



Installation of Firmware Updates for OmniSat-1 GOES Transmitters

FIRMWARE UPDATE: OMNISAT-1 / H-22DASE

OVERVIEW

YSI's WaterLOG/Design Analysis brand of GOES transmitters, model H-222DASE, were manufactured by Signal Engineering. These transmitters could potentially be branded either **H-222DASE** or **OmniSat-1**. The transmitter will be referred to as the *OmniSat-1* in this document.

It is advisable to inspect any WaterLOG/Design Analysis GOES transmitter that is not identified as either an H-2221 or H-2221-V2 to see if it is one of the affected units. **These transmitters will have a Signal Engineering serial number between: 1005-1521 or 6006-11790.**

These transmitters may be affected by a **WRNO (Week Number Roll-Over)** where the time reported will be correct, but the date will be incorrect. *More details are provided below.*

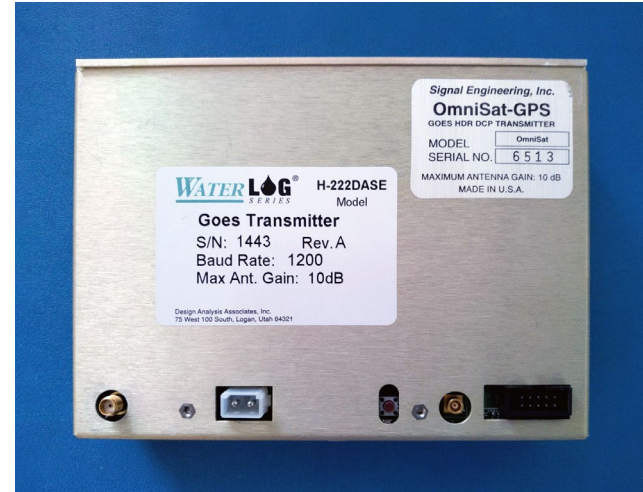
- **Group 1:** Serial numbers 1005 - 1099, WRNO occurred 4-7-2019
- **Group 2:** Serial numbers 1100 - 1521, 6006 - 6666, 6668, 6681, 6682, WNRO will occur 3-19-2023
- **Group 3:** Serial numbers 6667, 6669 - 6680, 6683 - 11790, WNRO will occur 7-6-2025

SCOPE

This service bulletin applies only to the Signal Engineering Inc. "OmniSat" model (GOES Version 1.0B 300/1200 BPS DCPRS) transmitter (referred to in this document as the "OmniSat-1") that includes a GPS receiver and automatically gets time-of-day from GPS. The OmniSat-1 was in production from 2004 until 2011.

Most (but not all) OmniSat-1 transmitters were equipped with a GPS receiver. The firmware update described here is NOT required for configurations where time-of-day is loaded into the OmniSat-1 by the datalogger. In those cases, there is no GPS antenna connected to the OmniSat-1.

The GPS WNRO issue described in this service bulletin does NOT apply to the earlier Signal Engineering "SE300" or "SE1200" model (GOES Version 1.0B 300/1200 BPS DCPRS) transmitters or to the later "OmniSat-3" model (GOES Version 2.0 300/1200 BPS DCPRS) transmitters.



OmniSat-1 / H-222DASE
GOES Transmitter

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RECOMMENDATION & RISK

OmniSat-1 shipments began in March 2004. All OmniSat-1s that were shipped before May 2006 will have a WNRO on March 19, 2023. Most OmniSat-1s that were shipped in or after May 2006 had GPS receiver firmware that will have a WNRO on July 6, 2025. A small number of the OmniSat-1s shipped after May 2006 have older GPS receiver firmware and will have a WNRO on March 19, 2023.

For users who wish to continue operating their OmniSat-1s after **March 19, 2023**, Signal Engineering Inc. recommends updating the firmware in all OmniSat-1 units that have a GPS receiver and automatically get time-of-day from GPS. **The GPS Week Number Roll-Over issue will cause any unit that has not been loaded with the new firmware to return the wrong UTC date after the WNRO event occurs.**

This risk involved in the firmware reload is low. Since only the main runtime firmware image is updated, the bootloader firmware should not be affected. This means that in the event of a failure during the firmware reload, it should always be possible to use the bootloader firmware image to retry the firmware reload until successful.

BACKGROUND

ISSUE: GPS Week Number Roll-Over

The GPS system keeps time using the combination of a GPS Week Number and a GPS Time Of The Week. The GPS Week Number is a 10-bit number that counts up from 0 to 1023 and then rolls over back to 0. A GPS Week Number Roll-Over (WNRO) occurs in the GPS system every 19.6 years. The last GPS system WNRO occurred on April 7, 2019.

The vendor (u-blox) of the GPS receiver used in the OmniSat-1 made each version of receiver firmware such that it will provide the correct UTC date for 19.6 years, starting from the date the GPS receiver firmware version was created. After that, the GPS receiver will experience the equivalent of a GPS system WNRO and the UTC date provided by the GPS receiver will roll back to a date 19.6 years in the past and then move forward from there.

During its production run, the OmniSat-1 used versions of the u-blox GPS receiver that will experience this WNRO effect on one of two different dates: either **March 19, 2023** or **July 6, 2025**. Following the WNRO, the date returned by the GPS receiver will roll back to a date 19.6 years in the past and then move forward from there. The UTC time it returns will be correct, but the date will be wrong.

Support from u-blox for the GPS receiver used in the OmniSat-1 ended over 10 years ago, so no new GPS receiver firmware is available to address this issue. Instead, the GPS vendor (u-blox) published an application note that details a workaround method that could be implemented in the “host” device (in this case, the OmniSat-1) that is connected to the GPS receiver and allows the erroneous dates output by the GPS receiver after the WNRO to be corrected.

SEI has developed a new version of OmniSat-1 firmware (V2.8) that implements the workaround method suggested by the GPS vendor. The new OmniSat-1 firmware detects and corrects any erroneous UTC date output by the GPS receiver after the WNRO and allows the OmniSat-1 to maintain correct UTC time in its time-of-day clock for up to 16 additional years.

For details on the workaround method used to handle the GPS WNRO, see the u-blox application note: “GPS week number roll-over workaround Application Note, UBX-19016936”. This document is available on the u-blox website at www.u-blox.com.

PC DATA CABLE FOR OMNISAT-1 WITH 10-PIN CONNECTOR

The **WaterLOG/Design Analysis H-222DASE** will have the **10-pin connector**. The 10-pin control connector contains an interface through which control information, status information and data are passed to and from the OmniSat.

Table 3 (Below) lists the signal assignments for each pin on the connector. The signal names and connections between the external host and the OmniSat follow an RS232 null-modem connection convention. All OmniSat control interface signals are compatible with standard RS232 logic levels.

Table 3: OmniSat-1 10-Pin Control Connector Description				
External Host Signal	OmniSat Connector Pin #	OmniSat Signal	OmniSat Signal Type	OmniSat Signal Description
DCD	1	DCD	NC	No Connect
DSR	2	DTR	NC	No Connect
RXD	3	TXD	Output	Transmit Data, RS232 compatible
RTS	4	CTS	Input	Clear To Send, RS232 compatible **
TXD	5	RXD	Input	Receive Data, RS232 compatible
CTS	6	RTS	Output	Request To Send, RS232 compatible
DTR	7	DSR	NC	No Connect
RI	8	RI	NC	No Connect
GND	9	GND	Ground	Ground
NC	10	GND	Ground	Ground
OmniSat Bulkhead Connector: 3M 2510-6002 (Low profile 10-pin box header) Mating Flat Cable Connector: 3M 3473-6600 (10-pin socket connector)				

ADDITIONAL NOTES:

1. "Input" signals are from the external host to the OmniSat.
2. "Output" signals are from the OmniSat to the external host.

Table 4: PC Data Cable for OmniSat-1 With 10-Pin Connector					
9-Pin PC Serial Port Pin #	PC Serial Port Signal	OmniSat Pin #	OmniSat Signal	OmniSat Signal Type	OmniSat Signal Description
5	Ground	9	GND	Ground	Signal Ground
7	RTS	4	CTS	Input	Clear To Send
8	CTS	6	RTS	Output	Request To Send
3	TXD	5	RXD	Input	Receive Data Input
2	RXD	3	TXD	Output	Transmit Data Output

INSTRUCTIONS

The OmniSat-1 firmware can be upgraded at the user or distributor level. Signal Engineering has created a loader program for Windows PCs that reloads the OmniSat-1 with the new version of firmware. The new OmniSat-1 firmware is embedded within the loader program. The loader program verifies that the transmitter it is connected to is an OmniSat-1 before reloading the firmware. The loader program should work on any version of Microsoft Windows XP, Windows Vista, Windows 7, Windows 8, and Windows 10.

The new OmniSat-1 V2.8 firmware can be deployed at any time before or after the GPS WNRO event. If deployed before the WNRO it will have no effect on normal operation. It will detect and correct the erroneous UTC dates output by the GPS receiver after the WNRO occurs, providing seamless continuity of operation.

Perform the following steps to upgrade the OmniSat-1 firmware to the new version:

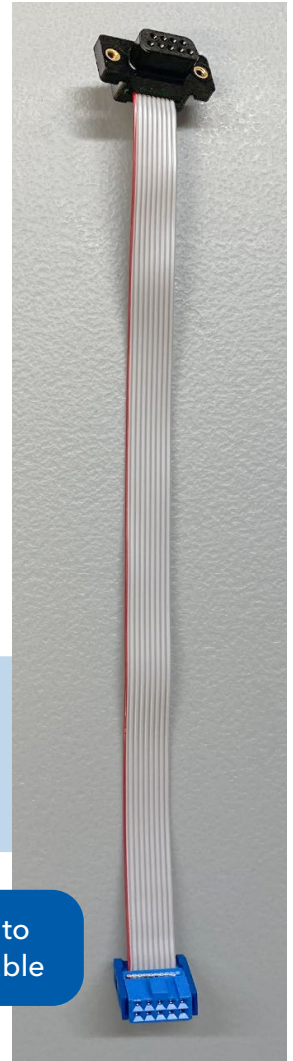
1 Step 1: PC Data Cable

If you don't already have one, make a data cable to connect a PC's RS-232 serial port to the OmniSat-1's control interface connector. See the "PC Data Cable For OmniSat-1 With 10-Pin Connector" section at the beginning of this document for details.

A PC Data Cable for an OmniSat-1 will typically consist of a 9-pin female D-sub connector (to connect to the PC's 9-pin serial port) and a 10-pin ribbon cable connector (to connect to the OmniSat-1) and a length of AWG 26 or AWG 28 flat ribbon cable (0.5 meter to 1 meter in length) with the same number of conductors as the number of pins in the OmniSat-1 control interface connector. Most H-222DASE transmitters will have a short 10-pin to serial cable already in use, this cable can be used for this firmware update (**see image: top right**).

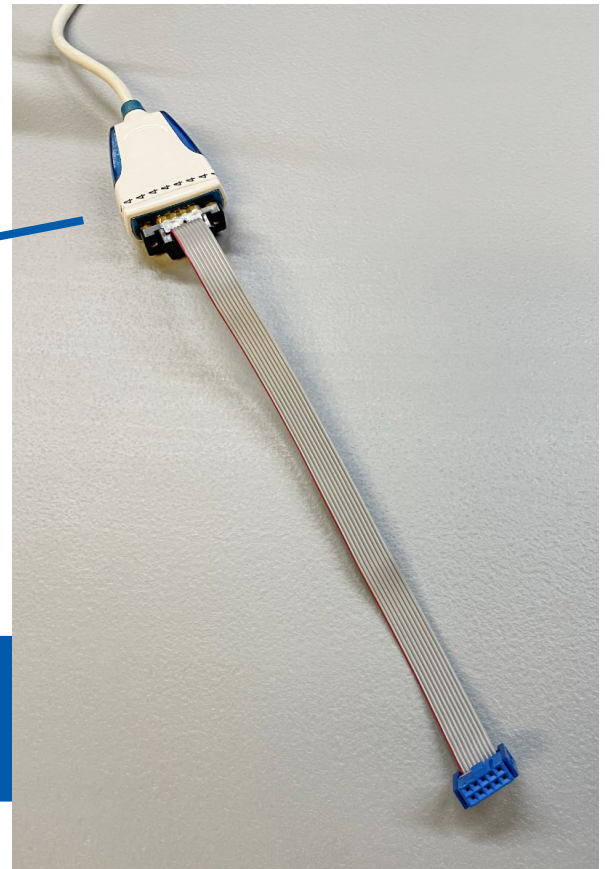
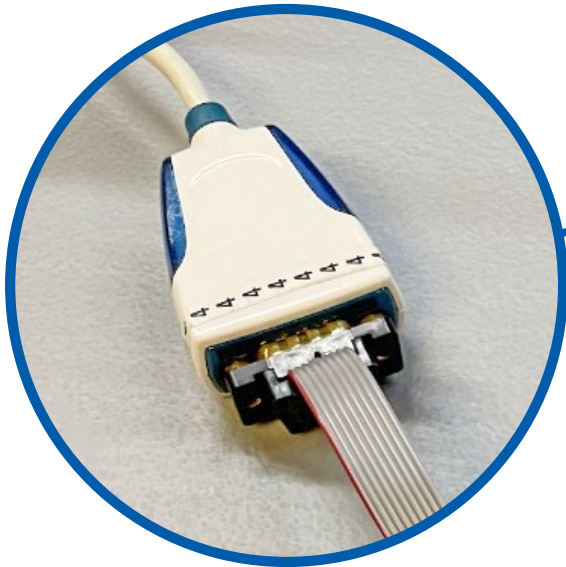
If the PC to be used does not have either a built-in RS-232 serial port or a serial port on a PCI or PCIe plug-in card, a USB-to-RS232 serial port adapter will be needed. In addition to the normal RS-232 Signal Ground, Transmit Data and Receive Data signals, the adapter must also support the RS-232 RTS and CTS control signals.

10-pin to
serial cable



USB to RS232
Serial Port Adapter

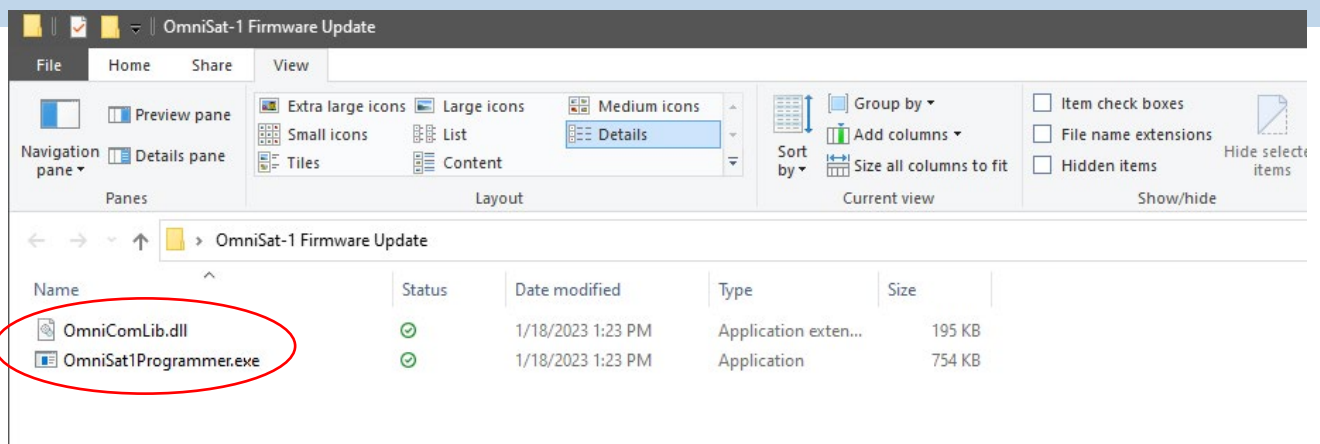




10-pin to serial cable connected to USB to serial adapter.

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Step 2: Copy Firmware Loader Files to PC



Copy the firmware loader files '**OmniSat1ProgrammerV28.exe**' and '**OmniComLib.dll**' to the same folder on the PC to be used. *These files are available at YSI.com or by request from Signal Engineering Inc.*

Download Firmware Loader Files
YSI.com/GOES-Support

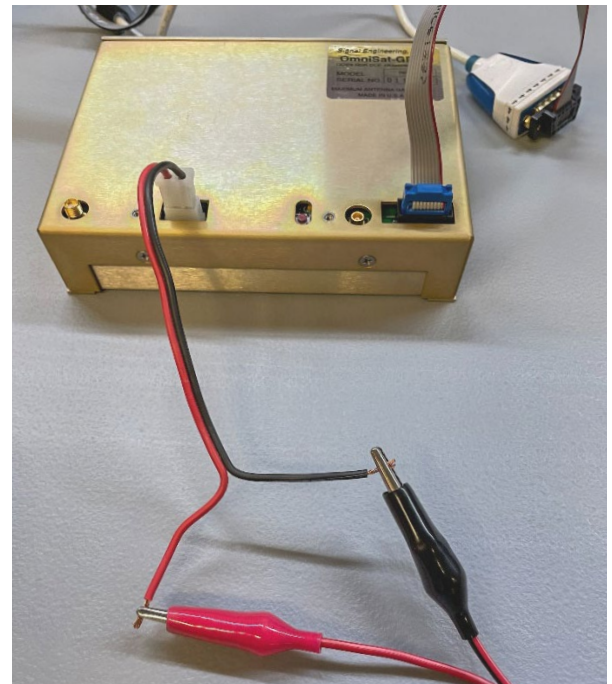
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Step 3: Connect Data Cable and Power Supply

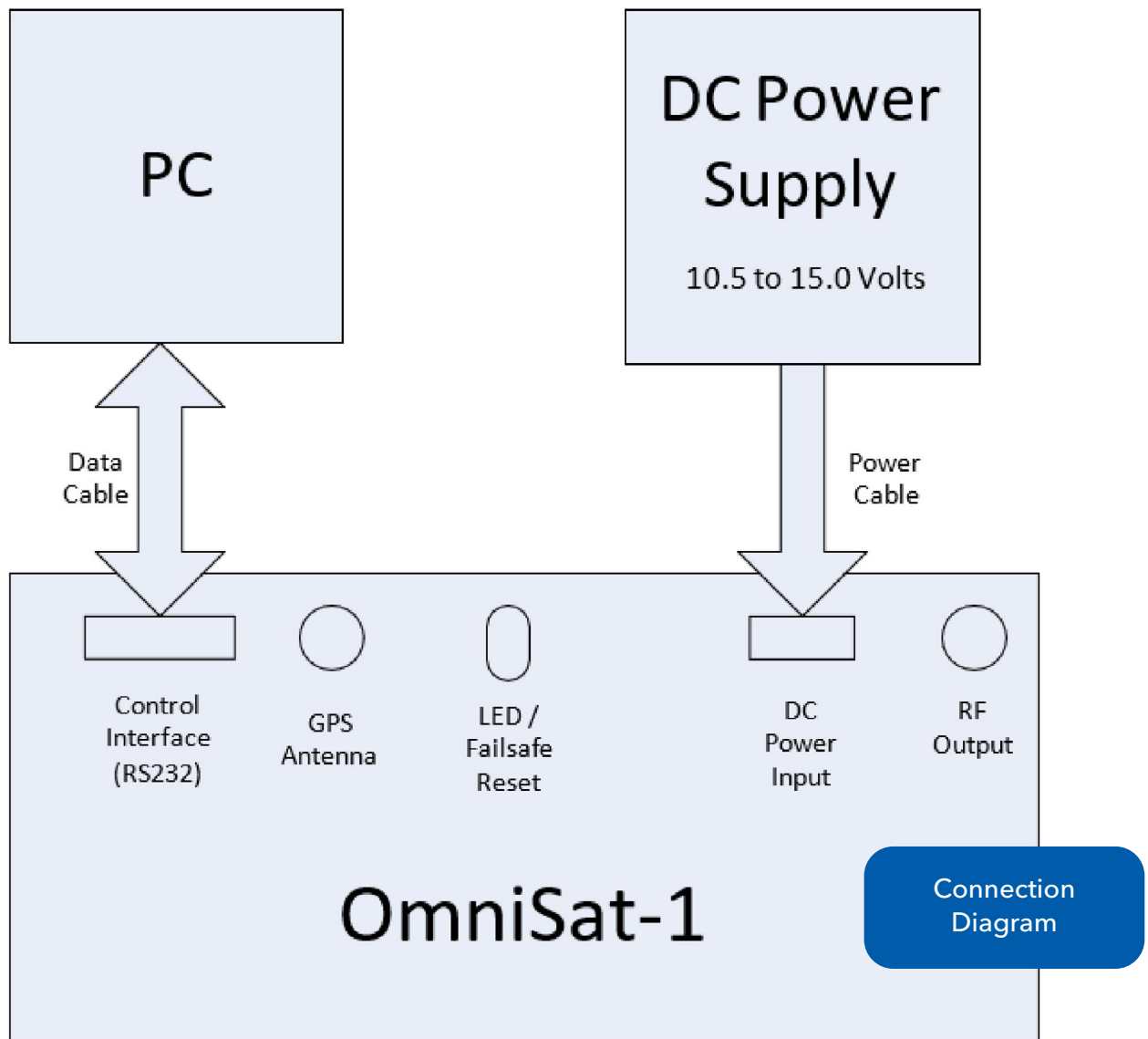
- If using a DC power supply, set the voltage to **12.5 volts**. The power supply should be capable of providing a current of at least 100 mA.
- If using a battery, ensure that the supply voltage is between **10.5 and 15 volts**.



Connect the PC serial port to the OmniSat-1 control interface connector using the data cable.

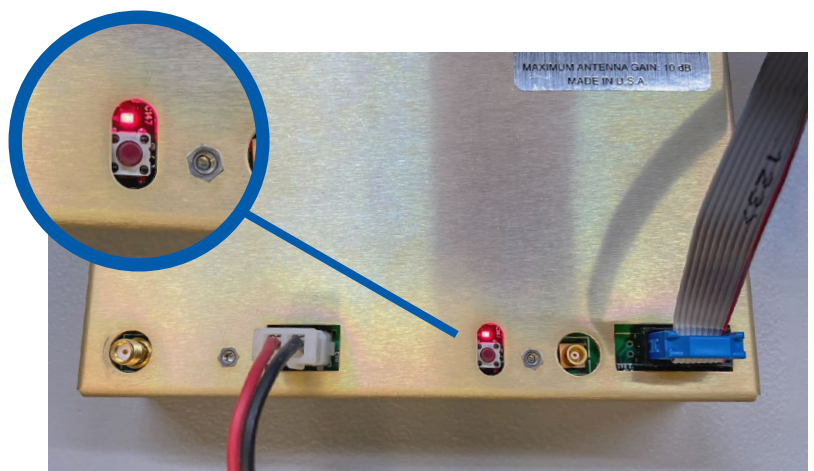


Connect the power supply or battery to the OmniSat-1.



When power is applied to the OmniSat-1, the red LED next to the Failsafe Reset pushbutton switch will **blink 2 times** to indicate that the Main (RS-232) firmware image is running and the RS232 interface is enabled.

If the LED blinks 6 times, this indicates that the Bootloader firmware image is running and the Main firmware is missing or corrupt and needs to be reloaded. Wait until the LED finishes blinking its pattern before continuing.



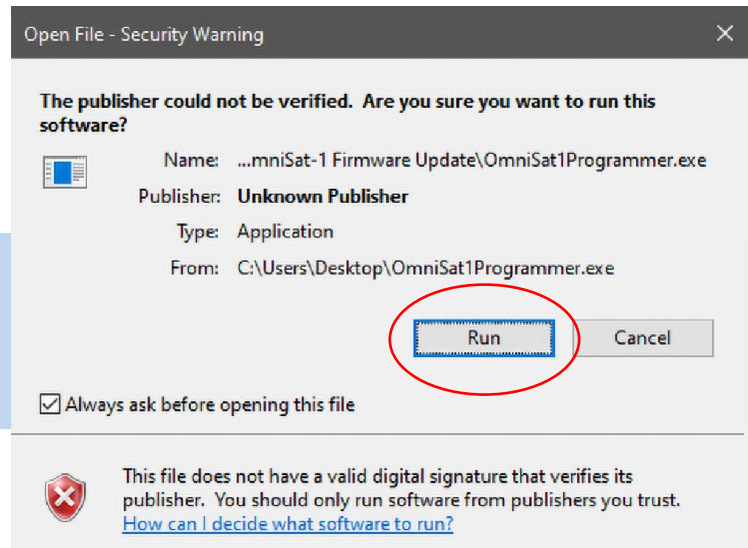
NOTE: If the LED blinks 4 times after power on, this indicates that the HSB firmware image is running and the HSB control interface is enabled (and the RS-232 interface DISABLED). The procedure described here does not apply to OmniSat-1s with their HSB interface enabled.

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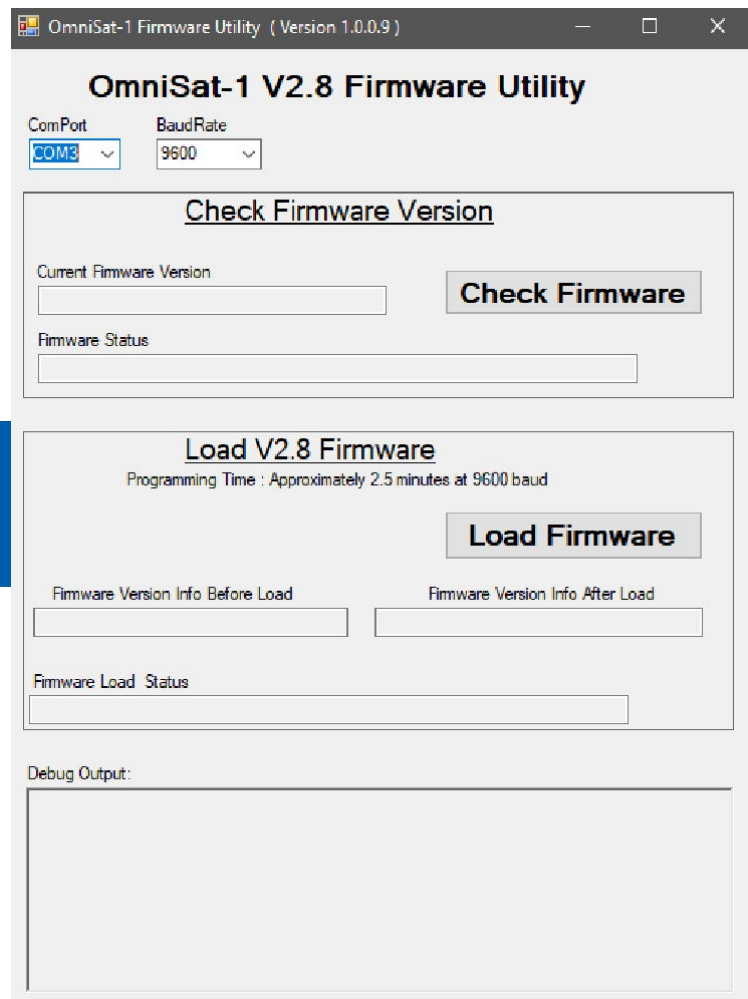
Step 4: Launch Firmware Loader Program

Launch the firmware loader program '**OmniSat1ProgrammerV28.exe**'.

This can be done by launching Windows Explorer, browsing to the folder containing the loader program, and then double-clicking on file 'OmniSat1ProgrammerV28.exe'. A warning may pop up after launching the loader, click "**run**".



The Loader will look like this screen shot, when launched.



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Step 5: Check OmniSat-1 Firmware

On the firmware loader program screen, select the **Microsoft Windows ComPort (COM1...COM99)** for the PC serial port to be used. The Baud rate is fixed at 9600 Baud.

Click on '**Check Firmware**' to check communication with the OmniSat-1 and to see if the OmniSat-1 needs to be reloaded with the new V2.8 firmware. The firmware loader program will also verify that the transmitter is an OmniSat-1.

OmniSat-1 Firmware Utility (Version 1.0.0.9)

OmniSat-1 V2.8 Firmware Utility

ComPort: COM3 BaudRate: 9600

Check Firmware Version

Current Firmware Version:

Firmware Status:

Check Firmware

Load V2.8 Firmware

Programming Time : Approximately 2.5 minutes at 9600 baud

Load Firmware

Firmware Version Info Before Load:

Firmware Version Info After Load:

Firmware Load Status:

Debug Output:

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Step 6: Load New OmniSat-1 Firmware

Click on '**Load Firmware**' to begin the firmware load.

The reload of the Main (RS232) firmware image with the new V2.8 firmware takes about 2.5 minutes.

Status is reported in the 'Firmware Load Status' window and progress messages are displayed in the '**Debug Output**' window. The firmware loader program will retry commands sent to the OmniSat-1 multiple times if necessary. If the firmware load is unsuccessful for any reason, correct any power or connection issues and retry the firmware load until successful.

OmniSat-1 Firmware Utility (Version 1.0.0.9)

OmniSat-1 V2.8 Firmware Utility

ComPort: COM3 BaudRate: 9600

Check Firmware Version

Current Firmware Version: Boot 2.3, Main 2.3

Firmware Status: Old or corrupt firmware Main image. Load New firmware

Check Firmware

Load V2.8 Firmware

Programming Time : Approximately 2.5 minutes at 9600 baud

Load Firmware

Firmware Version Info Before Load:

Firmware Version Info After Load:

Firmware Load Status:

Debug Output:

Successfully completing the firmware update will be confirmed by a message in the "Firmware Load Status" window that states **"Firmware Load Completed Successfully"**.

OmniSat-1 Firmware Utility (Version 1.0.0.9)

OmniSat-1 V2.8 Firmware Utility

ComPort: COM3 BaudRate: 9600

Check Firmware Version

Current Firmware Version:

Firmware Status:

Check Firmware

Load V2.8 Firmware

Programming Time : Approximately 2.5 minutes at 9600 baud

Load Firmware

Firmware Version Info Before Load: Boot 2.3, Main 2.3

Firmware Version Info After Load: Boot 2.3, Main 2.8

Firmware Load Status: **Firmware Load Completed Successfully.**

Debug Output:

```
12:27:08 Load Firmware DONE!
12:27:05 GPS Enabled, Confirmed
12:27:05 Main (RS232) image Load Completed Successfully
12:27:05 Main (RS232) image CRC is OK
12:27:03 Verifying CRC on Firmware Main image...
12:26:58 Writing 4K Bytes to Flash Addr = 0002E000
12:26:54 Writing 4K Bytes to Flash Addr = 0002D000
12:26:49 Writing 4K Bytes to Flash Addr = 0002C000
12:26:44 Writing 4K Bytes to Flash Addr = 0002B000
12:26:40 Writing 4K Bytes to Flash Addr = 0002A000
```



H-522 and H-522+ GOES Transmitters

The following section provides disassembly instructions for H-522 and H-522+ data loggers to gain access to the internal H-222DASE GOES transmitter. If you have a separate H-222DASE enclosure, you can disregard the H-522 disassembly instructions.



CAUTION

This update involves gaining access to the inside of the datalogger and exposing circuit boards. Make every effort to ensure no debris or liquids make contact with these sensitive internal components. Also, try your best to ground yourself before proceeding. Electrostatic can damage these components.

Remove the power supply from the main terminal on the bottom of the datalogger.



Remove the 4 screws using a 1/8" Allen wrench. You may need to puncture or remove the Void Warranty sticker.

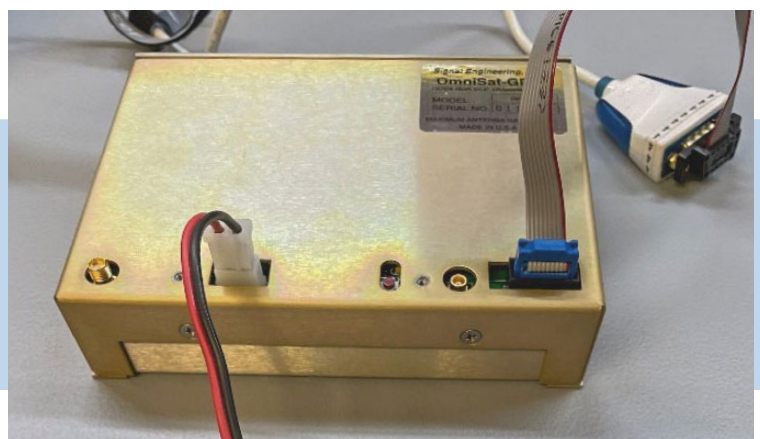


Lift up the display panel and carefully wedge it between the standoffs and the bottom of the enclosure as shown.

The "Host" ribbon cable can be unplugged for more wiggle room.



Remove the power cable from the terminal on the transmitter. Then plug the Serial to 10-PIN cable into the 10-PIN port on the transmitter and a PC containing the H-222DASE Firmware Update utility.



Apply power back to the main terminal on the bottom of the datalogger.



Refer back to main document to complete the firmware update procedure.

For more information:



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