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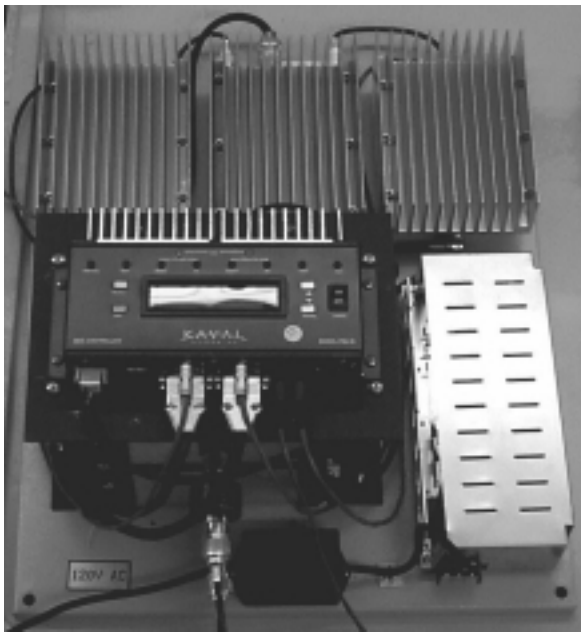
USER MANUAL FOR

BI-DIRECTIONAL AMPLIFIERS

800 & 900 MHz

MODEL BDA1200



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Revision 6, October 4, 1999

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- **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.

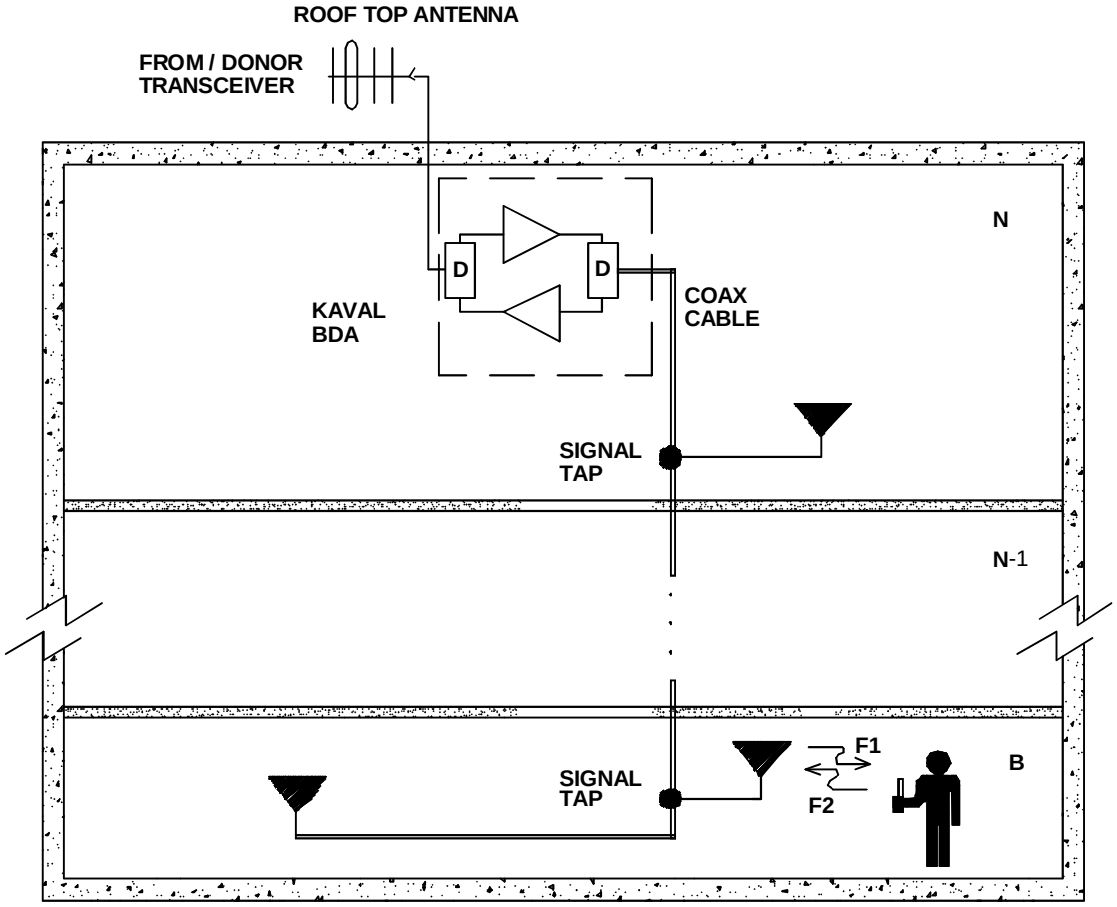
WARNING:

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

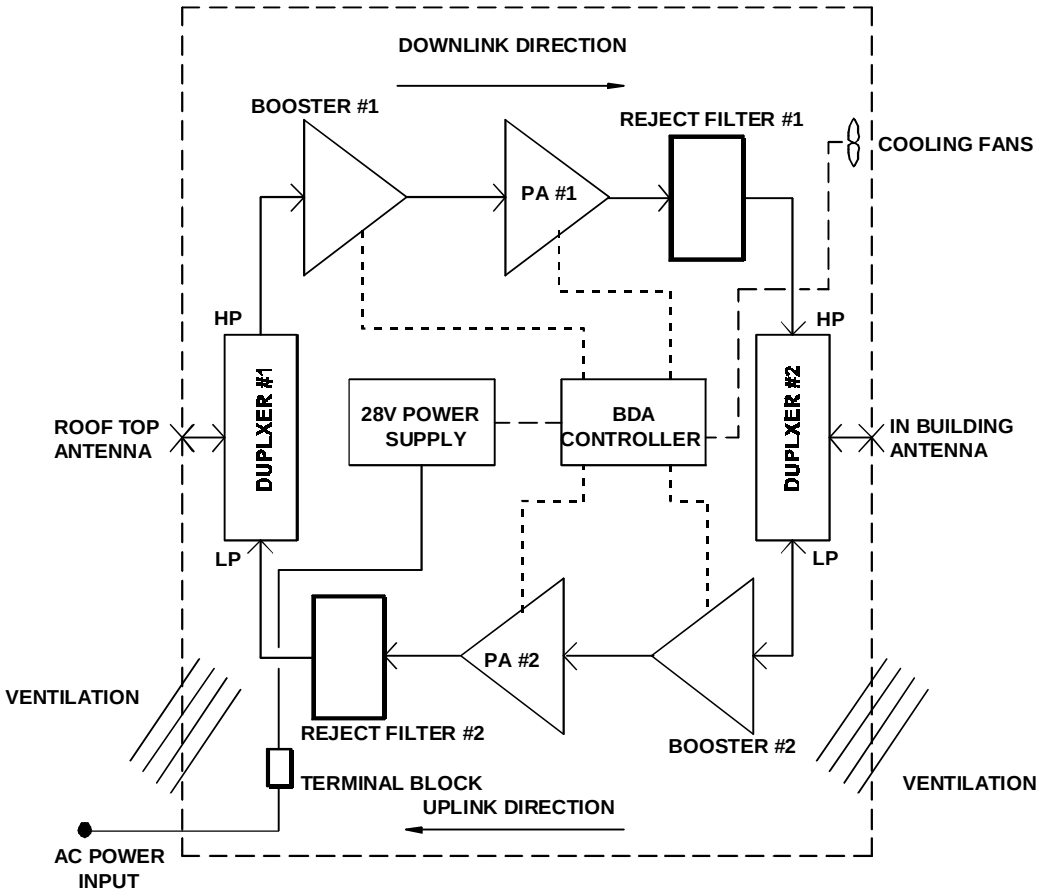
- **INTRODUCTION**

This Operator's Manual covers the use, operation and installation of the BDA1200 800 & 900 MHz Bi-Directional Amplifiers (**BDA's**). BDA's are intended to extend radio frequency coverage into areas with coverage deficiency such as inside office buildings, shopping malls, hospitals, tunnels etc. They are designed to be located independent of the Donor Transceiver Site and are equipped with their own antenna systems - one to communicate with the Donor Transceiver Site and the other(s) to communicate with radio equipment in the area with coverage deficiency.

For proper BDA System operation with no feedback problems, the RF isolation between the roof top antenna and the indoor antenna(s) must exceed the net system gain by at least 12 dB. Note that the net system gain takes into account the BDA gain, antenna gain, cable & connectors losses.



- **BLOCK DIAGRAM**



Power and Control Connections -------
RF Connections ____

BDA Controller : An enclosed unit with microcontroller, LED indicators, buttons, and two-line display.
Temp Sense & Cooling Fans : Controlled by the BDA Controller to ensure safe and reliable operation.
28V Power Supply : Providing all DC Power, with optional Gell-Cell Battery Backup.
Duplexers : Isolating Downlink and Uplink Frequencies, and coupling to antennas.
Reject Filters : Installed if required to eliminate feedback.
Boosters : High Gain (11 to 65 dB) Linear Amplifiers supplying up to 1 Watt of RF Power. The basic gain is adjustable via the BDA Controller over a 33 to 65 dB range, and an Automatic Gain Control (AGC) provides an additional 23 dB range.
PA Power Amplifiers : Optional Linear Power Amplifiers providing 15 dB of additional gain, and up to 20 Watts of RF Power.

- **BAND-SPLITS AND OPTIONS**

The standard available BDA1200 Band-Splits and options are ...

Model & Suffix	Description	Uplink Freq.	Downlink Freq.
BDA1200-0xxy-00	800 Services & Trunking	806-824 MHz	851-869 MHz
BDA1200-1xxy-00	800 15 MHz Sub-Band *	806-821 MHz	851-866 MHz
BDA1200-2xxy-00	800 5 MHz Sub-Band *	806-824 MHz	851-869 MHz
BDA1200-3xxy-00	800 3 MHz Sub-Band *	806-824 MHz	851-869 MHz
BDA1200-4xxy-00	Cellular A	824-846.5 MHz	869-891.5 MHz
BDA1200-5xxy-00	Cellular B	835-849 MHz	880-894 MHz
BDA1200-6xxy-00	1 MHz of 900 Trunking *	896-902 MHz	935-941 MHz

xx = "BB" Downlink and Uplink are Boosters only.
xx = "PB" Downlink is a Booster and PA, and Uplink is a Booster only.
xx = "BP" Downlink is a Booster only, and Uplink is a Booster and PA.
xx = "PP" Downlink and Uplink are Boosters and PA's.

y = "8" Maximum BDA Gain is 80 dB.
y = "6" Maximum BDA Gain is 65 dB.
y = "4" Maximum BDA Gain is 40 dB.

* Customers must specify exact frequency band required.

Please consult Kaval Telecom for other custom options.

- **TYPE ACCEPTANCES**

FCC Type Acceptance **H6M-BDA1200**
Industry Canada Type Acceptance **1541311193A**

- **TECHNICAL SPECIFICATIONS**

The BDA provides for both directions a nominal 65dB gain Booster and a 15dB gain Power Amplifier (PA). The linear Booster has a high gain range of 11 to 65 dB supplying up to 1 Watt of RF Power. The basic gain is adjustable via the BDA Controller over a 31 dB range, and an Automatic Gain Control (AGC) provides an additional 23 dB range. The isolation between the uplink and down-link paths is provided by two high performance bandpass Duplexers.

RF Performance	**Downlink**	**Uplink**
Frequency Range	As per Band-Split Option (see prev page): 851 to 941 MHz	As per Band-Split Option (see prev page): 806 to 902 MHz
Nominal Max. Gain	65 dB Max with Booster only 80 dB Max with Booster & PA	
Gain Adjustment	31dB with Booster only, 26 dB with Booster & PA (in 1dB steps) The AGC provides up to an additional 23 dB gain reduction depending upon input.	
Max. Allowable Input	-15 dBm In-Band, however when Gain Adjustment and AGC are considered, the output must not be allowed to exceed the 1 dB Compression Point for a single carrier, or the De-rated Power Output (see next page) for multiple carriers.	
1 dB Compression Point	+27 dBm with Booster only +40 dBm with Booster & PA	
3rd Order Intercept Point IP3	+37 dBm with Booster only +50dBm with Booster & PA	
Impedance	50 ohms Nominal	
VSWR	1.5:1 Max	
BDA Controller		
Features	Microprocessor Controller	
	Current Monitoring for 2 Boosters, 2 PA's, 2 Fans	
	Full Gain Control	
	Battery Backup Control & Charging	
Electrical		
Primary AC Power	Switchmode Universal 120/230V AC +/- 10%, 50-60Hz	
Total DC Current Drain	Nominal 2 to 6 Amps @ 28 VDC	
BDA Controller	300 ma @ 28 VDC	
1W Boosters	650 ma @ 28 VDC Fault thresholds Typically 200 ma and 900 ma	
20 Watt PA's	1.5A @ 28 VDC Fault thresholds Typically 160 ma and 1.8 A	
Batteries	Two 12 VDC Sealed Lead -Acid Batteries, 10-100 AH Battery Backup Time: Boosters only, 20 AH - 8 hrs Typical Battery Backup Time: Boosters & PA's, 100 AH - 8 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.	
Mechanical		
Dimensions W x H x D	20" x 24"x12"	
Weight	100 lbs. approx.	
Housing	Rugged Nema-Style Cabinet - Wall Mountable	
Connectors	N female	
Operating Temperature Range	-30 to +50°C	
Operating Humidity Range	95% RH Max, Non-Condensing	

- **MULTIPLE CHANNEL AMPLIFICATION 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 - off-channel signals produced from non-linear effects between the intended channel signals. These may cause interference to receiving equipment.

In order to minimize Intermodulation off-channel signals, Power De-rating must be applied. In the USA there are FCC Intermodulation Specifications published in the EIA Standard PN2009. The Tables below give 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.

Number of Channels	Maximum Output Power per Single Channel for Uplink or Downlink Using both a Booster and PA
1	+40.0 dBm
2	+28.7 dBm
4	+24.0 dBm
6	+21.3 dBm
8	+19.5 dBm
10	+18.1 dBm

Number of Channels	Maximum Output Power per Single Channel for Uplink or Downlink Using only a Booster
1	+27.0 dBm
2	+20.1 dBm
4	+15.4 dBm
6	+12.7 dBm
8	+10.8 dBm
10	+9.4 dBm

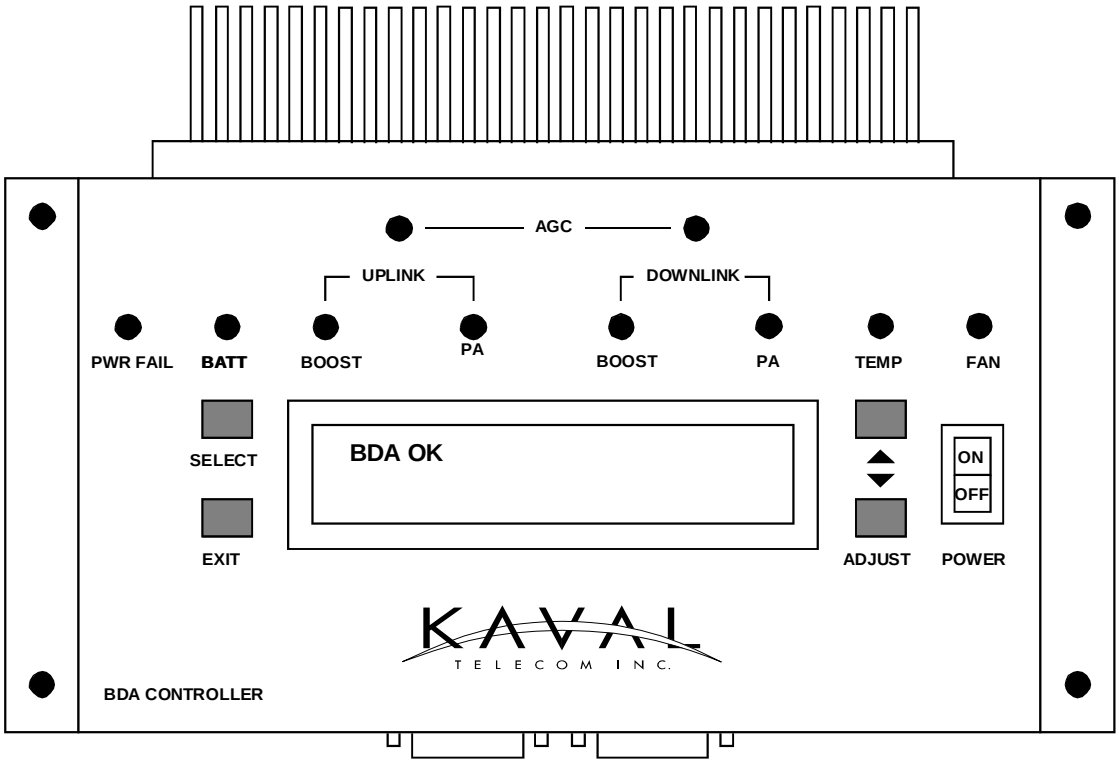
Note: Above levels are established with AGC disabled. De-ratings are based on values calculated using EIA standard PN2009. Actual Amplifier performance may exceed the above criteria.

- **BOOSTER AUTOMATIC GAIN CONTROL (AGC) FUNCTIONAL DESCRIPTION**

Both Downlink and Uplink paths, with Boosters only, or with Boosters and PA's, are equipped with AGC. The Booster based AGC has a dynamic attenuation range that maintains a factory set composite output nominal power of +23.2 dBm at the Booster output. The AGC gain varies dynamically to maintain this level and limits strong signal levels that could cause more Intermodulation. The AGC starts to turn on at +23.2 dBm, therefore, at a gain setting of 70 dB, the AGC will start to turn on at +23.2 – 70 = -46.8 dBm input level, and would maintain the +23.2 dBm output at an input levels higher than –46.8 dBm. Below the AGC turn-on threshold, the output level will decrease linearly with the input signal. With a PA installed in the path, the AGC maximum output level is 15 dB higher.

- **BDA CONTROLLER OPERATION**

The BDA Controller is a microprocessor based part of a Kaval BDA that provides all control, fault monitoring, and settings for the BDA. It interfaces to the 28 VDC Power Supply, the optional 24 VDC Battery (both monitoring, transferring, and charging), control signals to the Boosters, and provides monitored DC power for the Boosters and PA's. Overall dimensions of the case are 9" (including flanges) x 3.5" x 1.25". The heatsink extends about 1.75 inches above the case and is 4 inches wide.



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

- **BDA Controller User Interface**

  - ***LED and Audible Indicators:***

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 Booster 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 Booster 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 fault monitor, 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. Where 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.

  - ***Controls:***

ON/OFF Power Switch for turning the BDA operation on and off. Note that this only controls the BDA Controller, Boosters, PA's, and Fans; the DC Power Supply is still operating.

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.

- **Status Displays**

  The BDA Controller's Display normally shows one of 4 Status Displays. Pressing the Adjust Buttons sequences through the 4. Pressing the Select Button from any status screen enters the Main Menu. Pressing the Exit Button does nothing, except when a Fault condition exists and Exit Button clears the fault. If a Fault occurs, the display switches to the Master Status display and shows a text message for the Fault(s).

  - ***Current Monitor Status***

  This Screen displays the current drawn by each Booster and PA in the system. The top row shows abbreviated names for the amplifiers, the bottom row shows the current being drawn by each module. Entries for modules disabled by another module's fault show "Dsbl". Entries for modules that are manually disabled are blank. Modules that have a fault have their current indication blinking. If an overcurrent has occurred, then the word "Over" appears instead of a number.

```
Up-B Up-P Dn-B Dn-P
0.65 Over 0.60 2.35
```

  - ***Thermal Monitor Status***

  This Screen shows current temperature fan and battery status. 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. Battery voltage is displayed in volts to a resolution of 10 mV. If battery is not installed, display says "None" Battery voltage flashes if it is low.

```
Temp FanA FanB Batt
 53C ON   Fail 26.25
```

  - ***AGC Status***

  This Screen displays data about AGC operation and current gain setting. If AGC is disabled, then the readout for that direction shows "Off" (*). If AGC is enabled, but input signal is below minimum input level for AGC action, readout shows "Ok". If AGC is enabled, and AGC is acting, then readout shows equivalent single carrier input level for that direction in dBm. (*) If AGC is enabled, and amplifier is overdriven, readout shows blinking "Over" (*).

```
GN-UP-AGC GN-DN-AGC
65dB Dsbl 78dB 23dB
```

  - ***Master Status***

  This Screen shows normally ;

```
BDA OK
```

  If a Fault occurs, then a display such as ;

```
Fault!
Overtemperature
```

  Will be shown.

Fault Displays include ;

Up Boost Overcurrent	Up PA Overcurrent
Dn Boost Overcurrent	Dn PA Overcurrent
Up Boost Undercurr.	Up PA Undercurrent
Dn Boost Undercurr.	Dn PA Undercurr
Fan A Fail	Fan B Fail
Battery Low	Imminent Shutdown
Primary Power Fail	Overtemperature
Up Boost Internal	Up PA Internal
Dn Boost Internal	Dn PA Internal
External Fault	Controller Fault
Calibration Fail	Up Boost EEPROM
Dn Boost EEPROM	Uplink Overdrive
Downlink Overdrive	RS-232 Active

- **Menus**

  - ***Main Menu***

The Main Menu is entered by pressing the Select Button from any Status Display. If the Password is set to anything but 000 (default), then a Password Entry Screen appears. The user uses the Adjust Buttons to select a digit, and presses the Select Button to enter that digit. The cursor moves to the next digit and enters it. When the third digit is entered, and the Password is correct, the Main Menu becomes available. 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 000 (disabled) the Main Menu is available immediately.

```
Enter Password
4**
```

Main Menu entries are used to group **Functions** by category. The User selects the Category and a Sub-Menu appears listing available Functions. While in the Main Menu, the top row of the display shows “Main Menu”, and the bottom row shows the Sub-Menu headings as one scrolls through them. When a Sub-Menu is selected, the Sub-Menu heading replaces the Main Menu heading in the top row, and the bottom row then shows the Sub-Menu entries. If no Buttons are pressed for 5 minutes while in any Menu the Display reverts to the last Status Display.

Available main Menu entries are:

Gain	Uplink Booster
Uplink PA	Downlink Booster
Downlink PA	Temperature
Fans	Battery
Controller	Calibration

- ***Gain Menu***

The gain menu allows adjustment of overall System Gain in dB for each direction. These functions take into account programmed module gain values entered by the user, or entered during factory calibration. The values it considers include Booster maximum gain and PA gain. These gains must be entered in the appropriate menus and must account for system cable and duplexer losses. Invalid gains cannot be called up. Gain is set in 1 dB increments. Gain menu entries (typical) are:

```
Uplink Gain:  80dB
Downlink Gain:75dB
```

- ***Uplink & Downlink Booster Menus***

These Menus allow programming of Booster parameters. Current program range is up to 1 Amp. If max current is reduced below the minimum current setting, the minimum current setting is pushed down automatically, and kept 50mA less than the max current setting. If the minimum current setting is raised above the maximum current setting, the maximum current setting is pushed up and kept 50 mA higher. Current settings use 50 mA increments. Maximum gain setting is 80 dB. This applies to Booster gain, not System Gain. Booster Gain entries should account for losses before the booster. Menu selections are as follows (with typical data):

```
Enable:       Yes
Max Current: 1.00A
Min Current: 0.25A
Max Gain:    65 dB
Interlock
```

The Interlock entry, if selected, calls up a Sub-Menu that allows the user to select what modules are disabled if the Booster has a fault. In this menu, the top row shows:

```
Up Boost Interlock
```

The bottom row shows one of the other module names followed by Yes or No, which are toggled using the scroll keys.. The Interlock entries for the other amplifier modules operate in a similar manner. If all interlocks are off, then no deliberate shutdown occurs, and the fault detection is used for indication only.

```
Uplink Boost:  Yes
Uplink PA:     Yes
Downlink Boost:Yes
Downlink PA:   Yes
```

- ***Uplink and Downlink PA Menus***

The PA Menus are almost identical to the Booster menus except current programming range is up to 5 Amps. Maximum gain setting is 40 dB. Entries are as below:

```
Enable:        Yes
Output:      10dBm
Max Current: 1.00A
Min Current: 0.25A
Max Gain:    12 dB
Interlock
```

- ***AGC Menu***

The AGC Menu allows the user to turn AGC on or off. The AGC target is set in terms of equivalent single carrier output level at BDA antenna terminal. AGC menu entries are:

```
Uplink AGC:       On
Uplink Output:+22dBm
Downlink AGC:    Off
Downlink O/P:  +5dBm
```

- ***Temperature Menu***

This Menu allows setting of the over-temperature threshold and recovery temperature threshold. The recovery temperature is the temperature that the system has to cool down to for Boosters and PA's to be re-energized. A third menu item allows user to select whether an over-temperature will actually cause a system shutdown. Menu entries are:

```
Temp Limit:    60C
Recovery Temp: 40C
Temp Shutdown: Yes
```

- ***Fan Select***

This is a single entry Menu which allows selection of the primary fan. Allowable entries are Off, A, B and Both. If A is selected, then a fan A failure energizes fan B. If B is selected, fan A energizes in case of fan B failure. If both are selected, both fans are on all the time. If A or B are selected, then the second fan comes on if an over-temperature fault occurs, and stays on until the recovery temperature is reached.

```
Main Menu
Fan Select:    A
```

- ***Battery***

This Menu allows the user to tell the controller whether a backup battery is installed (Yes/No), and allows setting of battery voltage thresholds. If not installed, then no battery faults will signal, and no voltage display is shown.

```
Battery Menu

Batt. Installed? Yes
Low Voltage:    24.0
Warn Voltage:   21.5
Cutoff Voltage: 21.0
```

- ***Controller Menu***

This Menu allows the user to display the Software Revision, change the Password, perform a Lamp Test, control the Buzzer and reset to Factory Settings.. Pressing select key with Lamp test shown causes a test pattern to be shown on the VFD, and all LEDs light up all at once, then are lit individually in sequence. If the Factory Defaults function is selected, a confirmation screen appears asking the user to toggle the entry to yes and hit select before memory is cleared. Selecting “Set Password” allows user to enter a new password. The entry must be made a second time to confirm. In this case, display says “Confirm password”. If password is set to 000, then no password check is done (factory default). If password is forgotten, then EEPROM in controller must be replaced. Controller menu entries are:

```
Software Rev:    1.3
Set Password
Lamp Test:
Beep:            Yes
Factory Defaults?Yes
```

- ***Calibration Menu***

This Menu is for future use by the Kaval Factory only, and should not be used.

- **INSTALLATION**

  - Upon receiving the BDA shipment, examine the packaging and the Cabinet for damage.
  - Each BDA is carefully packaged for air shipment. Any damage incurred during the transportation must be claimed from the shipper.
  - The BDA is fully contained in a single Nema-style wall mountable cabinet.
  - Prior to installing the Roof Top Antenna and the Distribution Antenna System make sure that enough Antenna Isolation. If there is insufficient Isolation between the antennas, the amplifier gain must be set to a minimum of 12dB lower than the available Antenna Isolation. As a rule, this is easily achievable with in-building installation.
  - Check for and remove all packing materials prior to installing this unit.
  - 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. Four mounting lugs on the enclosure provided for this purpose. The cabinet is equipped on the left and right sides with an intake ventilation air at the bottom and exhaust fan at the top. Ensure that free air flow is available on both sides of the cabinet.
  - The AC electrical wiring is accessible via an opening at the bottom left hand side of the cabinet. The AC Terminal Strip is provided at the bottom of the cabinet:

Connection	North American Standard Color Code
Hot Line	BLACK
Neutral Line	WHITE
Ground connection	BARE

    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.
  - 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.
  - Connect the Roof Top Antenna feeder cable to the “Donor Cell Site” Antenna.
  - Connect the Distribution Antenna System feeder cable to the “In-building Antenna” port.
  - Make sure that the BDA Controller Power On/Off Switch is **“Off”**. Activate the circuit breaker or plug in the AC. The BDA Controller should light up momentarily then shut off. Turn the BDA Controller Power On/Off Switch to **“On”**. The BDA Controller screen should become active, and Cooling Fans should be running. Check the BDA Controller for any reported Fault conditions.

- **ANTENNA INSTALLATION**

  - **All Antenna Installation is to be performed by Qualified Technical Personnel only.**

  - 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 BDA1200 (+40 dBm with Booster & PA); +28 dBm, or 0.63 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.

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.

- **FIELD ADJUSTMENTS**

  The proper operation of the BDA in providing RF coverage extension is a function of not only the BDA, but also of proper systems engineering including isolation measurements and in building RF distribution design. The most critical requirement for the BDA installation is that the isolation between the “Roof-Top” Antenna and the in-building Antenna distribution system exceed the overall BDA System Gain by at least 12dB. The actual gain requirement for each Installation must be determined by the available antenna isolation and the operational requirements determined by local Systems Engineering.

  Each BDA has a Factory determined minimum gain both for the Uplink and Downlink Paths. The final Path Gain from Antenna Port in to Antenna Port out, is set by the BDA Controller.

  Follow through the BDA Controller Menus to set all configurable items as are appropriate for the installation.

- **TROUBLESHOOTING**

BDA Field Failures are often due to reasons not related to the BDA's themselves. Before attempting to troubleshoot the BDA, ensure that the Donor Repeater, the Portable Radios, Antennas and the in-building Distributed Antenna System are all functioning properly.

- **Maintenance & Safety**

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

- 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).
- PA's 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.

- **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.

- **Troubleshooting Procedure**

Once it has been determined that the Donor Site and Portable Radio Equipment are performing satisfactorily, and the BDA itself is suspect, proceed as follows:

1) Open the BDA door and observe the BDA Controller display. If none of the Status LED's are lit, and there is nothing on the Display, then the AC Power and / or Battery Backup Power (if present) has been lost / disconnected, the BDA's DC Power Supply has failed, or the BDA Controller itself has failed. Check the AC Circuit Breaker feeding the AC circuit that powers the BDA, or possibly the AC plug has been pulled. If AC is present, try turning it off, wait 1 minute, then on again; this may clear a DC Power Supply internal thermal fuse that has tripped. Also check that the **Power On/Off Switch** on the BDA Controller is **On**. If AC power appears to be present, then check for approximately 28 VDC from the BDA DC Power Supply. If there is no DC Voltage at the Power Supply terminals, it has likely failed. from Also check for 22 to 28 VDC on the Battery terminals if present. If the BDA Controller still has no lit LED's or Display Status then the BDA Controller has likely failed.

2) If the BDA Controller is functioning with any Fault Status indicated, then check the indicated failed component. Over or Under Current on Boosters, PA's or Fans may mean that the power and/or control wiring to that component has been disconnected or is broken, or that the component has failed and needs replacement. Suspected broken or faulty cables should be disconnected and reconnected to see if the Fault clears.

3) Over-temperature indications on the BDA Controller may occur as a result of failed Cooling Fans, blocked ventilation openings, faulty over-heating Boosters or PA's, or excessive ambient temperature (> 60^{o}C).

4) Other problems may include connector & cable failures or related problems, specification failure in a Booster or PA, etc. Problems of this sort are best referred to Kaval Service, or other supporting RF Test Lab.