

Operator Manual for Element Ka BUC



Operator Manual for Element KA BUC

Operator's Manual

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Technical Support

This manual provides engineers with information necessary to operate the applicable system. Technical support is available from Norsat.

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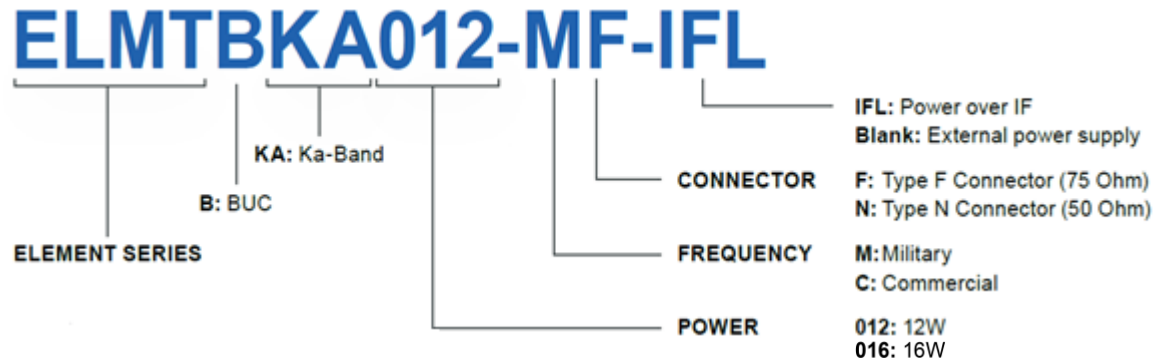
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1. Introduction

1.1 OVERVIEW

This operator's manual applies to all Element KA BUCs with the following marketing numbers:



The Element series BUC includes Commercial Band (29.0-30.0 GHz) and Military Band (30.0-31.0 GHz). Customized frequency band is available, please contact technical support for details.

1.1.1 BUC - Block Up Converter and Amplifier

If this unit is a BUC, the IF input signal is upconverted to Ka-Band RF frequencies and then amplified to the specified power.

1.2 FEATURES

1.2.1 Inputs and Outputs

Table 1-1: Input and Outputs

Element 12W-16W	
Input Type	Female F-Type Connector
	Female N-Type Connector
Output Type	Waveguide WR28


1.2.2 Electrical Interface


M&C Connector – a ten-pin connector is used to interface with a host computer. See **2.4 J2 – Monitor and Control Interface** for a detailed description of the pinouts.


Power Connector – the DC Unit use a four-pin connector to provide power to the BUC. See **2.3 J5 – DC Power** for a detailed description of pinouts. For the Power-over-IFL version, DC power is provided through the IF input connector J1.


Ground Terminal – a 1/4-20 pan head Phillips screw is used to ground the chassis during use.


1.3 SAFETY

WARNING	
	<p>Leakage Current</p> <p>The BUC may exhibit high leakage current during use. Ensure that the ground terminal is grounded according to local electrical codes before powering on the BUC.</p>

WARNING	
	<p>RF Radiation Hazard</p> <p>The BUC emits high power RF energy, which is harmful to the human body. Do not operate the BUC unless the RF output flange is either terminated in an RF load (100W min) or connected to the feed of a terminal.</p> <p>Do not obstruct the RF output or feed output with any body part.</p>

WARNING	
	<p>Do not allow equipment to be standing in water.</p> <p>While the BUC/SSPA is designed to be used outdoors, the equipment is not designed to operate in standing water. Failure to follow this precaution could result in electric shock and injury to persons.</p>

CAUTION	
	<p>Do not allow any items to fall into the unit from the waveguide opening.</p>

CAUTION	
	<p>Apply voltage to the AC/DC input connector only as specified in the original configuration of this unit. The application of a voltage outside the specified range may cause the unit to become damaged or non-functional.</p>

2. Interface Control

2.1 INTRODUCTION

The unit has three connectors on the input side of the housing and one waveguide port on the output side. The interface for these connectors is detailed in this document.

On the input side, there are the following connectors:

- J1 – IF Input; F-Type Jack or N-Type Jack,
- J2 – Ten-pin circular connector for M&C,
- J4 – Ground terminal,
- J5 – Four-pin circular DC power connector.

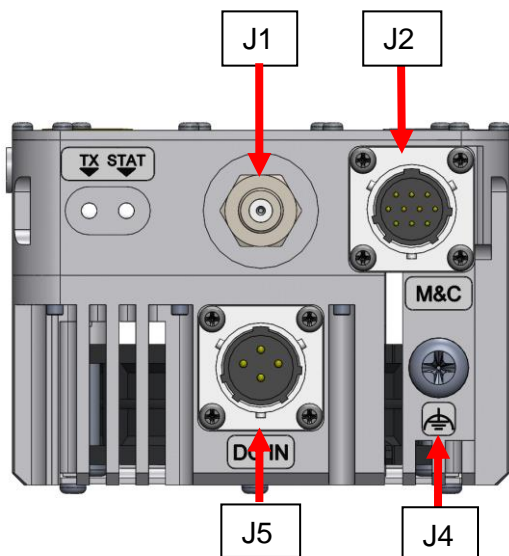


Figure 2-1: Input Connections for Element Ka BUC (F-Type Jack Shown)

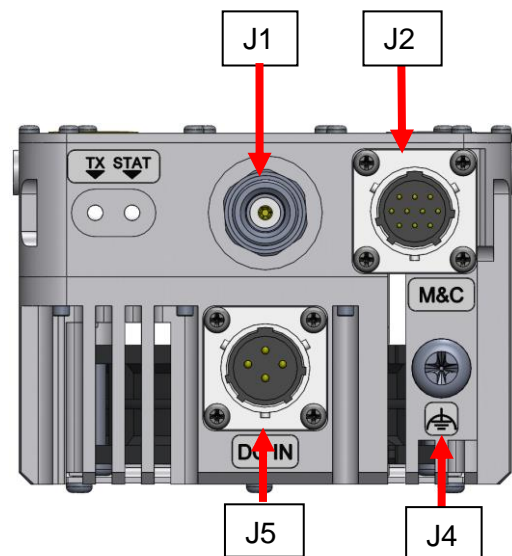


Figure 2-2: Input Connections for Element Ka BUC (N-Type Jack Shown)

On the output side, there is one connector:

- J3 – WR28 waveguide RF output with 4x 4-40x 1/4" deep tapped holes

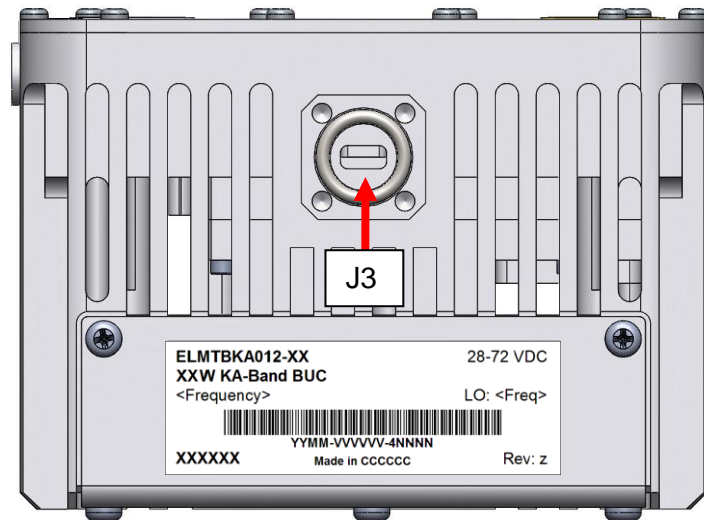


Figure 2-3: Standard Waveguide Output for Element Ka BUC

For the Power-over-IFL version, the DC power is provided over the IF input.

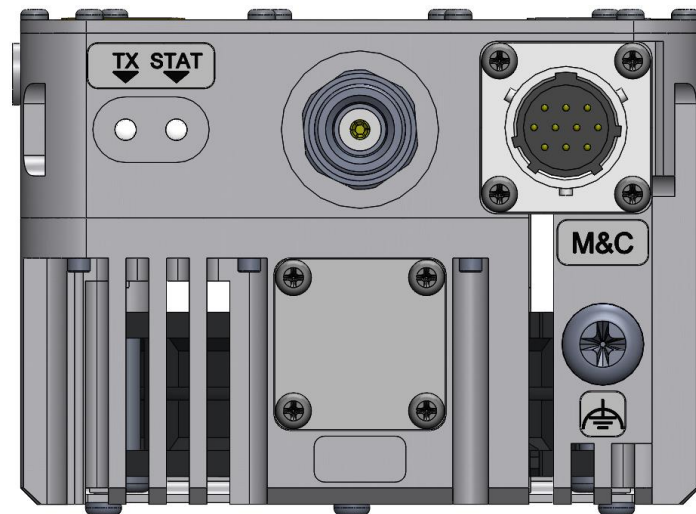


Figure 2-4: Input Connections for the Power-Over-IFL Version Element Ka BUC

2.2 J1 & J4– Inputs and Grounding

2.2.1 J1 – IF Input

BUC

The IF input connector is a 75-ohm Type F Female connector or a 50-ohm Type N Female connector. External reference mode is used for Ka-Band BUC. Once the absence of the external reference signal is monitored, the STAT LED on the BUC would turn red.

2.2.2 J4 – Ground Terminal

A 1/4–20 pan head Phillips screw and lock washers are used to ground the BUC. Ensure the unit is grounded before powering it on.

2.3 J5 – DC Power

The power input of the Element Ka-Band BUC requires 28V to 72V DC power. Each Element BUC is supplied with a mating connector for the power interface. Refer to the specific configuration of the unit for the exact voltage range.

Power is supplied through a four-pin type cylindrical connector. Two pins are used to deliver the positive connection and two pins are used for the negative connection in order to reduce resistance. The negative connection is internally connected to the case ground. The negative power connection may alternatively be applied directly to the ground screw terminal on the aluminum housing.

2.3.1 Connector Type

The J5 connector for the DC input is a four-pin miniature circular connector. This connector is a MIL-C-26482 Series 1 receptacle, shell size 12, 4 pin (Amphenol® PT02E-12-4P(027)). The connector is a receptacle with pins and requires the mating connector to be a plug with sockets (e.g Amphenol® PT06E-12-4S-476). A range of plug-compatible mating connectors may be used to add options to the plug such as right-angle, stress relief clamp, metal color/finish, etc. Please contact the connector manufacturer for more information and/or refer to the Amphenol® catalog 12-070.

2.3.2 DC Unit J5 Connector Pinouts

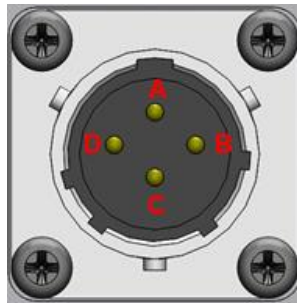


Figure 2-5: DC Unit J5 Connector Pinout

Table 2-1: DC Unit J5 Connector Pinout

Pin	Name
A	V-/Ground
B	V+
C	V+
D	V-/Ground

For the DC input, the positive terminals are pins B/C and the negative terminals are pins A/D. Pins A and D are connected to case ground internally; pins B and C are connected internally. It is recommended to apply the supply voltage evenly to both pairs of pins to evenly share the current among both sets of wires/pins.

2.4 J2 – Monitor and Control Interface

The M&C interface is used to control the unit with a host computer. All on-board sensors are accessed through this interface. The use of this connection is optional. Each BUC is supplied with a mating connector for the M&C interface.

2.4.1 Monitor and Control Interface Pinout

The M&C interface is a ten-pin miniature circular connector. This connector is a MIL-C-26482 Series 1 receptacle, shell size 12, 10 pin (Amphenol® part number PT02E-12-10P(027)). A mating connector is Amphenol® part number PT06E-12-10S-476. A range of compatible part numbers for the mating connector may be used to add options to the plug such as right-angle, stress relief clamp, metal color/finish, etc. Please contact the connector manufacturer for more information and/or refer to Amphenol® catalog 12-070.

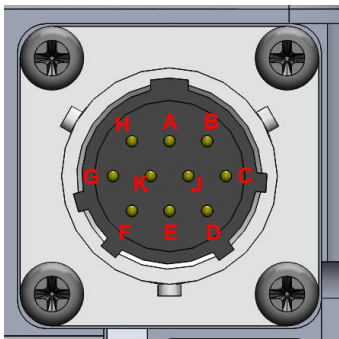


Figure 2-6: J2 M&C Connector Pin Arrangement

Table 2-2 J2 Pinouts for Element BUC

Connect or Pin	Standard Configuration	Signal Description
A	RS-485 Tx-	Host computer Tx- signal (signal into the unit)
B	RS-485 Tx+	Host computer Tx+ signal (signal into the unit)
C	RS-485 Rx+	Host computer Rx+ signal (signal out of the unit)
D	Mute	Controls Muting of Amplifier
E	RS-232 Rx	RS-232 host computer Rx signal (signal out of the unit)
F	RS-232 Tx	RS-232 host computer Tx signal (signal into of the unit)
G	GND	Ground reference for RS-485/RS-232 signals. This is internally connected to case ground.
H	NC	NA
J	RS-485 Rx-	Host computer Rx- signal (signal out of the unit)
K	NC	NA

2.4.2 Ground Pin(s): Pin G

Ground/shield for RS-485, RS-232 & Mute signals. This is internally connected to the case ground. Do not exceed 100mA.

2.4.3 Mute Control: Pin D

This pin controls the hardware mute state of the Element BUC. When muted, the power transistors are turned off, reducing power consumption and providing an RF output noise close to the thermal noise floor.

The operation of this pin is fully configurable through the M&C Interface. Pin D can be biased with either an internal Pull-Down (to 0V) or an internal Pull-Up (to 4V). Pin D is also configurable to be either active high (3-5V on Pin D will mute the unit) or active low (0-0.8V on Pin D will mute the unit). All voltages are relative to Pin G or the Case Ground.

Because of the configurable pull-down / pull-up resistor, the unit can be configured to be active (i.e. not muted) when Pin D is left floating. Therefore, it is possible to operate the unit with no connection pin D.

The mute control behavior is shown below in [Table 2-3](#). Note that the Element BUC may be factory ordered with alternate configurations. The Default configuration shown in the table is not reflective of all Element units.

Table 2-3: Mute Control Behavior of Element BUC

Configuration	Mute Line Polarity	Mute Line Bias	Sample Input 1	Sample Mute State 1	Sample Input 2	Sample Mute State 2	Sample Input 3	Sample Mute State 3
Default	0V = Unmute	Pull-Down	0V	Unmuted	5V	Muted	Floating	Unmuted
Sample 1	0V = Unmute	Pull-Up	0V	Unmuted	5V	Muted	Floating	Muted
Sample 2	5V = Unmute	Pull-Down	0V	Muted	5V	Unmuted	Floating	Muted
Sample 3	5V = Unmute	Pull-Up	0V	Muted	5V	Unmuted	Floating	Unmuted

Note that the mute state of Element BUC can also be controlled through the M&C interface. The software mute setting takes priority over the hardware pin. Refer to [2.5](#) for details.

2.4.4 RS-485 Port: Pins A, B, C, J, G

These five pins form a standard four-wire RS-485 serial port, with Rx+, Rx-, Tx+, Tx-, and serial port ground. Since communication with the Element BUC is only half-duplex, it is possible to deploy the Element BUC on a two-wire RS-485 network by connecting the Tx+ & Rx+ and Tx- & Rx- wires together.

Tx+ and Tx- are the differential pair which carries a signal from the host computer to the unit. Rx+ and Rx- are the differential pair which carries a signal from the unit to the host computer. Connect these to the host computer RS-485 port accordingly.

2.4.5 RS-232 Port: Pins E, F, & G

These pins form a standard RS-232 serial port. Pin F carries a signal from the host computer to the unit and Pin E carries a signal from the unit to the host computer. Pin G must be connected to the ground pin on the host computer.

2.5 Serial Port Software Interface

Communications to and from the serial interface are character-based. To setup serial port, use any standard “Terminal” program with setup parameters, bits per second: 9600, data bits:8, parity: none, stop bits:1, flow control: none.

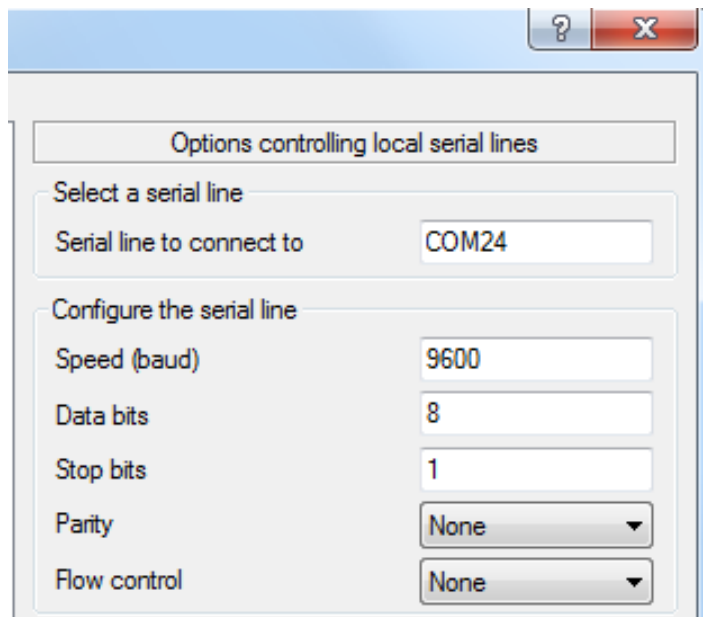


Figure 2-7: Setup Serial Port

2.5.1 Controller Responses

The unit will only generate messages in response to a command. Each command received will result in a single message reply, which may simply be an Acknowledge message.

In general, command responses are returned immediately, though the precise command-response delay varies slightly based on the specific command.

2.5.2 Message Definitions

getident

This command returns the part number, software revision and serial number of the unit.

```
Tx: "getident"  
Rx: "ok pn BUC-Ka25 swver 1.1.0_3 sn BUC-Ka25-31431"
```

Figure 2-8: Command getident (Ref Only)

getstatus

This command instructs the unit to respond with fault flag, forward power and temperature.

- A “0” after “fault” indicates no faults. A “1” indicates a fault. Use command “getfaults” to determine what fault exists.
- “fwdpwr” is RF Forward Power in dBm. Values are provided with 0.1dBm resolution.
- Temperature is in degrees C. The temperature scale is from –40 to 125 C, with approximately +/- 2 degrees C accuracy.

```
Tx: "getstatus"  
Rx: "ok fault 1 fwdpwr -40.0 revpwr +6507.9 temp 33"
```

Figure 2-9: Command getstatus

getfaults

This command obtains fault information from the Element BUC, including over temperature fault, PLL fault, power fault, and IF-over-input fault.

For “overtemp” and “PLL” faults, a value of 0 means no fault of the specific type has occurred and a value of 1 indicates a fault has occurred.

The “mute” status is controlled by mute-on-fault setting. When mute-on-fault is active, and the device is physically muted, a value of “0” indicates that the muting was not caused by a fault. A value of “1” indicates that the muting was caused by a fault. When mute-on-fault is inactive, “mute” status always shows a value of “0”.

```
Tx: "getfaults"  
Rx: "ok mute 1 overTemp 0 pll 0"
```

Figure 2-10: Command getfaults

resetfaults

This command resets the Over Temperature Fault for the ATOM device if the current System Temperature is below the device’s Temperature Trip Point.

getmuteonfault

This command obtains mute-on-fault setting from the Element BUC. Refer to Table 2-5 for more details.

setmuteonfault

This command configures mute-on-fault setting for the Element BUC. When set to on, the device mutes when any fault occurred. Refer to Table 2-5 for more details.

setmute

This command sets the software mute state of the unit. If the command code is 1, the amplifier will be muted. If the command code is 0, the amplifier mute will be controlled as shown in Section **Mute Logic**. The mute state can be monitored by examining the MUTE code in the “getfaults” message.

```
Tx: "setmute cmd 1"  
Rx: "ok"
```

Figure 2-11: Command setmute - mute unit

```
Tx: "setmute cmd 0"  
Rx: "ok"
```

Figure 2-12: Command setmute - unmute unit

2.5.3 Command Response

The CLI operates on a command response format. Each time a command is entered, a response will be displayed. If a command executed correctly, an “ok” along with potential parameters and values will be displayed. Otherwise, “err” will be displayed along with a description of the error.

The potential errors that may be displayed are:

- Invalid Command – The command was not recognized
- Invalid Parameter – The parameter was not recognized
- Invalid Value – The value was invalid for the command/parameter
- Missing Parameter – A required parameter was not provided

Each command response will have the following format:

```
<CR><LF><msg><CR><LF>
```

where msg is as described above and in the command summary and example tables below. Note that a response is enveloped by leading and trailing <CR><LF> characters. <CR> denotes a Carriage Return character, and <LF> denotes a Line Feed character.

Table 2-4: Command Summary

Command	Param-Value Pairs	Response Format (enveloping <CR><LF> characters not shown)
getident	None	<CR><LF>ok pn <Part Name> swver <Software Version> sn <Serial Number><CR><LF> where: <part#> = unit part number <swver#> = software version <serial#> = unit serial number
getstatus	None	<CR><LF>ok fault <Fault Status> fwdpwr <RF Forward Power> revpwr <RF Reverse Power> temp <Device Temperature> where: <Fault Status> = 0 (no fault) or 1 (fault condition occurred)
getfaults	None	<CR><LF>ok mute <Mute Fault> overtemp <Over Temperature Fault> pll <PLL Fault> where: <Mute Fault> = 0 (unit unmuted) or 1 (unit muted) <Over Temperature Fault> = 0 (temp ok) or 1 (error - over temp condition exists) <PLL Fault> = 0 (pll ok) or 1 (error – pll loss of lock)
resetfaults	None	<CR><LF>ok<CR><LF>
setmute	cmd (0 1) 0 = unmute 1 = mute	<CR><LF>ok<CR><LF>

Command	Param-Value Pairs	Response Format (enveloping <CR><LF> characters not shown)
getmuteonfault	None	<CR><LF>ok value <Mute On Fault><CR><LF> where: <Mute on Fault>= 1 (the device is automatically mute itself if a fault is detected) or 0 (the device is not mute automatically)
setmuteonfault	value (0 1) 0 = off 1 = on	<CR><LF>ok<CR><LF>

2.5.4 Mute Logic

The unit will be muted when any of the following conditions exist:

1. A software mute command is issued through the serial interface.
2. A mute command/signal is issued through the discrete SHUTDOWN line (Pin D of J2).
3. A fault condition exists.

For mute priorities, software precedes over faults and hardware, and faults precedes over hardware.

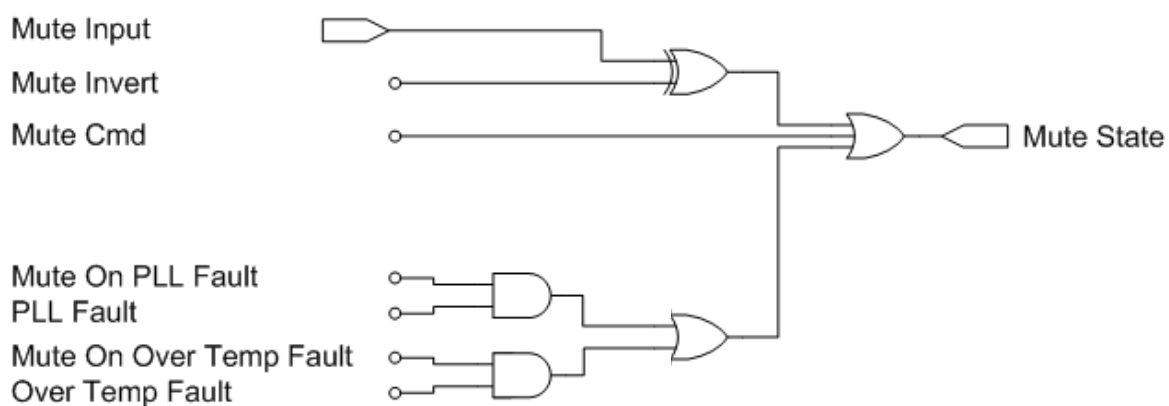


Figure 2-13: The Mute Logic Diagram

2.6 J3– RF output

The RF output port is WR28 waveguide flange. The unit is supplied with screws (four 4-40x3/8"); it is the user's responsibility to ensure that the appropriate screw length is used. There should be at least 4 threads of engagement (0.1") with the holes in the waveguide flange.

The waveguide output port should not be relied upon to act as mechanical support for the unit. Refer to [Appendix A](#) for the size and position of the Element BUC mounting holes.

2.7 Ground Connection

The unit is supplied with a 1/4-20 screw and internal tooth lock washers for grounding purposes. It is highly recommended that the unit be grounded according to national and local electrical codes before use.

2.8 Fault Indicator / LED

2.8.1 Description of Operation

Norsat Element series BUC is equipped in a general-purpose Status LED signal. This signal is intended to give a visual aid for the status of the device. There are two LEDs, status LED is for observing the fault status, and the Tx LED is for monitoring whether the BUC is transmitting or not.

Table 2-5: LED Status

LED	Status
Status Green	No Fault
Status Red	Fault
Tx Green	Transmitting
Tx Off	Transmitting Disabled

3. Misc. Info

3.1 Element BUC Installation

3.1.1 Mounting

Depending on the configuration, the weight of the Element series BUC is around 1.5kg (3.3lbs). When choosing an installation location, ensure the mounting brackets are capable of supporting the unit weight. Norsat recommends that the unit is supported using at least four of the mounting holes on two opposing sides (two holes per side). The waveguide output port (J3) must not be used to physically support the unit.

Refer to [Appendix A](#) for the size and position of the Element BUC mounting holes.

3.1.2 Outdoor Use

The Element BUC is designed for use in an outdoor environment and is sealed to prevent water ingress. Ensure the waveguide and/or feed connected to J3 are also sealed with gaskets to prevent water ingress.

3.2 Fan Cooling

The standard Element BUC configuration employs an integrated radiator and IP55 fans to cool the unit. A minimum clearance of 1 inch must be maintained around the air intake and exhaust during use. The fans are a field-replaceable assembly; contact Norsat for details on replacement kits. If the unit is deployed inside a radome, ensure there is adequate cooling to remove heat and prevent the unit from overheating.

3.3 Accessories

Each Element unit ships with mating connectors for the both M&C Port and the Power Port connectors as well as hardware for the waveguide flange and ground terminal. No hardware is provided to mount the unit.

A range of optional accessories such as pre-built power cables, M&C test cables, and M&C signal adaptors are also available; please contact Norsat for details.

3.4 General Specifications

Table 3- summarizes general specifications applicable to most Element units. Please refer to the specific Element BUC datasheet available on the Norsat website for complete unit specifications.

Table 3-1: General 12W Element Specifications

Parameter	Specifications
Rated Output Power (Psat)	40.8dBm
Gain (min)	60dB
Operating Temperature	-40°C to +60°C
Storage Temperature	-50°C to +70°C
Weight	1.5kg (3.3lbs)
Input Voltage (DC)	+28 to +72 VDC
Power Consumption	110W max.

Table 3-2: General 16W Element Specifications

Parameter	Specifications
Rated Output Power (Psat)	42dBm
Gain (min)	60dB
Operating Temperature	-40°C to +60°C
Storage Temperature	-50°C to +70°C
Weight	1.5kg (3.3lbs)
Input Voltage (DC)	+28 to +72 VDC
Power Consumption	120W max.

3.5 Standard Warranty

Norsat International Incorporated warrants that its equipment shall be free from defects in material or workmanship for one (1) year from the ship date, unless otherwise stated in the Offer Terms and Conditions.

The warranty does not cover units that have:

- been damaged through improper use or physical damage (e.g. dropped units)
- been modified, altered, or repaired by the user
- the security label(s) removed or damaged
- the serial number label removed or altered

To obtain warranty repair service, please contact Norsat [Technical Support](#) for any warranty claims.

Appendix A Mechanical Drawings

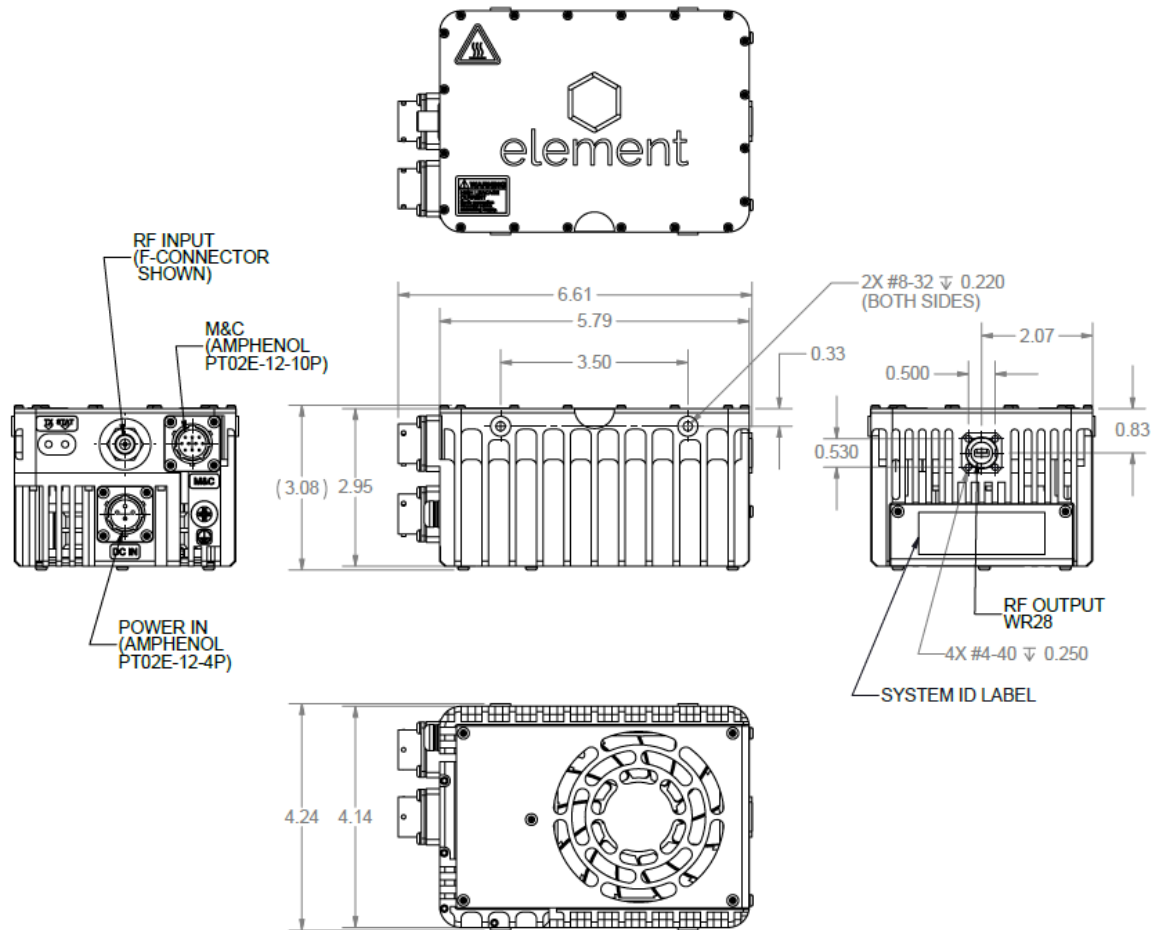


Figure A-3-1: Element Ka BUC, F-Connector IN

Note:

1. F-Connector Input Shown. The N-connector version is also available, as well as the power-over-IFL version.

Appendix B Acronyms and Abbreviations

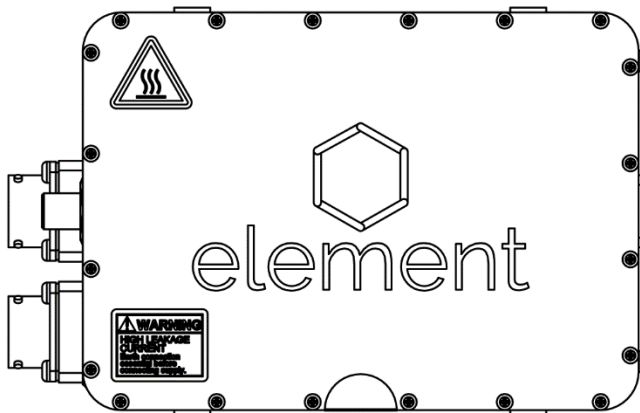
The following is a list of acronyms and abbreviations referenced in this document.

Table B-3-2: Acronyms and Abbreviations

Acronym	Definition
BUC	Block Upconverter
AMP	Amplifier
C	Celsius
<CR>	Carriage Return character (ASCII)
dBm	Decibel-milliwatts
DC	Direct Current
ESD	Electrostatic Discharge
freq	Frequency
GHz	Gigahertz
GND	Ground
IF	Intermediate Frequency
kHz	kilohertz
<LF>	Line Feed character (ASCII)
M&C	Monitor and Control
MHz	Megahertz
mm	Millimeter
N/A	Not Applicable
ppm	Pulses per minute
RF	Radio Frequency
RX	Receive
SSPA	Solid State Power Amplifier
TX	Transmit
V	Volt
VDC	Volts Direct Current



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