



**FIBER DISTRIBUTED ANTENNA SYSTEM
(FIBER DAS)**

OPERATION MANUAL

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INSTRUCTION BOOK PART NUMBER 920-FIBER-DAS REV. P3

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Safety Precautions

The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

WARNING

Keep Away From Live Circuits

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

WARNING

Shock Hazard

Do not attempt to remove the RF transmission line while RF power is present.

WARNING

Do Not Service Or Adjust Alone

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

WARNING

Safety Earth Ground

An uninterruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

WARNING

Resuscitation

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

WARNING

Remove Power

Observe general safety precautions. Do not open the instrument with the power applied.

Safety Symbols

WARNING

Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.

CAUTION

Caution notes call attention to a procedure, which if not correctly performed, could result in damage to the instrument.

Note: *Calls attention to supplemental information.*



The laser used in this system is a Class 3b laser that produces invisible infra-red coherent light. Avoid looking into connected fibers and receptacles. Not safe to view with optical instruments. Always put the protection caps on unused fibers and receptacles.

Warning Statements

The following safety warnings appear in the text where there is danger to operating and maintenance personnel and are repeated here for emphasis.

WARNING

This is NOT a consumer device.

It is design 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.

See [page 40](#)

For CMRS 817-824MHz Applications and American Cellular Applications:

WARNING

This is NOT a consumer device.

It is design 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. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

See [page 40](#)

WARNING

This is NOT a consumer device.

It is designed for installation by an installer approved by an ISED licensee.
You **MUST** have an **ISED LICENCE** or the express consent of an ISED licensee to operate this device.

See [page 40](#)

WARNING

Avoid looking into connected fibers and receptacles.

The laser used in this system is a Class 3b laser that produces invisible infra-red coherent light. Not safe to view with optical instruments. Always put the protection caps on unused fibers and receptacles.

See [page 15](#)

Caution Statements

The following equipment cautions appear in the text and are repeated here for emphasis.

CAUTION

Turn Off Test Tone

Do not forget to turn off the test tone when you are done with your uplink. Better check one extra time. They will otherwise interfere with the normal operation of the system by causing noise to the base station.

See [page 114](#)

CAUTION

Unauthorized antennas, cables, and/or coupling devices may cause non-conformity with national or international regulations, could cause damage, or non-conforming ERP/EIRP.

See [page 41](#).

CAUTION

When mating RF connectors, ensure that they are properly aligned and not cross threaded.

Tighten SMA connectors to 8 in.-lbs.

Do over torque RF connectors, this could result in damage to the Unit.

Do not under torque RF connectors, this could result in poor signal transmission.

See [page 47](#)

Safety Statements

USAGE

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

USO

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

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UTILISATION

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

IMPIEGO

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROIZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

SERVICE

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

SERVICIO

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERLO.

WARTUNG

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

ENTRETIEN

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

ASSISTENZA TECNICA

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

About This Manual

This manual covers the operating & maintenance instructions for the following models:

Fiber-DAS

Changes to this Manual

We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Solon, Ohio factory. This manual may be periodically updated. When inquiring about updates to this manual refer to the part number: 920-Fiber-DAS; and revision: P3.

Chapter Layout

Introduction — Describes the fundamentals of the Bird Fiber-DAS and provides a list of commonly used abbreviations and acronyms.

System Description — Describes the Major components that make up a Bird Fiber-DAS system.

Installation Guidelines — Provides FCC requirements and safety considerations when installing a Bird Fiber-DAS.

Commissioning — Lists the preparations and equipment required to successfully install and commission the Bird Fiber-DAS.

RF Commissioning — Chapter contains useful advice on how to design a well working system as well as examples for fine tuning link a budget and controlling noise in a Bird Fiber-DAS.

Model Identification — Provides a breakdown of the Bird part numbers for the Fiber-DAS systems. A table of part numbers used for Remote Units is also provided.

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The Bird fiber distributed antenna system (Fiber-DAS) was developed from the start with fiber-optic cable as the distribution medium. This allows for excellent radio performance and best in class system noise figure of less than 3 dB, from the remote unit antenna port to the base station interface port.

The Bird Fiber-DAS system is a flexible and scalable solution, meaning the system can be tailored for almost any requirement. This flexibility provides the user the ability to adjust many of the systems parameters to fit their specific needs.

This manual contains design, installation, and commissioning guidelines, as well as system maintenance practices. It also contains information regarding general practices within in the industry as well.

Fiber-DAS calculator — In addition to this manual, the Fiber-DAS calculator is an indispensable tool, this Excel spreadsheet includes the following features, providing insight to how well the system will perform:

- ✓ System Noise Figure calculator
- ✓ Intermodulation performance calculator
- ✓ Uplink / Downlink Balance
- ✓ Dynamic headroom

RF on fiber

A fiber distributed antenna system (Fiber-DAS) is an efficient method of transmitting radio signals over large distances. Our Fiber-DAS can provide as much as 30 km of fiber between the head-end and the remote unit, providing that the radio access technology used in the Radio Access Network (RAN) does not suffer timing issues and that the fiber loss is within the specification.

The Fiber-DAS uses an infra-red light source, modulated with the combined radio signals that need to be propagated. The fiber channel system is ultra wide-band, ranging from 88 MHz up to 2600 MHz, thus covering most types of radio communication systems including as FM broadcast, VHF communication radios, LTE, TETRA, GSM, CDMA, WCDMA and many other radio access technologies.

Most land mobile radio and cellular systems use Frequency Division Duplex (FDD) which means:

- Two separate fibers, one for the uplink (signals from the terminal towards the base station) and one for the downlink (signals from the radio base station towards the terminal)
- Or a single fiber and the signals must be multiplexed using different wavelengths.

Bird's Fiber-DAS uses wave-length division multiplexing (WDM) as the standard configuration featuring the following:

- ✓ Single mode fiber
- ✓ Angled connectors
- ✓ Up to 15 dB optical loss

Note: *Separate UL/DL fibers can be used if it is necessary or desired.*

The dynamic of the fiber is good enough to tolerate multi-carrier, multi-band and multi-operator solutions, but they share the available dynamics and if there is a large number of carriers the fiber attenuation needs to be considered.

Because the modulation is analog the system requires the fibers to be of single mode type. All connectors used in Bird's Fiber-DAS equipment are SC-APC type with a 7° angle. It is important that all connectors (i.e. patches) between the Master Unit (MU) and the Remote Units (RU) be angled, otherwise reflections could result causing problems with the quality of the signals through the system.

Definitions

The following abbreviations, industry standard lingo and acronyms are used in this document.

BGW	Base station Gateway, see "Base Station Gateway (BGW)" on page 4
BIU	Base station interface. Also known as the DIU. It is the electrical interface between the Master Frame Unit (MFU) and the operator radio base station or another source for the radio signals, such as a off-air repeater. See "Base Station Interface Unit (BIU)" on page 8
BTS	See RBS.
DAS	A distributed antenna system. Several antennas connected together in a coaxial network so that several antennas can be fed a signal from a central location.
DL	See "Downlink"
Downlink	The signals that are transmitted from a base station towards a terminal (phone).
Fiber	In this document it refers to the telecommunication fibers used to transmit modulated light as pulses or analog variations on a glass fiber. The Bird Fiber-DAS system should use single-mode fiber always.
Fiber-DAS	A general name for distribution systems using radio frequency on fiber (RF on Fiber) technology. DAS means "Distributed Antenna System" which refers to the practice of building "spreading nets" with coaxial cables, splitters and antennas to cover larger structures.
FOI	Fiber-optic interface. See "Fiber Optic Interface (FOI) unit" on page 15
FOR	Fiber-optic remote interface, part of the Remote Unit connecting to the fiber.
GSM	Global System for Mobile Communications
iDEN	Integrated Digital Enhanced Network
LTE	Long Term Evolution
MFU	Master Frame Unit. This is a rack that contains all the modules that builds up to the head end in the system. This is where the radio base stations interface to the Fiber-DAS system. This is also where the downlink signals from the base stations are converted into laser light and sent over the fiber-optics to the Remote Unit (RU) and the uplink signals from the RU are converted to radio frequency signals and transmitted to the radio base station (RBS, BTS).
ICU	Interconnect Unit, RF splitter/combiner unit, see "Interconnect Unit (ICU)" on page 13
QMA	Quick connect/disconnect type of RF Connector. Replacement for SMA RF Connectors. See SMA
RBS	Radio Base Station. The infrastructure unit normally connected to the antennas in the radio access network (RAN) and sometimes called just Base Station or Base Transceiver Station (BTS).
RGW	Remote Gateway Unit, see "Remote Gateway (RGW)" on page 6
RU	Remote Unit. This is the unit closest to the antenna that converts the downlink signal from the fiber to radio frequencies and distributes it over the antenna system. In the reverse, the uplink radio frequencies are converted to modulated laser light and transmitted back to the MFU.
SC-APC	The type of connector used for all Bird optical equipment. It is recommended that all connectors between the MFU and the RU are of this type. SC-AP can also be accepted in patch panels. All connectors MUST BE ANGLED to avoid signal reflections that are detrimental to the signal quality. Fibers need to be of single-mode type.
Single mode fiber	A fiber where the light at a specified range of wavelengths only have a single path through. This is required for analogue modulated systems such as the Bird Fiber-DAS system
SMA	Sub-miniature version A. A Type of RF Connector.
Switch	A network switch is a computer networking device that connects devices together on a computer network.

TETRA	Terrestrial Trunked Radio. TETRA uses Time Division Multiple Access (TDMA) with four user channels on one radio carrier and 25 kHz spacing between carriers.
UL	See "Uplink"
UMTS	Universal Mobile Telecommunications System is a system where broadband signaling and packeted data are used. The standards are handled in the 3GPP group and the most common type of modulation is WCDMA.
Uplink	The signals that are transmitted from the terminal (phone) towards the base station.
SC-PC	A type of fiber-optic connector which is not angled and should not be used with Bird Fiber-DAS
SC-UPC	Ultra-polished fiber-optic connector. Not recommended with Bird Fiber-DAS
RF	Radio Frequencies, denominates the range of transversal electromagnetic waves with a frequency from 3 kHz to 300 GHz. The upper end of the spectrum is often referred to as microwave frequencies.
WCDMA W-CDMA	Wideband Code Division Multiple Access is a technology employed by base station manufacturers who make UMTS base stations. This technology is commonly used in 3G networks and the main modulation employed in Europe.

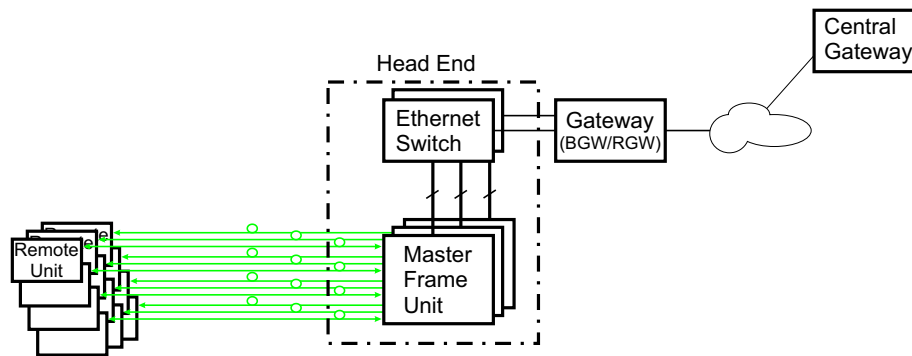
The Fiber-DAS system typically consists of three main segments:

Gateway — The Gateway acts as a firewall ensuring internal traffic on the system remains internal and at the same time allowing a web interface for monitoring and supervision. The gateway also handles SNMP traps.

Headend — The Headend serves as the interface with the operator's base station, housing the units required to transmit and receive communications between the operator's base station and the remote units of the Fiber-DAS system.

Remote Units — the remote units are located near the distributed antennas and house the equipment necessary to transmit and receive communications between the antenna and the headend.

Figure 1 Fiber-DAS System



Gateways

The gateways offered include the Central Gateway (CGW), Base Station Gateway (BGW) and Remote Gateway (RGW).

For remote supervision of a Fiber-DAS a gateway (RGW or BGW) is installed. BGWs and RGWs are typically located with the headend equipment, the RGW is a smaller compact embedded solution while the BGW is a full featured Linux server that can be set up in many different ways.

CGWs are used for monitoring multiple Fiber-DAS systems, communicating with the BGWs and RGWs.

Central Gateway (CGW)

The CGW is used to provide a single remote access point and to compile alarms from multiple BGW/RGW networks. The unit is a self-powered Linux based server.

Base Station Gateway (BGW)

The BGW assigns IP addresses to all the modules in the Fiber-DAS system, including the Headend and Remote Units as well as their components.

The BGW is a self-powered Linux based server.

Features of the BGW:

- ✓ Web interface configuration
- ✓ Automatic detection of modules
- ✓ Automatic detection of Remote Units
- ✓ Capable of handling large systems
- ✓ Functions for statistics

- ✓ Northbound communication to CGW
- ✓ Includes firewall to protect local net
- ✓ Portal to your Master Unit
- ✓ User-provided certificate based security via HTTPS

Figure 2 Base Station Gateway



The BGW has two Ethernet ports - INT and EXT.

- The INT port is connected to the internal network in the headend’s Master Unit to provide the local network for all the modules and the Remote Units. It also provides, via the built-in switch in the Master Unit, a way of locally configuring the network. It provides the web interface for all the settings of the system as well as many other functions.
- The EXT port is a “northbound” Ethernet port that allows the BGW to connect to the Internet, or a WAN/ MAN type of larger network. This means that the system can be monitored and managed remotely.

The BGW is the unit responsible for alarm handling and remote forward of alarms either by SMTP mail forwarding or by SNMP traps. A MIB file for your SNMP system is available from Bird upon request as well as documentation regarding SNMP.

If the BGW is replaced the Remote Units may not show up immediately. This is due to the lease time on the address they have. Eventually they will request a new address and when this is done they will show up.

The BGW can also launch VPN tunnels to a remote supervision center, the CGW. The CGW makes it possible to manage multiple systems from a single location. The CGW can handle a large number of such tunnels, providing a central point for supervising all the installations and collecting alarms and statistics from all the systems as well as centralized alarm management. The BGW can support a second VPN tunnel to the Bird management center providing supervision and management assistance, if needed.

Table 1 BGW Specifications

Parameter	Value
Input power voltage	100-240 VAC
Input power frequency	50 / 60 Hz
Operating temperature	10 to 30 °C (50 to 100 °F)
Power rating, Typical	< 100 W
Height	1 U
Width	19" (48.26 cm)
Depth	14.2" (36 cm)
Weight	< 11 lbs. (5 kg)

Remote Gateway (RGW)

The RGW is a small unit similar to the BGW but intended for small systems where there are only a few remotes or where there is no headend. The RGW has a form factor that allows it to be mounted inside a repeater casing.

The RGW can be used to run up to 4 Remote Units from a single Repeater on a single Fiber. The RGW has the capability to connect northbound to a CGW, just like the BGW, and it can also forward alarms through a VPN tunnel to a CGW.

The memory capacity and features are reduced compared to the BGW but for a small system with a single fiber this is an option.

In remote locations without Ethernet, the RGW can be equipped with a modem to allow remote access to the system. Typically a 3G modem is used allowing a VPN tunnel from the RGW to a CGW, enabling supervision, monitoring and control of the system.

Headend

The headend consists of a 19-inch rack with modules that are selected depending on the system design. Generally all headend Units contain:

- Network switch - connects communication paths between the modules
- Interconnect Unit (ICU) - RF splitter/combiner (rack-mount unit or module in the MFU)
- Master Frame Unit (MFU), may contain some or all of the following:
 - ✓ Power supply
 - ✓ Base Station Interface Unit (BIU)
 - ✓ Fiber-Optic Interface card (FOI)
 - ✓ Repeater
 - ✓ ICU

A DHCP server built into the RGW and BGW will assign IP addresses to all the headend subunits in the rack and the Remote Units when they are connected to the system. The configuration is automatic and creates a protected subnet for the system.

DCS - Network Switch

The network switch is an AC powered, 24-port switch with Spanning Tree Protocol (STP). The network switch provides an Ethernet link between the MFU and the BGW. Each card slot in the MFU has a dedicated Ethernet port, each port is connected to the network switch and the network switch is connected to the BGW.

A DC powered option is also available.



Actual network switch may be different from the image.

Master Frame Unit (MFU)

The Master Frame Unit (MFU) houses the Power Supplies, Base Station Interface Units (BIU), Interconnection Units (ICU), and Fiber-Optic Interface (FOI) cards. [Figure 3](#) shows an MFU equipped with 3 BIUs, 6 FOIs and one Power Supply.

Figure 3 Master Frame Unit



Functional description

One MFU supports several modules, or combination of module types. The modules can be placed anywhere in the frame. There are 16 single slot card positions in each MFU, however module widths vary (see each module's specifications) so the number of module that will fit in an MFU depends on the module type. One MFU can house up to 4 power supplies, 8 ICUs, 8 wide BIUs, 16 slim BIUs, 16 FOIs, or combination of modules. See [Table 2](#).

Each MFU requires at least one power supply, although the power supply does not need to be housed within the MFU. Quite often a system has more than one power supply and they are usually placed together in one MFU for easy access. Each MFU has two power input connectors, one primary and one redundant. A redundant power supply connected to an MFU ensures continued operation if one of the power supplies should fail.

The MFU contains two ventilation fans circulating ambient air through the units housed in the frame. These are high quality fans with a high mean time between failure (MTBF).

Each Module in the MFU are assigned an IP addresses via DHCP leases, modules inherit the MAC address from the backplane, this ensures that a new module inserted in the rack receives the same IP address as the one it is replacing, without the need of manual configuration.

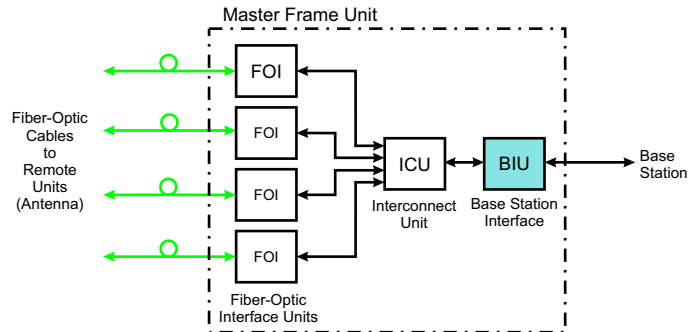
Table 2 MFU Specifications

Parameter	Value
Power connector	Molex, 10 Pin
Ethernet connector	RJ45
Weight (without modules)	5.5 lbs (2.5 kg)
Temperature range, Operational	0 to 45 °C (32 to 113 °F)
Width	19" (48.3 cm)
Height	3 U, 5.25" (13.34 cm)
Depth	11.8" (30 cm)
Maximum number of each type of modules supported	
PSU	4
BIU (DBI3xx, DBI3xxC(compact))	8, 16
FOI (DOI401, DOI30x)	8, 16
ICU	8

Base Station Interface Unit (BIU)

The Base Station Interface Unit (BIU) is the interface between the operator’s base station and the Fiber-DAS system. The primary purpose of the BIU is to adjust uplink and downlink signal levels. The BIU is powered from the MFU backplane and communicates via Ethernet with the BGW.

Figure 4 BIU Signal Flow

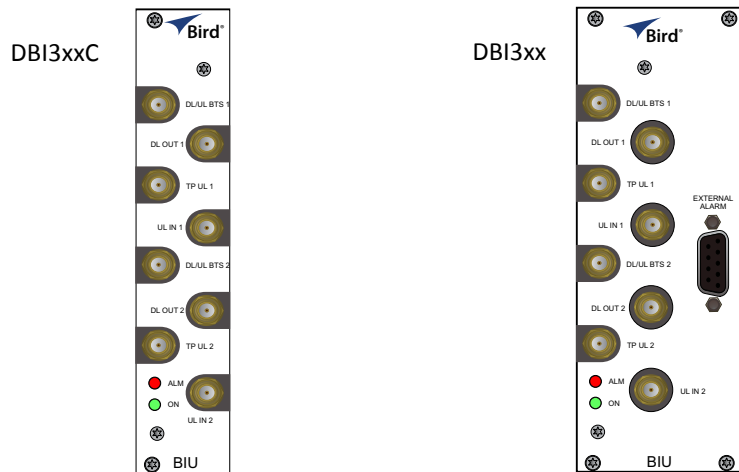


The BIU has uplink and downlink RF connectors on the front panel and is available in two variants, one containing duplex filters or one with separate uplink/downlink paths, depending on the needs for the connection to the base station. In most cases the duplexed version with a combined DL/UL ports is used.

In addition to duplexing options, there is a single slot and a dual version of the BIU:

- The DBI3xx (wide version) includes an external alarm connector (DB9) and requires two MFU slots.
- The DBI3xxC (compact version) does not have an external alarm connector (DB9) , and uses only one MFU slot.

Figure 5 Base Station Interface Unit (BIU)



Functional description

The BIU has four SMA ports (female type) to connect the RBS/BTS.

- Duplexed versions have combined DL/UL connectors used to connect to the RBS, and there are UL test (TP) connectors that can be used to monitor the signal out from the BIU.
- Non-duplexed (simplex) versions have the test connectors replaced by UL connectors and the normally combined UL/DL connectors are replaced by DL only connectors.

The BIU has four QMA ports (female type) that are normally used to connect it to an ICU.

- There are two uplink (input) ports and two downlink (output, TX) ports.
- These are two separate paths, the isolation between DL 1 and DL 2 ports and the isolation between the UL 1 and UL 2 ports is > 50 dB.

There are two separate RF paths in the BIU. The BIU is configured for the specific frequency band it will serve. The two paths in the BIU cannot have different frequencies; a GSM 900 BIU will have two GSM 900 paths and cannot be combined with an 1800 path. Separate frequencies require the use of an additional BIU.

RF patch cables are used to patch the DL and UL paths (QMA) to the ICU.

The DBI 3xx (dual slot) BIU has an alarm output port (DB9 female connector) on the BIU which can be used to connect external alarms.

Table 3 Alarm Port Pinout

Pin	Signal (A)	Signal (B)
1	RS485+	RS485+
2	Alarm out 1	Alarm out 1
3	Ground	Ground
4	Not connected	Alarm in 2
5	Not connected	Alarm in 4
6	RS485+	RS485+
7	Alarm out 2	Alarm out 2
8	G	Alarm in 3
9	Not connected	Alarm in 1

The BIU is technology neutral and the downlink path contains settable attenuators that can be used to adjust the signal strength to proper levels before feeding them into the ICU. In the uplink there is an amplifier followed by a settable attenuator used to adjust the signal and the noise level into the base station uplink.

CAUTION

Overdriving the RF source input into the BIU will cause permanent equipment failure and will void the warranty. The installer must ensure that input levels are not exceeded. Plan for maximum power out of the RF source and attenuate accordingly with external attenuators if needed.

All RF connections are made on the front of the BIU. The maximum recommended input power to the BIU is 30 dBm. A high power alarm is activated at > 30 dBm and a low power alarm at < 10 dBm input power.

Input power above the recommended level can cause permanent unit failure. For high power base stations, an attenuator should be used to ensure that the input power to the BIU can never exceed specifications.

There is a 0 dBm input version of the BIU available on request.

BIU Type	Minimum DL Input	Maximum DL Input
Low Level	-7dBm	+7dBm
High Level	+20dBm	+33dBm

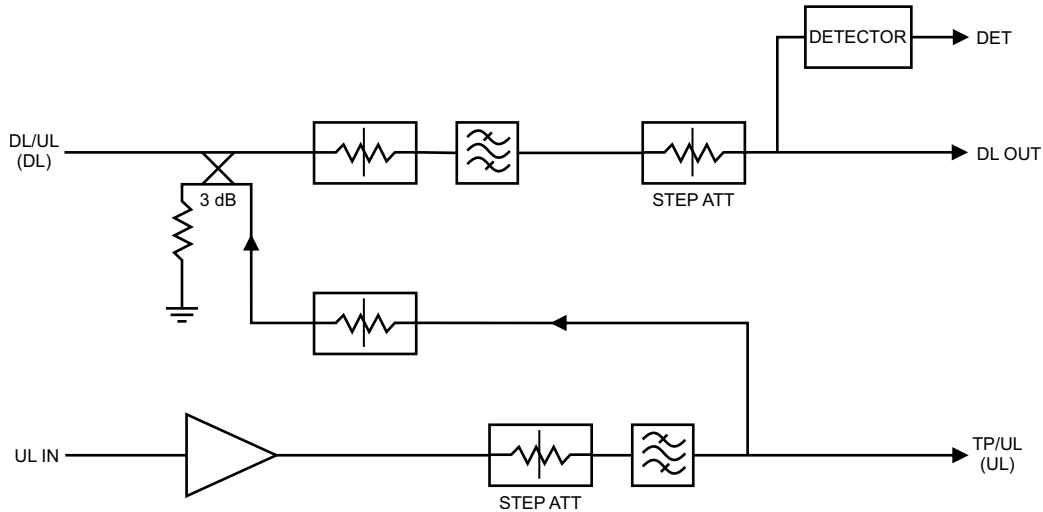
CAUTION

The UL from the FOI card is capable of damaging the UL port on the BIU. Maximum input to the BIU UL should be no higher than +13dBm. Use care to properly set FOI levels prior to enabling RF.

The schematic in [Figure 6](#) shows one of the channels in the BIU. The signal detector for the downlink level alarms is shown in the top right corner.

The UL1 and UL2 uplink test ports are 3 dB lower than the signal on the corresponding DL/UL BTS port.

Figure 6 Schematic of One BIU RF Path



[Table 4](#) lists standard cellular BIU's. Other configurations are available upon request as well as units without internal duplex filtering.

Table 4 Standard Variants of the BIU

Configuration	UL MHz	DL MHz	RF Input	High Level P/N	Low Level P/N
2 x VHF	136-174	136-174	Duplex	DBI312	DBI412
2 x TETRA 390 MHz [†]	380-385	390-395	Duplex	DBI301	DBI401
2 x UHF	450-470	450-470	Duplex	DBI313	DBI413
2 x 700 MHz ABC-band	698-716	728-746	Duplex	DBI307	DBI407
2 x 700 Upper C	777-756	746-756	Duplex	DBI304	DBI404
2 x 700 Public Safety	799-805	769-775	Duplex	DBI314	DBI414
2 x SMR 800	806-824	851-869	Duplex	DBI303	DBI403
2 x 850 MHz	824-849	869-894	Duplex	DBI308	DBI408
2 x 800	832-862	791-821	Simplex	DBI305	DBI405
2 x GSM-R 900	876-880	921-925	Duplex	DBI310	-
2 x 900 MHz	880-915	925-960	Duplex	DBI309	DBI409
2 x 1800 MHz	1710-1785	1805-1880	Duplex	DBI318	DBI408
2 x 1900 MHz	1850-1915	1930-1995	Duplex	DBI319	DBI419
2 x UMTS 2100 MHz	1920-1980	2110-2170	Duplex	DBI320	DBI420
2 x AWS 2100 MHz	1710-1755	2110-2155	Duplex	DBI321	DBI421
2 x LTE 2600	2500-2570	2620-2690	Duplex	DBI326	DBI426

[†] Several options exist for 5 MHz standard bands for TETRA

Table 5 RF and Electrical Performance of the BIU

Parameter		Value	Unit
Downlink attenuation	Settable	10-30 ± 3	dB
Uplink Gain for modules < 1000 MHz	Settable	10 to 20 ± 3	dB
Uplink Gain for modules > 1000 MHz	Settable	-10 to 10 ± 3	dB
IM3 performance		> 55	dB
Max input non-destructive		> 36	dBm
High input alarm threshold level		33	dBm
Low input alarm threshold level		10	dBm
Input return loss		> 20	dB
Impedance for all RF ports		50	Ω
Isolation between ports		> 60	dB
Power consumption		< 15	W
Temperature range		0-45	°C

Table 6 BIU Mechanical Specifications

Parameter	Value
Base station RF ports	SMA, Female
Test ports uplink (if present)	SMA, Female
Interconnecting RF ports to ICU	QMA, Female
Alarm connector (optional)	DB9, Female
Module Width	
DBI3xx	2 Slots
DBI3xxC(compact)	1 slot

BIU Indicator Operation

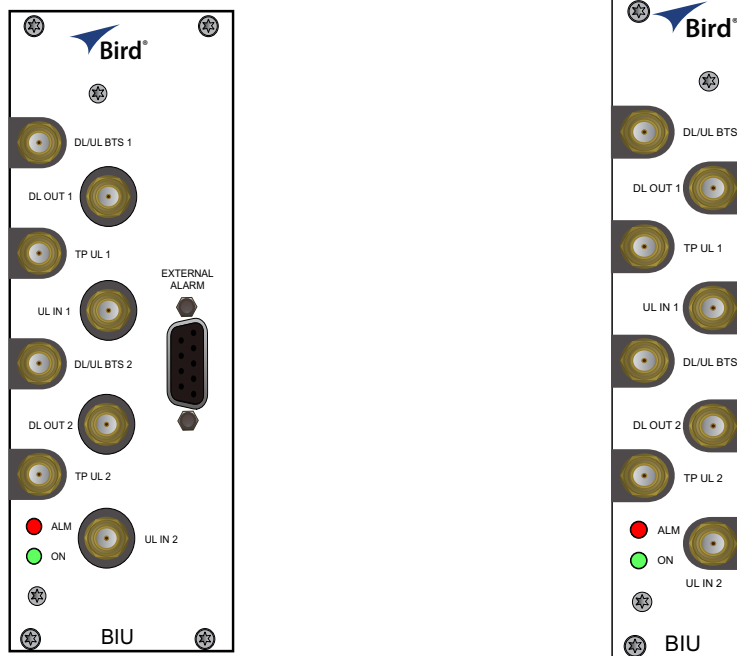
There are two LEDs located on the BIU front panel. One is the power LED (green), the other is the alarm LED (red). Both LEDs indicate a number of states by different flashing sequences, see [Table 7](#).

In an error state the web interface should be used to check the actual condition of the BIU but the LEDs can give a quick indication on the state of the unit. The LEDs are also useful for locating the physical unit if several BIUs are installed in the same rack.

Table 7 Indicator Behavior

State	ON LED	ALM LED	Note
Booting	2 Hz	Off	Normal boot
Booting standalone mode	2 Hz	2 Hz	Not attached to rack
Booting read of MAC address failed	2 Hz	On	Error
Starting	0,1 Hz 90%	0,1 Hz 90%	Kernel startup
Operation	0,5 Hz 10%	Off	Normal operation
Operation	0,5 Hz 10%	1 Hz 10%	Minor alarm state
Operation	0,5 Hz 10%	2 Hz 25%	Major alarm state
Operation	0,5 Hz 10%	On	Critical alarm state

Figure 7 BIU Interfaces



Item	Description
DL/UL BTS 1 / 2	Connection from the radio base station (RBS).
TP UL 1/2	Test port for the uplink of the DL/UL BTS port - 6 dB. The signal will be 3dBm below the DL/UL BTS port. Port is not valid on the simplex BIU.
DL OUT 1/2	Simplex downlink feed to the FOI.
UL IN 1/2	Simplex uplink from the FOI. The BIU will attenuate and/or amplify the signal and then route to the DL/UL BTS port.
EXTERNAL ALARMS	Used for external alarm monitoring (DBI3xx, two slot version only).
ON/ALM LED	The LEDs indicate various states, see Table 7 .

Interconnect Unit (ICU)

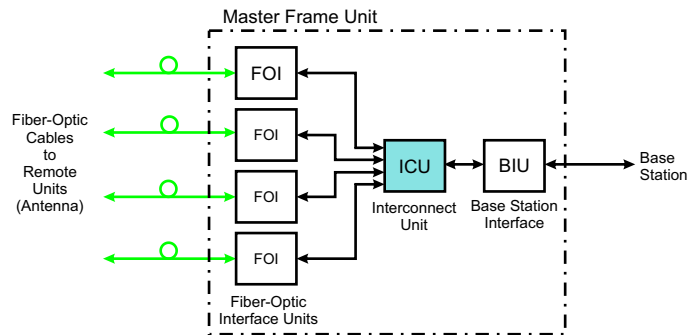
Interconnect units (ICU) are used to couple signals between the BIUs and the FOIs.

The functional purpose of the ICU is:

- Downlink - Split the signal from the BIU and route the balanced signals (minus insertion loss) to the FOIs.
- Uplink - Combine the signals from the FOIs and route the sum of the signals (minus insertion loss) to the BIU.

The RF ports on the ICU are QMA.

Figure 8 Interconnect Unit Signal Flow



MFU ICU

The MFU ICUs are available in several different configurations to support a variety of system configurations. These units are inserted into the MFU and provide signal routing to and from the BIUs and FOIs.

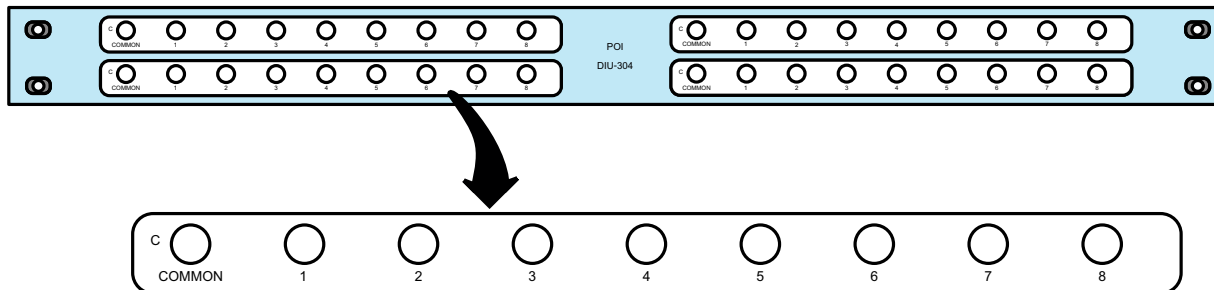
Figure 9 MFU ICU



Rack-mount ICU (DIU301, DIU302)

The Rack-mount ICU is a 1U unit that contains four fields containing splitters/combiners. Each field is capable of splitting one input into eight outputs or combining eight inputs into one output.

Figure 10 Rack-mount ICU



Each of the 4 fields has a COMMON port and ports 1-8.

- When used as a combiner, the signals to combine are connected to input ports 1-8, the sum of the signals (minus insertion loss) will be output on the COMMON port.
- When used as a splitter, the combined signal is input on the COMMON port and output on ports 1-8, with the output ports having balanced signals (minus insertion loss).

Table 8 Rack-mount ICU Specifications

Parameter	Value
Insertion loss (nominal) - DIU301	37 dB
Insertion loss (nominal) - DIU302	21 dB
Bandwidth - DIU301	88-2700 MHz
Bandwidth - DIU302	88-2700 MHz
Operating Temperature	-25 to +55 C (-13 to +131F)
Impedance	50 Ohm
IM3 performance	> 50 dB
Return loss performance	> 20 dB
Maximum common port power	20 dBm
Isolation between ports in same strip	> 15 dB
Isolation between ports in different strips	> 50 dB

QMA cable kit

A QMA cable kit (Bird part number DCC320) is available for use with the ICU. The kit contains 32 QMA to QMA cables (see [Table 9](#)) that can be used to patch between the BIU to the ICU, BIU to the FOI or ICU to FOI.

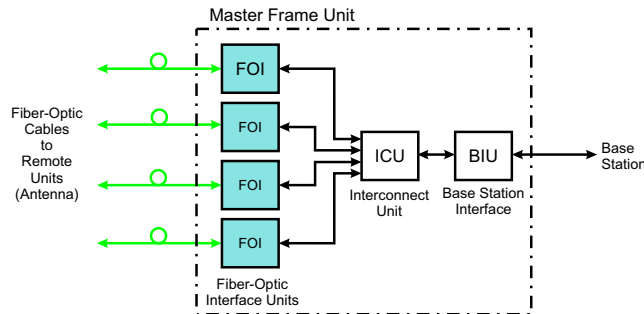
Table 9 QMA Cable Kit

Length	Quantity
250 mm (9.8")	13
350 mm (13.8")	13
500 mm (19.7")	6

Fiber Optic Interface (FOI) unit

The FOI converts the RF signals in the downlink to fiber-optical laser output that is transmitted on the fiber to the remote unit. It also receives the laser light transmitted by the Remote Unit and converts it back to RF signals that are then routed to the ICU and/or BIU.

Figure 11 FOI Signal Flow



The FOI is powered from the MFU backplane and communicates via Ethernet with the BGW.

Figure 12 Fiber Optic Interface (FOI) Unit



WARNING

Avoid looking into connected fibers and receptacles. The laser used in this system is a Class 3b laser that produces invisible infra-red coherent light. Not safe to view with optical instruments. Always put the protection caps on unused fibers and receptacles.

This interface is designed to work with SC-APC connectors (8° angled physical connector) and single mode fibers only. All connectors between the master unit and the remote unit must be APC, otherwise problems with reflections will arise, which could cause severe problems in the system.

The Ethernet communication between the Headend and the Remote Units takes place on two sub-carriers in the FOI where the Ethernet signals are superimposed on the RF signals.

As shown in [Table 10](#), Bird offers two styles of FOI cards. The "[DOI300 Series FOI](#)" on [page 16](#) and the "[DOI401Series FOI](#)" on [page 19](#).

Table 10 FOI Variants

Parameter	Fiber Ports	Wavelength
DOI 301	2	1310 nm
DOI 302 (WDM)	1	1310 nm
DOI 308x	1	various wavelengths available
DOI401	4	1550 nm

DOI300 Series FOI

The DOI300 series supports a single fiber optic link. The fiber-optic interface can either be a WDM (DOI302) which is most commonly used or an optional duplex feed with separate UL and DL fibers (DOI301). Bird also offers a WDM option (DOI380x). The WDM utilizes the duplex feed style card but the wavelength for the downlink are defined by the "x" in the DOI380x part number. Note that the Remote Unit will need to be ordered with the correct WDM uplink wavelength. Refer to the chart for the WDM wavelengths offered.

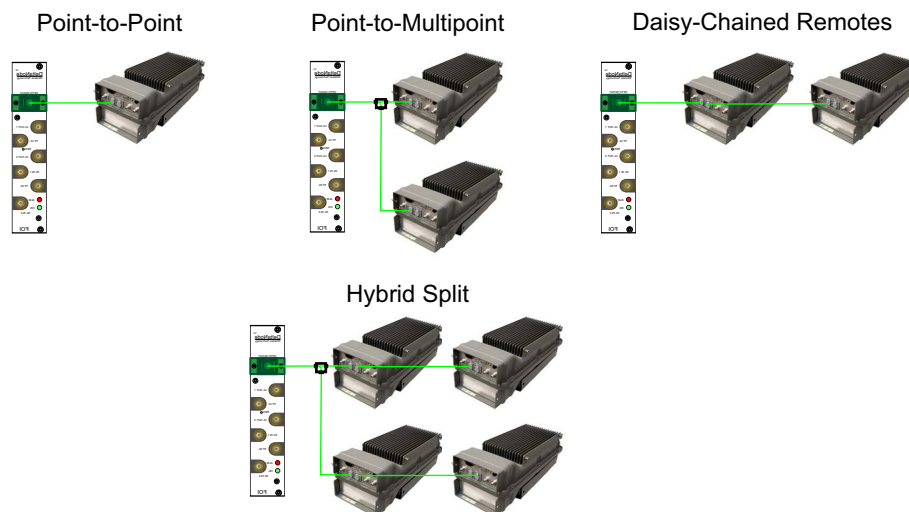
DOI300 Series Serving Multiple Remotes

The DOI300 Series FOI can serve up to 4 Remote Units on a single fiber run when using an optical splitter in the first Remote Unit. When utilizing the DOI302 WDM module each Remote Unit in the series must have different optical wavelengths in the uplink path to avoid interference.

When utilizing optical splitters, the optical loss of the splitter must be accounted for in the optical link budget. The DOI300 series FOI has a maximum link budget of 15 dB.

[Figure 13](#) shows the allowed FOI to FOR/Remote configurations. Bird offers various splitter options for the FOR/Remote to help account for optical losses. The standard optical splitter will have balanced outputs for each path. Consult with Bird engineering for special applications.

Figure 13 FOI to Remote Unit Configurations



Functional description

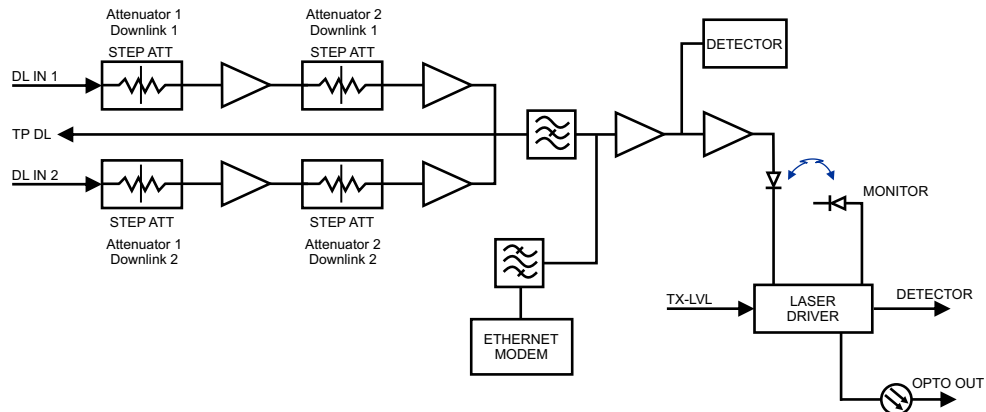
The FOI has a nominal gain of 35 dB and the laser transmitter should see a maximum composite input power of 0 dBm. This means that for 0 dB attenuation in the downlink a maximum input of -35 dBm composite power is recommended (when attenuators are set to 0 dBm). If the downlink attenuator is set to a higher value the maximum recommended input is adjusted accordingly.

The output power of the laser is calibrated to 3000 μ W. This can be used to check the loss over fiber in the remote because the remote reports the received optical levels. The loss may be different in the uplink compared to the downlink because of different wavelengths on the laser.

The FOI contains several adjustable attenuators which are used to compensate for loss before the FOI (e.g. in the ICU) and for loss on the fiber in the uplink. There are two sets of RF ports on the FOI that can be used to connect signals from two different strips in the rack-mount ICU, or two different MFU ICUs.

[Figure 14](#) is a block diagram showing the downlink path in the FOI and how the test port is connected. There are two attenuators that can be set in the downlink path. This allows for balancing the input signals from two different signal sources so that they can share the dynamics of the laser properly.

Figure 14 FOI Downlink Block Diagram



The RF drive levels are measured and accessible in the web interface.

TP DL is a test point measurement port for the downlink path. The RF level at TP DL will be the same as the input to the DL ports minus the GUI attenuator settings.

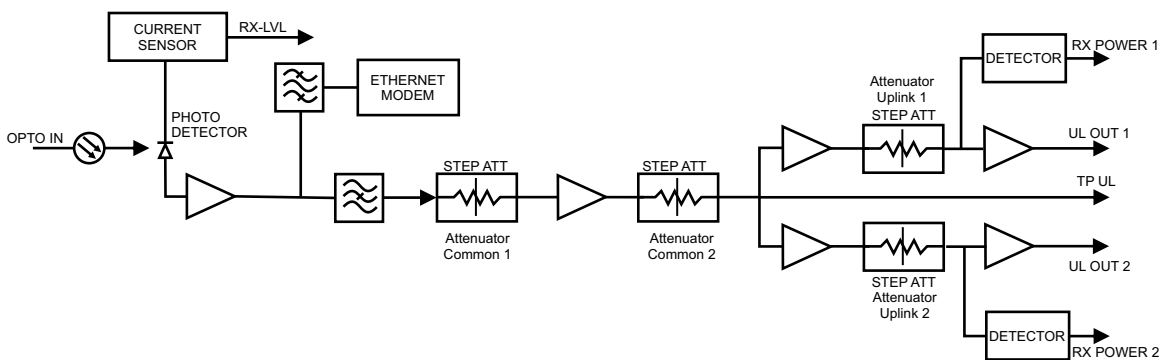
$$TP\ DL = "DL\ IN\ 1" \text{ minus } "Att.\ 1\ Downlink\ 1" \text{ minus } "Att.\ 2\ Downlink\ 1".$$

$$TP\ DL = "DL\ IN\ 2" \text{ minus } "Att.\ 1\ Downlink\ 2" \text{ minus } "Att.\ 2\ Downlink\ 2".$$

Example: Input into DL is -25dBm with the GUI setting for "Att. 1 Downlink 1" of 10 and a GUI setting for "Att 2 Downlink 1" of 0. The test point measurement will be: -25dB (input) minus 10dB (attenuator #1) minus 0dB (attenuator #2) = -35dBm.

Figure 15 is a block diagram showing the uplink path in the FOI and how the test port is connected. There are two common attenuators, and two uplink attenuators that can be set in the uplink path.

Figure 15 FOI Uplink Block Diagram



The UL test port on the FOI is tapped before the individual uplink path attenuators. The output level of TP UL will be:

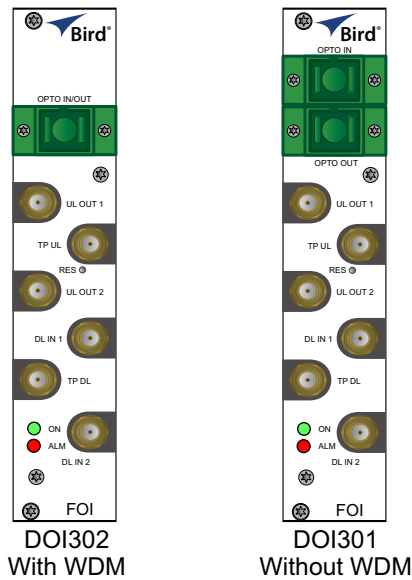
$$TP/UL[dB] = "Att.\ Uplink\ 1" \text{ setting} - 20dB$$

$$TP/UL[dB] = "Att.\ Uplink\ 2" \text{ setting} - 20dB$$

Example: If the FOI GUI setting for "Att. Uplink 1" is 0, the test port uplink path 1 signals will be 20dB lower than the uplink signal on the "UL Out 1" port.

Example: If the FOI GUI setting for "Att. Uplink 2" is 20, the test port uplink path 2 signals will be equal to the uplink signals on "UL Out 2" port.

Figure 16 DOI301/302 Interfaces



Item	Description
OPTO IN/OUT	SC-APC connection for the optical fiber. DOI302 module with built in WDM has a single connector (combined RX/TX). DOI301 module without WDM has two connectors, one for TX and one for RX.
UL OUT 1/2	Uplink ports (QMA) to the ICU.
DL IN 1/2	Downlink ports (QMA) to the ICU.
TP UL/DL	Test ports (QMA) used to check the signal levels or noise in the system.

The two LEDs on the unit provide FOI status as shown in [Table 11](#).

Table 11 FOI LED Indicators

State	ON LED	ALARM LED	Note
Booting	2 Hz	Off	Normal boot
Booting standalone mode	2 Hz	2 Hz	Not attached to rack
Booting read of MAC address failed	2 Hz	On	Error
Starting	0,1 Hz 90%	0,1 Hz 90%	Kernel startup
Operation	0,5 Hz 10%	Off	Normal operation
Operation	0,5 Hz 10%	1 Hz 10%	Minor alarm state
Operation	0,5 Hz 10%	2 Hz 25%	Major alarm state
Operation	0,5 Hz 10%	On	Critical alarm state

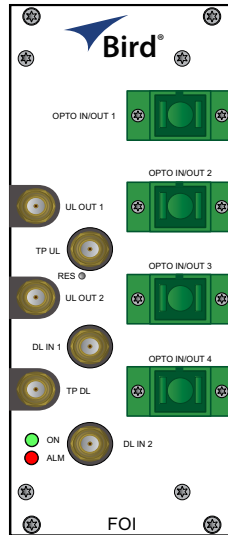
Table 12 DOI302 Specifications

Parameter	Value
Maximum fiber loss from MU to RU, Optical,	15 dBo
Optical output power, Calibrated	3 000 μW
Maximum number of RU supported on single fiber	4
Input RF power recommended, Composite	-50 to -35 dBm
Power consumption	< 15 W
Operational Temperature range	0 to 45 °C (32 to 133 °F)
Module Width	1 card slot
Optical connector type	SC-APC
RF connector type	QMA Female

DOI401Series FOI

The DOI401 four port FOI is very similar to DOI302 expect that it has four WDM optical ports instead of one. This allows the user to install dedicated fibers to each Remote Unit without having to balance optical splitter link budgets for each remote in a group. The balanced splitter loss is accounted for in the 7 dBo link budget of the DOI401. Unlike the DOI302, the DOI401 does not require the UL optical signals to be on different wavelengths.

Figure 17 DOI401 Interfaces



Item	Description
OPTO IN/OUT	SC-APC connections for the optical fiber.
UL OUT 1/2	Uplink ports to the ICU/BIU.
DL IN 1/2	Downlink ports to the ICU/BIU.
TP UL/DL	Test ports used to check the signal levels or noise in the system.

Table 13 DOI401 Specifications

Parameter	Value
Maximum fiber loss from MU to RU, Optical,	7 dBo
Optical output power, Calibrated	3 000 μ W
Maximum number of RU supported on single fiber	1
Input RF power recommended, Composite	-50 to -35 dBm
Power consumption	< 20 W
Operational Temperature range	0 to 45 °C (32 to 133 °F)
Module Width	2 card slot
Optical connector type	SC-APC
RF connector type	QMA Female

PSU – the rack power supply

The Power Supply Unit provides DC power to the Master Unit backplane. The unit is shipped as 240 VAC or 115 VAC units depending on the country. A -48 VDC input is offered as an option.

Figure 18 PSU



AC Power Supply



DC Power Supply

Functional description

The AC power supply can handle up to 16 cards or one chassis full of cards. The DC power supply is capable of handling 11 cards or one full chassis that includes the DC power supply.

All connectors are on the front side of the power supply. [Figure 18](#) shows the PSU equipped with European power inlet.

The PSU outputs are two 10-pin Molex connectors, these are connected to the chassis to supply power. One connector should always be connected to the chassis holding the PSU (for driving the fans).

One chassis can hold up to 4 power supplies. Two PSU's may be connected to a chassis to provide redundancy.

Table 14 PSU Specifications

Parameter	Value
Input power voltage, Mains	86-264 VAC
Input power frequency, Mains	50 / 60 Hz
Operating temperature	0 to 45 °C (32 to 113 °F)
Power rating	240 W
Width	4 card slots

Remote Unit (RU)

Remote units are available in a wide range of frequencies, gain and output power to cater to support a variety of requirements. Remote units are also capable of supporting more than one frequency band in a single unit.

Chassis types

Remote units (RUs) are available in two chassis, a single compact chassis for 1-2 bands and a dual chassis for up to 4 bands (Figure 19). There are multiple configurations that allow for various power level of amplifiers to be placed into the chassis. Table 15 shows how the chassis may be configured:

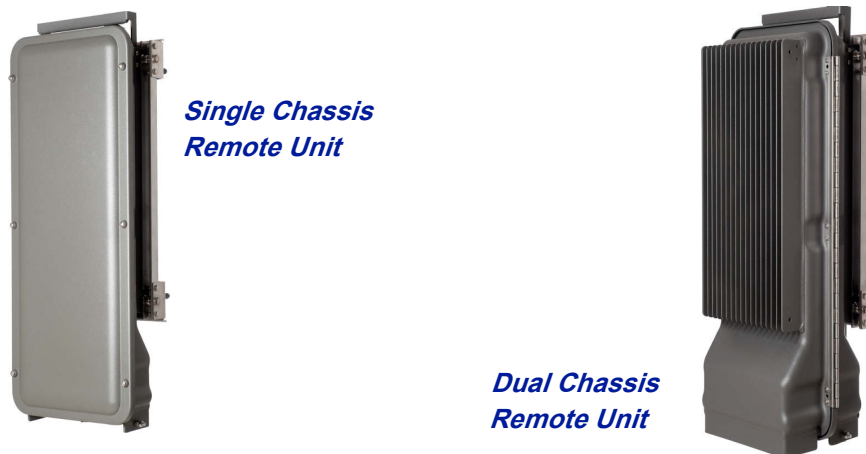
Table 15 Chassis Types

Chassis type	Low	Medium	High
Single chassis	1-2	1-2	1
Dual chassis	3-4	3-4	2

It is possible to have combinations of the above. For example it is possible to build a dual chassis with 2 medium power bands and 1 high power band in the same remote. Each side of a dual chassis is virtually identical to a single chassis remote unit. This ensures unparalleled flexibility when building multiple operator / multiple band solutions.

A dual chassis may have 1-2 fiber optical remote units (FOR). This allows for redundant fiber feeds, multiple-input and multiple-output (MIMO) applications, and dedicated amplifiers.

Figure 19 Remote Unit Chassis Types



All Remote Units have an excellent noise figure, contributing to an overall noise figure for the whole system from remote to head-end into the base station of < 3 dB for the RF link.

Both chassis comply with IP65 protection for use in any environment. The durable coating assists in convection cooling. No fans are used for the Remote Units.

Note: The heat generated by the Remote Units when powered up is used to prevent water ingress into units. Remote units must remain powered on when mounted outdoors.

Both wall or pole mounting kits are available for chassis mounting.

Table 16 contains a list of the most common remote units that are used with the Bird Fiber-DAS system. Variants are available upon request.

Table 16 Remote Comparison Table

Product code	Pout (ETSI)†	Pout (FCC)	Bands
DDR (medium power). See " DDR " on page 22.	26-30	36	1-4
DDS (High power quad band). See " DDS " on page 26.		41	1-4
DDH (high power). See " DDH " on page 28.	32-43	43	1-2
DDU (high power). See " DDU " on page 31.		46	1-2

21 † Actual power determined by frequency band and spectrum demands.

DDR

ETSI standard

Bird's Distributed Radio head is a high performing wideband radio head equipped with a linear power amplifier supporting all modulations. The light weight, convection cooled IP65 chassis secures the performance in almost any environment.

Table 17 General Specifications

Noise Figure, Typical	3 dB
Delay excluding optical fiber	< 0.5 μ s
Power Supply Standard Optional	85 to 264 VAC -32 to -100 VDC
Operating Temperature	-25 to 55 °C (32 to 113 °F)
Casing	IP65

Table 18 Specifications DDR100 (Single Band) & DDR200 (Dual band)

Power Consumption, max, DDR 100 (200)	90 (180) W
Dimensions, W x D x H	11.8 x 5.1 x 27.6 in. 30 x 13 x 70 cm
Weight	< 26.4 lbs (12 kg)

Table 19 Specifications DDR300(Triple Band) & DDR400(Quad Band)

Power Consumption, max, DDR 300 (400)	270 (360) W
Dimensions, W x D x H	11.8 x 8.7 x 27.6 in. 30 x 22 x 70 cm
Weight	< 52.9 lbs (24 kg)

Cellular Products

Table 20 Available Products, ETSI

System	UL Frequency MHz	DL Frequency MHz	Pout (DL) dBm/c, 1 Carrier	Pout (DL) dBm/c, 2 Carriers	Standard
TETRA, Public Safety	380 - 385	390 - 395	26	23	ETSI
TETRA, Commercial	410 - 415	420 - 425	26	23	ETSI
TETRA, Commercial	415 - 420	425 - 430	26	23	ETSI
CDMA450	452.5 - 457.5	462.5 - 467.5	33	28	FCC
GSM-R	876 - 880	921 - 925	26	23	ETSI
EGSM900	880 - 915	925 - 960	26	23	ETSI
GSM1800	1710 - 1785	1805 - 1880	28	25	ETSI
UMTS	1920 - 1980	2110 - 2170	30	25	3GPP

FCC/IC standard

Bird's Distributed Radio head is a high performing wideband radio head equipped with a linear power amplifier supporting all modulations. The light weight, convection cooled IP65 chassis secures the performance in almost any environment.

Table 21 General Specifications

Noise Figure, Typical	3 dB
Delay excluding optical fiber	< 0.5 μs
Power Supply Standard Optional	85 – 264 VAC -32 to -100 VDC
Operating Temperature	-25 to 55 °C (32 to 113 °F)
Casing	IP65

Table 22 Specifications DDR100 (Single Band) & DDR200 (Dual band)

Power Consumption, max, DDR 100 (200)	90 (180) W
Dimensions, W x D x H	11.8 x 5.1 x 27.6 in. 30 x 13 x 70 cm
Weight	< 26.4 lbs (12 kg)

Table 23 Specifications DDR300 (Triple Band) & DDR400 (Quad Band)

Power Consumption, max, DDR 300 (400)	270 (360) W
Dimensions, W x D x H	11.8 x 8.7 x 27.6 in. 30 x 22 x 70 cm
Weight	< 52.9 lbs (24 kg)

Cellular Products

Table 24 Available Products, FCC/IC

System	UL Frequency MHz	DL Frequency MHz	Pout, DL, dBm (Composite)	Standard
LTE LB	698 - 716	728 - 746	33	FCC/IC
LTE UB	746 -776†	776 – 806†	33	FCC/IC
iDEN	806 - 824	851 - 869	33	FCC/IC
Cellular	824 - 849	869 - 894	33	FCC/IC
PCS1900	1850 - 1915	1930 - 1995	33	FCC/IC
AWS	1710 - 1780	2110 - 2180	33	FCC/IC
WCS 2300	2305 - 2315	2350 - 2360	33	FCC/IC
IMT-E	2500 - 2570	2620 - 2690	33	FCC/IC

† Sub-bands available

Class B Industrial Booster — This equipment is a Class B Industrial Booster and is restricted to installation as an In-building Distributed Antenna System (DAS).

FCC RF Exposure — This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with the following minimum distances between the radiator and your body:

LTE 700 MHz (DDR700)	204.7 cm
iDEN 800MHz (DDR850)	173.0 cm
PCS 1900MHz (DDR1900)	142.9 cm
AWS-1 2100MHz (DDR2100)	134.9 cm
AWS-3 2155MHz (DDRAWS3)	97.7 cm
WCS 2300 MHz	97.7 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

IC RF Exposure — Equipment operating in the Cellular band should be installed and operated with the following minimum distance of between the radiator and your body:

LTE 700 MHz (DDR700)	269.0 cm
iDEN 800MHz (DDR850)	269.7 cm
PCS 1900MHz (DDR1900)	197.3 cm
AWS-1 2100MHz (DDR2100)	171.4 cm
AWS-3 2155MHz (DDRAWS3)	138.6 cm
WCS 2300 MHz	135.5 cm
IMT-E 2600MHz (DDR2600)	166.1 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

IC RF exposition — L'équipement fonctionnant dans la bande cellulaire doit être installé et utilisé avec la distance minimale suivante entre le radiateur et votre corps:

LTE 700 MHz (DDR700)	269.0 cm
iDEN 800MHz (DDR850)	269.7 cm
PCS 1900MHz (DDR1900)	197.3 cm
AWS-1 2100MHz (DDR2100)	171.4 cm
AWS-3 2155MHz (DDRAWS3)	138.6 cm
WCS 2300 MHz	135.5 cm
IMT-E 2600MHz (DDR2600)	166.1 cm

Si le système fonctionne sur plusieurs bandes, la distance de séparation requise est égale ou supérieure à la bande avec la plus grande distance de séparation.

Nominale de puissance de sortie du fabricant de cet équipement est pour un fonctionnement à une seule porteuse. Pour des situations où les signaux porteurs multiples sont présents, la cote devrait être réduite de 3,5 dB, en particulier lorsque le signal de sortie est re-rayonnée et peut provoquer des interférences avec les utilisateurs de bandes adjacentes. Cette réduction de puissance est effectuée au moyen d'une puissance d'entrée ou la réduction de gain, et non par un atténuateur à la sortie du dispositif.

Public Safety Products

Table 25 Available Products, FCC/IC

System	UL Frequency MHz	DL Frequency MHz	Pout, DL, dBm (Composite)	Nominal Bandwidth MHz	Nominal Passband Gain dB	Input/ Output Impedance Ohms	Standard
VHF	138-174	138-174	33	24(FCC); 36 (IC) [†]	70	50	FCC/IC
UHF	450-512	450-512	33	62 ^{††}	70	50	FCC/IC
700	793-805	763-775	33	12	70	50	FCC/IC
800	806-824	851-869	33	18	70	50	FCC/IC

[†] 2MHz with required external duplexers

^{††} 3MHz tor 1.5 MHz with required external duplexers

Class B Industrial Booster — This equipment is a Class B Industrial Booster and is restricted to installation as an In-building Distributed Antenna System (DAS).

FCC RF Exposure — This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with the following minimum distances between the radiator and your body.

VHF public safety band	69.1 cm - This distance must be maintained when a 10.5dBi antenna is used.
UHF public safety band	20.0 cm
700MHz public safety band	36.2 cm - This distance must be maintained when a 5.5dBi antenna is used.
800MHz public safety band	20.0 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

IC RF Exposure — Equipment operating in the public safety band should be installed and operated with the following minimum distance of between the radiator and your body:

VHF public safety band (DDR-V)	261.5 cm - This distance must be maintained when a 10.5dBi antenna is used.
UHF public safety band (DDR-U)	224.0 cm
700MHz public safety band (DDR-F)	187.0 cm - This distance must be maintained when a 5.5dBi antenna is used.
800MHz public safety band (DDR-S)	181.0 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

IC RF exposition — L'équipement fonctionnant dans la bande de sécurité publique doit être installé et utilisé avec la distance minimale suivante entre le radiateur et votre corps:

VHF bande de sécurité publique (DDR-V)	261.5 cm - Sa distance doit être maintenue lorsqu'une antenne de 10,5 dBi est utilisée.
UHF bande de sécurité publique (DDR-U)	224.0 cm
700MHz bande de sécurité publique (DDR-F)	187.0 cm - Sa distance doit être maintenue lorsqu'une antenne de 10,5 dBi est utilisée.
800MHz bande de sécurité publique (DDR-S)	181.0 cm

Si le système fonctionne sur plusieurs bandes, la distance de séparation requise est égale ou supérieure à la bande avec la plus grande distance de séparation.

Nominale de puissance de sortie du fabricant de cet équipement est pour un fonctionnement à une seule porteuse. Pour des situations où les signaux porteurs multiples sont présents, la cote devrait être réduite de 3,5 dB, en particulier lorsque le signal de sortie est re-rayonnée et peut provoquer des interférences avec les utilisateurs de bandes adjacentes. Cette réduction de puissance est effectuée au moyen d'une puissance d'entrée ou la réduction de gain, et non par un atténuateur à la sortie du dispositif.

DDS

Bird's DDS series distributed high power radio head is a high performing wideband radio head equipped with a Pre Distortion power amplifier that supports all modulations. The light weight, convection cooled IP65 chassis secures the performance in almost any environment.

FCC/IC Standard

Table 26 General Specifications

Noise Figure, Typical	3 dB
Delay excluding optical fiber	< 0.5 μ s
Instantaneous Band Width, Max	15 MHz
Power Supply Standard Optional	85 – 264 VAC -32 to -100 VDC
Operating Temperature	-25 to 55 °C (32 to 113 °F)
Casing	IP65

Table 27 Specifications DDS100 (Single Band) & DDS200 (Dual band)

Power Consumption, max, DDS100 (200)	90 (180) W
Dimensions, W x D x H	11.8 x 5.1 x 27.6 in. 30 x 13 x 70 cm
Weight	< 26.4 lbs (12 kg)

Table 28 Specifications DDS300 (Triple Band) & DDS400(Quad Band)

Power Consumption, max, DDS300 (400)	270 (360) W
Dimensions, W x D x H	11.8 x 8.7 x 27.6 in. 30 x 22 x 70 cm
Weight	< 52.9 lbs (24 kg)

Cellular Products

Table 29 Available Products, FCC/IC

System	UL Frequency MHz	DL Frequency MHz	Downlink Power RMS	Standard
LTE LB	698 - 716	728 - 746	41	FCC/IC
LTE UB	746 - 776 [†]	776 – 806 [†]	41	FCC/IC
850	824 - 849	869 - 894	41	FCC/IC
PCS1900	1850 - 1915	1930 - 1995	41	FCC/IC
AWS	1710 - 1755	2110 - 2155	41	FCC/IC

[†] Sub-bands available

Class B Industrial Booster — This equipment is a Class B Industrial Booster and is restricted to installation as an In-building Distributed Antenna System (DAS).

FCC RF Exposure — This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with the following minimum distances between the radiator and your body:

LTE LB 700 MHz	352.3 cm
LTE UB 700 MHz	349 cm
850MHz	323 cm
PCS 1900MHz	246 cm
AWS 2100MHz	246 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

IC RF Exposure — Equipment operating in the Cellular band should be installed and operated with the following minimum distance of between the radiator and your body:

LTE LB 700 MHz	504.6 cm
LTE UB 700 MHz	501 cm
850MHz	475 cm
PCS 1900MHz	362 cm
AWS 2100MHz	351 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

IC RF exposition — L'équipement fonctionnant dans la bande cellulaire doit être installé et utilisé avec la distance minimale suivante entre le radiateur et votre corps:

LTE LB 700 MHz	504.6 cm
LTE UB 700 MHz	501 cm
850MHz	475 cm
PCS 1900MHz	362 cm
AWS 2100MHz	351 cm

Si le système fonctionne sur plusieurs bandes, la distance de séparation requise est égale ou supérieure à la bande avec la plus grande distance de séparation.

Nominale de puissance de sortie du fabricant de cet équipement est pour un fonctionnement à une seule porteuse. Pour des situations où les signaux porteurs multiples sont présents, la cote devrait être réduite de 3,5 dB, en particulier lorsque le signal de sortie est re-rayonnée et peut provoquer des interférences avec les utilisateurs de bandes adjacentes. Cette réduction de puissance est effectuée au moyen d'une puissance d'entrée ou la réduction de gain, et non par un atténuateur à la sortie du dispositif.

DDH

Bird's Distributed High power radio head is a high performing wideband radio head equipped with a feed forward multi carrier power amplifier that supports all modulations. The light weight, convection cooled IP65 chassis secures the performance in almost any environment.

ETSI standard

Table 30 General Specifications

Noise Figure, Typical	3 dB
Delay excluding optical fiber	< 0.5 μ s
Power Supply Standard Optional	85 – 264 VAC -32 to -100 VDC
Operating Temperature	-25 to 55 °C (32 to 113 °F)
Casing	IP65

Table 31 Specifications DDH100 (Single Band)

Power Consumption, max, DDH100	210 W
Dimensions, W x D x H	11.8 x 5.1 x 27.6 in. 30 x 13 x 70 cm
Weight	< 30.8 lbs (14 kg)

Table 32 Specifications DDH200 (Dual Band)

Power Consumption, max, DDS200	420 W
Dimensions, W x D x H	11.8 x 8.7 x 27.6 in. 30 x 22 x 70 cm
Weight	< 61.7 lbs (28 kg)

Cellular Products

Table 33 Available Products, ETSI

SYSTEM	Number of carriers					
	2		4		8	
	Composite Power	Power per carrier	Composite Power	Power per carrier	Composite Power	Power per carrier
TETRA	32	29	33	27		
CDMA450	32	29	33	27		
GSM-R	37	34	40	34		
DD 800	37	34	33	27		
EGSM900	40	34	40	34	40	31
GSM1800	40	37	40	34	40	31
UMTS	43	40	43	37	43	34
2600	43	40	43	37	43	34

FCC standards

Table 34 General Specifications

Noise Figure, Typical	3 dB
Delay excluding optical fiber	< 0.5 μs
Instantaneous Band Width, Max	15 MHz
Power Supply Standard Optional	85 – 264 VAC -32 to -100 VDC
Operating Temperature	-25 to 55 °C (32 to 113 °F)
Casing	IP65

Table 35 Specifications DDH100 (Single Band)

Power Consumption, max, DDH100	210 W
Dimensions, W x D x H	11.8 x 5.1 x 27.6 in. 30 x 13 x 70 cm
Weight	< 30.8 lbs (14 kg)

Table 36 Specifications DDH200 (Dual Band)

Power Consumption, max, DDS200	420 W
Dimensions, W x D x H	11.8 x 8.7 x 27.6 in. 30 x 22 x 70 cm
Weight	< 61.7 lbs (28 kg)

Cellular Products

Table 37 Available Products, FCC/IC

System	UL Frequency MHz	DL Frequency MHz	Pout, DL, dBm (RMS)	Standard
LTE LB	698 - 716	728 - 746	43	FCC/IC
LTE UB	746 - 776†	776 – 806†	43	FCC/IC
iDEN	806 - 824	851 - 869	40	FCC/IC
Cellular	824 - 849	869 - 894	43	FCC/IC
PCS1900	1850 - 1915	1930 - 1995	43	FCC/IC
AWS	1710 - 1780	2110 - 2180	43	FCC/IC
2600 LTE	2620 - 2690	2500 - 2570	43	FCC/IC

† Sub-bands available

Note: All specifications subject to change without notice.

Class B Industrial Booster — This equipment is a Class B Industrial Booster and is restricted to installation as an In-building Distributed Antenna System (DAS).

Note: RF exposure distances are calculated using a 17 dBi antenna

FCC RF Exposure — This equipment complies with the FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with the following minimum distances between the radiator and your body:

2600 LTE (DDH 2600)	309 cm
AWS3 (DDHAWS3)	309 cm
PCS1900 (DDH1900)	309 cm
Cellular (DDH850)	406 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

IC RF Exposure — Equipment operating in the Cellular band should be installed and operated with the following minimum distance of between the radiator and your body:

2600 LTE (DDH 2600)	410.1 cm
AWS3 (DDHAWS3)	438.4 cm
PCS1900 (DDH1900)	455.2 cm
Cellular (DDH850)	597.9 cm

If system will operate on multiple bands, the separation distance required shall be equal to, or greater than, the band with the largest separation distance.

The Manufacturer's rated output power of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

IC RF exposition — FL'équipement fonctionnant dans la bande cellulaire doit être installé et utilisé avec la distance minimale suivante entre le radiateur et votre corps:

2600 LTE (DDH 2600)	410.1 cm
AWS3 (DDHAWS3)	438.4 cm
PCS1900 (DDH1900)	455.2 cm
Cellular (DDH850)	597.9 cm

Si le système fonctionne sur plusieurs bandes, la distance de séparation requise est égale ou supérieure à la bande avec la plus grande distance de séparation.

Nominale de puissance de sortie du fabricant de cet équipement est pour un fonctionnement à une seule porteuse. Pour des situations où les signaux porteurs multiples sont présents, la cote devrait être réduite de 3,5 dB, en particulier lorsque le signal de sortie est re-rayonnée et peut provoquer des interférences avec les utilisateurs de bandes adjacentes. Cette réduction de puissance est effectuée au moyen d'une puissance d'entrée ou la réduction de gain, et non par un atténuateur à la sortie du dispositif.

DDU

Bird's Distributed High power radio head is a high performing wideband radio head equipped with a feed forward multi carrier power amplifier that supports all modulations. The light weight, convection cooled IP65 chassis secures the performance in almost any environment.

FCC standards

Table 38 General Specifications

Noise Figure, Typical	3 dB
Delay excluding optical fiber	< 0.5 μ s
Instantaneous Band Width, Max	15 MHz
Power Supply Standard Optional	85 – 264 VAC -32 to -100 VDC
Operating Temperature	-25 to 55 °C (32 to 113 °F)
Casing	IP65

Table 39 Specifications DDU100 (Single Band)

Power Consumption, max, typical	225 W
Dimensions, W x D x H	11.8 x 5.1 x 27.6 in. 30 x 13 x 70 cm
Weight	31 lbs (14 kg)

Table 40 Specifications DDU200 (Dual Band)

Power Consumption, max, typical	450 W
Dimensions, W x D x H	11.8 x 8.7 x 27.6 in. 30 x 22 x 70 cm
Weight	62 lbs (28 kg)

Cellular Products

Table 41 Available Products, FCC/IC

System	UL Frequency MHz	DL Frequency MHz	Pout, DL, dBm (RMS)	Standard
LTE LB	698 - 716	728 - 746	46	FCC/IC
LTE UB	777 - 787	746 - 756	46	FCC/IC
LTE FB	690 - 716/777 - 787	728 - 756	46	FCC/IC
Cellular	824 - 849	869 - 894	46	FCC/IC
PCS1900	1850 - 1915	1930 - 1995	46	FCC/IC
AWS	1710 - 1780	2110 - 2180	46	FCC/IC

Note: All specifications subject to change without notice.

Class B Industrial Booster — This equipment is a Class B Industrial Booster and is restricted to installation as an In-building Distributed Antenna System (DAS).

Remote Unit Frequency Summary

Table 42 ETSI Bands

Band	3GPP Band	UL Frequency	DL Frequency	DDR Max Composite	DDH Max Composite
TETRA, Public Safety		380-385	390-395	26	33
TETRA, Commercial		410-415	420-425	26	33
TETRA, Commercial		415-420	425-430	26	40
CDMA 450	Band 31	452.5-457.5	462.5-467.5	33	40
DD800	Band 20	832-862	791-821	26	40
E-GSM 900	Band 8	880-915	925-960	26	40
GSM 1800	Band 3	1710-1785	1805-1880	28	40
UMTS	Band 1	1920-1980	2110-2170	30	43
LTE 2600	Band 7	2500-2570	2620-2690	30	43

Table 43 FCC/IC Bands

Band	3GPP Band	UL Frequency	DL Frequency	DDR Max Composite	DDS Max Composite (15MHz)	DDH Max Composite	DDU Max Composite
VHF		136-174	136-174	33	N/A	N/A	N/A
UHF		450-470	450-470	33	N/A	N/A	N/A
700 Lower	Band 12	698-716	728-746	33	N/A	43	46
700 Upper	Band 13 & 14	776-806	746-756	33	N/A	43	46
700 Combined	Band 12, 13 & 14	698-716 776-806	728-756	33	41	43	46
700 Public Safety		769-775	799-805	33	-	-	N/A
800 iDEN	Band 27	806-824	851-869	33	41	40	N/A
850 Cellular	Band 5	824-849	869-894	33	41	43	46
1900 PCS	Band 25	1850-1915	1930-1995	33	41	43	46
AWS	Band 4	1710-1755	2110-2155	33	41	43	46
2600 LTE	Band 7	2500-2570	2620-2690	33	N/A	43	N/A

DMU – Remote head end

Bird's DMU100 series is a compact head end that can function as a low power repeater or BTS interface. The unit can directly support up to 4 remotes or can fiber feed a Headend Master Unit. Remote access is provided by either the Bird RGW or via Ethernet connection. The unit is a rugged convection cooled, IP65 chassis designed for outdoor locations.

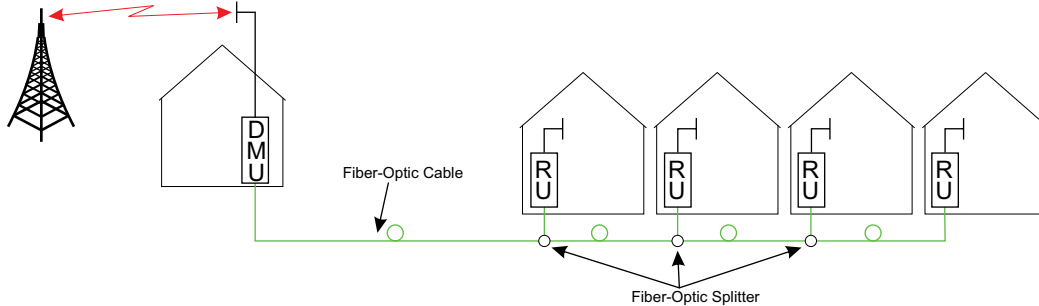
It is possible to build the DMU to support more than one band, however, the types of bands and the necessary duplexers for a configuration must be verified to ensure compatibility with the RGW.

Figure 20 DMU – Remote Head End



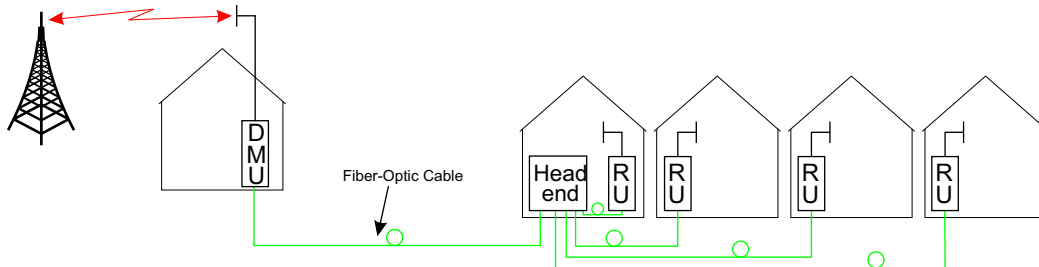
In [Figure 21](#), the DMU is used to pick up the signal at a remote location and then it is transmitted on the fiber to four different locations that need coverage. The RU can be connected to coaxial spreading networks if needed.

Figure 21 DMU Feeding Remote Units



In [Figure 22](#), the DMU is feeding a Headend Master Unit which in turn feeds the Remote Units (RU). This is a far more flexible solution and would be preferred when possible.

Figure 22 DMU Feeding BMU



The DMU is equipped with a low power uplink amplifier. The unit should be used in a location that has adequate signal so that power level of a mobile phone will suffice.

Repeaters

Bird Technologies offers a wide variety of repeaters to boost off air signals. The repeated signals can feed passive DAS or can be used as an input into the active DAS.

DMR 400 Series Rack Mount Repeater

The DMR 400 is designed to fit in the Headend Master Frame along with the BIU and FOI cards. The system was originally designed to be used in moving coverage areas such as ships and trains that require active control over the downlink gain (link symmetry) to compensate for wide variations in the off-air signals, but the system can easily be implemented in traditional fixed locations such as offices and hospitals.

Figure 23 DMR 400 Rack Mount Repeater



Although the DMR repeaters are rack mounted with the active DAS components, the DMR repeater can function as a stand alone unit to provide coverage to a passive DAS.

The DMR repeater family offers link symmetry settings. This function is used to automatically adjust the uplink gain based on the downlink signal. When installed in moving coverage areas such as trains, the feature prevents the repeater from desensitizing the donor site by automatically controlling uplink levels.

The DMR repeater also offers self-oscillation protection. This function is used to detect problems with isolation between the donor and service antenna. The repeater will intervene and lower the gain to a level equal to the isolation minus the stability margin. The settings are separate for UL and DL.

- On/Off
- Stability margin: Value setting of how much lower the gain should be than the calculated isolation. Range of 0.0 to 20.0dBm.
- Recovery time: Time that should pass before the repeater reset the gain to the value specified level in “RF Config” (set gain). Range of 30 to 86,400 seconds.
- Recovery margin: Set value of gain level above the gain specified in “RF Config” (set gain) that is used when the repeater recovers after the “Recovery Time”. Range of 0.0 to 20.0dBm.

The DMR400 offers variable bandwidths up to 35Mhz, depending on the configuration.

Remote access can be provided via an Ethernet connection or through the Bird Remote Gateway. SNMP is a standard on the units. No proprietary software is required. Operational parameters are set via a web browser.

Table 44 DMR400 Specifications

Gain	50-80 dBm in 1 dB steps
Noise Figure - Typical	< 5 dB
Delay	<6 s
Dimensions	2 card slots
Weight (module)	0.7 kg (1.5 lbs)
Operating Temperature	-25 to 55 °C (13 to 131 °F)

Table 45 Available Products, Cellular, FCC

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DMR407	iDEN	806-824	851-869	28dBm	FCC
DMR408	Cellular	824-849	869-894	28dBm	FCC
DMR419	PCS1900	1850-1915	1930-1995	28dBm	FCC
DMR420	AWS	1710-1755	2110-2155	28dBm	FCC

Table 46 Available Products, Cellular, ETSI

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DMR401	TETRA, Public Safety	380-385	390-395	20dBm	ETSI
DMR402	TETRA, Commercial	410-415	420-425	20dBm	ETSI
DMR403	TETRA, Commercial	415-420	425-430	20dBm	ETSI
DMR404	CDMA450	453-457.5	463-467.5	25dBm	FCC
DMR406	GSM-R	876-880	921-960	25dBm	ETSI
DMR409	EGSM900	880-915	925-960	19dBm	ETSI
DMR418	GSM1800	1710-1785	1805-1880	21dBm	ETSI
DMR421	UMTS 2100	1920-1980	2110-2170	23(DL)/20(UL)	3GPP

DLR 600 Series Low Power Repeater

The DLR 600 low power repeater is designed for environments where low signal levels are required. Although small, the unit still offers Bird's feature rich functions such as self-oscillation protection, fast AGC, link symmetry functionality, SNMP and remote access via Ethernet or the Bird Remote Gateway.

Figure 24 DLR 600 Low Power Repeater



Table 47 DLR600 Specifications

Gain	40-70 dBm in 1 dB steps
Noise Figure	<5 dB
Delay	<6 s
Power Supply Standard optional	100 to 240 VAC 12 to 28 VDC
Dimension (W x D x H)	30 x 5 x 21 cm (11.8x2x8.3 inches)
Weight	<1.4 Kg (3.1 lbs)
Operating Temp (DC)	-25 to 55 °C (13 to 131 °F)
Operating Temp (AC)	0 to +40 °C (+32 to +104 °F)
Casing	IP42
Bandwidth	0-15 MHz
Connectors	SMA or N-type

Table 48 Available Products, Cellular, FCC

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DLR607	iDEN	806-824	851-869	16dBm	FCC
DLR608	Cellular	824-849	869-894	16dBm	FCC
DLR619	PCS1900	1850-1915	1930-1995	16dBm	FCC
DLR620	AWS	1710-1755	2110-2155	16dBm	FCC

Table 49 Available Products, Cellular, ETSI

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DLR609	EGSM900	880-915	925-960	13dBm	ETSI
DLR618	GSM1800	1710-1785	1805-1880	23dBm	ETSI
DLR621	UMTS 2100	1920-1980	2110-2170	15dBm	3GPP

DMR600 Series Medium Power Repeater

The DMR 600 is a medium power repeater with band selective capabilities. Although small, the unit still offers Bird's feature rich functions such as self-oscillation protection, fast AGC, link symmetry functionality, SNMP and remote access via Ethernet or the Bird Remote Gateway

Figure 25 DMR 600 Low Power Repeater



Table 50 DMR600 Specifications

Gain	50-80 dBm in 1 dB steps
Noise Figure	<5 dB
Delay	<6 s
Power Supply Standard optional	100 to 240 VAC 12 to 30 VDC
Dimension (W x D x H)	30 x 5 x 21 cm (11.8x2x8.3 inches)
Weight	<1.4 Kg (3.1 lbs)
Operating Temp (DC)	-25 to 55 °C (13 to 131 °F)
Operating Temp (AC)	0 to +40 °C (+32 to +104 °F)
Casing	IP42
Bandwidth	35 MHz
Connectors	SMA or N-type

Table 51 Available Products, Cellular, FCC

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DMR607	iDEN	806-824	851-869	16dBm	FCC
DMR608	Cellular	824-849	869-894	16dBm	FCC
DMR619	PCS1900	1850-1915	1930-1995	16dBm	FCC
DMR620	AWS	1710-1755	2110-2155	16dBm	FCC

Table 52 Available Products, Cellular, ETSI

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DMR604	CDM450	453-457.5	463-467.5	25dBm	FCC
DMR606	GSM-R	876-880	921-925	19dBm	ETSI
DMR609	EGSM900	880-915	925-960	19dBm	ETSI
DMR618	GSM1800	1710-1785	1805-1880	29dBm	ETSI
DMR621	UMTS 2100	1920-1980	2110-2170	23 (DL)/20(UL)	3GPP

DHR 800 Series High Power Repeater

The DHR 800 offers a high power solution in a light weight, convection cooled IP65 chassis. The unit offers Bird's feature rich functions such as self-oscillation protection, fast AGC, link symmetry functionality, SNMP and remote access via Ethernet or the Bird Remote Gateway all in a rugged IP65 chassis.

Figure 26 DHR 800 Series High Power Repeater



The DHR repeater family offers link symmetry settings. This function is used to automatically adjust the uplink gain based on the downlink signal. When installed in moving coverage areas such as trains, the feature prevents the repeater from desensitizing the donor site by automatically controlling uplink levels.

The DHR repeater also offers self-oscillation protection. This function is used to detect problems with isolation between the donor and service antenna. The repeater will intervene and lower the gain to a level equal to the isolation minus the stability margin. The settings are separate for UL and DL.

- On/Off
- Stability margin: Value setting of how much lower the gain should be than the calculated isolation. Range of 0.0 to 20.0dBm.
- Recovery time: Time that should pass before the repeater reset the gain to the value specified level in “RF Config” (set gain). Range of 30 to 86,400 seconds.
- Recovery margin: Set value of gain level above the gain specified in “RF Config” (set gain) that is used when the repeater recovers after the “Recovery Time”. Range of 0.0 to 20.0dBm.

Table 53 DHR800 Specifications

Gain	50-88 dBm in 1 dB steps
Noise Figure	<5 dB
Delay	<6 s
Power Supply	85 to 264 VAC
Power Consumption	<130 W
Dimension (WxDxH)	30 x 13 x 70 cm (11.8 x 5.1 x 27.6 inches)
Weight	<12 kg (26.4 lbs)
Operating Temp	-25 to 55 °C (13 to 131 °F)
Casing	IP65
Bandwidth	35 MHz
Connectors	N-type or DIN 7/16

Table 54 Available Products, Cellular, FCC

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DHR807	iDEN	806-824	851-869	33(DL)/25(UL)	FCC
DHR808	Cellular	824-849	869-894	33(DL)/25(UL)	FCC
DHR819	PCS1900	1850-1915	1930-1995	33(DL)/25(UL)	FCC
DHR820	AWS	1710-1755	2110-2155	33(DL)/25(UL)	FCC

Table 55 Available Products, Cellular, ETSI

	Band	Uplink	Downlink	Pout, DL & UL	Standard
DHR801	TETRA, Public Safety	380-385	390-395	26(DL)/20(UL)	ETSI
DHR802	TETRA, Commercial	410-415	420-425	26(DL)/20(UL)	ETSI
DHR803	TETRA, Commercial	415-420	425-430	26(DL)/20(UL)	ETSI
DHR804	CDMA450	453-457.5	463-467.5	33(DL)/25(UL)	FCC
DHR806	GSM-R	876-880	921-960	26(DL)/19(UL)	ETSI
DHR809	EGSM900	880-915	925-960	26(DL)/19(UL)	ETSI
DHR818	GSM1800	1710-1785	1805-1880	28(DL)/21(UL)	ETSI
DHR821	UMTS 2100	1920-1980	2110-2170	30(DL)/21(UL)	3GPP

Bird Repeater Frequency Summary

Table 56 ETSI Bands

	DL Frequency	UL Frequency	DMR 400	DLR 600	DMR 600	DHR 800
TETRA Public Safety	390-395	380-385	✓			✓
TETRA, Commercial	420-425	410-415	✓			✓
TETRA, Commercial	425-430	415-420	✓			✓
CDMA 450	463-467.5	453-457.5	✓		✓	✓
GSM-R	921-925	876-880	✓		✓	✓
EGSM900	925-960	880-915	✓	✓	✓	✓
GSM 1800	1805-1880	1710-1785	✓	✓	✓	✓
UMTS	2110-2170	1920-1980	✓	✓	✓	✓

Table 57 FCC Bands

	DL Frequency	UL Frequency	DMR 400	DLR 600	DMR 600	DHR 800
Public Safety 800	851-869	806-824	✓	✓	✓	✓
Cellular 850	869-894	824-849	✓	✓	✓	✓
PCS 1900	1930-1995	1850-1915	✓	✓	✓	✓
AWS	2110-2155	1710-1755	✓	✓	✓	✓

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.

For CMRS 817-824MHz Applications and American Cellular Applications:

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. Unauthorized use may result in significant forfeiture penalties, including penalties in excess of \$100,000 for each continuing violation.

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.

For installations subject to Industry Canada certification:

WARNING

This is NOT a consumer device.

It is designed for installation by an installer approved by an ISED licensee.
You **MUST** have an **ISED LICENCE** or the express consent of an ISED licensee to operate this device.

Health and Safety

Bird DAS system is an advanced system and should be handled by skilled staff. Bird is happy to offer training of installation service providers in the case this is necessary.

Read all available documentation and warnings before handling the equipment. Equipment failures due to improper handling are normally not covered by the product warranty.

Respect all warning signs on the equipment and in the documentation. Make sure to only operate the equipment on frequencies allowed to use. Do not modify the equipment.

WARNING

Avoid looking into connected fibers and receptacles.

The laser used in this system is a Class 3b laser that produces invisible infra-red coherent light. Not safe to view with optical instruments. Always put the protection caps on unused fibers and receptacles.

The equipment contains a Class 3B laser and the equipment is Class 1. Do never look into the Laser beam directly or indirectly, it is strong invisible light and may cause serious damage to human eyes.

Always use protective caps on fiber and connector ends when fiber is removed from socket. Always clean socket and connector after a fiber has been removed before it is reconnected.

Make sure to keep passwords and other operational information away from unauthorized personnel.

Cable Routing/Antenna Selection

Ensure all cables, e.g. power cable, fiber-optic cable, Antenna cables are routed and secured in accordance with local/national requirements while avoiding damage to the cables.

Antennas and coax cables are selected as part of the DAS system design and may vary with location, frequency, and power level requirements.

Use only authorized and approved antennas, cables and/or coupling devices. The use of unapproved antennas, cables or coupling devices could cause damage and may be of violation of FCC regulations.

Each individual antenna used with the DAS must be installed to provide the separation distance as specified in the RF exposure requirements (refer to specific Remote Unit RF Exposure limits in the system description section).

CAUTION

Unauthorized antennas, cables, and/or coupling devices may cause non-conformity with national or international regulations, could cause damage, or non-conforming ERP/EIRP.

Antenna Installation

The Bird Fiber DAS systems do not include remote or head end antenna. The remote end antenna must be selected during system design, the antenna manufacturer's data will be required when calculating link budgets.

Antenna installation instructions are provided by the antenna manufacturer.

External donor antennas that are most commonly used in combination with DDR or DDH Remote Unit family for outdoor environment are 17 dBi gain antennas.

Safety and Care for Fibers

WARNING

Avoid looking into connected fibers and receptacles.

The laser used in this system is a Class 3b laser that produces invisible infra-red coherent light. Not safe to view with optical instruments. Always put the protection caps on unused fibers and receptacles.

Every time a fiber is disconnected and re-connected care should be taken to avoid getting dust on the connector or in the receptacle. Clean with a dry fiber cleaning tool before reconnecting the fiber at all times. A single speck of dust can severely impact the transmission. Do not touch the fiber ends with your fingers. That will leave grease on the connectors and may cause severe problems.

Tools and Material Requirements

Fiber Optics

All fiber optic cables, including patch cords, must be SINGLE MODE. Multi-mode fiber is not supported.

Bird equipment is designed to be used with only SC/APC fiber connectors. All connection points in the fiber must either be fusion spliced or equipped with APC connectors. UPC connectors anywhere in the fiber path will cause degradation in the performance of the equipment. APC connectors can be identified by their green jacket.

- Total optical loss must be < 15dB.
- Optical return loss -60 dB or greater.

Fiber panel inserts/couplings must be APC.

Tools

- Fiber Optic cleaner for SC/APC connectors
- T8 Torx bit for card cage modules
- Appropriate bit for rack screws
- Spectrum analyzer with RF power meter
- Appropriate jumper cables to connect spectrum analyzer to Bird equipment
- OTDR
- Optical power meter
- Optical visual fault finder
- Fiber splicer
- SMA torque wrench calibrate to 0.9 N-m
- ESD Strap - (Electrostatic Discharge): The BIU, FOI and Power Supplies contain highly sensitive components that can be destroyed by static.

NEVER open cards, BGW, CGW, repeaters or remotes!

Miscellaneous Material

- AC power cord(s) if using the DPU-301 power supply [AC to DC power supply]
- 18 AWG power wire if using the DPU-302 power supply [DC to DC power supply]
- Ferrite bead filter for the DC supply cable to the DPU-302. The ferrite bead filter must be installed close to the DPU-302. Follow manufacturer recommendations for proper installation of the ferrite bead filter.

Installing Headend Equipment

All equipment must be properly grounded. Ground peg in the main connector for both head-end gear (Master Unit) and remote gear (Remote Units) must be connected to Phase, Neutral and Ground in a proper way before power is connected.

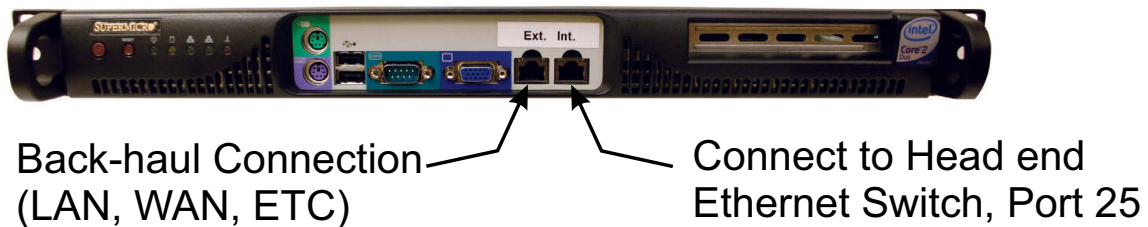
The chassis of the remote and the rack of the master unit should be grounded to a potential bar or safety grounding bar when operated. All electrical installations should be done by a certified electrician only.

BGW

The BGW is designed to be installed in a 19" rack.

- The BGW is typically mounted near the top of the rack.
- Connect power to an available NEMA5-15R receptacle.
- Using installer provided Ethernet cable, connect the "Ext" port to the appropriate back-haul connection. The back-haul connection can be DSL, off air modem, LAN, WAN. See BGW set up instructions.

Figure 27 *BGW Installation, Ethernet Connections*



Ethernet Switch

The Ethernet switch, ETH, is designed to be installed in a 19" rack.

- Placement is typically between the BGW and the Master Frame Unit. Placement consideration should include proper routing of Ethernet cables and the installation of additional cables after the initial installation is complete. Mounting may with Ethernet ports to the front or rear of the rack.
- Connect power to an available NEMA5-15R receptacle.
- Using installer provided Ethernet cable, connect port 25 of the Ethernet switch to the "INT" port on the BGW.

Figure 28 *Ethernet Switch*



Master Unit

The Master Unit is designed to be installed in a 19" rack.

- Before installing, consider cable routing for all cards to be installed in the Master Unit. The installer may want to consider horizontal cable managers to be mounted above and below the Master Unit to aid in the installation and ongoing maintenance of the system.
- Each card in the Master Unit will require an Ethernet connection to the BGW in order to be programmed and monitored. Install contractor provided Ethernet cable between the appropriate Ethernet port and the Ethernet switch.

Note: The port number on the Master Unit is in reverse order on the back of the Master Unit.

Figure 29 Ethernet Port Numbering, Front and Rear Views



- Only the active port on the Master Unit requires an Ethernet connection.
Example: The BIU will consume two slots in the Master Unit. If installed in slots #1 and #2, only slot #1 will make physical connection to the backplane. Install an Ethernet cable on the back of the Master Unit in port #1 to provide the BIU with BGW connectivity.
- All open slots on the Master Unit require a blank cover plate to allow for proper air circulation. Blank plates must be ordered separately.

Table 58 Available Blank Cover Plates

Part Number	Slots Covered
DB101	1 Slot
DB102	2 Slots
DB103	3 Slots
DB104	4 Slots

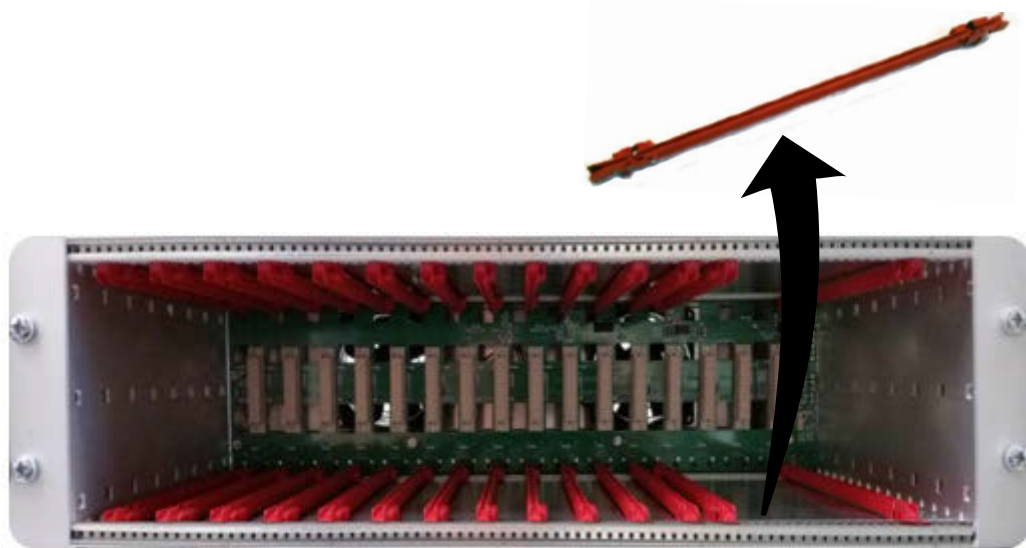
Power Supply Unit

Bird Technologies offers two different power supplies for the Master Unit: AC (DPU-301) and DC (DPU-302). The power supply can be located in a Master Unit other than the one it is powering. Each power supply is shipped with one Molex power supply jumper. If redundant power supplies are required additional power supply jumper(s) will need to be ordered.

The power supply uses four slots on the Master Unit.

- Prior to installing the PSU in the Master Unit chassis the red slide rails must be carefully removed from the slots that the PSU will occupy.

Figure 30 Slide Rail Removal



PSU DPU-301

The AC DPU-301 power supply has a standard C13 receptacle.

- The AC DPU-301 has an input range from 86-264 VAC with 50 or 60 Hz.
- Due to site-specific needs on length and varying standards of AC plug types, the AC power cord does not ship with the equipment. The installation contractor must provide the AC power cord.

The DPU-301 can support a single, fully loaded Master Frame Unit with up to 16 cards (BIU, FOI, ICU). The cards may be all of one type or a mixture of types.

Figure 31 Power Supply Units



PSU DPU-302

The DPU-302 uses a HAN four prong Heavy Duty Power Connector.

- The DC to DC DPU-302 power supply has in input rating of -36 VDC to -72 VDC.
- The DPU-302 requires the installer to provide 18 AWG wire for the HAN 3 A plug kit (Harting P/N 10 20 003 0002) that is provided with the power supply. See [Table 59](#) for connector pinout.

The DC power supply can support a single Master Frame Unit with up to 12 cards (BIU, FOI, ICU). The cards may be all of one type or a mixture of cards.

Table 59 DPU-302 Connector Pinout

Han 3A Pinout	
Pin #1	(+) Positive
Pin #2	Not connected
Pin #3	(-) Negative
Pin #4	Earth/Ground

Primary Power Configuration

Connect the output of the power supply to the input of the Master Unit.

- Use P101 on the Master Unit as the main power supply feed. See [Figure 32](#).

Note: Note that although there are two output connections on the front of the PSU, the PSU can only power one Master Frame at a time.

Figure 32 Primary Power Configuration



Primary Power for One Master Unit

Backup Power Configuration

It is not required to use a backup/redundant power supply, but if the primary PSU fails a backup PSU will allow the unit to continue operating without causing an outage.

The system designer may elect to have a single, redundant PSU act as a backup to two different Master Units simultaneously with the understanding that if the main PSU for each Master Unit fails during the same time period that the backup/redundant PSU can't support both Master Units.

- Use P102 on the Master Unit for a backup/redundant power supply. See [Figure 33 on page 46](#).

Figure 33 Backup Power Configuration



Backup Power for Two Master Units

BIU

CAUTION

Overdriving the RF source input into the BIU will cause permanent equipment failure and will void the warranty. The installer must ensure that input levels are not exceeded. Plan for maximum power out of the RF source and attenuate accordingly with external attenuators if needed.

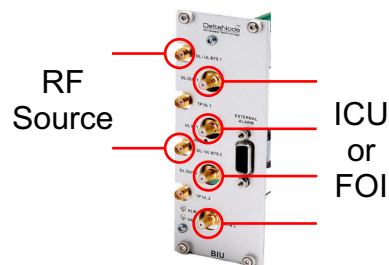
The BIU serves as the RF interface between the RF source and the ICU/FOI. Each BIU is pre-set to a frequency band and is not field tunable.

The BIU has two sets of RF source connections. The units can accept two independent feeds (within the same band). The feeds can be from separate sources or A and B paths in a MIMO configuration.

Due to the high level of RF coming into BIU, use only quality RF cables.

BIU Type	Minimum DL Input	Maximum DL Input
Low Level	-7dBm	+7dBm
High Level	+20dBm	+33dBm

Figure 34 BIU Connections



- Install the BIU in the Master Unit. The BIU uses two slots in the Master Unit.

CAUTION

When mating RF connectors, ensure that they are properly aligned and not cross threaded. Tighten SMA connectors to 8 in.-lbs (0.9 N-m). Do not over torque RF connectors, this could result in damage to the Unit. Do not under torque RF connectors, this could result in poor signal transmission.

Note: The UL1 and UL2 uplink test ports are 3dB lower than the signal on the corresponding DL/UL BTS port.

- Connect SMA to the RF source. Tighten to 8 in-pounds (0.9 N-m) with a calibrated torque wrench.
- Connect QMA to the ICU/FOI.

CAUTION

Excess tension on the cable or connectors may cause PIM issues. Cables must be secured in the rack without applying tension to the connectors.

ICU

The ICU is designed to be installed in a 19" rack.

- The ICU is typically installed directly above or below the Master Unit chassis. Consider post installation changes and testing when selecting a slot to install the ICU.

Figure 35 ICU



The ICU has QMA connectors. QMA cable kit - Bird part number DCC320 is available for use with the ICU. The kit contains 32 QMA to QMA cables (see [Table 60](#)) that can be used to patch between the BIU to the ICU, BIU to the FOI or ICU to FOI.

Table 60 QMA Cable Kit

Length	Quantity
250 mm (9.8")	13
350 mm (13.8")	13
500 mm (19.7")	6

The ICU is configured with two identical paths - uplink and downlink. The typical configuration [DIU301 (88MHz to 2700MHz)] is four 1:8 splitters/combiners (two for UL and two for DL). Note that the theoretical loss for each DIU301 is 35dBm.

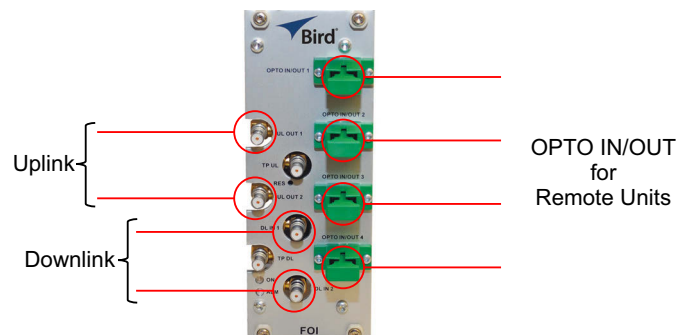
FOI

The FOI is mounted in the Master Unit chassis. The FOI uses one slot in the Master Unit.

- The RF connections are QMA.
- The fiber connections are SC/APC.

The FOI can be ordered with an optional DCC330 jumper kit. The kit contains two SC/APC jumpers that are 5 meters (16.4 feet) in length.

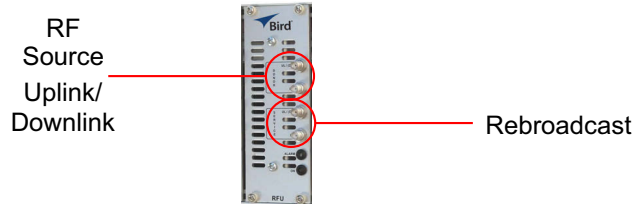
Figure 36 FOI Connections



RFU

The integrated repeater unit, RFU, DMR400 is mounted in the Master Unit chassis. The DMR400 uses two slots in the Master Unit.

Figure 37 RFU Connections



Powering Up the Head End

1. Apply power to the BGW by pressing the power button on the left side of the unit. The BGW requires approximately 5 minutes to completely boot up. During the BGW boot process, the modules in the Master Unit will flash Red and Green.
2. Apply power to the Ethernet Switch and the Master Unit.
3. Verify BGW boot cycle is complete,

Note: The BGW will have green LED's lit even when powered off. This is part of the LAN wake up feature. When the BGW is running there will be three LED's lit and the hard drive icon showing activity.

4. See [Table 61](#) for the LED alarm codes for the modules in the Master Unit. After the BGW boot process is complete, all modules in the Master Unit should have some LED indication. If not, see [Table 62](#).

Table 61 Master Unit Module LED Indicators

Status	LED Indication
Normal	Green - slow flash
Incoming Alarm	Solid Red - Limited to 5 seconds
Warning	Red LED flashes 1 Hz 1/8 duty cycle
Error	Red LED flashes 2Hz ¼ duty cycle
Critical	Red LED remains solid

Table 62 Master Unit Troubleshooting

Malfunction	Corrective Action
If no modules have LED indications	Check Power cable to PSU.
	Check power source for Master Unit.
	Check connection from PSU to Chassis.
If a module does not have LED ON Indicator	Verify the module is properly seated into the chassis.
	Move a module to another slot on the Master Unit chassis.
	Replace module.

Installing Remote Units

The remote units are factory configured and should not be opened in the field.

WARNING

The Remote Units are heavy , use care and always properly support units during installation. If allowed to fall Remote Units can cause injury or death.

CAUTION

Ensure the surfaces being used to mount Remote Units can safely support the full weight of the remote.

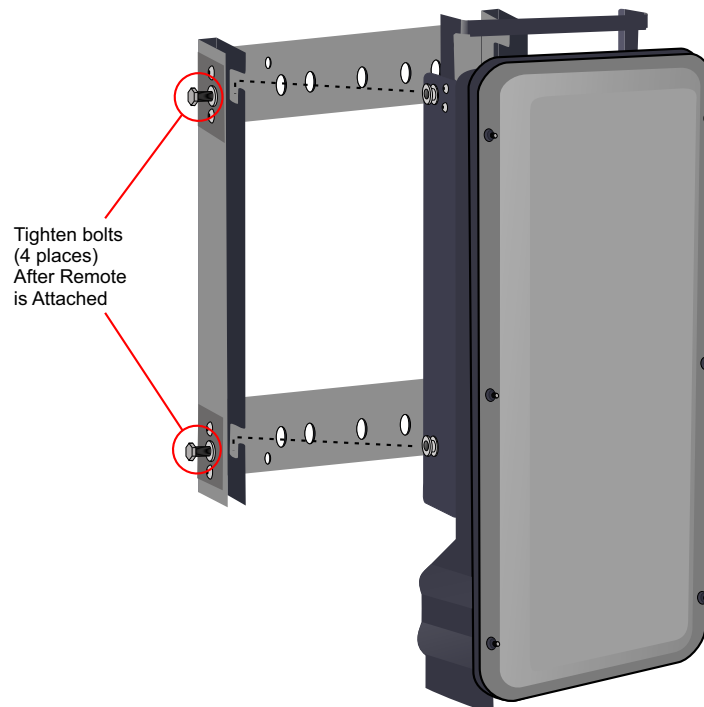
The remotes must be mounted in a vertical position. There are two recommended methods for Remote Unit installation, wall mounting or pole mounting. Regardless of the mounting style selected, the remotes must be mounted so that airflow over the external heat sink is not obstructed.

Single Remote Unit Wall Mounting

The remotes are shipped with standard wall mounting brackets. These brackets can be used indoors and outdoors.

- Mount the bracket (p/n DMB301) without the remote attached.
 - Note:** Always check local building codes for proper mounting techniques!
- Once the bracket is properly mounted, the remote easily slides into the mount. See [Figure 38](#).

Note: *Figure 38 Remote Wall Mount*

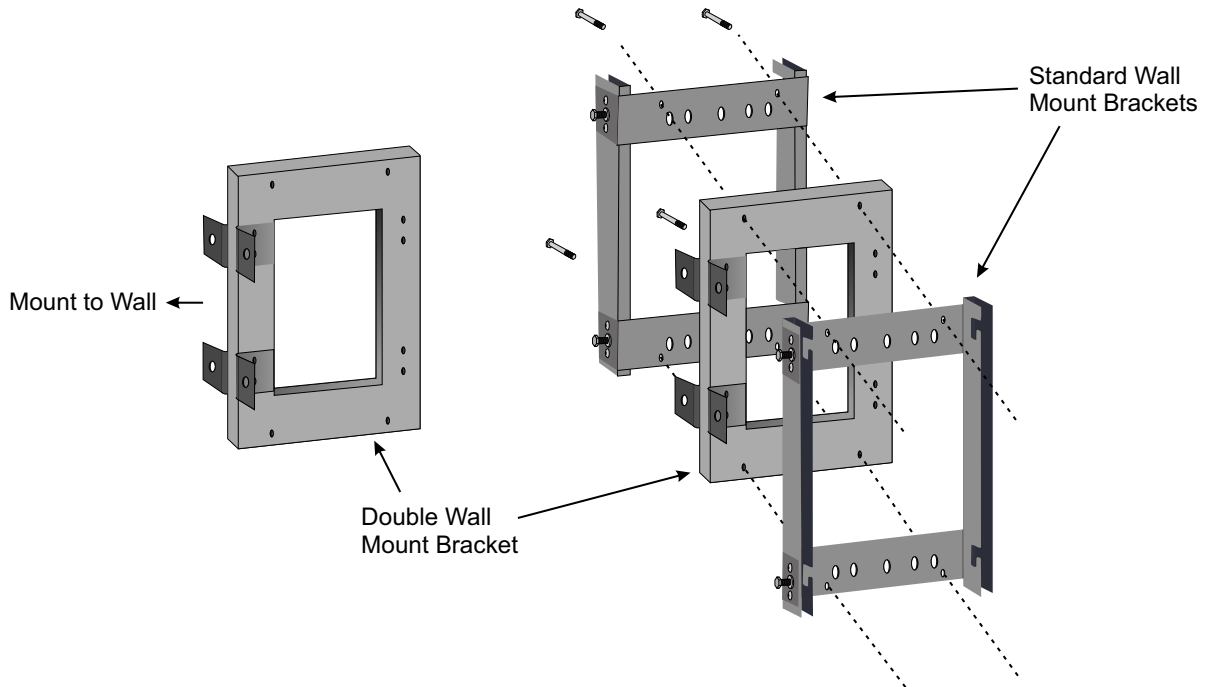


- Once the remote is attached to the wall mount, the remote must be properly secured to the mount by tightening bolts at each mounting point.

Double Remote Unit Wall Mounting

Bird Technologies offers a bracket that allows two wall mount racks to be mounted back to back. This reduces the amount of wall space required when two remotes are located together. The bracket is stainless steel and can be used indoors or outdoors.

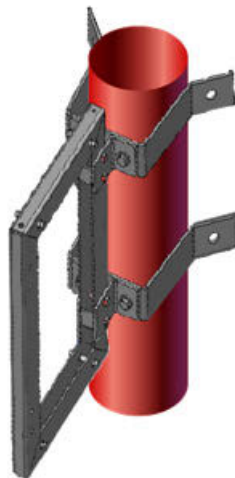
Figure 39 Double Wall Mounting Bracket



Remote Unit Pole Mounting

Bird Technologies also offers a pole mounting option. The pole mount brackets are designed to be used with the Double Remote Wall Mount bracket.

Figure 40 Remote Unit Pole Mounting Option



Solar Shield

Direct exposure to sun light can cause temperatures of the remote to exceed the 55 °C (131°F) rating. A simple solution offered by Bird is to attach an optional solar shield to the affected remotes. The solar shields (p/n DMA301) are sold separately.

Figure 41 Remote Unit Solar Shield

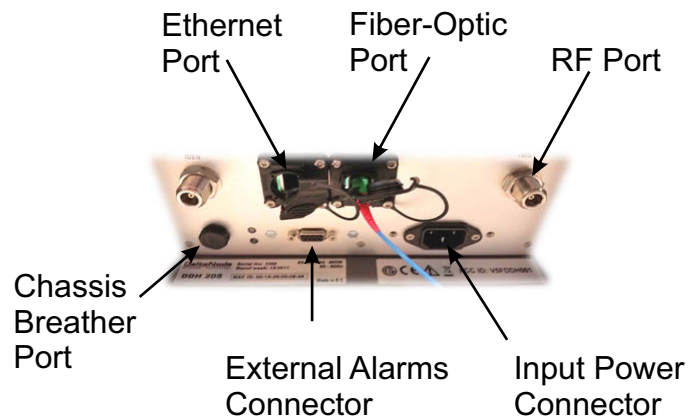


Cabling

There are many options for the Bird remotes which can affect the number of connections on the bottom of each remote. The standard connections are:

- Ethernet port
- RF Port (N, mini DIN or 7/16 DIN, Simplex or Duplex) - Number of ports varies
- Power (AC)
- External alarm port
- Grounding
- Fiber Optic

Figure 42 Remote Unit Cabling Connectors



Ethernet Port

The RJ45 Ethernet port is located on the bottom panel of the remote unit. Connection of the Ethernet port is not required for normal operation of the DAS. The port offers convenient access to the system GUI during installation, commissioning and troubleshooting of the DAS. Ensure the provided IP67 rated protective cap is replaced when the Ethernet port is not in use.

If the Ethernet connection is to be long term or permanent, ensure that the appropriate Ethernet patch cable is utilized to prevent the ingress of moisture into the port.

The Ethernet port will allow for two types of connections.

1. Remote unit is not connected to the FOI in the Master Unit
 - Access will be limited to the Remote Unit. User may change setting on the Remote Unit.
 - Static IP address for local access is https://169.254.48.1
 - ✓ Username: "extended"
 - ✓ Password: "admin"
2. Remote Unit is actively connected to the FOI in the Master Unit
 - Full access to all GUI features will be allowed
 - Access will require the Master Unit IP address: https://172.22.0.1
 - ✓ Username: "extended"
 - ✓ Password: "admin"

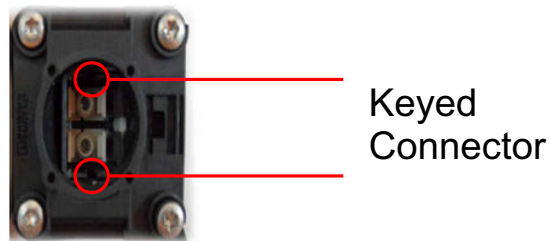
Fiber Optic Connection

The fiber connection on the bottom of the remote has an IP67 rated protective cap. The protective cap must remain in place until the fiber is to be inserted. This will help prevent foreign particles from degrading performance of the fiber.

The fiber connection has a keyed slot SC/APC connection. Care must be taken to ensure the fiber is installed correctly. It is possible to force the connection so that the fiber is installed at a 180 degree rotation causing performance issues.

Note: The SC/APC key is at the top and bottom on the connection on the remote.

Figure 43 Remote Fiber-Optic Connector



It is **highly recommended** that only the SCRJ fiber cables be used with the remotes. Not only does the SCRJ cable prevent the ingress of moisture and dust into the fiber port but the cable also insures the fibers are correctly aligned in the connector. SCRJ fiber cables are ordered separately from Bird Technologies.

Figure 44 SCRJ Connector

