

# MORPH MANUAL

## WORD FORMAT

### Table of Contents

Product Registration/Certification Information.....	1
Safety Guidelines.....	1
Product Information.....	2
Pin-Out Chart.....	2
LED Indicators.....	2
Mechanical Outline Drawing.....	3
Installation.....	4
Important Safety Information.....	5
Amplifier Adjustment.....	6-9
Troubleshooting.....	10
Product Warranty.....	11

### **Product Certification/Registration Information**

The serial number may be found on the label on the rear panel of the unit. For your convenience, note this number below. Retain this manual, along with proof of purchase, to serve as a permanent record of your purchase for future reference or in the event of theft.

### **Safety Guidelines**

The general safety information in this guideline applies to both operating and service personnel. Specific warnings and cautions will be found in other parts of this manual where they apply, but may not appear in this summary. Failure to comply with these precautions or specific warnings elsewhere in the manual violates safety standards of design, manufacture, and intended use of equipment. Cellular Specialties, Inc. assumes no liability for the customer's failure to comply with these requirements.

#### *Grounding*

This amplifier system is designed to operate from 120 Vac @ 1.3A maxpower and should always be operated with the ground wire properly connected. Do not remove or otherwise alter the grounding lug on the power cord.

#### *Explosive Atmospheres*

This product has an integral circuit breaker, which may cause an electrical flash if the breaker should reset. To avoid explosion or fire, do not operate this product in the presence of flammable gases or fumes.

### *Lightning Danger*

Do not install or make adjustments to this unit during an electrical storm.

### *No User Serviceable Parts Inside*

HAZARDOUS VOLTAGES ARE PRESENT WHEN THE COVER IS REMOVED. Opening the chassis will void your warranty. If you suspect a malfunction with this product, call your dealer or the Cellular Specialties Support Line at (603) 626-6677.

DISCLAIMER: All information and statements contained herein are accurate to the best of the knowledge of Cellular Specialties, Inc. (CSI), but Cellular Specialties makes no warranty with respect there to, including without limitation any results which may be obtained from the products described herein or the infringement by such products of any proprietary rights of any persons. Use or application of such information or statements is at the users sole risk, without any liability on the part of Cellular Specialties, Inc. Nothing herein shall be construed as license or of recommendation for use, which infringes upon any proprietary rights of any person. Product material and specifications are subject to change without notice. Specialties' standard terms of sale and the specific terms of any particular sale.

## **Product Description**

Cellular Specialties, Inc. (CSI) developed the LCD Model Bi-Directional Amplifier (BDA) for use in enclosed structures where sufficient signal from local cell sites to operate cell phones was unavailable within the building. It is necessary that sufficient signal be available on the roof of the structure. The BDA is connected to an external antenna, usually on the roof, and to one or more internal antennas placed strategically throughout the area where phone service is desired.

The external antenna is usually a directional type such as a "Yagi". Internal antennas are usually omni directional, although various other types may be used for certain installations. The BDA amplifies both the "uplink" (phone to tower) and "downlink" (tower to phone) signals thus facilitating communications to and from the local cell site.

There are seven amplification stages on the downlink and seven on the uplink for a total of +80dB nominal gain for each link. Gain can be set using the LCD display and select/up/down switches. There are also LED indicators on the top cover for power overload and gain reduction to prevent oscillation.

## **LED Indicators**

*Warning:* The unit has sensed instability due to insufficient isolation between the inside antenna and the outside antenna, and has reduced the gain of the amplifier. This is done to prevent oscillation, which can interfere with the handsets in the covered area and/or the wireless service provider's base station.

*Fault:* The gain of the unit has been reduced to a minimum in order (Red) to prevent very strong input signals from overloading the amplifier. The amplifier will attempt to recover from this condition, initially at fifteen-second intervals and then at four-minute intervals.

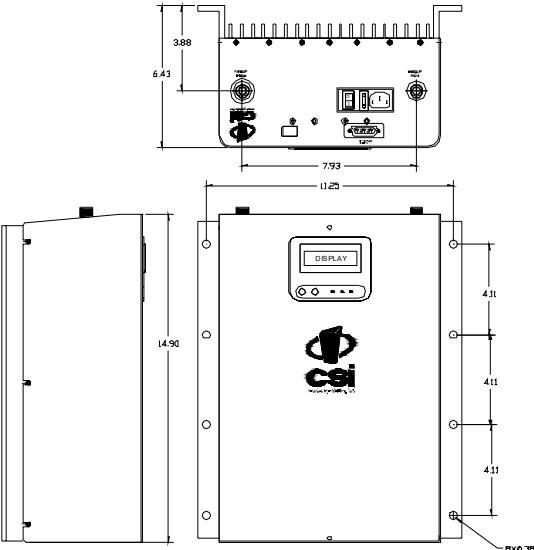
An automatic amplifier safety shutdown circuit is also incorporated that will disable the transmitters should the uplink or downlink overloads be reached to prevent excessive intermodulation and oscillation. The amplifier will periodically attempt to recover from this condition.

The BDA is also equipped with an interface connector (RJ-15) designed for use with an optional remote monitor. A second Connector (RJ-11) is used for remote monitoring and shutdown. The RJ-11 pin-out is listed below.

## **Pin-Out Chart**

- 1 Alarm Relay - Common
- 2 N/C
- 3 Shutdown (Input TTL)
- 4 Uplink Power
- 5 Alarm Relay – Active Open
- 6 N/C

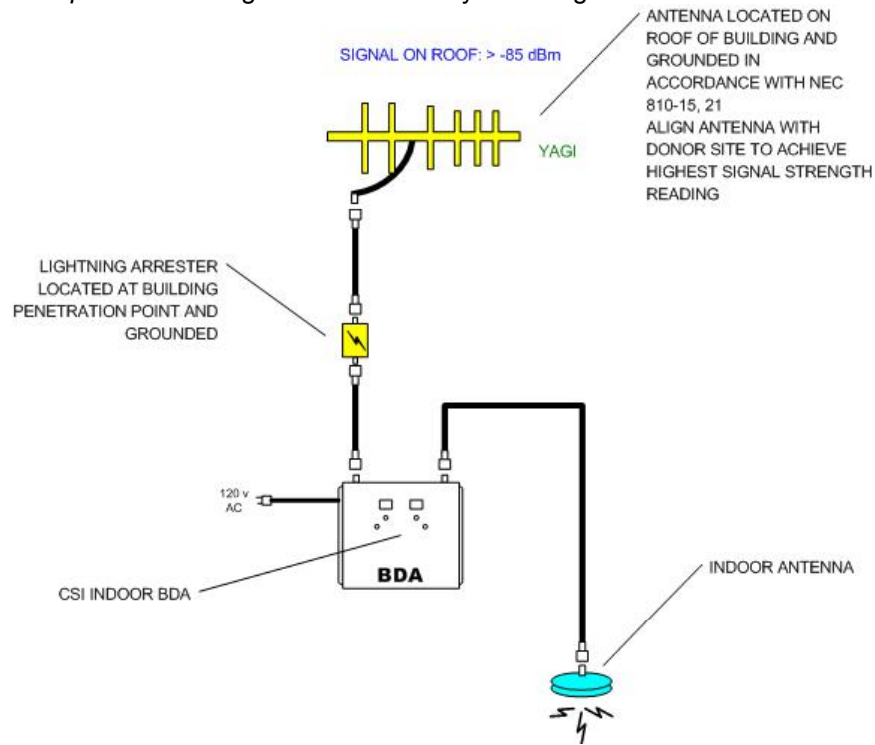
LCD Model Mechanical Drawing



## Installation

CSI recommends that all BDA installations be coordinated through the local wireless provider.

### Example: Standard Single Internal Antenna System Design



## Optional Accessories

Accessories are available directly from Cellular Specialties, Inc. or any of CSI's distributors.

- Outside High Gain Yagi Antennas
  - PCS – model number (CSI-AY/1.85-1.99/10)
  - SMR and Cellular – model number (CSI-AY/806-960/11) and (CSI-AY/806-960/14)
- Inside Omni directional Antennas
  - PCS – model number (CSI-AS/1.85-1.99/2)
  - SMR – model number (CSI-AS/806-866/4)
  - Dual-Band – model number (CSI-AO/800/2K/3)
- Power Dividers
  - 2:1 - model number (CSI-S2BSC)
  - 3:1 - model number (CSI-S3BSC)
  - 4:1 - model number (CSI-S4BSC)
- Grounding Kit - model number (CSI-GKIT)
- Lightning Arrestor - model number (CSI-CAP)
- Directional Couplers and Cross Band Couplers are also available

## Important Installation Notes

- A high degree of isolation must be afforded to prevent any re-generative feedback in the system. Feedback of this nature causes the amplifier to emit a continuous signal of maximum amplitude and could, in some cases, interfere with normal operation of the cell site. The minimum required isolation of 80 dB can usually be obtained by mounting the outside antenna away from the edges of the roof. The use of window mounts or other non-rooftop mountings should be avoided.
- The Installer should refer to the *Safety Precautions*, in the following section, for proper antenna selection and installation

**Warning! Amplifier Damage will occur if a handset is connected directly to the BDA or the coax that leads to the BDA.**

## Important Safety Information

For INDOOR use, an omni-directional antenna with a *maximum* gain of 3 dBi is authorized for use with this unit. Inside antennas must be positioned to observe minimum separation of 20 cm. (~ 8 in.) from all users and bystanders. For the protection of personnel working in the vicinity of inside (downlink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of an INDOOR antenna must be such that, under normal conditions, all personnel cannot come within 20 cm. (~ 8.0 in.) from any inside antenna. Exceeding this minimum separation will ensure that the employee or bystander does not receive RF-exposure beyond the maximum permissible exposure according to section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.

For OUTDOOR use, an omni-directional antenna with a *maximum* gain of 3 dBi is authorized for use with this unit. Outside antennas must be positioned to observe minimum separation of 20 cm. (~ 8 in.) from all users and bystanders. For the protection of personnel working in the vicinity of outside (uplink) antennas, the following guidelines for minimum distances between the human body and the antenna must be observed.

The installation of an OUTDOOR antenna must be such that, under normal conditions, all personnel cannot come within 20 cm. (~ 8.0 in.) from any outside antenna. Exceeding this minimum separation will ensure that the employee or bystander does not receive RF-exposure beyond the maximum permissible exposure according to section 1.1310 i.e. limits for General Population/Uncontrolled Exposure.

## Performance Adjustment

The menu system can be navigated with five buttons: *UP*, *DOWN*, *EDIT*, *SAVE*, and *MENU*. Feedback is given to the operator through the LCD panel.

Generally speaking, the *MENU* button is used to switch among various menus available on the LCD panel without altering the contents of non-volatile memory. The *EDIT* button is used to alter values that are present, when possible. The *UP* and *DOWN* buttons permit choice among various options available within a given menu. Once a desired value is found this way, it can be saved in the 610's non-volatile memory by pressing *SAVE*.

Here, then, is a complete list of the menus the operator can expect to encounter during normal operation and how to navigate them.

Default Menu. This menu is what the LCD panel will show after a power cycle, or after no button has been pressed for at least an hour and a button is pressed to “wake up” the LCD panel again. It reveals how much power is currently being carried through the uplink and downlink channels (dBm), as well as how much automatic gain control is being exerted by the attenuators (dB). A typical display might look like this:

```
UL 19 dBm AGC 00
DL 27 dBm AGC 02
```

In this instance, through the uplink channel, 19 dBm are being sent; there is no attenuation. Through the downlink channel, 27 dBm are being sent, and the signal is being attenuated by 2 dB by the AGC.

It should be noted that under circumstances when the power through a channel is less than 0 dBm, the display will show “<0” in the location where the reading usually appears.

The *UP*, *DOWN*, *EDIT*, and *SAVE* buttons have no effect in this menu. However, pressing the *MENU* button will advance the LCD panel to the Error Menu.

Error Menu. This menu shows the total of various errors logged by the unit, up to 999 of each type. If more than 999 errors occur in a particular category, 999 will be displayed. A typical display might look like this:

```
ERRORS RECORDED:
Overheat: 008
```

There are three errors that the Morph Board currently tracks: **Oscillation** errors, which are a total of the number of times the signal has gone into oscillation, combined between uplink and downlink; **Fan Speed** errors, which are discrepancies between the speed to which

the fans were set and the speed at which they were found to operate; and **Overheat** errors, which are catalogued when the temperature of the board runs too high despite the fans running at full speed.

Pressing *UP* and *DOWN* permits the user to examine the number of errors logged in each category. Pressing *EDIT* clears the counters of all errors. Pressing *SAVE* has no effect. Pressing *MENU* sends the user to the Peak Power Menu.

Peak Power Menu. This menu shows the peak power registered by the unit on both the uplink and the downlink channels. A typical screen for this menu might look like this:

UL	Pk	Pwr:	25		
DL	Pk	Pwr:	27		

In this instance, the uplink channel has registered a maximum of 25 dBm, and the downlink channel has registered a maximum of 27 dBm. The maximum power read is stored until a power cycle or until the user resets the peak power readings, which can be done by pressing *EDIT*. Pressing *UP*, *DOWN*, or *SAVE* in this menu has no effect. Pressing *MENU* moves the LCD screen to the Maximum Downlink Gain Menu.

Maximum Downlink Gain Menu. This menu shows the maximum gain the unit is permitted, within its range of acceptable values. Upon entering this menu, the unit defaults to showing you its current maximum downlink gain.

Max	DL	Gain:			
		77	dB		

If the user wants to skip this menu and move on, she may do so by pressing the *MENU* button. If, however, she wishes to change the maximum gain the unit will permit, she can press the *EDIT* button. The screen will then change to resemble this:

Set	Max	DL	Gain:		
		77	dB		

The user can then change the maximum gain of the unit by pressing the *UP* and *DOWN* keys. When the desired maximum gain is shown on the screen, the user can lock this number into memory by pressing the *SAVE* key, which will automatically move the unit on to the next menu: the Maximum Uplink Gain Menu.

Maximum Uplink Gain Menu. This menu behaves in much the same manner as the Maximum Downlink Gain Menu. If the user changed the maximum downlink gain previously, this menu will default to showing the same maximum uplink gain. If not, the screen defaults to

showing the current maximum uplink gain. Upon entering this menu, the screen will resemble this:

M	a	x	U	L	G	a	i	n	:				
			7	7	d	B							

The user can move on to the next menu by pressing the *MENU* key, or change the value by pressing *EDIT* and scrolling to the desired value with the *UP* and *DOWN* keys. If the user chooses to change the maximum uplink gain allowed, the screen will change subtly to resemble this:

S	e	t	M	a	x	U	L	G	a	i	n	:	
			7	7	d	B							

Whether the user moves past this menu or selects a new value and locks it in by pressing *SAVE*, the screen will move on to the Network Name menu.

Network Name Menu. This displays the amplifier's name – which consists of three characters – on the CAN network, provided the unit is to be plugged into such a network including a Web Monitor. The characters can be any of the uppercase letters ('A' through 'Z'), any of the lowercase letters ('a' through 'z'), any of the numerals ('0' through '9'), or a blank space, in any order desired.

When the user enters this menu, the screen displays the current name for the amplifier in a screen like this:

B	D	A	N	a	m	e	:						
			P	C	S								

If the user wishes to move on to the next menu, she may do so by pressing the *MENU* key. If she wishes to change the amplifier's name, however, she should press the *EDIT* key. Doing so will alter the screen to resemble this:

S	e	t	N	e	w	B	D	A	N	a	m	e	
			A	A	A								

A blinking cursor shows which character the user is editing. She can change the value of the given character by pressing *UP* and *DOWN*. Once a desired character is reached, it can be locked in by pressing *SAVE*, and the cursor will advance to the next character. If moving back a character is desired, the cursor can be moved to edit the previous character by pressing *EDIT*. Once *SAVE* is pressed while the cursor is on the last character, the new name is locked into non-volatile memory.



As an example, let's say the user wants to change the name of the amplifier on the network from "CEL" to "PCS". She gets to the menu by pressing *MENU* until this screen appears:

BDA	Name:						
		CEL					

Then, to inform the amplifier that she wants to change the name, she presses *EDIT*, and this screen appears:

Set	New	BDA	Name				
		CEL					

To change 'A' to 'P', she needs to press the *UP* key fifteen times. (Alternatively, she could hold the *UP* key down until the proper letter appears.) Once she does this, the display would look like this:

Set	New	BDA	Name				
		PEL					

Pressing *SAVE* would move the blinking cursor from the first letter's position to the second letter's position.

Changing an 'E' to a 'C' merely requires pressing the *DOWN* key twice:

Set	New	BDA	Name				
		PCL					

Pressing *SAVE* moves the cursor from the second letter's position to the third letter's position.

Finally, changing an 'L' to an 'S' requires pressing the *UP* key seven times, resulting in this display:

Set	New	BDA	Name				
		PCS					

Pressing *SAVE* at this point would save the new name to memory and move on to the Network Address Menu.

Network Address Menu. Each amplifier on a CAN network including a Web Monitor must have a unique address on the network that the Web Monitor can read and write to. This number can be between one and seven, inclusive. The default address is one.

When the user encounters this menu, the display might look like this:

Unique	BDA						
Address	(1-7):	1					

As usual, the user can move past this menu by pressing *MENU*, which would return the user to the Default Menu above. Pressing *EDIT*, however, changes the screen to resemble this:

New	Unique	BOA	
Address(1-7):	1		

The user can then use the *UP* and *DOWN* arrows to scroll to a desired address. Pressing *SAVE* locks the selected address in non-volatile memory and returns the user to the Default Menu.

It should be noted that while two amplifiers with the same address on the same network will not cause a crash, the Web Monitor will only report on the most recent amplifier to send it information. In addition, commands sent through the Web Monitor to one amplifier will also affect the other.

***Final Note:*** If the amplifier should become impossible to resuscitate for some reason, and none of these menu commands are working, the amplifier can be reset to factory defaults by pressing and holding the *UP*, *DOWN*, and *MENU* keys simultaneously for one second. This is a drastic measure, however, and should not be implemented unless all other attempts at regaining functionality of the amplifier have failed.

## Troubleshooting

All cables should be carefully checked for “shorts” and “opens”.

The rooftop antenna, if directional, should be checked for proper alignment along the calculated compass heading. Typically, the directional antenna should be aimed at the same site that your handset uses in the area where the outside antenna is placed.

If cables and alignment are acceptable, it may be necessary to use a spectrum analyzer to examine the signal environment in which the BDA is operating. The existence of strong analog signals within the frequency bands can cause the AGC to reduce the amplifier's gain particularly on the downlink. In some cases additional filtering might be required to reject these unwanted signals. In some instances the directional outside antenna can be reoriented, horizontally to place the interfering source in an antenna pattern “null”. There also may be some cases where the interference from outside signals is so great that they cannot be filtered or otherwise reduced or eliminated without expensive and possibly prohibitive measures. In these cases it may not be practical to use the BDA for providing coverage at these sites.

### **One Year Limited Warranty**

Seller warrants that its products are transferred rightfully and with good title; that its products are free from any lawful security interest or other lien or encumbrance unknown to Buyer; and that for a period of one year from the date of installation or fifteen months from the date of original shipment, whichever period expires first, such products will be free from defects in material and workmanship which arise under proper and normal use and service. Buyer's exclusive remedy hereunder is limited to Seller's correction (either at its plant or at such other place as may be agreed upon between Seller and Buyer) of such defects by repair or replacement at no cost to Buyer. Buyer shall pay transportation costs in connection with the return of products to Seller's plant or designated facility. The provisions of this warranty shall be applicable with respect to any product that Seller repairs or replaces pursuant to it. SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, OTHER THAN AS SPECIFICALLY STATED ABOVE. EXPRESSLY EXCLUDED ARE THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE. THE FOREGOING SHALL CONSTITUTE ALL OF SELLER'S LIABILITY (EXCEPT AS TO PATENT INFRINGEMENT) WITH RESPECT TO THE PRODUCTS. IN NO EVENT SHALL SELLER BE LIABLE FOR SPECIAL, CONSEQUENTIAL OR INCIDENTAL DAMAGES, INSTALLATION COSTS, LOST REVENUE OR PROFITS, OR ANY OTHER COSTS OF ANY NATURE AS A RESULT OF THE USE OF PRODUCTS MANUFACTURED BY THE SELLER, WHETHER USED IN ACCORDANCE WITH INSTRUCTIONS OR NOT. UNDER NO CIRCUMSTANCES SHALL SELLER'S LIABILITY TO BUYER EXCEED THE ACTUAL SALES PRICE OF THE PRODUCTS PROVIDED HEREUNDER. No representative is authorized to assume for Seller any other liability in connection with the products.