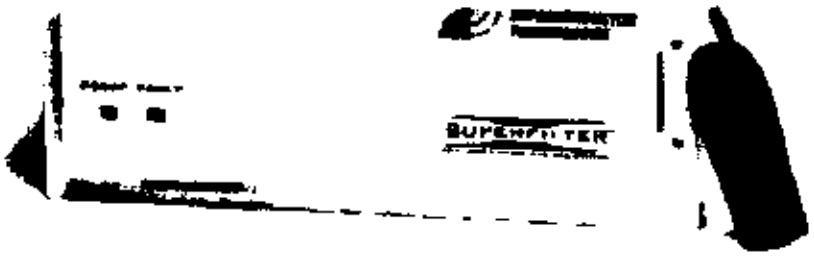
SUPERCONDUCTOR TECHNOLOGIES

Improving the Quality of Wireless

SuperFilter® Operation and Installation Manual

Applies to SuperFilter® Serial Numbers S00673 and up



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CHAPTER 1
INTRODUCTION

DOCUMENT PURPOSE

The purpose of this document is to provide customers with information on the operation and installation of the SuperFilter. Instructions in this manual cover 2-Pak and 6-Pak SuperFilter Systems, Serial Numbers S00673 and up, incorporating all variations of RF Configuration Options: Cascade, Variable Gain Option (VGO), and Replacement Option (RO).

HOW TO USE THIS MANUAL

This document consists of seven chapters plus four appendices. A brief description of each follows:

Chapter	Title	Description
1	Introduction	States the purpose of the document. Provides an overview of the document contents. Provides safety and warranty information.
2	Description	Describes the role of the SuperFilter in a typical wireless cellular system. Provides information on SuperFilter equipment configurations, system specifications, and functional descriptions.
3	Unpacking Procedures	Provides information on SuperFilter unpacking procedures.
4	Pre-Installation Requirements	Lists the tools, materials, and test equipment required for SuperFilter installation. These items are customer supplied.
5	Installation and Checkout Procedures	Provides information on mounting the SuperFilter, installing the power cable, performing the power up/cool-down procedures, performing the functional checks, connecting the RF cables, and verifying SuperFilter normal mode of operation. Also, this chapter provides instructions on connecting the alarm relay. Instructions in this chapter represent the STI-approved installation and checkout procedures.
6	Troubleshooting Procedures	Provides information on observing basic troubleshooting procedures for problems occurring during installation and operation, observing fault indications, and analyzing SuperFilter operational parameters.
7	Periodic Visual Inspection	Provides information on inspecting the SuperFilter on a periodic basis.
Appendix A	SuperFilter Communication	Provides information on monitoring the SuperFilter operational parameters.

Chapter	Title	Description
Appendix B	Packaging for Shipment Procedures	Provides SuperFilter packaging and shipment procedures. Special considerations during packaging procedures are covered.
Appendix C	Quick Installation Guide	Provides an alternative set of installation instructions when the recommended procedures contained in Chapter 5 cannot be performed.
Appendix D	Installation Data Record	Measurements and observations made during installation and checkout can be recorded on the Installation Data Record.

GENERAL SAFETY

Warnings, Cautions, and Notes

Warnings, cautions, and notes are used throughout this manual. The significance of each is as follows:

WARNING

A warning denotes a hazard to personnel. A warning calls attention to a procedure which, if not correctly performed or adhered to, could result in injury to personnel.

CAUTION

A caution denotes a hazard to equipment. A caution calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to the equipment.

NOTE

A note calls attention to a procedure for informational purposes only.

Electrostatic Discharge

The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Improper handling of the RF connectors, located on the rear panel of the SuperFilter chassis, can result in ESD damage. Ensure that all appropriate ESD precautions are adhered to when handling components mounted at the rear of the equipment. The following caution appears throughout the manual during procedures which the SuperFilter may be subject to damage by ESD.

CAUTION

The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted at the rear of the equipment.

WARRANTY

Superconductor Technologies Inc. (STI) warrants its SuperFilter® to be free from any defect in material and workmanship for a period of one year from date of shipment.

STI's sole obligation under this warranty is to repair or replace the SuperFilter® or any part thereof, which proves to be defective after inspection by STI. This warranty does not apply to any SuperFilter® that has been disassembled, modified, subjected to unusual electrical or physical stress, misuse, neglect, excessive deterioration or erosion, abuse, accident, unauthorized repair, improper installation, or use in any way that is contrary to the instructions set forth herein.

STI is not liable for any indirect, incidental, consequential or special damages, including without limitation, lost profits and cost of procurement of substitute goods.

This warranty is the full extent of obligation and liability assumed by STI with respect to its SuperFilter®. STI neither assumes nor authorizes any other person to assume for it any other obligations or liability in connection with the sale, installation or use of its SuperFilter®.

TECHNICAL ASSISTANCE

Technical assistance is available by calling (800) 727-3648, extension 767 or (805) 683-7646, extension 767.

CHAPTER 2
DESCRIPTION

OVERVIEW

The SuperFilter is a highly selective and sensitive RF filter intended for use at base stations of wireless telecommunications providers. The SuperFilter is designed to eliminate the trade-off between selectivity and sensitivity. The superior performance of the SuperFilter enables wireless service providers to enhance customer satisfaction and increase their subscriber base by improving the quality of voice and data transmissions of their networks.

Some advantages of incorporating a SuperFilter at a base station in a wireless telecommunications network are:

- Improved receiver noise figure
- Improved out-of-band signal rejection
- Stable sensitivity (cellular site performance not impacted by out-of-band interference)
- Low power consumption
- Virtually maintenance free operation
- Worry-free uplink enhancement
- Convenient base station installation

EQUIPMENT SPECIFICATIONS

Specifications provided for the SuperFilter consist of power requirements, physical characteristics, and environmental limitations. See Table 1 for SuperFilter specifications.

EQUIPMENT CONFIGURATIONS

The SuperFilter is available in United States A and B Cellular Frequency Bands. Both A-Band and B-Band SuperFilter systems are available in 2-Pak and 6-Pak RF receiver configurations. The 2-Pak SuperFilter system provides two RF channels. The 2-Pak SuperFilter system is designed to operate in a cellular system that uses omni-directional antennas, one main and one diversity. The 6-Pak SuperFilter system is designed for systems that use three antenna sectors, each consisting of one main and one diversity antenna. Figure 1 shows a typical wireless telecommunications base station diagram for both a 2-Pak and a 6-Pak SuperFilter system. Both 2-Pak and 6-Pak SuperFilter systems are available with the following RF Configuration Options: Cascade Option, Replacement Option, and Variable Gain Option.

Table 1. SuperFilter Specifications

Item	Characteristic
Power Requirements	
Input Power Voltage (+27V Nominal)	+25 to +30 VDC input power
Input Power Interface	Screw Terminal Block
• Fuse	12 A, 250V, 3AG or 10 A, 250V, 3AG, as marked on SuperFilter rear panel
Maximum Input Power @ 0 to 50° C Ambient Temperature	195 Watts Maximum
Steady-State Input Power @ 23° C Ambient Temperature	150 Watts Typical
Physical Specifications (not including Bypass Assembly)	
Dimensions	
• 2-Pak System	7 inches (H) x 17 inches (W) x 22 inches (D)
• 6-Pak System	7 inches (H) x 17 inches (W) x 22 inches (D)
SuperFilter Weight (excluding Rack Mount Brackets)	
• 2-Pak System	52 lbs.
• 6-Pak System	53 lbs.
Rack Mount Brackets Weight	
• 19-inch Rack Mount Brackets (pair)	2.25 lbs.
• 23-inch Rack Mount Brackets (pair)	3.25 lbs.
Environmental	
Operating Temperature	0 to +50° C
Operating Humidity	5 to 85 % RH @ 31° C
Operating Altitude	Sea level to 10,000 feet above sea level
Storage Temperature (Non-Operating)	–40 to +70° C
Storage Humidity (Non-Operating)	0 to 95 % RH non-condensing @ 40° C
Storage Altitude (Non-Operating)	Sea level up to 45,000 feet
Electrostatic Sensitive Devices that require Electrostatic Discharge Protection	The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted at the rear of the equipment.

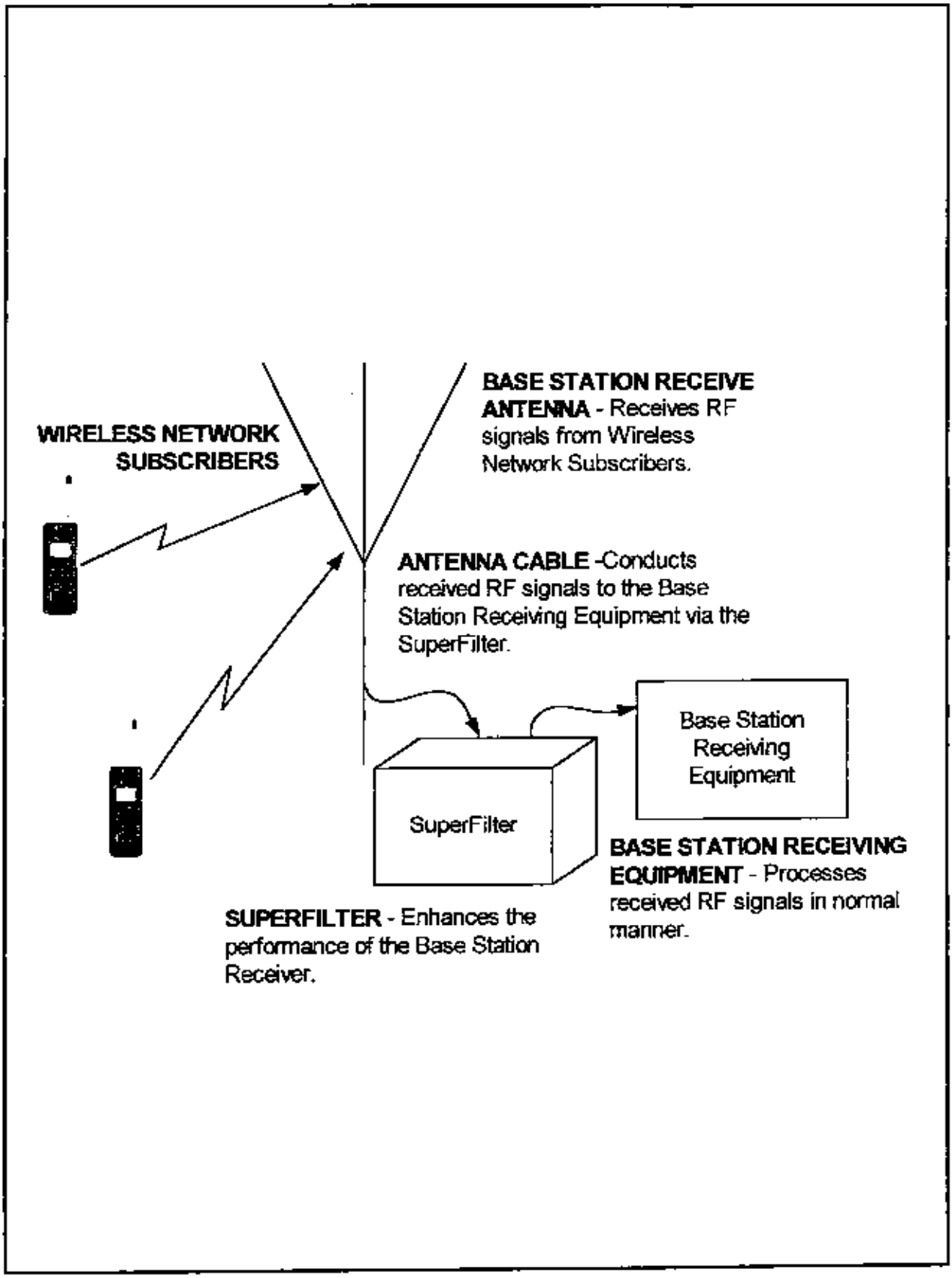


Figure 1. Typical Base Station Diagram for Cascade RF Configuration Option

Cascade Option

The Cascade Option is provided for installation where the Filter-Amplifier is connected in-line (cascade) with the existing receiver equipment. Figure 2A shows a Cascade Option connection with a cellular base station sector. The block diagram shows the Bypass RF path, which is provided to allow graceful degradation of service if the Filter-Amplifier should develop a problem. The Filter-Amplifier connects directly to the antenna cable, and provides a clear, low noise signal to the receiver.

Variable Gain Option

The Variable Gain Option allows the user to take advantage of the low noise benefits of the SuperFilter and control the amplification in the base station RF receive signal paths. This allows the user to optimize base station receiver performance. The gain of each RF path may be individually adjusted. The block diagram shown in Figure 2B allows the receive signal path gain to be similar in both Bypass and SuperFilter operation modes.

Replacement Option

The Replacement Option provides a reception path that is independent of the existing LNA. With added gain and a 1-dB resolution gain adjustment, the Replacement Option enables the SuperFilter to precisely match the gain of the base station receiver filter-LNA. See Figure 2C.

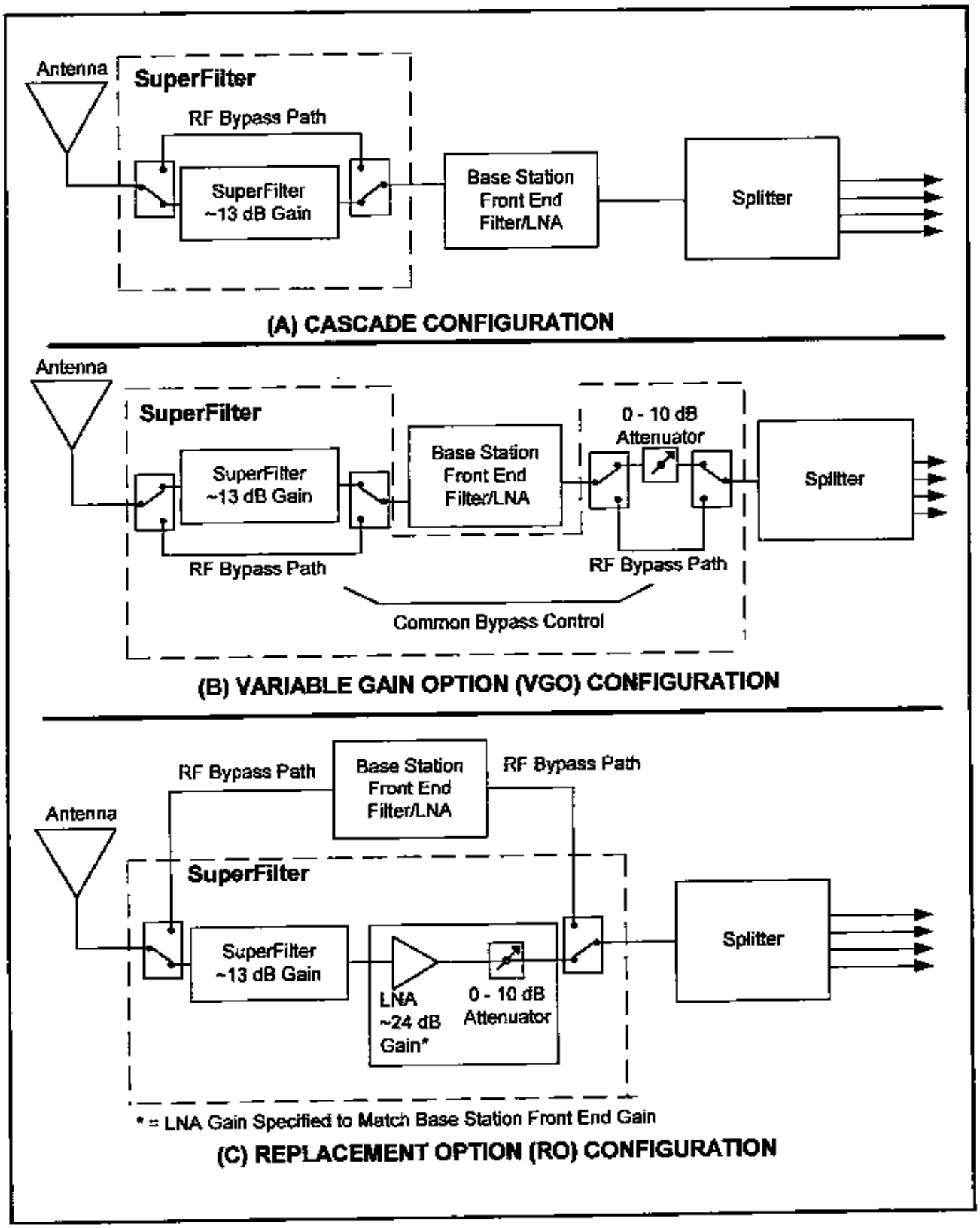


Figure 2. Signal Flow Block Diagram of RF Configuration Options

FUNCTIONAL DESCRIPTION

The functional areas of the SuperFilter are described in the following paragraphs. See Figure 3 for a functional block diagram of the SuperFilter.

RF Signal Flow

RF signals from the Antenna are fed into the initial RF Bypass Relay. Under Normal operation, the RF signals are routed through the RF Bypass Relay and into the Cryogenic RF Enclosure (CoRE). The CoRE consists of band-specific filters and a Low Noise Amplifier (LNA) for each RF path. The CoRE circuits provide highly selective filtering along with ~13 dB gain. For Cascade and VGO configured SuperFilter systems, RF signals from the CoRE are fed into the second RF Bypass Relay. For RO configured SuperFilter systems, RF signals from the CoRE are first fed into an additional adjustable gain block and then into the second RF Bypass Relay. The output of the second Bypass Relay connects back into the base station receive path.

The SuperFilter is in Bypass Mode upon power up and only switches to Normal Mode when the filter circuits in the CoRE reach the operating temperature. If a problem develops during normal operation, such as the CoRE dropping out of the operating temperature, or, a loss of power, the system will automatically switch into Bypass Mode. The RF signals from the Antenna are routed through the initial RF Bypass Relay, bypassing the SuperFilter, connecting to the original RF Filter-Amplifier Front End, and into the second RF Bypass Relay.

For Cascade configured SuperFilter systems, in both Normal and Bypass Mode of operation, the RF signals pass through the second RF Bypass Relay and are routed to the base station receiver.

For VGO configured SuperFilter systems, there is a second set of RF Bypass Relays. During Normal Mode of operation the RF signals are routed to an adjustable attenuator, allowing the user to optimize base station receiver performance. During Bypass Mode of operation the adjustable attenuators are no longer in the RF signal path.

In Normal Mode of operation for RO configured SuperFilter systems, RF signals bypass the gain of the base station receiver and are routed through an equivalent gain in the SuperFilter. In Bypass Mode of operation the RF signals are routed through the base station receiver as they were prior to installation of the SuperFilter.

The user may place the SuperFilter in Bypass Mode using the Console Terminal.

With the Console Terminal connected to the SuperFilter, type the command: SET FORCED BYPASS ON<Enter>. This places the SuperFilter in Bypass Mode indefinitely, until the command: SET FORCED BYPASS OFF<Enter> is entered at the Console Terminal. When the SuperFilter is in Forced Bypass Mode, the READY indicator on the SuperFilter front panel will Slow Flash AMBER.

Control

The Control Electronics and Processor provides the SuperFilter control and performance monitoring function. The Control Electronics and Processor monitors: input power from the Power Supply, driver current for the Cooling Motor Driver, CoRE temperature from the Thermal Sensor Interface, and LNA voltage. If input power drops or rises to an unacceptable level the Control Electronics and Processor will cause the SuperFilter to switch into the Bypass Mode and, at the same time, activate the Alarm Relay.

Signals from the Alarm Relay are available for connection to a base station alarm system. The FAULT LED, located on the SuperFilter front panel, will illuminate RED.

The Control Electronics and Processor senses variations in driver current. If the motor driver current levels move to an unacceptable level the Control Electronics and Processor will cause the SuperFilter to switch into the Bypass Mode and, at the same time, activate the Alarm Relay as previously mentioned.

The Control Electronics and Processor controls the temperature of the CoRE. The Thermal Sensor Interface routes multiplexed sensor signals to the Control Electronics and Processor. Correction signals are sent to the Cooling Motor Driver. If temperature levels move to an unacceptable level the Control Electronics and Processor will cause the SuperFilter to switch into the Bypass Mode. Additionally, the Control Electronics and Processor monitors the LNA voltage. Unacceptable levels of LNA voltage are sensed via the Power Supply and will cause the SuperFilter to switch into the Bypass Mode. Each time the SuperFilter is switched into the Bypass Mode the Alarm Relay is activated.

CryogenicCooling

The STI Stirling Cycle Cryogenic Cooler is a highly efficient, state-of-the-art Cryogenic Cooler. The Cryogenic Cooler maintains the CoRE at an operating temperature of ~78 Kelvin (K). The compressor and cold finger are fully integrated into a single self-contained unit. The Cooling Motor Driver provides drive and control to maintain a constant temperature. Temperature sensors in both the CoRE and the STI Stirling Cycle Cryogenic Cooler provide for constant temperature monitoring of the units by the Thermal Sensor Interface.

Power

27 VDC input power is received at the POWER terminal block connections, located on the rear panel of the SuperFilter. DC power is routed through a 12-amp fuse (10-amp fuse on some SuperFilter Models) to the Fans and the Power Supply. Two Fans provide cooling air for SuperFilter components installed outside the CoRE. The Power Supply routes regulated DC power to all SuperFilter assemblies.

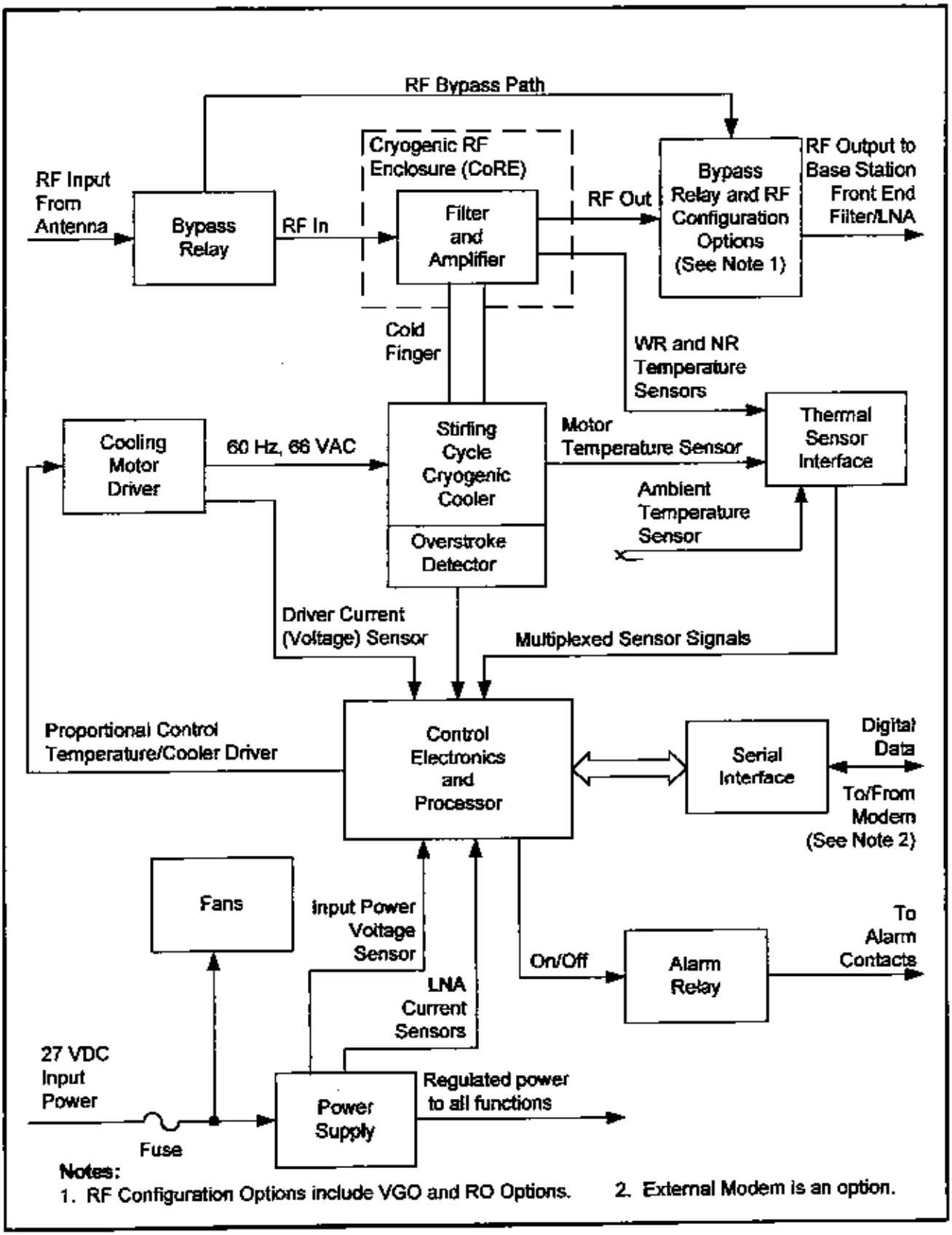


Figure 3. SuperFilter Functional Block Diagram

INDICATORS, CONNECTORS, AND CONTROLS

The SuperFilter incorporates two indicators on the front panel as shown in Figure 4 and described in Table 2. The rear panel contains signal and power connectors. On SuperFilter models incorporating the VGO and RO options, attenuator controls are associated with each RF signal path. These items are located on the Bypass Assembly. See Figure 5 for typical rear panel views of 2-Pak SuperFilter systems. See Figure 6 for typical rear panel views of 6-Pak SuperFilter systems. Table 3 provides a description of each connector and control.

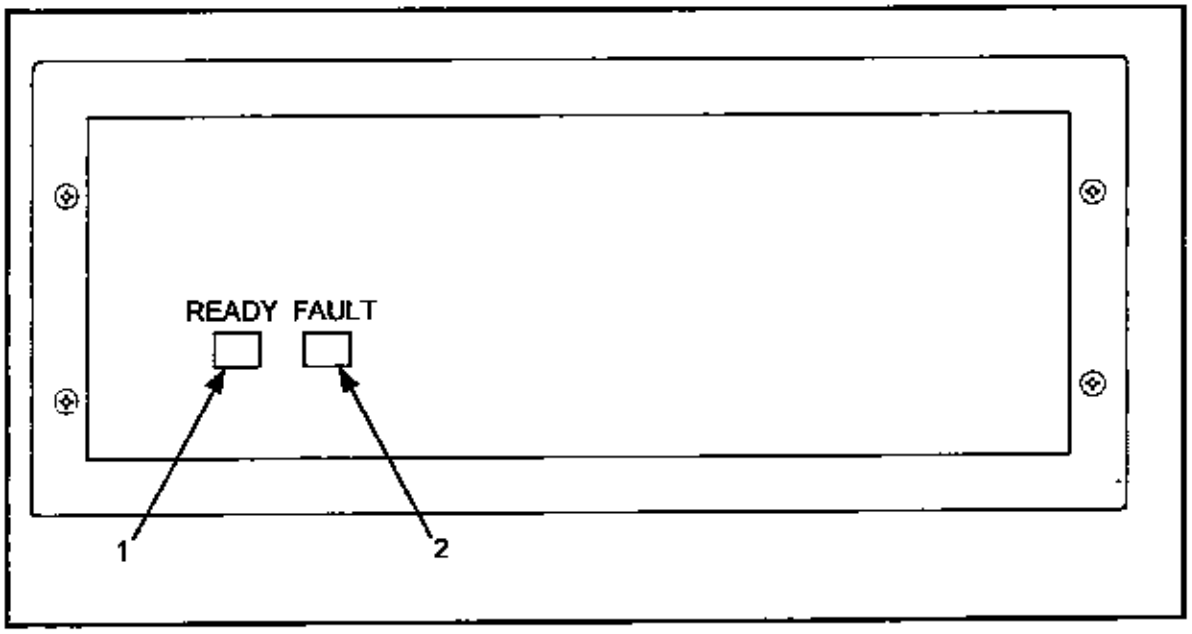


Figure 4. SuperFilter Front Panel Indicators

Table 2. Front Panel Indicators

Item No.	Item	Description
1	READY LED	Illuminates green when the SuperFilter is in Normal Mode and ready for operation. Illuminates Slow Flash amber when the SuperFilter is placed into Forced Bypass Mode.
2	FAULT LED	Illuminates red when the SuperFilter is in Bypass Mode.

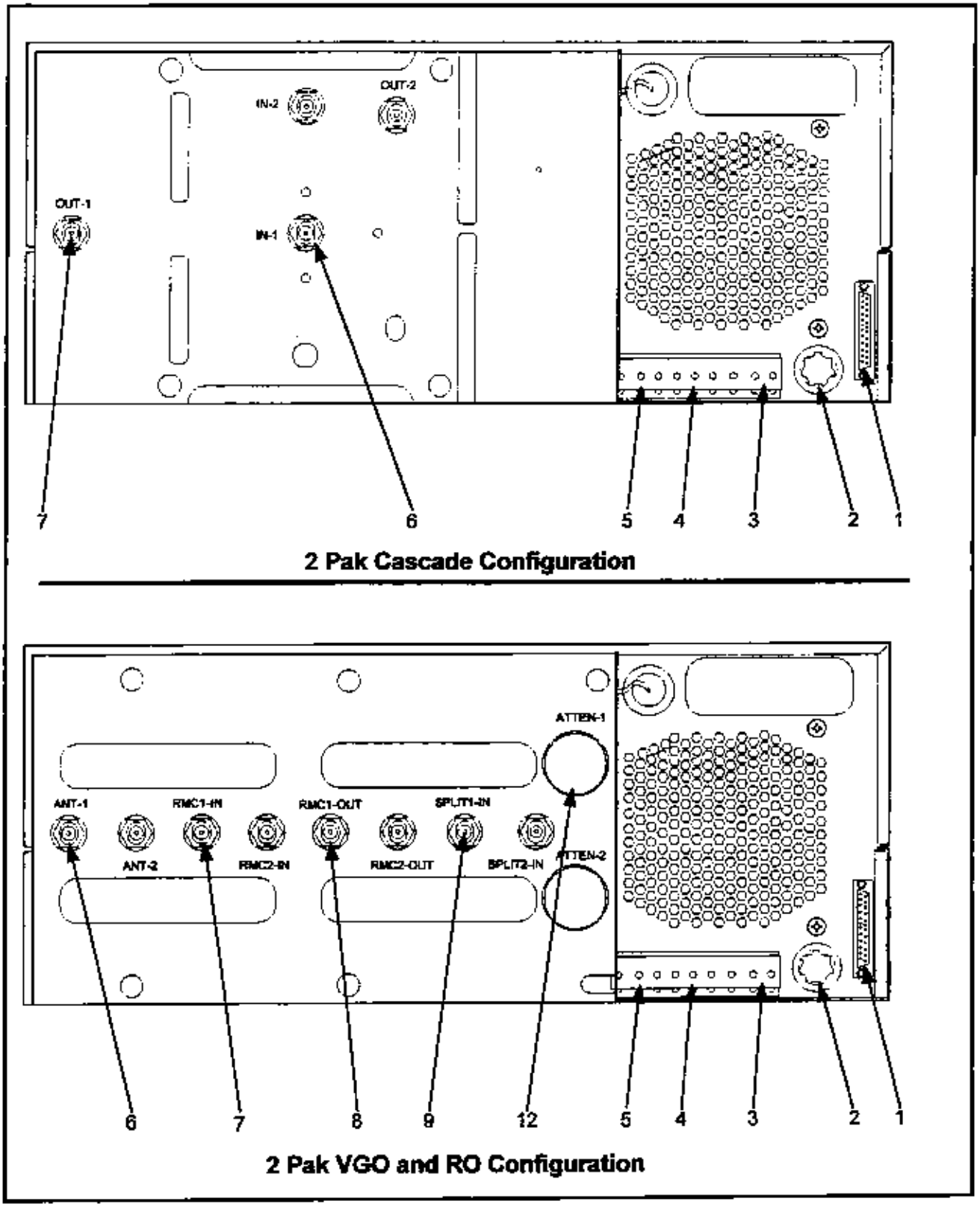


Figure 5. 2-Pak SuperFilter Rear Panel Connectors and Controls

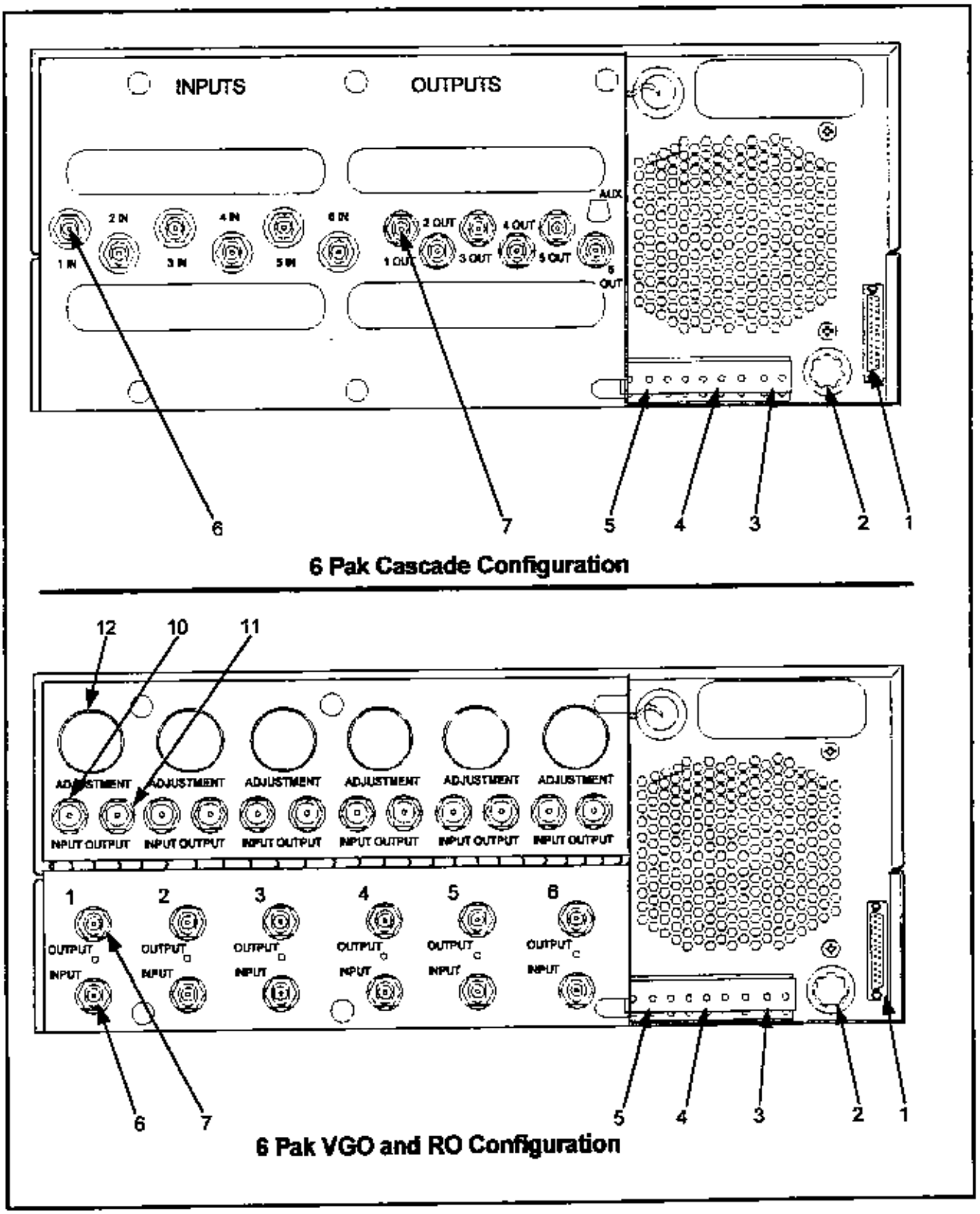


Figure 6. 6-Pak SuperFilter Rear Panel Connectors and Controls

Table 3. Rear Panel Connectors and Controls

Item No.	Item	Description
	Power and Control Connectors	
1	CONSOLE Connector	Provides an RS-232 serial interface connection to the Console Terminal. The user can verify SuperFilter Normal Mode operation and check system parameters using the Console Terminal. Also, the user can place the SuperFilter into Forced Bypass Mode by entering commands at the Console Terminal.
2	FUSE	With a 27 VDC input, provides 12-ampere (10-ampere on some SuperFilter Models) input power protection for the SuperFilter.
3	POWER 27VDC + and – (Terminal Block)	Provides input connection for 27 VDC.
4	MINOR NO, C, and NC (Terminal Block)	Reserved for future expansion.
5	MAJOR NO, C, and NC (Terminal Block)	Provides connection from the Alarm Relay to the base station alarm system. Activation of the Alarm Relay triggers the RF Bypass Relay.
	RF Connectors	
6	N-type RF Connector (SuperFilter input)	Receives RF signals from the Antenna for each SuperFilter channel.
7	N-type RF Connector (SuperFilter output)	Routes RF signals from each SuperFilter channel output to the base station front end input.
8	N-type RF Connector (SuperFilter adjustment section input)	Routes RF signals from the base station front end output to the adjustment section input of each SuperFilter channel. (2-Pak VGO and RO Configuration.)
9	N-type RF Connector (SuperFilter adjustment section output)	Routes RF signals from the adjustment section of each SuperFilter channel output to the splitter input. (2-Pak VGO and RO Configuration.)
10	BNC-type RF Connector (SuperFilter adjustment section input)	Routes RF signals from the base station front end output to the adjustment section input of each SuperFilter channel. (6-Pak VGO and RO Configuration.)
11	BNC-type RF Connector (SuperFilter adjustment section output)	Routes RF signals from the adjustment section of each SuperFilter channel output to the splitter input. (6-Pak VGO and RO Configuration.)
	RF Controls	
12	ATTENUATOR Control	Rotary attenuator control. Allows the user to add 0 to 10 dB of attenuation for a given RF channel. The gain of each RF path may be individually adjusted. (Both 2-Pak and 6-Pak VGO and RO Configuration.)

MODEL NUMBER IDENTIFICATION

The SuperFilter model number provides information on filter generation, frequency range, number of RF channels, and types of options selected. See Figure 7 for a description of the STI SuperFilter model numbers.

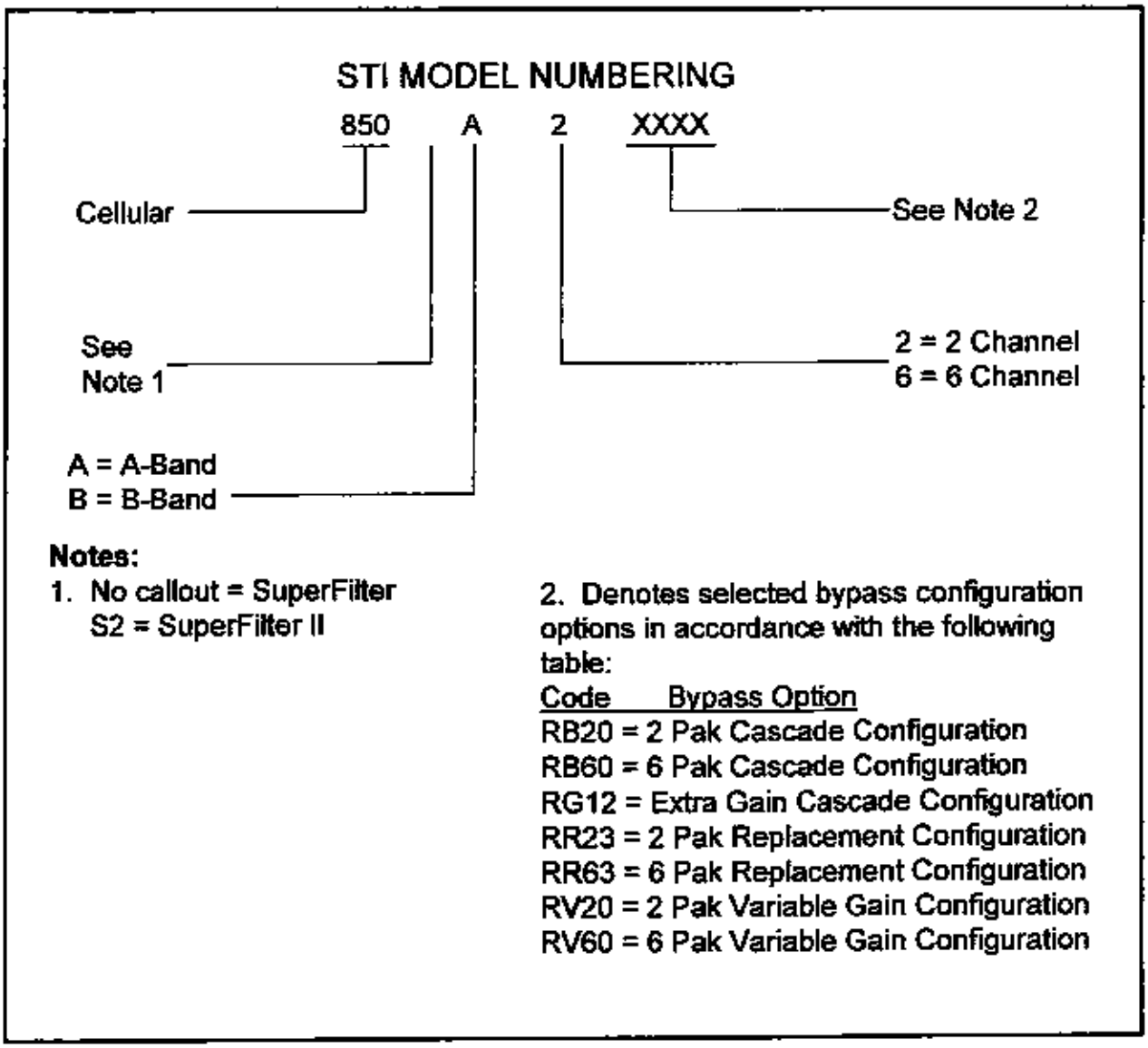


Figure 7. SuperFilter Model Numbering

CHAPTER 3
UNPACKING PROCEDURES

UNPACKING

The SuperFilter is boxed for shipping with cutout protective foam packing. Packed with the SuperFilter is one pair of Rack Mount Brackets and attaching hardware. After unpacking, confirm receipt of the components listed in Table 4.

Table 4. Equipment Supplied

Item	Part Number	Qty	Notes
SuperFilter, 2-Pak or 6-Pak	As ordered	1 each	2-Pak or 6-Pak SuperFilter as ordered by customer
Rack Mount Brackets, 19-inch • Right Side • Left Side	 180-0286 180-0287	1 pair	As ordered by customer, 1 pair of either 19 or 23-inch Rack Mount Brackets are shipped with each SuperFilter
Rack Mount Brackets, 23-inch • Right Side • Left Side	 180-308 180-309	1 pair	
Machine Screws, Round Head, Phillips Head 10/32" x ½"-long		8 each	Use 4 Round Head Screws to mount each of 2 Rack Mount Brackets

SuperFilter Unpacking Procedure

To unpack the SuperFilter, proceed as follows:

Step No.	Procedure
1.	Check the shipping container for signs of damage. Report any discrepancies at (800) 727-3648, extension 767 or (805) 683-7646, extension 767.

WARNING

The un-boxed SuperFilter weighs between 50-60 pounds, depending upon configuration. To prevent injury to personnel and damage to equipment, it is recommended that two people are available for unpacking the SuperFilter.

2.	Remove loose packing material on top of SuperFilter.
3.	Remove small piece of packing material that protects the RF connectors on the rear panel of the SuperFilter.
4.	Remove Rack Mount Brackets (one pair). Brackets are located between corner of shipping container and foam packing material.
5.	Remove bag containing attaching hardware for brackets. Bag is taped to top of SuperFilter.
6.	Lift the SuperFilter, with foam packing materials in place, from the shipping container. Place the SuperFilter on a work surface.
7.	Remove foam packing materials from each side of the SuperFilter.
8.	Remove plastic bag that covers the SuperFilter.

CAUTION

The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted on the rear panel of the SuperFilter.

9.	Remove plastic dust covers from RF connectors. Store dust covers in the shipping container.
10.	Inspect the SuperFilter for signs of damage. Report any discrepancies at (800) 727-3648, extension 767 or (805) 683-7646, extension 767.
11.	Retain shipping container and all packing materials for re-use. Store shipping container in a dry place.

CHAPTER 4
PRE-INSTALLATION REQUIREMENTS

PRE-INSTALLATION REQUIREMENTS

Pre-installation consists of establishing the installation site requirements, assembling the installation tools and materials required for SuperFilter installation but not supplied, and assembling the functional checkout test equipment required but not supplied.

Installation Site Requirements

The customer is responsible for providing the following facilities and environmental controls for installation of the SuperFilter.

- A sheltered enclosure that is temperature and humidity controlled.
- Conditioned air as required to maintain the SuperFilter unit between 0° C and 50° C.
- Humidity control as required to maintain the relative humidity level between 10 % and 95 % (non-condensing).
- A mounting location with unobstructed air vent space at the front and rear of the SuperFilter.
- 27 VDC Power Source (25 to 30 VDC) provided through a Power Distribution Panel Circuit Breaker of 20 Amp capability.
- Remote monitoring connection for the SuperFilter Alarm Relay.

Installation Tools and Materials Required But Not Supplied

The customer is responsible for providing hand tools and materials for installation of the SuperFilter. The hand tools are listed in Table 5. Materials required are listed in Table 6.

Table 5. Hand Tools Required

Item	Notes
Screwdriver, 1/8-inch flat blade	Fits SuperFilter terminal block screws
Screwdriver, Phillips #2 blade	For attaching Rack Mount Brackets
Wire Stripper	For power cable installation
Wire Cutter (diagonal cutter)	For power cable installation and wire tie removal
Rack Mount Fastener Driver	For attaching SuperFilter, with Rack Mount Brackets installed, to equipment rack

Table 6. Materials Required

Item No.	Item	Quantity	Notes
1	RF Jumper Cable, Flexible, Low Loss (½-inch) (Suggest LDF-4 Cable or equivalent)	1 per Receiver Channel	Male N-type connectors on each end. This cable must be long enough to connect between the existing antenna feed coaxial input connector and the rack mounted SuperFilter. (Rerouting the existing feed jumper cable may provide this cable.)
2	RF Jumper Cable, Flexible, Low Loss (½-inch) (Suggest LDF-4 Cable or equivalent)	1 per Receiver Channel	Male N-type connectors on each end. This cable must be long enough to connect the rack mounted SuperFilter output to the existing antenna input connector of the base station receiver.
3	RF Jumper Cable, Flexible, Low Loss (½-inch) (Suggest LDF-4 Cable or equivalent)	2 per Receiver Channel	Male N-type connectors on each end. This cable must be long enough to connect between the multi-coupler input and output connectors and the rack mounted SuperFilter input and output connectors. (Used for 2-Pak SuperFilter VGO and RO Configuration installations.)
4	RF Jumper Cable, Flexible, Low Loss (½-inch) (Suggest LDF-4 Cable or equivalent)	2 per Receiver Channel	Male N-type connector on one end and BNC-type connector on the other end. This cable must be long enough to connect between the multi-coupler input and output connectors and the rack mounted SuperFilter input and output connectors. (Used for 6-Pak SuperFilter VGO and RO Configuration installations.)
5	Wire, Duplex 10-gauge	Length As Required	Power cable, 12-gauge for lengths up to 20 feet, 10-gauge up to 30 feet (red and black jacketed wire preferred for color coding + and - power, respectively).
6	Wire, Duplex 20-gauge	Length As Required	If desired, for connecting the SuperFilter MAJOR Alarm Relay output to the base system Alarm Control Unit.
7	Nylon Wire Ties	As Required	Used to dress cables after installation.
8	Rack Mount Fasteners	4 each	Required to mount the SuperFilter to the equipment rack.
Note: Item numbers in this table are shown on cabling diagrams Figures 15 through 17.			

Functional Checks Test Equipment Required But Not Supplied

The customer is responsible for providing test equipment to perform functional checks on the SuperFilter. Test equipment is listed in Table 7.

Table 7. Test Equipment Required

Item No.	Test Equipment	Notes
1	Digital Multimeter (DMM) or equivalent	Used to check Alarm Relay and input power.
2	PC with serial port (set for 19.2 K Baud, No parity, 8 bits data, 1 stop bit [N.8.1])	Used with Terminal Emulation software for control of the SuperFilter (e.g. HyperTerminal).
3	DB-25 Female to DB-9 Female Connector Adapter (Cable)	Adapts PC terminal serial port to the Modem Cable.
4	Modem Cable, DB-25 Male Connector to DB-25 Male Connector (25 feet)	Used to connect Console Terminal to SuperFilter.
5	Signal Generator, Radio Frequency	Generate a CW carrier at 830 MHz (A-Band) or 840 MHz (B-Band), output level adjusted to –50 dBmW.
6	Spectrum Analyzer	Receive and display CW carrier at 830 MHz (A-Band) and 840 MHz (B-Band), across levels –55 dBmW to –35 dBmW; measure received power level accurately (+/- 1 dB).
7	Connector Adapter,N-Female to N-Female Barrel	Replaces the SuperFilter for test signal level calibration.
8	RF Jumper Cable, N-Male Connector to N-Male Connector	Used during Test Generator Calibration Data Testing of 2-Pak SuperFilters with VGO and RO Configuration.
9	RF Jumper Cable, N-Male Connector to BNC-Male Connector	Used during Test Generator Calibration Data Testing of 6-Pak SuperFilters with VGO and RO Configuration.
Note: Item numbers in this table are shown on test setup diagrams Figures 11 through 14. **Note:** HP 8921 Test Set, or equivalent, provides both the Signal Generator and the Spectrum Analyzer function.		

CHAPTER 5
INSTALLATION PROCEDURES

INSTALLATION PROCEDURES

Installation procedures consist of mounting the SuperFilter, installing the power cable, performing the power up/cool-down procedures, performing the functional checks, installing the RF cables, and performing the SuperFilter System State verification. Additionally, instructions for connecting the alarm relay are provided.

The installation procedures in this manual are the STI recommended installation procedures for the SuperFilter. In some instances, the user may wish to follow the "Quick Installation" guide, located in Appendix C. Site-specific installation and checkout information may be found in the applicable STI Application Notes listed in Table 8.

Table 8. STI Application Notes

Part No.	Title
820-0001	Application Note 1: SuperFilter Installation in Ericsson 882 Cellular Base Stations
820-0002	Application Note 2: SuperFilter with Variable Gain Option (VGO) Installation in a Motorola HD-II, Recommended Configuration, & Optimization
820-0003	Application Note 3: SuperFilter Installation in Motorola Model SC 4812T Cellular Base Stations
820-0004	Application Note 4: SuperFilter Installation in Nortel Cellular Base Stations
820-0005	Application Note 5: SuperFilter Installation in Lucent Cellular Base Stations

Mounting the SuperFilter

The rack mount location of the SuperFilter should be selected to allow the jumper cable attached to the antenna bulkhead RF cable to reach the input connector of the SuperFilter. If this is not possible, the jumper cable must be replaced with a cable of sufficient length in order to complete the connection. Note that this cable contributes to the input noise figure and must be of a minimum length and have a low insertion loss for optimum performance.

Mount the SuperFilter in the equipment rack as follows:

Step No.	Procedure

CAUTION

The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted on the rear panel of the SuperFilter.

NOTE

The SuperFilter can be mounted to the equipment rack using either 19 or 23-inch Rack Mount Brackets as shown in Figure 8, Views A and B.

1.	Secure Rack Mount Brackets to the SuperFilter using four machine screws for each bracket. Ensure that brackets are installed on the correct side of the SuperFilter. The brackets are labeled with part numbers.

NOTE

Ensure that the selected mounting location provides an unobstructed air vent space at the front and rear of the SuperFilter.

WARNING

The SuperFilter weighs between 50-60 pounds, depending upon configuration. To prevent injury to personnel and damage to equipment, it is recommended that two people are available in mounting the SuperFilter.

2.	Install the SuperFilter into the equipment rack. Secure SuperFilter to equipment rack using rack mount fasteners.

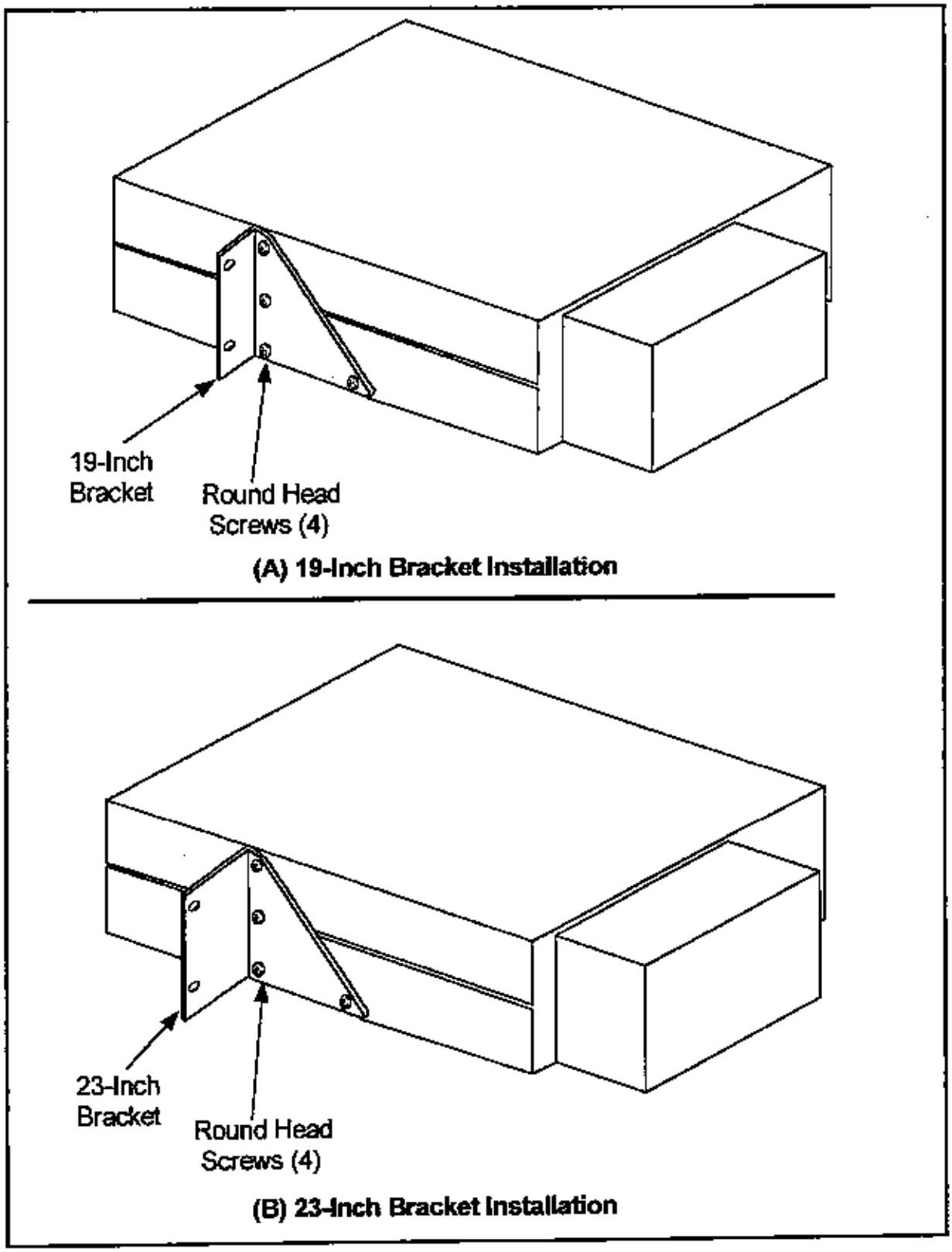


Figure 8. SuperFilter with Mounting Brackets

Power Cable Installation

Install the SuperFilter power cable as follows:

Step No.	Procedure
1.	Set the power source circuit breaker to the open or off position.

WARNING

Do not exceed a 30-ampere circuit breaker rating on a 12-gauge cable or a 40-ampere circuit breaker rating on a 10-gauge cable. Excess current capacity may result in a fire hazard.

NOTE

The power cable should be kept to less than 30 feet in length. A 10-gauge cable is preferred but a 12-gauge cable may be used for cable lengths of less than 20 feet.

2.	Run the power cable from the base station power distribution circuit breaker box to the terminal block on the rear panel of the SuperFilter. The terminal block connections are labeled POWER 27VDC + and -. See Figure 9 for rear panel terminal block connections on the SuperFilter.
3.	Connect the wires at each end, taking care to maintain the correct voltage polarity. Do not close the circuit breaker at this time.

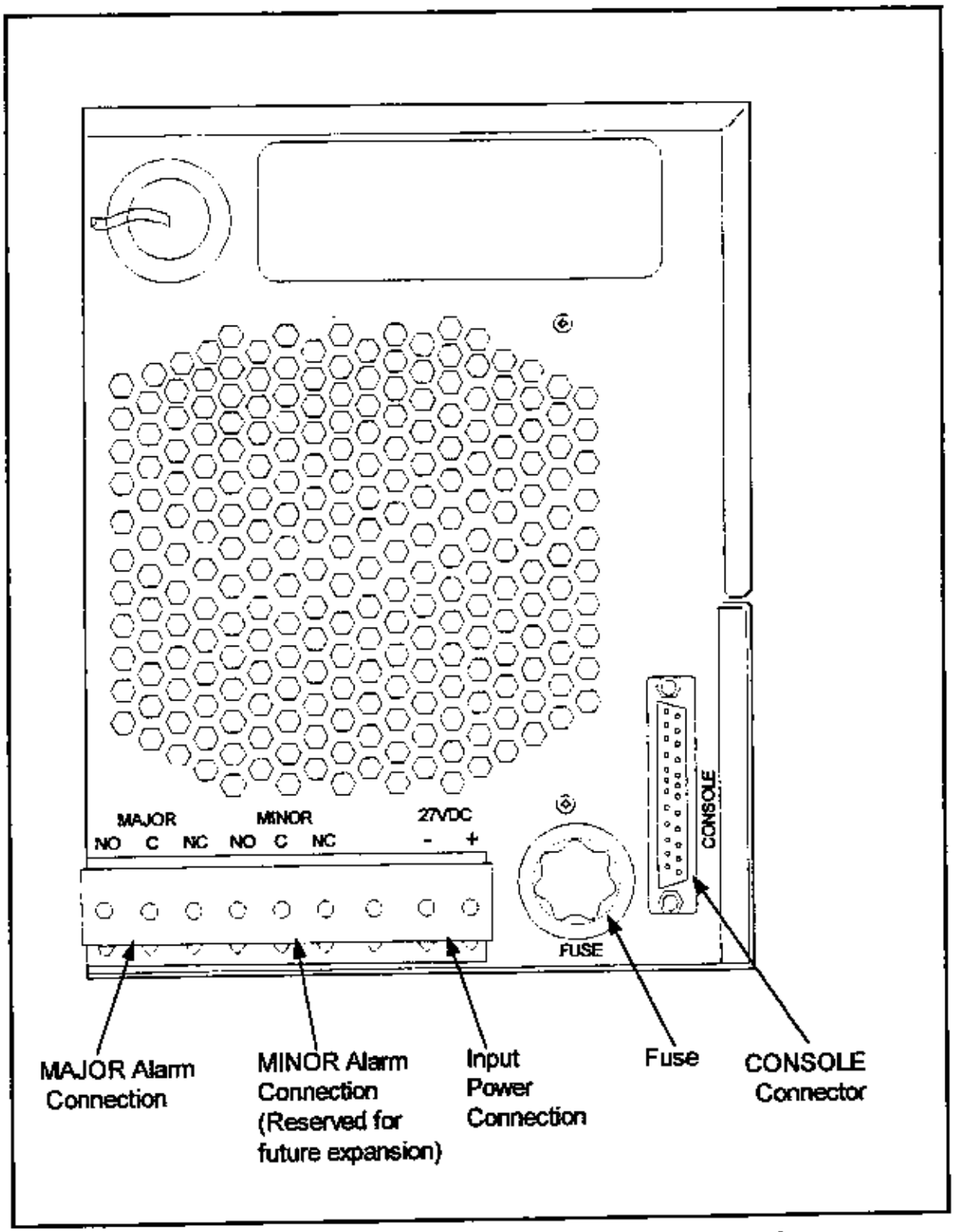


Figure 9. SuperFilter Rear Panel Power and Control Connections

Power Up/Cool-Down

Apply power to the SuperFilter unit as follows:

Step No.	Procedure

WARNING

Ensure that the power source circuit breaker is in the open or off position before proceeding. Failure to comply may result in personnel injury.

1.	Ensure the power source circuit breaker is set to the open or off position.
2.	Remove fuse from the fuseholder located on the rear panel of the SuperFilter.
3.	Set the power source circuit breaker to the closed or on position.
4.	Set the DMM to read VDC.
5.	Place the leads of the DMM on the SuperFilter terminal block connections marked POWER 27VDC + and -.
6.	Verify that SuperFilter input voltage reads 27 $\pm$ 2 VDC on the DMM. Verify correct polarity. Record reading on Installation Data Record in Appendix D.
7.	Remove the DMM.

WARNING

Ensure that the power source circuit breaker is in the open or off position before proceeding. Failure to comply may result in personnel injury.

8.	Set the power source circuit breaker to the open or off position.
9.	Reinstall the fuse in the fuseholder.
10.	Apply power to the SuperFilter by setting the power source circuit breaker to the closed or on position.

NOTE

- Initially, both LED's on the front panel of the SuperFilter will flash amber. The READY LED will then go out. Then, the FAULT LED will illuminate red, which is normal. After a couple of minutes, the FAULT LED will begin to Fast Flash* red. The SuperFilter is beginning to cool down.
- As the cool down progresses, the READY LED will begin to Slow Flash* green. The cool down sequence progresses through eight stages, which are indicated by different patterns of flashing red and green LED's. The system state machine controls the cooling for the superconductor circuits and the bypass relay switching. Refer to Table 9 for a list of the possible states and a brief description of each state.
- Initial cooling of the SuperFilter takes 3 to 5 hours. When the SuperFilter cryogenic chamber has reached operating temperature (~78 K), the READY LED will stay on green and the FAULT LED will stay off.

11.	The SuperFilter will automatically switch from Bypass Mode to Normal Mode when it has cooled. If the SuperFilter fails to go into Normal Mode within 5 hours, as indicated by the steady green READY LED on the SuperFilter front panel, call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.
12.	Perform Functional Checks procedure.
Note: * = Fast Flash is twice per second, Slow Flash is once per second.	

Table 9. Cool-Down State Table

State No.	State Name	Bypass Relay State	Indicators		Description
			FAULT	READY	
0	Initialize	Bypass	On **	Off **	Initial Power Up State
1	Idle	Bypass	On RED	Off	Cold stage is warm, Dewar is not cooling
2	Coarse Cool-down	Bypass	Flash Fast * RED	Off	Cooling, cold stage is above 85 K
3	Fine Cool-down	Bypass	Flash Fast * RED	Flash Slow * GREEN	Cooling, cold stage is below 85 K
4	Over shoot	Bypass	Flash Fast * RED	Flash Fast * GREEN	Cold stage is cooler than set point (nominally 78 K) and the control algorithm integrator is settling
5	Settle	Normal	Flash Fast * RED	Flash Fast * GREEN	Cold stage temperature is settling, circuits are switched to Normal
6	Baseline	Normal	Off	On GREEN	Cold stage temperature has settled and baseline data is being collected
7	Operating	Normal	Off	On GREEN	System is operating normally and being checked for deviations from the baseline
8	Fault	Bypass	On RED	Off	Alarm relay is switched on

Note: * = Fast Flash is twice per second, Slow Flash is once per second.
** = On power up, both FAULT and READY Indicators will momentarily illuminate AMBER during System State zero (0).

Functional Checks

Functional checks of the SuperFilter consists of: console connection and operation, operation status check, alarm relay test, establishing test generator calibration data, and calculating SuperFilter preamplifier channel data. Test equipment required for these checks is listed in Chapter 4, Pre-Installation Requirements, Table 7.

Console Connection and Operation

The operational parameters of the SuperFilter can be monitored using a "Terminal" or Personal Computer (PC). The CONSOLE connector on the rear panel of the SuperFilter is a serial port wired as a DCE-type RS-232 interface. A connection can be made to any ANSI-compatible "dumb" terminal or terminal emulator with an off-the-shelf Modem Cable. The following terminals and terminal emulator programs have been used successfully. For more information, call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.

- DEC VT 220 and 320 "dumb" terminals
- IBM PC-compatible computers running "Terminal" in Windows 3.1,or "HyperTerminal" in Windows 95/98 or communications software such as, ProComm or Mirror
- Macintosh computers running "Reflection2+".

To check the operational parameters of the SuperFilter, proceed as follows:

Step No.	Procedure
1.	Configure the Console Terminal interface to run at 19,200 Baud, 8 bits, no parity, 1 stop bit.
2.	Use the Modem Cable and Adapter to connect the Console Terminal to the CONSOLE connector on the rear panel of the SuperFilter.
3.	Turn on the Console Terminal. Press Enter or Return on the Console Terminal to display a prompt similar to the following: 3:12:34:16>

NOTE

The displayed prompt indicates the number of Days:Hours:Minutes:Seconds the system has been running since its most recent power-up. In the above example, the system indicates it has been running for 3 days, 12 hours, 34 minutes, and 16 seconds. The prompt is not continually updated; the elapsed time is updated only upon completion of a given command, and when the user is prompted again.

NOTE

Table 10 is a list of commands, the command mnemonic, and a brief description of the command.

4.	In order to assess the operational status of the SuperFilter issue the following command: **STATE**<Enter>
5.	The Console Terminal display screen should show a System State report like the example shown in Figure 10. Record System State results on the Installation Data Record in Appendix D.
6.	With the STATE command issued, verify the SuperFilter is in System State Machine (SM) State: 7: Operating. This indicates the SuperFilter is operating normally. Record the displayed data and continue with procedures. If the cool-down process is completed and the System SM State does not read 7: Operating, call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.

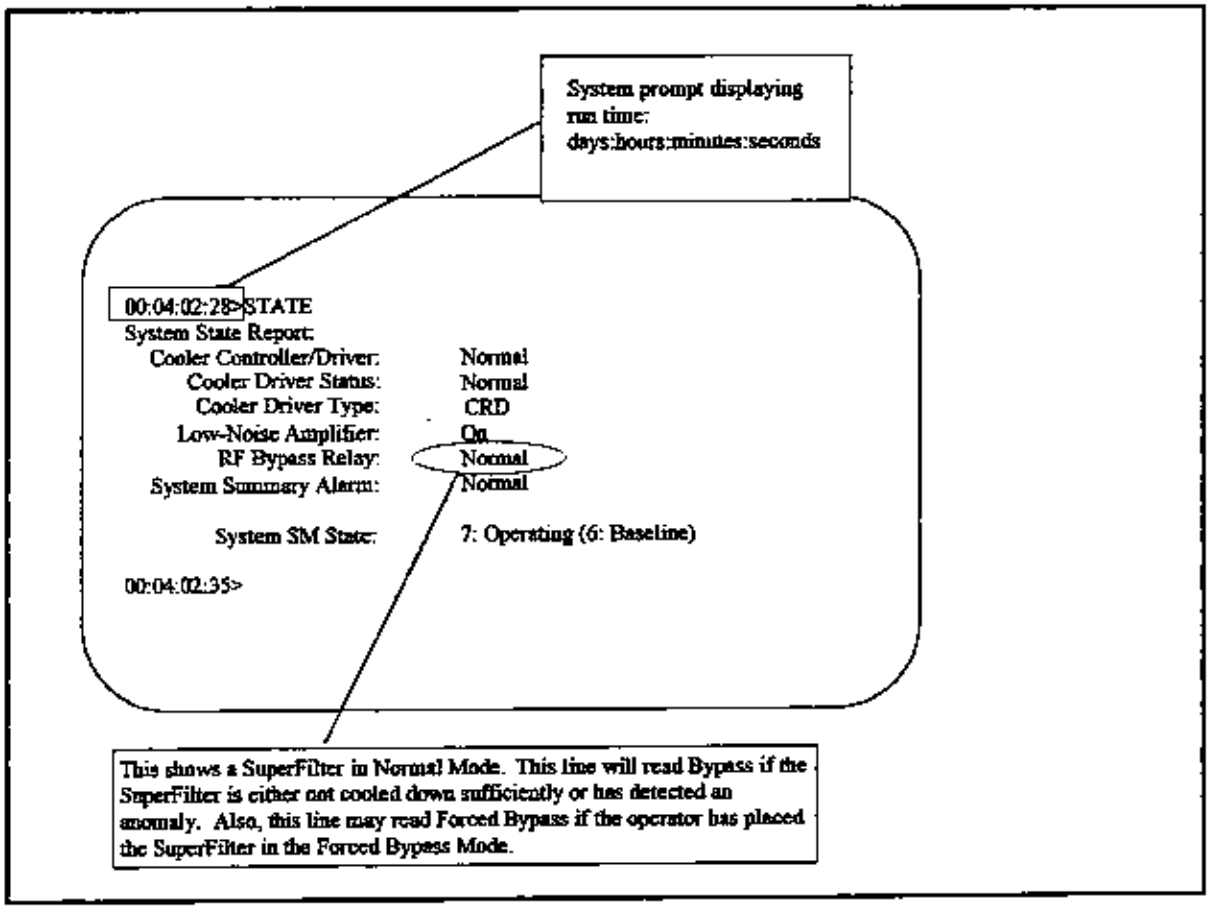


Figure 10. Example of a System State Report

Table 10. SuperFilter Console Terminal Commands

Command	Mnemonic	Description
Clear Screen	(CL)S	Clear the console screen
Loop	(L)oop	Display the temperature loop control parameters
Set Point	(N)sp	Dump Non-volatile set point parameters
State	(ST)ate	Dump filter subsystem state data
Temperature	(T)emperature	Display temperatures measured within the Filter - Amplifier (in Kelvin).
Forced Bypass	(S)ET (F)ORCED (B)YPASS (O)N	Places the SuperFilter in the Forced Bypass State until removed from that state by the operator.
Forced Bypass	(S)ET (F)ORCED (B)YPASS (O)FF	Removes the SuperFilter from the Forced Bypass State and returns it to the Normal Mode of operation.
Note: Parentheses in the Mnemonic Column indicates an abbreviated form of the command syntax. Commands may be abbreviated, if desired to the first few characters, and usually just the first character if desired. For example, TEMP could be abbreviated T and STATE could be abbreviated with ST.		

Alarm Relay Test

To check the operation of the MAJOR Alarm Relay, proceed as follows:

Step No.	Procedure
	NOTE The SuperFilter has provisions for a MINOR Alarm that is not functional for this system.
1.	Type the following command at the Console Terminal: **(S)ET (F)ORCED (B)YPASS (ON)**<Enter>
	NOTE The SuperFilter READY Indicator will Slow Flash amber; the Alarm Relay is now placed in an alarm condition.
2.	Set the DMM to measure resistance.
3.	Place the DMM leads between the SuperFilter terminal block connections marked MAJOR C and NO. The DMM should read less than 10 Ohms.
4.	Move the DMM leads between terminal block connections marked MAJOR C and NC. The DMM should read greater than 10,000 Ohms.
5.	Record resistance measurements on Installation Data Record in Appendix D.
6.	Type the following command at the Console Terminal to return the SuperFilter to normal operation: **(S)ET (F)ORCED (B)YPASS (OF)F**<Enter>
	CAUTION Ensure that the SET FORCED BYPASS OFF<Enter> command is typed at the Console Terminal. Otherwise, the SuperFilter will remain in the Bypass Mode, as indicated by the READY Indicator remaining in a Slow Flash amber state.
	NOTE The SuperFilter READY Indicator will be steady on green; the Alarm Relay is now placed in normal condition.
7.	Place the DMM leads between the SuperFilter terminal block connections marked MAJOR C and NO. The DMM should read greater than 10,000 Ohms.
8.	Move the DMM leads between terminal block connections marked MAJOR C and NC. The DMM should read less than 10 Ohms.
9.	Remove the DMM.
10.	Record resistance measurements on Installation Data Record in Appendix D.

Test Generator Calibration Data

A signal power measurement is used as the reference level for finding the SuperFilter RF path gain and loss values. To set up the SuperFilter RF reference levels, proceed as follows:

Step No.	Procedure
1.	Turn on the RF Signal Generator and the Spectrum Analyzer and allow them to warm up. Consult equipment operator manuals for proper test equipment warm up time.
2.	Set the RF Signal Generator to output a continuous wave (CW) signal with a frequency of 830 ± 3MHz (SuperFilter A-Band operation) or 840 ± 3MHz (SuperFilter B-Band operation), and the level set to –50 ± 1 dBm maximum. Record frequency level on Installation Data Record in Appendix D.
3.	Connect the RF Signal Generator output to the Spectrum Analyzer as shown in Figure 11, substituting an N-to-N barrel connector adapter for the SuperFilter.
4.	Measure the signal frequency and power level, and record the values on the Installation Data Record in Appendix D. This signal power measurement is used as the reference level for finding the SuperFilter RF path gain and loss values.
5.	Remove the N-to-N barrel connector adapter.
6.	Continue with remaining procedures.

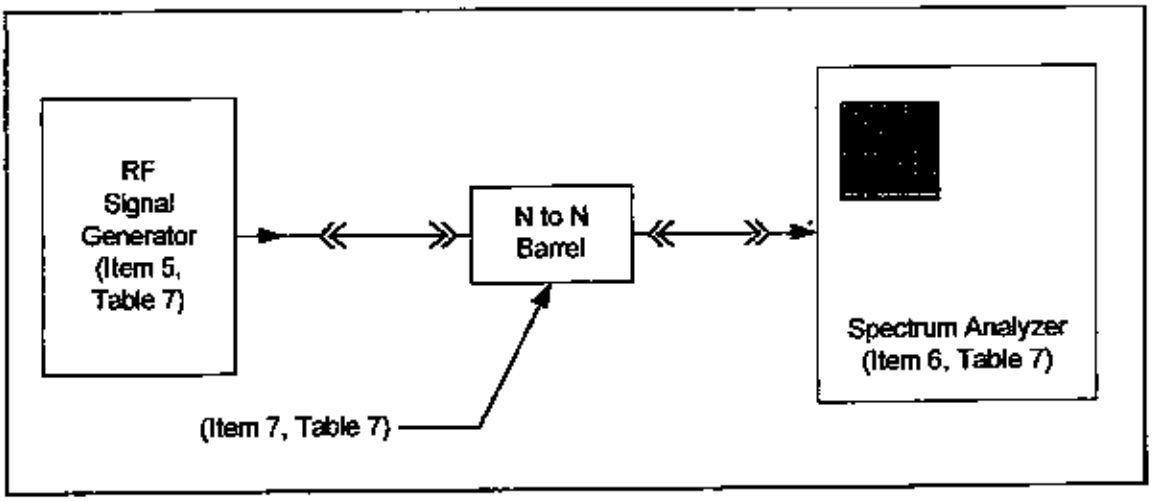


Figure 11. Test Generator Calibration Reference

SuperFilter Preamplifier Channel Data

Calculate the RF path loss (Bypass) and gain (Normal) levels for the SuperFilter preamplifier channels as follows:

Step No.	Procedure

CAUTION

The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted on the rear panel of the SuperFilter.

NOTE

During these procedures, refer to the appropriate SuperFilter test setup diagram: Figure 12 for a Cascade Configuration, Figure 13 for a 2-Pak VGO and RO Configuration, or Figure 14 for a 6-Pak VGO and RO Configuration.

1.	To check the RF gain and loss on SuperFilter channel number 1, connect the RF Signal Generator to the SuperFilter Number 1 N-type antenna input connector.
2.	Connect the Spectrum Analyzer to the SuperFilter Number 1 N-type (BNC-type on 6-Pak VGO and RO Models) filter output connector.
3.	On VGO and RO Models, connect jumper cable (Item 8, Table 7) in accordance with Figure 13 or 14. Set Bypass Assembly gain adjustment to zero (0) dB.
4.	The SuperFilter is commanded into Bypass Mode using the Console Terminal. Type the following command at the Console Terminal: **(S)ET (F)ORCED (B)YPASS (ON)**<Enter>
5.	Measure and record the RF output level for Channel 1 Gain on the Installation Data Record in Appendix D.
6.	Type the following command at the Console Terminal to return the SuperFilter to Normal Mode of operation: **(S)ET (F)ORCED (B)YPASS (OF)F**<Enter>
7.	Measure and record the RF output level for Channel 1 Bypass Loss on the Installation Data Record in Appendix D.
8.	Calculate the RF path loss (Bypass) and gain (Normal) by subtracting the reference level recorded as a result of the Test Generator Calibration Data procedure. The Channel 1 Bypass Loss should be −1 dB ± 1 dB. The Channel 1 Gain should be + 13 dB ± 2 dB (+ 25 dB ± 2 dB for RO Models). Record calculation results on the Installation Data Record in Appendix D.
9.	Repeat steps 1 through 8 to check the RF gain and bypass loss on all additional SuperFilter channels.
10.	Disconnect the RF Signal Generator and the Spectrum Analyzer and secure them. Leave the Console Terminal connected to the SuperFilter at this time.

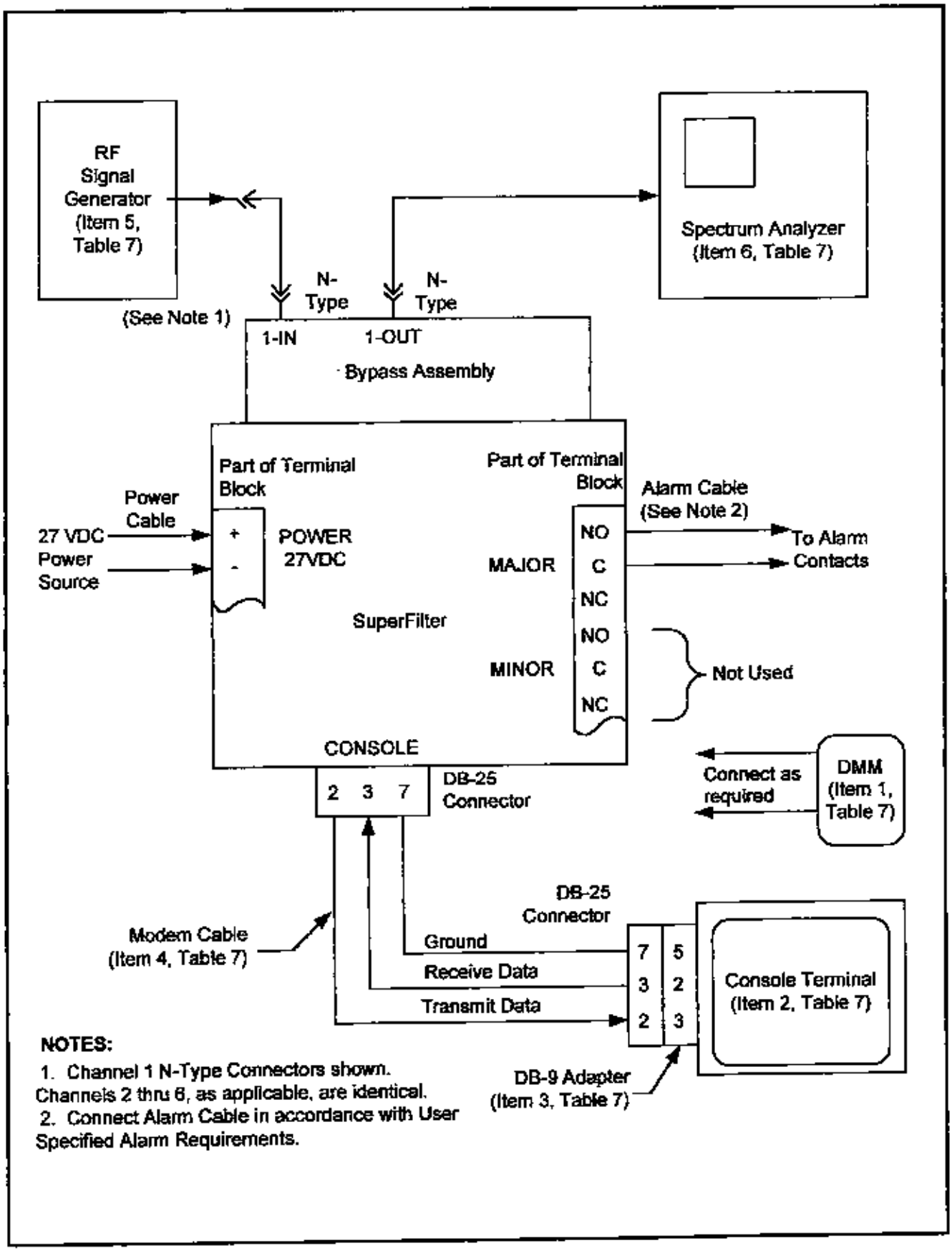


Figure 12. SuperFilter Cascade Configuration Test Setup

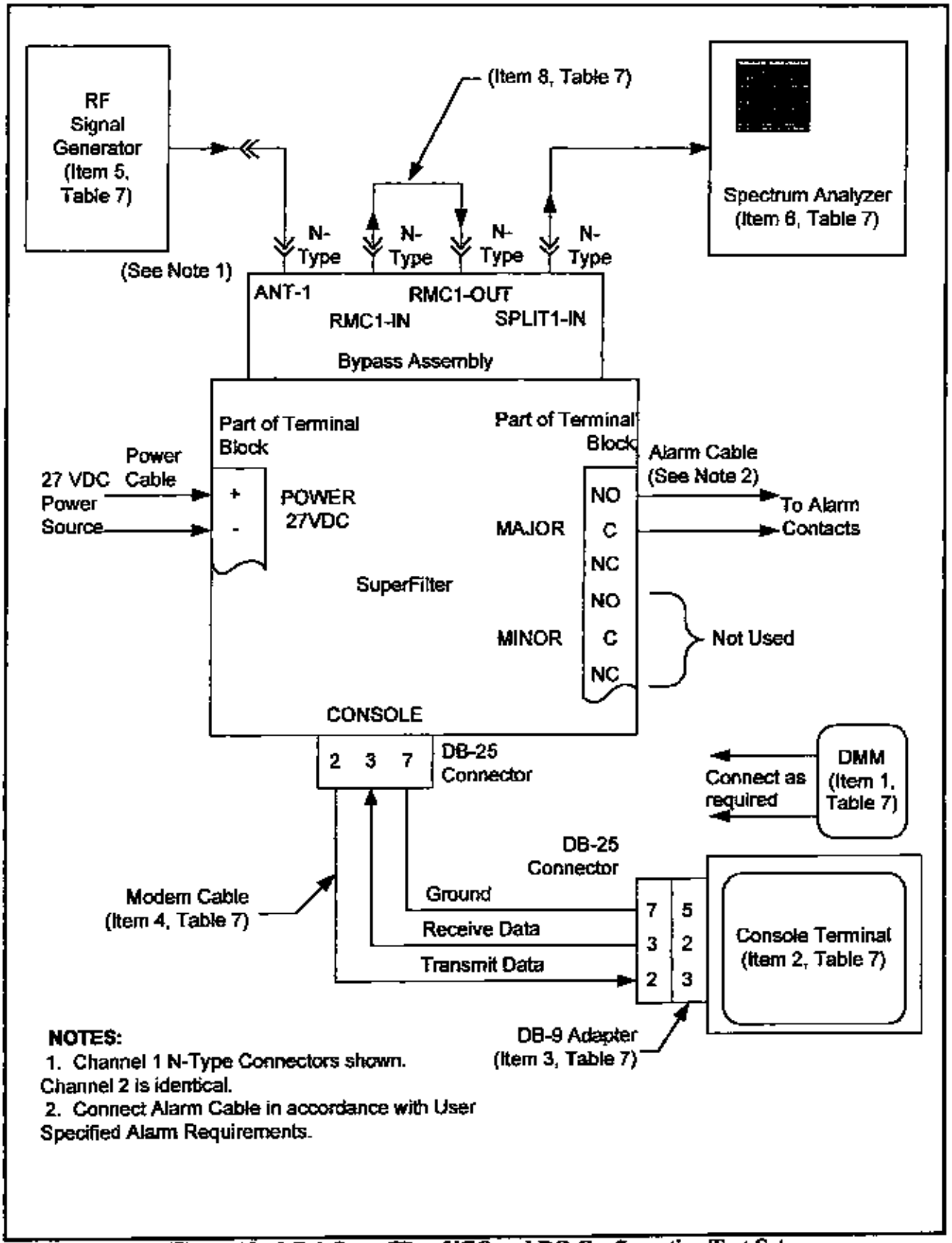
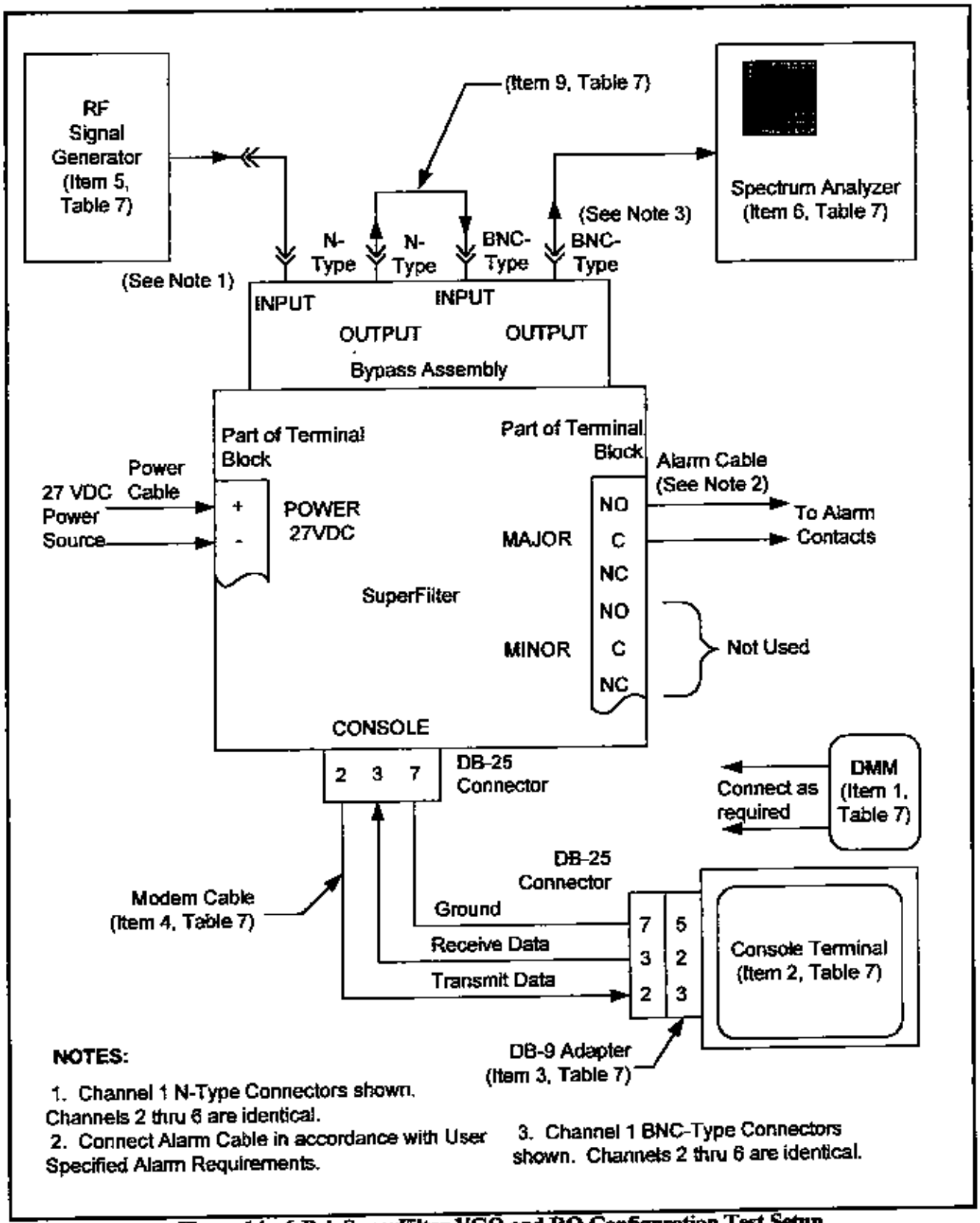


Figure 13. 2-Pak SuperFilter VGO and RO Configuration Test Setup



NOTES:

1. Channel 1 N-Type Connectors shown. Channels 2 thru 6 are identical.
2. Connect Alarm Cable in accordance with User Specified Alarm Requirements.
3. Channel 1 BNC-Type Connectors shown. Channels 2 thru 6 are identical.

Figure 14. 6-Pak SuperFilter VGO and RO Configuration Test Setup

RF Connections to SuperFilter (Cascade Option)

The existing RF feed cables from the antenna may not reach the RF connectors on the rear panel of the SuperFilter as installed in the equipment rack. If the antenna cable does not reach the SuperFilter input connector, replace it with a jumper cable of sufficient length. See Table 6 for cabling information. Additional RF cables, as listed in Table 6, will be required to patch from the filter-amplifier outputs to the Cell site RF front end inputs. See Figure 15 for a SuperFilter Cascade Configuration cabling diagram.

Step No.	Procedure

CAUTION

- The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted on the rear panel of the SuperFilter.
- For base station equipment that incorporate a duplexer, ensure that cabling connections made between the duplexer and the SuperFilter are from the receive side of the duplexer only. Connecting cables from the duplexer transmit port to the SuperFilter will cause damage to the SuperFilter.

1.	Disconnect the existing channel 1 antenna input jumper cable from the base station front end antenna input connector and connect it to the SuperFilter channel 1 input connector. If the antenna cable does not reach the SuperFilter input connector, replace it with a jumper cable of sufficient length.
2.	Using a RF N-type jumper cable, connect the SuperFilter channel 1 output to the base station front end antenna input connector. At this point the RF path from the antenna through the SuperFilter and into the base station receiver should be complete and carrying traffic.

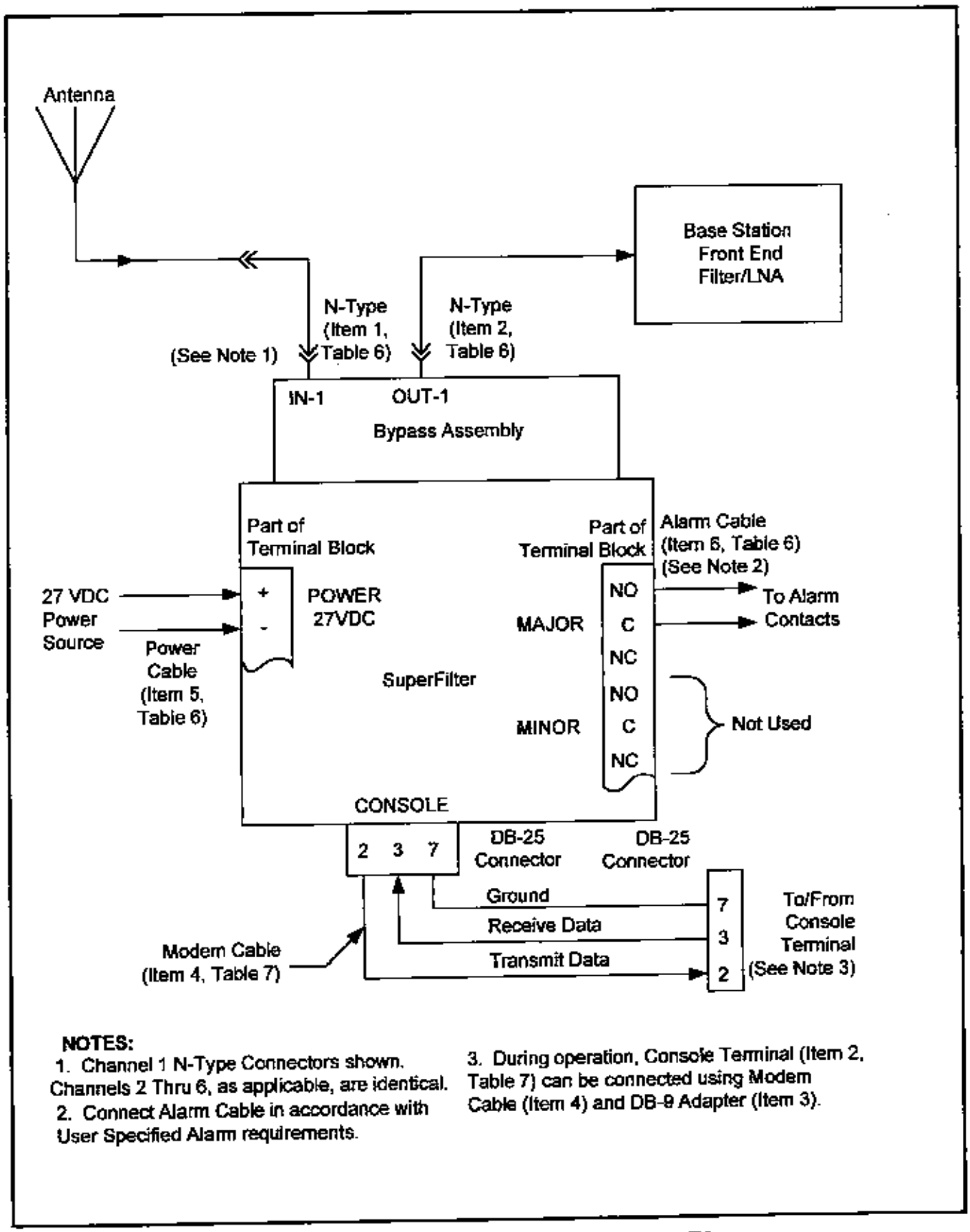
CAUTION

Work with only one receiver channel at a time. Completely reconnect and verify operation of a channel before moving to another antenna channel. If both channels in a sector are disconnected at the same time, all service will be lost in that sector.

3.	Attach the Spectrum Analyzer to an unused splitter output in the channel 1 RF path. Verify that signal traffic is evident in the Spectrum Analyzer display.
4.	Repeat steps 1 through 3 for the remaining antenna channels.
5.	At the conclusion of the RF cable connections to the SuperFilter, dress cables using nylon wire ties (Item 7, Table 6) as required.

RF Connections to SuperFilter (VGO and RO Option)

The existing RF feed cables from the antenna may not reach the RF connectors on the rear panel of the SuperFilter as installed in the equipment rack. If the antenna cable does not reach the SuperFilter input connector, replace it with a jumper cable of sufficient length. See Table 6 for cabling information. Additional RF cables will be required to patch from the filter amplifier outputs to the front end inputs and between the filter-amplifier and the splitter. See Figures 16 and 17 for SuperFilter VGO and RO Configuration cabling diagrams.



NOTES:

1. Channel 1 N-Type Connectors shown. Channels 2 Thru 6, as applicable, are identical.
2. Connect Alarm Cable in accordance with User Specified Alarm requirements.
3. During operation, Console Terminal (Item 2, Table 7) can be connected using Modem Cable (Item 4) and DB-9 Adapter (Item 3).

Figure 15. SuperFilter Cascade Configuration Cabling Diagram

Step No.	Procedure

CAUTION

- The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted on the rear panel of the SuperFilter.
- For base station equipment that incorporate a duplexer, ensure that cabling connections made between the duplexer and the SuperFilter are from the receive side of the duplexer only. Connecting cables from the duplexer transmit port to the SuperFilter will cause damage to the SuperFilter.

1.	Disconnect the existing channel 1 antenna input jumper cable from the base station front end antenna input connector and connect it to the SuperFilter channel 1 input connector. If the antenna cable does not reach the SuperFilter input connector, replace it with a jumper cable of sufficient length.
2.	Using a RF N-type jumper cable, connect the SuperFilter channel 1 output to the base station front end antenna input connector.
3.	Disconnect the existing jumper cable between the base station front end filter/LNA output connector and splitter input connector. The jumper cable may include a 3 dB attenuator.

NOTE

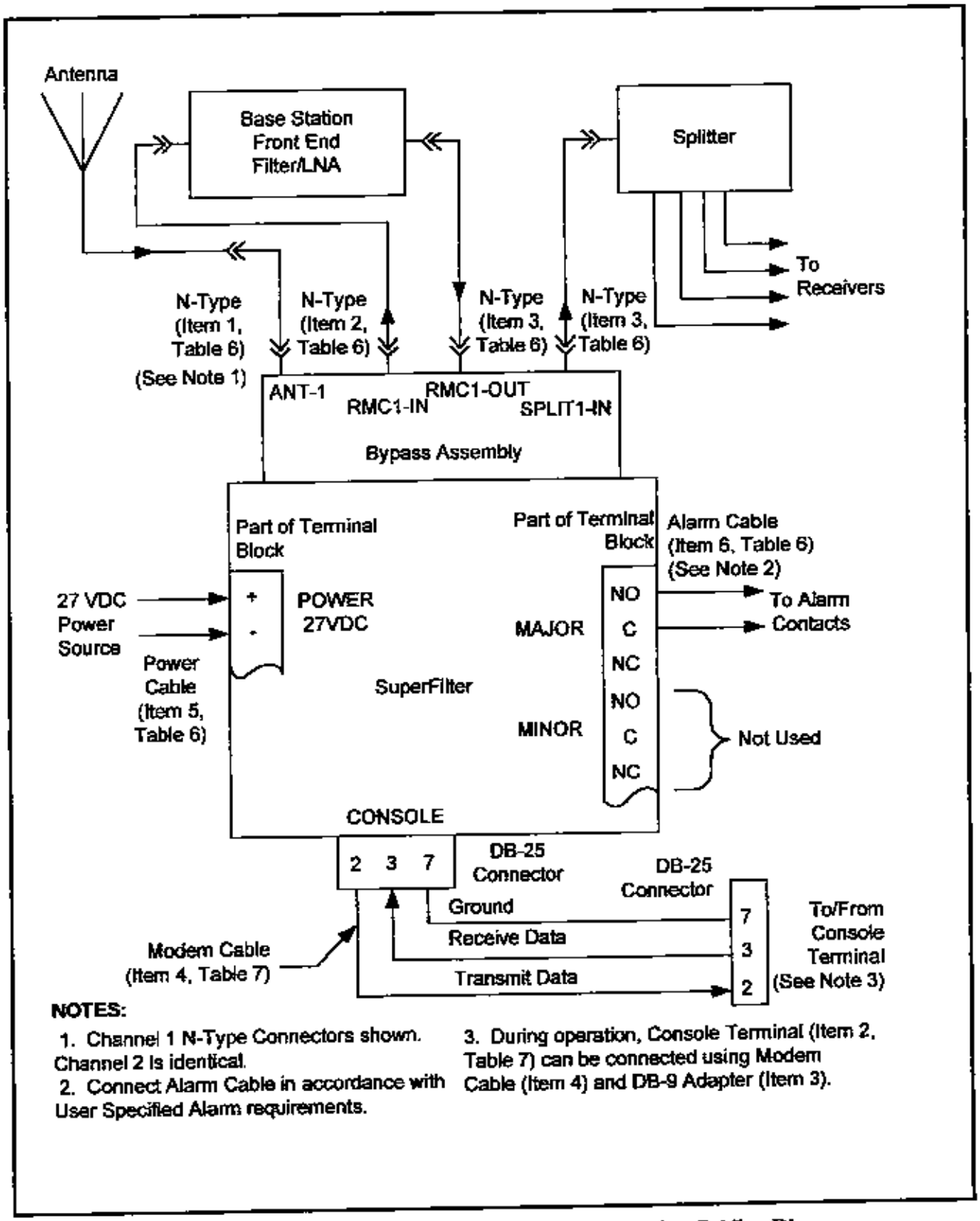
On 2-Pak SuperFilters, refer to Figure 16, perform steps 4 and 5, and continue procedure with step 8.
On 6-Pak SuperFilters, refer to Figure 17, perform steps 6 and 7, and continue procedure with step 8.

4.	Using a RF N-type jumper cable, connect the base station front end filter/LNA output connector to the SuperFilter channel 1 input connector.
5.	Using a RF N-type jumper cable, connect the SuperFilter channel 1 output connector to the splitter input connector. At this point the RF path from the antenna through the SuperFilter and into the base station receiver should be complete and carrying traffic.
6.	Using a RF BNC-type jumper cable, connect the base station front end filter/LNA output connector to the SuperFilter channel 1 input connector.
7.	Using a RF BNC-type jumper cable, connect the SuperFilter channel 1 output connector to the splitter input connector. At this point the RF path from the antenna through the SuperFilter and into the base station receiver should be complete and carrying traffic.
8.	Attach the Spectrum Analyzer to an unused splitter output in the channel 1 RF path. Verify that signal traffic is evident in the Spectrum Analyzer display.

CAUTION

Work with only one receiver channel at a time. Completely reconnect and verify operation of a channel before moving to another antenna channel. If both channels in a sector are disconnected at the same time, all service will be lost in that sector.

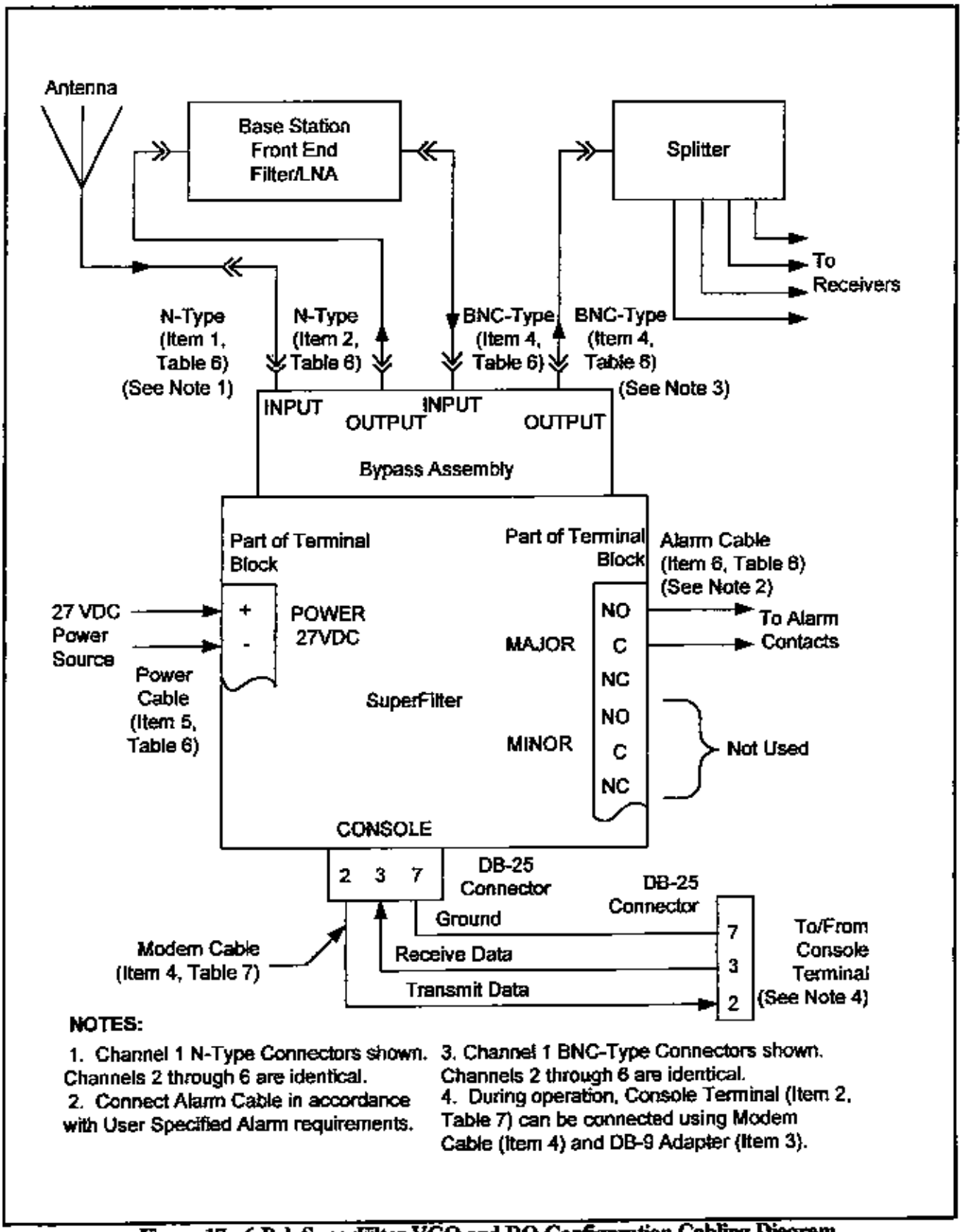
9.	On 2-Pak SuperFilters, repeat steps 1 through 5 then step 8 for channel 2.
10.	On 6-Pak SuperFilters, repeat steps 1 and 2, then steps 6 through 8 for the remaining antenna channels.
11.	At the conclusion of the RF cable connections to the SuperFilter, dress cables using nylon wire ties as required.



NOTES:

1. Channel 1 N-Type Connectors shown. Channel 2 is identical.
2. Connect Alarm Cable in accordance with User Specified Alarm requirements.
3. During operation, Console Terminal (Item 2, Table 7) can be connected using Modem Cable (Item 4) and DB-9 Adapter (Item 3).

Figure 16. 2-Pak SuperFilter VGO and RO Configuration Cabling Diagram



NOTES:

1. Channel 1 N-Type Connectors shown. Channels 2 through 6 are identical.
2. Connect Alarm Cable in accordance with User Specified Alarm requirements.
3. Channel 1 BNC-Type Connectors shown. Channels 2 through 6 are identical.
4. During operation, Console Terminal (Item 2, Table 7) can be connected using Modem Cable (Item 4) and DB-9 Adapter (Item 3).

Figure 17. 6-Pak SuperFilter VGO and RO Configuration Cabling Diagram

SuperFilter System State Verification

After completion of all SuperFilter installation procedures and functional checks verify the SuperFilter is in Normal Mode of operation. Proceed as follows:

Step No.	Procedure
1.	Type the following command at the Console Terminal: **STATE**<Enter>

NOTE
The Console Terminal display screen should look like the example shown in Figure 18.

2.	If the SuperFilter is in Bypass Mode, type the following command to return the SuperFilter to Normal Mode of operation: **(S)ET (F)ORCED (B)YPASS (OF)F**<Enter> Then type: **STATE**<Enter>
3.	Check the SuperFilter front panel. The READY Indicator is steady on green and the FAULT Indicator is off.
4.	With the STATE command issued, verify the SuperFilter is in System State Machine (SM) State: 7: Operating. This indicates the SuperFilter is operating normally. Record the displayed data on the Installation Data Record in Appendix D, then continue with procedures. If the cool-down process is completed and the System SM State does not read 7: Operating, call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.
5.	If a base station alarm system is in use perform Alarm Relay Installation. Otherwise, disconnect the Console Terminal from the SuperFilter, if desired.

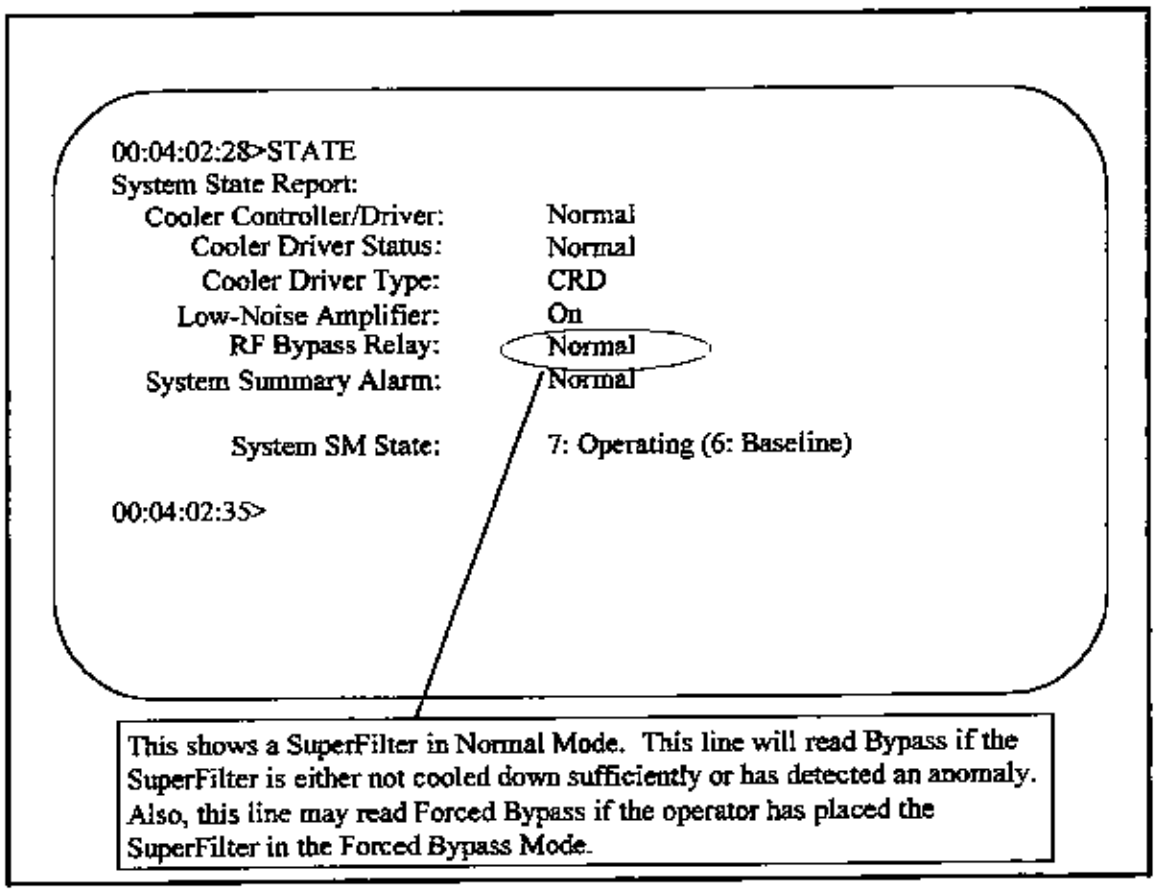


Figure 18. SuperFilter System State Verification

Alarm Relay Installation

Connecting the output of the SuperFilter MAJOR Alarm Relay to the base station alarm control unit is an option and is not required for SuperFilter operation. The Alarm Relay provides a warning alarm that can be remotely monitored. See Figure 19 for Alarm Relay in its normal and alarm state. To connect the SuperFilter Alarm Relay to the base station alarm control unit, proceed as follows:

Step No.	Procedure
1.	Some base station alarm systems require an open contact while others require a closed circuit. When making connections to the SuperFilter terminal block connections, select either the NO (normally open) or the NC (normally closed) terminal block connection. Determine which contacts to use by consulting the base station alarm system documentation for information.
2.	Connect 20-gauge duplex wire (24-gauge wire minimum) between the base station alarm control unit and the terminal block connections on the rear panel of the SuperFilter. The terminal block connections are labeled MAJOR NO, C, and NC. Dress wires.
3.	Type the following command at the Console Terminal: **(S)ET (F)ORCED (B)YPASS (ON)**<Enter>
4.	The SuperFilter READY Indicator will Slow Flash amber; the Alarm Relay is now placed in an alarm condition. Verify that the base station alarm system is activated.
5.	Type the following command at the Console Terminal: **(S)ET (F)ORCED (B)YPASS (OF)F**<Enter>

CAUTION

Ensure that the SET FORCED BYPASS OFF<Enter> command is typed at the Console Terminal. Otherwise, the SuperFilter will remain in the Bypass Mode, as indicated by the READY Indicator remaining in a Slow Flash amber state.

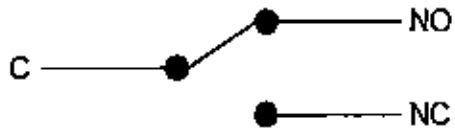
6.	The SuperFilter READY Indicator will be steady on green; the Alarm Relay is now placed in normal condition. Verify that the base station alarm system is no longer activated.
7.	If desired, disconnect the Console Terminal from the SuperFilter.

Alarm Relay Normal Operating Condition

NO = Open in normal operation
C = Common
NC = Closed in normal operation

Alarm Relay Fault Condition (Failure)

NO = Closed during fault condition
C = Common
NC = Open during fault condition



NOTES:

1. On all SuperFilter Models covered in this manual, the MINOR Alarm is not operational.
2. Alarm Relay, dry contacts, rated at 2 amps.

Figure 19. Alarm Relay in Normal and Alarm State

CHAPTER 6
TROUBLESHOOTING PROCEDURES

TROUBLESHOOTING

A problem may be caused by errors that occur during installation, or, by hardware or software failures that occur during operation.

Installation Troubleshooting

If a problem occurs during installation, re-checking the steps being performed may solve the problem. A few minutes spent in performing the following basic checks may eliminate time spent waiting for service or repair.

- Ensure that the SuperFilter was not left in a Forced Bypass Mode. If the SuperFilter is in the Forced Bypass Mode the SuperFilter READY indicator will Slow Flash amber. To return the SuperFilter to Normal Mode, perform the SuperFilter System State Verification Procedure in Chapter 5.
- Ensure that the SuperFilter is connected to a sufficient DC power source.
- Ensure that the DC power voltage is stable and within specifications.
- Inspect the fuse, located on the rear panel of the SuperFilter. Ensure that the fuse is good.
- Ensure that the SuperFilter Frequency Band matches the Base Station Operating Band.
- Ensure that the other equipment, cables, and connections are mated properly and operating correctly.
- If the problem persists, please call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.

Operation Troubleshooting

If a problem occurs during operation, the base station alarm system, the SuperFilter front panel indicators, or the base station performance statistics, such as voice signal quality may indicate the problem. Table 11 lists fault indications with probable cause and corrective actions that can be taken.

> **NOTE**
>
> All corrective actions described in the Table 11 Troubleshooting Procedures are accomplished with the SuperFilter covers in place. There are no user-serviceable components inside the SuperFilter. If the problem persists, please call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.

Table 11. Troubleshooting Procedures

Indication	Possible Cause	Corrective Action
Front Panel Indicators off; Alarm may be on	Input Power Drop out	Restore Power • Reset Circuit Breaker • Check/Replace Line Fuse • Check Power Supply • Check power cable
	Indicators failed	Connect Console Terminal in accordance with Appendix A. At Console Terminal, type the command: STATE. Verify that System is in System State 7. Call (800) 727-3648 extension 767, or (805) 683-7646 extension 767.
Alarm on; Front Panel Indicators show READY off and FAULT Steady On (Red)	Low Input Power condition	Restore Power (as above) Note: Alarm should be on with power failed.
	Cooling system fault	Call (800) 727-3648 extension 767, or (805) 683-7646 extension 767.
	LNA power fault	Call (800) 727-3648 extension 767, or (805) 683-7646 extension 767.
Front Panel READY Indicator shows Slow Flash* (Amber)	Operator set "Forced Bypass On"	Return SuperFilter to Normal Mode of operation. Perform SuperFilter System State Verification procedure, Chapter 5.
Front Panel FAULT Indicator shows Fast Flash* (Red)	Power restored after power outage; SuperFilter is cooling down normally after power up	Wait for unit to cool, may take up to 5 hours. If after 5 hours the indicators do not show READY on and FAULT off; call (800) 727-3648 extension 767, or (805) 683-7646 extension 767.
Calls are not processing on one channel; no alarm; Front Panel Indicators show READY Steady On (Green) and FAULT off	RF signal path in one of SuperFilter channels is open	Connect Console Terminal in accordance with Appendix A. At Console Terminal, type the command: (S)ET (F)ORCED (B)YPASS (ON)<Enter> If the problem clears, call (800) 727-3648 extension 767, or (805) 683-7646 extension 767. If the problem remains, the fault is outside the SuperFilter; check the cables and base station equipment.
* Note: Fast Flash is twice per second, Slow Flash is once per second.		

Analysis of SuperFilter Operational Parameters

STI Customer Service accomplishes the analysis of SuperFilter operational parameters. To facilitate the trouble analysis process, please provide the current SuperFilter operational parameters to STI.

Step No.	Procedure
1.	Connect the Console Terminal to the SuperFilter in accordance with instructions in Appendix A.
2.	Type CLS<Enter> command. Observe the Console Terminal screen. Record operational parameters in space provided on blank CLS display in Installation Data Record, Appendix D.
3.	Type STATE<Enter> command. Observe the Console Terminal screen. Record operational parameters in space provided on blank STATE display in Installation Data Record, Appendix D.
4.	Type TEMP<Enter> command. Observe the Console Terminal screen. Record operational parameters in space provided on blank TEMP display in Installation Data Record, Appendix D.
5.	Type LOOP<Enter> command. Observe the Console Terminal screen. Record operational parameters in space provided on blank LOOP display in Installation Data Record, Appendix D.
6.	Type NSP<Enter> command. Observe the Console Terminal screen. Record operational parameters in space provided on blank NSP display in Installation Data Record, Appendix D.
7.	Call STI at (800) 727-3648 extension 767, or (805) 683-7646 extension 767 with completed Installation Data Record. STI Customer Service will provide analysis and insight into the probable cause and corrective action.

CHAPTER 7
PERIODIC VISUAL INSPECTION

PERIODIC VISUAL INSPECTION PROCEDURES

The SuperFilter cryogenic cooling system is sealed and the electronic circuits are solid state, therefore, no maintenance is required. However, the following periodic visual inspection steps are suggested. The frequency of periodic visual inspections depends on the installation site conditions. The following periodic visual inspections are offered as a guide, allowing the site circumstances to modify the procedure.

Periodically inspect the SuperFilter for the following:

- Look for loose electrical connections and loose components on rear panel of SuperFilter.
- Look for frayed input power wires.
- Look for damaged RF cables.
- Check the front panel indicators. When the SuperFilter is in the Normal Mode of operation, the READY LED should be lit (on, green) and the FAULT LED should be un-lit (off). When the SuperFilter is in the Bypass Mode of operation, the READY LED should be un-lit and the FAULT LED should be lit (red).
- Check that mounting hardware is tight and the SuperFilter is securely mounted.
- Check that ventilation spaces in front and in back of the SuperFilter are clear.
- Feel for cooling air exiting the rear of the chassis. The fans run continuously and a steady flow of air should be evident.
- Inspect the air filter elements for dust and dirt accumulation that would impede the flow of air. If necessary, clean with a vacuum cleaner or brush. Frequency of cleaning depends upon the air quality of the site. (There are two air filter elements, both are located behind the front panel display plate.)

APPENDIX A
SUPERFILTER COMMUNICATION

SUPERFILTER /USER INTERFACE

This appendix provides Console Terminal connection and operation procedures and describes the operational commands that appear on the Console Terminal screen.

Console Connection and Operation

The operational parameters of the SuperFilter can be monitored using a "Terminal" or Personal Computer (PC). The CONSOLE connector on the rear panel of the SuperFilter is a serial port wired as a DCE-type RS-232 interface. A connection can be made to any ANSI-compatible "dumb" terminal or terminal emulator with an off-the-shelf Modem Cable. The following terminal and terminal emulator programs have been used successfully. For more information, call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.

- DEC VT 220 and 320 "dumb" terminals
- IBM PC-compatible computers running "Terminal" in Windows 3.1, or "HyperTerminal" in Windows 95/98 or communications software such as, ProComm or Mirror
- Macintosh computers running "Reflection2+".

Equipment required to monitor the SuperFilter operational parameters is listed in Table 12. A typical test setup diagram is shown in Figure 20.

Table 12. Console Operation Equipment Required

Item No.	Test Equipment	Notes
1	PC with serial port (set for 19.2 K Baud, No parity, 8 bits data, 1 stop bit [N.8.1])	Used with Terminal Emulation software for control of the SuperFilter (e.g. HyperTerminal).
2	DB-25 Female to DB-9 Female Connector Adapter (Cable)	Adapts the PC terminal serial port to the Modem Cable.
3	Modem Cable, DB-25 Male Connector to DB-25 Male Connector (25 feet)	Used to connect the Console Terminal to the SuperFilter.

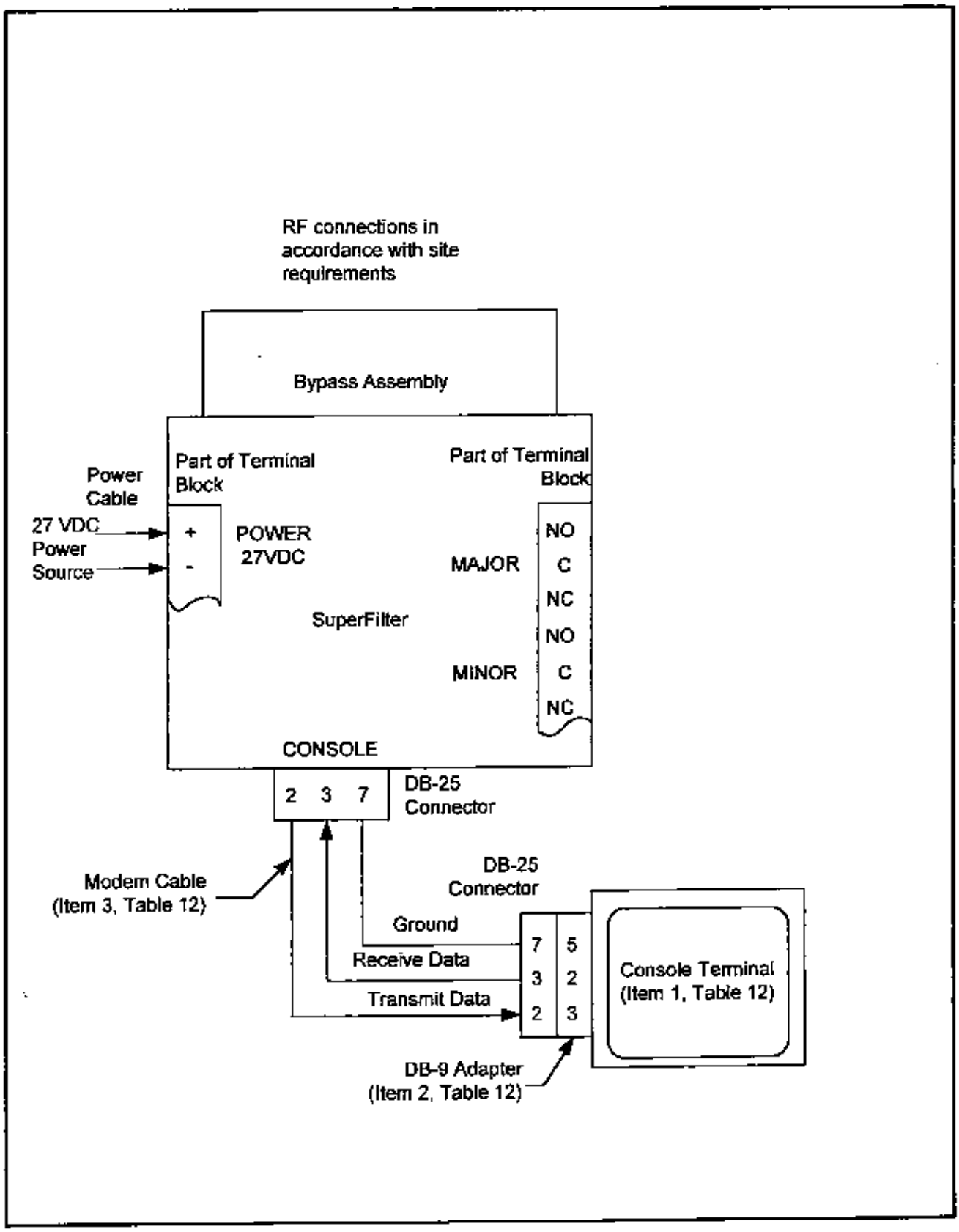


Figure 20. Console Terminal Connection

To check the operational parameters of the SuperFilter, proceed as follows:

Step No.	Procedure
1.	Configure the Console Terminal interface to run at 19,200 Baud, 8 bits, no parity, 1 stop bit.
2.	Use the Modem Cable and Adapter to connect the Console Terminal to the CONSOLE connector on the rear panel of the SuperFilter.
3.	Turn on the Console Terminal. Press Enter or Return on the Console Terminal to display a prompt similar to the following: 3:12:34:16>

NOTE

The displayed prompt indicates the number of Days:Hours:Minutes:Seconds the system has been running since its most recent power-up. In the above example, the system indicates it has been running for 3 days, 12 hours, 34 minutes, and 16 seconds. The prompt is not continually updated; the elapsed time is updated only upon completion of a given command and the user is prompted again.

NOTE

Table 13 is a list of commands, the command mnemonic, and a brief description of the command.

4.	In order to assess the operational status of the SuperFilter issue the following command: **STATE**<Enter>
5.	The Console Terminal display screen should show a System State Report like the example shown in Figure 21.
6.	With the STATE command issued, verify the SuperFilter is in System State Machine (SM) State: 7: Operating. This indicates the SuperFilter is operating normally. If System SM State does not read 7: Operating, call (800) 727-3648 extension 767, or (805) 683-7646 extension 767.

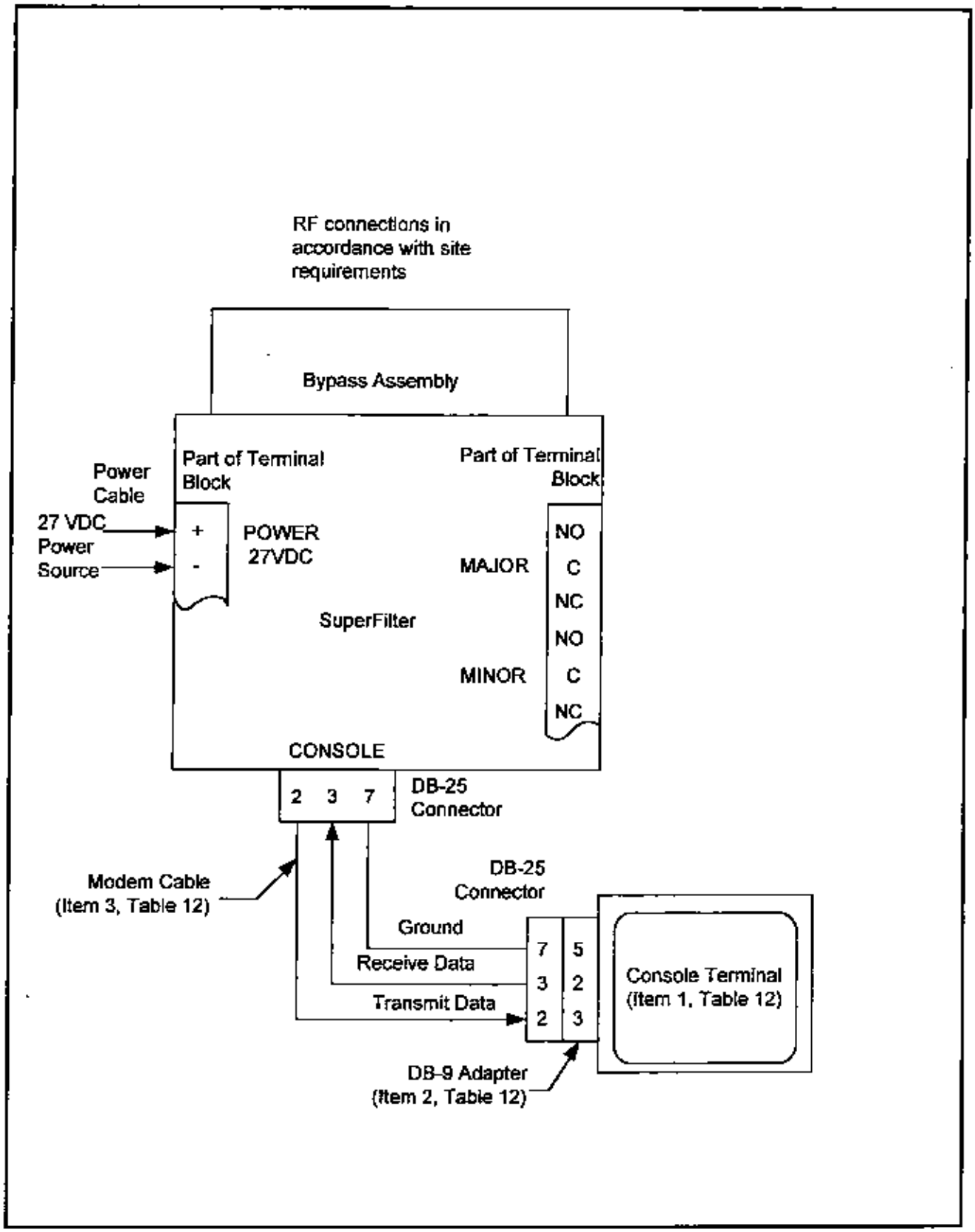


Figure 20. Console Terminal Connection

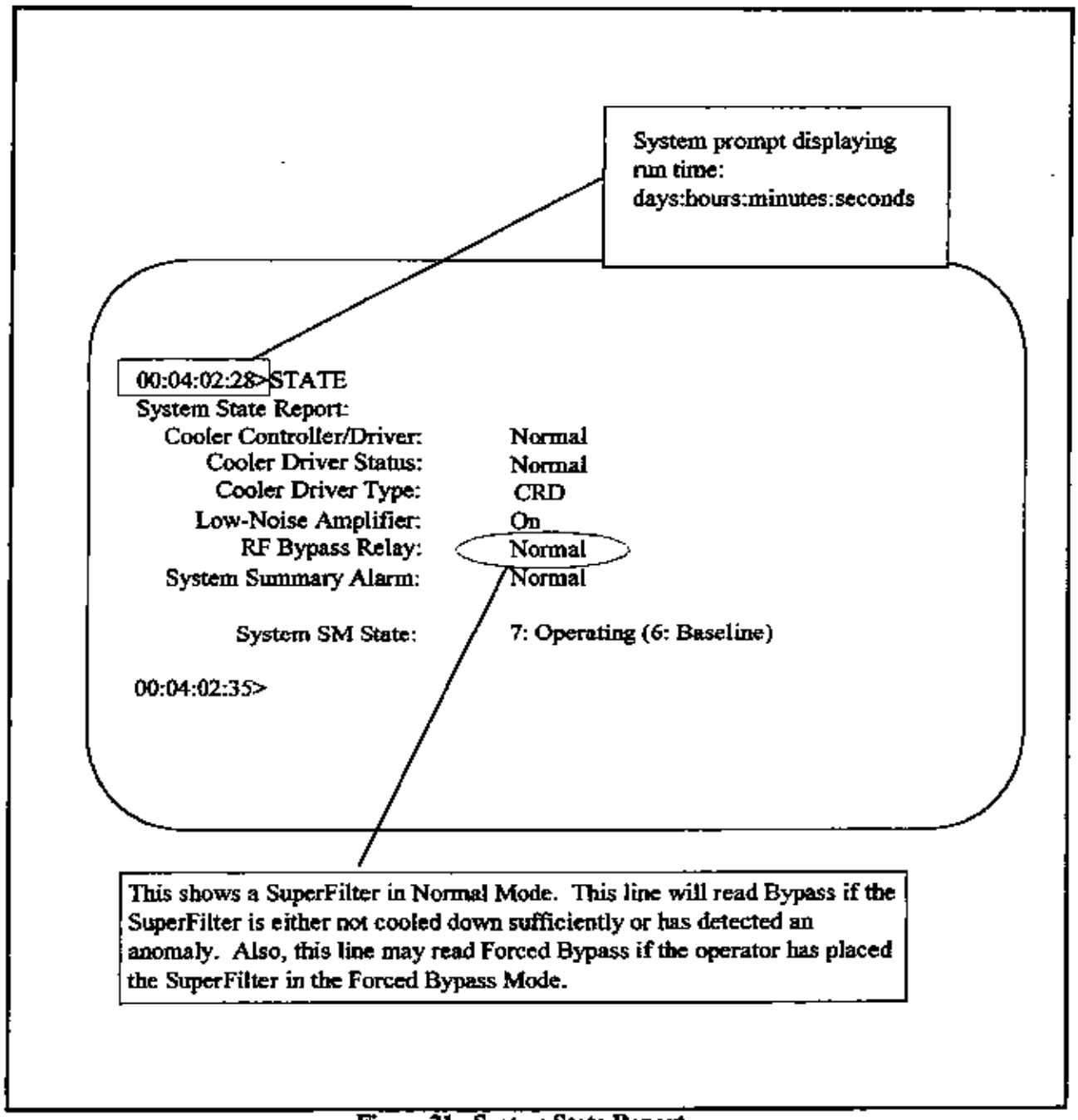


Figure 21. System State Report

Table 13. SuperFilter Commands

Command	Mnemonic	Description
Clear Screen	(CL)S	Clear the console screen
Loop	(L)oop	Display the temperature loop control parameters
Set Point	(N)sp	Dump Non-volatile set point parameters
State	(ST)ate	Dump filter subsystem state data
Temperature	(T)emperature	Display temperatures measured within the Filter - Amplifier (in Kelvin).
Forced Bypass	(S)ET (F)ORCED (B)YPASS (O)N	Places the SuperFilter in the Forced Bypass State until removed from that state by the operator.
Forced Bypass	(S)ET (F)ORCED (B)YPASS (O)FF	Removes the SuperFilter from the Forced Bypass State and returns it to the Normal Mode of operation.
Note: Parentheses in the Mnemonic Column indicates an abbreviated form of the command syntax. Commands may be abbreviated, if desired to the first few characters, and usually just the first character if desired. For example, `TEMP` could be abbreviated `T` and `STATE` could be abbreviated with `ST`.		

Command Descriptions

Each command is described in more detail in the following paragraphs. In each of the commands, the following convention is used:

- Items in [] denote options: they may be included or excluded
- Items in {}, e.g. {+|-} denote a choice: type '+' or '-'
- Signed values, e.g. +3 or -5 denote CHANGES from the current value.
- Unsigned values, e.g. =46, are treated as ABSOLUTE

CLS

Typing `CLS` provides the user with a display of the system identification details. A typical display is as follows:

```
Superconductor Technologies Inc.
Superfilter - 6000
S/W Version          07/05/00
1.0.6.0-B

User ID:             STI TEST W/ILNA/PIEZO
System:              S00665
Cooler:              HC00651
Dewar:               D00567
Bypass:              225
```

State

Typing STATE provides the user with a display of the internal state of the filter subsystem. A typical display is as follows:

```
System State Report:
  Cooler Controller/Driver:     Normal
  Cooler Driver Status:         Normal
  Cooler Driver Type:           CRD
  Low-Noise Amplifier:          On
  RF Bypass Relay:              Normal
  System Summary Alarm:         Normal

  System SM State:              7:Operating (6:Baseline)
```

The meaning of each line is described as follows:

Cooler Controller/Driver: The line labeled 'Cooler Controller/Driver:' indicates the state of the controller & cooler driver chain. Its valid states can be one of {Normal/Off/Reset}.

Cooler Driver Status: The line labeled 'Cooler Driver Status:' indicates the state of the cooler driver. Its valid states can be one of {Normal/Fault}.

Cooler Driver Type: The line labeled 'Cooler Driver Type:' indicates which of the two types of technology are in use: pulse width modulation (PWM) or cost reduction (CRD) voltage control. Its valid states can be one of {PWM/CRD}.

Low-Noise Amplifier: The line labeled 'Low Noise Amplifier:' indicates whether power is applied to the amplifier or not. Its valid state can be one of {On/Off} and is normally controlled by the system state machine.

RF Bypass: The line labeled 'RF Bypass:' indicates whether the HTS filter subsystem is in the main RF path or not. Its valid states can be one of {Normal/Bypass/Forced} and is normally controller by the system state machine. The operator may place the SuperFilter in the Forced Bypass State using the Console Terminal.

System Summary Alarm: The line labeled 'System Summary Alarm:' indicates whether the system is experiencing an alarm or not. Its valid states can be one of {Normal/Fault}.

System SM State: The line labeled 'System SM State:' indicates the current state of the system state machine; the previous state is indicated in parenthesis. A list of possible states and a brief explanation of each is in Table 14. When the SuperFilter is placed in a Forced Bypass State the READY Indicator will Slow Flash AMBER in all states.

Table 14. System State Machine

State No.	State Name	Bypass Relay State	Indicators		Description
			FAULT	READY	
0	Initialize	Bypass	On **	Off **	Initial Power Up State
1	Idle	Bypass	On RED	Off	Cold stage is warm, Dewar is not cooling
2	Coarse Cool-down	Bypass	Flash Fast * RED	Off	Cooling, cold stage is above 85 K
3	Fine Cool-down	Bypass	Flash Fast * RED	Flash Slow * GREEN	Cooling, cold stage is below 85 K
4	Over shoot	Bypass	Flash Fast * RED	Flash Fast * GREEN	Cold stage is cooler than set point (nominally 78 K) and the control algorithm integrator is settling
5	Settle	Normal	Flash Fast * RED	Flash Fast * GREEN	Cold stage temperature is settling, circuits are switched to Normal
6	Baseline	Normal	Off	On GREEN	Cold stage temperature has settled and baseline data is being collected
7	Operating	Normal	Off	On GREEN	System is operating normally and being checked for deviations from the baseline
8	Fault	Bypass	On RED	Off	Alarm relay is switched on

Note: * = Fast Flash is twice per second, Slow Flash is once per second.
** = On power up, both FAULT and READY Indicators will momentarily illuminate AMBER during System State zero (0).

Temp

Typing `TEMP` provides the user with a display of the various temperatures within the filter subsystem. A typical display is as follows:

```
System Temperature Report:
                    #1        #2        #3        #4        #5        #6
Cold Stage:          80.91K
NR Cold Finger:      80.20K
WR Cold Finger:      81K

Motor Temp:          28.3C
Ambient Temp:       +27C
```

Temperature sensing in the filter subsystem is done in two ways:

1. A wide-range, low resolution temperature sensor (the WR Cold Finger temp sensor)
2. Narrow-range, high resolution temperature sensors (NR Cold Finger sensor and the Cold Stage temp sensors)

This approach allows the system to achieve its impressive temperature stability and control, while still providing some visibility into the cool-down process.

To track the temperature during cool-down observe the WR Cold Finger sensor. When the system temperature reads approximately 85K, as indicated by the WR Cold Finger sensor, then rely on the Cold Finger and Cold Stage sensors.

A more detailed description of each line is as follows:

Cold Stage: The line labeled 'Cold Stage:' indicates the operating temperature of the cold-stage as seen by the two cold-stage temperature sensors. A slight difference in temperature reading between these two is normal, due to the relative location of the sensor on the cold-stage itself, and of the finite calibration accuracy of the sensors.

NR Cold Finger: The line labeled 'NR Cold Finger:' indicates the operating temperature of the cold-finger (at the dewar-side). Its valid range is 65k-83k. Temperatures warmer than 83k simply indicate 87k. In this case, consult the 'WR Cold Finger' temperature to determine how far out of range the system is from the system operating temperature.

WR Cold Finger: The line labeled 'WR Cold Finger' provides a low-resolution, wide range indication of the cold-finger temperature, and is the principle indicator used to monitor the cool-down progress.

Motor Temp: The line labeled 'Motor Temp' indicates the temperature of the cooler's heat exchanger in degrees C. Normally, this temperature will be warmer than the ambient temperature by a factor of 5°C to 15°C depending upon how hard the cooler is being driven.

Ambient Temp: The line labeled 'Ambient Temp' indicates the temperature of the controller board in degrees C. Normally this temperature is about 5°C higher than the outside ambient temperature.

Loop

Typing `LOOP` provides the user with a display of the internal state of the cooler subsystem. A typical display is as follows:

```
System Control-Loop Status Report:
                    #1        #2        #3        #4        #5        #6
System Error:         +.02V

Cooler V (RMS):      68V
Supply Voltage:      27.1V
Back Off Count:       0
  DAC Back Off:      300
  (Int)LNA I(mA):    101
  (Ext)LNA I(mA):      0
```

A description of each line in LOOP status report is as follows:

System Error: The line labeled 'System Error' indicates a voltage within the range of -5.1V to 5.1V and corresponds to the output of the PID (Proportional-Integral-Derivative) cold-stage temperature controller. A positive voltage corresponds to the PID controller commanding the cold-finger (via the cooler) to "get warmer"; Similarly, a negative voltage corresponds a "get colder" command. During cool-down, this voltage will be at the negative rail (around -5V). When the system has reached operating temperature, this voltage will be around 0 volts, and will change depending upon the subsystem ambient temperature (hotter ambient temperatures induce more of a heat-load on the system which requires the cold finger to get colder, which is indicated by a less positive number).

Cooler V (RMS): The line labeled 'Cooler V (RMS)' indicates the RMS value of the drive voltage to the cooler. On some SuperFilter systems this line is labeled 'Cooler I (RMS)' which indicates the RMS value of the drive current to the cooler.

Supply Voltage: The line labeled 'Supply Voltage' indicates the line voltage at the input to the filter subsystem.

Back-off Count: The line labeled 'Back-off Count' is an STI diagnostic which indicates the amount the maximum cooler drive is 'Backed off' due to the cooler over-stroke detector. The cooler cannot be driven at full input power in all conditions. For example, when initially cooling down from room temperature, the maximum power that can be delivered to the cooler will be a relatively low value, then gradually increase as the cold-finger temperature decreases. If one tries to drive the cooler at full power, the cooler will over-stroke. The controller monitors the cooler for potential over-stroke conditions and "backs off" the drive. This value displayed is a relative amount the controller has "backed off" the maximum cooler drive: A value of 0 indicates no back-off has occurred. Higher numbers indicate correspondingly less maximum drive is available to the cooler.

DAC Back Off: The line labeled 'DAC Back Off' is a factory set value.

(Int)LNA I(mA): The line labeled '(Int)LNA I(mA)' is a display for the current monitoring circuit associated with the Low-Noise Amplifiers in the Core. If the current draw changes from the initial set value by $\pm$ 20%, then this circuit will declare a fault, set the alarm relay, and switch the system into Bypass Mode.

(Ext)LNA I(mA): Applies to Replacement Option or Extra Gain Option only which have additional "warm" LNA's mounted in the Bypass Assembly. The line labeled '(Ext)LNA I(mA)' is a display for the current monitoring circuit associated with the Low-Noise Amplifiers in the Bypass Assembly (Replacement or Extra Gain bypass options). If the current draw changes from the initial set value by $\pm$ 20%, then this circuit will declare a fault, switch to System State 8, set the alarm relay, and switch the system into Bypass Mode.

NSP

Typing `NSP` provides the user with a display of the non-volatile set-point storage values from within the system. Normally, NSP is used by the STI Customer Service Department for diagnostic purposes. A typical display is as follows:

```
NSP Contents Report:
                    #1          #2          #3          #4          #5          #6
Cold Stage:         158
Cooler Offset:      165
Osc. Divisor:       0520
Switch:             08
```

On this screen, the numbers indicated are relative values, are in the range of 0-255 (except the Oscillator Divisor has a range from 0-4095), and are the relative set-points of the various parameters indicated. For example:

Cold Stage: The line labeled 'Cold Stage:' indicates the relative set-point for the cold-stage temperature. A larger number indicates a warmer temperature.

Cooler Offset: The line labeled 'Cooler Offset:' indicates the relative amount of nominal temperature difference between the cold stage and the cold finger. A larger number indicates a larger temperature difference.

Osc Divisor: The line labeled 'Osc. Divisor:' indicates the divisor used to reduce an internal 2MHz clock signal down to the cooler operating frequency, nominally 60Hz.

Switch: The line labeled 'Switch:' indicates the state of some internal digital nodes and is for STI diagnostic purposes only.

APPENDIX B
PACKAGING FOR SHIPMENT

PACKAGING FOR RETURN SHIPMENT

The SuperFilter may be returned to STI for incorporation of an optional feature, upgrade to a newer model, or repair. All upgrade or repair activity is accomplished at STI's facility.

Prior to returning a SuperFilter, contact STI for a Return Material Authorization (RMA) number. When requesting an RMA number, provide the model number, serial number, and as much information as possible about the return. After a return has been approved, an RMA number will be issued. The RMA number must be marked on the shipping container as shown in Figure 22.

SuperFilter Packaging Procedure

The SuperFilter is boxed for shipping with cutout protective foam packing. Re-use the original shipping container and the cutout protective foam packing.

To pack the SuperFilter, proceed as follows:

Step No.	Procedure
1.	Obtain shipping container from storage area. If necessary, obtain a new shipping container and cutout protective foam packing by calling STI at (800) 727-3648, extension 767 or (805) 683-7646, extension 767.
2.	Remove Rack Mount Brackets. Place attaching hardware in plastic bags. Retain Rack Mount Brackets and attaching hardware.

CAUTION

The SuperFilter contains components that are subject to damage from electrostatic discharge (ESD). Take precautionary measures when handling components mounted on the rear panel of the SuperFilter.

3.	Obtain plastic dust covers from shipping container. Install dust covers on RF connectors.
4.	Enclose SuperFilter in plastic bag.

NOTE

Prior to packaging, observe the foam packing material for the SuperFilter left side. On 6-Pak SuperFilter VGO and RO models, model part numbers that end with RV60 and RR63, two small sections of foam packing material have been removed from the foam packing material on the SuperFilter left side. This is done to allow space for the Bypass Assembly. See Figure 20, Detail A (two places).

Step No.	Procedure
5.	Install foam packing material along the right side of the SuperFilter, the side with the fuse. Only one of the two foam packing materials will fit, it has a cutout to accommodate the fuse. Check to ensure that the rear support block is fully engaged above the fuse. See Figure 23, Detail B.
6.	Install the other foam packing material along the left side of the SuperFilter. Check to ensure that the rear support block is fully engaged against the chassis behind the Bypass Assembly. See Figure 23, Detail C.

WARNING

The un-boxed SuperFilter weighs between 50-60 pounds, depending upon configuration. To prevent injury to personnel and damage to equipment, it is recommended that two people are available for packing the SuperFilter.

7.	Lift the SuperFilter into the shipping container.
8.	Protect the RF connectors at the rear of the SuperFilter with packing material.
9.	Place foam packing material on top of SuperFilter.

NOTE

The SuperFilter contains a small amount of compressed helium. In order to ship the unit, the shipper must fill out a Shipper's Declaration for Dangerous Goods form and affix both a Compressed Helium Label and a Non-Flammable Gas Label to the outside of the shipping container. For assistance in obtaining and filling out forms, call STI at (800) 727-3648, extension 767 or (805) 683-7646, extension 767.

10.	Fill out a Shipper's Declaration for Dangerous Goods form and affix the form to the outside of the shipping container. See Figure 22.

NOTE

The Compressed Helium Label, Non-Flammable Gas Label, and the shipping address label must be affixed to the same side of the shipping container.

11.	Affix a Compressed Helium Label and a Non-Flammable Gas Label to the outside of the shipping container. Also, include the RMA number on the outside of the shipping container. See Figure 22.
12.	Seal shipping container. Ship container prepaid and insured in accordance with your company policy to STI's facility.

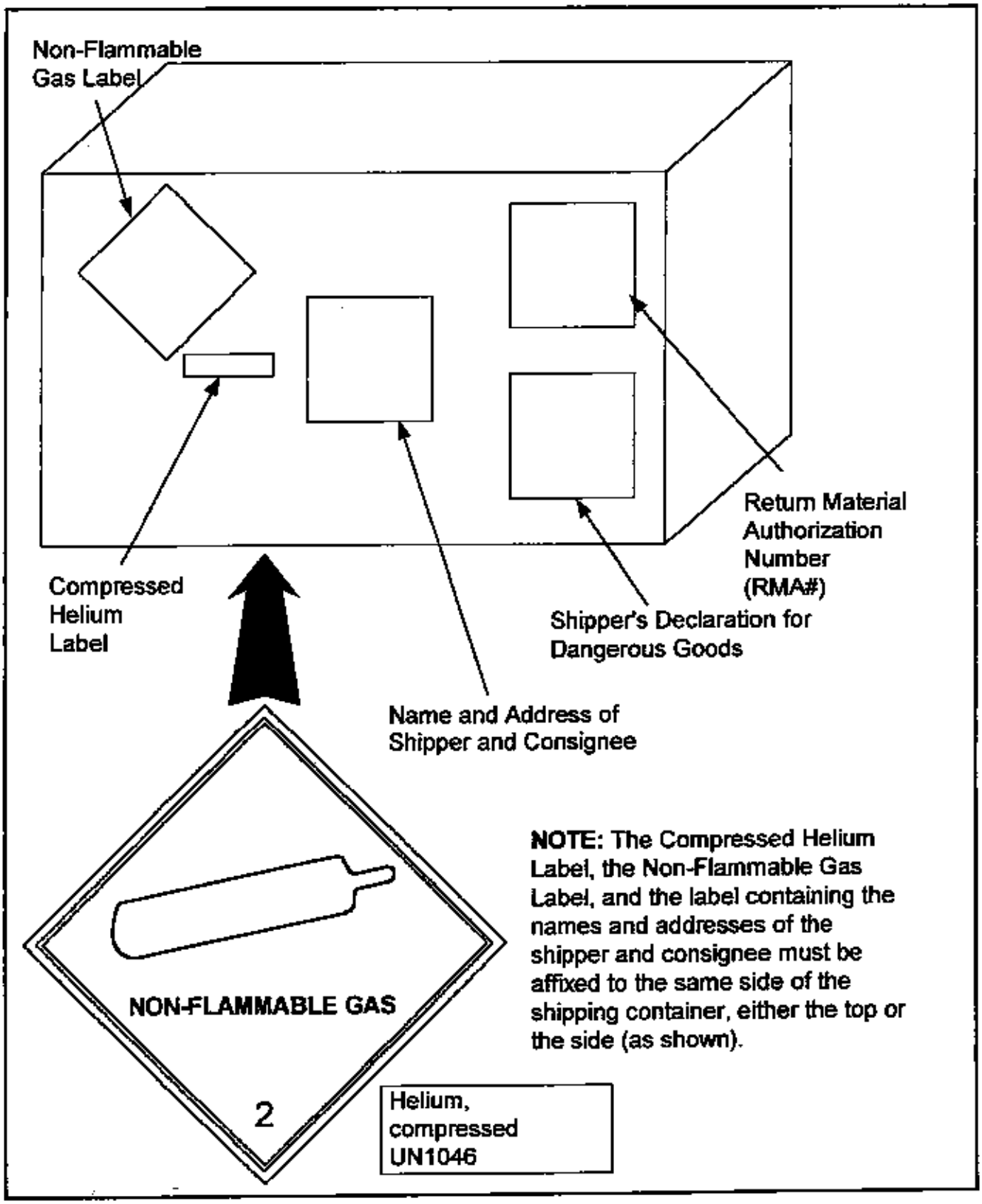


Figure 22. Outer Packaging Marking and Labeling Requirements

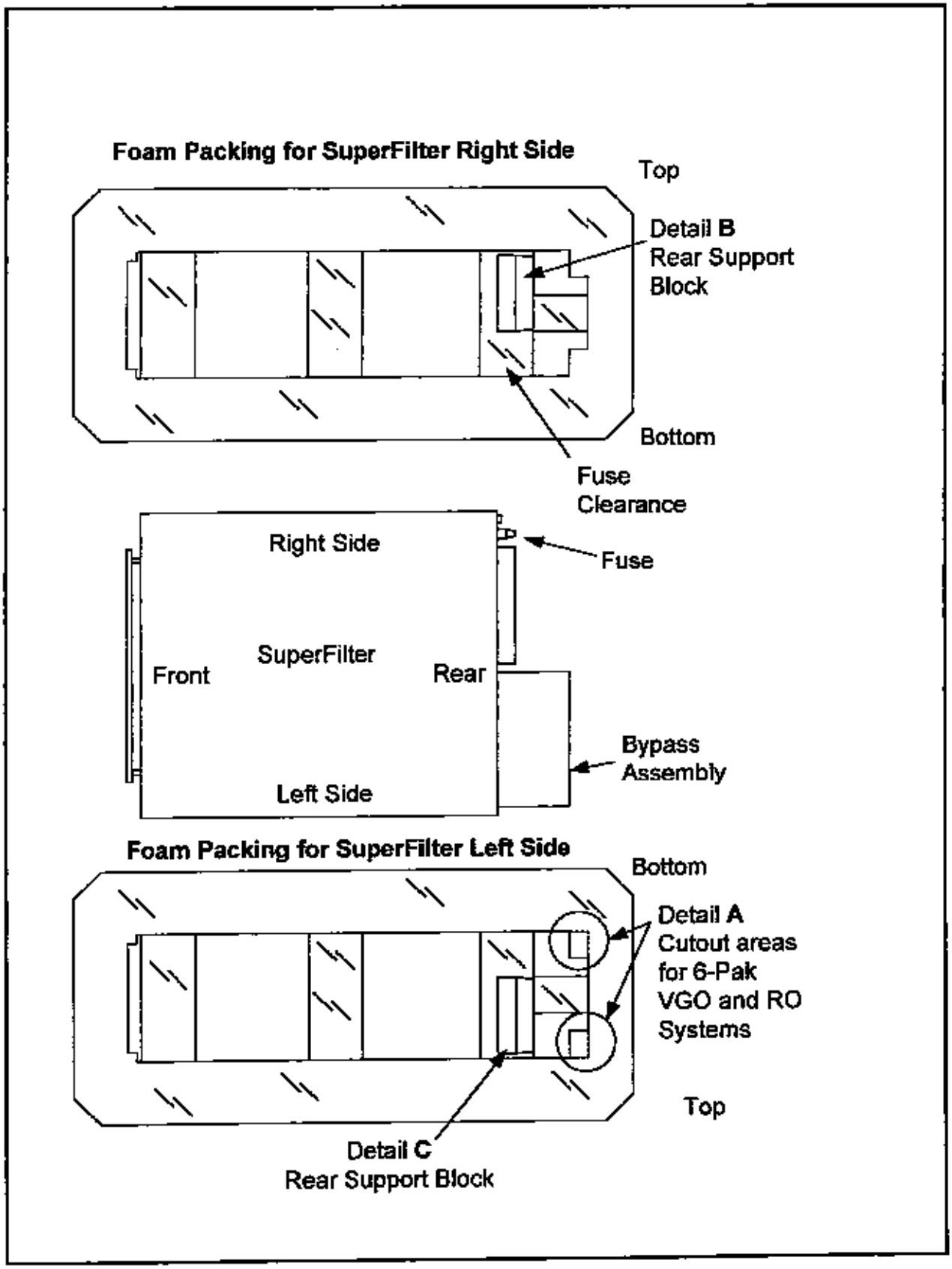


Figure 23. SuperFilter Foam Packaging Installation

APPENDIX C
QUICK INSTALLATION GUIDE

QUICK INSTALLATION GUIDE

Chapter 5 contains the STI recommended SuperFilter installation and checkout procedures. Not following the procedures outline in Chapter 5 increases the possibility of a failed installation resulting in base station downtime. The quick installation guide is provided to present an alternative set of installation instructions when the recommended procedures contained in Chapter 5 cannot be performed. It is not the intent of STI to endorse the quick installation guide as a direct replacement for the STI recommended SuperFilter installation and checkout procedures.

Step No.	Procedure
1.	Install Rack Mount Brackets on SuperFilter. See Figure 8.
2.	Mount SuperFilter in equipment rack.
3.	Set the power source circuit breaker to open or off position.
4.	Run the power cable from the base station power distribution circuit breaker box to the terminal block on the rear panel of the SuperFilter. The terminal block connections are labeled POWER 27VDC + and - . See Figure 9.
5.	Connect the wires at each end, taking care to maintain the correct voltage polarity.
6.	Apply power to the SuperFilter by setting the power source circuit breaker to the closed or on position.

NOTE

Initially, both LED's on the front panel of the SuperFilter will flash amber. The READY LED will then go out. Then, the FAULT LED will illuminate red, which is normal. After a couple of minutes, the FAULT LED will begin to Fast Flash* red. The SuperFilter is beginning to cool down.

The SuperFilter is in Bypass Mode during the cool-down process. RF cable connections can be made to the SuperFilter at this time. The RF signals will "bypass" the SuperFilter until the cool-down process is completed.

CAUTION

In step 7, work with only one RF receiver channel at a time. After the first RF channel is connected, re-check those connections to verify correctness. An improper connection could cause the sector to go down when integrating the diversity channel.

7.	Working with one RF receiver channel at a time, perform RF connections to SuperFilter as shown in Figure 15 (Cascade), Figure 16 (2-Pak VGO and RO), or Figure 17 (6-Pak VGO and RO).

NOTE

During the cool down process, the READY LED will begin to Slow Flash* green. The cool down sequence progresses through eight stages, which are indicated by different patterns of flashing red and green LED's. Refer to Table 9.

Initial cooling of the SuperFilter takes 3 to 5 hours. When the SuperFilter cryogenic chamber has reached operating temperature (~78 K), the green LED will stay on and the red LED will stay off.

Step No.	Procedure
8.	The SuperFilter will automatically switch from Bypass Mode to Normal Mode when it has cooled. If the SuperFilter fails to go into Normal Mode within 5 hours, as indicated by the steady green READY LED on the SuperFilter front panel, call (800) 727-3648 extension 767, or (805) 683-7646, extension 767.
9.	If desired, connect the output of the SuperFilter MAJOR Alarm Relay to the base station alarm control unit. Some base station alarm systems require open contact while others require a closed circuit. When making connections to the SuperFilter terminal block connections, select either the NO (normally open) or the NC (normally closed) terminal block connection. Consult base station alarm system documentation for information. See Figure 19.
10.	Connect 20-gauge duplex wire (24-gauge wire minimum) between the base station alarm control unit and the terminal block connections on the rear panel of the SuperFilter. The terminal block connections are labeled MAJOR NO, C, and NC. Dress wires. See Figure 9.
Note: * = Fast Flash is twice per second, Slow Flash is once per second.	

APPENDIX D
INSTALLATION DATA RECORD

INSTALLATION DATA RECORD

Measurements and observations made during the installation and checkout process outlined in Chapter 5 may be recorded on the Installation Data Record. Recording these key data elements can provide the user with an installation baseline of equipment performance. In the event of a base station failure, this data will prove to be useful to STI Customer Service personnel in providing valuable troubleshooting assistance, thereby reducing equipment downtime.

SuperFilter
Installation Data Record

Location: _____ _____

Installed By: _____ SuperFilter Model No. _____

Date: _____ SuperFilter Serial No. _____

Applies To All SuperFilter Systems

- Prime Input Power Verification (+27 VDC)

SuperFilter Terminal Block	Measurement	Spec.	Pass/Fail
Voltage		27 VDC ± 2 V	

- Operation Status Check

Console Command 'State' data display	Observation	Spec.	Pass/Fail
`Cooler Controller/Driver:`		`Normal`	
`Cooler Driver Status:`		`Normal`	
`Cooler Driver Type:`		CRD	
`Low-Noise Amplifier:`		On	
`RF Bypass Relay:`		`Normal`	
`System Summary Alarm:`		`Normal`	
`System SM State:`		`7: Operating (6: Baseline)`	

- Alarm Relay Test

SuperFilter State Command and Signal Path	Measurement	Spec.	Pass/Fail
Bypass: NO to C contact resistance (Alarm)		R < 10 Ohms	
Bypass: NC to C contact resistance (Alarm)		R > 10,000 Ohms	
Normal: NO to C contact resistance (Normal)		R > 10,000 Ohms	
Normal: NC to C contact resistance (Normal)		R < 10 Ohms	

- Test Generator Calibration Data

Signal Generator Output	Measurement	Spec.	Pass/Fail
Frequency		830 MHz ± 3 MHz, A Band, or 840 MHz ± 3 MHz, B Band	
Reference Level	(RL)	-50 dBm ± 1 dB	

SuperFilter
Installation Data Record (Continued)

Applies To Cascade and VGO Configured SuperFilter Systems

- SuperFilter Preamplifier Channel Data

Test	Measurement (A)	Calculation (A-RL)	Spec.	Pass/Fail
Channel 1 Bypass Loss			-1 dB ± 1 dB	
Channel 1 Gain			+13 dB ± 2 dB	
Channel 2 Bypass Loss			-1 dB ± 1 dB	
Channel 2 Gain			+13 dB ± 2 dB	
(Continue recording values for 6-Pak SuperFilter Systems)				
Channel 3 Bypass Loss			-1 dB ± 1 dB	
Channel 3 Gain			+13 dB ± 2 dB	
Channel 4 Bypass Loss			-1 dB ± 1 dB	
Channel 4 Gain			+13 dB ± 2 dB	
Channel 5 Bypass Loss			-1 dB ± 1 dB	
Channel 5 Gain			+13 dB ± 2 dB	
Channel 6 Bypass Loss			-1 dB ± 1 dB	
Channel 6 Gain			+13 dB ± 2 dB	

Applies To RO Configured SuperFilter Systems

- SuperFilter Preamplifier Channel Data

Test	Measurement (A)	Calculation (A-RL)	Spec.	Pass/Fail
Channel 1 Bypass Loss			-1 dB ± 1 dB	
Channel 1 Gain			+25 dB ± 2 dB	
Channel 2 Bypass Loss			-1 dB ± 1 dB	
Channel 2 Gain			+25 dB ± 2 dB	
(Continue recording values for 6-Pak SuperFilter Systems)				
Channel 3 Bypass Loss			-1 dB ± 1 dB	
Channel 3 Gain			+25 dB ± 2 dB	
Channel 4 Bypass Loss			-1 dB ± 1 dB	
Channel 4 Gain			+25 dB ± 2 dB	
Channel 5 Bypass Loss			-1 dB ± 1 dB	
Channel 5 Gain			+25 dB ± 2 dB	
Channel 6 Bypass Loss			-1 dB ± 1 dB	
Channel 6 Gain			+25 dB ± 2 dB	

SuperFilter Operational Parameters

- CLS Display

Superconductor Technologies Inc.	
Superfilter - 6000	
S/W Version	
User ID:	
System:	
Cooler:	
Dewar:	
Bypass:	

- STATE Display

System State Report:	
Cooler Controller/Driver:	
Cooler Driver Status:	
Cooler Driver Type:	
Low-Noise Amplifier:	
RF Bypass Relay:	
System Summary Alarm:	
System SM State:	

- TEMP Display

System Temperature Report:						
	#1	#2	#3	#4	#5	#6
Cold Stage:						
NR Cold Finger:						
WR Cold Finger:						
Motor Temp:						
Ambient Temp:						

- LOOP Display

System Control-Loop Status Report:						
	#1	#2	#3	#4	#5	#6
System Error:						
Cooler V (RMS):						
Supply Voltage:						
Back Off Count:						
DAC Back Off:						
(Int)LNA I(mA):						
(Ext)LNA I(mA):						

- NSP Display

NSP Contents Report:						
	#1	#2	#3	#4	#5	#6
Cold Stage:						
Cooler Offset:						
Osc. Divisor:						
Switch:						

SUPERCONDUCTOR TECHNOLOGIES

Improving the Quality of Wireless

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