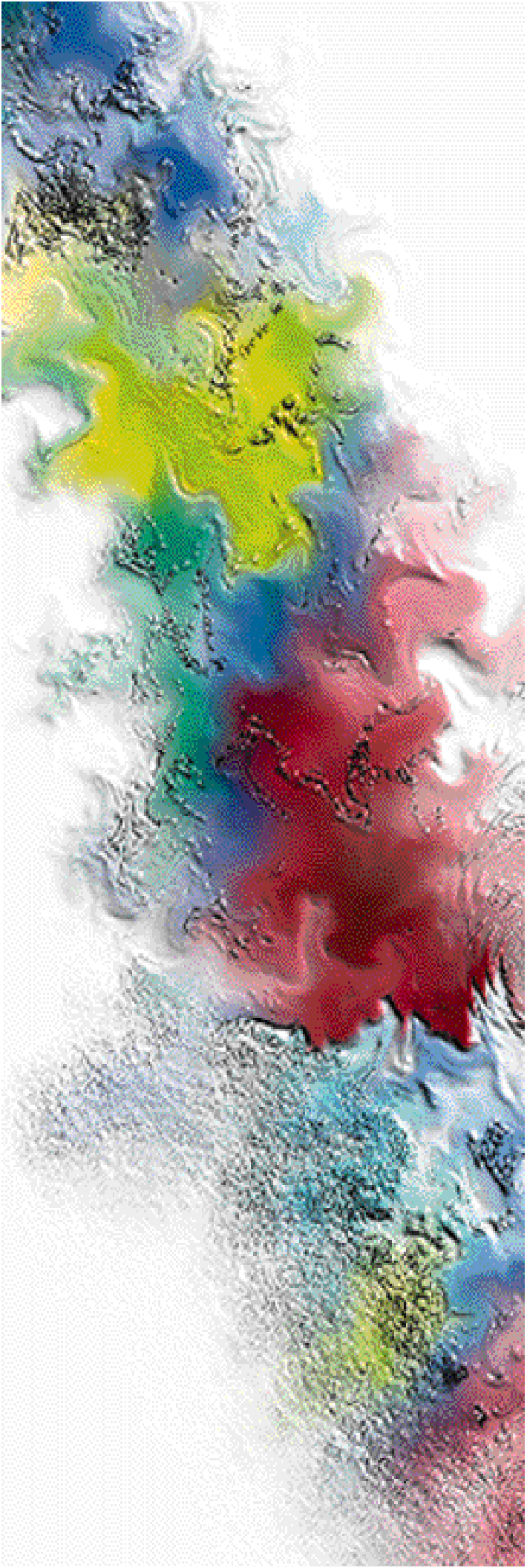

Nucleus® Paging Station

Installation and Operation

Series: Wireless Messaging System

System Version: One-Way 1.08,
Two-Way 3.0
Software Version: 4.110

Issue Date: January 1999

6881002F05-D

MOTOROLA

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MOTOROLA

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) 245-4260**

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

The Motorola products described in this manual might include copyrighted Motorola computer software stored in semiconductor memories and other media. Laws in the United States and other countries preserve for Motorola certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer software.

Accordingly, any copyrighted Motorola computer software contained in the Motorola products described in this manual cannot be copied or reproduced in any manner without the express written permission of Motorola.

Furthermore, the purchase of Motorola products does not grant, either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Motorola, except for the normal, nonexclusive, royalty-free license to use that arises by operation of law in the sale of a product.

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–

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–

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 U.S. And 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, except for AlphaMate® 250 paging entry terminal products, is one (1) year parts and labor. The term of Warranty for AlphaMate 250 paging entry terminals is one (1) year parts and 120 days labor in Motorola PSG-authorized service centers. In-field labor for warranty claims (excluding AlphaMate 250 products) will be provided by Motorola PSG-authorized service centers during normal business hours.

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.

   a. 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

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

   a. The Customer shall promptly notify the Motorola Paging One-Call-Support Center at 1-800-520-PAGE (7243) as to the problem and provide the serial number of the defective item. Motorola shall, 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 Paging One-Call-Support Center 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 and to part availability, Motorola shall complete the repair or exchange of Motorola-manufactured equipment returned under Warranty within ten (10) 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

8. 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 Motorola 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.

9. 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.

Telephone Technical Assistance

10. During the Warranty Period, Motorola will provide the Customer with over-the-telephone technical fault analysis free of labor charges. The Customer may call the Motorola One-Call-Support Center at 1-800-520-PAGE (7243) for assistance. For warranty calls in excess of 15 per location per month or for non-warranty calls, Motorola shall charge the Customer per Motorola's then-current labor rates.

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.

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;
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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

About this Manual

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

Audience

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

Contents

This manual contains the following chapters and appendices:

- Chapter 1, "Introduction" provides general information about the manual itself.
- Chapter 2, "Nucleus Paging Station Description" describes the operation of the station.
- Chapter 3, "Preparing For Installation" describes the basic requirements for a Nucleus paging station site. These requirements include power, ground, and antenna installation.
- Chapter 4, "Mechanical Installation" describes mechanical installation, including unpacking, drilling anchor holes in a concrete floor, and bolting the Nucleus paging stations to the floor.
- Chapter 5, "Connectors and Interfaces" describes the backplane interfaces and the internal interfaces for special uses, such as alignment.
- Chapter 6, "Front Panel Indicators and Controls" describes the front panels on the Nucleus paging stations, including use of the keypad, and interpreting the light emitting diodes (LEDs).
- Appendix A, "Acronyms" contains a list of acronyms and abbreviations used in this manual.
- Appendix B, "Configuration Record" contains a configuration record for a Nucleus paging station.
- Appendix C, "Internal Network Interface Unit" describes the internal Network Interface Unit (NIU) to configure it during system installation.
- Appendix D, "Receivers" describes the receivers used in a Nucleus paging station.
- Appendix E, "GPS Antenna" describes installing and repairing a Global Positioning System (GPS) antenna and receiver.
- Appendix F, "Nucleus® Paging Station Quick Reference Menu Guide" provides a quick guide to configure the station. You can post it (we recommend you use a photocopy) near the paging station for easy reference.

Software Versions

This section describes software compatibility in the Nucleus paging station. Each station contains four software entities:

- Station Control Module (SCM) 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 software release. A software upgrade requires a new SCM module and Exciter and does not cause a compatibility problem with the SIMM. Motorola ships the correct version of the boot software with the SCM application version of the software.

Software Compatibility

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

- SCM application version—4.110
- Boot version—2.000
- Exciter—7.200

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

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

Motorola tracks compatibility for Nucleus paging station 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 1-1: Nucleus paging station Software Compatibility Matrix

SCM Application SW Version	Boot ROM Version	Exciter EPROM					
		6.400	6.600	6.630	7.030	7.110	7.200
2.920	2.000	1, 2	2		C	C	C
3.210	2.000	1, 2, 3	2,3	2,3	C	C	C
3.320, 3.400, 4.030, 4.100	2.000	1, 2, 3, 4, 5	2,3, 4, 5	2, 3, 4, 5	C 4, 5	C	C

1. This release does not support UHF
2. This release does not support the complete low forward power feature.
3. This release does not support the antenna relay improvement. This release does not support the station dekeyed software fix
4. This release does not support the 250 W 900 MHz PA with internal triple circulator.
5. This release does not support the high forward power alarm and the PA alignment alarm

Related Publications

For further information, see the following publications:

- *RF-Baton!™ Transmitter Controller Installation and Operation*, Motorola part no. 6880497G05
- *C-NET External Network Interface Unit (NIU) Installation and Operation*, Motorola part no. 6880451F10.
- *External NIU Transmitter Controller Installation and Operation*, Motorola part no. 6880497G10
- *Nucleus Paging Station I-20 Upgrade*, Motorola part no. 6881100F56
- *Nucleus Paging Station Configuration for I-20 Protocol*, Motorola part no. 6881100F63

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 1-2).
- Cabinet capacity (see Table 1-3).
- Power consumption (see Table 1-4).
- Transmitter performance specifications (see Table 1-5).
- Internal link and monitor receiver specifications (see Table 1-6).

Table 1-2: 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
276–286	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
276–286	300 W (variable to 100 W)	PT1143A 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
927–941	300 W[2]	PT1173 48 VDC PT1174 24 VDC	4 x 19 x 20 in. 36 x 48 x 51 cm	105 lb 48 kg

Table 1-2: 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 PA cable.

Table 1-3: 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 1-4: 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
276–286	Standard	Transmit Standby	540 W 66 W	500 W 66 W	515 W 77 W
276–286	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 1-5: Transmitter Performance Specifications (Sheet 1 of 2)

Specification	Requirement	Performance Capability
Input Power	Power supply type	Switching
	AC voltage	100-250 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	Greater than -80 dBc
	Adjacent channel noise	Greater 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
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 1-5: 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
	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

Table 1-6: 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	276–288	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
Note: The radio must be set to deemphasised audio to get this reading.					
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
Audio Response	Front panel switchable: flat or EIA de-emphasis				

Table 1-6: Internal Link and Monitor Receiver Specifications (Sheet 2 of 2)

Requirement	Midband	VHF	280 MHz	UHF	900 MHz
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 1-7 and Table 1-8).

Table 1-7: Option Numbers and Descriptions

Option Category	Option Number	Description
Power Supply	X115	700 W AC power supply (100-250 Vac, 47–63 Hz)
	X30	700 W AC power supply with battery revert (high power station: control only)
	X43	700 W AC power supply with battery revert (station power, does not include battery)
	X342	700 W DC power supply (input Voltage 21–34.5 Vdc)
	X581	700 W DC power supply (input Voltage 41–72 Vdc)
Control	X151	SCM
	X179	RF Baton
	X621	External control (SCM with Wildcard Interface Board)
Reference Module and Frequency Stability	X576	GPS receiver/with antenna
	X206	Reference module with UHSO (5 ppb)
	X208	Reference module with HSO (30 ppb)
	X212	External frequency stability
Cabinet	X92	25 in. cabinet
	X308	46 in. cabinet
	C307	70 in. cabinet
	X362	Packing kit for station without cabinet
Accessories	X371	Antenna relay
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)
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) Available only with C-NET

Table 1-8: 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 927–941 MHz
	TTF1016	X201AA	300 W 927–941 MHz
	TTD2070	X213	125 W 276–286 MHz
	TTD2080	X214	300 W 276–286 MHz
	TTD2090	X330A	25 W VHF range 1 and 2: 132–174 MHz
Power Supplies	PTPN1019	X30, X43	AC power supply with battery revert
	TPN1018	X115	700 W AC power supply and hardware AC adapter/No Battery Revert
	TPN1293	X581	48 Vdc power supply
	TPN1294	X342	24 Vdc power supply
Line Cords (North America)	TRN7663	X187AC	2.5 meters for standard power model (single)
	TTN5051	X188AA	6.1 meters for standard power model (single)
	TRN7951	X187AD	2.5 meters for high power model (dual)
	TTN4054	X188AB	6.1 meters for high power model (dual)
Line Cords (United Kingdom)	TTN5049	X162AA	2.5 meters for standard power model (single)
	TTN5050	X162AB	2.5 meters for high power model (dual)
Line Cords (Europe)	TRN7755	X189AA	2.5 meters for standard power model (single)
	TTN4055	X189AB	2.5 meters for high power model (dual)
Line Cords (Australia and China)	TTN5103	X191AA	2.5 meters for standard power model (single)
	TTN5104	X191AB	2.5 meters for high power model (dual)
Control	PTYN1002	X151	CNET Control Board
	TLN3452		Front panel and keyboard for CNET

Table 1-8: FRU Numbers (Sheet 2 of 2)

FRU Type	Model Number	Option Number	Description
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 276–286 MHz
	TTE1940	X132AH, X158, X621	Matched at 438–470 MHz
	TTF1630	X134AB, X158, X621	Matched at 927–941 MHz
Internal Link/Diagnostic Receivers	TRC1100	X209AA	Midband FMK (72–76 MHz)
	TRD1900	X333AC, X662	Internal VHF link receiver FMK (132–154 MHz), diagnostic receiver (132–174 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 (494–520) MHz)
	TRE1440	X334AE	Internal UHF link receiver FMK (403–433 MHz)
	TRF1470	X336AB, X630AA	Internal 900 MHz link/diagnostic receiver FMK (922–941 MHz)
	TRF1480	X336AC, X630AB	Internal 900 MHz link/diagnostic receiver FMK (941–960 MHz)
	PTRD1006	X01AA	Internal 280 MHz diagnostic
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)
	CLN1149	X208	HSO reference modulator w/front panel
	CLN1150	X206	UHSO reference modulator w/front panel
	PTNN1003		Battery backup with batteries and tray

Nucleus I-20 FRU Option

The contents of the I-20 FRU kit depend on the frequency of the Nucleus paging station being upgraded. Each kit contains a matched SCM and Exciter Module. Table 1-9 lists the equipment required for each upgrade FRU kit.

Table 1-9: Upgrade Parts List for I-20

If your Nucleus is:	...to upgrade to I-20, order:	Part Number
900 MHz	- Matched Pair FRU - I-20 BSC Cable (if Glenayre) - BNC T connector and 50 ohm male terminator	- PTTF1029A (includes PTKN4117A with 3086144G03, PTTF1013A, PTGN4029A[1], and PTYN4059B) - PTKN1003A (includes 3086453G02) - PTLN4450A (includes 0909907D01 and 0909906D01)
280 MHz	- Matched Pair FRU - I-20 BSC Cable (if Glenayre) - BNC T connector and 50 ohm male terminator	- PTTF1030A (includes PTKN4117A with 3086144G03, PTTD1001A, PTGN4029A[1], and PTYN4059B) - PTKN1003A (includes 3086453G02) - PTLN4450A (includes 0909907D01 and 0909906D01)
VHF R1 (132–154 MHz)	- Matched Pair FRU - I-20 BSC Cable (if Glenayre) - BNC T connector and 50 ohm male terminator	- PTTF1031A (includes PTKN4117A with 3086144G03, PTTD1003A, PTGN4029A[1], and PTYN4059B) - PTKN1003A (includes 3086453G02) - PTLN4450A (includes 0909907D01 and 0909906D01)
VHR R2 (150–174 MHz)	- Matched Pair FRU - I-20 BSC Cable (if Glenayre) - BNC T connector and 50 ohm male terminator	- PTTF1032A (includes PTKN4117A with 3086144G03, PTTD1002A, PTGN4029A[1], and PTYN4059B) - PTKN1003A (includes 3086453G02) - PTLN4450A (includes 0909907D01 and 0909906D01)
UHF	- Matched Pair FRU - I-20 BSC Cable (if Glenayre) - BNC T connector and 50 ohm male terminator	- PTTF1033A (includes PTKN4117A with 3086144G03, TLE9082D, PTGN4029A[1], and PTYN4059B) - PTKN1003A (includes 3086453G02) - PTLN4450A (includes 0909907D01 and 0909906D01)

1. The Exciter front panel is shipped installed on the Exciter.

FCC Type Acceptance Data

This section describes Federal Communication Commission (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 (T5481 with X195AA)	ABZ89FC3783
132–154 (VHF)	25 W (variable to 5 W)	PT1146A (T5481 with X330AC)	ABZ89FC3781
144–160 (VHF)	350 W (variable to 100 W)	PT1150A[1] high power (T5482 with X830AD)	ABZ89FC3782
150–174 (VHF)	125 W (variable to 20 W)	PT1149A standard power (T5481 with X195AB)	ABZ89FC3783
150–174 (VHF)	25 W (variable to 5 W)	PT1147A (T5481 with X330AC)	ABZ89FC3781
158–174 (VHF)	350 W (variable to 100 W)	PT1151A[1] high power (T5482 with X830AE)	ABZ89FC3782
276–286	125 W (variable to 20 W)	PT1142A standard power (T5481 with X213AA)	----
276–286	300 W (variable to 100 W)	PT1143A[1] high power (T5482 with X214AA)	----
438–470 (UHF)	100 W (variable to 25 W)	PT1158A standard power (T5481 with X640AH)	ABZ89FC4806
927–941	100 W (variable to 20 W)	PT1161A	ABZ89FC5766
927–941	300 W (variable to 100 W)	PT1104[1]	ABZ89FC5765
927–941	250 W	PT1105[1]	ABZ89FC5766
927–941	300 W DC	PT1104[1]	ABZ89FC5765

1. Not available in the Peoples Republic of China.

Nucleus Paging Station Description

General Description

A Nucleus paging station consists of the following elements (see Figure 2-1):

- Station Control Module (SCM)–controls the station, and processes inputs from and displays to the SCM front panel.
- Exciter module–provides the carrier frequency for the transmitter. Combines the messaging data stream with the carrier frequency, enhances the signal, and sends it to the power amplifier.
- Power amplifier (PA)– Amplifies the RF signal from the Exciter and sends the RF signal to the antenna.
- Transmitter controller–provides an interface to the network control device. The transmitter controller is one of the following:
  - Internal Network Interface Unit (NIU)
  - External NIU
  - RF-Baton!™ (RF-B!) transmitter controller (Refer to *RF-Baton!™ Transmitter Controller Installation and Operation*, Motorola part no. 6880497G05)
  - I-20 compatible Base Station Controller
- Optional Receiver–processes received RF signals for use by the SCM for a monitor receiver.
- Power Supply module-provides the necessary DC voltages for operating the paging station modules.

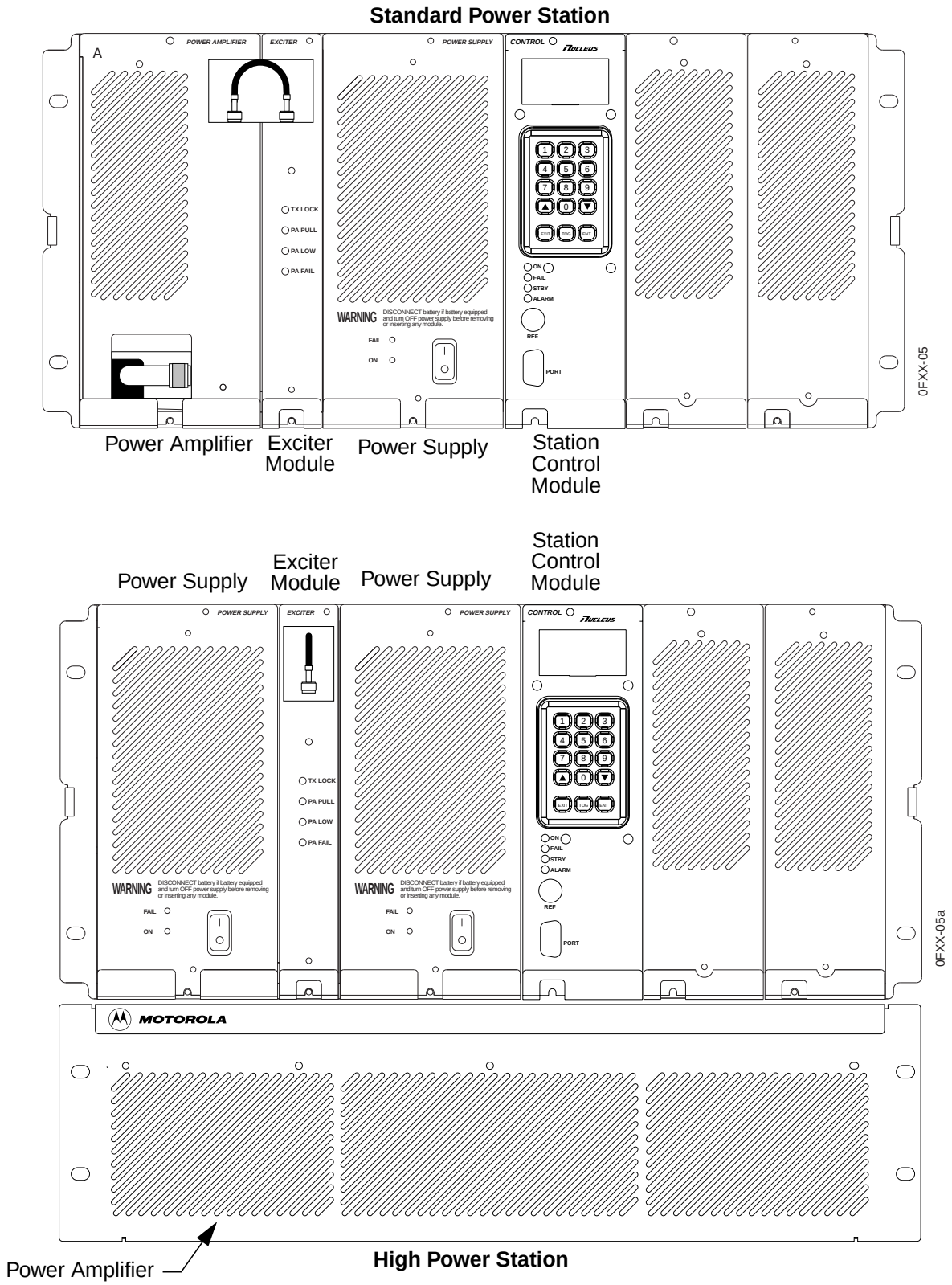


Figure 2-1: Nucleus Paging Station

Station Control Module

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

- Controls the transmitter
- Maintains communication with a receiver
- Maintains communication with a Base Station Controller, such as:
  - NIU
  - RFB

This section describes both functions briefly.

Controlling the Transmitter

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

The SCM (see Figure 2-3) 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 by reading 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 addresses 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.

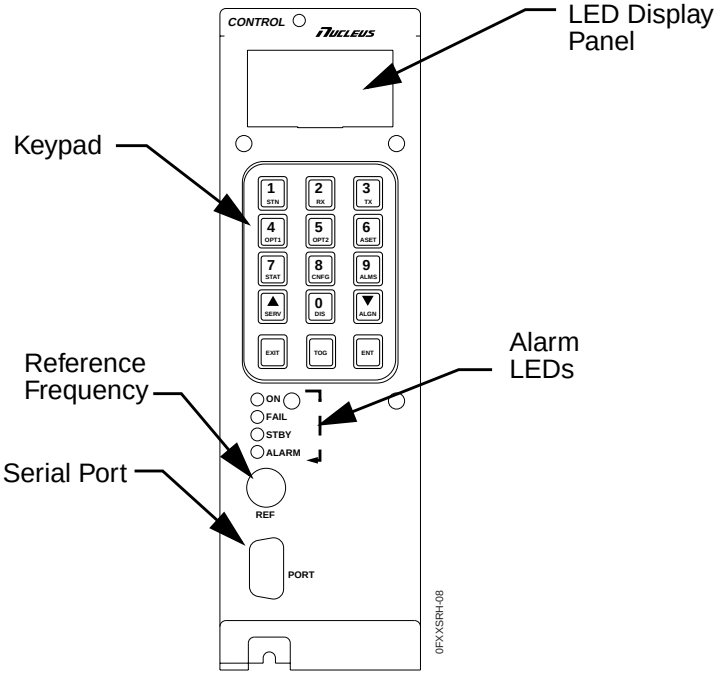


Figure 2-2: Station Control Module Front Panel

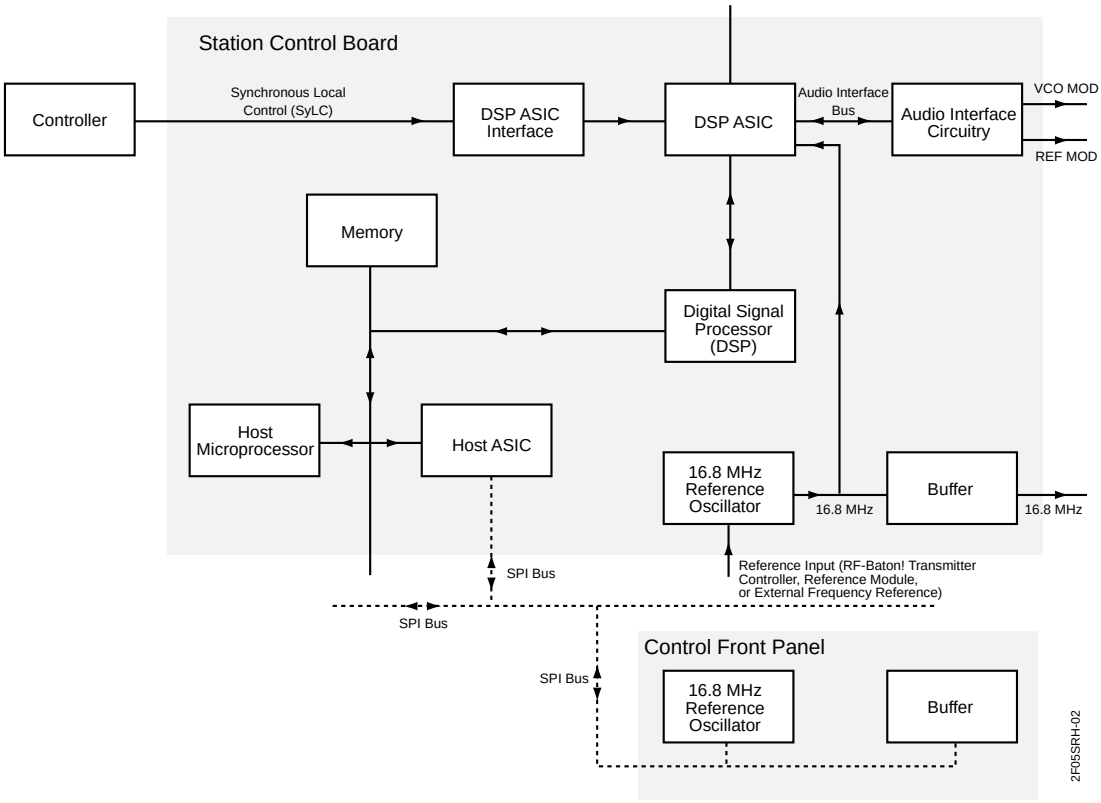


Figure 2-3: Station Control Board Block Diagram

Maintaining Communication with the Receiver

An internal monitor receiver resides in a Nucleus paging station cabinet and monitors performance of transmitters in a maintenance group. In this configuration, the SCM controls the receiver. The SCM 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 SCM control.

The SCM host microprocessor measures and controls various signals on the receiver (see Figure 2-4). To measure or adjust a signal, the SCM 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 SCM 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.

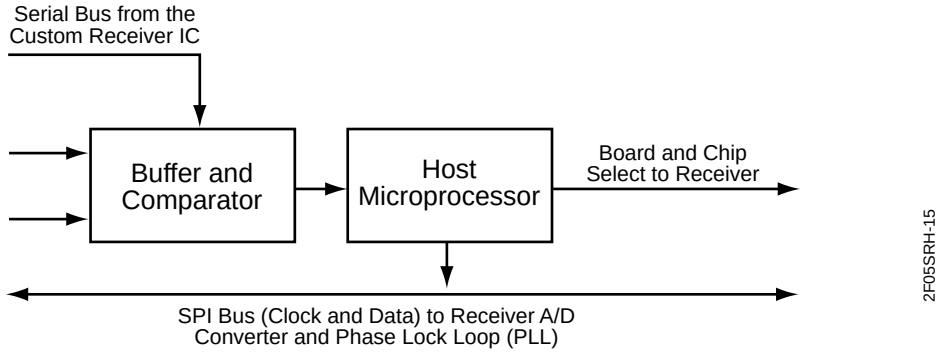


Figure 2-4: Station Control Module Board Relationship with Receiver

Note: The receiver (not the transmitter) is controlled by the SCM software.

Exciter Module

The Exciter (see Figure 2-1 for location) 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 (see Figure 2-5). 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 control circuit. The Exciter has its own microprocessor. The Exciter synthesizer and microprocessor communicate with the host ASIC on the SCM through the SPI bus.

The Nucleus requires having a matching pair SCM and Exciter. Motorola aligns the Exciter and Station Control Board during manufacturing as a pair and assigns a common alignment ID number The modules must always be replaced together as a pair.

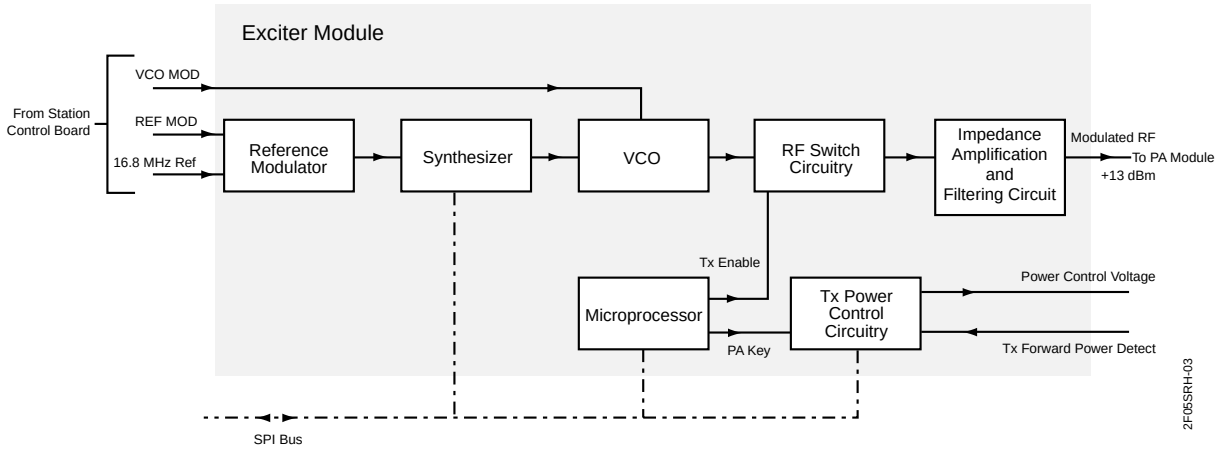


Figure 2-5: Exciter Module Process Flow

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 Station Control Module. 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 to prepare for transmitting. The structure of the PA depends on the station power level:

- Standard power Nucleus paging station (100 to 125 W), (see Figure 2-1)
- High power Nucleus paging station (250 to 350 W), (see Figure 2-1)

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 module and Transmit Frequencies

PA (Full Power)	PA Frequency Range	Exciter Module 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
350 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 on the backplane on the Nucleus paging station. Motorola offers two options for the PA:
  - Single circulator, available for standard power and high power stations
  - Double circulator, available for high power stations only

PA for a Standard Power Nucleus Paging Station

The PA consists of the following elements (see Figure 2-6):

- Intermediate power amplifier
- Driver power amplifier
- Final power amplifier
- Standard circulator
- Harmonic filter / coupler
- Impedance matching and filtering circuit

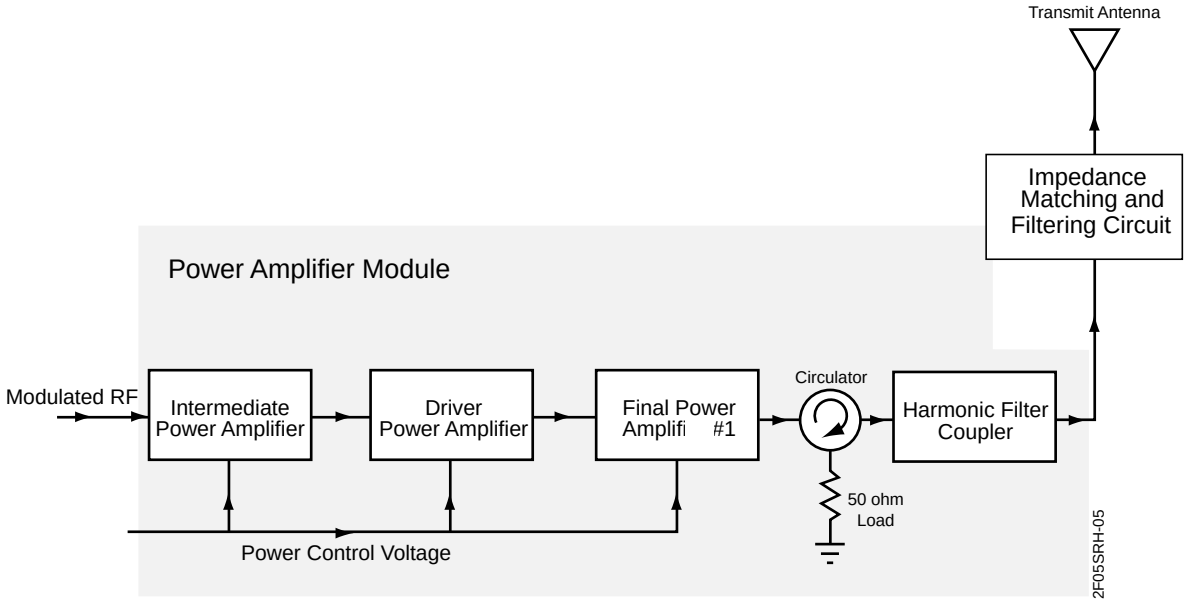


Figure 2-6: Standard Power Nucleus Paging Station Process Flow

In the standard power system, the modulated RF passes through the intermediated power amplifier, the driver power amplifier, and the final power amplifier. 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 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 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 shuts down completely. An internal wattmeter sends Forward (FWD) or Reflected (REF) RF voltage to the Exciter. The SPI bus transmits the wattmeter reading to the SCM.

PA for a High Power Nucleus Paging Station

The PA consists of the following elements (see Figure 2-7):

- Intermediate power amplifier
- Driver power amplifier
- Power splitter
- Three final power amplifiers
- Power combiner
- Standard circulator
- Harmonic filter and coupler
- Impedance matching and filtering circuit

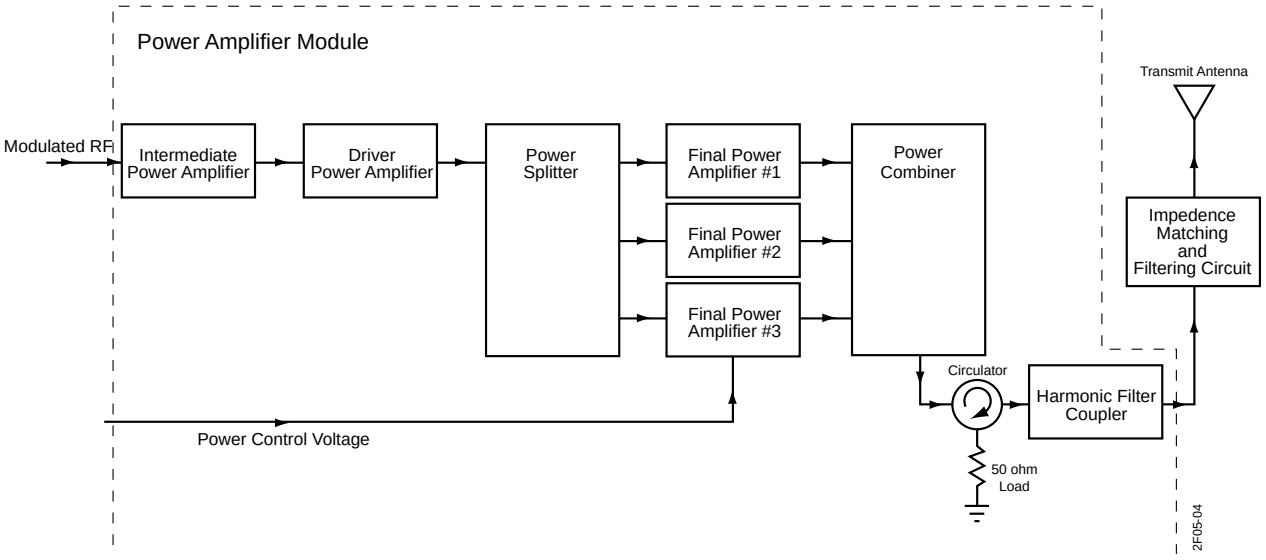


Figure 2-7: High Power Nucleus Paging Station Process Flow

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 them to the final power amplifiers. Each power amplifier sends its output to a power combiner circuit 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 transmit antenna system and the power amplifier circuitry. 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 coupler reduces circulator harmonics.

The power readings displayed on the front panel are generated by the internal wattmeter.

Power Supply Module

The power supplies provide DC voltage for the station modules (see Figure 2-1). The high-power station has two power supply modules. Each power supply module 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 (see Figure 2-8):

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

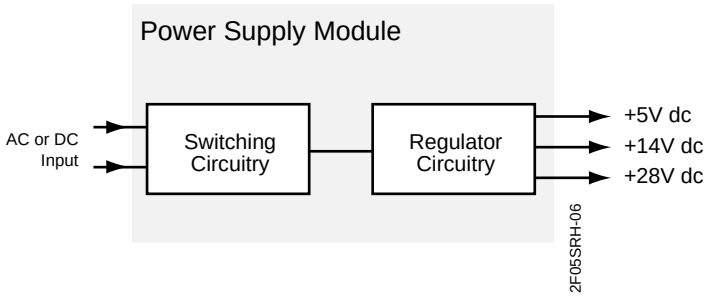


Figure 2-8: Power Supply Module

Receiver Module

The Nucleus high data rate paging station receiver is used in one of two ways:

- As a monitor receiver, to monitor the transmissions 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 SCM board

The receiver board consists of a preselector filter, a mixer, a bandpass filter, a custom receiver integrated circuit, and a differential driver (see Figure 2-9). 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 board.

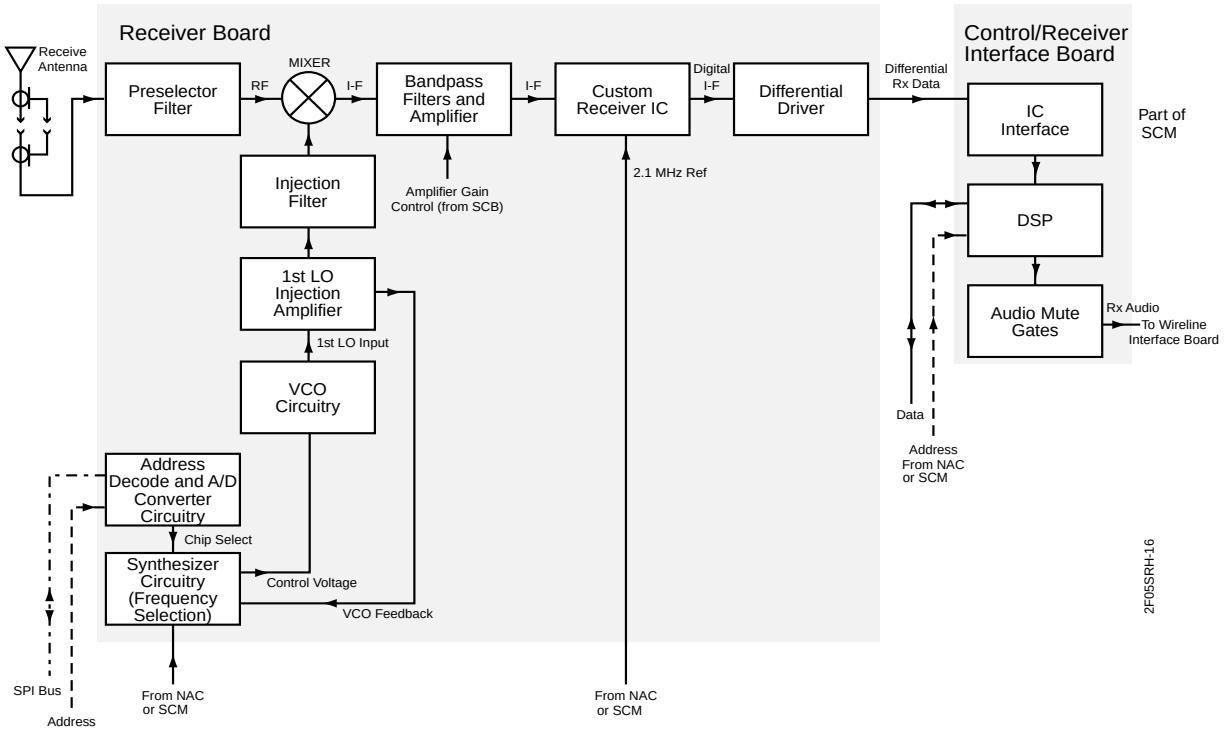


Figure 2-9: Receiver Board Module and CRIB Process Flow

The SCM 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 VCO. 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 SCM. When the SCM requests the data, the DSP sends the RX audio to the SCM.

Reference Modules

This section describes reference modules. Nucleus 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 a Global Positioning System (GPS) Receiver

Systems that use GPS synchronization require reference modules with a GPS receiver (option X576). The GPS signal reaches the GPS antenna (see Figure 2-10). 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.

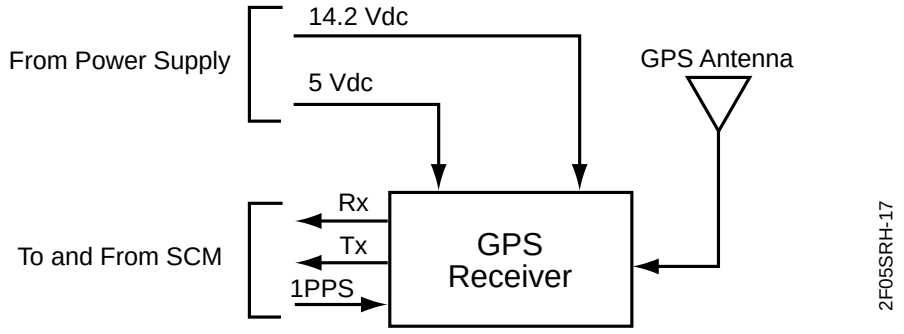


Figure 2-10: Reference Module with GPS Receiver

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

Each reference module contains a D / A converter, A / D converter, and the oscillator (see Figure 2-11). 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.

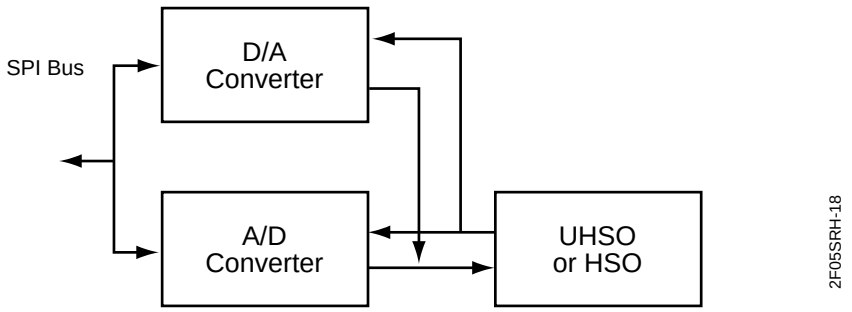


Figure 2-11: Reference Module with a UHSO or HSO Process Flow

Transmitter Controllers

This section describes high data rate (HDR) transmitter controllers. The transmitter controllers and their interfaces include the internal Network Interface Unit (NIU) installed in the Nucleus HDR paging station which uses a direct interconnect with the SCM.

Network Interface Unit (NIU)

The internal NIU replaces an external NIU for systems with C-NET Control Point controllers. The NIU sends the data stream, maintenance, and configuration data to the NUC SCM. The NUC SCM sends the alarm information to the NIU (see Figure 2-12).

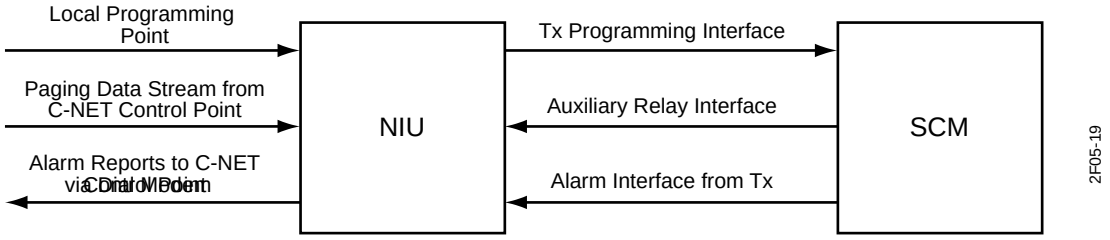


Figure 2-12: Inputs and Outputs to an Internal NIU

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 Module (behind the front panel) and communicates through the backplane to the SCM.

Preparing For Installation

Pre-Installation Planning

Proper installation maximizes performance and reliability for Nucleus 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 antennas
- 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 chapter 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

Federal Communication Commission (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, Protecting, 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 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.

Lug Grounding

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.

Do not use the ground lug for grounding 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 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).

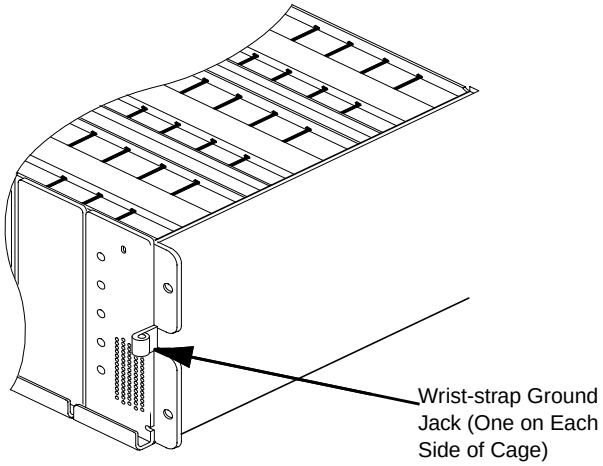


Figure 3-1: Location of Electrostatic Ground Jacks

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

CAUTION

To install the station in an environment that does not meet air quality requirements, cool and filter the air for station modules 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° to +60°C (-22° to +140°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

Failure to ensure proper ventilation and cooling voids the product warranty for a Nucleus 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 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 from 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 paging stations have one or two AC power supplies (100 to 250 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 350 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).

Mounting Equipment

Motorola supplies four mounting options for Nucleus HDR 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.

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.

Cage Without Cabinet

The dimensions and recommended clearances for a standard power or high-power station mounted without a cabinet appear in the figures shown 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)

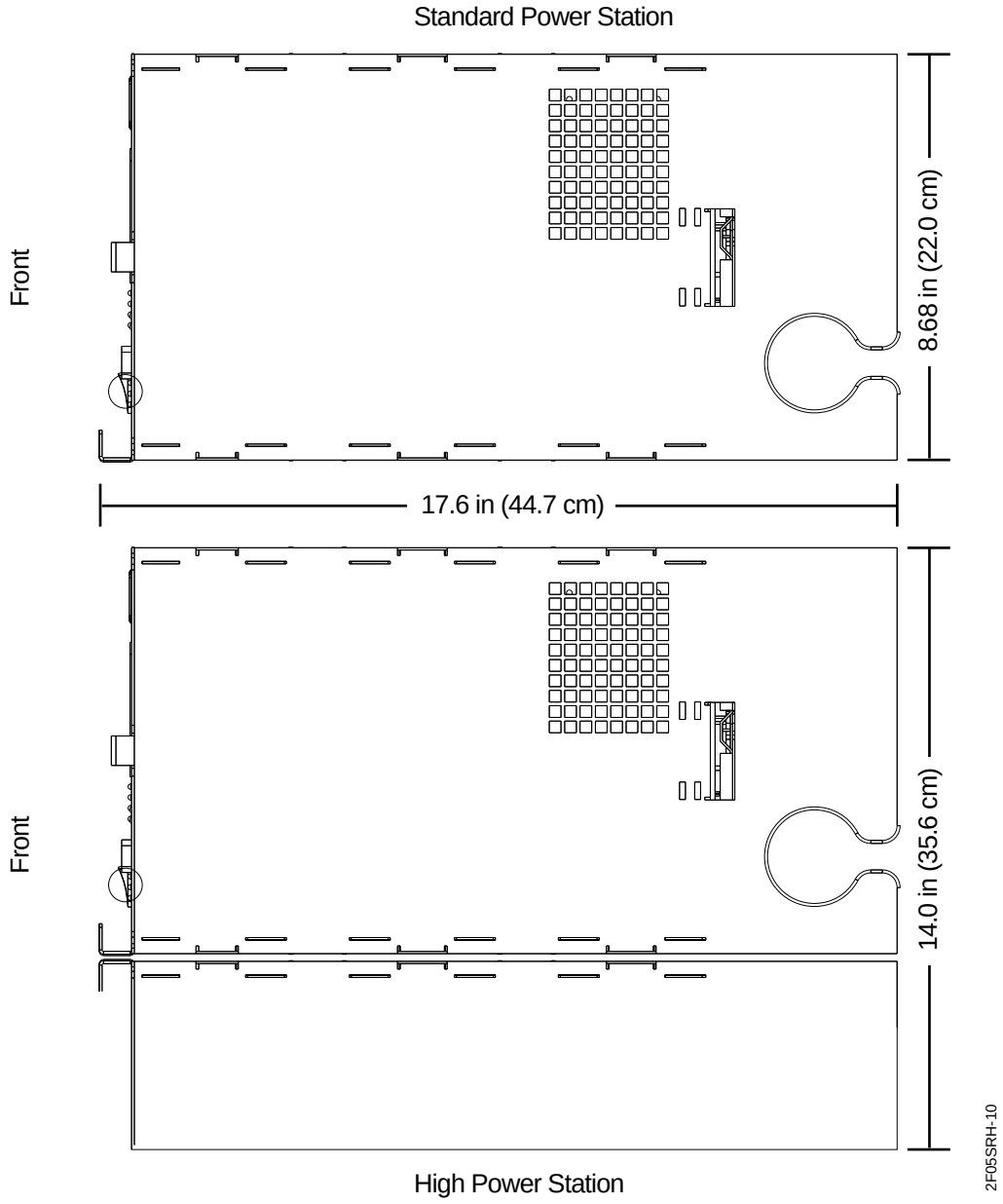


Figure 3-2: Side View of the Standard Power and High Power Stations Without a Cabinet

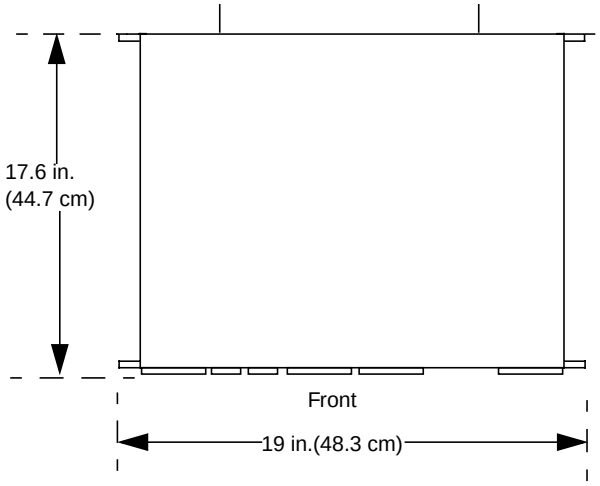


Figure 3-3: Top View of the Station Without a Cabinet

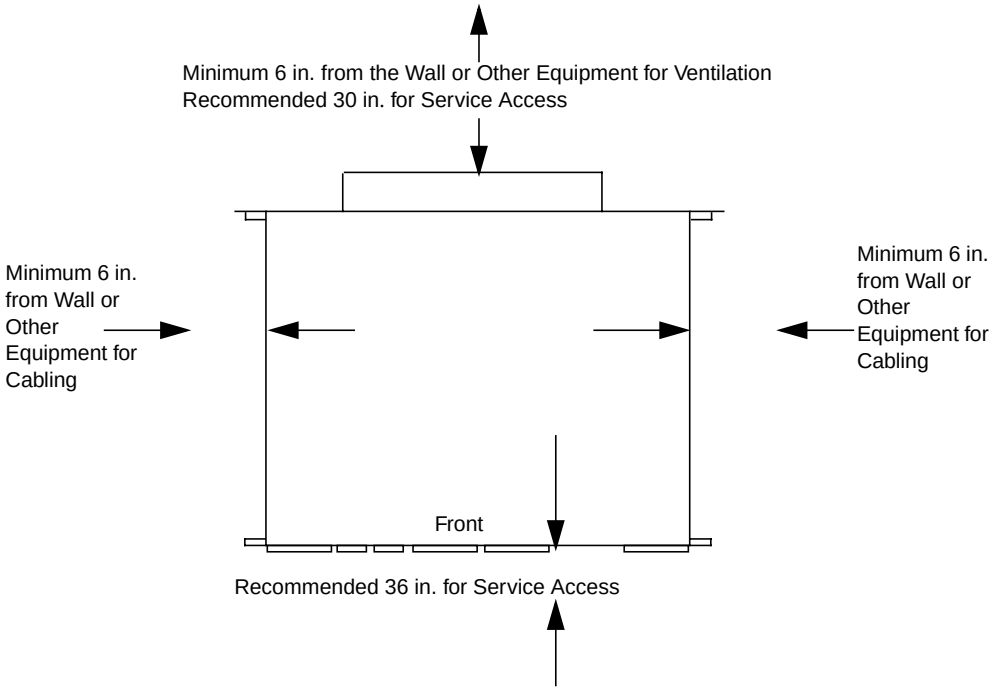


Figure 3-4: Clearance View of the Station Without a Cabinet

25-in. Cabinet

The figures 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 3-5)
- Base mounting (see Figure 3-6)

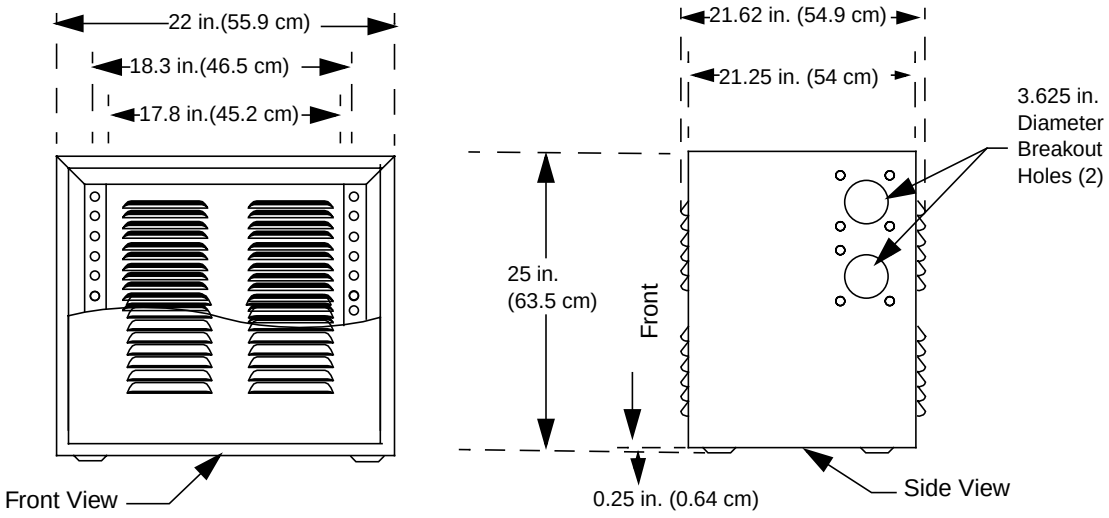


Figure 3-5: Front and Side View of the 25-in. Station Cabinet

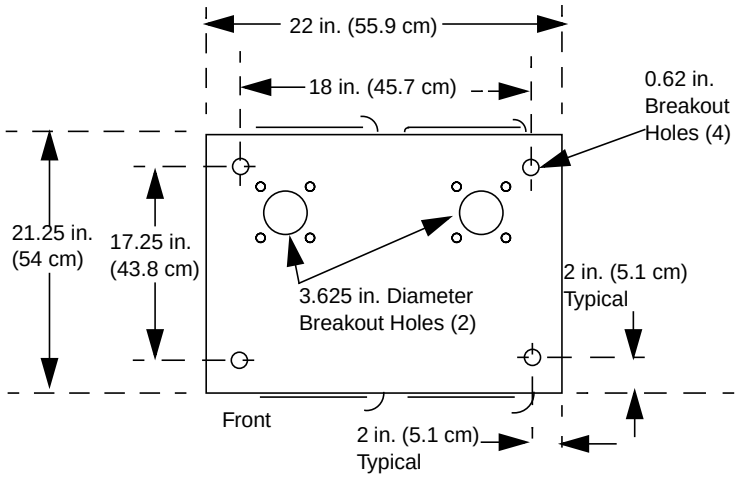


Figure 3-6: Drilling Template for Base of a 25-in. Station Cabinet

46-in. Cabinet

The figures 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 3-7)
- Side view (see Figure 3-7)
- Base mounting (see Figure 3-8)

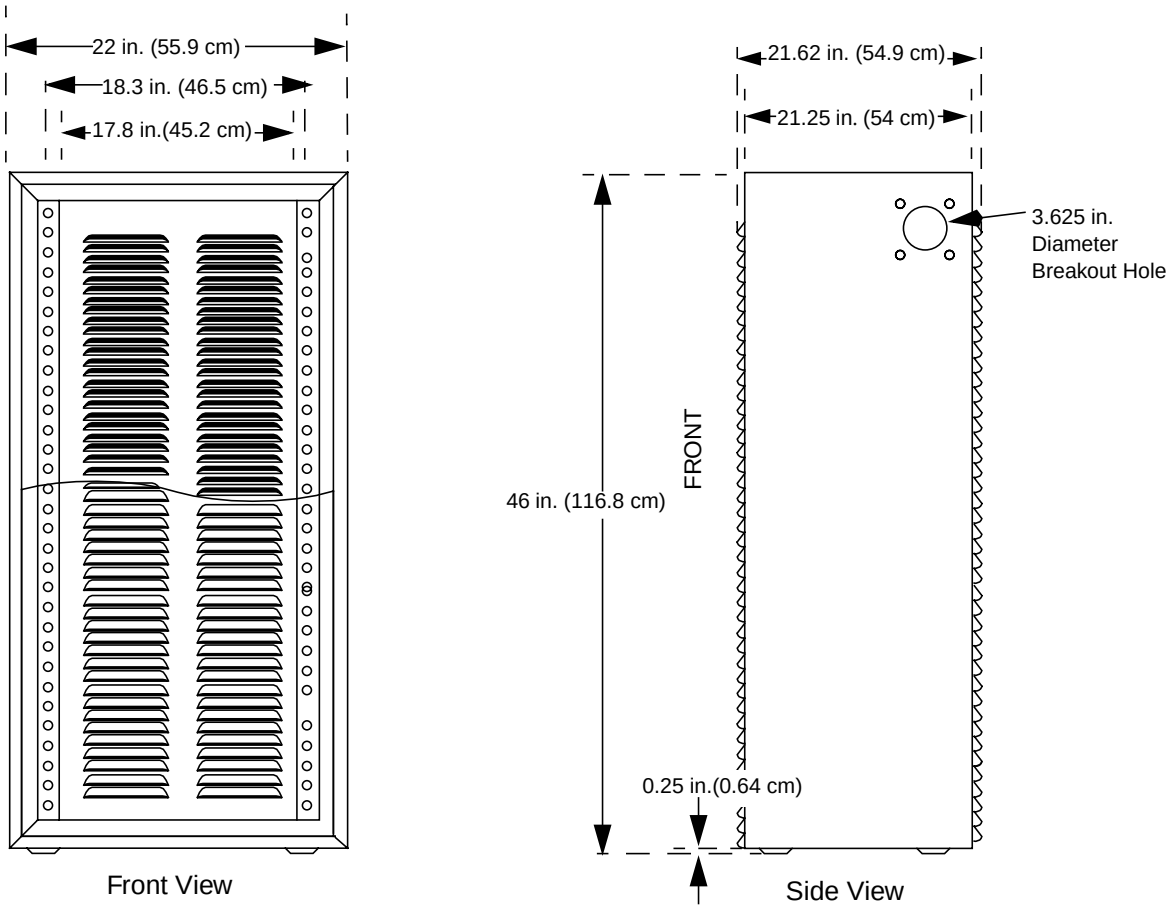


Figure 3-7: Front and Side View of the 46-in. Station Cabinet

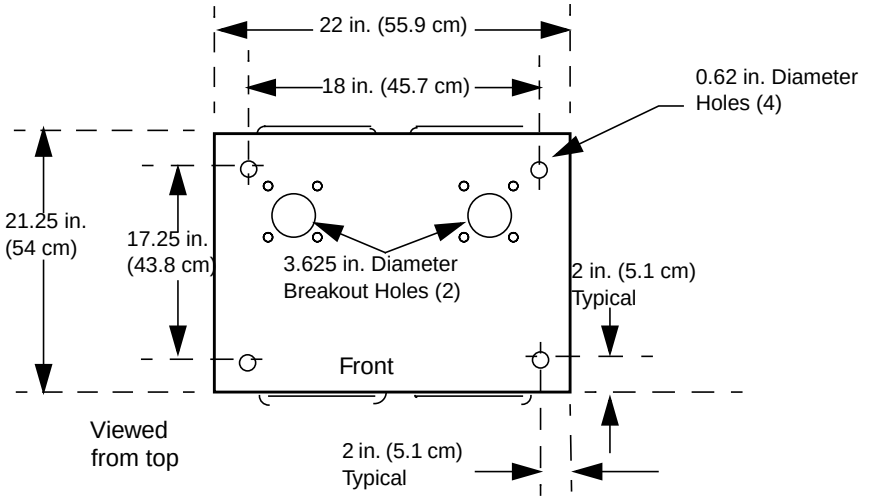


Figure 3-8: Drilling Template for the Base of a 46-Inch Cabinet

70-in. Cabinet

The figures below show the dimensions for a 70-in. cabinet (option X307). The minimum recommended clearances are 36 in. (front) and 30 in. (rear) for installation access.

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

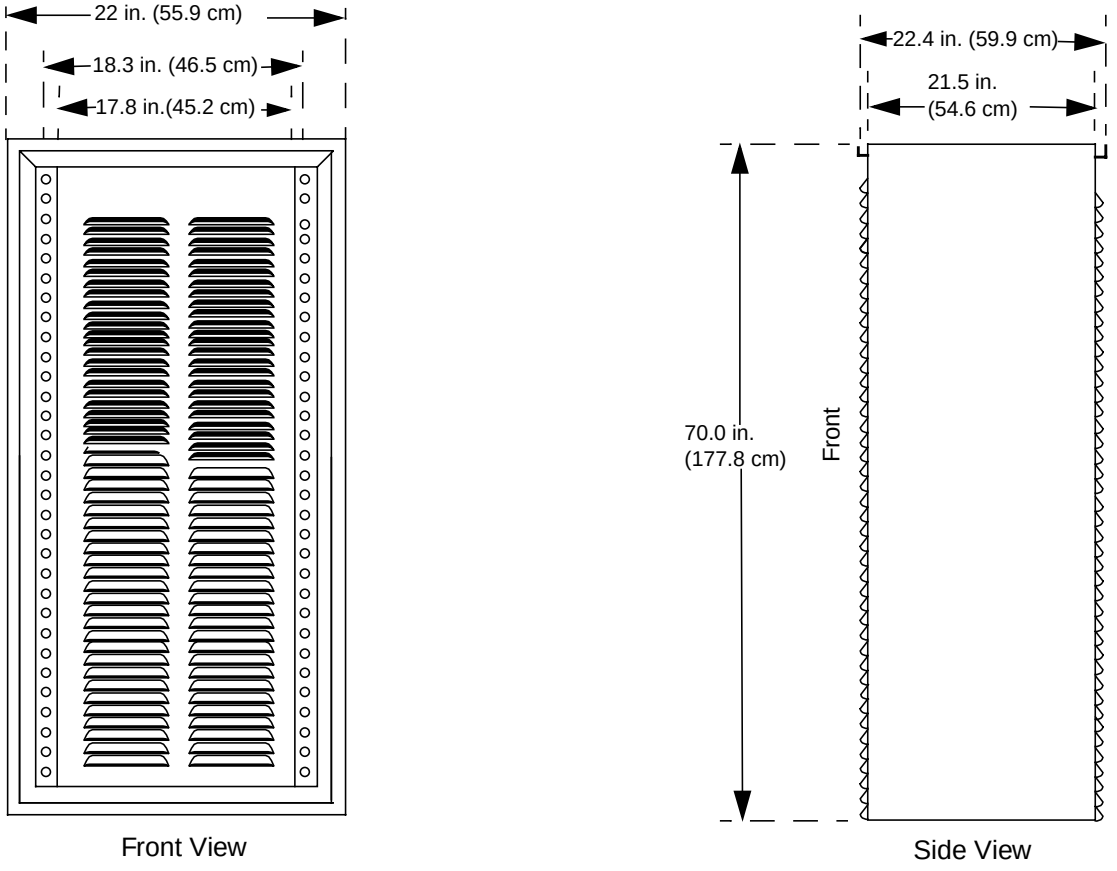


Figure 3-9: Front and Side View of the 70-in. Station Cabinet

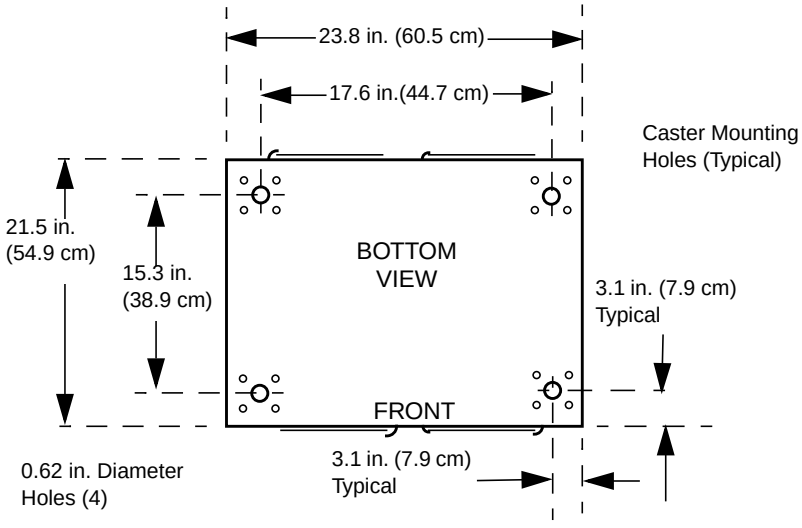


Figure 3-10: Drilling Template for a 70-in. Station Cabinet

Tools and Equipment

Use a fiberglass or wood 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 wood stepladder, six to eight feet (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 approximately 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 floor)
- Vacuum cleaner for removing concrete dust (for installations where cabinet or rack is being anchored to concrete floor)
- 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)

Mechanical Installation

Unpacking and Inspecting Equipment

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 the station without a cabinet, Motorola ships the Nucleus paging station in a cardboard container with interior packing supports.
- If shipping the station in a cabinet, Motorola ships the cabinet bolted to a wood 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 damage to the transportation company.

Unpacking 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.

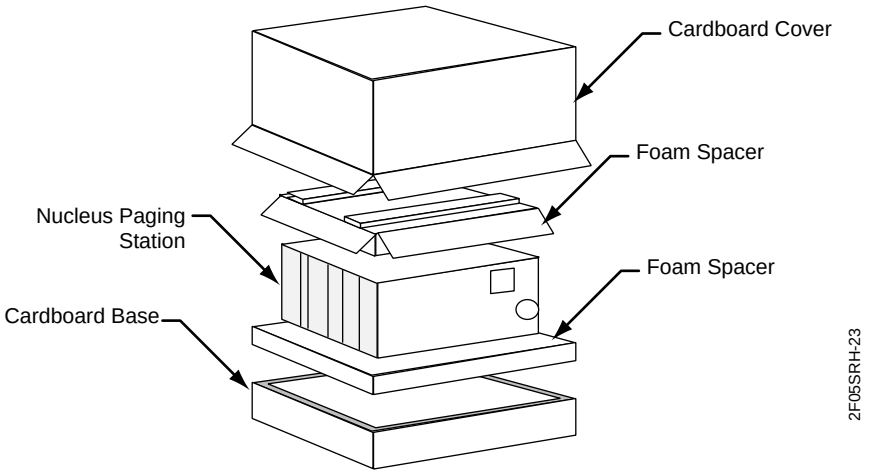


Figure 4-1: Unpacking the Station Shipped Without a Cabinet

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

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

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

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

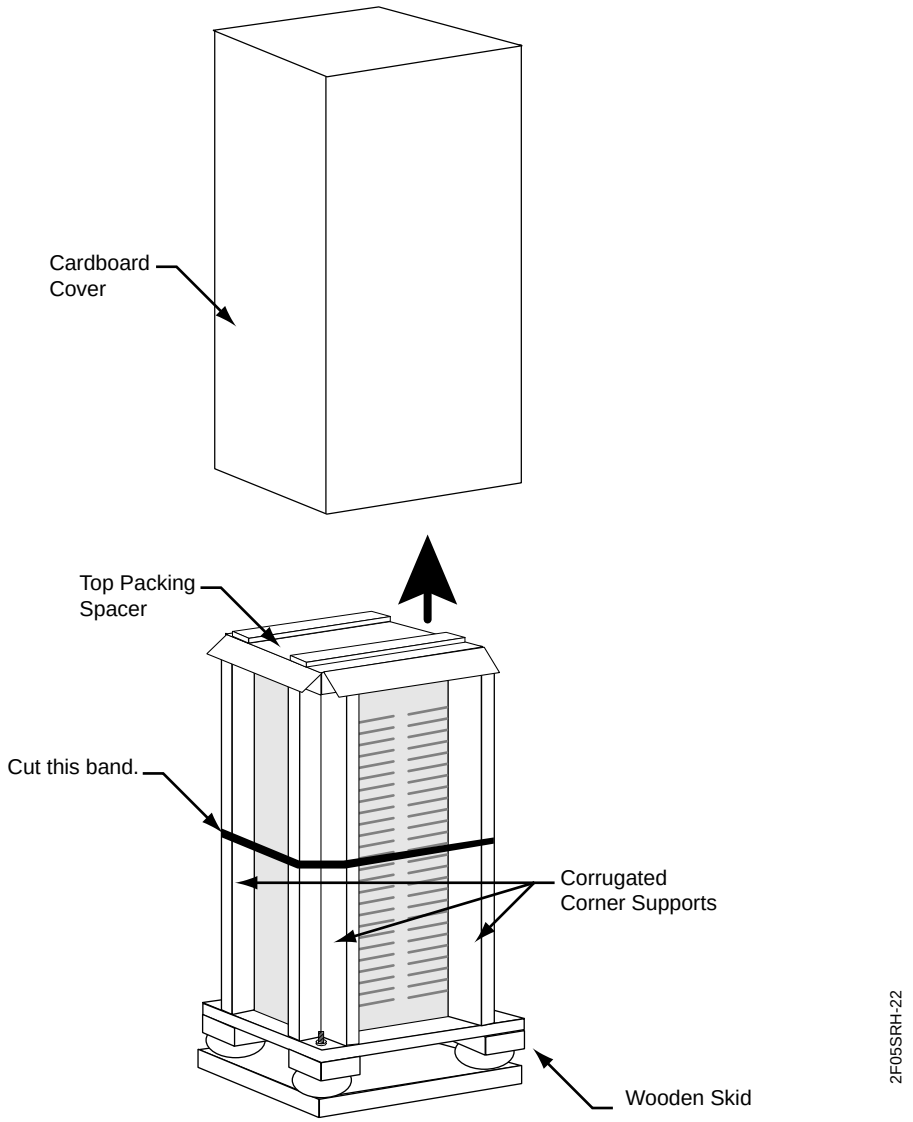


Figure 4-2: Removing the Cardboard Cover

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.

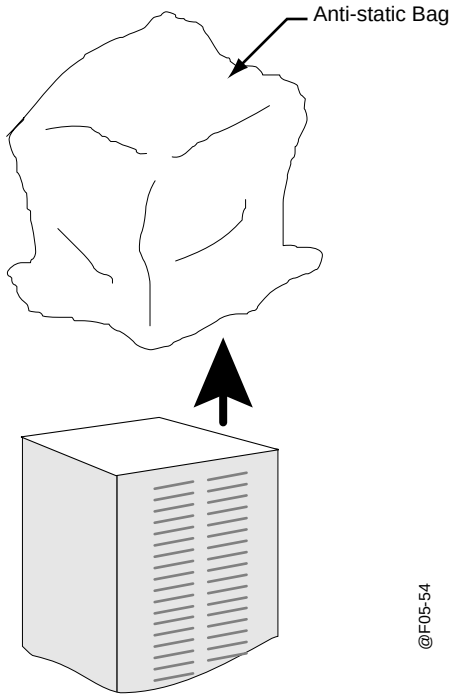


Figure 4-3: Removing the Antistatic Bag

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 wood skid. Remove the bolts and nuts (see Figure 4-4).

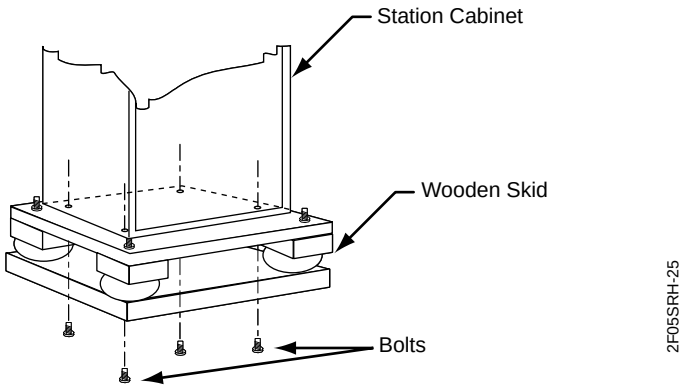


Figure 4-4: Removing the Bolts and Nuts

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

9. Remove the skid and place 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, "Preparing For Installation". 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 3-6)
   - 46-in. cabinet (see Figure 3-8)
   - 70-in. cabinet (see Figure 3-10)
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 wood 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.

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 or standard 19 inch equipment racks. 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 or Equipment Racks

Note: Do not begin this procedure until the EIA cabinet or equipment rack 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.

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, "Preparing For Installation").

Mounting the Standard Power Station

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

Note: Perform the procedures in sequence.

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

Rack Installation

1. Remove the station from the packing kit (see paragraph, "Unpacking and Inspecting Equipment"). If the station is too heavy to lift from the packing carton, lighten the station by removing the power supply and power amplifier (PA) module 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 using a TORX screwdriver and TX15 bit. Remove the PA from the cage and set it aside in a safe location.

2. Remove the fan door and rear cowling 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 fan bracket aside for later reinstallation.
   e. Remove the TORX® screws holding the rear cowling using a TORX screwdriver and TX30 bit. Set the screws and cowling aside for later reinstallation.

3. Install PA in the equipment racks:
   a. Determine where to insert the station in the equipment 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).
   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 4-5). The screw head is approximately 1/8 in. from the rail surface. These screws assist in positioning and holding the station for mounting.
   e. Carefully lift the station and position the station in the equipment rack so it rests on the two screws installed above (see Figure 4-5).

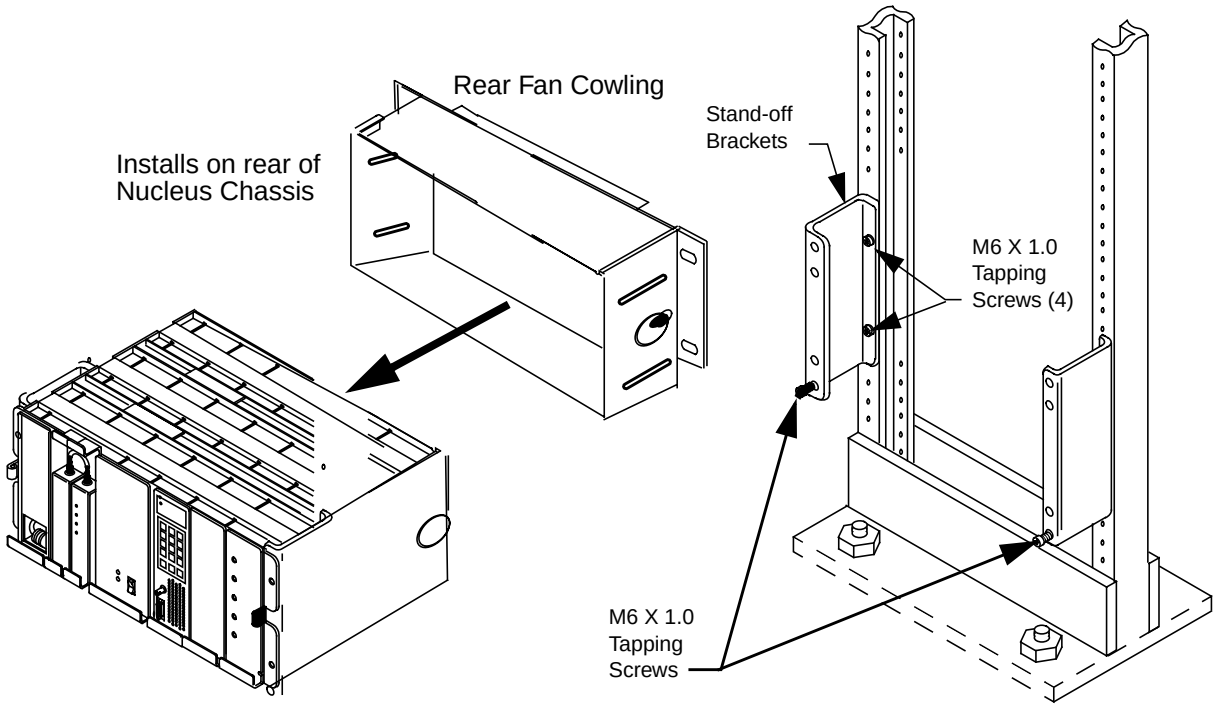


Figure 4-5: Attaching Screws to the Brackets

f. Insert four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-6).

g. Tighten all mounting screws securely. Remove the two screws that the cage is resting on.

h. At the rear of the equipment racks, place the rear fan cowling in position over the rear of the station (see Figure 4-6).

i. Secure in place with four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit.

j. If a peripheral bracket was removed, replace the bracket and connect all cables associated with the bracket according to diagram made during removal.

k. Connect the station antenna according to directions in Chapter 5, "Connectors and Interfaces".

l. Reinstall the fan door and connect the fan power cable to J31 on the rear panel.

m. Route the supplied power supply cable through the right side (viewed from rear) wiring access hole.

n. Clear all cables before closing the fan door. Rotate the quarter-turn fasteners on the right side of the fan door clockwise to lock the fan door.

o. At the front of the station, install the PA in the PA slot and secure in place using a TORX screwdriver and TX15 bit.

p. At the front of the station, install the power supply in the power supply slot and secure in place using a TORX screwdriver and TX15 bit.

q. Ensure the station power supply ON / OFF switch is in the OFF position.

r. Connect the power cable to the power supply AC power connector.

.

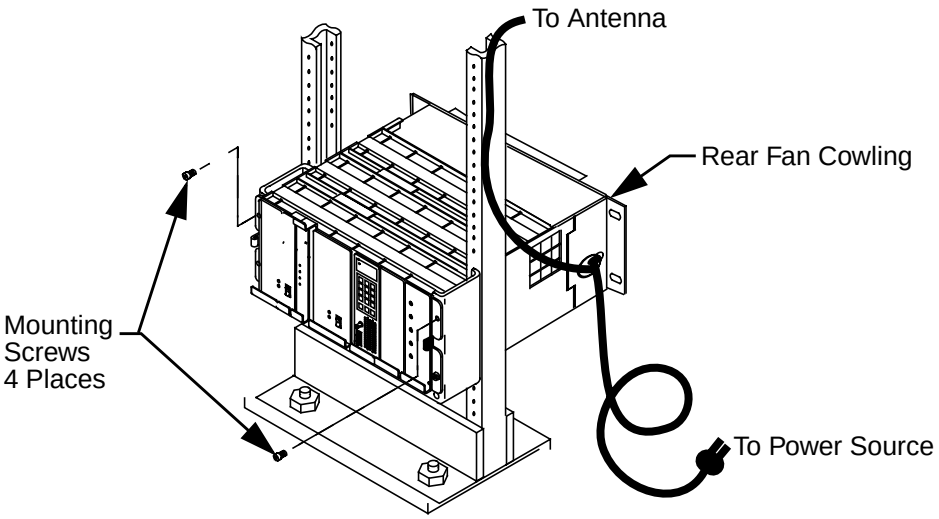


Figure 4-6: Standard Paging Station Mounted In Equipment Rack

Cabinet Installation

Install the station in a standard 19 inch cabinet as follows (see Figure 4-7).

1. Remove the station from the packing kit (see paragraph, "Unpacking and Inspecting Equipment").

2. Lighten the station by removing the power supply, power amplifier (PA) module, fan panel and the rear cowling from 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 using a TORX screwdriver and TX15 bit. Remove the PA from the cage and set it aside in a safe location.
   c. At the rear of the station rotate the quarter-turn fasteners on right side of the fan door counterclockwise to unlock the fan door.
   d. Open the fan door and disconnect the fan cable connector.
   e. Lift the fan door off its hinge pins. Set the fan door aside in a safe place.
   f. If a peripheral bracket assembly is installed in the duct, disconnect the cables. Draw a diagram or tag the cables for reconnection.
   g. Remove the four TORX® screws holding the rear cowling using a TORX screwdriver and TX30 bit. Set the screws and cowling aside for later reinstallation.

3. Install Station in the cabinet:
   a. Determine where to insert the station in the cabinet.
   b. Insert a M6x1.0 tapping screw (supplied) into each front cabinet rail where the station is to be mounted (see Figure 4-7). The screw head is approximately 1/8 in. from the rail surface. These screws assist in positioning and holding the station for mounting.
   c. Carefully lift the station and position the station in the cabinet so it rests on the two screws installed above (see Figure 4-7).
   d. Insert four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-7).
   e. Tighten all mounting screws securely.
   f. Remove the two screws that the cage is resting on.
   g. At the rear of the cabinet, place the rear cowling in position over the rear of the station.
   h. Secure in place with four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-7).
   i. If a peripheral bracket was removed, replace the bracket and connect all cables associated with the bracket according to the diagram made during removal.
   j. Connect the station antenna according to directions in Chapter 5, "Connectors and Interfaces".
   k. Reinstall the fan door and connect the fan power cable to J31 on the rear panel.

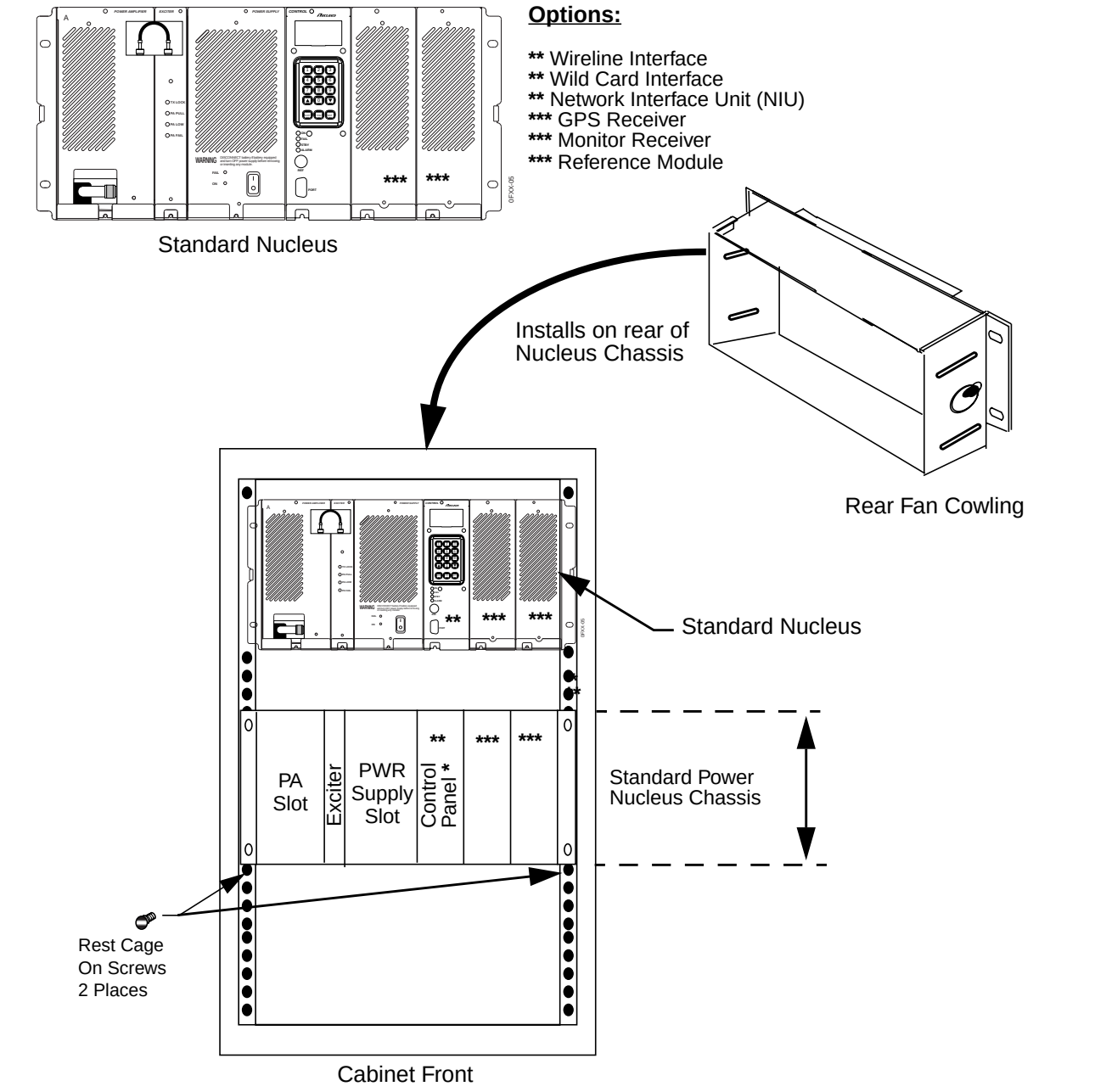


Figure 4-7: Installation of Standard Station in a Cabinet

l. Route the supplied power supply cable through the right side (viewed from rear) wiring access hole.

m. Clear all cables before closing the fan door. Rotate the quarter-turn fasteners on the right side of the fan door clockwise to lock the fan door.

n. At the front of the station, install the PA in the PA slot and secure in place using a TORX screwdriver and TX15 bit.

o. At the front of the station, install the power supply in the power supply slot and secure in place using a TORX screwdriver and TX15 bit.

p. Ensure the station power supply ON / OFF switch is in the OFF position.

q. Connect the power cable to the power supply AC power connector.

4. This portion of the installation procedure is complete.

Mounting the High Power Station

This procedure describes installing a high power station in an equipment rack or a standard EIA 19-in. cabinet.

Note: Perform the following procedures in sequence.

CAUTION

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

Rack Installation

1. Remove the station from the packing kit (see paragraph, "Unpacking and Inspecting Equipment"). If the station is too heavy to lift from the packing carton, lighten the station by removing the two power supplies and power amplifier (PA) module from the front of the station as follows:

   a. Remove the two TORX® screws holding each power supply using a TORX screwdriver and TX15 bit (see Figure 4-8). Remove each power supply and set it aside in a safe location.

   b. Remove the four TORX screws holding the PA in the cage using a TORX screwdriver and TX30 bit (see Figure 4-8).

   c. Slide the PA partially out of the chassis to gain access to the RF output cable (see Figure 4-8).

   d. Disconnect the RF output cable from the PA and slide the PA out of the chassis.

CAUTION

The PA weights 25.65 lb (11.65 kg).

   e. Remove the PA from the cage and set it aside in a safe location.

   a. At the rear of the station rotate the quarter-turn fasteners on the 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.

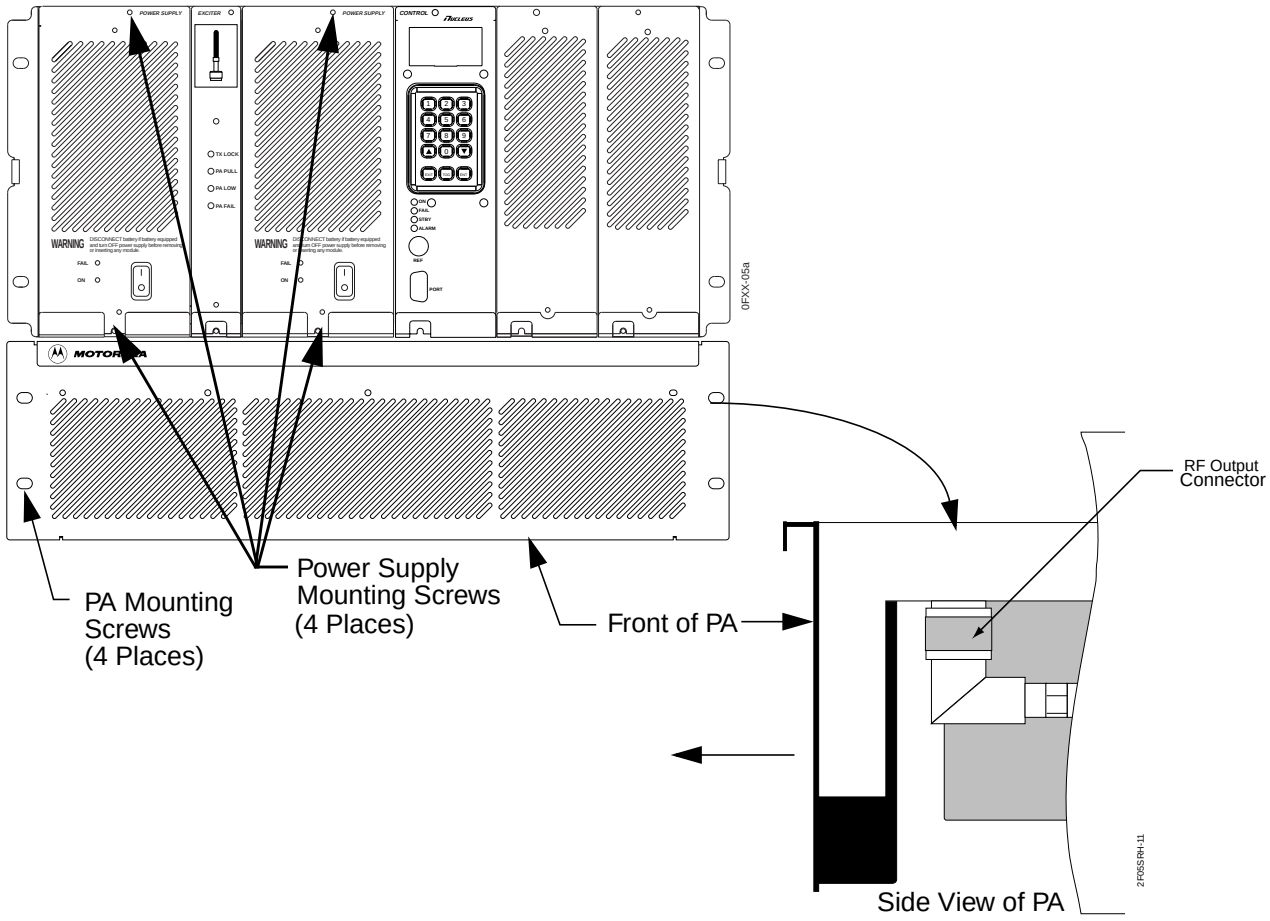


Figure 4-8: Pulling the PA from the Chassis

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.

e. Remove the four TORX® screws holding the rear cowling using a TORX screwdriver and TX30 bit. Set the screws and cowling aside for later reinstallation.

2. Install Nucleus chassis in the equipment rack (see Figure 4-9):

a. Determine where to insert the station in the equipment rack.

b. Mark the screw holes for the stand-off brackets.

c. Install the brackets on the rails using four M6x1.0 tapping screws.

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 4-9). The screw head is approximately 1/8 in. from the rail surface. These screws assist in positioning and holding the station for mounting.

e. Carefully lift the station chassis and position the chassis in the equipment rack so it rests on the two screws installed in above (see Figure 4-9).

f. Do not install screws in the two holes on each side of the chassis PA slot.

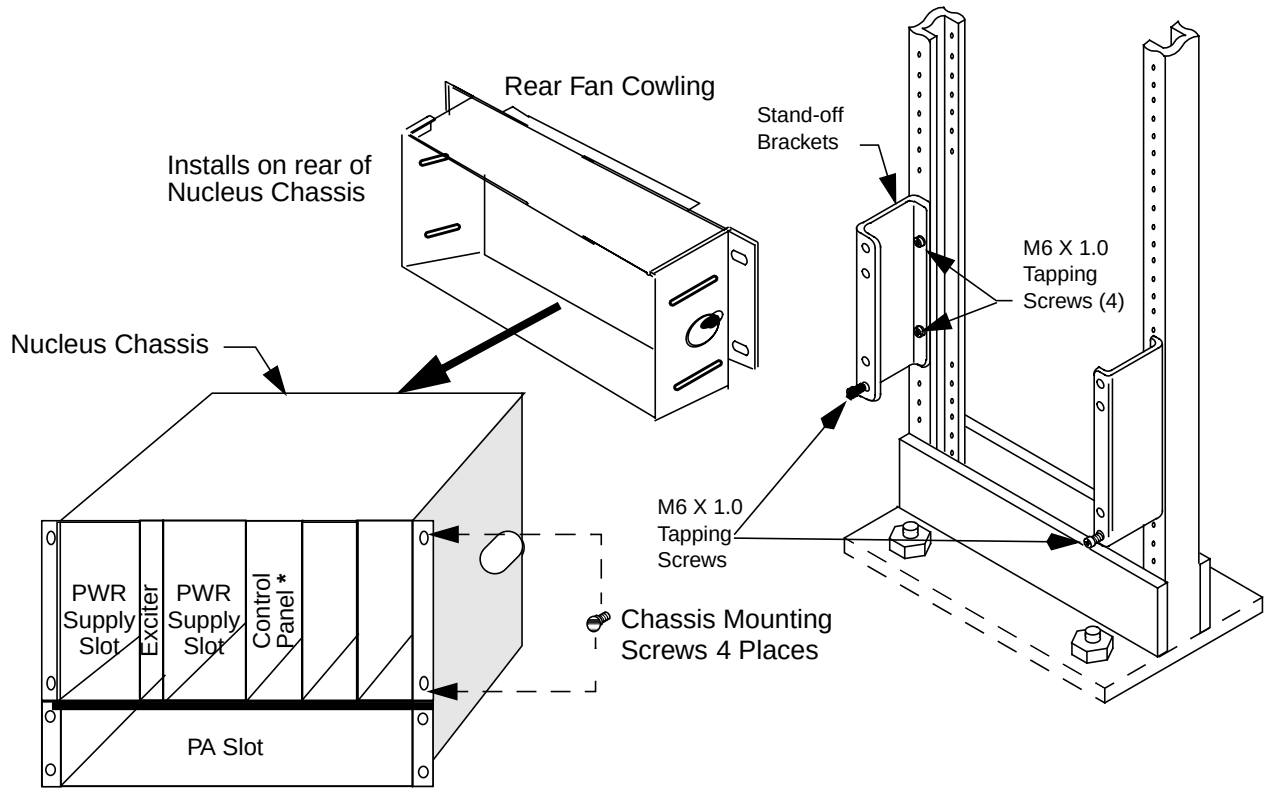


Figure 4-9: High Power Station Mounting in a 19 Inch Equipment Rack

g. Insert four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-9).

h. Tighten all mounting screws securely. Remove the two screws that the cage is resting on.

i. Place the PA in the PA slot and slide partially into the chassis.

j. Connect the RF power connector to the RF output connector on the PA (see Figure 4-8).

k. Slide the PA into the chassis and secure in place with four M6x1.0 tapping screw (supplied) using TORX screwdriver and TX 30 bit.

l. At the rear of the equipment racks, place the rear cowling in position over the rear of the station.

m. Secure in place with four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-9).

n. If a peripheral bracket was removed, replace the bracket and connect all cables associated with the bracket according to diagram made during removal.

o. Connect the station antenna according to directions in Chapter 5, "Connectors and Interfaces".

p. Reinstall the fan door and connect the fan power cable to J31 on the rear panel.

q. Route the supplied power supply cable through the right side (viewed from rear) wiring access hole.

r. Clear all cables before closing the fan door. Rotate the quarter-turn fasteners on the right side of the fan door clockwise to lock the fan door.

s. At the front of the station, install the two power supplies in the power supply slots and secure each power supply in place using a TORX screwdriver and TX15 bit.

t. Ensure the station power supply ON / OFF switch is in the OFF position.

u. Connect the power cable to the power supply AC power connectors.

Cabinet Installation

Install the station in a standard size 19 inch cabinet as follows (see Figure 4-10).

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 (see paragraph, "Unpacking and Inspecting Equipment").

2. Lighten the station by removing the power supplies, power amplifier (PA) module, fan panel and the rear cowling from the station chassis as follows:

   a. Remove the two TORX screws holding each power supply using a TORX screwdriver and TX 15 bit.

   b. Remove the two 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 of the chassis approximately 5 in. (see Figure 4-8).

   f. Disconnect the RF cable located at the right front of the PA (see Figure 4-8).

CAUTION

The PA weights 25.65 lb (11.65 kg).

   g. Pull the PA out of the chassis and set it aside in a safe location.

   h. At the rear of the chassis, open the fan door and disconnect the fan cable connector.

   i. Lift the fan door off its hinge pins. Set the fan door aside in a safe location.

   j. If a peripheral bracket assembly is installed in the cowling, disconnect the cables. Draw a diagram or tag the cables for reconnection.

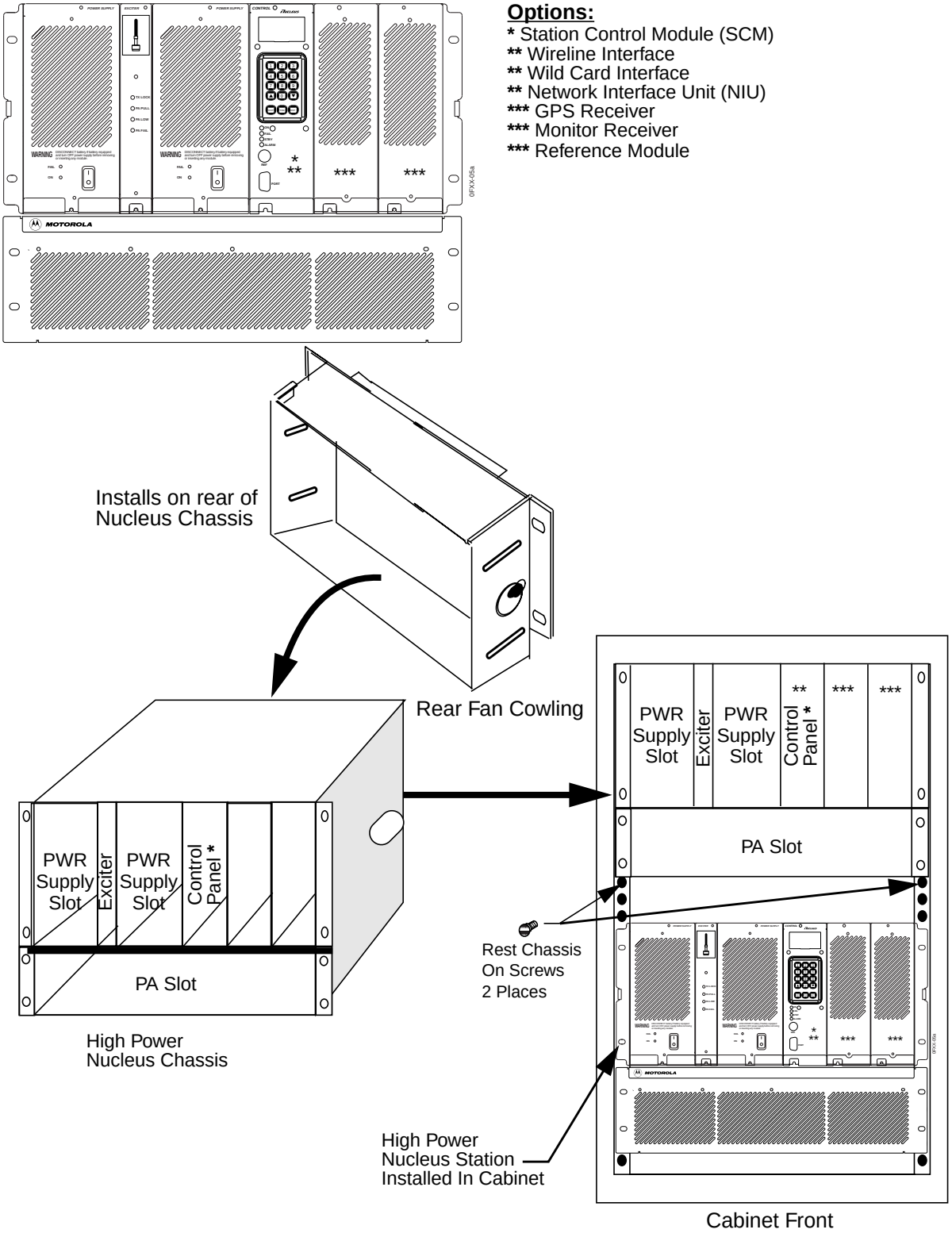


Figure 4-10: Installing High Power Station in a Cabinet

3. Install the Chassis in the cabinet as follows (see Figure 4-10):
   a. Remove the four TORX® screws holding the rear cowling in place using a TORX screwdriver and TX30 bit. Set the screws and cowling aside for later reinstallation.
   b. Insert an M6x1.0 tapping screw (supplied) into each front rail of the cabinet at the lower of the two holes where the chassis is to be installed (see Figure 4-10).
   c. The screw head is approximately 1/8 in. from the rail surface. These screws assist in positioning and holding the station chassis for mounting.
   d. Carefully lift the station chassis and position the chassis in the cabinet so it rests on the two screws installed in above (see Figure 4-10).
   e. Do not install screws in the two holes on each side of the chassis PA slot.
   f. Insert four M6x1.0 tapping screws (two on each side), using a TORX screwdriver and TX 30 bit (see Figure 4-10).
   g. Remove the two screws that the chassis is resting on.
   h. Tighten the four chassis mounting screws securely.

4. Install PA, Power supplies, cowling, peripheral equipment and fan door as follows:
   a. Place the PA in the PA slot and slide partially into the chassis (see Figure 4-8).
   b. Connect the RF power connector to the RF output connector on the PA (see Figure 4-9).
   c. Slide the PA firmly into the chassis so it seats in the backplane properly.
   d. Secure the PA in place with four M6x1.0 tapping screw (supplied) using a TORX screwdriver and TX 30 bit (see Figure 4-10).
   e. Reinstall the two power supplies in the original location and secure with original TORX screws using a TORX screwdriver and TX 15 bit (see Figure 4-10).
   f. At the rear of the cabinet, place the rear fan cowling in position on the chassis and secure in place with four M6x1.0 screws using a TORX screwdriver and TX 30 bit (see Figure 4-10).
   g. Reinstall the peripheral bracket and reconnect any cables which were disconnected.
   h. Secure the bracket to the backplane with two M6x1.0 screws using a TORX screwdriver and TX 30 bit.
   i. Route the RF antenna cable from the RF output connector through the left side wiring access hole.
   j. 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.
   k. Reinstall the rear fan door on the mounting pins located on the fan cowling.
   l. Connect the fan power connector to J31 on the backplane.
   m. Close the fan door and secure it by pushing inward on the two quarter-turn fasteners while rotating clockwise.

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

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 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)
- Standard power station (see Figure 5-2)

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

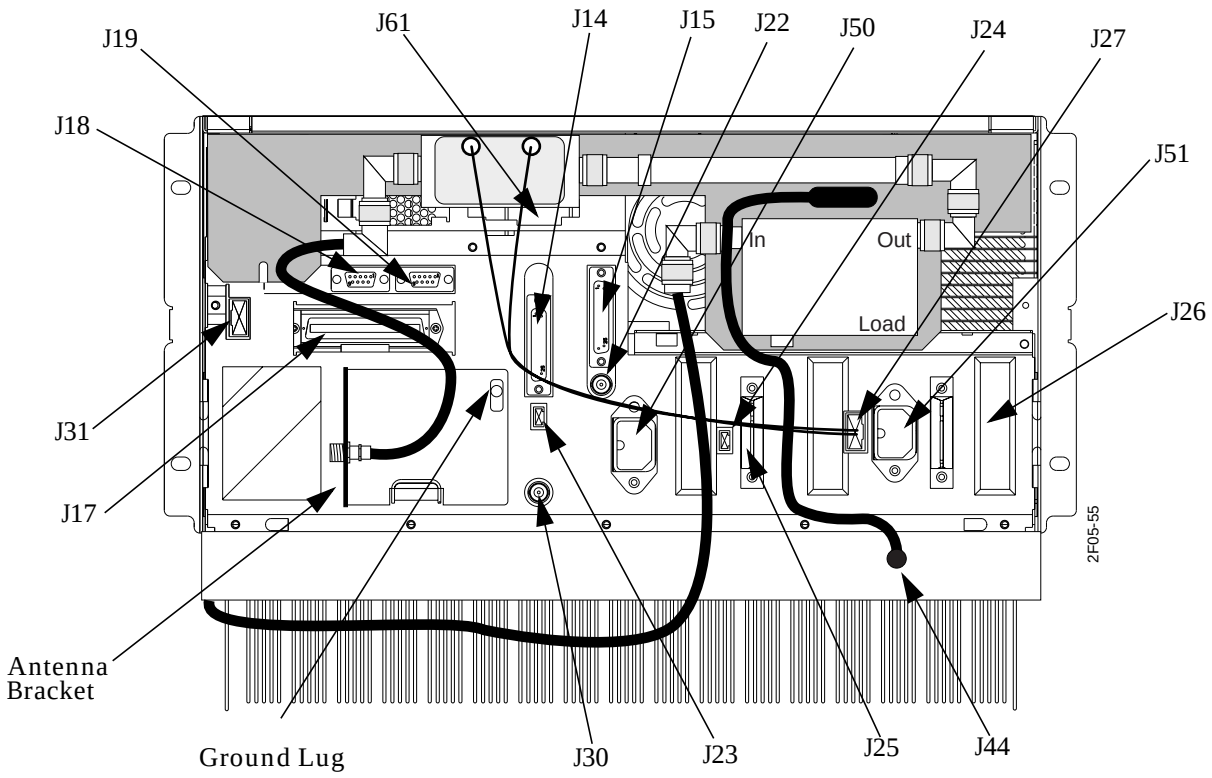


Figure 5-1: Backplane Connectors for a High Power Station (with Circulator Option)

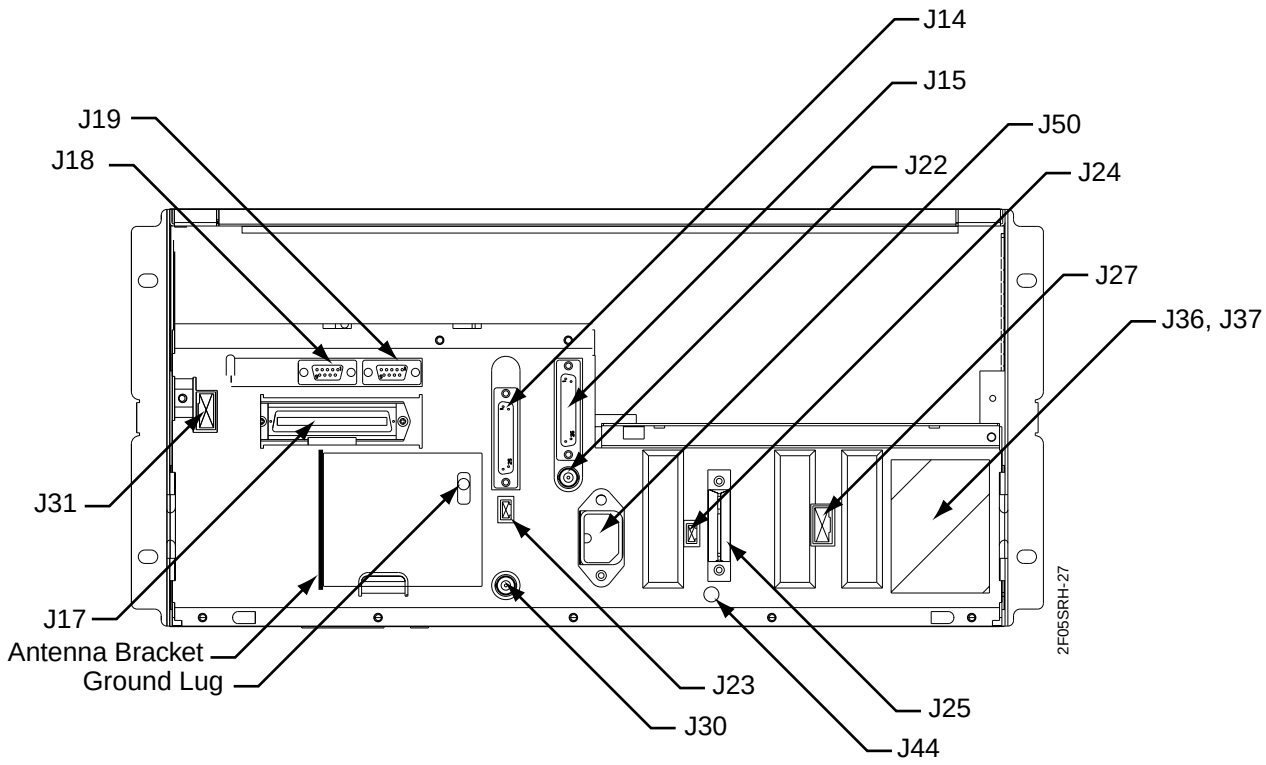


Figure 5-2: Backplane Connectors for a Standard Power Station

Use Table 5-1to determine the type of connector and its function for both high and standard power stations.

Table 5-1: Backplane Connectors

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	J18	N LAN	DB9	LAN	LAN
	J19	Receiver link	DB9	Ext Link receiver	Ext Link receiver
	J22	1 pps reference port	BNC	GPS	GPS
	J30	5 MHz or 10 MHz input	BNC	Measures 5MHz or 10 MHz Frequency Standard for calibrating station Reference Oscillator (UHSO or HSO)	Measures 5MHz or 10 MHz Frequency Standard for calibrating station Reference Oscillator (UHSO or HSO)
RF	J23	Antenna relay	AMP-MODU	Control for relay	Control for relay
	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	Battery connection	Battery connection
	J26	Battery revert	4-pin modular	Battery connection	Battery connection
	J31	DC power to fan(s) and external devices	10-wire	Fan door and External Devices	Fan door and External Devices
	J50	AC input	3-prong receptacle	AC power	AC power
	J51 (High Power only)	AC input	3-prong receptacle	Not populated	AC power
Circulator Option	J27	Peripheral interface	10-pin		Single or Double circulator option

Installing Communication Peripherals

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

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.

- J14—the PSTN modem channel connector used only with NAC stations. 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 with a satellite receiver set for RS232 output.
- J17—the external control and communication connector used for several options. Options include an external Network Interface Unit (NIU) or the internal modem on the internal NIU (see Table 5-4).

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

Pin No.	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
20	PSTN DTR		X	PSTN data terminal ready

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

Pin No.	Signal	Input	Output	Function
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

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

Pin Number	Signal	Input	Output	Function
22	Open			Not used
23	Open			Not used
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

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

Signal	Pin Number	Wire Color (Main/Trace)	Signal	Function
Ring	25	Slate/Violet	WIB In 7	External alarm 7 to WIB
Tip	26	White/Blue	Open	Open
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

Installing Synchronization Peripherals

This section describes the function of pins for synchronization peripherals. The synchronization connectors are the following:

- J18—N LAN connector (see Table 5-6).
- 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 or 10 MHz input reference. J30 is a 1-pin BNC connector.
-

Table 5-5: J18 N LAN Connector

Pin No.	Signal	Input	Output	To/From	Function
1	Shield Gnd		x	GND (A —)	Shield Gnd
2	N LAN Clk +	x		#8 — pin 16	N LAN Clock +
3	N LAN Clk -	x		#8 — pin 16	N LAN Clock -
4		x	x	#8 — pin 12	Different Data (+)
5		x	x	#8 — pin 14	Different Data (-)
6		x		#8 — pin 16	N LAN Clock +
7		x		#8 — pin 16	N LAN Clock -
8		x	x	#8 — pin 12	Different Data (+)
9		x	x	#8 — pin 14	Different Data (-)

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

Pin No.	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 the external and output for the internal receiver.

Installing RF Interfaces and Antenna Options

This section describes RF pins and functions. The RF connectors are the following:

- J23—provides power for the antenna relay (if used) (see Table 5-7)
- J27—provides operational voltages for the optional peripheral such as the external circulator, wattmeter See (Figure 5-2 and Table 5-8)
- J44—the RF input connector to the power amplifier (PA). J44 is a 1-pin blindmate connector used only on the high power station (used only for high power)

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 No.	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)

Table 5-8: J27 Peripheral Interface Connector Pins and Signals

Pin No.	Signal	Input	Output	Function
1	Gnd		x	Ground
2	EXT WM Vf	x		DC voltage to Ext. Wattmeter forward power
3	EXT WM Vr	x		DC voltage to Ext. Wattmeter reflected power
4	EXT WM Ref	x		Ground reference for External Wattmeter
5	Ext Circulator Temp	x		DC voltage prop. to temp. from sensor on circulator
6	Ext mon Volt. 1		x	Sw. + 14.2 V to energize Main/Standby relay
7	Ext. I/O 2	x		Future use
8	Ant. Rly Keyed A+			Sw. +14.2 Vto energize antenna relay
9	Gnd		x	Ground
10	13.8 V dc		x	13.8 V dc from power supply.

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 on the antenna bracket of the station backplane
- RF cables from the PA and Receiver are normally 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.

Use the following procedure to install or verify installation of the cables (see Figure 5-3):

1. Inspect the antenna relay control cable. Ensure that it is securely attached to J23 (see Figure 5-3).
2. Connect the station receive input cable from the Receiver to the top connector of the antenna relay (see Figure 5-3).
3. Attach the transmit output cable from the PA to the lower antenna relay connector (see Figure 5-3).
4. Attach the cable from the antenna to the middle connector of the antenna relay (see Figure 5-3).

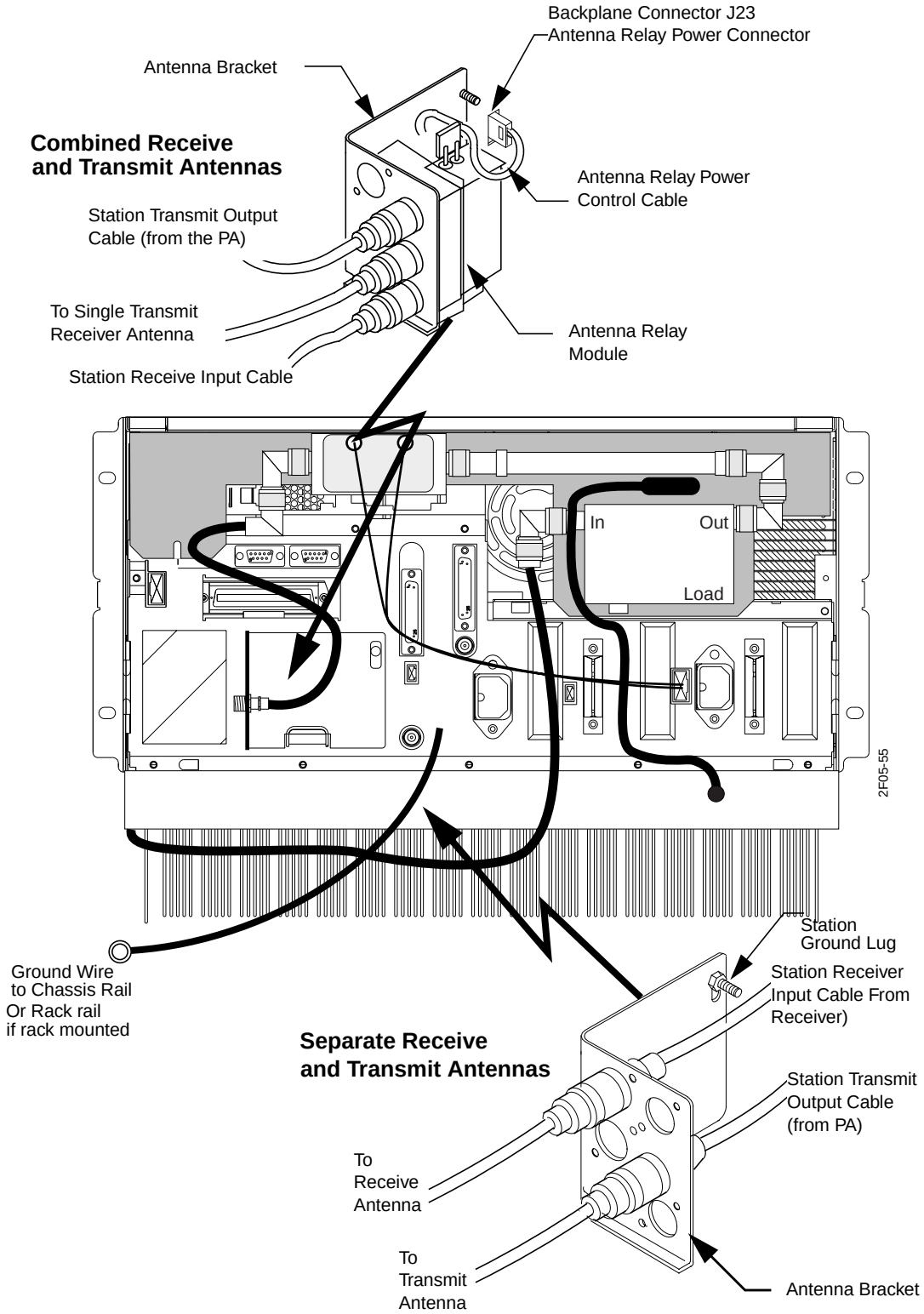


Figure 5-3: Backplane Connections for an Antenna With and Without Relay Module

Separate Transmit and Receive Antenna

A Nucleus paging station without an antenna relay option requires a separate transmit and receive antenna. A station 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 connect with the external transmit and receive cables through the antenna bracket (see Figure 5-3).

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.

Connecting Power

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

- Ground at the ground lug on the antenna bracket (see Figure 5-3).
- J31—the DC power to fans and external devices (see Table 5-9).
- J50—the AC input to standard stations and one of the two receptacles for high power stations. J50 is a 3-prong receptacle suitable to the site country, and designated during the ordering process.
- J51—the second AC input power receptacle for high power stations. J51 is a 3-prong receptacle suitable to the site country, and designated during the ordering process.
- J24—the battery temperature measurement to the station (Table 5-10).
- 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 5-9: 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 5-10: 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 rail of the cabinet or rack mount if it is a rack mounted station (see Figure 5-3).

Use the following procedure to install the ground lug:

1. Connect a #10 gauge (or larger) 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.

DC Power to Fans and External Devices

J31 provides DC power to fans and external devices. Use the following procedure to route the power to the fans and external devices (Figure 5-4):

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

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

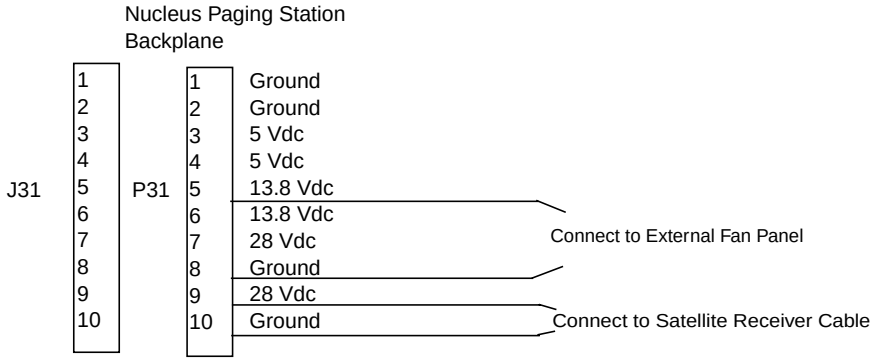


Figure 5-4: Connector J31 Output to the Fan Panel and Other External Devices

AC Power

Each Nucleus paging station with AC power arrives with a customer-specified line cord. Occasionally, by customer request, the cord arrives in the unterminated state (without a 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. Motorola installs the receptacle end of the cords in J50 and J51 for the high power station (if required).

CAUTION

Do not apply power after connection. Turn the Power Supply Module On/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 arrives 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 5-5).

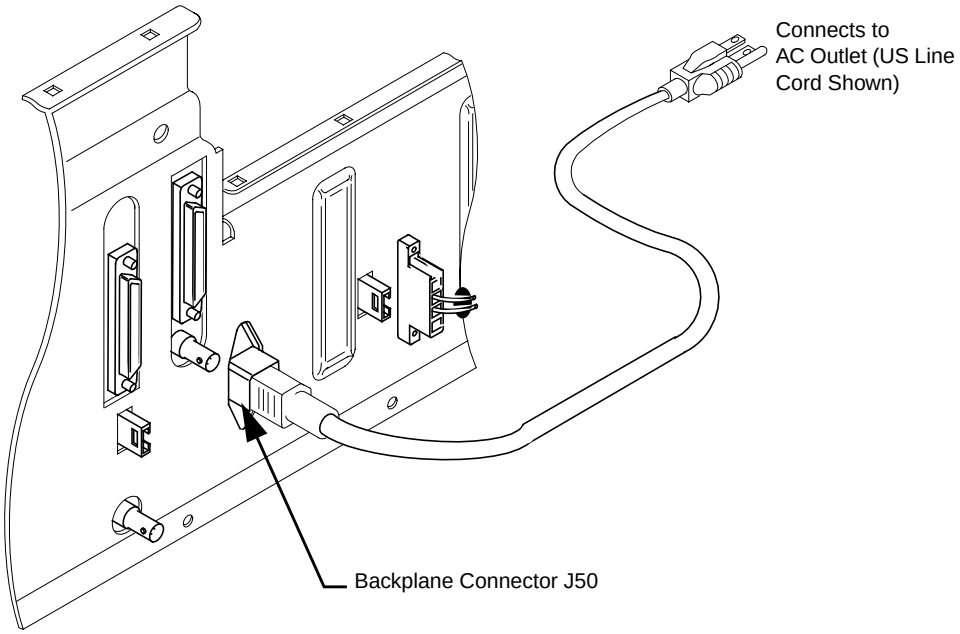


Figure 5-5: AC Power (US 120 Vac Shown)

DC Power from a Power Supply

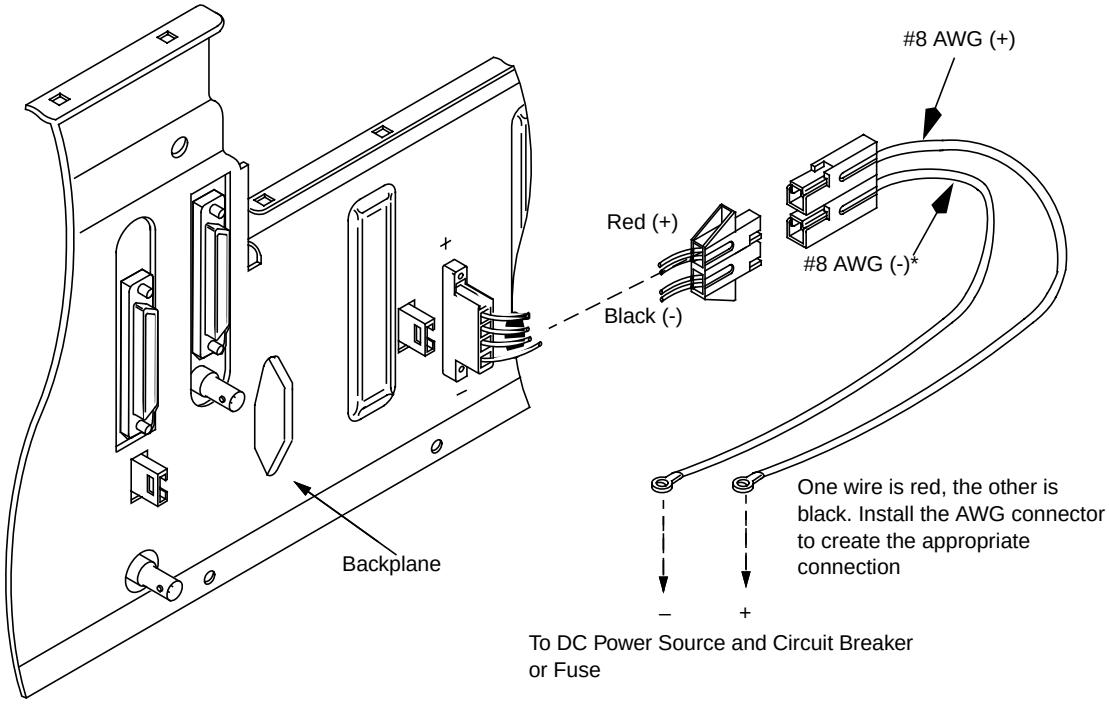
The DC power options for battery revert are options X342 and X581 (see Table 5-11).

Table 5-11: 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 wire and a black wire. Each wire terminates in an eyelet terminal (see Figure 5-6). The cable assembly provides 10 ft lengths of black and red wire. If the DC power connection exceeds 10 ft, use thicker wire to compensate for the increased distance.



NOTE: On the J25 connecto, the 2 red wires are on top and the 2 black wires are on the bottom.

Figure 5-6: DC Power Supply Option

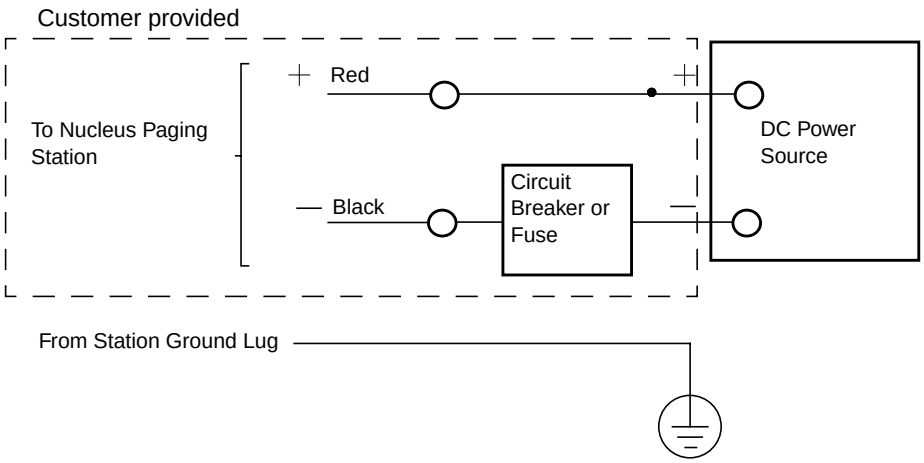
Installing a Positive Ground DC Power Supply

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

Use the following procedure to install a positive ground DC power supply (see Figure 5-7):

1. Connect the black cable from J25 to the circuit breaker or fuse connector on the negative side of the customer provided DC power source.

2. Connect the red cable from J25 to the circuit breaker or fuse connector on the positive side of the customer provided DC power source.



NOTE: The high power Nucleus paging station uses connector J26 and uses the same procedures as the low power J25 connector.

Figure 5-7: Positive Ground DC Power Supply

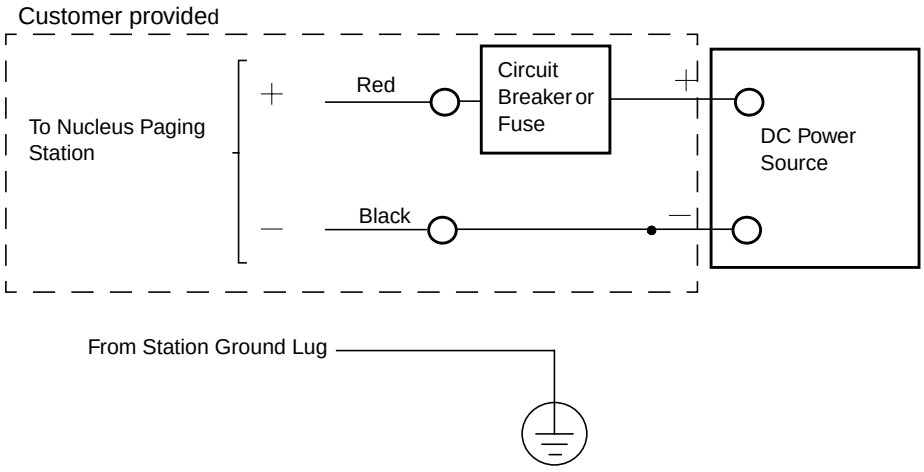
Installing a Negative Ground DC Power Supply

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

Use the following procedure to install a negative ground DC power supply see Figure 5-8):

1. Connect the red cable from J25 to the circuit breaker or fuse connector on the positive side of the customer provided DC power source.

2. Connect the black cable from J25 to the circuit breaker or fuse connector on the negative side of the customer provided DC power source.



NOTE: The high power Nucleus paging station uses connector J26 and uses the same procedures as the low power J25 connector.

Figure 5-8: Negative GroundDC Power Supply

High Power Station Battery Revert

High power Nucleus paging stations 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 installed on the backplane. This assembly has two 10-ft 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, 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 5-9).

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.

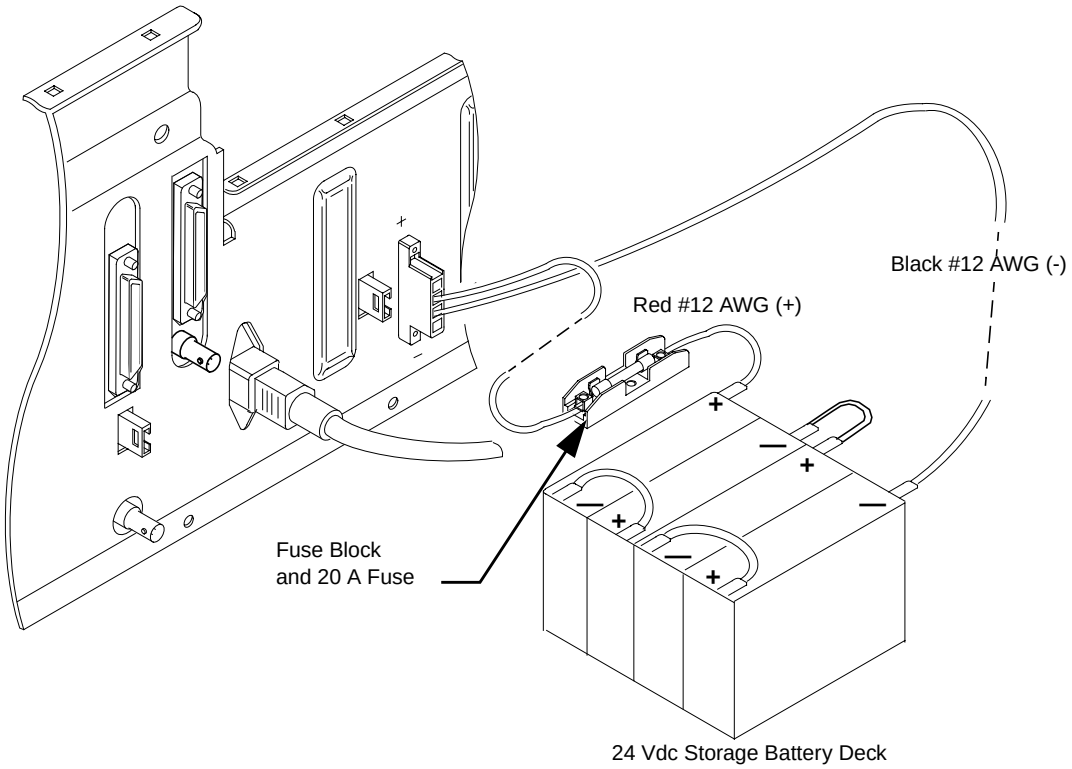


Figure 5-9: Battery Revert in a High Power Station

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 wire.

If Nucleus paging station power is turned on, 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 (negative) #8 AWG wire to the negative terminal on the battery (see Figure 5-10).

2. Connect the red (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.

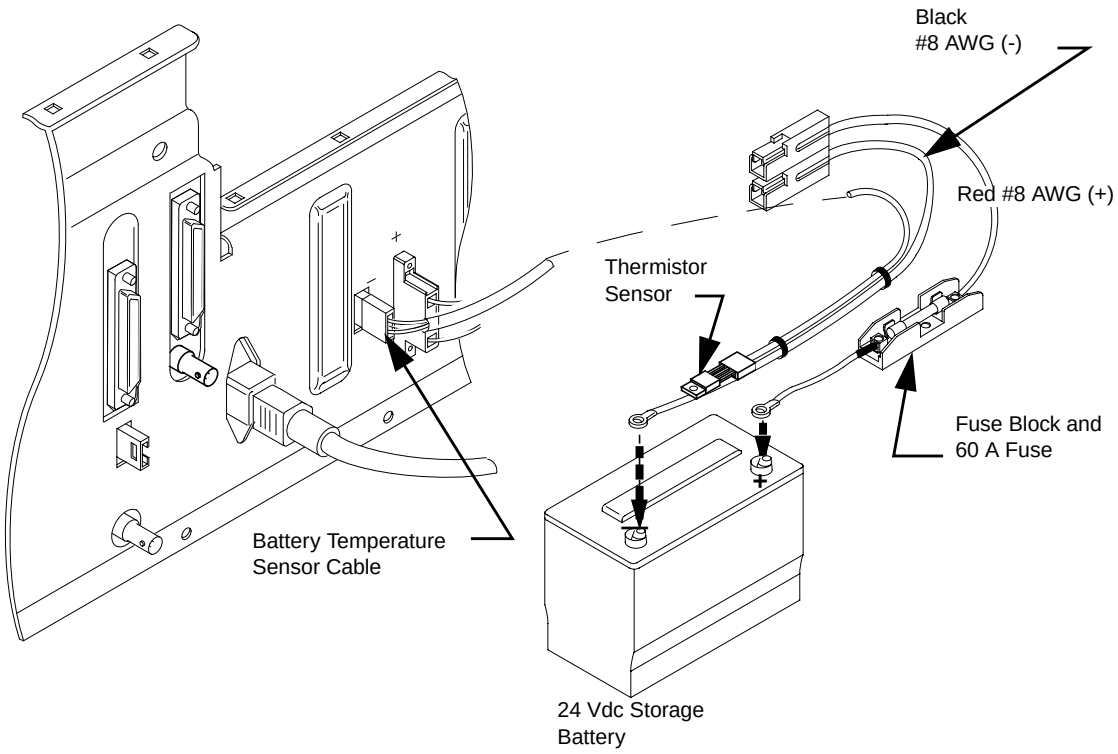


Figure 5-10: Battery Revert for a Standard Power Nucleus Paging Station

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 5-11).

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.

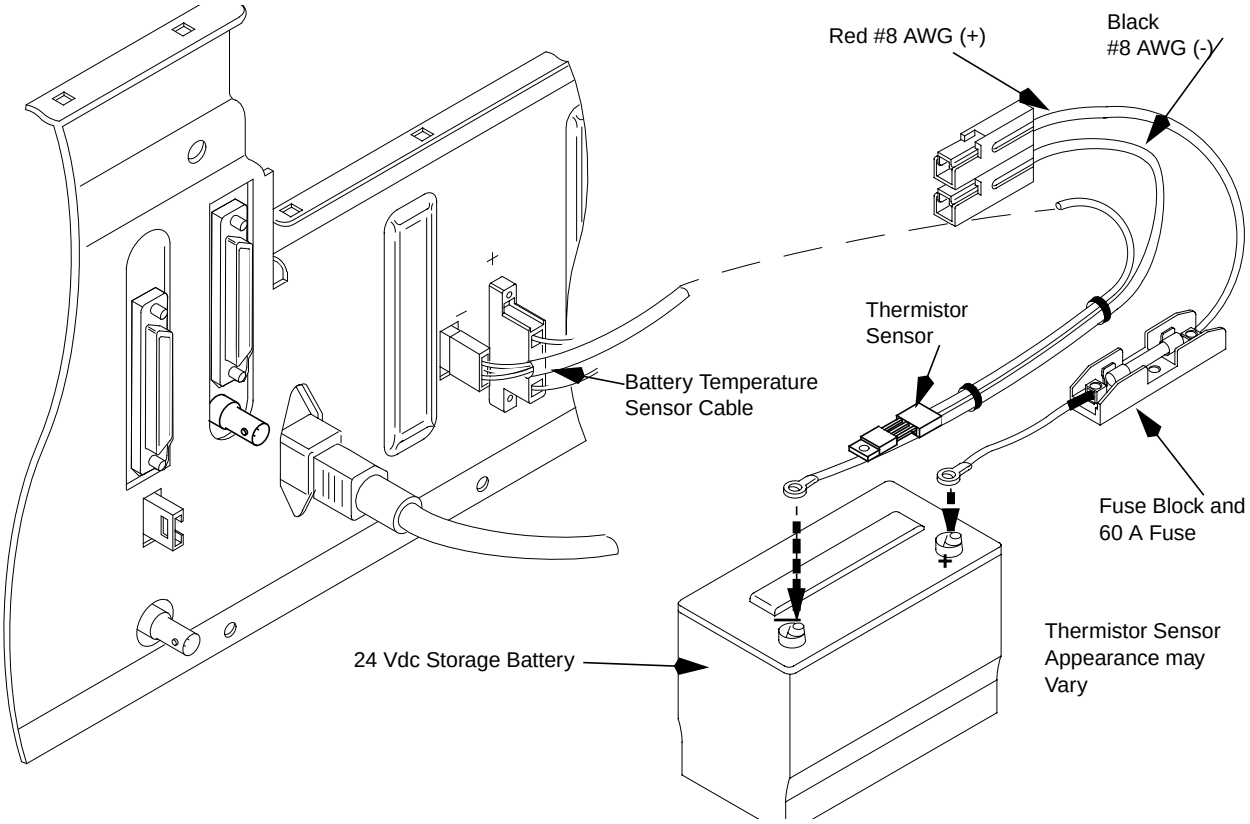


Figure 5-11: Battery Temperature Sensor

Front Panel Indicators and Controls

Control Module Front Panel

This section describes the front panels for the Station Control Module (SCM) 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

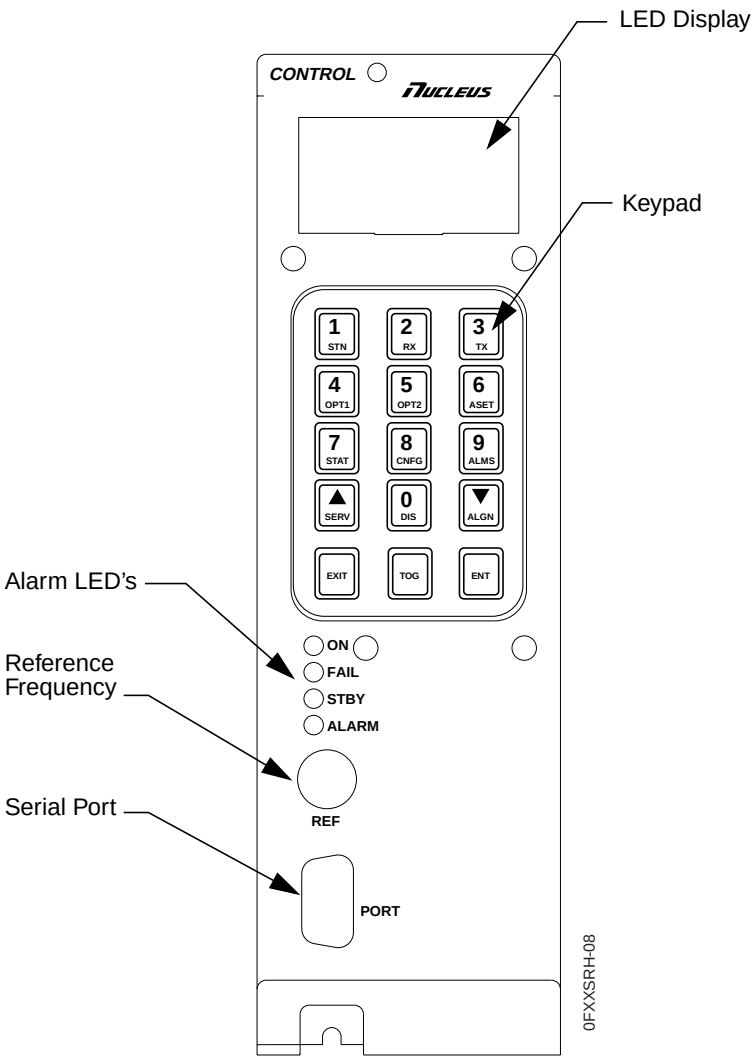


Figure 6-1: Nucleus CM Front Panel

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 6-2). The top 12 keys serve two functions:

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

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

Menu Select Mode

The menu select mode accesses a station menu or submenu (for a list of menus and submenus, see Figure 6-2). 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.

Reset Pressing the **1/STN** and **3/TX** keys simultaneously causes the station to reinitialize, perform power-up diagnostics and resets all RAM values to their default settings.

1 STN — **Edit Mode:** Press to enter value of 1. **Menu Select Mode:** Use **STN** to set up station parameters.

2 RX — **Edit Mode:** Press to enter value of 2. **Menu Select Mode:** Use **RX** to set up parameters of the received audio and receiver applications.

3 TX — **Edit Mode:** Press to enter value of 3. **Menu Select Mode:** Use **TX** to set up parameters for transmitting.

4 OPT1 — **Edit Mode:** Press to enter value of 4. **Menu Select Mode:** Use **OPT 1** to access station option parameters.

5 OPT2 — **Edit Mode:** Press to enter value of 5. **Menu Select Mode:** Use **OPT 2** for access to communication option parameters.

6 ASET — **Edit Mode:** Press to enter value of 6. **Menu Select Mode:** Use **ASET** to set up alarms.

7 STAT — **Edit Mode:** Press to enter value of 7. **Menu Select Mode:** Use **STAT** to display station status.

8 CNFG — **Edit Mode:** Press to enter value of 8. **Menu Select Mode:** Use **CONFG** to setup and view configuration parameters.

9 ALMS — **Edit Mode:** Press to enter value of 9. **Menu Select Mode:** Use **ALMS** to view alarms, clear alarms, or both.

0 DIS — **Edit Mode:** Press to enter value of 0. **Menu Select Mode:** Use **DIS** to disable remote keyup while allowing local keyup; also to view disable status.

▲ SERV — **Edit Mode**: Press ▲ to move up to the next menu selection. **Menu Select Mode:** Use **SERV** to enter the service mode or key and read power.

▼ ALGN — **Edit Mode:** Press ▼ to move down to the next menu selection. **Menu Select Mode:** Use **ALGN** to perform station alignment.

EXIT — Use **EXIT** to return to the **READY** mode, move upward one menu level, or abort an edit session.

TOG — Use **TOG** to change values or selections.

ENT — Use **ENT** to store keyed-in values, move inward one menu level, or begin an edit session.

Figure 6-2: SCM Front Panel Keypad

SCM Front Panel LEDs

The SCM font panel has four LEDs for the SCM (see Table 6-1 and Figure 6-1). 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 6-1: 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

SCM Serial Port

The serial port is a 9-pin connector for serial access to the station from a laptop computer running a VT100 emulation program (see Figure 6-1).

SCM Reference Frequency Port

The Ref. Freq. port is a 1-pin connector for injecting a reference frequency into the SCM to measure the 5 MHz signal from the NIU (see Figure 6-1).

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 6-3 and Table 6-2).

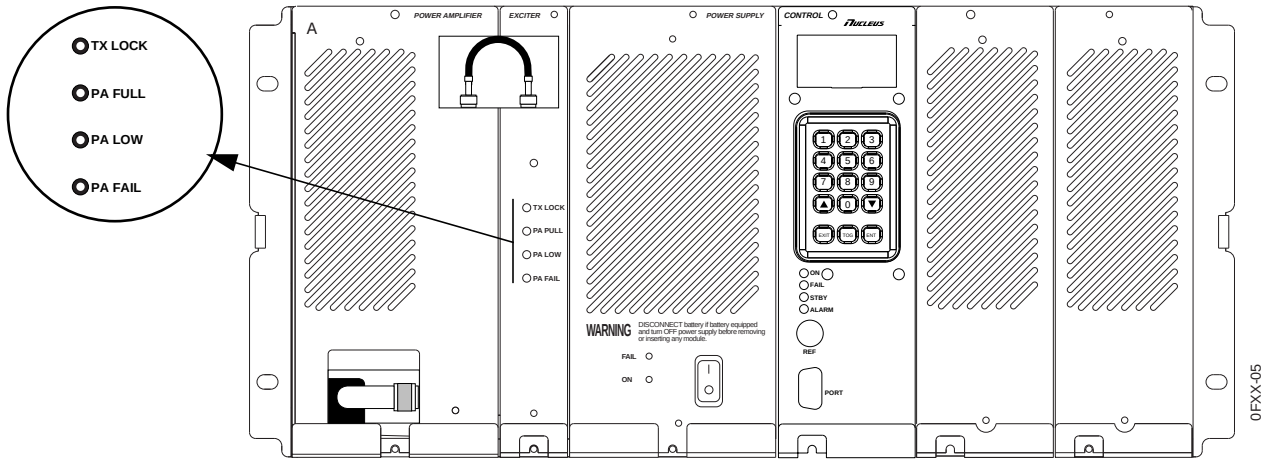


Figure 6-3: Exciter LEDs

Table 6-2: 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
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)

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

LED Name	Color	Lighted	Off
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 6-4 and Table 6-3). 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.

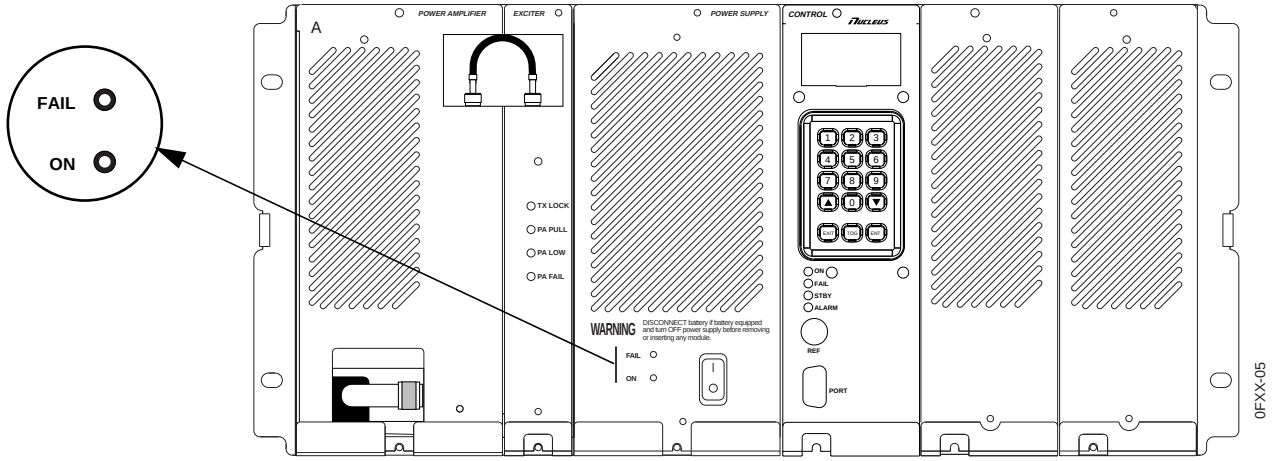


Figure 6-4: Power Supply LEDs (Low Power Station Shown)

Table 6-3: 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 the SCM	Normal operation
Power On	Green	AC input power present and system turned on or on battery power	AC power not present, or system turned off

Keypad Functions

Conventions

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

- Chapter 8, "Configuring the SCM Station"
- Chapter 9, "Troubleshooting and Alignment"
- Appendix D

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

Note: A Quick Menu Reference Guide is provided to use with the control panel (see Appendix F).

Table 7-1: Notational Conventions for Software Procedures

Item	Description	Examples
SCM or NAC front panel keys	- Enclosed in angle brackets (<>) - **9 point Palatino Bold**	**<TX>** **<STN>** **<down arrow>**
Station output	- All capital letters (except for variables) - 9 point Helvetica	EXT CIRCULATOR: NOT PRESENT RX TYPE: INTERNAL MONITOR OPERATING POWER: yyy W
User input	- 9 point Helvetica bold	**Enabled** **Disabled**
Starting point in a procedure	- 9 point Helvetica	READY prompt
End point in a procedure	- 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 panel:

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

   If the station has the password enabled, see paragraph, "Using a Password". 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. (The default password is 6000)

3. Press **<ENT>**.

   The LED display shows the READY prompt.

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.

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

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

Toll Free: 1-800-520-7243

Local: 1-817-245-4643

FAX: 1-817-245-2141

BBS: 1-817-245-4227

Using a Password

The default password for the paging station is 6000. It will be necessary to enter the default password (6000) the first time the keypad is used. You are encouraged to assign a unique password for your particular paging station.

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 edit mode.
4. Type the new numerical 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 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 edit mode.
4. Press **<TOG>** to select **Disable**. The message continues to flash**.**
5. Press **<ENT>**. 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 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.

Using the Menu System

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 Appendix B, Table B-1 for the SCM 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 Table B-1). Use the following information while working with menus:

- In Appendix B, Table B-1, the first column, Menu Name, refers to the name of a key on the SCM front panel.

  When you select the menu name, the display shows the first item in the second column. This is the first item in the column titled Submenu Name.

- When the display shows the first submenu name, press <**down arrow**> to scroll to the next submenu name in the menu.

  As each submenu appears, the display shows the value that is currently stored in memory for the submenu item.

  – To change the value, press **<ENT>**.
    - If the value is a number, type the new value on the keypad. Press **<ENT>** to store the value. For example, in Table B-1, the value for the password is 6000. To replace this value, type the new value and press **<ENT>**.
    - If the value is in a list, press <**down arrow**> to scroll through all the values in the list. Press **<ENT>** to select and store the value. For example, in Table B-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.
    - If the value is one of two choices, press <**TOG**> to show the other value. Press <**ENT**> to select and store the new value. For example, in Table B-1 the FRONT PANEL PASSWORD has two values. Press <**TOG**> to toggle between the two values and press <**ENT**> to store the selected value.

- 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.

- At the end of each procedure, press **<EXIT>** until the top level of the menu appears. Press **<EXIT>** again. The READY prompt appears.

Configuring the SCM Station

Assumptions for Configuring

The procedures described in this chapter apply to a transmitter that is being installed for the first time, reinstalled, or has had extensive repairs and requires reconfiguration. It is assumed that the Nucleus paging station has the same defaults that were set at the factory. The same defaults reset automatically after the station recovers from a power down.

Note: If you do not finish configuring the transmitter before the station display screen saver timer expires and goes blank (see Chapter 7, paragraph, "Accessing the LED Display"), you have to start over.

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

Note: A Quick Menu Reference Guide is provided for use with the control panel (see, Appendix F).

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) Menu

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

- Transmit channel
- System timer alarm
- Station time

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 is in edit mode.

4. Press <**down arrow**> or <**up arrow**> or <**Tab**> 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.

   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 furnishes an alarm.

Note: If the station is not keyed before the timer expires, an alarm is set.

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 is in 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, "Keypad Functions".*

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: 1997

4. Press **<ENT>**.

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

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

   The display stops flashing and shows the new value:

   YEAR: 1998

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

   The display flashes to show the system is in 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 is in 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 is in 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 is in 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 is in 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) Menu".

Transmit (TX) Menu

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

- Transmitter channel frequencies
- Transmitter channel power
- Transmitter channel offsets
- Low-speed splatter filter
- High-speed splatter filter
- Nominal binary deviation
- Special Transmitter data
- Idle deviation

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

Changing the Frequency

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 is in 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>** again to return to the READY prompt.

Continue with the paragraph, "Identifying the Mean Frequency".

Identifying the 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>** again to return to the READY prompt.

   Continue with the paragraph, "Setting Transmitter Channel Power".

Setting 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 transmits 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, "Setting Transmitter Channel Power (if Channel Mapping is disabled)". To set the transmitter channel power for each channel, see paragraph, "Setting Transmitter Channel Power (if Channel Mapping is enabled)".

Setting Transmitter Channel Power (if Channel Mapping is 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 is in 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**> again to return to the READY prompt.

   Continue with the paragraph, "Transmitter Channel Offsets".

Setting Transmitter Channel Power (if Channel Mapping is 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, "Enabling 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 is in 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 each channel.

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

   Press **<EXIT>** again 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 configure offsets.

The messaging data type determines the offset (high or low) that maximizes performance for your system (see Table 8-1). Consult your Motorola representative 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
All Reflex	Reflex25 offset

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".

   To set the Reflex offset, see paragraph, "Reflex 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 is in 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>** again 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 is in 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>** again 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 is in 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.

   Skip to 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 Low-Speed 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 is in 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 is in edit mode.

4. Type the value for nominal binary deviation.

5. Press **<ENT>**.

   The text stops flashing and 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, "Setting the Special Transmitter".

Setting the Special Transmitter

The special transmitter setup procedure includes setup for transmitter data and the relationship between the transmitter and a receiver.

Inverting Transmitter Data

The Nucleus paging station can be configured to invert messaging data at the transmitter output. This configuration 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.

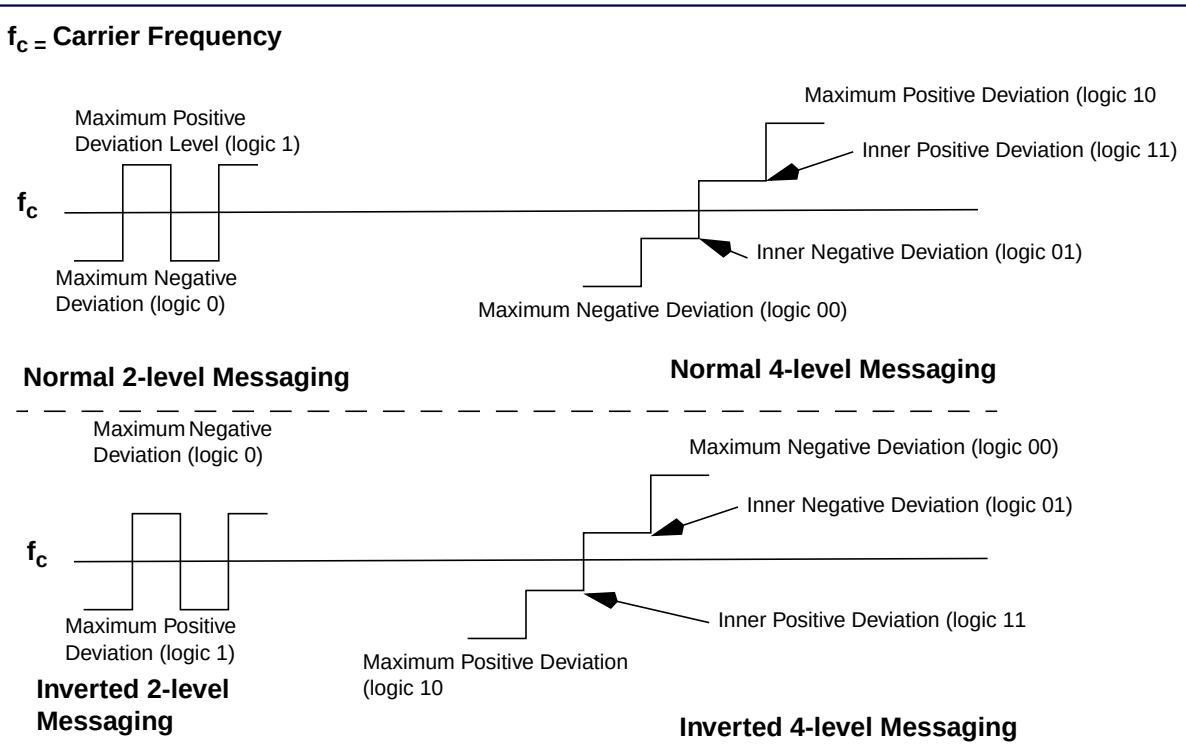


Figure 8-1: Carrier Deviations for 2-level and 4-level Normal and Inverted Transmissions

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 is in 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>** again to return to the READY prompt.

   If the transmitter site contains a receiver, continue with the paragraph, "Transmitter and Receiver in One".

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

Transmitter and Receiver in One

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.

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 transmitter equals receiver (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 is in 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**> again to return to the READY prompt.

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

Setting the Channel for Transmitter Equals Receiver

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.

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 is in 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>** again 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

Table 8-4: Idle Deviation Frequency

Messaging Type	Idle Deviation Setting	TX Frequency when Station is Idle
All REFKEX	space (-)	Channel Frequency -2400Hz
	mark (+)	Channel Frequency -2400Hz

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 is in edit mode.

4. Press **<down arrow>** to 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.

Options (OPT1) Menu

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

I-20 GL-C2000/2010

The I-20 option allows the Station Control Module (SCM) in the Nucleus® and Nucleus II paging stations to communicate with the GL-C2000 / 2010 transmitter controller from Glenayre. The instructions for the Installation and configuration of the Nucleus or Nucleus II to work with the GL-C2000 / 2010 transmitter controller are contained in two FRU documents (See paragraph, "Related Publications" located in Chapter 1, "Introduction") of this manual.

The I20 interface is used only with SCM model number PTYN4059B or later. The internal I-20 interface cable connects to connector J120 located just above the connector for the control panel of the SCM. Earlier SCM models do not have the I-20 interface connector.

The interface cable may be installed in a low or high power Nucleus paging station. Procedures are provided for the installation on both Nucleus paging stations. The Exciter module and SCM are a matched set and were aligned at the factory.

Antenna Relay

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

Motorola sets the value for antenna relay during manufacturing. Do not change this setting without consulting Motorola engineering.

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 is in 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.

External Circulator

This procedure configures the Nucleus paging station to accommodate the external circulator (option X676 or option X677).

Note: Set this parameter to PRESENT if the station has either option.

Motorola sets the value for external circulator during manufacturing. Do not change this setting without consulting Motorola engineering.

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 is in 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, "Enabling Channel Mapped Power". If the station is not channel mapped, skip to the paragraph, "Alarm Setup (ASET) Menu".

Enabling 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 is in 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) Menu".

Alarm Setup (ASET) Menu

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 Thresholds for Non-channel Mapped 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 non-channel 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 non-channel 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 is in 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>** again 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 RFL 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 Channel Mapped 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 is in 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>** again to return to the READY prompt.

   Continue with paragraph, "Internal Reflected Channel Mapped Alarms".

Internal Reflected Channel Mapped 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 is in 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>** again to return to the READY prompt.

   If the system contains an external wattmeter, continue with the paragraph, "External Forward Channel Mapped Alarms".

   If the system does not contain an external wattmeter, continue with the paragraph, "Configuration (CNFG) Menu".

External Forward Channel Mapped 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 is in 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>** again to return to the READY prompt.

   If the system contains an external wattmeter, continue with the paragraph, "External Reflected Channel Mapped Alarms".

   If the system does not contain an external wattmeter, skip to the paragraph, "Configuration (CNFG) Menu".

External Reflected Channel Mapped 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 is in 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>** again to return to the READY prompt.

   Continue with the paragraph, "Configuration (CNFG) Menu".

Configuration (CNFG) Menu

This section describes the configuration procedures available from the CNFG menu. These procedures includes setting the following:

- Battery revert
- External wattmeter type
- Network control type
- Receiver type
- Special key select
- 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 is in 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.

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: SEALED LEAD CALCIUM

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 is in 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>** again to return to the READY prompt.

   Continue with the paragraph, "Backup Option".

Backup Option

The backup option selects a backup mode during an AC power failure. The mode selected depends on the option you have:

- Option X43 requires the backup station option.
- Option X30 requires the backup control option.

Use the following procedure to configure the backup 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: SEALED LEAD CALCIUM

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 is in 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>** again 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, skip to paragraph, "Control Type".

Fixed Cutback Reduction

The fixed cutback reduction option determines the level of cutback in power that the station uses in a station backup configuration.

External Wattmeter

This procedure identifies the type of wattmeter being used at the station. Currently, 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 is in edit mode.

5. Press **<down arrow>** to sequence through the selections.

   The display flashes the values:

   NONE

   CLASS 1 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 is in 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

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 and Receiver in One" and paragraph, "Setting the Channel for Transmitter Equals Receiver".

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 is in 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 is in 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 is in 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 (used with NIU and RFB)
   - EXT HIGH– (use with I-20/BSC configurations)

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.

Troubleshooting and Alignment

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
    - SCM hardware version
- Hardware 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	Description
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
SCM HARDWARE VERSION	Hardware version

Note: A SCM hardware version of 1 is required for I-20 configuration. Version 0 does not support I-20.

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>** again to return to the READY prompt.

Controlling Access

The Nucleus paging station allow you to control access by 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.

Disable remote access and enable maintenance access for all repair procedures.
Service mode keyup is still possible when maintenance access is enabled.

Disabling Remote Access (Enabling Maintenance Access)

Note: Enabling maintenance access automatically disables remote access the reverse is also true.

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 is in 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 is in 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 is in 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 is in 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>** again 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.

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	Get another matched pair
High Forward Power	Power output poorly aligned: forward power exceeds 10% 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 with correct power alignment/calibration
Exciter Startup Failure	Problem occurred during Exciter module or problem with Receiver module	No	Exciter starts without problem
I20 Comm Poll Timeout	With an I-20 configuration, the SCM has not received a valid communication packet from the BSC for over 20 seconds	No	Cleared from ALRM Menu

Clearing Alarms

This section describes special procedures required to clear some alarms. See Appendix F for the replacement procedures required to clear module failure 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.

Ensure that all paging station power is turned off before replacing a module.

Always replace the Exciter and the SCM as a 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.

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.

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.

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.

d. If the station keys at a high reflected power level (measured at the wattmeter and by test equipment), 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 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, or any other Base Station Control (BSC), inspect the backplane connector and cable between the station and the transmitter controller.

Note: The external NIU, RF-Baton, or BSC must be turned ON.

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.

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 by 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.
2. Restart or reset the station.

Clearing a PA Not Aligned Alarm

This alarm occurs when the PA is not aligned.

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 is in 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 Appendix F).

Note: This procedure uses a Motorola R2000 Series Communications Analyzer (or equivalent).

Module replacement is described in the chapter that follows (see Appendix F).

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.

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 (appropriate for the power rating of the paging station)

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 backplane 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 500 watt RF 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".

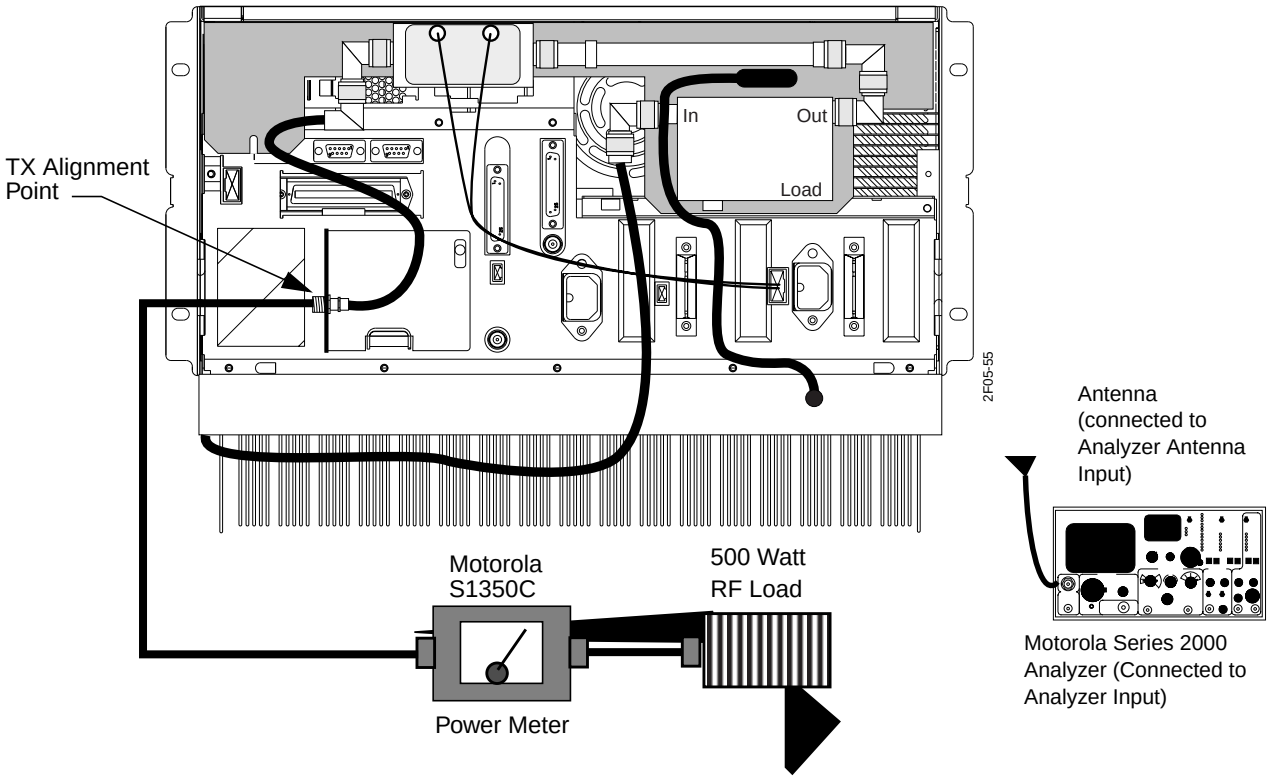


Figure 9-1: Test Equipment Setup

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.

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, readjust the station power output.

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).

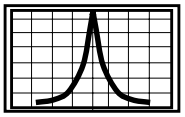


Figure 9-2: Correct Silent Carrier Wave Form

9. If the analyzer shows multiple carriers around the center, replace the PA, SCM, and Exciter (replace Exciter and SCM 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).

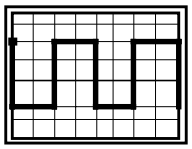


Figure 9-3: Modulation Wave Form

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.

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.

Selecting 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:

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 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.

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 is in 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.

Calibrating 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.xxxxx 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.xxxxx MHz

   where xxx.xxxxx 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.xxxxx MHz

   where xxx.xxxxx 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 is in 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.

   Skip to paragraph, "Calibrating Station Power" 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. 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 current power level for the first programmed channel:

   CHN n PWR xxx W

   where xxx is the currently programmed transmit power for channel n.

4. Press <**down arrow**> to show the calibration power level:

   CAL PWR LEVEL zzz W

   where zzz is the currently programmed power level used during power calibration in Channel Mapped Power Mode.

5. If the level power is incorrect, press <**ENT**>.

   The message flashes to show the system is in edit mode:

   zzz

6. Type the correct calibration power level.

7. Press <**ENT**>.

   The message stops flashing and shows the new power level:

   yyy

   where yyy is the newly programmed power level.

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

   Continue with paragraph, "Calibrating Station Power".

Calibrating Station Power

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

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, skip to 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, skip to 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 standard 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 extreme accuracy during manufacturing. Use this procedure for periodic maintenance or after replacing the Exciter and SCM.

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.

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 ≤ 5 ppb
  - For UHSO, accuracy ≤ 3 ppb
- RF coupler, attenuator, and load (for keyed state alignment only)

Aligning While Not Keying

This section describes alignment with a 5 MHz reference frequency while the station can not key and send messages.

If the station has an internal Network Interface Unit (NIU) and a UHSO or HSO reference, DIP switch 8, position 1 must be on.

If the station has an internal NIU and no other reference, DIP switch 8, pole 1, must be off.

In either case, DIP switch 8, pole 2, must be on.

Use the following procedure to align the reference while the station cannot key:

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.

Aligning While Keying

If the station has an internal Network Interface Unit (NIU) and a UHSO or HSO reference, DIP switch 8, position 1 must be on.

If the station has an internal NIU and no other reference, DIP switch 8, pole 1, must be 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.

Completing Alignment

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 for 250 W and 300 W Nucleus paging stations with SCM application version 3.320 or greater.

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

Previously, 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 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 completely linear.

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.

Aligning Automatically

The high power Nucleus paging station PA contains an internal wattmeter which is used to monitor RF power during calibration. The accuracy of this wattmeteris precisely tuned during manufacturing. Every PA has the same voltage output for its internal wattmeter when the operating power is 300W. The software look-up table used for power control is now adjusted to work with this accuracy. (The technician does not need to enter the 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. Automatic station power alignment also ensures that the station self-protection features are functioning.

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 significantly from transmitter to receiver. A high power Nucleus paging station is rated 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 to 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

Operation	Result	Physical Meaning	Appropriate Operation?
dB + dB	dB	Product of two numbers	Yes
dB - dB	dB	Comparison of two numbers	Yes
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 have small but measurable resistance which consumes 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

Replacing Modules

General Replacement Information

Note: This chapter does not describe replacement procedures for the following modules:
- Internal Network Interface Unit (NIU)
- Receiver module
- Reference module

The replacement procedures for these modules appear in the appendices.

This section describes general procedures to follow for any replacement activity. As with all replaceable equipment, consult your local system supervisor or contact your local Motorola representative for proper disposition of replaced equipment.

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).

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 10-1). Connect the wrist strap.

When you wear a wrist strap, use extreme caution in the presence of high voltage. The wrist strap provides a good ground; however,. it also increases the danger of lethal shock from accidental contact with high voltage.

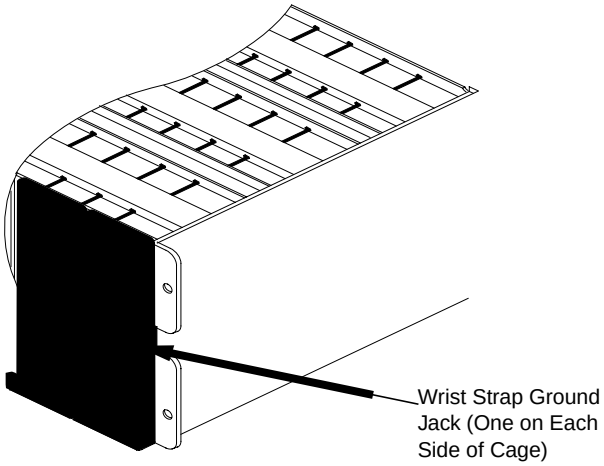


Figure 10-1: Location of Ground Jack for Wrist Strap Connection

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 located on the power supply 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 module in an antistatic bag for storing and transporting. Pack modules in antistatic materials to ship them.

4. To restore power, use the following procedure:
   a. Turn the power On-Off switches 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 two mounting screws (one at the top and bottom of the module).

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.

Cleaning 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.

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.

- If the troubleshooting diagnostics procedure detected the faulty module, run the diagnostics again after the repair to 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 9, "Troubleshooting and Alignment"), 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 PA in a Standard Power Station

This section describes the replacement procedure for a Power Amplifier (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 10-2).
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.

Do not slam the PA against the backplane or push any harder than necessary to seat the connectors.

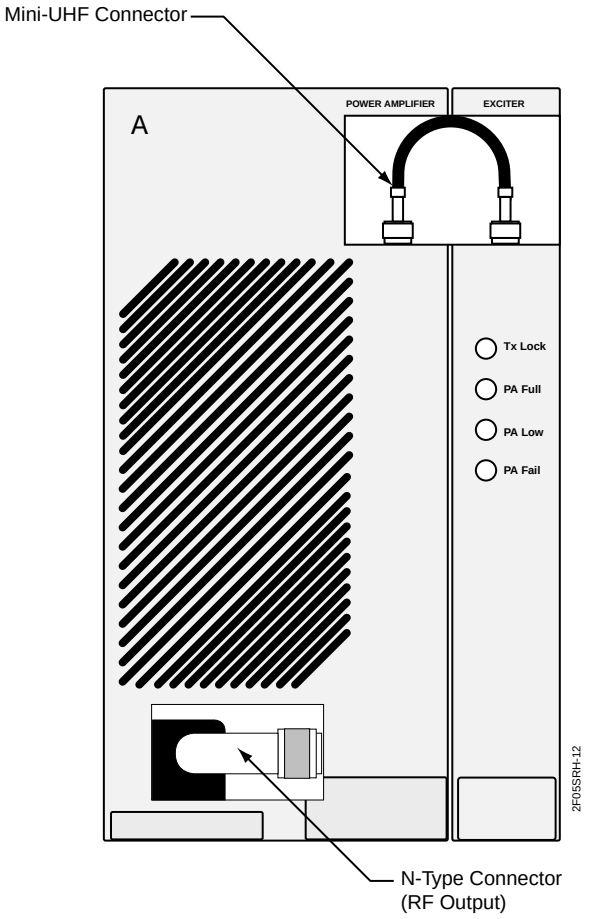


Figure 10-2: Location of N-type Connector and Mini-UHF Connector in a Standard Power Nucleus Paging Station

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 switches 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, "Troubleshooting and Alignment"). If the Nucleus paging station has an External Circulator option (X676 or X677), calibrate the external Wattmeter.

Replacing the PA in a High 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 switches 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 10-3).
7. Remove the faulty PA from cage.
8. Slide the replacement PA into the cage (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.

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).

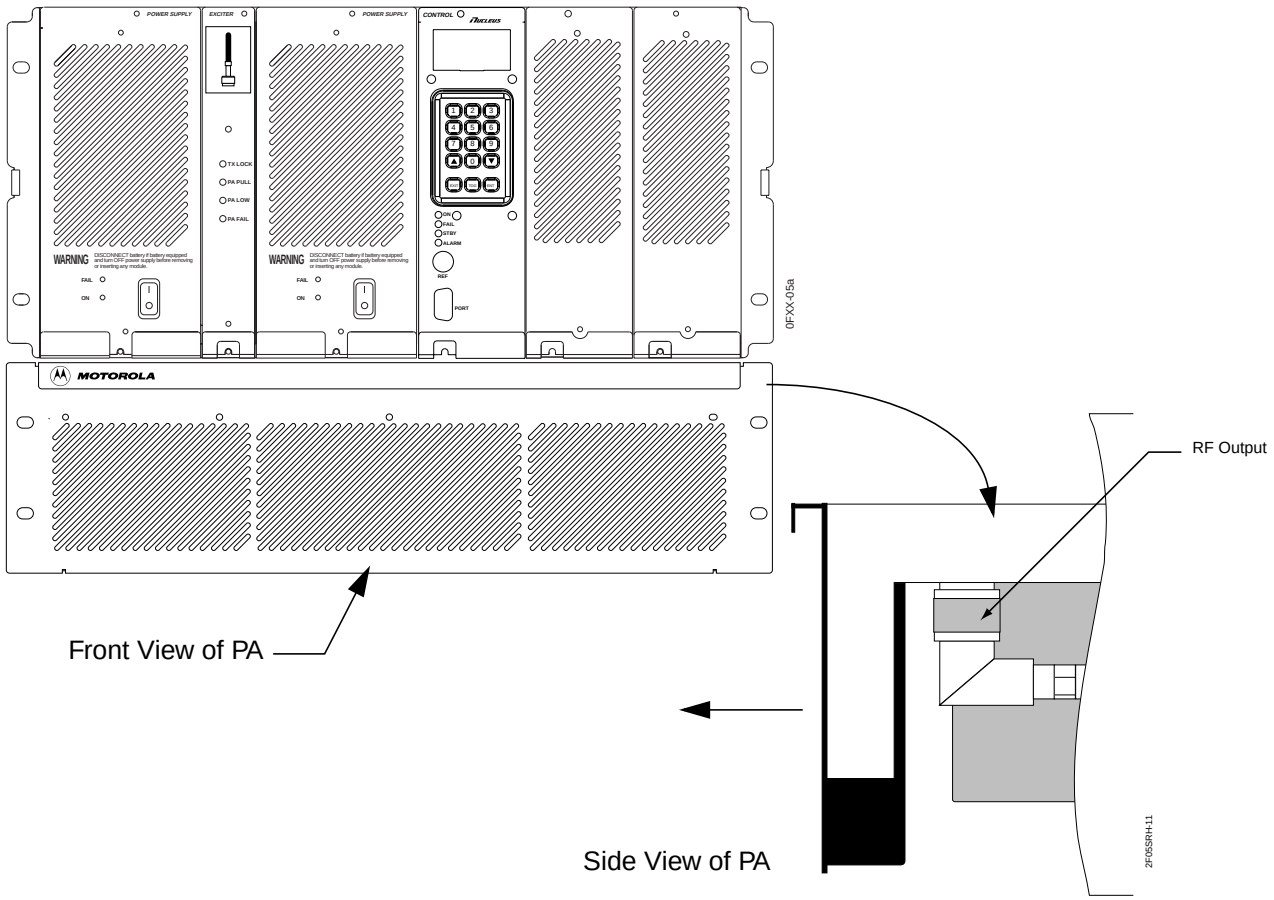


Figure 10-3: Location of RF Output Connector in a High Power Nucleus Paging Station

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, "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 faulty 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.

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, "Troubleshooting and Alignment"):

- Manual alignment
- Automatic alignment

Replacing the Station Control Board and Exciter

Motorola aligns the Exciter and Station Control Board during manufacturing as a pair and assigns a common alignment ID number. If these modules are not replaced 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 10-2).

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.

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.

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 F, "Nucleus® Paging Station Quick Reference Menu Guide"). 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, "Troubleshooting and Alignment").

4. Verify transmitter circuitry and reference oscillator performance.

Replacing the Backplane

This section describes the replacement procedure and post-replacement verification 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
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
BSC	Base Station Control
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

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 following table to record configuration (see Table B-1):

Refer to the 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 9 10	11 12 13 14 15 16 17 18 19 20	
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)		
Receiver		RX CHN FREQ		
Receiver		CHN SPACING		12.5 kHz 20 kHz 25 kHz
Receiver		RX DEEMPHASIS		ENABLED DISABLED

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 2 of 5)

Menu	Submenu Name	Selection		Settings
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 CHN 9 FREQ CHN 10 FREQ	CHN 11 FREQ CHN 12 FREQ CHN 13 FREQ CHN 14 FREQ CHN 15 FREQ CHN 16 FREQ CHN 17 FREQ CHN 18 FREQ CHN 19 FREQ CHN 20 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 PWR CHN 2 PWR CHN 3 PWR CHN 4 PWR CHN 5 PWR CHN 6 WPR CHN 7 PWR CHN 8 PWR CHN 9 PWR CHN 10PWR	CHN 11 PWR CHN 12 PWR CHN 13 PWR CHN 14 WPR CHN 15 PWR CHN 16 PWR CHN 17 PWR CHN 18 WPR CHN 19 PWR CHN 20 PWR CAL PWR LEVEL	
Transmit	TX CHN OFFSETS	HIGH SPEED OFFSET LOW SPEED OFFSET REFLEX25 OFFSET		
Transmit	HIGH SPEED SPLATTER FILTER	88 US LOW PASS (µs) 160 US LOW PASS REFLEX25 OFFSET		
Transmit	LOW SPEED SPLATTER FILTER	88 US LOW PASS 140 US LOW PASS 160 US LOW PASS 250 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 9 10	11 12 13 14 15 16 17 18 19 20
Transmit		IDLE DEVIATION		NULL/SPACE/MARK	
Options 1	ANTENNA RELAY	DISABLED/ENABLED			
	EXT CIRCULATOR	NOT PRESENT/PRESENT			
	CHN MAPPED PWR	DISABLED/ENABLED			
	FREQ REF TYPE	INT UHSO INT HSO EXT 5 MHz	EXT 10MHz EXT 1MHz INT NIU NON SIMULCAST		
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 CHN 9 FWD ALM PT CHN 10 FWD ALM PT	CHN 11 FWD ALM PT CHN 12 FWD ALM PT CHN 13 FWD ALM PT CHN 14 FWD ALM PT CHN 15 FWD ALM PT CHN 16 FWD ALM PT CHN 17 FWD ALM PT CHN 18 FWD ALM PT CHN 19 FWD ALM PT CHN 20 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 CHN 9 RFL ALM PT CHN 10 RFL ALM PT	CHN 11 RFL ALM PT CHN 12 RFL ALM PT CHN 13 RFL ALM PT CHN 14 RFL ALM PT CHN 15 RFL ALM PT CHN 16 RFL ALM PT CHN 17 RFL ALM PT CHN 18 RFL ALM PT CHN 19 RFL ALM PT CHN 20 RFL ALM PT		

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 4 of 5)

Menu	Submenu Name	Selection		Settings
Alarm Setup (Channel Mapped)	EXT FWD CHN MAPPED ALMS (if EXT WATTMETER TYPE	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 CHN 9 EXT FWD ALM PT CHN 10 EXT FWD ALM PT	CHN 11 EXT FWD ALM PT CHN 12 EXT FWD ALM PT CHN 13 EXT FWD ALM PT CHN 14 EXT FWD ALM PT CHN 15 EXT FWD ALM PT CHN 16 EXT FWD ALM PT CHN 17 EXT FWD ALM PT CHN 8 EXT FWD ALM PT CHN 19 EXT FWD ALM PT CHN 20 EXT FWD ALM PT	
Alarm Setup (Channel Mapped)	EXT FWD CHN MAPPED ALMS (if EXT WATTMETER TYPE	CHN 1 EXT RFL ALM PT CHN 2 EXT RFL ALM PT CHN 3 EXT RFL ALM PT CHN 4 EXT RFL ALM PT CHN 5 EXT RFL ALM PT CHN 6 EXT RFL ALM PT CHN 7 EXT RFL ALM PT CHN 8 EXT RFL ALM PT CHN 9 EXT RFL ALM PT CHN 10 EXT RFL ALM PT	CHN 11 EXT RFL ALM PT CHN 12 EXT RFL ALM PT CHN 13 EXT RFL ALM PT CHN 14 EXT RFL ALM PT CHN 15 EXT RFL ALM PT CHN 16 EXT RFL ALM PT CHN 17 EXT RFL ALM PT CHN 18 EXT RFL ALM PT CHN 19 EXT RFL ALM PT CHN 20 EXT RFL 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		
Status	SCM HARDWARE VERSION			
Configuration	MAX PWR (read only)	NO PA (Power Amplifier) 20 W 25 W 100 W	125 W 250 W 300 W 350 W	
Configuration	BATTERY REVERT SETUP	BATTERY TYPE		SEALED LEAD CALCIUM, or BATTERY REVERT DISABLED
Configuration		CHARGING		ENABLED/DISABLED

Table B-1: Nucleus SCM Hierarchical Menu Structure (Sheet 5 of 5)

Menu	Submenu Name	Selection	Settings
Configuration		BACKUP	BACKUP STATION/ BACKUP CONTROL
Configuration		FIXED CUTBK RED%	1-99
Configuration	EXTERNAL WATTMETER TYPE (≠ NONE)	NONE CLASS 1 EXT	
Configuration	CONTROL	INTERNAL CNET EXT SYCH LOCAL CTROL	
Configuration	RX TYPE	NO INTERNAL/INTERNAL LINK/INTERNAL MONITOR	
Configuration	SPECIAL KEY SELECT (≠ NONE)	NONE CD INT CD EXT SPCL KEY FAST LOW FAST HIGH EXT LOW EXT HIGH	 Not supported Not supported Not supported Not supported Not supported Used in NIU and RFB Used with I-20 BSC's
Service	PA TEST MODE	ACTIVE INACTIVE	
Service	SELECT SYMBOL	STAIRCASE 01-10 00-11 10 11 01 00 CARRIER	
Service	KEY ON SYMBOL		

Internal Network Interface Unit

Functions

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

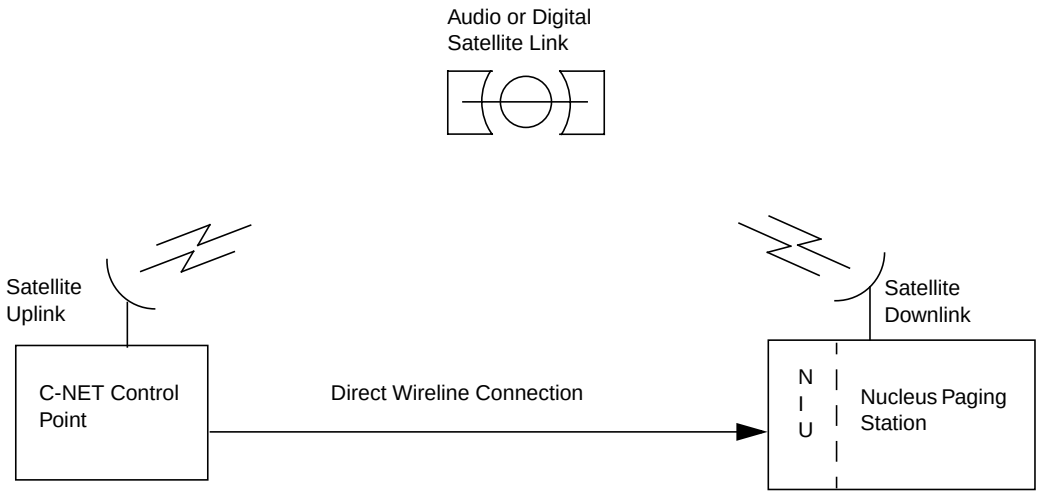


Figure C-1: Internal NIU Interface to a Nucleus Paging Station

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.

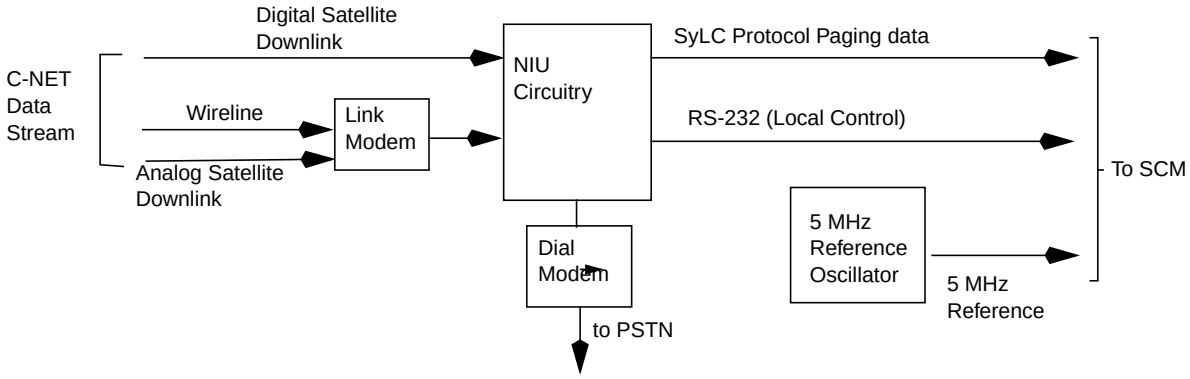


Figure C-2: NIU Interfaces

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.

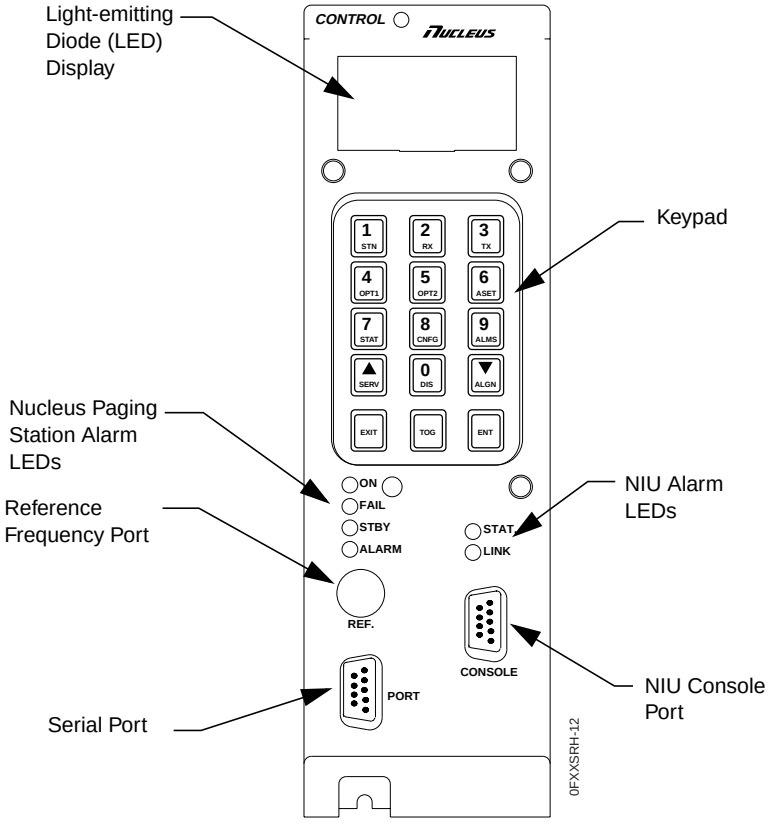


Figure C-3: SCM Front Panel Showing Internal NIU LEDs and Console Port

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. By 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 the 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”. This 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 top facing upward.

Jumper J17 pins 5 and 30 are the PSTN connections.

This adapter is available as Motorola Part No. 2882174W02.

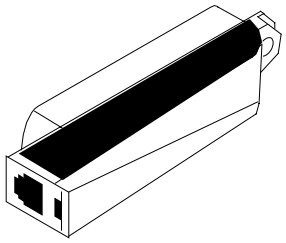


Figure C-4: Model 259B Single-line RJ-45 Adapter

Table C-4: Model 259B Modular Spring Positions

Pair	Modular Jack Spring Position	J17 Pin Connection
1	5	30
	4	5
2	3	32
	6	7
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.

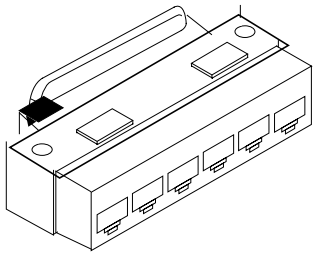


Figure C-5: Model 258B Six-line RJ-45 Adapter

Table C-5: Model 258B Modular Spring Positions

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
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

Receivers

Types of Receivers

The Nucleus paging station uses two types of receivers:

- A link receiver which provides an interface to a link transmitter.
- A monitor receiver which 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 1-6 and Table 1-7):

- Midband (72–76 MHz) link receiver only
- VHF (132–154 MHz and 150–174 MHz) link receivers and monitor receivers
- 280 MHz (276–288 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.

Receiver Operations

This section describes the operation of a receiver. This description is for five receiver ranges. The differences between the ranges are explained.

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 D-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.

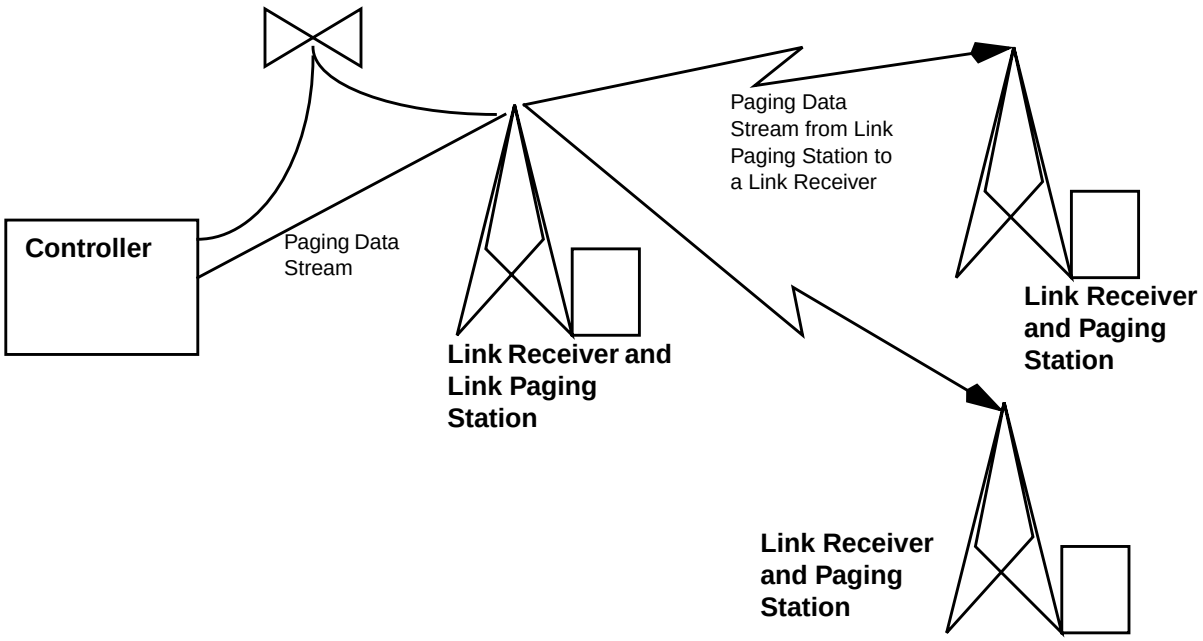


Figure D-1: Link Receiver Application

Monitor Receiver

Networks that use maintenance groups to synchronize transmitters also use monitor receivers (see Figure D-2).

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 it was 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.

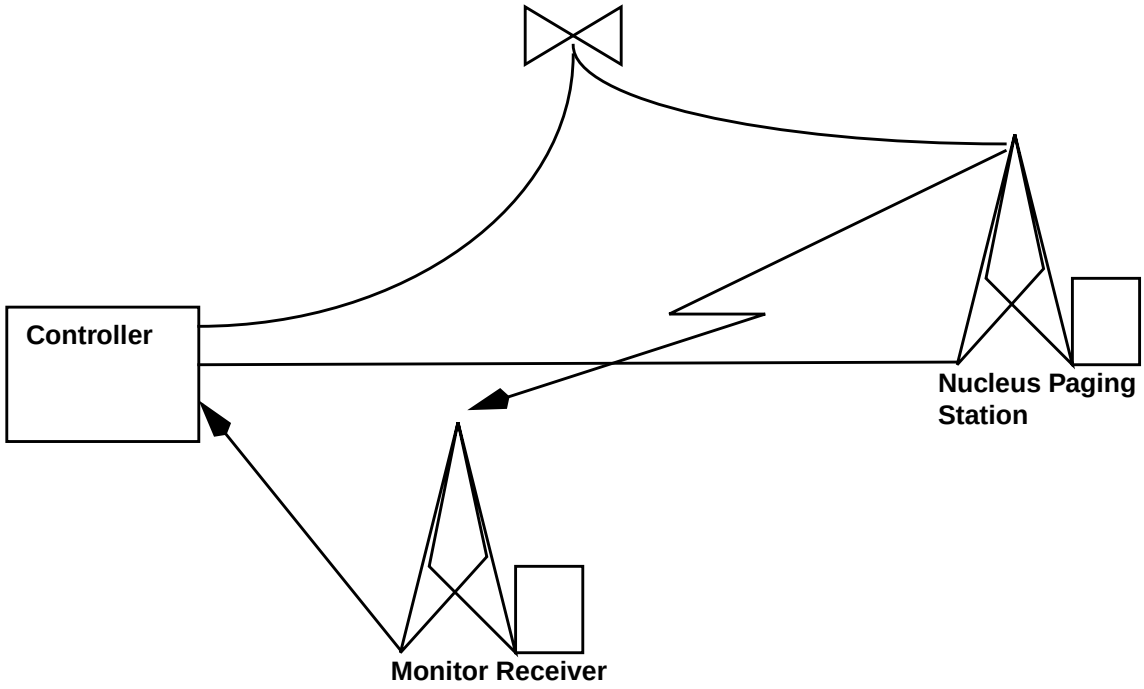


Figure D-2: Monitor Receiver Application

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 receiver integrated circuit (IC) circuitry is custom. It performs the second down conversion and 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 and provides 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; however, it 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 D-3).

2. Connect the wrist strap to one of the ground jacks.

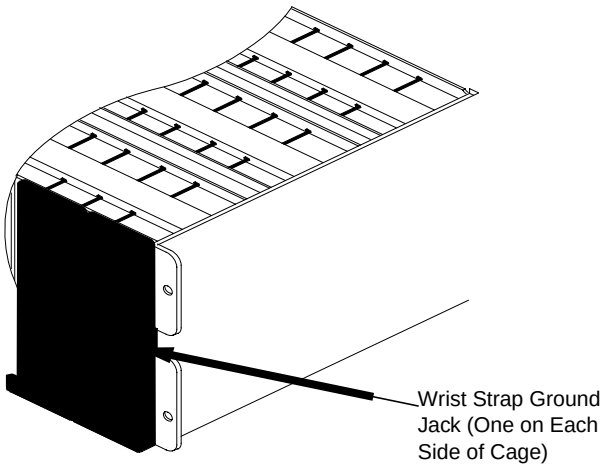


Figure D-3: Location of the Ground Jack for the Wrist Strap Connection

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 top 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 D-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 D-1: J19 Link Receiver Pinouts

Pin No.	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”. The 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.

Software Version

For a Nucleus paging station, the application software must be Version 4.100 or higher to use with the receiver module.

Installation

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.

Do not insert or remove a module or board with the power turned on since it 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 module in an antistatic bag for storing and transporting. Pack modules in antistatic materials to ship them.

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 D-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)

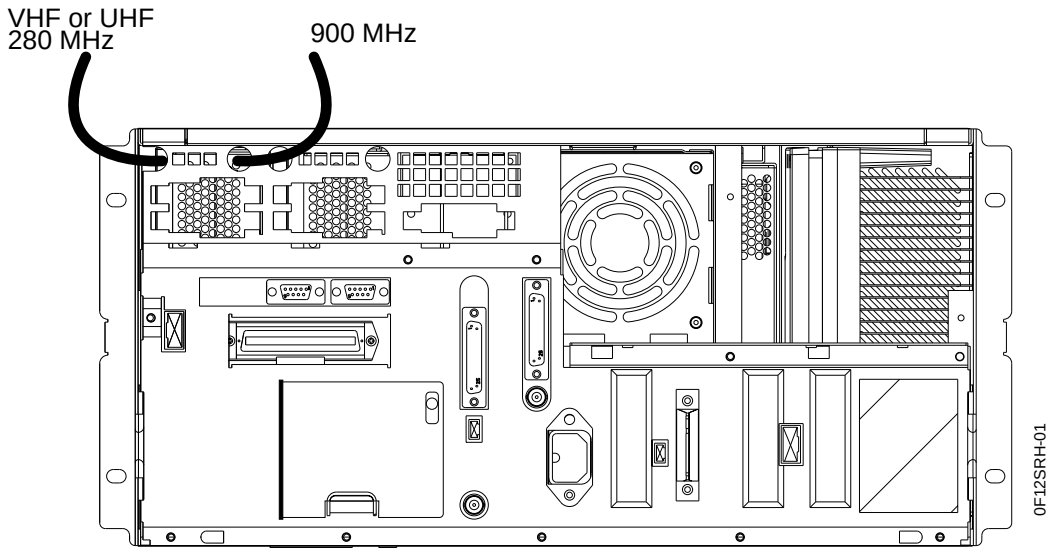


Figure D-4: Routing for the Receive Cable

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 D-5).

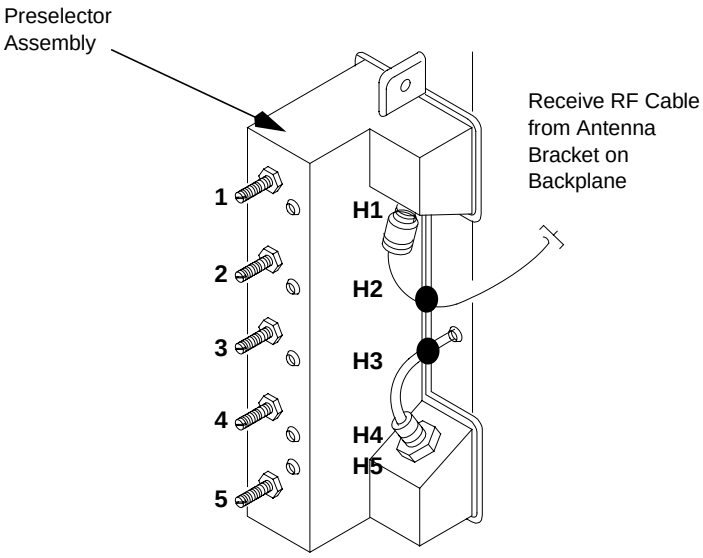


Figure D-5: Preselector Assembly in a VHF, 280 MHz, or UHF Module

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
- C-NET and NIU control or RF-Baton!™ transmitter controller

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 D-6).

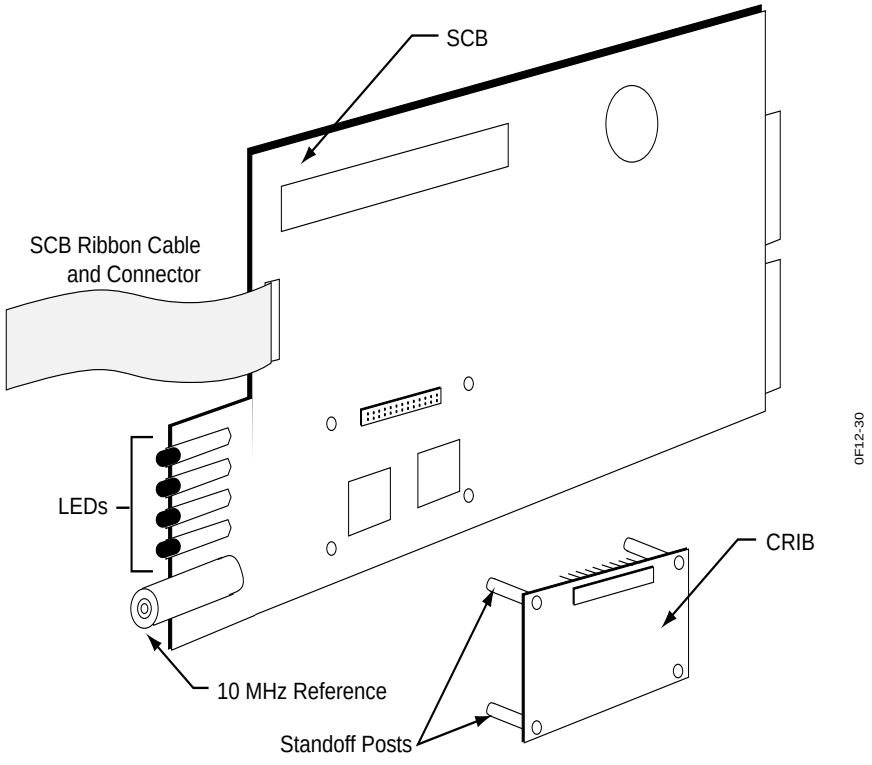


Figure D-6: Location of the Standoffs on the CRIB for an SCB

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 D-7).

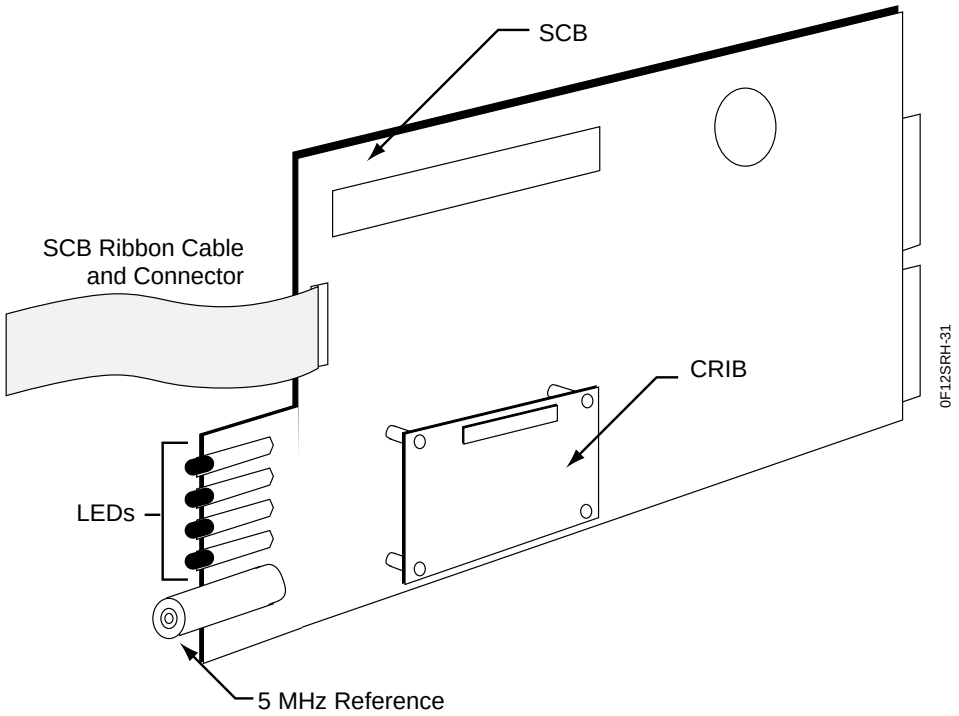


Figure D-7: CRIB Mounted on the SCB

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.

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.

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

Replacing the Assembly and Antenna Bracket

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 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 switches to the Off position (press the 0 side of the switch). Continue with the procedure to replace the receiver.

Replacing 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 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.

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 switches 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.

Replacing 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 the replacement assembly. Secure it 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 frequencies 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.

Test Equipment

The test equipment required to tune the preselector assembly properly is listed in Table D-2.

Table D-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 the 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 each tension nut on the adjustment screw to 6 in.lb.

5. Connect the test equipment (see Figure D-8).

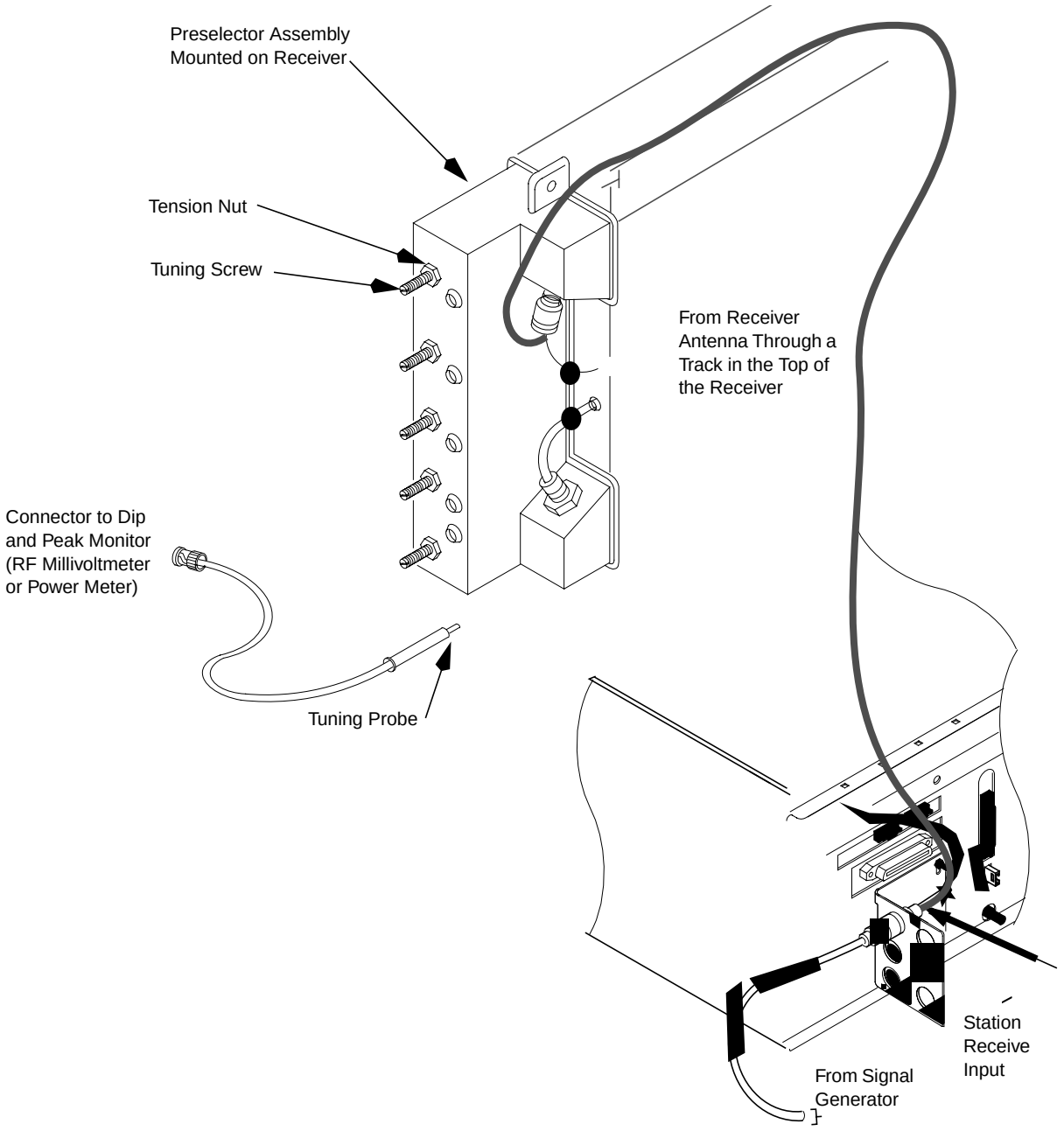


Figure D-8: Test Equipment Setup (UHF Has Three Screws)

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.

Single Receive Frequency

Use the following steps to calculate the appropriate alignment frequency:

1. Determine the receiver receive frequency (f_{rx}).

2. 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.
   - 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.
   - for a Midband 72–76 MHz receiver:
     - $f_{align} = f_{rx}$.

Multiple Receive Frequencies

Note: Record 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 reading. Then turn the screw back to 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 D-9).

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.

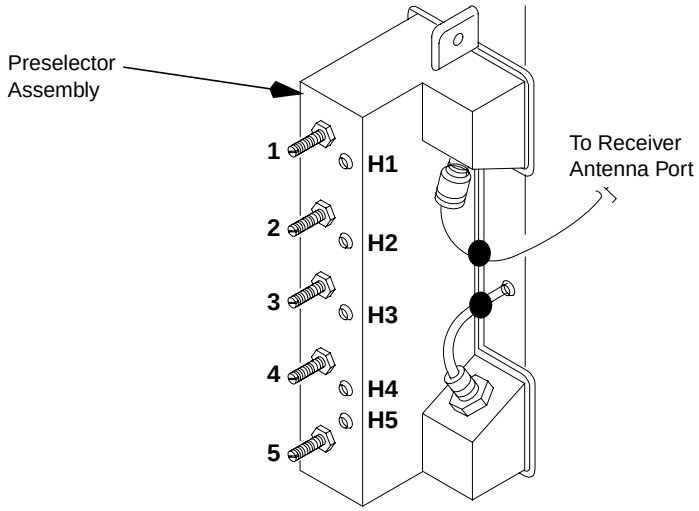


Figure D-9: Location of Tuning Screws and Cavity Probe Holes

Alignment Frequency–UHF Preselector

Use the following method 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}).
   - 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.
   - 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.
   - for a UHF 470–496 MHz or 496–520 MHz receiver:
     - If $472 \leq f_{rx}$ 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 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.

Alignment Frequency–280 MHz Preselector

Use one of the following methods to calculate the alignment frequency (f_{align}) for the signal generator.

Single Receive Frequency

1. Determine the 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.

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 Test 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 D-8).

Note: When tuning for peak or dip, turn the tuning screw 1/2 turn past the peak or dip to obtain a true reading. 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 counterclockwise 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 tune tuning screw 1 for a PEAK.

8. Keep tuning probe in cavity H1 and adjust tuning screw 2 counterclockwise for a DIP.

9. Tighten tension nut on tuning screw 2 to at least 12 in.-lb and tune tuning screw 2 for a DIP.

10. Insert tuning probe into cavity H2 and adjust tuning screw 3 counterclockwise for a DIP.

11. Tighten tension nut on tuning screw 3 to at least 12 in.-lb and tune tuning screw 3 for a DIP.

12. Insert tuning probe into cavity H3 and adjust tuning screw 4 counterclockwise for a DIP.

13. Tighten tension nut on tuning screw 4 to at least 12 in.-lb and tune tuning screw 4 for a DIP.

14. Insert tuning probe into cavity H4 and adjust tuning screw 5 counterclockwise for a DIP.

15. Tighten tension nut on tuning screw 5 to at least 12 in.-lb and tune tuning screw 5 for a DIP.

GPS Antenna

Installing the GPS Antenna

This section describes installation procedures for a GPS antenna (Model No. RLN4394A).

The GPS antenna installation 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 horizontally (see Figure E-1). The post-mounted L-shaped mounting bracket accepts a maximum diameter 30-mm post or bar.

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

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).

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 amplifiers 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.

Tools and Equipment

Required tools and materials include the following:

- TORX® screwdriver set
- Torque wrench
- 10 mm wrenches
- Fiberglass or wood ladder (if needed to put the antenna in place)
- One or more scissor clamps Procedure

Installing the Antenna

Use the following procedure to install an antenna:

Note: This procedure may require two people if the site is windy.

1. Remove the antenna, cable, bracket, and hardware from the box. The antenna is completely assembled, including the L-shaped bracket of the post clamp (see Figure E-1). The curved part of the post clamp, the nuts, the bolts, and the washers are in a separate plastic bag.

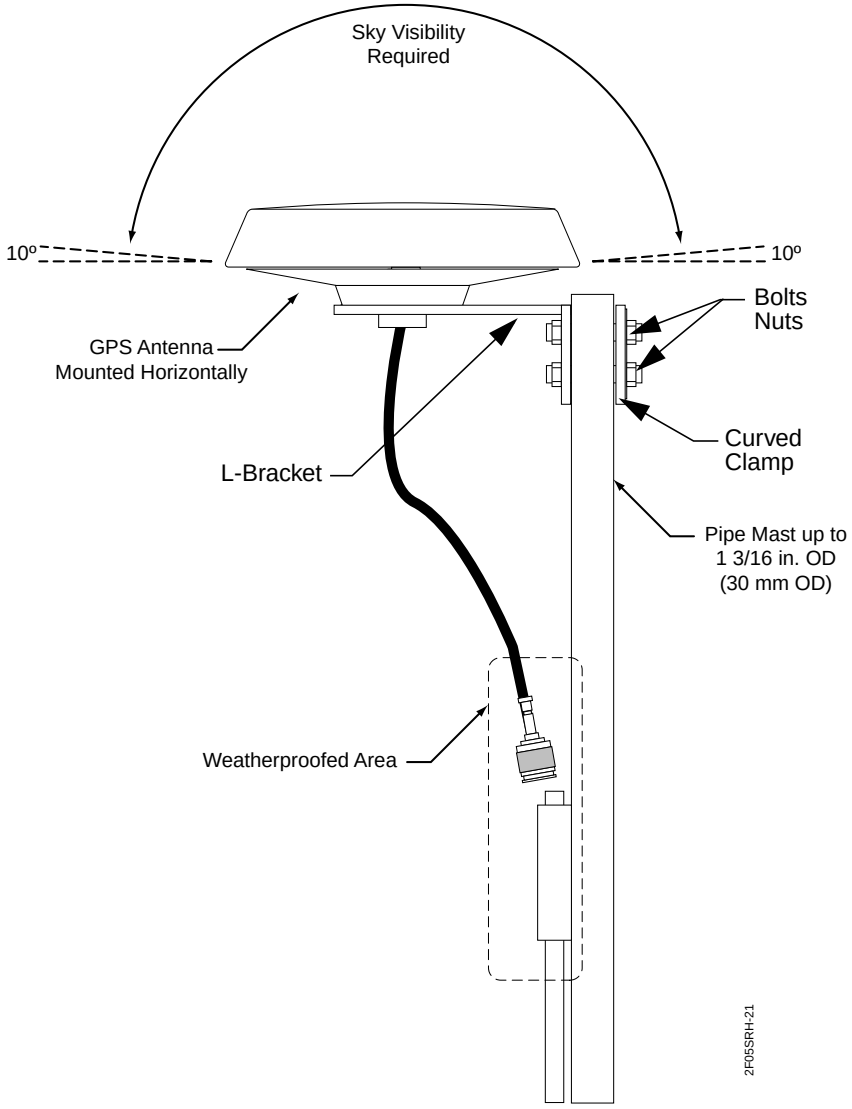


Figure E-1: Assembled Antenna, Cable, and Bracket

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 or scissor 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 a bolt through the 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 the Antenna

This section describes replacing parts of the antenna (see Figure E-2 and Table E-1).

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

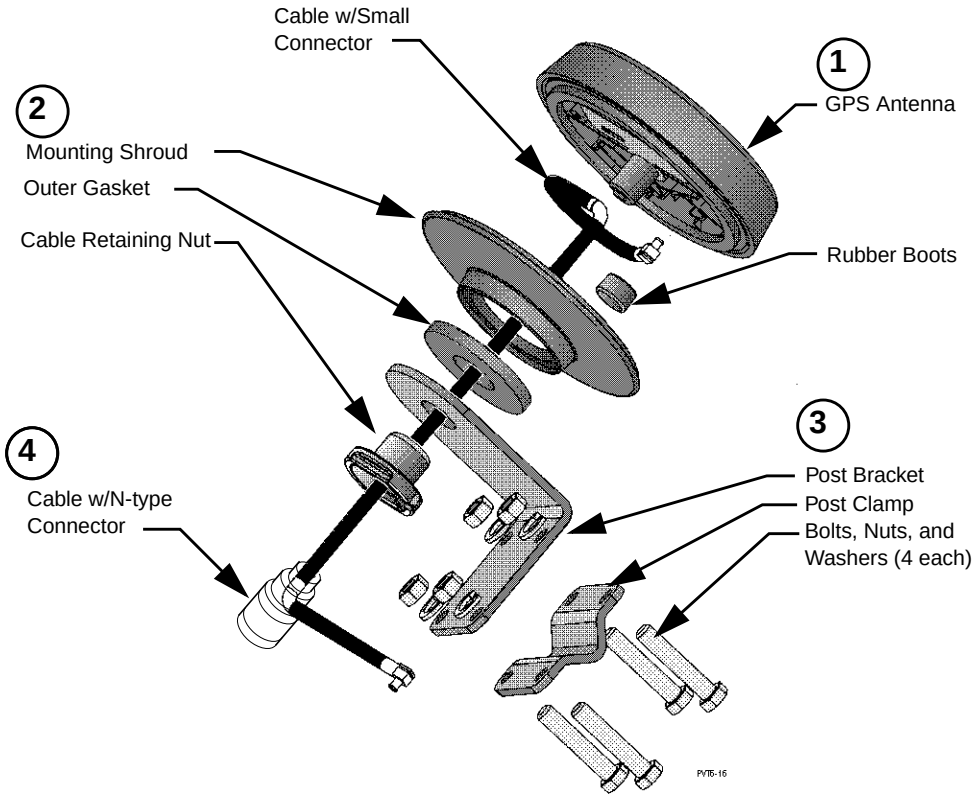


Figure E-2: Kit numbers and included parts

Table E-1: GPS Antenna Kit Numbers

Kit number	Number in Figure E-2	Description
RLN4388A	1	core GPS antenna and rubber boot
RLN4390A	2	mounting shroud, outer gasket and cable-retaining nut
RLN4391A	3	post clamp, post bracket, nuts (4), lockwashers (4) and bolts (4)
RKN4395A	4	1 ft cable with N-type connectors
RLN4394A	all	complete antenna kit

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.

Reassembling the Antenna

Use this procedure to attach the cable to the antenna and reassembling it:

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 E-3):
   - 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.

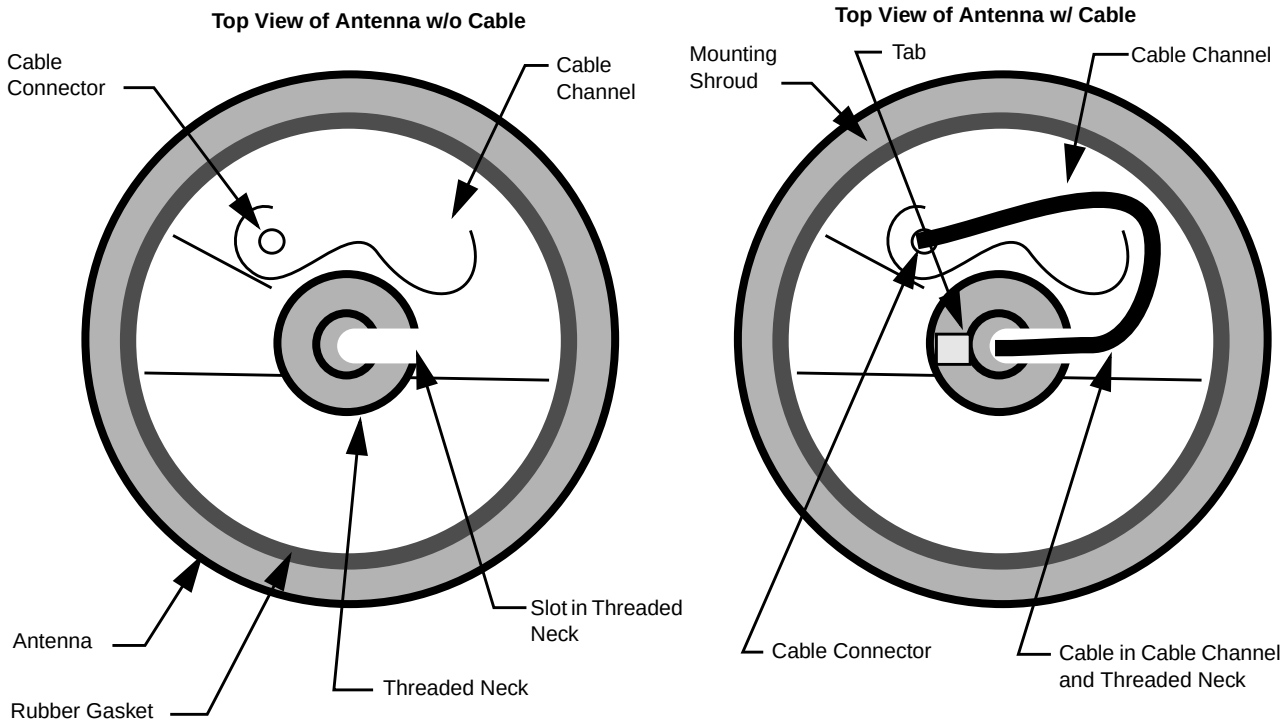


Figure E-3: Location and Orientation of the Cable and Connectors

4. Place the rubber boot over the small cable connector.

5. Bend the cable around the cable channel 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 E-3).

7. Press the mounting shroud gently into the antenna.

8. Place the L-shaped part of the bracket (with the antenna attached) on the pipe mast and hold it in place.

9. Place the curved part of the bracket on the opposite side of the pipe mast. Clamp it or hold it in place.

10. Insert one bolt through one hole in each bracket. Place a washer on the bolt and tighten with a nut. Use 10-mm wrenches.

11. Insert the other three bolts through the brackets. Tighten the assembly with washers and nuts.

12. Screw the large N-type male connector down over the N-type female connector on the carrier cable.

13. Waterproof the area around the large N-type connection.

14. Place the antenna back in operation.

Replacing the GPS Receiver

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 E-4).

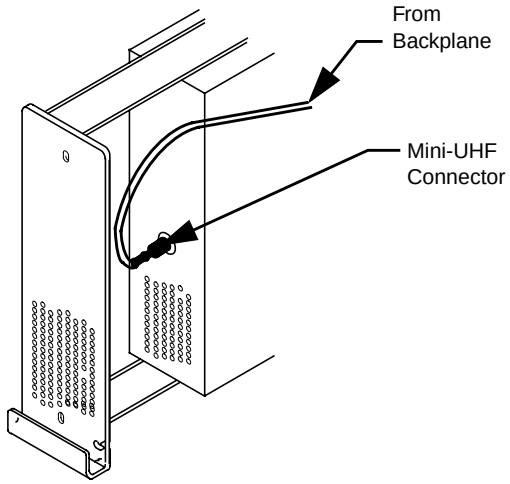


Figure E-4: Mini-UHF Cable in the GPS Receiver Module

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.

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). Reconnect the battery.

11. Disconnect the antistatic wrist strap.

Nucleus® Paging Station Quick Reference Menu Guide

STN - STATION

- TX FREQ RANGE (read-only)
- CURRENT TX CHN
  - 1
  - *through*
  - 20
- 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

RX - RECEIVER

- LINK/MONITOR RECEIVER
  - RX FREQ RANGE (read-only)
  - RX CHN FREQ
  - CHN SPACING
    - 12.5 KHZ
    - 20 KHZ
    - 25 KHZ
  - RX DEEMPHASIS
    - ENABLED
    - DISABLED
  - RX OUTPUT
    - INVERTED
    - NOT INVERTED
  - MONITOR RX OUTPUT
    - ANALOG
    - TTL CNET

TX - TRANSMIT

- TX CHN FREQS
  - CHN 1 FREQ
  - *through*
  - CHN 20 FREQ
  - MEAN FREQ
- TX CHN PWR *(if CHN MAPPED PWR disabled)*
  - OPERATING PWR
- TX CHN PWR *(if CHN MAPPED PWR enabled)*
  - CHN 1 PWR
  - *through*
  - CHN n PWR *(if CHN FREQ #)*
  - CAL PWR LEVEL
- TX CHN OFFSETS
  - HIGH SPEED OFFSET
  - LOW SPEED OFFSET
  - REFLEX25 OFFSET
- LOW SPEED SPLATTER FILTER
  - 88 US LOW PASS
  - 140 US LOW PASS
  - 160 US OFFSET
  - 250 US LOW PASS
- HIGH SPEED SPLATER FILTER
  - 88US LOW PASS
  - 160US LOWPASS
- NOMINAL BINARY DEVIATION
- SPECIAL TX SETUP
  - TX DATA INVERT
    - ENABLED
    - DISABLED
  - TX = RX
    - ENABLED
    - DISABLED
  - TX = RX CHANNEL
    - 1
    - *through*
    - 20
- IDLE DEVIATION
  - NULL
  - SPACE
  - MARK

ASET - ALARM SETUP

If CHN MAPPED PWR disabled:

- 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

If CHN MAPPED PWR enabled:

- INT FWD CHN MAPPED ALMS
  - CHN 1 FWD ALM PT
  - *through*
  - CHN 20 FWD ALM PT
- INT RFL CHN MAPPED ALMS
  - CHN 1 RFL ALM PT
  - *through*
  - CHN 20 RFL ALM PT
- EXT FWD CHN MAPPED ALM *(if EXT WATTMETER TYPE ≠ NONE)*
  - CHN 1 EXT FWD ALM PT
  - *through*
  - CHN 20 EXT FWD ALM PT
- EXT RFL CHN MAPPED ALMS *(if EXT WATTMETER TYPE ≠ NONE)*
  - CHN 1 EXT RFL ALM PT
  - *through*
  - CHN 20 EXT RFL ALM PT

OPT 1 - STATION OPTIONS 1

- ANTENNA RELAY
  - DISABLED
  - ENABLED
- EXT CIRCULATOR
  - NOT PRESENT
  - PRESENT
- CHN MAPPED PWR
  - DISABLED
  - ENABLED
- FREQ REFERENCE TYPE
  - INPUT UHSO
  - INPUT HSO
  - EXT 5 MHz
  - EXT 10 MHz
  - EXT 1 MHz
  - INT NIU
- NON SIMULCAST

STAT - STATION STATUS

- FWD PWR
- RFL PWR
- VSWR
- EXT WM FWD PWR
- EXT WM RFL PWR
- EXT WM VSWR
- SOFTWARE VERSIONS
  - APPLICATION
  - EXCITER
  - BOOT
  - ALIGNMENT ID
    - SCM (read-only)
    - EXCITER (read-only)
- SCM HARDWARE VERSION (read-only)

CNFG - STATION CONFIGURATION

- MAX PWR (read only)
  - NO PA
  - 20 W
  - 25 W
  - 100 W
  - 125 W
  - 250 W
  - 300 W
  - 350 W
- BATTERY REVERT SETUP
  - BATTERY TYPE
    - SEALED LEAD CALCIUM
    - BATTERY REVERT DISABLED
  - CHARGING
    - ENABLED
    - DISABLED
  - BACKUP
    - BACKUP STATION
    - BACKUP CONTROL
  - FIXED CUTBK RED %
- EXT WATTMETER TYPE
  - NONE
  - CLASS 1 EXT
- CONTROL
  - INTERNAL CNET
  - EXT SYNCH LOCAL CTRL
- RX TYPE
  - NO INTERNAL
  - INTERNAL LINK
  - INTERNAL MONITOR
- SPECIAL KEY SELECT
  - EXT LOW
  - EXT HIGH

ALMS - STATION ALARMS

- LOW FORWARD POWER
- HIGH REFLECTED POWER
- EXT LOW FORWARD POWER
- EXT HIGH REFLECTED POWER
- PA FAN
- SYNTH OUT OF LOCK
- BATTERY REVERT
- SYS TIMER EXPIRED
- PA FAIL
- STATION RESET
- HIGH STABILITY REF FAIL
- ALIGNMENT ID MISMATCHED
- PA NOT ALIGNED
- HIGH FWD POWER
- EXCITER STARTUP FAILURE
- I-20 COMM POLL TIMEOUT

SERV - SERVICE MODE

- PA TEST MODE
  - ACTIVE
  - INACTIVE
- SELECT SYMBOL
  - STAIRCASE
  - 01-10
  - 00-11
  - 10
  - 11
  - 01
  - 00
  - CARRIER
- KEY ON SYMBOL

DIS - ACCESS DISABLE

- MAINT ACCESS
  - DISABLED
  - ENABLED
- PAGING ACCESS
  - DISABLED
  - ENABLED
- DISABLE STATUS (read-only)
  - DISABLE_1
  - *through*
  - DISABLE_n

ALGN - STATION ALIGNMENT

- CAL STATION POWER
  - AUTO PA CALIBRATION
- CAL EXT WM
- ALIGN UHSO
  - KEY START
  - START
- KEY AND READ POWER
- KEY AND READ EXT WM POWER

RESET - RESET STATION

PRESS BUTTONS 1 & 3 SIMULTANEOUSLY

SOFTWARE VERSION 4.100