SkyWave

IDP 600 Terminal Series

Hardware Guide

T200, Version 02

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Preface

Note: **Refer to the SkyWave Customer Support website for a possible Errata Sheet available after the release of this document. Always check the site for the most current documentation releases.**

What's New?

Updates since the last release of this document are listed below.

- Updated elevation angle for IDP-690 (-15 to +90) (Table 1)

- Added power consumption information (Table 5)

- Added new IDP 600 Series Extension Cable figure and updated details (APPENDIX E)

Purpose

This document is as an overview of the installation procedures and hardware characteristics and specifications for the IDP 600 series of terminals.

Audience

This document is for technical readers. It provides information to ensure successful installation and operation of IDP 600 series terminals.

Notation

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

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

Note: **A note indicates information with no potential hazard, but the user should make special note. A note is also used to indicate points of interest or to provide 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 may be useful in conjunction with this guide. These documents are available from the IDP Developer Toolkit or support.skywave.com.

[T202]   IDP 600 Terminal Series Developer Guide

SkyWave

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Please read all cautions and warnings throughout this document.

Safety Precautions

The mobile device must comply with all safety precautions relating to the operation, usage, service and repair of the terminal. SkyWave assumes no liability for the customer's failure to comply with any of these precautions.

Caution warnings appear throughout this document.

Installation Warning

SkyWave recommends that this product be installed by the authorized distributor from whom it has been purchased. By carrying out the installation of the product, the installer assumes exclusive responsibility for, and agrees to indemnify SkyWave from, any injury or damage of any kind arising from the installation.

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A fault report is required for each unit returned under warranty. Please contact SkyWave's Customer Support for additional information.

User Serviceable Parts

The terminals contain no user serviceable parts or replaceable fuses.

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1 Product Overview

Each IDP 600 series terminal consists of a single environmentally sealed mechanical enclosure containing an integral antenna, a satellite modem for communicating with the satellite, an integral GPS subsystem, four input/output ports, an RS-232 port, and an RS-485/J1708 port. The terminals are available in various configurations. Figure 1 shows the IDP-680 model.

Figure 1   IDP-680 Model

Each terminal is designed for industrial and fixed applications or to be mounted outdoors on a wide range of platforms such as vehicles or boats.

The terminal's built-in programmability allows it to work as a stand-alone 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 its status and location monitored, as well as 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

- Broadcast messages

- Default acknowledged messages

- Global service

Figure 2   SkyWave's IsatData Pro Network
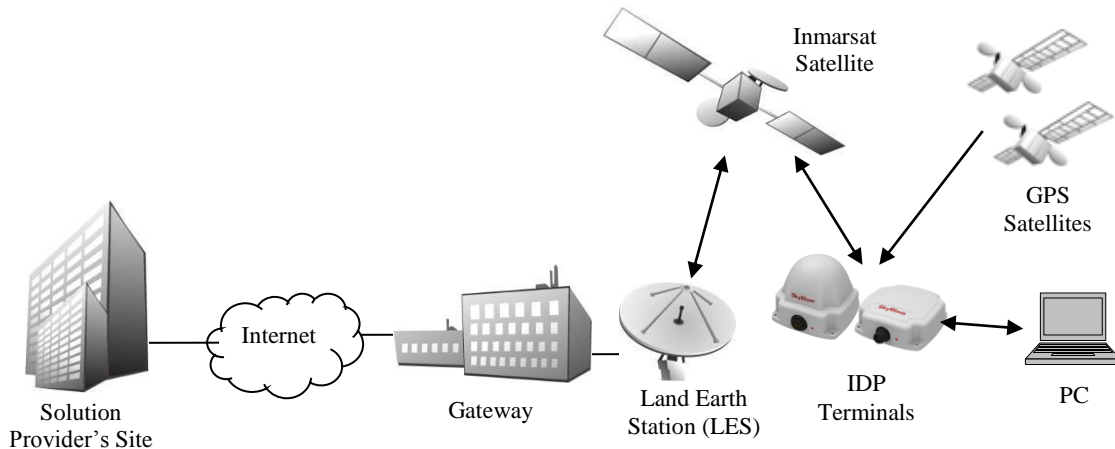
Service is provided to end users by Solution Providers (SPs) who use the SkyWave IsatData Pro network to offer particular applications and/or services to their clients. The SPs link their application services to the satellite terminals by connecting to the IsatData Pro gateway. This acts as the communications hub of the system, routing traffic to and from the terminals and the various service providers.

Configuration and data retrieval from the terminal can be easily accomplished through Internet-based application services provided by SPs or by integrating existing customer enterprise software to receive information from the Gateway.

1.2   Terminals[1]

The IDP 600 series (Table 1) of SkyWave mobile satellite terminals operate on the IsatData Pro network. The terminals are self-contained, environmentally sealed, compact, and provide low power consumption.

Terminals include an omni-directional antenna, satellite modem, GPS, programmable microcontroller, and several I/O (input/output) feeds capable of monitoring and controlling external sensors and devices.

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. Each model is suitable for both mobile and fixed installations.

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

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[1] Hardware components may not be exactly as shown in this document.

Table 1   IDP 600 Series Models

Model	Elevation Angle	Connector	GPS (optional)
IDP-680	20° - 90°	10-pin side or bottom	Yes
IDP-690	-15° - 90°	10-pin side or bottom	Yes

Part numbers are specified in Table 9.

All terminals are available in two configurations: bottom connector or side connector (see figures below).

Figure 3   IDP-680 with Side Connector

Figure 4   IDP-680 with Bottom Connector
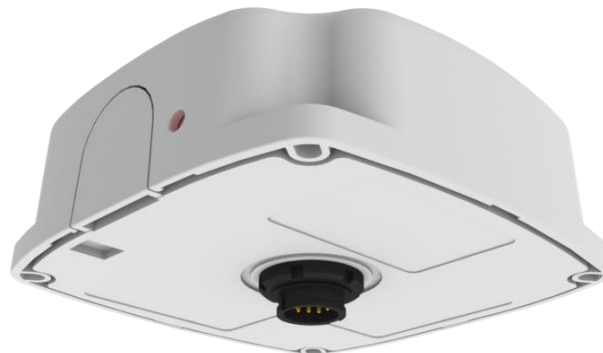
Figure 5   IDP-690 with Side Connector

Figure 6   IDP-690 with Bottom Connector

1.3   Terminal Key Features and Benefits

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

The IDP 600 series terminals have the following key features and benefits:

- Designed to be used as a standalone or incorporated into an SP solution

- Built-in GPS receiver to calculate position, speed and heading

- Quick and easy installation reduces labor time and costs

- Ships with installed firmware

- Flexible custom scripting

- Broad operational temperature range

- Rugged construction

1.4 Pass-Through Mode

The terminal operates in pass-through mode when there is no valid application firmware present. In pass-through mode, the terminal connects the external RS-232 port to the serial port on its internal modem, making the terminal an IP67 modem that accepts a wide input voltage. The packaged modem inherits all the IDP 600 terminal series certifications.

Figure 7   Pass-Through Mode
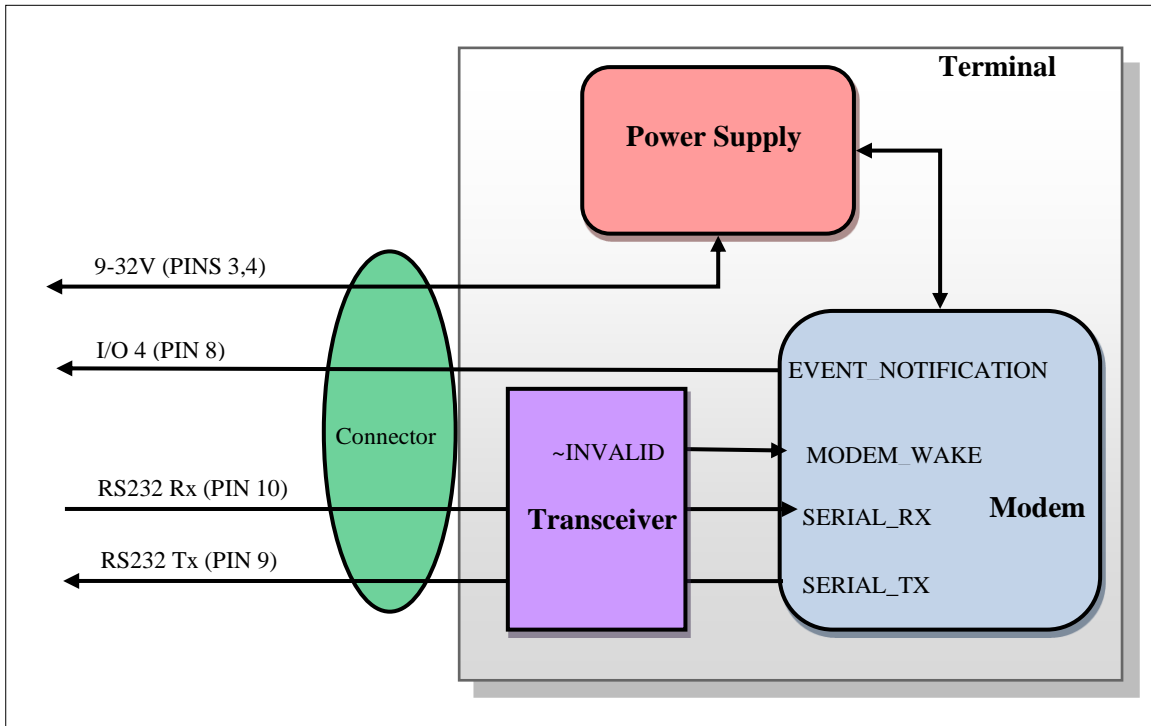
1.5 Operating Modes

The terminal operates in a number of modes while the application processor portion of the terminal has its own independent set of modes.

Transmit Mode

In transmit mode the terminal is transmitting a signal to the gateway. Several transmissions can occur within any 5 second frame.

Receive Mode

In receive mode the terminal is receiving a signal from the gateway. This is mutually exclusive with transmit mode.

Sleep Mode

In sleep mode the terminal draws minimal current. It monitors its external inputs (digital and serial) for activity, and reacts as required by transitioning to processing mode with no loss of information such as incoming serial characters.

Processing Mode

In its processing mode the applications processor is actively running while transmit and receive are powered down.

2 Compliance

The following certifications are **pending** for the IDP terminal.

Inmarsat Type Approval

Industry Canada

- ICES-003, Issue 4, Feb 2004, Spectrum Management and Telecommunications Policy, Interface-Causing Equipment Standard

- RSS-170, Issue 1, Rev. 1, Nov 6, 1999, Spectrum Management and Telecommunications Policy, Radio Standard

- RSS-102, Radiation Safety per Safety Code 6

FCC Part 25

- CFR Title 47: Telecommunication, Part 25 - Satellite Communications, Sub-part C - Technical Standards

- OET 65 - Radiation Safety

R&TTE Directive 1999/5/EC (CE Mark)

- EN 301 426 V1.2.1 (2001-10), Satellite Earth stations and Systems (SES); Harmonized EN for Low data rate Land Mobile satellite Earth Stations (LMES) and Maritime Mobile satellite Earth Stations (MMES) not intended for distress and safety communications operating in the 1,5/1,6 GHz frequency bands covering essential requirements under article 3.2 of the R&TTE Directive

- EN 301 489-20 V1.2.1 (2002-11), Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 20: Specific conditions for Mobile Earth Stations (MES) used in the Mobile Satellite Services (MSS)

- EN 301 489-1 V1.2.1 (2002-11) - EMC

- EN 60950:2002 - Safety

- IEC 62311 - Radiation safety

RoHS

Restriction of Hazardous Substances (RoHS)[2]

Ingress Protection

IP67

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

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3 Specifications

3.1 Connector

The terminals use a circular 10-pin connector.

Table 2   Terminal Connector

Parameter	Part Number
Mating Connector Kit	SA901020-001

3.1.1 Connector Pin-out

Figure 8   Terminal Connector Pin Assignment (Male)
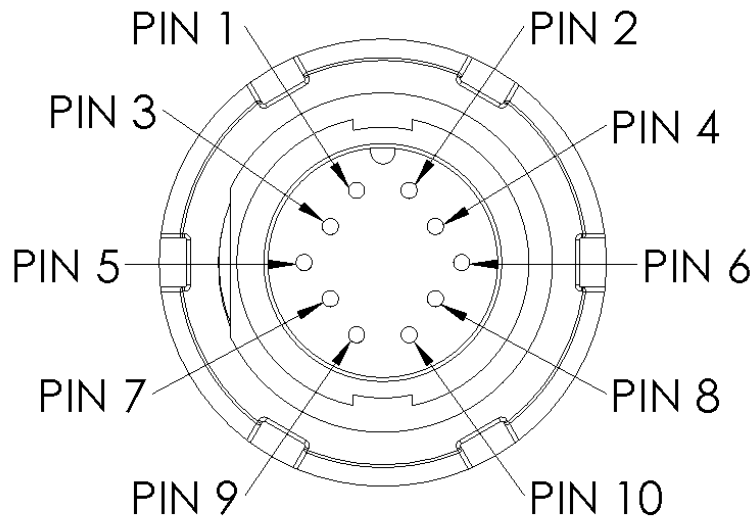
Table 3   Terminal Electrical Pin Assignment

Pin	Functionality	Pin	Functionality
1	RS-485/J1708[3] A	2	RS-485/J1708 B
3	GND	4	VIN
5	I/O 02	6	I/O 03
7	I/O 01	8	I/O 04
9	RS-232 Tx (Output)	10	RS-232 Rx (Input)

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[3] J1708 is configurable in software control.

Figure 9   View of Terminal Male Connector

Figure 10   Face View of Mating Connector (Female)

29.3 mm
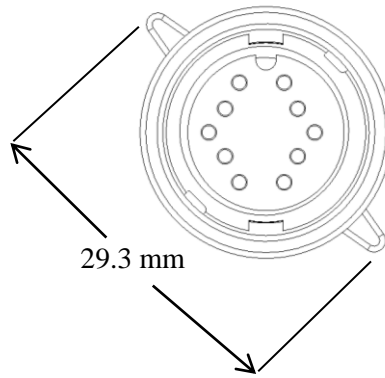
Figure 11   Rear View of Mating Connector (Solder Cups)
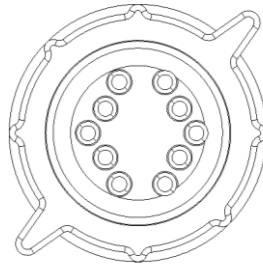
3.2   Power

3.2.1   Input Range

Parameter	Value
Power Supply Voltage	9 to 32 V DC

3.2.2 Power Consumption

Typical power consumption values at Vbatt=12 V and at room temperature (22°C)

Table 4   Power Consumption Values

Mode of Operation	Current
Transmit	0.75 A
Receive	45 mA
Sleep	100 μA
Processing	10 mA

3.2.2.1 Average Power Consumption

Average terminal power consumption depends on many factors including how often the modem wakes to receive to-mobile messages, how often GPS fixes are requested, and how often from-mobile messages are sent. Table 5 characterizes several scenarios and shows the estimated average power consumption assuming a 12 V power source.

Table 5   Power Consumption Scenarios

Scenario	Fixed 1	Fixed 2	Mobile 1	Mobile 2	Mobile 3
Wake to Receive Period	30 min	3 min	60 min	30 min	10 min
Tx/Day and Message Size/Tx	48X, 98 bytes	96X, 98 bytes	1X, 98 bytes	2X, 98 bytes	2X, 98 bytes
GPS Fix/Day	1 (network)	1 (network)	24	4 (network)	4 (network)
Power Mode	Fixed - battery	Fixed - battery	Mobile - powered	Mobile - battery	Mobile - battery
Average Power Consumption (mAh/day at 12 V)	24	111	16	11	25
Serial (terminal only)	On Rx Wake Up	On Rx Wake Up	On Rx Wake Up	None	None
Notes	-	-	10 seconds of application card geofence processing per fix (assumed) (terminal only)	-	-

3.2.3 Load Dump Circuitry

The terminal's operating range is 9-32 V. Above this range; the load dump protection circuitry opens an electronic switch so that the terminal is not damaged, up to 150V. When the voltage drops below the threshold, the terminal recovers, going through power on reset.

With this protection, the terminal is capable of withstanding load dumps as specified in SAE J1455 (rev JUN2006) paragraph 4.13.2.2.1.

3.2.4   Fuse

The IDP 600 series terminals have an internal fuse. The internal fuse provides protection in the event of an internal short on the terminal. The internal fuse cannot be reset and is not field repairable.

3.3   Input/Output

The terminal's four configurable I/O lines are each independently operable in one of following modes:

- Digital Input

- Digital Output

- Analog Input

- Disabled

    When disabled the I/O is physically configured as an analog input.

3.3.1 Digital Input

Figure 12 shows a schematic of the I/O when configured as a digital input.

Figure 12   Digital Input
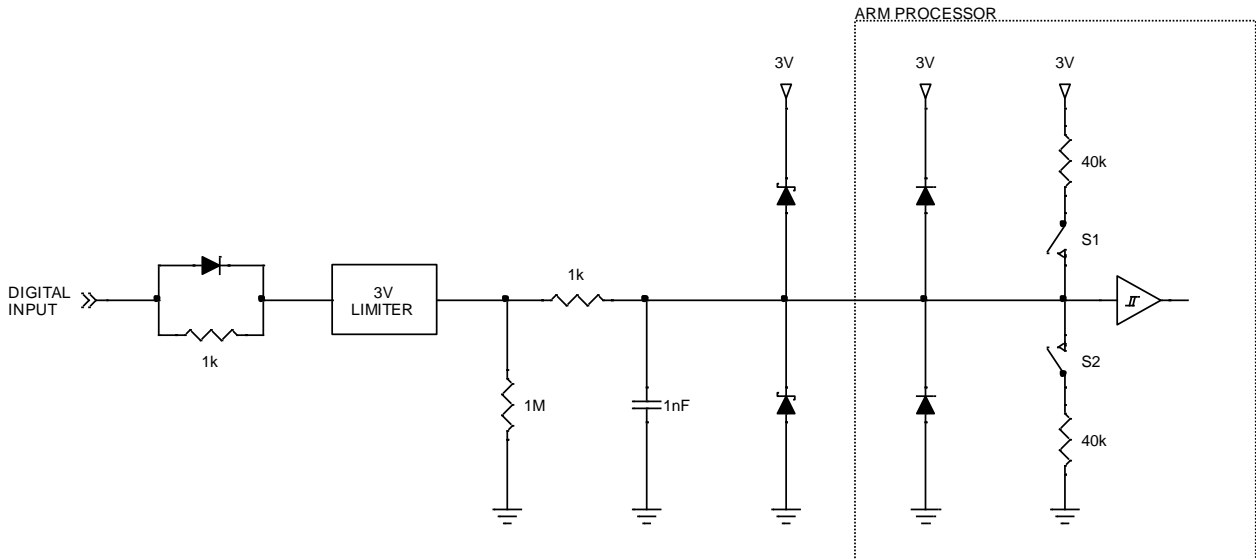
Input Type	S1	S2
With weak pull-down	Open	Open
With pull-down	Open	Closed
With pull-up	Closed	Open

The input specifications are provided in the table below.

Parameter	Minimum	Typical	Maximum	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	-	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)	-	80	-	µA

3.3.2 Digital Output

Figure 13 shows a schematic of the I/O when configured as a digital output. It must be noted that I/O 04 is the only I/O with built-in short circuit protection for open drain outputs.

Figure 13   Digital Output
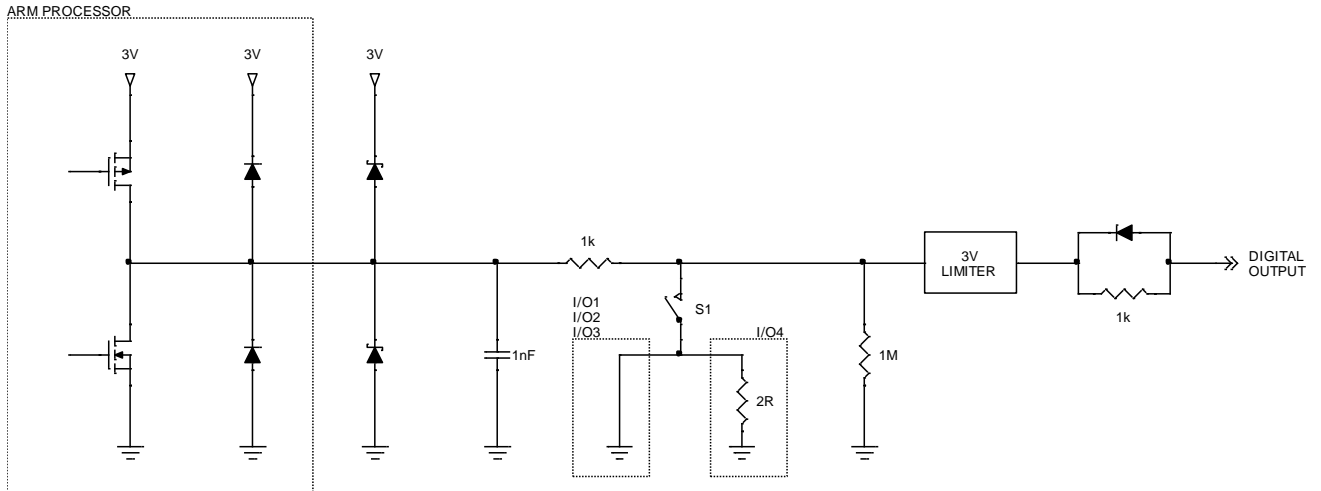
Push-pull	S1 = Open
Open drain	S1 = Closed (Low Impedance) S1 = Open (High Impedance)

The following tables describe the output specifications.

Push-pull

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

Parameter	Minimum	Typical	Maximum	Units
Output high voltage - open circuit	2.85	3.0	3.15	V
Output high voltage (sourcing 25 μA)	2.80	-	-	V
Output low voltage (sinking 25 μA)	-	-	0.05	V

Open Drain (I/O 01 to I/O 03)

Parameter	Minimum	Typical	Maximum	Units
Sink current (do not exceed)	-	-	250	mA
Voltage (active drawing at 250 mA)	-	-	2.56	V

Protected Open Drain (I/O 04 only)

Parameter	Minimum	Typical	Maximum	Units
Sink current (current limited)	-	-	300	mA
Voltage at 250 mA	-	-	3.09	V

3.3.3 Analog Input

Figure 14 contains a schematic of the I/O when configured as an analog input.

Figure 14   Analog Input
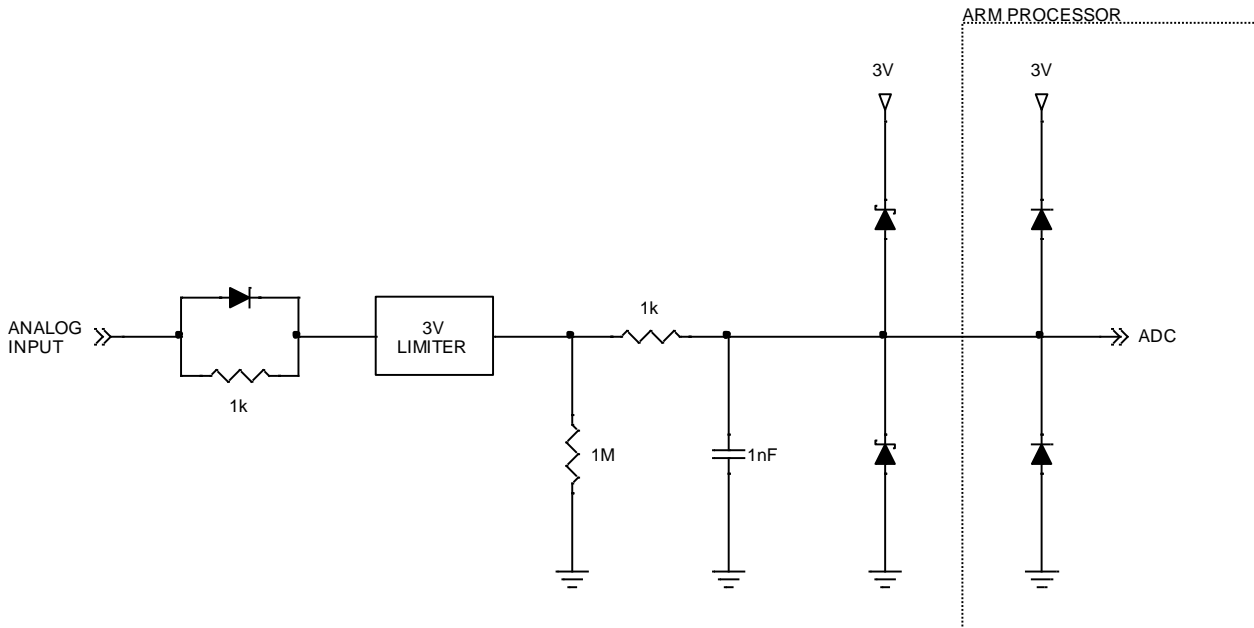
Parameter	Value
Input Impedance	1 MΩ (typical)
Nominal Input Range	0 to 3 V
Resolution	0.7 mV (12 bits)
Accuracy	3% + 2 LSB

3.3.4 Input Bandwidth

When used as a digital or analog input, the I/O circuitry's bandwidth is ≥ 1 kHz.

Note: This does not imply that the terminal software has a sample rate > 1 Hz.

3.3.5 Output Bandwidth

When used as a digital output (either a push-pull or open drain) the I/O circuitry's bandwidth exceeds 100 Hz.

Note: This does not imply that the terminal software has the capability of generating high rate pulse trains at frequencies > 10 Hz.

3.3.6 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 15. In pass-through mode, the terminal connects the modem's serial interface to the terminal's RS-232 port.

Figure 15   Pass-Through Mode Signals
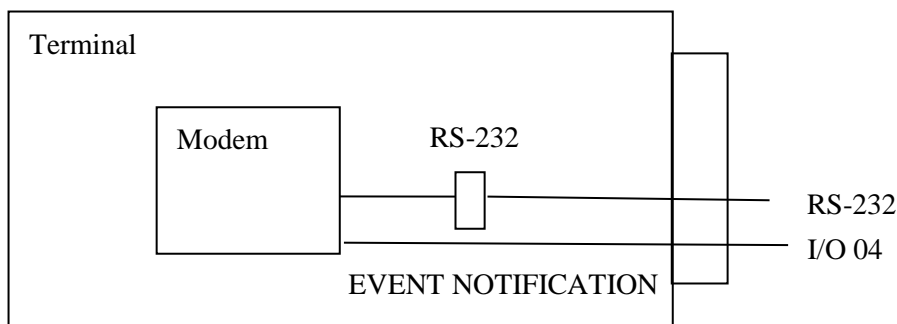
The terminal's I/O lines are configured as per Table 6 when in pass-through mode. The modem's serial data and the EVENT_NOTIFICATION pins are connected to the terminal's external connector.

Table 6   Pass-Through Mode I/O States

I/O Pin	State	Specification
I/O 04	Output	Connected to EVENT_NOTIFICATION
I/O 01, I/O 02, I/O 03	Analog Input	Do not use
RS-485	Disabled	-
RS-232	RS-232	Disabled if no valid RS-232 level on receiver

When in pass-through mode, the application controller samples inputs and drives the equivalent output appropriately. Pass-through mode time specifications are given in Table 7.

Table 7   Pass-Through Mode Timing Specifications

Parameter	Specification
Baud Rate	As per modem configuration
Maximum Jitter on Signals (Modem to External)	10 μs
Maximum Jitter on Signals (External to Modem)	10 μs

Table 8   Pass-Through Mode Power Consumption

Mode of Operation	Current[4]
Pass-Through Mode	45 mA

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[4] Drawn from a 12 V supply. Average time of receive and idle current, with the DSP powered on without any transmits or GPS receivers.

3.4 Serial Interfaces

3.4.1 RS-232

The RS-232 interface defaults to the following settings: 9600 bit/s, 1 start, 8 data, 1 stop bit, no parity. The baud rate is configurable up to 230,400 bit/s.

The electrical characteristics of the interface are:

Parameter	Minimum	Typical	Maximum	Units
Serial Rx Input Low Threshold	0.6	-	-	V
Serial Rx Input High Threshold	-	-	2.4	V
Serial Tx Low Output (3 K load)	-	-	3.7	V
Serial Tx High Output (3 K load)	3.7	-	-	V

3.4.2 RS-485/J1708

The terminal can be configured for an RS-485 or J1708 interface. It can be used for general bus or for SCADA interfacing. The RS-485/J1708 does not incorporate a termination resistor.

The electrical characteristics of the interface are:

Parameter	Minimum	Typical	Maximum	Units
Input Common Mode Voltage	-7.0	-	+12	V
Differential Input Threshold	-200	-125	-50	mV
Output Common Mode Voltage	-	1.5	3.0	V
Differential Drive Output, 54 Ω load	1.5	-	-	V

3.5 RF Specifications

3.5.1 Frequency

Parameter	Value
Receive	
Frequency Band	1525 to 1559 MHz
Modulation	OQPSK
Symbol Rate	3000 symbols/seconds
Polarization	RHCP
Transmit	
Frequency Band	1626.5 to 1660.5 MHz
Modulation	OQPSK
Symbol Rate	900 symbols/seconds (maximum)
Polarization	RHCP

3.5.2 IDP-680 Antenna

Parameter	Value
Maximum EIRP	7 dBW
Elevation Angle	20 degrees elevation

3.5.3 IDP-690 Low Elevation Antenna

Parameter	Value
Maximum EIRP	5.0 dBW
Elevation Angle	-15 degrees elevation

3.6 GPS

Standard GPS

Parameter	Value
Receive Type	GPS C/A Code
Frequency	L1 (1575.42 MHz)
Mean Time to First Fix	
Cold Start	36 s
Warm Start	8 s
Sensitivity	
Tracking	-146 dBm
Acquisition	-136 dBm
Accuracy	
Horizontal Position (CEP)	4 m
Horizontal Speed (CEP)	0.02 m/s
Heading (at 100 km/hr speed; 50%)	0.1°

3.7 Physical Details

The terminal's mechanical enclosure is a rugged, impact, and chemical resistant plastic material. All dimensions are shown in millimeters (mm).

Figure 16   IDP-680 Top View Enclosure Dimensions (mm)
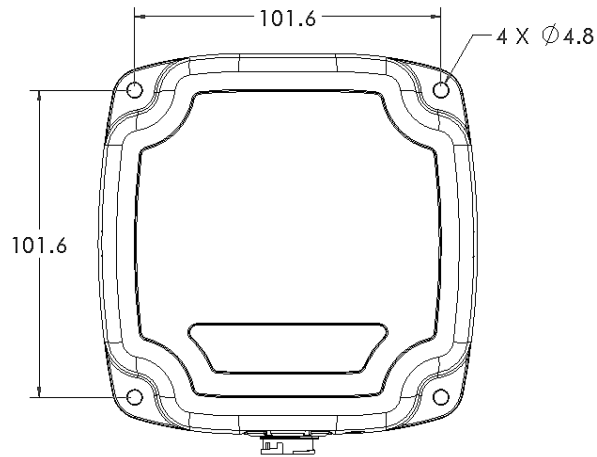
Figure 17   IDP-680 Side View Enclosure Dimensions (mm)
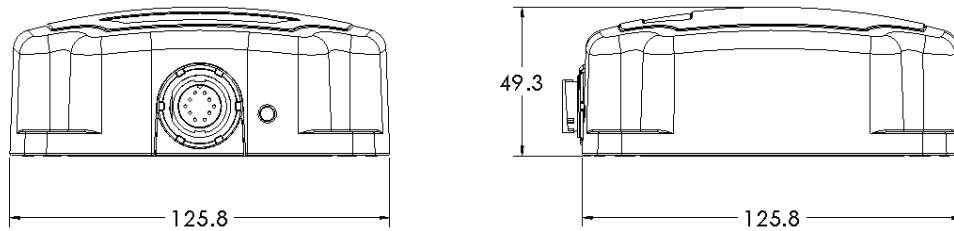
Figure 18   IDP-680 and IDP-690 Bottom View Enclosure Dimensions (mm)
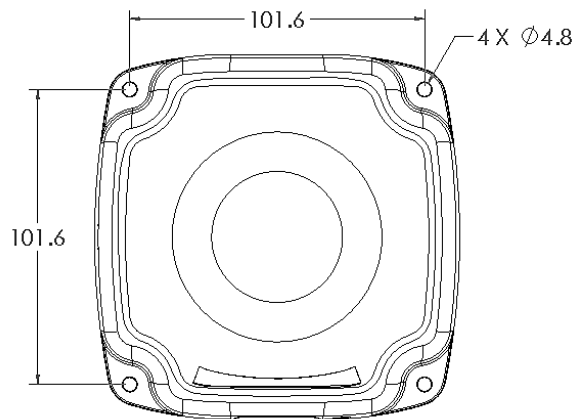
Figure 19   IDP-690 Side View Enclosure Dimensions (mm)
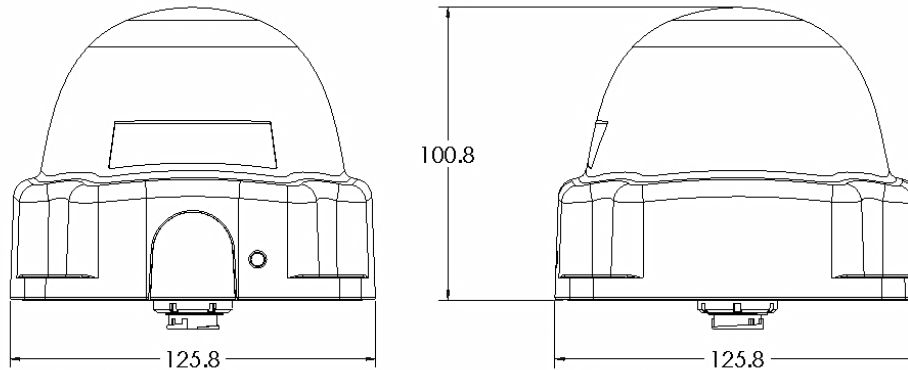
IDP-680

Parameter	Value
Mass	460 g
Enclosure Material	Xenoy® 5220U Resin[5]

IDP-690

Parameter	Value
Mass	460 g
Enclosure Material	Xenoy® 5220U Resin[5]

3.8   LED

The terminal has an integral LED to indicate that the terminal has successfully powered up (Section 4.8).

The visual indicator (LED) does not indicate satellite status. Its only purpose is to confirm terminal start-up.

Parameter	Value
Color	Red

3.9   Non-Volatile Storage

The IDP 600 series has non-volatile flash memory that is shared by the terminal firmware and user services.

Parameter	Value
Non-volatile On-board Flash Storage	4 MB
Write-Erase Cycles (per operating life)	100 000

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[5] For additional details, see http://www.ides.com/PWeb/obds.aspx?E=15025

3.10 Environmental

Temperature

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

IDP-680 and IDP-690

Parameter	Description
Humidity	The IDP-680 meets all its specifications during exposure to 90% relative humidity at +85°C, per the test methodology of SAE J1455, section 4.2.3.
Vibration	The IDP-680 meets all its specifications during exposure to random vehicular vibration levels per SAE J1455, section 4.9.4.2 and MIL-STD-810G, section 514.6C-1.
Mechanical Shock	The terminal meets all its specifications after exposure to positive and negative saw tooth shock pulses with peaks of 20G and durations of 11 ms as specified in MIL-STD-810G, section 516.6, Procedure I, section 2.3.2c.
Altitude	The terminal meets all of its specifications after a non-operating 12.2 km altitude test as detailed in SAE J1455, section 4.9.3, except with an ambient temperature of -40°C.
Thermal Shock	The terminal meets all of its specifications after a thermal shock test as detailed in SAE J1455, section 4.1.3.2.
Salt Spray Atmosphere	The IDP-680 meets all of its specifications after a salt spray test as detailed in SAE J1455, section 4.3.3.1.
Immersion	The terminal meets all of its specifications after a 6 hour alternating hot/cold salt water immersion test as detailed in SAE J1455, section 4.3.3.2. The terminal meets all of its specifications after a 30 minute, 1 m depth fresh water immersion test as detailed in IEC 60529, section 14.2.7. These immersions were performed without a cable mating with the circular connector.
Exposure to Chemicals and Oils	The terminal meets all of its specifications after a light to moderate splash test as detailed in SAE J1455 section 4.4.3.2, for the following chemicals: • Window Washer Solvent • Gasoline • Diesel Fuel • Fuel Additives • Alcohol • Anti-Freeze Water Mixture

Parameter	Description
	• Degreasers
	• Soap and Detergents
	• Steam
	• Waxes
	• Kerosene
	• Freon
	• Spray Paint
	• Paint Strippers
	• Ether
	• Dust Control Agents (magnesium chloride)
	• Moisture Control Agents (calcium chloride)
	• Ammonia
	• Aluminum brightener (acid wash)
Steam Cleaning and Pressure Washing	The terminal meets all of its specifications after a steam cleaning and pressure wash test as detailed in SAE J1455, section 4.5.3.
Fungus	The terminal meets all of its specifications after a fungus test as detailed in SAE J1455, section 4.6.3.
Dust and Sand Bombardment	The terminal meets all of its specifications after a dust and sand bombardment test as detailed in SAE J1455, section 4.7.3. The terminal meets the acceptance conditions of IEC 60529, section 13.6.2 after a dust and sand bombardment test as detailed in IEC 60529, section 13.4.
Drop Test	The terminal meets all its specifications after a handling drop test as specified in SAE J1455, section 4.11.3.1.
ESD	The terminal meets all its specifications after exposure of the enclosure to 6 kV ESD contact discharge per IEC 61000-4-2, level 3.

3.11 Temperature Sensor

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

4   Installation

The following section contains SkyWave's 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 injury or damages as a result of the installation, except any such injury or damages arising solely from a defective SkyWave product. In addition to the liability imposed upon the installer on the account of personal injury, bodily injury, including death, or property damage suffered as a result of the installer's installation of the product, the installer assumes the obligation to save harmless SkyWave, including its agents, employees and assigns, and to indemnify SkyWave, including its agents, employees and assigns, from every expense, liability or payment arising out of such wrongful or negligent act or omission, including legal fees. The installer also agrees to hold harmless SkyWave, including its agents, employees and assigns, from any wrongful or negligent act or omission committed by any subcontractor or other person employed by or under the supervision of the installer for any purpose, and to indemnify SkyWave, including its agents, employees and assigns, from every expense, liability or payment arising out of such wrongful or negligent act or omission.

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. Identify the fuse panel location (Section 4.3)
3. Determine a suitable mounting location (Section 4.4)
4. Route the main cable (Section 4.5)
5. Mount the terminal (Section 4.6)
6. Protect the cables and cable connectors (Section 4.7)
7. Connect to power (Section 4.8)
8. Register the terminal (Section 4.9)

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 and use the list below as a guide to check that you received the items you ordered.

- IDP-680 or IDP-690 terminal

- Mating connector kit

- Tube of dielectric grease (e.g., silicone lubricant)

- Installation Guide

- Optional kits (APPENDIX A)

4.2.2 Mobile Identification

Each mobile device 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 NNNNNNNNNSKYXXXX. The mobile ID is located on the bottom of the terminal and on the shipping box.

Figure 20   Mobile ID Location
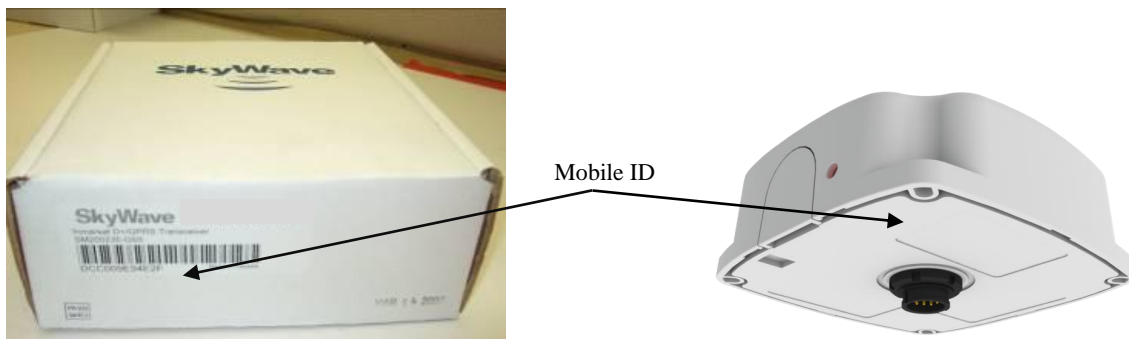
Mobile ID

1. Record the mobile ID in APPENDIX E for future reference.

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

4.2.3 Contact SkyWave to Activate the Terminal

In order to send or receive any message you must activate the terminal on the IsatData Pro network.

1. Send an email to support@skywave.com to request account and terminal activation.

2. Provide the terminal's mobile ID.

   Keep a copy (APPENDIX E) of the terminal's mobile ID along with the server access ID and password you receive in the email from SkyWave Customer Support. You need these to communicate remotely with the terminal.

Figure 21   Sample Activation Report
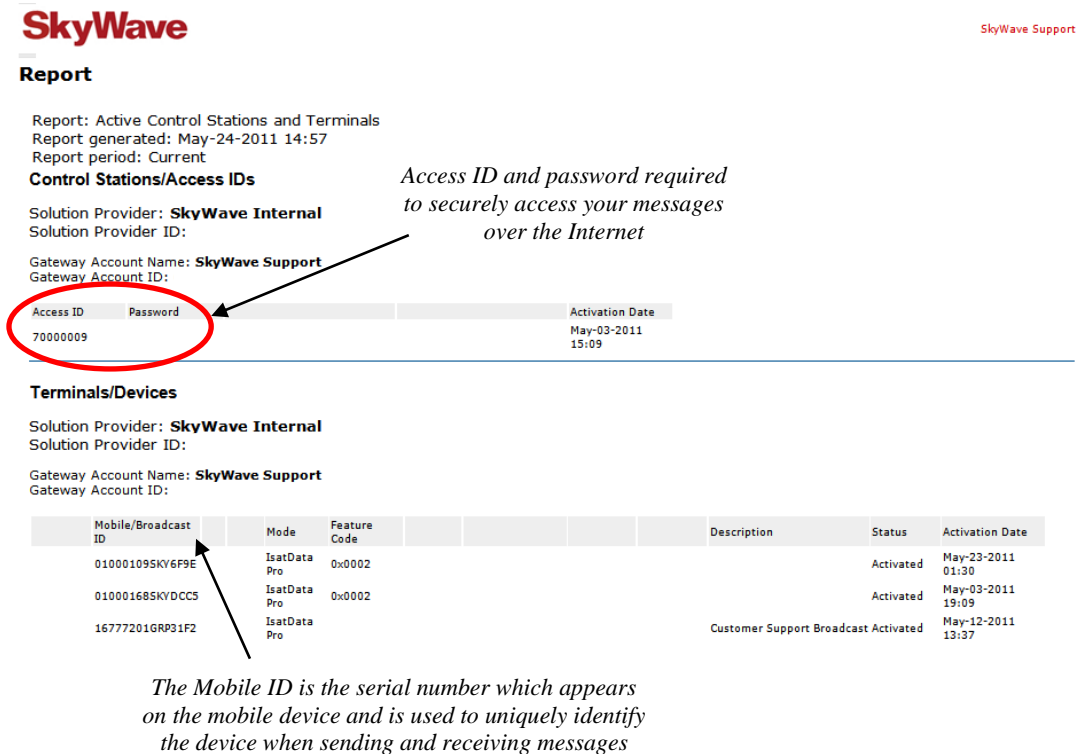
4.2.4   Required Materials

You require the following materials to install a terminal. These materials do not ship with the terminal.

- Qty 4 - M4 (8-32) 18-8 stainless steel screws (length depends on mounting surface thickness)
- Qty 4 - M4 (8-32) nuts with 18-8 stainless steel flat and lock washers
- Waterproof sealing tape
- Waterproof sealing compound such as RTV silicone (bottom connector version only)
- Qty 1 - Custom cable[6]

SkyWave recommends that the Solution Provider supply the end-user with a custom built cable.

4.2.5   Required Tools

You require the following tools to install a terminal.

- Drill

---

[6] Refer to Section 5 for instructions on making a custom cable.

- 5.5 mm drill bit

- 30 mm diameter hole punch or hole saw (bottom connector version only)

- Screwdriver

- Socket wrench set

4.3   Identify the Fuse Panel Location

For installation in a truck, the cable from the terminal connects to the truck's fuse panel for power.

1. Locate the fuse panel in the truck. The location depends on the type, age, and model of the truck.

2. Identify an un-switched vehicle power source within the fuse panel for terminal power.

3. Ensure that the cable you ordered is of sufficient length to reach from the fuse panel to the final mounting location of the terminal.

4.4   Determine a Suitable Mounting Location

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

CAUTION   Most users install the terminals on 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.

- Mount the terminal where it has a clear view of the sky/satellite. For a mobile installation, this means at the highest point on the vehicle or vessel where it has a clear view of the sky in all directions.

- Mount the terminal so that the Inmarsat satellite is within α degrees of the mounting surface, α = 0 to 90 degrees for IDP-680 terminals and -15 to 90 degrees for IDP-690 terminals. Make sure that the line of sight is clear of obstructions.

- Mount the terminal on a flat surface for mobile installations such that the elevation angle does not change with rotation.

Note: For fixed installations, the terminal can be pointed at the Inmarsat satellite to improve performance. This is not necessary for IDP-690 terminals.

- Fasten the terminal securely so that it is not loose and does not move easily.

- Mount the terminal on a solid, stable surface. If necessary, use a mounting bracket (not supplied) or other suitable support.

- Mount the terminal so that the top surface is horizontal (flat). Failure to do so may compromise line of sight between the satellite and the terminal.

- Mount the terminal on a surface that does not get hotter than the maximum operating temperature. If the surface may get hotter, mount the terminal with a thermal barrier between it and the mounting surface.

CAUTION   Mount the terminal at least 20 cm away from humans.

- Do not mount the terminal close to other electrical equipment due to possible radiated and/or conducted electromagnetic interference.

- 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

- Do not mount the terminal where water may build-up or collect.

- Ensure that any paint above the terminal is non-metallic and non-metallic flake, if the installation is under fiberglass or composite wind fairings.

- Check that the terminal's cable reaches the power source before you drill any mounting holes.

- Do not mount the terminal close to an exhaust pipe due to the excessive heat and the potential for the exhaust pipe causing satellite blockage.

- Do not mount the terminal close to air horns or any tractor roof hardware (e.g., emergency lights) that could interfere with satellite communications.

- Mount the terminal on the driver's side of the vehicle, if possible, when there is a possibility of strikes by overhanging tree branches.

- Do not install the terminal inside the truck under the roof liner.

Once you have picked the mounting location, mount the terminal (refer to Section 4.5).

4.5   Route the Main Cable

Consider the following guidelines before routing the cable assembly.

CAUTION   *Ensure the power cable will not be 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 will not start while work is in progress.*

- Do not route the cable near the engine if routing through the engine compartment. This location will subject the cable to extreme heat.

- Keep the cable away from hot surfaces such as exhaust pipes as 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 22 Sample Cable Placement in a Vehicle Cab

Run the cable assembly following the steps below.

1. Use tape to temporarily secure the terminal in its final location while you run the cable.

   CAUTION *Do not drill any mounting holes at this time.*

2. Search for vehicle cab entry points on the side of the vehicle closest to the fuse panel. This will help to minimize the amount of cable routed along the floor of the cab.

   Where possible route the cable through existing holes in the floor or the firewall of the engine compartment.

3. Route the cable starting from the terminal to the fuse panel or battery source.

Note: *SkyWave recommends that you tape cable ends to prevent dirt from collecting on the contacts.*

4.6   Mount the Terminal

CAUTION *Painting terminals or antennas may interfere with their performance.*

The terminal will either have a bottom connector or a side connector.

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: *It is the installer's responsibility to comply with local electrical codes.*

Figure 23   Bottom Connector and Side Connector (IDP-680 shown)
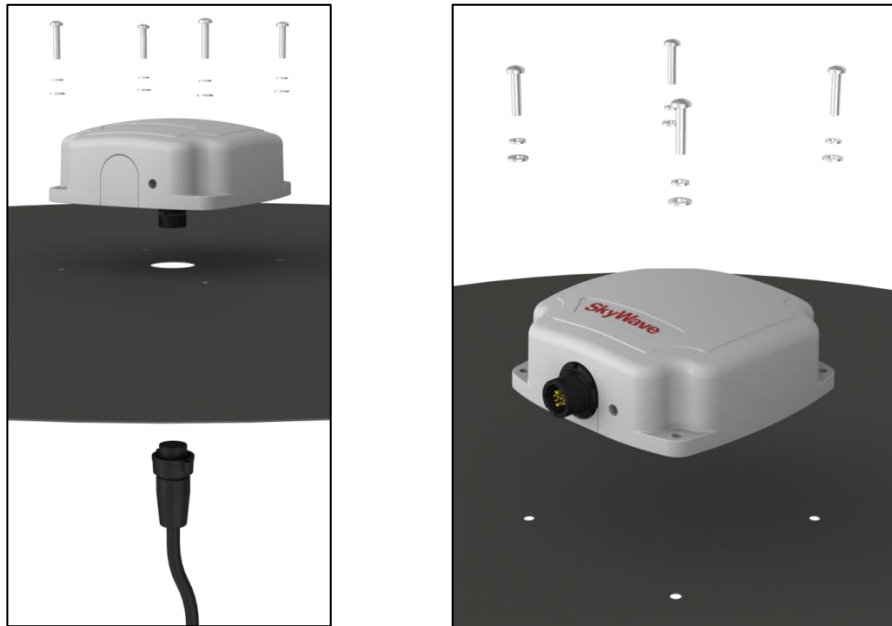
4.6.1   Drill Mounting Holes (optional)

> *Note: **These steps are only needed if you do not require a mounting bracket (provided by the Solution Provider).***

1. Use the drill template (APPENDIX F) to mark the location of the four mounting holes and the connector hole. The direction of the terminal with a bottom connector is not important.

2. Drill the four mounting holes using the drill with the 5.5 mm bit.

3. Punch or drill the 30 mm hole for the connector (bottom connector only).

4. Continue with the steps, below, for Mount the Terminal.

4.6.2   Mount the Terminal

1. Apply waterproof sealing compound, such as RTV silicone, to the locations shown in Figure 24 (bottom connector only).

   Optional: You can also apply waterproof sealing compound to the drilled mounting holes before inserting the screws.

Figure 24   Location for Waterproof Sealing Compound

Apply waterproof sealing compound
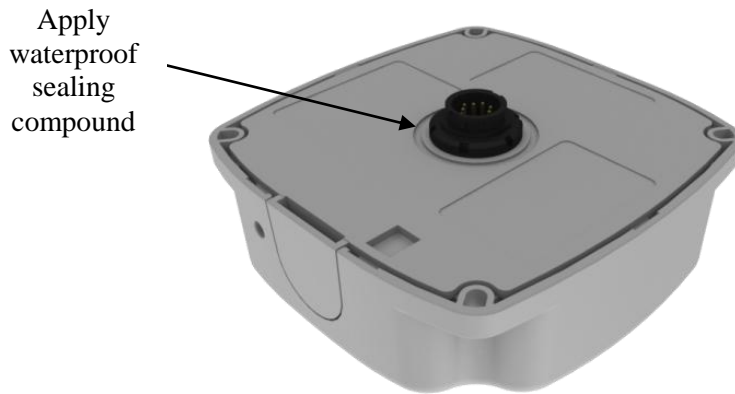
2. Use the screwdriver and socket set to lock the terminal in place with the mounting hardware.

> *CAUTION*   *Do not over-tighten.*

### 4.6.3   Apply Dielectric Grease

1. Cut off one end of the tube of silicone lubricant (Figure 25). Adding the silicone lubricant (grease) will make sure that there is a watertight seal.

2. Insert the tube into the male end of the mating connector (Figure 25).

> *CAUTION*   *Do not apply pressure to the cable/connector during the installation.*

Figure 25   Apply Silicone Lubricant to Connector
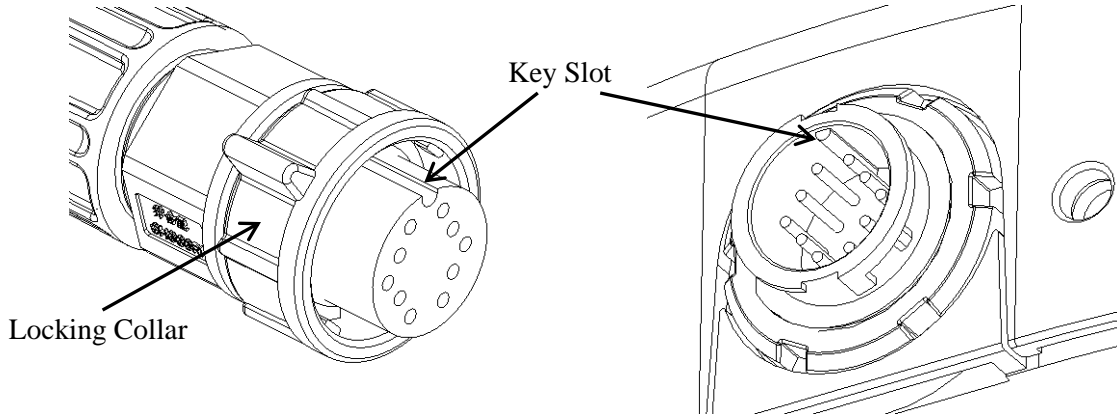
Fill this cavity
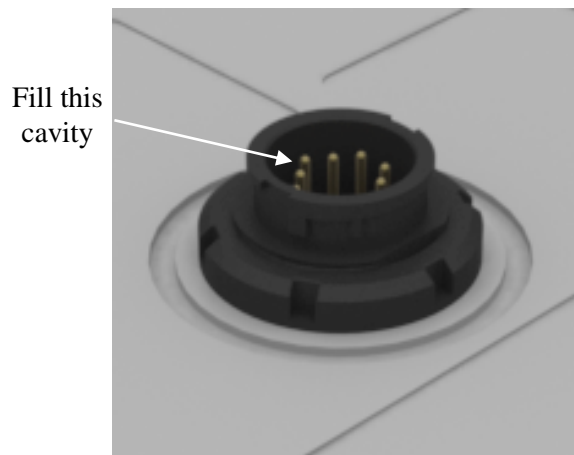
3. Squeeze the lubricant into the mating connecter opening until it is full. Some lubricant will spill out.

4. Connect the cable connector to the terminal by aligning the corresponding connector key slot (Figure 26) and gently squeezing together.

CAUTION ⚠️   *Do not force the connector pins*
to mate since this
may damage the pins.

Figure 26   Key Slot

5. Tighten the cable connector with hand pressure by rotating the locking collar on the cable connector clockwise. **Do not use a wrench**. A tactile click is felt when the collar is properly engaged.

Figure 27   Cable Connector and Locking Collar
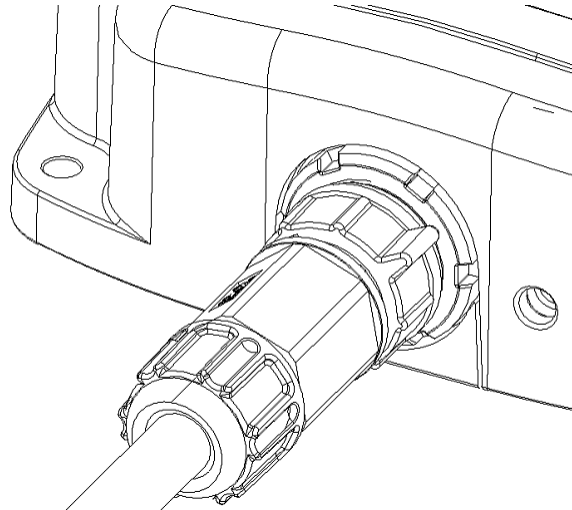
6. Wipe off any extra lubricant around the connector.

7. Wrap the mating connector with waterproof sealing tape if using the connector in changing weather conditions.

4.7   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

*terminal connector. Damage to the terminal connector interface or cable may otherwise result leading 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 will not stress or strain the connection.

- Tie the cable down using cable ties and tie holders (Figure 28) 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 28) for best holder retention.

Figure 28   Cable Management
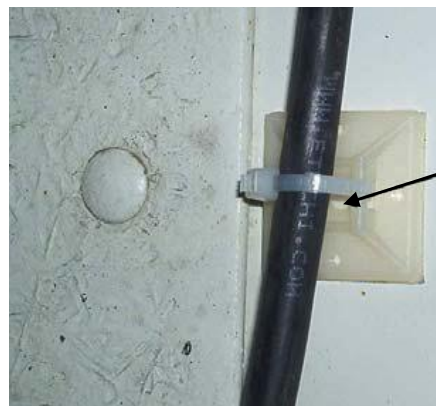
Adhesive cable tie holder. Apply a self-tapping screw here for added strength.

4.8   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.**

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

Note: *SkyWave recommends that if possible the user wait until the terminal is unblocked (i.e., has a full view of the sky) before powering up the terminal.*

1. Locate the main power input and the ground (GND) wires on the cable breakout.

   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 wire to the main power input and ground wires so that they reach the fuse panel. Cover any splices with adhesive lined heat shrink.

3. Connect the ground wire to the grounding point selected in Section 4.3.

4. Connect the main power input wire to the un-switched vehicle power source within the fuse panel.

5. Loop and secure any excess cabling.

When connected to an external power source, the terminal gives an indication that it has power when the LED lights up.

Figure 29   LED Location
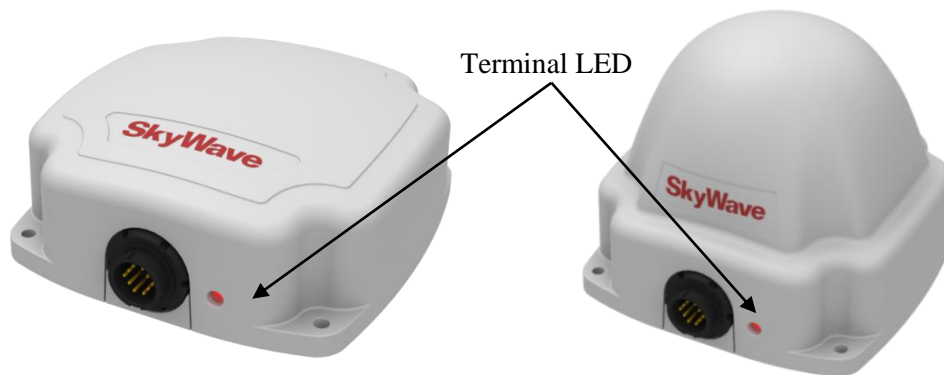
If your application requires extended cable lengths, it is necessary to calculate the cable voltage drop to determine if the terminal is receiving at least 9 V (with 1.7 A draw). Large cable voltage drops may adversely affect terminal operation.

Note: Connect only SkyWave approved cables to the terminal. Use of other cables will void the terminal warranty.

4.9   Register the Terminal

Note: The IDP 600 series terminals must complete registration to operate.

Once 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 6 for troubleshooting suggestions.

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

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

2. The SkyWave IsatData Pro network records the registration message and forwards the registration message to the user's application.

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

4.10   Cleaning Instructions

Wash the terminals with mild soaps or detergents.

4.11   Application Programming Interface

Refer to [T202] for programming information for the terminals.

5   Cable Assembly Instructions

This section provides the information necessary for the Solution Provider to assemble IDP power/interface cables for the end-user. The solder cup cable connector kit ships with the terminal.

Figure 30   Basic Connector Parts for Soldering Configuration

Connector Body

Back Shell

Coupling Ring

Sealing Nut

5.1   Required Tools and Materials

The following tools and materials are required to build the cable using this method:

- A cable[7] appropriate for the terminal's environment

- A knife

- A wire stripper

- Solder

- A fine-tip soldering iron

- A flexible high temperature silicone sealant for outdoor exposure

5.2   Cable Assembly Steps

1. Use a knife to cut and remove the outer jacket of the cable, 20 mm from the end (Figure 31) and remove any foil shielding.

   CAUTION   Be careful not to nick the wire insulation.

2. Use a wire stripper to remove 5 mm of insulation from the wires (Figure 31).

Figure 31   Recommended Stripping Length

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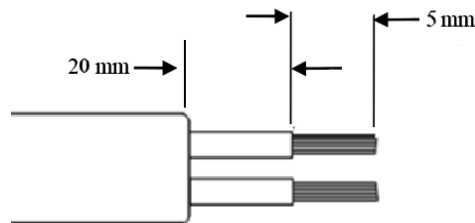
[7] For cables exposed to extreme temperatures and sun, select a cable with a thermal rating of -40°C to +85°C and a UV resistant jacket.

3. Twist the ends tightly to prevent stranded wires from fraying.

   CAUTION   Do not solder dip.

4. Slide the following items over the cable in sequence and as shown in Figure 32: a sealing nut, a back shell and a coupling ring.

Figure 32   Cable with Sealing Nut, Back Shell and Coupling Ring

*CAUTION   **Ensure that the black back shell cable grommet is present inside the cable grip area (Figure 33) and the red gasket is present and oriented with flat face visible as shown in Figure 34.***
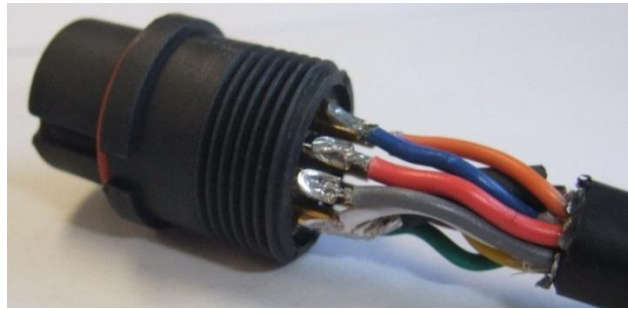
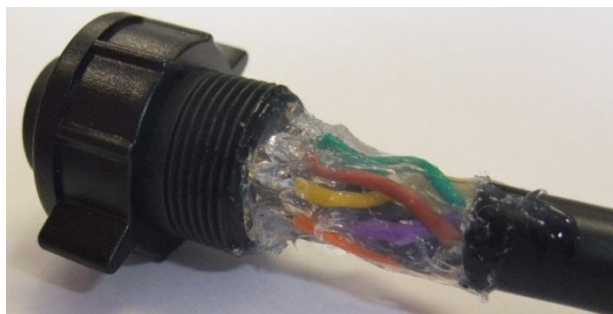**Figure 33   Cable Grommet**

Figure 34   Red Gasket

5. Using a soldering iron and solder, tin the wires and solder them to the connector solder cups (Figure 35) as per the proper pin-out.

Figure 35   Wires and Solder Cups

6. Ensure the O-ring is in place over the connector body as shown in Figure 36.

Figure 36   O-Ring over Connector Body

7. Slide the coupling ring over the connector body and give it a twist to prevent it from falling off.

8. Use silicone sealant to completely fill the end of the connector and the area between the wires (Figure 37).

Figure 37   Silicone in the Connector

9. Slide the back shell up the cable as close as possible to the connector body and fill it with silicone sealant (Figure 38).

Figure 38   Silicone in the Grommet

10. Assemble the back shell to the connector body and wipe away any excess sealant (Figure 39). To aid in tightening the back shell, align the coupling ring key feature with the slot in the connector body (Figure 39).

Figure 39   Key Features in the Coupling Ring and Connector Body

11. Apply sealant over the cable exit area as shown in Figure 40.

Figure 40   Cable Exit Area

12. Assemble the sealing nut over the back shell until the cable grip makes full contact with the perimeter of the cable jacket (Figure 41). Wipe away any excess sealant.

Figure 41   Assembled Sealing Nut

6   Troubleshooting the Terminal

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

6.1   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 (i.e., atop the terminal) and blocking transmission.

- Verify with your SP that the terminal is assigned to your account and registered (i.e., that it is sending and receiving) and that the SkyWave IsatData Pro network is operating properly.

- Check the condition of the power cable.

Replace the device, if the above checks fail to uncover the problem.

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APPENDIX A   Order Part Numbers

Table 9   Order Part Numbers

Terminal	Part Number	
	Side Connector	**Bottom Connector**
IDP-680 with standard GPS	SM201016-SXG	SM201016-BXG
IDP-690 with standard GPS	SM201009-SXG	SM201009-BXG

Kits	
Cable Connector and Solder Cup Kit	SA901020-001
Pole Mount Kit	SA900503
Contact your Account Executive for additional products and ordering codes.	

APPENDIX B   Activation Information

Server User Name: _____

Password: _____

Terminal Type/ Description	Mobile ID (NNNNNNNNSKYXXXX)	Location

APPENDIX C   IDP 600 Series Mating Cable

This cable (ST301005-001) connects the IDP terminal to external I/O lines and serial ports. There are a total of ten pins on this blunt cut cable; two connect the terminal to an RS-232 console serial port or an RS-485, four wires to connect to external I/O lines, and one each for ground and voltage. The cable has an over-molded connector.
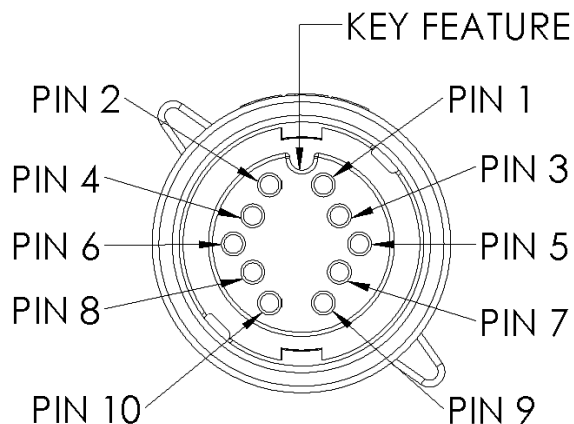
Figure 42   IDP 600 Series Mating Cable

Specifications

Parameter	Value
Length	Maximum length 25 meters
Temperature	-40°C to +85°C
Ultraviolet rating	UV stabilized

Figure 43 Face View of IDP 600 Series Mating Cable Connector

Connector Face View

Table 10   IDP 600 Series Mating Cable Color Code

Position	Color	Wire Gauge	Functionality
1	White	22 AWG	RS-485_A
2	Grey	22 AWG	RS-485_B
3	Black	20 AWG	Ground
4	Red	20 AWG	VIN (Vbatt)
5	Green	22 AWG	I/O 02
6	Blue	22 AWG	I/O 03
7	Brown	22 AWG	I/O 01
8	Purple	22 AWG	I/O 04
9	Orange	22 AWG	RS-232 Tx (output)
10	Yellow	22 AWG	RS-232 Rx (input)

APPENDIX D   IDP 600 Series to DMR-800 Adapter Cable

This cable (ST301006-001) allows an IDP 600 series terminal to be installed in place of a DMR-800. The cable has eight connectors and the RS-485 connections on the IDP 600 series terminal are left unconnected.
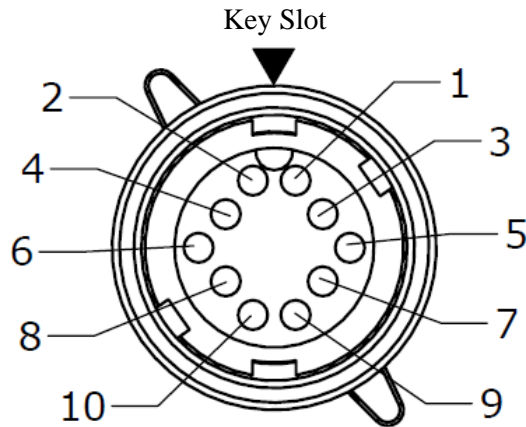
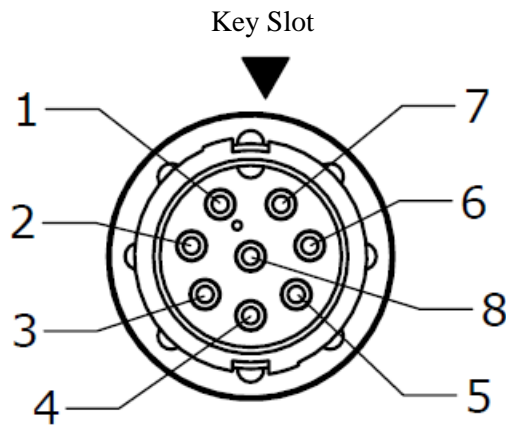**Figure 44   IDP 600 Series to DMR-800 Adapter Cable**

Specifications

Parameter	Value
Length	610 mm ± 51 mm
Temperature	-40°C to +85°C
Material	PVC jacket, 30 mils thick, black
Ultraviolet rating	UV stabilized

Figure 45   IDP Connector End Pin-Out

Key Slot

Figure 46   DMR-800 Mating Connector End Pin-Out

Key Slot

Table 11   Cable Connector Pin-Out

IDP Position	DMR-800D Position	Wire Gauge
1	N/C	-
2	N/C	-
3	4	18 AWG
4	5	18 AWG
5	6	20AWG
6	7	20 AWG
7	1	20 AWG
8	8	20 AWG
9	2	20 AWG
10	3	20 AWG

APPENDIX E   IDP 600 Series Extension Cable

This cable (ST301017-001) allows an IDP 600 series terminal to be installed in place of a DMR-800.

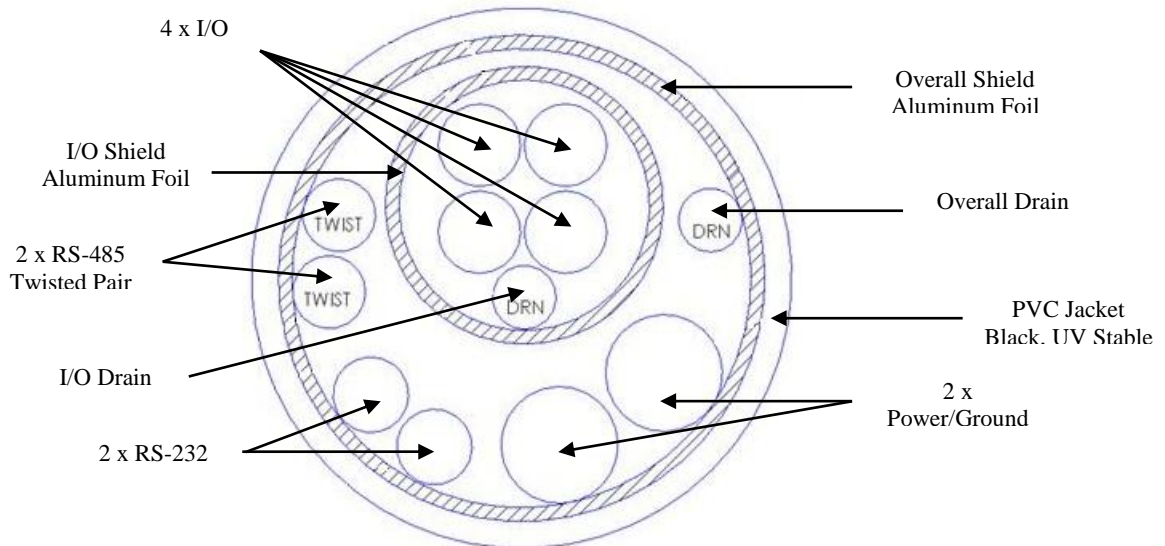**Figure 47   IDP 600 Series Extension Cable**

Specifications/Guidelines

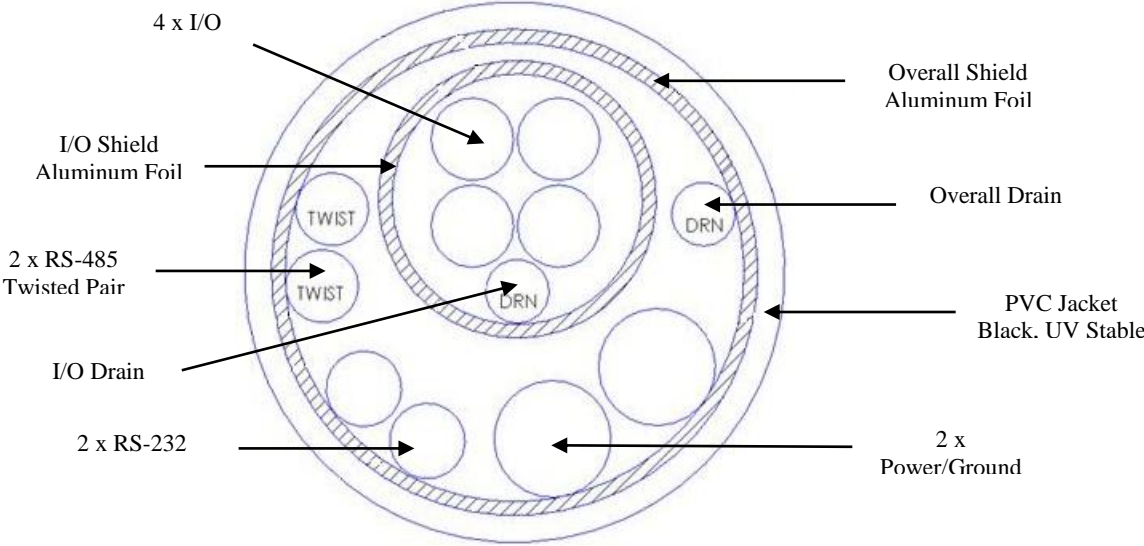| Parameter	Value
Length	500 mm ± 51 mm
Temperature	-40°C to +85°C
Material	PVC jacket, 30 mils thick, black
Ultraviolet rating	UV stabilized cable jacket
Rating	IP67 when mated
Minimum bend radius	25 mm

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 leading to hardware failure.

Table 12   Cable Connector Pin-Out

Cable End A Position	Cable End B Position	Wire Gauge	Functionality
1	1	22 AWG	RS-485_A
2	2	22 AWG	RS-485_B
3	3	20 AWG	Ground
4	4	20 AWG	VIN (Vbatt)
5	5	22 AWG	I/O 02
6	6	22 AWG	I/O 03
7	7	22 AWG	I/O 01
8	8	22 AWG	I/O 04
9	9	22 AWG	RS-232 Tx (output)
10	10	22 AWG	RS-232 Rx (input)

Figure 48   Raw Cable Details

SkyWave

4 x I/O

Overall Shield
Aluminum Foil

I/O Shield
Aluminum Foil

Overall Drain

2 x RS-485
Twisted Pair

PVC Jacket
Black. UV Stable

I/O Drain

2 x RS-232

2 x
Power/Ground

APPENDIX F   Drill Template

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

101.6 mm (4.0 in)

50.8 mm (2.0 in)

Ø 5.5 mm (7/32 in)
4 PLACES

50.8 mm
(2.0 in)

101.6 mm
(4.0 in)

Place RTV Silicone
in this region (360°)
prior to mounting.

Ø 30.0 mm (1 3/16 in)
Bottom Connector Mount
ONLY
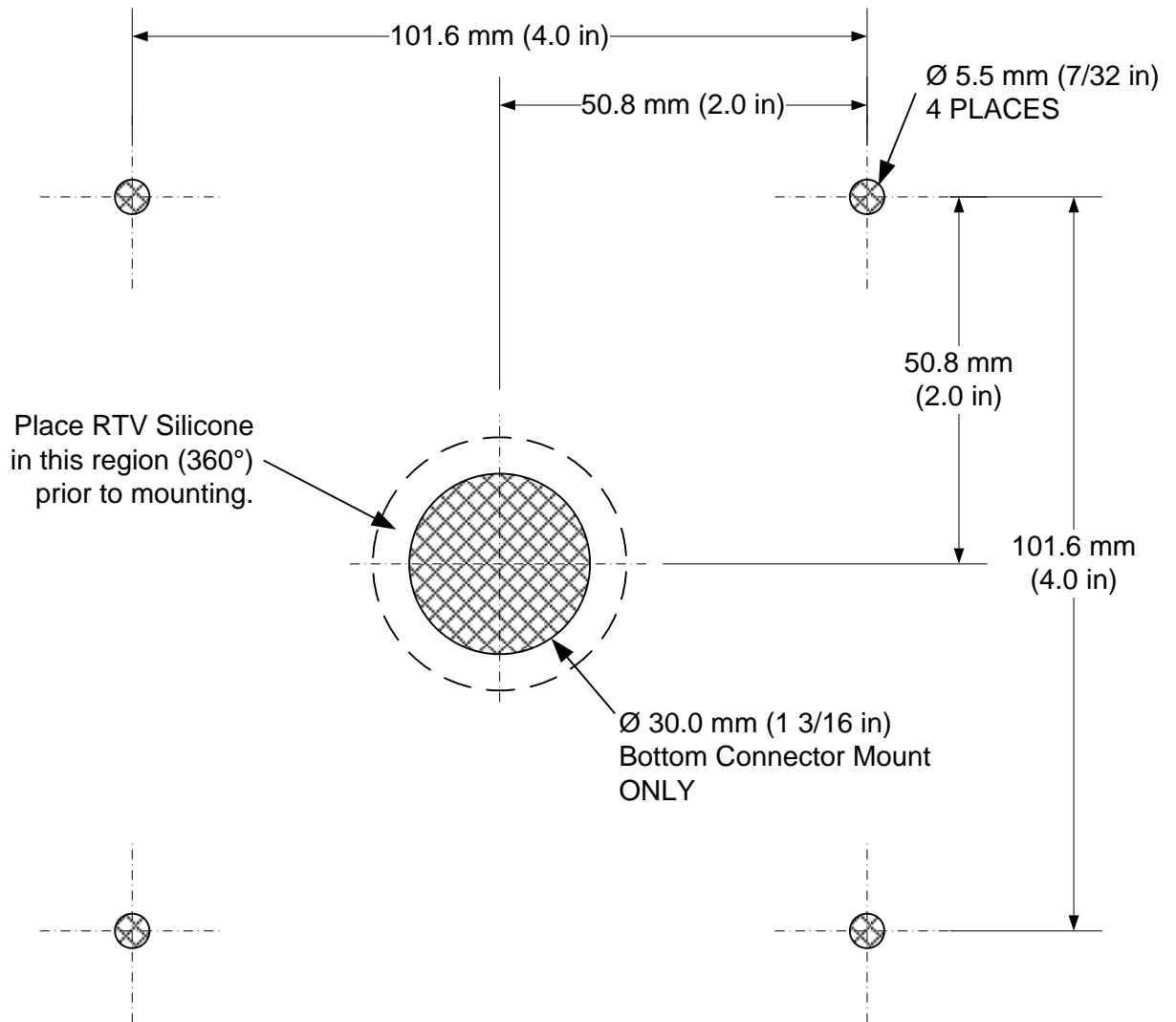
Nominal Dimensions Shown

Documentation Version

Version	Date	Details
02	Nov 2011	See What's New section for details
01	Aug 2011	Official customer release
.18	Jul 2011	Limited customer release
.17	Jun 2011	Limited customer release
.13	Apr 2011	Limited customer release
.10	Feb 2011	Limited customer release

Acronyms/Glossary

DC	direct current
ESD	Electrostatic Discharge
FCC	Federal Communications Commission
GND	ground
GPS	Global Positioning System
I/O	input/output
IEC	International Electrotechnical Commission
kgf·cm	kilogram-force centimeter
LED	light-emitting diode
RF	radio frequency
RoHS	Restriction of Hazardous Substances
R&TTE	Radio and Telecommunications Terminal Equipment
Rx	receive
SP	Solution Provider
Tx	transmit

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