

SkyWave

SureLinx 8100

Hardware Guide

T7, Version 03

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NOTE

THIS DOCUMENT CONTAINS INFORMATION ABOUT D+ AND ISATM2M.

PLEASE MAKE SURE TO USE THE INFORMATION APPROPRIATE FOR
THE SERVICE TYPE YOU ARE USING.

PLEASE CONTACT SKYWAVE CUSTOMER SUPPORT FOR ADDITIONAL
ASSISTANCE.

Preface

What's New?

Updates since the last release are below:

- Introduction of the new SureLinx 8100c terminal
 - Added procedures and specifications
 - Added electrical pin connection table (Table 5)
 - Added Bus application controller information (Section 8)
 - Added functional description (Figure 40)
- Introduction of the new bottom entry satellite/GPS antenna
 - Added specifications and drill template (Appendix C and Figure 43)
- Added table for elevation angle guidelines (Table 1)
- Added satellite/GPS antenna cable guidelines (Table 2)
- Added SureLinx LED status table (Table 3)
- Updated SureLinx 8100 functional description – RS232 console (Appendix E)
- Updated to SureLinx 8100 electrical pin connection table – removed ext I/O_15 and I/O_16 (Table 5)
- Minor update to document content and images

Purpose

This document is an overview of hardware characteristics and specifications of the SureLinx 8100 and 8100c terminals.

Audience

This document is for technical readers. It provides information to ensure successful installation and operation of the SureLinx terminals.

Notation

The SureLinx 8100 and 8100c are dual mode satellite/GPRS terminals. The SureLinx terminals are available with D+ or IsatM2M service.

This document uses ‘satellite’ or ‘satellite service’ to refer to D+ and IsatM2M service except when discussing information specific to a particular service (D+ only or IsatM2M only) or a specific satellite (GPS satellite or Inmarsat satellite).

Reference

It is recommended that you be familiar with the content of the following documents before using this guide. These documents are available from the SkyWave Developer's Toolkit (SDK), or support.skywave.com.

- [G1] Introduction to SkyWave Products and Services
- [R4] SureLinx 8100 Evaluation Kit – Getting Started Guide
- [R5] SureLinx 8100c Evaluation Kit – Getting Started Guide
- [T8] DMR-800 and SureLinx User's Guide
- [WN001] What's New? – SkyWave IsatM2M

Other third party documents referenced in this document

- [TC63] Siemens Cellular Engine, Hardware Interface Description

Safety Disclaimer

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Safety Precautions

The SureLinx 8100 and 8100c must comply with all safety precautions relating to the operation, usage, service and repair of the cellular terminal. SkyWave assumes no liability for the customer's failure to comply with any of these precautions.

Caution warnings appear throughout this document.

Warranty

SkyWave warrants its products and services will perform in accordance with SkyWave's specifications and will be free from defects in material and workmanship for a period of fifteen (15) months from date of shipment. This warranty is limited to the repair and/or

replacement of any defective components experienced under normal specified operating use and storage conditions, at SkyWave's discretion. It does not cover any damages caused or associated with the product's misuse. Notify your Solution Provider of any defective products. Ship any defective product, along with a fault report, back to the Solution Provider according to the Solution Provider's instructions. SkyWave is not responsible for corrosion damage caused by improperly assembled or installed cables. Warranty is void if the unit is opened.

A fault report is required for each unit returned under warranty. Please contact SkyWave's customer support.

User Serviceable Parts

The SureLinx 8100 and 8100c contains no user serviceable parts or replaceable fuses.

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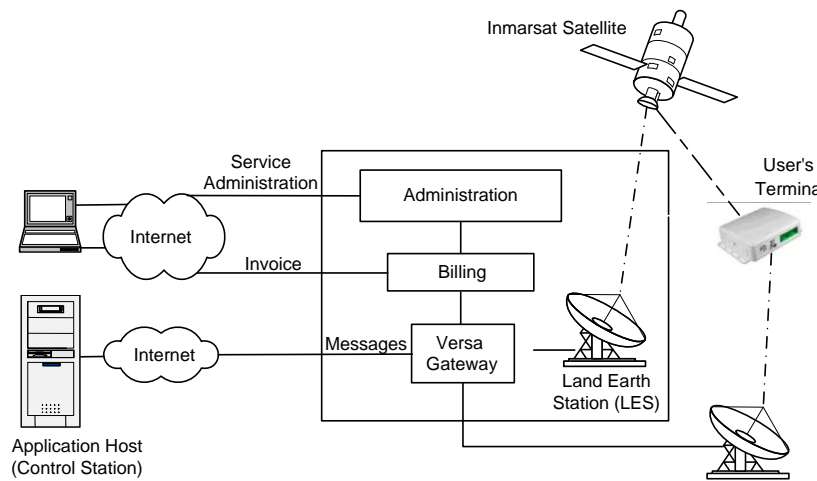
1 Product Overview

The SureLinX 8100 and 8100c are high-performance dual mode satellite GPRS communication terminals designed for short messaging applications. The terminals conform to Inmarsat standards for satellite communications and offer either the D+ or IsatM2M service. A GPRS modem implements SkyWave’s proprietary protocol. Their low cost, low power, small size and versatility make them ideal for short messaging mobile applications that require coverage in both urban and rural environments.

A thirty pin automotive connector provides an interface to the SureLinX terminals for power, I/O, serial and other communications.

SkyWave Mobile Communications Inc. designs and manufactures the SureLinX terminals [G1] and distributes them through SkyWave’s solution providers as part of SkyWave’s satellite communications network (Figure 1).

Figure 1 The SureLinX and the SkyWave System



1.1 SureLinX Components

The SureLinX terminals consist of the following components, excluding interconnecting cabling.

- Transceiver unit (with built-in Bus application controller – SureLinX 8100c only)
- Satellite/GPS antenna
- GPRS antenna

1.1.1 Transceiver Unit

Each SureLinX terminal is a self-contained unit, including satellite transceiver (modem), quad-band GPRS modem, GPS module, programmable microcontroller, and multiple I/O (input/output) feeds capable of monitoring and controlling external sensors and devices. Ideal for mobile applications, it is also suitable for fixed installations. The SureLinX 8100c also includes a built-in Bus application controller providing a C-programmable interface and allowing it to access external devices using CANbus, RS485 and RS232 interfaces.

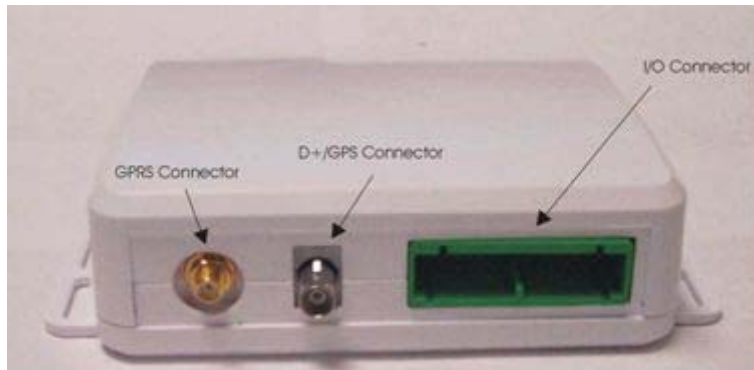
The transceiver unit (Figure 2) is dust proof, but not waterproof. Use it in an indoor environment, inside a vehicle, away from exposure to the elements (i.e. rain, snow, wind). The separate low-profile antennae provide terrestrial and wireless communication. The SureLinx terminals are side connector mounting transceiver units.

Figure 2 Transceiver Unit



Arranging all three (Figure 3) of the transceiver unit's connectors at one end of the unit makes installation easier. Sturdy flanges on the side make mounting quick and easy.

Figure 3 SureLinx Connector Positioning



A screw-on doorway on the side of the unit (Figure 4) provides easy access to the SIM card holder for installation and replacement.

Figure 4 SureLinx SIM Access Door



Transceiver Assembly

The transceiver unit contains a single PCB, ROHS compliant assembly. The transceiver card is a double-sided multi-layer FR4 printed circuit board.

Note: The transceiver assembly contains no user serviceable parts.

SIM Holder

The terminals use a 6 circuit, SMT SIM holder with an ejector and a removable SIM card tray.

1.1.2 Satellite/GPS Antenna

Each satellite/GPS antenna is hermetically sealed and designed to operate in extreme environments. It has four mounting tabs for installation. Figure 5 shows the satellite/GPS side entry antenna with a 5m cable. The satellite/GPS antenna is available in various cable lengths. The antenna is also available in a bottom entry model which ships without cables (Appendix A).

Each satellite/GPS antenna connects to the transceiver unit using LMR195-PVC coax cable terminated with an industry standard automotive FAKRA RF connector.

Figure 5 Satellite/GPS Side Entry Antenna



Satellite/GPS Antenna Magnetic Mount

An optional flexible rubber magnetic mount is available in the case where the user does not wish to permanently mount the antenna. The magnet has an adhesive backing on one side which attaches the magnet to the antenna body. The magnet is factory installed. Figure 6 shows the satellite/GPS antenna with the magnet installed.

Figure 6 Magnetic Mount Satellite/GPS Antenna

Satellite/GPS Antenna Assembly

The satellite/GPS antenna assembly is an active antenna – it uses a DC voltage on the coax cable. The DC voltage powers an LNA for GPS receive and a power amplifier for Inmarsat satellite transmit.

The antenna assembly consists of a single PCB, ROHS compliant, assembly containing no user serviceable parts. This assembly is factory epoxy sealed into the antenna enclosure to prevent water damage.

Grommet

The rubber grommet on the antenna enclosure reduces wear and tear on the antenna cable due to chaffing.

1.1.3 GPRS Antenna

Each SureLinX uses a standard GPRS antenna which ships with the terminal. The GPRS antenna is a quad-band adhesive patch antenna, designed for installation on the interior of a windshield. It connects to the transceiver unit with a 2.5m RG174 coaxial cable terminated with a male SMA connector.

Figure 7 SureLinX GPRS Antenna

GPRS Connection

The GPRS antenna connects directly to the GPRS module. Only use SkyWave approved GPRS antennae since they ensure proper operation to prevent damage to the GPRS module.

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2 SureLinx 8100 and 8100c

2.1 Getting Started

Getting the terminals ready for operation requires doing the following:

1. Preparing for the installation (Section 2.2)
2. Determining the mounting location (Section 2.3)
3. Mounting the terminal (Section 2.4)
4. Applying power (Section 2.5)
5. Activating the terminal (Section 2.6)

2.2 Preparing for the Installation

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

2.2.1 Shipping Box Contents

SkyWave ships the SureLinx in an individual packaging box with the following parts.

- SureLinx transceiver unit (terminal)
- Satellite/GPS side entry antenna with coax cable and FAKRA connector OR Satellite/GPS bottom entry antenna (FAKRA to SMA cables not included)
- GPRS antenna with coax cable and SMA connector
- Mating connector with crimp terminals
- Installation guide
- Optional magnetic mount assembly

2.2.2 Additional Materials

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

- Mounting hardware
- P-Clip
- Cable with mating connector JAE (part number IL-AG5-30S-D3C1)
- SIM card (Refer to section 2.4.1 for SIM card procurement and installation).

2.2.3 Mounting Hardware

You can use two types of screws depending on the installation. If screwing the transceiver unit and the satellite/GPS antenna to a mounting surface, you will require

- Qty 8 - M5 stainless steel pan head screws.

- If bolting the terminal to a mounting surface, the following materials are required.
- Qty 8 - M5 stainless steel pan head bolts (length depends on mounting surface)
- Qty 8 - M5 washers
- Qty 8 - M5 lock washers
- Qty 8 - M5 nuts

2.2.4 Required Tools

You require the following tools to install the SureLinX.

- Drill & 5.5 mm drill bit
- Screwdriver
- Socket wrench set
- Crimping tool
- Small flat nosed screwdriver

2.2.5 Inmarsat Serial Number (ISN)

The terminal's Inmarsat serial number (a hexadecimal number beginning with DCC) is located on the side of the box under the barcode (Figure 8) or on the bottom of the terminal.

1. Record the terminal's Inmarsat serial number (a hexadecimal number beginning with DCC) required for terminal activation. Provide the IMEI 15 digit number, located near the DCC number, to your GPRS Service Provider if using the GPRS capabilities.

The ISN number is located on the side of the box under the barcode (Figure 8), on a label under the transceiver unit, and electronically inside the transceiver. Record the terminal's Inmarsat serial number (ISN), required for terminal activation.

Figure 8 Terminal's Inmarsat Serial Number



2.3 Determining the Mounting Location

Before installing the SureLinX terminal, consider the following important guidelines.

2.3.1 Transceiver Mounting Guidelines

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

- Mount indoors, inside a vehicle, or in an area protected from environmental elements.
- Do not mount the transceiver unit where water may build-up or collect. The unit is not waterproof.
- Mount on a flat, solid, stable surface. Do not mount the unit on a curved surface as undue stress could cause mechanical failure to the enclosure as well as damage to the internal circuitry.
- Mount the transceiver unit away from any heat source.
- Mount the transceiver unit so mating cables are away from sharp edges.
- Mount the transceiver unit in an area where there is minimum shock and vibration to the unit and cables.
- Fasten the transceiver unit securely so that it is not loose and does not move easily. If necessary, use a mounting bracket (not supplied) or other suitable support.
- Mount the transceiver unit on a surface that is wide enough to support the base of the transceiver unit. If necessary, use a mounting bracket (not supplied) or other suitable support.
- Mount the transceiver unit on a surface that does not get hotter than the maximum operating temperature (Appendix C). If the surface gets hotter, mount the unit with a thermal barrier between it and the mounting surface.
- Do not mount the transceiver unit too close to other electrical equipment (Electronic Magnetic Interference) since it may interact because of radiated and conducted emissions.

CAUTION: *In a hospital or other health care facility, interference from the SureLinx cellular modem may affect the operation of cardiac pacemakers or other implanted medical equipment and hearing aids.*

CAUTION: *The SureLinx uses radio signals, cellular networks and satellite signals. Do not rely solely on the SureLinx for emergency (SOS) calls because these connections are not guaranteed at all times and under all conditions.*

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

- Do not use the SureLinx on an aircraft.
- Do not mount the SureLinx close to metallic objects. Metallic objects can affect GPRS coverage. Do not paint the terminal or antennae.
- Mount the transceiver unit so that connecting cables are below the unit. This will prevent any water on the cable from leaking into the transceiver unit.
- Do not mount the transceiver unit or antennae close to radar or other communications antennae. 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 antennae and
- Not within a radar beam.

2.3.2 GPRS Antenna Mounting Guidelines

- Mount indoors, generally on the inside of a vehicle window, near the transceiver unit.
- Mount on a flat surface for maximum adhesion.
- Mount on a surface that is free from dirt, grime, water and grease.
- Mount at least 20 mm from metal objects.
- Mount the antenna at least 1 m away from the satellite/GPS antenna.

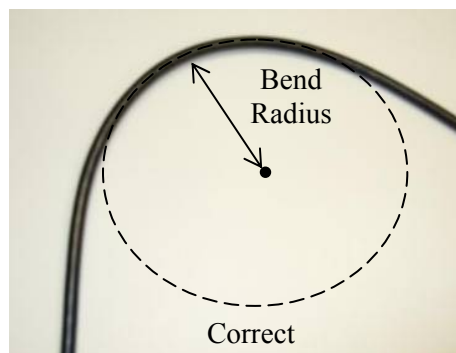
2.3.3 Satellite/GPS Antenna Mounting Guidelines

Because the GPS satellites are not geosynchronous, they are always moving in the sky. This can cause sporadic GPS results when the satellite antenna is pointing out of a window, because there are fewer GPS satellites visible and they will change over time.

Before installing the antenna consider the following important instructions:

- Mount the satellite/GPS antenna at least 20 cm (8 in) away from all persons.
- Mount the satellite/GPS antenna where it can reach the transceiver unit and has a clear view of the satellite. For a mobile installation, this means at the highest point on the vehicle or vessel where it has a clear view in all directions.
- Do not drill any holes before checking that you have room for the bend radius of the LMR195-PVC cable. For reliable operation, do not go below a bend radius of 13mm. Measure the bend radius of the cable as below:

Figure 9 Cable Bend Radius



- Mount on a surface that is wide enough to support the base of the antenna.
- Mount on a surface that does not get hotter than the maximum operating temperature (Appendix C). If the surface gets hotter, mount the terminal with a thermal barrier between it and the mounting surface.

- Mount on a flat surface for maximum adhesion (magnetic mount antenna only).
- 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.

CAUTION: *Carefully consider the roof mounting location if passing branches may knock the magnetic antenna off the roof.*

- Mount the antenna so that the Inmarsat satellite is within 0 to 90 degrees (look angle) of the mounting surface. Make sure that the line of sight is clear of obstructions. Use the following guidelines:

Table 1 Elevation Angle Guidelines

Height of Obstruction	Min. Antenna Mounting Distance from Obstruction
0.5 m	5 m
0.4 m	4.5 m
0.3 m	3.5 m
0.2 m	2 m

Once you have selected your mounting location, mount the terminal and the antennae (see Section 2.4).

2.4 Mounting the Terminal

CAUTION: *Most users install the terminals on a moving 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: *Painting the terminal or antennae may interfere with their performance.*

Follow the specific mounting instructions provided by your Solution Provider if mounting the terminal using tools or configurations that are different from the ones in this document.

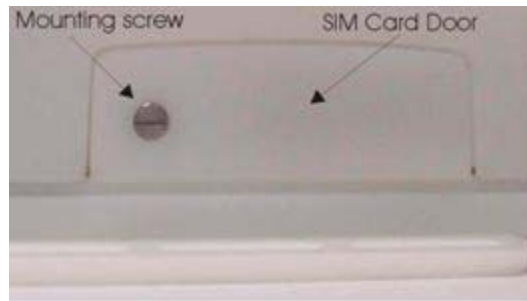
2.4.1 Installing the SIM Card

The SureLinx does not ship with a SIM card. To use the GPRS capabilities of this terminal you must purchase and install a SIM card. Purchase a SIM card, activated for use with a GPRS network, from a Service Provider serving the area where the terminal will operate.

CAUTION: *If there is power to the SureLinx, never insert or remove the SIM card. Inserting or removing the SIM card while there is power disables the GPRS connection and may damage the SIM card.*

1. Remove the SIM card door, located on the left side of terminal, using a small flat nosed screwdriver to loosen the mounting screw (Figure 10).

Figure 10 SIM Card Door



2. Press gently on the rod lever (Figure 11) with a small screwdriver or pen to eject the SIM card tray (Figure 12).

Figure 11 SIM Card Holder with Tray Ejected

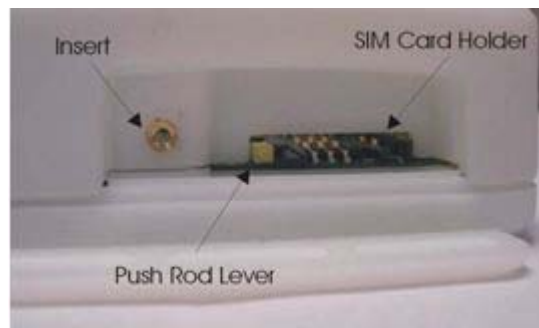


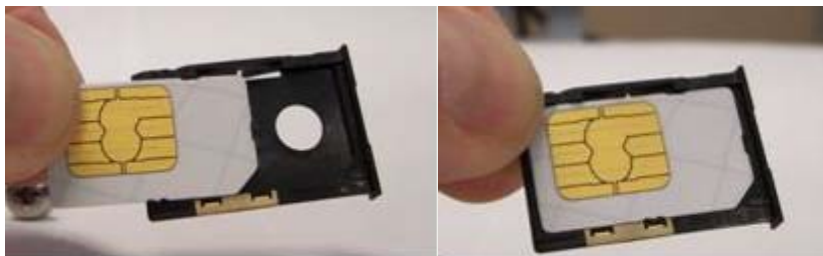
Figure 12 SIM Card Holder with Tray Installed



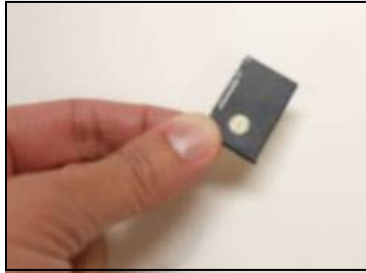
3. Pull the SIM card tray completely out of the card holder using your fingers.
4. Insert the SIM card into the tray (Figure 13) with the gold colored side facing up. Listen for the snap to make sure it is securely in place.

Note: *The SIM card is cut at an angle so it can only fit into the tray in one direction.*

Figure 13 Slide SIM Card into Tray



5. Flip the SIM card tray over so that the gold colored area is facing down (Figure 14).

Figure 14 Flipped SIM Card Tray

6. Slide the tray, with SIM card facing down, into the terminal's SIM card holder (Figure 15).

Note: *Make sure that you insert the SIM card tray flat into the SIM card holder. The rod lever will not function if the SIM makes contact with the transceiver unit's enclosure.*

Figure 15 Install SIM Card Tray

7. Replace the SIM card door and tighten the screw gently. Do not over tighten.

2.4.2 Drilling Mounting Holes for the Transceiver Unit (optional)

Note: *These steps are only required if your Solution Provider did not provide you with a mounting bracket.*

1. Use the drill template (Appendix G) to mark the location of the terminal's four mounting holes.
2. Drill the four mounting holes using the drill with the 5.5 mm bit.
3. Use the screwdriver and socket set to lock the terminal in place with the mounting hardware.

CAUTION: *Do not over tighten. Torque in excess of 11.5 kgf.cm (10 lbf.in) may damage the plastic flanges.*

4. Continue with the steps for Connecting the Antennae.

2.4.3 Connecting the Antennae

In order for the SureLinx to use the satellite network, its satellite/GPS antenna must have a clear view of one of the Inmarsat satellites.

When connecting the SureLinX to a PC or laptop, it is easier to point the satellite antenna out of a window or set it on a window ledge. This is fine as long as the terminal has a view of the appropriate Inmarsat satellite and the building or other large object is not blocking it.

Review the mounting guidelines in section determine the mounting location (Section 2.3) before mounting the antennae following the procedures below:

2.4.3.1 Mounting the Antenna

Magnetic Mount Satellite/GPS Antenna

1. Find a location for the satellite/GPS antenna following the guidelines provided in section 2.3.3.
2. Clean the mounting surface with a damp cloth and a mild detergent to remove any dirt or grime.

CAUTION: *Remember to leave enough cable for strain relief so as not to introduce any additional force on the connector or antenna sealing.*

3. Mount the magnetic antenna securely in place.

Drill Mount Satellite/GPS Antenna

Note: *These steps do not apply to the magnetic mount antenna.*

1. Find a location for the satellite/GPS antenna following the guidelines provided in section 2.3.3.
2. Use the drill template (Appendix G) to mark the location of the mounting holes. For a bottom connector antenna you will also need to drill a hole for the antenna cable.

CAUTION: *Only drill the antenna cable hole if installing a bottom connector antenna.*

CAUTION: *Remember to leave enough cable for strain relief so as not to introduce any additional force on the connector or antenna sealing. SkyWave recommends restraining the cables during installation.*

3. Drill the mounting holes using the drill.
4. Apply waterproof sealing compound, such as RTV silicone, around the drill holes.
5. Secure the antenna in place with screws or bolts depending on the mounting surface.

2.4.3.2 Connecting the Cables

1. Connect the satellite/GPS antenna to the FAKRA connector on the transceiver unit (Figure 16) by pushing until you hear a click.

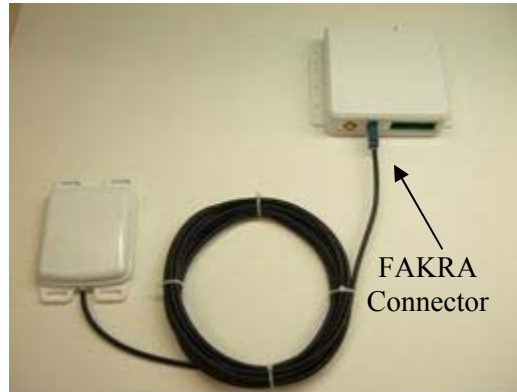
For the bottom connector antenna, attach an SMA to FAKRA connector cable (not supplied) following the guidelines in the table below.

Table 2 Satellite/GPS Antenna Cable Guidelines

Cable Length	Cable Specification
Up to 2m	RG316
Up to 10m	LMR-195

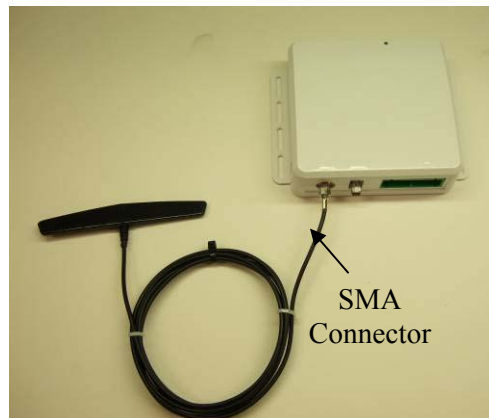
CAUTION: Remember to leave enough cable for strain relief so as not to introduce any additional force on the connector or antenna sealing.

Figure 16 Satellite/GPS Antenna with FAKRA Connector



2. Connect the GPRS antenna to the SMA connector (Figure 17) on the transceiver unit and tighten with a suitable wrench (recommended torque specification: 80-110 N.cm (7-10 inch pounds)).

Figure 17 GPRS Antenna with SMA Connector



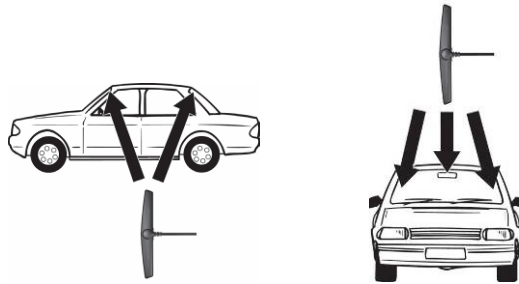
3. Clean the antenna mounting surface with a damp cloth and mild detergent to remove any dirt or grime. Make sure the surface is dry before applying the antenna's adhesive strip.
4. Remove the adhesive strip from the GPRS antenna (Figure 18).

Figure 18 Adhesive Strip



5. Mount the GPRS antenna on the inside of the window. Figure 19 shows mounting examples on an automobile.

Figure 19 Sample GPRS Mounting Locations – automobile example



6. Secure the GPRS antenna cable in place.
7. Connect the green I/O/serial (electrical) adapter cable to the transceiver unit (Figure 20) by pushing until you hear a click.

Figure 20 I/O/Serial Adapter Cable



8. Install a cable P-Clip (Figure 21) to secure the mating cable to the mounting surface. Size the P-clip according to the diameter of the mating cable.

Figure 21 Cable P-Clip



2.4.4 Disconnect Magnetic Mount Antenna

If at some time you need to disconnect or reposition the magnetic mount antenna, follow the steps below.

1. Grab the satellite GPS magnetic antenna firmly in one hand (Figure 22).

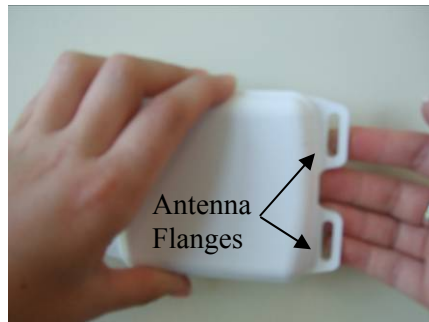
CAUTION: *Do not slide or twist the magnetic antenna while attached to the mounting surface. This can cause damage to the surface or the vehicle's paint.*

CAUTION: *Do not use the cable to lift the antenna as this may damage the cable connection to the antenna.*

2. Slide the finger tips of your other hand under the flanges and pull firmly away from the mounting surface.

You should hear a snap as the antenna pulls away from the surface and breaks the magnetic force.

Figure 22 Disconnecting the Magnetic Mount Antenna



2.4.5 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 23.
2. Press down firmly, with your thumb, on the raised section of the FAKRA thumb release (Figure 23).

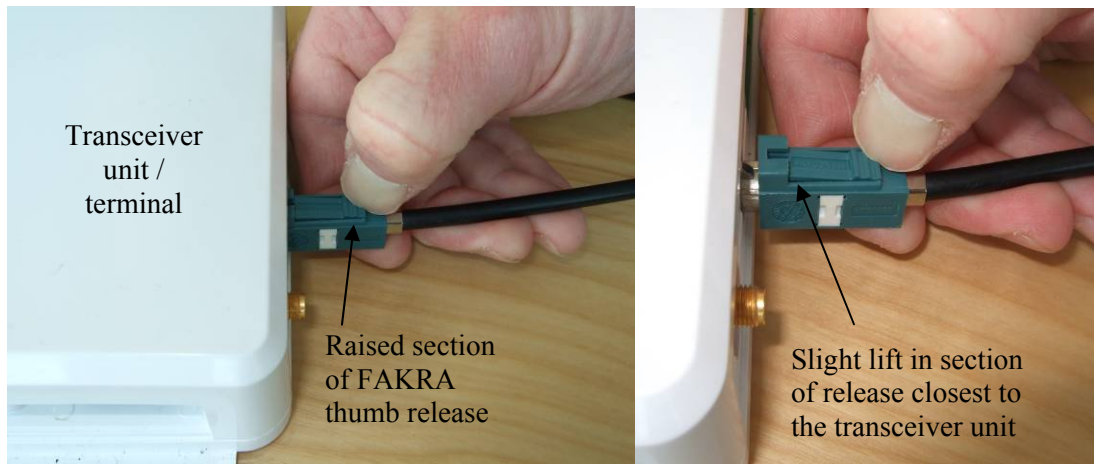
Pressing the thumb release will cause part of the release, closest to the transceiver unit (terminal), to lift.

CAUTION: *Do not pull on the FAKRA connector unless the thumb release is down, or you may damage the connector.*

3. Pull the FAKRA connector away from the transceiver unit while firmly holding down the thumb release (Figure 23).

This causes the FAKRA connector to disconnect from the transceiver unit.

Figure 23 Disconnecting the FAKRA Connector from the Transceiver Unit



2.5 Applying Power

Follow the guidelines below before applying power to the terminal.

Check that the polarity is correct and the voltage source is as specified in Appendix C before connecting the terminal to an external voltage source. Figure 26 shows the mating connector that plugs into the terminal. Refer to Table 5 for the connector pin-out description.

Correctly mate connectors before applying power and make sure to connect the battery ground at the same time or before applying power. This is especially important when the battery ground is also connected to an external RS232 console communication port.

An LED provides status indication and is visible on the top side of the transceiver unit. The flashing rates indicate if an error is present.

The following table describes the meaning of the SureLinx LED status for each component:

Table 3 SureLinx LED Status

Flashes	Component			
	Terminal	GPS	D+ and IsatM2M	GPRS
1	no error	valid GPS position	no error	GTM online
2	error	no GPS position	Not on satellite Traffic Channel	No GTM session established
ON continuously	Error – Contact SkyWave Customer Support			

To obtain more details on the type of error or condition present, an RS232 console connection would be required to view a detailed status message for the component(s) in question.

After powering on the terminal, the LED (Figure 24) comes on for 5 seconds. This indicates that the terminal is correctly executing its start-up self-test sequence.

Figure 24 SureLinx LED

After about 5 seconds, the LED flashes a sequence of flashing codes. A single flash in each sequence indicates no errors. Multiple flashes in the sequence indicate a problem with one of the SureLinx subsystems.

2.6 Activate the Terminal

To activate the terminal refer to *Preparing for the Evaluation* in [R4 or R5] for detailed instructions.

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3 Cleaning Instructions

The SureLinx is 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 if necessary. Do not immerse in water and ensure that water does not enter through the connector openings.

4 SureLinx Mating Cable Assembly Instructions

The following section provides the information necessary to assemble a SureLinx terminal power/interface cable for the end-user. Pay attention to the assembly and installation steps to protect the connector pins operation of the terminal.

4.1 Mating Connector & Terminal Pins Part Numbers

The mating connector and terminal pin part numbers are shown in the table below.

Table 4 Connector and Terminal Pin Part Numbers

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

4.2 Electrical Pin Assignments

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

CAUTION: *Provide proper protection against electrical transient conditions.*

Figure 25 shows the SureLinx power and I/O connector and Figure 26 shows the mating connector which plugs into the SureLinx transceiver unit.

Figure 25 Transceiver Electrical Mating Connector Pins (front view)

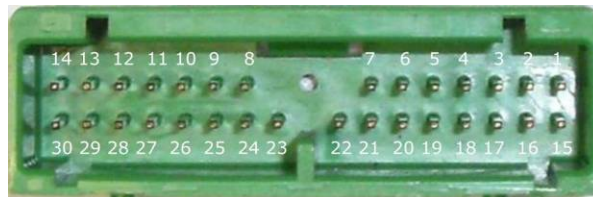


Figure 26 Mating Connector Electrical Cable (front view)

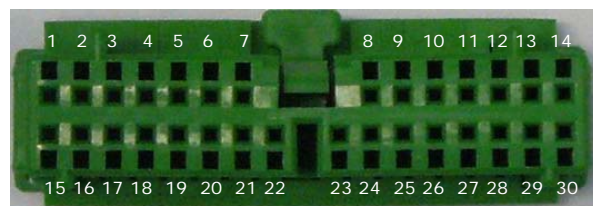


Table 5 Electrical Pin Assignments

SureLinx 8100			SureLinx 8100c		
Pin #	Name	Functionality	Pin #	Name	Functionality
1	Reserved	This pin must be left unconnected	1	Reserved	This pin must be left unconnected
2	Reserved	This pin must be left unconnected	2	I/O_BUS_H	Can be configured for RS485 or CANbus_1
3	Reserved	This pin must be left unconnected	3	I/O_BUS_L	Can be configured for RS485 or CANbus_1
4	Reserved	Reserved	4	CANbus_2_L	Can be configured for CANbus_2
5 to 12	EXT_I/O_01 To EXT_I/O_08	General purpose extended I/O configurable as i) Digital Input - switch to ground/battery (provide an external pull-up/pull-down resistor) ii) Current Source Output (total current sourced by all EXT_I/O lines must not exceed 24mA) iii) Analog Input iv) Frequency Input	5 to 12	EXT_I/O_01 to EXT_I/O_08	General purpose extended I/O configurable as i) Digital Input - switch to ground/battery (provide an external pull-up/pull-down resistor) ii) Current Source Output (total current sourced by all EXT_I/O lines must not exceed 24mA) iii) Analog Input iv) Frequency Input
13	Reserved	This pin must be left unconnected	13	RS232_1 Tx	RS232_1 transmit data (output from SureLinx)
14	Reserved	This pin must be left unconnected	14	RS232_1 Rx	RS232_1 receive data (input to SureLinx)
15 to 20	EXT_I/O_09 to EXT_I/O_14	Same as EXT_I/O_01	15 to 20	EXT_I/O_09 to EXT_I/O_14	Same as EXT_I/O_01
21	Reserved	Reserved	21	CANbus_2_H	Can be configured for CANbus_2
22	Reserved	This pin must be left unconnected	22	Reserved	This pin must be left unconnected
23	RS232 console Rx	RS232 console receive data (input to SureLinx)	23	RS232 console Rx	RS232 console receive data (input to SureLinx)
24	RS232 console Tx	RS232 console transmit data (output from SureLinx)	24	RS232 console Tx	RS232 console transmit data (output from SureLinx)
25 to 27	I/O_01 to I/O_03	General Purpose Input Output configurable as i) Digital Input ii) Digital Output (Open Collector) iii) Analog Input	25 to 27	I/O_01 to I/O_03	General Purpose Input Output configurable as i) Open Collector Output ii) Digital Input iii) Analog Input
28	I/O_04	General Purpose Input Output configurable as i) Open Collector Output ii) Digital Input iii) Analog Input iv) Current Loop Input (4-20mA)	28	I/O_04	General Purpose Input Output configurable as i) Open Collector Output ii) Digital Input iii) Analog Input iv) Current Loop Input (4-20mA)
29	Power	Power supply voltage Vbatt (9 to 32V)	29	Power	Power supply voltage Vbatt (9 to 32V)
30	Ground	Ground and battery return	30	Ground	Ground and battery return

4.3 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.
- Maximum wire gauge is 18AWG for proper crimping into the mating connector.
- The GPRS can consume up to 2A peak current (Appendix C), therefore use a 2.5A Slow Blow fuse, regardless of the voltage.
- Minimum recommended wire gauge is 22AWG for cable lengths up to 25 meters and 20AWG for cable lengths up to 40m.
- De-rate the input voltage range by 1 volt for every 5m increase in length. Make sure the de-rated input voltage meets the SureLinX minimum input specification of 9V.
- Ensure that the cable operating temperature matches the terminals operational environment
- If exposed to sunlight, cover the cable in a jacket or protect it from UV rays.
- Cable should have operating voltages exceeding 100V
- Provide a separate return ground reference connection for cable lengths longer than 2m if using analog inputs on either the I/O or Ext I/O. With 2m cable lengths and a single ground return connection, analog voltage reading errors introduced by ground reference difference in the return cable should be less than 0.2V.

4.4 Analog Input

- Provide a separate return ground reference connection for cable lengths longer than 2m if using analog inputs on either the I/O or Ext I/O. With 2m 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 0.2V.
- Without a separate ground reference, the voltage drop induced across the ground reference affects the accuracy of the SureLinX analog reading. Changes to the SureLinX current consumption that occur with changes to the terminals' mode (ie GPRS transmit, satellite transmit) will change the analog input reading.
- Ensure the output impedance of the analog signal source is <1 kohm.

4.5 RF Immunity

If the SureLinX 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 (RS232, RS485, CAN) should also be twisted for longer lengths.

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

4.6 Tools

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

For Production cable assembly, SkyWave recommends the Crimping and Extraction tools listed in Table 6 below.

Table 6 Crimping and Extraction Tools

Description	Manufacturer	Part Number
Hand Crimper	JAE	CT150-1-AG-5
Extraction Tool	JAE	ET-AG5

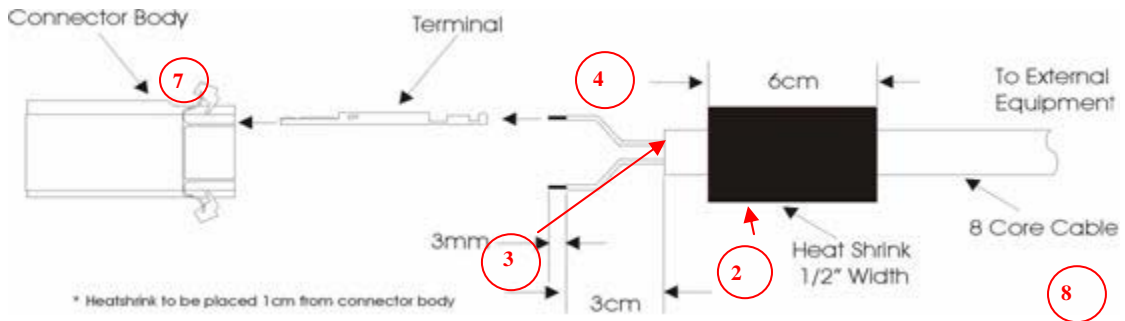
4.7 Cable Assembly Steps

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 SureLinx mating end (Figure 27).

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. Gently tug the connector to make sure the inserted terminal remains in place.
6. Repeat for all the wires.
7. Lock the terminals in place by closing the locking tabs on either side of the connector body.

Figure 27 Mating Cable



8. Apply heat shrink to cover most of the unshielded wires between the connector and the cable sheath.
9. Connect the cable to the customer equipment/connectors as specified by the manufacturer.

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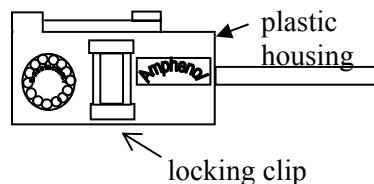
5 SureLinx FAKRA Connector

5.1 Removing the FAKRA Housing for Cable Installation (optional)

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

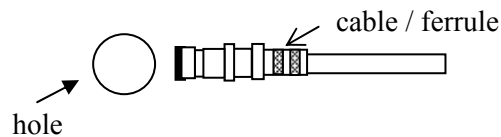
1. Remove the locking clip (Figure 28) from the plastic housing using a small pair of electronics pliers. Do not lose the locking clip since you will insert it later.

Figure 28 Locking Clip and Plastic Housing



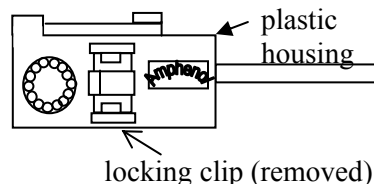
2. Pull off the plastic housing (Figure 28) from the cable's main body.
The exposed ferrule has a maximum diameter slightly wider than the cable.
3. Push the cable through the hole (Figure 29).

Figure 29 Cable without Housing



4. Slide the plastic housing back onto the ferrule as far as it will go (Figure 28).

Figure 30 Locking Clip (removed) and Plastic Housing

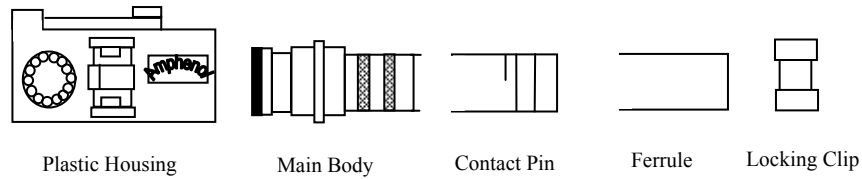


5. Press the locking clip, until you hear a snap, back into the main body (Figure 28).

5.2 Assemble a FAKRA Cable (optional)

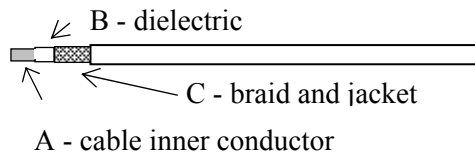
To assemble a FAKRA cable, follow the assembly steps below. The example uses a FAKRA straight female (J) connector. The FAKRA comes with two versions of the contact assembly, namely a solder and a crimp type. In the case of the solder version, solder the contacts rather than crimp them.

Figure 31 Connector Parts



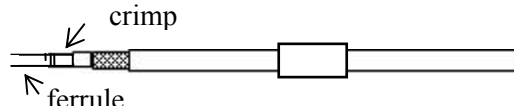
1. Strip the Insulator's cable inner conductor, dielectric, and braid and jacket (Figure 32).

Figure 32 Strip the Cable



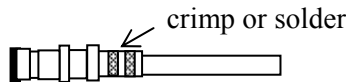
2. Insert the inner conductor into the contact pin (Figure 33). Crimp (or solder) the center contact with the crimping tool.
3. Slide the ferrule onto the cable (Figure 33).

Figure 33 Insert Inner Conductor



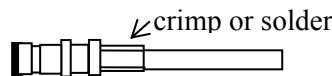
4. Insert the main body into the braid and dielectric until it pushes against the insulator (Figure 34).

Figure 34 Insert Main Body



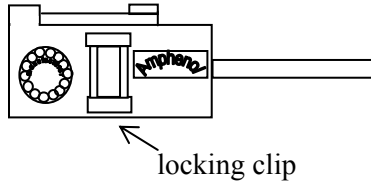
5. Slide the ferrule over the braid and crimp or solder (Figure 35).

Figure 35 Slide Ferrule



6. Insert the main body into the plastic housing and press the locking clip into it (Figure 36). You should hear a snap.

Figure 36 Main Body and Plastic Housing



- Verify the pin height from the end of SMB metal body to the top of the contact (1.18-1.81 mm).

Cable Group	Stripping Length (mm)			Center Contact Crimp Tool	Ferrule Crimp Size
	A	B	C		
1	3 mm (.118")	2.8 mm (.110")	5.2 mm (.205")	AFM8	Hex 3.25 mm (.128")
4	3 mm (.118")	1.7 mm (.067")	8.3 mm (.327")	AFM8	Hex 5.41 mm (.213")
9	2.4 mm (.095")	5.8 mm (.228")	5.7 mm (.224")	AFM8	Hex 3.25 mm (.128")
10	3 mm (.118")	2.6 mm (.102")	5.2 mm (.205")	AFM8	Hex 3.25 mm (.128")
Please refer to FAKRA catalog for recommended tools.					

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6 SureLinx GPRS SMA Connector

Tighten the SMA connector using an appropriate spanner. Do not use pliers or any tools which may damage the connector. Incorrect tools may also result in over tightening of the connector. Adhere to the following torque settings for reliable installation.

Table 7 SMA Torque Specifications

SMA Type	Torque Specification
Mating Torque	Minimum: 2 inch pounds (22 N.cm) Recommended: 7-10 inch pounds (80-110 N.cm) Maximum: 15 inch pounds (170 N.cm)
Coupling Nut Retention	Axial force: 100 inch pounds min. (300 N.cm) Torque: 15 inch pounds. min. (76 N.cm) Jacks: N/A

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7 SureLinx 8100 and 8100c Functional Description

7.1 MCU

7.1.1 Processor

- Atmel 32 bit AT91M55800 based on the ARM7TDMI processor core.

7.1.2 Flash Memory

- 32Mbits of low-power flash memory, organized with boot code, configuration data and application firmware.
- The boot code's software update application is sector protected.
- Both the application firmware section and the configuration data flash sectors are field programmable.
- The flash memory is capable of 100,000 erase cycles per sector.
- Data retention is typically 20 years.

7.1.3 Volatile Memory

- 4 Mbits of static read and write memory, organized as 256k x 16 bits.
- Memory operates at very low active power and automatically powers down when deselected.

7.2 RS232 Console

- A single voltage RS232 transceiver chip (ICL 3221E or equivalent) with a built in charge pump. By default, the RS232 console transmitter charge pump is disabled if a valid RS232 console input is not present.
- The RS232 console can wake-up the SureLinx from sleep mode.
- An external interrupt occurs when a voltage greater than 0.5V, for at least 0.1 second, is present on the RS232 console Rx data input port.

7.3 Power Supply

CAUTION: *Voltage levels applied to SureLinx I/O pins should not exceed the power supply voltage (V_{batt}) at any time.*

7.3.1 Input voltage

- The SureLinx operates from a 9V to 32V DC supply.

7.3.2 Battery Monitor

- Can monitor the power supply input.

7.4 Temperature Sensor

- It measures the internal temperature of the terminal. This temperature may be slightly higher than the ambient external temperature due to self heating effects.

7.5 GPS Module

- When the SureLinx transmits a satellite message, the RF input is disconnected from the satellite/GPS antenna and the GPS module is powered off.
- The GPS backup battery input to the GPS module is always connected even if the GPS module has no power. This allows the GPS module to perform a warm start if the almanac data is current.

7.6 GPRS Module

- Has an optional power-on mode.
- When powered and correctly initialized, the GPRS module will periodically transmit to maintain a session.
- The GPRS module communicates with the MCU using an asynchronous serial communications port.
- The SureLinx hardware forces the GPRS module to power down whenever an Inmarsat satellite transmission occurs. The GPRS module is powered down to prevent satellite transceiver brown outs and to ensure compliant Inmarsat satellite transmit emissions.

7.7 LED

- An LED provides status indication and is visible on the top of the transceiver unit.
- The flashing rates indicate if an error is present. Refer to [T8] for more details.

7.8 Standard I/O

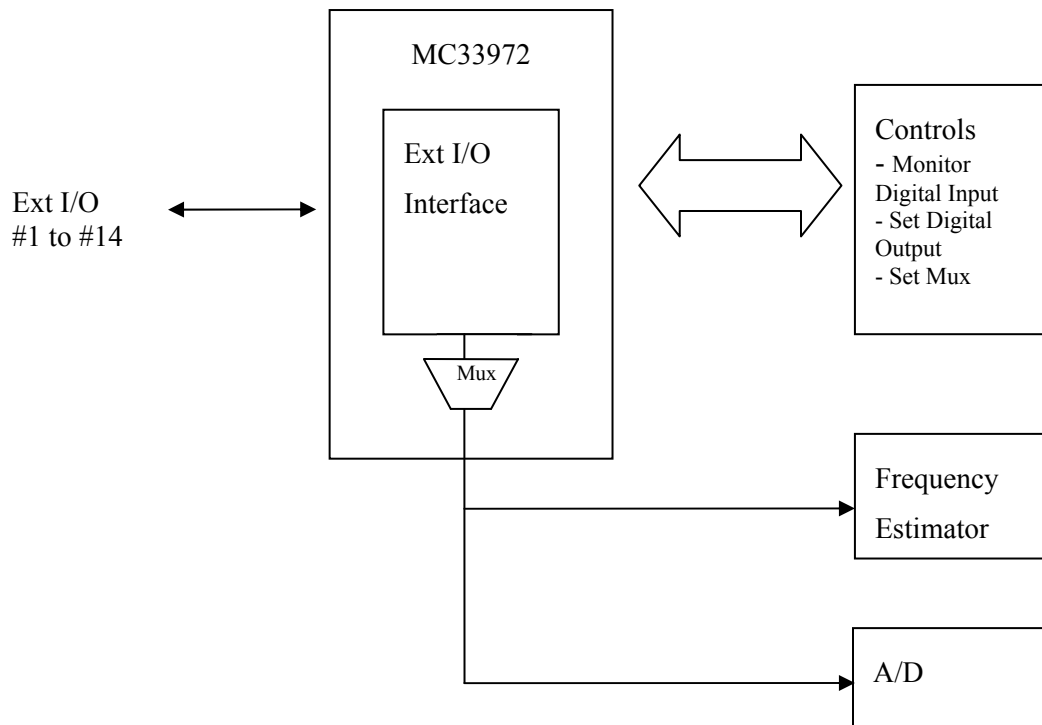
- Independently program these 4 standard I/O lines as digital input, digital output or analog input.
- Standard I/O_04 can also be configured as current loop input.
- Applications require a 4-20mA current sensor and 50 ohm extra resistor to ground.

7.9 Extended I/O

- Configure the extended I/O on the SureLinx to provide the following functions
 - Digital Input - Switch to GND or battery

- Current Source Output (source 2mA current)
- Analog Input
- Frequency Input
- All extended I/O on the SureLinX use a Multiple Switch I/O (MSIO) chip from Freescale (MC33972). Figure 37, shows the MC33972's implementation in SureLinX.
- All extended I/O lines connect directly to the MC33972.
- The MC33972 connects to the SureLinX processor on a serial bus. In addition to the serial bus, the MC33972 provides a multiplexer output that could map to any of the sixteen extended I/O pins.
- The MSIO's multiplexer output connects also connects to the SureLinX processor for direct analog and frequency measurements.

Figure 37 SureLinX Extended I/O Block Diagram



7.10 Satellite/GPS Antenna

- SkyWave provides the satellite/GPS antenna to ensure proper operation with both GPS and the Inmarsat satellite transmit and receive.
- The satellite/GPS antenna operates in either receive or transmit mode. The mode selection is under the control of an automatic DC switch.

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8 SureLinX 8100c Functional Description

The SureLinX 8100c includes all the features and functionality mentioned in section 7, as well as those in this section.

8.1.1 Bus Application Controller's Microcontroller Description

The microcontroller is a dsPIC33FJ256GP710-I/PF with 256kB on-board flash and 30kB SRAM.

Listed below are the microcontroller's major building blocks. Appendix C provides additional operating specifications.

- C compiler optimized instruction set
- SPI port
- 2 x UART channels
- 2 x CANbus channels
- ICSP
- I²C port
- On-board flash and SRAM
- 100 Pin TQFP

8.1.2 In-Circuit Serial Programming Interface (ICSP)

Note: *This is only used by developers designing and debugging applications.*

- The Bus application controller allows programming of the microcontroller's onboard flash, either from an external MPLAB REAL ICE debugger or directly by the SureLinX main controller (terminal controller).
- The terminal controller and the REAL ICE debugger use the microcontroller's port pins, PGC1, PGD1 and ~MCLR for in-circuit programming.
- The REAL ICE debugger connects to the Bus application controller via connector J4.
- Programming requires only three signals from the REAL ICE debugger: PGD, PGC and ~MCLR.
- For correct operation, connect the Bus application controller's 3.3V supply to the REAL ICE debugger.
- Table 8 shows the SureLinX and MPLAB REAL ICE wiring details and programming signals.

Table 8 Interface Wiring Details and Programming Signals

MPLAB REAL ICE	Signals
PIN 1	~MCLR
PIN 2	3V3
PIN 3	GNDDIG
PIN 4	PGD
PIN 5	PGC
PIN 6	NC

8.1.3 Data Flash

- 16Mbits (2Mbytes) of serial data flash is available for user data such as data logging and code shadowing.
- Appendix C shows the data flash specifications.

8.1.4 EEPROM

- 32kbits of serial EEPROM is available for power-up purposes.
- The Bus application controller's microcontroller accesses the EEPROM via the primary IIC1 interface.
- Appendix C shows the EEPROM specifications and other important features are below:
 - ESD protection > 4,000V
 - More than 1 million erase/write cycles
 - Data retention > 200 years
 - Hardware write-protect

8.1.5 External Serial Interfaces

The Bus application controller provides access to 3 additional data interfaces so that the maximum configuration can be:

- RS232_1
- RS485 or CAN_1
- CAN_2

Note: *CANbus_1 is mutually exclusive with RS485 since they share common physical pins on the I/O connector. The application designer is responsible to configure both interfaces so that only one is used.*

8.1.6 RS232_1

- RS232_1 interface connects with an external device such as a smart keyboard. The UART2 on the Bus application controller's microcontroller is used for this purpose.

- The RS232_1 uses only three wires; transmit, receive, and ground.
- The processor controls the RS232_1 driver via four (4) control lines.
 - \sim RS232_1_Enable
If \sim RS232_1_Enable is driven high (+3.3V) the receiver is placed into a high impedance condition.
If asserted low (0V) the microcontroller UART2 is able to receive data from the RS232_1 transceiver.
The ICL3221 is capable of automatic shutdown if there is no activity on the output CANbus.
 - \sim FORCEOFF_1
 \sim FORCEOFF asserted low is used to place the RS232_1 transceiver in a low power mode of operation and overrides the automatic power down and FORCEON_1.
 - FORCEON_1
FORCEON_1 overrides the automatic power down and keeps the transmitter active.
 - \sim INV
By monitoring \sim INV the processor is able to determine if valid RS232_1 levels are available on the receiver input.

Note: *On power-up, the RS232_1 should be placed in a high impedance condition. Appendix C shows the RS232_1 specifications. Other important features are below:*

- ESD Protection for RS232_1 I/O pins to ± 15 kV
- Minimum data rate 250kbps
- Manual and automatic power down

8.1.7 RS485

- An RS485 interfaces with external RS485 devices.
- UART1 on the microcontroller is used for communication with the RS485. Two lines control the RS485.
 - \sim RE
If \sim RE is asserted low (0V) the driver input circuitry is enabled and data can be received by the UART1. If \sim RE is driven high (+3.3V) the input circuit is placed in a high impedance condition.
 - \sim DE
The \sim DE control line when asserted low (0V) places the output driver in a high impedance condition.
If \sim DE is asserted high (3.3V), the driver is enabled for transmission.

- The Bus application controller provides a 120ohm bus termination for the RS485.

Note: *The output circuit of the RS485 is multiplexed with the output circuit of CANbus_1. For this reason, if the RS485 is selected for use, the application designer must ensure that the output driver of CANbus_1 is placed in a high impedance condition.*

- Appendix C shows the driver and UART1 specifications. Other important features are below:
 - ESD Protection for RS485 I/O pins to $\pm 15\text{kV}$
 - Full fail-safe (open, short, terminated/floating)
 - Hot plug - Tx and Rx outputs remain three-state during power up
 - Allows up to 256 devices on each CANbus
 - Current limiting and thermal shutdown, overload protection
 - Half-duplex operation

8.2 CANbus Interfaces

8.2.1 Overview

The microcontroller includes two on-board ECAN 2.0 compliant CANbus interfaces. These interfaces directly drive two external CANbus interfaces (CANbus_1) and (CANbus_2). The Bus application controller provides a 120 ohm bus termination for CANbus_1. CANbus_2 has no termination.

Note: *Firmware drivers are not provided for CANbus.*

8.2.2 Driver Configuration

- The RS pin (pin 8) of each CANbus allows two modes of operation: high-speed, or low-power standby mode.
 - The high-speed mode of operation is selected by connecting pin 8 directly to ground allowing the driver output transistors to switch on and off as fast as possible with no limitation on the rise and fall slope.
 - The transceiver enters a low-current standby mode during which the driver is switched off and the receiver remains active if a high logic level is applied to pin 8.
- The LBK on the transceiver inputs when asserted will allow data to be looped back to the processor to ease debugging.

Note: *The output circuit of CANbus_1 is multiplexed with the output circuit of the RS485. For this reason, if CANbus_1 is used, the application designer must ensure that the output driver of the RS485 is placed in a high impedance condition.*

- Appendix C shows the CANbus transceiver specifications. Other important features are as follows:

- Thermal shutdown protection
- Driver loopback capability
- Driver power down
- Tri-state outputs
- SAE J1939, NMEA 2000, ISO 11783 standard data bus interface
- Adjustable driver transition times

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Appendix A Terminal Order Part Numbers

Table 9 SureLinX Order Part Numbers

Description	Part Number
SureLinX 8100 - GPS module (G) - Side entry satellite/GPS antenna with magnet mount (M) - 5 meter cable (5) - GPRS antenna	SM200235-GM5
SureLinX 8100 - GPS module (G) - Side entry satellite/GPS antenna (S) - 5 meter cable (5) - GPRS antenna	SM200235-GS5
SureLinX 8100c - GPS module (G) - Side entry satellite/GPS antenna with magnet mount (M) - 5 meter cable (5) - GPRS antenna	SM200254-GM5
SureLinX 8100c - GPS module (G) - Side entry satellite/GPS antenna (S) - 5 meter cable (5) - GPRS antenna	SM200254-GS5
Antenna Only	
Satellite/GPS side entry antenna	SA900226-5SP
Satellite/GPS bottom entry antenna (FAKRA to SMA cables not included)	SA900226-5BP
Terminal Only (does not include satellite/GPS antenna, antenna cables or mating connectors)	
SureLinX 8100 with GPRS antenna	SA900224-XGV
SureLinX 8100c with GPRS antenna	SA900224-XGS

Note: Terminals are available with or without a GPS module and the GPS antenna is available in various cable lengths.

Appendix B Compliance

The SureLinx terminals comply with the following certifications.

Inmarsat Type Approval

SureLinx 8100 and SureLinx 8100c are Inmarsat type approved (DCC009, Type Approval Particular Issue No. 002, 31 May, 2007).

Industry Canada

Pending

CE Mark

Safety (art 3.1.a)	EN 60950-1:2001+A11:2004, EN 50392:2004 Safety of Information Technology Equipment
EMC (art3.1.b)	EN 301 489-1:V.1.5.1, EN 301 489-7:V.1.2.1, EN 301 489-20:V.1.2.1 The protection requirements with respect to electromagnetic compatibility contained in Directive 89/336/EEC.
Spectrum (art 3.2)	EN 301 426:V.1.2.1 EN 301 511:V.9.0.2 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.

Intrinsic Protection

Transceiver unit: NEMA1 and IP40

Satellite/GPS antenna: NEMA-4X and IP67

RoHS

Compliant

IATA Shipping Restrictions

Compliant

Appendix C Specifications

Physical

SureLinx 8100 Transceiver Unit

Size (without mating connector)	154.5 mm x 123.4 mm x 38 mm
Mass	~ 244 g
Color Code	CMR#051947STD (white)
Enclosure Material	GE Xenoy 5220
Light pipe Material	Lexan
Fasteners	Zinc
UV	Resistant
Mounting	2 Flanges with 4 slots each, on each side
Mounting Hardware	M5

SureLinx 8100c Transceiver Unit

Size (without mating connector)	154.5 mm x 123.4 mm x 38 mm
Mass	~ 258 g
Color Code	CMR#051947STD (white)
Enclosure Material	GE Xenoy 5220
Light pipe Material	Lexan
Fasteners	Zinc
UV	Resistant
Mounting	2 Flanges with 4 slots each, on each side
Mounting Hardware	M5

Satellite/GPS Side or Bottom Entry Antenna

Overall Size (without cable)	126.24 mm x 92.20 mm x 22.07 mm
Mass	Side entry with 5m cable:379 g Bottom entry: 183 g
Enclosure Material	GE Xenoy 5220
Color Code	CMR#051947STD (white)
Gasket Material	Santoprene
Sealing	Epoxy
UV	Resistant
Mounting	4 Flanges on side
Mounting Hardware	M5 pan head

Satellite/GPS Rubber Magnet Mount

Overall Size	126.3 mm x 92.2 mm x 02.0 mm
Mass	74 g
Material	NP12 in Nylon Binder
Color	Black
Adhesive	Acrylic
Water	Resistant
UV	Resistant
BH(Max)Typ	11.9KJ/m ³
Operating Temperature	-40 - +100°C

GPRS Antenna

Mass	80 g including cable (2.8oz)
Dimensions	127.0 x 18.0 x 9.5 (LxWxH) mm
Cable length	2.5 m
Mounting	Adhesive backing

Bus Application Controller

Microcontroller

Part Number	dsPIC33FJ256GP710-I/PF
Operating Voltage	3.3V
Flash	256kB
SRAM	30kB

Data Flash

Part Number	AT45DB161D-SU
Operating Voltage	3.3V
Capacity	2MB
Operating Current	4mA
Standby Current	2uA
I/F	SPI

EEPROM

Part Number	24LC32A-I/SN
Operating Voltage	3.3V
Capacity	32kbit
Operating Current	1mA
Standby Current	1uA
I/F	IIC

RS232_1

Part Number	ICL3221EIA
Interface Circuit	ICL3221E (or equivalent)
Operating Voltage	3.3V
Operating Speed	250 kbps
Operating Current	1uA
Baud Rate	9600 bits/s, 8 data, 1 stop, no parity
ESD Protection	± 15KV
Auto Power Down	On cable removed
Power Down Current	1uA
Voltage Range	-25V to +25V

RS485

Part Number	ISL83072E
Interface Circuit	ISL83072E (or equivalent)
Operating Voltage	3.3V
Operating Speed	20Mbps
Quiescent Current	800uA
Standby Current	10nA
Operating Mode	Half-duplex
Supported Data Rate	Up to 38400bps
Number of Nodes¹	256
I/O Pin ESD Protection	±15kV
Full Fail Safe Protection	Open, Short, Terminated/Floating, Hot Plug
Shutdown Current	10nA
Quiescent Supply Current	800uA
RS485 Voltage Range	-7V to 12V (shared with CANbus_1)

¹ Applies if common-mode voltage range is restricted to the ISO-11898 Standard range of -7V to 12V on CANbus_1.

CANbus_1 and CANbus_2

Part Number	SN65HVD233D
Interface Circuit	SN65HVD233D (or equivalent)
Operating Voltage	3.3V
Transmit Current	30mA
Standby Current	200uA
Operating Mode	Half-duplex
Data Rate	Up to 1Mbps
Number of Nodes²	120
Bus-Pin Fault Protection	+/- 36V
Bus-Pin ESD Protection	>16-kV HBM
Common Mode Protection	= -100V
Sleep Supply Current	2uA
Operating Supply Current	6mA (no load)
CANbus_1 Voltage Range	-7V to 12V (shared with RS485)
CANbus_2 Voltage Range	-7V to 12V

Connectors

Transceiver Unit for 8100 and 8100c

Satellite/GPS Antenna	FAKRA FAI-NARP-PCB-M (ITTCannon)
GPRS Antenna	SMA female, normal polarity
Electrical	JAE IL-AG5-30P-D3L2 (JAE) (Green)
Electrical Mating Connector	JAE IL-AG5-30S-D3C1
Mating Connector Pins	JAE IL-AG5-C1-5000
Color Code	CMR#051947STD

Satellite/GPS Antenna

RF Connector	FAKRA FA1-NZSJ-C04-0 (Amphenol)
---------------------	---------------------------------

² Applies if common-mode voltage range is restricted to the ISO-11898 Standard range of -7V to 12V on the RS485.

GPRS Antenna

RF Connector	SMA male
---------------------	----------

Environmental

Transceiver Unit for 8100 and 8100c

Operating Temperature Range	-40C to +70C
Storage Temperature Range	-40C to +85C
Humidity	95% relative humidity at 30C non-condensing
Vibration	5-20 Hz: 1.92 m ² /s ³ random noise
	20-500Hz: -3dB octave random noise
Shock (survival)	Half sine 6ms, 300m/s ²
Intrinsic Protection	IP40

Satellite/GPS Antenna

Operating Temperature Range	-40C to +85C
Storage Temperature Range	-40C to +85C
Vibration	5-20 Hz: 1.92 m ² /s ³ random noise
	20-500Hz: -3dB octave random noise
Shock (survival)	Half sine 6ms, 300m/s ²
Intrinsic Protection	IP67

GPRS Antenna

Operating Temperature Range	-30C to +65C
Storage Temperature Range	-40C to +85C
Intrinsic Protection	Not waterproof

Power

Power Supply Voltage (Vbatt)	9 - 32VDC
Reverse Polarity	-60V max.

Power Consumption

CAUTION: *Apply power only after making ground connection.*

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

	8100	8100c
	Typical @ 12VDC	Typical @ 12VDC
Satellite Receive (GPS active): (GPS off):	1 W 0.9 W	1.32 W 1.2 W
D+ Idle:	1 W	1.2 W
Transmit (Satellite): (GPRS):	10 W 8 W (peak)	10.5 W 8.5 W (peak)
Shutdown / Sleep current:	~300μA	~350μA

Note: *The GPRS radio module can consume up to 2A peak current (as per reference [T8]). SureLinx terminals provide a 4V voltage supply for the module.*

Note: *If the GPRS radio module supply voltage drops by more than 400mV from the nominal 4V level, it will power itself down.*

Standard Input/Outputs (I/O1, I/O2, I/O3, I/O4)

Modes	Programmable as digital input, digital output or analog input. Only standard I/O_04 can also be configured as Current Loop Input.
Digital Input *	0 to 32V low: 0 to 0.8V high: 2.5V to Vbatt
Digital Output	Open collector output Max current sink: 250mA ³
Analog Input **	10-bit ADC Dynamic range: 0-2.8V Linear operation: 0.5-2.5V Resolution: 3mV Inputs clamped at 2.8V Accuracy: $\pm 3\%$
Maximum Voltage	≤ 32 V

Note: *The analog inputs are measured with respect to the SureLinx ground, using a very short power supply and return wire connection. If using long wire connections, the cable length and SureLinx terminal draw to calculate the voltage drop or the ground reference as any voltage drops on the ground reference affect the accuracy of the analog input.*

³ Hardware version up to and including 0x21 has a maximum sink current of 50mA [T9].

Extended Input/Outputs (Ext I/O1 to Ext I/O 14⁴)

CAUTION: *Voltage levels applied to I/O lines must not exceed the power supply voltage (Vbatt) at any time*

Modes	Programmable as digital input, current source output, analog input, or frequency input
Digital Input	Switch to Ground/Battery Input low: 0 to 4V high : 4V to Vbatt (provide external pull-up/pull-down resistor)
Current Source Output	Current Source Output Off - Open Circuit On – Current Source (programmable as 2mA) Max load at 2mA : 350 ohm (total current sourced by all EXT I/O lines must not exceed 24mA)
Analog Input	10-bit ADC Dynamic range: 0-2.8V Linear operation : 0.5-2.5V Resolution: 3mV Inputs clamped at 2.8V Accuracy < 3%
Frequency Input	Min Frequency: 10 Hz Max Frequency: 25.5 kHz Accuracy: < 1% Duty Cycle Minimum: 30% Maximum: 70% Low : < 0.8V High : > 2.0 V

⁴ Hardware versions earlier than 22 have 16 extended I/O lines.

RS232 Console

Interface Circuit	ICL 3221E (or equivalent)
Baud rate	9600 bit/s, 8 data, 1 stop, no parity

GPS Receiver

Receiver Manufacturer	u-blox
Channels	16 channel, parallel L1 frequency, C/A code
Position Accuracy	3 m CEP, 5 m SEP
Sensitivity	Acquisition -140dBm Tracking -150dBm
Operational Limits	Altitude 18,000m Velocity 515m/s
Start-up Times	Hot start 3.5 s Warm start 33 s Cold start 41.5 s
Operating Temperature	-40C to +85C

GPRS Module

The GPRS specifications listed below are taken from Siemens TC63 Hardware Manual.

Type	Siemens TC63
GPRS Module	GSM 850/900/1800/1900MHz
Output Power	<p>Class 4: 33dBm \pm 2dB for EGSM850/900</p> <p>Class 1: 30dBm \pm 2dB for GSM 1800/1900</p> <p>The values stated above are maximum limits. According to Release 99, Version 5, the maximum output power in a multi-slot configuration may be lower. The nominal reduction of maximum output power varies with the number of uplink timeslots used and amounts to 3.0dB for 2Tx, 4.8dB for 3Tx and 6.0dB for 4Tx.</p>
Input Power	<p>Peak currents of 2A. SureLinX 8100 provides a 4V voltage reference for the module.</p> <p>The GPRS module auto powers down if voltage differences exceeding 400mV are detected. It is important that the SureLinX 8100's power supply does not brown out during GPRS transmit.</p>
Operating Temperature	<p>-30 to +65C</p> <p>The GPRS module auto powers down when the temperature exceeds it operating temperature.</p>
Data Transfer	<p>GPRS</p> <ul style="list-style-type: none"> • Multi-slot Class 12 • Full PBCCH support • Mobile Station Class B • Coding Scheme 1 – 4 <p>CSD</p> <ul style="list-style-type: none"> • V.110, RLP, non-transparent • 2.4, 4.8, 9.6, 14.4kbps • USSD <p>PPP-stack for GPRS data transfer</p>
SIM interface	Supported SIM cards: 3V, 1.8V
Antenna	50 ohms external antenna

GPRS Antenna

Network Coverage	GSM 900/1800 MHz, AMPS/PCS 800/1900 MHz
Frequency	824 – 960 MHz, 1710 – 2170 MHz
Impedance	Nominal 50 ohm
VSWR	2:1@BW 8%
Gain	0 dBd
Max Power	10 W

SIM Holder and Card Tray

SIM Voltage	3V
Polarization	Polarized on card holder to ensure proper card alignment
Card Detection	Switch connected to GPRS module
Extraction Method	Push-push button

Satellite Interface

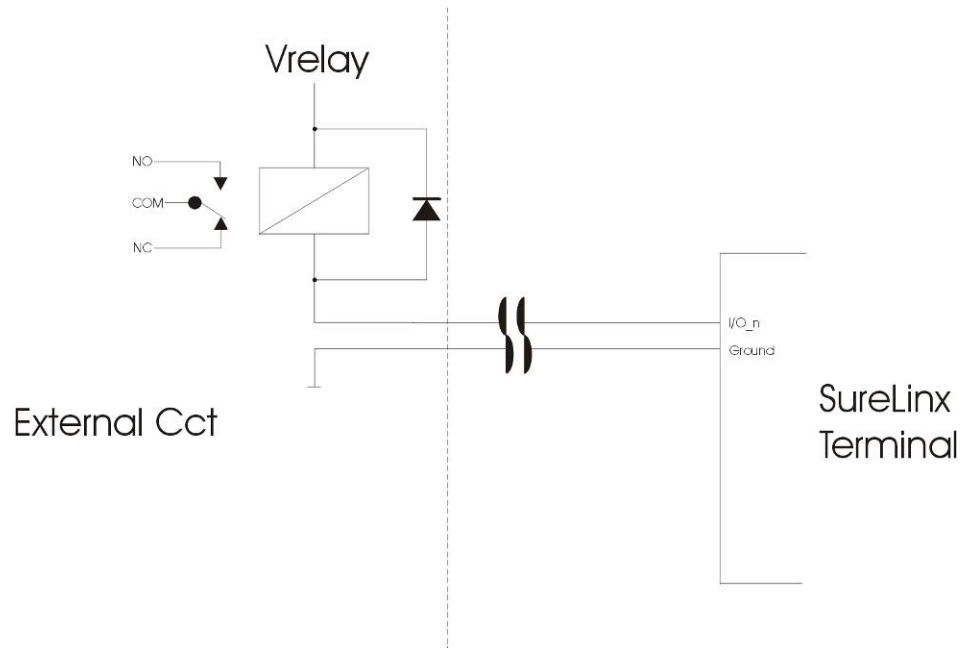
Frequency Range	Rx: 1525.0 to 1559.0 MHz Tx: 1626.5 to 1660.5 MHz
Sensitivity	>-25dB/K
EIRP	0 dBW to +9 dBW
Modulation	Forward channel: 32-ary FSK, 20 bit/s Forward channel: 32-ary FSK 80 bit/s (IsatM2M) Reverse Channel: binary FSK, 4-128 bit/s
Forward Error Correction	Forward channel: Reed-Solomon (31,15) Reverse channel: Half-rate convolutional (k=7)
Operation	Global; 5 overlapping satellites
From-Terminal Messages Supported	Acknowledgement, Long Burst, Extended Burst (IsatM2M only)
From-Terminal Message Length	Long Burst: 64 bits (typical), 80 bits (max) Extended Burst: 204 bits (IsatM2M only)
To-Terminal Messages Supported	Tone, Numeric, Alphanumeric, Transparent
To-Terminal Message Length	Numeric: up to 32 digits Alphanumeric: up to 128 chars Transparent : up to 250 bytes

Appendix D Output Relay Driver Application

The standard digital outputs of the SureLinx (I/O_01 to I/O_04) are current limited open collector outputs. Typical relay coils draw in the region of 100mA. The SureLinx outputs (I/O_01 to I/O_04) can sink sufficient current for such a relay. Follow the guidelines when using a relay.

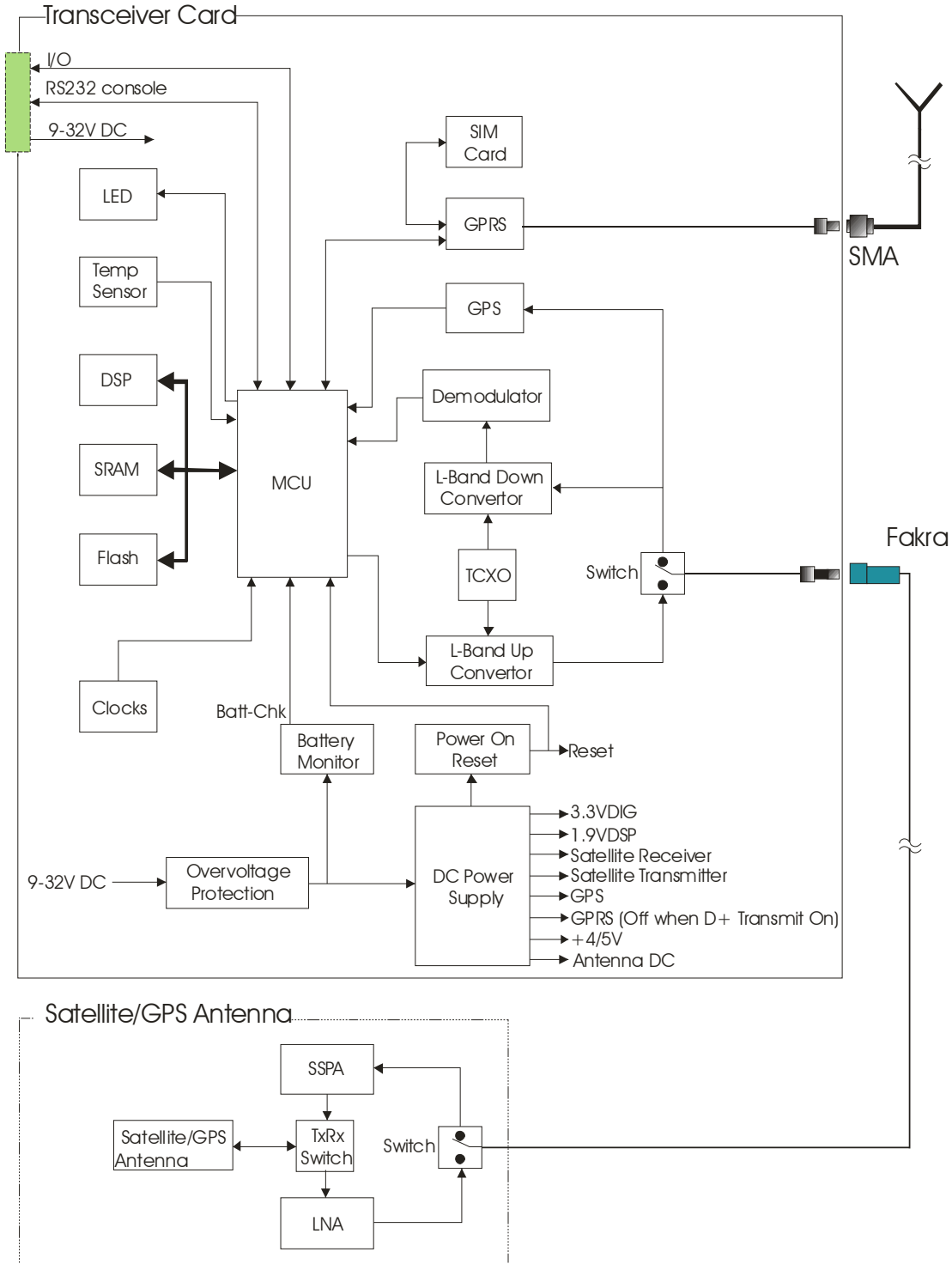
1. Connect a suitable diode across the relay coil as shown in the figure below.
2. Carefully choose a relay so that its contacts can carry the load current without incurring damage to the contacts through overloading.
3. The contacts should also be able to withstand the applied voltage.

Figure 38 SureLinx Relay Driver



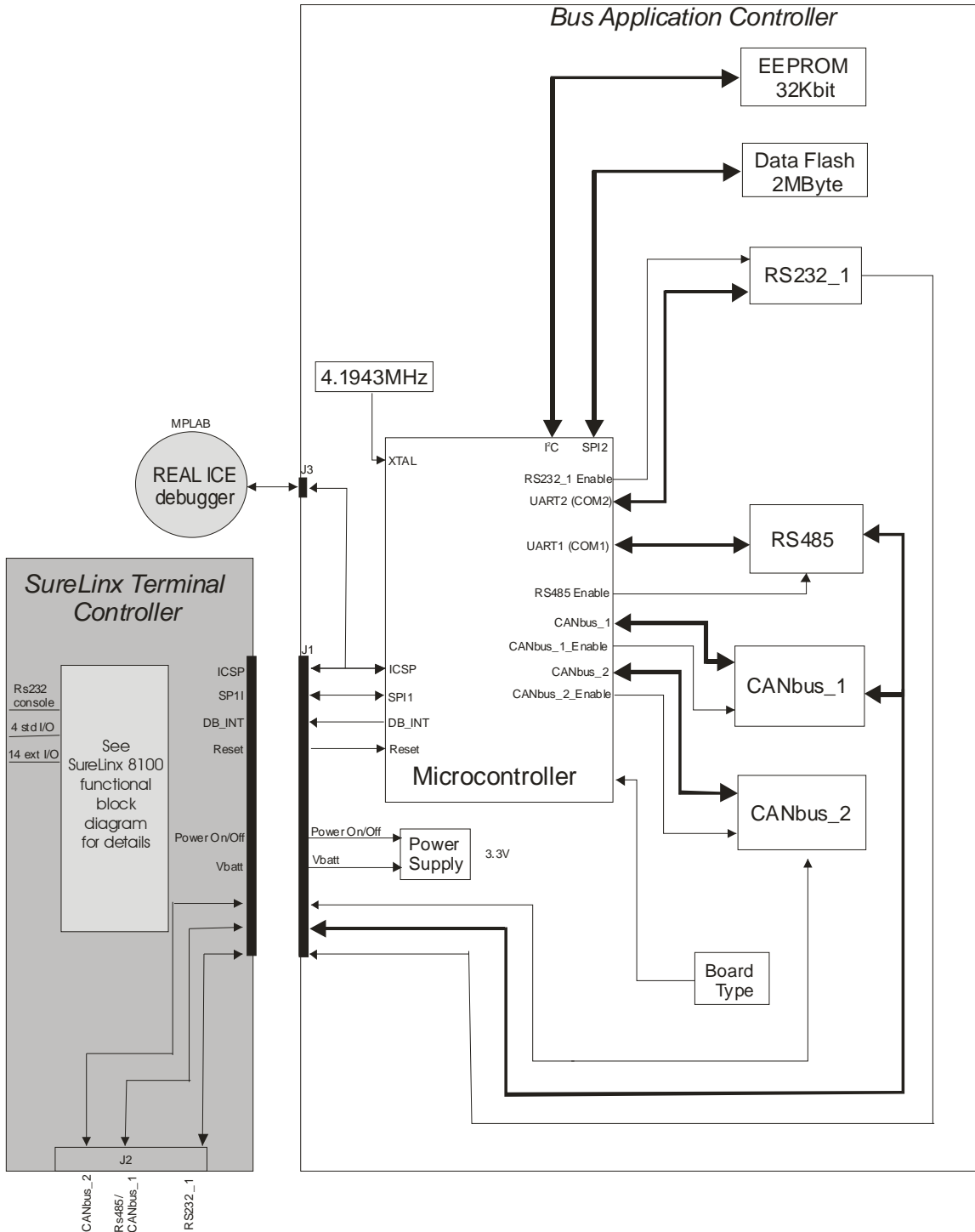
Appendix E SureLinX 8100 Functional Block Diagram

Figure 39 A Functional Block Diagram for the SureLinX 8100 Terminal Controller



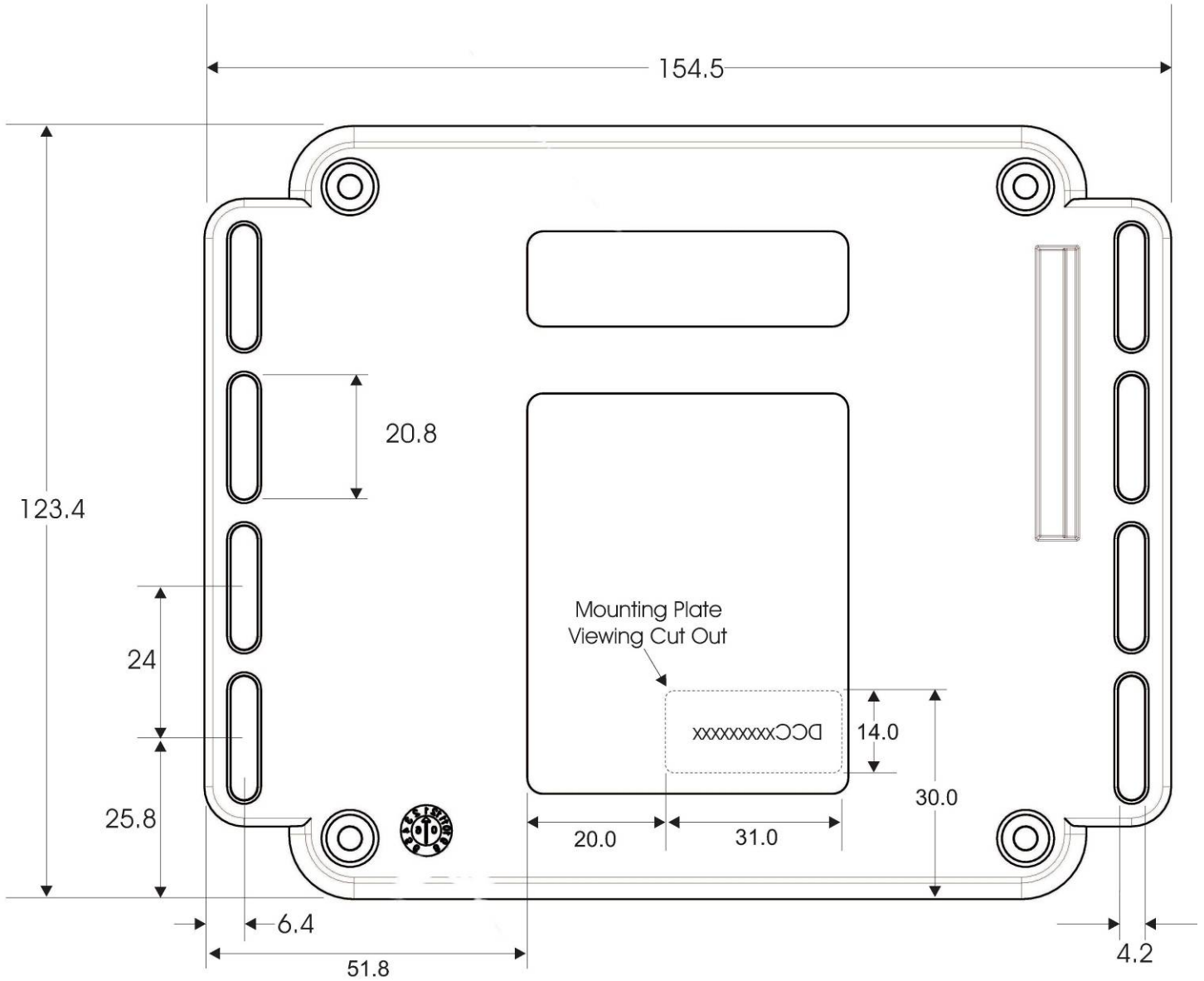
Appendix F SureLinX 8100c Functional Block Diagram

Figure 40 Functional Block Diagram for the SureLinX 8100c Bus Application Controller



Appendix G SureLinx Drill Template

Figure 41 SureLinx Transceiver Unit Drill Template



Appendix H Satellite/GPS Antenna Dimensions

Figure 42 to Figure 44 show the SureLinx satellite/GPS antenna dimensions.

The satellite GPS magnetic mount antenna dimensions are the same as the ones shown here.

Figure 42 Satellite GPS Footprint Dimensions

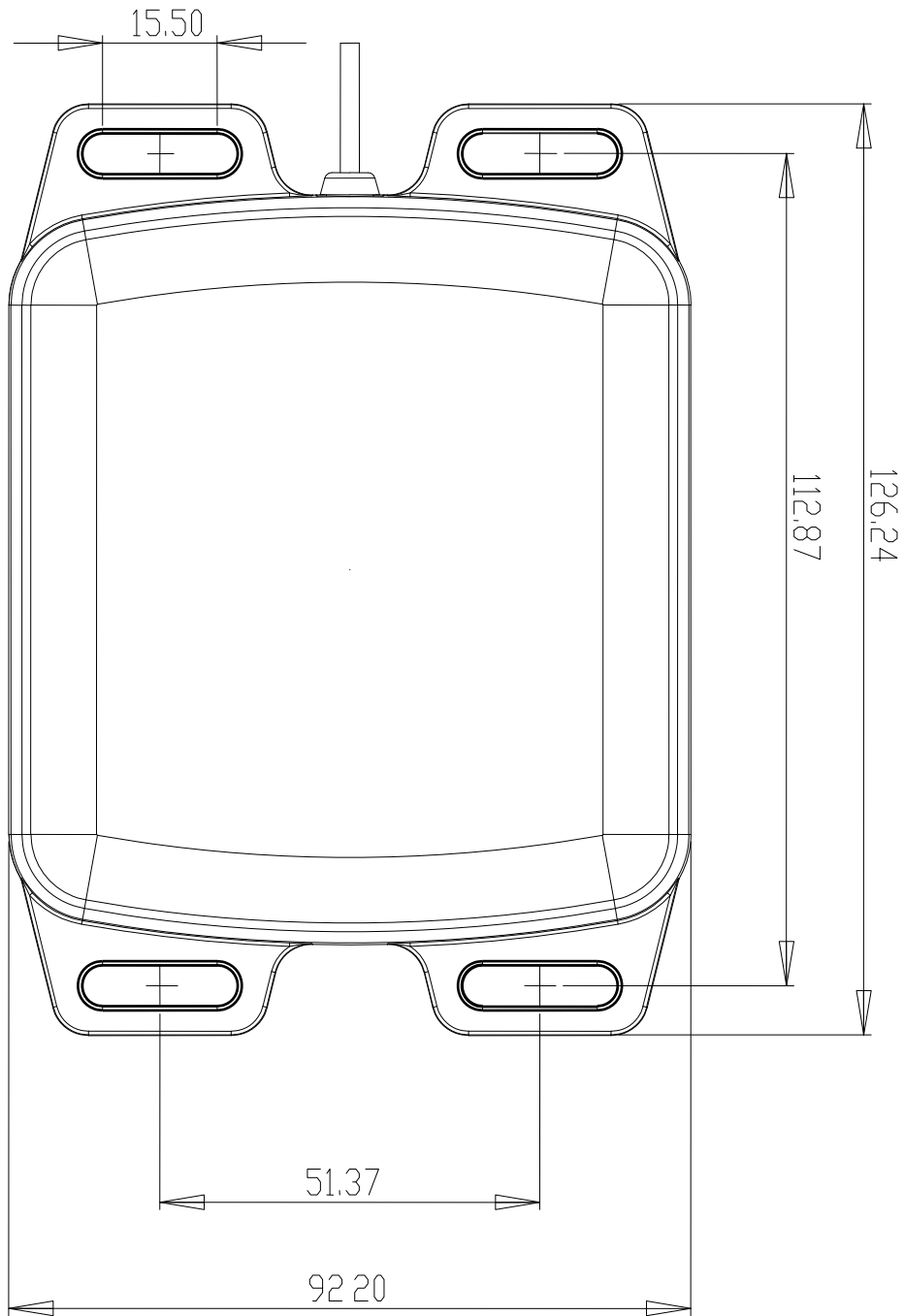


Figure 43 Bottom Entry Satellite/GPS Antenna Drill Template

CAUTION: *Centre antenna cable hole is for bottom entry antenna only.*

CAUTION: *Remember to leave enough cable for strain relief so as not to introduce any additional force on the connector or antenna sealing. SkyWave recommends restraining the cables during installation.*

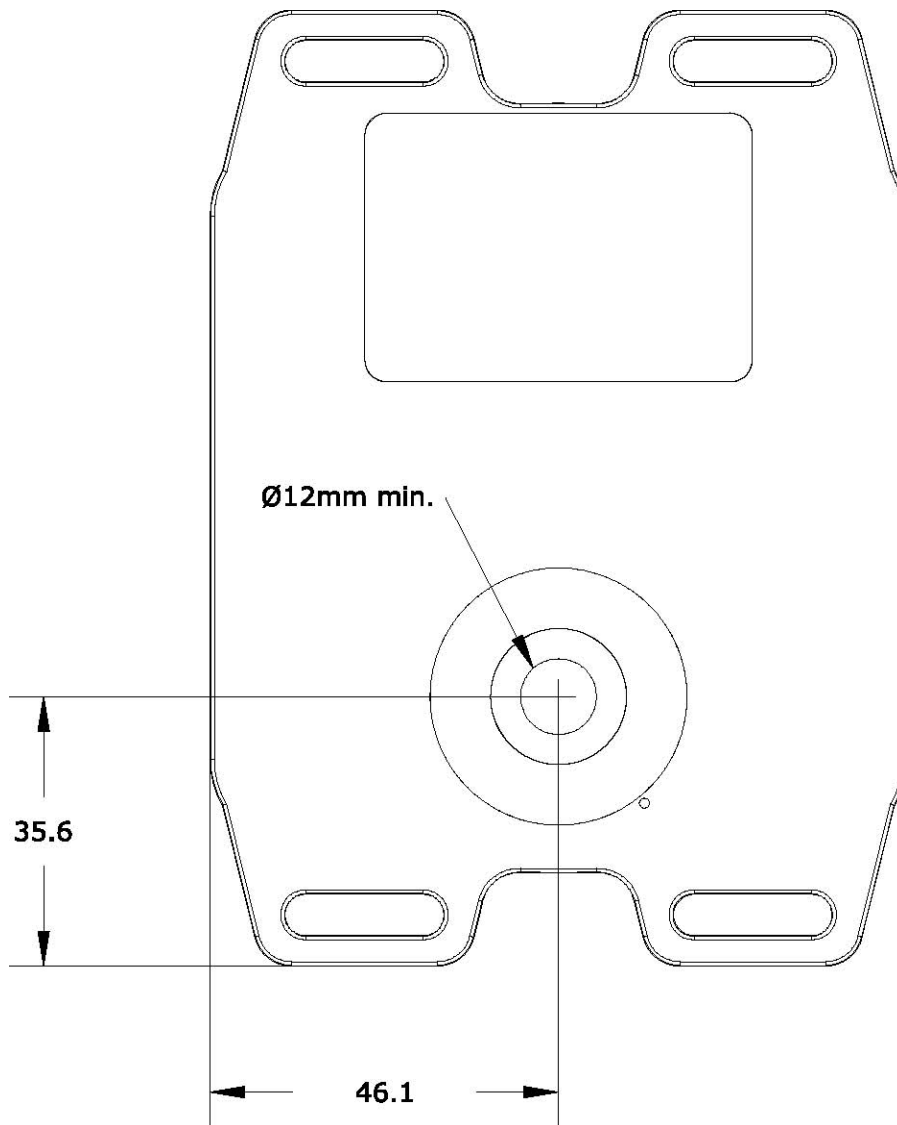
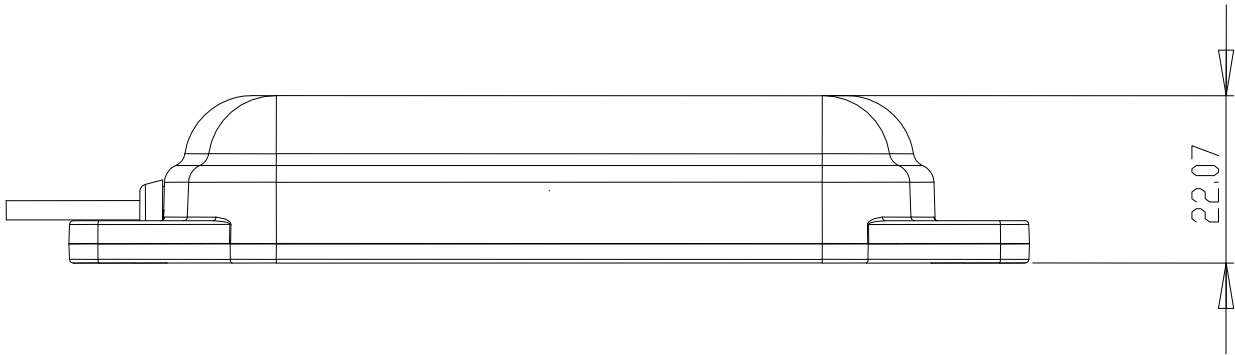


Figure 44 Satellite/GPS Antenna Height Dimensions



Document Versions

Version	Date	Details
1.0	Dec. 2006	Initial product release
02	Sept 2007	Document updates – see What's New section
2.01	Oct 2007	Minor change to voltage range, analog input voltage and look angle. Some document restructuring. Added getting started section, mounting and antenna, and FAKRA connector instructions. Updated drill templates.
2.02	May 2008	Title change – limited customer release
03	June 2008	Added SureLinX 8100c content.

Glossary

CAN	Controller Area Networks
EGSM	Enhanced GSM
EMI	Electromagnetic Interference
FCC	Federal Communications Commission
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
IAM	I/O Access Module
kgf·cm	kilogram-force centimeter
lbf·ft	pound-force feet
LNA	Low Noise Amplifier
MCU	Microprocessor Control Unit
NMEA	National Maritime Electronics Association
OEM	Original Equipment Manufacturer
SDK	SkyWave Developer's Toolkit
SIM	Subscriber Identification Module
SSPA	Solid State Power Amplifier
TCXO	Temperature Compensated Crystal Oscillator

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