WARNING: This is NOT a CONSUMER device. It is designed for installation by FCC Licensees and Qualified Installers. You must have an FCC license or express consent of an FCC Licensee to operate this device. You must register Class B signal boosters (as defined in 47 CFR 90.219) online at www.fcc.gov/signal-boosters/registration. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of $100,000 for each continuing violation.

Refer to Appendix A for default IP Address and account details.
TERMS AND CONDITIONS OF SALE

Please visit the Bird website for complete information regarding terms and conditions and warranty information.

http://www.birdrf.com/~media/Bird/Files/PDF/Sales/bird-terms-and-conditions-of-sales.ashx

DISCLAIMER

Product part numbering in photographs and drawings is accurate at time of printing. Part number labels on Bird products supersede part numbers given within this manual. Information is subject to change without notice.
Symbols Commonly Used

- **WARNING**
- **High Voltage**

- **CAUTION** or **ATTENTION**
- **Hot Surface**

- **Important Information**
- **ESD Electrostatic Discharge**

- **Training Video Available**
- **Electrical Shock Hazard**
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For Class A or Class B Unintentional Radiators
This equipment has been tested and found to comply with the limits for a Class A or Class B 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 the user will be required to correct the interference at his own expense.

Pour Classe-A ou Classe-B Radiateurs Involontaires
Cet équipement a été testé et jugé conforme avec les limites de la Classe-A ou Classe-B des appareils numériques, suivants à la Partie 15 des règlements de la FCC. Ces limites sont conçues pour fournir une protection raisonnable contre les interférences dangereuses lorsque l'équipement est utilisé dans un environnement commercial. Cet équipement génère, utilise et peut émettre des fréquences radio et, s'il n'est pas installé et utilisé conformément aux instructions du manuel, ceci peut causer des interférences dangereuses aux communications radio. Le fonctionnement de cet équipement dans une zone résidentielle est susceptible de causer des interférences mauvaises dans lequel l'utilisateur sera tenu pour responsable de corriger l'interférence à sa propre discrétion.

WARNING: Changes or modifications which are not expressly approved by Bird could void the user's authority to operate the equipment.

AVERTISSEMENT: Les changements ou modifications qui ne sont pas approvés par Bird pourrait annuler l'autorité de l'utilisateur de faire fonctionner l'équipement.

ATTENTION: This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

ATTENTION: Cet appareil est conforme à la Partie 15 des règlements de la FCC. L'opération doit se conformer aux deux conditions suivantes: (1) cet appareil ne peut causer d'interférences nuisibles et (2) cet appareil doit accepter toute interférence reçue, y compris les interférences qui peuvent provoquer un fonctionnement indésirable.
GENERAL DESCRIPTION

Signal boosters extend radio coverage into areas where abrupt propagation losses prevent reliable communication. This system receives an RF signal, raises its power level, and couples it to an antenna or leaky (radiating) coaxial cable system so that it can be re-radiated. No frequency translation (conversion) occurs with this device. The two-way SBII+ signal booster is a broadband, bidirectional, dual branch (uplink and downlink) system. The booster transmits into a Distributed Antenna System (DAS) for downlink output signals and a Donor antenna for uplink output signals. The Bird Technologies SBII+ signal booster, an industrial, Class-B, signal booster is designed to operate in the UHF, 700, and 800 MHz public safety band.

The system is based on a modular design that is bi-directional with one uplink and one downlink branch in the module. The module is powered by a DC power supply assembly. The module is the core of the product and may or may not have ancillary assemblies such as filters, duplexers, or isolators included as part of the overall system installation.

Because of its modular design the completed booster system can be housed in a variety of cabinet designs or even a rack mounted deck. The most common cabinet enclosure used for the sys-

<table>
<thead>
<tr>
<th>63-nnX-2-A-X-n-X (nomenclature breakdown)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>63</strong></td>
</tr>
<tr>
<td><strong>nnX</strong></td>
</tr>
<tr>
<td>70 = 450 - 470 MHz</td>
</tr>
<tr>
<td>71E = 482 - 500 MHz</td>
</tr>
<tr>
<td>82P = 763 - 805 MHz</td>
</tr>
<tr>
<td>82R = 763 - 861 MHz</td>
</tr>
<tr>
<td>89A = 806 - 869 MHz</td>
</tr>
<tr>
<td><strong>2</strong></td>
</tr>
<tr>
<td>2-Way, Standard, SBII+</td>
</tr>
<tr>
<td><strong>A</strong></td>
</tr>
<tr>
<td>80</td>
</tr>
<tr>
<td><strong>X</strong></td>
</tr>
<tr>
<td>B = 0.5</td>
</tr>
<tr>
<td>F = 2.0</td>
</tr>
<tr>
<td>N = 10</td>
</tr>
<tr>
<td>R = 18</td>
</tr>
<tr>
<td>PN = 12, 10</td>
</tr>
<tr>
<td><strong>n</strong></td>
</tr>
<tr>
<td>1 = Gray NEMA 4 case</td>
</tr>
<tr>
<td>2 = Red NEMA 4 case</td>
</tr>
<tr>
<td><strong>X</strong></td>
</tr>
<tr>
<td>Blank = No options</td>
</tr>
<tr>
<td>N = NFPA</td>
</tr>
<tr>
<td>H = Fiber Head End</td>
</tr>
<tr>
<td>J = Fiber Head End + Local RF</td>
</tr>
<tr>
<td>R = Fiber Remote End</td>
</tr>
<tr>
<td>D = Dual Port</td>
</tr>
</tbody>
</table>

Table 1: Model number nomenclature.
tem is either a small clamshell type or a large clamshell type. The small clamshell style can be identified by its status LED being located on the lower center of the door and the large clamshell style by its status LED being located on the lower left-side of the door. The front cover of this manual shows examples of both clamshell styles. Both the small and large style clamshell enclosures use convectional cooling. The clamshell style enclosures are used in illustrations throughout this manual as an example. The module is powered by a DC power supply assembly.

The SBII+ Signal Booster is available in a variety of configurations as shown in Table 1. The product model number is used to describe each configuration available. As an example the model number 63-70-2-A-B-1-J represents an SBII+ signal booster operating in the 450 - 470 MHz band, signal flow is in 2 directions (uplink and downlink), the gain of the booster is 80 dB, the passband of the filters used in the booster will be 0.5 MHz, the booster will be housed in a gray NEMA 4 style case, and the factory installed options would be a Fiber-optic Head End with an RF Remote End (local RF). Custom designed SBII+ Signal Boosters use the same model number formatting except that a 5 digit number will be inserted into the model number in place of the fields for signal direction, gain, and filter bandwidth. The model number nomenclature is illustrated in table 1. The front view of a typical 700/800 MHz booster with the door open is shown in Figure 1. Likewise, Figure 2 shows the front view of a typical UHF booster with the door open. Specifications for the SBII+ Signal Booster are listed in Table 2.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain</td>
<td>80 dB</td>
</tr>
<tr>
<td>Gain Range (dB)</td>
<td>35 dB - 80 dB in 0.5 dB steps</td>
</tr>
<tr>
<td>Maximum Output Power</td>
<td>450 - 512 MHz +32 dBm UL/DL (composite)</td>
</tr>
<tr>
<td></td>
<td>764 - 869 MHz +33 dBm UL/DL (composite)</td>
</tr>
<tr>
<td>Maximum Input Level</td>
<td>-20 dBm</td>
</tr>
<tr>
<td>RF Sampler</td>
<td>-40 dB typ.</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-30°C to +50°C</td>
</tr>
<tr>
<td>Nominal Impedance</td>
<td>50 Ohms, &lt;1.5:1 VSWR</td>
</tr>
<tr>
<td>Input/Output Connectors</td>
<td>N Female</td>
</tr>
<tr>
<td>RF Sample Connectors</td>
<td>BNC female</td>
</tr>
<tr>
<td>UL Rated AC/DC Power Supply</td>
<td>100 - 240 VAC; 50 - 60 Hz, +24 VDC nominal</td>
</tr>
<tr>
<td>Enclosure</td>
<td>NEMA 4</td>
</tr>
<tr>
<td>Size/Weight 700,800</td>
<td>18.1” x 14” x 6.5” / 45 lbs.</td>
</tr>
<tr>
<td>Size/Weight 700/800 (Dual) Band, UHF</td>
<td>24” x 17.5” x 9” / 90 lbs.</td>
</tr>
<tr>
<td>Propagation Delay</td>
<td>&lt;0.5 micro-seconds</td>
</tr>
<tr>
<td>Unit Power Consumption (AC/DC)</td>
<td>75 W (3 Amps at 24 VDC)</td>
</tr>
</tbody>
</table>

Table 2: Specifications.
Figure 1: SBII+ booster system in a typical small clamshell cabinet enclosure. (700/800 MHz unit shown as an example)

Note: Front door hold-down screws require a special tool.
Figure 2: SBII+ booster system in a typical large clamshell cabinet enclosure.
(UHF unit shown as an example)

Note: Front door hold-down screws require a special tool.
**Class B SB Module**

The Class B SB module contains and shields both the uplink and downlink signal amplification paths. The maximum gain for each path is 80 dB and a maximum output power of 2 Watts is typical. Output power is limited by an Output Level Control function (OLC) so as not to exceed the 5 Watt ERP FCC specification or not to exceed the user output power limit setting (21 to 33 dBm). The customer can configure the module via an Ethernet connection and a software user interface (GUI). The GUI can be used to alter the gain of either or both signal paths, monitor system performance metrics, vary network and SNMP/SMTP notification settings.

**SIGNAL FLOW BLOCK DIAGRAM**

*Figure 3A and 3B* are the signal flow block diagrams for the typical UHF and 700/800 MHz SBII+ signal boosters. The box shown in the center of the drawing (yellow) is the Class B SB Module. The external passive filters/duplexer provide the isolation between the uplink and downlink paths and are required to prevent oscillation. The size of the external passive filters/duplexer will determine the size of the enclosure or the amount of rack space needed. The connections between the module and the external passive filters/duplexer would be made with double shielded coaxial cable. The filters/duplexer also insure that only signals in the desired operational band are amplified and not those of other radio services. Isolators may be used as shown in the UHF block diagram to simplify the RF connections to the two signal paths or appropriately phased cables might also be used.

**UNPACKING**

It is important to report any visible damage to the carrier immediately. It is the customer’s responsibility to file damage claims with the carrier within a short period of time after delivery (1 to 5 days). Care should be taken when removing the unit from the packing box to avoid damage to external heat-sink fins.

**INSTALLATION**

The following sections discuss general considerations for installing the booster. All work should be performed by qualified personal in accordance with local codes.

---

*Figure 3A: Signal flow block diagram of the typical UHF SBII+ Booster.*
Location
The layout of the signal distribution system will be the prime factor in determining the mounting location of the booster. However, safety and serviceability are also key considerations. The unit should be located where it cannot be tampered with by the general public, yet is easily accessible to service personnel. Also consider the weight of the unit and the possibility for injury if the unit should become detached from its mounting surfaces for any reason.

Although signal boosters can operate for years without being attended to, the unit will need to be accessed by service personnel with troubleshooting equipment, such as a digital multimeter and spectrum analyzer or a laptop computer from time to time. The location of the power source will also have a bearing on the mounting location. SBII+ uses external heat sinks and needs to be mounted where there can be an unobstructed air flow over the heat sinks fins. The SBII+ cabinet will stay warm during normal operation so in the interest of equipment longevity, avoid locations that carry hot exhaust air or are continually hot.

Mounting
Figure 4 shows the mounting scheme for the clamshell style enclosure. Brackets are attached to the sides of the cabinet and the unit is then mounted to the wall using steel bolts up to 5/16” diameter (not supplied). We recommend flat washers and a lock washer under the head of the bolt. Nut and bolt mounting is preferred to the use of lag bolts whenever possible. Use backer blocks where necessary to spread the force over a larger surface area. In areas of known seismic activity, additional devices such as tether lines may be necessary. The mounting hole dimensions of the mounting brackets are shown in Figure 5.

Because Bird cannot anticipate all the possible mounting locations and structure types where these devices will be located, we recommend consulting local building inspectors, engineering con-
Figure 4: Mounting brackets attached to the cabinet. Small clamshell style shown as an example.

Bolt slot will accommodate mounting bolts up to 5/16" diameter with bolt heads up to 11/16"

Distance between the bolt slots on the right bracket and the left bracket is 12.5" for the 700/800 MHz Enclosure and 15.625" for the UHF Enclosure

Figure 5: Mounting bracket hole dimensions.
sultants or architects for advice on how to properly mount objects of this type, size and weight in your particular situation. It is the customer’s responsibility to make sure these devices are mounted safely and in compliance with local building codes.

Cable Connections
All cabling connections to the booster should be made and checked for correctness prior to powering up the system. Connections are made through conduit openings on the bottom of the cabinet. The bottom of the small clamshell style enclosure is shown in Figure 6 and the bottom of the large clamshell enclosure is shown in Figure 7. Notice that the small enclosure has three conduit entry ports and the large enclosure has four.

AC LINE CONNECTION
Signal Booster II+ is designed to be hard-wired to 100 - 240 single phase AC at 50 - 60 Hz. The power supply assembly used in the SB II+ is auto ranging so there is no voltage select switch (110 or 240) on the supply assembly. Bring the AC line into the cabinet through a conduit opening on the bottom of the enclosure. For the small clamshell style enclosure connect the AC line to the terminal strip located behind the flip-up panel and to the right of the On/Off switches. Refer to the photo shown in Figure 8. For the large clamshell style enclosures connect the AC line to the terminal strip located to the left of the Form-C contact terminals. Refer to the photo shown in Figure 9. Use conduit for running the AC wiring into the SB II+ and #14 gauge or

![Diagram of AC Line Connection](image.png)

Figure 6: Bottom view of the small clamshell enclosure.
larger conductors. The AC feed line should have an independent circuit breaker (a 15 Amp breaker is recommended).

**BACKUP DC POWER CONNECTION**
SB II+ may be run on a DC power source that can supply 20 to 27 volts DC (24 VDC nominal). Screw terminals are provided for this connection. For the small clamshell style enclosure connect the DC line to the terminal strip located behind the flip-up panel and to the right of the On/Off switches. Refer to the photo shown in figure 8. For the large clamshell style enclosures connect the AC line to the terminal strip located to the right of the Form-C contact terminals. Refer to the photo shown in figure 9. Bring the DC backup voltage lines into the cabinet through a conduit opening on the bottom of the enclosure.

The power system in SB II+ automatically switches to this backup DC voltage when the AC supply fails for any reason including a power outage or intentional disconnection. It is not necessary that this DC backup connection be made for normal operation of the booster on the AC line.

**RF CONNECTIONS**
All RF cabling connections to the booster should be checked for correctness prior to powering up the system. N(F) bulkhead connectors are provided on the bottom of the cabinet for connection to the signal distribution system. Be sure that the correct branch of the distribution system is connected to its corresponding Uplink/Downlink connector or the system will not work properly. Using high-quality connectors with gold center pins is advised. Flexi-
Figure 8: AC and DC power connections to the small clamshell style enclosure.

Figure 9: AC and DC power connections to the large clamshell style enclosure.
ble jumper cables made of high-quality coax are also acceptable for connecting to rigid cable sections.

**CAUTION:** The maximum RF input power level for the SBII+ is -20 dBm. Stronger input signals will cause the unit to exceed its IM specifications. Static Input signals stronger than -10 dBm may physically damage the unit.

**PRE-RF CONNECTION TESTS**
Antenna isolation between the uplink and downlink branches should be measured before connecting the signal booster to the antenna system. This step is necessary to insure that no conditions exist that could possibly damage the signal booster and should not be skipped for even the most thoroughly designed system.

The booster is factory preset to 50 dB gain and should only be reset to a higher value after determining the safe maximum gain based on antenna isolation.

**NOTE**

**Test Equipment**
The following equipment is required in order to perform the pre-installation measurements.

1) Signal generator for the frequencies of interest capable of a -20 dBm output level. Modulation is not necessary.

2) Spectrum analyzer that covers the frequencies of interest and is capable of observing signal levels down to -100 dBm or better.

3) Double shielded coaxial test cables made from RG142, RG55 or RG223 coaxial cable.

**Antenna Isolation**
Just like the feedback squeal that can occur when the microphone and speaker get too close to each other in a public address system, a signal booster can start to self oscillate. This can occur when the isolation between the input antenna or signal source and the output distribution system does not exceed the signal boosters gain by at least 15 dB.

![Figure 10: Typical test equipment interconnection for measuring antenna isolation.](image-url)
Oscillation will reduce the effectiveness of the system and may possibly damage the power amplifier stages.

In general, if one or both antenna ports are connected to sections of radiating coaxial cable (lossy cable) the isolation will be more than adequate because of the high coupling loss values that are encountered with this type of cable. When a network of antennas are used for the input and output, this problem is much more likely. Isolation values are relatively easy to measure with a spectrum analyzer and signal generator.

**Procedure for Measuring Antenna Isolation**

1) Set the signal generator for a -20 dBm output level at the center frequency of one of the signal boosters passbands.

2) Set the spectrum analyzer for the same center frequency and a sweep width equal to or just slightly greater than the passband chosen in step one.

3) Connect the test leads of the signal generator and the spectrum analyzer together using a female barrel connector, see Figure 10. Observe the signal on the analyzer and adjust the input attenuator of the spectrum analyzer for a signal level that just reaches the -20 dBm level at the top of the graticule.

4) Referring to figure 10, connect the generator test lead to one side of the signal distribution system (external antenna) and the spectrum analyzer lead to the other (internal distribution system) and observe the signal level. The difference between this observed level and -20 dBm is the isolation between the sections. If the signal is too weak to observe, the spectrum analyzer's bandwidth may have to be narrowed and its input attenuation reduced. Record the isolation value for future reference. The isolation value measured should exceed the signal boosters gain figure by at least 15 dB.

5) Repeat step 4 again with the signal generator set at the passband edges in order to see if the isolation is remaining relatively constant over the complete width of the passband.

6) Repeat the isolation measurements if necessary at other system passbands to determine the overall minimum isolation value for the system. Physical modification of the antenna system may be required in order to reach an acceptable minimum value.

**RF EXPOSURE**

To comply with FCC RF exposure compliance requirements, a separation distance of at least 32.5 cm (for UHF), 23 cm (for 700 MHz PS), 27 cm (for 800 MHz PS), or 22 cm (for 800 MHz CRMS) must be maintained between the Donor antenna of this equipment and all persons. To comply with FCC RF exposure compliance requirements, a separation distance of at least 32.5 cm (for UHF), 20 cm (for 700 MHz PS), 21 cm (for 800 MHz PS), or 27 cm (for 800 MHz CRMS) must be maintained between the DAS antenna of this equipment and all persons. This equipment must not be co-located or operating in conjunction with any other antenna or transmitter.

To comply with IC RF exposure compliance requirements, a separation distance of at least 39.4 cm (for UHF), 30.5 cm (for 700 MHz), 36.1 cm (for 800 MHz) must be maintained between the Donor and DAS antennas of this equipment and all persons.

**EXPOSITION RF**

Pour conformer aux exigences d'exposition de FCC RF, une distance de séparation d'au moins 32.5 cm (pour UHF), 23 cm (pour 700 MHz PS), 27 cm (pour 800 MHz PS), or 22 cm (pour 800 MHz CRMS) doit être maintenue entre les Donor antenne de cet équipement et toutes les personnes. Pour conformer aux exigences d'exposition de FCC RF, une distance de séparation d'au moins 32.5 cm (UHF), 20 cm (pour 700 MHz PS), 21 cm (pour 800 MHz PS), or 27 cm (pour 800 MHz CRMS) doit être maintenue entre les DAS antenne de cet équipement et toutes les personnes. Cet équipement ne doit pas être co-localisé ou exploités en conjonction avec toute autre antenne ou transmetteur.

Pour conformer aux exigences d'exposition de IC RF, une distance de séparation d'au moins 39.4 cm (pour UHF), 30.5 cm (pour 700 MHz), 36.1 cm (pour 800 MHz) doit être maintenue entre les Donor et DAS antennes de cet équipement et toutes les personnes.
OPERATION

The RF ports of SBII+ should be terminated before energizing the booster. If an RF port is not connected to an antenna then the port should be connected to a 50 Ohm load whenever operating power is applied to the booster. Power is applied to the booster by turning on the AC and DC power switches. The status LED located on the front door of the unit will illuminate indicating that operational power is being applied.

Status LED

The status LED is located on the front cover of the unit as shown in Figure 11 (small clamshell style enclosure shown as an example). This is a tri-color indicator (red, yellow, green). Each color represents a different status as listed in Table 3.

Operational Problems

Even in the most carefully designed signal distribution systems, unpredictable situations can arise which can cause problems. A few of the more common causes are:

a) Unintended signals entering the system. Primarily caused by radios operating on channels that are within the operational bandwidth of the booster. Sometimes this will be a transient problem caused by mobile units when they transmit while in close proximity to your system.

b) Hand-held and mobile units that approach much closer than expected to one of the antennas in the signal distribution system.

c) Unexpected signal propagation anomalies. Building geometry can cause signal ducting and other phenomena that cause signal levels that are much stronger (or lower) than expected.

d) Lower than estimated signal attenuation can cause signals to be unusually strong. Higher losses can also occur giving weaker signals than desired.

e) Excessive Signal Booster gain. In systems that have an existing booster, it is sometimes assumed that an identical unit should be installed when expanding the system to provide extended coverage. In many cases a booster with far less gain than the first is required. Users should consult with the Bird Applications Engineering group whenever expanding an existing signal booster system for extended coverage.

f) Improper installation/application of signal splitters or directional couplers in the signal distribution system. This is usually the cause of too low a signal level but deserves mentioning here. Signal splitting needs to be done with constant impedance signal splitters so that the proper power splitting ratios and VSWR are maintained. Using tee connectors by themselves is inviting trouble. Directional couplers must be connected with regard to their directionality and coupling levels or improper system signal levels may result. Users should consult with the Bird Applications Engineering group whenever considering the expansion of an existing signal distribution system for extended coverage.

<table>
<thead>
<tr>
<th>Color</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>System has a critical error.</td>
</tr>
<tr>
<td>Yellow</td>
<td>System has an error - Warning: Performance may be impaired. Example - OLC is active.</td>
</tr>
<tr>
<td>Green</td>
<td>System is running normally.</td>
</tr>
</tbody>
</table>

Table 3: Status LED.
Input Signal Levels
Signals that exceed the maximum input rating of the booster may either damage the booster or cause it to generate intermodulation products that exceed the maximum allowed by the FCC or other regulatory agencies. The addition of PA Protection and OLC (Output Level Control) in the design of the booster helps prevent these ill effects.

PA Protection will temporarily reduce the booster's gain to the lowest amount possible and at the same time dial-in the maximum attenuation possible. This will help protect the PA from damage. RF signals will still pass through the booster however they will be considerably reduced in amplitude compared to normal operation. PA Protection will turn on automatically whenever the input level to the PA amplifier is too high. The booster will keep applying PA Protection until 1 minute after the fault condition clears. Both the uplink and downlink branches have PA Protection which operates independently of the other branch.

The booster’s OLC circuitry will automatically activate whenever the maximum desired output power level of the booster is reached. The maximum output power level is user selectable between 21 and 33 dBm. When OLC is active it will reduce the incoming signals by an amount necessary to keep the output power from exceeding the user specified value. The maximum amount of OLC attenuation that the booster can apply is 30 dB. If all the available OLC is used and the input signals continue to increase in amplitude then the output power of the booster will rise until PA protection is activated. The 30 dB range of OLC attenuation is more than adequate for most real life situations.

OLC circuitry should not be considered a panacea for poor system design. One undesirable side effect of OLC is that the signal level of all signals being passed by the branch will be reduced when the OLC circuitry is active. This means that the performance of the branch is actually decreased for other passband signals as long as OLC is active.

OLC has been designed to handle short term or transient overdrive signals only. Under normal operation some small amount of OLC might be applied on an occasional basis depending on the RF environment the booster is operating in. However, if excessive amounts of OLC are applied or the OLC is being applied often then the user should consider remedial action. Choices include reducing the gain of the booster and/or redesigning the antenna system.

Increase Isolation or Decrease Gain
As mentioned earlier in the manual in the section titled “Pre-RF Connection Tests” the isolation between the uplink and downlink signal paths must be 15 dB greater than the signal boosters gain setting. Modification of the signal distribution system is required to increase isolation between the uplink and downlink paths. This can sometimes require significant changes that may or may not be practical from a cost or logistical standpoint. Gain reduction may be the practical or only alternative that is available to the user. Fortunately this is easy to accomplish with the SBII+ Signal Booster using the software GUI interface discussed later in this manual in the section titled “RF Configuration Submenu”. The gain of each branch in the system is independently adjustable from 35 to 80 dB.

COMMUNICATING WITH THE BOOSTER
The booster provides Ethernet connectivity that allows user interaction via a web based user interface (GUI). Communications will require connecting your laptop computer to the ENET connector located on the bottom of the unit as shown in figures 6 and 7. A standard Ethernet crossover cable is used to make the direct connection between your laptop computer and the booster cabinet. Refer to Appendix A at the back of this manual for detailed instructions on how to properly connect your laptop or office desktop computer to the ENET port of the booster.

System Status Submenu
Once your laptop computer is properly connected to the signal booster a system summary screen will be displayed as shown Figure 12. This screen shows an overall operational status of the booster. There are no user interactions available on this page. It is designed to provide the big picture of what the booster is doing and the values displayed on this screen are updated in real time. The top banner of this submenu screen shows the current software version, model number, and serial number of the booster. The front door status LED is shown as an icon to the right of the banner and will be updated in real time. If the GUI cursor is placed on the status icon a message bubble will appear describing the meaning of the status indication. This can be particularly helpful during warning (yellow) and alarm (red) conditions. This message bubble feature is also available for most of the
labels boxes shown on the menu pages and can be a useful tool for the user when learning the software features of the product.

On the left-hand side of the page are a list of the major submenus available to the user including System Status, RF Configuration, Alarm Configuration, Network Configuration, OLC History, User Administration, and Firmware Update. Place your cursor over a particular submenu heading and left click to make a selection. Each major submenu page contains a group of related functions and each is discussed in detail in later sections of this manual.

The center of the System Status submenu screen is divided into four graphical boxes. Identical boxes for the uplink and downlink branches and a smaller box for power subsystem status and NFPA alarms. The uplink and downlink boxes have their passband displayed on the top border of the box. Both RF Status values and Power Amplifier Status values are displayed in a column format. The values displayed are updated in real time.

The Power Subsystem Status reports on the current power source operating the booster, either AC or Battery Backup. In addition, the battery backup voltage level being supplied to the booster is displayed.

The NFPA alarm status box is displayed whenever the NFPA option is installed in the booster and the NFPA alarm function is activated in the Alarm Configuration, (discussed in a later section of this manual). The NFPA alarm status box shows four of the five alarms associated with NFPA compliance. The fifth alarm is overall signal booster status which is indicated by the Status LED icon in the upper right corner of the screen.

**RF STATUS**

The RF status items list is identical for both the uplink and downlink passbands. A description of each of the 7 status items is listed below.

**Composite Input Power** - The composite input power of the link's passband. The composite input power is not directly measured, but is calculated...
based on the output power. This is why both input and output composite power values stop displaying at the same time. The input power must be greater than -70 dBm in order to show up as a value on the system status screen otherwise the display will show "--" instead of a value.

**CAUTION:** The maximum input power level to the booster in order to maintain specifications is -20 dBm. To prevent damage to the booster the maximum input power level is -10 dBm.

**Composite Output Power** - The composite output power of the link's passband. The output power must be greater than +10 dBm in order to show up as a value on the system status screen otherwise the display will show "--" instead of a value.

**Oscillation Detected** - This is an indication that oscillation has been detected. The displayed value will change from false (the normal state) into true. If oscillation is detected the unit can be configured to shutdown and restart.

**Output Level Limit** - The desired output power level of the booster. This is user selectable via the RF Configuration submenu. The selectable range is from 21 to 33 dBm in 0.5 dBm increments.

**Set Gain** - The desired gain of the booster as determined by the user. This is user selectable via the RF Configuration submenu (referred to as maximum gain). The selectable range is 35 to 80 dB in 1 dB increments.

**Calculated Gain** - This is a calculated value. Defined as the (user selectable) Set Gain value minus the current amount of OLC attenuation.

**OLC Attenuation** - This is the amount of attenuation the OLC is providing. Ideally there should be little or no OLC applied. OLC (output level control) is meant to reduce gain for transient episodes of very strong signals. However, when OLC is active, gain is reduced for all signals being passed by that link's passband and that reduction may compromise communications for weaker signals in the passband. If a large amount of OLC is applied more than occasionally, it is advised that the gain of that branch be reduced or re-orient the antenna for better isolation.

**PA STATUS**
The items for PA Status are identical for both the uplink and downlink passbands. A description of each of the 4 status items is listed below.

**PA Current** - The amount of current the power amplifier is drawing.

**PA Temp** - Temperature of the power amplifier in degrees Celsius.

**LNA Current** - The amount of current the LNA is drawing.

**LNA Temperature** - Temperature of the LNA in degrees Celsius.

**POWER SUBSYSTEMS STATUS**
This area of the screen provides a convenient summary of the operating voltage currently powering the booster as well as the value of the backup voltage being applied.

The power source for the booster is normally the AC supply line and AC will be displayed in the Power Source item box as shown in the example in figure 12. When the AC supply is interrupted the booster will switch over to the battery source for continued uninterrupted operation. The item box will change to battery and will become backlit in red to draw the attention of the user. The battery connected box located on the Alarm Configuration screen should be checked if the user has battery backup voltage applied to the booster.

If the battery connected box is checked on the Alarm Configuration page the booster will provide warning and alarm notifications based on the value of the battery voltage. When the battery voltage is low a warning state will occur at 20.5 VDC and an alarm state at 20.0 VDC. When the battery voltage is high a warning state will occur at 31.5 VDC and an alarm state will occur at 32.0 VDC.

**NFPA ALARMS**
This area shows the current status of 4 of the 5 NFPA alarms including Charge Failed, Low Battery, AC Lost, and Antenna Failed. A detailed description of each of these alarm events is provided in a later section of this manual titled “NFPA Compliance”. In order for the NFPA alarm status items to appear on the System Status screen they must first be enabled on the Alarm Configuration screen by checking the box for Enable NFPA Alarms. In addi-
tion, each of the four individual alarms must further be enabled by placing a check mark in the appropriate box. The fifth NFPA alarm which is a booster summed alarm is represented by the Status LED icon in the upper right corner of the display.

**RF Configuration Submenu**

The RF Configuration submenu screen is shown in Figure 13 and allows the user to configure the RF operating characteristics of the booster. If the user is not properly logged into the booster a link to the login page will be provided and no information will be displayed.

Similar to the system status screen this screen is broken into two identical graphical boxes, one for the uplink branch and one for the downlink branch. The user is allowed to adjust the maximum gain of each link and the desired power output level from each link. The maximum gain is adjustable from 35 to 80 dB in 0.5 dB increments which is an adjustment range of 45 dB. The output power level is adjustable from 21 to 33 dBm in 0.5 dB increments which is an adjustment range of 12 dB.

Buttons are provided to clear an oscillation detection or to clear PA protection. Oscillation detection and PA protection are safe modes the booster will place itself into if a severe problem is detected.

On the right side of the RF Configuration submenu screen underneath the Status LED icon there is a check box for turning on advanced configuration items which are OLC adjustments for Hold Time and Decay Time. OLC Hold Time is adjustable from 2 to 5 seconds (in 0.1 second increments) and determines the amount of time that OLC will be applied (once it is activated by a strong transient input signal). OLC decay begins after the user specified hold time is expired. Decay Time can be adjusted between 0.01 to 1 second (in 0.01 second increments). Decay time will determine how long it takes for the applied OLC to fade from on to off.

The OLC decay time should normally be kept at a very low value. Increasing the OLC decay time will also increase how long it takes the booster to initialize after a power interruption.

Oscillation detection can be characterized using the two entry fields that are shown below the graphical boxes for the uplink and downlink branches. Changes to the behavior of the oscillation detection feature will be applied equally to both uplink and downlink passbands. This feature shuts off the output signals from the booster for both the uplink and downlink branches whenever an oscillation condition is detected. Oscillation detection occurs whenever port to port isolation falls down to 25 dB or less. For normal operation the port to port isolation needs to be at least 15 dB greater than the gain of the booster.

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**Figure 13: RF Configuration submenu screen.**
Oscillation detection can operate 3 ways including Ignore, Retry, and Halt. Select the desired mode of operation from the drop down choices. Left click on the desired choice and the selected mode will now appear in the box next to the item label. In the example shown in figure 13 the Retry mode is selected as the desired mode of operation.

In the Ignore mode the booster will ignore oscillation events. In the Halt mode the booster shuts off the output signals in both the uplink and downlink directions. The halted condition persists until the user selects the Clear Oscillation button and then presses the Save button. In the Retry mode the booster will halt for a short period of time then retry normal operation to see if the condition has cleared itself. The number of times a retry will be attempted is determined by the Oscillation Retry Count value which is user selectable. After the specified number of retry’s have occurred, and if the booster is still experiencing an oscillation condition, then the booster will enter the Halt mode where it turns off and stays off until there is user intervention to correct the condition causing oscillation.

Note that button selections or user changes made to drop down menu’s or value counters will NOT become active until the user clicks on the SAVE button.

**Alarm Configuration Submenu**

The Alarm Configuration submenu screen is shown in Figure 14 and allows the user to configure the alarm operating characteristics of the booster. The screen is broken into distinct areas based on alarm related functions. These areas include Enabled Alarms, SNMP Configuration, and Email Alert Configuration. All the areas displayed on this screen allow user interaction.

**ENABLED ALARMS**

The first three items in this area of the screen include System Location, Battery Connected, and Enable NFPA Alarms. The System Location feature allows the user to assign a site name to the booster. The site name will be used in SNMP and SMTP notifications sent out by the Booster. This feature is particularly useful when the signal booster is in an area or territory along with other operational boosters.

The Battery connected and Enable NFPA Alarms boxes will allow the booster to send SNMP and SMTP alarms as well as provide GUI alarm indications (red backlit boxes) for the specified items. Physical relay operation is not affected by the setting of these two boxes.

If a battery backup voltage source is connected to the booster and the booster is setup in a non-NFPA manner then the user should place a check mark in the battery is connected box. When this box is checked the booster will annunciate alarms based on a measurement of the backup battery voltage being applied. The alarm thresholds are 20.0 volts for low alarm, 20.5 volts for low warning, 31.5 volts for high warning, and 32.0 volts for high alarm. Please note that if there is not a battery backup connected to the booster and the AC operation is disabled, then on air signals will not pass through the booster in either branch.

When the Enable NFPA Alarm box is checked then the NFPA alarm group list shown in figure 14 will appear on the Alarm Configuration screen. The list includes Antenna Malfunction, Charge Fail, AC Lost, and Low Battery. Placing a check mark in these four boxes will allow the booster to send SNMP and SMTP notifications as well as provide GUI alarm indications (red backlit boxes) for the checked item. Physical relay operation is not affected by the setting of these four boxes.

In order to insure correct NFPA operation the booster must be physically setup to be NFPA compliant. NFPA compliance is discussed in detail in a later section of this manual. In order to be NFPA compliant the booster must have the required NFPA hardware (Bias-T and Antenna line sensor) installed and the booster must be connected to an NFPA capable battery backup unit. These hardware enhancements to the communications system will allow the booster to support the NFPA alarm functionality correctly. Note; Recommended NFPA capable battery backup units include the Bird model 6160-E/F-24-NG/NR family of battery backups.

In the case of the NFPA low battery alarm a possible confusion can occur if the battery connected box is checked at the same time the NFPA low battery function is checked. When the battery connected box is checked the signal booster is instructed to monitor the backup voltage level and generate alarms if necessary. When the NFPA low battery function is enabled the battery backup unit itself will monitor the backup voltage and generate
alarms if necessary. This situation can be confusing for the user. To simplify operation the battery backup box should be checked for non-NFPA systems that are connected to a backup voltage source. The battery connected box should be unchecked for systems that are NFPA compliant.

Note that button selections or user changes made to drop down menu’s or value counters will NOT become active until the user clicks on the SAVE button.

Figure 14: Alarm Configuration submenu screen.

SYSTEM FAIL RELAY TEST
These two buttons are provided to easily test the summed alarm output relay. When the System Fail Alarm button is pressed the booster will be forced into a summed alarm state and the system fail Form-C contacts will change state and the front door Status LED will turn red. When the Clear System Fail button is pressed, the forced enable of the system fail relay will be removed. It takes several seconds for these button presses to become effective after they are pressed. These buttons have no effect if the booster is already in an alarmed state. That is, the Clear button will NOT clear real alarms, it will only clear forced alarms which are used for testing purposes. If the user initiates a relay test
the booster will automatically clear it after about 5 minutes. This prevents the booster from being left accidently in a test mode. Also, at system reboot a forced failure mode alarm will automatically be removed. If the cursor is placed over the status icon (shown on the upper right of the GUI Interface) while the booster is performing a relay test then a message bubble will appear notifying the user that the unit is in a forced alarm condition.

SNMP CONFIGURATION

Simple Network Management Protocol (SNMP) is an Internet-standard protocol for managing devices on IP networks. The SNMP feature is designed to provide reliable internet notification of an alarm occurrence or a change in operational status in the booster. In order to configure the booster to send SNMP messages (called traps) to a destination device, such as your computer, the following values need to be entered into the booster: the IP address of the destination computer, User name, Authentication type, Encryption type, and Password. To enter these values into the booster click on the ADD SERVER button shown on the Alarm Configuration screen. Each time the button is selected an entry row will be created. Users can add as many SNMP Manager configurations as needed. An example of the SNMP configuration table is shown in figure 14.

Destination IP addresses that are entered into the SNMP configuration table should be the IP addresses of the computers that you want the traps to be sent to. These destination computers must have SNMP manager software installed and running properly in order to receive the messages. SNMP manager software installation into the destination computers is the customer’s responsibility. Consult with your IT specialist for assistance.

When using authentication and/or encryption (SNMP version 3) the User Name is the name of the person to receive the trap. If not (SNMP version 2C), this is the community name of the trap receiver. Authentication type is used to verify that the person receiving the trap is the person the trap is intended for. Authentication type choices are NONE, MD5, or SHA, with SHA being the strongest encryption type. This setting needs to reflect what the SNMP Manager computer is configured to receive.

The Encryption type is used to protect the contents of the message from unauthorized receivers. Encryption type choices are NONE, DES, or AES, with AES being the strongest supported encryption type. If Authentication is none then Encryption must be none. If the Authentication and Encryption are none then the message is compatible with SNMP version 2. The Encryption setting needs to reflect what the SNMP Manager computer is configured to receive.

The Password is a string used to encrypt and authenticate the user. It is only used when authentication and/or encryption types are enabled (SNMP version 3). This setting needs to reflect what the SNMP Manager computer is configured to receive. The password should be eight characters long.

The System location is a user defined string which will be returned with every trap that is generated and can assist the user in identifying which unit is sending the trap message. This value is added into a box at the top of the Alarms Configuration screen and is labeled System Location.

Whenever values in the SNMP Configuration table are changed you must click on the SAVE button to initiate the changes.

Initial SNMP Setup

When the booster is installed the SNMP feature should be setup for proper communications. There are several steps required for proper setup of the SNMP feature as discussed below.

1) Connect a laptop directly to the booster. The booster is shipped from the factory setup for static IP addressing. See Appendix A for default IP Address and account information. Change the factory default IP address of the booster to one provided by your IT department.

2) Use the Network Configuration submenu to setup the DHCP as either active or inactive. When DHCP is inactive the booster will be using a static IP and the user must enter values for IP address, netmask, and gateway. Make sure you consult with your IT department regarding setting DHCP active or inactive.
DCHP is activated by placing a check mark into the box labeled Configure Automatically and then saving the change and restarting the network.

3) Use the SNMP Configuration table to enter the destination device addresses. These are addresses where the SNMP feature will send trap messages whenever a qualifying event takes place.

4) Setup the SNMP format using the SNMP Configuration table. Items that need to be configured include User Name, Authentication Type, Encryption Type, and Password. Consult with your IT specialist for assistance.

5) Load the SNMP manager software into the destination computer and configure the manager so that it will be able to receive the SNMP traps.

6) Download MIB files from the Bird Technologies website (www.birdrf.com) and load the MIB files into your SNMP manager software. The MIB files allow the SNMP manager software to sort out the trap messages into an understandable message format.

**SNMP Manager Example**

SNMP manager software is designed to provide a GUI style interface for the user so that traps sent from the booster can be received and displayed for viewing. SNMP manager software can also be used to determine what actions are taken when a trap is received, such as distribute to groups of users, archive, ignore, etc. The SNMP manager software chosen and used by the customer is up to the customers discretion and as such may not exactly match the example shown in this discussion. SNMP manager software packages will need to be properly configured in order to successfully receive messages from the booster. Refer to the SNMP configuration setup discussed earlier in this manual and ask your IT specialists for assistance.

When a qualifying event occurs in the booster a trap is formulated and sent to the destination computer. A typical trap is shown in **Figure 15**. In the example shown the trap messages are shown at the top of the screen display. Three trap messages...
have been received by this manager from a signal booster. In this particular SNMP manager software package if a trap message is selected the details of that message are displayed in the lower portion of the screen. The details show the raw message as it was received by the manager while the upper box shows the message after it has been interpreted by the MIB files.

**EMAIL ALERT CONFIGURATION (SMTP)**

The SMTP feature allows the SBII+ Signal Booster to send status change and alarm notification email messages to user specified recipients. The body of the email message will contain a date/time stamp, status notification, and a description. For example;

2017-01-20 18:47:35  Error  Antenna Malfunction

An SMTP server is used to resolve the email address of a recipient to a proper location on the internet. The SBII+ does not have a resident SMTP server so it has to be told by the user which server is going to send the message. This can be a server on your corporate network or it can be a server outside your network as long as the SBII+ is configured to know how to access resources external to your network. If you are using an SMTP server that is external to your network then the gateway in the SBII+ needs to be set properly. Network settings are adjusted using the Network Configuration Submenu discussed in a later section of this manual.

**Configuring the SMTP Server**

To configure the SMTP server perform the following in a step-by-step fashion.

1) Make sure you are properly logged onto the SBII+.

2) Go to the Alarm Configuration submenu and scroll down to the Email Alert Configuration area at the bottom of the screen.

3) Enter information into the following fields;

   **Server Address** - This is the address of the SMTP server that is going to be used to send the emails over the internet. If you are using an SMTP server name rather than an IP address (i.e. smtp.gmail.com), you MUST have the “Name Server” value on the Network Configuration Submenu filled in correctly.

   **Server Port** - This is the port that is used to connect to the SMTP server.

   **Server Username** - The username used to log on the server.

   **Server Password** - The password associated with the Username.

4) Enter the address that email messages will be sent to. If more than one address is desired then click on the “Add Email” button.

5) Click on the SAVE button.

Whenever values in the SNMP Configuration table are changed you must click on the SAVE button to initiate the changes.

**Network Configuration Submenu**

the Network Configuration submenu screen is broken into two major areas including IP Configuration and Time Configuration. IP Configuration is further divided into the current configuration and the new configuration. The current configuration fields show what the network setting are for the SBII+ right now. The new configuration fields give the user the ability to change the settings. Time configuration shows what the SBII+ currently thinks the time is and offers methods to change the time if desired.

**IP CONFIGURATION**

Under the Current Configuration fields the values for the boosters IP Address, Netmask, the Gateway and Hostname are displayed. Refer to Figure 16. None of these are user interactive because they simply display the boosters current network settings.

The New Configuration fields are all interactive and allow the user to change the current network configuration. The configure automatically check box will permit the selection of either static or dynamic configuring. In static configuring the user is responsible for setting each network parameter manually and in dynamic configuring the network decides what the settings are. The SBII+ ships from the factory in the static mode and should normally be operated that way. If dynamic configuring is going to be used instead make sure you consult with your IT personnel before turning on configure automatically. Enabling dynamic configuring is accomplished by placing a check mark in the box next to the label “Configure Automatically”. Click the Save button then the restart network button to initiate the
Dynamic configuring is known as the Dynamic Host Control Protocol (DHCP) and is a standardized networking protocol used on IP networks for dynamically distributing network configuration parameters, such as IP addresses for interfaces and services. With DHCP, computers request IP addresses and networking parameters automatically from a DHCP server, reducing the need for a network administrator or a user to configure these settings manually.

When static configuring is being used and parameters need to be changed the user must enter the values for IP address, Netmask, Gateway, and Hostname manually into the appropriate fields in the new configuration boxes. The Name Servers field is the DNS Server. Consult with your IT personnel before making changes to the boosters network configuration to ensure you are making changes that are compatible with your particular network.
Whenever values in the Network Configuration are changed you must click on the SAVE button and then the RESTART NETWORK button to initiate the changes.

**TIME CONFIGURATION**

The SBII+ does not have an internal means of determining the current time so it must be synchronized to the correct time by an outside source. Two methods are available, either by synchronizing to a PC that is connected to the booster or via the internet by synchronizing with an NTP server. The Time Configuration area of the Network Configuration submenu shows what the booster thinks the current time is and allows the user to choose which method is used to synchronize the time. Once the time is set the booster will keep track of it accurately so long as the booster has operating voltage applied to it. The time will need to be set whenever the booster is powered up. This is accomplished by the radio buttons labeled Use NTP and Do Not Use NTP.

When the USE NTP radio button is selected synchronization is accomplished by visiting an NTP server to retrieve the correct time. The NTP server's IP address must be entered into the displayed box and your current offset from GMT must be selected from the drop down choices. When the Do Not Use NTP radio button is highlighted the NTP address and GMT offset fields are removed from the screen.

When the Do Not Use NTP radio button is selected synchronization is accomplished by connecting a PC to the booster. If for some reason the current time being used is not correct a forced synchronization can be initiated. Uncheck the box labeled Use Current System Time and an entry field will appear. The current time can be entered into this entry field manually if desired. Click on the SAVE button and the time synchronization will take place. The Current System Time should now match the value in the Set Time entry field.

**OLC History Submenu**

The OLC History feature provides a convenient log of OLC activity taking place in the booster for both the uplink and down link branches. To access the log click on the OLC History submenu button which appears on the right side of any displayed screen.

<table>
<thead>
<tr>
<th>Log Number</th>
<th>Time</th>
<th>Duration (S)</th>
<th>Average Attenuation (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>10/14/2016 19:00:00</td>
<td>900.0</td>
<td>21.30</td>
</tr>
<tr>
<td>13</td>
<td>10/14/2016 20:00:00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>13</td>
<td>10/14/2016 21:00:00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>13</td>
<td>10/14/2016 22:00:00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>11</td>
<td>10/10/2016 11:00:00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>11</td>
<td>10/10/2016 10:00:00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>11</td>
<td>10/10/2016 09:00:00</td>
<td>201.0</td>
<td>16.0</td>
</tr>
</tbody>
</table>

*Figure 17: OLC History (sample of a downlink branch log).*
The OLC History log for both downlink and uplink branches of the booster will appear. The downlink branch is listed first then the uplink branch.

Figure 17 shows a sample portion of a typical downlink branch log. The hourly summary is shown for explanation purposes. Each vertical row in the log represents a log entry and 1 hour of sampling time. Each log entry records the Log Number, Time, Duration, and Average Attenuation. The logged data is stored in non-volatile memory and will not be erased when the unit is powered down. This archived information will permit the creation of a user signal-profile to facilitate optimum system configuration and performance. It also allows you to see if there are transient episodes of strong signals perhaps desensing other channels being amplified by the booster.

The booster must run for at least 1 hour after initial power up in order to generate at least one log entry or the user will not be able to call up the log for display.

The Log Number is a number which increments each time the booster powers up. Because the boosters internal clock might not be set to wall clock time after powering up the Log Number is used as a way to differentiate power cycles. For instance the example log shown in figure 17 shows the booster was turned on October 10th long enough to successfully record three log entries (Log Number 11). Once again the booster was turned on for testing on October 14th at least long enough to record four log entries (Log Number 13). The lack of Log Number 12 says that the booster was turned on at some point but not long enough (at least 1 hour) to record even a single log entry.

The Time entry in the OLC History log represents the time the record was stored. The time stamp represents what time the booster thought it was and might not be accurate. By default the log entries are displayed with the most recent entry at the top of the log. Clicking on the arrow will sort the log in the opposite direction. The Duration column represents the amount of time within the 1 hour logging period that the booster applied OLC to the branch. The duration value is expressed in seconds so the value may be any number between 0 and 3600. A value of 0.0 means that no OLC was applied to the branch during the one hour logging period and 3600 would mean that OLC was constantly applied for one hour. In the example shown in figure 17 most log entries show a duration of 0.0 which is normal.

The Average Attenuation is a value expressed in dB's which is the average value of the attenuation while the OLC was active. The time that the OLC was not active is not included in the Average Attenuation value. For example, if the OLC was engaged for 10 seconds at 20 dB the Duration column would read 10 seconds and the Average Attenuation column would read 20 dB.

The OLC log has a download feature which allows the OLC History data to be exported to other software packages as a text file. To export the OLC data press the DOWNLOAD button that appears in the upper right of the display screen. A popup window will present. The default choice for export is Notepad but the user can specify other choices if desired.

User Administration Submenu
The User Administration submenu allows password protected access to the booster. The boxes on this page are interactive. To make changes click inside the box and a cursor will appear. When first visited the user is queried for a User Password. The default user password is “admin”. It is recommended that once the booster system is properly installed the password is changed to a unique customer specified password.

The change password prompt will appear immediately after the user logs in successfully. To change the boosters password enter the new password in the appropriate entry field and the confirm entry field. Click on the UPDATE PASSWORD button. It is important to write down the new password for safekeeping.

Firmware Update Submenu
The Firmware Update submenu is used to update already existing firmware running on the SBII+. The user must be logged onto the booster in order to perform updates. To update the firmware perform the following procedure in a step-by-step fashion.

1) Check and record the current software version of the booster. It appears on the System Status screen in the upper left corner.
2) Update files are typically sent to users via an email message from Bird. Save firmware update files to a convenient location in your computer. It is important to know where the firmware update file has been stored in your computer. Go to the Firmware Update screen and then click on the BROWSE button. Note that after the file is selected the file name will appear next to the browse button.

3) Select the firmware update file. The correct file should be provided by the factory or your Bird representative.

4) Click on the SUBMIT button.

5) A percent readout will be displayed and represents the amount of the file that has been uploaded. Once it reaches 100% there will be a pause for about 20 seconds.

6) After the pause a list of status messages will appear. Wait until there is a message that notifies you that the update is complete and asks you to reboot the system. Refer to the example shown in Figure 18.

7) Power cycle the signal booster to complete the update process. Close the GUI interface then relaunch it.

Verify the update is successfully accomplished by viewing the software version number that appears on the upper left of the System Status submenu screen. It should be a different number than the one that was recorded in step 1 above.

ALARM FORM-C CONTACTS

ALARM Form-C relay contacts are located on the Alarm Form-C terminal circuit board as shown in Figure 19. On the 700/800 MHz units the circuit board is located on the back of the flip-up panel. On the UHF units it is mounted to the shelf next to the conduit entry holes. See figures 1 or 2 respectively. These push-on style terminals are intended for connection to the customer's supervisory and data acquisition system. Both normally open and normally closed contacts are available for each of five alarm functions.

The normal condition for the SBII+ is power applied, no alarms occurring, and the booster operating as usual with the front door status LED colored green. Under these normal conditions there will be continuity between the Com and NC alarm contacts and no continuity between the COM and NO alarm contacts. When an alarm condition occurs the status LED on the front door will turn red and the appropriate form-C contacts will change state. When alarming there will be continuity between the COM and NO alarm contacts and no continuity between the COM and NC alarm contacts. The alarm terminals are push-on type for ease of connection. Route the alarm wires through one of the access holes in the bottom of the cabinet, strip about 3/16” of insulation from the end of each wire and insert into the appropriate terminal. To remove a wire push down on the tab and pull out the wire. Use #20 or #22 gauge insulated wire for alarm connections.

Attention: In the unlikely event that all operating voltage to the booster is lost the Form-C alarm contacts may present in an undefined state.

NFPA Compliance

The SBII+ signal booster is designed to be compliant with the national public safety in-building codes issued in the International Fire Code and by the National Fire Protection Association. The booster
accomplishes compliance when used in conjunction with an appropriate battery backup unit. An optional battery backup unit is available from Bird Technologies, model number 6160-H/E-24-NG/NR. Detailed installation and operating instructions for the battery backup unit are included with the backup unit when it ships from the factory.

The NFPA system consists of the SBII+ signal booster unit as well as the optional battery backup unit. Figure 20 shows a block diagram of an NFPA compliant SBII+ system.

An NFPA compliant signal booster system is designed to easily interface to fire alarm panels. Five alarms are provided including SB Failure (FAIL), Loss of AC Power (AC), Charge Fail (CHG), Antenna Malfunction (ANT), and Low Battery Capacity (BAT). These five alarm functions are available at the terminal contacts shown in figure 19. Figure 21 is a close up view of the terminal identification sticker attached to the inside of the front door for customer convenience. The terminals provide a common access point to the alarm signal relay contacts. Available alarm functions include;

![Figure 19: Alarm Form-C contacts.](image)

![Figure 20: Block diagram of an NFPA compliant SBII+ system.](image)

![Figure 21: Alarm terminal identification sticker.](image)
Figure 20: Block diagram of an NFPA compliant SBII+ system.
SB Failure - this is a summed alarm that is active when any number of fault conditions arise within the booster unit such as when an over current or high temperature event occurs.

Loss of AC Power - indicates that AC power to the booster unit has failed.

Low Battery Capacity - the source of this alarm is the battery backup unit and it indicates that the battery backup voltage level has dropped significantly.

Charge Fail - the source of this alarm is the battery backup unit and it indicates failure of the battery charger. If the battery charger loses AC power this alarm will be active.

Antenna Malfunction - indicates there is a loss of RF cable integrity between the signal booster unit and the remote antenna line sensor. In order to detect an antenna malfunction an antenna line sensor must be installed as close to the Donor antenna as possible. This sensor works with the Bias-T assembly inside the booster cabinet to verify the continuity of the antenna line. Refer to Figure 22. The sensor is waterproofed but the connections to both the antenna and the antenna feedline should be sealed to prevent water entry. We recommend that the connections be tightly and completely wrapped with rubber splicing tape. Connect the port that is labeled “antenna” on the sensor to your donor antenna and the port that is labeled “transline” to the antenna feedline cable coming from the signal booster.

All five of the alarms use “supervising” alarm circuits. A supervised circuit includes technology that will detect open or shorted circuits regardless of the alarm status. This is accomplished by using EOL (end-of-line) resistors at the alarm terminal strip in the signal booster cabinet. The value of the EOL resistors is a function of the alarm panel so you should consult the manual for the alarm panel when you are determining the resistor value.

MAINTENANCE AND REPAIR
Signal boosters manufactured by Bird Technologies can perform for years with little maintenance and repair. However, if the amplifiers are subjected to excessively high signal levels, power surges or lightning strikes, failures may occur. The following procedures may be followed for detecting a malfunctioning unit or as part of a periodic maintenance program.

1) The heatsink areas should be cleared of dust and debris.

2) Inspect the unit to see that the front door Status LED is lit (remove any dust or debris that may obscure the LED). This will verify that operating power is flowing properly. Check all hardware for tightness.

3) Compare system performance to initial performance levels measured when the system was first installed. Or measure the gain at any convenient frequency in the working frequency band (both uplink and downlink directions) to verify that the performance is still within specifications.
Appendix A
Ethernet Connectivity

GENERAL DESCRIPTION
The bottom panel ENET connector on the booster provides for 10/100 BASE-T Ethernet connection using the TCP-IP protocol. This product feature allows access to a web-based interface for interacting with the booster. The booster is shipped from the following default IP Address, Subnet, and account login information:

Default IP Address: 192.168.1.100
Default Subnet: 255.255.255.0
Login: admin         Password: admin

Two connection schemes are discussed including a direct connection from your laptop computer to the booster as well as connecting the booster to a networked environment. A direct connection (at the installation site) should be established the first time you interface to the booster using the fixed IP mentioned above. Once the initial communications are established the IP address in the booster can be changed to permit a networked connection (from a remote site such as your office).

Direct Connection
Your initial connection to the booster system should be a direct connection using an Ethernet crossover cable as shown in Figure A1. The correct pinout for a CAT-5 crossover cable is shown in Figure A2 in case you need to build a cable or check one you are trying to use.

REQUIRED EQUIPMENT
To perform a direct connection to the booster the following items are required.

- Ethernet Cable Cat-5
- Laptop Computer with a network interface card installed. The laptop computer should be running a windows based operating system with at least version 7.

PROCEDURE
To connect your laptop computer to the ENET port and access the web page interface, perform the following steps;

1) Connect your laptop's network port to the ENET connector on the boosters bottom panel using a standard CAT-5 cable.

2) Insure that your laptop's IP address is compatible with the default address of the signal booster system. This may require changes be made to the Ethernet adaptor address on your laptop. Your laptop's IP address will need to be set to “192.168.1.2” along with a subnet mask of “255.255.255.0”.

3) Launch your web browser software on the laptop.

Figure A1: Direct connection to the booster using a crossover cable.
**Figure A2**: Cat-5 cable pinout diagrams.
4) In your web browsers address box type-in the address of the booster “http://192.168.1.100” (factory default) and press the ENTER key. The web page interface to the booster should appear in your laptop’s browser window.

Networked Connection
Before attempting a networked connection to the signal booster system consult with your IT support personnel for information concerning the correct IP address to use and any additional connectivity issues such as firewall settings.

Once you have the correct IP address you will need to direct connect to the booster system as discussed in the earlier section of this appendix and reconfigure the booster ENET port with this new address. You can then connect the signal booster system using a straight-through CAT-5 cable to the networked environment and interface to it from a remote computer. Figure A3 shows the proper way to interconnect the equipment for a networked connection. The correct pinout for a CAT-5 straight-through cable is shown in Figure A2 in case you need to build a cable or check one you are trying to use.

REQUIRED EQUIPMENT
To perform a direct connection to the booster the following items are required.

- Cat-5 Straight-thru Cable for connection to the network.
- Temporary use of a laptop computer with a network interface card installed and a Cat-5 crossover cable. These temporary items are used to adjust the boosters network settings.

PROCEDURE
Before a networked connection can be established, the boosters ENET Port must be changed to an IP address that’s compatible with your network. If you are unsure how to determine this address check with your IT support personnel. To connect the boosters ENET port to a networked environment and access the web page interface, perform the following steps:

**Figure A3:** Network connection to the booster using straight-through cable.
1) Change the boosters ENET port IP address. To do this, direct connect your laptop to the booster as discussed in the earlier section of this appendix titled “Direct Connection” and follow steps 1 through 4.

2) Once you have established a direct connection to the booster go to the Admin page and log in. You must be logged in to the booster in order to make any kind of changes to its configurations.

3) Go to the Network Configuration page and enter the new configuration values provided by your network administrator for:

   A) IP Address
   B) Subnet Mask
   C) Gateway Address

4) Enter labels for Hostname and Server.

5) Click the “Save” button to store the new values in the boosters memory.

6) Click the “Restart Network” button to initiate the use of the new values. At this time your laptop will stop communicating with the booster because your laptop should no longer be set to communicate with active network configuration values.

7) Disconnect your laptop and use the straight-through cable to connect the booster to the network.

8) Verify that the booster can now be accessed from the remote PC.