only	160 µs low pass filter

1. From the READY prompt, press <**TX**> to access the Transmit menu. The display briefly shows the TX menu, then shows the first submenu item:

   TX CHN FREQS

2. Press <**down arrow**> to access the LOW SPEED SPLATTER FILTER submenu. Press <**ENT**>.

   The display shows the default:

   LOW SPEED SPLATTER FILTER: xxx US LOW PASS

   Where xxx is 88 µs, 140 µs, 160 µs, or 250 µs.

3. Press <**ENT**>.

   The display flashes to show the system has entered the edit mode.

4. Press <**down arrow**> to sequence through the values for low-speed splatter filter:

   88 US LOW PASS

   140 US LOW PASS

   250 US LOW PASS

   160 US LOW PASS

5. At the appropriate filter value press <**ENT**>.

   The text stops flashing. The display shows the splatter filter value:

   HIGH SPEED SPLATTER FILTER: yyy US LOW PASS

   Where yyy is the new value.

   Press <**EXIT**> to return to the READY prompt.

   Continue with the paragraph, "Nominal Binary Deviation".

Nominal Binary Deviation

The nominal binary deviation adjusts the amount of acceptable deviation for data levels above and below the carrier frequency. The range is 0–7000 Hz in 1 Hz increments.

Note: Nominal binary deviation for 2-level 3200 FLEX transmissions is fixed at 4800 Hz.

Use the following procedure to set the nominal binary deviation:

1. From the READY prompt, press <**TX**> to access the Transmit menu. The display briefly shows the TX menu, then shows the first submenu item.

   TX CHN FREQS

2. Press **<down arrow>** to access the NOMINAL BINARY DEVIATION submenu. The display shows the current value:

   NOMINAL BINARY DEVIATION xxxx HZ

   Where xxxx is the current binary deviation value for the station.

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Type the value for nominal binary deviation.

5. Press **<ENT>**.

   The text stops flashing. The text scrolls to show the binary deviation value:

   NOMINAL BINARY DEVIATION yyyy HZ

   Where yyyy is the new value.

   Press **<EXIT>** to return to the READY prompt.

   Continue with the paragraph, "Special Transmitter Setup".

Special Transmitter Setup

The special transmitter setup procedures include setup for transmitter data and the relationship between the transmitter and a receiver.

Inverted Transmitter Data

The Nucleus paging station can be configured to invert messaging data at the transmitter output. This configuration procedure defines the data level for each type of messaging data and 2-level or 4-level transmission. For an explanation of these inversion patterns, see Figure 8-1 and Table 8-3.

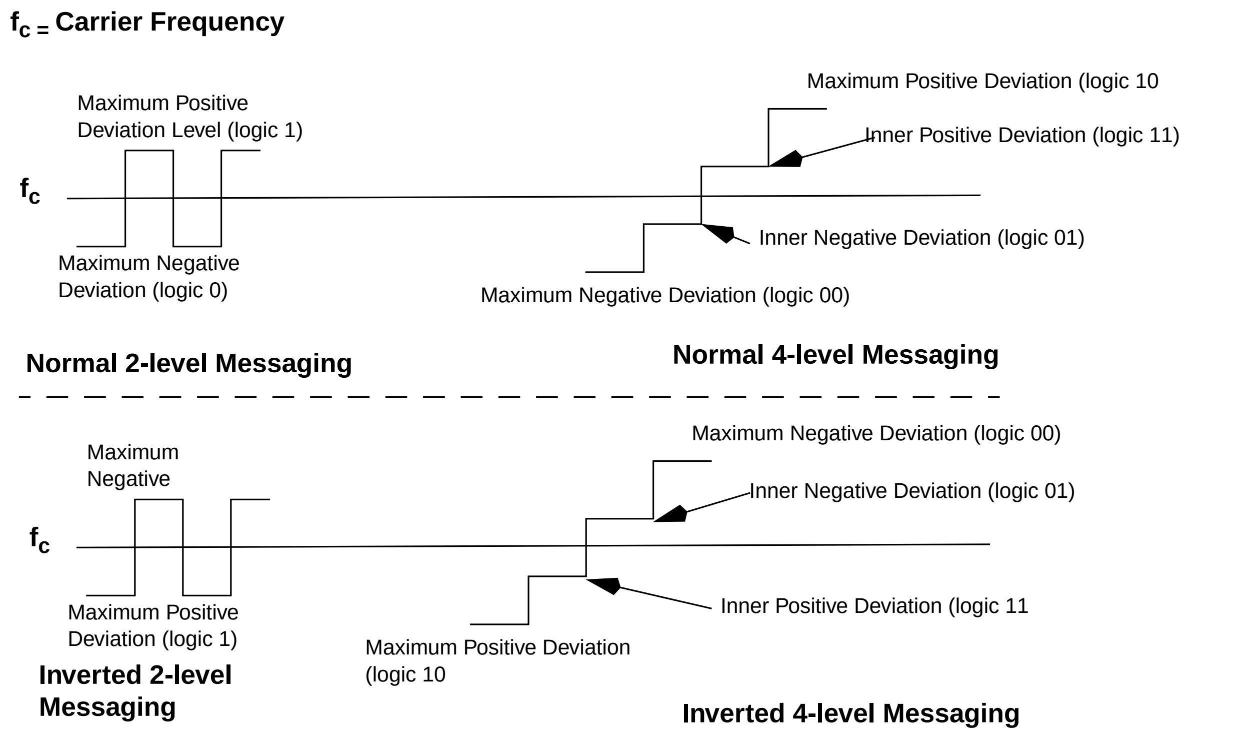


Figure 8-1: Carrier Deviations for 2-level and 4-level Normal and Inverted Transmissions

Table 8-3: Carrier Deviations for Normal and Inverted Data

Messaging Data Type	Data Value	Carrier Deviation for Normal Transmission	Carrier Deviation for Inverted Transmission
2-level FLEX	1	Maximum positive deviation	Maximum negative deviation
	0	Maximum negative deviation	Maximum positive deviation
4-level FLEX	10	Maximum positive deviation	Maximum negative deviation
	11	Inner positive deviation	Inner negative deviation
	01	Inner negative deviation	Inner positive deviation
	00	Maximum negative deviation	Maximum positive deviation

Use the following procedure to configure data inversion:

1. From the READY prompt, press **<TX>** access the Transmit menu. The display briefly shows the TX menu, then shows the first submenu item:

   TX CHN FREQS

2. Press **<down arrow>** to access the SPECIAL TX SETUP submenu. The display shows the submenu:

   SPECIAL TX SETUP

3. Press **<ENT>**.

The display shows the default:

TX DATA INVERT: DISABLED

4. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

5. Press **<TOG>**.

   The display shows the new mode:

   ENABLED

6. Press **<ENT>**.

   The display stops flashing and shows the new value:

   TX DATA INVERT: ENABLED

   Press **<EXIT>** once to return to the SPECIAL TX SETUP prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   The the transmitter site contains a receiver, continue with the paragraph, "Transmitter Equals Receiver".

   If the transmitter site does not contain a receiver, continue with the paragraph, "Idle Deviation".

Transmitter Equals Receiver

A system with a collocated monitor receiver tuned to the same frequency as a station transmitter frequency risks receiver desensitization. This procedure enables the transmitter antenna and circuitry to switch to receiving when required.

CAUTION

Motorola sets the value for receiver type during manufacturing. Do not change this setting.

Note: This procedure does not affect other transmit channels.

Use the following procedure to enable TX=RX:

1. From the READY prompt, press <**TX**> to access the Transmit menu. The display briefly shows the TX menu, then shows the first submenu item:

   TX CHN FREQS

2. Press <**down arrow**> to access the SPECIAL TX SETUP submenu.

3. Press **<ENT>**.

   The display shows the first item of the SPECIAL TX SETUP selection:

   TX DATA INVERT: DISABLED

4. Press **<down arrow>** to access the TX=RX submenu:

   TX=RX:

5. Press **<ENT>**.

   The display shows the default:

   TX=RX: DISABLED

6. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

7. Press **<TOG>**.

   The display stops flashing:

   ENABLED

8. Press **<ENT>**.

   The display shows the new value:

   TX=RX: ENABLED

   Press **<EXIT>** once to return to the SPECIAL TX SETUP prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Transmitter Equals Receiver Channel".

Transmitter Equals Receiver Channel

This procedure causes the transmit channel to switch to a frequency 100 kHz above or below the normal transmit frequency whenever the transmitter is not keyed.

CAUTION

Motorola sets the value for receiver type during manufacturing. Do not change this setting.

Use the following procedure to configure the receiver channel:

1. From the READY prompt, press **<TX>** to access the Transmit menu. The display briefly shows the TX menu, then shows the first submenu item.

   TX CHN FREQS

2. Press **<down arrow>** to access the SPECIAL TX SETUP submenu.

3. Press **<ENT>**.

   The display shows the first item of the SPECIAL TX SETUP selection:

   TX DATA INVERT: DISABLED

4. Press **<down arrow>** to access the TX=RX CHANNEL submenu:

   TX=RX CHANNEL: xx

   Where xx is the current channel.

5. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

6. Press **<down arrow>** or <**up arrow**> to sequence through the available channel numbers (1–8):

   yy

   Where yy is the new channel.

7. When the display shows the appropriate channel number, press **<ENT>**.

8. The display shows the new channel:

   TX=RX CHANNEL: yy

   Where yy is the new channel.

   Press **<EXIT>** once to return to the SPECIAL TX SETUP prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Idle Deviation".

Idle Deviation

Idle deviation determines the station transmit frequency when the station is idle (keyed but not transmitting). Idle deviation improves compatibility with other transmitters in the same system. Table 8-4 shows appropriate idle deviation settings.

Table 8-4: Idle Deviation Frequency

Messaging Type	Idle Deviation Setting	TX Frequency when Station is Idle
All	Null	Current channel frequency
FLEX 1600	Space (-)	Channel frequency - nominal binary deviation (NBD)
	Mark (+)	Channel frequency + NBD
FLEX 3200	Space (-)	Channel frequency - 4800 Hz
	Mark (+)	Channel frequency + 4800 Hz
FLEX 6400	Space (-)	Channel frequency - 4800 Hz
	Mark (+)	Channel frequency + 4800 Hz

Note: During station alignment, idle deviation is null regardless of the setting.

Use the following procedure to change idle deviation:

1. From the READY prompt, press <**TX**> to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu item.

   TX CHN FREQS

2. Press **<down arrow>** to access the IDLE DEVIATION submenu.

   IDLE DEVIATION: NULL

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<down arrow>** toto sequence through the selections (SPACE, MARK, and NULL). Each value flashes as it appears.

5. When the display shows the appropriate selection, press **<ENT>**.

   The display shows the new channel:

   IDLE DEVIATION: MARK

   Press **<EXIT>** to return to the READY prompt.

   Continue with the paragraph, "Options (OPT1) Configuration".

Options (OPT1) Configuration

This section describes the option configuration procedures available from the OPT1 menu. These procedures include the following:

- Setting antenna relays
- Setting up external circulators
- Enabling or disabling channel mapped power

Antenna Relay

This procedure enables the use of an antenna relay option (X371) for use with the Nucleus paging station.

CAUTION

Motorola sets the value for antenna relay during manufacturing. Do not change this setting unless the change must be made. Consult Motorola engineering before performing this procedure.

Display the alignment channels from the STN menu and CURRENT TX CHN submenu. This procedure does not automatically select the alignment channels. Do not attempt to select any alignment channels using the CURRENT TX CHN parameter.

1. From the READY prompt, press <**OPT1**> to access the Options 1 menu.

   The display briefly shows the OPT1 menu, then shows the ANTENNA RELAY submenu:

   ANTENNA RELAY: DISABLED

2. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

3. To change the configuration, press **<TOG>**.

   The display flashes:

   ENABLED

4. Press **<ENT>**.

   The display stops flashing and shows the new value:

   ANTENNA RELAY: ENABLED

   Press **<EXIT>** to return to the READY prompt.

   Continue with the paragraph, "External Circulator".

External Circulator

This procedure configures the Nucleus paging station to accommodate the external circulator installed in it (option X676 or option X677).

Note: Set this parameter to PRESENT if the station has either option.

CAUTION

Motorola sets the value for external circulator during manufacturing. Do not change this setting unless the change must be made. Consult Motorola engineering before performing this procedure.

Use the following procedure to configure a circulator:

1. From the READY prompt, press <**OPT1**> to access the Options 1 menu.

   The display briefly shows the OPT1 menu, then shows the ANTENNA RELAY submenu:

   ANTENNA RELAY: DISABLED

2. Press **<down arrow>** to access the EXT CIRCULATOR submenu.

   The display shows the current value:

   EXT CIRCULATOR: NOT PRESENT

3. Press **<ENT>**.

   The text flashes to show the system has entered the edit mode.

4. To change the configuration, press **<TOG>**.

   The display shows the new value:

   PRESENT

5. Press **<ENT>**.

   The display shows the value:

   EXT CIRCULATOR: PRESENT

   Press **<EXIT>** to return to the READY prompt.

   If the system is channel mapped, continue with the paragraph, "Channel Mapped Power". If the station is not channel mapped, continue with the paragraph, "Alarm Setup (ASET) Configuration".

Channel Mapped Power

The channel mapping feature provides a programmable power level for each channel. Use the following procedure to enable the channel-mapped power feature.

1. From the READY prompt, press <**OPT1**> to access the Options 1 menu.

   The display briefly shows the OPT1 menu, then shows the ANTENNA RELAY submenu:

   ANTENNA RELAY: DISABLED

2. Press **<down arrow>** to access the CHN MAPPED POWER submenu.

   The text scrolls to show the default:

   CHN MAPPED PWR: DISABLED

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<TOG>**.

   The display flashes the new value:

   ENABLED

5. Press **<ENT>**.

   The display stops flashing and shows the new value:

   CHN MAPPED PWR: ENABLED

   Press **<EXIT>** to return to the READY prompt.

   Continue with the paragraph, "Alarm Setup (ASET) Configuration".

Alarm Setup (ASET) Configuration

This section describes the alarm setup configuration procedures available from the ASET menu. These procedures include the following:

- Setting alarms for non-channel mapped systems
- Setting alarms for channel mapped systems

Alarms for Non-channel Mapped Power Systems

Configuration for non-channel mapped systems affects the following alarms:

- Forward power alarm
- Reflected power alarm
- External forward alarm
- External reflected power alarm

This procedure programs the thresholds (points) that cause the system to declare an alarm. Use this procedure to configure any of the four alarms. In a nonchannel mapped system, one setting for each alarm for the system applies to every channel.

Note: The system makes all measurements when the station keys.

EXT WM FWD PWR ALM PT and EXT WM RFL PWR ALM PT require an external Wattmeter.

Use the following procedure to program alarm thresholds for nonchannel mapped stations:

1. From the READY prompt, press **<ASET>** to access the Alarm Setup menu.

   The display briefly shows the ASET menu, then shows the NON-CHAN MAPPED PWR ALARMS submenu:

   NON-CHAN MAPPED PWR ALARMS

2. Press **<ENT>**.

   The first selection of the submenu appears:

   FWD PWR ALM PT: xxx W

   Where xxx is the current alarm threshold.

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Type a threshold value for this alarm.

   The display shows this value:

   yyy

   Where yyy is the new alarm threshold.

5. Press **<ENT>**.

   The display shows the value:

   FWD PWR ALM PT: yyy W

6. Press **<down arrow>** to access the next alarm.

7. Perform Step 3 through Step 6 for each alarm.

   Press **<EXIT>** once to return to the NON CHN MAPPED ALARM prompt.

   Press **<EXIT>** twice to return to the READY prompt.

Alarm Thresholds for Channel-mapped Systems

The configuration for channel-mapped systems affects the following alarms:

- Forward power alarm (channel 1–8) (INT FWD CHN MAPPED ALRM)
- Reflected power alarm (channel 1–8) (INT FRL CHN MAPPED ALRM)
- External forward alarm (channel 1–8) (EXT FWD CHN MAPPED ALRM)
- External reflected power alarm (channel 1–8) (EXT FWD CHN MAPPED ALRM)

This procedure programs the thresholds (“points”) that cause the system to declare an alarm.

Note: The system makes all measurements when the station keys.

The EXT WM FWD PWR ALM PT and EXT WM RFL PWR ALM PT alarms require an external Wattmeter.

Internal Forward Power Alarms

Use the following procedure to configure forward power alarm thresholds:

1. From the READY prompt, press <**ASET**> to access the Alarm Setup menu.

   The display briefly shows the ASET menu, then shows the INT FWD CHN MAPPED ALMS submenu with the current value for the first channel:

   INT FWD CHN MAPPED ALMS

2. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

3. Type a new value for the forward power alarm for the channel.

   The display flashes:

   yyy

   Where yyy is the new forward power alarm for the channel.

4. Press **<ENT>**.

   The display shows the new value.

   INT FWD CHN MAPPED CHN 1 ALRM PT: xxx W

   Where xxx is the current value.

5. Press **<down arrow>** to access the forward power alarm for the next channel.

6. Perform Step 2 through Step 5 to set the forward power alarm thresholds for other channels.

   Press **<EXIT>** to return to the INT FWD CHN MAPPED ALRM prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with paragraph, "Reflected Power Alarms".

Reflected Power Alarms

Use the following procedure to configure reflected power alarm thresholds:

1. From the READY prompt, press <**ASET>** to access the Alarm Setup menu.

   The display briefly shows the ASET menu, then shows the INT FWD CHN MAPPED ALMS submenu with the current value for the first channel:

   CHN 1 FWD ALM PT: xxx W

   Where xxx is the current forward power alarm for the channel.

2. Press **<down arrow**> to access the INT RFL CHN MAPPED ALMS submenu.

3. Press **<ENT>**.

   The display shows the first channel for configuration:

   CHN 1 RFL ALM PT: xxx W

   Where xxx is the current value.

4. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

5. Type a new value for the forward power alarm for the channel.

   The display flashes:

   yyy

   Where yyy is the new forward power alarm for the channel:

6. Press **<ENT>**.

   The display shows the new value

   CHN 1 RFL ALM PT: xxx W

   Where xxx is the current value.

7. Press **<down arrow>** to access the forward power alarm for the next channel.

8. Perform Step 4 through Step 7 to set the forward power alarm thresholds for other channels.

   Press **<EXIT>** to return to the INT FWD CHN MAPPED ALRM prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   If the system contains an external Wattmeter, continue with the paragraph, "External Forward Power Alarms".

   If the system does not contain an external Wattmeter, continue with the paragraph, "Configuration (CNFG)".

External Forward Power Alarms

Use the following procedure to configure forward power alarm thresholds measured at a Wattmeter:

1. From the READY prompt, press **<ASET>** to access the Alarm Setup menu.

   The display briefly shows the ASET menu, then shows the INT FWD CHN MAPPED ALMS submenu with the current value for the first channel:

   INT FWD CHN MAPPED ALMS: xxx W

2. Press **<down arrow>** to access the EXT FWD CHN MAPPED ALMS submenu.

3. Press **<ENT>**.

   The display shows the first channel for configuration:

   CHN 1 EXT FWD CHN MAPPED ALM PT: xxx W

   Where xxx is the current value.

4. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

5. Type a new value for the external forward power alarm for the channel. The display flashes the new value:

   yyy

   Where yyy is the new value.

6. Press **<ENT>**.

   The display stops flashing and shows the new value:

   CHN 1 EXT FWD ALM PT: yyy W

7. Press **<down arrow>** to access the external forward power alarm for the next channel.

8. Perform Step 3 through Step 7 to configure forward power alarm thresholds for other channels.

   Press **<EXIT>** to return to the INT FWD CHN MAPPED ALMS prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   If the system contains an external Wattmeter, continue with the paragraph, "External Reflected Power Alarms".

   If the system does not contain an external Wattmeter, continue with the paragraph, "Configuration (CNFG)".

External Reflected Power Alarms

Use the following procedure to configure forward power alarm thresholds:

1. From the READY prompt, press <**ASET>** to access the Alarm Setup menu.

   The display briefly shows the ASET menu, then shows the INT FWD CHN MAPPED ALMS submenu with the current value for the first channel:

   CHN 1 FWD ALM PT: xxx W

2. Press **<down arrow>** to access the EXT RFL CHN MAPPED ALMS submenu.

3. Press **<ENT>**.

   The display shows the first channel for configuration:

   CHN 1 EXT RFL ALM PT: xxx W

   Where xxx is the current value.

4. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

5. Type a new value for the external reflected power alarm for the channel:

   yyy

   Where yyy is the new value.

6. Press **<ENT>**.

   The text stops flashing and shows the new value.

   CHN 1 EXT RFL ALM PT: yyy W

7. Press **<down arrow>** to access the external reflected power alarm for the next channel.

8. Perform Step 3 through Step 7 to configure reflected power alarm thresholds for other channels.

   Press **<EXIT>**to return to the INT FWD CHN MAPPED ALM prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Configuration (CNFG)".

Configuration (CNFG)

This section describes the configuration procedures available from the CNFG menu. These procedures include the following:

- Setting up battery revert
- Setting up external Wattmeter type
- Setting network control type
- Setting receiver type
- Setting special key select
- Setting seconds

Note: The first option, MAX PWR, *is read only.*

Battery Revert

Battery revert provides power if AC power fails. Two options are available: option X30 or option X43. If the system uses one of the battery revert options, use this procedure to configure or verify the option.

This procedure configures these aspects of battery revert:

- Battery type
- Battery charging
- Battery backup

Battery Type

Use the following procedure to configure the battery type:

1. From the READY prompt, press <**CNFG**> to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the BATTERY REVERT SETUP submenu.

3. Press **<ENT>**.

   The display shows the BATTERY TYPE selection:

   BATTERY TYPE: BATTERY REVERT DISABLED

4. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

   DISABLED

5. Press **<down arrow>** or **<TOG>** to select SEALED LEAD CALCIUM. The display flashes:

   SEALED LEAD CALCIUM

6. Press **<ENT>**.

   The display stops flashing and shows the new type:

   BATTERY TYPE: SEALED LEAD CALCIUM

   Press **<EXIT>** once to return to the READY prompt.

   Continue with the paragraph, "Charging Option".

Charging Option

Use this procedure to configure the charging option:

1. From the READY prompt, press <**CNFG**> to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the BATTERY REVERT SETUP submenu.

3. Press **<ENT>**.

   The display shows the BATTERY TYPE selection:

   BATTERY TYPE: BATTERY REVERT ENABLED

4. Press **<down arrow>** to access the CHARGING selection. The display shows the current configuration:

   CHARGING: DISABLED

5. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

6. Press **<down arrow>**. The display flashes the new value:

   ENABLED

7. Press **<ENT>**.

   The text stops flashing and shows the CHARGING option:

   CHARGING: ENABLED

   Press **<EXIT>** once to return to BATTERY REVERT SETUP prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "Backup Option".

Backup Option

The backup option selects backup mode during an AC power failure. The mode depends on the option:

- Option X43 requires the backup station mode.
- Option X30 requires the backup control mode.

Use the following procedure to configure the backup option:

Use this procedure to configure the charging option:

1. From the READY prompt, press <**CNFG**> to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the BATTERY REVERT SETUP submenu.

   The display shows the BATTERY TYPE option:

   BATTERY TYPE: BATTERY REVERT ENABLED

3. Press **<ENT>**.

4. Press **<down arrow>** to access the BACKUP selection.

   The display shows the current selection:

   BACKUP: BACKUP STATION

5. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

6. To configure battery backup, press **<down arrow>** to select BACKUP CONTROL. The display flashes:

   BACKUP CONTROL

7. Press **<ENT>**.

   The text stops flashing and shows the BACKUP option:

   BACKUP: BACKUP CONTROL

   Press **<EXIT>** once to return to BATTERY REVERT SETUP prompt.

   Press **<EXIT>** twice to return to the READY prompt.

   If the station has an external Wattmeter, continue with the paragraph, "External Wattmeter". If the station does not have an external Wattmeter, continue with the paragraph, "Control Type".

Fixed Cutback Reduction Percent

The fixed cutback reduction percent option determines the level of cutback in power that the station uses to conserve power when using battery revert. This option is not available for this release.

External Wattmeter

This procedure identifies the type of Wattmeter being used at the station. At the current time, the Nucleus paging station uses the Wattmeter identified as Class 1 External. Use this procedure to configure the external Wattmeter.

1. From the READY prompt, press **<CNFG>** to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the EXT WATTMETER TYPE submenu.

3. Press **<ENT>**.

   The display shows the default:

   EXT WATTMETER TYPE: NONE

4. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

5. Press **<down arrow>** to sequence through the selections.

   The display flashes the values:

   NONE

   CLASS 1 EXT

   CLASS 2 EXT

   CLASS 3 EXT

   CLASS 4 EXT

6. When the display shows the CLASS 1 EXT selection, press **<ENT>**.

   The display shows the Wattmeter selection:

   EXT WATTMETER TYPE: CLASS 1 EXT

   Press **<EXIT>** once to return to the READY prompt.

   Continue with the paragraph, "Control Type".

Control Type

This procedure configures the type of network controller being used in the system. The types are:

- C-NET Control Point
- RF-Conductor!™ (RF-C!) controller and the RF-Baton!™ (RF-B!) transmitter controller

Use the following procedure to configure the station control type:

1. From the READY prompt, press <**CNFG**> to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the CONTROL submenu.

   The display shows the default control type:

   CONTROL: INTERNAL CNET

   This control type is correct for an NIU.

3. To configure the station for an RF-B! transmitter controller, press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<down arrow>**.

   The display flashes the selection:

   EXT SYNCH LOCAL CONTROL.

5. Press **<ENT>**.

   The text stops flashing. The display shows the control type:

   CONTROL: EXT SYNCH LOCAL CONTROL

   Press **<EXIT>** to return to the READY prompt.

   If the station has a receiver, continue with the paragraph, "Receiver Type".

   If the station supports external keying, continue with the paragraph, "Special Key Select".

Receiver Type

CAUTION

Motorola sets the value for receiver type during manufacturing. Do not change this setting unless you install a receiver in the station.

The receiver type submenu configures the station for an internal monitor receiver or link receiver. Use the following procedure to configure a receiver. Then perform the procedures in paragraph, "Transmitter Equals Receiver" and paragraph, "Transmitter Equals Receiver Channel".

Use the following procedure to configure the receiver type:

1. From the READY prompt, press <**CNFG**> to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the RX TYPE submenu**.**

   The display shows the default control type:

   RX TYPE: NO INTERNAL

   Continue with the paragraph, "Link Receiver" or paragraph, "Monitor Receiver".

Link Receiver

Use the following procedure to configure a link receiver.

1. At the RX TYPE: prompt, press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

2. Press **<down arrow>** to access INTERNAL LINK.

   The display flashes the selection:

   INTERNAL LINK

3. Press **<ENT>**.

   The display stops flashing and shows the control type:

   RX TYPE: INTERNAL LINK

   Press **<EXIT>** to return to the READY prompt.

   If the station supports external keying, continue with the paragraph, "Special Key Select".

Monitor Receiver

Use the following procedure to configure a monitor receiver.

1. At the RX TYPE: prompt, press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

2. Press **<down arrow>** to access INTERNAL MONITOR. The display flashes this selection:

   INTERNAL MONITOR

3. Press **<ENT>**.

   The display stops flashing and shows the new selection:

   RX TYPE: INTERNAL MONITOR

   Press **<EXIT>** to return to the READY prompt.

   If the station supports external keying, continue with the paragraph, "Special Key Select".

Special Key Select

The special key select submenu enables external keying and configures the station for external high or external low. Use the external low selection if the station has an internal NIU transmitter controller or external synchronous control (external NIU transmitter controller or an RF-B! transmitter controller).

Use the following procedure to configure external keying:

1. From the READY prompt, press <**CNFG**> to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR

2. Press **<down arrow>** to access the SPECIAL KEY SELECT submenu**.**

   The display shows the default control type:

   SPECIAL KEY SELECT: NONE

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<down arrow>** to sequence through the selections and select external low keying:
   - CD INT–not supported
   - CD EXT–not supported
   - SPCL KEY–not supported
   - FAST LOW–not supported
   - FAST HIGH–not supported
   - EXT LOW–external low key
   - EXT HIGH–not supported

5. Press **<ENT>**.

   The display stops flashing and shows the key select:

   SPECIAL KEY SELECT: EXT LOW

   Press **<EXIT>** to return to the READY prompt.

   This procedure concludes configuration for the Nucleus paging station.

SCM Station Alarms, Status, Troubleshooting, and Alignment

This chapter describes operational and troubleshooting procedures for the Nucleus paging station using the keypad and a test equipment setup. The Nucleus paging station supports power output adjustment and alignment with manual and automatic procedures. The station also displays status and alarms. This chapter describes these procedures. This chapter contains the following information:

Station Status

The Nucleus paging station shows status values for power levels, software versions, and the alignment values for the Exciter and the Station Control Module (SCM). The station also controls access to messaging and maintenance.

The Nucleus paging station provides a method of reading the status of the station without interrupting messaging. Station status is read-only information. The menu does not allow changes in data.

The Station Status menu provides status on the following station parameters:

- Forward power level measured during the most recent station key-up
- Reflected power level measured during the most recent station key-up
- Voltage standing wave ratio (VSWR) level measured during the most recent station key-up
- External Wattmeter reading for forward power level measured during the most recent station key-up
- External Wattmeter reading for reflected power level measured during the most recent station key-up
- External Wattmeter reading for VSWR level measured during the most recent station key-up
- Software versions for installed components:
  - Application software
  - Exciter software
  - Boot software
  - Alignment ID
    - Station Control Module (SCM) alignment ID
    - Exciter alignment ID

Use the following procedure to access station status:

1. From the READY prompt, press **<STAT>** to access the Status menu.

   The display briefly shows the STAT menu, then shows the first submenu item:

   FWD PWR: sss W

   Where sss is the forward power value in Watts.

2. Press **<down arrow>** to sequence through the submenus (see Table 9-1).

Table 9-1: Status Values

Submenu Items	Displayed Value or Values
FWD PWR	Forward power
RFL PWR	Reflected power
VSWR	Voltage standing wave ratio
EXT WM FWD PWR	External forward power, measured at a Wattmeter
EXT WM RFL PWR	External reflected power, measured at a Wattmeter
EXT WM VSWR	External VSWR, measured at a Wattmeter
SOFTWARE VERSIONS	Software version numbers and alignment numbers

3. At the SOFTWARE VERSIONS submenu press **<ENT>**.

   The display shows the first selection in the SOFTWARE VERSIONS submenu:

   APPLICATION SW t.ttt

   Where t.ttt is the application software version number.

4. Press **<down arrow>** to display the software version numbers:

   EXCITER: u.uuu

   Where u.uuu is the Exciter software version number.

   BOOT: v.vvv

   Where v.vvv is the boot software version number.

5. At the ALIGNMENT ID selection, press **<ENT>**.

   The display shows the SCM ALIGNMENT ID:

   SCM wwwwwwwwww

   Where wwwwwwwwww is the SCM alignment ID number

6. Press **<down arrow>** to show the EXCITER ID

   EXCITER xxxxxxxxxx

   Where xxxxxxxxxx is the Exciter alignment ID number.

   Press **<EXIT>** once to return to the SOFTWARE VERSIONS submenu.

   Press **<EXIT>** twice to return to the READY prompt.

Controlling Access to the Nucleus Paging Station

The Nucleus paging station supports methods for disabling it. Disabling a station is appropriate during the following circumstances:

- Installation (after the station power up, but before testing and alignment)
- Local maintenance

If maintenance access is enabled (remote access disabled), the system cannot key for a remote messaging command.

DANGER

Disable remote access and enable maintenance access for all repair procedures.

The procedure for controlling access also shows the disable status.

Disabling Remote Access (Enabling Maintenance Access)

Note: Enabling maintenance access disables remote access. Disabling maintenance access enables remote access.

Use this procedure to disable remote access to a Nucleus paging station:

1. From the READY prompt, press **<DIS>** to access the Disable menu.

   The display briefly shows the DIS menu, then shows the first submenu item:

   MAINT ACCESS: DISABLED

2. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

3. Press **<TOG>**.

   The display flashes to show the change:

   ENABLED

4. Press **<ENT>**.

   The display stops flashing and shows the status:

   MAINT ACCESS: ENABLED.

   Press **<EXIT>** to return to the READY prompt.

Enabling Remote Access (Disabling Maintenance Access)

Use this procedure to enable remote access to a Nucleus paging station:

1. From the READY prompt, press **<DIS>** to access the Disable menu.

   The display briefly shows the DIS menu, then shows the first submenu item:

   MAINT ACCESS: ENABLED

2. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

3. Press **<TOG>**.

   The display flashes to show the change:

   DISABLED

4. Press **<ENT>**.

   The display stops flashing and shows the status:

   MAINT ACCESS: DISABLED.

   Press **<EXIT>** to return to the READY prompt.

Disabling Messaging Access

The Nucleus paging station supports remote diagnostics with messaging disabled. Use this procedure to facilitate remote diagnostics:

1. From the READY prompt, press **<DIS>** to access the Disable menu.

   The display briefly shows the DIS menu, then shows the first submenu item:

   ACCESS: DISABLED

2. Press **<down arrow>** to access the PAGING ACCESS submenu.

   The display shows the current maintenance access status:

   PAGING ACCESS: ENABLED

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<TOG>**.

   The display flashes to show the change:

   DISABLED

5. Press **<ENT>**.

   The display stops flashing and shows the status:

   PAGING ACCESS: DISABLED.

   Press **<EXIT>** to return to the READY prompt.

Enabling Messaging Access

Use this procedure to restore messaging:

1. From the READY prompt, press **<DIS>** to access the Disable menu.

   The display briefly shows the DIS menu, then shows the first submenu item:

   MAINT ACCESS: DISABLED

2. Press **<down arrow>** to access the PAGING ACCESS submenu.

   The display shows the current maintenance access status:

   PAGING ACCESS: DISABLED

3. Press **<ENT>**.

   The display flashes to show the system has entered the edit mode.

4. Press **<TOG>**.

   The display flashes to show the change:

   ENABLED

5. Press **<ENT>**.

   The display stops flashing and shows the status:

   PAGING ACCESS: ENABLED.

   Press **<EXIT>** to return to the READY prompt.

Reading Disable Status

The Disable Status submenu shows active disable states for maintenance or messaging. Use the following procedure to read the status:

1. From the READY prompt, press **<DIS>** to access the Disable menu.

   The display briefly shows the DIS menu, then shows the first submenu item.

2. Press **<down arrow>** to access the DISABLE STATUS submenu.

3. Press **<ENT>**.

   The display shows the first item that is disabled. If nothing is disabled, the display shows the following:

NO DISABLES

4. Press **<down arrow>** to sequence through the list of disabled items.

   Press **<EXIT>** to return to the MAINT ACCESS submenu.

   Press **<EXIT>** twice to return to the READY prompt.

Alarms

This section describes the alarms generated by a Nucleus™ paging station and methods for reading Alarm Reporting

The Nucleus paging station currently supports the alarms described in Table 9-2. This table shows the name of the alarm and its interpretation, whether it is programmable, and how to clear it.

To configure programmable alarms, see Chapter 8, "SCM Station Configuration".

Table 9-2: Alarms and Their Interpretations

Alarm Name	Interpretation	Programmable	Condition that Clears the Alarm
Low Forward Power	Forward power is below a threshold	Yes	Station keys at correct power level (above threshold)
High Reflected Power	Reflected power is above a threshold	Yes	Station keys at correct power level (below threshold)
External Low Forward Power	Forward power is below a threshold, measured at the external Wattmeter (requires external Wattmeter)	Yes	Station keys at correct power level (above threshold)
External High Reflected Power	Reflected power is above a threshold, measured at the external Wattmeter (requires external Wattmeter)	Yes	Station keys at correct power level (below threshold)
PA Fan	Power Amplifier (PA) fan has failed	No	PA fan is operational
Synthesizer out of Lock	Synthesizer is not locked with the programmed frequency	No	TX synthesizer locks on the programmed frequency
Battery Revert	System has reverted to battery power	No	Station switches to AC power
System Timer Expired	System timer has expired	No	System keys, or Reset from the ALRM menu
PA Fail	System has determined that the PA has failed	No	PA is functional
Station Reset	System has performed a reset	No	Cleared from ALRM menu
High Stability Reference Failure	High stability reference oscillator (HSO) or ultra high stability oscillator (UHSO) has failed	No	HSO or UHSO in Network Interface unit (NIU) is functional
Alignment ID Mismatched	Station Control Module (SCM) and Exciter are not aligned	No	Cleared from ALRM menu
High Forward Power	Power output poorly aligned: forward power exceeds 5% more than the rated PA power	No	Power is calibrated
PA not Aligned	PA is not aligned with the SCM	No	start-up occurs with matched pair
Exciter Setup Failure	Problem occurred during Exciter module or problem with Receiver module	No	Exciter starts without problem

Clearing Alarms

This section describes special procedures required to clear some alarms. See Chapter 13, "Replacing Modules" for the replacement procedures required to clear some alarms.

Note: Whenever the Nucleus paging station is turned off and then turned on, or reset, it issues a reset alarm. Clear this alarm from the ALRM menu. Allow the station to warm up for at least one hour before aligning the system.

DANGER

Disable messaging before replacing a module.

CAUTION

Always replace the Exciter and the SCM as a matched pair. If the Exciter and SCM are not matched, the mismatch results in an alarm that cannot be cleared until they are matched.

Clearing a Low Forward Power Alarm

This alarm occurs when the Nucleus paging station reads a forward alarm that is less that 95 percent of threshold. Use the following procedure to clear a low power alarm:

1. From the READY prompt, press **<ALGN>** to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the KEY AND READ POWER submenu.

3. Press **<ENT>**.

   The station keys.

   a. If the station keys at a forward power level above the forward power alarm point, the station clears the alarm automatically.

   b. If the station keys at a low forward power level, recalibrate the power level (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

4. Press **<EXIT>** to return to the READY prompt.

Clearing a High Reflected Power Alarm

This alarm occurs when the reflected power is higher than the programmed threshold. Use the following procedure to clear a high reflected power alarm:

1. From the READY prompt, press <**ALGN**> to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the KEY AND READ POWER submenu.

3. Press **<ENT>**.

   The station keys.

   a. If the station keys at a reflected power level lower than the reference power alarm point, the station clears the alarm automatically.

   b. If the station keys at a high reflected power level, correct the power level (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

4. Press **<EXIT>** to return to the READY prompt.

Clearing an External Low Forward Power Alarm

This alarm occurs if the station has an external Wattmeter that measures forward power at less than 95 percent of the threshold. Use the following procedure to clear a external low forward power alarm:

1. From the READY prompt, press <**ALGN**> to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the KEY AND READ EXT POWER submenu.

3. Press **<ENT>**.

   The station keys.

   a. If the station keys at a forward power level above the forward power alarm point, and the Wattmeter reads the power correctly, the station clears the alarm automatically.

   b. If the station keys at the correct forward power level (measured by test equipment) and the Wattmeter reads the power incorrectly, recalibrate the external Wattmeter.

   c. If recalibration is unsuccessful, replace the Wattmeter.

   d. If the station keys at a low forward power level (measured at the Wattmeter and by test equipment), correct the power level (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

4. Press **<EXIT>** to return to the READY prompt.

Clearing an External High Reflected Power Alarm

This alarm occurs if the station has an external Wattmeter that measures reflected alarm at a level higher than the threshold. Use the following procedure to clear a external high reflected power alarm:

1. From the READY prompt, press <**ALGN**> to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the KEY AND READ EXT POWER submenu.

3. Press **<ENT>**.

   The station keys.

a. If the station keys at a reflected power level lower than the forward power alarm point, and the Wattmeter reads the power correctly, the station clears the alarm automatically.

b. If the station keys at a forward power level above the forward power alarm point (measured by test equipment) and the Wattmeter reads the power incorrectly, recalibrate the external Wattmeter.

c. If recalibration is unsuccessful, turn off the station and replace the Wattmeter. Turn on the station, allow it to warm up, and calibrate the Wattmeter (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

d. If the station keys at a high reflected power level (measured at the Wattmeter and by test equipment), see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment" and correct the power level.

Clearing a PA Fan Alarm

The Nucleus paging station requires the PA fans to operate for the safe operation of the PA. This alarm occurs if the fan or fans stop operating. Use the following procedure to clear a PA fan alarm.

1. Inspect the fan opening to ensure the fan mechanism can draw air.
2. Inspect the fan mechanism if possible to ensure it is clean and has power.
3. Turn off the Nucleus paging station and restart it.
4. If Step 3 was unsuccessful, turn off the station and replace the PA.

Clearing a Synthesizer out of Lock Alarm

This alarm occurs if the Nucleus paging station senses faulty synthesizer circuitry. Use the following procedure to clear a synthesizer out of lock alarm:

1. If the Nucleus paging station has an external NIU or RF-Baton!™ transmitter controller, inspect the backplane connector and cable between the station and the transmitter controller.
2. Correct any cable or connector problems that appear.
3. If Step 2 was unsuccessful, replace the backplane.
4. If the Nucleus paging station has an internal NIU, check the LEDs on the transmitter controller to ensure it is functioning normally.
5. Reset or turn off the Nucleus paging station and restart it.
6. If Step 5 was unsuccessful, turn off the station and replace the NIU.

Clearing a Battery Revert Alarm

This alarm occurs when the station has an AC power failure and reverts to battery power. Use the following procedure to reset the battery revert alarm:

1. Inspect the Nucleus paging station backplane connectors to see if AC power is connected to the power supply.
2. Replace connectors as required.
3. Restore AC power to the Nucleus paging station. The alarm resets.
4. If the alarm does not reset, replace the power supply in a standard power system, or the middle power supply in a high power system.

Clearing a System Timer Expired Alarm

This alarm occurs when the system timer expires before the station keys. Use the following procedure to reset the system timer expired alarm:

1. Use one of the following steps to reset the alarm:
   - Key the system at the site. The station resets the alarm.
   - Key the system remotely. The station resets the alarm.
   - Reset the alarm from the alarm menu.
2. From the READY prompt, press <**STN**> to access the Station menu.

   The display briefly shows the STN menu, then shows the first submenu item.
3. Press **<down arrow>** to access the SYS TIMER ALRM submenu.
4. Set the timer alarm for a period longer period.
5. Press **<EXIT>** to return to the READY prompt.
6. Monitor station performance to ensure the system does not repeat the alarm.

Clearing a PA Fail Alarm

This alarm occurs when the PA fails. Use the following procedure to clear the PA fail alarm:

1. Inspect the PA fans to ensure they are operating. If not, perform the steps in the paragraph, "Clearing a PA Fan Alarm".
2. Reset or restart the Nucleus paging station.
3. If Step 2 was not successful, turn off the station and replace the PA module.
4. Calibrate the station (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

Clearing a Station Reset Alarm

This alarm occurs when the Nucleus paging station performs a power-up or reset.

Clear this alarm from the Station Alarms menu.

Clearing a High Stability Reference Fail Alarm

This alarm occurs when the oscillator fails. Use the following procedure to clear the high stability reference fail alarm:

1. Reset or restart the Nucleus paging station.
2. If Step 1 was unsuccessful, and the station has an external NIU, replace the cable connector.
3. Turn off the station and replace the internal or external NIU.

Clearing an Alignment ID Mismatch Alarm

This alarm occurs when the Nucleus paging station software reads the alignment ID of the SCM and Exciter at start-up or reset and the alignment IDs of the two modules do not match. The Nucleus paging station requires that the SCM and Exciter are a matched pair. Use the following procedure to check the alignment ID numbers:

Note: While this alarm is active, the station may perform 2-level messaging, but 4-level messaging is disabled.

1. From the READY prompt, press <**STAT**> to access the Status menu.

   The display briefly the STAT menu, then shows the first submenu item.
2. Press **<up arrow>** to access the SOFTWARE VERSIONS submenu.
3. Press **<ENT>**.
4. Press **<up arrow>** to access the ALIGNMENT ID selection.
5. Press **<ENT>**.

   The display shows the alignment ID for the SCM.
6. Press **<down arrow>**. The display shows the alignment ID for the Exciter.
7. If the two alignment ID numbers are not identical, turn off the station and replace the SCM and the Exciter.
8. Clear the alarm from the Alarms menu.

Clearing a High Forward Power Alarm

This alarm occurs when the forward power reading measured at the internal Wattmeter exceeds the rated PA power level by more than 5 percent. In a high power station, this level is greater than 315 W (300 + 5 percent). Use the following procedure to control the high forward power:

1. Calibrate the output power (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").
2. Restart or reset the station.

Clearing a PA Not Aligned Alarm

This alarm occurs when the PA is not aligned (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

Clearing an Exciter Start-up Failure

This alarm occurs when the Nucleus paging station senses an Exciter initialization problem or a problem in initializing an internal receiver. Use the following procedure to clear this alarm:

1. From the READY prompt, press <**RX**> to access the Receiver menu.
2. The display briefly shows the RX menu, then shows the first submenu item.

   If the RX FREQ RANGE submenu shows a receiver range, the station has a receiver.
3. Press **<down arrow>** to sequence through the submenus. Note the configuration of the receiver for future reference.
4. Press **<EXIT>** to return to the READY prompt.
5. If the station has a Receiver, turn off the station and replace the Receiver. Restart the station.
6. If the station does not have a Receiver, replace the Exciter and the SCM as a matched pair and restart the station

Resetting Station Alarms from the Alarms Menu

This section describes the procedures for reading and clearing alarms.

Reading Alarms

Use the following procedure to read alarms:

1. At the READY prompt, press <**ALMS**> to access the Station Alarms menu.

   The display briefly shows the ALM menu.

   If no alarms are active, the display then shows the following text:

   NO ALARMS

   If the system has at least one current alarm, the display shows the first alarm.

2. Press **<down arrow>** to sequence through the active alarms.

3. Press **<EXIT>** to return to the READY prompt.

Clearing Alarms

Use the following procedure to clear alarms:

1. At the READY prompt, press <**ALMS**> to access the Station Alarms menu.

   The display briefly shows the ALM menu.

2. If the system has at least one current alarm, the display shows the name of the first alarm and shows that it is active:

   LOW FORWARD POWER: ACTIVE

3. Press **<ENT>** to select the alarm.

   The display flashes to show the station has entered the edit mode:

   ACTIVE

4. Press **<TOG>**.

   The display stops flashing and shows the state of the alarm:

   INACTIVE

5. Press **<ENT>**.

   The station clears the alarm.

6. Press **<down arrow>** to sequence through the active alarms.

7. Repeat Step 3 through Step 6 to clear other active alarms.

8. Press **<EXIT>** to return to the READY prompt.

Troubleshooting

This section describes troubleshooting the Nucleus paging station to the field replaceable unit (FRU) level.

General Troubleshooting Procedure

Repair of the Nucleus paging station is limited to replacing a known faulty module with a FRU. Return faulty modules to an authorized Motorola Service Representative.

Several methods exist for identifying a failing or failed module for replacement:

- An LED shows an alarm (see Chapter 6, "Front Panel Indicators and Controls").
- The Station Alarms menu shows an alarm (see Chapter 10, "NAC Configuration").
- The Station Status menu suggests a problem, such as falling forward power (see Chapter 11, "NAC Alignment and Equalization").

Note: This procedure uses a Motorola R2000 Series Communications Analyzer (or equivalent).

Module replacement is described in the chapter that follows (see Chapter 13, "Replacing Modules").

Test Setup

The procedure described below verifies operation of the following modules and circuits:

- Exciter
- Power Amplifier (PA)
- Power supplies
- 16.8 MHz reference oscillator circuitry
- Transmitter-related circuitry on the Station Control Board (SCB)

This procedure injects signals of known values into the circuits and measures the output signals. Incorrect measurement values indicate one or more faulty modules. Measurement values within the acceptable range verify proper operation of the modules and circuitry listed above.

Required Test Equipment

These procedures require the following test equipment:

- Motorola R2000 Series Communications Analyzer (or equivalent)
- In-line Wattmeter (Motorola Model S-1350 or equivalent)
- Dummy load (50 W station power or higher)

Equipment Setup

Note: Connect the in-line Wattmeter directly to the station transmit output cable. Connect the transmit output cable to the outer row of the 6-hole transmitter bracket on the back of the backplane at the rear of the station (see Chapter 5, "Connectors and Interfaces".

CAUTION

Use the connectors provided for installation. Do not use adapters or intermediate cables between the transmit output cable connector (N-type) and the Wattmeter.

Use the following procedure to connect the test equipment (see Figure 9-1).

1. Connect the dummy load to the Wattmeter.
2. Disconnect the cable from the PA power alignment point.
3. Connect the PA power output alignment point to the Wattmeter.
4. Continue with the paragraph, "Verifying Transmitter Circuitry".

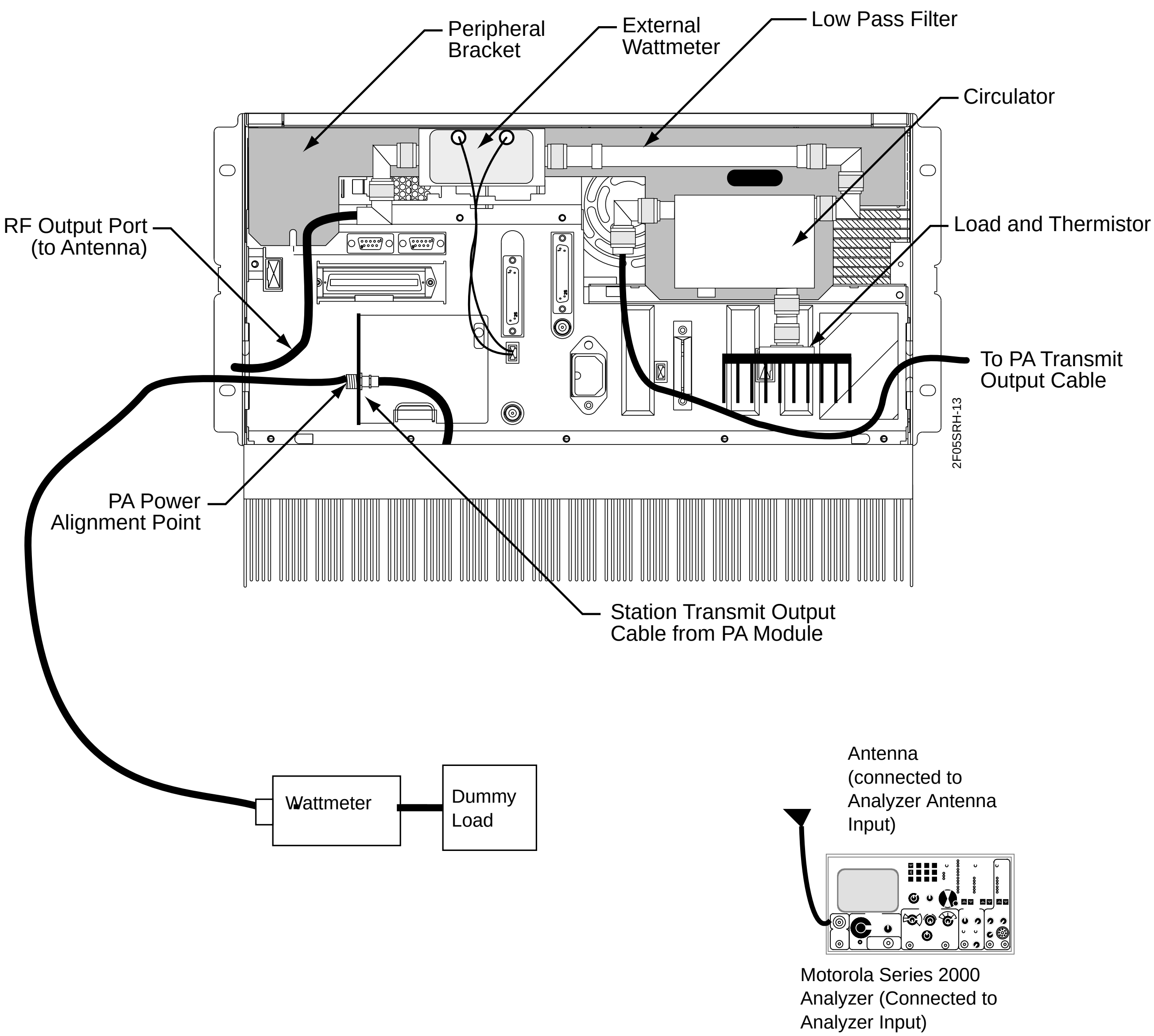


Figure 9-1: Test Equipment Setup

Verifying Transmitter Circuitry

Note: *This procedure lists modules in the order of most likely failure. Replace one module or component at a time and repeat the test.*

CAUTION

Turn off the power to replace a module or cable.

Replace the Exciter and SCM only as a matched pair.

Use the following procedure to key with a silent carrier:

Note: Restart and warm up the transmitter after each replacement procedure to determine whether the transmitter circuitry is functioning correctly.

1. From the READY prompt, press <**ALGN**>.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press <**down arrow**> to access KEY AND READ POWER.

3. Press **<ENT>**.

4. Observe the LEDs on the Exciter Module front panel:

   a. If the PA Low LED or the PA Fail LED lights, replace or repair the following items in the order listed.
      - Improperly calibrated station
      - Improperly set operating power
      - PA
      - SCM and Exciter module
      - Loose or failed Exciter-to-PA RF cable
      - Loose or failed PA-to-antenna RF output cable
      - PA RF output cable termination

   b. If the Tx Lock LED is off, replace or return the following items in the order listed.
      - Frequency not programmed on the current channel
      - PA
      - SCM and Exciter module (replace as a matched pair)
      - Faulty backplane
      - Hardware mismatch

5. Measure the output power by keying the transmitter with a silent carrier. Observe the display on the SCM front panel.

6. If the PA is not at the proper power level for the site, adjust the station power output (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

7. If the PA is at the proper power level for the site, configure the analyzer for spectrum analyzer display.

8. Key the transmitter with silent carrier. From the READY prompt, press <**ALGN**>. Press <**down arrow**> to access KEY AND READ POWER and observe the analyzer display. The image should have a precise peak (see Figure 9-2).

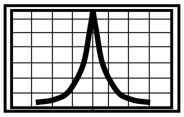


Figure 9-2: Correct Silent Carrier Wave Form

9. If the analyzer shows multiple carriers around the center, replace the PA and Exciter (replace as a matched pair).

10. If the analyzer shows a solid carrier that is off frequency, recalibrate the following items in the order listed. Retest after every replacement procedure. If recalibration does not improve performance, replace the module.
    – SCM and Exciter SCM
    – Faulty 5 MHz from the Reference Module or external source
    – Incorrectly tuned 5 MHz source
    – High speed offset not set to 0
    – Low speed offset not set to 0

11. If the analyzer display shows a single carrier moving erratically, replace the following modules in the order listed. Retest after every replacement procedure.
    – SCM module and Exciter module
    – Reference module

12. If the image on the analyzer is a precise peak (see Figure 9-2), configure the analyzer to display modulation. Key the transmitter for high speed data. The image at the analyzer should be a square wave form (see Figure 9-3).

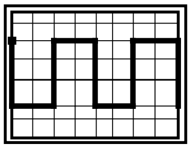


Figure 9-3: Modulation Wave Form

13. If the image is not a square wave form, replace the SCM and Exciter and test.

14. If the image still does not match the figure, and the station includes an internal NIU, replace the NIU and test.

15. If the station contains an internal NIU, configure the analyzer for Gen / Mon Mtr.

16. At the NIU terminal, type **test txd** <**Enter**>. command at the NIU.

17. Key the transmitter with high speed data. The image should show a ±5 kHz maximum.

18. If the image is outside this range, replace the SCM and Exciter and test.

    If all measurements are now correct, the verification procedure is now complete.

    If all measurements are not correct, repeat this procedure from Step 1.

Using the Service Mode

The service mode provides two useful procedures for troubleshooting:

- Select the pattern transmitted by the station.
- Verify proper 4-level messaging alignment.

Note: If the PA test mode is active, the PA keys even if a PA fault exists.

CAUTION

The station produces hazardous levels of RF power and the tests can damage the PA. The PA test mode allows the transmitter to key with a PA fault, such as high temperature or high Voltage standing wave ratio (VSWR). The Nucleus paging station does not provide protective power reduction. Before using these procedures, reduce transmit power through the TX menu and the TX CHN PWR submenu.

Enable PA Test Mode

The PA test mode allows the transmitter to key even if a PA fault exists. This feature facilitates troubleshooting.

Note: The normal control circuitry in the Nucleus paging station does not allow the station to remain keyed with a PA fault for more than 5 min.

Use the following procedure to read the status:

1. From the READY prompt, press <**SERV**> to access the Service menu.

   The display briefly shows the SERV menu, then shows the first submenu item.

2. Press **<ENT>** to access the PA TEST MODE submenu.

   The display shows the current status of the test mode:

   PA TEST: INACTIVE

Note: If the PA test mode is enabled, the PA Full LED on the Exciter Module front panel flashes.

3. To enable the test mode, press **<ENT>**.

   The display flashes to show the system is in the edit mode.

4. Press **<TOG>**.

   The display shows the new status of the test mode:

   PA TEST: ACTIVE

5. Press **<ENT>**.

   The display stops flashing and shows that the test mode is enabled.

6. Press **<EXIT>** to return to the READY prompt.

7. Disable the PA test mode when testing and repairs are complete.

Select a Test Pattern

The Nucleus paging station supports pattern selection for transmission testing. Use this procedure to change the pattern:

1. From the READY prompt, press <**SERV**> to access the Service menu.

   The display briefly shows the SERV menu, then shows the first submenu item:

   PA TEST MODE: INACTIVE

2. Press **<down arrow>** to access the SELECT SYMBOL submenu.

   SELECT SYMBOL: STAIRCASE

3. Press **<ENT>**.

   The display flashes.

4. Press **<down arrow>** to select a pattern from the following:
   – STAIRCASE (the station transmits the 4-level staircase [10, 11, 01, 00)
   – 01–10 (the station transmits 01, 10, 01, 10)
   – 00–11 (the station transmits 00, 11, 00, 11)
   – 10 (the station transmits 10, 10, 10)
   – 11 (the station transmits 11, 11, 11)
   – 01 (the station transmits 01, 01, 01)
   – 00 (the station transmits 00, 00, 00)
   – CARRIER (the station transmits the carrier frequency)

5. Press **<ENT>**.

   The station begins testing.

6. Press **<EXIT>** to return to the READY prompt.

Key on Symbol

The Nucleus paging station supports testing to verify 4-level messaging alignment (for 4-level FLEX messaging). Use this procedure to select a pattern the pattern:

1. From the READY prompt, press <**SERV**> to access the Service menu.

   The display briefly shows the SERV menu, then shows the first submenu item.

2. Press **<up arrow>** to access the KEY ON SYMBOL submenu.

3. Press **<ENT>**.

   The display shows the following text:

   TRANSMITTING SYMBOL

4. Press **<EXIT>** once. The station dekeys.

5. Press **<EXIT>** again to return to the READY prompt.

Alignment

The procedure described in this section aligns and optimizes a standard or high power station.

Note: Use this procedure only if troubleshooting or alarm clearance requires replacement of the Exciter and SCM or the PA.

This procedure applies equally to stations with and without a circulator option. For a station with a double or triple circulator option, perform this procedure before performing the procedure in paragraph, "External Wattmeter Calibration for Stations with Circulator Options".

Test Equipment and Setup

This procedure requires the following test equipment:

- RF coupler, attenuator, and load
- RF power meter (Hewlett Packard 438 power meter or equivalent with an accuracy of 3.5 percent or better)

Use the following procedure to connect equipment for testing:

1. Connect the RF coupler cable to the Power Amplifier (PA) output alignment point. Connect the RF load to the output of the RF coupler.

2. Connect the attenuator to the RF coupler. Connect the RF power meter to the attenuator.

CAUTION

Connect the coupler, attenuator, load, and power meter directly to the PA power alignment point without adapters or intermediate cables. The PA power alignment point has an N-type connector.

The mean frequency may not be an approved transmit frequency. Connect the station transmit output to a dummy load during this procedure. Do not attach the station transmit output to a transmit antenna.

3. Turn on the Nucleus paging station and allow it to warm up for one hour.

4. From the READY prompt, press <**OPT1**> to access the Options 1 menu.

   The light-emitting diode (LED) display briefly shows the OPT1 menu, then shows the first submenu item.

5. Press **<down arrow>** to access the EXT CIRCULATOR submenu.

6. If the EXT CIRCULATOR selection is PRESENT, press **<ENT>**.

   The display flashes to show the system has entered the edit mode:

   PRESENT

7. Press **<TOG>**. The display stops flashing and shows the change:

NOT PRESENT

8. Press **<EXIT>** once to return to the READY prompt.

Calibration for the RF Power Output Level

Note: The station uses the mean frequency in three procedures:
- station power output alignment
- external wattmeter calibration
- UHSO/HSO alignment

Use the following procedure to calibrate the RF power output level:

1. From the READY prompt, press <**TX**> to access the Transmit menu.

   The display briefly shows the TX menu, then shows one of the following:

   – The first transmitter channel frequency in a channel mapped system:

   CHN n FREQ xxx.xxxx MHz

   where xxx.xxxx is the current frequency for the first configured channel.

   – The frequency for all channels in a non-channel mapped system:

   FREQ xxx.xxxx MHz

   where xxx.xxxx is the current frequency.

2. Press **<up arrow>** once to access the MEAN FREQ submenu.

   The display shows the mean frequency value:

   MEAN FREQ xxx.xxxx MHz

   where xxx.xxxx is the current mean frequency.

3. Record this value.

4. Press **<EXIT>** to return to the READY prompt.

5. Press <**CNFG**> to access the Station Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu item:

   MAX PWR xxx W

   where xxx is the rated power of the PA.

6. Record this value.

7. Press **<EXIT>** to return to the READY prompt.

Note: Two procedures follow:
- power for a non-channel mapped station
- power for a channel mapped station
Use the procedure appropriate to the base station.

Power for a Non-channel Mapped Station

Use the following procedure to align power for a non-channel mapped station:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu item.

2. Press **<down arrow>** to access the TX CHN PWR submenu.

3. Press **<ENT>**.

   The display shows the operating power level:

   OPERATING PWR xxx W

   where xxx is the currently programmed station transmit power.

4. To change the station power, press **<ENT>**.

   The message flashes to show the system has entered the edit mode:

   xxx

5. Type a new value for operating power.

6. Press **<ENT>**.

   The message stops flashing and shows the new value:

   OPERATING PWR yyy W

   where yyy is the newly programmed station transmit power.

7. Press **<EXIT>** to return to the READY prompt.

   Continue with paragraph, "Station Power Calibration" or paragraph, "Automatic Station Power Alignment".

Power for a Channel Mapped Station

Use this procedure to enable channel mapping and set the mean frequency if required:

1. From the READY prompt, press **<OPT1>** to access the Options 1 menu.

   The LED briefly shows the OPT1 menu, then shows the first submenu item.

2. Press **<down arrow>** to access the TX CHN PWR submenu.

3. Press **<ENT>**.

   The display shows the current configuration for channel mapping:

   CHN MAPPED PWR: DISABLED

4. Press **<ENT>**.

   The message flashes to show the system has entered the edit mode:

   DISABLED

5. Press **<TOG>**.

   The message flashes the new setting:

   ENABLED

6. Press **<ENT>**.

   The message stops flashing and shows the new configuration:

   CHN MAPPED PWR: ENABLED

7. Press **<EXIT>** to return to the READY prompt.

8. Press <**TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu item.

9. Press **<down arrow>** to access the TX CHN PWR submenu.

10. Press **<ENT>**.

    The display shows the current power level for the first programmed channel:

    CHN n PWR xxx W

    where xxx is the currently programmed transmit power for channel n.

11. Press **<down arrow>** to show the mean frequency power:

    MEAN FREQ PWR zzz W

    where zzz is the currently programmed power level for the mean frequency.

12. If the mean frequency power is incorrect, press **<ENT>**.

    The message flashes to show the system has entered the edit mode:

    zzz

13. Type the correct mean frequency power.

14. Press **<ENT>**.

    The message stops flashing and shows the new mean frequency power:

    yyy

    where yyy is the newly programmed power level for the mean frequency.

15. Press **<EXIT>** to return to the READY prompt.

    Continue with paragraph, "Station Power Calibration".

Station Power Calibration

DANGER

Do not use the CALIBRATE submenu. Motorola uses this submenu in manufacturing. Do not use it in the field.

Note: If station power output has degraded by more than 5 percent of rated power output, the station automatically exits the Alignment menu and dekeys. The PA Low LED lights momentarily. See paragraph, "Power for a Non-channel Mapped Station" or paragraph, "Power for a Channel Mapped Station" to set the power level before performing this procedure.

Use the following procedure to calibrate station power:

1. From the READY prompt, press **<ALGN>**.

   The display briefly shows ALGN menu, then shows the first submenu item:

   CAL STATION POWER

2. Press **<ENT>**.

   The station keys and the Exciter PA Full LED lights.

   The display shows the following message:

   INITIALIZE CALIBRATION

3. Read the values at the power meter output for an indication of output power.

4. Press **<ENT>**. The display shows the following message:

   INPUT MEASURED PWR

CAUTION

The alignment procedure prevents PA cutbacks by preventing large changes in output power. If the output power is more than 20 percent less than the programmed power level, perform Step 5 and type a value that is approximately 20 percent less than the previously programmed value. Then, perform Step 1 through Step 4 again.

5. Read the power output at the power meter.

6. Type the power output value.

7. Press **<ENT>**.

8. When the measured power is correct, press **<EXIT>** once. The station automatically calibrates the internal Wattmeter and sets the overdrive set point. The display shows the following messages:

   INT WM CAL

   SET OVER

9. Press **<EXIT>** to return to the READY prompt.

Automatic Station Power Alignment

This procedure calibrates the RF power output level of the station (measured at the PA power output alignment point) to within ±5 percent of the programmed value.

1. Detach one of the following (depending on options) from the PA power output alignment point:
   – Transmit antenna cable
   – External circulator assembly
   – Antenna relay module

2. Connect the RF load to the PA output alignment point.

3. At the READY prompt, press <**ALGN**> to access the Alignment menu. The display briefly shows the ALGN menu, then shows the first submenu item:

   CAL STATION POWER

4. Press **<ENT>**.

   The display shows the Calibration Station Power option:

   AUTO PA CALIBRATION

5. Press **<ENT>**.

   The display shows the prompt to start automatic calibration:

   PRESS ENTER TO START

6. Press **<ENT>**.

   The station keys. The station automatically adjusts the output power to reach the programmed power. The station dekeys.

Note: This procedure takes 20 to 60 seconds.

   The display shows the complete prompt:

   COMPLETE

7. Detach the RF Load from the PA power output alignment point.

8. Press **<EXIT>** twice to return to the READY prompt.

   If the station has an external Wattmeter, continue with paragraph, "External Wattmeter Calibration for Stations with Circulator Options".

Alignment Failure

If the PA cuts back or fails to key during the alignment procedure, the display shows a failure message:

ALIGNMENT FAILED!

Correct one or more of the following:

- Check the RF connections from the station to the RF load.
- Run the alignment procedure again, but do not press **<EXIT>** during the procedure.
- Check the station to determine if one of these conditions exists:
  - High Voltage standing wave ratio (VSWR)
  - PA overdrive condition
  - Low PA supply voltage
  - High external circulator temperature
  - Antenna relay short
  - Battery revert

Completion

Use the following procedure to complete calibration:

1. Press **<EXIT>** twice. The station dekeys, and the power reading goes to zero.

2. Detach the power meter setup from the PA power output alignment point. Reattach one of the following (depending on options) to the PA power output alignment point:
   - Transmit antenna cable
   - External circulator assembly

– Antenna relay module

If required, continue with the paragraph, "Alignment for an HSO or UHSO Reference".

External Wattmeter Calibration for Stations with Circulator Options

This procedure is required for Nucleus paging stations with double or triple circulator options. The circulator options include an external Wattmeter mounted on the peripheral bracket on the rear of the station. Motorola calibrates the external Wattmeter during calibration. Do not calibrate it unless you replace the PA module.

Note: Perform the Automatic Station Power Output Calibration procedure before performing the External Wattmeter Calibration.

The stand power Nucleus paging station has one circulator option: external double circulator (option X677).

The high power Nucleus paging station has three circulator options:
- external double circulator (option X677)
- external triple circulator (option X676)
- internal triple circulator (Nucleus paging station model 1105)
This procedure applies to the external circulator options.

Use this procedure to calibrate the external Wattmeter on a station with a circulator.

1. At the rear of the station, lift out the peripheral bracket.

2. Detach the transmit antenna cable from the RF output port on the peripheral bracket.

3. Attach the power meter (with coupler, attenuator, and load) to the RF output port.

4. From the READY prompt, press <**ALGN**> to access the Alignment menu.

   The display briefly shows the **ALGN** menu, then shows the first submenu item.

5. Press **<down arrow>** to access the CAL EXT WM submenu:

6. Press **<ENT>**.

   The station keys.

   The PA Full LED on the Exciter lights.

   The display shows the following message:

   ENTER POWER MEASUREMENT

7. Read the power level (in Watts) on the power meter and type the value.

8. Press **<ENT>**.

9. Press **<EXIT>** to return to the READY prompt. The station rekeys.

10. Detach the power meter from the RF output port on the peripheral bracket. Reattach the transmit antenna cable to the RF output port.

    If required, continue with paragraph, "Alignment for an HSO or UHSO Reference".

Alignment for an HSO or UHSO Reference

The Nucleus paging station has two reference options:

- High stability oscillator (HSO)
- Ultra high stability oscillator (UHSO)

Motorola aligns oscillators with a high degree of accuracy during manufacturing. Use this procedure for periodic maintenance or following the Exciter and SCM replacement.

This section describes two procedures:

- The non-keyed state (using a 5 MHz reference frequency) does not interrupt messaging.
- The keyed state (using the station mean frequency) interrupts messaging.

This procedure adjusts the frequency to within 1 Hz of complete accuracy.

Required Test Equipment

This procedure requires the following test equipment:

- Frequency counter with external rubidium standard–the required accuracy for this equipment is one of the following:
  – For HSO, accuracy ≤ 3 ppb
  – For UHSO, accuracy ≤ 5 ppb
- RF coupler, attenuator, and load (for keyed state alignment only)

Alignment in the Non-keyed State

This section describes alignment with a 5 MHz reference frequency while the station continues to key and send messaging.

CAUTION

If the station has an internal Network Interface Unit (NIU) and a UHSO or HSO reference, DIP switch 8 position 1 must be switched on.

If the station has an internal NIU and no other reference, DIP switch 8, pole 1, must be switched off.

In either case, DIP switch 8, pole 2, must be on.

Use the following procedure to align the reference in the keyed state:

1. Connect a BNC cable to one of the following locations:
   – Ref. Freq. port on the Station Control Module (SCM) front panel
   – Backplane connector J30

From the READY prompt, press <**ALGN**> to access the Alignment menu.

The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press **<down arrow>** to access the ALGN UHSO submenu.

3. Press **<ENT>**.

   The display shows the following message:

   KEY START

4. Press **<down arrow>**.

   The display shows the following message:

   START

5. Press **<ENT>**.

   The station does not key.

   The display shows the steering line Voltage (in the range 1 through 4096):

   UHSO xxxx

   where xxxx is the steering Voltage.

6. Monitor the reference frequency. At the same time, type a new steering Voltage (a value in Volts, in the range 1 to 4096).

7. Press **<ENT>**.

8. Repeat Step 6 and Step 7 as many times as required to bring the displayed frequency into agreement with specifications.

9. Press **<EXIT>** to return to the READY prompt.

Alignment in the Keyed State

CAUTION

If the station has an internal Network Interface Unit (NIU) and a UHSO or HSO reference, DIP switch 8 position 1 must be switched on.

If the station has an internal NIU and no other reference, DIP switch 8, pole 1, must be switched off.

In either case, DIP switch 8, pole 2, must be on.

Use the following procedure to align a keyed station:

1. Connect the RF cable to the RF coupler.

2. From the READY prompt, press **<ALGN>** to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

3. Press <**down arrow**> to access the ALIGN UHSO submenu.

4. Press <**ENT**>.

   The display shows the following message:

   KEY START

5. Press <**ENT**>.

   The station keys.

   The display shows the steering line Voltage (in the range 1 through 4096):

   HSO xxxx

   where xxxx is the steering Voltage.

6. Monitor the reference frequency. At the same time, type a new steering Voltage (a value in Volts, in the range 1 to 4096).

7. Press <**ENT**>.

8. Repeat Step 6 and Step 7 as many times as necessary to bring the displayed frequency into agreement with specifications.

9. Press <**EXIT**> twice to return to the READY prompt.

Alignment Completion

This section describes two procedures (with and without an external Wattmeter) for completing the alignment procedure and verifying operation. Use one of these procedures after completing all other alignment procedures.

Wattmeter Present

Use the following procedure to measure forward power, reflected power, and Voltage standing wave ratio (VSWR) with an external Wattmeter:

Note: The EXT WATTMETER TYPE must be EXT CLASS 1 (from the Configuration menu) and PRESENT (from the Options 1 menu).

1. From the READY prompt, press <**ALGN**> to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press <**up arrow**> to access the KEY AND READ POWER submenu.

3. Press <**ENT**>.

4. The station keys with a silent carrier. The display shows the forward power value, the reflected power value, and the VSWR sequentially:

   FORWARD POWER xxx

   REFLECTED POWER yyy

VSWR zzz

5. Press **<ENT>**.

   The display shows the forward power value, the reflected power value, and the VSWR measured at the external Wattmeter sequentially:

   EXTERNAL WM FORWARD POWER xxx

   EXTERNAL WM REFLECTED POWER yyy

   EXTERNAL WM VSWR zzz

6. Press **<EXIT>** to return to the READY prompt.

Wattmeter Not Present

Use the following procedure to measure forward power, reflected power, and Voltage standing wave ratio:

Note: The EXT WATTMETER TYPE must be NONE (from the Configuration menu) and NOT PRESENT (from the Options 1 menu).

1. From the READY prompt, press **<ALGN>** to access the Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu item.

2. Press **<up arrow>** to access the KEY AND READ POWER submenu.

3. Press **<ENT>**.

   The station keys with a silent carrier. The display shows the forward power value, the reflected power value, and the VSWR:

   FORWARD POWER xxx

   REFLECTED POWER yyy

   VSWR zzz

4. Press **<EXIT>** to return to the READY prompt.

Advanced Power Measurements

This section describes advanced power measurement procedures s for 250 W and 300 W Nucleus paging stations with SCM application version 3.320.

The use of a high power Nucleus paging station in the field has raised some issues regarding operation and output power alignment. These issues include the following:

- Inconsistencies in measured power
- Compensation for errors associated with measurement techniques or equipment problems

In the past, Nucleus paging stations allowed manual RF power alignment. Manual power alignment has a major drawback. It inadvertently compensates for measurement errors: RF power alignment is adjusted until the technician achieved a desired in-line Wattmeter reading at a device–a reading that might be very different from the true power level.

The release of the software version 3.21 (or later) introduces automatic power alignment for high power stations. High power stations with the new software do not allow external manual adjustment. The station now calibrates itself to ensure that output power is always within the station design specification.

Measurement Issues

Measuring output at a paging station had a number of problems:

- Measuring equipment that is not itself calibrated–such equipment produces errors in measurement.
- Rating specification–the power rating for any base station transmitter is specified at one point only in the RF output path. If power is measured anywhere else in the RF output path, a reading other than the specified power will result.
- Equipment in the RF path–Circulators, filters, power meters, relays, or cables degrade the RF power and the validity of the reading.
- Component tolerance limits on accuracy.
- Mismatches between any two items in the RF path.
- Degradation over time.
- Power output adjustments between 100 W and 300 W–the power does not vary in a completely linear way.

As the signal frequency increases, these errors become more pronounced.

Motorola ships high power PAs as FRUs. This means that all PAs with application software 3.21 or higher has the same power output accuracy as a new high power station.

Automatic Alignment

The high power Nucleus paging station PA contains an internal Wattmeter for that generates TX_VF. The accuracy of this Wattmeter allows Motorola to tun the PA during manufacturing to a high degree of accuracy. Every PA has the same voltage value for TX_VF when the operating power is 300W. The software look-up table used by power control is now configured to work with this accuracy. (The technician does not type power values into the Nucleus paging station front panel to adjust this table.)

Auto station power alignment results in maximized PA operating lifetime and minimized thermal stress to the PA. Auto station power alignment also ensures that station self-protection features.

Perform a simple functional check after installing a replacement PA in the system to ensure continued high quality performance.

Decibel Mathematics

In messaging systems, RF power levels can vary quite significantly from transmitter to receiver. A high power Nucleus paging station is rated at as much as 300 Watts of output power while a messaging unit may receive signals at approximately 10 to 13 Watts. We measure these changes using logarithmic scales. A logarithmic scale increases or decreases by a factor of 10 and uses only non-zero positive integers.

A log scale is used compare power or voltage levels. The unit is a deciBel (dB). The definition of the decibel, abbreviated dB is

dB = 10 * log(P1/P2)

As an example, if P1 = 20W and P2 = 5W, P1 is four times larger than P2. Expressed on a decibel scale, this statement is:

dB = 10 * log(20/5), = 10 * log(4), = 10 * 0.602, = 6.02dB, or = 6dB, the difference between P1 and P2

Unlike watts, volts, and amperes, the dB is not a physical quantity. The dB represents a ratio of two physical quantities, typically power; and it is itself a dimensionless number much like the units radian and degree which are used to measure plane angles.

Measurements that use log scales to manipulate deciBel values use two rules:

- The product of two pure numbers (or ratios) A and B is equivalent to their sum when the values are expressed in dB.

  A = 2 (3 dB)

  B = 3 (5 dB)

  Therefore:

  A * B = 2 * 3

  3 dB + 5 dB = 6 = 8 dB

- The division of two pure numbers (or ratios) A and B is equivalent to their difference when the values are expressed in dB.

  A = 4 (6 dB)

  B = 2 (3 dB)

A / B = 4 / 2 (6 dB -3 dB) = 2 = 3 dB

Use the following procedure to convert dB values to pure numbers:

1. Divide the given dB value by 10.

2. Use the anti-log of (dB / 10) to obtain the number.

Here is an example: Find the value that corresponds to 5 dB:

1. 5 / 10 = 0.5

2. Number = anti-log (0.5) = 3.16

The standard unit of electrical power is the Watt (W), the product of voltage (V) across and the current (A) through some circuit. The terms dBW and dBm (milliwatt) are used widely in RF and microwave engineering.

Here is an example: Find a given power in dBm for a power level:

1. Express the given power in mW:

   300W = 300,000mW

2. Take the numerical part of the power in mW and convert it to dB:

   300,000 = 54.77 dB

3. Write the power using dBm:

   300W = 54.77 dBm

Mathematically the definition of can be written

dBm = 10 * log(P1/1mW)

where P1 is the power of a signal in Watts

Note: Use some care in manipulating values because dBm represents power levels. Certain operations are valid while others are not when one considers the physical quantities being used.

A PA amplifies power. Amplification is known as gain, G. The formula for gain is:

dBm + dB = dBm

Power can be divided (or attenuated):

dBm - dB = dBm

These values can be expressed if they are used carefully (see Table 9-3).

Table 9-3: Mathematical Operations with dB and dBm (Sheet 1 of 2)

Operation	Result	Physical Meaning	Appropriate Operation?
dB + dB	dB	Product of two numbers	Yes
dB - dB	dB	Comparison of two numbers	Yes

Table 9-3: Mathematical Operations with dB and dBm (Sheet 2 of 2)

Operation	Result	Physical Meaning	Appropriate Operation?
dBm + dBm	N/A	Multiple of two powers	No
dBm - dBm	N/A	Comparison of two powers	No
dBm + dB	dBm	Power amplification only	Yes
dBm - dB	dBm	Power attenuation only	Yes

Wires and cables used in low frequency circuits has small but measurable resistance that consume some original power and dissipates it as heat. At RF frequencies, the effects of insertion loss and attenuation are even more pronounced.

In addition, RF systems lose some fraction of their power during transmission because of absorption and reflection. The amount of power measured at the output of a given length of cable or device can be significantly less than the input power due to the insertion loss of that component.

Insertion loss for a given component is defined as the ratio of the input power to the output power:

IL (insertion loss) = Pin/Pout

Here is an example: A high power transmitter aligned to 300 W is connected to a five foot length of RG393 coaxial cable. The power level at the output of this cable is measured as follows:

RG393 loss = 0.08 dB/ft (26dB/100m)

300 W = 54.77 dBm Pout (dBm) = Pout @ transmitter (dBm) - Loss

= 54.77 dBm - (0.08dB/ft) * 5 ft

= 54.37 dBm = 273.84 W

A representative measuring system might measure the same output as follows:

- The measuring system uses a 500 W slug.
- Accuracy is ±5% of full scale or ±25 W Pout = 273.84 W ±25W

NAC Configuration

This chapter describes configuration procedures for a Nucleus paging station with Advanced Control (NAC). The procedures in this chapter are intended for first time installations and reinstallations when a station is reconfigured. This chapter contains the following information:

Station Configuration

This section describes station configuration from the Station menu, the Transmit menu, and the Configuration menu.

Transmit Frequency Configuration

This section describes two procedures:

- Configuring hardware to enable transmit frequency configuration through software
- Configuring transmit frequency

Hardware Configuration

Use the following procedure to change transmit frequency from the front panel:

1. Turn off the system.
2. Remove the NAC board.
3. Turn DIP switch S300 pole 1 on.
4. Reinstall the NAC board.
5. Turn on the station and allow it to warm up for one hour.
6. Change the frequency (see paragraph, "Transmit Frequency Range").
7. Align the station (see Chapter 11, "NAC Alignment and Equalization", paragraph, "Station Alignment").
8. Turn the station off.
9. Remove the NAC board
10. Turn DIP switch S300 pole 1 off.
11. Reinstall the NAC board.
12. Turn on the station.

    Continue with paragraph, "Transmit Frequency Range".

Transmit Frequency Range

The transmit frequency range is a prerequisite to setting the transmit frequency. Use the following procedure to configure frequency range:

1. From the READY prompt, press **<STN>** to access the Station menu.

    The display briefly shows the STN menu, then shows the first submenu:

    STN TYPE

2. Press <**down arrow**> to access the TX RANGE submenu.

3. Press <**ENT**>.

   The display flashes to show the NAC has entered the edit mode.

4. Type the appropriate transmit frequency (see Table 10-1) and press <**ENT**>.

Table 10-1: Frequency Ranges

Menu Range	Frequency Rage	Exciter Module Number
VHF Range 1	132 through 154 MHz	TDL9921
VHF Range 2	150 through 174 MHz	TLD9922
280 MHz	276 through 284 MHz	TYD4364
UHF Range 2	438 through 470 MHz	TLE9082
900 Range 2	928 through 960 MHz	TLF7540

   The display stops flashing to show the NAC has stored the value.

5. Press <**EXIT**> twice to return to the READY prompt.

   Continue with paragraph, "Transmit Frequencies".

Transmit Frequencies

Use the following procedure to configure the transmit frequencies:

1. From the READY prompt, press <**STN**> to access the Station menu.

   The display briefly shows the STN menu, then displays the first submenu:

   STN TYPE

2. Press <**down arrow**> to access the CHANNEL FREQS submenu.

3. Press <**ENT**>.

   The first channel frequency appears:

   CHAN 1 X.XXXXX MHz

4. Press <**ENT**>.

   The display flashes to show the NAC has entered the edit mode.

5. Type the value for the frequency for channel 1 and press <**ENT**>.

   The display stops flashing to show the NAC has stored the value.

6. Press <**down arrow**>. The next channel frequency appears:

7. Type the value for the frequency and press <**ENT**>.

8. Repeat Step 4 through Step 7 until all channels are programmed.

9. Press **<EXIT>** twice to return to the READY prompt.

   If the receiver uses the same frequency as one of the paging station channels, continue with paragraph, "Enable Tx=Rx". If the receiver does not use the same frequency as one of the paging station channels, continue with paragraph, "Operating Power".

Enable Tx=Rx

If a co-located receiver uses a transmit channel for receiving, configure the channel to prevent desensitization of the co-located receiver.

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the SPECIAL TX SETUP submenu.

3. Press **<ENT>**.

4. Press **<down arrow>** to access the TX=RX submenu.

5. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select ENABLED.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the value.

8. Press **<EXIT>** twice to return to the READY prompt.

   Continue with paragraph, "Operating Power".

Operating Power

This procedure configures an operating power level within the allowable output power range for the installed PA. Use the following procedure to set this level:

1. From the READY prompt, press **<CNFG>** to access the Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu:

   OPERATING POWER

2. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode and shows the current value.

   OPERATING POWER: XXX.X W

   Where XXX.X is the current power level.

3. Type a new value and press **<ENT>.**

   The display stops flashing to show the NAC has stored the value.

4. Press **<EXIT>** twice to return to the READY prompt.

   Continue with paragraph, "Control Schemes".

Control Schemes

The *Nucleus* Advanced Control station supports several control schemes. This section describes these control schemes and the methods for configuring them. The control schemes comprise the following:

- Digital remote control (DRC) (see paragraph, "Digital Remote Control (DRC)")
- Key on external carrier detect control (see paragraph, "Key on External Carrier Detect")
- Local control (see paragraph, "Local Control")
- Direct digital control (see paragraph, "Direct Digital Control")
- Binary communication control (see paragraph, "Binary Communication Control")

Digital Remote Control (DRC)

Digital Remote Control (DRC) is a Motorola proprietary communication control scheme that uses 1200-baud digital signaling (also called MDC-1200) and minimum shift keying (MSK). DRC is a flexible scheme with multi-frequency keying on as many as 4 channels, sector paging on as many as 254 sectors, and individual station keying for as many as 1024 stations.

DRC signaling supports information transfer and keying control between the controller and station. DRC employs extensive error detecting and correcting techniques. DRC uses modem tones for 1200 and 1800 Hz signaling. This signalling is equally accurate for phone lines and RF.

DRC Data Sets

DRC has two types of data sets, DRC 1 and DRC 2:

- DRC 1 is the communication protocol used by the Digital Diagnostic Controller (DDC), ASC 1000, and NAC DRC station s.
- DRC 2 is the enhanced communication protocol used by the ASC 1500 and NAC stations. The DRC 2 control byte provides more flexibility, more efficient polling, and better equalization, resulting in a higher throughput per hour than DRC 1.

DRC Setup

Use the following procedure to set up DRC.

1. From the READY prompt, press **<STN>** to access the Station menu.

   The display briefly shows the STN menu, then shows the first submenu:

   STN TYPE

2. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

3. Press **<ENT>.**

   The display shows the DRC SETUP option.

4. Press **<ENT>.**

   The display shows the first item:

   DRC ENABLE

or

DRC DISABLE

5. If DRC is enabled, go to Step 8. If DRC is disabled, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select **ENABLED**.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the value.

   DRC is now enabled.

8. Press **<EXIT>** once to return to the STN menu and the first submenu:

   STN TYPE

9. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

10. Press **<ENT>.**

    The display shows the DRC SETUP option.

11. Press **<ENT>.**

    The display shows the first item:

    DRC ENABLE

12. Press **<EXIT>** once to return to the STN menu and the first submenu:

    STN TYPE

13. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

14. Press **<ENT>.**

    The display shows the DRC SETUP option.

15. Press **<ENT>.**

    The display shows the first item:

    DRC ENABLE

16. Press **<down arrow>** to access SYSTEM ID. The display shows one of the following messages:

    SYSTEM ID LOCKED

    SYSTEM ID UNLOCKED.

17. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

18. Press **<TOG>** to select **LOCKED**.

19. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

20. Press **<EXIT>** once to return to the STN menu and the first submenu:

    STN TYPE

21. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

22. Press **<ENT>.**

    The display shows the DRC SETUP option.

23. Press **<down arrow>** to access POLL RESPONSE VIA.

24. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

25. Press **<TOG>** to select:
    - **LINE 2** if the command response route is over the Line 2 audio connection
    - **RF** if the command response is s sent over-the-air on the diagnostics channel

26. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

27. Press **<EXIT>** once to return to the STN menu and the first submenu:

    STN TYPE

28. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

29. Press **<ENT>.**

    The display shows the DRC SETUP option.

30. Press **<down arrow>** to access PAGING KEYUP.

31. If paging keyup is already disabled, go to Step 34. If paging keyup is enabled, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

32. Press **<TOG>** to select **DISABLED**.

33. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

34. Press **<EXIT>** once to return to the STN menu and the first submenu:

    STN TYPE

35. Press **<down arrow>** to access STN ID (#).

36. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

37. Type a unique station identification number in the range 1 to 1023. Press **<ENT>.**

38. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

39. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Receivers".

Key on External Carrier Detect

This procedure configures key on external carrier detect.

Note: The NAC station receives data on J15 pin 3 (External Paging Data) and carrier detect on J15 pin 8 (External Carrier Detect).

Use the following procedure to configure key on external carrier detect:

1. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

2. Press **<ENT>.**

   The display shows the first option:

   SPECIAL KEY DISABLED

3. Press **<down arrow>** to access KEY ON INTERNAL CD.

4. If key on internal CD is disabled, to Step 7. If key on internal CD is enabled, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

5. Press **<TOG>** to select **DISABLE**.

6. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the value.

7. Press **<EXIT>** once to return to the OPT1 menu, and the first submenu:

   SPECIAL KEY SETUP

8. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

9. Press **<ENT>.**

10. Press <**down arrow**> to access DRC BINARY DATA: INTERNAL / EXTERNAL.

11. If DRC binary data is external, go to Step 14. If DRC binary data is internal, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

12. Press **<TOG>** to select **EXTERNAL**.

13. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

14. Press **<EXIT>** once to return to the OPT1 menu, and the first submenu:

    SPECIAL KEY SETUP

15. Press <**down arrow**> to access WILDCARD CHAN CHANGE.

16. If wildcard chan change is enabled, go to Step 19. If wildcard chan change is disabled, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

17. Press **<TOG>** to select **ENABLE**.

18. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

19. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Receivers".

Local Control

Local Control is a standard feature that allows the station to be keyed with the external TTL-level signals, External Key Request and External Mode Request. The station receives binary data on the External Paging Data line. The station keys when External Key Request goes active. The active level is programmable. The station keys analog if External Mode Request is high, and keys binary if External Mode Request is low (see Figure 10-1).

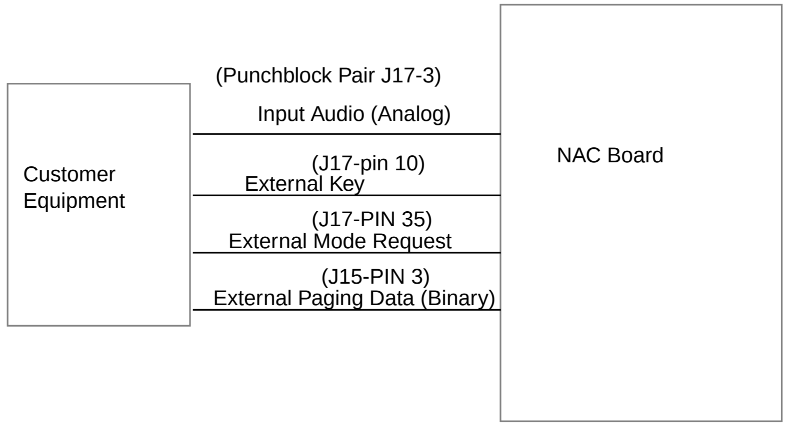


Figure 10-1: Local Control Scheme

When the station keys in the analog mode, the audio is routed from the Input Audio Source. Use the following procedure to select the source:

1. From the READY prompt, press **<RX>** to access the Receive Audio menu.

   The display briefly shows the RX submenu, then shows the first submenu:

   INPUT AUDIO FROM

2. If input audio is programmed for external receiver, go to Step 6. If input audio is programmed for Line 1 or internal receiver, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

3. Press **<TOG>** to select **EXTERNAL RX**.

4. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the value.

5. Press **<EXIT>** twice to return to the READY prompt.

6. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

7. Press **<ENT>.**

8. Press **<down arrow>** to select one of the following:
   – **KEY ON EXT KEY REQ LOW**
   – **KEY ON EXT KEY REQ HIGH**

9. Press **<ENT>.**

10. Press **<EXIT>** once to return to the OPT1 menu and the first submenu:

    SPECIAL KEY SETUP

Note: Configure input audio for Line 1 if no Link Receiver is present.

11. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

12. Press **<ENT>.**

13. Press **<down arrow>** to access DRC BINARY DATA.

14. If DRC binary data is programmed external, go to Step 17. If DRC binary data is programmed internal, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

15. Press **<TOG>** to select **EXTERNAL**.

16. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

17. Press **<EXIT>** once to return to the OPT1 menu and the first submenu:

    SPECIAL KEY SETUP

18. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

19. Press **<ENT>.**

20. Press **<down arrow>** to access RS232 or EXT MODEM RX DATA.

21. If external paging data setup is programmed for an external modem, go to Step 24. If external paging data setup is programmed for RS232, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

22. Press **<TOG>** to select **EXT MODEM RX DATA**.

23. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

24. Press **<EXIT>** once to return to the OPT1 menu and the first submenu:

    SPECIAL KEY SETUP

25. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

26. Press **<ENT>.**

27. Press **<down arrow>** to access WILDCARD CHAN CHANGE.

28. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

29. Press **<TOG>** to select **ENABLE**.

30. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

31. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Receivers".

Direct Digital Control

Direct digital control replaces the typical wireline or RF link path from the ASC to the NAC board with a direct digital link. The direct digital link from the ASC 1500 to the NAC Board may be one of the following:

- Satellite link
- Digital phone network
- Local direct connection

The NAC Board receives digital remote control (DRC) messages through the RS-232 port (connector J15 on the station backplane). The station must have DRC enabled for direct digital to operate. The ASC 1500 is required.

Use the following procedure to configure the station for direct digital control:

1. From the READY prompt, press **<STN>** to access the Station menu.

   The display briefly shows the STN menu, then shows the first submenu:

   STN TYPE

2. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

3. Press **<ENT>.**

4. The display shows the first option:

   DRC SETUP

5. Press **<ENT>.**

   The display shows one of the following:

   DRC: ENABLED

   DRC: DISABLED

6. If DRC is enabled, go to Step 9. If DRC is disabled, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

7. Press **<TOG>** to select **ENABLED**.

8. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

9. Press **<EXIT>** twice to return to the READY prompt.

10. From the READY prompt, press **<OPT 1>** to access the Stations Options menu.

    The display briefly shows the OPT1 menu, then shows the first submenu:

    SPECIAL KEY SETUP

11. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

12. Press **<ENT>.**

13. Press **<down arrow>** to access DIRECT DIGITAL.

14. If direct digital is enabled, go to Step 17. If direct digital is disabled, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

15. Press **<TOG>** to select ENABLED.

16. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

17. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Receivers".

Binary Communication Control

Binary communication control is an external digital control path that uses binary data for control messages. Use the following procedure to create a binary communication control path:

1. From the READY prompt, press **<OPT 1>** to access the Stations Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

2. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

3. Press **<ENT>.**

   The display shows the first option:

   DELAY ANALOG

   or

   DIGITAL PATH

4. If the external paging data path is programmed for a digital path, to Step 7. If the external paging data path is delay analog, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

5. Press **<TOG>** to select **DIGITAL PATH**.

6. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the value.

7. Press **<EXIT>** once to return to the OPT1 menu and the SPECIAL KEY SETUP submenu.

8. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

9. Press **<ENT>.**

   The display shows the first option:

   DIGITAL PATH

10. Press **<down arrow>** to access DRC BINARY DATA.

11. If DRC binary data is programmed for an external source, go to Step 14. If DRC binary data is programmed for an internal source, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

12. Press **<TOG>** to select **EXTERNAL**.

13. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

14. Press **<EXIT>** once to return to the OPT1 menu and the SPECIAL KEY SETUP submenu.

15. Press **<down arrow>** to access EXTERNAL PAGING DATA SETUP.

16. Press **<ENT>.**

17. Press **<down arrow>** to access one of the following.

    RS232

    or

    EXTERNAL MODEM RX DATA.

18. If the display shows EXTERNAL MODEM RX DATA, go to Step 21. If the display shows RS232, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

19. Press **<TOG>** to select **EXTERNAL MODEM RX DATA**.

20. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the value.

21. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Receivers".

Receivers

Note: Before programming an External Rx 1 input verify that the ASC is connected to J19 on the NAC backplane.

The NAC board requires that the External Paging Carrier Detect signal is active when paging data is present. If this signal is not active the station dekeys after the dropout delay time expires. If the external device does not provide External Paging Carrier Detect, connect pin 8 (Ext Paging CD) to pin 9 (A+) on connector J19. External Paging Carrier Detect is active when input voltage is greater than +3 V and inactive when input voltage is less than -3 V. The state is indeterminate when input voltage is between -3 V and +3 V.

The control path is from the controller to the station through a receiver. The NAC station accepts three types of control path inputs:

- Input audio from line 1–This selection identifies wireline tones transmitted across a dedicated phone line to the station as the control tones.
- Input audio from an internal receiver–This selection identifies the internal receiver module, connected to the Control Receiver Interface Board (CRIB). The Internal Rx control path configures the station to use RF data received by the internal Receiver Module.
- Input audio from an external receiver–This select identifies the external receiver. Wide-area systems use external receiver connections, such as a satellite receiver for external modems, for analog signaling to the station.

This section describes procedures for configuring the following receiver characteristics:

- Internal link receiver frequencies (see paragraph, "Internal Link Receiver Frequencies")
- Internal link receiver squelch (see paragraph, "Internal Link Receiver Squelch")
- Internal monitor receiver (see paragraph, "Internal Monitor Receiver")
- External monitor receiver (see paragraph, "External Monitor Receiver")

Control Path Configuration

Use the following procedure to configure the station for the control path input:

1. From the READY prompt, press **<RX>** to access the Receiver menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM

2. Press **<down arrow>** to access INTERNAL RX SETUP.

3. Press **<ENT>.**

4. Press **<down arrow>** to access RX FREQ. XXX.XXXX MHZ.

   Where XXX.XXXX is the current receiver frequency.

5. Press **<ENT>.**

The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select one of the following:
   - **LINE 1** for input from Line 1
   - **INTERNAL RX** for input from an internal receiver
   - **EXTERNAL RX 1** for input from an external receiver

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Press **<EXIT>** twice to return to the READY prompt.

   Continue with one of the following, depending on the configuration:
   - Internal link receiver frequencies (see paragraph, "Internal Link Receiver Frequencies")
   - Internal link receiver squelch (see paragraph, "Internal Link Receiver Squelch")
   - Internal monitor receiver (see paragraph, "Internal Monitor Receiver")
   - External monitor receiver (see paragraph, "External Monitor Receiver")

Internal Link Receiver Frequencies

Use the following procedure to configure the internal receiver module as a link receiver:

1. From the READY prompt, press **<RX>** to access the Receiver menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM

2. Press **<down arrow>** to access the RX CHAN SPACING submenu.

3. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to select one of the following values:
   - **12.5 KHZ**
   - **25 KHZ**

5. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

6. Press **<EXIT>** twice to return to the READY prompt.

   Continue with paragraph, "Internal Link Receiver Squelch".

Internal Link Receiver Squelch

A NAC link receiver has two modes of squelch control:

- Carrier squelch–The receiver unsquelches when the receiver detects a a carrier signal on the programmed internal receiver frequency.
- Digital private line (DPL) squelch–The receiver unsquelches when the receiver detects the programmed internal receiver frequency, *and* the modulated DPL code.

Use the following procedure to modify the squelch operation of the internal receiver:

1. From the READY prompt, press **<RX>** to access the Receive Audio menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM

2. Press **<down arrow>** to access INTERNAL RX SETUP.

3. Press **<ENT>.**

4. Press **<down arrow>** to access SQUELCH TYPE.

5. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select the appropriate squelch type for the system:
   – **CARRIER**
   – **DPL**

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Press **<down arrow>** to access SQUELCH MODE.

9. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

10. Press **<TOG>** to select **NORMAL**.

11. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

12. Press **<down arrow>** to access DPL.

13. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

14. Press **<TOG>** to select the appropriate DPL squelch type for the system:
    - **ENABLED** for DPL as the squelch type
    - **DISABLED** to override the squelch type and make the station unsquelch on carrier detect

15. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

16. Press **<down arrow>** to access INVERT RX DPL.

17. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

18. Press **<TOG>** to select one of the following:
    - **ENABLED** to receive inverted data
    - **DISABLED** to receive non-inverted data

19. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

20. Press **<down arrow>** to access DPL CODE.

21. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

22. Press **<TOG>** to select one of the following:
    - **ENABLED** if the squelch type is DPL and DPL is enabled
    - **DISABLED** if the station unsquelches for the programmed DPL code

23. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

24. Press **<down arrow>** to access DPL HIGH PASS FILTER.

25. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

26. Press **<TOG>** to select **ENABLED**.

27. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

28. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Battery Revert Setup" or paragraph, "Other Configuration Parameters".

Internal Monitor Receiver

Use the following procedure to configure an internal receiver module as a monitor receiver:

1. From the READY prompt, press **<RX>** to access the Receive Audio menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM

2. Press **<down arrow>** to access the INTERNAL RX SETUP submenu.

3. Press **<ENT>.**

4. Press **<down arrow>** to access LINE 2 AUDIO FROM.

5. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select **INT RX**.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Press **<up arrow>** to access MONITOR RX.

9. If the monitor receiver is enabled, go to Step 12. If the monitor receiver is disabled, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

10. Press **<TOG>** to select **ENABLED**.

11. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

12. Press **<down arrow>** to access MONITOR RX SETUP.

13. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

14. Press **<TOG>** to select one of the following:
    - **ANALOG** if the system sends analog signals
    - **TTL** if the system sends TTL signals

15. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

16. Press **<down arrow>** to access RX FREQ: XXX.XXXX MHZ.

17. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

18. Type the receiver frequency value. Type additional zeros to ensure the decimal is in the correct position.

19. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

20. Press <**down arrow**> to access RX CHAN SPACING.

21. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

22. Press <**TOG**> to select one of the following values:
    - **12.5 KHZ**
    - **25 KHZ**

23. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

24. Press <**down arrow**> to access STATUS TONE.

25. If the tone is enabled, go to Step 28. If the tone is disabled, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

26. Press <**TOG**> to select **ENABLED**.

27. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

Note: The default Status Tone Frequency is 2175 Hz, a level that is correct for most stations. If it is necessary to change the frequency or the level of the status tone, perform Step 28 through Step 34.

28. Press <**down arrow**> to access STATUS TONE FREQ.

29. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

30. Type the frequency value in the range 300 to 3000 Hz and press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

Note: The default setting for the status tone level is -13 dB relative to a received tone at 60% of full system deviation.

31. Press <**down arrow**> to access STATUS TONE LEVEL.

32. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

33. Press **<TOG>** (to provide a negative value) and type a value in the range 7.0 to 19.0 dB.

34. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

35. Press **<EXIT>** to return to the RX menu and the INPUT AUDIO FROM submenu.

36. Press **<down arrow>** to access the LINE 2 AUDIO FROM submenu.

37. If the line 2 audio source is internal receiver, continue to Step 40. If the line 2 audio source is programmed Line 1 or external receiver, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

38. Press **<TOG>** to select **INT RX.**

39. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

Note: If the monitor receiver is tuned to the same frequency as the paging station the station may suffer desensitization problems. Configure TX>SPECIAL Tx SETUP>Tx=Rx: ENABLED.

40. Press **<EXIT>** twice to return to the READY prompt.

Note: Perform line 2 output level adjust (see Chapter 11, "NAC Alignment and Equalization", paragraph, "Line 2 Output Level Adjust". Also perform internal receiver squelch threshold alignment (see Chapter 11, "NAC Alignment and Equalization", paragraph, "Internal Receiver Squelch Threshold Adjustment"). In addition perform an internal receiver test tone procedure (see Chapter 11, "NAC Alignment and Equalization", paragraph, "Internal RX Test Tone").

Continue with paragraph, "Battery Revert Setup" or paragraph, "Other Configuration Parameters".

External Monitor Receiver

Use the following procedure to configure the station for use with an External Monitor Receiver:

1. From the READY prompt, press **<RX>** to access the Receive Audio menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM.

2. Press **<down arrow>** to access the EXTERNAL RX SETUP submenu.

3. Press **<ENT>.**

4. Press **<down arrow>** to access MONITOR RX.

5. If the monitor receiver is enabled, go to Step 8. If the monitor receiver is disabled, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select **ENABLED**.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Press **<EXIT>** to return to the RX menu.

9. If the line 2 source is configured for external receiver 2, go to Step 13. If the line 2 source is internal receiver or none, press **<down arrow>** to access the LINE 2 AUDIO FROM submenu.

10. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

11. Press **<TOG>** to select **EXT RX 2**.

12. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

13. Press **<EXIT>** to return to the RECEIVE AUDIO menu.

14. Press **<down arrow>** to access the LINE 2 AUDIO submenu.

15. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

16. Press **<TOG>** to select one of the following values:
    - **FLAT**
    - **DEEMPHASIS**

17. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

Note: If the monitor receiver is tuned to the same frequency as the paging station, the station may suffer desensitization problems. Configure TX>SPECIAL TX SETUP>TX=RX: ENABLED.

18. Press **<EXIT>** twice to return to the READY prompt.

Note: Perform line 2 output level adjust (see Chapter 11, "NAC Alignment and Equalization", Chapter , "Line 2 Output Level Adjust").

Continue with paragraph, "Battery Revert Setup" or paragraph, "Other Configuration Parameters".

Battery Revert Setup

Battery revert provides power if the AC power fails. Motorola offers two battery revert options, X30 and X43 (see Chapter 5, "Connectors and Interfaces", paragraph, "Battery Revert Setup").

Use the following procedure to verify battery revert:

1. From the READY prompt, press **<CNFG>** to access the Station Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu:

   OPERATING PWR

2. Press **<down arrow>** to access the BATTERY REVERT SETUP submenu.

3. Press **<ENT>.**

4. Press **<down arrow>** to access the BATTERY REVERT option and the current value.

5. If the value is SEALED LEAD CALCIUM, go to Step 8. If the value is NONE, and battery revert is installed, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select **SEALED LEAD CALCIUM**.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Press **<down arrow>** to access BACKUP.

9. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

10. Press **<TOG>** to select one of the following:
    – **STATION** for use with option X43–the station continues to key during battery revert (perform Step 12 through Step 14).
    – **CONTROL** for use with option X30–the station stops keying during battery revert

11. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

12. Press **<down arrow>** to access FIXED CUTBK RED %.

13. Press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

14. Type a value that represents the percentage of power that the station will cut during paging when a battery revert occurs. Press **<ENT>.**

The display stops flashing to show the NAC has stored the data.

15. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Other Configuration Parameters".

Other Configuration Parameters

The procedures described in this section are for two special applications:

- Binary transmit data inversion (see paragraph, "Binary Transmit Data Inversion")
- Remote gain adjust (see paragraph, "Remote Gain Adjust")
- Station parameters (see paragraph, "Station Parameters")

Binary Transmit Data Inversion

Binary transmit data inversion inverts the transmitted data. Use the following procedure to enable data inversion:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the SPECIAL TX SETUP submenu.

3. Press **<ENT>.**

4. Press **<down arrow>** to access the BINARY TX DATA INVERT option.

5. If data inversion is already enabled, go to Step 8. If data is not inverted, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select **ENABLED**.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Press **<EXIT>** to return to the READY prompt.

Remote Gain Adjust

If remote gain adjust is enabled, the ASC remotely adjusts the station analog gain to compensate for changes in control path attenuation that affect the station output analog deviation.

Note: This feature requires DRC.

Use the following procedure to enable remote gain adjust:

1. From the READY prompt, press **<RX>** to access the Receive Audio menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM.

2. Press **<down arrow>** to access the GAIN submenu. The display shows one of the following:

GAIN: ENABLED

or

GAIN: DISABLED

3. If gain is already enabled, go to Step 6. If gain is disabled, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to select **ENABLED**.

5. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

6. Press **<down arrow>** to access the GAIN (value) submenu.

7. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

8. Type a value for the gain in the range -10 dB to +10 dB (0.1 dB increments) and press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

9. Press **<EXIT>** twice to return to the READY prompt.

Station Parameters

The procedures described in this section are specific to an individual station. These values include the following:

- Drop-out delay
- Key time-out
- System timer alarm

Use the following procedure to set these values if required:

1. From the READY prompt, press **<STN>** to access the Station menu.

   The system briefly shows the STN menu, then shows the first submenu:

   STN TYPE

2. Press **<down arrow>** to access the DROP OUT DELAY submenu. The drop out delay is a period after the end of paging of control data when the station remains keyed.

Note: The default value for a DRC station is 6 seconds.

3. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to select a drop out value. and press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

5. Press **<down arrow>** to access the KEY TIMEOUT submenu. The key time out value is the maximum time the station can remain keyed.

6. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

7. Type a value or press **<TOG>** to select **DISABLED**.

8. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

9. Press **<down arrow>** to access the SYSTEM TIMER ALARM submenu. The system timer alarm value is the maximum length of idle time before the station declares an alarm.

10. Type a value or press **<TOG>** to select **DISABLED**.

11. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

Note: This parameter sets the value. The ASC enables the alarm.

12. Press **<EXIT>** twice to return to the READY prompt.

NAC Alignment and Equalization

This chapter describes three post-installation procedures that maximize the performance of a Nucleus paging station with Advanced Control (NAC). This chapter contains the following information:

Station Alignment

This section describes station alignment. Motorola aligns a stations during manufacturing, with the exception of input gain adjust (specific to the network) and internal receiver squelch threshold adjustment. Perform alignment only after replacement of a field replaceable unit (FRUs) or a change in channel information.

Test Equipment

Note: Tune station output attenuation to less than 0.25 W before applying to HP 53310A Modulation Domain Analyzer.

This procedure requires the following items of test equipment:

- R2000 Series Service Monitor, or equivalent
- High stability oscillator, Ball Efratom, Model PRFS (or equivalent)
- RF load with coupler and attenuator
- RF power Wattmeter (capable of handling maximum station output power)
- Frequency counter with accuracy 0.1 ppb or better
- HP 53310A Modulation Domain Analyzer

CAUTION

Do not perform the procedures described in this section unless you have a thorough knowledge of NAC operation. Read all test equipment manuals before beginning these procedures.

Preliminary Checks

Perform all the following preliminary checks on the NAC station before beginning alignment:

1. Verify that all boards are securely installed against the backplane and are connected to the frame with their mounting screws.
2. Verify that all backplane connectors are correct and secure.
3. Turn on the station and allow it to warm up for one hour. The ON LED on each power supply must light.
4. Verify that station RF output is properly loaded in a 50-ohm load capable of absorbing the maximum station output power.

Perform all the following procedure:

1. Press **<STN>** and **<TX>** to reset the station.

   All LEDs light on the front panels.

   The display shows the following message:

NUCLEUS ADVANCED CONTROL VERSION X.XXX ERR# 0FF PWR RST TESTING

The display shows the READY prompt.

2. Clear the alarm (see Chapter 12, "NAC Alarm Configuration and Verification", paragraph, "Resetting Alarms").

Connecting Test Equipment

Use the following procedure to connect the equipment for testing (see Figure 11-1).

1. Connect an RF cable to the transmitter port on the NAC station.

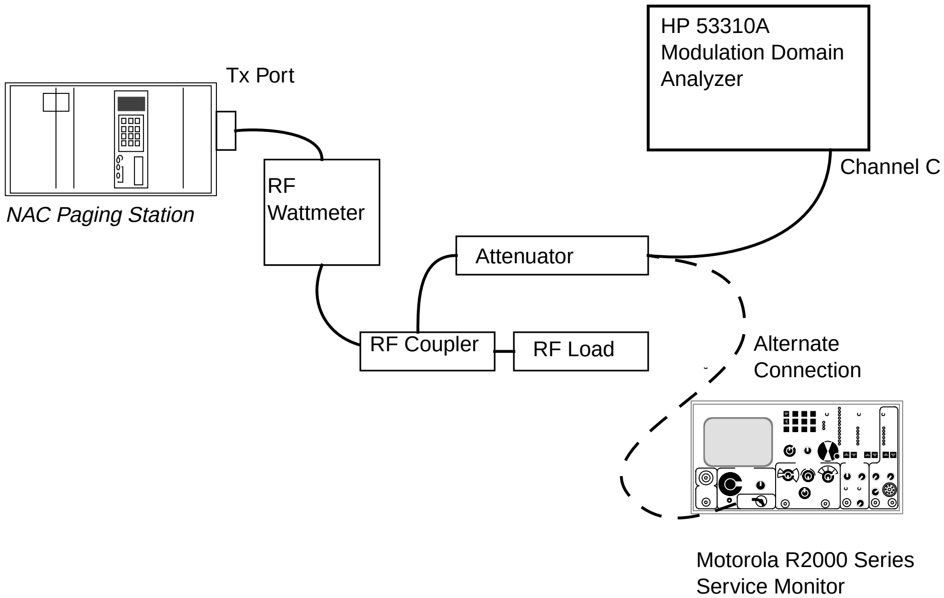


Figure 11-1: Test Equipment Setup for Station Alignment Procedure

2. Connect the other end of the RF cable to the RF Wattmeter.

3. Connect an RF cable from the output of the RF coupler to the input of the RF load.

4. Connect an RF cable from a second output on the RF coupler to an attenuator.

5. Connect an RF cable from the attenuator to one of the following:
   – Channel C on an HP 53310A Modulation Domain Analyzer, or
   – RF connector on the front of a Motorola R2000 Series Service Monitor

6. Turn all equipment on and allow the equipment to warm up for one hour.

7. Continue with paragraph, "Internal Receiver Squelch Threshold Adjustment".

Internal Receiver Squelch Threshold Adjustment

Motorola cannot set the squelch threshold during manufacturing. Perform the following procedure to set this threshold:

1. Connect a signal source to the receiver antenna with a minimum signal level equal to the signal level that the receiver must unsquelch.

2. Modulate the signal with a 1 kHz tone at 60% of full system deviation:
   – 3 kHz peak for 20, 25, and 30 kHz channel spacing systems
   – 1.5 kHz peak for 12.5 kHz channel spacing systems

3. From the control panel display of the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

4. Press **<down arrow>** to access the INTERNAL RX SQUELCH submenu.

5. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

6. Type a threshold value in the range 0 to 20,000.

   A maximum setting of 20,000 (tight squelch) corresponds to approximately 20 mV rms at the antenna.

   A value of 0.35 mV results from a value 350.

Note: The threshold integer value equals the mV rms at the antenna multiplied by 1000 approximately. Accuracy decreases as the value approaches zero.

7. Press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

8. Repeat Step 2 to Step 7 until the squelch value is appropriate to the system.

9. Press **<EXIT>** twice to return to the READY prompt.

   Continue with the paragraph, "External Link Receiver Audio Adjust".

External Link Receiver Audio Adjust

This procedure configures an audio level adjustment to link and monitor receivers. This procedure applies to stations with any of the following options:

- C659 external receiver option
- C660 external receiver option

- C661 external receiver option
- C662 external receiver option
- C663 external receiver option
- C850 link receiver option
- X209 internal receiver option
- X333 link receiver option
- X334 link receiver option
- X335 link receiver option
- X336 link receiver option

Note: This procedure provides the audio level adjustment, but does not provide RF alignment for a link transmitter.

CAUTION

Align the RF portion of a link receiver before performing this procedure.

Do not perform this procedure on wireline-controlled stations and stations equipped with internal link receivers.

CAUTION

After completing alignment and maintenance, ensure that squelch control is turned on.

Use the following procedure to adjust audio for an external link receiver:

1. Turn the station off.

2. Remove the Link Receiver Audio and Squelch board from the station.

3. Place the Link Receiver Audio and Squelch board on an extender board so it can be measured.

4. From the READY prompt, press **<RX>** to access the Receiver Audio menu.

   The display briefly shows the RX menu, then shows first submenu:

   INPUT AUDIO FROM

5. Press **<down arrow>** to access the EXTERNAL RX SETUP submenu.

6. Press **<ENT>.**

7. Press **<down arrow>** to access LINK RX SQUELCH TYPE.

8. Press **<ENT>.**

The display flashes to show the NAC has entered the edit mode.

9. Press **<TOG>** to select one of the following:
   - **CARRIER**
   - **DPL**

10. Press **<ENT>.**

    The display stops flashing to show the NAC has stored the data.

11. Press **<EXIT>** twice to return to the READY prompt.

12. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

    The display shows the first submenu:

    DE-EMP RX LEVEL

13. Connect an RF signal generator to the receiver antenna connection.

14. Adjust the generator output for an RF level of 1000 mV rms, modulated with a 1000 Hz test tone at system deviation.

15. Adjust R203 on the Link Receiver Audio and Squelch board until the display shows 0.40 ±0.05 V.

Note: A value of 0.40 V on the front-panel display corresponds to a -5 dBm receiver output level.

16. When the measured value is correct, press **<EXIT>** to return to the READY prompt.

17. Turn the station off.

18. Remove the Link Receiver Audio and Squelch board from the extender board.

19. Install the Link Receiver Audio and Squelch board in the station.

20. Turn the station on.

    Continue with paragraph, "Input Gain Adjust".

Input Gain Adjust

Note: System level is defined as the nominal audio input level required to achieve nominal transmit deviation. Motorola aligns the station with a default system level of -5 dBm during manufacturing. Realign the station after installation for the actual system level. Generate the test tone with a paging controller and distribute the tone to each paging transmitter through the normal control path. Adjust the path before performing this procedure.

CAUTION

If the station uses an external link receiver, configure De-Emp Level Squelch before performing this procedure (see Chapter 10, "NAC Configuration", paragraph, "Receivers", paragraph, "Internal Link Receiver Squelch".

Use the following procedure to adjust gain:

1. Apply a balanced 1 kHz test tone at the system level to Line 1 on the backplane board [connector J17, pin 3 (+), pin 28 (-)].

2. Modulate an on-channel RF signal with a 1 kHz test tone at system level deviation.

Note: In DRC systems, the test tone level should be equal in amplitude to the MDC modem tones to provide the greatest sensitivity with respect to DRC command decoding.

3. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

4. Press **<down arrow>** to access the INPUT AUDIO LEVEL submenu.

5. Press **<ENT>.**

   The NAC adjusts the audio gain stages for the optimal board level.

   The display shows the following message:

   ADJ GAIN

   After adjustment, the display shows one of the following message:

   – TOO LOW–Check the test tone level and external audio connections and repeat Step 4 and Step 5 to correct the level.
   – TOO HIGH–Check the test tone level for proper adjustment and repeat Step 4 and Step 5 to correct the level.
   – COMPLETE–Exit the function (go to Step 6).

6. Press **<EXIT>** twice to return to the READY prompt.

Frequency and Power Configuration

Motorola aligns power output to a high degree of accuracy during manufacturing. Perform field alignment after replacing the power amplifier (PA), power supplies, or the NAC board.

Note: Allow the station to warm up for a minimum of one hour before performing the procedures in this section. Perform these procedures in the order presented in this section.

DANGER

Follow procedures and precautions carefully to avoid serious damage to the PA and the station.

Connect the coupler, attenuator, load, and power meter directly to the PA Power output alignment point. The alignment point is an N-type connector at the end of the station transmit output cable. Do not use adapters or intermediate cables between the PA Power output alignment point and the Wattmeter.

Note: For an external circulator option (X676 or Option X677), detach the station transmit output cable from the input to the circulator assembly. Connect the end of the cable (the PA power output alignment point) directly to the coupler, attenuator, load, and power meter. Do not attempt to compensate for losses beyond the PA power output alignment point.

Use the following procedure to calibrate the RF power output level of the station:

1. From the READY prompt, press **<STN>** to access the Station menu.

   The display briefly shows the STN menu, then shows the first submenu:

   STN TYPE:

2. Press **<down arrow>** to access the CHANNEL FREQS submenu.

3. Press **<ENT>.**

   The display shows the first channel frequency:

   CHAN 1 XXX.XXXX MHZ

4. Press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

5. Type the channel frequency and press **<ENT>.**

   The display stops flashing to show the NAC has stored the data.

6. Press **<down arrow>** to access the next channel.

7. Repeat Step 4 through Step 6 to configure all active channels.

8. Press **<EXIT>** twice to return to the READY prompt.

Continue with paragraph, "Manual Station Power Output Calibration" or paragraph, "Automatic Station Power Output Calibration".

Manual Station Power Output Calibration

Note: *Do not use this procedure for a high power Nucleus paging station with an external circulator.*

If the station does not have an external circulator, ensure that the circulator type is configured to not present.

This procedure requires input from an external meter to calibrate the power.

Equipment Setup

Use the following procedure to configure the test equipment (see Figure 11-2):

1. Connect an RF cable to the transmit port on the NAC station.

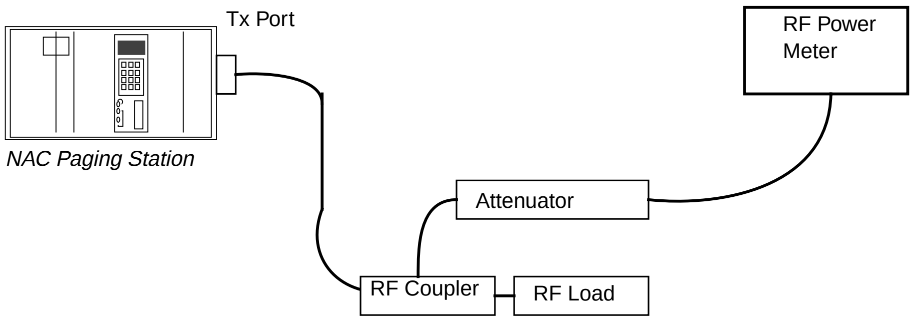


Figure 11-2: Test Equipment Setup for Power Output Alignment Procedure

2. Connect the other end of the RF cable to an RF coupler.

3. Use an RF cable to connect the RF coupler to the RF load.

4. Use another RF cable to connect the RF coupler to the attenuator.

5. Connect the RF attenuator to an RF power meter.

6. Calibrate the coupler and the load. The return for the load must be at lest 30 dB greater than the loss.

7. Connect the RF power meter. The accuracy of the power meter must be 3.5% or better.

Manual Calibration Procedure

This procedure requires the technician to read a power level from an external meter and to type it in at the front panel. The station compares the measured power with the output power level, then raises or lowers the power level to achieve the correct value at the output.

Note: Complete the entire procedure. Terminating the calibration procedure before completion results in a loss of all data.

Use the following procedure to calibrate power:

1. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

2. Press **<down arrow>** to access the CALIBRATE STATION POWER submenu.

3. Press **<ENT>**.

4. Press **<down arrow>** to access the CAL EXT WATTMETER option.

5. Press **<ENT>**.

   The station keys and the Exciter PA Full LED lights.

   The display shows the following message:

   ENTER POWER MEASUREMENT

6. Read output power on the power meter.

7. Type the value from the power meter and press **<ENT>**.

Note: This alignment procedure prevents PA cutback by preventing large changes in output power. If the actual measured output power on the wattmeter is significantly less than the programmed power level, do not type the actual power level in the input measured power field. Type a value that is approximately 20% less than the programmed value. Repeat this step until the actual measured power level is within 20% of the programmed value. At this point, type the actual measured value.

For example, if the programmed value is 50 watts and the actual measured value is 15 watts, type the value 40 as the value repeatedly until the actual measured value is greater than 40 watts. Then begin entering the actual measured value (50) until the wattmeter indicates 50 watts.Repeat Step 5 through Step 7 until the measured power equals of is very near the required operating power level.

8. Press **<EXIT>** three times to return to the READY prompt.

9. Detach the test equipment.

   Continue with paragraph, "Reference Alignment".

Automatic Station Power Output Calibration

NAC software releases 3.100 and higher support automatic power output calibration on 900 Hz stations.

CAUTION

Do not use a label value from a PA from another station. Use the value from the PA installed in the station being calibrated.

Use the following procedure to perform automatic power calibration:

1. Turn off the station.

2. Detach the PA power output alignment point from one of the following locations:
   – Transmit antenna cable
   – External circulator assembly
   – Antenna relay module

3. Connect an RF load to the output of the PA cable.

4. Turn on the station and allow it to warm up for an hour.

5. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

6. Press **<down arrow>** to access the CALIBRATE STATION POWER submenu.

7. Press **<ENT>**.

8. Press **<down arrow>** to access the AUTO PA CALIBRATION option.

9. Press **<ENT>**.

   The display shows the following message:

   PRESS ENTER TO START

10. Press **<ENT>**.

    The station keys and automatically adjusts the output power until the power level is close to the required operating power.

    The station dekeys and the display shows the following message:

    COMPLETE

11. If the display shows an ALIGNMENT FAILED! message before calibration is complete, check the following items:

– The RF is disconnected from the station to the RF load.
– The PA failed to key.
– The PA cut back for one of the following reasons:
  - High VSWR
  - PA overdrive
  - Low PA supply voltage
  - High external circulator temperature
  - Antenna relay short
  - Battery revert

12. Press **<EXIT>** twice to return to the READY prompt.

Note: Do not press **<EXIT>** *before the test is complete.*

13. Disconnect the test equipment.

14. Reattach the PA power output alignment point to one of the following:
   – Transmit antenna cable
   – External circulator assembly
   – Antenna relay module (depending upon which options your *Nucleus* station has).

   Continue with paragraph, "External Wattmeter Calibration".

External Wattmeter Calibration

Note: Validate the current channel frequency before performing this procedure.

This procedure is used for stations with double circulators and triple circulators and external Wattmeters.

Motorola installs the external Wattmeter during manufacturing. It does not require recalibration under normal circumstances. Perform this procedure if the Wattmeter is replaced.

1. From the READY prompt, press **<CNFG>** to access the Station Configuration menu.

   The display briefly shows the CNFG menu, then shows the first submenu:

   OPERATING PWR

2. Press **<down arrow>** to access the WATTMETER SETUP submenu.

3. Press **<ENT>**.

   The display shows the first option:

   WATTMETER POLL RESP

4. If the Wattmeter poll response is already programmed for external, go to Step 7. If the Wattmeter poll responses is programmed to internal, press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

5. Press **<TOG>** to select **EXTERNAL**.

6. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

7. Press **<down arrow>** to access the EXTERNAL WATTMETER TYPE.

8. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

9. Press **<TOG>** to select **CLASS 1**.

10. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

11. Press **<EXIT>** twice to return to the READY prompt.

12. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

    The display briefly shows the ALGN menu, then shows the first submenu:

    DE-EMP RX LEVEL

13. Press **<down arrow>** to access the CALIBRATE STN POWER submenu.

14. Press **<ENT>**.

    The display shows the following message:

    INITIALIZE POWER CALIBRATE

15. Press **<down arrow>** to access CAL EXT WATTMETER.

16. Press **<ENT>**.

    The display shows the following message:

    ENTER POWER MEASUREMENT

17. Press **<ENT>**.

18. Measure the output power using an accurate Wattmeter at the output of the antenna feed.

19. Type the output power on the keyboard and press **<ENT>**.

    The NAC stores the power level.

20. Press **<EXIT>** twice to return to the READY prompt.

21. From the READY prompt, press **<SERV>** to access the Service Mode menu.

    The display briefly shows the SERV menu, then shows the first submenu.

    KEY AND READ EXT POWER

22. Press **<ENT>**.

    The display shows the Wattmeter reading.

23. Verify that the Wattmeter reading matches the external measurement.

24. If the two values do not match, repeat Step 12 through Step 23 until the Wattmeter reading matches the external measurement.

25. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Reference Alignment".

Reference Alignment

This procedure aligns the frequency reference. This procedure adjusts the carrier frequency to within 1 Hz of the programmed frequency value. Use this procedure if system specifications require better performance that provided by system specifications, or if the system nets the oscillators.

Note: *Validate the current channel frequency before performing this procedure.*

Set TX>FREQ ADJUST to zero (0).

This procedure requires a frequency counter or communication analyzer to align the Pendulum value and the reference module. the accuracy of the test equipment should be 10 times better than the oscillator it needs to measure (3ppb for an HSO and 0.5 ppb for a UHSO).

Do not perform this procedure if the station uses an external frequency reference or has no reference.

Use the following procedure to align the reference (see Figure 11-3):

1. Connect the N-type connector from the PA output alignment point to the RF coupler.

2. Connect the RF coupler to an RF load

3. Connect the RF coupler to an attenuator.

4. Connect the attenuator to the front panel of a Motorola R2000 Series Communications Analyzer.

5. Connect a rubidium standard to the ref port of the Motorola R2000 Series Communications Analyzer.

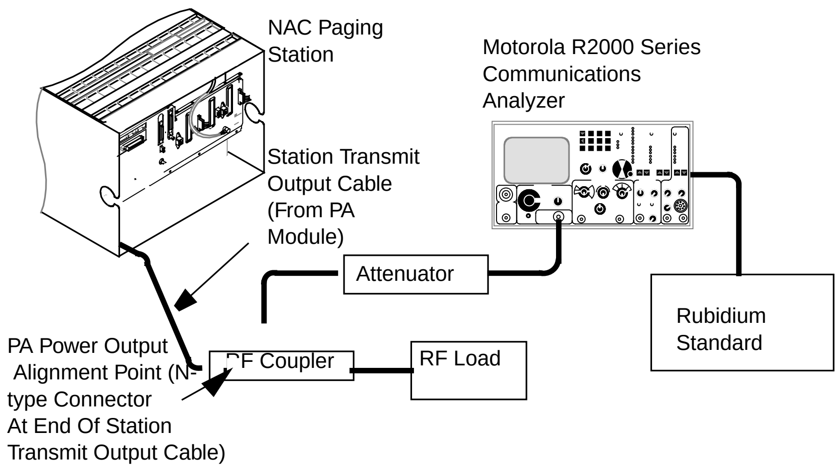


Figure 11-3: Test Equipment Setup for Reference and Pendulum Alignment

6. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

7. Press **<down arrow>** to access the REFERENCE ALIGNMENT submenu.

8. Press **<ENT>**.

9. Press **<down arrow>** to access the PENDULUM ALIGNMENT option.

   The display shows the pendulum value.

10. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

11. Read the station frequency at a frequency counter or communication analyzer.

12. If the two values disagree, type a change value in the range 0 to 215 and press **<ENT>**.

13. Repeat Step 10 through Step 12 until the measured value and the displayed value are within 180 Hz of each other.

14. Press **<down arrow>** to access the REF MOD VALUE option.

    The display shows the reverence mod value in the range 0 to 4095.

15. Press **<ENT>**.

The display flashes to show the NAC has entered the edit mode.

16. If the display value does not match the station frequency shown on the frequency counter or communication analyzer, type a value in the range 0 to 4095 to begin correcting the value.

17. Press **<ENT>**.

18. Repeat Step 15 through Step 17 until the display value is within 1 Hz of the measured value.

19. Press **<EXIT>** twice to return to the READY prompt.

20. Continue with paragraph, "VCO Modulation Sensitivity Calibration".

VCO Modulation Sensitivity Calibration

This calibration procedure accounts for modulation sensitivity variations in the Voltage controlled oscillator (VCO). Motorola calibrates the VCO during manufacturing.

Note: *Align the frequencies according to the following specifications:*
- *Align Frequency 1 as the lowest frequency in the band ±25 kHz.*
- *Align Frequency 2 at 25 kHz less that the frequency in the middle of the band.*
- *Align Frequency 3 at 25 kHz greater than the frequency in the middle of the band.*
- *Align Frequency 4 at the highest frequency in the band ±25 kHz.*

Use the following procedure after replacement of a NAC board or Exciter.

1. Connect the test equipment as shown in Figure 11-3.

2. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

3. Press **<down arrow>** to access the VCO MODULATION FREQS submenu.

4. Press **<ENT>**.

   The display shows the first frequency deviation:

   FREQ 1 DEV: XXXX

5. Press **<ENT>**.

   The station keys and modulates the transmitter with a software-generated 1012.5 Hz tone. The display shows the current correction table entry.

6. Type the deviation shown on an external frequency deviation meter and press **<ENT>**.

7. Press **<down arrow>** to access the next value.

8. Perform Step 5 through Step 7 to calibrate the four frequency deviations.

9. Press **<EXIT>** twice to return to the READY prompt.

   Continue with paragraph, "Analog Deviation Verification".

Analog Deviation Verification

Motorola aligns each NAC station for nominal audio transmit deviation of ±3 kHz, and maximum audio deviation of ±5 kHz. Use the following procedure to verify or change these values:

Note: Validate the current channel frequency before performing this procedure.

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the TX DEVIATION SETUP submenu.

   The display shows the following message:

   MAXIMUM DEVIATION: XXXX

   The value is in the range 0 to 7000 Hz (in 1 Hz increments).

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. Type a new value and press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

5. Apply a 2 kHz test tone at the system level to Line 1.

6. If the station is equipped with a link receiver option, modulate an on-channel RF signal with a 1 kHz test tone at system deviation.

7. Press **<EXIT>** twice to return to the READY prompt.

8. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

9. Press **<down arrow>** to access the NOMINAL DEVIATION submenu.

10. Press **<ENT>**.

    The station keys and modulates the carrier with the test tone at the nominal deviation level.

    The display shows the nominal deviation.

11. Monitor the nominal deviation.

12. To change the nominal deviation type the new deviation and press **<ENT>**.

13. Repeat Step 10 through Step 12 to ensure the new deviation is correct.

14. Press **<EXIT>** twice to return to the READY prompt.

15. Continue with paragraph, "Transmit Audio Response".

Transmit Audio Response

Use the following procedure to ensure that the transmit audio response is flat:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the FLAT/PRE-EMPHASIS submenu.

   The display shows the current setting:

   FLAT

   or

   PRE-EMP

Note: Pre-emphasis response is 6 dB per octave.

3. If the current value is flat, go to Step 6. If the current value is pre-emphasis, press **<ENT>**.

   The display flashes to show the NAC is in the edit mode.

4. Press **<TOG>** to select **FLAT**.

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the data.

6. Press **<EXIT>** twice to return to the READY prompt.

   Continue with paragraph, "Binary Splatter Filter".

Binary Splatter Filter

The binary splatter filter configures the station for compatibility with other paging transmitters in the system. The default value is a rise time of 140 ms or can be changed to read 250 ms. Use the following procedure to select the splatter filter:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the BINARY SPLATTER FILTER submenu.

   The display shows the current value.

3. If the default rise time (140 ms) is correct, go to Step 6. If the default rise time is incorrect, press **<ENT>**.

   The display flashes to show the NAC is in the edit mode.

4. Press **<TOG>** to select 250 ms.

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the data.

6. Press **<EXIT>** twice to return to the READY prompt.

   Continue with the appropriate procedure:
   - SRM alignment if the NAC board or Exciter has been replaced (see paragraph, "SRM Alignment")
   - Line 2 output level adjustment (see paragraph, "Line 2 Output Level Adjust")
   - Line 2 adjustment for an external monitor receiver (see paragraph, "Line 2 Adjustment for an External Monitor Receiver Audio Source")
   - Line 2 adjustment for an internal tone-encoding source (see paragraph, "Line 2 Adjustment for an Internal Tone-Encoded Source")
   - Binary deviation programming (see paragraph, "Binary Deviation Values")
   - Internal receiver test tone (see paragraph, "Internal RX Test Tone")
   - Alignment completion (see paragraph, "Alignment Completion")

SRM Alignment

Note: Perform SRM alignment only if the NAC board or Exciter is replaced.

This procedure fine-tunes the deviation of the square-wave transmit data.

This procedure requires a modulation domain analyzer.

1. Connect the modulation domain analyzer to the station.

2. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

3. Press **<down arrow>** to access the SRM ALIGNMENT submenu.

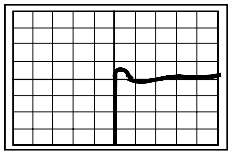
4. Press **<ENT>**.

5. Press **<down arrow>** to access the DELAY option. The display shows the current delay value in the range 0.00 to 19.75.

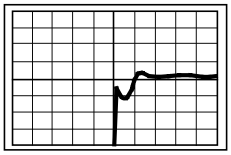
6. Observe the wave form that appears on the modulation domain analyzer screen.

   The wave form should have flat rising edge (see Figure 11-4).

7. Adjust the delay to create a flat rising edge. Type a change in value and press **<ENT>**.



If the Waveform Resembles This Example, Decrease SRM Delay



If the Waveform Resembles This Example, Increase SRM Delay

Figure 11-4: Sample SRM Alignment Waveforms

8. Repeat Step 6 and Step 7 until the edges are approximately correct.

9. Press **<EXIT>**.

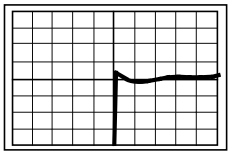
10. Press **<down arrow>** to access GAIN.

    The display shows gain in the range 000 to 999

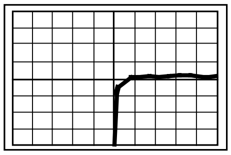
11. Press **<ENT>**.

12. Configure the modulation analyzer to show one rising edge.

13. Adjust the gain (see Figure 11-5). Type a change in value and press **<ENT>.**



If Waveform Resembles This Example, Decrease SRM Gain Level



If Waveform Resembles This Example, Increase SRM Gain Level

Figure 11-5: Sample SRM Gain Waveforms

14. Observe the wave form on the modulation domain analyzer.

15. When the waveform is as flat as possible, press **<EXIT>** twice to return to the READY prompt.

    Continue with the appropriate procedure:

    – Line 2 adjustment for an external monitor receiver (see paragraph, "Line 2 Adjustment for an External Monitor Receiver Audio Source")

– Line 2 adjustment for an internal tone-encoding source (see paragraph, "Line 2 Adjustment for an Internal Tone-Encoded Source")
– Binary deviation programming (see paragraph, "Binary Deviation Values")
– Internal receiver test tone (see paragraph, "Internal RX Test Tone")
– Alignment completion (see paragraph, "Alignment Completion")

Line 2 Output Level Adjust

This section describes adjustments for wireline MDC tones, verification tones, or monitor receiver audio. The source of the Line 2 output audio is internal or external. The internal source is a set of tones generated by the NAC board. An external source is a set of tones generated on a monitor receiver and route to the NAC board. This section describes procedures for both sources.

Line 2 Adjustment for an External Monitor Receiver Audio Source

Note: This procedure requires an RF signal generator connected to the receiver antenna connection.

Use this procedure for a station with option C664 monitor receiver or the equivalent field upgrade:

1. Turn off the monitor receiver.
2. Remove the Audio and Squelch board.
3. Mount the Audio and Squelch board on an extender card.
4. Install the extender card in the monitor receiver.
5. Turn on the monitor receiver.
6. From the READY prompt on the NAC front panel, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL
7. Press **<ENT>**.
8. Connect an RF signal generator to the receiver antenna connection.
9. Adjust the generator output for an RF level of 1000 mV rms, modulated with a 1000 Hz test tone at system deviation.
10. Adjust R203 on the monitor receiver Audio and Squelch board until the display shows a reading 0.40 ±0.05 V. This reading corresponds to a receiver output of -5 dBm.

    From the NAC control panel press **<EXIT>** once to return to the ALGN menu and the DE-EMP RX LEVEL submenu.
11. Press **<down arrow>** to access the OUTPUT RX AUDIO submenu.

12. The display shows the wiper position of the Line 2 level adjustment potentiometer.

    The gain range, from lowest to highest, is 0 to 255.

13. To adjust the wiper position, press **<ENT>.**

    The display flashes to show the NAC has entered the edit mode.

14. Type the new value for the Line 2 level and press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

15. Press **<EXIT>** twice to return to the READY prompt.

    Continue with the appropriate procedure:
    - Line 2 adjustment for an internal tone-encoding source (see paragraph, "Line 2 Adjustment for an Internal Tone-Encoded Source")
    - Binary deviation programming (see paragraph, "Binary Deviation Values")
    - Internal receiver test tone (see paragraph, "Internal RX Test Tone")
    - Alignment completion (see paragraph, "Alignment Completion")

Line 2 Adjustment for an Internal Tone-Encoded Source

Use this procedure for MDC or verification tone generation.

1. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

2. Press **<down arrow>** to access the OUTPUT AUDIO INTERNAL SOURCE submenu.

3. Press **<ENT>**.

   The display shows the wiper position of the Line 2 level adjustment potentiometer.

   The gain range, from lowest to highest, is 0 to 255.

4. To adjust the wiper position, press **<ENT>.**

   The display flashes to show the NAC has entered the edit mode.

5. Type the new value for the Line 2 level and press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

6. Press **<EXIT>** twice to return to the READY prompt.

   Continue with the appropriate procedure:
   - Binary deviation programming (see paragraph, "Binary Deviation Values")
   - Internal receiver test tone (see paragraph, "Internal RX Test Tone")
   - Alignment completion (see paragraph, "Alignment Completion")

Binary Deviation Values

Motorola configures the NAC board for a binary transmit deviation of ±4 kHz during manufacturing. Use the following procedure to display the current value without keying the station:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the TX DEVIATION SETUP submenu.

3. Press **<ENT>**.

   The display shows the MAXIMUM DEVIATION option.

4. Press **<down arrow>** to access the NOMINAL DEVIATION SETUP value.

   NOMINAL DEVIATION XXXX

   This value is the wiper position of the Line 2 level adjustment potentiometer.

5. Press **<EXIT>** twice to return to the READY prompt.

6. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

7. Press **<down arrow>** to access the BINARY INST submenu.

8. The NAC shows the current binary deviation value in Hz.

9. Press **<EXIT>** twice to return to the READY prompt.

   Continue with the appropriate procedure:

   – Internal receiver test tone (see paragraph, "Internal RX Test Tone")

   – Alignment completion (see paragraph, "Alignment Completion")

Internal RX Test Tone

Use the internal receiver test tone for the following functions:

- Setting status tone level
- Measuring phone line response

Use the following procedure to set the internal receiver test tone:

1. From the READY prompt, press **<ALGN>** to access the Station Alignment menu.

   The display briefly shows the ALGN menu, then shows the first submenu:

   DE-EMP RX LEVEL

2. Press **<down arrow>** to access the Internal RX TEST TONE SETUP submenu.

3. Press **<ENT>**.

   The display shows the test tone value.

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to select **ENABLED**.

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

6. Press **<down arrow>** to access TEST TONE FREQ.

7. Press **<ENT>**.

   The display shows the test tone frequency.

   The display flashes to show the NAC has entered the edit mode.

8. Type a value in the range 300 to 3000 Hz.

9. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

10. Press **<EXIT>** twice to return to the READY prompt.

    Continue with paragraph, "Alignment Completion".

Alignment Completion

The station is now fully aligned.

If the NAC station is part of a simulcast group, continue with paragraph, "Simulcast Equalization".

Simulcast Equalization

This section defines simulcast equalization for simulcast operation. The rest of the section gives the specific procedures for configuring a station for simulcast equalization.

Simulcast Operation

A simulcast system covers a continuous geographic area with more than one station transmitter. In a simulcast system, every station sends a message at the same time. However, each transmitter may receive the message at a slightly different time because of delays in the system that vary from station to station. Every distribution path, wireline, radio link, or satellite, has a different signal arrival time to each transmitter.

Equalization introduces delays to stations nearest the source. These delays cause the stations to wait a programmed length of time before paging to ensure that they are simulcast with stations farther from the source. val to each transmitter from the paging terminal. The NAC has a 0 to 262.143 ms variable delay (Digital Delay Line) that is controlled from the front panel or from the Advanced Simulcast Controller (ASC).

Automatic Delay

Automatic Delay Equalization is an equalization system for the outbound station control path. The consists of the ASC 1500 controller, a NAC stations, and at least one *Spectra-TAC* monitor receiver system. The ASC 1500 measure station closed loop audio propagation delays individually and compares all the stations in the system. The ASC uses these readings to adjust the system for simulcast transmission.

Delay measurements use an analog closed loop path from the ASC 1500 to the station and back (see Figure 11-6). The analog closed loop path consists of the following items:

- Outbound control path from the ASC to the station (wireline or RF link)
- Station analog transmit audio path with digital delay line
- RF transmission from the station to a Spectra-TAC monitor receiver
- Return dedicated phone line from the *S*pectra-TAC monitor receiver to a Spectra-TAC voting comparator
- Audio link to the ASC.

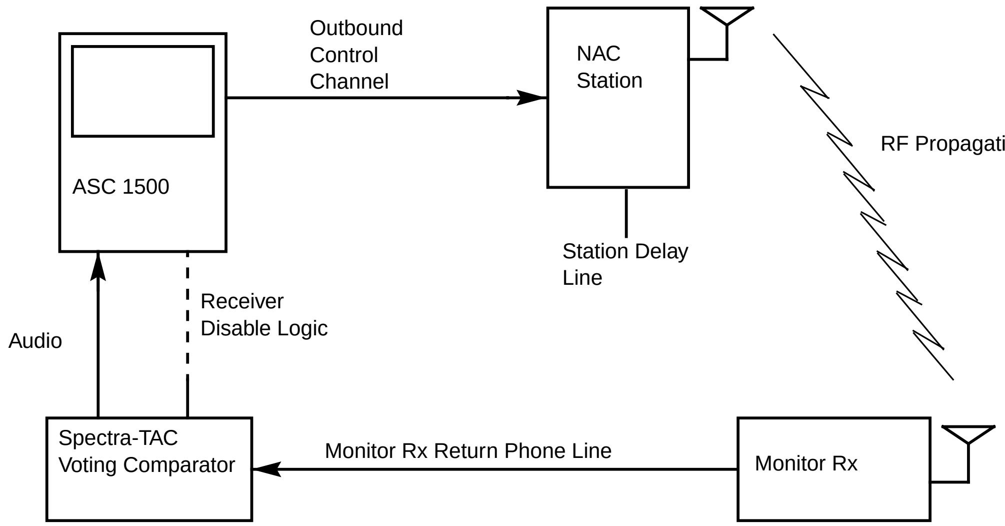


Figure 11-6: Closed Loop Audio Delay Measurement

The ASC uses the following procedure to calculate the delay for each transmitter:

1. The ASC mutes all receivers except the one programmed as the monitor receiver for the station being tested.
2. The ASC keys the station in the analog mode.
3. After 100 ms the ASC sends the equalization timing pattern.
4. The station transmits the equalization test signal to the monitor receiver.
5. The monitor receiver reads the transmitter RF signal.
6. The monitor receiver sends the signal to the Spectra-TAC.
7. The comparator gates the audio through an SQM.
8. The comparator passes the audio to the ASC.

   Perform one of the following procedures to ensure equalization:

   – Automatic station configuration (see paragraph, "Station Configuration for Automatic Delay Equalization")
   – Analog equalization setup (see paragraph, "Analog Equalization Setup")
   – Remote carrier frequency adjust (see paragraph, "Remote Carrier Frequency Adjust")

Station Configuration for Automatic Delay Equalization

Use the following procedure to configure the station for automatic delay equalization:

1. From the READY prompt, press **<RX>** to access the Receive Audio menu.

   The display briefly shows the RX menu, then shows the first submenu:

   INPUT AUDIO FROM

2. Press **<down arrow>** to access the DELAY submenu.

   The display shows the current value.

   DELAY ENABLE

   or

   DELAY DISABLE

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. If delay is already enabled, go to Step 6. If delay is disabled, press **<TOG>** to select **ENABLED**.

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

6. Press **<EXIT>** twice to return to the READY prompt.

7. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY DISABLED

8. Press **<down arrow>** to access the EXTERNAL PAGING DATA SETUP submenu.

9. Press **<ENT>**.

10. Press **<down arrow>** to access DELAY PATH.

    The display shows the current value.

11. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

12. Press **<TOG>** to select **DIGITAL**.

13. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

14. Press **<EXIT>** twice to return to the READY prompt.

15. From the READY prompt, press **<TX>** to access the Transmit menu.

    The display briefly shows the TX menu, then shows the first submenu:

    FREQ ADJUST

16. Press **<down arrow>** to access the GT NOTCH submenu.

    The display shows the current value.

17. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

18. Press **<TOG>** to select **DISABLED**.

19. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

20. Press **<EXIT>** twice to return to the READY prompt.

21. Calibrate the VCO sensitivity (see paragraph, "VCO Modulation Sensitivity Calibration").

22. From the READY prompt, press <TX> to access the Transmit menu.

    The display briefly shows the TX menu, then shows the first submenu:

    FREQ ADJUST

23. Press **<down arrow>** to access the AUDIO DEVIATION submenu.

    The display shows the current value.

24. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

25. Type a value in the range 3.0 to 4,0 kHz and press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

26. Configure the transmit audio response to be flat (see paragraph, "Transmit Audio Response").

27. Press **<EXIT>** twice to return to the READY prompt.

Analog Equalization Setup

In analog simulcast systems, especially those with voice paging, the audio response for all stations must match. When a NAC station is installed in a system with other types of transmitters, the NAC station requires adjustment for the audio response.

Use the following procedure to configure analog equalization:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<down arrow>** to access the ANLG EQ FILTER submenu.

   The display shows the current value.

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to select one of the following:

   – **ENABLED** for networks where some transmitters do not have advanced control

   – **DISABLED** for networks that do have advanced control

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

6. Press **<EXIT>** once.

7. Press **<down arrow>** to access the SPECIAL TX SETUP submenu.

   The display shows the current value.

8. Press **<ENT>**.

   The display shows Audio Phase Invert option.

9. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

10. Press **<TOG>** to select the correct audio phase inversion (see Table 11-1).

Table 11-1: Mixed Analog Simulcast Setup

First Station	Second Station and Control Type	Control	Delay 1	Delay 2	Invert Audio Phase
NAC	Micor ACB	Wireline	150 µs	0 µs	Yes
		Link	118 µs	0 µs	Yes
	Micor TRC	Wireline	0 µs	2590 µs	Yes
		Link	0 µs	2560 µs	Yes
	PURC 5000 TRC	Wireline	0 µs	2560 µs	Yes
		Link	0 µs	2560 µs	Yes
	PURC 5000 ACB	Wireline	0 µs	0 µs	No
		Link	0 µs	0 µs	No

11. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

12. Press **<EXIT>** twice to return to the READY prompt.

13. From the READY prompt, press **<RX>** to access the Receive Audio menu.

    The display briefly shows the RX menu, then shows the first submenu:

    INPUT AUDIO FROM...

14. Press **<down arrow>** to access the Delay (value) submenu.

15. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

16. Type a value in the range 0 to 262.143 ms. Do not type the decimal point; it is in a fixed position.

17. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

Remote Carrier Frequency Adjust

The carrier frequency adjust feature remote control of the station transmit carrier frequency from the ASC. The NAC board fine tunes an ultra high stability oscillators (UHSO) or high stability oscillator (HSO) steering line to increase or decrease the transmit frequency. Fine tuning consists of 99 steps: 49 steps for decrementing the value and 50 steps for incrementing the value, centered around 0 (see Table 11-2).

Note: Motorola sets the remote frequency adjustment potentiometer to +0 steps. Centering around 0 provides maximum swing up and down for fine tuning the carrier frequency.

Table 11-2: HSO and UHSO Frequency Adjustments

Band	Minimum Change per Single Step		Average Change per Single Step		Average Change for 99 Steps (-49 to +50)	
	UHSO	HSO	UHSO	HSO	UHSO	HSO
VHF	0.21 Hz	0.83 Hz	0.24 Hz	0.94 Hz	23.8 Hz	93.0 Hz
280 MHz	0.41 Hz	1.65 Hz	0.48 Hz	1.86 Hz	47.5 Hz	183.9 Hz
UHF	0.58 Hz	2.35 Hz	0.69 Hz	2.66 Hz	68.1 Hz	263.6 Hz
900 MHz	1.27 Hz	5.14 Hz	1.50 Hz	5.80 Hz	148.6 Hz	574.7 Hz

Use the following procedure to adjust the frequency:

1. From the READY prompt, press **<TX>** to access the Transmit menu.

   The display briefly shows the TX menu, then shows the first submenu:

   FREQ ADJUST

2. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

3. Type a value for the frequency adjust. If the value is negative, press **<TOG>** to change the sign.

   The range is -49 to 50 in increments of 1.

   The display stops flashing to show the NAC has stored the value.

4. Press **<EXIT>** twice to return to the READY prompt.

NAC Alarm Configuration and Verification

This chapter describes alarms for the Nucleus paging station with Advanced Control. A NAC system may use one or more of the following methods:

- Alarm polling
- Unsolicited alarm reporting (UAR)
- ASCII diagnostics
- Wildcard inputs

This chapter contains the following information:

Alarm Definitions

This section defines the alarms:

- Option alarms (see Table 12-1)
- Station alarms (see Table 12-2)
- MDC alarms (see Table 12-3)
- RS-232 communication alarms (see Table 12-4)
- LAN communication alarms (see Table 12-5)
- Miscellaneous alarms (see Table 12-6)
- Switchover alarms (see Table 12-7)

Table 12-1: Option Alarms

Alarm Name	Interpretation[1]
Binary Airtime Overflow	Airtime counter for binary key-ups overflows its upper bound
Analog Airtime Overflow	Airtime counter for analog key-ups overflows its upper bound
Binary Timeout Dekey	Station dekeys during a binary key for a reason other than a proper dekey command.
Analog Timeout Dekey	Station dekeys during an analog key for a reason other than a proper dekey command
Binary Key Count Overflow	Counter of binary keyups overflows it upper bound
Analog Key Count Overflow	Counter of analog keyups overflows it upper bound
Redundancy Switchover	Station was switched out of the system due to an active Redundancy Switchover Alarm

1. The system clears these alarms when the condition is corrected by internal operation.

Table 12-2: Station Alarms (Sheet 1 of 2)

Alarm Name	Interpretation	Condition for Clearing
PA Fault 1	Key request is present, but the exciter stops keying	Exciter becomes active on the next key request.
PA Fault 2	- PA transmits insufficient power - PA transmits too much power - Fans fail	PA module becomes active on the next key request.
PA Cutback	$\overline{\text{PA ON}}$ is active, but the PA Full LED is not lit; station operates at reduced power	PA Full LED lights on the next key request.
Synthesizer Out-of-Lock	Out-of-lock alarm from the exciter is present	Transmitter synthesizer re-locks at the programmed frequency
Low Forward Power	Forward power drops below the forward power alarm threshold	Station key-up produces a forward power reading above the forward power alarm threshold.

Table 12-2: Station Alarms (Sheet 2 of 2)

Alarm Name	Interpretation	Condition for Clearing
High Reflected Power	Reflected power rises above the reflected power alarm threshold	Station key-up produces a reflected power reading below the reflected power alarm threshold.
High VSWR	Measured VSWR exceeds 5.0	Cannot clear itself.
Tx in Limit	Transmitter modulation circuitry limits output deviation to maximum deviation	Transmitter modulation circuitry no longer limits output deviation to maximum deviation.
High Tray Temperature	Ambient temperature exceeds the tray temperature alarm trip point	Ambient temperature no longer exceeds the Tray Temperature Alarm Trip Point.
Battery Revert	Station switches to battery power	Station switches back to AC power
Station Executed Reset	Station executes any reset	Cannot clear itself.
Diagnostics Failure	Station board-level self-diagnostic tests fail during a reset sequence	Cannot clear itself.
System Timer	System timer expired	The system timer restarts keyup.

Note: A momentary alarm is the latched version of a Station Alarm. A momentary alarm cannot clear itself, even when the condition that produced the alarm is corrected. The momentary alarms are:

- *PA Fault 1*
- *PA Fault 2*
- *PA Cutback*
- *Synthesizer Out-of-Lock*
- *Low Forward Power*
- *High Reflected Power*
- *High VSWR*
- *TX in Limit*
- *High Tray Temperature*
- *Battery Revert*
- *Station Executed Reset*
- *Diagnostics Failure*
- *System Timer*

Table 12-3: MDC Communication Alarms

Alarm Name	Interpretation[1]
MDC RX Wrong Sys Id	Received message contained the wrong System ID
MDC RX Undefined Reg	Received a command to read an illegal register
MDC RX Undefined Cmd	Received a command cannot be executed
MDC RX Protected Reg	Command cannot write to a register
MDC RX Invalid Sequence	Out-of-sequence message
MDC RX System ID Access	Attempt to write to the System ID when access is no allowed

1. The system ignores these alarms.

Table 12-4: RS-232 Communication Alarms

Alarm Name	Interpretation[1]
RS-232 Wrong Sys ID	Received message contained the wrong System ID
RS-232 Undefined Reg Access	Command to read an illegal register
RS-232 Undefined Cmd	Illegal command
RS-232 Protected Reg Access	Command to write to an illegal register
RS-232 Invalid Sequence	Out-of-sequence message
RS-232 System ID Access	Attempt to write to the System ID when access to the System ID is not allowed
RS-232 Dial-In Invalid Pswd	Invalid attempt to log in to the station via the RS-232 communications port
RS-232 Hang Up/Time Out	Inactive RS-232 port more than five minutes and the station disconnected prior to a logout
RS-232 Dial-Out Max Retries	Station tried to dial out to the controller; unable to connect for several attempts were made
RS-232 No Dial-Out Ph	Station attempted to dial out but was unable to because a dial-out phone number was not programmed

1. The system ignores these alarms.

Table 12-5: LAN Communication Alarms

Alarm Name	Interpretation[1]
LAN Wrong Sys ID	Received message contained the wrong system ID
LAN Undefined Reg Access	Command to read an illegal or undefined register
LAN Undefined Cmd	Received message was to execute an undefined command
LAN Protected Reg Access	Command to write to a register that cannot be written
LAN Invalid Sequence	Out-of-sequence message
LAN System ID Access	Attempt to write to the System ID when access to the System ID is not allowed.
LAN Master Failed to Respond	N group station on the LAN: station has no activity for 10 seconds
LAN Slave Failed to Respond	+1 station on the LAN: N group station fails to respond
Minor/Momentary Alm on LAN	+1 station on the LAN: N group station has a minor or momentary alarm
Major Alm on LAN	+1 station on the LAN: N group station has a major alarm

1. The station ignores these alarms.

Table 12-6: Miscellaneous Alarms

Alarm Name	Interpretation
Wild Card Input 1 through Wild Card Input 8	Failure on programmed wildcard input
Paging Keyup Disable	Station disabled from remote paging keyups
No Modem Response	Station enabled for smart modem operation but no modem was connected.
Modem Dial Out Timer Expired	- The modem wait period for carrier is longer than the station's dial-out timer. - The modem failed to respond to a Hayes® AT dial-out command.
No Dialtone/Carrier Modem	Modem failure: phone line interruption
NAC LAN - Line Failure	LAN failed
Incompatible HW/SW	NAC hardware and software are not compatible

Table 12-7: Switchover Alarms

Alarm Name	Interpretation
Switchover Alarm on LAN ID 1, 2, 3, OR 4	Alarm on an N group station in a redundant group
SWITCHOVER FOR LAN ID 1, 2, 3, or 4	+1 station has switched in for an N group station
LAN FAILURE - NO RESP LAN ID 1, 2, 3, or 4	LAN connection to the station with LAN ID 1, 2, 3, or 4 is damaged
Hot Standby Slave Key Failure	N group station failed to key
Hot Standby Master Key Failure	+1 station failed to key
Front Panel Forced Switchover	Switchover was forced from the front panel

Alarm Polling

The Advanced Simulcast Controller (ASC) 1500 initiates alarm polling. When the ASC polls the station, the station reports forward power, reflected power, and alarm status. If the station has active alarms, the ASC reads the alarm information, logs it into the ASC database, and clears the station's alarms (if possible). This method uses the least amount of communication. Alarm polling requires digital remote control (DRC). The return path from the station to the ASC can be a dedicated Wildcard, a dial-up phone line (using modems), or over-the-air (RF). If the return path is a dial-in phone line, the station and the ASC require modems.

Alarm Polling for a Direct Line

Use the following procedure to configure alarm polling if the NAC uses a dedicated phone line for alarm polling:

1. From the READY prompt, press **<STN>** to access the Station menu.

   The display briefly shows the STN menu, then shows the first submenu:

   STATION CONTROL SETUP

2. Press **<down arrow>** to access the DRC SETUP submenu.

3. Press **<ENT>**.

4. Press **<down arrow>** to access POLL RESPONSE VIA.

5. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select:
   – **LINE 2** for Wildcard return path
   – **RF** for over-the-air return path

7. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

8. Press **<EXIT>** twice to return to the READY prompt.

Polling Setup Procedure (Dial-Up Phone Line Only)

Use the following procedure to configure polling if the NAC uses a dial-up phone line for polling.

1. From the READY prompt, press **<OPT2>** to access the Options 2 menu.

   The display briefly shows the OPT2 menu, then shows the first submenu:

   COMM OPTIONS

2. Press **<down arrow>** to access the RS232 DIAL IN SETUP submenu.

3. Press **<ENT>**.

4. Press **<down arrow>** to access POLL RESPONSE VIA.

5. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

6. Press **<TOG>** to select: **ENABLED**.

7. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

8. Press **<EXIT>** once to return to RS232 DIAL IN SETUP.

9. Press **<down arrow>** to access ANSWER ON RING #.

10. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

11. Press **<TOG>** to select: the correct number of rings.

12. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

13. Press **<EXIT>** once to return to RS232 DIAL IN SETUP.

14. Press **<ENT>**.

15. Press **<down arrow>** to select the modem option. The display shows one of the following:
    – NO MODEM CONNECTED
    – SMART MODEM CONNECTED

Note: To configure a modem for the NAC station see paragraph, "Modem Connections for Alarm Reporting".

16. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

17. Press **<TOG>** to select: **SMART MODEM CONNECTED**.

18. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

19. Press **<EXIT>** once to return to RS232 DIAL IN SETUP.

20. Press **<down arrow>** to access BAUD RATE.

21. Press **<ENT>**.

The display flashes to show the NAC has entered the edit mode.

22. Type the correct value for the modem (1200). and press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

23. Press **<EXIT>** twice to return to the READY prompt.

Unsolicited Alarm Reporting (UAR)

The station initiates UAR communication with the ASC 1500 when the station discovers an alarm in its own operation. The station continues reporting an alarm until the ASC acknowledges it. UAR also requires DRC. The UAR path from the station to the ASC 1500 must be a dedicated Wildcard or a dial-up phone line (using modems).

In a redundant system, the +1 station initiates UAR communication when it polls a station in the N group and discovers an alarm in the N group station.

If the system uses a dedicated Wildcard, the ASC waits for a pause in paging traffic. During this pause, the ASC interrogates the station for detailed alarm information. If the system uses a dial-up phone line, the station dials the ASC. The ASC retrieves the alarm information by modem without inhibiting paging traffic.

Setting up UAR

Note: UAR reduces the need to do alarm polling, but Motorola recommends an occasional full system poll to ensure the communications path from the station to the ASC is operational.

The station and the ASC must have Hayes-compatible 1200 baud modems access to dial-up phone lines. When the station sends a UAR to the ASC, the ASC retrieve the alarm information, logs it, attempts to clear the alarm, and hangs up when processing is complete. Other stations that call the ASC receive a busy signal during alarm processing. A station that gets a busy signal continues to call until it reaches the ASC.

The station modem is external or internal. The external modem is attached to connector J14 on the backplane with an RS-232 connector. Motorola installs the internal modem (Option C474) during manufacturing.

Use the following procedure to configure UAR:

1. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

2. Press **<down arrow>** to access the UNSOLICITED ALM REPORTING submenu.

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to select: **ENABLED**.

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

6. Press **<EXIT>** once to return to UNSOLICITED ALM REPORTING.

7. Press **<down arrow>** to access UNSOLICITED ALARMS ON.

8. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

9. Press **<down arrow>** to select **ALL**.

10. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

11. Press **<EXIT>** once to return to the UNSOLICITED ALM REPORTING submenu.

12. Press **<down arrow>** to access REPORT VIA.

13. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

14. Press **<TOG>** to select:
    - **LINE 2** for a dedicated wildcard
    - **RS232** for a dial-up phone line

15. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

16. Press **<EXIT>** twice to return to the READY prompt.

17. From the READY prompt, press **<STN>** to access the Station menu.

    The display briefly shows the STN menu, then shows the first submenu:

    STN TYPE

18. Press **<down arrow>** to access the STATION CONTROL SETUP submenu.

19. Press **<ENT>**.

20. Press **<down arrow>** to access DRC SETUP.

21. Press **<ENT>**.

22. Press **<down arrow>** to access ATC ID.

23. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

24. Type a value for the ATC ID and press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

25. Press **<EXIT>** twice to return to the READY prompt.

Dial-up Phone Line Only

Use the following procedure to configure a dial-up phone line for UAR:

1. From the READY prompt, press **<OPT2>** to access the Communication Options menu.

   The display briefly shows the OPT2 menu, then shows the first submenu:

   RS232 DIAL IN SETUP

2. Press **<down arrow>** to access the RS232 DIAL OUT SETUP submenu.
3. Press **<ENT>**.
4. Press **<down arrow>** to access BAUD RATE.
5. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

6. Type **1200** and press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

7. Press **<EXIT>** once to return to the OPT2 menu.
8. Press **<down arrow>** to access RS232 DIAL OUT SETUP.
9. Press **<ENT>**.
10. Press **<down arrow>** to access PHONE NUMBER.
11. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

12. Type a phone number with as many as 18 digits and press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

13. Press **<down arrow>** to access PAUSE AFTER 1ST DIGIT.
14. Press **<TOG>** to select **DISABLED**.
15. Press **<ENT>**.
16. Press **<down arrow>** to access DIAL OUT VIA.
17. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

18. Press **<TOG>** to select:

– **TONE** if the telephone network uses Touch-Tone®
– **PULSE** if the network uses rotary-dial pulse

19. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

20. Press **<down arrow>** to access NUMBER OF ATTTEMPTS BEFORE ALAM.

21. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

22. Press **<TOG>** to select:
    – **DISABLED** to disable the RS-232 Dial-Out Max Retries Comm Alarm feature
    – **BEFORE ALM 2** to select two failed UAR retries
    – **BEFORE ALM 5** to select five failed UAR retries
    – **BEFORE ALM 10** to select ten failed UAR retries

23. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

24. Press **<EXIT>** to return to the OPT2 menu and the RS232 DIALIN SETUP submenu.

25. Press **<ENT>**.

26. Press **<down arrow>** to select the modem option. The display shows one of the following:
    – NO MODEM CONNECTED
    – SMART MODEM CONNECTED

Note: To configure a modem for the NAC station see paragraph, "Modem Connections for Alarm Reporting".

27. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

28. Press **<TOG>** to select: **SMART MODEM CONNECTED**.

29. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

30. Press **<EXIT>** twice to return to the READY prompt.

ASCII Diagnostics

The NAC board transmits ASCII text communications through an RS-232 port for display on a VT100 terminal, simulating the station's front-panel keypad, display, and LEDs. A technician can use a terminal to interrogate the NAC, access parameter and function menus, and display front panel LEDs in real time. This connection requires modems.

NAC supports ASCII text communications through the RS-232 port, J14. ASCII communication simulates the station's front-panel keypad, display, and LEDs. This connection uses modems. The technician can dial into the NAC from a remote location and access all station parameters. ASCII diagnostics also display front panel LEDs in real time.

Modem Setup

The station modem is external or internal. An external modem uses J14 on the backplane with an RS232 connector. An internal modem is installed during manufacturing.

Use the following procedure during initial installation to configure ASCII diagnostics from the front panel:

1. From the READY prompt, press **<OPT2>** to access the Communication Options menu.

   The display briefly shows the OPT2 menu, then shows the first submenu:

   COMM OPTIONS

2. Press **<down arrow>** to access the RS232 DIAL OUT SETUP submenu.

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. Type **1200** and press **<ENT>** to configure this rate.

   The display stops flashing to show the NAC has stored the value.

5. Press **<down arrow>** to access RS232 DIAL IN SETUP.

6. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

7. Press **<TOG>** to select **ENABLED**.

8. Press **<ENT>**.

9. Press **<down arrow>** to access ANSWER ON RING #.

10. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

11. Press **<TOG>** to select a value in the range 1 through 4.

12. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

13. Press **<EXIT>** to access RS232 DIAL IN SETUP.

14. Press **<down arrow>** to select the modem option. The display shows one of the following:
    - NO MODEM CONNECTED
    - SMART MODEM CONNECTED

Note: To configure a modem for the NAC station see paragraph, "Modem Connections for Alarm Reporting".

15. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

16. Press **<TOG>** to select: **SMART MODEM CONNECTED**.

17. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

18. Press **<EXIT>** twice to return to the READY prompt.

19. From the READY prompt, press **<DIS>** to access the DISABLE ACCESS menu.

    The display briefly shows the DIS menu, then shows the first submenu:

    ACCESS

20. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

21. Press **<TOG>** to select **ENABLED**.

22. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

23. Press **<EXIT>** once to return to the READY prompt.

VT100 Dumb Terminal Configuration

Use the following procedure to configure a VT100 terminal:

1. Configure the RS-232 serial communications port set for asynchronous communication with 8 data bits, 1 stop bit, and no parity.

2. Configure the modem for 1200 baud.

3. Configure the serial port in full duplex mode with no local echo.

4. Configure the VT100 to use the VT100 protocol.

5. Configure the terminal width for 80 characters.

6. If the VT100 dumb terminal uses an underline cursor and audible beeps enable them.

7. Connect the terminal end of the cable to the terminal Datacom serial port.

8. Connect the DB-25 mail connector to J61.

Personal Computer as a Terminal Emulator

A personal computer used as the remote terminal with a VT100 emulator software package. This computer must meet the following requirements:

- IBM® PC, XT, AT, PS/2 or compatible
- MS-DOS or PC-DOS version 2.0 or later operating system
- RS-232 serial communications port set for asynchronous communication with 8 data bits, 1 stop bit, and no parity
- 1200 baud rate
- Serial port in full duplex mode

Use the following procedure to connect and configure the PC:

1. Connect the DB-25 cable to the COM1 port on the PC.

2. Connect the DB-25 cable to J61 on the station.

3. Boot the terminal emulation program. Type:

   <program command + CR>

4. Press **<ALT + P>** to configure port settings.

5. Configure the computer for the following communication attributes:
   - 1200 baud
   - 8 data bits
   - 1 stop bit
   - no parity

6. Select the COM port.

7. Press **<ESC>**.

8. Type **<ALT + S>** for the setup utility.

9. In the setup utility, select **Choose Terminal Options**.

10. Configure the following characteristics:
    – Terminal emulation = VT100
    – Full duplex
    – Terminal width = 80 characters
11. Press **<Esc>**.
12. Select Display / Sound Options.
13. Turn on sound effects and alarm sound.
14. Select line as the cursor type.
15. Press **<ESC>** twice.
16. Select Protocol Options.
17. Disable Local Echo.
18. Press **<ESC>** several times to exit configuration.

Apple Macintosh Computer (VT100 Emulator) Setup

An Apple Macintosh® computer used as the remote terminal with a VT100 emulator software package must meet the following requirements:

- Apple Macintosh operating system
- RS-232 serial communications port set for asynchronous communication with 8 data bits, 1 stop bit, and no parity
- 1200 baud
- Serial port in full duplex mode

Note: This connection requires an Apple Macintosh IIe modem-8 cable (part number A2C0311).

Use the following procedure to configure the Apple Macintosh computer.

Note: The Product Group has qualified MicroPhone® software for Apple Macintosh computers. This procedure is based on MicroPhone software.

1. Boot MicroPhone.
2. Double click the mouse on the MicroPhone icon.
3. Move the cursor to the Settings menu. Hold down the mouse button.

   The system displays the Settings menu.
4. Select the Communications category and release the mouse button.

The software displays the Communications screen.

5. Configure the following items:
   - 1200 baud
   - 8 data bits
   - 1 stop bit
   - No parity
   - Activate phone connection port
   - Deactivate hardware handshaking

6. Click on OK.

7. Move the cursor to the Settings menu item and hold down the mouse button.

8. Select the Terminal category and release the mouse button. The software displays the Terminal screen.

9. Set the following by clicking on the mouse button:
   - VT VT102 emulation
   - ANSI mode
   - Column width =80
   - 9-point or 12-point font size
   - Activate underline cursor shape
   - Deactivate local echo
   - Deactivate auto line feed
   - Deactivate auto wraparound
   - Activate backspace key

10. Click on OK.

Dialing the Station with the Remote Terminal

Note: Save all terminal configuration data before attempting to dial the station for the first time.

Use the following procedure to dial into the station:

1. Type the following Hayes AT command:

   ATX4E1V1Q0 <CR>

2. Type the following command:

   ATDT####### <CR>

   The terminal responds:

   Connect

   The station requires approximately five seconds to make the connection.

3. Type the following command:

   ASCII <CR>

   The station changes the RS-232 communication format from DRC to ASCII.

Terminal Operation

The terminal interface corresponds to the keys on the NAC front panel (see Table 12-8).

Table 12-8: ASCII Diagnostics Function Keys Related to NAC Front Panel Keys

NAC Front Panel	Function	Remote Terminal Equivalent
<ENT>	Process menu selection	<CR> (Carriage return)
<TOG>	Edit menu selection	<SP> (Space)
	Add minus sign	<->)Minus sign)
<EXIT>	Exit from menu	
<up arrow>	Move up one menu selection	Up Arrow key
<down arrow>	Move down one menu selection	Down Arrow key

Initial Screen Messages

This section displays screen messages during the login procedure.

- Initial, successful login message (see Figure 12-1)
- Initial, unsuccessful login message (see Figure 12-2)
- Password screen (see Figure 12-3)
- Main menu (see Figure 12-4)

Note: The password screen does not appear if the password is disabled.

```
WELCOME TO MOTOROLA INC
NUCLEUS PAGING BASE STATION
ASCII DIAGNOSTICS

PRESS <CR> TO CONTINUE
```

Figure 12-1: Initial, Successful Login Screen

SORRY – BUT THE NUCLEUS PAGING BASE STATION IS BUSY.
PLEASE TRY AGAIN LATER

Figure 12-2: Initial, Unsuccessful Login Screen

ENTER PASSWORD:

ENTER IN ‘0–9’ THEN

ENTER CARRIAGE RETURN TO PROCESS DATA OR

ENTER ‘X’ TO EXIT

Figure 12-3: Enter Password Screen

```
MAIN MENU
STN–STATION
RX–RECEIVER AUDIO
TX–TRANSMIT
OPT 1–STATION OPTIONS
OPT 2– COMMUNICATION OPTIONS
ASET–ALARM SETUP
STAT–STATION STATUS
CNFG–STATION CONFIGURATION
ALARMS–ALARMS
SERV–SERVICE MODE
ACC DS–ACCESS DISABLE
ALGN–STATION ALIGNMENT
LEDS–STATION LED INDICATORS
RESET–STATION RESET
QUIT AND DISCONNECT LINE

USE UP AND DOWN ARROW KEYS TO SELECT AND ENTER <CR>
TO PROCESS SELECTION
```

Figure 12-4: Main Menu

The ASCII Diagnostics MAIN MENU represents a listing of the front panel keys and additional functions. Use **<up arrow>** and **<down arrow>** to select menu items.

Inactivity Timer

The inactivity timer disconnects the terminal interface after the timer expires. After remote login, the timer starts running each time input from the terminal ends. If the timer expires before additional keystrokes, the station disconnects the interface. The timer is configured for five (5) minutes.

Use the following procedure during the first login to ensure continued logins:

1. From the main menu, select **OPT2** to access the Communication Options menu.
2. From the COMM OPTIONS menu, select RS232 DIAL IN SETUP>DIAL IN and enable this option.
3. Select RS232 DIALIN SETUP>ACC DS\ACCESS and enable this option.
4. Press **<ESC>** three times to return to the MAIN MENU.

Wildcard Inputs/Outputs

The NAC uses the Wildcard interface to sense an external logic switching states (wildcard input) or to control an external peripheral device (wildcard output). Wildcard inputs are TTL inputs. When a wildcard input is active, the wildcard alarm triggers. The controller reads these triggers during diagnostic polling or a UAR. Wildcard outputs are open-collector transistor outputs. When an output signal is active, the corresponding open collector goes low (ON). The front panel provides programing control of each wildcard input or output.

Wireline inputs and outputs are control signal interfaces used as follows:

- External logic switch states (wild card inputs)
- External peripheral device control (wild card output)

Note: When the transmitter is in TRC mode, you cannot modify these parameters. The wildcard outputs will act as outputs for predetermined alarms and status indicators.

Use the following procedure to enable inputs and outputs:

1. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

2. Press **<down arrow>** to access the WILD CARD INPUT SETUP submenu

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. Press **<TOG>** to configure the input.

5. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

6. Press **<down arrow>** to access the next Wild Card input.

7. Repeat Step 2 through Step 6 to configure the wildcard inputs.

8. Press **<EXIT>** to return to the READY prompt.

9. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

10. Press **<down arrow>** to access the WILD CARD OUTPUT SETUP submenu.

11. Press **<ENT>**.

    The display flashes to show the NAC has entered the edit mode.

12. Press **<TOG>** to configure the input.

13. Press **<ENT>**.

    The display stops flashing to show the NAC has stored the value.

14. Press **<down arrow>** to access the next wildcard input.

15. Repeat Step 10 through Step 14 to configure the wildcard inputs.

16. Press **<EXIT>** to return to the READY prompt.

Alarm Verification Relay

The alarm verification relay responds to selected station alarms. It operates in two modes:

- In the alarm mode, the NAC logically ORs all selected alarms together.
- In the verify mode, the NAC logically NORs the alarms together.

An optional tone also provides alarm information, The relay outputs are on the station backplane.

This section describes configuration for the alarm verification relay and the optional tone.

Alarm Verification Relay

The alarm verification relay is a DPDT relay on the NAC Wildcard Interface Board (WIB) that responds to selected station alarms (see Figure 12-5).

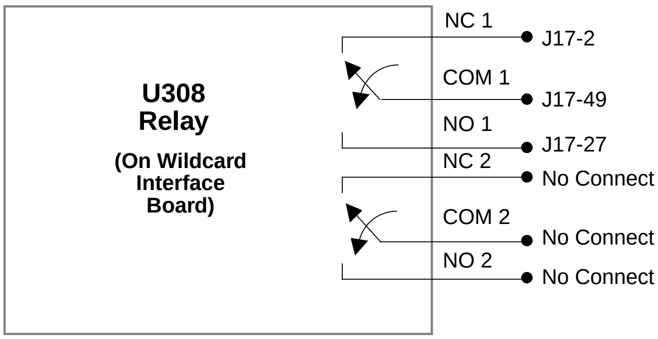


Figure 12-5: Alarm Verification Relay

Use the following procedure to enable the alarm verification relay:

1. From the READY prompt, press **<ASET>** to access the Alarm Setup menu.

   The display briefly shows the ASET menu, then shows the first submenu:

   STATION OPTIONS

2. Press **<down arrow>** to access the ALM VERIFICATION RELAY submenu.

3. Press **<ENT>**.

4. Press **<down arrow>** to access the RELAY submenu.

5. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

6. Press <**TOG**> to select **ALARM MODE**.

7. Press <**ENT**>**.**

   The display stops flashing to show the NAC has stored the value.

8. Press <**down arrow**> to access ALM VERIFICATION RELAY.

9. Press <**ENT**>.

   The display shows the first alarm:

   OPT ALARM

   The display flashes to show the NAC has entered the edit mode.

10. Press <**TOG**> to select **ENABLED**.

11. Press <**ENT**>.

    The display stops flashing to show the NAC has stored the value.

12. Press <**down arrow**> to access the rest of the alarms:
    – REDUNDANCY SWITCH OCCURRED
    – STN ALARM
    – PA FAULT 1
    – PA FAULT 2
    – PA CUTBACK
    – SYNTH OUT OF LOCK
    – LOW FORWARD POWER
    – HIGH REFLECTED POWER
    – HIGH VSWR
    – TX IN LIMIT
    – HIGH TRAY TEM
    – BATTERY REVERT
    – STN EXECUTED RESET
    – DIAG FAILURE
    – SYSTEM TIMER

13. Repeat Step 10 through Step 12 to enable the rest of the alarms.

14. Press <**ENT**>.

15. Press <**up arrow**>.

16. The display shows the first MISC ALARM.

    WILD CARD INPUT 1

17. Press <**ENT**>.

The display flashes to show the NAC has entered the edit mode.

18. Press **<TOG>** to enable this alarm.

19. Press**<ENT>**.

    The display stops flashing to show the NAC has stored the value.

20. Press **<down arrow>** to access the rest of the alarms:
    - WILD CARD INPUT 2
    - WILD CARD INPUT 3
    - WILD CARD INPUT 4
    - WILD CARD INPUT 5
    - WILD CARD INPUT 6
    - WILD CARD INPUT 7
    - WILD CARD INPUT 8
    - PAGING KEYUP DISABLE
    - NO MODEM RESPONSE
    - MODEM DIAL OUT TIMER EXPIRED
    - NO DIALTONE/CARRIER MODEM
    - NAC LAN - LINE FAILURE
    - EE DATA MODIFIED

21. Repeat Step 18 through Step 20 to enable the rest of the alarms.

22. Press **<EXIT>** twice to return to the READY prompt.

Alarm Verification Tone

In cases where an alarm or verification tone is preferred to a relay closure, the NAC encodes a 387 Hz tone to Line 2 when all alarms are inactive. Use the following procedure to enable this tone:

1. From the station backplane, connect pin 4 to pin 29 on the orange connector.

2. From the READY prompt, press **<OPT1>** to access the Station Options menu.

   The display briefly shows the OPT1 menu, then shows the first submenu:

   SPECIAL KEY SETUP

3. Press **<down arrow>** to access the 387 VERIFICATION TONe submenu.

4. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

5. Press **<TOG>** to select **ENABLED**.

6. Press **<ENT>**.

The display stops flashing to show the NAC has stored the value.

7. Press **<EXIT>** twice to return to the READY prompt.

Modem Connections for Alarm Reporting

This section describes the modems required for alarm reporting.

Modem Requirements

Modems provide one communication option for alarm polling and UARs. ASCII diagnostic require modems for the communication link between the NAC and the terminal or computer (unless the terminal/computer is connected to the station locally).

The station and terminal/computer modems must meet the following communications requirements:

- The data format is serial, binary, and asynchronous, with 8 data bits, 1 stop bit, and no parity.
- The dialing is Touch-Tone® or rotary-dial pulse dialing.
- The data rate is 1200 baud.
- The port interface follows an RS-232C standard.
- The modem must accept Hayes® "AT" software commands (this includes "AT" S-Register commands).
- The modem is internally set or can be configured to ignore the data terminal ready (DTR) pin signal.
- The modem is internally set or can be configured to assume that the data carrier detect (DCD) pin signal is always present.

The station accepts an internal or external modem. Motorola installs the internal modem option, C474, during manufacturing. Attach an external modem to connector J14 on the backplane.

The following modems are acceptable as a station external modem or as a terminal/computer modem:

- Hayes Smartmodem 2400B–This modem does not require dual in-line package (DIP) switch settings. The station configures the modem automatically.
- UDS 2440–This modem has front panel configuration with a liquid crystal display (LCD) screen and three push-buttons (see Table 12-9 for configuration).
- Practical Peripherals PM1200SA Mini–This modem has DIP switches for configuration (see Table 12-10).
- US Robotics Sportster 2400–This modem has DIP switches for configuration (see Table 12-11).

Table 12-9: UDS 2440 Modem Configuration

Menu	Submenu	Option	Configuration	Note
Auto Ans			D	
Data Opts	Sync Mode		Async	
	DTE Options	DTE Echo	D	If modem is attached to a station
			E	If modem is attached to a terminal
		Clock Option	Internal	
		AT Commands	E	
	DCE Options	Raw and Mode	Auto/Dir	
		Low Rate	330	
		Bell/CCITT	Bell	For US
Options	Speaker Options			As Required
	Telephone Options	Line Type	Dial Up	
		Dial Type	NA	
		DTone Det	E	
		Busy Det	E	
		Tx Level	Permissive	
		Force A/O	Normal	
		Excl Key	D	
	Pin Opts	DTR Opts	0	
		DSR Opts	Forced	
		CD Opts	Normal	
		CTS Opts	Forced	
		P21	D	
		P23	D	
		P25	D	
		Rate Messages	E	
		Message Sets	Minimum Set	
		Con Messages	Minimum	
	Disc Options	Rx Space	D	
		CD Disc	E	
		Tx Space	D	

Table 12-10: Practical Peripherals PM1200SA Mini Configuration

Switch Number	Configuration	Note
1	On	Ignore DTR
2	Off	Full word result codes
3	On	Result codes enabled
4	On	Command echo off if modem is attached to the station
	Off	Command echo on if modem is attached to the terminal
5	On	Auto answer disabled
6	On	Ignore DCD
7	Off	Not used
8	On	Enabling AT commands
9	Off	Bell 103/212A
10	Off	M/S ratio in the US

Table 12-11: US Robotics Sportster 2400

Switch Number	Configuration	Note
1	Down	Ignore DTR
2	Up	Verbal word results
3	Down	Result codes enabled
4	Down	Echo suppressed if modem is attached to the station
	Up	Echo enabled if modem is attached to the terminal
5	Down	Auto answer disabled
6	Down	CD always on
7	Up	Loading modem attributes from user-defined nonvolatile memory
8	Down	Enable smart modem

Station to External Modem Cabling

Use a DB25 cable with a DB25 male connector attached to connector J14 on the station backplane. The other end of the cable is modem-dependent. The cable pin assignments are specified in Table 12-12.

Table 12-12: Station to External Modem Pin Assignments

Station Connector J14 or Terminal RS-232 Port (DB-25 Connector)		Modem RS-232 Port (DB-25 Connector)
Pin	**Signal Function**	**Pint**
1	Frame Ground	1
2	Transmitted Data	2
3	Received Data	3
4	Request to Send	4
7	Signal Ground	7
20	Data Terminal Ready	20

ASCII Diagnostics Terminal or Computer to Modem Cabling

For a VT100 used as a dumb terminal, the terminal end of the cable is typically a DB25 mal connector that attaches to the Terminal Datacomm serial port (see Table 12-13).

For a personal computer, the computer end of the cable is typically a DB25 mail connector that attaches to the compute COM1 port. The cable pin assignments are identical to the assignments for a VT100.

Table 12-13: Station to External Terminal Pin Assignments

Computer RS-232 Port (DB-9 Connector)		Modem RS-232 Port (DB-25 Connector)
Pin	**Signal Function**	**Pin**
2	Transmitted Data	2
3	Received Data	3
4	Request to Send	4
7	Signal Ground	7
20	Data Terminal Ready	20

Modem to Phone Network Cabling

The phone line connection for any external modem uses a telephone cable with RJ-11 connectors attached to the phone network and the modem Telco Port. If the paging station uses an internal modem, use the following procedure to connect the internal modem to the telephone port:

1. Strip the wire insulation from one end of the telephone cable.
2. Attach it to the J61 Wildcard modem connector (orange connector) on the backplane.
3. Attach the red wire to the MODEM + screw terminal of Line 2.

4. Attach the green wire to the MODEM - screw terminal of Line 2 on the Wildcard interface terminal block.

Local Connection Without Modems

Use the following procedure to create a local connection without modems:

Note: The terminal does not display the typed commands.

The NAC cannot perform UAR without a modem.

1. Use the same cable that attaches the VT100 terminal to the external modem. Use a modem adapter (product number 5805092T01) to the DB-25 male connector.

2. Attach one end of the converted cable to the VT100 terminal serial port.

3. Attach the other end to J14 on the station’s backplane.

4. Configure the terminal (see paragraph, "Station to External Modem Cabling"). The exception is that the terminal port setting must be NAC.

5. Configure the terminal for the following:
   - smart modem connected
   - alarms disabled from the ASC

Resetting Alarms

This section describes station and alarm reset procedure.

Note: When a n alarm title appears on the display, press **<up arrow>** *or* **<down arrow>** *to display other alarms. The display shows alarms that are set.*

Use the following procedure to clear an alarm:

1. From the READY prompt, press **<ALMS>** to access the Alarm menu.

   The display briefly shows the ALMS menu, then shows the first submenu:

   STATION ALMS

2. Press **<ENT>**.

   The display shows the first active alarm.

3. Press **<ENT>** to clear the alarm.

   The display shows the next active alarm.

4. Repeat Step 3 to clear all active alarms.

5. Press **<EXIT>** to return to the READY prompt.

Alarm Configuration for Alarms Based on Thresholds

Most alarms are based on a simple on-off decision. For example, if the station receives a key command and fails to key, the system has an alarm condition.

However, some alarms are based on achievement of a threshold. These thresholds require configuration (see Table 12-14). An example of an alarm with a threshold is forward power. The station is configured for a specific forward power reading. If the station achieves some forward power level, but that level is below the threshold, the station declares an alarm.

Use the following procedure to configure the alarms based on thresholds:

1. From the READY prompt, press <**ALMS**> to access the Alarm menu.

   The display briefly shows the ALMS menu, then shows the first submenu:

   STATION ALMS

2. Press <**down arrow**> to access the ALRM SETUP submenu.

3. Press <**ENT**>.

   The display flashes to show the NAC has entered the edit mode.

4. Configure each alarm to set its threshold (see Table 12-14).

5. Press <**ENT**> to store the threshold.

   The display stops flashing to show the NAC has stored the value.

6. Press <**down arrow**> to access the next alarm.

7. Repeat Step 3 through Step 6 to configure all the alarms.

8. Press <**EXIT**> twice to return to the READY prompt.

Table 12-14: Alarms Based on Thresholds

Alarm Name	Time Measured	Range	Recommended Configuration
Forward Power Alm Point	When station keys	0 to 1023 watts in 1 W increments	50% of station power
Reflected Power Alm Point	When station keys	0 to 1023 W in 1 W increments	20% of station power
External Forward Power Alm Point	When station keys	0 to 300 W in 1 W increments	As the system requires
External Reflected Forward Power Alm Point	When station key	0 to 300 W in 1 W increments	As the system requires
Tray Temp Alm Point	Any time	0^{o}C to 127^{o}C, in 1^{o}C increments	As the system requires

Alarms for N+1 Redundancy

If this station is part of an N+1 redundancy system, use the following procedure to set the alarms.

1. From the READY prompt, press **<ALMS>** to access the Alarm menu.

   The display briefly shows the ALMS menu, then shows the first submenu:

   STATION ALMS

2. Press **<down arrow>** to access the ALRM SETUP submenu.

3. Press **<ENT>**.

   The display flashes to show the NAC has entered the edit mode.

4. Press **<ENT>**. The display shows the first alarm:

   REDUN SWITCHOVER ALARM

5. Press **<TOG>** to select the alarm level:
   - **CRITICAL** (high priority)
   - **GENERAL** (low priority)
   - **NOT SELECTED**

6. Press **<ENT>**.

   The display stops flashing to show the NAC has stored the value.

7. Press **<down arrow>** to access the rest of the alarms:
   - PA FAULT 1
   - PA FAULT 2
   - PA CUTBACK
   - SYNTH OUT OF LOCK
   - LOW FORWARD POWER
   - HIGH REFLECTED POWER
   - HIGH VSWR
   - TX IN LIMIT
   - HIGH TRAY TEMP
   - BATTERY REVERT
   - STN EXECUTED RESET
   - DIAG FAILURE
   - SYSTEM TIMER

8. Repeat Step 5 through Step 7 to configure the alarms.

9. Press **<EXIT>** twice to return to the READY prompt.

Replacing Modules

When troubleshooting identifies a faulty module in the Nucleus™ paging station, replacing it with a known good module restores the station to proper operation. This chapter describes replacement procedures and required post-replacement adjustments or programming. This chapter contains the following information:

Note: *This chapter does not describe replacement procedures for the following modules:*
- *Internal Network Interface Unit (NIU)*
- *Wildcard Interface Board (WIB)*
- *Receiver module*
- *Reference module*

The replacement procedures for these modules appear in the appropriate appendices.

General Replacement Information

This section describes general procedures to follow for any replacement activity.

Antistatic Precautions

The circuitry in modules and boards contains CMOS and other static-sensitive devices. Use the following procedure to prevent damage to the modules from electrostatic discharge (ESD).

DANGER

When you wear a wrist strap, exercise extreme caution in the presence of high voltage. The wrist strap provides a good ground. The wrist strap also increases the danger of lethal shock from accidental contact with high voltage.

1. Wear a wrist strap (Motorola Part No. 4280385A59, or equivalent) during all service procedures to minimize static buildup. The cage contains ground jacks to connect to the wrist strap (see Figure 13-1). Connect the wrist strap.

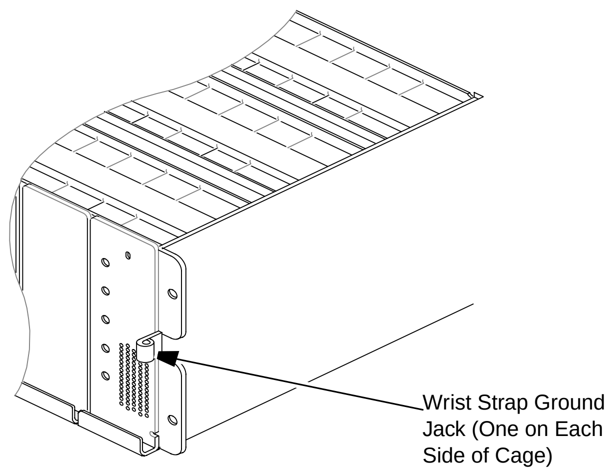


Figure 13-1: Location of Ground Jack for Wrist Strap Connection

2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), use the following procedure:
   a. Disconnect the batteries.
   b. Turn the power On-Off switch(es) to Off (press the 0 side of the switch).
   c. Remove the module or board by following the instructions in the sections that follow.

DANGER

Do not insert or remove a module or board with the power turned on. Inserting or removing a module with the power turned on may result in damage to the station or the module.

In high power Nucleus paging stations, turn off both power supplies.

3. Keep each spare modules in an antistatic bag for storage and transporting. Pack modules in antistatic materials to ship them.

4. To restore power, use the following procedure:
   a. Turn the power On-Off switch(es) to On (press the 1 side of the switch).
   b. Reconnect the batteries.

Mechanical Restraints

Each module slides on rails built into the cage. Each module plugs into the backplane. Each module is held in place by a mounting screw at the very top of the front panel and a mounting screw at the very bottom of the front panel. Remove the two mounting screws completely before removing a module. Use a TORX® screwdriver with a T-15 bit to remove the screws.

Each front panel has two additional screws. These screws connect the front panel to the module. Do not remove these screws unless instructed to do so. The front panel provides the only method of pulling many modules from the Nucleus paging station.

Note: Remove the Station Control Module (SCM) front panel to remove the Station Control Board and any board that resides in the slot to the right (facing the front panels) of the station.

Read the appropriate section in this chapter for additional required procedures for each module.

Gold-plated Connector Contacts

The card-edge connectors between the modules and the backplane are gold-plated to provide maximum conductivity and reliability. Gold-plated materials do not form a non-conductive oxide layer, and therefore do not require cleaning under normal conditions.

During a replacement procedure, you may notice that the contacts do need cleaning as a result of many extraction and insertion cycles or dusty environment.

CAUTION

Do not use an eraser or abrasive substance to clean the module card-edge connectors or the backplane connector contacts. Abrasive cleaning may remove the gold plating or bend the connector contacts.

If the contacts require cleaning, use a soft cloth dampened with alcohol. Wipe the contacts lightly. Do not touch the contact surfaces with your fingers. Body oil and salt can contaminate the contact surfaces.

Validating Repairs

After replacement procedures are complete, perform one of the following tests to validate the repair before leaving the site.

- If the troubleshooting diagnostics procedure detected the faulty module, run the diagnostics again after the repair ensure that the replacement module passes all diagnostic tests.
- If an operational failure detected the faulty module, perform the operation again to ensure that the repair corrected the failure.

Note: Troubleshooting and repair for a Nucleus paging station may require iterative testing (testing after each replacement procedure such as the procedures described in Chapter 12, "NAC Alarm Configuration and Verification"), or may require that all replacements are complete before testing.

Each replacement procedure described in this chapter begins by turning off power and ends by turning on power. If station repair requires multiple module replacement, and does not require iterative testing, do not restore power between replacement procedures. Perform all optimization procedures after turning on power.

Replacing the Power Amplifier (PA) in a Standard Power Station

This section describes the replacement procedure for a PA in a standard power Nucleus paging station and verifies the success of the procedure.

Note: Standard PAs are rated at 125 W or less.

Replacement Procedure

Use the following procedure to replace a standard PA:

1. Connect an antistatic wrist strap connector to one of the two ground jacks on the cage.
2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn off power at the power supply On-Off switch (press the 0 side of the switch).
4. Remove the front-panel mounting screws from the very top and very bottom of the PA front panel. These screws hold the front panel in the cage.
5. Disconnect the mini-UHF connector on RF cable that connects the Exciter to the PA (see Figure 13-2).
6. Hold the front panel firmly. Slide the PA partially out.
7. Disconnect the N-type connector (RF output from the PA) from the lower left side of the PA.
8. Remove the faulty PA from the cage.
9. Slide the replacement PA into the cage (approximately 2 in. from full insertion).
10. Connect the RF output cable to the N-type connector at the lower left side of the PA.
11. Slide the PA in completely and press the connector into the backplane.

CAUTION

Do not slam the PA against the backplane or push any harder than necessary to seat the connectors.

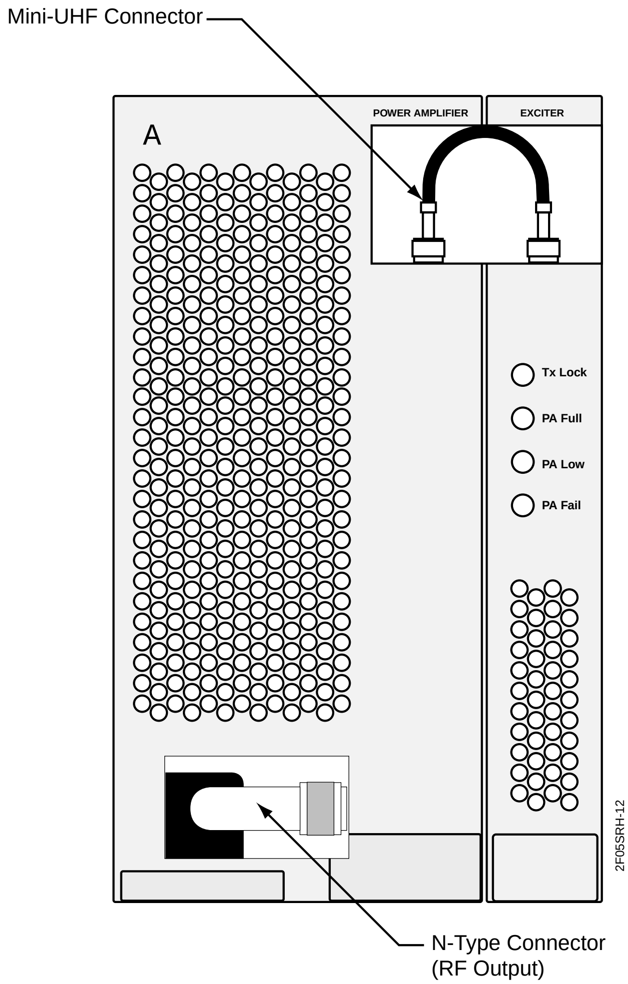


Figure 13-2: Location of N-type Connector and Mini-UHF Connector in a Standard Power Nucleus Paging Station

12. Reconnect the mini-UHF cable from the Exciter.

13. Secure the Exciter with two mounting screws removed in Step 4.

14. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).

15. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), then reconnect the batteries.

16. Remove the antistatic wrist strap from the cage.

Post-replacement Optimization Procedure

Perform the alignment procedure (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment"). If the Nucleus paging station has an External Circulator option (X676 or X677), calibrate the external Wattmeter.

Replacing the Power Amplifier (PA) in a Standard Power Station

This procedure replaces a PA in a high power Nucleus paging station and verifies the success of the procedure.

Note: High power PAs are rated at 250 or 300 W.

Replacement Procedure

1. Connect an antistatic wrist strap connector to one of the two ground jacks on the cage.
2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn off power by turning the power supply On-Off switch(es) to Off (press the 0 side of the switch).
4. Remove five mounting screws at the top of the PA.
5. Slide the PA partially out of the cage.
6. Disconnect the N-type connector (RF output from the Exciter) from the cutout in the lower left corner of the PA (see Figure 13-3).
7. Remove the faulty PA from cage.
8. Install a replacement PA by sliding the PA to within approximately 3 in. from full insertion.
9. Connect the RF output cable to the N-type connector at the cutout in the lower left corner of the PA.
10. Slide the PA in completely. Firmly press the connector into the backplane.

CAUTION

Do not force the PA into the backplane connectors and do not slam the PA against the backplane. The PA has several connectors that must seat simultaneously. Do not push any harder than necessary to seat the connectors.

11. Secure the PA with mounting screws removed in Step 4.
12. Restore power by turning both On-Off switches to On (press the 1 side of the switch).

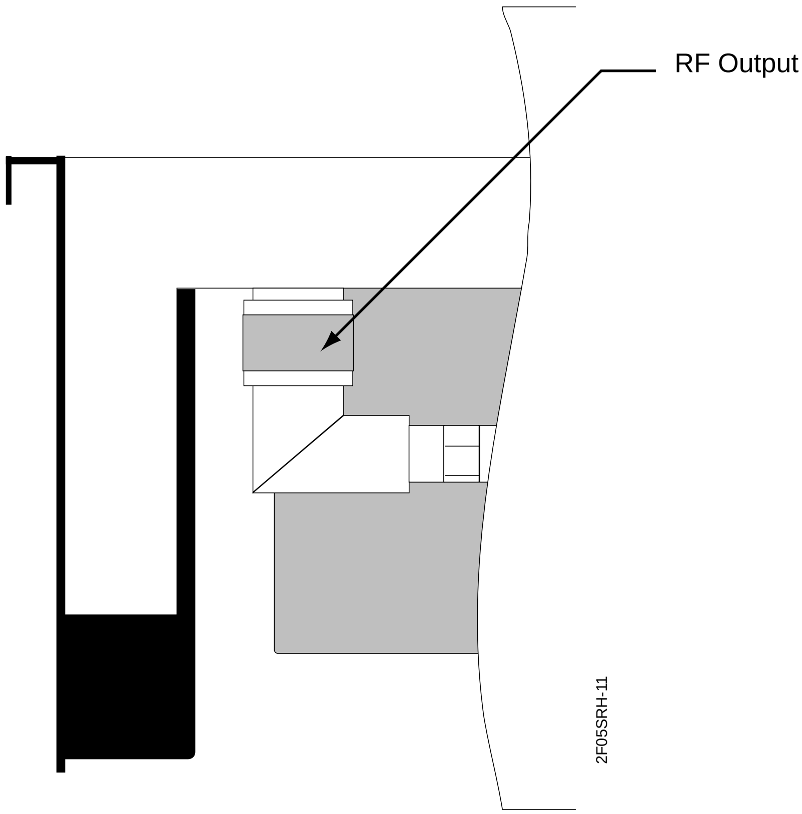


Figure 13-3: Location of RF Output Connector in a High Power Nucleus Paging Station

13. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

14. Remove the antistatic wrist strap from the cage.

Post-replacement Optimization Procedure

Perform the alignment procedure (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment"). If the Nucleus paging station has an External Circulator option (X676 or X677), calibrate the PA and the external Wattmeter.

Replacing the Power Supply

Use this procedure to replace a single power supply in a standard power Nucleus paging station or both power supplies in a high power Nucleus paging station.

Note: The power supply located between the SCM and the Exciter on a high power station is power supply number 1. The power supply on the extreme left-hand side, to the left of the Exciter, is power supply number 2.

Replacement Procedure

1. Connect an antistatic wrist strap connector to one of the two ground jacks on the cage.
2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn off power by turning the power supply On-Off switch(es) to Off (press the 0 side of the switch).
4. Remove the front-panel mounting screws from the very top and the very bottom of the power supply front panel. These screws secure the power supply in the cage.
5. Remove the faulty power supply from the cage.
6. Remove the front cover from the faulty power supply.
7. Remove the front cover from the replacement power supply. Install the front cover from the faulty power supply on the replacement power supply.
8. Install the replacement power supply by sliding it into the cage.
9. Seat the connector firmly in the backplane.

CAUTION

Do not slam the power supply against the backplane or push any harder than necessary to seat the connectors.

10. Secure power supply with two mounting screws removed in Step 4.
11. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).
12. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

Post-replacement Optimization Procedure

Perform one of the following alignment procedures (both described in Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment"):

- Manual alignment
- Automatic alignment

Replacing the Station Control Board and Exciter as a Matched Pair

Note: This procedure also applies to the Nucleus Advanced Control (NAC) and matched Exciter.

Motorola aligns the Exciter and Station Control Board during manufacturing as a matched pair and assigns a common alignment ID number. If the replacement procedure does not replace them together, the system records an ALIGNMENT ID MISMATCHED alarm during start-up or reset.

Verify the alignment IDs from Status menu, SOFTWARE VERSIONS submenu, ALIGNMENT ID selection.

Note: The Station Control Board is part of the Station Control Module (SCM). The SCM front panel is also part of the SCM. The SCM front panel connects to the Station Control Board through a ribbon connector.

Configuration Settings

The Station Control Board assigns a portion of memory to configuration parameters. This memory contains default settings for customer-specific parameters such as channel frequency and output power. Before replacing the Station Control Board, record all non-default values from the current configuration to facilitate reconfiguration after a installation.

Use Table B-1 to record Nucleus paging station configuration. Circle selections or write in values for all menu and submenu items that are not default values.

Replacing the Exciter

1. Connect an antistatic wrist strap connector to one of the two ground jacks on the cage.
2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn off power by turning the power supply On-Off switch(es) to Off (press the 0 side of the switch).
4. Remove the front-panel mounting screws from the very top and the very bottom of Exciter front panel. These screws secure the Exciter in the cage.
5. Disconnect the mini-UHF connector on RF cable that connects the PA to Exciter (see Figure 13-2).

Note: On a 300-W station, the mini-UHF connector passes through a slot in the front panel and connects to the PA in the backplane. Remove the cable connector from the Exciter. Then slide the Exciter out, maintaining the cable in the track until the Exciter is clear of the station.

6. Remove the faulty Exciter from the cage.

CAUTION

Do not slam the Exciter against the backplane or push any harder than necessary to seat the connectors.

7. Install the replacement Exciter by sliding it into the cage. Seat the Exciter firmly in the backplane.

8. Reconnect the RF cable from the PA.

Note: On a standard power station, move the mini-UHF connector slightly to the right (slightly overreaching the Exciter) to provide enough slack to connect the cable.

9. Secure the Exciter with the mounting screws removed in Step 4.

Replacing the Station Control Board

Use the following procedure to replace the Station Control Board:

Note: The station power supplies should still be turned off.

1. Connect an antistatic wrist strap connector to one of the two ground jacks on the cage.

2. Remove the mounting screws from the very top and very bottom of control front panel. Pull the control front panel out until ribbon cable connector is accessible.

3. Disconnect the ribbon cable connector from the Station Control Board and set the control front panel aside.

4. Remove the faulty Station Control Board (on the left side in the cavity) from the cage.

5. Insert the board-pulling arm into the notch at the bottom front of the Station Control Board. Pull the Station Control Board straight outward.

6. If the faulty Station Control Board has a Control-Receiver Interface Board (CRIB), remove the CRIB standoffs from the back of the faulty Station Control Board. Press the two tabs on each standoff together and pull the board off the standoff.

7. Remove the CRIB carefully from the faulty Station Control Board.

8. Insert the pins of the CRIB into connector P11 on the replacement Station Control Board. Align the pins properly. Seat the CRIB fully on the standoffs.

CAUTION

Do not slam the Station Control Board against the backplane or push any harder than necessary to seat the connectors.

9. Slide the replacement Station Control Board in the cage. Press the connectors firmly into the backplane.

10. Reconnect the ribbon cable from the rear of the SCM front panel to the connector on the Station Control Board.

11. Replace the SCM front panel and secure it with the mounting screws removed in Step 2.

12. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).

13. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

14. Remove the antistatic wrist strap from the cage.

Post-replacement Optimization Procedure

Perform the following procedures to verify that the replacement procedure is successful, and to reconfigure the system, and to calibrate the transmitter.

1. Access the Station Alarms menu and verify that the system has not generated an ALIGNMENT ID MISMATCHED alarm.

2. Configure the Nucleus paging station (see Chapter 8, "SCM Station Configuration"). Use the configuration settings recorded in Appendix B to restore the Nucleus paging station to its previous configuration.

3. Perform Nucleus paging station alignment (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment").

4. Verify transmitter circuitry and reference oscillator performance (see Chapter 12, "NAC Alarm Configuration and Verification").

Backplane

This section describes the replacement procedure and post-replacement checkout for the Nucleus backplane.

Replacement Procedure

1. Connect an antistatic wrist strap connector to one of the two ground jacks on the cage.
2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn off power by turning the power supply On-Off switch(es) to Off (press the 0 side of the switch).
4. Remove all modules and boards from the cage. Place all modules and boards in antistatic bags or on properly grounded antistatic surfaces.
5. Label all cables connected to the rear of the backplane. Disconnect all cables from the backplane.
6. Remove the 11 TORX head screws securing the rear metal shield and backplane to the cage.
7. Remove the metal shield and the backplane.
8. Slide the two guide pins located at each end on the bottom of the metal shield from the backplane.
9. Remove the backplane from the cage.
10. Install the replacement backplane and rear metal shield. Insert and tighten the 11 TORX head screws removed in Step 6.
11. Reconnect all cables to the rear of the backplane (see Step 5)
12. Reinstall all modules and boards removed in Step 4.
13. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).
14. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

Post-replacement Optimization Procedure

This procedure requires no post-replacement optimization.

Acronyms

This appendix lists the acronyms used in this manual (see Table A-1).

Table A-1: List of Acronyms (Sheet 1 of 3)

Term	Definition
µs	Microsecond
AC	Alternating Current
A/D	Analog to Digital (Converter)
AIC	Audio Interface Circuit
ALS	Advanced Low Power Schottkey
APM	Augmented Phase Modulation
ASC	Advanced Simulcast Controller
ASIC	Application Specific Integrated Circuit
A/D	Analog to Digital
bps	Bits per Second
CPU	Central Processing Unit
CRIB	Controller/Receiver Interface Board
CTS	Clear to Send
D/A	Digital to Analog
DC	Direct Current
DCD	Data Carrier Detect
DCTS	Distribute Clear to Send
DPL	Data Private Line
DRC	Digital Remote Control
DSP	Digital Signal Processor
DSR	Data Set Ready
DTR	Data Terminal Ready
EIA	Electronic Industries Association
EMI	Electromagnetic Interference
ERP	Effective Radiated Power
FCC	Federal Communications Commission
FM	Frequency Modulation

Table A-1: List of Acronyms (Sheet 2 of 3)

Term	Definition
FMK	Field Modification Kit
FRU	Field Replaceable Unit
FSK	Frequency Shift Keying
GPS	Global Positioning System
HSO	High Stability Oscillator
IC	Integrated Circuit
LED	Light-emitting Diode
LS	Low Power Schottkey
MDC	Another term for DRC
MHz	Mega Hertz
ms	Millisecond (1 thousandth of a second)
MSK	Minimum Shift Keying
NBD	Nominal Binary Deviation
NIU	Network Interface Unit (transmitter controller)
PA	Motorola Power Amplifier
PLL	Phase Locked Loop
ppb	Parts per Billion
ppm	Parts per Million
pps	Pulses per Second
REF MOD	Reference Modulation Signal
RF	Radio Frequency
RF-B!	RF-Baton!™ Transmitter Controller
RF-C!	RF-Conductor™ controller
rms	Root Mean Squared
RTS	Request to Send
Rx	Receiver
SCM	Station Control Module
SIMM	Single In-line Memory Module™
SPI	Motorola 68000 series serial peripheral interface bus structure
SyLC	Synchronous Local Control
Tx	Transmitter
UHF	Ultra High Frequency

Table A-1: List of Acronyms (Sheet 3 of 3)

Term	Definition
UHSO	Ultra High Stability Oscillator
Vac	Voltage, Alternating Current
VCO	Voltage-controlled Oscillator
VCO MOD	VCO Modulation Signal
Vdc	Voltage, Direct Current
VSWR	Voltage Standing Wave Ratio
WIB	Motorola Wildcard Interface Board

Configuration Record

This appendix contains the installation and configuration record for the Nucleus™ paging station installed at a single site. The contents of this appendix include:

Use in Initial Configuration

When you install and configure the Nucleus Paging Station, use Table B-1 to record the complete configuration of the station. Record all settings in the right hand column of the table or circle the appropriate setting if it is already listed there. For values that are read only, record them for future reference (to guard against system drift).

Use in Module Replacement

A configuration record is an invaluable aid during a module replacement. Use the followint tables to record configuration:

- Station Control Module (SCM) for a Nucleus paging station (see Table B-1)
- Nucleus Advanced Control (NAC) module for a NAC paging station (see Table B-1)

Refer to the appropriate table during replacement and reconfiguration procedures to ensure that a replacement module is configured correctly for the station.

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 1 of 5)

Menu	Submenu Name	Selection	Settings
Station	TX FREQ RANGE (read-only)		
Station	CURRENT TX CHN	1 2 3 4 5 6 7 8 ALIGN 1 VCO ALIGN 2 VCO ALIGN 3 VCO ALIGN 4 VCO ALIGN 5 VCO ALIGN 6 VCO ALIGN 1 DELAY ALIGN 2 DELAY ALIGN 3 DELAY ALIGN 4 DELAY	
Station	SYS TIMER ALRM	DISABLE 2 MIN 15 MIN 30 MIN 60 MIN 90 MIN 120 MIN 180 MIN	
Station	FRONT PANEL PASSWORD	ENABLED DISABLED	
Station	PASSWORD (DEFAULT = 6000)		
Station	SET STATION TIME	YEAR MONTH DAY HOUR MINUTE SECONDS	
Receiver	LINK/MONITOR RECEIVER	RX FREQ RANGE (read-only)	

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 2 of 5)

Menu	Submenu Name	Selection	Settings
Receiver		RX CHN FREQ	
Receiver		CHN SPACING	12.5 kHz 20 kHz 25 kHz
Receiver		RX DEEMPHASIS	ENABLED DISABLED
Receiver		RX OUTPUT	INVERTED NOT INVERTED
Receiver		MONITOR RX OUTPUT	ANALOG TTL CNET
Transmit	TX CHN FREQS	CHN 1 FREQ CHN 2 FREQ CHN 3 FREQ CHN 4 FREQ CHN 5 FREQ CHN 6 FREQ CHN 7 FREQ CHN 8 FREQ MEAN FREQ	
Transmit	TX CHN PWR (if CHN MAPPED PWR disabled)	OPERATING PWR	
Transmit	TX CHN PWR (if CHN MAPPED PWR enabled)	CHN 1 FREQ CHN 2 FREQ CHN 3 FREQ CHN 4 FREQ CHN 5 FREQ CHN 6 FREQ CHN 7 FREQ CHN 8 FREQ MEAN FREQ (if CHN n FREQ= 0)	
Transmit	TX CHN OFFSETS	HIGH SPEED OFFSET LOW SPEED OFFSET	
Transmit	REFLEX25 OFFSET		
Transmit	HIGH SPEED SPLATTER FILTER	88 US LOW PASS (µs) LOW PASS 160 US LOW PASS	
Transmit	LOW SPEED SPLATTER FILTER	88 US 140 US LOW PASS 250 US LOW PASS 160 US LOW PASS	
Transmit	NOMINAL BINARY DEVIATION		
Transmit	SPECIAL TX SETUP	TX DATA INVERT	ENABLED DISABLED
Transmit		TX = RX	ENABLED DISABLED

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 3 of 5)

Menu	Submenu Name	Selection	Settings
Transmit		TX = RX CHANNEL	1 2 3 4 5 6 7 8
Transmit		IDLE DEVIATION	NULL SPACE MARK
Options 1	ANTENNA RELAY	DISABLED ENABLED	
	EXT CIRCULATOR	NOT PRESENT PRESENT	
	CHN MAPPED PWR	DISABLED ENABLED	
Options 2	Not used		
Alarm Setup (Non-Channel Mapped)	NON-CHAN MAPPED PWR ALARMS	FWD PWR ALM PT RFL PWR ALM PT EXT WM FWD PWR ALM PT EXT WM RFL PWR ALM PT	
Alarm Setup (Channel Mapped)	INT FWD CHN MAPPED ALMS	CHN 1 FWD ALM PT CHN 2 FWD ALM PT CHN 3 FWD ALM PT CHN 4 FWD ALM PT CHN 5 FWD ALM PT CHN 6 FWD ALM PT CHN 7 FWD ALM PT CHN 8 FWD ALM PT	
Alarm Setup (Channel Mapped)	INT RFL CHN MAPPED ALMS	CHN 1 RFL ALM PT CHN 2 RFL ALM PT CHN 3 RFL ALM PT CHN 4 RFL ALM PT CHN 5 RFL ALM PT CHN 6 RFL ALM PT CHN 7 RFL ALM PT CHN 8 RFL ALM PT	
Alarm Setup (Channel Mapped)	EXT FWD CHN MAPPED ALMS (if EXT WATTMETER TYPE NONE)	CHN 1 EXT FWD ALM PT CHN 2 EXT FWD ALM PT CHN 3 EXT FWD ALM PT CHN 4 EXT FWD ALM PT CHN 5 EXT FWD ALM PT CHN 6 EXT FWD ALM PT CHN 7 EXT FWD ALM PT CHN 8 EXT FWD ALM PT	

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 4 of 5)

Menu	Submenu Name	Selection	Settings
Alarm Setup (Channel Mapped)	EXT RFL CHN MAPPED ALMS (if EXT WATTMETER TYPE NONE)	CHN 1 EXT FWD ALM PT CHN 2 EXT FWD ALM PT CHN 3 EXT FWD ALM PT CHN 4 EXT FWD ALM PT CHN 5 EXT FWD ALM PT CHN 6 EXT FWD ALM PT CHN 7 EXT FWD ALM PT CHN 8 EXT FWD ALM PT	
Status	FWD PWR	(read only)	
Status	RFL PWR	(read only)	
Status	VSWR	(read only)	
Status	EXT WM FWD PWR	(read only)	
Status	EXT WM RFL PWR	(read only)	
Status	EXT WM VSWR	(read only)	
Status	SOFTWARE VERSIONS	APPLICATION	
Status		EXCITER	
Status		BOOT	
Status		ALIGNMENT ID	
Configuration	MAX PWR (read only)	NO PA (Power Amplifier) 20 W 25 W 100 W 125 W 250 W 300 W	
Configuration	BATTERY REVERT SETUP	BATTERY TYPE	SEALED LEAD CALCIUM, or BATTERY REVERT DISABLED
Configuration		CHARGING	ENABLED DISABLED
Configuration		BACKUP	BACKUP STATION BACKUP CONTROL
Configuration		FIXED CUTBK RED%	not supported in this release
Configuration	EXTERANAL WATTMETER TYPE	NONE CLASS 1 EXT CLASS 2 EXT CLASS 3 3XT CLASS 4 EXT	
Configuration	CONTROL	INTERNAL CNET EXT SYCH LOCAL CTROL	

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 5 of 5)

Menu	Submenu Name	Selection	Settings
Configuration	RX TYPE	NO INTERNAL INTERNAL LINK INTERNAL MONITOR	
Configuration	SPECIAL KEY SELECT	NONE CD INT CD EXT SPCL KEY FAST LOW FAST HIGH EXT LOW EXT HIGH	
Service	PA TEST MODE	ACTIVE INACTIVE	
Service	SELECT SYMBOL	STAIRCASE 01-10 00-11 10 11 01 00 CARRIER	
Service	KEY ON SYMBOL		

Table B-2: Hierarchical NAC Menu Structure (Sheet 1 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Station	STN TYPE	Page TX	
Station	TX RANGE (read-only)		
Station	TX RANGE CHECKING	Enabled Disabled	
Station	CHANNEL FREQS	1 2 3 4 5 6 7 8	
Station	STN ID		
Station	STATION CONTROL SETUP	DRC Setup	DRC Enabled or Disabled DRC System ID System ID Locked or Unlocked Poll Response via Line 2 or RF Paging Keyup Enabled or Disabled ATC ID
Station	STATION CONTROL SETUP	TRC Setup	TRC Enabled or Disabled TRC Tone Table Selection Guard Tone Frequency
Station	DROP OUT DELAY	Value	
Station	KEY TIMEOUT	Value Delay	
Station	SYSTEM TIMEOUT ALM	Value Disable	
Station	FRONT PANEL PASSWORD	Enabled Disabled	
Station	PASSWORD	Value	
Station	CURRENT CHANNEL	1 2 3 4 5 6 7 8	
Receive Audio	INPUT AUDIO FROM	Line1 Int Rx Ext RX	Selects an internal audio source
Receive Audio	LINE 2 ADUIO FROM	Int Rx (none) Ext RX	Selects an external audio source

Table B-2: Hierarchical NAC Menu Structure (Sheet 2 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Receive Audio	EXTERNAL RX SETUP	Link Rx Squelch Type	Carrier DPL
Receive Audio	EXTERNAL RX SETUP	Monitor RX	Enab Dis
Receive Audio	EXTERNAL RX SETUP	DPL	Enab Dis
Receive Audio	INTERNAL RX SETUP	Monitor Rx:	Enab Dis
Receive Audio	INTERNAL RX SETUP	Rx Freq Range Checking	Enab Dis
Receive Audio	INTERNAL RX SETUP	Rx Freq Range (read only)	
Receive Audio	INTERNAL RX SETUP	Rx Freq Range	
Receive Audio	INTERNAL RX SETUP	Rx Chan Spacing	
Receive Audio	INTERNAL RX SETUP	Squelch Type	Carrier DPL
Receive Audio	INTERNAL RX SETUP	DPL	Enab Dis
Receive Audio	INTERNAL RX SETUP	Invert Rx DPL	Enab Dis
Receive Audio	INTERNAL RX SETUP	DPL Code	
Receive Audio	INTERNAL RX SETUP	DPL High Pass Filter	Enab Dis
Receive Audio	INTERNAL RX SETUP	Audio Phase Invert	Enab Dis
Receive Audio	INTERNAL RX SETUP	Status Tone	Enab Dis
Receive Audio	INTERNAL RX SETUP	Status Tone Freq	
Receive Audio	INTERNAL RX SETUP	Status Tone Level	
Receive Audio	DELAY	Enab Dis	
Receive Audio	DELAY	Value	
Receive Audio	GAIN	Enab Dis	
Receive Audio	GAIN	Value	
Receive Audio	LINE 1 IMPEDANCE	600 ohm Bridge	
Receive Audio	LINE 2 AUDIO	Flat De-emphasis	
Transmit	FREQ ADJUST	Steps	
Transmit	TX DEVIATION SETUP	Maximum Deviation	
Transmit	TX DEVIATION SETUP	Nominal Deviation	

Table B-2: Hierarchical NAC Menu Structure (Sheet 3 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Transmit	TX DEVIATION SETUP	Nominal Binary Deviation	
Transmit	CARRIER FREQ OFFSET		
Transmit	BINARY SPLATTER FILTER	140 µsec 250 µsec	
Transmit	GT NOTCH	En Dis	
Transmit	ANIG EQ FILTER	En Dis	
Transmit	SPECIAL TX SETUP	Audio Phase Invert	En Dis
Transmit	SPECIAL TX SETUP	Binary Tx Data Invert	En Dis
Transmit	SPECIAL TX SETUP	Tx=Rx	En Dis
Station Options	SPECIAL KEY SETUP	Special Key Disabled Key on Internal CD Key on External DC Key on Ext Key Req Low Key on Ext Key Req High	
Station Options	WILDCARD INPUT SETUP	Wild Card 1 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 2 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 3 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 4 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 5 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 6 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 7 Active	High Low
Station Options	WILDCARD INPUT SETUP	Wild Card 8 Active	High Low
Station Options	WILDCARD OUTPUT SETUP	Wild Card 1	Active Inactive
Station Options	WILDCARD OUTPUT SETUP	Wild Card 2	Active Inactive
Station Options	WILDCARD OUTPUT SETUP	Wild Card 3	Active Inactive
Station Options	WILDCARD OUTPUT SETUP	Wild Card 4	Active Inactive

Table B-2: Hierarchical NAC Menu Structure (Sheet 4 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Station Options	WILDCARD OUTPUT SETUP	Wild Card 5	Active Inactive
Station Options	WILDCARD OUTPUT SETUP	Wild Card 6	Active Inactive
Station Options	WILDCARD OUTPUT SETUP	Wild Card 7	Active Inactive
Station Options	WILDCARD OUTPUT SETUP	Wild Card 8	Active Inactive
Station Options	REDUNDANCY SETUP	Redundancy	En Dis
Station Options	REDUNDANCY SETUP	Master Station Setup Only	Number of Stns in System
Station Options	REDUNDANCY SETUP	Master Station Setup Only	Prioritizing: En Dis
Station Options	REDUNDANCY SETUP	Master Station Setup Only	Keyup: En Dis
Station Options	REDUNDANCY SETUP	Master Station Setup Only	Force Switchover Setup: Switchover LAN ID Activate Switchover: Yes/No
Station Options	EXTERNAL PAGING DATA SETUP	Delay	Analog Path Digital Path
Station Options	EXTERNAL PAGING DATA SETUP	DRC Binary Data	Internal External;
Station Options	EXTERNAL PAGING DATA SETUP	Receive Data	RS-232 Ext Modem
Station Options	EXTERNAL PAGING DATA SETUP	Direct Digital	En Dis
Station Options	PA SHUTDOWN ON HIGH VSWR	En Dis	
Station Options	UNSOLICITED ALM REPORTING	Unsolicited Alm	En Dis
Station Options	UNSOLICITED ALM REPORTING	Unsolicited Alarms On	All Major Minor
Station Options	UNSOLICITED ALM REPORTING	Report via	Line 2 RS-232
Station Options	387 VERIFICATION TONE	En Dis	
Communication Options	RS-232 DIALIN SETUP	Dial in	En Dis

Table B-2: Hierarchical NAC Menu Structure (Sheet 5 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Communication Options	RS-232 DIALIN SETUP	Answer on Ring #	1 2 3 4
Communication Options	RS-232 DIALIN SETUP	Auto Baud Detect	En Dis
Communication Options	RS-232 DIALIN SETUP	Connect	Smart Modem No Modem Connected
Communication Options	RS-232 DIAL OUT SETUP	Baud Rate	Value
Communication Options	RS-232 DIAL OUT SETUP	Phone Number	Value (18 digits)
Communication Options	RS-232 DIAL OUT SETUP	Pause After 1st Digit	En Dis
Communication Options	RS-232 DIAL OUT SETUP	Dial Out via	Tone Pulse
Communication Options	RS-232 DIAL OUT SETUP	Number of Attempts Before Alarm	Value
Communication Options	NAC LAN SETUP	NAC LAN	En Dis
Communication Options	NAC LAN SETUP	NAC LAN	Master Slave
Communication Options	NAC LAN SETUP	Alm on # of Inv Attempts	Value
Communication Options	NAC LAN SETUP	NAC Slave LAN ID	Value
Alarm Setup	FORWARD POWER ALM POINT	Value	
Alarm Setup	REFLECTED POWER ALM POINT	Value	
Alarm Setup	EXT FORWARD POWER ALM POINT	Value	
Alarm Setup	EXXT REFLECTED POWER ALM POINT	Value	
Alarm Setup	TRAY TEMP ALM POINT	Value	
Alarm Setup	REDUN SWITCHOVER ALM	Crit Gen Not Sel	

Table B-2: Hierarchical NAC Menu Structure (Sheet 6 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Alarm Setup	REDUN SWITCHOVER ALM	PA Fault 1 PA Fault 2 PA Cutback Synth Out of Lock Low Forward Power High Reflected Power High VSWR Tx in Limit High Tray Temp Battery Revert Stn Executed a Reset Diag Failure System Timer	
Alarm Setup	ALM VERIFICATION RELAY	Relay	Disabled Alarm Mode Verify Mode
Alarm Setup	ALM VERIFICATION RELAY	Opt Alarm	Selected Not Selected
Alarm Setup	ALM VERIFICATION RELAY	Opt Alarm	Redundancy Switch Occurred
Alarm Setup	ALM VERIFICATION RELAY	Stn Alarm	Selected Not Selected
Alarm Setup	ALM VERIFICATION RELAY	Stn Alarm	PA Fault 1 PA Fault 2 PA Cutback Synth Out of Lock Low Forward Power High Reflected Power High VSWR TX in Limit High Tray Temp Battery Revert Stn Executed a Reset Diag Failure Station timer
Alarm Setup	MISC ALRM	Selected Not Selected	
Alarm Setup	MISC ALRM	Wild Card Input 1 . . . Wild Card Input 8 Paging Keyup Disable No Modem Response Modem Dial Out Timer Expired No Dial tone or Carrier Modem NAC LAN Line Failure EE Data Modified	

Table B-2: Hierarchical NAC Menu Structure (Sheet 7 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Station Status	HARD/FIRMWARE VERSIONS	Main Proc FW Version Control Board Version Cnt Rx Intfc Bd Sw Version Sec Proc Version Exciter Firmware Version Main DSP SW Version	
Station Status	REDUNDANCY STAT	Redundancy	En Dis
Station Status	REDUNDANCY STAT	Slave Stat	Switched out of System: Yes No
Station Status	REDUNDANCY STAT	Master Stat	Switched for Slave: Yes No
Station Status	REDUNDANCY STAT	Master Stat	Switched LAN ID (Value)
Station Status	REDUNDANCY STAT	Master Stat	Switchover Upon Alm: Yes No
Station Status	REDUNDANCY STAT	Master Stat	Switchover Due to: Alarm Forced
Station Status	REDUNDANCY STAT	Internal Rx	Squelched Unsquelched
Station Status	REDUNDANCY STAT	Internal DPL	Detected Not Detected
Station Status	REDUNDANCY STAT	External Rx	Squelched Unsquelched
Configuration	PWR RATING	No PA 25 W 125 W 350 W	
Configuration	BATTERY REVERT SETUP	Batt Revert	None Sealed LD Calcium
Configuration	BATTERY REVERT SETUP	Backup	Station Control
Configuration	BATTERY REVERT SETUP	Fixed Cutbk Red%	Value
Configuration	BATTERY REVERT SETUP	Battery Bank Voltage	
Configuration	WATTMETER SETUP	Wattmeter Poll Resp	Internal Secondary
Configuration	WATTMETER SETUP	External Wattmeter Type	
Configuration	EXTERNAL CIRCULATOR	Present Not Present	

Table B-2: Hierarchical NAC Menu Structure (Sheet 8 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Configuration	REFERENCE TYPE	UHSO HSO Ext None	
Service	KEY AND READ POWER		
Service	KEY AND READ EXT POWER		
Service	KEY ANALOG PASS AUDIO		
Service	KEY ANALOG 1 KHZ		
Service	KEY BINARY PASS DATA		
Service	VCO STEERING LINE VOLTAGES	Freq 1	Value
Service	VCO STEERING LINE VOLTAGES	Freq 2	Value
Service	VCO STEERING LINE VOLTAGES	Freq 3	Value
Service	VCO STEERING LINE VOLTAGES	Freq 4	Value
Service	PA SERVICE MODE	Ena Dis	
Service	USER AUDIO	Source	None Input Audio Gained Audio DSP Input Audio Exciter Audio Rx Audio F Plus Audio Transmit Audio Line 1 Audio Line 2 Audio
Service	USER AUDIO	Phone Line Loop	Ena Dis
Alignment	DE-EMP RX LEVEL		
Alignment	INPUT AUDIO LEVEL	Enter to Adjust Exit to Cancel	
Alignment	OUTPUT RX AUDIO		
Alignment	OUTPUT AUDIO INTERNAL SOURCE		
Alignment	CALIBRATE STATION POWER	Initialize Power Calibrate	
Alignment	CALIBRATE STATION POWER	Power Calibrate	Value
Alignment	CALIBRATE STATION POWER	Cal Ext Wattmeter	Value

Table B-2: Hierarchical NAC Menu Structure (Sheet 9 of 9)

Menu Name	Submenu Name	Selection	Definition and Additional Selections
Alignment	REFERENCE ALIGNMENT	Pendulum	Value
Alignment	REFERENCE ALIGNMENT	Reference Module	Value
Alignment	VCO MODULATION FREQS	Freq 1 Dev	Value
Alignment	VCO MODULATION FREQS	Freq 2 Dev	Value
Alignment	VCO MODULATION FREQS	Freq 3 Dev	Value
Alignment	VCO MODULATION FREQS	Freq 4 Dev	Value
Alignment	SRM ALIGNMENT	Delay	Value
Alignment	SRM ALIGNMENT	Gain	Value
Alignment	NOMINAL DEVIATION		
Alignment	BINARY INST		
Alignment	INTERNAL RX SQUELCH		
Alignment	INTERNAL RX TEST TONE SETUP	Test Tone	En Dis
Alignment	INTERNAL RX TEST TONE SETUP	Test Tone Freq	Value

Internal Network Interface Unit (NIU)

This appendix describes the function, configuration, and replacement procedures for an internal NIU interface used with a Nucleus™ paging station. This appendix does not describe the NIU when it is part of a monitor receiver or link receiver (see Appendix E). This appendix includes the following information:

Internal NIU Function

The internal NIU provides an interface between a C-NET Control Point and a Nucleus paging station. The C-NET Control Point sends a C-NET data stream to the internal NIU installed in a Nucleus paging station. The NIU receives the messaging stream, identifies the Nucleus paging station's address, and extracts the contents of the messages addressed to the station.

Note: An external NIU also provides an interface between a C-NET Control Point and a transmitter. However, the external NIU provides fewer features and functions, and is not described here.

The communication link from the C-NET Control Point is one of the following (see Figure C-1):

- Direct wireline connection
- RF through an analog or digital satellite

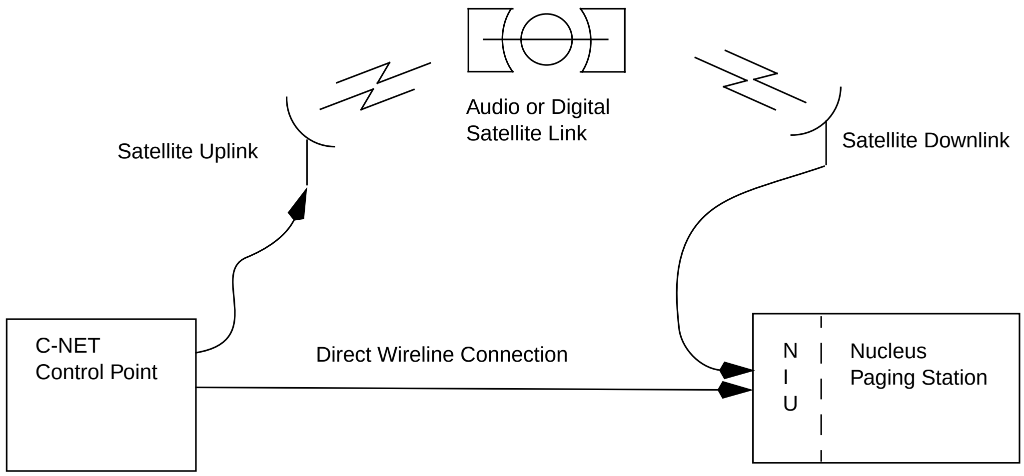


Figure C-1: Internal NIU Interface to a Nucleus Paging Station

The internal NIU decodes the C-NET data stream for the transmitter and extracts the messaging data and instructions. The NIU performs some processing, then sends the data in Synchronous Local Control (SyLC) protocol to the Station Control Module (SCM) (see Figure C-2).

Note: Internal modems mount behind the SCM control panel, next to the Station Control Board. The Station Control Board is also part of the SCM.

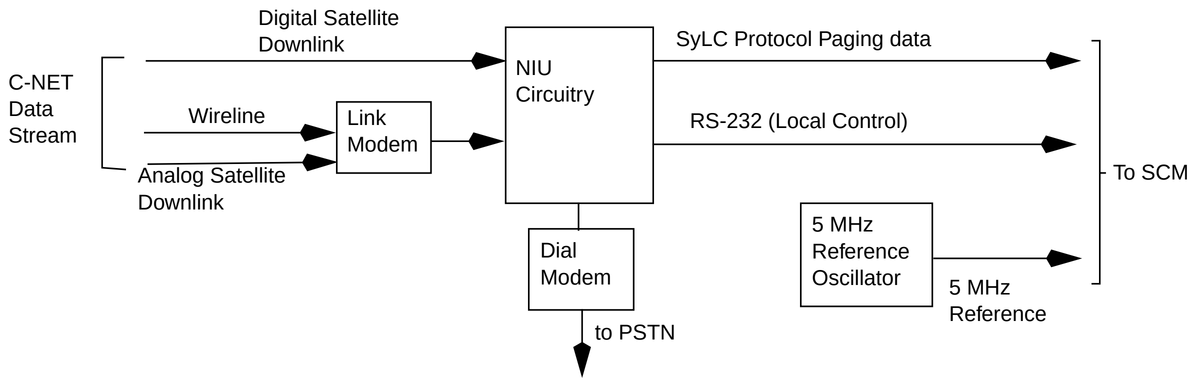


Figure C-2: NIU Interfaces

The input data stream to the NIU has one of the following forms:

- Digital data from a digital satellite downlink
- Analog data from an analog wireline connection or an analog satellite downlink

The outputs from the NIU to the SCM are:

- SyLC protocol messaging data stream
- Local control through an RS-232 interface
- 5 MHz reference oscillator timing pulses

Note: If the NIU sends diagnostic information back to the C-NET Control Point through a Public Switched Telephone Network (PSTN), the NIU requires a dial modem.

Indicators

The SCM front panel is part of the SCM. The internal NIU rests in a slot to the right of the Station Control Board. To support the internal NIU, the SCM front panel provides a serial port and two light-emitting diodes (LEDs) (see Figure C-3 and Table C-1). The console port provides a connection for a personal computer (PC) or PC compatible interface.

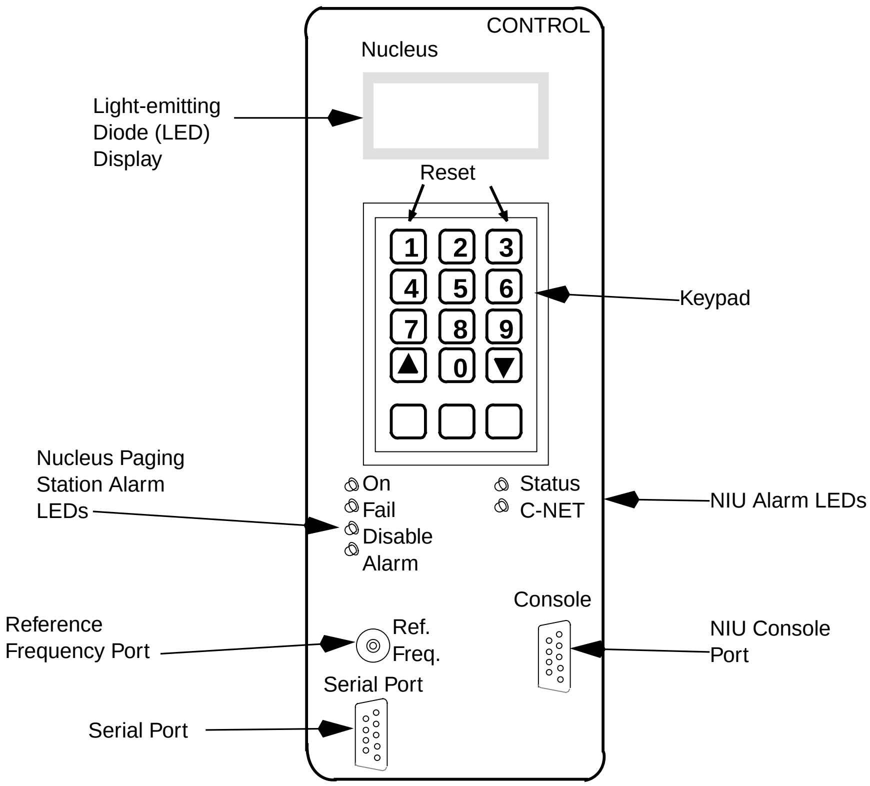


Figure C-3: SCM Front Panel Showing Internal NIU LEDs and Console Port

Table C-1: LED Functions and Definitions for the Internal NIU (Sheet 1 of 2)

LED Name	Color	On	Flashing	Off
Status	Green	Not used	(Slow) normal NIU operation with no alarms (Fast) data carrier detect (DCD) connected to internal dial modem	Not used
	Orange	Not used	(Slow) alarm in the NIU (Fast) alarm in NIU with dial modem connected	Not used
	Red	Not used	Internal NIU failure	Not used

Table C-1: LED Functions and Definitions for the Internal NIU (Sheet 2 of 2)

LED Name	Color	On	Flashing	Off
C-NET	Green	Synchronized with C-NET	Synchronized with C-NET and running from ROM	Not used
	Orange	Synchronization lost with C-NET less than 30 seconds	Synchronization lost with C-NET less than 30 seconds and running from ROM	Not used
	Red	Synchronization lost with C-NET more than 60 seconds	Synchronization lost with C-NET more than 60 seconds and running from ROM	Not used

Interfaces

The internal NIU uses the following interfaces:

- Link modem, required for a wireline interface or analog satellite downlink
- External modem adapter, required for interfaces with phones lines
- External analog receiver, required for other analog interfaces
- External digital receiver, required for digital interfaces

Link Modem Connectors

An internal NIU uses a link modem (option 443) for a wireline or analog satellite downlink input. At a customer request, Motorola installs option 443 during manufacturing. This modem requires no site installation.

Wireline interface

The wireline messaging data input for a link modem requires connection. Use the following procedure: to install this connection:

1. Connect the telephone tip line to Nucleus paging station backplane connector J17, pair 14, ring conductor (pin 14, NIU line +). For a list of the pinouts for J17 see Chapter 5, "Connectors and Interfaces".

2. Connect the telephone ring line to station backplane connector J17, pair 15, ring conductor (pin 15, NIU line -).

External Modem Adapter

The option X774 external modem adapter provides an external interface for non-US modems. These modems communicate with phone lines that comply with local code regulations.

Motorola installs option X774 on the internal NIU during manufacturing.

External Analog Receiver

Note: The external analog link receiver requires link modem option X443.

If the Nucleus paging station uses an external analog link receiver, the installation package contains a cable that connects the receiver to the Nucleus paging station backplane connector J19, the link receiver connector.

Use the following procedure to connect the receiver:

1. Connect the link receiver audio line to backplane connector J19, pin 5. This is the link receiver audio line (Link Rx Audio) (see Table C-2).

2. Connect link receiver squelch line (if applicable) to backplane connector J19, pin 3. This is the external link (Ext Link Rx Sq Ind).

3. Connect link receiver ground line to backplane connector J19, pin 1. This is ground (GND).

Table C-2: J19 Link Receiver Pinouts

Pin Number	Signal	Input	Output	Function
1	GND		X	Ground
2	Ext Link Rx DPL En	X		External link receiver data private line (DPL) enable
3	Ext Link Rx Sq Ind	X		External link receiver squelch indicator
4	Ext Link Rx DPL Ind	X		External link receiver DPL detect
5	Link Rx Audio[1]	X	X	Internal or external link receiver audio
6	Open			Open
7	Open			Open
8	Open			Open
9	13.8 V		X	13.8 Vdc from power supply

1. This line is an input if a receiver module is configured as a link receiver, or as "no internal". Line is an output if a receiver module is configured as a monitor receiver.

External Digital Satellite Downlink Receiver

If the Nucleus paging station uses an external digital satellite downlink receiver, connect the receiver as follows:

1. Connect the data line on the receiver to backplane connector J15, pin 3. This is the distribution receive data A (Dist RXDA) line (Table C-3).

2. Connect the clock line on the receiver to backplane connector J15, pin 17. This is the distribution receive clock A (Dist RCLKA) line.

3. Connect the ground line on the receiver to backplane connector J15, pin 7 (Ground).

4. If the installation uses satellite receiver squelch or carrier detect, connect the receiver squelch line to backplane connector J19, pin 3 (External Link Rx Squelch Ind).

Table C-3: J15 Paging Distribution Channel Pinouts

Pin Number	Signal	Input	Output	Function
1	GND		X	Ground
2	Dist TXDA		X	Distribute transmit data A
3	Dist RXDA	X		Distribute receive data A
4	Dist RTS		X	Distribute request to send (RTS)
5	Dist CTS	X		Distribute clear to send (CTS)
6	Dist DSR	X		Distribute data set ready (DSR)
7	GND		X	Ground
8	Dist DCD	X		Distribute data carrier detect
9	Open			
10	Open			
11	Open			
12	Open			
13	Dist RCLKB	X		Distribute receive clock B
14	Dist TXDB		X	Distribute transmit data B
15	Dist TCLKA		X	Distribute transmit clock A
16	Dist RXDB	X		Distribute receive data B
17	Dist RCLKA	X		Distribute receive clock A
18	Open			
19*	Dist TCLKB		X	Distribute transmit clock B
20	Dist DTR		X	Distribute data terminal ready (DTR)
21	Open			
22	Open			
23	Open			
24	Open			
25	Open			

PSTN Modem Adapters

If the NIU uses a PSTN line to send diagnostic information to the C-NET Control Point, it requires a PSTN modem. The PSTN dial modem is option X437. Motorola installs the PSTN dial modem on an internal NIU during manufacturing. To replace the option in the field, see the paragraph, "PSTN Modem Adapters".

Use the following procedure to connect the PSTN lines to the modem:

1. Connect the PSTN to the dial modem with one of the following:
   – Model 259B single-line adapter (one RJ-45 module jack for phone connections)
   – Model 258B six-line adapter (six RJ-45 module jack for phone connections)

   These adapters mate with the backplane 50-pin telephone connector (J17).

2. Connect the telephone tip line to backplane connector J17, pair 5, ring conductor (pin 5, Dial Modem +).

3. Connect the telephone ring line to backplane connector J17, pair 5, tip conductor (pin 30, Dial Modem).

259B Single-line RJ-45 Adapter

The 259B adapter has a 50-pin male mini-ribbon connector. This adapter distributes the line pairs from a 25-pair cable to a single RJ-45 modular jack (see Figure C-4 and Table C-4). The adapter's physical dimensions are:

- 0.6 in. (18 mm) wide
- 3.625 in. (90 mm) high
- 1.3 in. (33 mm) deep

Note: Modular jack spring positions are numbered sequentially from left to right with the tap facing upward.

Jumper J17 pins 5 and 30 are the PSTN connections.

This adapter is available as Motorola Part No. 2882174W02.

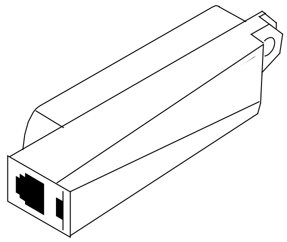


Figure C-4: Model 259B Single-line RJ-45 Adapter

Table C-4: Model 259B Modular Spring Positions (Sheet 1 of 2)

Pair	Modular Jack Spring Position	J17 Pin Connection
1	5	30
	4	5
2	3	32
	6	7

Table C-4: Model 259B Modular Spring Positions (Sheet 2 of 2)

Pair	Modular Jack Spring Position	J17 Pin Connection
3	2	6
	7	33
4	1	31
	8	8

258B Six-line RJ-45 Adapter

The 258B Adapter has a 50-pin male mini-ribbon connector. This adapter distributes the pairs from a 25-pair cable to six RJ-45 modular jacks (see Figure C-5 and Table C-4). This adapter can be used for single line applications. However, it is required for multiple telephone line connections. The adapter's physical dimensions are:

- 0.9 in. (23 mm) wide
- 3.6 in. (90 mm) high
- 1.7 in. (43 mm) deep

Note: Modular jack spring positions are numbered sequentially from left to right with the tap facing upward.

Jumper J17 pins 30 and 5 are the PSTN connections.

This adapter is available as Motorola Part No. 2882174W01.

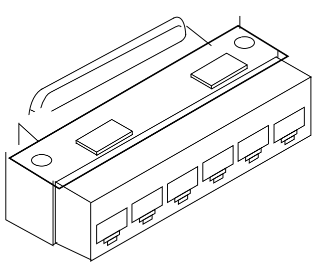


Figure C-5: Model 258B Six-line RJ-45 Adapter

Table C-5: Model 258B Modular Spring Positions (Sheet 1 of 2)

Pair	Modular Jack Spring Position	J17 Pins					
		Jack 1	Jack 2	Jack 3	Jack 4	Jack 5	Jack 6
1	5	26	30	34	38	42	46
	4	1	5	9	13	17	21
2	3	28	32	36	40	44	48
	6	3	7	11	14	19	23

Table C-5: Model 258B Modular Spring Positions (Sheet 2 of 2)

Pair	Modular Jack Spring Position	J17 Pins Jack 1	Jack 2	Jack 3	Jack 4	Jack 5	Jack 6
3	2	2	6	10	14	18	22
	7	29	33	37	41	45	49
4	1	27	31	35	39	43	47
	8	4	8	12	16	20	24

J14 PSTN Modem Channel

J14 is the PSTN modem connector (see Table C-6).

Table C-6: J14 PSTN Modem Connector Pinouts (Sheet 1 of 2)

Pin Number	Signal	Input	Output	Function
1	GND		X	Ground
2	PSTN TXD		X	PSTN transmit data
3	PSTN RXD	X		PSTN receive data
4	PSTN RTS		X	PSTN request to send
5	PSTN CTS	X		PSTN clear to send
6	PSTN DSR	X		PSTN data set ready
7	GND		X	Ground
8	PSTN DCD	X		PSTN data carrier detect
9	Open			
10	Open			
11	Open			
12	Open			
13	Open			
14	Open			
15	PSTN TCLK		X	PSTN transmit clock
16	Open			
17	PSTN RCLK	X		PSTN receive clock
18	Open			
19	Open			
20	PSTN DTR		X	PSTN data terminal ready
21	Open			
22	PSTN RI	X		PSTN ring indicator

Table C-6: J14 PSTN Modem Connector Pinouts (Sheet 2 of 2)

Pin Number	Signal	Input	Output	Function
23	Open			
24	Open			
25	Open			

RF-Baton! Transmitter Controller Interface

This appendix describes the interface between a Nucleus™ paging station and an RF-Baton!™ (RF-B!) transmitter controller. The interface is the Wildcard Interface Board (WIB) that resides in the Nucleus paging station. This chapter contains the following information:

Overview

The RF-B! transmitter controller provides an interface between the WMG-Administrator! and the Nucleus paging station. The RF-B! transmitter controller also provides synchronization timing for the transmitter in the network from the Global Positioning System (GPS).

For a complete description of the RF-B! transmitter controller, see *RF-Baton!*™ *Transmitter Controller Installation and Operation Guide*, 6880497G05.

WIB Interface

The WIB interface consists of the following elements:

- Eight inputs that the Nucleus paging station uses to monitor external site equipment
- Eight open-collector outputs which may be used to indicate alarms

The WIB outputs drives the following types of transistor-transistor (TTL) and complementary metal-oxide semiconductor (CMOS) logic:

- Low-power Schottkey (LS) TTL
- Advanced Low-power Schottkey (ALS) TTL
- Fast TTL
- CMOS logic

Note: The WIB outputs cannot drive standard TTL reliably. The low voltage specified for standard TTL is marginal on the WIB.

Synchronous Local Control (SyLC) Protocol

The WIB uses Synchronous Local Control (SyLC) protocol. The SyLC protocol is synchronous and uses three TTL-compatible lines:

- Tx Baud Clock—runs at the symbol rate and indicates the symbol boundaries.
- Tx Data Clock—runs at the bit rate and clocks Tx Data bits from the Tx Data Line.
- Tx Data—runs at the clocked rate from Tx Data Clock

Note: In the 2-level FLEX messaging, the baud clock and the data clock run at equal rates. During idle conditions, the baud and data clocks go to a high state.

External key request (Ext Key Req) provides external control. Ext Key Req goes active 250 ms before valid data. The Ext Key Req line is programmable for active high or active low.

Note: For POCSAG and FLEX operation, the FLEX Select line must be pulled high. To do this, connect pin 18 of the interface through the 10 kW pullup resistor to pin 8.

Each pullup resistor on a WIB output is 470 Ohm. The output of the resistor acts as a divider when the output is used as an external pullup (see Figure D-1). An external pullup resistor with a value of 10 kOhm or more minimizes the output voltage increase. A collector current (Ic) ≤ 12 mA ensures that V_{out} is ≤ 0.8 V for logic integrity.

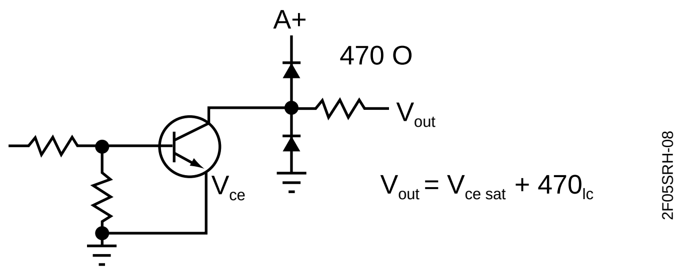


Figure D-1: Pullup Resistor in a WIB Output

WIB Inputs

The WIB provides eight software-controlled WIB inputs (active low). The WIB input interface effectively looks like a 28 k pullup resistor that can be pulled up to +5 V. WIB inputs are typically at 1.5 V in the idle state as a result of an internal resistor divider network. For the WIB to read an input successfully, the input must be stable for 40 ms.

WIB Alarm Relay

The alarm relay provides external closure contacts for user-selected station alarms (see Table D-1).

Table D-1: WIB External Closure Contact Specifications

Specification	Value
Maximum Switching Power	30 W 62.5 Vac
Maximum Switching Current	1 A
Maximum Switching Voltage	220 Vdc, 250 Vac
Operate Time	2 ms
Release Time	1 ms

Replacement Procedure

The WIB resides behind the control front panel to the right of the Station Control Board when viewed from the front of the station. This section describes replacement.

Replacement Procedure

Use this procedure to replace the WIB:

1. Connect a antistatic wrist strap connector to one of the two ground jacks on the cage.
2. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn off power by turning the power supply On-Off switch(es) to Off (press the 0 side of the switch).
4. Remove the mounting screws from the very top and very bottom of the Station Control Module (SCM) front panel. Pull the SCM front panel outward until the ribbon cable connector is accessible.
5. Disconnect the ribbon cable connector from the rear of the SCM front panel to the Station Control Board, and set aside the SCM front panel.
6. Remove the WIB (on right side in cavity behind SCM front panel) by pulling it straight out.
7. Set all jumpers on the replacement WIB to match those on the faulty WIB. These include input-output impedance matching jumpers, 2-wire or 4-wire selection jumper, and DC remote control selection jumpers.

CAUTION

Do not force the WIB into the backplane connector. Use moderate pressure and rock the WIB slightly until it is completely seated.

8. Install the replacement WIB by sliding the it into the cage. Seat the WIB connectors firmly in the backplane.
9. Reconnect ribbon cable from Station Control Board to the rear of the SCM front panel.
10. Replace the SCM front panel and secure with two mounting screws removed in Step 4.
11. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).
12. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

Post-replacement Optimization Procedure

The WIB does not require a post-replacement procedure.

Receivers

This appendix describes the function, configuration, and replacement procedures for the receivers used in a Nucleus™ paging station. This appendix describes link receivers and monitor receivers.

The contents of this appendix include:

The Nucleus paging station uses two types of receiver:

- A link receiver provides an interface to a link transmitter.
- A monitor receiver receives maintenance messages from paging stations, including the paging station at the same site, for transmission to a controller.

These receivers comprise the following (see Table 1-7 and Table 1-8):

- Midband (72–76 MHz) link receiver only
- VHF (132–154 MHz and 150–174 MHz) link receivers and monitor receivers
- 280 MHz (276–286 MHz) monitor receiver only
- UHF (403–433 MHz, 438–470 MHz, 470–494 MHz, and 494–520 MHz) link receivers and monitor receivers
- 900 MHz (922–941 MHz and 941–960 MHz) link receivers and monitor receivers

Configure a receiver as a monitor receiver or a link receiver through the Configuration (<**CNFG**>) menu, RX TYPE submenu.

Operation

This section describes the operation of a receiver. This description is for all five ranges. Where differences occur between ranges, the differences appear in a table or other explanatory information.

Overview

A Nucleus paging station receiver can operate either as a link receiver or as a monitor receiver. The Station Control Module (SCM) controls and supports the receiver.

Link Receiver

Networks that use link transmitters to cover large distances use link receivers at the Nucleus paging station site (see Figure E-1). The controller sends the paging data stream to the link paging station. The transmission may be land line or satellite.

The link transmitter sends the messaging data stream to the other transmitters in the network. A link receiver at each destination transmitter receives an RF messaging signal from a link transmitter and converts it to messaging data for the destination transmitter.

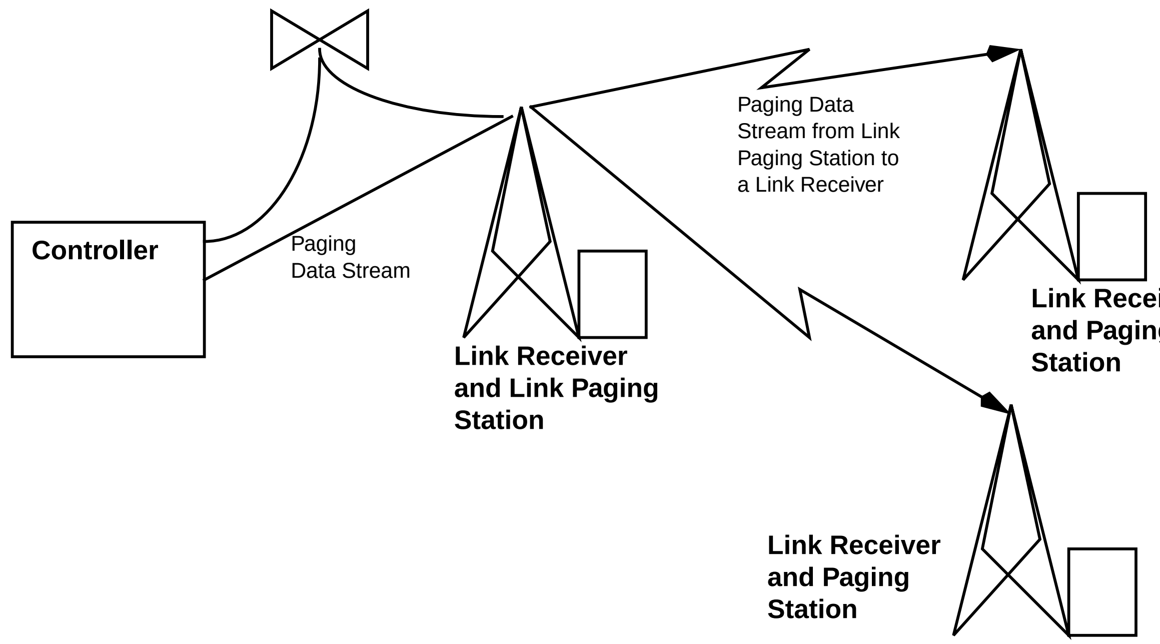


Figure E-1: Link Receiver Application

Monitor Receiver

Networks that use maintenance groups to synchronize transmitters also use monitor receivers (see Figure E-2).

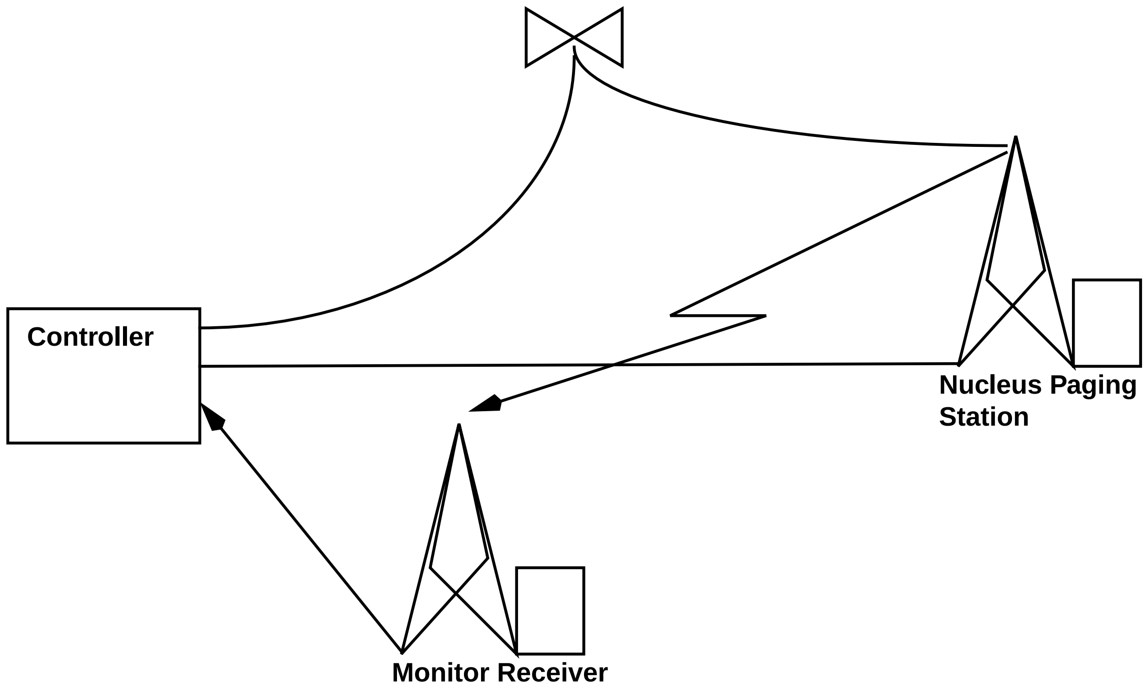


Figure E-2: Monitor Receiver Application

The controller sends a paging data stream to a transmitter. At various times during the day, the controller also sends a maintenance signal to the transmitter. The transmitter responds to the maintenance signal by transmitting a maintenance signal.

The monitor receiver receives the response and logs the time when the response is received. The monitor receiver sends the responses of all the transmitters back to the network controller for analysis to determine:

- Whether each transmitter is responding.
- Whether the paging station is synchronized with the other transmitters.

Circuitry

A receiver consists of a preselector and a receiver. In addition, a Control/Receiver Interface Board (CRIB) resides on the SCM.

Preselector Assembly

The preselector assembly provides a bandpass filter for the receive RF input signal. The filter assembly is mounted on the front of the receiver housing and provides mini-UHF connectors for input from the receive antenna and output to the receiver. The filter assembly has tuning screws for filter tuning. The tuning procedures for the receivers are described in paragraph, "Tuning Procedure–VHF and Midband", paragraph, "Tuning Procedure–UHF Preselector", and paragraph, "Tuning Procedure–280 MHz Preselector".

Note: The 900 MHz receiver does not use a preselector.

Receiver Circuitry

The receiver contains the following circuitry:

- The receiver front end circuitry filters and amplifies the receiver RF signal performs the first down conversion for the receive RF signal.
- The custom receiver integrated circuit (IC) circuitry is a custom IC. It performs the second down conversion. It also filters and amplifies the receive signal and performs A/D conversion on the receive signal.
- The synthesizer circuitry contains a phase-locked loop (PLL).
- The voltage controlled oscillator (VCO) circuitry contains two VCOs and a band-shift switch. The VCO circuitry generates signal that passes to the first low injection amplifier in the receiver front end circuitry.
- The address decode and A/D converter circuitry decodes addresses provide memory board and chip select signals. This circuitry also converts analog status signals to digital format for transfer to the SCM.
- The local power supply regulation circuit accepts +14.2 Vdc input and creates +10 Vdc and +5 Vdc operating voltages.

CRIB Circuitry

The CRIB contains the following circuitry:

- The digital signal processing circuitry converts the digital signal from the receiver to the desired audio output.
- The interface circuitry controls the audio path of the desired audio signal.

The CRIB processes the digitized receive signal into an analog audio output. For a link receiver, the CRIB gates the audio to LINK_RX_AUDIO. For a monitor receiver, the CRIB gates the audio to MONITOR_RX_AUDIO.

By default, the audio output data is not inverted. To invert the data, use the Nucleus paging station SCM front panel (Receiver menu).

Receiver Replacement Procedures

This section describes replacement procedures for the receivers.

Antistatic Precautions

The circuitry in modules and boards contains CMOS and other static-sensitive devices. Use the following procedure to prevent damage to the modules from electrostatic discharge (ESD).

DANGER

Use extreme caution in the presence of high voltage. The wrist strap provides a good ground. The wrist strap also provides danger of lethal shock from accidental contact with high voltage.

Use the following procedure to connect a wrist strap to the station:

1. Wear a wrist strap (Motorola Part No. 4280385A59, or equivalent) during all service procedures to minimize static buildup. The cage contains ground jacks to connect to the wrist strap (see Figure E-3).

2. Connect the wrist strap to one of the ground jacks.

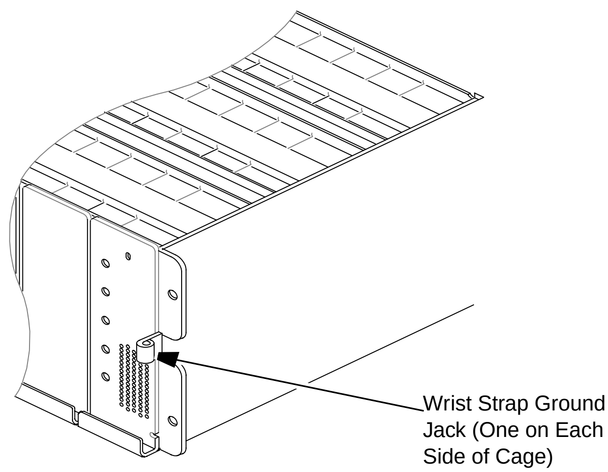


Figure E-3: Location of the Ground Jack for the Wrist Strap Connection

External Monitor Receiver Connector

If the Nucleus paging station has an external monitor receiver, it requires an external monitor receiver connector. Use the following procedure to connect the receiver:

1. Locate the external monitor receiver cable (shipped with the external monitor receiver option).

2. Connect the monitor receiver audio line to the backplane connector J17, pair 22, pin 47. This is the tip conductor for Monitor Rx Audio.

3. Connect the monitor receiver ground line to the backplane connector J17, pair 9, pin 43. This is the conductor for Transmitter Data Polarity.

External Analog Link Receiver Connector

Note: The external analog link receiver requires link modem option X443.

If the Nucleus paging station uses an external analog link receiver, the installation package contains a cable that connects the receiver to the Nucleus paging station backplane connector J19, the link receiver connector.

Use the following instructions to connect or replace an external analog link receiver:

1. Connect the link receiver audio line, Link Rx Audio, to backplane connector J19, pin 5 (see Table E-1).

2. If it is used, connect link receiver squelch line, Ext Link Rx Sq Ind, to backplane connector J19, pin 3. This is the external link.

3. Connect link receiver ground line, GND, to backplane connector J19, pin 1.

Table E-1: J19 Link Receiver Pinouts

Pin Number	Signal	Input	Output	Function
1	GND		X	GND
2	Ext Link Rx DPL En	X		External link receiver digital private line (DPL) enable
3	Ext Link Rx Sq Ind	X		External link receiver squelch indicator
4	Ext Link Rx DPL Ind	X		External link receiver DPL detect.
5	Link Rx Audio[1]	X	X	Internal or external link receiver audio
6	Open			Open
7	Open			Open
8	Open			Open
9	13.8 V		X	13.8 Vdc from power supply

1. Pin 5 is an input if a receiver is configured as a link receiver, or as “no internal”. Line is an output if a receiver is configured as a monitor receiver.

Internal Monitor Receiver

This section describes the replacement procedure for an internal monitor receiver in a Nucleus paging station or a Nucleus paging station with Advanced Control (NAC).

Software

For a Nucleus paging station, the application software must be Version 3.21 or higher to use with the receiver module (see Chapter 9, "SCM Station Alarms, Status, Troubleshooting, and Alignment", Chapter , "Station Status").

For a NAC station, the NAC firmware must be Version 3.2x or higher to use with the receiver module (see Chapter 7, "Basic Keypad Procedures", Table 7-2).

Preparation

Use the following procedure to install or replace the monitor receiver:

1. If the station has AC power with a battery revert option (X30 or X43), use the following procedure:
   a. Disconnect the batteries.
   b. Turn the power On-Off switch(es) to Off (press the 0 side of the switch).
   c. Remove the module or board by following the instructions in the sections that follow.

DANGER

Do not insert or remove a module or board with the power turned on. Inserting or removing a module with the power turned on may result in damage to the station or the module.

In high power Nucleus paging stations, turn off both power supplies

2. Keep each spare modules in an antistatic bag for storage and transporting. Pack modules in antistatic materials to ship hem.

3. To restore power, use the following procedure:
   a. Turn the power On-Off switch(es) to On (press the 1 side of the switch).
   b. Reconnect the batteries.

4. At the rear of the station, route the receive input RF cable from the back of the antenna bracket through the hold in the station backplane (see Figure E-4):
   a. Route the 900-MHz cable through a hole in the backplane.
   b. Route the VHF, 280-MHz or UHF cable around the side of the backplane.

5. Go to the appropriate procedure:
   - VHF, 280 MHz, or UHF (see paragraph , VHF, 280 MHz, or UHF Receiver Procedure)
   - 900 MHz (see paragraph , 900-MHz Receiver Procedure)

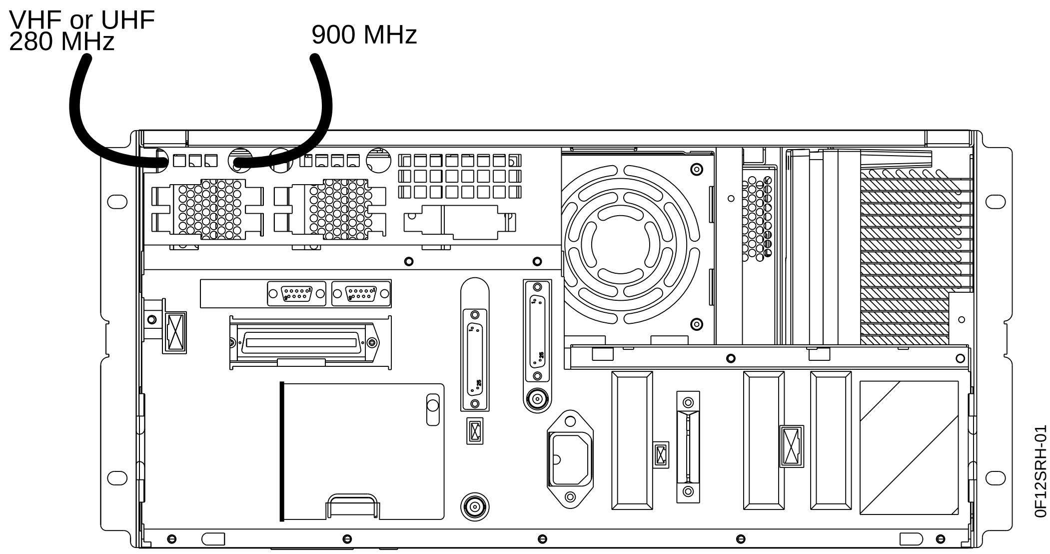


Figure E-4: Routing for the Receive Cable

VHF, 280 MHz, or UHF Receiver Procedure

Use the following procedure to install a VHF, 280 MHz, or UHF receiver:

1. At the front of the station, remove the blank front cover from the far right-hand side of the station.

2. Slide the receiver module part-way into the slot on the far right-hand side of the station. (Do not push the receiver module all the way in. The receiver module should extend from the front of the transmitter by approximately two inches.)

3. Connect the receive RF module cable to the mini-UHF connector on the station preselector assembly (see Figure E-5).

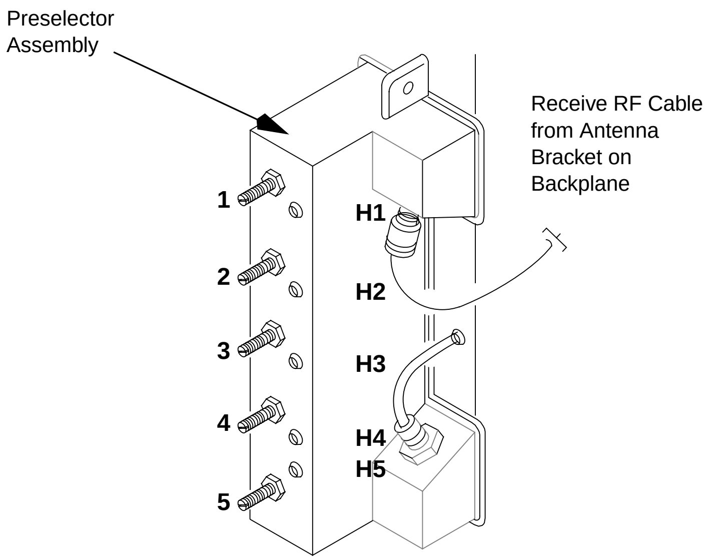


Figure E-5: Preselector Assembly in a VHF, 280 MHz, or UHF Module

4. Slide the module the rest of the way into the backplane.

CAUTION

Do not slam the module against the backplane or push any harder than necessary to seat the connectors.

5. Secure the front panel of the receiver with two mounting screws.

900-MHz Receiver Procedure

Use the following procedure to install a 900-MHz receiver:

1. At the front of the station, remove the blank front cover from the far right-hand side of the station to expose two slots.

2. Slide the receiver module part-way into the left slot on the front of the station. (Do not push the receiver module all the way in. The receiver module should extend from the front of the transmitter by approximately two inches.)

3. Route the cable along the slot at the top of the module and out through the Receiver front panel.

4. Connect the receive input RF cable to the mini-UHF connector on the front of the module.

5. Slide the module into the backplane.

CAUTION

Do not slam the module against the backplane or push any harder than necessary to seat the connectors.

6. Secure the front panel of the receiver with two mounting screws.

7. Secure the half-width blank front panel with two mounting screws over the open slot.

CRIB Replacement

The CRIB board is required for the receiver. Use one of the following procedures to install or replace the CRIB board:

- Nucleus paging station
- NAC paging station
- C-NET and NIU control or RF-Baton!™ transmitter controller
- Nucleus Advanced Control (NAC) control

Note: The station power supplies should still be turned off.

CRIB for a Nucleus Paging Station

Use the following procedure to install a CRIB in a Nucleus paging:

1. Remove the mounting screws from the very top and very bottom of Station Control Module (SCM) front panel.

Note: The SCM consists of the SCM front panel and the Station Control Board (SCB). This procedure refers to the SCB.

2. Pull the SCM front panel out until the ribbon cable connector is accessible.

3. Disconnect the ribbon cable connector from the SCB, and set the SCM front panel aside.

4. Insert the board-pulling arm into the notch at the bottom front of the SCB.

5. Pull the SCB straight out.

6. In the package, locate the CRIB standoffs. Pinch each standoff and insert it into one of four standoff holes in the CRIB (see Figure E-6).

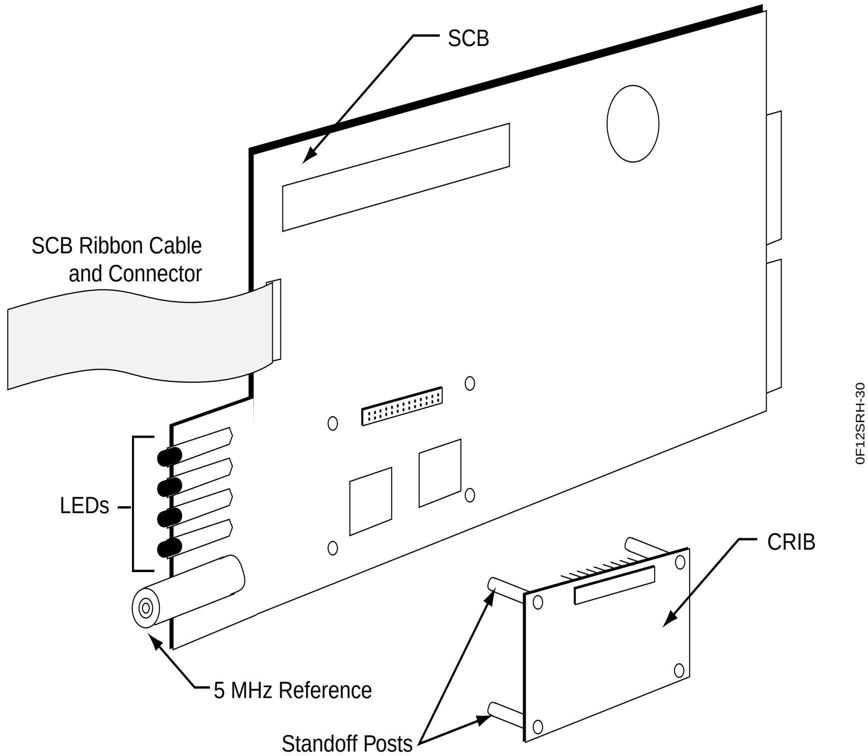


Figure E-6: Location of the Standoffs on the CRIB for an SCB

7. Insert the CRIB connector pins of the SCB into connector P11 on the SCB.

8. Align the pins properly.

9. Seat the CRIB fully on the standoffs (see Figure E-7).

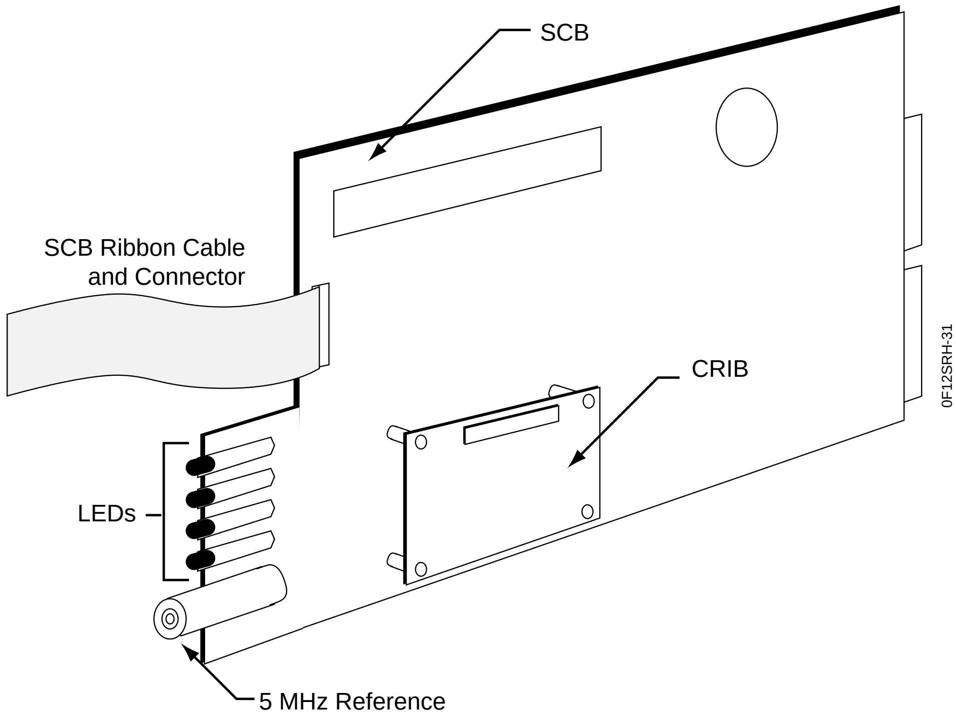


Figure E-7: CRIB Mounted on the SCB

10. Slide the SCB in the cage.

11. Press the connectors firmly into the backplane.

CAUTION

Do not slam the module against the backplane or push any harder than necessary to seat the connectors.

12. Reconnect the ribbon cable from the rear of the SCM front panel to the connector on the SCB.

13. Replace the SCM front panel, and secure it with the mounting screws.

14. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).

15. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

16. Remove the antistatic wrist strap from the cage.

CRIB for a NAC Station

Use the following procedure to install a CRIB on a NAC station:

1. Remove the mounting screws from the very top and very bottom of NAC front panel.
2. Pull the NAC front panel out until the ribbon cable connector is accessible.
3. Disconnect the ribbon cable connector from the NAC Board, and set the NAC front panel aside.
4. Insert the board-pulling arm into the notch at the bottom front of the NAC Board. Pull the NAC Board straight out.
5. In the package, locate the CRIB standoffs. Pinch each standoff and insert it into one of four standoff holes in the CRIB.
6. Insert the CRIB connector pins into connector P11 on the NAC Board (see Figure 1).

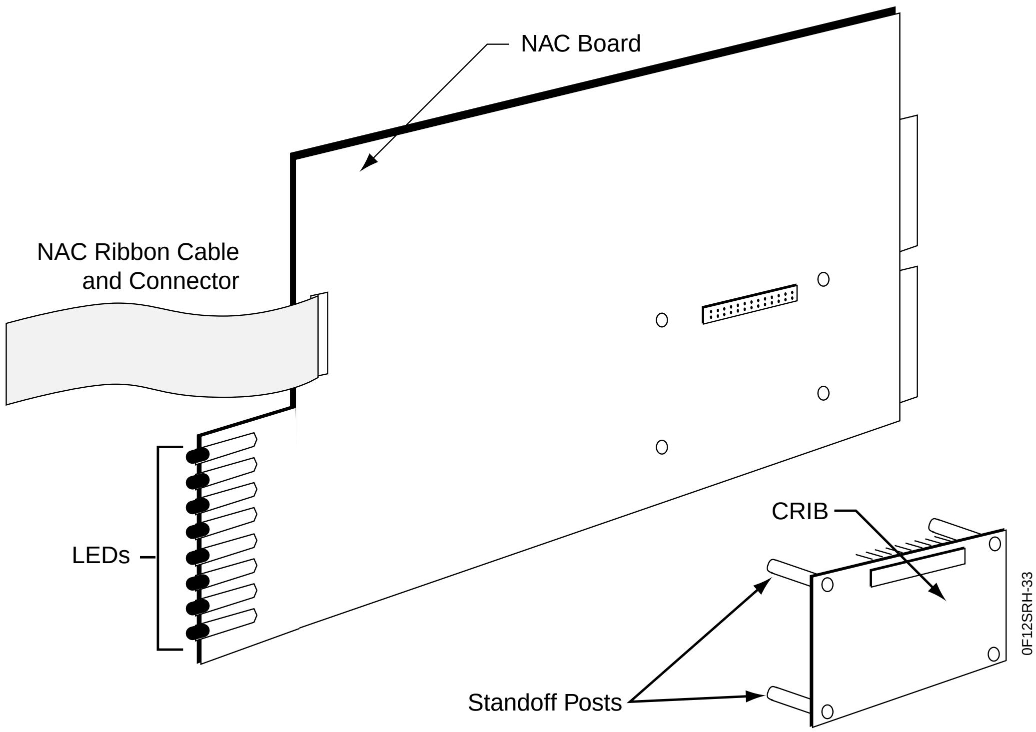


Figure 1: Location of Standoffs on the NAC Board

Figure E-8: Location of the Standoffs for a NAC CRIB

7. Align the pins properly.
8. Seat the CRIB standoffs fully on the NAC board (see Figure E-9).
9. Slide the NAC Board in the cage.

CAUTION

Do not slam the module against the backplane or push any harder than necessary to seat the connectors.

10. Press the connectors firmly into the backplane.

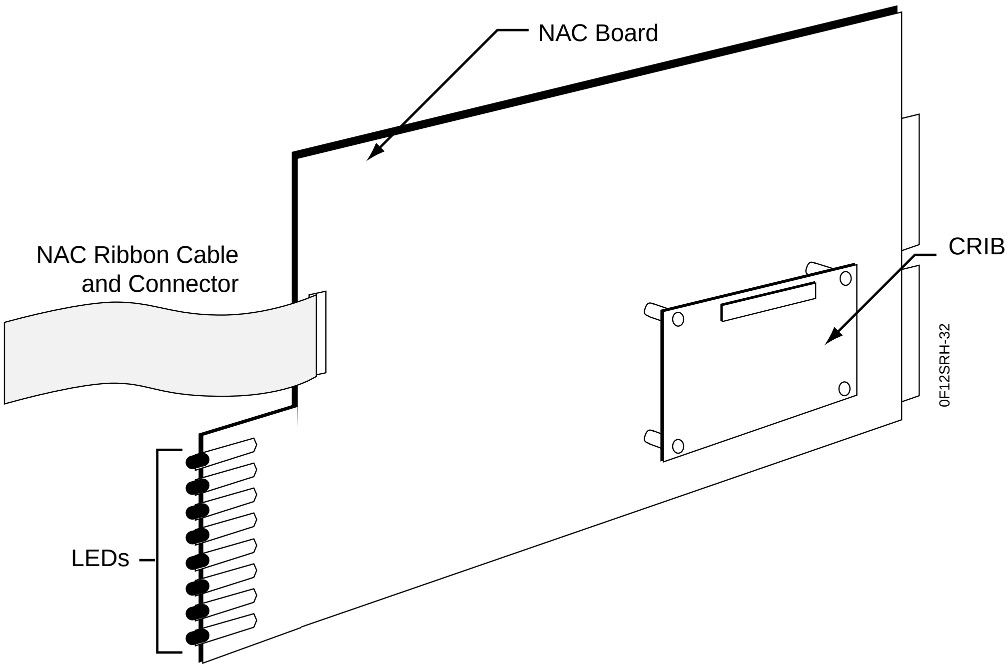


Figure E-9: CRIB Mounted on the NAC Board

11. Reconnect the ribbon cable from the rear of the NAC front panel to the connector on the NAC Board.

12. Replace the NAC front panel, and secure it with the mounting screws.

13. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).

14. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), reconnect the batteries.

15. Remove the antistatic wrist strap from the cage.

900 MHz Receiver Replacement

Use this procedure to replace a 900 MHz receiver:

1. Connect a antistatic wrist strap connector to one of the two ground jacks in the cage.
2. If the station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn the power On / Off switch(es) to the Off position (press the 0 side of the switch).
4. Remove the mounting screws from the top and bottom of the receiver.
5. Disconnect mini-UHF connector on RF cable connecting receiver to the antenna.
6. Remove faulty module from cage.
7. Install replacement receiver by sliding module into cage.
8. Route the RF cable connecting the receiver to the antenna in the slot on top of the module housing.
9. Firmly press the module connector into the backplane.

CAUTION

Replace the module in the second from the right side of the station cage. Do not slam the module against the backplane or push any harder than necessary to seat the connectors.

10. Connect the RF cable from the antenna.
11. Secure the reference module with two mounting screws removed in Step 4.
12. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).
13. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), then reconnect the batteries.
14. Remove the antistatic wrist strap from the cage.

Midband, 280 MHz, VHF, and UHF Receiver Replacement

Midband, VHF, and UHF receivers consist of two field replaceable units (FRUs):

- Preselector assembly attached to the antenna bracket
- Receiver

Use the following procedures to replace the assembly and the module. If the receiver has a preselector, perform the preselector tuning procedure that follows.

1. Connect a antistatic wrist strap connector to one of the two ground jacks in the cage.
2. If the station has AC power with a battery revert option (X30 or X43), disconnect the batteries.
3. Turn the power On / Off switch(es) to the Off position (press the 0 side of the switch). Continue with the procedure to replace the receiver.

Replace the Receiver

Use the following procedure to replace the receiver:

1. Remove the mounting screws from the very top and very bottom of the receiver.
2. Slide the module out just far enough to disconnect the mini-UHF connector on the RF cable (RF input to the module) connected to the preselector assembly.
3. Disconnect cable (mini-UHF connector) connected to receiver.
4. Remove nine (9) TORX® head screws that secure the receiver to the module housing. Note the location of foam insulating pad under the Voltage controlled oscillator (VCO) portion of receiver.
5. Remove the faulty board and replace it with a known good board. Position the foam insulating pad behind the VCO.
6. Secure the board using the TORX head screws removed in Step 4. Reconnect RF cable to mini-UHF connector on board.
7. Install the replacement receiver by sliding the module into the cage. Push the module in to within approximately 2 in. of complete installation.
8. Connect the RF input cable to the mini-UHF connector on the Preselector assembly.
9. Slide the module in completely and firmly press the module connector into the backplane.

CAUTION

Do not slam the module against the backplane or push any harder than necessary to seat the connectors.

10. Secure with the two screws in the top and bottom of the module.
11. Restore power by turning the power supply On-Off switch(es) to On (press the 1 side of the switch).
12. If the Nucleus paging station has AC power with a battery revert option (X30 or X43), then reconnect the batteries.

Replace the Preselector Assembly

Use the following procedure to replace the Preselector Assembly:

1. Disconnect cables (mini-UHF connectors) from assembly.

2. Remove the faulty Preselector assembly by removing two (2) TORX head screws from the module housing.

3. Install a known good assembly. Secure the assembly using the TORX head screws removed in Step 2.

4. Reconnect the RF cables to the mini-UHF connectors.

5. Remove the antistatic wrist strap from the cage.

Testing and Tuning

The preselector assembly is a bandpass filter equipped with tuning slugs to adjust the passband corresponding to the operating frequency(s) of the receiver. The preselector assembly used in this procedure is one of the following:

- 5-pole, used for a Midband or VHF receiver
- 3-pole, used for a UHF receiver

The preselector assembly must be field-tuned if replaced in the field or if the receiver operating frequency(s) are modified. The tuning procedures follow.

Note: The 900 MHz receiver does not have a preselector and does not require tuning.

Required Test Equipment

The test equipment required to tune the preselector assembly properly is listed in Table E-2.

Table E-2: Test Equipment for Preselector Tuning

Equipment	Recommended	Used for	Notes
RF Signal Generator	Motorola R2600 communication analyzer, Motorola R2001 communication analyzer, or HP8657A signal generator	R2600 generates and measures simultaneously. R2001 generates or measures; not both at once	R2001 as the signal generator: take the RF signal from the antenna port
Dip and Peak Monitor	HP435B power meter (or equivalent) with HP8484A sensitive power head, or Boonton Model 92E with BNC input, or R2001/R2600 using the spectrum analyzer function.	Dip and peak monitoring and tuning	
Torque Screwdriver	12 in.-lb or torque		Requires 10 mm deep well socket
Tuning Probe	Motorola PN 0180763D22		Part of TRN7799A tuning kit
Flat-blade Screwdriver			

Preparing Test Equipment

Use the following procedure to prepare the test equipment:

1. Install the receiver (with Preselector assembly) in a functional station equipped with a power supply module.

2. Remove the two TORX head screws from the receiver front panel and remove the front panel.

3. Detune the preselector by turning the tuning screws in (clockwise) until 1/8 in. of each screw extends past its tension nut.

4. Use the torque driver and deep well socket to tighten the each tension nut on the adjustment screw to 6 in.lb.

5. Connect the test equipment (see Figure E-10).

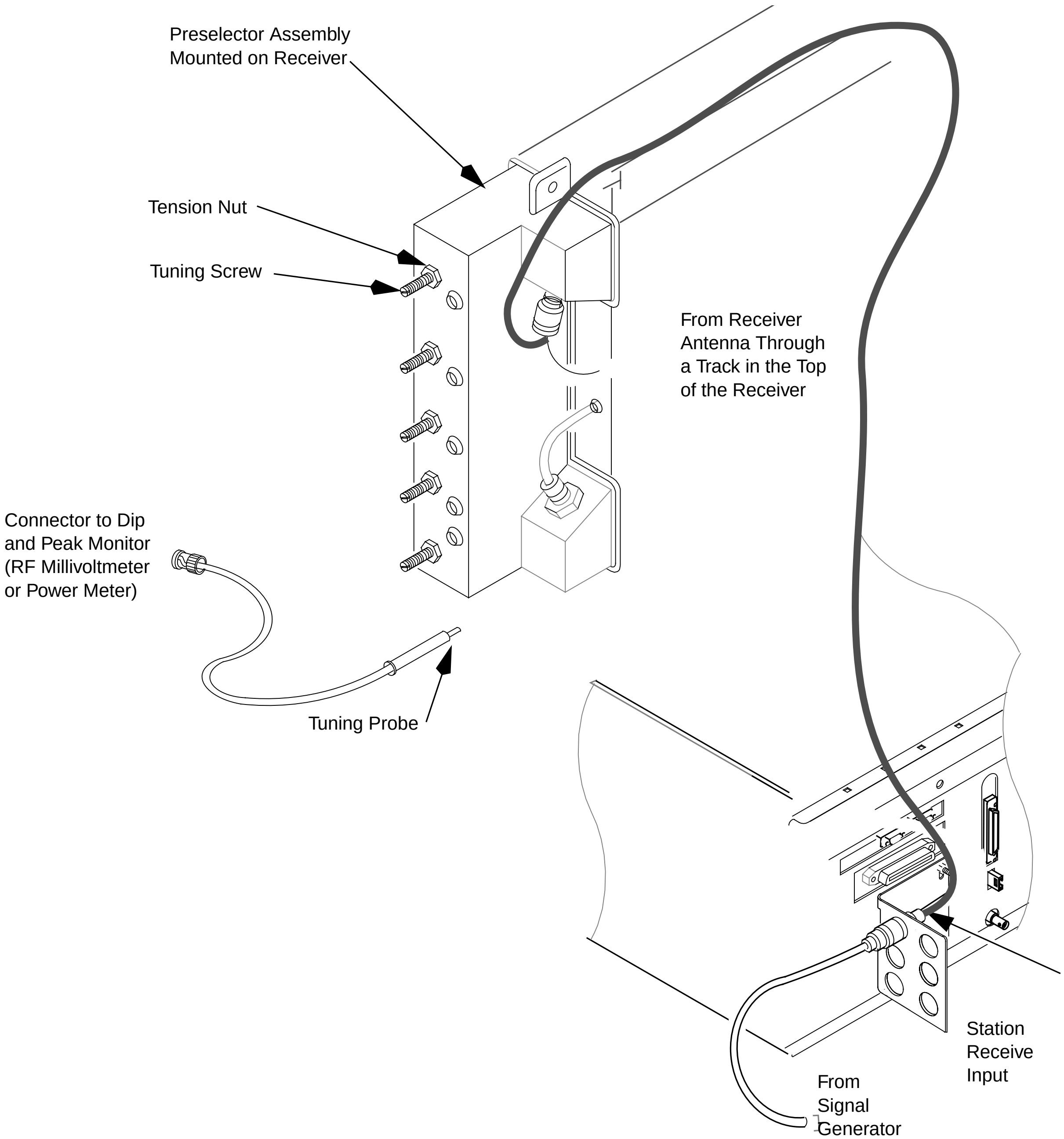


Figure E-10: Test Equipment Setup (UHF Has Three Screws)

Proper Alignment Frequency–VHF and Midband

Note: Tuning for best SINAD response does not result in optimum tuning of the preselector assembly. You must use this field tuning procedure to obtain optimum preselector performance.

Use one of the following methods to calculate the alignment frequency to be generated by the signal generator.

Receivers with a Single Receive Frequency

Use the one of the following steps to calculate the appropriate alignment frequency:

1. Determine the receiver receive frequency (f_{rx}).

2. Calculate the alignment frequency (f_{align}):
   - Calculate the alignment frequency (f_{align}) for a VHF 132–154 MHz receiver:
     - If $134 \leq f_{rx}$ v 152 MHz, then $f_{align} = f_{rx}$.
     - If $f_{rx} < 134$ MHz, then $f_{align} = 134$ MHz.
     - If $f_{rx} > 152$ MHz, then $f_{align} = 152$ MHz.
   - Calculate the alignment frequency (f_{align}) for a VHF 150–174 MHz receiver:
     - If $152 \leq f_{rx}$ v 172 MHz, then $f_{align} = f_{rx}$.
     - If $f_{rx} < 152$ MHz, then $f_{align} = 152$ MHz.
     - If $f_{rx} > 172$ MHz, then $f_{align} = 172$ MHz.
   - Calculate the alignment frequency (f_{align}) for a Midband 72–76 MHz receiver:
     - $f_{align} = f_{rx}$.

Receivers with Multiple Receive Frequencies

Note: The receive frequency for each channel supported by the receiver.

1. Calculate a midpoint frequency:

   $f_{mid} = (f_{highest} + f_{lowest}) \div 2$

2. Using f_{mid} in place of the receiver receive frequency (f_{rx}), perform the appropriate calculation above.

Note: When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to verify that you have obtained a true peak or dip. Then turn the screw back to the location of the original peak or dip.

Tuning Procedure–VHF and Midband

Use the following procedure to tune the preselector:

1. Turn the station power supply ON (to provide the active 50 W termination).

2. Adjust the signal generator to the alignment frequency calculated previously. Set the level to +5 dBm.

3. Insert the tuning probe into cavity H2 and adjust tuning screw 1 for a PEAK.

4. Insert the tuning probe into cavity H1 and adjust tuning screw 2 for a DIP (see Figure E-11).

5. Insert the tuning probe into cavity H2 and adjust tuning screw 3 for a DIP.

6. Insert the tuning probe into cavity H3 and adjust tuning screw 4 for a DIP.

7. Insert the tuning probe into cavity H4 and adjust tuning screw 5 for a DIP.

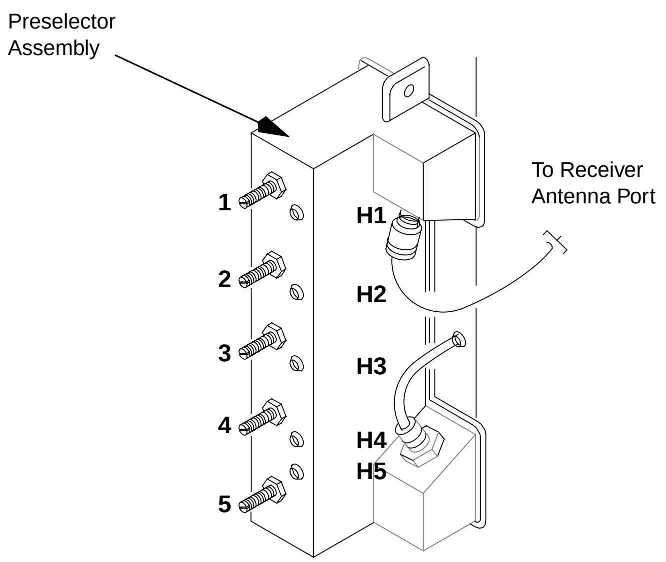


Figure E-11: Location of Tuning Screws and Cavity Probe Holes

Proper Alignment Frequency–UHF Preselector

Use one of the following methods to calculate the alignment frequency (f_{align}) for the signal generator.

Single Receive Frequency

1. Determine the receiver receive frequency. Add 200 kHz. This frequency is f_{rx}.

2. Calculate the alignment frequency (f_{align}).
   – Calculate the alignment frequency (f_{align}) for a UHF 403–433 MHz receiver:
     - If $405 \leq f_{rx}$ v 431 MHz, then $f_{align} = f_{rx}$.
     - If $f_{rx} < 405$ MHz, then $f_{align} = 405$ MHz.
     - If $f_{rx} > 431$ MHz, then $f_{align} = 431$ MHz.
   – Calculate the alignment frequency (f_{align}) for a UHF 438–470 MHz receiver:
     - If $440 \leq f_{rx}$ v 468 MHz, then $f_{align} = f_{rx}$.
     - If $f_{rx} < 440$ MHz, then $f_{align} = 440$ MHz.

    - If f_{rx} > 468 MHz, then f_{align} = 468 MHz.
- Calculate the alignment frequency (f_{align}) for a UHF 470–496 MHz or 496–520 MHz receiver:
    - If 472 ≤ f_{rx} v 518 MHz, then $f_{align} = f_{rx}$.
    - If f_{rx} < 472 MHz, then f_{align} = 472 MHz.
    - If f_{rx} > 518 MHz, then f_{align} = 518 MHz.

Multiple Receive Frequencies:

1. Note the receive frequency for each channel supported by the receiver.
2. Calculate a midpoint frequency:

   $f_{mid} = (f_{highest} + f_{lowest}) \div 2$

3. Using f_{mid} in place of the receiver receive frequency, perform the appropriate calculation above.

Tuning Procedure–UHF Preselector

Use this procedure to tune the UHF preselector:

1. Turn the station power supply ON (to provide the active 50 W termination).
2. Adjust the signal generator to the alignment frequency calculated previously. Set the level to +5 dBm.
3. Insert a tuning probe into cavity U2 and adjust tuning screw 2 for a PEAK.
4. Tighten the tension nut on tuning screw 2 to at least 12 in.-lb. Fine tune tuning screw 2 for a PEAK.
5. Keep the tuning probe in cavity U2 and adjust tuning screw 3 for a DIP.
6. Tighten the tension nut on tuning screw 3 to at least 12 in.-lb. Fine tune tuning screw 2 for a DIP.
7. Insert the tuning probe into cavity U3. Decrease the output from the signal generator to -5 dBm.
8. Adjust tuning screw 4 for a DIP.
9. Tighten tension nut on tuning screw 4 to at least 12 in.-lb and fine tune tuning screw 4 for a DIP.

Proper Alignment Frequency–280 MHz Preselector

Use one of the following methods to calculate the alignment frequency (f_{align}) to be generated by the signal generator.

Single Receive Frequency

1. Determine the receiver receive frequency**.** Add 200 kHz. This frequency is f_{rx}.
2. Calculate alignment frequency (f_{align}) for a UHF 276–288 MHz receiver:

If 278 £ f_{rx} ≤286 MHz then f_{align}= $f_{rx.}$

If f_{rx} < 278 MHz then f_{align}= 278 MHz.

If f_{rx} > 286 MHz then f_{align} = 286 MHz.

3. For receivers with multiple receive frequencies
   a. Note the receive frequency for each channel supported by the receiver.
   b. Calculate a midpoint frequency as follows:

   $f_{mid} = (f_{highest} + f_{lowest}) * (1 / 2)$

   c. Using f_{mid} in place of the receiver frequency, perform Step 1 and Step 2 above.

Required Test Equipment–280 MHz Preselector

The following test equipment is required to properly tune the preselector assembly:

- RF signal generator
- Dip and peak monitor
- Torque driver capable of delivering 12 in.-lb of torque and 10 mm deep well socket
- Tuning probe—Motorola Part No. 0180763D22, part of TRN7799A tuning kit
- Flat-blade screwdriver

The preferred signal generator is a Motorola R2600 Communications Analyzer, R2001 Communications Analyzer, or HP8657A signal generator (or equivalent).

The R2600 Communications Analyzer can both generate and measure simultaneously. The R2001 may be used for either the generator or the monitor function, but not both simultaneously. When using R2001 as the signal generator, take the RF signal from the antenna port.

The preferred monitor is HP435B Power Meter (or equivalent) with HP8484A sensitive power head, Boonton Model 92E with BNC input, or R2001 / R2600 using the spectrum analyzer function.

Preparing Equipment–280 MHz Preselector

1. Install the receiver and Preselector assembly in a functional station cage with a power supply module.

2. Remove the two TORX head screws from the receiver front panel and remove the panel.

3. Detune the preselector. Turn tuning screws 3 and 4 clockwise until they no longer turn. Be careful not to apply more than 3 in.-lb of torque to prevent warping the preselector cover and housing.

4. Connect the test equipment (see Figure E-10).

Note: When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to obtain a true peak or dip. Then turn the screw back to the location of the original peak or dip.

Tuning Procedure–280 MHz Preselector

Use the following procedure to tune the 280 MHz Preselector.

1. Remove the two TORX head screws from the receiver front panel and remove the panel.
2. Use the torque driver and deep well socket to loosen the three tension nuts on the adjustment screws.
3. Detune the preselector by turning each of the five tuning screws clockwise until they are fully turned. Be careful not to apply more than 3 in.-lb of torque to prevent warping the preselector cover and housing.
4. Turn the receiver power supply ON (to provide the active 50 Ohm termination).
5. Adjust the signal generator to the frequency f_{align} calculated above (with no modulation). Set the input level to the receiver at +5 dBm.
6. Insert the tuning (RF) probe into cavity H1 and adjust the tuning screw 1 anti-clockwise for a PEAK.

Note: When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to verify that you have obtained a true peak or dip. Then turn the screw back to the location of the original peak or dip.

7. Tighten tension nut on tuning screw 1 to at least 12 in.-lb and fine tune tuning screw 1 for a PEAK.
8. Keep tuning probe in cavity H1 and adjust tuning screw 2 anti-clockwise for a DIP.
9. Tighten tension nut on tuning screw 2 to at least 12 in.-lb and fine tune tuning screw 2 for a DIP.
10. Insert tuning probe into cavity H2 and adjust tuning screw 3 anti-clockwise for a DIP.
11. Tighten tension nut on tuning screw 3 to at least 12 in.-lb and fine tune tuning screw 3 for a DIP.
12. Insert tuning probe into cavity H3 and adjust tuning screw 4 anti-clockwise for a DIP.
13. Tighten tension nut on tuning screw 4 to at least 12 in.-lb and fine tune tuning screw 4 for a DIP.
14. Insert tuning probe into cavity H4 and adjust tuning screw 5 anti-clockwise for a DIP.
15. Tighten tension nut on tuning screw 5 to at least 12 in.-lb and fine tune tuning screw 5 for a DIP.

GPS Antenna

This appendix describes installing or repairing a Global Positioning System (GPS) antenna installed at a Nucleus™ paging station. This chapter contains the following information:

Installation

This section describes installation procedures for a complete GPS antenna (Model No. RLN4394A).

Required Tools and Equipment

Required tools and materials include the following:

- TORX® screwdriver set
- Torque wrench
- 10 mm wrenches
- Fiberglass or wooden ladder (if needed to put the antenna in place)
- One or more scissor clamps

Procedure

Use the following procedure to install a complete antenna:

Note: This procedure can require two people if the site is windy.

1. Remove the antenna, cable, bracket, and hardware from the box. The antenna is complete assembled, including the L-shaped part of the post clamp (see Figure F-1). The curved part of the post clamp, the nuts, the bolts, and the washers are in a separate plastic bag.

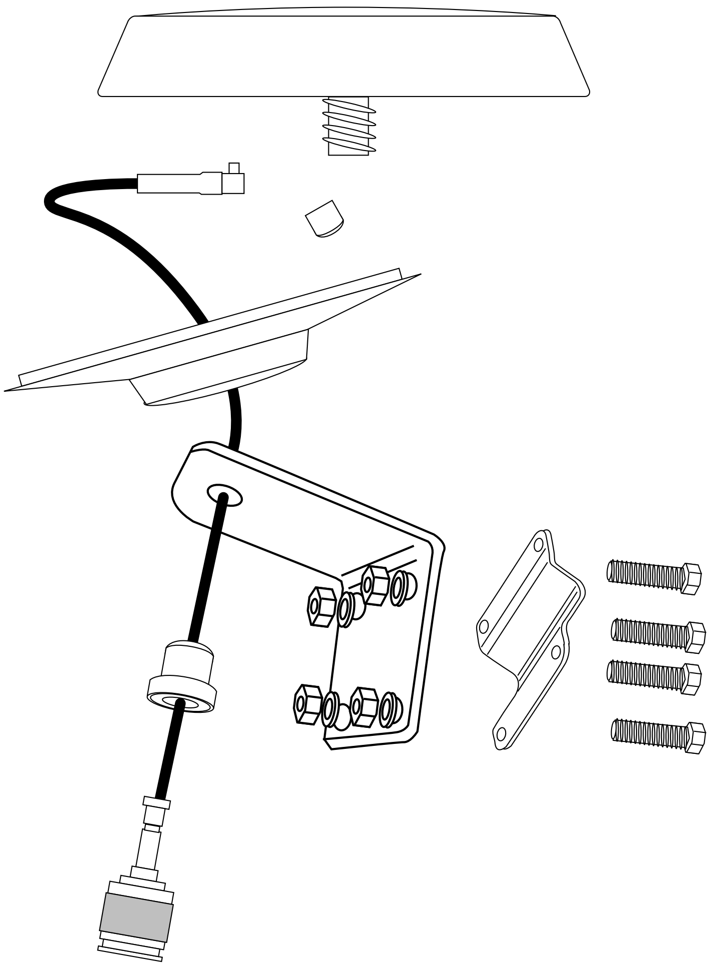


Figure F-1: Assembled Antenna, Cable, and Bracket

2. Place the L-shaped part of the bracket (with the antenna attached) on the pipe mast where it will be installed. Hold it in place. Use a second person to hold the antenna in place or clamp it in place with scissors clamps.

3. Place the curved part of the bracket on the opposite side of the pipe mast. Clamp it or hold it in place.

4. Insert one bolt through one hole in each bracket. Place a washer on the bolt and tighten with a nut. Use 10-mm wrenches.

5. Insert the other three bolts through the brackets. Tighten with washers and nuts.

6. Screw the large N-type male connector down over the N-type female connector on the carrier cable.

7. Waterproof the area around the large N-type connection.

Repairing an Installed Antenna

This section describes replacement of any part of the antenna.

The models for replacement parts are:

- RLN4388A–GPS antenna and rubber boot
- RLN4390A–mounting shroud, outer gasket and cable-retaining nut
- RLN4391A–post clamp, post bracket, nuts (4), lock washers (4) and bolts (4)
- RKN4395A–1 ft length cable with N-type connectors

This procedure includes:

- Disassembling the antenna to remove the defective part
- Connecting the cable to the antenna
- Attaching the antenna to the pipe mast

Disassembling the Antenna

Use this procedure to disassemble the antenna:

1. Take the antenna out of operation.
2. Disconnect the N-type base connector from the antenna cable.
3. Hold the antenna firmly. Remove four nuts, bolts, and washers from the curved bracket and the L-shaped bracket.
4. Remove the antenna from the pipe mast.
5. Unscrew the cable retaining nut. Allow the bracket to slide down the cable to the large N-type connector.
6. Hold the mounting shroud by its edges. Pull the mounting shroud away from the antenna. Allow the mounting shroud to slide down the cable.
7. Gently pull the cable out of the threaded stem of the antenna.
8. Remove the rubber boot from the small connector on the antenna.
9. Use a small straight-blade screwdriver to remove the small connector from the antenna.
10. Pull the cable out of the assembly.
11. Replace the faulty or broken parts of the antenna.
12. Continue with the reassembly instructions that follow.

Connecting the Cable to the Antenna

Use this procedure to attach the cable to the antenna:

1. Attach the outer gasket to the mounting shroud if it is not already attached.

2. Slide the small connector end of the cable through the following items (see Figure F-2):
   - Cable retaining nut
   - L-shaped bracket
   - Mounting shroud (with outer gasket attached)

3. Press the small end of the connector into the mating connector in the antenna.

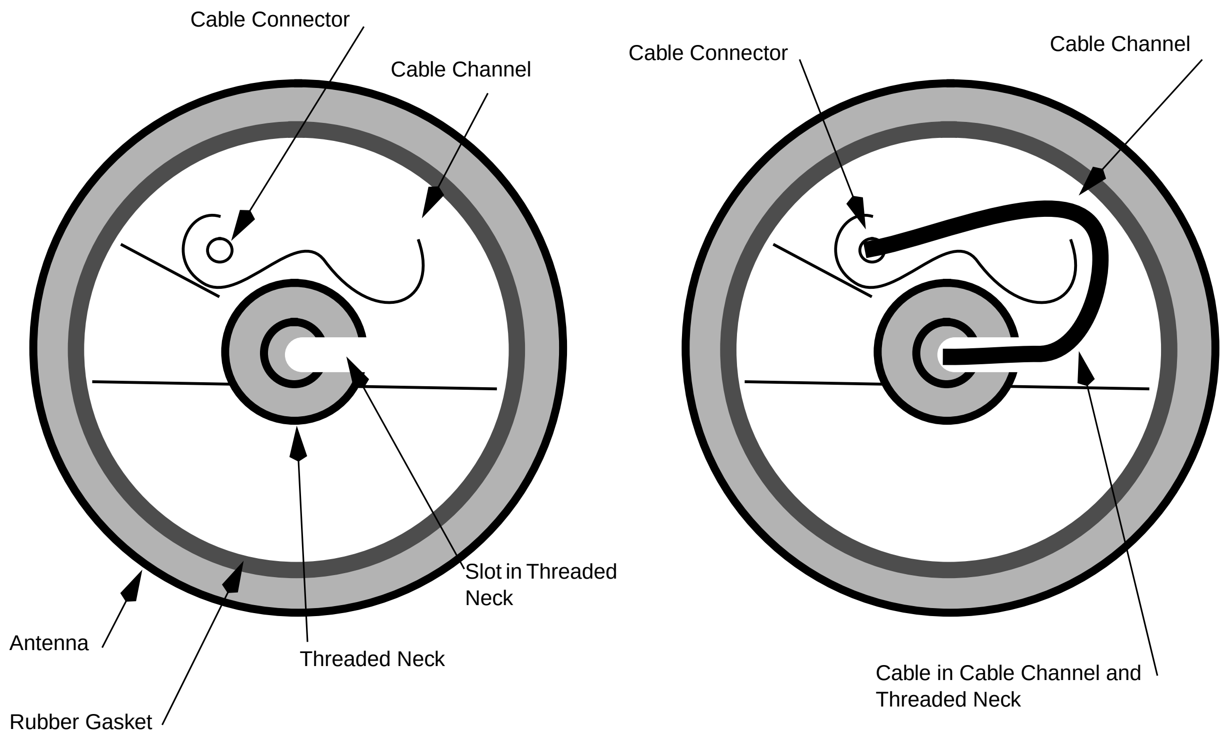


Figure F-2: Location and Orientation of the Cable and Connectors

4. Place the rubber boot over the small cable connector.

5. Bend the cable around the cable channel and bend it to fit inside the threaded neck. Press the cable tightly into each curve.

6. Rotate the mounting shroud so the small tab in the center hole aligns with the cutout on the threaded neck of the antenna (see Figure F-3).

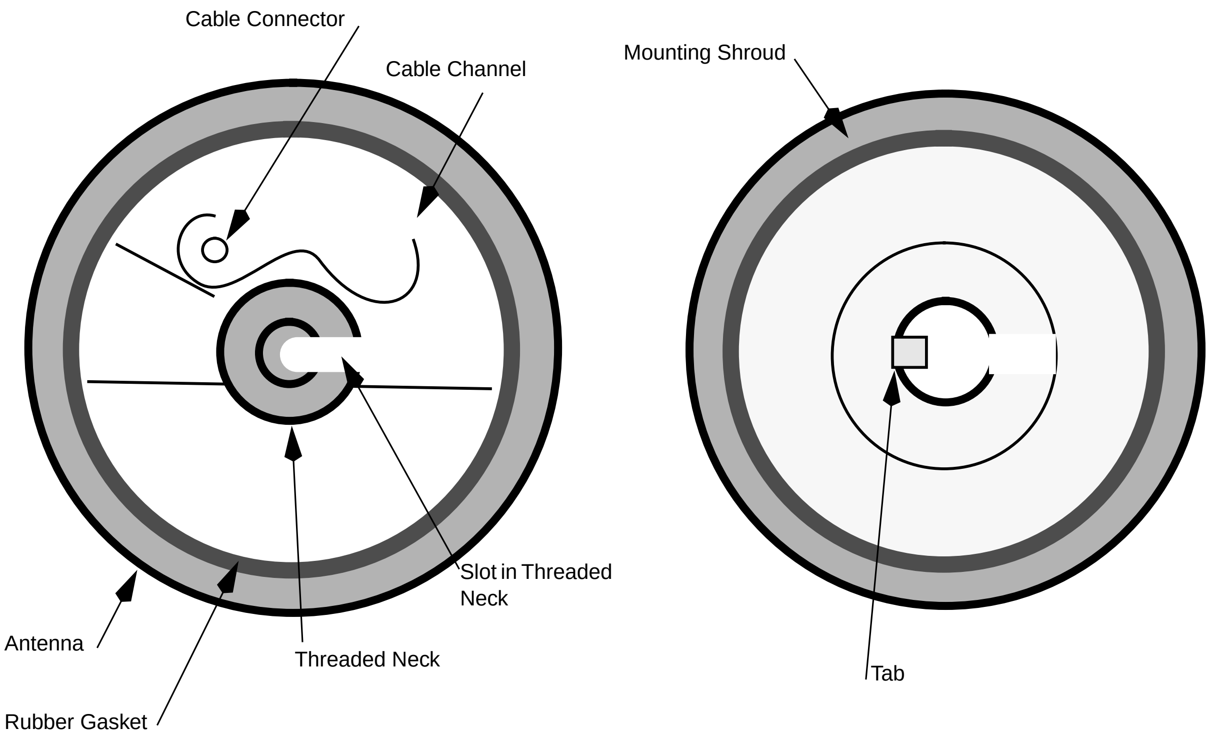


Figure F-3: Location and Orientation of the Cable Channel, Tab, and Slot

7. Press the mounting shroud gently into the antenna.

8. Continue with the following procedure.

Attaching the Antenna to the Pipe Mast

Use the following procedure to attach the antenna to the pipe mast:

1. Place the L-shaped part of the bracket (with the antenna attached) on the pipe mast and hold it in place.

2. Place the curved part of the bracket on the opposite side of the pipe mast. Clamp it or hold it in place.

3. Insert one bolt through one hole in each bracket. Place a washer on the bolt and tighten with a nut. Use 10-mm wrenches.

4. Insert the other three bolts through the brackets. Tighten the assembly with washers and nuts.

5. Screw the large N-type male connector down over the N-type female connector on the carrier cable.

6. Waterproof the area around the large N-type connection.

7. Place the antenna back in operation.

Replacing a GPS Receiver Module

Use this procedure to replace the GPS receiver module for an internal Network Interface Unit (NIU).

1. Connect an antistatic wrist strap connector to one of the two ground jacks in the cage.

2. If the station has AC power with a battery revert option (X30 or X43), disconnect the batteries.

3. Turn the power On / Off switch(es) to the Off position (press the 0 side of the switch).

4. Remove the mounting screws from the top and bottom of the reference module.

5. Slide the faulty GPS Receiver module partially out of the cage. Disconnect the mini-UHF connector on the inside front surface of the module, behind the front panel (see Figure F-4).

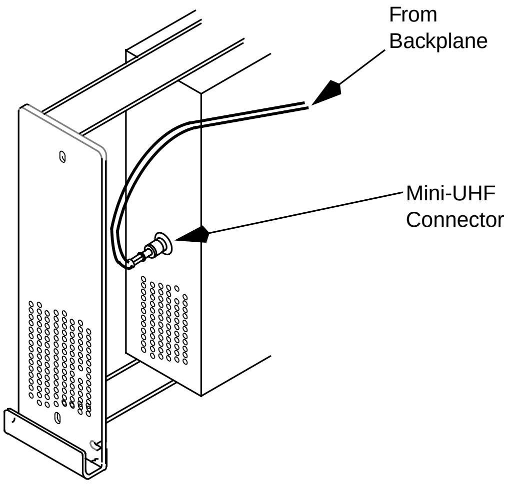


Figure F-4: Mini-UHF Cable in the GPS Receiver Module

6. Remove the faulty GPS receiver from the cage.

7. Install the replacement GPS receiver. Slide the GPS receiver partially into the cage.

8. Connect the mini-UHF connector. Push the module into the cage. Seat the module connector firmly in the backplane.

CAUTION

Do not force the module into the backplane connectors. Use moderate pressure and rock the module slightly until it is completely seated.

9. Replace the mounting screws removed in Step 4.

10. If the Nucleus paging station has AC power with a battery revert option (X30 or X43) turn the power On-Off switch to On (press the side of the switch). Then reconnect the battery.

11. Disconnect the antistatic wrist strap.