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ORBCOMM™

CONNECTING THE
WORLD'S ASSETS



IDP-782

Hardware Guide

T213, Version 04
Apr 2016

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PREFACE

Purpose

This document is as an overview of the installation procedures and hardware characteristics and specifications for the IDP-782 terminal.

Audience

This document is for technical readers. It provides information to ensure successful installation and operation of IDP-782 terminal.

Errata Sheet

Refer to the Customer Support website for updates or for an Errata Sheet that might be available after the release of this document. Always check the website for the most current documentation.

Notation

Hardware components and hardware labels in this document might not be exactly as shown and are subject to change without notice.

CAUTION: This safety symbol warns of possible hazards to personnel, equipment, or both. It includes hazards that will or can cause personal injury, property damage, or death if the hazard is not avoided.

Note: A note indicates information with no potential hazard. A note indicates points of interest or provides supplementary information about a feature or task.

Numbered lists indicate a series of steps required to complete a task or function.

Bulleted lists highlight information where order or sequence is not crucial.

Reference

The content of the following documents might be useful in conjunction with this guide. These documents are available from the downloads section at support.skywave.com guide or from the IDP Toolkit, which is also available from the website.

[N201]	IsatData Pro Gateway Web Service User Guide
[N206]	MTWS Cellular Protocol
[T202]	IDP Terminal API Reference

[T203]	IDP Modem Developer Guide
[T204]	IDP Terminal User Guide

The following software tools are available from the IDP Toolkit or from support.skywave.com.

- Console

User Serviceable Parts

The IDP-782 contains two SIM card holders and may also have SIM cards installed (not supplied).

Battery Safety Warnings

CAUTION: Do not short circuit or expose the battery to temperatures above the maximum rated temperature.

1 PRODUCT OVERVIEW

The IDP-782 (Figure 1) is available as a cellular or satellite-cellular terminal. Terminals include the following:

- A transceiver unit with
- An IsatData Pro cellular or satellite-cellular modem for communicating with the network
- An integral multi-GNSS subsystem
- I/O interface for wired sensors and devices
- Two RS-232 ports
- RS-485 port
- CAN bus port
- iButton interface
- Mini-B USB Slot
- Two SIM card slots
- Cellular module (GPRS or HSPA)
- (optional variant) Backup battery
- Satellite antenna (satellite-cellular models)
- Cellular antenna (cellular and satellite-cellular models)
- GPS antenna (cellular models)

Figure 1: IDP-782 Satellite-Cellular Transceiver with Antennas



Figure 2: IDP-782 Cellular Transceiver with Standard Antennas



The terminal's built-in programmability allows it to work as a standalone data-messaging terminal, with built-in I/O data collection and processing capabilities. Feature-rich software tools make programming easy and shorten the design and testing time.

1.1 Overview of the Messaging System

SkyWave's IsatData Pro satellite messaging system is designed to support the management of mobile or fixed assets located around the world. An asset fitted with one of SkyWave's satellite based mobile terminals can have their status and locations monitored, and send large messages.

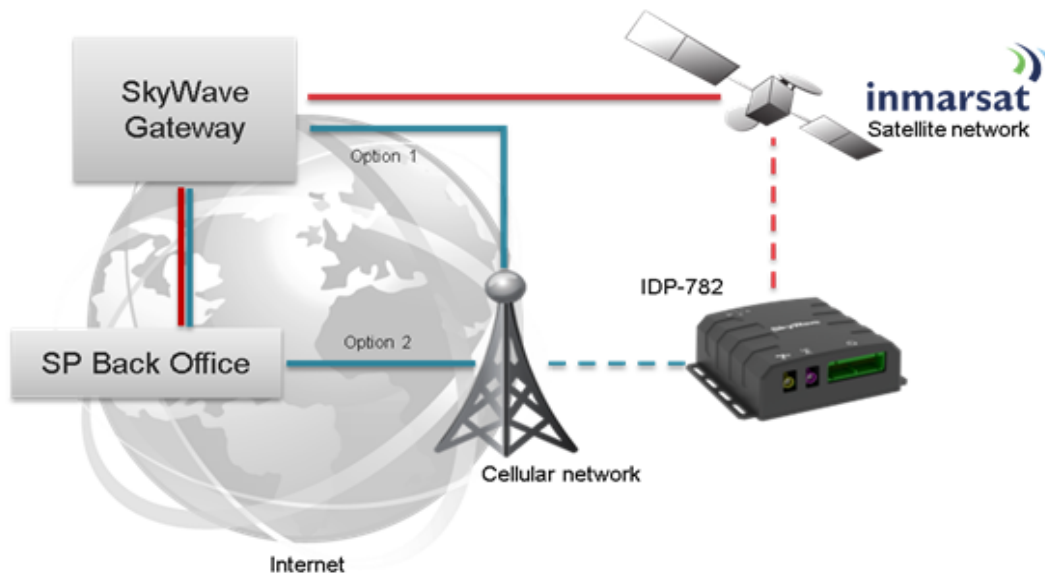
The network provides the following key features and benefits:

- Polling of terminal status and location
- Scheduled reporting of terminal status and location
- Transmission of text messages to and from a serial port on the terminal
- Two-way communication for messaging to and from the asset for near real-time control
- Up to 6,400 bytes from-mobile messages
- Up to 10,000 bytes to-mobile messages
- Default acknowledged messages
- Global service

Service is provided to end users by Solution Providers (SPs) who use the SkyWave IsatData Pro network to offer particular applications and/or services to their clients. The SPs link their application services to the satellite terminals by connecting to the IsatData Pro gateway. This acts as the communications hub of the system, routing traffic to and from the terminals and the various service providers.

The IDP-782 terminal can be configured to route cellular messages through the same SkyWave IsatData Pro Gateway that supplies satellite messages. This is shown as Option 1 in the System Diagram. Option 2 represents a terminal configured to route cellular messages directly to a customer or Solution Provider proprietary cell server. In this case the connection to SkyWave's IsatData Pro Gateway supplies satellite messages. Refer to [\[T202, N201 and N206\]](#) for more information about configuring the terminal's cellular messaging transport.

Figure 3: System Architecture



The satellite-cellular terminals are based on the IDP-680/IDP-690 Lua software and are supported by the same suite of IDP tools, enabling SPs a programmable platform they can tailor to their specific applications.

1.2 Terminal

Note: Hardware components may not be exactly as shown in this document. A terminal consists of a transceiver unit plus antennas. Part numbers are specified in [Table 8](#).

Terminals with a standard antenna operate on the IsatData Pro network at an elevation angle of 20° to 90° and -15° to 90° for terminals with low elevation antennas. The terminals are self-contained, compact, and provide low power consumption.

A cellular model is available to operate over the cellular network. This terminal does not include a satellite transceiver and provides substantial cost savings.

The terminal's built-in programmability allows it to work as a stand-alone terminal with built-in I/O data collection and processing capabilities. Terminals are suitable for the AVL market.

Feature-rich software tools make application design easy, and shorten the design and testing time. SkyWave also provides consulting services to SPs to help program the terminals and get customer applications running quickly.

1.3 Terminal Components

CAUTION: Do not rely solely on the terminal for emergency (SOS) calls.

The terminal has the following key features and benefits:

- Designed to be used as a standalone or incorporated into an SP solution
- Built-in GPS or GPS/GLONASS/BeiDou¹ receiver to calculate position, speed, and heading
- Quick and easy installation reduces labor time and costs
- Installed firmware
- Flexible custom application design (Lua Services Framework)
- Wide operational temperature range
- Satellite plus cellular modem integration (satellite-cellular models)
- Discrete I/O ports to interface with a wide range of after-market accessories
- Rugged construction
- Dual SIM
- Optional Li-Ion Polymer rechargeable backup battery
- Optional terminal shroud

1.3.1 Transceiver Unit

Each transceiver is a self-contained unit, including cellular modem or satellite/cellular modem, GPS or GPS/GLONASS/BeiDou² module, programmable microcontroller, and multiple discrete and analog I/Os (input/output) capable of monitoring and controlling external sensors and devices. Ideal for mobile applications, it is also suitable for fixed installations. A variant of the IDP-782 is available with a rechargeable backup battery. Refer to [APPENDIX A](#) for details.

The transceiver unit is not waterproof. Use it in an indoor environment, for example, inside a vehicle, away from environmental exposure (that is, any form of moisture such as rain, snow, or pooled water). An optional terminal shroud accessory is available to cover the terminal and protect it from water ingress. Refer to [APPENDIX D](#) for further details.

Arranging the transceiver unit's connectors ([Figure 4](#)) at one end of the unit simplifies installation. Sturdy flanges on the side make mounting quick and easy.

¹Contact your Account Executive if you require BeiDou functionality.

²Contact your Account Executive if you require BeiDou functionality.

Figure 4: Connector Position for Satellite-Cellular Models



Figure 5: Connector Position for Cellular Models

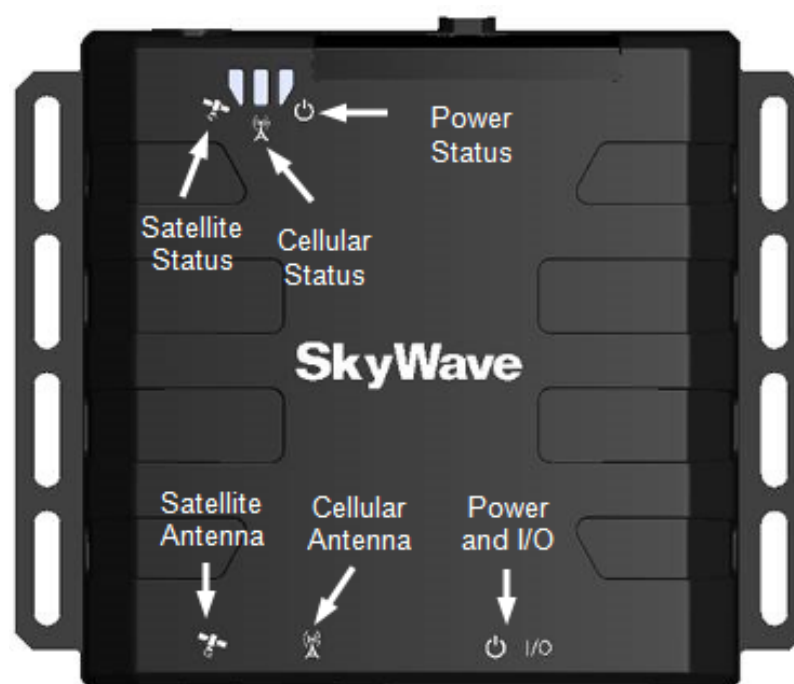


An anti-tamper SIM door on the back side of the unit ([Figure 6](#)) provides easy access to the two SIM card holders. A mini-B USB connector located next to the SIM door provides a serial port for programming and debugging.

Figure 6: Dual SIM Access Door



Figure 7: LEDs



1.3.2 Satellite Antenna

The IDP-782 satellite-cellular terminal's satellite antenna is waterproof and designed to operate in extreme environments. It has four mounting flanges for installation.

The satellite antenna connects to the transceiver using a 5 m cable terminated with a curly yellow colored FAKRA RF connector.

The IDP-782 satellite-cellular terminal is available with either the standard satellite antenna ([Figure 8](#)) or the low elevation satellite antenna ([Figure 9](#)).

Figure 8: Standard Satellite Antenna



Figure 9: Low Elevation Satellite Antenna



1.3.3 Cellular Antenna

IDP-782 terminals use a quad-band adhesive glass mount antenna, designed for installation on the interior of a vehicle windshield. It connects to the transceiver unit with a 2.5 m cable terminated with a violet colored FAKRA

connector. If this antenna is used with the IDP-782 cellular model, the GPS/GLONASS patch antenna (section 1.3.4) is also required.

Figure 10: Cellular Antenna



1.3.4 GPS Antenna

The GPS antennas are for use with the IDP-782 cellular model. Two options are available:

- Cellular antenna (section 1.3.3) plus a GPS/GLONASS patch antenna
- Cellular premium antenna

Figure 11: GPS/GLONASS Patch Antenna



Figure 12: Cellular Premium Antenna



2 COMPLIANCE

Unless noted otherwise, the information below refers to terminals without backup battery.

Inmarsat Type Approval

Industry Canada

- ICES-003
- RSS-170, Issue 2, Spectrum Management and Telecommunications Policy, Radio Standard (IDP-180/IDP190)
- RSS-102, radiation safety per Safety Code 6 (compliance shown by computation)

FCC

- CFR 15 Title 47
- CFR 25 Title 47 (IDP-180/IDP-190)

CE 1622 - R&TTE Directive 1999/5/EC

- EN 301 426 - Spectrum (IDP-180/IDP-190)
- EN 301 489-1, EN 301 489-7, EN 301 489-20, and EN 301 489-24
- EN 60950 - Safety
- EN 62311 - Radiation Safety (compliance shown by computation)
- Compliance for terminals with backup battery is pending

Ingress Protection

- Cellular antenna: IP65
- Satellite antenna: IP67
- GPS (patch) antenna: IP66
- GPS/Cellular (low profile) antenna: IP6K9K
- Transceiver unit: IP40
- Transceiver unit with optional terminal shroud: IP65 (as per installation instructions)
- Transceiver with backup battery: IP40

RoHS

- Restriction of Hazardous Substances (RoHS) ¹

¹European Union's (EU) Directive 2002/95/EEC "Restriction of Hazardous Substances" (RoHS) in Electronic and Electrical Equipment.

Anatel

- ETS 300 254, clauses 4.2.1, 4.2.2 and 4.2.4

UN

- UN 38.3 Transportation Compliance

PTCRB

- Compliant for terminals without backup battery
- Compliance for terminals with backup battery is pending

3 SPECIFICATIONS

3.1 Temperature

Parameter	Value
Operating Temperature excluding batteries	-40° to +85°C
Storage Temperature excluding batteries	-40° to +85°C

3.1.1 Backup Battery Temperature

Table 1 defines the backup battery's temperature specifications.

Table 1: Terminal with Backup Battery Temperature Specifications

Parameter	Value
Charge Temperature Range	0°C to +45°C
Discharge Temperature Range	-10°C to +60°C
Storage Range	≤ 1 month -20°C to +45°C ≤ 3 months -20°C to +35°C ≤ 1 year 0°C to +30°C Ideal for long-term storage 10°C to +25°C

3.2 Electrical

3.2.1 Input Range

Parameter	Value
Power Supply Voltage	9 to 32 V DC

3.2.2 Power Consumption

Typical values at ambient temperature with a terminal input voltage of 12 VDC.

Table 2 shows current without the data cable connected.

Table 2: Terminal Input Currents

Mode of Operation	Condition	Satellite Tx	Satellite Rx	GPS	Cellular	Current
Satellite Rx (C/No=42dBHz)	Burst current for Rx freq. 1540045000 1000 2	OFF	ON	OFF	OFF	64.1 mA

Mode of Operation	Condition	Satellite Tx	Satellite Rx	GPS	Cellular	Current
GPS Rx (C/No=42dBHz)	Cold fix current during u-blox on command	OFF	OFF	ON	OFF	32.4 mA
	Hot fix current during u-blox on command	OFF	OFF	ON	OFF	30.1 mA
IDP-782 GPRS - Rx (Idle)	850 MHz band; RSSI=10-12	OFF	OFF	OFF	ON	36.5 mA
IDP-782 HSPA - 2G Rx (Idle)	850 MHz band; RSSI=10-12	OFF	OFF	OFF	ON	34.5 mA
IDP-782 HSPA - 3G Rx (Idle)	850 MHz band; RSSI=10-12	OFF	OFF	OFF	ON	34.1 mA
Satellite Tx mode	Burst current	ON	OFF	OFF	OFF	1078.7 mA
IDP-782 GPRS - Tx max.	850 MHz band; burst current peak	OFF	OFF	OFF	ON	392.3 mA
	50 MHz band; average current	OFF	OFF	OFF	ON	112.9 mA
IDP-782 HSPA - 2G Tx max.	850 MHz band; GPRS; burst current peak	OFF	OFF	OFF	ON	557.7 mA
	850 MHz band; GPRS; average current	OFF	OFF	OFF	ON	153.5 mA
IDP-782 HSPA - 3G Tx max.	HSPA+ 850 MHz band	OFF	OFF	OFF	ON	231.0 mA
Standby	IDP modem powered on, cellular modem powered off	OFF	OFF	OFF	OFF	13.2 mA
Sleep	IDP modem sleep mode=0, power LED on	OFF	OFF	OFF	OFF	1.979 mA
Sleep (no LED)	IDP modem sleep mode=0, power LED off	OFF	OFF	OFF	OFF	0.110 mA ±15%
Standby (backup battery)	IDP modem powered on, cellular modem powered off, LED on	OFF	OFF	OFF	OFF	12.9 mA
Sleep (backup battery)	IDP modem sleep mode=0, LED off	OFF	OFF	OFF	OFF	138 µA

Table 3: Additional Terminal Input Currents

Mode of Operation	Port	Condition	Current ¹
Sleep mode	Main serial port	(cable connected)	0.070 mA
	AUX serial port	(trace enabled and cable connected)	0.033 mA
	USB main port	-	37.9 mA
Standby mode	Main serial port	(cable connected)	1.993 mA
	AUX serial port	(trace enabled and cable connected)	1.986 mA
	USB main port	-	25.8 mA

3.2.2.1 Accelerometer Power Consumption

The power consumption of the accelerometer varies depending on the settings. Refer to the Accelerometer section in [\[T202\]](#) for more details.

¹These values need to be added to either sleep or standby mode values in [Table 2](#) if the main (console), AUX, or USB port is connected.

3.2.3 Load Dump Protection

Active load dump protection is provided on the power pins. The cut-off is >35 V and automatic reset of the load dump occurs when the input voltage is <35 V.

3.2.4 Inrush Currents

Typical inrush currents: 12 volts

Quantity	Value
Peak in-rush current	2.92 A
In-rush pulse duration	3 μ S

3.2.5 Reverse Voltage Input

Parameter	Voltage
Reverse Polarity Protection	-40 V DC (maximum)

3.2.6 Cellular Antenna

Parameter	Value
Network Coverage	UMTS/HSPA/GPRS Bands 800/850/900/1700/1800/1900/2100 MHz
Frequency	800/850/900/1700/1800/1900/2100 MHz
Impedance	Nominal 50 ohm
VSWR	2.5:1
Gain	0 dB (3 dBi max.)
Maximum EIRP	8 dBW

3.2.7 External GPS Antenna

GPS/GLONASS Patch Antenna

Parameter	Value
Frequency	GLONASS: 1602.0 to 1614.94 MHz GPS: 1,575.42 GHz $\pm$ 1,023 MHz (L1-band)
Impedance	50 ohm
VSWR	<1.5
Gain (typ.)	2 dBic ¹ at 90° elevation
Amplification (typ.)	27 dB $\pm$ 1 dB

¹Referenced to an isotropic radiator, circular polarization

GLONASS/GPS/Cellular Low Profile Antenna

Parameter	Value
GLONASS/GPS	
Frequency	GLONASS: 1602.0 to 1614.94 MHz GPS: 1,575.42 GHz $\pm$ 1,023 MHz
Impedance	50 ohm
VSWR	<1.5
Gain	4.5 dBi
Polarization	Right hand circular
Amplification (LNA)	20 $\pm$ 2 dB @ 3.3 $\pm$ 0.3 V
Bandwidth (LNA)	100 MHz
Cellular	
Frequency	GSM 850: 824-894 MHz GSM 900: 880-960 MHz GSM 1800: 1710-1880 MHz GSM 1900: 1850-1990 MHz UTSM: 1920-2170 MHz
Impedance	50 ohm
VSWR	$\leq$ 3.0
Gain	0 dBi
Polarization	Linear, vertical

3.2.8 SIM Holders

The terminal offers two SIM card holders. The specifications for both SIM holders are the same. If using only one SIM card, use the main SIM card holder slot on the left when facing the holders.

Parameter	Value
SIM Voltage	1.8 V or 3 V standard SIM cards
Card Detection	Switch connected to cellular module

3.3 Mating Connectors

Transceiver 30 position mating connector	JAE Electronics Inc. IL-AG5-30S-D3C1
Satellite Antenna	IMS Connector Systems 3400.SMBA.2K10.089 K-curry yellow

Cellular Antenna	IMS Connector Systems 3400.SMBA.2D10.029 D-bordeaux-violet
GPS Antenna	IMS Connector Systems 3400.SMBA.2C10.029 K-blue

For detailed instructions on the connector contact crimp, assembly and extraction, refer to the manufacturer's website¹. [APPENDIX F](#) provides mating cable assembly instructions and mating connector, crimp, and tool part numbers.

3.3.1 IDP-782 Connector Pin Assignment

[Table 4](#) maps to the layout shown in [Figure 13](#).

Figure 13: Transceiver View of Connector

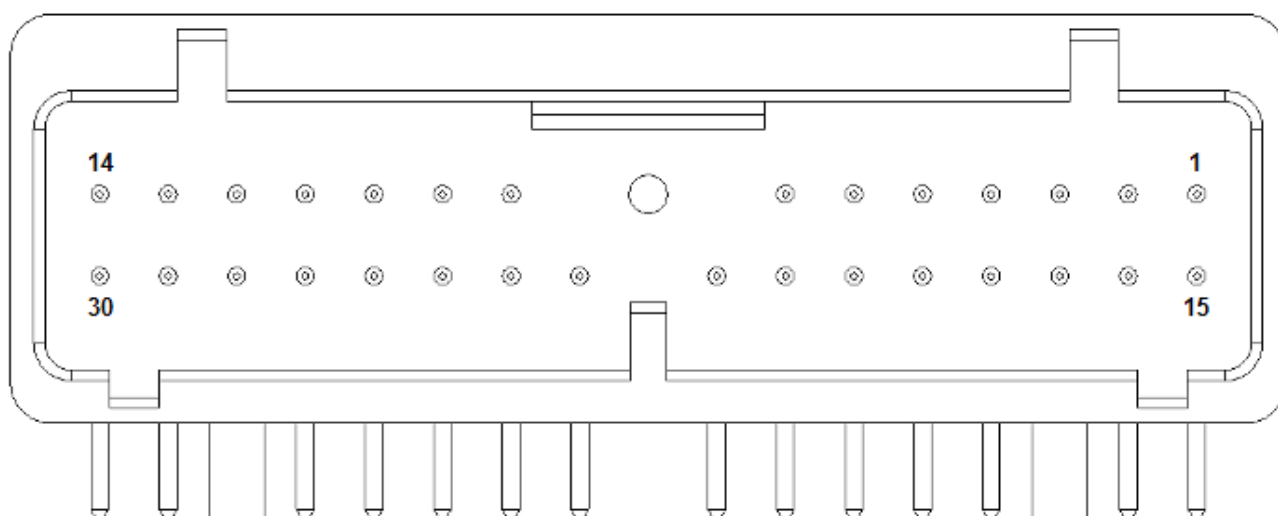


Table 4: Electrical Pin Assignment

AUX_ RS232 _Rx	AUX_ RS232 _Tx	N/C	Output 06	Output 05	N/C	N/C	MIC_B	N/C	SPK_B	CAN_L	RS485 _B	RS485 _A	SPK_ A
14	13	12	11	10	9	8	7	6	5	4	3	2	1

¹<http://www.te.com/commerce/DocumentDelivery/DDEController>, document ID/document number: 411-5761, document title: 040II SERIES MULTI-LOCK CONNECTOR MK-II 72POS.

GND	VIN	I/O 04	I/O 03	I/O 02	I/O 01	Main_ RS232_ Tx	Main_ RS232_ Rx	MIC_A	CAN_H	1_WIRE_ _COM	1_WIRE_ _DATA	N/C	N/C	N/C	N/C
30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15

3.4 Input/output Interface Specifications

The terminal supports four configurable I/Os (I/O 01 to I/O 04):

- Digital input with weak (1 MΩ) pull-down
- Digital input with 30-50 K pull-down
- Digital input with 30-50 K pull-up
- Analog input
- Digital output – push-pull
- Digital output – open drain switch-to-ground
- Disabled

I/O 01 can be used for ignition. Refer to section [3.4.1](#)

I/O 04 provides dedicated overcurrent/short circuit protection circuitry when operated in the open drain, switch-to-ground mode. The other I/Os do not have this circuitry therefore I/O 04 is recommended for applications requiring overcurrent/short circuit protection.

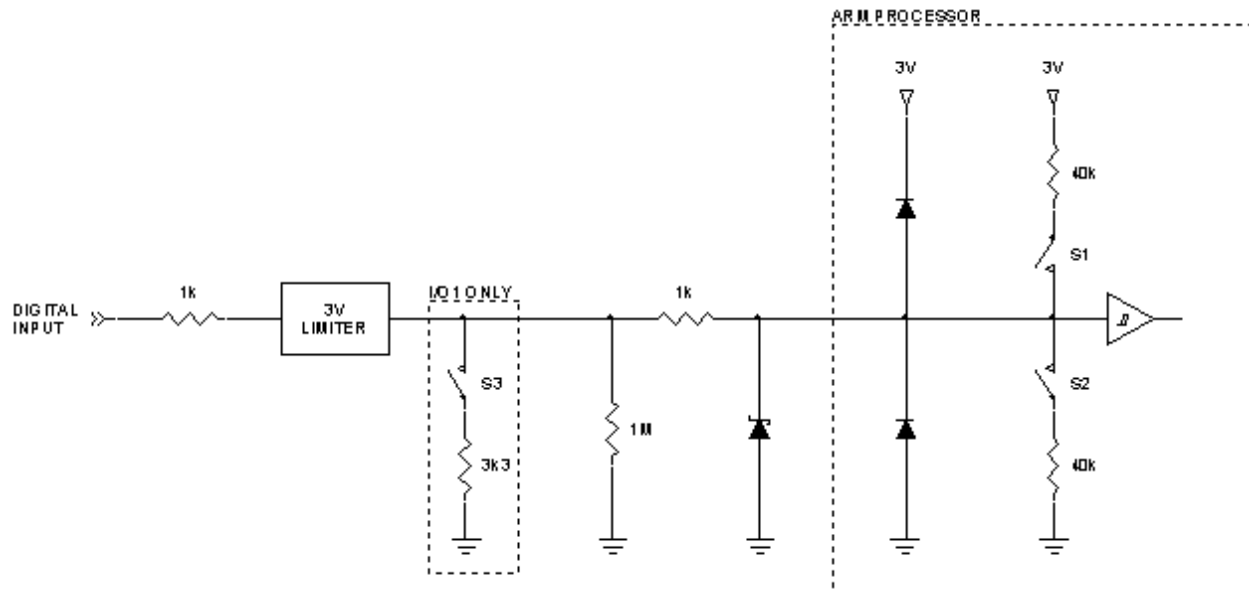
Simplified block diagrams of the I/O when configured as digital inputs, digital outputs, and analog inputs are shown in the figures below ([Figure 14](#), [Figure 15](#) and [Figure 16](#)).

The terminal also supports two dedicated outputs (Output05 and Output06). More information on these outputs can be found in section [3.4.4](#).

3.4.1 Digital Input

Figure 14 shows a schematic of the I/O when configured as a digital input.

Figure 14: Digital Input



Input Type	S1	S2	S3
With weak pull-down	Open	Open	-
With pull-down	Open	Closed	-
With pull-up	Closed	Open	-
Ignition	-	-	Closed

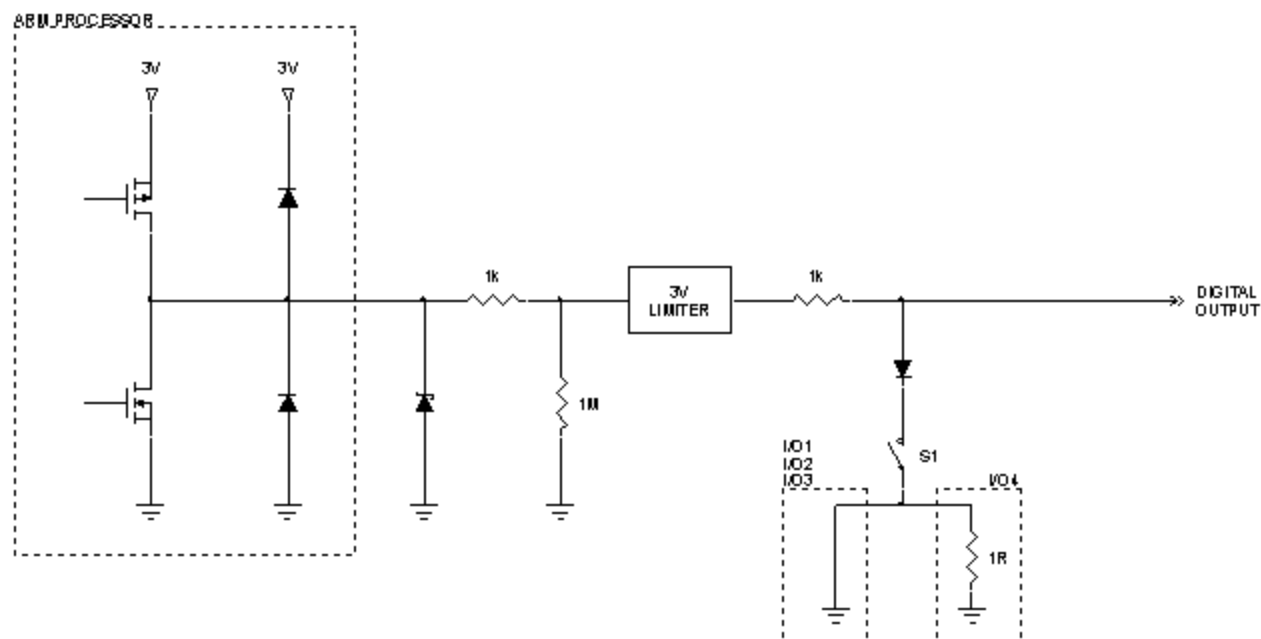
The input specifications are provided in the table below.

Parameter	Min.	Typical	Max.	Units
Input low range	-10	-	1.05	V
Input high range	1.95	-	150	V
Input current with weak pull-down (weak 1 MΩ pull-down still in place); $V_{in} = 3.0$ V	-	4.5 3	-	μA
Input source current with pull-up ($V_{in} = 0.0$ V)	-	75	-	μA
Input sink current with pull-down ($V_{in} = 3$ to 150 V)	-	81	-	μA
Input bandwidth	1	-		kHz

3.4.2 Digital Output

Figure 15 shows a schematic of the I/O when configured as a digital output.

Figure 15: Digital Output



Push-pull	S1 = Open
Open drain	S1 = Closed (Low Impedance) S1 = Open (High Impedance)

3.4.2.1 Push-pull

In the push-pull configuration the output is driven directly from the microprocessor.

Parameter	Min.	Typical	Max.	Units
Output high voltage - open circuit	2.65 2.85	3.0 3.0	3.15 3.15	V
Output high voltage (sourcing 25 μ A)	2.50 2.80	-	-	V
Output low voltage (sinking 25 μ A)	-	-	0.05	V
Output bandwidth	100	-	-	Hz

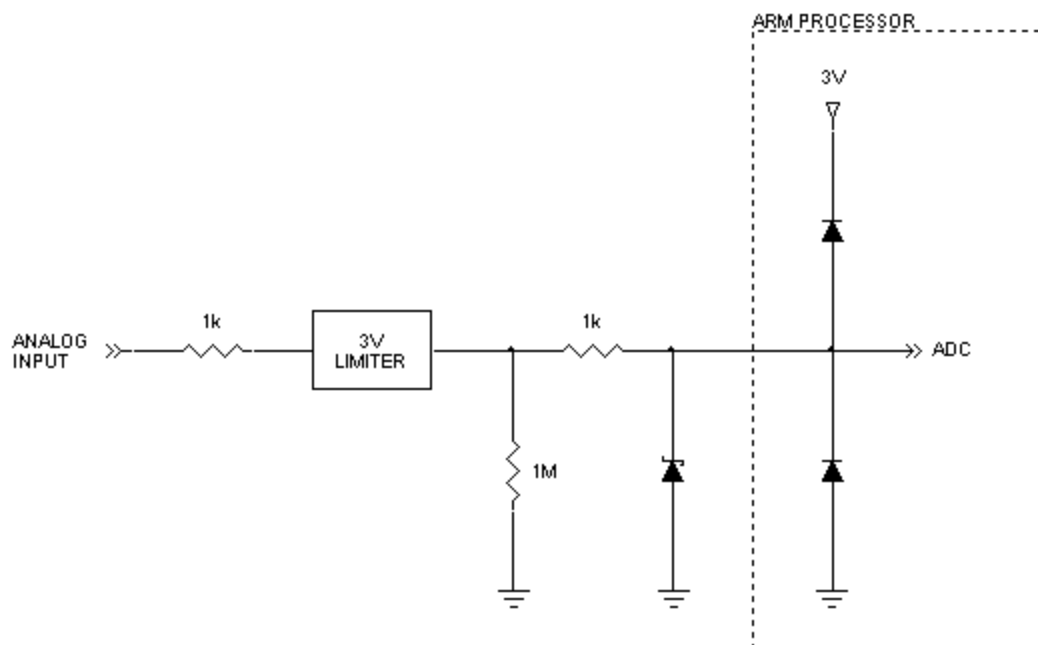
3.4.2.2 Open Drain

Parameter	Min.	Typical	Max.	Units
Sink current (do not exceed)	-	-	250	mA
Output voltage (sinking 250 mA)				
I/O 01 to I/O 03	-	1.15	1.35	V
I/O 04	-	1.40	1.60	V
Absolute limits (high impedance)	-10	-	150	V
Output bandwidth	100	-	-	Hz

3.4.3 Analog Input

Figure 16 shows a schematic of the I/O when configured as an analog input.

Figure 16: Analog Input



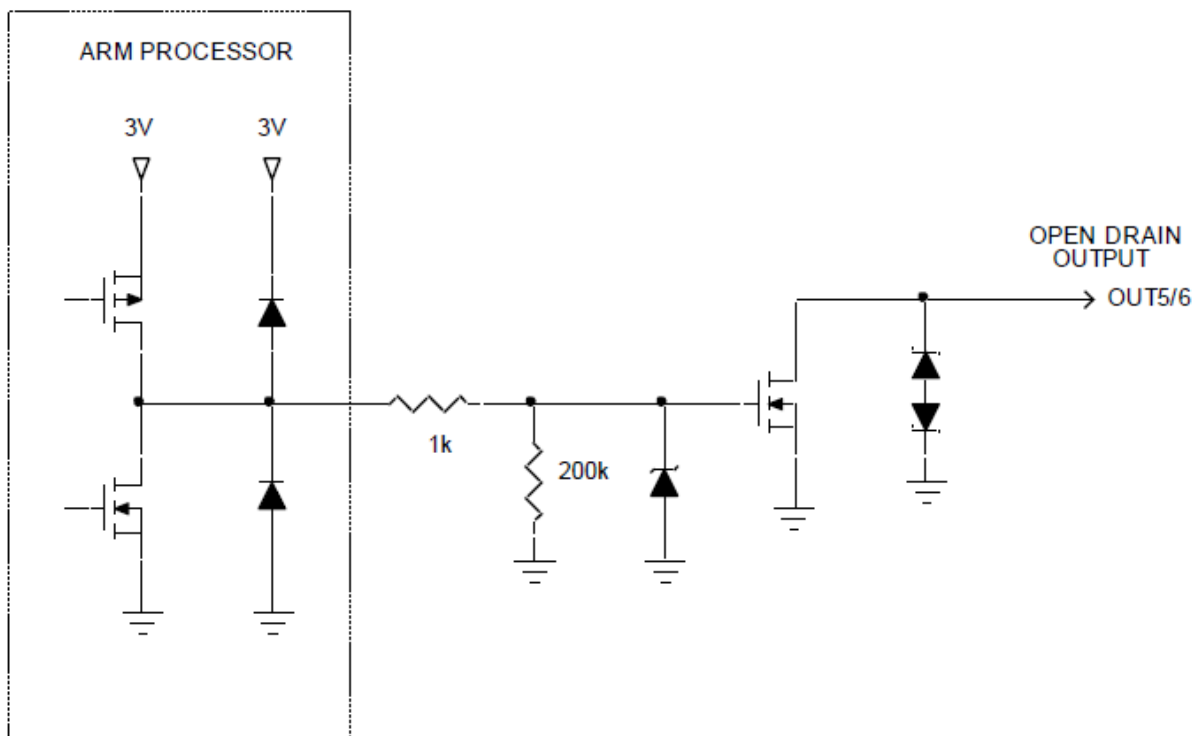
Parameter	Min.	Typical	Max.	Units
Input impedance	-	1	-	MΩ
Minimum measurement voltage	-	0	-	V
Maximum measurement voltage	2.75	3.0	-	V
Normal input range	-	-	3	V
Resolution (12 bits)	-	0.7	-	mV
Proportional measurement error	-	-	3	%

Parameter	Min.	Typical	Max.	Units
INL error	-	-	2	LSB
Absolute limits	-10	-	150	V

3.4.4 Open Drain Outputs

The terminal provides two open drain outputs (output05 and output06) that can be used to turn on various devices such as relays, lights or audible alarms. These outputs are capable of sinking current only. Both outputs are controlled from the ARM processor. The outputs are not protected against over current conditions and you must ensure that the maximum current capability of the internal switch is not exceeded. Both outputs include ESD protection. You must also ensure that the voltage applied to the output pin does not exceed the maximum value as shown in the table below.

Figure 17: Open Drain Outputs

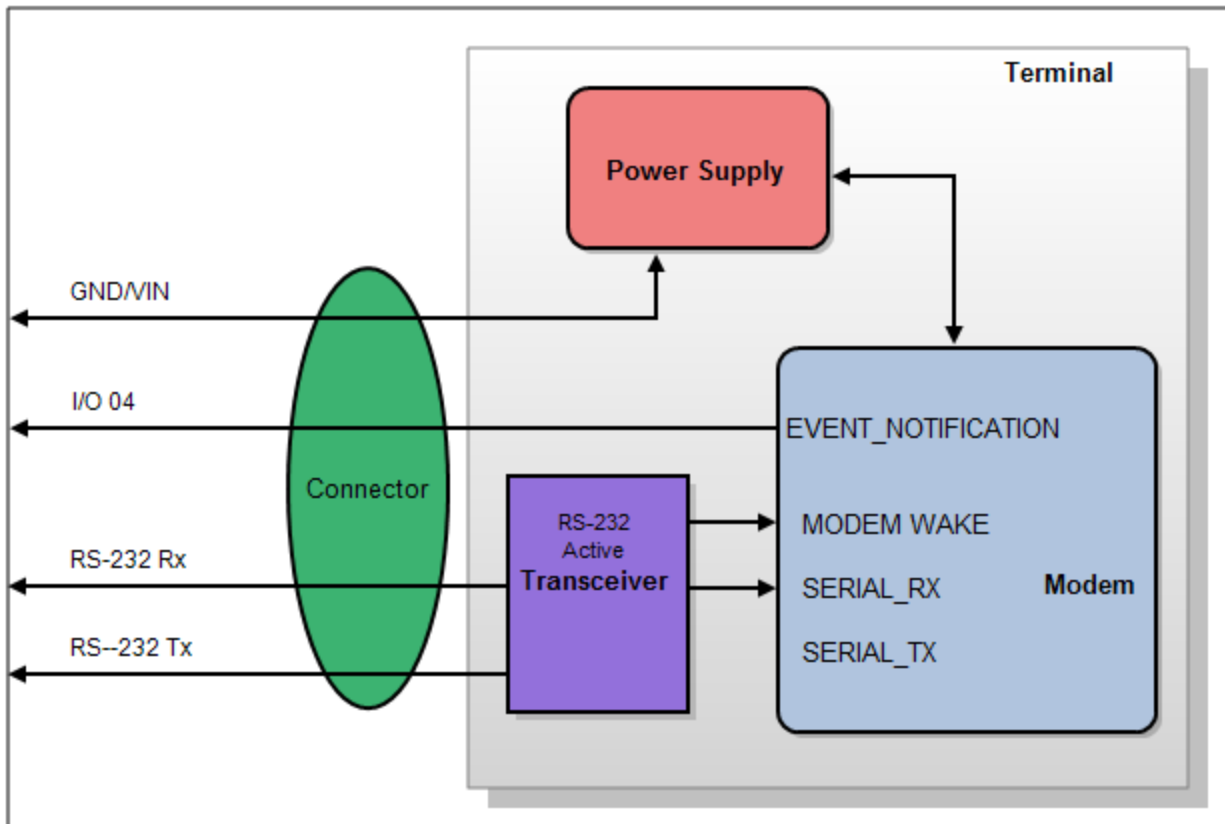


Parameter	Typical	Max.	Units
Sink Current	-	250	mA
Applied Voltage	-	20	V
Voltage output (sink current = 250 mA)	0.34	1.6	V

3.4.5 Pass-Through Mode

A terminal can be configured for pass-through mode when there is no application firmware present. A block diagram of pass-through mode is shown in [Figure 18](#). In pass-through mode, the terminal connects the modem's serial interface to the terminal's RS-232 port.

Figure 18: Pass-Through Mode Signals



The terminal's I/O lines are configured as per [Figure 18](#) when in pass-through mode. The modem's serial data and the EVENT_NOTIFICATION pins are connected to the terminal's external connector.

3.5 Serial Interfaces

Terminals have the following interfaces:

- 1 x CAN bus
- 1 x RS-485/J1708
- 2 x RS-232
- 1 x iButton Reader (1-Wire)
- 1 x USB

3.5.1 CAN

The driver provides CAN Bus link layer interfaces for sending and receiving frames.

- Open/Close CAN device.
- Configure/change CAN frame format, baud rate, acceptance filters.
- Interrupting service for receive, transmit.
- Receive and transmit message queue management.

The terminal incorporates a controller area network interface with signaling rates up to 1 Mbps.

Note: You must provide a termination resistor externally to the terminal.

Parameter	Min.	Typical	Max.	Units
Input Common Mode Voltage	-7	-	12	V
Differential Input Threshold	-6	-	6	V
Peak to Peak Output Common Mode Voltage	-	1	-	V
Differential Output Voltage (dominant)	1.2	-	3	V
Differential Output Voltage (recessive) No Load	-0.5	-	0.05	V
CANH or CANL	-36	-	36	V
ESD Protection				
Human Body Model ¹	-	±15	-	kV
Contact Discharge Model	-	±8	-	kV

3.5.2 RS-485

The terminal provides a half-duplex RS-485 /J1708 interface as an accessory bus and for SCADA interfacing with signaling rates up to 250 kbps.

Note: You must provide a termination resistor externally to the terminal when required.

The electrical characteristics of the interface are:

Parameter	Min.	Typical	Max.	Units
Input Common Mode Voltage	-8	-	13	V
Differential Input Threshold	-200	-125	-50	mV
Output Common Mode Voltage	-	1.5	3	V
Differential Drive Output, 54 Ω load	1.5	-	-	V
ESD Protection				
Human Body Model	-	±15	-	kV
Contact Discharge Model	-	±8	-	kV

¹All electrical interfaces operate normally after being subjected to 8 kV ESD contact discharge per IEC 60945 and IEC 61000-4-2 human body model, level 3.

3.5.3 RS-232

The RS-232 interface defaults to the following settings: 9600 bit/s, 1 start, 8 data, 1 stop bit, and no parity. The baud rate is configurable up to 115,200 bps.

The electrical characteristics of the interface are:

Parameter	Min.	Typical	Max.	Units
Rx Input Low Threshold for DTE Connected	-	-	-2.7	V
Rx Input High Threshold for DTE Connected	2.7	-	-	V
Rx Threshold for DTE Disconnected	-0.3	-	0.3	V
Serial Rx Input Low Threshold	0.6	-	-	V
Serial Rx Input High Threshold	-	-	2.4	V
Rx Input Voltage Range	-25	-	25	V
Serial Tx Low Output (3 k Ω load)	-	-	-3.7	V
Serial Tx High Output (3 k Ω load)	3.7	-	-	V
ESD Protection				
Human Body Model	-	± 15	-	kV
Contact Discharge Model	-	± 8	-	kV

3.5.4 iButton Reader

The iButton 1-Wire interface allows connection to downstream 1-Wire devices connected on a bus, or to a single button reader. Relative to any attached iButton device the terminal behaves as the master. The iButton driver supports 3 or 5 V devices on the bus.

At standard speed, the iButton supports up to 39 devices over a 60 meter CAT5 cable. In overdrive, the usable expected distance is reduced to ≤ 15 meters with a maximum node count of 9.

The electrical characteristics of the interface are:

Parameter	Min.	Typical	Max.	Units
Input High Voltage	1.8	-	-	V
Input Low Voltage	-	-	0.6	V
Output Low Voltage	-	-	0.2	V
Load Current @ 3 V	-	4	-	mA
ESD Protection				
Human Body Model	-	± 27	-	kV

3.5.5 USB

The terminal incorporates a USB to 4 port UART bridge chip. Both RS-232 serial ports can be switched through the bridge to the USB port. The USB port is accessible via a Mini-B connector on the rear of the terminal. The USB port is full-speed V2.0 (12 Mbps) compliant.

By default both primary and auxiliary serial ports are automatically switched to the USB port on connection of a USB host. The application card processor however can redirect the serial ports independently to whichever destination it is programmed.

The electrical characteristics of the interface are:

Parameter	Min.	Typical	Max.	Units
Input High Voltage	2.0	-	5.5	V
Input Low Voltage	-0.3	-	0.8	V
Output High Voltage	2.8	-	3.6	V
Output Low Voltage	0	-	0.3	V
ESD Protection				
Human Body Model	-	±5	-	kV

3.6 RF Specifications

3.6.1 Standard Antenna

Parameter	Value
Maximum EIRP	7 dBW
Elevation Angle	20° to 90° degrees
Maximum transmit antenna gain	4.5 dBic

3.6.2 Low Elevation Antenna

Parameter	Value
Maximum EIRP	5 dBW
Elevation Angle	-15° to 90° degrees
Maximum transmit antenna gain	2.5 dBic

3.7 Multi-GNSS Module

The manufacturer's specifications are given in the table below. Refer to [APPENDIX A](#) for hardware part numbers.

Table 5: Multi-GNSS Specifications

Parameter	GPS	GLONASS	BeiDou	GPS/GLONASS	GPS/BeiDou
Time to First Fix¹					
Cold Start	29 s	30 s	36 s	26 s	27 s

¹All satellites at -130 dBm

Parameter	GPS	GLONASS	BeiDou	GPS/GLONASS	GPS/BeiDou
Hot Start	1 s	1 s	1 s	1 s	1 s
Sensitivity					
Tracking	-166 dBm	-166 dBm	-160 dBm	-167 dBm	-165 dBm
Hot Start	-156 dBm	-155 dBm	-155 dBm	-156 dBm	-156 dBm
Cold Start	-148 dBm	-145 dBm	-138 dBm	-148 dBm	-148 dBm
Accuracy					
Horizontal Position (CEP) ¹	2.5/2.0 m	4.0 m	3.0 m	2.5/2.0 m	2.5/2.0 m
Velocity	0.05 m/s	0.1 m/s	0.1 m/s	0.05 m/s	0.05 m/s
Heading	0.3 degrees	0.4 degrees	-	0.3 degrees	0.3 degrees

3.8 Audio

The GPRS cellular module provides one analog differential audio interface and a digital audio interface. These interfaces are only for emergency purposes. The analog audio input can be connected to the output of an external analog audio device or an external electret microphone.

The HSPA cellular module supports a digital audio interface. The digital audio interface produces the applicable analog signals for the external microphone and speaker.

3.8.1 GPRS Audio

Parameter	Min.	Typical	Max.	Units
Microphone				
Microphone bias voltage	-	2.2	-	V
Microphone supply current	-	-	4	mA
Load resistance	1	-	-	kΩ
Differential input voltage	-	-	0.8	V _{pp}
Differential input resistance	-	50	-	kΩ
Common mode DC voltage	-	0.5	-	V
Signal to noise	75	-	-	dB
Bandwidth	300	-	3900	Hz
Speaker				
Differential output voltage	4.0	4.1	4.2	V
Common mode output voltage	-	1.25	-	V
Output current limit	-	-	200	mA

¹CEP, 50%, 24 hours static, -130 dBm

Parameter	Min.	Typical	Max.	Units
Output load resistance	14	16	32	Ω
Signal to noise (16 Ω load, input signal = 0 dBFS)	70	80	-	dB
Signal to noise (32 Ω load, input signal = 0 dBFS)	60	70	-	dB

3.8.2 HSPA Audio

Parameter	Condition	Min.	Typical	Max.	Units
Microphone					
Microphone bias voltage	-	1.5	1.55	1.6	V
Differential input voltage	-	0.7	0.8	0.9	V _{pp}
Differential input resistance	-	30	50	-	k Ω
Common mode DC voltage	-	-	0.5	-	V
Signal to noise	-	75	-	-	dB
Bandwidth	-	300	-	3900	Hz
Speaker					
Output power	16 Ω load	30	50	-	mW
	32 Ω load	-	33	3	mW
Total harmonic distortion + noise	16 Ω load, 25 mW, F=1 kHz	-	0.08	-	%
	32 Ω load, 25 mW, F=1 kHz	-	0.05	-	%
Dynamic range	0 dB volume setting	-	90	-	dB
Power supply rejection ratio	V _{dd} = 1.8 V	60	84	-	dB
Output offset voltage	-	-	-	+3.5	mV
Capacitive drive capability	32 Ω load	-	500	-	pF

3.8.3 Headset Microphone

Parameter	Min.	Typical	Max.	Units
Omni-directional Electret Condenser Microphone Output Impedance	-	2.2	-	k Ω
Operating Voltage	1.5	-	-	V
Operating Current	-	-	4	mA
Operating Frequency	100	-	20000	kHz

3.8.4 Headset Speaker

Parameter	Min.	Typical	Max.	Units
Speaker Impedance (1 kHz)	14	16	32	Ω

Parameter	Min.	Typical	Max.	Units
Power Handling Capacity	-	50	-	mW
Operating Frequency	20	-	20000	kHz

3.9 Backup Battery

Terminals with backup batteries are shipped in shelf mode with the backup battery disabled. External power must be applied to exit shelf mode and begin charging the battery to its maximum capacity. The terminal continues to operate on external power until the supply voltage drops below the configurable minimum voltage threshold, at which point it switches over to the backup battery.

The terminal operates on the backup battery, and then perform a graceful shutdown when the battery reaches its minimum discharge voltage. The battery begins recharging when external power is reapplied and the external temperature is within the acceptable range. When external power is applied to the terminal, power is simultaneously applied to the backup battery. To bring the terminal out of shelf mode, external power needs to be connected to the terminal. Power supplied to the battery (VIN) is protected by a fuse and load dump within the terminal.

Typically a terminal can be reset by disconnecting and then reconnecting external power. With the backup battery, cycling external power does not cause a reset because the terminal switches to the backup battery. There is a small hole on the bottom of the terminal to access the reset button. Insert a paper clip through the hole to interrupt power and cause the terminal to reset.

Table 6: Internal Backup Battery

Parameter	Value
Battery Chemistry	Lithium Ion Polymer
Back-up Period	12 hours
Rated Capacity	800 mAh
Charge (capacity) Retention	90% (after 28 days at 25°C)
Nominal Pack Voltage	11.1 V
Minimum Discharge Voltage	9 V
Protection Module Cut-Off Voltage	8.8 V
Charging Voltage / Current	12.65 V / 425 mA
Nominal Output Current	160 mA
Peak Output Current	3000 mA (pulse current 3.0 C5A)

Refer to section 3.1.1 for backup battery temperature ranges.

3.10 Memory

Parameter	Value
SRAM	8 Mb
Flash	16 Mb

3.11 Environmental

Parameter	Description
Vibration	The terminal meets all its specifications during exposure to random vehicular vibration levels per SAE J1455, section 4.9.4.2 figures 6, 7, and 8, and MIL-STD-810G, section 514.6, figure 514.6C-1.
Mechanical Shock	The terminal meets all its specifications after exposure to positive and negative saw tooth shock pulses with peaks of 20 G and durations of 11 ms as specified in MIL-STD-810G, section 516.6, Procedure I, section 2.3.2c.
Thermal Shock	The terminal meets all of its specifications after a thermal shock test as detailed in SAE J1455, section 4.1.3.2
Drop Test	The terminal meets all its specifications after a handling drop test as specified in SAE J1455, section 4.11.3.1.
ESD	All electrical interfaces operate normally after being subjected to 8 kV ESD contact discharge per IEC 60945 and IEC 61000-4-2 human body model, level 3.
Altitude	The terminal meets all specifications after a nonoperating 12.2 km altitude test as detailed in SAE J1455, section 4.9.3, except with an ambient temperature of -40°C.
Humidity	The terminal meets all its specifications during exposure to 90% relative humidity at +85°C, per the test methodology of SAE J1455, section 4.2.3 (8 hour humidity cycle per figure 4a)
Ingress Protection	IP40 – The terminal (with and without backup battery) meets all of its specifications after a probe test as detailed in IEC 60529, section 13.1.
Ingress Protection with optional terminal shroud	IP65 – The terminal meets all of its specifications after a dust ingress test as detailed in IEC 60529, section 13.4. The terminal meets all of its specifications after a water spray test as detailed in IEC 60529, section 14.2.5
Drop Test	The terminal meets all its specifications after a handling drop test as specified in SAE J1455, section 4.11.3.1.

3.12 Sensors

3.12.1 Temperature Sensor

Parameter	Value
Range	-40 to +85°C
Accuracy	±2°C (-25 to +85°C) ±3°C (below -25°C)

3.12.2 Accelerometer

The terminal has a 3D accelerometer to detect motion in any axis.

In low power applications frequent GPS fixes can dominate the power budget. To reduce the power budget effects of GPS fixes, the accelerometer can be used to detect if motion has occurred.

The accelerometer thresholds to detect advanced features such as driver behavior monitoring vary depending on the environment. In order to avoid false detects, extensive testing is required to ensure that adequate acceleration magnitude thresholds and time durations are used.

Parameter	Condition	Min.	Typical	Max.	Units
Resolution	2 g	-	3.91	-	mg
Acceleration Range	software selectable	-	±2	-	g
		-	±4	-	g
		-	±8	-	g
		-	±16	-	g
Bandwidth Filtering	Selectable via digital interface	8	-	1000	Hz
Sensitivity	2 g	-	256	-	LSB/g
	4 g	-	128	-	LSB/g
	8 g	-	64	-	LSB/g
	16 g	-	32	-	LSB/g
Sensitivity Temperature Drift	3V supply	-	+0.02	-	%/K
Zero-g Offset	Ta = 25°C	-	+80	-	mg
Zero-g Offset Temperature Drift	3V supply	-	+1	-	mg/K
Wake up time	From low power or suspend modes	-	0.8	-	mS
Start Up Time	Power on reset	-	2	-	mS

3.13 GPRS - Cellular Module

Type	u-blox SARA-G3 series (SARA-G350)
GPRS Module	GSM 850/900/1800/1900 MHz
Output Power	Class 4: 33 dBm for EGSM850/900 Class 1: 30 dBm for GSM 1800/1900
Input Power	Peak current of 1.5 A typical. Module Supply Peak Current: peak of current consumption through the VCC pads during a GSM 1-slot transmit burst, with a matched antenna
Data Transfer	GPRS - Multislot Class 10 - Full PBCCH support - Coding Scheme 1 – 4 CSD - GSM maximum 9.6 kb/s
Antenna Detect	Output DC current pulse: 20 µA typical Output DC current pulse period 3.7 to 8.1 ms, 5.4 typical

3.14 HSPA - Cellular Module

Type	u-blox LISA-U2 series (LISA-U200)
HSPA Module	GSM/GPRS/EDGE Quad-band support: - GSM 850, E-GSM 900, DCS 1800, and PCS 1900 MHz HSPA Six-band support: - Band I (2100 MHz), Band II (1900 MHz), Band IV (1700 MHz), Band V (850 MHz), Band VI (800 MHz), Band VIII (900 MHz)
Output Power	GPRS Class 4: 33 dBm for GSM/E-GSM bands Class 1: 30 dBm for DCS/PCS bands Edge Class E2 (27 dBm) for GSM/E-GSM bands Class E2 (26 dBm) for DCS/PCS bands HSPA Class 3 (24 dBm) for WCDMA/HSDPA/HSUPA mode
Input Power	Peak currents of 1.8 A typical, 2 A maximum. Module supply peak current consumption: peak of current consumption through the VCC pins during a GSM 1-slot Tx burst at maximum Tx power, with a matched antenna
Data Transfer	GPRS - GPRS multislot class 334, coding scheme CS1-CS4, up to 107 kb/s DL, 85.6 kb/s UL - GPRS multislot class 125, coding scheme CS1-CS4, up to 85.6 kb/s DL/UL - EDGE multislot class 334, coding scheme MCS1-MCS9, up to 296 kb/s DL, 236.8 kb/s UL - EDGE multislot class 125, coding scheme MCS1-MCS9, up to 236.8 kb/s DL/UL HSPA - HSUPA category 6, up to 5.76 Mb/s UL - HSDPA category 8 up to 7.2 Mb/s DL - WCDMA PS data up to 384 kb/s DL/UL

3.15 Mechanical

3.15.1 Transceiver

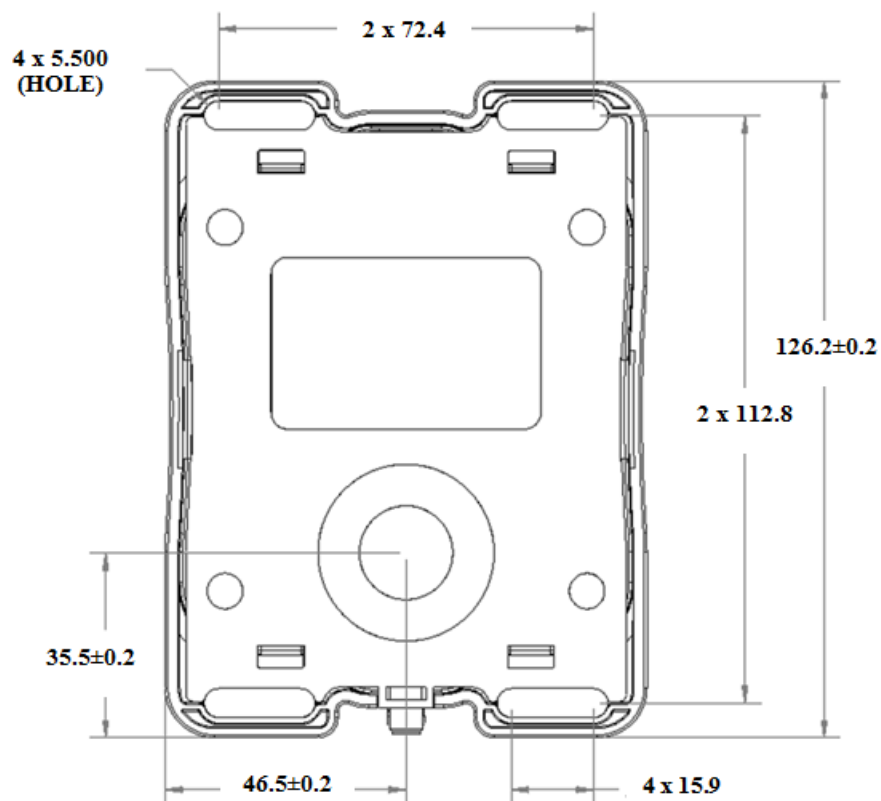
Parameter	Value
Dimensions	114.5 x 136 x 41 mm (LxWxH)
Mass	250 g
Enclosure Material	Lexan Plastic
Backup Battery Mass	80 g

3.15.2 Cellular Antenna

Parameter	Value
Mass	80 g including cable
Dimensions	116.0 x 21.5 x 4.3 mm (LxWxH)
Cable length	2.5 m
Mounting	Adhesive backing

3.15.3 Satellite Antenna

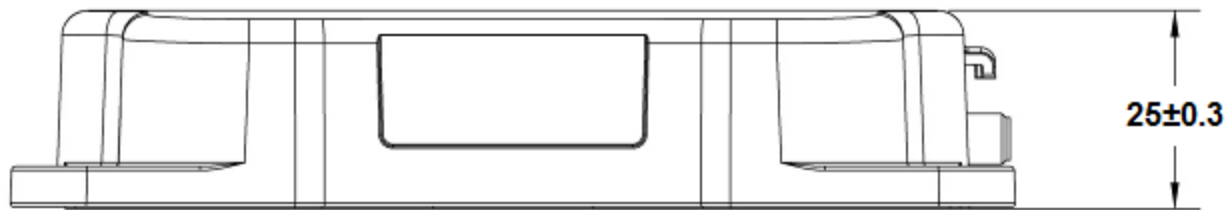
Figure 19: Satellite Antenna (standard and low elevation) - Bottom View (mm)



3.15.3.1 Standard Antenna

Parameter	Value
Mass	Side entry with 5 m cable: 360 g
Enclosure Material	Lexan EXL 9330
Color Code	8T9D076 (white)
Sealing Gasket Material	Santoprene®

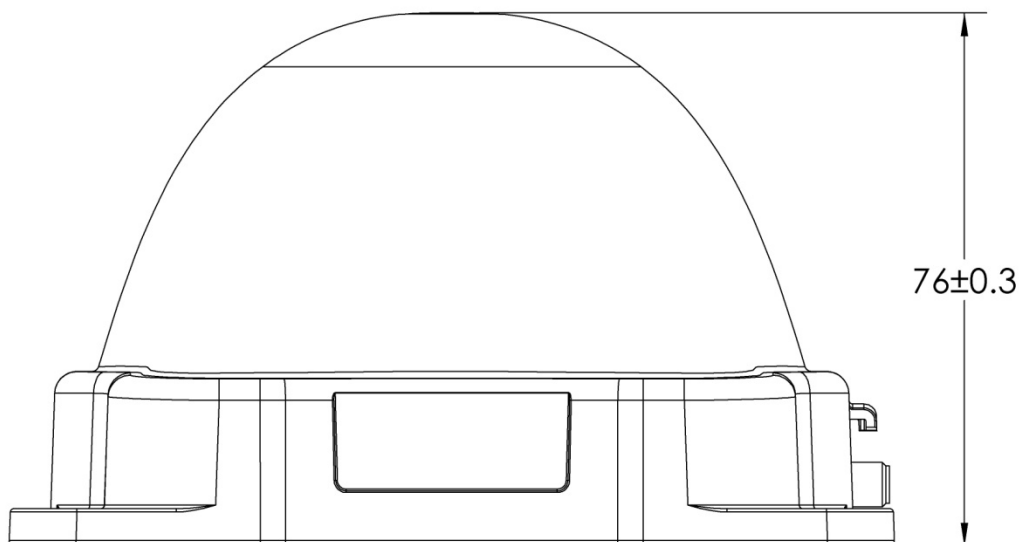
Figure 20: Standard Antenna Height Dimensions (mm)



3.15.3.2 Low Elevation Antenna

Parameter	Value
Mass	Side entry with 5 m cable: 365 g
Enclosure Material	Lexan EXL 9330
Color Code	8T9D076 (white)
Sealing Gasket Material	Santoprene®

Figure 21: Low Elevation Antenna Height Dimensions (mm)



3.15.4 GPS Antenna

GPS/GLONASS Patch Antenna

Parameter	Value
Mass	70 g (2.5 oz.) including cable
Dimensions	38 x 34 x 15.5 mm (LxWxH) (1.5 x 1.3 x 0.6 in.)
Cable length	5 m (16 ft.)
Connector	FAKRA, blue
Cable type	RG 174
Operating temperature	-40°C to +80°C (-40°F to +176°F)

Figure 22: GPS/GLONASS Patch Antenna - Top View

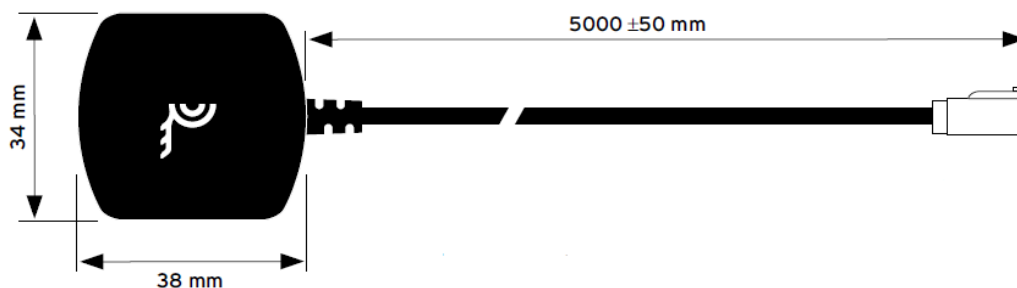
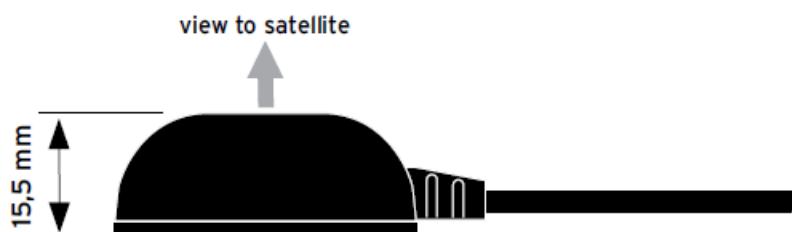


Figure 23: GPS/GLONASS Patch Antenna - Side View



GLONASS/GPS/Cellular Low Profile Antenna

Parameter	Value
Mass	340 g including cable (12 oz.)
Dimensions	112 x 80 x 21 mm (LxWxH) (4.9 x 3.1 x 0.8 in.)

Parameter	Value
Cable length	GLONASS/GPS Cellular 5 m (16 ft.) 5 m (16 ft.)
Connector	GLONASS/GPS Cellular FAKRA, blue FAKRA, bordeaux
Operating temperature	-40°C to +85°C (-40°F to +185°F)

Figure 24: GLONASS/GPS/Cellular Low Profile Antenna - Top View

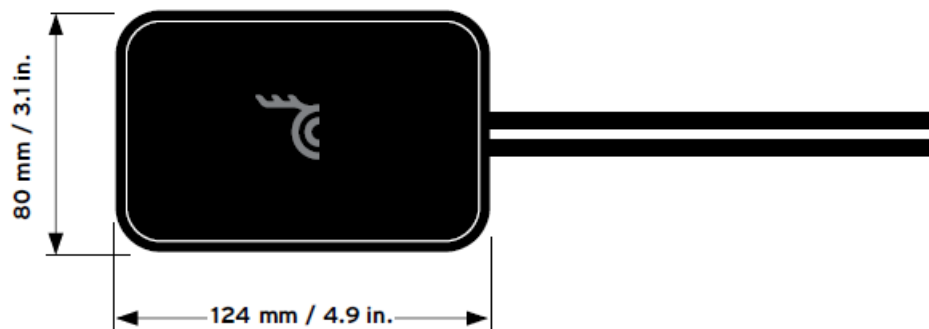
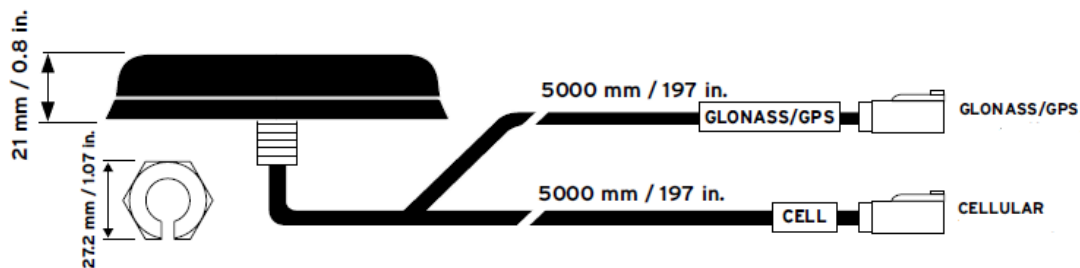


Figure 25: GLONASS/GPS/Cellular Low Profile Antenna - Side View



4 INSTALLATION

The following section contains recommended installation guidelines for the Solution Provider (SP). These recommendations should be incorporated into installation guidelines for end users.

CAUTION: The installer is responsible for following all safety guidelines during product installation. Refer to the [Preface](#) section for details.

The terminal uses very low power during transmission and therefore presents no radiation hazard during normal use, installation, testing, and troubleshooting.

4.1 Getting Started

Getting the terminals ready for operation requires doing the following:

1. Prepare for the installation (Section [4.2](#))
2. Determine a suitable mounting location (Section [4.3](#))
3. Mount the antennas (Section [4.4](#))
4. Route the main cable (Section [4.5](#))
5. Connect to power (Section [4.6](#))
6. Connect the cables (Section [4.7](#))
7. Register the terminal (Section [4.8](#))

4.2 Prepare for the Installation

Check that you have the items and tools listed below before installing the terminal.

4.2.1 Shipping Box Contents

Unpack the contents of the shipping box(es) and use the list below as a guide to check that you received the items you ordered.

- IDP-782 transceiver unit
- Power and I/O connector with crimp contacts
- Installation Guide
- Cellular antenna with FAKRA connector (satellite-cellular models)
- Satellite (standard or low elevation) antenna with FAKRA connector (satellite-cellular models)
- (separate order) GPS antenna and a cellular antenna or a GPS/cellular antenna (cellular models)
- SIM door screw (optional)
- Terminal shroud (optional)

4.2.2 Additional Materials

You might require some of the following materials to install a terminal. These materials do not ship with the terminal:

- SIM card (Refer to section 4.2.5 for SIM card procurement and installation)
- Cable ties (Qty. 4) mounting option for the transceiver
- Cable ties (Qty. 2) if using a terminal shroud
- Silicone adhesive if using a terminal shroud

If fastening the transceiver unit and the antenna to a mounting surface, you require:

- Qty. 4 - M4 stainless steel fasteners (for the terminal)
- Qty. 4 - M4 stainless steel fasteners (for the antenna)

4.2.3 Required Tools

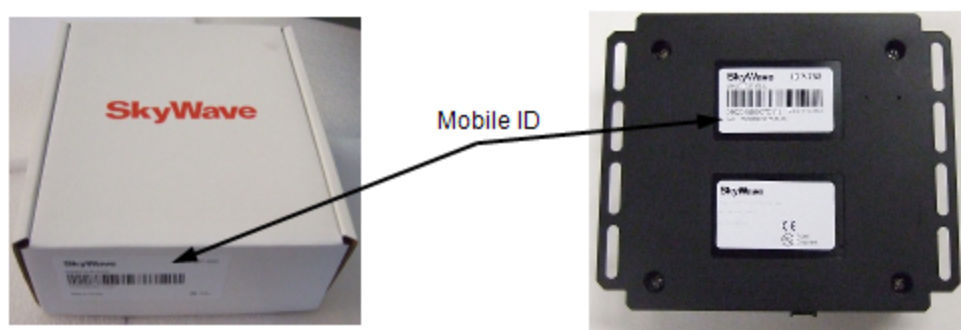
You may require the following tools to install a terminal:

- Drill and drill bit
- #1 and #2 Philips screwdriver

4.2.4 Terminal Identification

Each terminal has a unique mobile ID used by SkyWave to register it on the IsatData Pro network. This is a 15-digit alphanumeric identifier in the format NNNNNNNNSKYXXXX for satellite-cellular terminals or an International Mobile Station Equipment Identity (IMEI) 15-digit identifier for cellular terminals. The mobile ID is located on the bottom of the terminal and on the shipping box. The IMEI number is located near the mobile ID.

Figure 26: Mobile ID Location



1. Record the mobile ID in [APPENDIX B](#) for future reference.

Note: SkyWave might activate terminals on the network prior to or after shipping based on the Purchaser (SP) agreement.

2. Provide the IMEI 15-digit number to your cellular Service Provider if using the cellular capabilities.

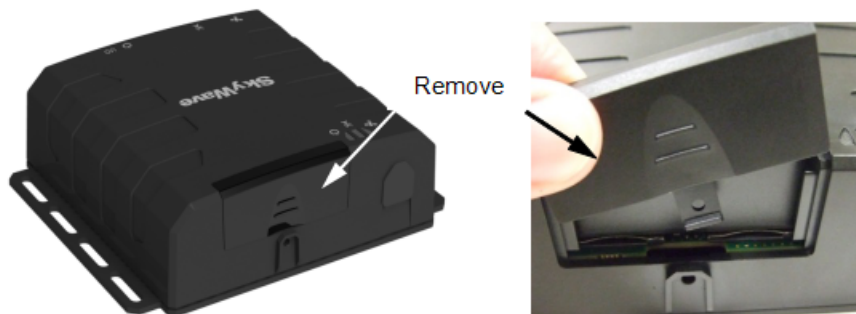
4.2.5 Install the SIM Card

The terminal can be supplied with or without an ORBCOMM SIM card and provides the option of installing a second, optional, SIM card. To use the cellular capabilities of this terminal you must install a SIM card. You may need to purchase a SIM card, activated for use with a cellular network, from a Service Provider serving the area where the terminal operate. The SIM card must support operation on 1.8 V or 3 V. The terminal does not support 5 V SIM cards. You might want to record the SIM card's ICCID number in [APPENDIX B](#).

CAUTION: Never insert or remove the SIM card if there is power to the terminal. Terminals with a backup battery might still be powered on if the power connector is disconnected from the terminal. In this case, it is recommended that the terminal be powered off locally using the shutdown command [\[T204\]](#) at the shell prompt, or by sending an over-the-air powerOff message (SIN 17, MIN 1) [\[T202\]](#). The terminal automatically wakes up when the power connector is reconnected.

1. Disconnect the power connector from the power source.
2. Remove the SIM card door ([Figure 27](#)). You might need to remove the screw ¹ (used for optional tamper resistance) if it is attached.

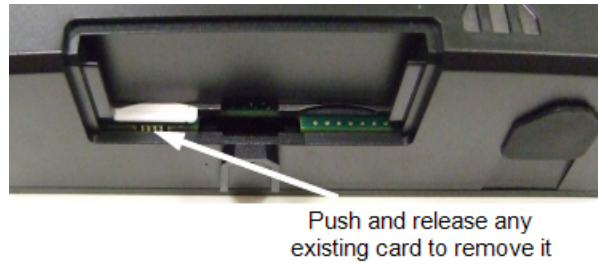
Figure 27: Remove SIM Card Door



3. Push and release any existing SIM card ([Figure 28](#)) to remove it from the SIM holder. The terminal has dual SIM card holds, with the slot on the left (when looking into the SIM door) being the main/primary slot.

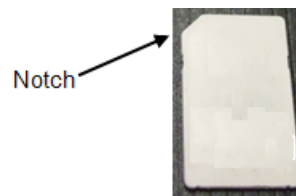
¹Phillips screw: M3x6 mm thread forming screw.

Figure 28: Remove an Existing SIM Card



4. Insert the SIM card, circuit down and the notch facing away from you and to the left (Figure 29).

Figure 29: Sample SIM Card Orientation



5. Push gently until the card is all the way in (Figure 30). Use the main SIM card holder slot (Figure 31) if using only a single SIM card.

Figure 30: SIM Card Installed

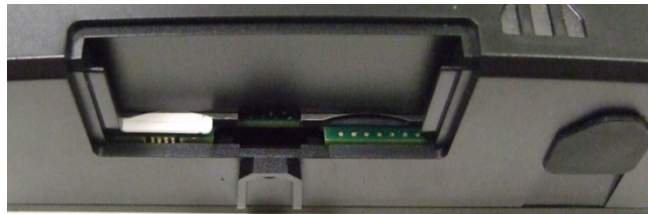


Figure 31: SIM Card Holders



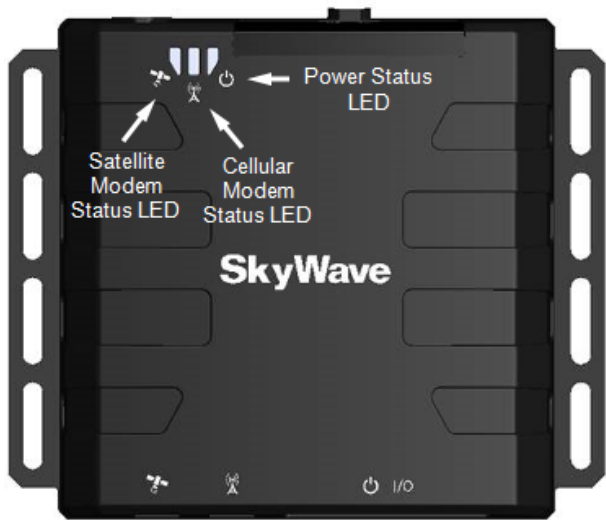
6. Repeat steps 3 and 5 if a second SIM card is required.
7. Replace the SIM card door.

- 8. Reconnect any cables you removed earlier and connect to external power.
- 9. Contact your cellular data solution provider to ensure your SIM cards are operational.

4.2.5.1 LED Location and Operation

The terminal has three visible LEDs (Figure 32) to indicate status.

Figure 32: LED Location



- Terminal Power - Red
Indicates that the terminal has external power. This LED is on continuously (solid red) when power is applied.
- Satellite Status - Yellow
Indicate satellite communications status as follows:

Figure 33 and Figure 34 show the power on LED flashing sequence.

Figure 33: Power On Sequence

Second 0	1	2	3	4	Meaning
					Power on: 1s/5s

Figure 34: Terminal Booting Sequence

Second 5	Second 6...	Sec 7...16	Meaning
			Terminal Booting 12 Flashes @200ms/1s

When the terminal firmware is up and running along with the Lua Services Framework, the LSF or a user application can be set to control the LED. The `ledControl` property [T202] of the system service is used for this purpose.

When the LED is under the control of the LSF, the flashing patterns shown in Table 7 are used to indicate the current state of the modem.

Table 7: Modem State LED Flashing Patterns

Modem State	Flashing Pattern	Class-Subclass ¹
Power on	As per above	-
Waiting for GPS fix	3 flashes every 30 seconds	Class 3, Subclass 1, Field 19, Flags = Need GPS Fix
Registration in progress	2 flashes every 30 seconds	Occurs when Need GPS Fix flag is cleared (Class 3, Subclass 1, Field 19)
Connection online	1 flash every 30 seconds	Occurs when registered flag is set and at least 1 minute of metrics are available (Class 3, Subclass 17) and the percentage of successful receives is > 75%
Connection offline	4 flashes every 30 seconds	Occurs when the percentage of successful receives (Class 3, Subclass 17) falls below 25% and/or Satellite Control State (Class 3, Subclass 1, and Field 22) is set to 3.

- Cellular Status - Green

Flashing sequences controlled by the cellular modem to indicate cellular communications status as follows:

- Continuously off - no network coverage or not registered
- GPRS cyclic output - on for 100 ms, off for 2 s (Registered with the home network)
- GPRS cyclic Output - on for 100 ms, off for 100 ms, on for 100 ms, off for 2 s (Registered with the visitor network - roaming)
- HSPA cyclic output - on for 50 ms, off for 50 ms, on for 50 ms, off for 2 s (Registered with the home network)
- HSPA cyclic Output - on for 50 ms, off for 50 ms, on for 50 ms, off for 100 ms (Registered with the visitor network - roaming)
- Continuously on - voice or data call enabled

4.2.5.2 LED User Control

After power on and ignition, you have the ability to control the LED by configuring the LED Control property to 1. The firmware supports a function call (`ledControl`) that defines this operation. You can specify on time (msec), period (msec), and number of repetitions (0 - 65535 where 0 signifies repeat forever).

This function allows a user service to flash the LED over a short period of time. The user service is responsible for repeating this short pattern over a longer period. As an example, using the connection offline case from the previous section, the LED control API allows a user service to flash the LED four times; the service is responsible for setting a timer allowing it to restart this pattern every 30 seconds [T202].

¹Refer to [T203] for details.

4.2.6 Activate the Terminal

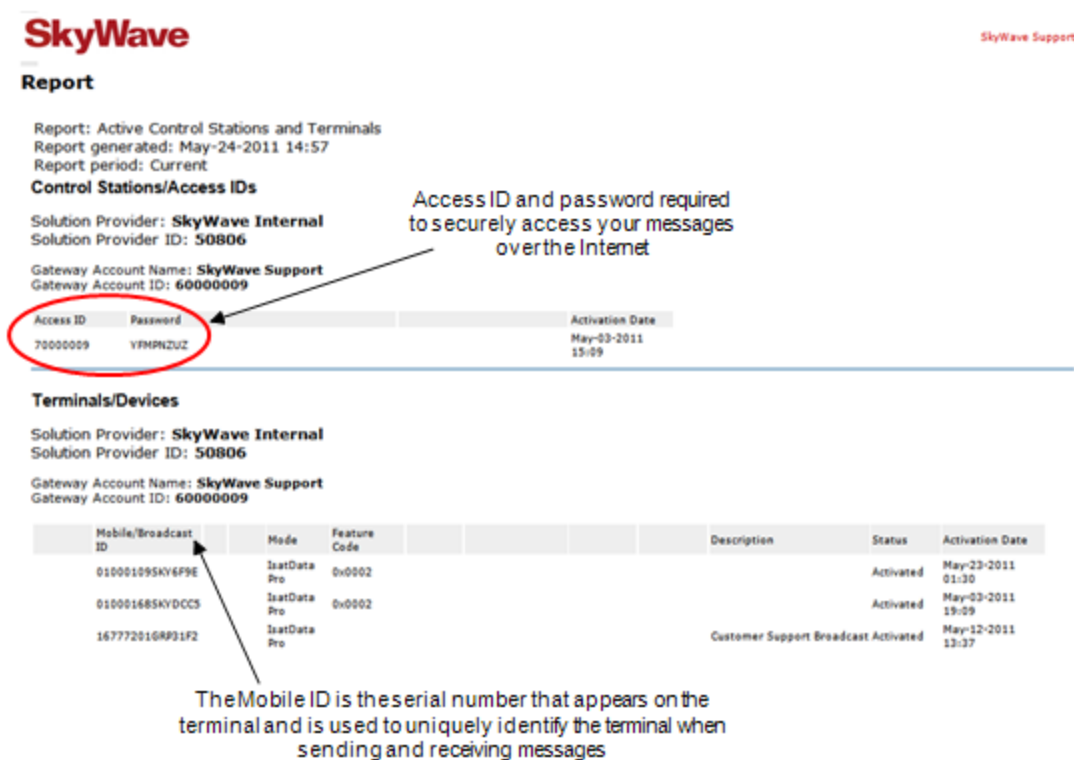
To send or receive any message you must activate the terminal on the IsatData Pro network.

1. Log in to <https://support.skywave.com>, type your user name (registered email) and password, and then click **GO**. Contact SkyWave Customer Support at support@skywave.com if you do not have access to this website.
2. Click the Manage Mobiles icon. The Manage Terminals page appears.
3. Click the button next to *IsatData Pro Terminal Activations*, and click **NEXT**.

Figure 35: Manage Terminals

4. Select your Gateway Account from the drop-down list.
5. Type the terminal's mobile ID in the appropriate field, and click **ADD**.
If you have multiple mobile IDs, you can use the **UPLOAD FILE** option.
6. Verify that at least one contact email address is shown in the Notification section on the data entry page.
Keep a copy ([APPENDIX B](#)) of the terminal's mobile ID along with the server access ID and password you receive in the activation report email ([Figure 36](#)) from SkyWave Customer Support. You need these to communicate remotely with the terminal.
7. Click **SUBMIT**.

Figure 36: Sample Activation Report



4.3 Determine a Suitable Mounting Location

Before installing the terminal, consider the important guidelines provided below.

CAUTION: Most users install the terminals in a vehicle. It is very important for installers to install the terminals in a safe and secure way to avoid danger or damage to persons or property.

CAUTION: Do not mount or operate near flammable gases or fumes.

- Mount indoors, inside a vehicle, or in an area protected from environmental elements.
- Fasten the terminal securely so that it is not loose and does not move easily.
- Mount the terminal on a surface that does not get hotter than the maximum operating temperature. If the surface might get hotter, mount the terminal with a thermal barrier between it and the mounting surface.
- Do not mount the terminal close to other electrical equipment due to possible radiated and/or conducted electromagnetic interference.
- Do not mount the terminal where water might build-up or collect. The terminal is not waterproof. Choose a location where water moves away from the terminal.

- Check that the terminal's cable reaches the power source before you drill any mounting holes.
- Do not mount the terminal close to radar or other communications antennas. Use the following guidelines:
 - > 1 m from VHF/UHF antenna
 - > 3 m from loop antenna
 - > 4 m from MF/HF antenna
 - > 5 m from other satellite antennas
 - Not within a radar beam

- Mount the terminal on a flat surface that is either parallel or perpendicular to the ground, for proper operation of the internal accelerometer. Record the position of the top surface (SkyWave logo) and connector face relative to the ground and the front or side of the vehicle as if you were sitting in the driver's seat. This information is used later to setup the accelerometer service.

Example 1: If the transceiver is mounted horizontally under the vehicle dash such that the white SkyWave logo is facing down and the cables are exiting towards the driver, then record "Top facing down and connectors facing back".

Example 2: If the transceiver is mounted vertically on the side wall of a vehicle with the cables exiting in an upward direction, then record "top facing right side and connectors facing up".

Refer to [\[T202\]](#) for more details.

When you have selected the mounting location, mount the terminal.

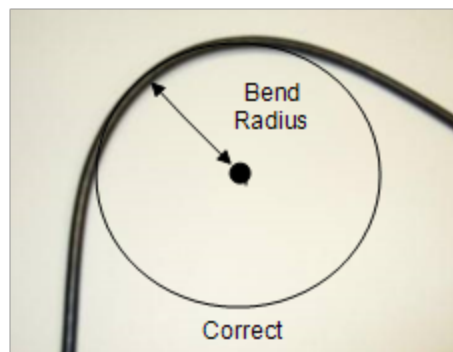
4.3.1 Standard Antenna Mounting Guidelines

CAUTION: Mount the antenna at least 25 cm away from humans.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. Secure the cable no more than 15 cm from the antenna enclosure and at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the connector. Damage to the connector interface or cable may otherwise result and lead to hardware failure.

- Do not drill any holes before checking that you have room for the bend radius of the antenna cable. For reliable operation, do not go below a bend radius of 1.5 cm. Measure the bend radius of the cable as shown in [Figure 37](#).

Figure 37: Antenna Cable Bend Radius



- Mount on a surface that is free from dirt, grime, water and grease to avoid damaging the mounting surface or the vehicle's paint.
- Mount so that the cable end faces the rear of the vehicle.
- For fixed installations ensure that the satellite antenna is pointing towards the equator, facing south if in the Northern Hemisphere and facing north if in the Southern Hemisphere, and its line-of-sight to the sky (satellite) is clear of obstructions.
- For a mobile installation, mount the antenna at the highest point on the vehicle or vessel where it has a clear view of the sky (satellite) in all directions.

4.3.2 Cellular Antenna Mounting Guidelines

- Mount indoors, for example, on the inside of a vehicle window, near the transceiver unit.
- Mount on a flat surface for maximum adhesion.
- Mount at least 20 mm from metal objects.
- Mount the antenna at least 1 m away from the satellite antenna.

4.3.3 GPS Antenna Mounting Guidelines

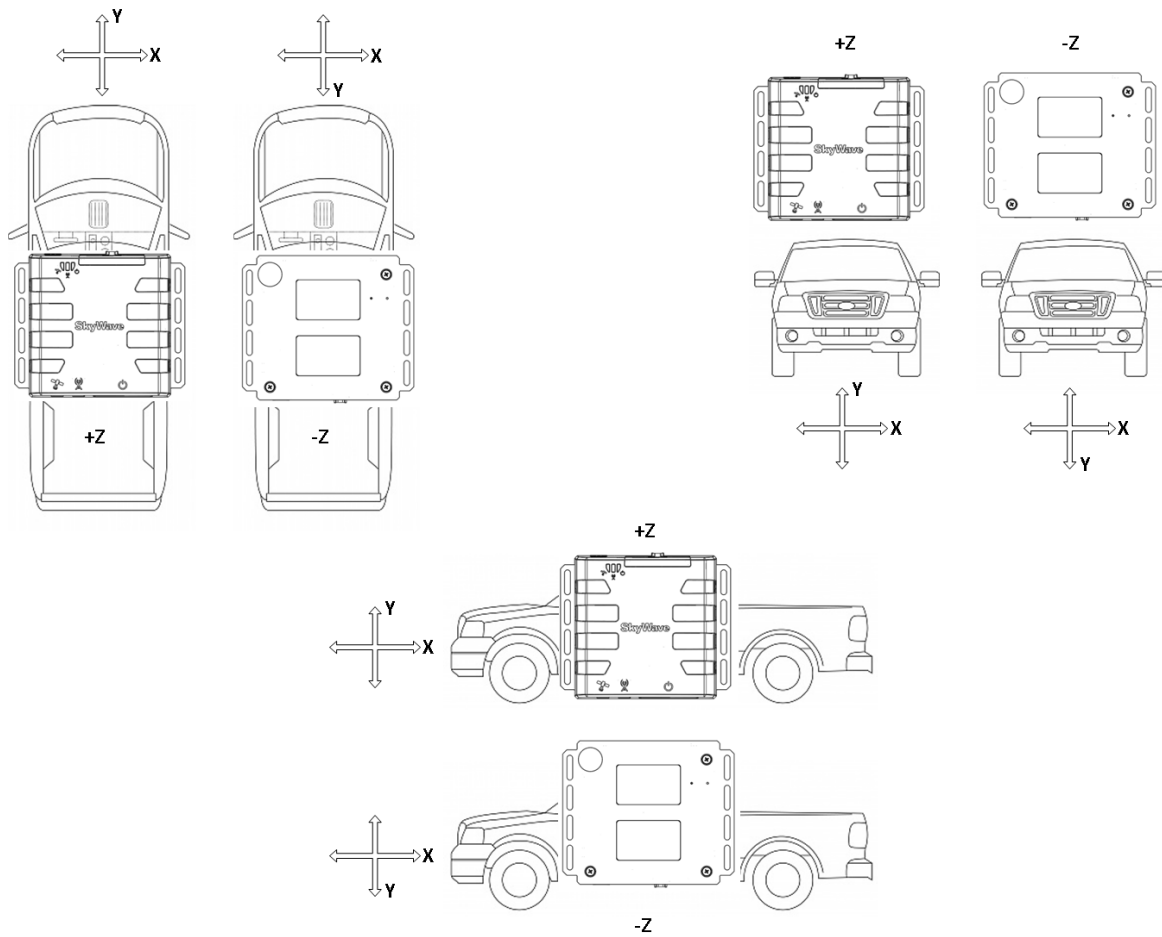
- Mount on a flat vehicle roof mounting surface.
- Mount the antenna so that there is a tight seal between the antenna and vehicle door.
- Do not twist, bend or pull the cable across sharp edges.

4.3.4 Determine Terminal Orientation for Accelerometer Use

Remember to mount the terminal on a flat surface, which is either parallel or perpendicular to the ground, for proper operation of the internal accelerometer.

Mount the terminal in one of the configurations shown below. Refer to [\[T202\]](#) for further details.

Figure 38: Accelerometer and Terminal Orientation



4.4 Mount the Antennas

The IDP-782 satellite-cellular terminals operate with a satellite antenna and/or a cellular antenna (section 4.4.3). Two mounting options are available for the satellite antenna: screw mount (section 4.4.1) or adhesive mount (section 4.4.2).

The IDP-782 cellular terminals operate with a cellular antenna and a GPS/GLONASS patch antenna (sections 4.4.3 and 4.4.4), or a GLONASS/GPS/Cellular low profile antenna (section 4.4.4).

4.4.1 Screw Mount

If mounting an antenna the following tools and materials are required:

- Drill
- M4 hardware
- Outdoor waterproof adhesive sealant (silicone)

To mount the antenna, follow the steps below.

1. Find a location for the antenna following the guidelines provided in section 4.3.1.
2. Use the mounting template (APPENDIX C) or the antenna as a template, to mark the location of the mounting holes.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. Secure the cable no more than 15 cm from the antenna enclosure and at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the terminal connector. Damage to the terminal connector interface or cable may result in hardware failure

3. Drill the holes using a drill.
4. Apply waterproof sealing compound, such as RTV silicone, around the drill holes so water does not leak into the asset.

CAUTION: Do not block the air vent features (2 places) shown in Figure 39.

5. Secure the antenna in place with self-tapping screws or machine screws and nuts depending on access to the mounting surface.

4.4.2 Adhesive Mount

The antenna can be mounted using adhesive or a high strength outdoor grade silicone when mounting holes are not an option in the mounting surface.

Refer to the adhesive manufacturer's recommendations for application temperature, application conditions, compatible bonding materials, and minimum curing times when working with an adhesive. Failure to follow the manufacturer's guidelines could result in the antenna separating from the mounting surface.

4.4.2.1 Silicone Side Connector Mount

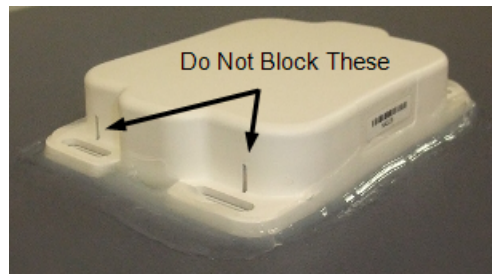
The following tools and materials are required if mounting a side cabled antenna with silicone.

- Outdoor rated silicone adhesive sealant (GE RTV 108)
- Isopropyl alcohol or an equivalent

To mount the antenna:

1. Find a location for the antenna following the guidelines provided in section 4.3.1.
2. Clean the asset surface with isopropyl alcohol or an equivalent product that does not leave a residue.
3. Apply a generous bead of silicone around the entire perimeter of the antenna enclosure. The two vertical slots shown in Figure 39 are vent features and must not be filled with silicone.

Figure 39: Apply Silicone to Antenna



4. Place some weight on the antenna while the silicone cures.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. Secure the cable no more than 15 cm from the antenna enclosure and at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the terminal connector. Damage to the terminal connector interface or cable might result in hardware failure.

4.4.2.2 Silicone Bottom Connector Mount

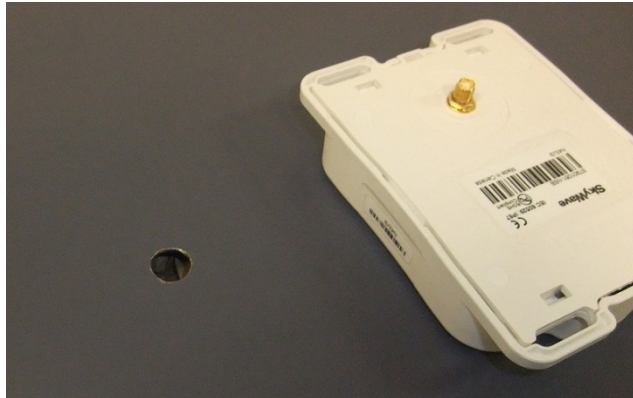
The following tools and materials are required if mounting a bottom connector antenna with silicone.

- Outdoor rated silicone adhesive sealant (GE RTV 108)
- 5/16" or 8 mm wrench
- Drill
- 12 to 19 mm drill bit for a straight SMA cable connector
- 29 mm minimum drill bit (hole saw) for right angle SMA cable connector
- Isopropyl alcohol or an equivalent

To mount the antenna:

1. Find a location for the antenna following the guidelines provided in Section [4.3.1](#).
2. Drill a 12 to 19 mm hole in the asset surface ([Figure 40](#)) when using a straight SMA cable connector. For a right angle SMA cable connector, refer to step 7.

Figure 40: Drill Mounting Hole



3. Clean the asset surface with isopropyl alcohol or an equivalent product that does not leave a residue.
4. Insert the cable through the hole, from inside the asset, and thread the cable connector onto the antenna. Torque the connector finger tight plus a 45 degree rotation using an 8 mm wrench.

Figure 41: Attach Cable to Terminal



5. Apply silicone around the hole in the asset and to the bottom surface of the antenna.

Figure 42: Apply Silicone to Hole in Asset



6. Lower the antenna onto the mounting surface.

The straight SMA cable connector can be lowered straight down onto the mounting surface.

The right angle SMA cable connector, not shown, must be pivoted down onto the mounting surface to fit the right angle cable and connector through a larger clearance hole. Additional care is required with this installation to ensure the right angle cable and connector does not smear the silicone around the clearance hole when attempting to pivot the antenna into position.

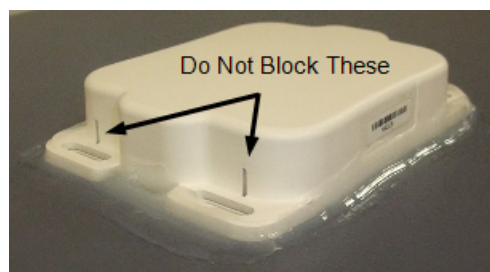
7. Apply a generous bead of silicone around the entire perimeter of the antenna enclosure. The two vertical slots shown in [Figure 43](#) are vent features and must not be filled with silicone.

Note: If the large clearance hole required for the right angle SMA cable connector is considered too large, there is the option to use a smaller clearance hole in the mounting surface and install the cable from inside the asset after the antenna has been adhered with silicone.

In this case, first confirm there is enough room from inside the asset to thread the SMA cable connector by hand and clearance for the wrench to apply the final torque.

Also note that the silicone used to mount the antenna must be fully cured before the cable can be installed from the inside otherwise the seal and mounting are compromised.

Figure 43: Apply Silicone to Terminal



8. Place some weight on the antenna while the silicone cures.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. Secure the cable no more than 15 cm from the antenna enclosure and at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the terminal connector. Damage to the terminal connector interface or cable might result in hardware failure.

4.4.3 Cellular Antenna

1. Clean the antenna mounting surface with isopropyl alcohol to remove any dirt or grime. Make sure the surface is dry before applying the antenna's adhesive strip.
2. Remove the adhesive strip from the cellular antenna.
3. Mount the cellular antenna on the inside of the window. [Figure 44](#) shows mounting examples on an automobile.

Figure 44: Sample Cellular Mounting Locations – automobile example



4. Secure the cellular antenna cable in place.

4.4.4 GPS Antenna

If you are installing an IDP-782 cellular model, mount the appropriate GPS antenna following the instructions below.

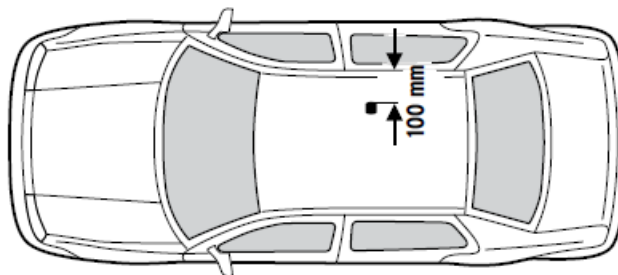
GPS/GLONASS Patch Antenna

Figure 45: GPS/GLONASS Patch Antenna



1. Clean the antenna mounting surface with isopropyl alcohol to remove any dirt or grime. Make sure the surface is dry before applying the antenna's adhesive strip.
2. Remove the adhesive strip from the antenna.
3. Mount the antenna on the roof of a vehicle. [Figure 46](#) shows the mounting example on an automobile.

Figure 46: GPS/GLONASS Patch Antenna Automobile Example



4. Connect the FAKRA connector end (blue) of the antenna cable to the mating end on the terminal by pushing until you hear a click.

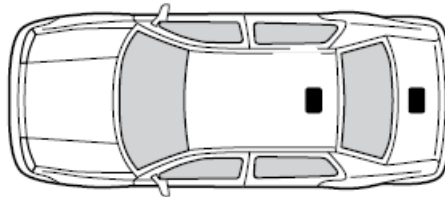
GLONASS/GPS/Cellular Low Profile Antenna

Figure 47: GLONASS/GPS/Cellular Low Profile Antenna



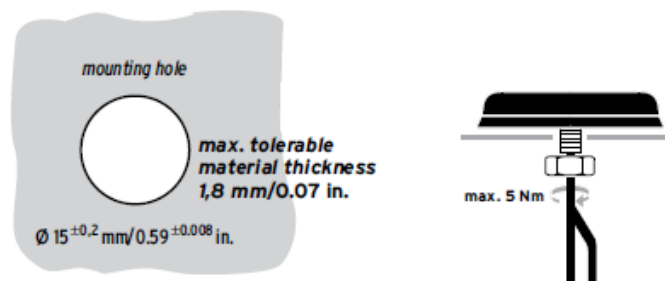
1. Review the recommended mounting locations for the low profile antenna ([Figure 48](#)).

Figure 48: GLONASS/GPS/Cellular Low Profile Antenna Automobile Example



2. Drill a 0.15 mm (0.59 in.) hole in the vehicle for the threaded connector on the base of the antenna ([Figure 49](#)).

Figure 49: GLONASS/GPS/Cellular Low Profile Antenna Mounting Hole (not to scale)



3. Unscrew and remove the mounting nut from the threaded connector.

Figure 50: Threaded Connector and Nut



4. Push the antenna cables and threaded connector through the hole.
5. Screw the mounting nut onto the threaded connector and torque to 5 N-m.
6. Apply silicon lubricant to the hole if required to ensure a watertight seal.
7. Connect the GPS/GLONASS FAKRA connector (blue) to the mating connector on the terminal by pushing until you hear a click
8. Connect the cellular FAKRA connector (bordeaux-violet) to the mating connector on the terminal by pushing until you hear a click.

4.5 Route the Main Cable

Consider the following guidelines before routing the cable assembly.

CAUTION: Ensure the power cable is not pinched, kinked or worn down by any objects or moving parts such as the door hinges. It is very important to secure the cable at many points along its path.

CAUTION: Prior to working on any cabling, ensure that the terminal is powered off and unable to start while work is in progress.

- Do not route the cable near the engine if routing through the engine compartment. This location subjects the cable to extreme heat.
- Keep the cable away from hot surfaces such as exhaust pipes because this may damage the cable.
- Do not run the cable over sharp or jagged edges.
- Place the cable in recesses and channels, whenever possible, to prevent potential damage or wear by foot traffic.

Note: Remember to leave enough cable slack near the terminal for strain relief so as not to introduce any additional force on the connector. SkyWave recommends securing the cables during installation.

Figure 51: Sample Cable Placement in a Vehicle Cab



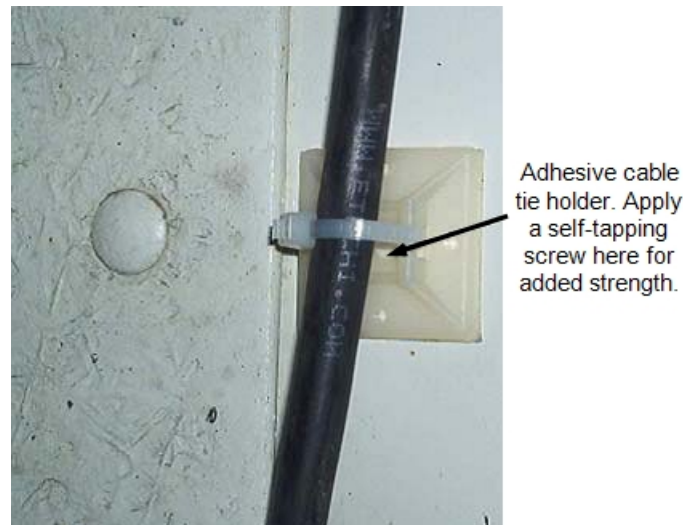
4.5.1 Protect the Cables and Cable Connectors

CAUTION: Cable management and connector strain relief must be incorporated in the installation. SkyWave highly recommends securing the cable at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the connector. Damage to the connector interface or cable may otherwise result and lead to hardware failure.

To protect the terminal's connector interface, follow the guidelines below:

- Apply tape around the cable ends to help in routing the cable.
- Secure the cable such that it does not pull on the connector or strain the terminal connector.
- Tie the cable down so that the weight of a vibrating cable does not stress or strain the connection.
- Tie the cable down using cable ties and tie holders (Figure 52) at 300 to 600 mm intervals along the cable route to prevent chafing, wear, or strain.
- Secure the cable tie holder with a self-tapping screw (Figure 52) for best holder retention.

Figure 52: Cable Management



4.6 Connect to Power

CAUTION: Apply power only after making ground connection.

CAUTION: Before applying power to the terminal, make sure that your power supply's rated voltage follows the recommended values specified in [Section 2 Compliance](#).

CAUTION: The installer is responsible for complying with local electrical codes.

Note: SkyWave recommends that if possible you wait until the terminal is unblocked (has a full view of the sky) before powering on the terminal.

1. Locate the main power input and the ground (GND) wires using the connector pin out table ([Table 4](#)).

You can connect the terminal ground to ground in the fuse panel or to chassis ground. To do this, secure the ground wire on the cable assembly to a piece of metal electrically connected to the vehicle chassis using a sheet metal screw.

2. Ensure that the main power input and ground wires reach the vehicle fuse panel.

If the wires are not long enough, splice similar gauge wires to the main power input and ground wires so that they reach the fuse panel. Cover any splices with adhesive lined heat shrink.

3. Correctly mate connectors before applying power.
4. Connect the ground wire to the grounding point selected in an earlier step. Check that the polarity is correct and the voltage source is as specified in [Section 3](#).

5. Connect the main power input wire to the unswitched vehicle power source within the fuse panel.
6. Loop and secure any excess cabling.

If your application requires extended cable lengths, it is necessary to calculate the cable voltage drop to determine if the terminal is receiving at least 9 V (with 1.7 A draw). Large cable voltage drops might adversely affect terminal operation.

4.6.1 CAN bus Connection

It is recommended that you do not connect directly to the CAN bus wires on the installation vehicle. Cutting or damaging those wires might void the warranty on the vehicle.

To connect the terminal CAN bus serial interface to the CAN bus of the vehicle, SkyWave recommends using a J1962 (OBDII) connector or an induction sensor, which allows the terminals' CAN bus interface to read information from the CAN bus without damaging the vehicle wires. An example of this type of sensor is the CANGOclick. Refer to <http://www.cango.ro/index.php/en/product/10/cangoclick.html> for more information on the CANGOclick.

4.7 Connect the Cables and Mount the Terminal

Note: The Solution Provider is responsible for providing mounting instructions if the mounting is to be done using tools or configurations that are different from the ones described in this document.

Note: The Installer is responsible for complying with local electrical codes.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. SkyWave highly recommends securing the cable at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the connector. Damage to the connector interface or cable might result and lead to hardware failure.

4.7.1 Terminals without a Terminal Shroud

1. Connect the antenna (Figure 53) to the terminal by pushing until you hear a click.
 - For satellite-cellular terminals, connect the FAKRA end of the cable to the curly yellow connector on the terminal.
 - For cellular terminals, connect the FAKRA end of the cable to the blue connector on the terminal.

Figure 53: Connect the Remote Antenna (satellite antenna shown)



2. Connect the cellular antenna (Figure 54) to the violet FAKRA connector on the terminal by pushing until you hear a click.

Figure 54: Connect the Cellular Antenna



3. Connect the power and I/O cable to the terminal by pushing until you hear a click.

Figure 55: Connect the I/O Power Cable



4. Mount the terminal using cable ties, or washers and screws. You can use cable ties as long as the terminal remains flat and is either parallel or perpendicular to the ground, for proper operation of the internal accelerometer. Otherwise, fasten the terminal to a rigid surface using washers and screws.

Use the slotted holes to mark and drill pilot holes based on the type of screws.

Figure 56: Mounting Flange



4.7.2 Terminals with a Terminal Shroud

In order for the transceiver to be IP65 compliant, the terminal shroud must be assembled as per the following instructions. If you are not using a terminal shroud, continue to section [4.8](#)

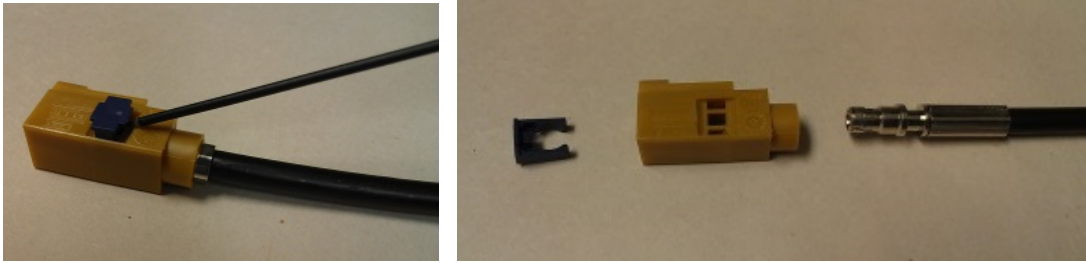
1. Cut off the tip of the RF cable portion of the terminal shroud.

Figure 57: Cut Tip of RF Cable Portion



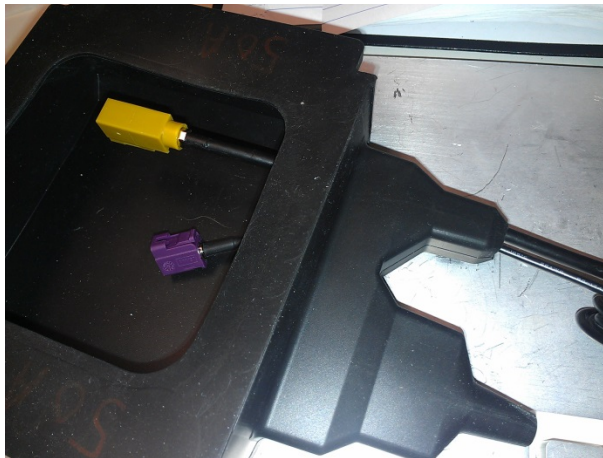
2. Route the cellular antenna cable through the RF cable opening in the terminal shroud.
3. Disassemble the FAKRA connector and clip from the satellite or GPS antenna [Figure 58](#).

Figure 58: Disassemble the FAKRA Connector (satellite connector shown)



4. Route the satellite or GPS antenna cable through the RF cable opening in the terminal shroud (Figure 59) and then reattach the FAKRA connector and clip.

Figure 59: RF Cable through the Terminal Shroud Opening

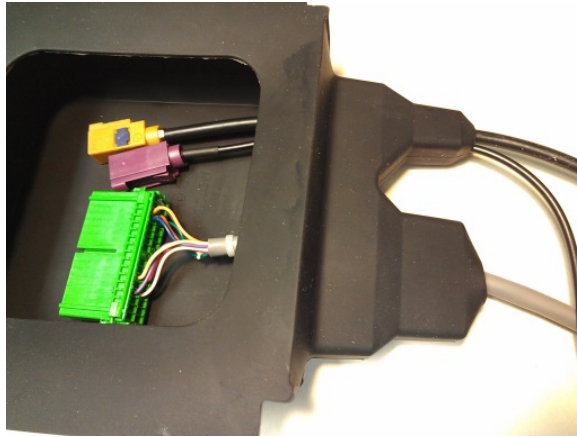


5. Cut the smallest hole possible to pass the green I/O connector through the I/O cable portion of the terminal shroud.

Note: If the other end of the cable is smaller than the green I/O connector, SkyWave recommends passing the smaller end through the hole from inside to outside to limit the size of the hole required. The smaller the hole, the easier it is to seal the opening.

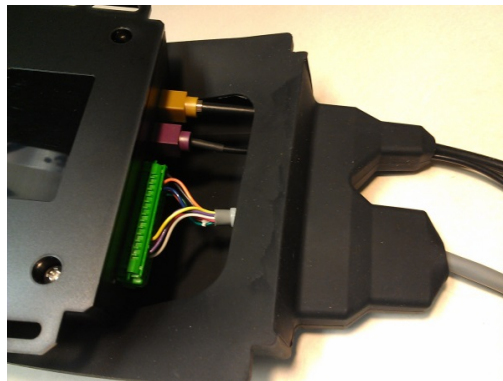
6. Route the green I/O connector through the I/O cable portion of the terminal shroud.

Figure 60: I/O Cable through the Terminal Shroud Opening



7. Connect each of the connectors to the terminal by pushing until you hear a click.

Figure 61: Connect the Connectors to the Terminal



8. Insert the terminal in the terminal shroud as shown in [Figure 62](#). Ensure the shroud sits properly over the terminal.

Figure 62: Terminal in Shroud



9. Apply outdoor grade silicone, for maximum protection, around the perimeter of the terminal shroud opening, over the small reset hole, and around any mounting hardware (Figure 63). Cleaning surfaces with isopropyl alcohol ensures proper adhesion of the silicone.

If using the terminal reset button, remember to reseal the hole with silicone after use.

Figure 63: Apply Silicone

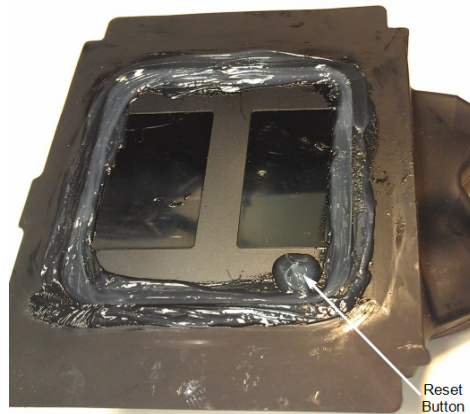
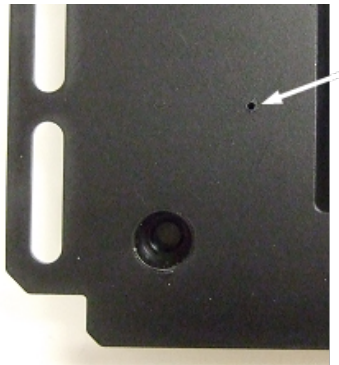


Figure 64: Reset Button



10. Inject outdoor grade silicone inside the cable openings of the terminal shroud and massage the terminal shroud to remove any bubbles.
11. Attach a cable tie around each opening and tighten around the cables ([Figure 65](#)).
12. Apply additional outdoor grade silicone around each of the cable entry points ([Figure 65](#)).

Figure 65: Cable Ties and Silicone



13. If mounting the terminal with mounting hardware, pierce holes in the terminal shroud using the mounting slot indicators on the shroud ([Figure 66](#)).

Figure 66: Mounting Slot Indicators



14. If mounting the terminal with cable ties, or washers and screws, insert the mounting hardware through the pierced holes and then mount the terminal. You can use cable ties as long as the terminal remains flat and is either parallel or perpendicular to the ground, for proper operation of the internal accelerometer. Otherwise, fasten the terminal to a rigid surface using washers and screws. Apply additional outdoor grade silicone on top of the mounting hardware (Figure 67).

Figure 67: Apply Silicone to Hardware



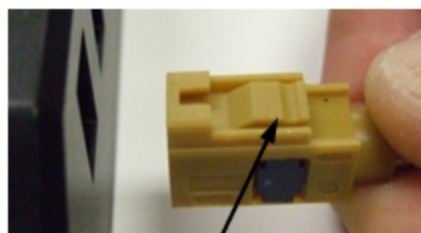
15. Allow the silicone to dry for 24 hours.

4.7.3 Disconnect the FAKRA Connector

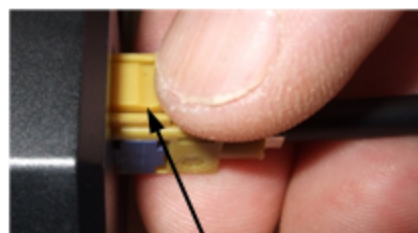
If you need to disconnect the FAKRA connector follow the steps below.

1. Hold the FAKRA connector between your thumb and finger as shown in Figure 68.
2. Press down firmly, with your thumb, on the raised section of the FAKRA thumb release (Figure 68) and pull the FAKRA connector away from the transceiver unit while firmly holding down the thumb release (Figure 68). You might need to hold the transceiver unit while removing the connector.

Figure 68: Disconnecting the FAKRA Connector from the Transceiver Unit



Raised section of FAKRA
thumb release



Press down and pull to remove the
connector from the transceiver

4.8 Register the Terminal

Note: The terminals must complete registration to operate.

When you apply power, the terminal goes into satellite search mode to acquire the SkyWave IsatData Pro network. This activity may take a few minutes to complete. If you experience difficulties, refer to Section 5 for troubleshooting suggestions.

When the terminal synchronizes itself with the network, it sends a registration message to the SkyWave IsatData Pro network.

Note: The terminal does not register until it has a clear line-of-sight to the satellite.

The SkyWave IsatData Pro network records the registration message and forwards the registration message to your application.

The SkyWave IsatData Pro network sends an acknowledgment message over the satellite to the terminal. The terminal is now available to send and receive messages.

4.9 Application Programming Interface

Refer to [\[T202\]](#) for programming information for the terminal.

4.10 Cleaning Instructions

The transceiver and cellular antenna are for indoor use, and under normal circumstance should not require any cleaning. However, if cleaning is required, wipe with a damp cloth using a mild detergent. Do not immerse in water, and ensure that water does not enter through the connector openings.

The satellite and cellular antennas can be steam cleaned, or pressure washed with mild soap or detergent.

5 TROUBLESHOOTING THE TERMINAL

The following section contains troubleshooting information for the Solution Provider (SP) to provide to end users.

5.1 Terminal Does Not Register or Report

On application of external power the terminal should register with the satellite and send a report.

Note: The terminal must be visible to the satellite to register with the network and registration normally takes a few minutes.

If the terminal fails to register or report:

- Ensure that the antenna has a clear line-of-sight to the satellite. The terminal must operate outdoors and be unobstructed by buildings, forest canopy, and rock cuts.
- Check that no objects or debris are on the antenna and blocking transmission.
- Verify with your SP that the terminal is assigned to your account and registered (that it is sending and receiving) and that the SkyWave IsatData Pro network is operating properly.
- Check the condition of the power cable. The IDP-782 features a red power LED to indicate power is available.

Replace the terminal if the above checks fail to uncover the problem.

APPENDIX A ORDER PART NUMBERS

Transceivers and antennas come with various options and cable lengths. Contact your Account Executive for additional details.

Table 8: Order Part Numbers

Transceiver (requires remote antenna for operation)	
IDP-782 satellite-cellular GPRS transceiver with cellular antenna	SM201329-GNU
IDP-782 satellite-cellular HSPA /GPRS transceiver with cellular antenna	SM201329-HNU
IDP-782 satellite-cellular GPRS transceiver with backup battery and cellular antenna	SM201329-GBU
IDP-782 satellite-cellular HSPA/GPRS transceiver with backup battery and cellular antenna	SM201329-HBU
IDP-782 cellular HSPA/GPRS transceiver, no antenna, AT&T SIM (requires one of antennas mentioned below for cellular terminals)	SM201455-HNA
IDP-782 cellular HSPA/GPRS transceiver, no antenna, Vodafone SIM (requires one of antennas mentioned below for cellular terminals)	SM201455-HNV
IDP-782 cellular HSPA/GPRS transceiver with backup battery, no antenna, AT&T SIM (requires one of antennas mentioned below for cellular terminals)	SM201455-HBA
IDP-782 cellular HSPA/GPRS transceiver with backup battery, no antenna, Vodafone SIM (requires one of antennas mentioned below for cellular terminals)	SM201455-HBV
Antennas	
Standard satellite side entry antenna (5 m cable, FAKRA)	ST901065-AFA
Low elevation satellite side entry antenna (5 m cable, FAKRA)	ST901066-AFA
Standard satellite bottom connector antenna (no cable)	ST901061-NSB
Low elevation satellite bottom connector antenna (no cable)	ST901063-NSB
Antenna cable (5 m) for bottom connector satellite antenna (mentioned above)	ST301044-AFC
Right angle antenna cable (5 m) for bottom connector satellite antenna (mentioned above)	ST301044-ARC
IDP-782 cellular premium antenna kit (tamper proof, combination GPS/GLONASS and a cellular antenna)	ST100445-001
IDP-782 cellular premium antenna	ST100446-001
Accessories	
Terminal development cable	ST100320-001

Refer to the SkyWave Catalog for additional accessories or contact your SkyWave Account Manager.

APPENDIX B ACTIVATION INFORMATION

Server User Name: _____

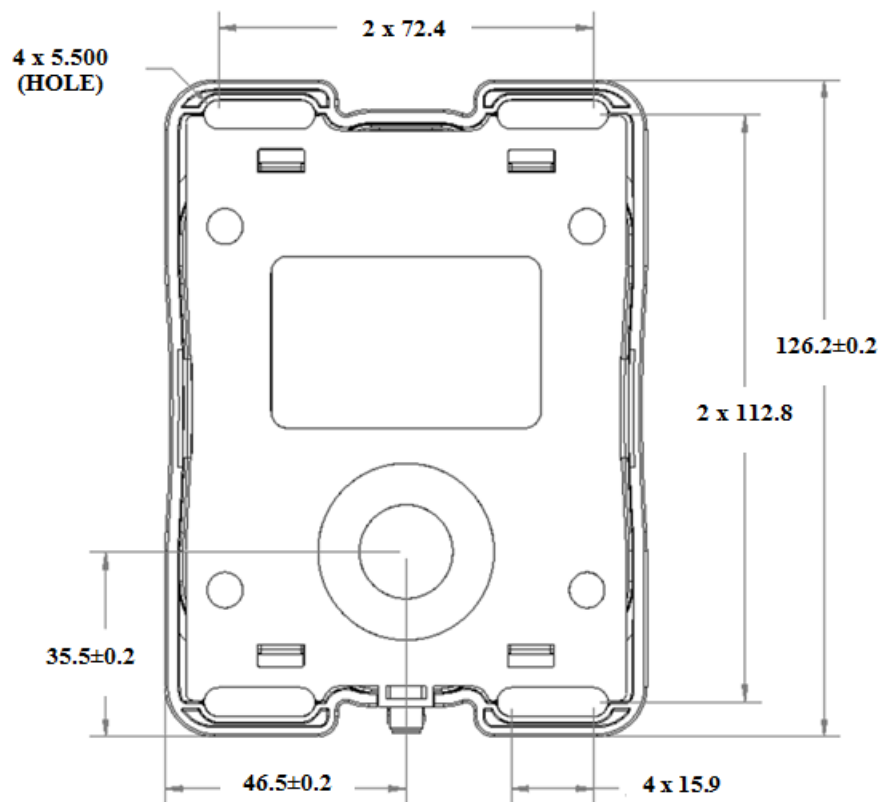
Password: _____

[illegible]

APPENDIX C SATELLITE ANTENNA DIMENSIONS

CAUTION: Before drilling check the template against actual hardware for dimensional accuracy. If it is not correct, DO NOT USE THIS TEMPLATE. Use the physical antenna hardware as a template.

CAUTION: Cable management and connector strain relief must be incorporated in the installation. Secure the cable no more than 15 cm from the antenna enclosure and at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the connector. Damage to the connector interface or cable may otherwise result and lead to hardware failure.

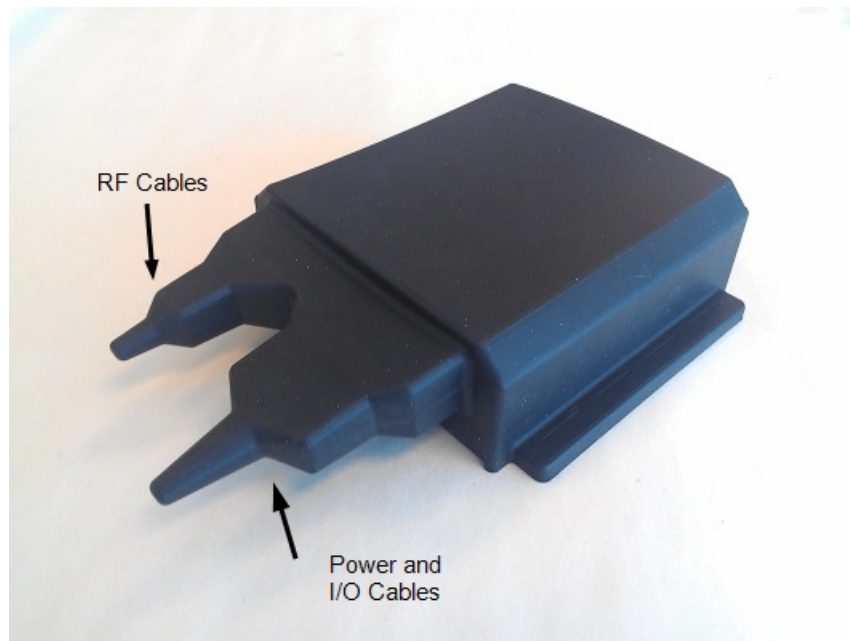


APPENDIX D TERMINAL SHROUD

The optional terminal shroud protects the cable connectors that connect to the transceiver unit. The terminal shroud has two (2) pass through features for the following cables:

- RF cables
- Power and I/O cables

Figure 69: Terminal Shroud

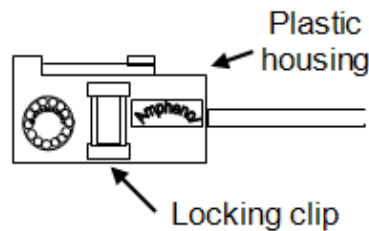


APPENDIX E REMOVE THE FAKRA HOUSING FOR CABLE INSTALLATION (OPTIONAL)

To remove the FAKRA housing, so it can fit through a small hole, follow the steps below.

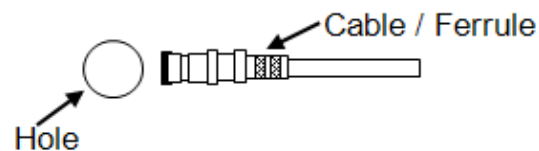
1. Remove the locking clip (Figure 70) from the plastic housing using a small pair of electronics pliers. Do not lose the locking clip. You require it later.

Figure 70: Locking Clip and Plastic Housing



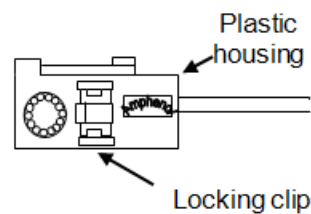
2. Pull off the plastic housing (Figure 71) from the cable's main body.
The exposed ferrule has a maximum diameter slightly wider than the cable.
3. Push the cable through the hole (Figure 71).

Figure 71: Cable without Housing



4. Slide the plastic housing back onto the ferrule as far as it can go (Figure 72).

Figure 72: Locking Clip (removed) and Plastic Housing



5. Press the locking clip, until you hear a snap, back into the main body (Figure 72).

APPENDIX F MATING CABLE ASSEMBLY INSTRUCTIONS

The following section provides the information required to assemble a terminal power/interface cable. Protect the connector pins during assembly and installation.

Mating Connector and Terminal Pins Part Numbers

The mating connector and crimp contact part numbers are shown in [Table 9](#).

Table 9: Connector and Crimp Contact Part Numbers

Description	Manufacturer	Part Number
Mating Connector	JAE	IL-AG5-30S-D3C1
Crimp Contact	JAE	IL-AG5-C1-5000

Electrical Pin Assignments

[Figure 73](#) shows the terminal power and I/O connector and [Figure 74](#) shows the mating connector that plugs into the transceiver unit. Section shows the pin assignment for the connector.

CAUTION: Voltage levels applied to I/O pins should not exceed the power supply voltage at any time.

Figure 73: Transceiver Electrical Mating Connector Pins (front view)

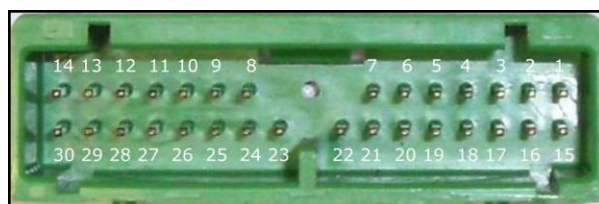
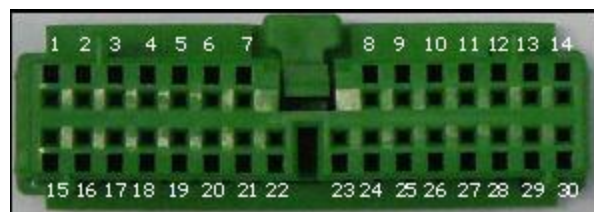


Figure 74: Mating Connector Electrical Cable (front view)



Cable Selection

Cable length should be as short as possible and built to the following guidelines:

- For reliable operation, use twisted pair and shielded cables for data connections to the terminal.
- 18-22 AWG is recommended for proper crimping into the mating connector.
- Transmitting can consume up to 2 A peak current, therefore use a 2.5 A Slow Blow fuse, regardless of the voltage.
- Minimum recommended wire gauge is 22 AWG for cable lengths up to 25 meters and 20 AWG for cable lengths up to 40 m.
- If the power cable length exceeds 4.57 m (15 ft), the input voltage range should be derated by 1 volt for every 46 cm (1.5 ft) increase in length. Make sure the derated input voltage meets the terminal minimum input specification of 9 V.
- Ensure that the cable operating temperature matches the terminal's operational environment.
- If exposed to sunlight, ensure the cable jacket is UV stabilized.
- Cable should have operating voltages exceeding 100 V.
- Provide a separate return ground reference connection for cable lengths longer than 2 m if using analog inputs. With 2 m cable lengths and a single ground return connection, analog voltage readings errors introduced by ground reference difference in the return cable should be less than 0.2 V.
- Without a separate ground reference, the voltage drop induced across the ground reference affects the accuracy of the analog reading. Changes to the current consumption that occur with changes to the terminal's mode (cellular transmit, satellite transmit) change the analog input reading.

RF Immunity

If the terminal is intended for operation in a strong RF environment, it is recommended that cables used for power, data interfaces and I/O be shielded and grounded. Data interface cables (RS-232, RS-485, and CAN) must use twisted pairs wiring.

CAUTION: It is important to do field testing with RF environments before finalizing the cable design.

Tools

- Wire Cutter
- Wire Stripper
- Crimping Tool
- Fine-tip Soldering Iron
- Solder

For production cable assembly, SkyWave recommends the crimping and extraction tools listed in [Table 10](#).

Table 10: Crimping and Extraction Tools

Description	Manufacturer	Part Number
Hand Crimp Tool	JAE	CT150-1-AG5
Extraction Tool	JAE	ET-AG5

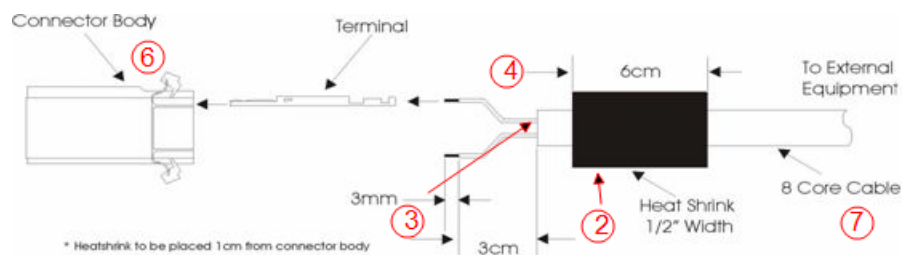
Cable Assembly Steps

1. Select a cable made of a material suitable for the operational environment, the correct number of cores and cut to the required length.
2. Cut and remove the outer jacket of the cable, 3 cm from the transceiver mating end (Figure 75).

Note: Be careful not to cut the insulation on the individual wires.

3. Use a wire stripper to remove 3 mm of insulation from the wires. Do not tin the exposed wires.
4. Use the appropriate crimping tool to crimp a terminal pin onto each of the stripped wires on the transceiver end of the cable.
5. Insert each terminal pin into its correct position in the transceiver mating connector. Push firmly to make sure that it has gone all the way into the connector.
6. Lock the terminals in place by closing the locking tabs on either side of the connector body.

Figure 75: Mating Cable



7. Apply heat shrink to cover most of the unshielded wires between the connector and the cable sheath.

Cable management and connector strain relief must be incorporated in the installation. SkyWave highly recommends securing the cable at regular intervals along its length as part of the installation to prevent cable wear and eliminate strain on the terminal connector. Damage to the terminal connector interface or cable might result leading to hardware failure.

ACRONYMS/GLOSSARY

CAN	Controller Area Networks
COFETEL	Comisión Federal de Telecomunicaciones (Federal Telecommunications Commission of Mexico)
DC	direct current
EGSM	Enhanced GSM
ESD	Electrostatic Discharge
ESP	encapsulating security payload
FCC	Federal Communications Commission
GND	ground
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global Standard for Mobile Communications
I/O	input/output
IP	Ingress protection
IAM	I/O Access module
IEC	International Electrotechnical Commission
IMEI	International Mobile Station Equipment Identity
kgf-cm	kilogram-force centimeter
LED	light-emitting diode
LMES	Land Mobile satellite Earth Stations
LNA	Low Noise Amplifier
MCU	Microprocessor Control Unit
MDT	mobile display terminal
MMES	Maritime Mobile satellite Earth Stations
NMEA	National Maritime Electronics Association
PBCCH	Packet Broadcast Control Channel
RF	radio frequency
RoHS	Restriction of Hazardous Substances
R&TTE	Radio and Telecommunications Terminal Equipment
Rx	receive
SES	Satellite Earth Stations and Systems
SIM	Subscriber Identification module
SP	Solution Provider
SRAM	Static Read and Write Memory
Tx	transmit
USB	Universal Serial Bus
Vbatt	Power supply voltage