SBDpro

User's Guide

(ASE-SBD01)

v1.01

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Precautions

Please read and understand this User's Manual before installing your SBDpro. Careless or incorrect installation can degrade performance, damage both new and existing equipment, and incur unexpected network airtime charges.

Safety Information

Exposure to Radio Frequency Signals

The embedded Iridium transceiver contained in this satellite unit is a low power radio transmitter and receiver. When it is ON, it receives and sends out radio frequency (RF) signals.

International agencies have set standards and recommendations for the protection of public exposure to RF electromagnetic energy:

- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1996
- Verband Deutscher Elektrotechniker (VDE) DIN-0848
- United States Federal Commission, Radio Frequency Exposure Guidelines (1996)
- National Radiological Protection Board of the United Kingdom, GS 11, 1988
- American National Standards Institute (ANSI) IEEE C95, 1-1992
- National Council on Radiation Protection and Measurements (NCRP) Report 86
- Department of Health and Welfare Canada, Safety Code 6

These standards are based on extensive scientific review. For example, over 120 scientists, engineers, and physicians from universities, government health agencies, and industry reviewed the available body of research to develop the updated ANSI standard.

The transceiver in this satellite product complies with these standards when used as described under "Unit Operation."

Antenna Care

Use only the supplied or an approved replacement antenna. Unauthorized antennas, modifications, or attachments could damage your satellite product and may violate local agency regulations.

Unit Operation

Do not operate the unit when a person is within 4 inches (10 centimeters) of the antenna. A person or object within 4 inches (10 centimeters) of the antenna could impair call quality and may cause the

unit to operate at a higher power level than necessary and expose that person to RF energy in excess of that established by the FCC RF Exposure Guidelines.

Electronic Devices

Most modern electronic equipment is shielded from RF signals. However, certain equipment may not be shielded against RF signals from this satellite transceiver.

Pacemakers

The Health Industry Manufacturers Association recommends that a minimum separation of 6 inches be maintained between a wireless phone's antenna and a pacemaker to avoid potential interference with the pacemaker. These recommendations are consistent with the independent research by and recommendations of Wireless Technology Research.

Persons with pacemakers:

- Should ALWAYS keep the satellite transceiver more than six inches from their pacemaker when the unit is turned ON.
- Should turn the unit OFF immediately if you have any reason to suspect that interference is taking place.

Other Medical Devices

If you use any other personal medical device, consult the manufacturer of your device to determine if it is adequately shielded from external RF energy. Your physician may be able to assist you in obtaining this information.

Turn your unit OFF in health care facilities when any regulations posted in these areas instruct you to do so. Hospitals or health care facilities may be using equipment that could be sensitive to external RF energy.

Vehicles

RF signals may affect improperly installed or inadequately shielded electronic systems in motor vehicles. Check with the manufacturer or its representative regarding your vehicle. You should also consult the manufacturer of any equipment that has been added to your vehicle.

Posted Facilities

Turn your unit OFF in any facilities where posted notices so require.

Blasting Areas

To avoid interfering with blasting operations, turn your unit OFF when in a "blasting area" or in areas posted "Turn off two-way radio." Obey all signs and instructions.

Potentially Explosive Atmospheres

Turn your unit OFF and disconnect the power supply when you are in any area with a potentially explosive atmosphere. Obey all signs and instructions. Sparks from your battery or power source in such areas could cause an explosion or fire resulting in bodily injury or even death.

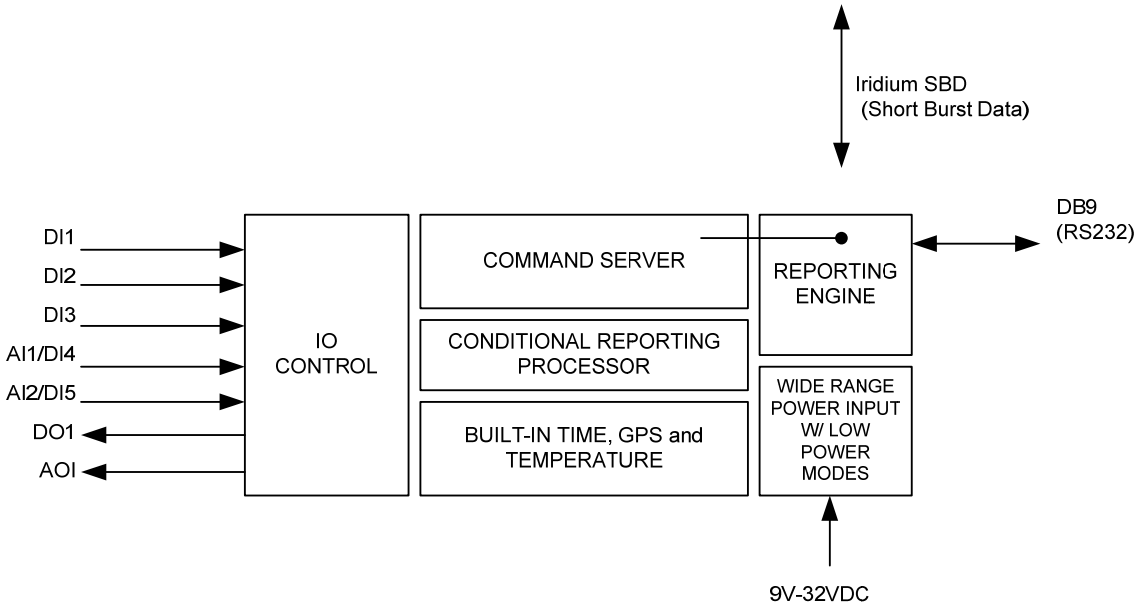
Areas with a potentially explosive atmosphere are not always clearly marked. They include, but are not limited to: fueling areas such as gasoline stations; below deck on boats; fuel or chemical transfer or storage facilities; areas where fuel odors are present (for example, if a gas/propane leak occurs in a car or home); areas where the air contains chemicals or particles, such as grain, dust, or metal powders; and any other area where you normally would be advised to turn off your vehicle engine.

For Vehicles Equipped With Airbags

An air bag inflates with great force. Do NOT place objects, including both installed or portable wireless equipment, in the area over the air bag or in the air bag deployment area. If in-vehicle wireless equipment is improperly installed and the air bag inflates, serious injury could result.

Product Overview

The SBDpro is a global access data tracking and reporting terminal that communicates via the low earth orbit Iridium Satellite constellation using a Short Burst Data (SBD) protocol. The SBDpro allows low-cost asset tracking and remote data reporting. Integrated Time, GPS and temperature modules provide UTC time, global position coordinates and temperature data. Additional circuitry, switches and sensors can be connected to the SBDpro's versatile digital and analog I/O allowing custom tailored monitoring applications. All sensors, internal or external, can be used as report transmission 'triggers' and 'gate conditions' are fully configurable by the user.



The SBDpro can be configured to report over the SBD network (primary intended application), can be configured to report over a local RS232 connection to assist in lab-based configuration and debug, or can be integrated into a larger system. Configuration scripts and commands can be received by the SBDpro from either the SBD network or the local RS232 connection.

The SBDpro also supports several modes of diminishing power consumption. Power consumption is reduced as the different subsystems within the SBDpro are disabled until required. If power consumption is not an issue, always run the SBDpro in the FULL POWER mode to achieve maximum performance and readiness.

The SBDpro senses and reports up to 15 unique data fields: TIME, LATITUDE, LONGITUDE, ALTITUDE, SPEED, HEADING, TEMPERATURE, ANALOG INPUTS 1 and 2, DIGITAL INPUTS

1,2,3,4 and 5, and a 20-character user-defined text field. In addition, the sensed inputs (Analog, Digital and GPS) can be used for report triggers and gate conditions. The SBDpro controls 2 outputs – one digital and one analog – either as a remotely configured set-level or as a local controlled function of a user-defined input.

Getting Started

The SBDpro is a highly configurable product supporting many diverse applications. So, to get started, the SBDpro must be configured for your application. This will include building your application interface wiring harness (ASE can provide generic or custom wiring harnesses), downloading your application configuration script (ASE has many configuration scripts available), and configuring your airtime account with your requested SBD delivery address (standard email address).

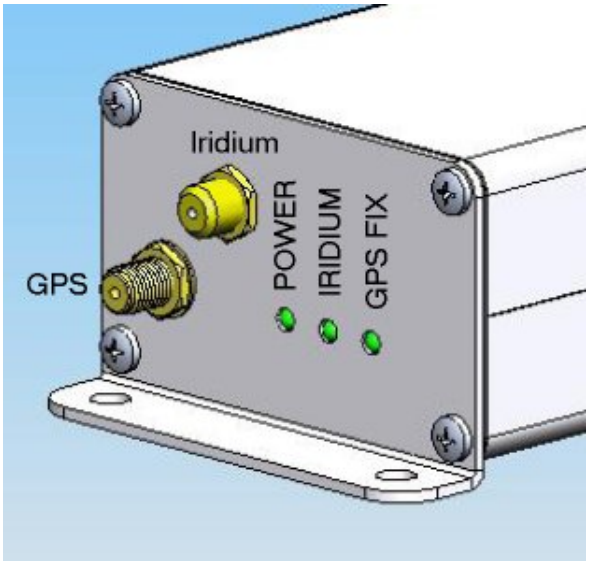
Messages can be delivered to either Email destinations or directly to the queue for delivery to other SBD devices.

- Destination can be 1 to 5 email addresses *or* 1 to 5 SBD devices.
- Only one delivery method is permitted per SBD device

This user manual includes the information required to develop both of these pieces. The configuration script can be downloaded over the SBD network or downloaded over a local RS232 connection in your lab.

Installation

Once configured, the SBDpro is ready for installation. Installation includes installing and connecting the Iridium antenna, the GPS antenna, mounting the SBDpro and connecting the application wiring harness.



On the SBDpro, both the Iridium and the GPS antenna connections use a SMA style connector, so care must be taken to connect the correct antenna. Refer to the instructions provided with your antennas to ensure proper placement. Clear line of sight to the Iridium satellites is fundamental to satellite connectivity.

The SBDpro can be mounting using the 4 mounting holes in the mounting flanges. The SBDpro should be mounted in a location that adheres to its rated environmental specifications.

Finally, connect your wiring harness. Your unit automatically starts when power is applied.

Configuration and Commands

Configuration Methods

The SBDpro can be configured using 3 separate methods: (1) typing commands using a terminal emulation program over the RS232 connection, (2) batch processing of command scripts sent to the SBDpro over the RS232 connection, and (3) batch processing of command scripts sent to the SBDpro via the Iridium SBD network. These commands and command scripts are used to set the device reporting formats, reporting triggers and gates, IO control, operating mode, home position, and power mode.

The configuration commands are ASCII based commands and follow a similar format:

- "<cmd>?" to query the command parameter status
- "<cmd>=?" to query the command parameter setup
- "<cmd> = " to setup the command parameter.

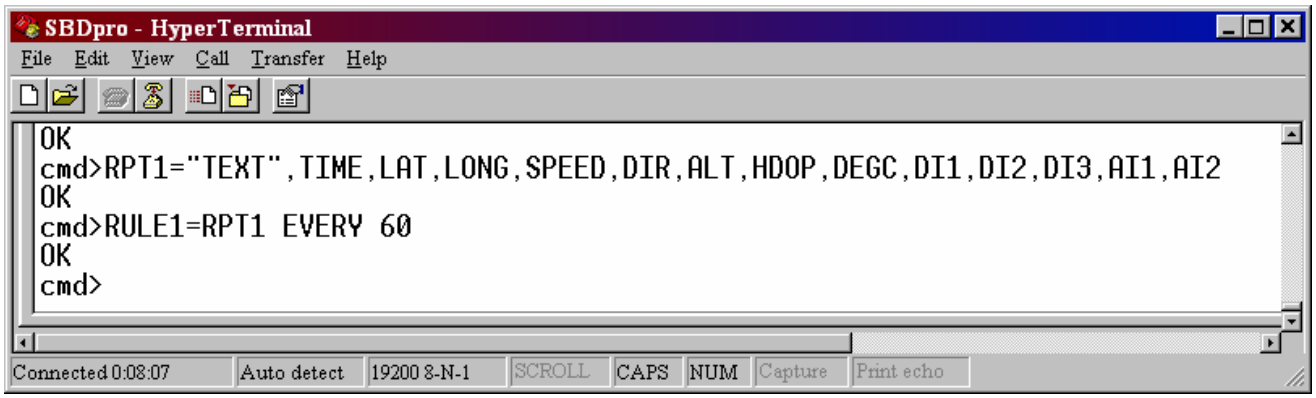
Configuration via RS-232 port

Set your terminal emulation program to the following communication protocol;

Bit rate: 19200
Data bits: 8
Parity: none
Stop bits: 1
Flow control: none

When properly connected and configured, the SBDpro's RS-232 interface will send a command prompt (cmd>) and wait for either a valid typed command or a downloaded script file (text file transfer) containing one or more valid configuration commands.

An example of typed configuration commands is shown below where report 1 (RPT1) and RULE1 are defined. In this example, RULE1 specifies that RPT1 will be sent every 60 seconds.



Configuration via Email attachment

Your SBDpro can be configured remotely over the SBD network by simply sending it an email message with a text file attachment that contains your specific configuration information. The email message format is shown below and must be sent to the address shown with your unit's IMEI number in the subject line. Also, the attached file must have a .sbd extension and be 270 bytes or less in size - or it will be rejected by Iridium's SBD service. Additionally, your service provider must configure your SBDpro airtime account with the "Automatic Notification" feature enabled.

```
To: data@sbd.iridium.com
From: <your_email_address@your_domain.com>
Subject: 304050607080903
<Message Attached = your_config.sbd>
```

Configuration messages must follow Iridium's SBD service formatting rules outlined below:

- Messages to the SBDpro are sent to the email address: data@sbd.iridium.com
- Placing at least one, and up to a total of four, IMEI(s) into the subject line of the email identifies the destination SBDpro(s). If there are more than one destination IMEIs then list the additional IMEIs on the subject line separated with a single space between each IMEI.
- The message must contain a properly formatted sender ("From:" address),otherwise the message will be dropped by Iridium's SBD service.
- The configuration script sent to the SDBpro must be carried as an attachment to the email:
    - The attachment name must have a '.sbd'file name extension: E.g. 'configdata.sbd'
    - File names must be 80 characters or less. (Including the .sbd extension.)
    - File names are not case sensitive.
    - The maximum size of the attached message is 270 bytes. Iridium's SBD service will reject message sizes that are too large.
    - The attachment must use standard Multipurpose Internet Mail Extensions (MIME) Base64 encoding as defined in RFC 2045.
- Multiple messages may be queued by a single email by including the additional separate attachments in the email message, subject to the maximum number of messages permitted in the queue. Note that if one of the attachments has an incorrect extension (.sbd), while others are correct then no error indication email will be sent.
- The message body plays no role in the message transfer process; any information contained in the body will be discarded.

IMPORTANT NOTE: Configuration scripts sent via email are processed by the SBDpro immediately upon receipt ***except*** when the unit is operating in a Power Saving mode. Under Power Saving conditions, updates occur upon the next scheduled data transmission when the unit wakes up, sends it's scheduled report and then checks for pending messages.

Using Configuration Scripts

Sending configuration scripts to the SDBpro is the easiest and most reliable setup method. Configuration scripts can be sent either via an RS-232 text file transfer or remotely via SBD email attachment. Note that the email attachment must be 270 bytes or less in size.

The following shows the format of an SBDpro configuration script. We highly recommend that you visit www.ase-corp.com for downloadable, tested scripts. Find one that closely matches your application and then modify it to your specific needs.

Sample Configuration Script

```
MODE=2
HOME= 33 38.1229,-111 52.8965
RPT1=TIME,LAT,LONG,SPEED,DIR,ALT,HDOP,DEGC,DI1,DI2,DI3,AI1,AI2
RPT2="MAN DOWN",TIME,LAT,LONG,SPEED,DIR,ALT,HDOP,DEGC,DI1,DI2,DI3,AI1,AI2
RPT3="RSVD"
RULE1=RPT1 EVERY 180
RULE2=RPT2 UPON DI1=0
RULE3=RPT3 OFF
DO1=0
AO1=0
<CR>
```

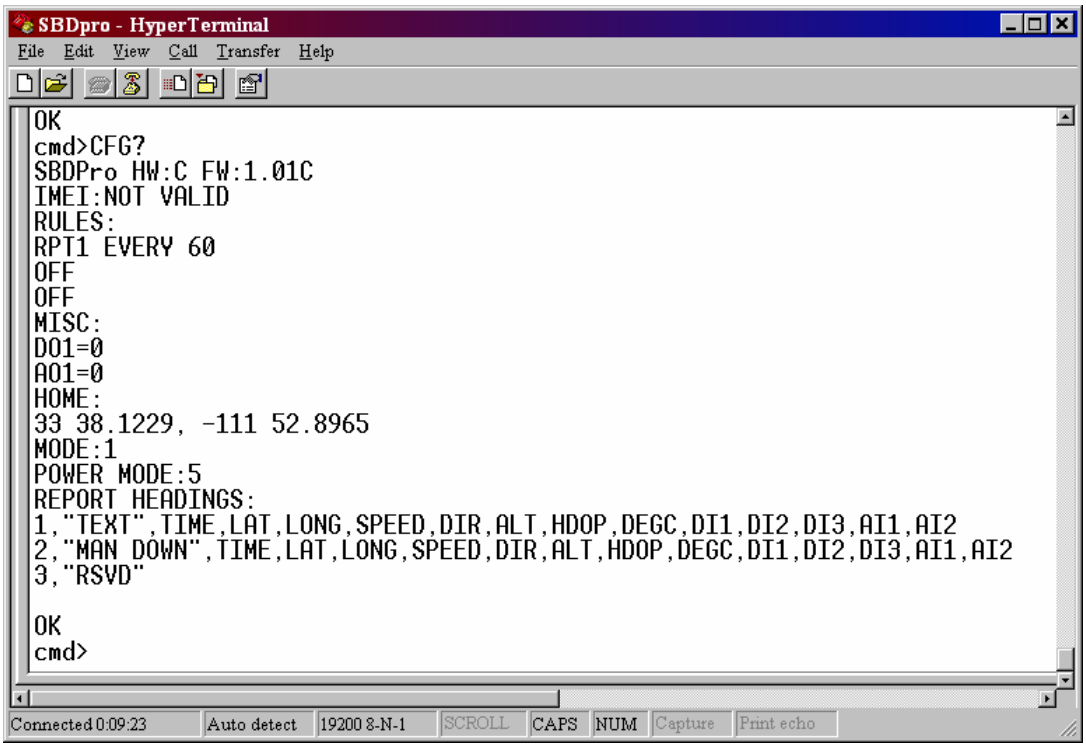
IMPORTANT NOTE: the last line of text in the configuration file must be followed by a carriage return (shown as <CR> above) or the last command line will not be executed. Always query the configuration status to confirm settings.

Verifying Your Configuration

To confirm that the SBDpro has understood your specific configuration commands and that there were no errors in the process, the configuration should be queried using the CFG? command.

The CFG? command can be sent via RS-232 or remotely via an .sbd email attachment. However, due to file size limitations, when requesting configuration over the SBD network, the configuration data will be returned in two separate email attachments.

The CFG? command example below shows confirmation of the settings established in the previous RS-232 configuration example.



Reports

The SBDpro can be configured to transmit up to three user configured reports based on user configured triggers and gate conditions. A report is a comma delineated listing of the field data proceeded by the report number. For example report 1 including unit name , UTC time and gps location would look like this: 1,“UNIT001”, 170238.203,3338.1239N,11152.8978W.

REPORT command:

Set usage: RPT1, RPT2, or RPT3 = [comma delineated list of fields] where the valid field is

Field	Description	Reported Data
“ANY TEXT “	framed with quotation marks	Maximum number of characters is 20.
TIME	UTC time	HHMMSS.SSSSS format
LAT	Latitude	DDMM.MMMMN format
LONG	Longitude	DDDMM.MMMMW format
ALT	Altitude (Meters)	AAAA.AM
DIR	Heading	
SPEED	Ground Speed	
DEGC	Degrees C	-35 to +70
DI1	Digital Input 1	0 or 1
DI2	Digital Input 2	0 or 1
DI3	Digital Input 3	0 or 1
DI4	Digital Input 4	0 or 1
DI5	Digital Input 5	0 or 1
AI1	Analog Input 1	0 to 5000 mV
AI2	Analog Input 2	0 to 5000 mV

Fields can be listed in any order with the one exception that the “ANY TEXT” message – if included - must be the first field.

Examples: RPT1 = TIME, LAT, LONG, DEGC, DI1, AI1
RPT2 = “MAN DOWN”, TIME, LAT, LONG

Query usage: RPT1, RPT2, or RPT3? will return the report field DATA

Examples: RPT1? returns
1, 170238.203,3338.1239N,11152.8978W,26,1,2500
RPT2? returns
2,“MAN DOWN”, 170238.203,3338.1239N,11152.8978W

Query setup usage: RPT1, RPT2, or RPT3 =? will return the report field HEADER

Examples: RPT1 = ? returns
1, TIME, LAT, LONG, DEGC, DI1, AI1
RPT2 = ? returns
2,“MAN DOWN”, TIME, LAT, LONG

Rules

The SBDpro is configured to transmit reports based on trigger events and gating conditions. The trigger events include time, input conditions, and GPS position. Gating conditions are input conditions and GPS position. The SBDpro can have up to three reporting rules defined.

RULE command:

Set usage: RULE1, RULE2, or RULE3 = RPT(n) <trigger event> WHEN <gate condition>

The <trigger event> = EVERY <number of secs> or
= UPON <GPS position> or <input condition>
= OFF

An EVERY event is a repetitive event and sets the time period at which the report will be repeated.. An UPON event is a single transmission event and reports ONCE upon the event trigger. The event trigger must be cleared before the UPON event will report again.

The <gate event> = WHEN <GPS position>
= WHEN <input condition>
or can be omitted

The gating conditions determine whether a report trigger is allowed. For example the SBDpro might be configured to report every 600 seconds, but only when away from the home region. If no gating condition is desired, then the WHEN <gate condition> can be omitted.

<GPS position>	HOME	current GPS position is verified to be within the HOME region
	AWAY	current GPS position is verified to be outside of the HOME region
	MOVING	current GPS speed is > 5km/h or current GPS position is different from previously report GPS position
<input conditions>	DIn = 0 or 1	sensed Digital Input [1 to 5] equal to the 0 or 1 level
	AIn <> value	sensed Analog Input [1 or 2] greater than or less than the 0 – 5000mV value

Examples: RULE1 = RPT1 EVERY 600 WHEN AWAY
RULE2 = RPT2 UPON DI1=0
RULE3 = RPT3 UPON AI1>2500

Query setup usage: RULE1, RULE2, or RULE3 =? will return the rule setup

Examples: RULE1 = ? returns
RPT1 EVERY 600 WHEN AWAY
RULE2 = ? returns
RPT2 UPON DI=0

Outputs

The SBDpro output control can be configured to drive one digital and one analog output to user set levels, to functions of input levels, or, for the digital output only, to the special case BLINK behavior – which is ideal for warning lamps.

DO1 and AO1 commands:

Set usage: DO1 = <digital output control> or AO1 = <analog output control>

The <digital output control>	0	turn DO1 off (open collector floats)
	1	turn DO1 on (output driven to GND)
	FOLLOW DIn	set DO1 to the same on/off state as DIn (n=1 to 5)
	INVERT DIn	set DO1 to the opposite on/off state as DIn (n=1 to 5)
	BLINK	toggle DO1 state at a 1 Hz Rate
The <analog output control>	0 to 5000	set AO1 to mV between 0 and 5000
	FOLLOW AIn	set AO1 to the same mV as AIn (n=1 to 2)

Examples: DO1 = FOLLOW DI1
AO1 = 2500

Query setup usage: DO1=? or AO1=? will return the output setup

Examples: DO1 = ? returns
DO1=FOLLOW DI1
AO1 = ? returns
AO1=2500

Inputs

The SBDpro can sense and report 5 digital inputs and 2 analog inputs. These input levels can be included in reports, used for report trigger events or gate conditions, or queried over the RS232 port. The following commands can be used to query the input level.

Note: DI4 and DI5 are multiplexed with AI1 and AI2 which are analog inputs. Although they can be used as digital inputs, DI4 and DI5 must be driven high since they do not have internal pull up resistors like DI1 through DI3. Consequently, for simple contact closure sensing (switches), DI1 through DI3 should be used.

DIn and AIn commands:

Query usage: DIn? or AIn? will return the input level

Examples: DI1? returns
DI1=0
AI2? returns
AI2=1245

Operating Modes

The SBDpro can be configured to operate in 4 reporting modes - SBD, RS232, both SBD AND RS232, and 9601 DIRECT CONNECT. And, can be configured to operate in one of 6 power saving modes.

MODE command:

Set usage: MODE = <reporting mode>

The <reporting mode>	0	send all reports over SBD network only
	1	send all reports over RS232 connection only
	2	send all reports over SBD and RS232
	3	stop all reporting and provide direct RS232 connection to the 9601 (future implementation)

PWR command:

Set usage: PWR = <power saving mode>

The <power saving mode>	5	FULL POWER. All subsystems available at all times
	4	Satellite transceiver OFF except during report transmission
	3	Satellite transceiver and GPS OFF except prior to report transmission
	2	<under development>
	1	< under development >
	0	< under development >

Viewing Configuration

The SBDpro configuration can be reported over the RS232 connection or sent over the SBD network. The SBDpro replies over the same network as the source of the command. In other words, when the SBDpro receives the "CFG?" command from SBD network, the SBDpro replies over the SBD network. Note: A full configuration report requires two SBD transmissions due to file size restrictions.

CFG command:

Query usage: CFG?

Example: CFG? returns
SBDPro HW:C FW:1.00
IMEI:3000312456000
RULES:
RPT1 EVERY 180
RPT2 OFF
RPT3 OFF
MISC:
DO1=FOLLOW DI1
AO1=FOLLOW AI1
HOME= 33 38.1229, -111 52.8965
MODE:3
PWR:5
REPORT HEADINGS:
1,TIME,LAT,LONG,DEGC
2,"MAN DOWN", TIME, LAT, LONG
3,"RPT3 OFF"

Locking Configuration

The SBDpro provides the ability to password lock the configuration settings using the LOCK command. The UNLOCK command with matching password must be issued prior to executing configuration commands. The password provided with the LOCK command should be documented and stored in a secure location. The password is case sensitive.

LOCK and UNLOCK commands:

Set usage: LOCK = <password> where <password> is any (up to) 7-alphanumeric combination

Example: LOCK=abcd123

Set usage: UNLOCK = <password> where <password> must match the stored password.

Example: UNLOCK=abcd123

Setting Home Position

The HOME position is used by the SBDpro rules to determine the GPS-based trigger events or gate conditions, HOME and AWAY, based on the current GPS position. A unit is considered to be HOME when the current GPS position is within a 150m radius of the set HOME position and AWAY when outside of this radius.

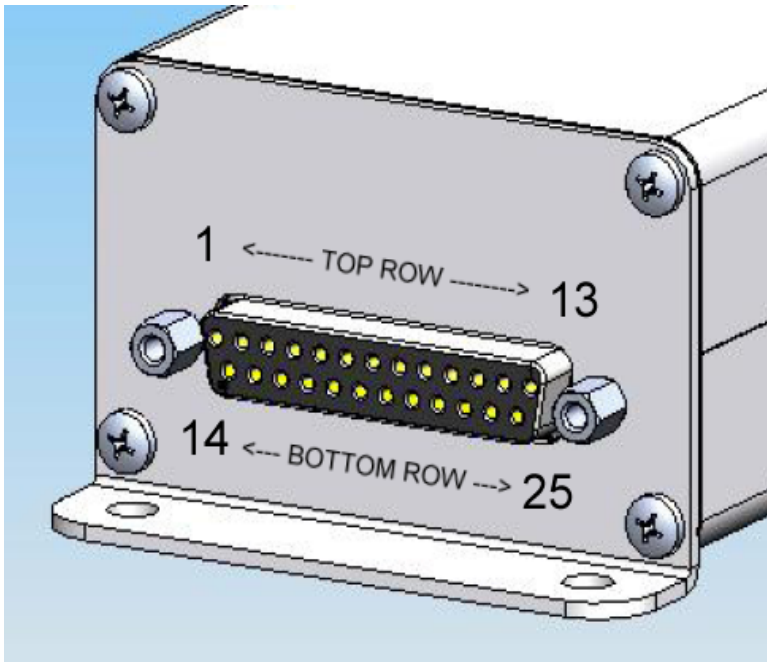
Note: The HOME command format uses the negative sign to represent S longitude values and W latitude values.

HOME command:

Set usage: HOME = lat_deg lat_minutes, long_deg long_minutes

Example: HOME = 33 38.1229, -111 52.8965

Interface Connector



Pin No.	Signal Name	Signal Dir	Signal Function	Signal Level
1	EXT_PWR	Input	Supply	+9VDC to +32VDC
2	EXT_GND		Supply Return	0V
3	EXT_RX	Output	Data port, serial data from SBDpro	RS-232
4	EXT_DCD	Output	Data port, Data Carrier Detect	RS-232
5	EXT_RI	Output	Data port, Ring Indicator	RS-232
6	EXT_RTS	Input	Data port, Request To Send	RS-232
7	EXT_DIG_OUT	Output	Open Collector (External pull up required) Max external switching voltage: 12VDC	On/Off
8	SIG_GND		Signal Ground	0V
9	EXT_DIG_IN2	Input	Logic Level Input (10K internal pull up)	0V or +5VDC
10	RSVD			
11	RSVD			
12	EXT_AN_IN1	Input	Analog Level Input (10K internal pull down)	0V to +5VDC
13	EXT_AN_OUT	Output	Analog Level Output	0V to +5VDC
14	EXT_PWR	Input	Supply (tied internally to pin 1)	+9VDC to +32VDC
15	EXT_GND		Supply Return (tied internally to pin 2)	0V
16	EXT_DSR	Output	Data port, Data Set Ready	RS-232
17	EXT_CTS	Output	Data port, Clear To Send	RS-232
18	EXT_TX	Input	Data port, serial data into SBDpro	RS-232
19	EXT_DTR	Input	Data port, Data Terminal Ready	RS-232
20	+5V_OUT	Output	5VDC, 75mA Voltage Output	+5VDC
21	EXT_DIG_IN1	Input	Logic Level Input (10K internal pull up)	0V or +5VDC
22	EXT_DIG_IN3	Input	Logic Level Input (10K internal pull up)	0V or +5VDC

23	RSVD			
24	AN_GND		Analog Signal Ground	0V
25	EXT_AN_IN2	Input	Analog Level Input (10K internal pull down)	0V to +5VDC

Electrical Specifications

DC Input Power

The SBDpro will operate from a wide range DC input from +9V to +32VDC, at up to 8W max.

A universal AC/DC Adapter (ASE-PS01) can be purchased separately from ASE.

ASE-PS01 ratings;

Input: 85 – 240VAC, 50 – 60 Hz, IEC input connector

Output: 12VDC @ 1.5A max

Power Saving Modes

Low power mode options for battery powered applications with infrequent reporting requirements.

Mode	Idle	Modules Active	Transmitting	Conditions
5	1.6W	1.6W	4.5W	Full power – all modules and status LEDs active
4	1.2W	1.6W	4.5W	Iridium transceiver powered only during wake-up and transmit times. Power status LED blinking, GPS module and status LED active.
3	0.54W	1.6W	4.5W	Iridium transceiver and GPS module powered only during wake-up and transmit times. Power status LED blinking, all others off.
2 – 0	---	---	---	Lower power modes under development
NOTES: Power ratings are typical values based on nominal 12VDC input with excellent antenna signal strength. Power ratings will increase with poor satellite visibility. With good signal strength, peak transmitting power occurs for approximately 8 seconds, Iridium wake-up time is approximately 30 seconds, and GPS wake-up time to position fix is approximately 90 seconds.				

Digital I/O Interfaces

Inputs: Contact Closure, or 0 to +5VDC, 10K ohm internal pull-up

Output: Open Collector, 100mA sink current. Can directly drive LEDs, lamps, small relays and solenoids. For logic level interface, use an external 10K pull up resistor to the logic rail of the mating equipment. Maximum pull up voltage: 12VDC.

Analog I/O Interfaces

Input: 0 to +5.00VDC, 10K ohm input impedance

Output: 0 to 5.00VDC, 15mA MAX

RS232 Connection

Your operating system and terminal software should be configured to address the SBDpro at 19,200 bps, no parity, 8 data bits, 1 stop bit (or 19200, N, 8, 1). Hardware handshaking (sometimes designated as CTS/RTS) should be set "ON". Software handshaking (or XON/XOFF) will not work.

Antenna Specifications

Iridium Antenna Specifications

Parameter	Value
Operating Temperature Range (without loss of function)	-40°C to +85°C
Measurement Frequency Range	1616 MHz to 1626.5 MHz
Return Loss (minimum)	9.5 dB (< 2:1 VSWR)
Gain (weighted average minimum)	0.0 dBic
Minimum 'Horizon' Gain	-2.0 dBic (82 degree conic average)
Nominal Impedance	50 ohm
Polarization	Right Hand Circular (RHCP)
Basic Pattern	Omnidirectional and Hemispherical
Termination	SMA male

Antenna Cable Specifications

The cable signal loss (including connectors) must be less than 3 dB and the minimum link margin of 12.1dB must be maintained.

Unobstructed View

The Iridium antenna must have an unobstructed view of the horizon for proper operation.

GPS Antenna

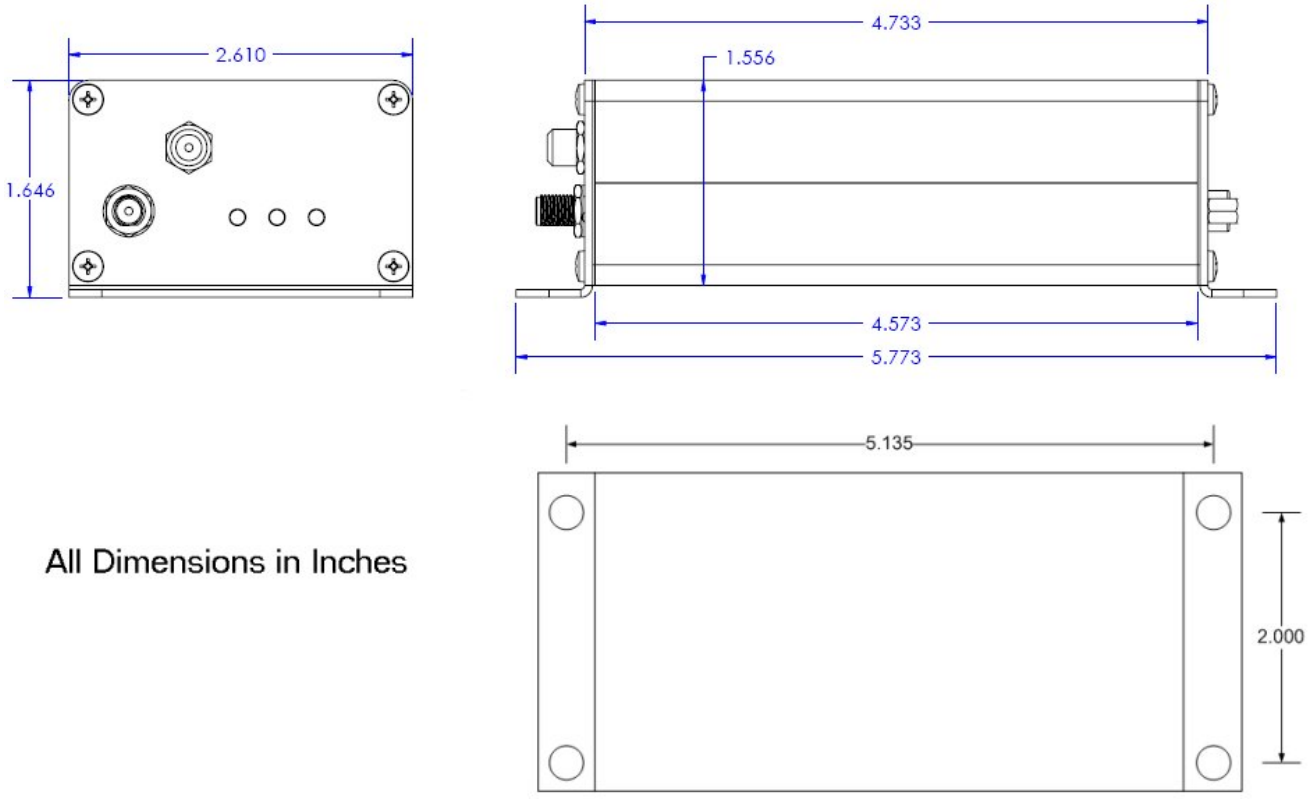
The GPS antenna must be an active type, passive GPS antennas will not work.

GPS Antenna Specifications

Parameter	Value
Operating Temperature Range (without loss of function)	-40°C to +85°C
Measurement Frequency Range	1.57542 GHz
Signal at Antenna	27 dB
Signal at Device (minimum)	3 dB
Termination	SMA male
Example Cable Length (RG174/U)	10m (33 feet)

Physical Specifications

Size and Mounting Dimensions



Environmental Specifications

Operating Temperature Range: -35°C to +70°C
Operating Humidity Range: ≤75% RH
Storage Temperature Range: -40ºC to + 85ºC
Storage Humidity Range: ≤ 93% RH

Connector Sealing in Harsh Environments

Place a bead of Silicone RTV Material along this area all around the connector mating to the SBD Pro multi-interface connector.

Standards Compliance

The SBDpro contains an embedded Iridium 9601 SBD Transceiver which has been tested to the regulatory and technical certifications shown below. Similar approvals and certifications for the SBDpro are pending.

Regulatory Approvals	Radio Tests	EMC Tests	Electrical / Mechanical / Operational Safety Tests
CE FCC Industry Canada	ETSI EN 301 441 V1.1.1 (2000-05) FCC CFR47 parts 2, 15, and 25 Industry Canada RSS170 Issue 1, Rev 1, November 6, 1999	ETSI EN 301 489-1 V1.4.1 (2002-08) ETSI EN 301 489-20 V1.2.1(2002-11) EN61000-4-2 : 1995/A2 : 2001 Part 4.2 EN61000-4-3 : 2002 Part 4.3 EN61000-4-4 : 1995/A1 : 2001/A2 : 2001 Part 4.4 EN61000-4-6 : 1996/A1 : 2001 Part 4.6 EN55022:1998/A1:2000/A2:2003	EN60950-1:2001 Part 1 UL60950-1 Part 1

ASE Limited Warranty

1. Coverage and Duration

Applied Satellite Engineering, Inc. (ASE) warrants that its new satellite subscriber radiotelephone products and accessories (the "Product") shall be free from defects in materials and workmanship for a period of twelve (12) months from the date such Product is delivered to the first end-user purchaser or first lessee (the "Purchaser"), or the date such Products are first placed into satellite subscriber service, whichever occurs earliest. ASE, at its option, shall at no charge to Purchaser, either repair or replace the Product, or refund the purchase price of a Product that does not conform to this warranty, provided the Product is returned in accordance with the instructions set out below and within the warranty period. These remedies are Purchaser's exclusive remedies under this warranty. Repair may include the replacement of parts or boards with functionally equivalent reconditioned or new parts or boards. A Product that has been repaired or replaced is warranted for the balance of the original warranty period. A Product for which a replacement has been provided shall become ASE's property.

This warranty is made by ASE to the Purchaser of the Products only, and it is not assignable or transferable by the Purchaser. This is ASE's sole and complete warranty for the Products. ASE assumes no obligation or liability for additions or modifications to this warranty unless made in writing and signed by an officer of ASE. ASE does not warrant any installation, maintenance, or service of the Products not performed by ASE.

This product is covered by a U.S.A. warranty. If the Product has been sold outside of the U.S.A., ASE will honor the U.S.A. warranty terms and conditions only. Outside of the U.S.A., any different warranty terms, liabilities, and/or legal requirements of the country in which the Product is sold are specifically disclaimed by ASE.

2. Conditions Not Covered By This Warranty

a) Products that are integrated, installed, maintained, or serviced in any manner other than in accordance with the ASE user documentation furnished with or applicable to the Product.

b) Product damage caused by the use of ancillary equipment not furnished by ASE, including accessories and peripherals.

c) Problems where the Product is used in a combination with ancillary equipment not furnished by ASE and it is determined by ASE there is no fault with the Product.

d) Ancillary equipment not furnished by ASE that is attached to or used in connection with the Products is not the responsibility of ASE, and all such equipment is expressly excluded from this warranty. Furthermore, ASE does not warrant the integrated operation of the combination of the Products with any ancillary equipment not furnished by ASE.

e) Defects or damage resulting from: use of the Product in any manner not normal or customary; misuse, accident, or neglect, including but not limited to dropping the Product onto hard surfaces, immersion in or exposure to water, rain or extreme humidity, immersion in or exposure to sand, dirt, or other particulates, exposure to extreme heat, spills of food or liquid; improper testing, operation, maintenance, installation, adjustment; or any alteration or modification of any kind.

f) Batteries manufactured by ASE and sold with Products whose capacity exceeds 80% of rated capacity are not covered. Batteries whose capacity falls below 80% of rated capacity, or that develop leakage, shall be considered non-conforming. This warranty is voided for batteries if: i) such batteries are charged by other than the ASE-approved battery charger specified for charging such batteries; ii) any seals on such batteries are broken or show evidence of tampering; iii) such batteries are used in equipment other than the Product for which they are specified; or iv) such batteries are charged and stored at temperatures greater than 60 degrees Celsius.

g) Breakage or damage to antennas, or scratches or other damage to plastic surfaces or other externally exposed parts caused by Purchaser's use.

h) Products disassembled or repaired in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.

i) Products on which serial numbers or date tags have been removed, altered, or obliterated.

j) Coil cords that are stretched or on which the modular tab is broken; leather cases, which are covered under separate manufacturer's warranties.

k) Products rented on a month-to-month basis.

l) Normal wear and tear.

3. Obtaining Warranty Service

For warranty questions, repairs, or for the return of Product, please call your Service Provider or Point-of-Sale, not ASE. Equipment needing service should be returned to your Service Provider or

Point-of-Sale, not ASE. SERVICE WORK PERFORMED BY SERVICE CENTERS NOT AUTHORIZED BY ASE TO PERFORM SUCH WORK WILL VOID THIS WARRANTY.

All products shipped to ASE's authorized Warranty Service Center must be shipped with freight and insurance prepaid. Purchaser must include with the Product a bill of sale, a lease, or some other comparable proof of purchase, the name and location of the installation facility, if any, and most importantly, the Purchaser's name, address, and telephone number and a written description of the problem. Product that is repaired or replaced under this warranty shall be returned to Purchaser at ASE's expense for the freight and insurance, and at Purchaser's expense for any applicable duties or other charges. If additional information is needed, please contact ASE at the address and phone number listed in Paragraph 6 below.

4. General Provisions

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. FURTHER, THIS WARRANTY COVERS THE PRODUCTS ONLY, AND NO WARRANTY IS MADE AS TO COVERAGE, AVAILABILITY, OR GRADE OF SERVICE PROVIDED BY ASE SEPARATELY FOR ASE SATELLITE SERVICES. IN NO EVENT SHALL ASE BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT IN QUESTION, OR FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE SUCH PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

5. State Law and Other Jurisdiction Rights; Software Copyrights

Some states and other jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, or limitation on how long an implied warranty lasts, so the above limitations or exclusions may not apply to Purchaser.

This warranty gives Purchaser specific legal rights, and Purchaser may also have other rights that vary from jurisdiction to jurisdiction.

Laws in the United States and other countries preserve for ASE certain exclusive rights for copyrighted Product software such as the exclusive rights to reproduce in copies and distribute copies of such Product software. Product software may be copied into, used in, and redistributed with only the Product associated with such Product software. No other use, including without

limitation disassembly, of such Product software or exercise of exclusive rights in such Product software is permitted.

6. Contact

For additional information about this Product warranty, please contact your Service Provider or Point-of-Sale. For additional information about ASE products and services, please contact ASE as follows:

Telephone: 480.443.1424

Facsimile: 480.452.0971

E-mail: info@ase-corp.com

Web: www.ase-corp.com

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