

**BDA1300
BI-DIRECTIONAL AMPLIFIER
UHF 403-512 MHz
EQUIPMENT MANUAL**



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1 FCC NOTICE

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

WARNING:

Changes or modifications not expressly approved by Kaval Telecom Inc. could void the user's authority to operate the equipment.

2 INTRODUCTION TO BDA's

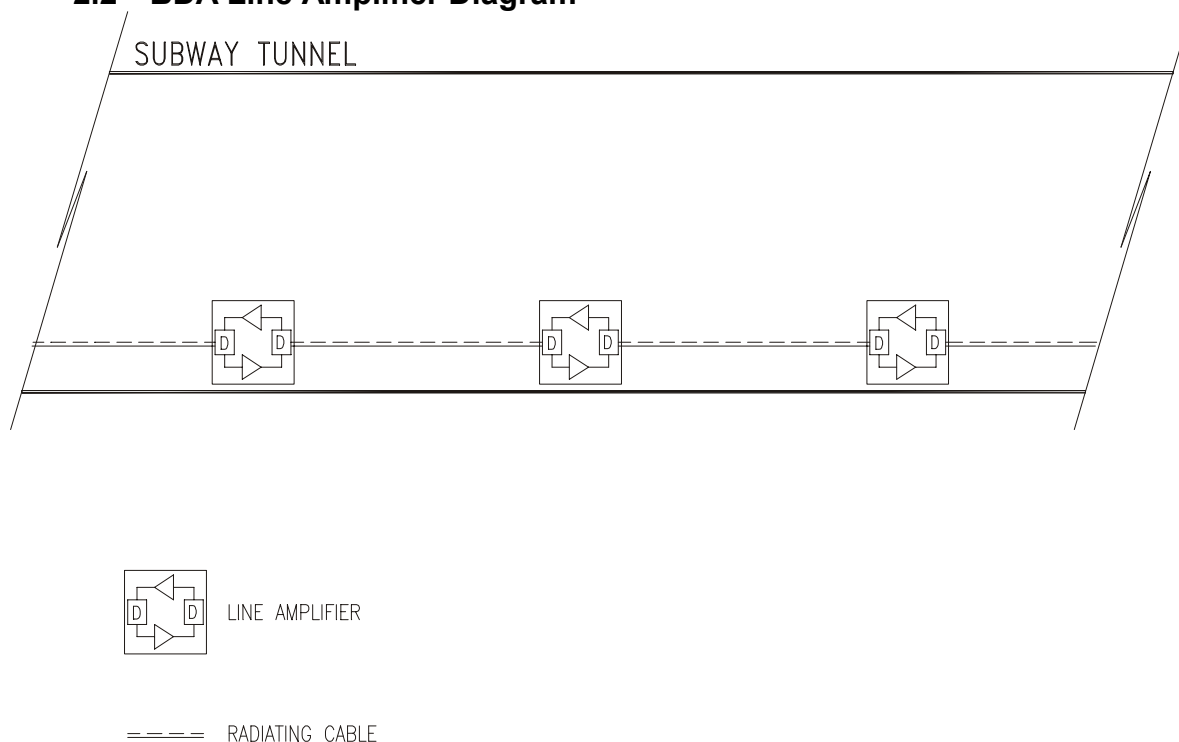
Bi-Directional Amplifiers (BDA's) are radio frequency amplifiers that amplify signals in two directions. There are two basic BDA Applications; Line Amplifiers and "Off-the-Air"...

2.1 BDA Line Amplifier System Application

In-building RF distribution system usually takes on one of several forms including, but limited to, radiating cable, distributed tapped radiators, or high power repeater antennas. For in-building RF distribution system that requires some gain to compensate for the system loss, line amplifier is the best device for the job. Line Amplifiers provides amplifications of RF signals to recover signal loss contributed by radiating cable and other system components.

Figure 1-1 shows an example of a subway tunnel RF distribution system using Line Amplifiers. The system consists of Line Amplifiers strategically inserted between radiating cables. As the RF signal travelling along the radiating cable, it loses strength because some of its energy is converted into heat. Line amplifiers recover the RF loss by amplifying the signal to the desired signal strength before sending it down the next section of radiating cables. Hence, the in-building RF seamless coverage can be maintained.

2.2 BDA Line Amplifier Diagram

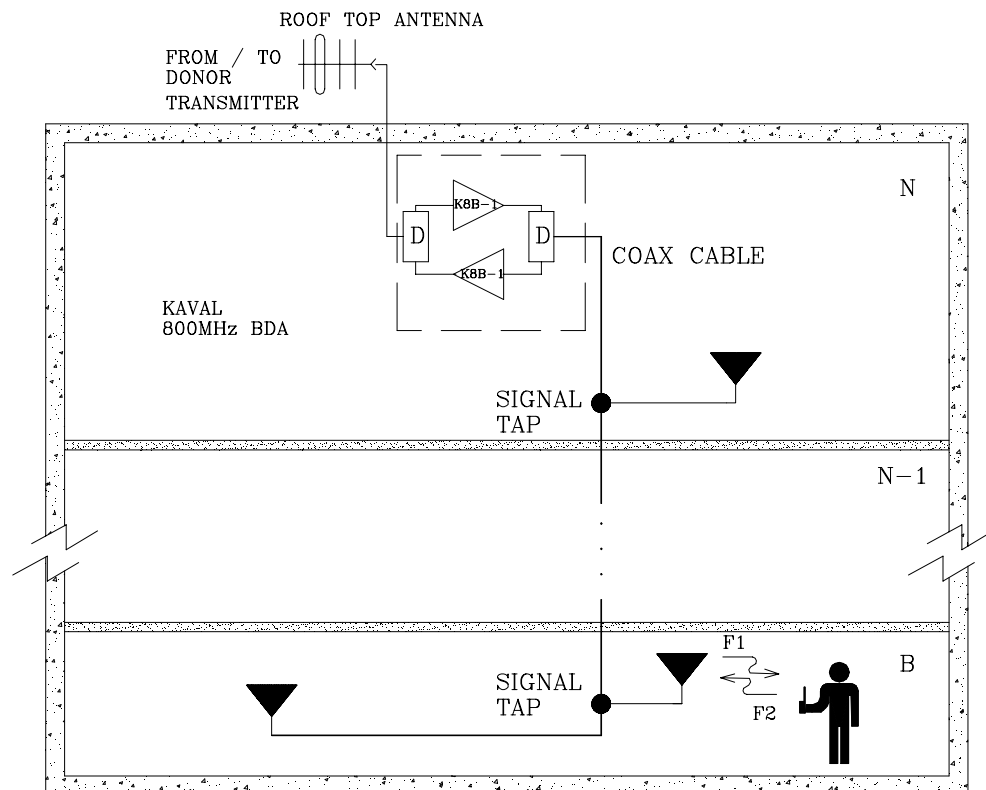


2.3 BDA “Off-the-Air” Amplifier System Application

The Bi-Directional Amplifier is intended to extend Cellular coverage into areas with coverage deficiency such as inside office buildings, shopping malls, hospitals etc. It is designed to be located independent of the donor site and must be equipped with its own antenna systems - one to communicate with the donor site and the other(s) to communicate with portables in the shadow zone.

A typical in-building coverage extension system is shown in Figure 1-2. The head-end subsystem, namely Kaval bi-directional amplifier, is responsible for the amplification of both incoming “off-the-air” downlink signal and outgoing uplink signals. The in-building distribution antenna system comprises of Coaxial cable, Signal taps, splitters and antennas to extend coverage on every floor, basement and underground parking garage.

2.4 BDA “Off-the-Air” Drawing



This distributed antenna system is based on Kaval’s patented “Tapped Radiator” RF signal distribution approach. The technology makes use of coaxial cable with Signal Taps strategically located and connected to Omni-directional ground plane antennas. This technology offers flexibility in system design, installation and optimization. Once the RF cable backbone has been installed, additional signal taps and antennas can quickly and easily be added to a live system, without the need to take the system out of service. Hence, new coverage areas can be added, or the system can easily be modified if the layout should change (e.g. modernization retrofits or process modifications).

3 BDA1300 Bi-Directional Amplifier Description

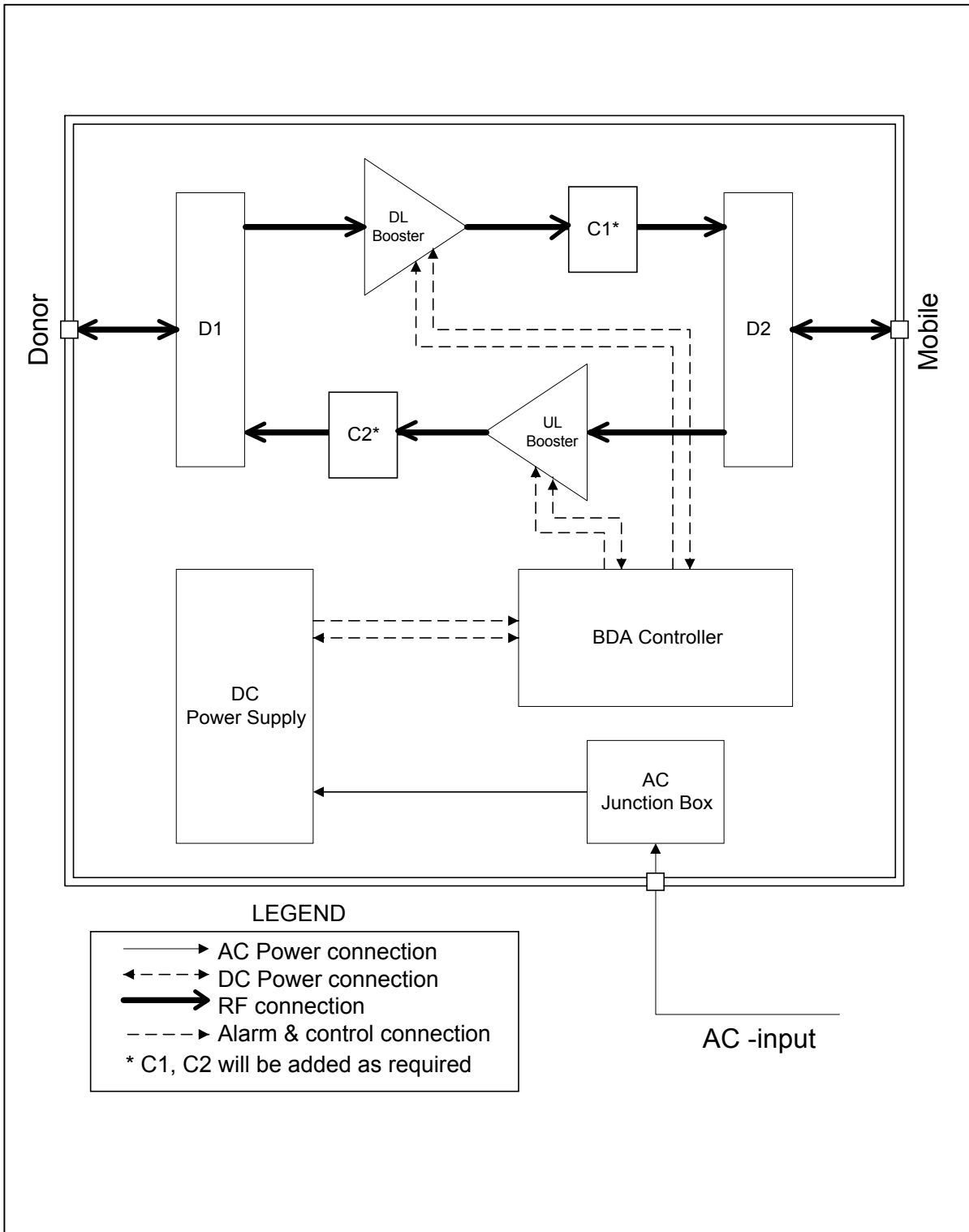
3.1 BDA1300 Functional Description

The BDA1300 series Amplifier is a compact, yet flexible bi-directional amplifier. It is equipped with a microprocessor based controller to provide a friendly user interface and to simplify set up and operating procedures.

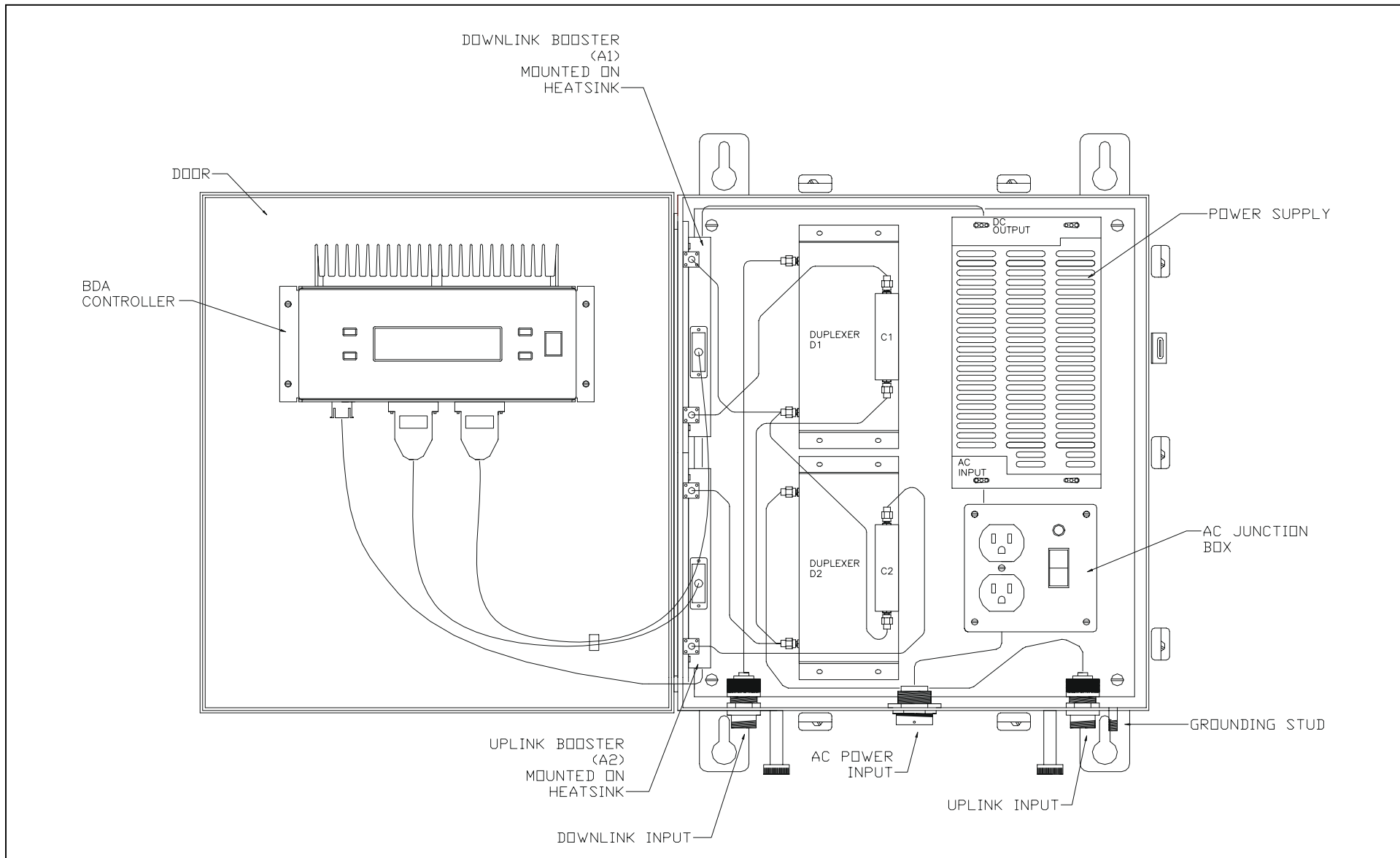
The BDA1300 consists of the following functions:

- **1 BDA Controller:** Microprocessor based units that provides all control, fault monitoring and settings for the BDA.
- **2 Duplexers D1, D2:** Pass the Downlink frequency band to the mobile antenna and the Uplink frequency band to the donor antenna and provide the isolation between the Uplink and Downlink frequency bands.
- **2 Amplifiers A1, A2:** Amplify the Uplink and Downlink signals.
- **2 Isolators C1, C2 (as required):** Provide consistent matching for amplifier output.
- **1 Power Supply:** Operates on 120/230VAC to provide 28V DC to amplifiers, BDA Controller.
- **BDA enclosure:** Rugged Nema 4, 4x or 12 with heatsink attached to transfers heat that dissipated from Amplifiers directly to the outside of the BDA enclosure.
- **1 AC Junction Box:** This box consists of AC power switch, AC outlet and AC surge protector.

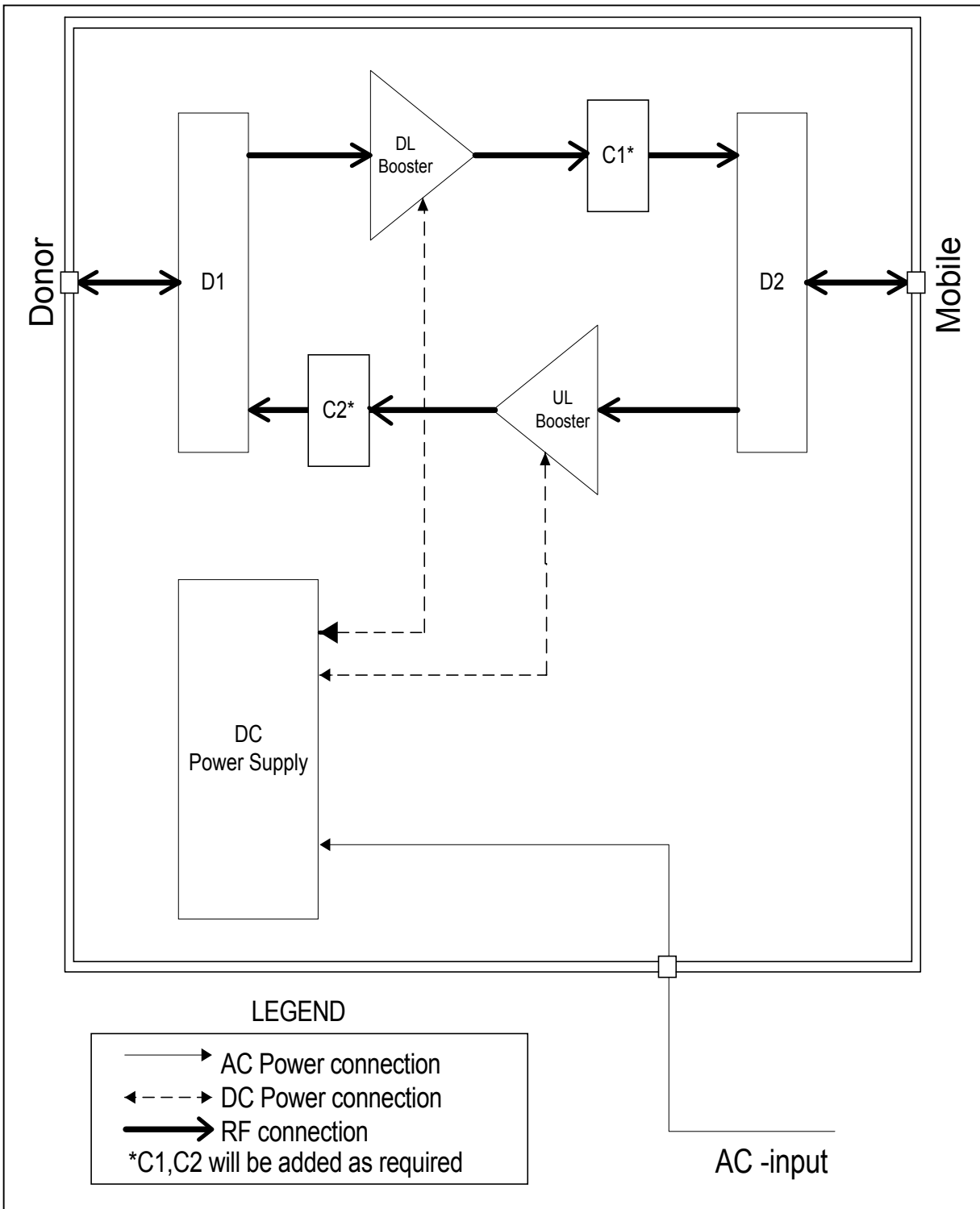
3.2 BDA1300 Block Diagram with Controller



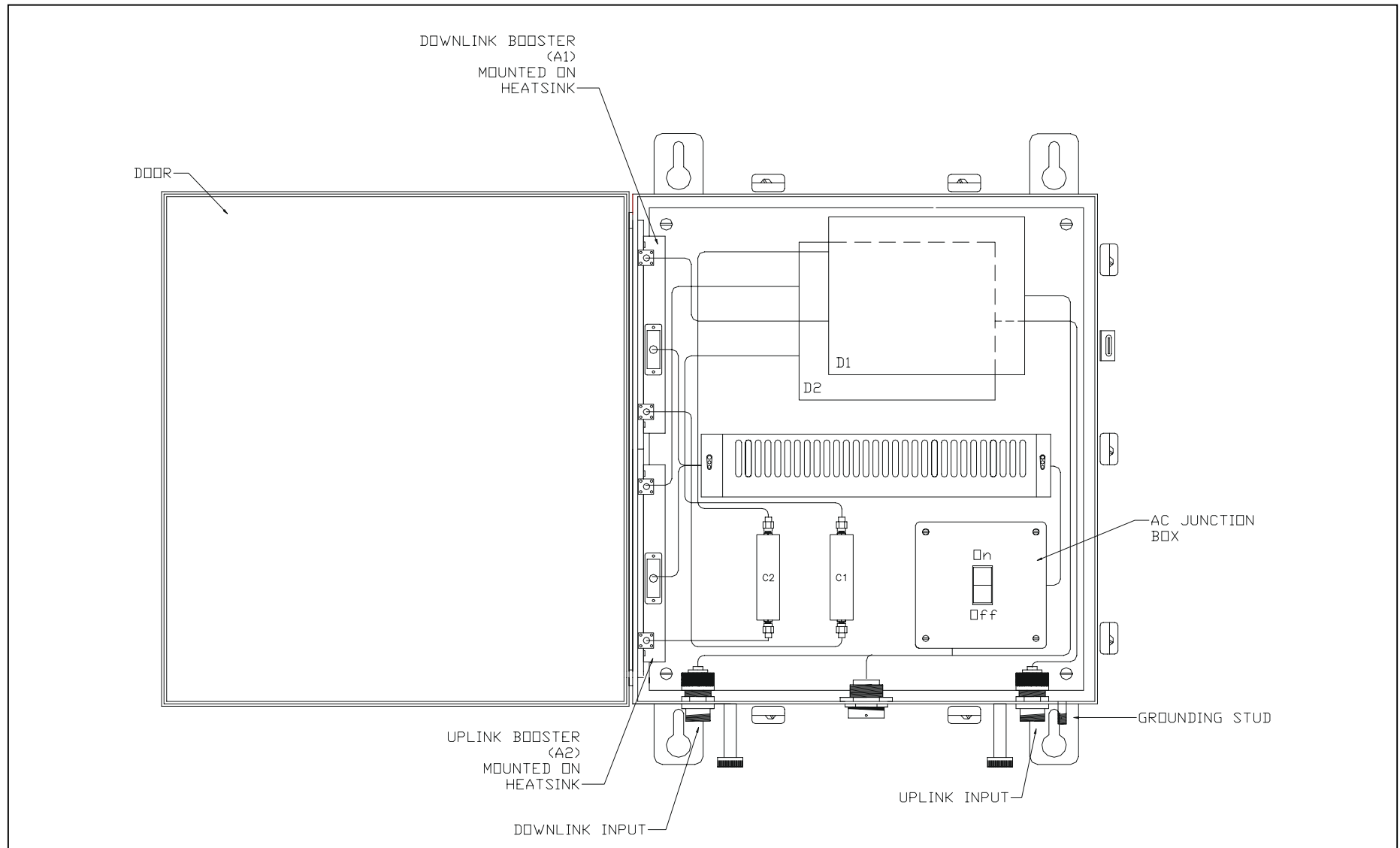
3.3 BDA1300 Components in Enclosure with Controller



3.4 BDA1300 Block Diagram without Controller



3.5 BDA1300 Components in Enclosure without Controller



4 BDA1300 Models and Specifications

4.1 BDA1300 Specifications

RF Performance	
Frequency Range	403 to 512 MHz See model chart below
Passband Ripple	± 2.5 dB
Maximum Gain (nominal)	40 to 80 dB See model chart below
Digital Gain Adjustment	16 or 32 dB See model chart below
AGC Dynamic Range	25 dB
1 dB Compression Point	+35 dBm Typical
3rd Order Intercept Point IP3	+45 dBm Typical
Noise Figure	<12 dB
Propagation Delay	<5 µs
Impedance	50 ohms
VSWR	<2:1
Maximum RF Input	+10 dBm without damage
Electrical Specifications	
Primary Voltage	120/230VAC +/- 10%, 50-60Hz
Primary Power	180 VA
Secondary Power	Two 12 VDC Sealed Lead -Acid Batteries, 10-100 AH Battery Backup Time: Boosters only, 20 AH - 4 hrs Typical Charge Time: 10 AH - Approx. 6 hrs, 100 AH - Approx. 48 hrs. Typical Charge Current from BDA Controller is 3 Amps Maximum The BDA will shut down for Battery Voltages below 21 VDC. Consult Factory for more information.
Mechanical Characteristics	
Dimensions W x H x D	17" x 16" x 10"
Weight	50 lbs. approx.
Housing	Rugged Nema 4-Style Cabinet - Wall Mountable
Connectors	N female
Operating Temperature Range	-30°C to +50°C
Humidity	95% RH Max, Non-Condensing
Type Acceptance	
FCC Type Acceptance	H6M-BDA1300
IC Type Acceptance	TBD

4.2 BDA1300 Series Model Chart

Model	Frequency (MHz)		Maximum Gain (dB)	Digital Gain Adjustment (dB)	IP3 (dBm)	
	DL	UL			DL	UL
BDA1300-xBB4-A	TBD	TBD	40	16	45	45
BDA1300-xBB7-A	TBD	TBD	70	32	45	45
BDA1300-xBB8-A	TBD	TBD	80	32	45	45

4.3 Power De-Rating Requirements

BDA's will amplify all signals that fall within their Pass-Band range. The output power will be **“shared”** between all channels being amplified. Another multiple channel effect is Intermodulation signals produced from non-linear effects between the intended channel signals. These intermodulation may cause interference to receiving equipment.

In order to minimize Intermodulation signals, Power de-rating must be applied. In the USA there are FCC Intermodulation Specifications published in the EIA Standard PN2009. The tables 2.2 shows the maximum per channel **Output Levels** allowed as a function of the number of channel.

Note that depending on the actual amplifier input levels, the gain of the BDA may need to be reduced to comply with the above regulations.

4.4 Automatic Gain Control (AGC)

Both Downlink and Uplink paths are equipped with AGC. The Amplifier based AGC has a dynamic attenuation range that ensures that a field set (adjustable) nominal composite output power is not exceeded. The AGC gain varies dynamically to maintain this composite power level by limiting strong signal levels which could cause excessive intermodulation.

For example, if the AGC limit is set for +25 dBm and the gain of the unit is set for 40dB , then the AGC circuit will begin to attenuate composite incoming signals at +25dBm – 40dBm = -15dB (composite power input). The AGC circuit will maintain this composite power limit even if the input signals increased. This composite level would be maintained by reducing the gain from 40 dB. For every 1dB increase in input signal there would be a 1dB decrease in the gain.

The BDA Controller is used to set the AGC composite power threshold level. The AGC setting is a value ranging from 0 to 255.

4.5 AGC Threshold level Setting

BDA Controller AGC Setting #	Composite Power Level Setting (+/- 1 dB)
240	+30 dBm
160	+25 dBm
118	+20 dBm
94	+15 dBm
77	+10 dBm

BDA's may be shipped with an AGC setting chart specific to that unit.

This includes a 5 dB insertion loss for the internal Duplexers. Consult the Factory for more information.

The AGC Threshold level (in dBm) for the number of channels to be amplified is shown on the next page. This AGC threshold should be set to ensure intermodulation products do not exceed –13dBm. This table also shows the de-rated power per channel for the number of channels to be amplified.

4.6 BDA Per Channel Power De-Rating & AGC Threshold Setting (for maximum level of 3rd order IMD products of -13 dBm)

No. of Channels	Max. de-rated Po/Channel, (dBm)	Composite Power (dBm)
IP3=+45		
2	25.4	28.4
3	22.6	27.4
4	20.7	26.7
5	19.2	26.2
6	18.0	25.8
7	17.0	25.5
8	16.2	25.2
9	15.4	24.9
10	14.7	24.7
11	14.1	24.5
12	13.6	24.4
13	13.1	24.2
14	12.6	24.1
15	12.2	24.0
16	11.8	23.8
17	11.4	23.7
18	11.1	23.6
19	10.7	23.5
20	10.4	23.4
21	10.1	23.4
22	9.8	23.3
23	9.6	23.2
24	9.3	23.1
25	9.1	23.1
26	8.8	23.0
27	8.6	22.9
28	8.4	22.9
29	8.2	22.8
30	8.0	22.8
31	7.8	22.7
32	7.6	22.7
64	3.6	21.7

Note: Above levels are established with AGC disabled. De-ratings are based on values calculated using EIA standard PN2009. Actual Amplifier performance may exceed the above criteria.

5 BDA Enclosure Installation

5.1 Preparation for the installation of BDA enclosures

a. Equipment and hardware required

- Each BDA is carefully packaged for air shipment. Any damage incurred during the transportation must be claimed from the shipper.
- Make sure the following necessary equipment and hardware are available and undamaged.
- 1 BDA enclosure (supplied by Kaval)
- 2 50-ohm jumper cables (not supplied by Kaval)
- 1 12' AC power cord (not supplied by Kaval)
- AC Outlet is nearby (not supplied by Kaval)
- Padlocks, optional (not supplied by Kaval)
- Mounting hardware such as: Four washers and four bolts (not supplied by Kaval)

b. Preparing the installation site

- Make sure the mounting area is large enough to accommodate the installation of the BDA enclosure (17"Wx16"Hx10"D) and free air flow is available on both sides of the cabinet.
- RF cables must be in place and labeled clearly as "Donor Cell Site" and "In-building".

5.2 Mounting the BDA Enclosure

The physical installation is accomplished by mounting the enclosure onto a vertical wall. Ensure that the unit is mounted in the upright position, as indicated by the upright Kaval logo and the door hinge on the left side of the housing. Using four mounting lugs on the enclosure (see figure 3.1) as a template insert four bolts to the wall. Make sure the bolts are capable of supporting at least 70 lbs. BDA Enclosure can be mounted as described below:

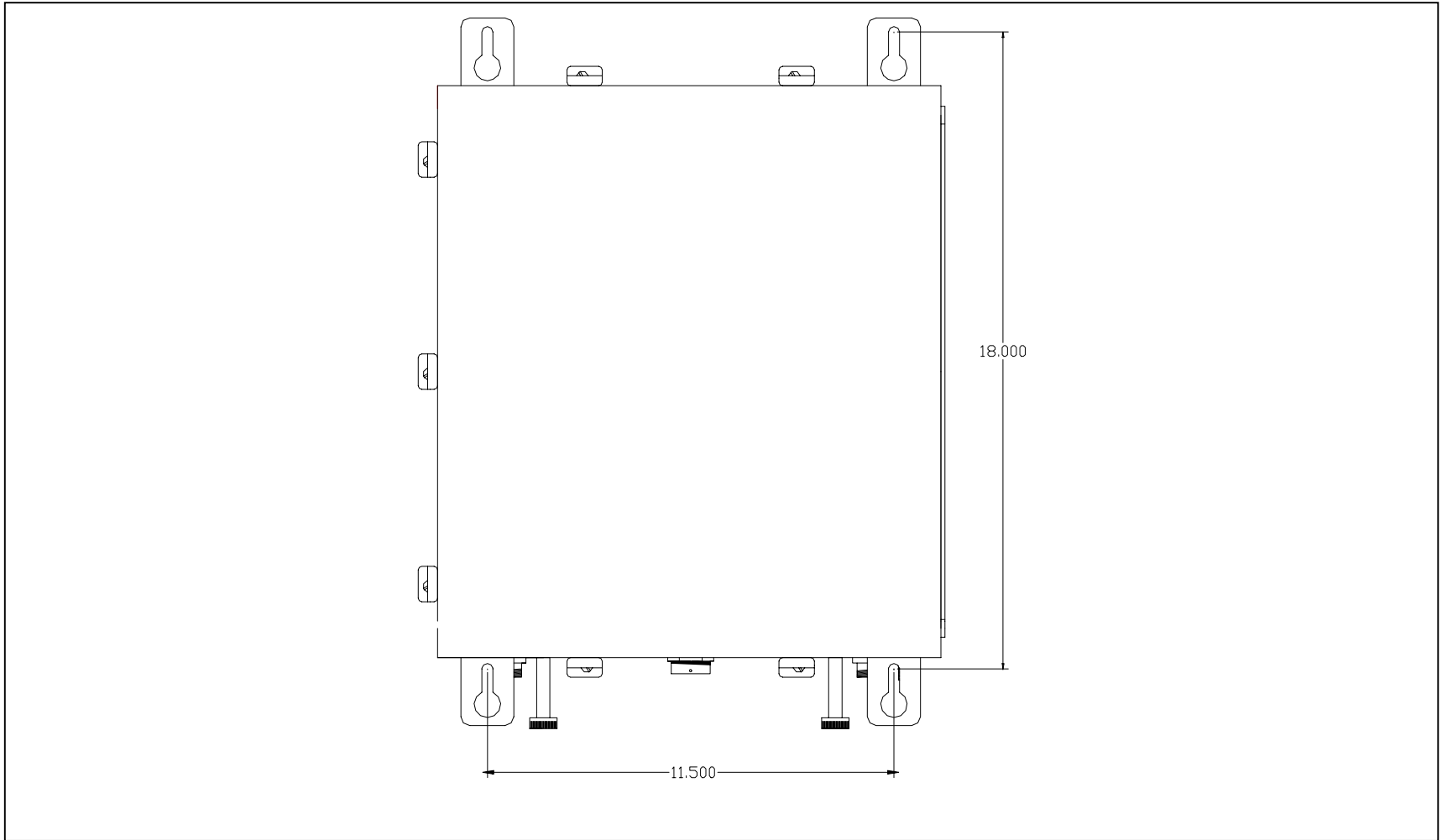
1. Raise the BDA enclosure so that the BDA enclosure is about 1" to 3" away from the bolts so that one can see the bolts through the larger diameter of the keyhole slots, see figure 3-1.
2. Move the BDA enclosure closer to the wall so those four keyhole type slots are hooked onto the bolts.
3. Slide the BDA enclosure down until all bolts fit well in the narrow part of the keyhole slots.

5.3 Connecting the Coaxial cables

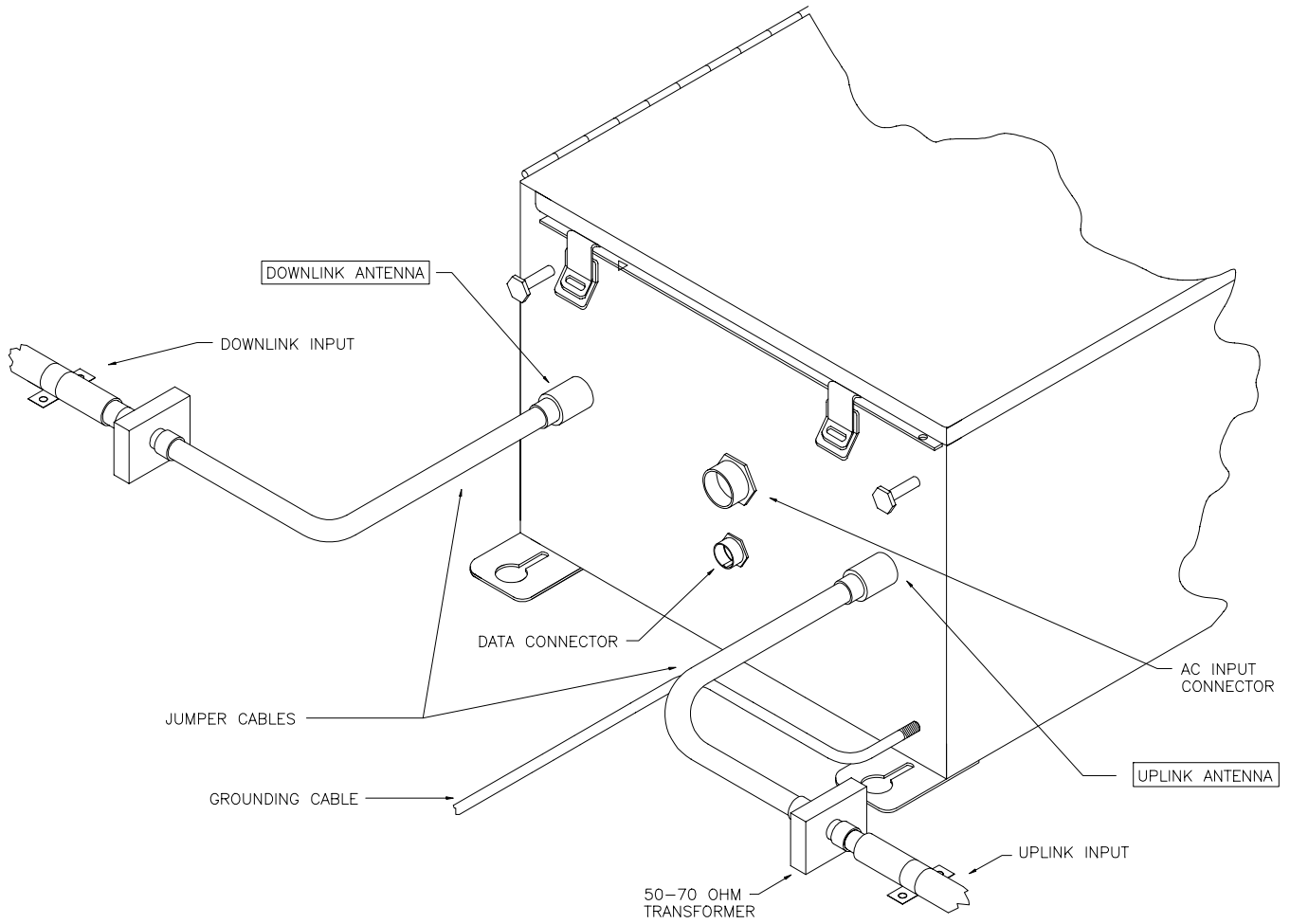
Connectors of the BDA are located on the bottom of the BDA enclosure (see figure 3-2). RF cables can be connected to these connectors using jumper cables as follows.

1. Connect one end of the first jumper cable to the BDA connector marked "Downlink Antenna."
2. Connect the other end of the first jumper cable to the connector marked "Donor Cell Site" antenna.
3. Connect one end of the second jumper cable to the BDA connector marked "Uplink Antenna."
4. Connect the other end of the second jumper cable to connector marked "In-building" cable.

5.4 BDA Enclosure Outline



5.5 RF and Power Connections



5.6 Connecting the Power Cables

AC Power and RF Connections should be installed with all standard installation practices for lightning protection. This includes the grounding and electrical bonding together of all equipment racks and cabinets in the room. It also includes a grounding of the primary antenna cable and the installation of proper surge suppression (lightning arrestor) equipment at the entrance to the equipment room. It is highly recommended that AC Power Wiring be performed by a qualified Electrician so as to ensure compliance with all National and Local Electrical Wiring Regulations. Connecting power cables can be done as follows:

1. Locate the AC on/off switch inside the BDA enclosure. Turn the switch to the OFF position.
2. The BDA enclosure can be grounded by connecting a No. 6 copper grounding wire to the grounding stud located on the bottom of the BDA enclosure.
3. Connect the eight-pin connector on the power cable to the AC INPUT connector located on the bottom of the BDA enclosure.
4. Turn the Power supply switch and the controller switch to the ON position. The light on the power supply switch should be luminous and the controller display should say "BDA: OK".
5. Set BDA operating parameters.

5.7 Securing the Door

The final step in installation BDA enclosure is to secure the door by fastening all the clamps and attaching padlock as follows:

1. Close the door and fastening all seven clamps.
2. Attach padlock to BDA enclosure door as required.

6 Antenna Installation

- **All Antenna Installation is to be performed by Qualified Technical Personnel only.**
- **Antenna Installation Instructions** and locations below, are for the purpose of satisfying **FCC RF Exposure Compliance** requirements.
- The **Roof Top Antenna** for linking to the *Donor Site* is a directional (high gain) Antenna fixed-mounted physically on the side or top of a building, or on a tower. The Antenna Gain must be no more than 10 dB. The *Roof Top Antenna* location should be such that only Qualified Technical Personnel can access it, and that under normal operating conditions no other person can touch the Antenna, or approach within 10 meters of the Antenna.
- The **In-Building Antenna** connection is via a coaxial cable distribution system with Signal Taps at various points connected to the fixed-mounted **Indoor Antennae**. This is shown in the figure in the Introduction. The *Indoor Antennae* are simple 1/4 Wavelength (0 dB Gain) types. They are used with Kaval 12, 16, or 20 dB Cable Taps. As such the maximum EIRP will be at the first Tapped Antenna, which will be 12 dB below the maximum signal level of the BDA1300 +25 dBm, or 0.32 Watts EIRP. These Antennae are to be installed such that no person can touch the Antenna, or approach within 0.2 Meters.

ANTENNA INSTALLATION WARNING

ALL ANTENNA INSTALLATION IS TO BE PERFORMED BY QUALIFIED TECHNICAL PERSONNEL ONLY.

ANTENNA INSTALLATION INSTRUCTIONS AND LOCATIONS ARE FOR THE PURPOSE OF SATISFYING FCC RF EXPOSURE COMPLIANCE REQUIREMENTS, AND ARE NOT OPTIONAL.

ALL ROOF TOP ANTENNA INSTALLATION MUST BE SUCH THAT NO PERSON CAN TOUCH THE ANTENNA, OR APPROACH CLOSER THAN 10 METERS.

ALL IN-BUILDING ANTENNAE INSTALLATIONS MUST BE SUCH THAT NO PERSON CAN TOUCH THE ANTENNAE, OR APPROACH CLOSER THAN 0.2 METERS.

7 BDA Controller and Configuration

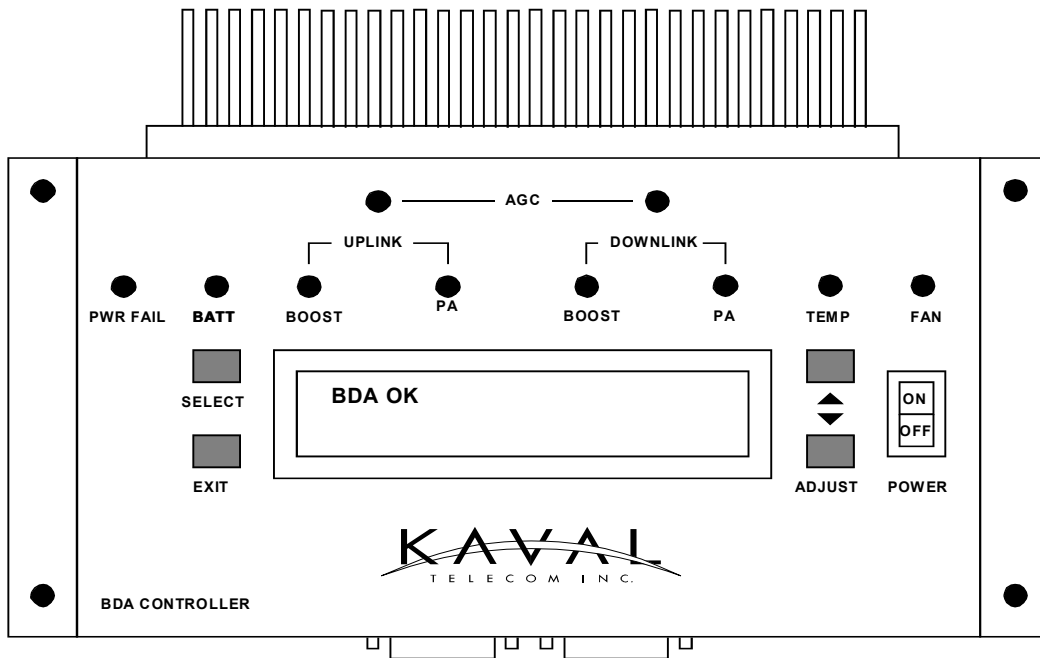
Kaval's BDA's can be configured very easily without the use of any tool via the BDA Controller. The BDA must be powered up before setting the BDA operating parameters. The operating parameters are set to specific defaults at the Kaval factory. All controller settings are recorded in the BDA Controller Settings As-built list. The customer may also reset these parameters to optimize BDA performance in the operating condition.

7.1 BDA1300 Controller Operation

The BDA Controller is a microprocessor based part of a Kaval BDA that provides password protected, keypad entry of all system parameters including digital gain control, module fault monitoring, and battery backup control. It interfaces to the 28 VDC Power Supply, the optional 24 VDC Battery (both monitoring, transferring, and charging), control signals to the amplifiers, and provides monitored DC power for the amplifiers.

The BDA Controller display is a 2 line by 20 character Vacuum Fluorescent (VFD) display. The connectors are all secure lock type and should only be plugged and unplugged with power off.

7.2 BDA Controller Drawing



7.3 BDA Controller User Interface


LED and Audible Indicators:

LED and audible indicators are used to enhance the user interface of the BDA. 10 LEDs and buzzer are described below:

PWR FAIL	Lights if primary power fails, and the system is on Battery Backup.
BATT	Lights when the battery (if installed) voltage drops below 24 VDC which roughly indicates 50% of backup capacity remaining. This may occur as a result of normal discharge in a backup situation, battery exceeding its useful life, or a battery failure such as water loss or shorted cell. In addition, while running on battery backup, if the battery drops below 22 VDC, the LED will begin to blink indicating that self-shutdown is imminent. If the battery drops below 21 VDC the BDA will shut down completely to protect the Battery from damaging deep discharge.
UPLINK BOOST	Lights if the Uplink Amplifier is enabled and has an overcurrent, undercurrent, or internal fault.
UPLINK PA	Lights if the Uplink PA (Power Amplifier) is enabled and has an overcurrent, undercurrent, or internal fault.
DNLINK BOOST	Lights if the Downlink Amplifier is enabled and has an overcurrent, undercurrent, or internal fault.
DNLINK PA	Lights if the Downlink PA is enabled and has an overcurrent, undercurrent, or internal fault .
UPLINK AGC	Lights to indicate that an Input Signal of sufficient strength is present to cause the AGC circuit (if enabled) to act to reduce gain. The level at which AGC action occurs is not a fixed signal level. It depends upon the user setting for output level target. When lower targets are set, the AGC will begin to act at lower input levels. When AGC is disabled, the LED does nothing. If the Input Signal exceeds the AGC ability to reduce gain, an overload condition exists, and the AGC LED blinks rapidly.
DNLINK AGC	Operates the same as the Uplink AGC LED, but for the Downlink.
TEMP	Lights when the BDA system temperature, as detected by a digital sensor in the controller, exceeds the user programmed high temperature threshold.
FAN	Lights when the Cooling Fan(s) (if enabled) have an overcurrent or undercurrent condition.
BUZZER	The Buzzer sounds briefly during button presses for audible feedback. When a User Function requires a confirmation, a short beep is emitted. During a Fault Condition, a long periodic beep is sounded (this can be disabled). When the Battery is about to be depleted when on Battery Backup Power, the Buzzer will sound continuously.

Functions:

BDA system parameters can be set using the four button BDA controller keypad. Description for the keypad buttons are listed below:

ON/OFF	Power Switch for turning the BDA operation on and off. Note that this only controls the BDA Controller, Amplifiers, PA's, and Fans; the DC Power Supply is still operating where BDA controller is switched off.
SELECT	This Button is used to enter the Main Function Menu and Submenus, and where applicable to confirm a Function selection chosen with the Adjust Buttons.
EXIT	This Button is used to cancel any Function changes, reverting to previous settings. If a Fault has occurred and its Status is displayed, pressing the Exit Button clears the fault.
ADJUST 	These buttons Scroll up and down between Status, Function, and Menu display items. They also adjust programmable numeric values up and down.

7.4 Checking BDA Status

Use ADJUST button to scroll through the Status menu such as Master status, current Monitor status and Thermal Monitor Status. The controller should display "BDA OK" otherwise it would display "Fault!" and the appropriate fault descriptions.

7.5 Setting BDA Operating Parameters

Before allowing the operator to change operating parameters, at the Main Menu, the controller will ask the operator to enter a *three-digit* Password. The controller will skip the Password section if the field password is set to '0000' (disabled).

To enter the password, the operator uses the ADJUST button to scroll up or down for the desired number, then depress the SELECT button to accept the number. The cursor will move to the next digit. For the password to be valid, all three digits password must be entered correctly, one at a time, starting from left to right.

**Note: Always write down the new password!
If BDA password is lost, the Network administrator must contact Kaval to clear the Password.**

BDA functions such as Gain, AGC, Battery, Temperature, Fans and Controller can be set through the Menu. However, only certain parameters should be modified in the field. All other parameters have been factory set based on the model configuration of the BDA and MUST NOT be modified. The chart below shows the BDA parameters which may require modification in the field (based on each specific BDA application).

CAUTION: *The operator should not reset any other parameters.*

To set these parameters please follow the programming guide for each parameter. The programming guide shows the menus and key entries required to modify each parameter. The programming guides for each parameter and an example are included at the end of this section.

Please note that it is recommended that any field-modified parameters be recorded on the “BDA CONTROLLER SETTINGS - As-Built” sheet provided with the BDA. This As-built document should be available for reference should the controller require replacement.

7.6 BDA Controller Field Settings Parameters

AS-Built Reference	BDA Parameter	Descriptions
1A	Uplink Gain	Set the overall Uplink gain of the BDA. <i>Refer to FIELD SETTINGS – MAIN MENU PROGRAMMING GUIDE</i>
1B	Downlink Gain	Set the overall Downlink gain of the BDA. <i>Refer to FIELD SETTINGS – MAIN MENU PROGRAMMING GUIDE</i>
1C	Uplink AGC	Set AGC based on number of channel for Uplink. The AGC setting is from 0 to 255. <i>Refer to Table 2.1 for desired AGC level and FIELD SETTINGS – MAIN MENU PROGRAMMING GUIDE to set AGC parameter value</i>
1D	Downlink AGC	Set AGC based on number of channel for Downlink. The AGC setting is from 0 to 255. <i>Refer to Table 2.1 for desired AGC level and FIELD SETTINGS – MAIN MENU PROGRAMMING GUIDE to set AGC parameter value</i>
1E	Backup Power	This parameter can be set to either SUPPLY or BATTERY. <i>Refer to FIELD SETTINGS – MAIN MENU PROGRAMMING GUIDE</i>
1F	Beep	Audio indicator – <i>not available on this model</i>
2B	Password	New password can be set through the Controller main menu. If BDA password is lost, contact network manager. <i>Refer to CONTROLLER – MAIN MENU PROGRAMMING GUIDE</i>
8A	Temp Shutdown	If set to “Yes”, BDA will shutdown once the BDA reaches the Temperature limit setting (not recommended in the Public safety applications). <i>Refer to TEMPERATURE – MAIN MENU PROGRAMMING GUIDE</i>
8B	Temp Limit	Alarm warning will issued once the BDA reach this Maximum operating temperature setting. <i>Refer to TEMPERATURE – MAIN MENU PROGRAMMING GUIDE</i>
8C	Recovery Temp	After shutting itself down, BDA will turn back on when it reaches this recovery temperature setting. <i>Refer to TEMPERATURE – MAIN MENU PROGRAMMING GUIDE</i>

7.7 BDA Controller Configuration Guide

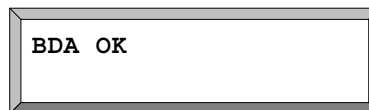
NOTE: Refer to the CONFIGURATION GUIDE diagrams at the end of this section to navigate throughout all menus.

There are *four* levels of displays in the BDA controller:

- Level 1 - Status menus
- Level 2 - Main menus
- Level 3,4 - Submenus

Status Menus

When the BDA is first turned on, the controller performs a self-diagnostic check. If the unit passes this test, "PASS" will be momentarily displayed, which then changes to "BDA OK" as shown below.



This display is always present under normal operating conditions.

The BDA Controller has 2 other status displays, which can be viewed by pressing the Adjust Buttons. The screens are:

1. Amplifier Current Monitor Status
2. Temperature, Fan, and Backup Power Status

Amplifier Current Monitor Status

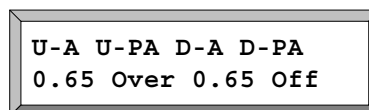
This Screen displays the current drawn by each Amplifier and PA in the system. The top row shows abbreviated names for the amplifiers as follows:

- U-A** is the abbreviation for Uplink Amplifier
- U-PA** is the abbreviation for Uplink Power amplifier
- D-A** is the abbreviation for Downlink Amplifier
- D-PA** is the abbreviation for Downlink Power amplifier

The bottom row shows the current being drawn by each amplifier (in Amps) or the status of the amplifier. Each amplifier will display one of 4 possible statuses as follows:

- X.XX** – Current consumption (in Amps) of amplifier (displayed under normal operation conditions)
- OVER** - Displayed if amplifier is consuming excessive current
- Undr** - Displayed if amplifier is consuming insufficient current
- NONE** - Displayed if amplifier has not been program installed

The display below shows a sample CURRENT MONITOR STATUS



Temperature, Fan, and Backup Power Status

This Screen shows the current ambient temperature of the BDA, the status of Fan A &B, and the status of the Backup Power (if installed). Temperature readout is in degrees Celsius. If an over-temperature condition exists, temperature will flash. Each fan has an indication of On, Off or Fail.

Backup Power voltage is displayed in volts to a resolution of 10 mV. If Backup Power is not installed, display says "None".

Temp	FanA	FanB	BkPWR
53C	ON	Fail	None

Fault Conditions

When a Fault occurs, the associated fault LED will light and the display will show a text message identifying the specific fault(s) condition.

The display below shows a sample fault for an amplifier drawing excessive current. The fault LED for the associated amplifier is also lit.

Fault!
Overtemperature

The following list shows all possible fault displays:

Main Up Amp. Overcur	Up PA Overcurrent
Back Up Amp. Overcur	Dn PA Overcurrent
Main Dn Amp. Overcur	Up PA Undercurrent
Back Dn Amp. Overcur	Dn PA Undercurr
Main Dn Amp. Undrcur	Fan A Fail
Back Dn Amp. Undrcur	Fan B Fail
Main Dn Amp. Undrcur	Overtemperature
Back Dn Amp. Undrcur	Imminent Shutdown
Backup Power Low	Primary Power Fail

Main Menus

The Main Menu is entered by pressing the Select Button from any Status Display. If the Field Password is set to anything but '0000' (default), then a Password Entry Screen appears. The Adjust Buttons are used to scroll to the desired password digit value. Pressing SELECT will enter the digit and move the cursor to the next digit. When the third digit is entered, and the Password is correct, the Main Menu becomes available and is displayed. If an incorrect Password is entered, then the message "Wrong Password" appears for a few seconds and the user must start again. If the Password is set to 0000 (disabled) the Main Menu is available immediately. The display below shows the password entry dialog.

Enter PASSWORD
4***

Main Menu entries are used to group **Functions** by category. The User SELECTS the desired category and a submenu appears listing available Functions. While in the Main Menu, the top row of the display shows "Main Menu", and the bottom row shows the Main menu name (e.g., "Field Settings"). The main menu categories are accessed by scrolling up or down using the ADJUST buttons. When the desired main menu category is displayed, pressing SELECT will access the submenus within the main menu category. When in the submenu the first row of the displays the main menu category name (e.g., "Field Settings") and the bottom row displays the submenu name (e.g., "SYSTEM LOSS: XdB"). The following list shows all available MAIN MENUS

MAIN MENUS

- Field Settings
- Passwords
- Defaults
- Temperature
- Backup Power
- Fan Control
- Downlink Power Amp.
- Downlink Amplifier
- Uplink Power Amp.
- Uplink Amplifier

Field Settings Main Menu

The Field Settings main menu allows adjustment of the following submenu items:

- Uplink Gain
- Downlink Gain
- Uplink AGC
- Downlink AGC
- Backup Power
- Beep
- Lamp Test
- Factory (display only when the factory password is set)

Passwords Main Menu

This Menu allows the factory password settings. Once the password is set to anything but 0000 (default), only the Field Settings main menu is available for adjustment. A password submenu called Factory will be available in the Field Settings. User will have access to all the main menus when a correct Factory password is entered.

A second password level called Field Password will be available once the factory password is set to anything but 0000 (default). When this Field Password is set to anything but 0000 (disabled), user cannot access any Main Menu without entering the correct Field Password.

Backup Power Main Menu

This Menu allows the user to configure the BDA for backup power functionality.

If a battery is select in the Field Settings as backup power then this main menu category must be programmed as follows:

- Low Voltage: 24.0 (indicates voltage at which Warning is displayed)
- Warn Voltage: 21.5 (voltage level at which imminent BDA shutdown is displayed as an alarm)
- Cutoff Voltage: 21.0 (voltage level at which battery back up is discontinued to prevent battery damage)

Fan Control Main Menu

This menu has been programmed by the factory, based on the BDA configuration and should not be accessed or modified.

This menu is used to configure the BDA cooling fans (if installed). Entry submenus include:

- Fan Select: selects BDA fan configuration (available entries are NONE, A, B, BOTH)
- Fan B min: indicates Fan B minimum operating current
- Fan B max: indicates Fan B maximum operating current
- Fan A min: indicates Fan A minimum operating current
- Fan A max: indicates Fan A maximum operating current

If Fan A is selected then Fan B functions as a hot-switchover backup for Fan A

If an overtemperature condition occurs, then both fans will engage until the temperature drops below a pre-set recovery limit.

If BOTH are selected then both fans operate under normal conditions

Temperature Main Menu

This menu allows the user to define the acceptable operating temperature of the BDA. Note that the BDA will operate normally in temperatures of –30 C to + 50C (ambient temperature external to BDA), however, the user may wish to monitor the ambient temperature inside the BDA as an indicator of external conditions and take appropriate action if the temperature rises above a preset limit. The menu setting include:

Temp Limit: 60C	<i>(indicates the temperature at which the BDA will shut itself down)</i>
Recovery Temp: 40C	<i>(indicates the temperature at which the BDA will re-start itself)</i>
Temp Shutdown: Yes	<i>(enables automatic BDA shutdown if temp. limit, is exceeded)</i>

If an over-temperature condition occurs and FANS are installed and enabled, then both fans will engage until the temperature drops below a pre-set recovery temperature limit.

Uplink & Downlink Amplifier Main Menus

These menus have been programmed by the factory, based on the BDA configuration and should not be accessed or modified.

Submenu entries include:

System Loss:	<i>(indicates insertion loss of the duplexers)</i>
Enable Int Fault:	<i>(not used)</i>
Interlock	<i>(indicates action to be taken by other amplifiers if this amplifier fails)</i>
Min Current	<i>(indicates minimum normal operating current in Amps)</i>
Max Current:	<i>(indicates maximum normal operating current in Amps)</i>
Gain:	<i>(indicates amplifier max gain configuration in dB)</i>
Enable:	<i>(enables/disables amplifier)</i>
Redundancy:	<i>(enables/disables power stage redundancy feature)</i>

Interlock Submenu

The Interlock entry, if selected, calls up another submenu that allows the user to select what modules are disabled if the Amplifier has a fault. This submenu includes:

Uplink Amplifier:	<i>(disables amplifier in event that the subject amplifier has a fault)</i>
Downlink PA:	<i>(disables amplifier in event that the subject amplifier has a fault)</i>
Downlink Amplifier:	<i>(disables amplifier in event that the subject amplifier has a fault)</i>
Uplink PA:	<i>(disables amplifier in event that the subject amplifier has a fault)</i>

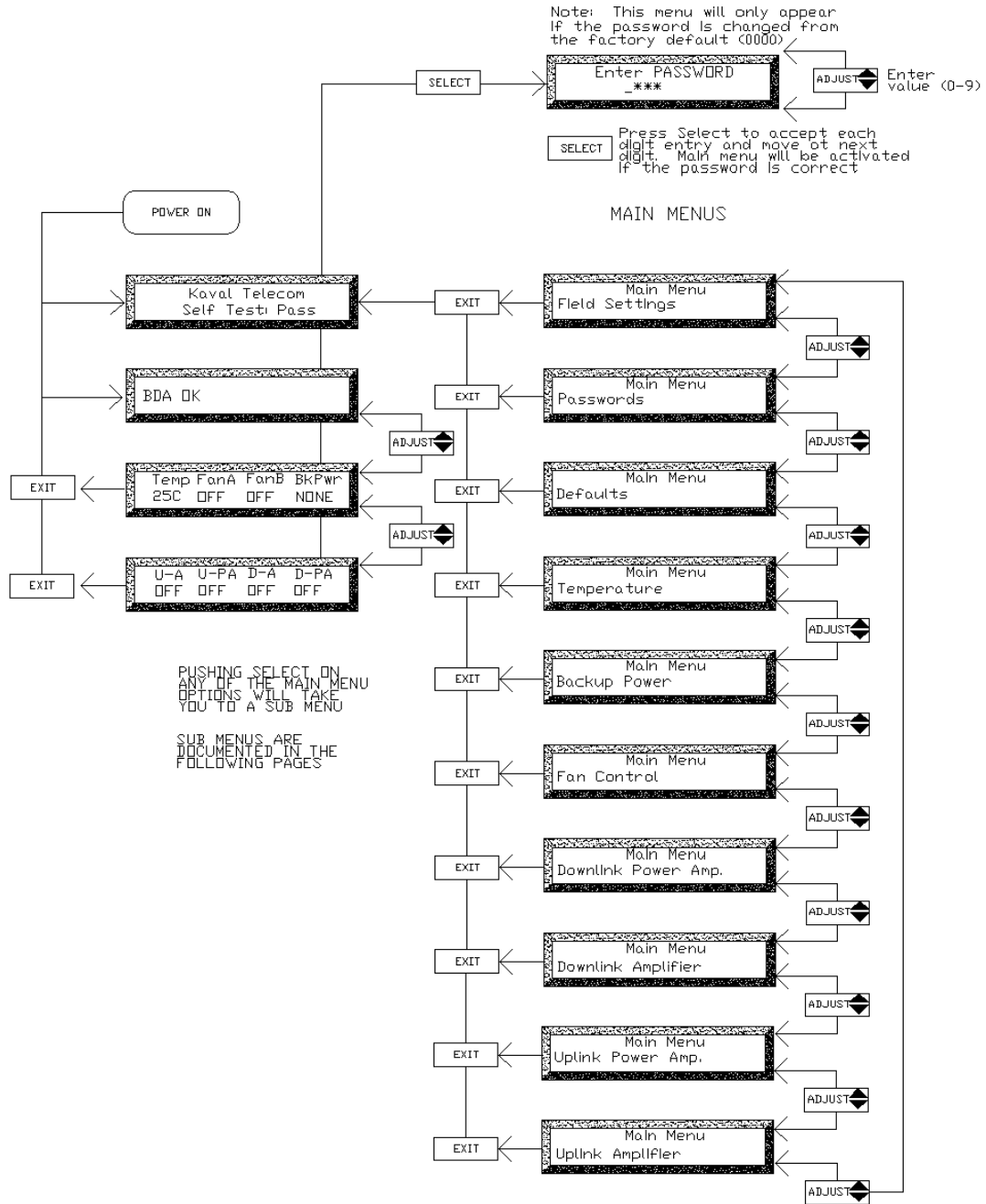
Uplink and Downlink Power Amp. Main Menus

These menus have been programmed by the factory, based on the BDA configuration and should not be accessed or modified.

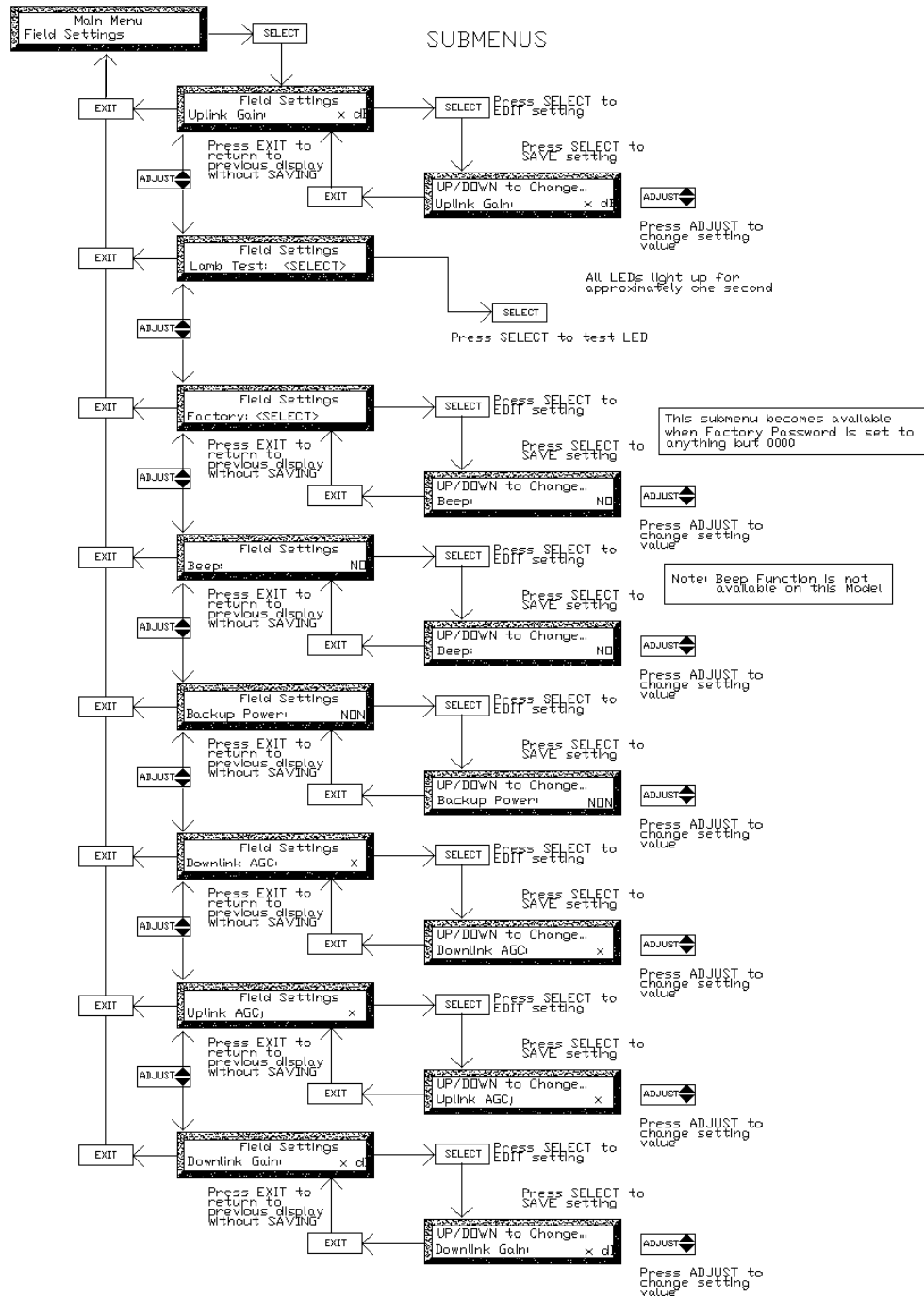
Submenu entries include:

Enable:	<i>(enables/disables amplifier)</i>
Enable Int Fault:	<i>(not used)</i>
Interlock	<i>(indicates action to be taken by other amplifiers if this amplifier fails)</i>
Max Current:	<i>(indicates maximum normal operating current in Amps)</i>
Min Current	<i>(indicates minimum normal operating current in Amps)</i>
Gain:	<i>(indicates amplifier max gain configuration in dB)</i>

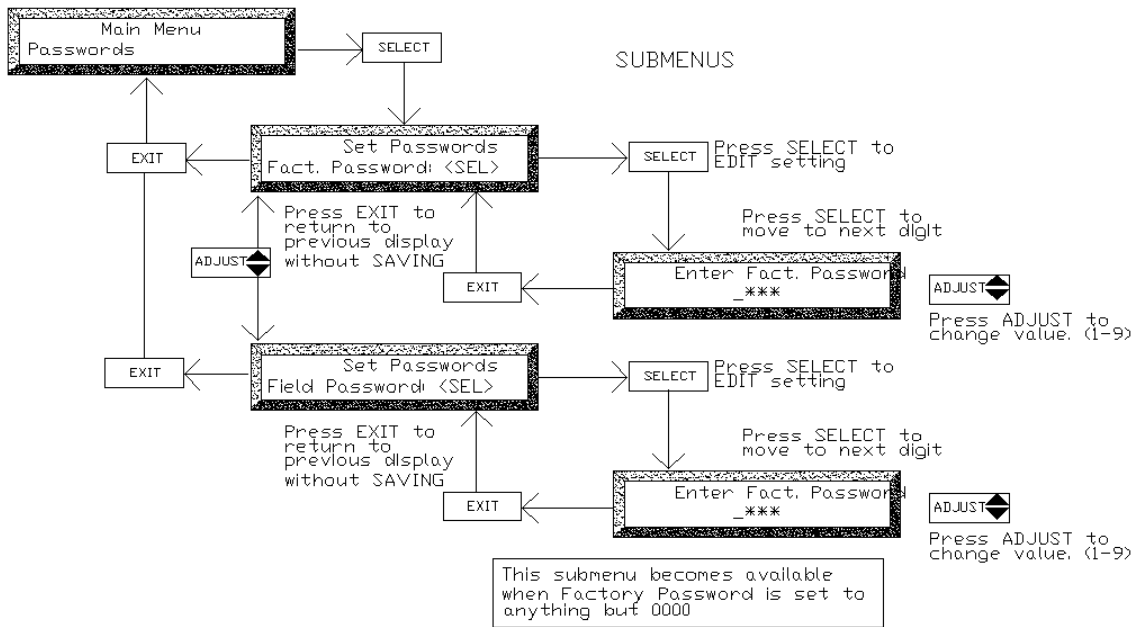
BDA CONTROLLER PROGRAMMING GUIDE



FIELD SETTINGS - MAIN MENU PROGRAMMING GUIDE

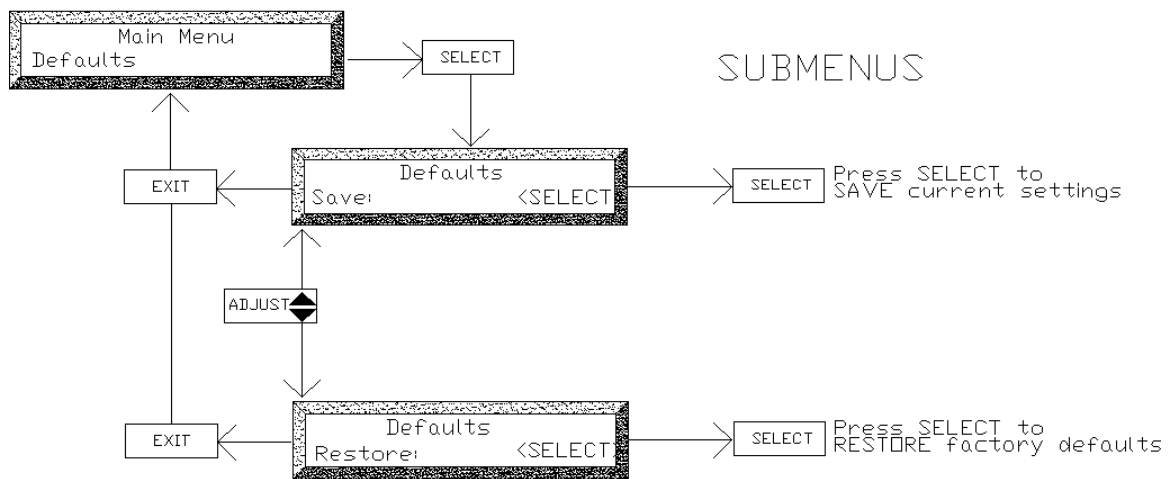


PASSWORDS - MAIN MENU PROGRAMMING GUIDE



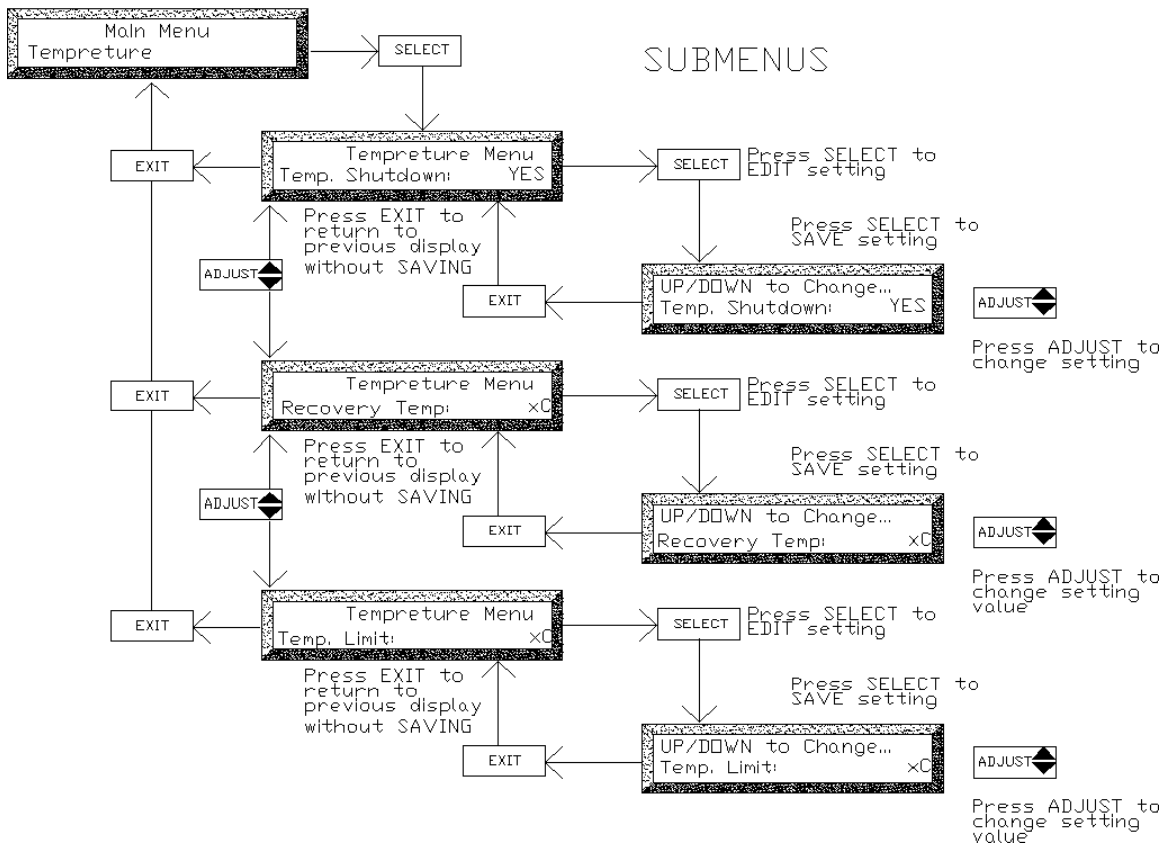
Caution:
Please make sure to record your password in the "BDA CONTROLLER SETTINGS-AS-BUILT"

DEFAULTS - MAIN MENU PROGRAMMING GUIDE

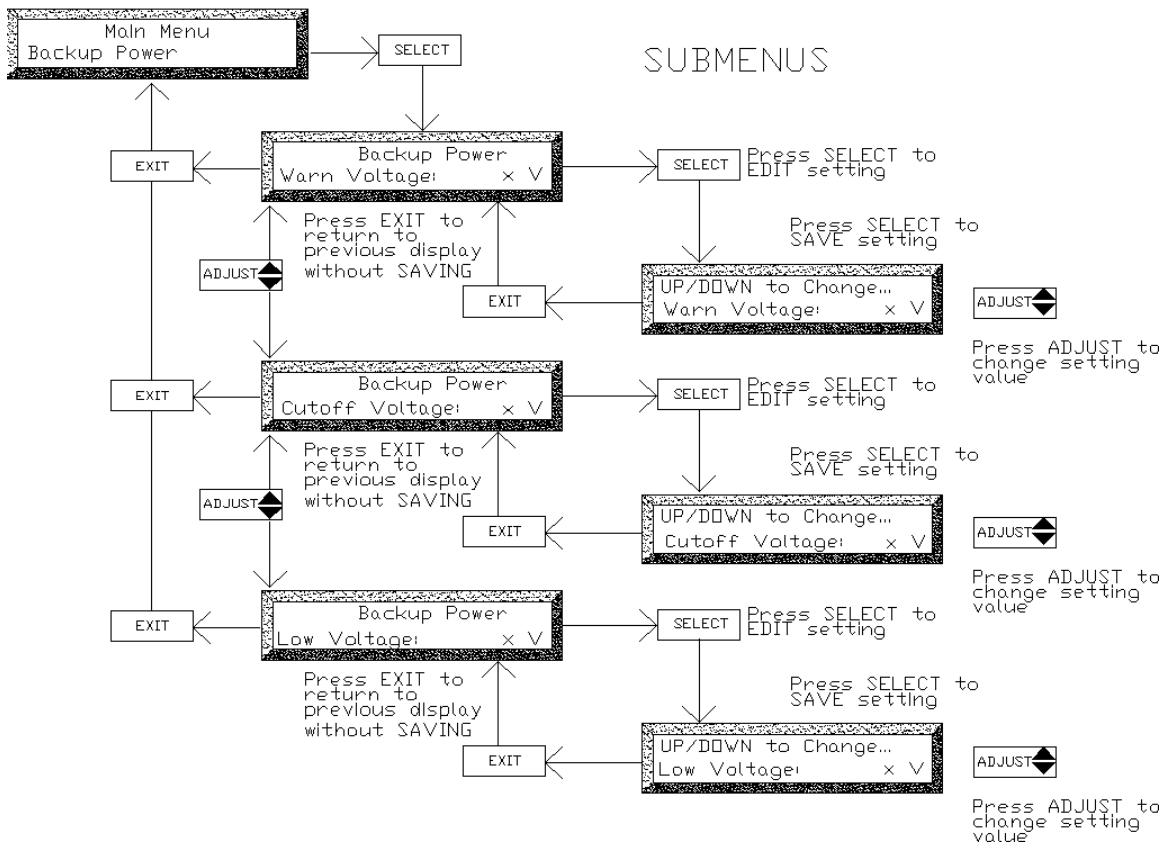


Caution:
factory setting may not be
appropriate for your BDA
configuration. Consult Kaval
before resetting parameters
to factory settings

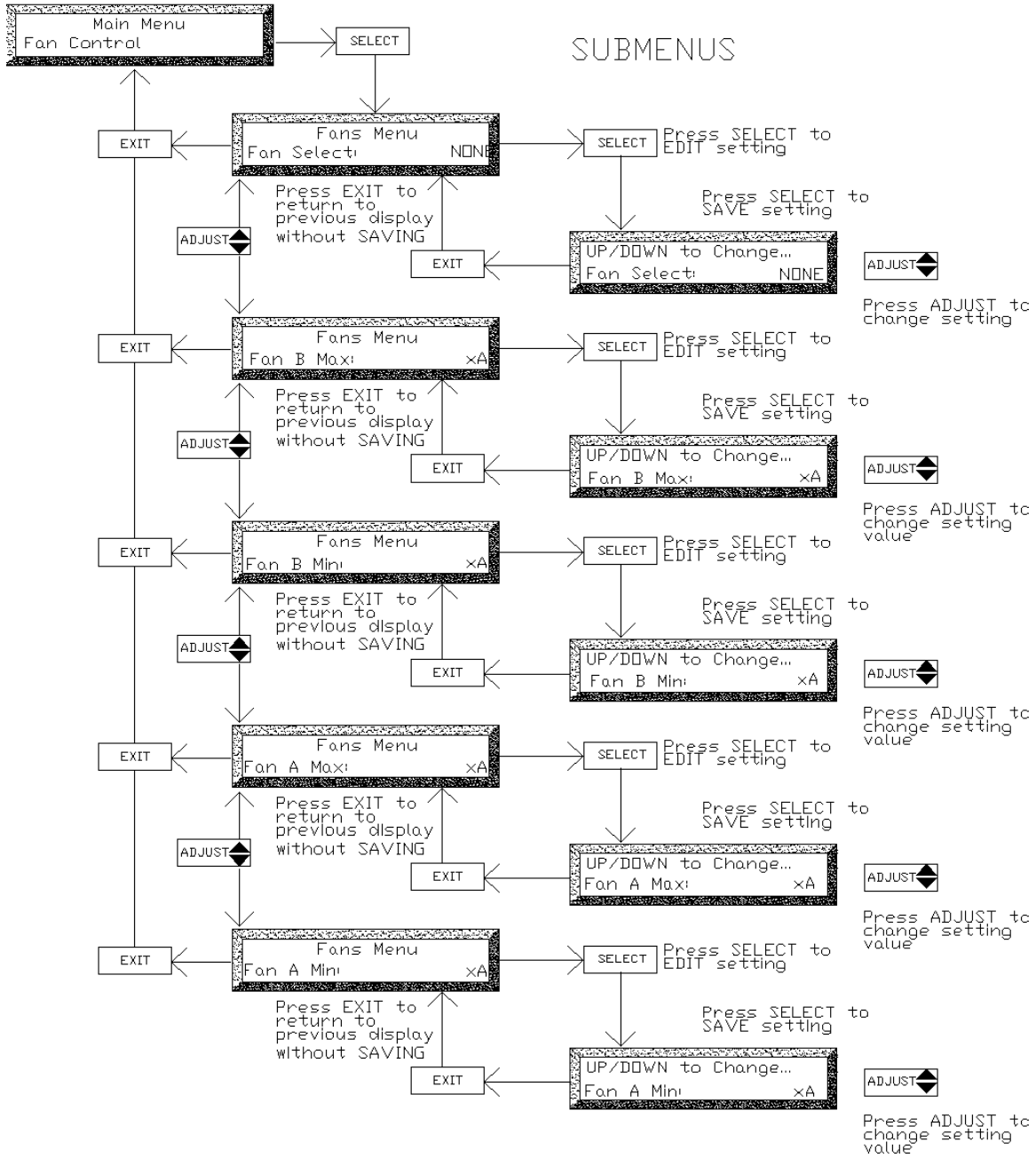
TEMPERATURE - MAIN MENU PROGRAMMING GUIDE



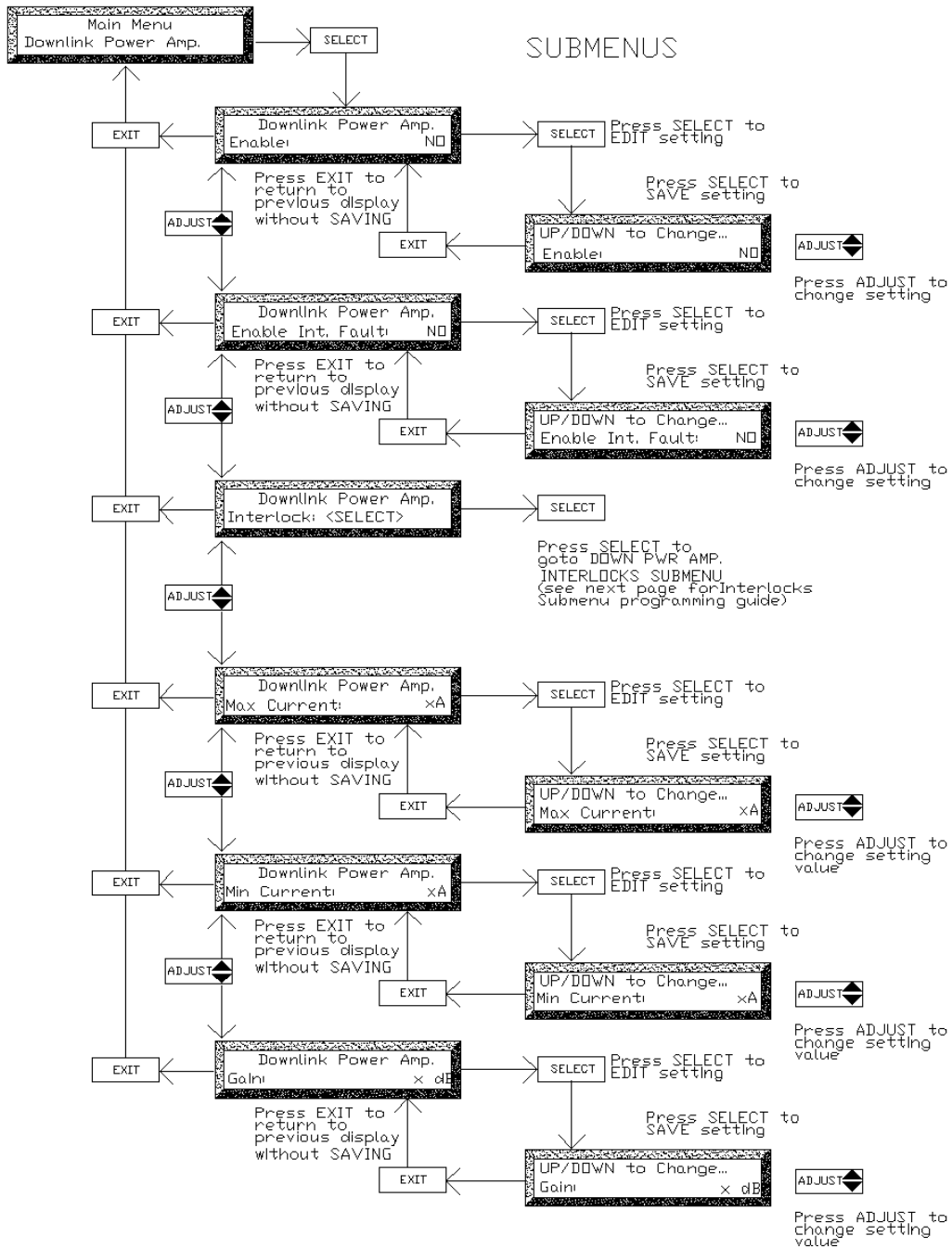
BACKUP POWER - MAIN MENU PROGRAMMING GUIDE



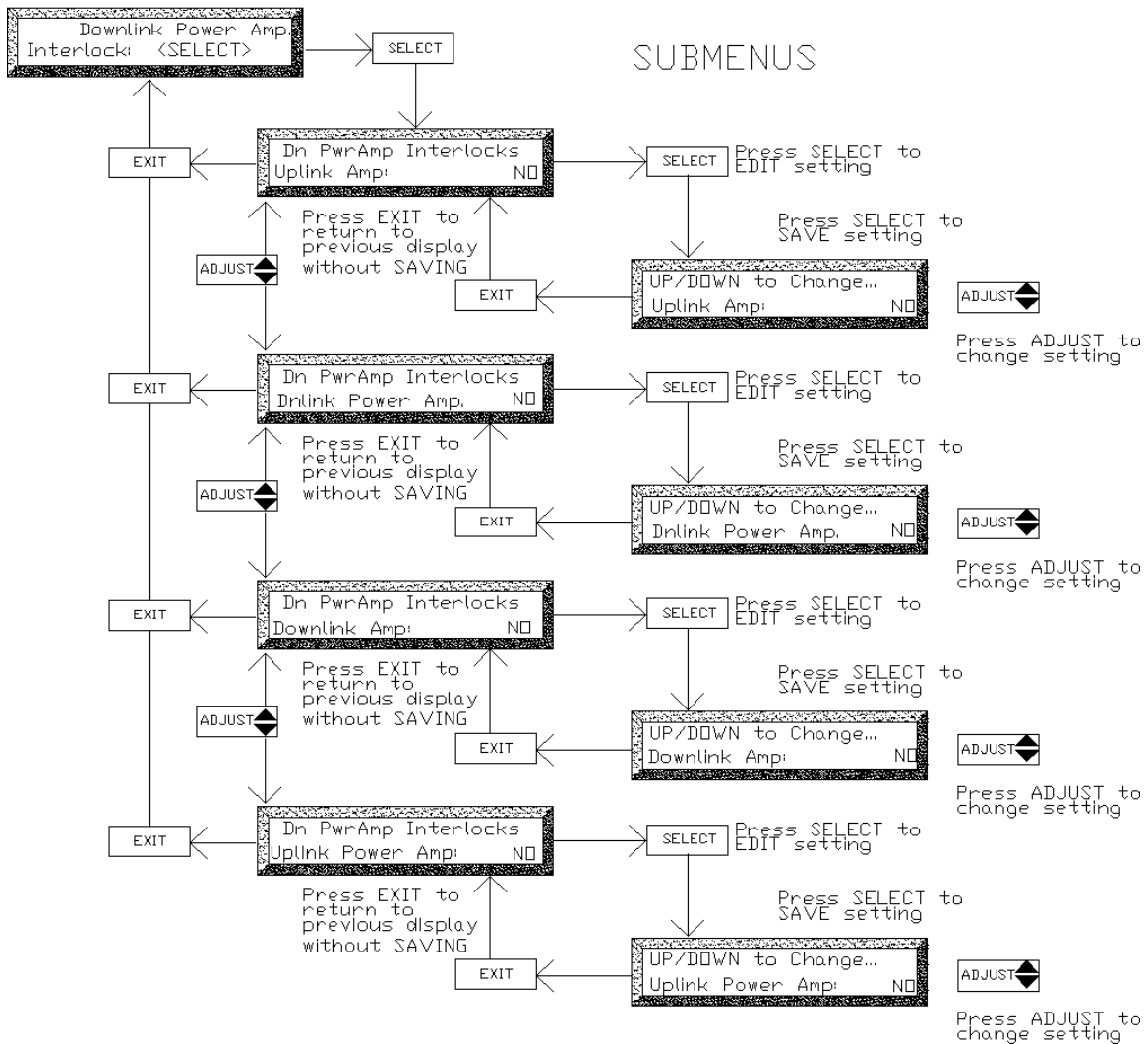
FAN CONTROL - MAIN MENU PROGRAMMING GUIDE



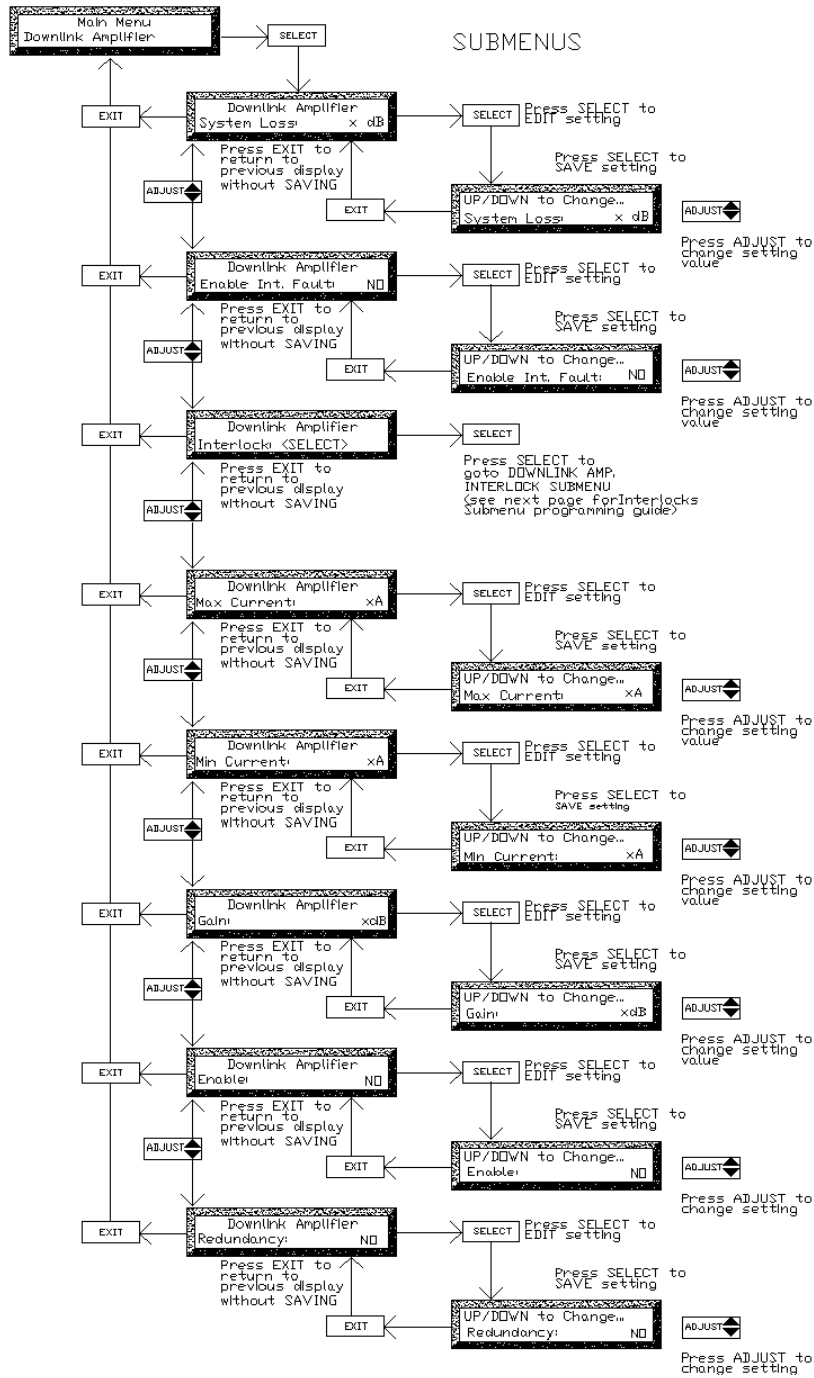
DOWNLINK POWER AMP. - MAIN MENU PROGRAMMING GUIDE



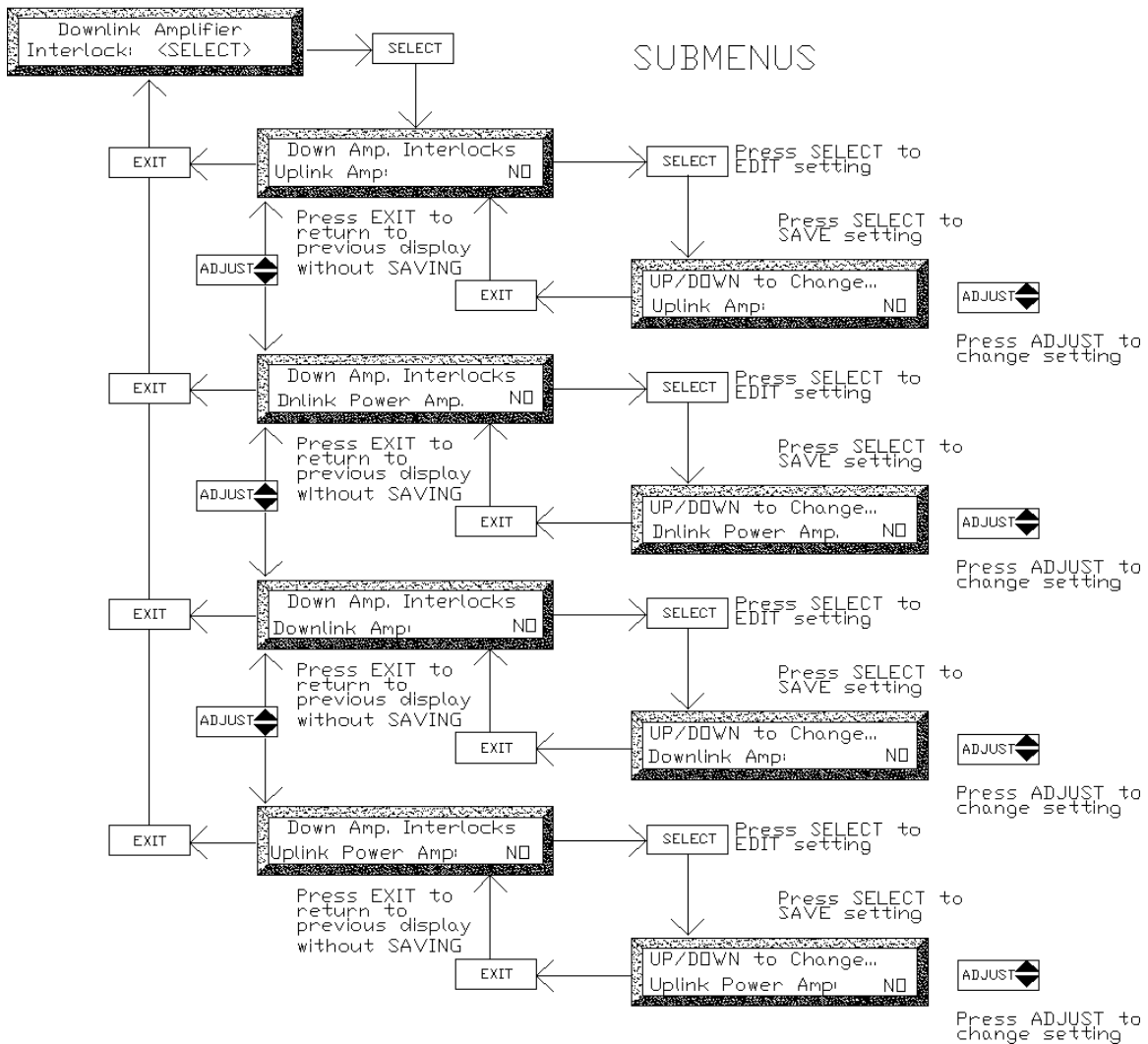
DOWN PWR. AMP. INTERLOCK - SUB MENU PROGRAMMING GUIDE



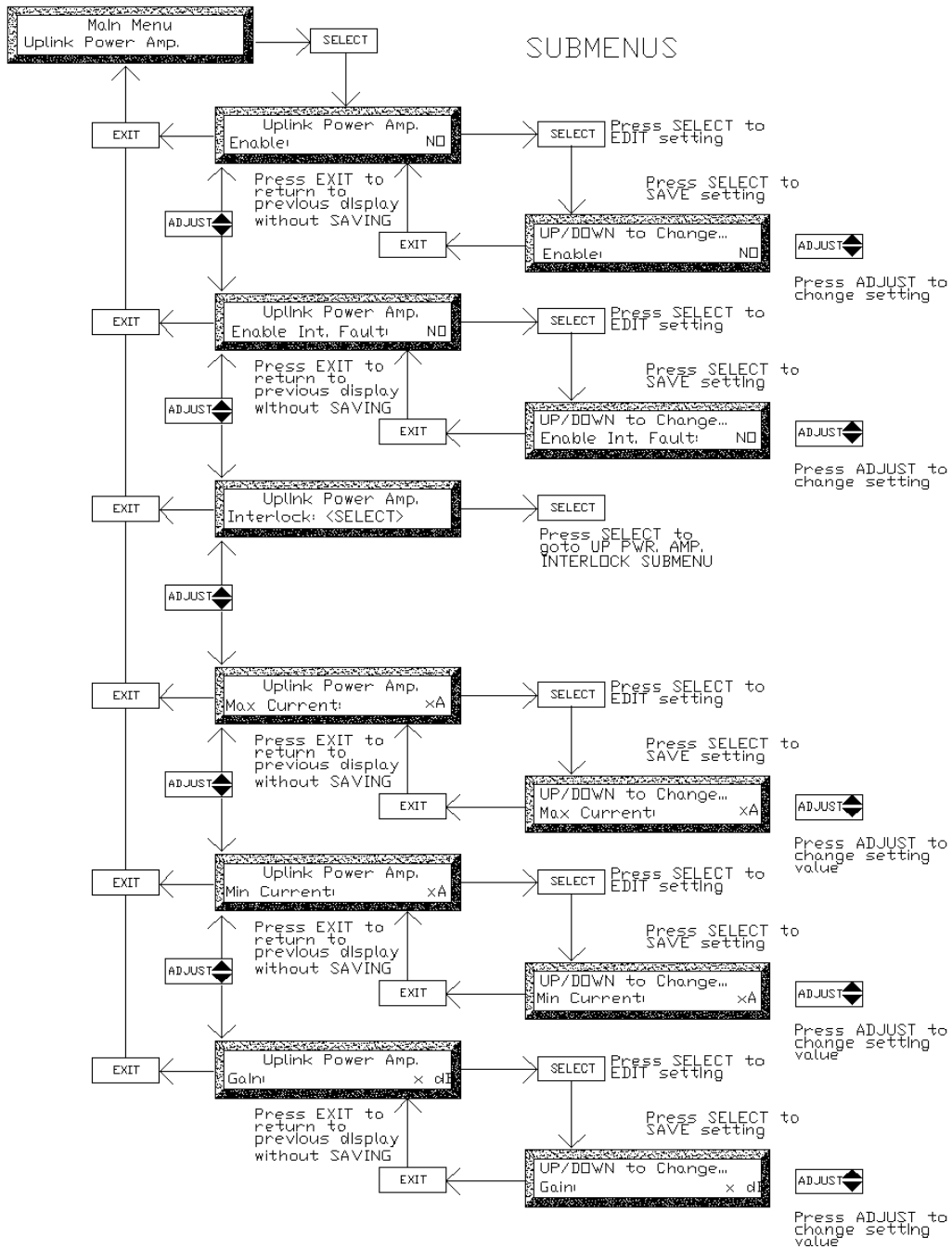
DOWNLINK AMPLIFIER - MAIN MENU PROGRAMMING GUIDE



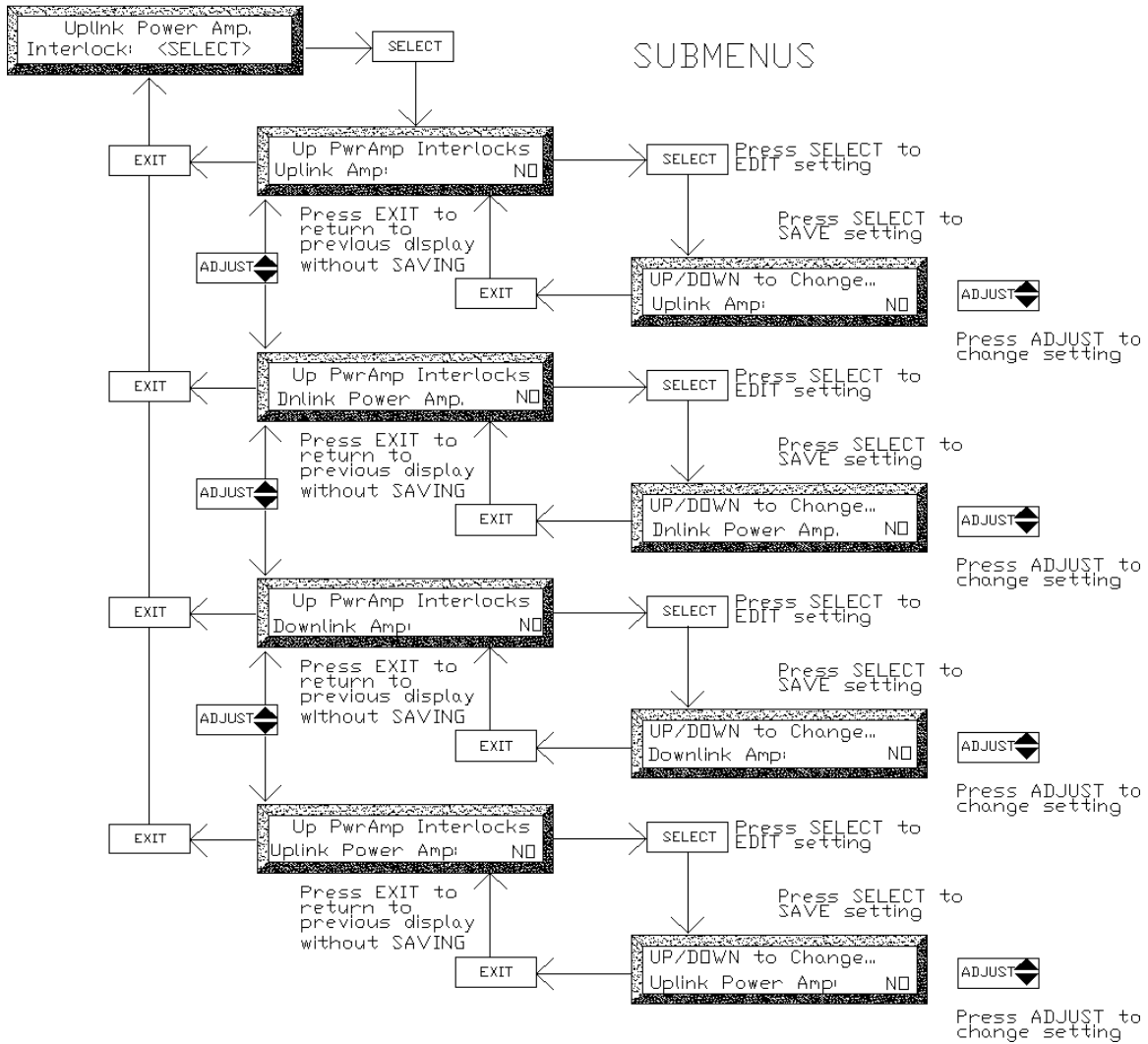
DOWNLINK AMP. INTERLOCK - SUB MENU PROGRAMMING GUIDE



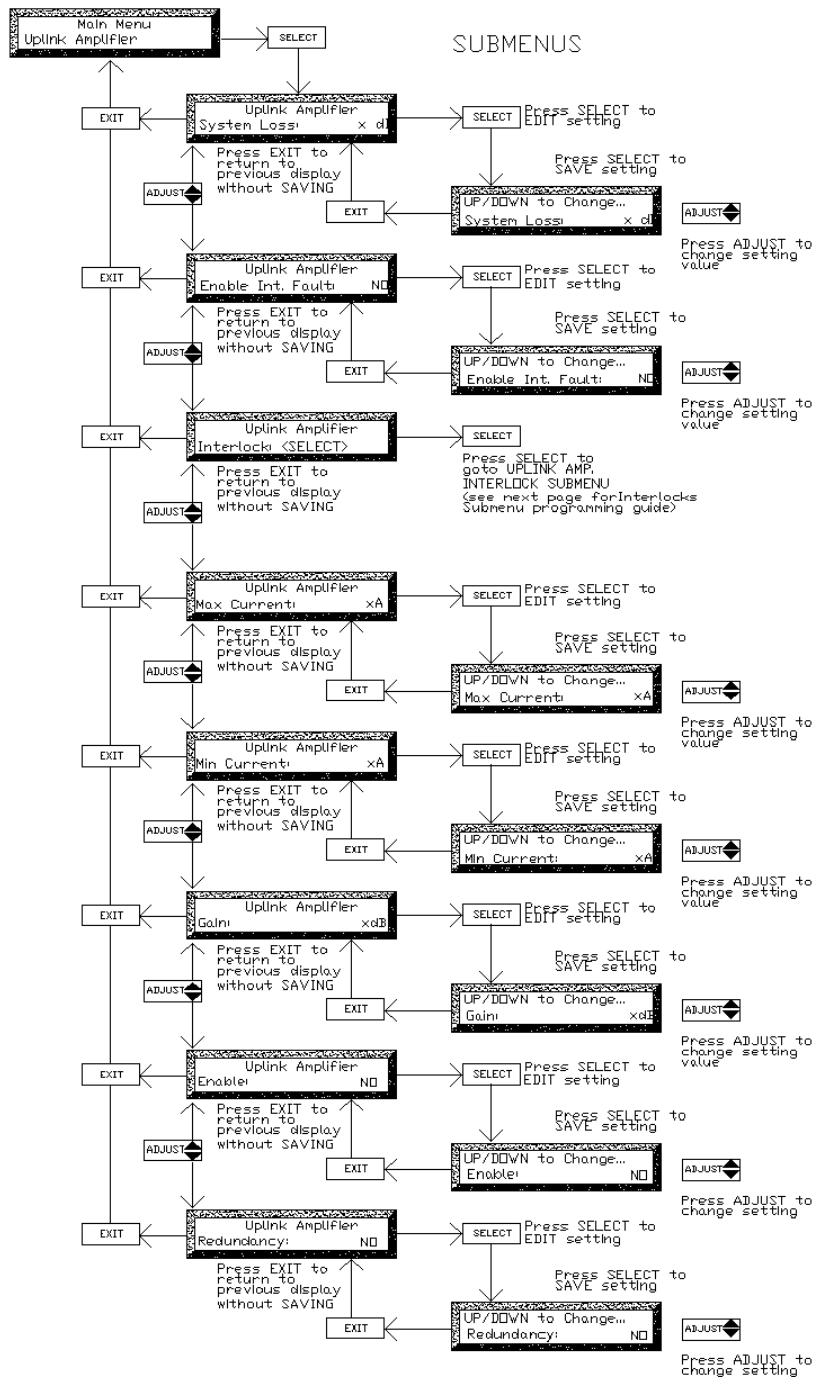
UPLINK POWER AMP. - MAIN MENU PROGRAMMING GUIDE



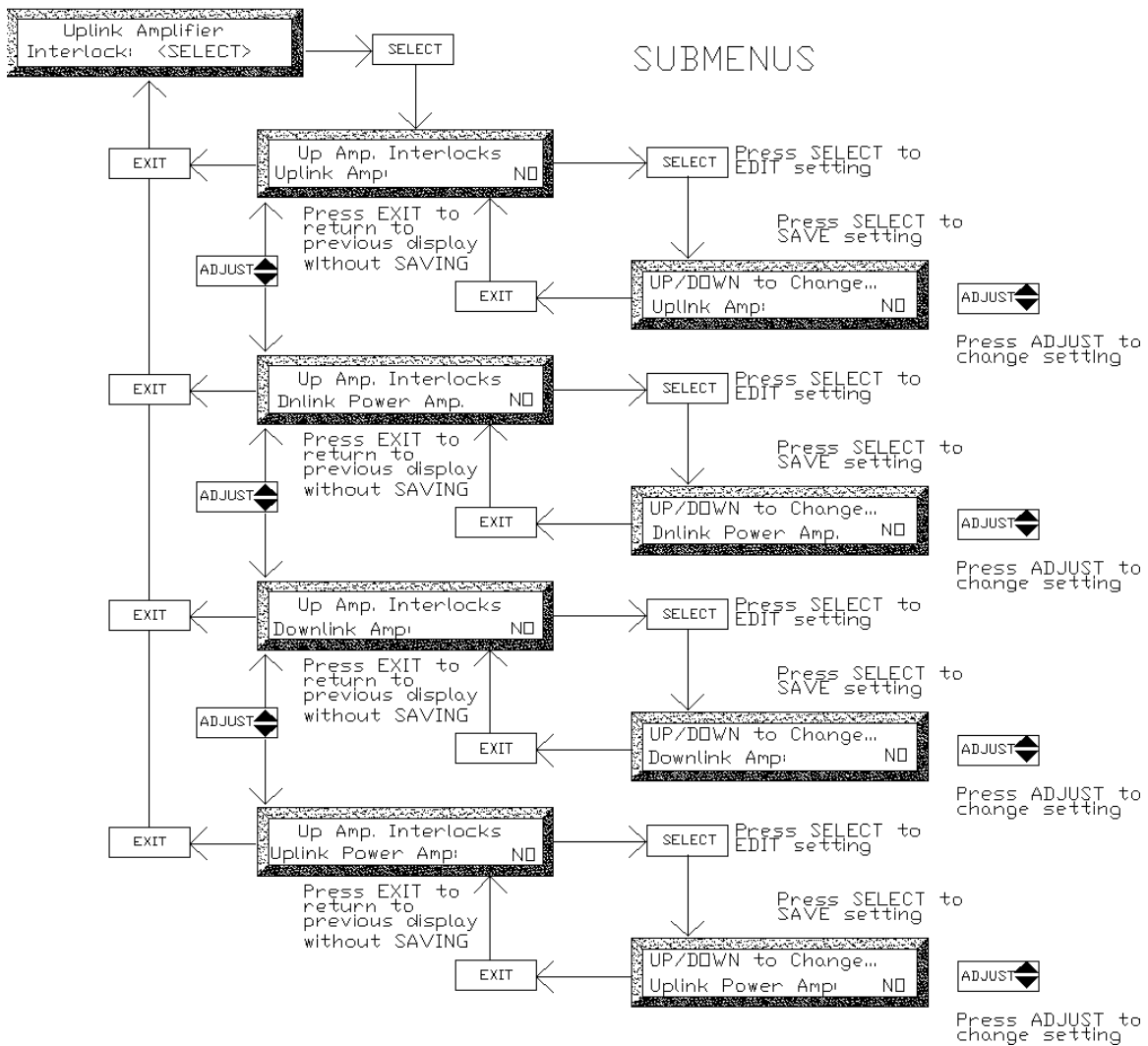
UP PWR. AMP. INTERLOCK - SUB MENU PROGRAMMING GUIDE



UPLINK AMPLIFIER – MAIN MENU PROGRAMMING GUIDE



UPLINK AMP. INTERLOCK - SUB MENU PROGRAMMING GUIDE



7.8 Example - Setting the Downlink Gain

Below is an example of setting the BDA Downlink Gain. Setting for other parameters can be done in a similar fashion.

1. From Master Status press **SELECT** to get to the Field Settings Menu. The controller will ask for the password if the field password was not 0000 (disabled). Use the **ADJUST** button to select a digit and presses the **SELECT** button to enter that digit and move to the next digit. The controller will display the Field Settings Main Menu once all three digits were entered correctly.
2. Press **SELECT** to get into Field Settings submenu, displaying the first entry: "Uplink Gain".
3. Use the **ADJUST** the **↑** button to scroll up to "Downlink Gain".
4. Press **SELECT** to edit this parameter.
5. Use **ADJUST** **↑** **↓** to change the "Downlink Gain" to the desired x dB value. Then press **SELECT** to **SAVE** the change, or press the **Exit** button to exit edit mode without changing the Downlink Gain value.

When all adjustments are completed in the Field Settings submenu, use **EXIT** to go back to the Field Settings Main Menu and then Master Menu.

8 Troubleshooting and Maintenance

8.1 Maintenance & Safety

The BDA has been engineered for easy maintenance and for safe operation. This has been achieved as follows :

- BDA Controller provides fault monitoring and accurate status report through LED.
- The 28V DC Power-supply is over-rated for actual requirements.
- Boosters are monitored for both Over-current and Under-current (most failures are sensed this way).
- Cabinet temperature is monitored for excessive temperature.
- Components are easily removable via quick connect DC and RF connectors.

8.2 Maintenance Philosophy

Field maintenance should require a screwdriver, a multi-meter, spares of each of the active BDA component parts, and a Portable Radio to monitor off the air signals. There is no requirement to have any test equipment to accomplish most service repairs.

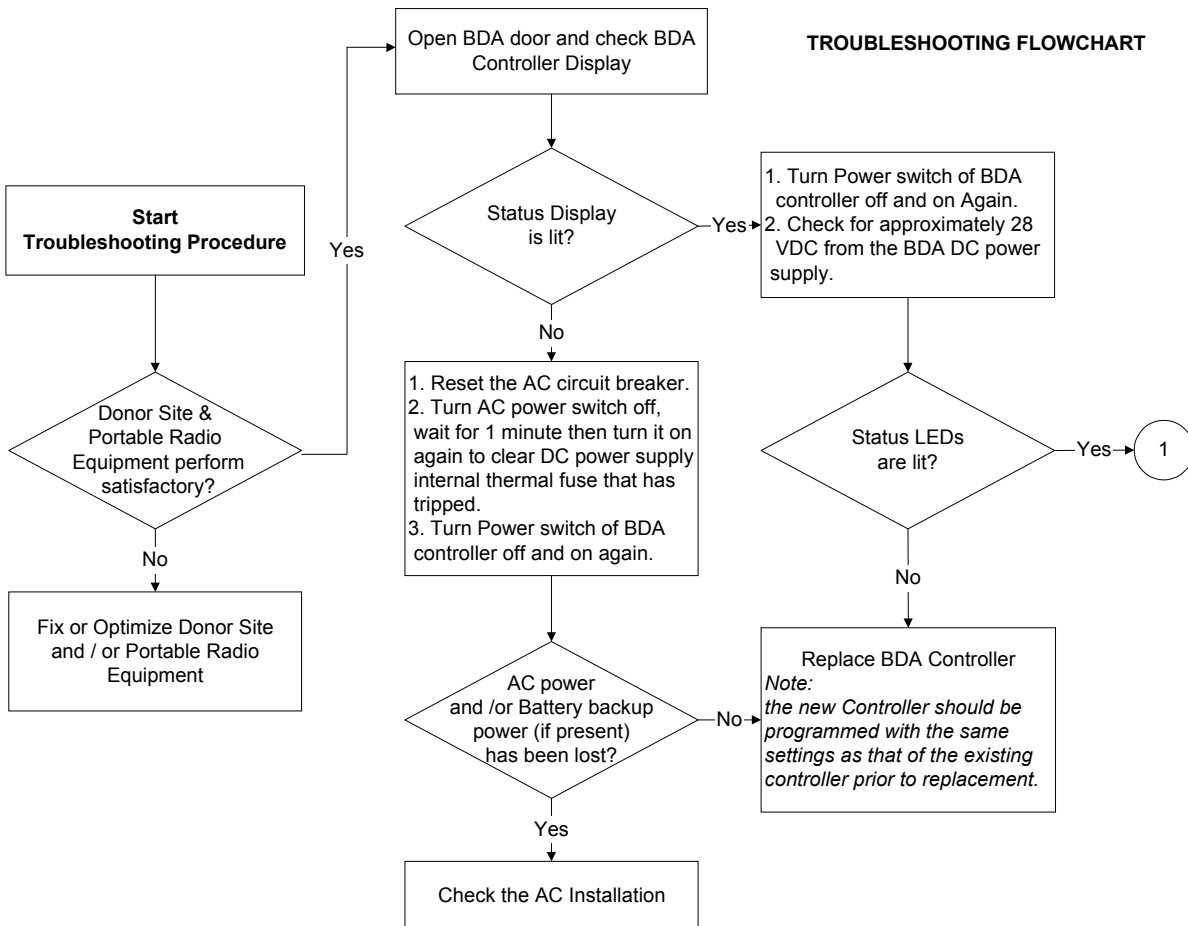
- All BDA component parts have been designed for reliable long life operation.
- The BDA Controller performs ongoing extensive built in diagnostics.
- Corrective action can often be taken without detailed technical knowledge or the need for any test equipment.

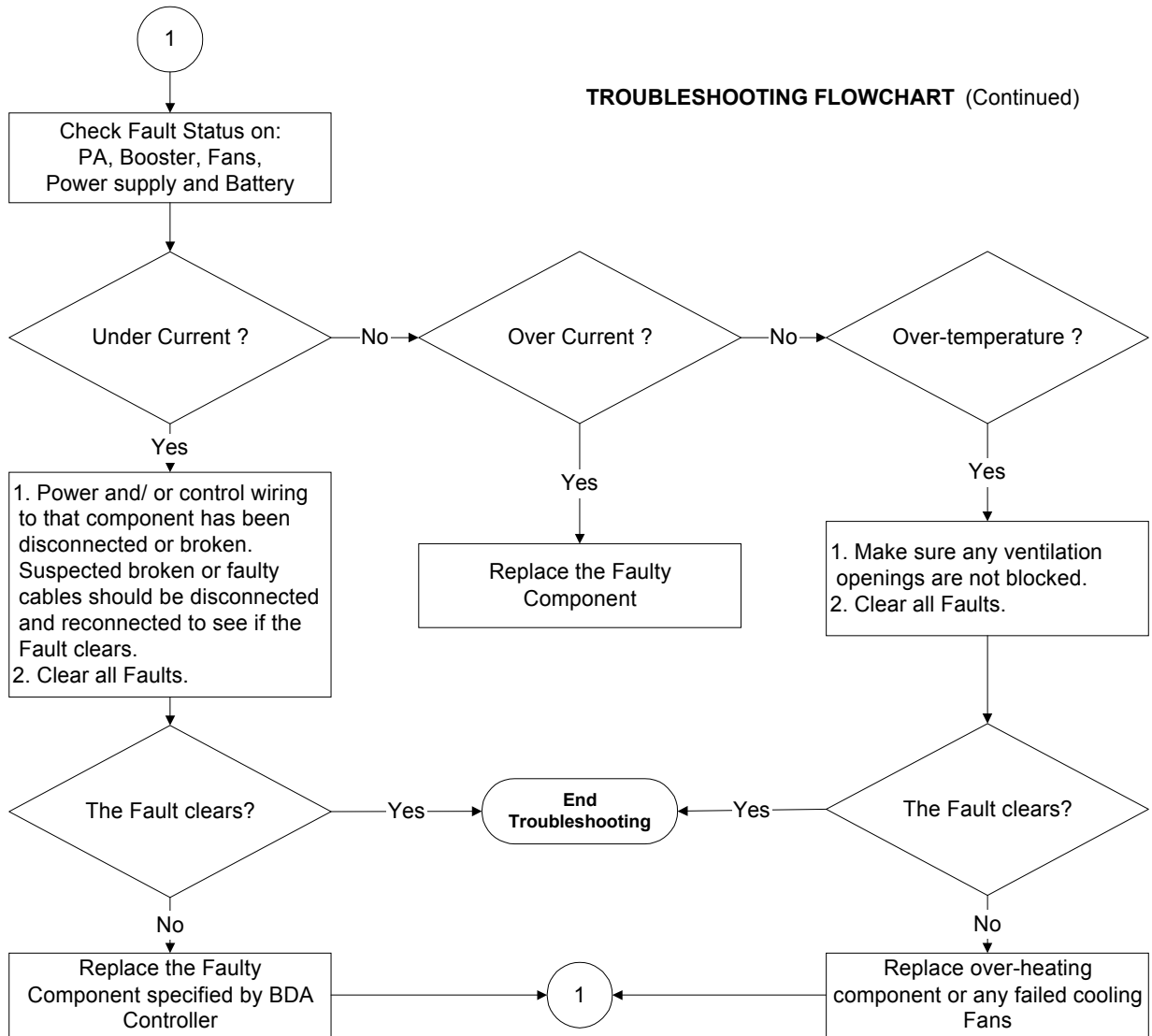
8.3 Troubleshooting Procedure

1. Before attempting to troubleshoot the BDA, you should study the troubleshooting flowchart carefully.
2. Always observe personal and equipment safety practices during troubleshooting.
3. Follow each step of the troubleshooting flowchart to check for the fault and to replace the recommended component.
4. Recommended Test Equipment:
 - Multimeter
 - Test cables, SMA adapter
 - Spare components for substitution.
 - Phillips screwdrivers



Note: If you are not familiar with electronic system troubleshooting, Please contact Kaval at 1-888-86-KAVAL for assistance or ask for a RMA (Return Material Authorization) before sending BDA unit to an authorized service agent





9 STANDARD WARRANTY

Products manufactured by Kaval Telecom Inc. are warranted to be free under normal use and service from defect in workmanship or materials for a period of one year from the date of shipment to the original purchaser. This warranty supersedes and voids any and all other warranties expressed or implied. In no event shall Kaval Telecom Inc. be liable for incidental or consequential damages arising from the use, misuse, failure to operate or improper operation of any Kaval product or product accessory.

Specifically excluded from this warranty is any claim of merchantability or fitness for a particular purpose or application.

This warranty is void if the product has been subject to misuse, neglect, accidental damage, damage of a cosmetic nature, misapplication, extreme environmental conditions, unauthorized repair or alteration.

Customer must contact Kaval Telecom before shipping a product for warranty services to obtain a Returned Material Authorization. Shipping charges for returned products must be PREPAID. A return shipping fee will be charged if a returned item is found by Kaval not to be defective or defective for a reason that voids the warranty.

10 Product Service Procedure

Return and Repair Procedures

The BDA can be returned for repair by the following procedures:

- Contact Kaval Telecom Inc. at 1888-86-KAVAL for a Return Materials Authorization (RMA) number. Please provide serial number and model number.
- Ship the defective part prepaid in the original shipping box to:

Kaval Telecom Inc.

ATTN: Returned Part ; RMA number:XXXX

60 Gough Road

Markham, On

L3R 8X7

Canada

11 Ordering Parts and Accessories

Parts ordering information

Parts and accessories for the BDA may be purchased by contacting Kaval Telecom Inc. at 1888-86-KAVAL for prices and delivery. When ordering a replacement part, please provide model number, serial number and software version number (See BDA Controller Settings-“As-Built” list).

12 Glossary

AGC	Automatic gain control is an RF output limiter that protects against damage from oscillations and prevents excessive intermodulation distortion.
Amplifier	A class A amplifier. BDA cabinet contains four amplifiers, two for the uplink/downlink path of A-band and two for the uplink/downlink path of B-band.
Downlink	Also called the forward path . In this path, the RF signal is transmitted by the donor cell then received, amplified and re-radiated by distribution system to the portable/mobile radio equipment
Interlock	BDA controller function that allows the user to select (from Amplifier or PA menu) which modules are to be disabled in the even that component (Amplifier or PA) has a fault.
Line Amplifier	Bi-directional amplifier that provides amplifications of RF signals to recover signal loss contributed by system components such as radiating cable, splitter and so on.
PA	Power Amplifier. To increase power, some BDA cabinet contains two PA, one for the uplink path and one for the downlink path.
Uplink	Also called the reverse path . In this path, the RF signal is transmitted by the portable/mobile radio equipment then received, amplified and re-radiated by the distribution system to the donor cell.