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► E-mail: techpubs@spectracom.com

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Introduction & Overview

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1.1 Product Overview

VelaSync® 1232 High-Speed Time Server is an enterprise-class time serving appliance designed for high-frequency trading and other network applications that require low latencies.

VelaSync's customized configuration, comprising state-of-the-art network synchronization software, precision GNSS (GPS) timing technology, and reliable server hardware allows it to provide high-performance time management over multiple network interfaces.

\textbf{VelaSync 1232 (part number 1232-xxxx-xxxx) is the latest version of this unit. For the user manual for an original VelaSync 1225 (part number 1225-xxxx-xxxx) see the VelaSync User’s Manual, archived on the Spectacom website.}

Hardware

The customized Supermicro® server platform is a 1U server comprised of a standard chassis and motherboard, as well as a GNSS receiver plus oscillator (OCXO, or Rubidium), two hard disks (RAID), two power supplies, and several time, frequency, and communication ports.

Software

The pre-installed Spectracom time synchronization and management software allows to distribute very accurate time throughout a network, supporting NTP and PTP protocols. In day-to-day operation, the software allows system administrators to centrally monitor time synchronization accuracy throughout the network in an efficient manner.

\textbf{Figure 1-1: VelaSync High Speed Time Server}

1.2 About this Manual

This User Manual for the VelaSync High-Speed Enterprise Time Server provides you with:

- descriptions of features and functions, as well as
- installation and configuration guidance
- instructions for specific tasks related to using this product
- safety-related information
The main objectives of this User Manual are:

a. to assist you with the installation and configuration of this product in a safe and efficient manner

b. to help you familiarize yourself with VelaSync's user interfaces, features and functionality.

This User Manual is written for a professional audience, targeting experienced system integrators and PC technicians.

Other relevant documentation

Note: VelaSync 1232, is the latest version of this unit. For the user manual for an original VelaSync 1225, see the VelaSync User's Manual, part number 1225-5000-0050, archived on the Spectacom website.

This Spectracom User Manual is complemented by the Spectracom VelaSync Quick Reference Guide (PN: 1232-5000-0051), a printed copy of which is shipped with the unit, and the user documentation for the Supermicro™ SuperO® SuperServer 5018R-WR, which can be found under:


Manual Organization

This User Manual is organized as follows:

CHAPTER 1: Introduction and Overview

This chapter describes the main features of VelaSync, its hardware operating elements, and status indicators. Furthermore, the introductory chapter also includes VelaSync's technical specifications, and regulatory information.

CHAPTER 2: Installation

This chapter describes the preparatory measures, as well as the actual steps necessary to install VelaSync in a server rack. Also included are SAFETY notes, and typical configuration steps required prior to, or after initial powering on the system.

CHAPTER 3: Managing Time

The software running on VelaSync not only serves time during normal operation, but also represents the main user interface for configuring and monitoring VelaSync.
guides you through the web user interface, **Web UI**, explaining its features and functions.

**CHAPTER 4: System Administration**

Frequently executed tasks are described in CHAPTER 4, broken down into the categories, including, "Hardware Tasks" on page 163, "Notifications" on page 166, and "Managing Users and Security" on page 175.

**APPENDIX**

The document appendix includes "Troubleshooting" on page 208, as well as administrative information, how to contact Spectracom Support, and license notices.

## 1.3 Designated Use of this Product

This product has been designed and built in accordance with state-of-the-art standards and the recognized safety rules. Nevertheless, its use may constitute a risk to the operator or installation/maintenance personnel if used under conditions that must be deemed unsafe, or for purposes other than the product’s designated use.

The VelaSync High-Speed Enterprise Time Server is intended for use in restricted access areas. A restricted access area can be accessed only through the use of a special tool, lock and key, or other means of security.

Installation and maintenance of this device should be performed by experienced technicians only.

For additional information on how and where to use this product, see also "Selecting the Right Installation Location" on page 24 and "YOUR SAFETY" on page 17.
1.4 Technical Specifications

1.4.1 Hardware

1.4.1.1 Server

- Supermicro SuperServer 5018R-WR rackmount server with 1U chassis and X10SRW-F motherboard:
  - Four 8cm counter-rotating PWM fans
  - One passive CPU heatsink
  - Two riser cards
  - Four hot-swap 3.5" drive bays (SATA)
- Intel 1.8 GHz Quad-Core Xeon Processor
- 8 GB RAM
- Two Western Digital Re 1 TB Enterprise-Class Hard Drives in RAID Mirroring configuration
- Two redundant, hot-swap power supplies, 100-240 VAC auto-switch, 50-60 Hz, 500 W each, with IEC60320 C14 inlet coupler
- Connectivity:
  - I/O connectors: See "Rear Panel Overview" on page 12.

1.4.1.2 GPS/GNSS Receiver

- Connector: SMA, +5V to power active antenna (SMA-to-Type-N-adapter cable included)
- Frequency: GNSS L1 (1575.42 MHz)
- Satellite tracking: 1 to 50, T-RAIM satellite error management
- Synchronization time:
  - Cold start < 15 minutes (includes almanac download)
  - Warm start < 5 minutes (assumes current almanac downloaded)
- GNSS Antenna system: See antenna installation guide (antenna sold separately)
1.4.1.3 Oscillator

Table 1-1: Oscillator accuracies

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<thead>
<tr>
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<th>OCXO</th>
<th>Rb</th>
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</thead>
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<tr>
<td><strong>Accuracy to UTC</strong> (1 sigma locked to GPS)</td>
<td>50 ns</td>
<td>25 ns</td>
</tr>
<tr>
<td><strong>Holdover Accuracy</strong> (loss of GPS signal after 2 weeks locked, constant temperature)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 4 hours</td>
<td>1 μs</td>
<td>0.2 μs</td>
</tr>
<tr>
<td>After 24 hours</td>
<td>25 μs</td>
<td>1 μs</td>
</tr>
</tbody>
</table>

**Notes:**
- Accuracy to UTC is measured by comparing the internal 1PPS with the GPS on-time point.
- When ordering a VelaSync unit, either an OCXO or Rubidium oscillator must be specified.
- The specifications are subject to a steady environment temperature.

1.4.2 I/O Connectors

1.4.2.1 Timing Connector

The pre-installed TSync-model 25-pin Micro D-Sub Connector, when combined with the adaptor cable and breakout cable (both included), provides the following I/O options:

**Inputs:**
- 1 PPS Input
  - 1 Hz pulse, rising edge or falling edge active (selectable); 100 ns minimum pulse width
  - Amplitude: 0 V to +5.5 V input range, +0.8 V<sub>VIH</sub>, +2.0 V<sub>VIL</sub>
  - Input impedance: <150 pF capacitive
- IRIG AM Input
  - Accepts IRIG formats A, B, G; NASA36; IEEE 1344
  - Amplitude: 500 mV<sub>p-p</sub> to 10 V<sub>p-p</sub>
  - Modulation ratio: 2:1 minimum, 6:1 maximum
  - Input impedance: 10 kΩ minimum
  - DC Common Mode Voltage: ±150 V<sub>DC</sub> maximum
  - Input Stability: Better than 100 ppm
IRIG DCLS Input
- Accepts IRIG formats A, B, G; NASA36; IEEE 1344 pulse width codes (does not accept Manchester modulated codes)
- RS-485 differential input: –7V to +12 V common mode voltage input range, 200 mV\text{p-p} differential voltage threshold
- Single-ended input:
  - +1.3 V\text{ VIL min}, +2 V\text{ VIH max}
  - +1.45 V\text{ VIL typ}, +1.85 V\text{ VIH typ}

GPIO Inputs
- Amplitude: 0V to +5.5 V input range, +0.8 V\text{ VIL}, +2.0 V\text{ VIH}
- Polarity (selectable): Positive or negative
- Input impedance: <150 pF capacitive
- 50 ns active pulse width minimum; 50 ns minimum between pulses
- Repetition rate. More than 10,000 events per second
- Resolution: 5 ns

Outputs
1 PPS Outputs
- 1Hz pulse, rising edge or falling edge active (selectable)
  - 40 ns to 900 ms active pulse width (selectable, 200 ms default)
- Rise time: <10 ns
- Signal level: TTL compatible, 4.3 V\text{ min}, base-to-peak into 50 Ω [PCIe only: TTL compatible, 2.2 V minimum, base-to-peak into high impedance]
- Accuracy: Positive edge within ±[X] nanoseconds of UTC when locked to a valid 1PPS input reference (for [X], see table below).

Table 1-2: 1 PPS output accuracy

<table>
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<th>OCXO</th>
<th>OCXO (Rugged Option, cPCI &amp; VPX only)</th>
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<tr>
<td>Accuracy to UTC (1-sigma locked to GPS)</td>
<td>±50 ns</td>
<td>±50 ns</td>
<td>±25 ns</td>
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1.4 Technical Specifications

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<th>OCXO</th>
<th>OCXO (Rugged Option, cPCI &amp; VPX only)</th>
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<td>Holdover (constant temp after 2 weeks of GNSS lock)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 4 hours</td>
<td>12 μs</td>
<td>3 μs</td>
<td>1 μs</td>
</tr>
<tr>
<td>After 24 hours</td>
<td>450 μs</td>
<td>100 μs</td>
<td>25 μs</td>
</tr>
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- **10 MHz Output**
  - 10 MHz sine wave output from oscillator
    - Output impedance: 50 Ω nominal
    - Output load: 50 Ω minimum
    - Output harmonics: < -40 dBc
    - Output spurious: < -70 dBc

- **IRIG AM Output**
  - Output formats A, B, E (100 Hz, 1 kHz), G; NASA36; IEEE 1344
  - Amplitude:
    - 0.5 \( V_{p-p} \) to 6 \( V_{p-p} \) into 50 Ω, user settable
    - 1\( V_{p-p} \) to 12 \( V_{p-p} \) into > 600 Ω
  - Output impedance: 50 Ω nominal
  - Output load: 50 Ω minimum
  - Modulation ratio: 3:1 nominal
  - Accuracy: ±2 to 200 microseconds (IRIG-format dependent)

- **IRIG DCLS Output**
  - Outputs formats: A, B, E, G; NASA36; IEEE 1344 pulse width codes (does not generate Manchester modulated codes)
  - RS-485 differential signal:
    - 1.8 \( V_{max} \) common mode output voltage (RS-485 compatible)
    - 1.5 \( V_{min} \) to 3.3 \( V_{max} \) differential output voltage swing
  - Single-ended amplitude (100 Ω load):
    - 0.5 \( V_{VOL} \) max, +2.5 \( V_{VOH} \) min (TTL compatible)

- **GPIO Outputs**
  - Periodic Output:
» Amplitude: TTL compatible, 4.3 V min, base-to-peak into 50 Ω [PCIe only: 2.2 V minimum, base-top-peak into high impedance]
» Pulse width: 50 ns to 999 ms active pulse width, in 20 ns increments
» Period: 100 ns min, 60 s max, in 20 ns increments
» Polarity (selectable): Positive or negative

Time-Match/Alarm Output
» Amplitude: TTL compatible, 4.3 V minimum, base-to-peak into 50 Ω; 2.2 V minimum, base-to-peak into high-impedance
» Range: 100 days in 5 ns steps

1.4.2.2 Communication Ports
2x 10 GbE SFP+ (optionally 4x, or 2x 10 Gb plus 2x 40 Gb1)
2x 1GbE RJ-45 with hardware time stamping
1x IPMI (V.2.0)
1x RS-232 (Fast UART)
4x USB 2.0
1x VGA

1.4.3 Environmental Specifications
» Operation: 10°C to 35°C, RH: 8 to 90% (non-condensing @ 35°C)
» Storage: –40°C to +50°C, RH: 5 to 95% (non-condensing @ 35°C)

1.4.4 Size, Weight & Power
» Dimensions: (WxHxD) 437 x 43 x 650 mm (17.2 x 1.7 x 25.6 in.)
» Weight: 23.5 lbs. (10.7 kg)
» AC input: 100 - 240 V_{RMS}, 50 - 60 Hz, 6.1 - 2.6 A

For additional hardware specifications, see the User's Manual of the Original Equipment Manufacturer:
https://www.supermicro.com/manuals/superserver/1U/MNL-1771.pdf

1Please inquire about availability.
1.5 Front Panel Overview

1.5.1 Control Buttons

- UNIT ID ("UID"): Unit identifier button – to identify this unit, press this button (or activate via IPMI) to turn the blue "i" LED in front and back of unit on/off.
- RESET button: Reboot the system
- Power button: Apply/remove power from the power supply of the server. (Note: Standby power continues to be supplied to the system, i.e. the power supplies and the IPMI remain energized)
- HDD Release Lever: Pull to release one of the two hot-swap RAID hard disks.

1.5.2 Control Panel LEDs

- Info (red):
  - Red blinking fast (1x/sec): Fan fail
  - Red blinking slowly (1x/4 sec): Power fail
  - Red solid: CPU overheat
- Info (blue):
  - Blue solid: Local UID button depressed
  - Blue blinking: UID has been activated via IPMI
- NIC 2, 1: Activity on GLAN 1,2 when flashing green
1.5.3 **Hard Disk Drives**

Each hard disk drive (HDD) carrier has two LEDs:

- **Green LED**: Indicates drive activity, when illuminated.
- **Red LED**:
  - When *blinking*, the drive is rebuilding.
  - When *solid*, indicates drive failure (you should also receive an automatic message from your system management software).

To release a hard disk drive carrier, in order to remove the hot-swappable hard disk drive, push the red button for the carrier to release the lever, then pull the carrier out, using the lever.

For additional instructions on how to replace a hard disk, see "Removing/Installing a Hard Disk Drive" on page 164.
1.6 Rear Panel Overview

Figure 1-3: VelaSync rear panel

Legend:

1./2.: 1GbE ports (RJ-45)
3./4.: 10 GbE ports (SFP+)
5./6.: Optional 10 GbE ports (SFP+), or 40 GbE (QSFP+)
7.: GPS/GNSS antenna connector (SMB)
8.: VGA
9.: Spectacom TSync timing connector 2 Includes rear status LED’s ("Status LEDs" on page 42).
10.: USB (4x)
11.: IPMI
12.: Serial
13./14.: Power supplies

Note: VelaSync does not support having multiple network interfaces on the same subnet or multipath routing.

---

1 Please inquire about availability.
2 PPS Output is 3.3V and should be terminated to 50 Ohms.
1.7 The VelaSync Web UI

VelaSync has an integrated web user interface (referred to as "Web UI" throughout this documentation) that can be accessed from a network-connected computer, using a standard web browser. The Web UI is used to configure and monitor the unit.

Note: An integrated Command-Line Interpreter interface (CLI) allows the use of a subset of commands that are integrated into the Web UI.

The minimum browser requirements for the Web UI are: Internet Explorer® 9 or higher, Firefox®, or Chrome®.

1.7.1 The Web UI HOME Screen

The HOME screen of the VelaSync web user interface ("Web UI") provides comprehensive status information at a glance, including:

- vital system information
- current status of the references
- key performance/accuracy data
- major log events.

The HOME screen can be accessed from anywhere in the Web UI, using the HOME button in the Primary Navigation Bar:

The Primary Navigation Bar provides access to all menus:
HOME: Return to the HOME screen (see above)

INTERFACES: Access the configuration pages for ...
  - ... references (e.g., GNSS, NTP)
  - ... outputs (e.g. 10 MHz, PPS, NTP) and
  - ... installed input/output option cards.

MANAGEMENT: Access the NETWORK setup screens, and OTHER setup screens e.g., to configure Reference Priorities, System Time, and the Oscillator.

TOOLS: Opens a drop-down menu for access to the system maintenance screens and system logs.

HELP: Provides Spectracom Service Contact Information and high-level system configurations you may be required to furnish when contacting Spectracom Service.

1.7.2 The INTERFACES Menu

The INTERFACES menu on the Main screen provides access to VelaSync's:
  - External REFERENCES e.g., the GNSS reference input
  - Detected OUTPUTS, such as 10 MHz and 1PPS
  - Installed OPTIONS.

Clicking on any of the line items will open a status screen, providing real-time information on the selected interface e.g., availability, performance data and events history.

To configure settings for the selected interface, click the GEAR icons or buttons provided on most of the status screens. Icons like the INFO symbol provide access to more detailed status information and history data.

The headings of each of the INTERFACES drop-down menus (white on orange) open overview status screens for the respective menu items.
1.7.3 The Configuration MANAGEMENT Menu

The MANAGEMENT menu on the Web UI’s Main screen provides access to VelaSync’s configuration screens and settings.

On the left side, under NETWORK, the following standard setup screens can be found:

- **Network Setup**
- **HTTPS Setup**
- **SSH Setup**
- **SNMP Setup**
- **NTP Setup**
- **PTP Setup**

Under OTHER, you can access non-network related screens:

- **Authentication**: Manage user accounts, Security Policy, LDAP Setup, RADIUS setup, Login Preference and Remote Servers. Change My Password is also available.
- **Reference Priority**: Define the order of priority for timing inputs.
- **Notifications**: Configure the notifications triggered by VelaSync’s events. A notification can be a combination of a mask alarm and/or SNMP Trap and/or email.
- **Time Management**: Manage the Local Clock, UTC Offset, DST Definition and Leap Second information.
- **System Time Message**: Configure a regularly delivered message of the system time.
- **Log Configuration**: Manage the system logs.
- **Disciplining**: Manage oscillator disciplining.
- **Change My Password**: Configure the admin password.

1.7.4 The TOOLS Menu

The TOOLS menu on the Web UI’s Main screen provides access to:

- The System Upgrade screen
- System and network monitoring screens
- Miscellaneous system administration screens
- Log screens
1.7 The VelaSync Web UI
1.8 YOUR SAFETY

This product has been designed and built in accordance with state-of-the-art standards and the recognized safety rules. Nevertheless, its use may constitute a risk to installation/maintenance personnel if used under conditions that must be deemed unsafe, or if the warnings and precautions explained below are ignored.

Additional Safety Notes pertaining to hardware installation can be found under "Rack Mounting: SAFETY" on page 25.

1.8.1 SAFETY: Symbols Used

**Note:** The following symbols may be found in Spectracom technical documentation, or on Spectracom products:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Signal word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>![DANGER!]</td>
<td>DANGER!</td>
<td>Potentially dangerous situation which may lead to personal injury or death! Follow the instructions closely.</td>
</tr>
<tr>
<td>![CAUTION!]</td>
<td>CAUTION!</td>
<td>Potential equipment damage or destruction! Follow the instructions closely.</td>
</tr>
<tr>
<td>![NOTE]</td>
<td>NOTE</td>
<td>Tips and other useful or important information.</td>
</tr>
<tr>
<td>![ESD]</td>
<td>ESD</td>
<td>Risk of Electrostatic Discharge! Avoid potential equipment damage by following ESD Best Practices.</td>
</tr>
<tr>
<td>![CHASSIS GROUND]</td>
<td>CHASSIS GROUND</td>
<td>This symbol is used for identifying the functional ground of an I/O signal. It is always connected to the instrument chassis.</td>
</tr>
<tr>
<td>![Analog Ground]</td>
<td>Analog Ground</td>
<td>Shows where the protective ground terminal is connected inside the instrument. Never remove or loosen this screw!</td>
</tr>
<tr>
<td>![Recycle]</td>
<td>Recycle</td>
<td>Recycle the mentioned components at their end of life. Follow local laws.</td>
</tr>
</tbody>
</table>
1.8.2 SAFETY Advisories

**DANGER!** ELECTRICAL HAZARD — DO NOT OPEN THE ENCLOSURE: No user-serviceable parts inside (the product warranty will be voided, if the Seal is broken). Should you ever decide to open the enclosure at your own risk, unplug and remove BOTH power supplies first (the POWER button will NOT de-energize the system!).

**Caution:** Only trained and qualified personnel should be allowed to install, replace, or service this equipment.

**DANGER!** — GROUNDING: A reliable ground must be maintained at all times. To ensure this, the rack itself should be grounded. Particular attention should be given to power supply connections other than the direct connections to the branch circuit (i.e. the use of powerstrips, etc.).

**Caution:** CIRCUIT OVERLOADING — Consideration should be given to the connection of the equipment to the power supply circuitry and the effect that any possible overloading of circuits might have on overcurrent protection and power supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

**DANGER!** Hazardous voltage or energy is present on the back panel when the system is operating. Use caution when servicing.

**Caution:** Do not use power supplies other than the p/s model installed in your VelaSync, and do not mix power supplies with different power ratings.

**NOTE:** Replacement power supplies can be purchased directly from Spectracom (Part no. PS09R-070J-SL01). Please be sure to also consult local and national electrical codes, and the User’s Manual of the Original Equipment Manufacturer which can be accessed online under: https://www.supermicro.com/manuals/superserver/1U/MNL-1771.pdf.
Ultimate disposal of this product should be handled according to all national laws and regulations.

SAFETY: General Advice

» Make sure you possess the professional skills, and have received the training necessary for the type of work you are about to perform.

» The equipment must only be used in technically perfect condition. Check components for damage prior to installation. Also check for loose or scorched cables on other nearby equipment.

» Do not modify the equipment.

» Use only spare parts authorized by Spectracom.

SAFETY: Hands-On Advice

» Before working with or on the equipment, familiarize yourself with the location of the ON/OFF switch on the unit, the closest disconnection switch in the room, and electrical outlet, so that you can quickly remove power from the unit in the event of an emergency.

» Do not work alone. The other person should also know how to disconnect power to the unit you are working on.

» Always remove power from the unit, before working on it. Before disconnecting power, gracefully shut down the unit.

» Should you ever have to work on powered on electrical equipment, use only one hand, in order to avoid making a complete circuit.

» To protect yourself from electrical shock, use rubber mats specifically designed as electrical insulators (not ESD mats).

» Keep these instructions at hand, near the place of use.

» Keep your workplace tidy.

» Do not wear loose clothing.

» Remove any metal objects, such as jewelry, from your body.

» Apply technical common sense: If you suspect that it is unsafe to use the product, do the following:
  » Disconnect the supply voltage from the unit.
  » Clearly mark the equipment to prevent its further operation.

ESD: Best Practices

This product does not require opening. In the event that an internal component failed (e.g.,
a fan), contact Spectracom service (see "Technical Support" on page 237).

**DANGER! — ELECTRICAL HAZARD — DO NOT OPEN THE ENCLOSURE:**
No user-serviceable parts inside. Should you ever decide to open the enclos-
ure at your own risk, unplug and remove BOTH power supplies first (the
POWER button will NOT de-energize the system!)

**Caution:** Electronic equipment is sensitive to Electrostatic Discharge
(ESD). Observe all ESD precautions and safeguards when handling Spec-
tracom equipment.

» Use a grounded wrist strap to prevent static discharge.
» Put components and PCBs back into their antistatic bags, while not in use.
» Touch a grounded metal object before removing a PCB from its antistatic bag.
» Make sure the unit’s chassis, its power supply, and main components are electrically
  connected to one another, so as to allow reliable grounding.
» Do not let components or PCBs come into contact with your clothing.
» Handle PCBs on their edges only; avoid touching electronic components or contacts.
  If you have to handle a chip, avoid touching its pins.

**1.9 Regulatory Compliance**

This product has been found to be in conformance with the following regulatory pub-
lications.

**FCC**

This equipment has been tested and found to comply with the limits for a Class A digital
device, pursuant to Part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference
when the equipment is operated in a commercial environment. This equipment gen-
erates, uses, and can radiate radio frequency energy and, if not installed and used in accord-
ance with the user documentation, may cause harmful interference to radio
communications.

Operation of this equipment in a residential area is likely to cause harmful interference
in which case the user will be required to correct the interference at his/her own expense.
Note: This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Safety
This product has been tested and meets the requirements specified in:

- IEC/EN/UL/CSA 62368-1:2014

EMC Compliance
This product has been tested and meets the following standards:

- ICES-003 Issue 6: Class A
- FCC CFR 47 PART 15 SubPart B:2016: Class A
- EN55024:2010: Class A
- EN 61000-3-2:2014
- EN 61000-3-3:2013
- AS/NZS CISPR 32:2015
- Radio Spectrum Efficiency:EN 303 413 V1.1.1

European Directives
This product has been tested and complies with the following:

- 2014/30/EU Electromagnetic Compatibility (EMC)
- 2014/35/EU Low Voltage (LVD)
- 2011/65/EU on the Restriction of Hazardous Substance (RoHS2)
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CHAPTER 2

Installation & Setup

The following topics are included in this Chapter:

2.1 Unpacking and Inventory .................................................24
2.2 Selecting the Right Installation Location ..................24
2.3 Rack Mounting: SAFETY ..................................................25
2.4 Rack Installation .............................................................25
2.5 Basic Connections Setup .................................................29
2.6 Accessing the Web UI ........................................................31
2.7 Configuring IP Address(es) ..............................................32
2.8 Advanced Timing Connections ......................................35
2.9 Configuring Network Settings .........................................43
2.10 Configure NTP ...............................................................68
2.11 Configuring PTP ..............................................................86
2.12 PRISMA Compliance Setup ..........................................91
2.1 Unpacking and Inventory

**Caution:** Electronic equipment is sensitive to Electrostatic Discharge (ESD). Observe all ESD precautions and safeguards when handling the unit.

Unpack the equipment and inspect it for damage. If any components have been damaged in transit, you should file a damage claim with the carrier who delivered the unit.

Should you experience any problems during installation and configuration of your Spectracom product, please contact your closest Spectracom Customer Service Center (see "Technical Support" on page 237).

**Note:** Retain all original packaging for use in return shipments, if necessary.

What’s in the box?

- VelaSync unit
- Two (2) sets of rail assemblies
- Two (2) rail mounting brackets, extension elements, and mounting hardware
- Front bezel, and keys
- Two (2) power cables
- Spectracom Ancillary Kit, containing one (1) antenna cable, one (1) TSync standard breakout cable, and one (1) timing I/O adaptor cable.
- Optional equipment e.g., GPS antenna and surge suppressor

After inspecting the contents of the shipment, continue with Chapter "Selecting the Right Installation Location" below.

2.2 Selecting the Right Installation Location

VelaSync has been designed to be installed in an industry-grade, slide-mount 19” server rack or cabinet. Note that VelaSync is not suitable for use with a visual display work place device (§2 of the German Ordinance for Work with Visual Display Units).

Select a suitable location that meets the following requirements:
A dedicated room with restricted access

- Electrically grounded and mechanically stable rack, with physical clearance for unrestricted air flow and servicing: approx. 650 mm [25"] in front of rack, 770 mm [30"] in the back of rack
- Clean, dust-free, and stable\(^1\) ambient temperature not to exceed 35°C [95°F].
- Virtually free of EMC noise
- Access to a reliable grounded power outlet
- Sufficiently dimensioned power supply circuitry, to prevent overloading of circuits.
- The use of a regulating UPS (Uninterruptible Power Supply) is recommended.

Next Steps:

- Read "YOUR SAFETY" on page 17, and "Rack Mounting: SAFETY" below before familiarizing yourself with the procedure for the "Rack Installation" below.

### 2.3 Rack Mounting: SAFETY

- Read "YOUR SAFETY" on page 17.
- Before installing VelaSync in the fully extended rails, or before extending the unit from the rack, ensure that the rack is stable enough to support the weight of the fully extended unit. If you are using a standalone rack, it may be necessary to install stabilizers to the rack.
- Always extend only one unit at a time.
- Install heavier servers near the bottom of the rack.
- The unit weighs approximately 24 lbs (11 kg). Depending on your chosen installation location, it may be advisable to lift the unit with two persons.

### 2.4 Rack Installation

Note: We recommend that you read this Chapter in its entirety before you begin with the installation.

\(^1\)An environment where a constant temperature can be maintained during operation, to allow for the best possible timing accuracy.
2.4 Rack Installation

![Diagram of rack rail assembly]

All VelaSync units are shipped with two rack rail assemblies, each of which consists of two sections:

- **inner rail**, which is pre-installed to the server chassis
- **outer rail assembly**, which faces the rack

Optional inner rail extension elements (shown in red) are provided to accommodate installation scenarios requiring maximum unit extension from the rack, e.g. for service & maintenance. Consult your rack manufacturer’s user manual for additional information.
Installing the outer rail to the rack:

1. Measure the distance from the front rail to the rear rail of the rack. Attach a short bracket to the front side of each of the outer rails, and a long bracket to the rear side of each outer rail.

2. Adjust both the short, and the long brackets to the proper distance so that the rails fit snugly into the rack. Secure the short bracket to the front side of the outer rail with two screws, and the long bracket to the rear side of the outer rail with three screws.

Installing the server into the rack:

Once all the rails have been installed to the VelaSync chassis and the rack, the VelaSync unit can be installed into the rack.

Caution: The unit weighs approximately 24 lbs (11 kg). Depending on your chosen installation location, it may be advisable to lift the unit with two persons.
3. Line up the rear of the inner rails at the chassis with the front of the outer rails at the rack. Slide the server chassis into the rack, keeping the pressure even on both sides. Depress the locking tabs, if needed (they will click upon proper engagement).

Figure 2-3: Rack installation

2.4.1 TELCO Rack Installation

To install the VelaSync unit in a Telco-type rack, use two L-shaped brackets on either side of the VelaSync chassis.

1. Determine how far forward the unit will extend out of the front of the rack. Determine a balanced front-to-back position of the chassis.

2. Remove the bezel from the VelaSync. Attach the two front brackets to each side of the chassis, then the two rear brackets, leaving just enough space to accommodate the width of the telco rack.

3. Slide the VelaSync into the rack, and tighten the brackets to the rack.
2.5 Basic Connections Setup

This section is designed to take your through the initial setup steps in order to allow you to communicate with and configure your VelaSync.

2.5.1 Connecting the GPS Antenna

For instructions on how to install a GPS/GNSS antenna, the signal cable, and accessories such as surge protectors, weatherproofing kits, or amplifiers, refer to the Installation Guide that came with the respective equipment.

For additional information regarding the GPS antenna location selection, see "Choosing a GNSS Antenna Location" on page 233.

1. Connect the GPS/GNSS antenna to the GNSS RF connector (see illustration above, item number 7), using the supplied Type-N adapter cable, and an LMR-400 equivalent cable with surge suppressor and active GPS L1 antenna, such as Spectracom model 8230.

   Note the GNSS receiver connection provides 5V DC power for the antenna.

2.5.2 Connecting Power

Before connecting power to the unit, make sure that you have read all safety information detailed in section "YOUR SAFETY" on page 17.

DANGER! When installing the product, use only the provided or designated power cables. Using any other cables and adaptors could cause a malfunction or a fire.
2. Plug in power to both power supplies (items 13 & 14 "Basic Connections Setup" on the previous page).

As soon as at least one of the two power supplies has been connected to the mains voltage, you may hear **fan noise** from inside the VelaSync housing. However, note that the unit is not running yet (check the front indicator lamps: they will remain dark).

3. Switch the unit on by pressing the ON/OFF button on the front panel. Wait for the device to boot up.

   **Note:** If only one power supply is running, and the other one is inserted all the way, but not plugged in, or defective, VelaSync will emit a long BEEP, so as to alert you of a problem with the backup power.

4. Once the boot process is completed, only the green POWER status LED should be lit.
### 2.5.3 Establishing a Network Connection

5. You can choose to communicate with your VelaSync upon setup in one of three ways:
   - ETH0, using the default static IP address (see step 6),
   - ETH1-ETH5, using a DHCP network (see step 7),
   - via the serial port (see "Setting Up an IP Address via the Serial Port" on page 33).

6. The unit is shipped with one static IP address: ETH0 = 192.168.1.1. To communicate with the Web UI using this address, connect a PC with a configured LAN port via Ethernet cable to the VelaSync server using ETH0.

7. To connect a device using DHCP, connect to an Ethernet port without a static IP address (any Ethernet port except ETH0). Find the unit on your network by contacting your network administrator, and log in to the unit’s assigned IP address.

8. Log on to the Web UI (see directions in "Accessing the Web UI" below).  

   **Note:** You'll likely want to change the default IP address of the ETH ports you plan on using. This procedure is described in the next topic. (You will need an Ethernet cable, or a serial null modem cable for this.)

For more detailed information on network setup, see the section on "Configuring Network Settings" on page 43

---

### 2.6 Accessing the Web UI

VelaSync’s Web UI is the recommended tool to interact with the device, since it provides access to nearly all configurable settings, and obtain comprehensive status information without having to use the Command Line Interpreter (CLI).

You can access the Web UI either by using the manually set static IP address (ETH0 = 192.168.1.1), or by using the DHCP IP address automatically assigned during zero config setup.

1. Log into the Web UI as an administrator.

   **Note:** The default login credentials are:
   - User name = spadmin
   - Password = admin123
2. Upon initial login, you will be asked to register your product. Spectracom recommends to register VelaSync, so as to receive software updates and services notices. You can also register your product on the Spectracom website: register.spectracom.com.

See also "Product Registration" on page 235.

2.7 Configuring IP Address(es)

VelaSync's ETH0 network interface port is configured with a unique static IP address: 192.168.1.1. The DHCP is shipped disabled on this port, but can be reinstated below. The other Ethernet ports default to DHCP; if connected to a DHCP server via ETH1 through ETH5, VelaSync will accept a dynamic IP address.

Once you are connected to the Web UI, you can manually adjust the IP addresses for each ethernet port, and enable or disable DHCP.

2.7.1 Changing the IP address using an Ethernet connection

1. In order to manipulate network configurations, open a web browser, using a PC that is on the same network as the VelaSync.

2. Navigate to the IP address connected to VelaSync; either the default static address (ETH0) or the dynamic address assigned by your DHCP.

3. Log onto the Web UI as an administrator. If not yet updated, use the default password:

   **Note:** The default login credentials are:
   - **User name** = spadmin
   - **Password** = admin123

4. In the Web UI HOME screen, select the MANAGEMENT menu > Network Setup.

5. In the Ports panel on the right, click the GEAR button next to the Ethernet port to be configured: the Edit Ethernet Port Settings panel will open.
6. In this panel, you can perform the following actions:
   - enable or disable the ethernet port
   - enable DHCP
   - disable DHCP (selecting this function will provide access to the remaining settings)
   - assign a static IP address
   - set netmask values
   - set Gateway, domain, DNS, and MTU values.

   **Note:** Wait to click **Submit** or **Apply** until fully finished assigning values to avoid errors.

In order to apply a static IP address to any Ethernet port, DHCP must be disabled.

To update network settings using a serial connection, please see "Setting Up an IP Address via the Serial Port" below.

### 2.7.2 Setting Up an IP Address via the Serial Port

VelaSync’s rear panel serial port connector is a standard DB9 male connector. Communication with the serial port can be performed using a PC with a terminal emulator program (such as PuTTY or TeraTerm), using a pinned null-modem standard DB9F to DB9M
serial cable. The VelaSync serial port operates at 9600 baud, 8 data bits, no parity, 1 stop bit.

The serial port can be used to make configuration changes (such as the network settings), retrieve operational data (e.g., GNSS receiver information) and log files, or to perform operations such as resetting the admin password.

The serial port is account and password protected. You can log in via the serial port using the same user names and passwords as would be used to log in to the VelaSync Web UI. Users with administrative permissions can perform all available commands. Users with user permissions only can perform “get” commands that retrieve data, but cannot perform any “set” commands or change/reset any passwords.

To configure an IP address via the serial port:

1. Connect a serial cable to a PC running PuTTY, Tera Term, or HyperTerminal, and to your VelaSync. For detailed information on the serial port connection, see "Setting up a Terminal Emulator" on page 215

2. Login to VelaSync with a user account that has “admin” group rights, such as the default spadmin account (the default password is admin123).

3. Disable DHCP, type: dhcp4set 0 off <Enter>.

   Note: For a list of CLI commands, type helpcli, or see "CLI Commands" on page 216.

4. Configure the IP address and subnet mask, type:

   ▶ ip4set 0 x.x.x.x y.y.y.y <Enter>
   (where 0 is the desired interface, “x.x.x.x” is the desired IP address for VelaSync, and “y.y.y.y” is the full subnet mask for the network (For a list of subnet mask values, see "Subnet Mask Values" on the facing page.)

5. Configure the gateway by typing gw4set 0 z.z.z.z <Enter>
   (where 0 indicates which interface routing table to add the default gateway for, and “z.z.z.z” is the default gateway address).

6. Remove the serial cable, connect VelaSync to the network, and access the Web UI, using the newly configured IP address. (For assistance, see "Accessing the Web UI" on page 31).

The remainder of the configuration settings will be performed via the Web UI (accessed via an external workstation with a web browser such as Firefox® or Chrome®).
2.7.3 Subnet Mask Values

Table 2-1: Subnet mask values

<table>
<thead>
<tr>
<th>Network Bits</th>
<th>Equivalent Netmask</th>
<th>Network Bits</th>
<th>Equivalent Netmask</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>255.255.255.252</td>
<td>18</td>
<td>255.255.192.0</td>
</tr>
<tr>
<td>29</td>
<td>255.255.255.248</td>
<td>17</td>
<td>255.255.128.0</td>
</tr>
<tr>
<td>28</td>
<td>255.255.255.240</td>
<td>16</td>
<td>255.255.0.0</td>
</tr>
<tr>
<td>27</td>
<td>255.255.255.224</td>
<td>15</td>
<td>255.254.0.0</td>
</tr>
<tr>
<td>26</td>
<td>255.255.255.192</td>
<td>14</td>
<td>255.252.0.0</td>
</tr>
<tr>
<td>25</td>
<td>255.255.255.128</td>
<td>13</td>
<td>255.248.0.0</td>
</tr>
<tr>
<td>24</td>
<td>255.255.255.0</td>
<td>12</td>
<td>255.240.0.0</td>
</tr>
<tr>
<td>23</td>
<td>255.255.254.0</td>
<td>11</td>
<td>255.224.0.0</td>
</tr>
<tr>
<td>22</td>
<td>255.255.252.0</td>
<td>10</td>
<td>255.192.0.0</td>
</tr>
<tr>
<td>21</td>
<td>255.255.248.0</td>
<td>9</td>
<td>255.128.0.0</td>
</tr>
<tr>
<td>20</td>
<td>255.255.240.0</td>
<td>8</td>
<td>255.0.0.0</td>
</tr>
<tr>
<td>19</td>
<td>255.255.224.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.8 Advanced Timing Connections

2.8.1 TSync I/O Signals

The updated VelaSync holds a factory-installed TSync timing card which contains a GPS/GNSS antenna connection, status LED’s, and a 25 pin Micro D-Sub connector. The Micro D-Sub connector can be expanded into different configurations by use of the adapter cable and standard breakout cable.
2.8.1.1 Timing Interface Adapter Cable

VelaSync is shipped with a 15 cm (6”) adapter cable that is used to connect the micro 25-pin timing interface connector on the card to the breakout cable:

![Adapter cable](image)

**Figure 2-7:** Adapter cable

**Table 2-2:** Adapter pinout, timing connector

<table>
<thead>
<tr>
<th>END &quot;A&quot;</th>
<th>END &quot;B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIN-1</td>
<td>PIN-1</td>
</tr>
<tr>
<td>PIN-2</td>
<td>PIN-2</td>
</tr>
<tr>
<td>PIN-3</td>
<td>PIN-3</td>
</tr>
<tr>
<td>PIN-4</td>
<td>PIN-4</td>
</tr>
<tr>
<td>PIN-5</td>
<td>PIN-5</td>
</tr>
<tr>
<td>PIN-6</td>
<td>PIN-6</td>
</tr>
<tr>
<td>PIN-7</td>
<td>PIN-7</td>
</tr>
<tr>
<td>PIN-8</td>
<td>PIN-8</td>
</tr>
<tr>
<td>PIN-9</td>
<td>PIN-9</td>
</tr>
<tr>
<td>PIN-10</td>
<td>PIN-10</td>
</tr>
<tr>
<td>PIN-11</td>
<td>PIN-11</td>
</tr>
<tr>
<td>PIN-12</td>
<td>PIN-12</td>
</tr>
</tbody>
</table>
2.8.1.2 Basic Breakout Cable

The basic breakout cable breaks out a subset of features from the 26-pin timing connector to separate BNC and DB-9 connectors for use. The basic breakout cable supports the following features: External 1PPS Input, IRIG AM Input, IRIG DCLS Input, IRIG AM Output, (1) GP Input, (2) GP Outputs.
Figure 2-8: Breakout cable, basic version

Table 2-3: Pinout, basic breakout cable (unspecified pins in the table are not connected)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>GPIO Output 0</td>
<td>11</td>
<td>IRIG AM Input –</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td>16</td>
<td>GPIO Output 1- Reserved</td>
</tr>
<tr>
<td>6</td>
<td>GPIO Input 0</td>
<td>18</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>External 1PPS Input</td>
<td>21</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>Ground</td>
<td>24</td>
<td>IRIG DCLS Input –</td>
</tr>
<tr>
<td>9</td>
<td>IRIG AM Output</td>
<td>25</td>
<td>IRIG DCLS Input +</td>
</tr>
<tr>
<td>10</td>
<td>IRIG AM Input +</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground</td>
<td>6</td>
<td>GPIO Output 0</td>
</tr>
<tr>
<td>2</td>
<td>GPIO Input 0</td>
<td>7</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
<td>8</td>
<td>GPIO Output 1- Reserved</td>
</tr>
</tbody>
</table>
### 2.8.1.3 Premium Breakout Cable

**Note:** The premium breakout cable must be purchased separately. Contact Spectracom for details.

The premium breakout cable breaks out all features from the timing connector to separate BNC and DB-9 connectors for use. See table below for details.
### 2.8 Advanced Timing Connections

![Breakout cable, premium version](image)

**Figure 2-9:** Breakout cable, premium version

**Table 2-4:** Pinout, premium breakout cable (unspecified pins are not connected in the cable)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GPIO Output 2- Reserved</td>
<td>14</td>
<td>GPIO Output 3- Reserved</td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>15</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>GPIO Output 0</td>
<td>16</td>
<td>GPIO Output 1- Reserved</td>
</tr>
<tr>
<td>4</td>
<td>GPIO Input 2- Reserved</td>
<td>17</td>
<td>GPIO Input 3- Reserved</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td>18</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>GPIO Input 0</td>
<td>19</td>
<td>GPIO Input 1- Reserved</td>
</tr>
<tr>
<td>7</td>
<td>External 1PPS Input</td>
<td>20</td>
<td>1PPS Output</td>
</tr>
<tr>
<td>8</td>
<td>Ground</td>
<td>21</td>
<td>Ground</td>
</tr>
<tr>
<td>9</td>
<td>IRIG AM Output</td>
<td>22</td>
<td>10 MHz Output</td>
</tr>
<tr>
<td>10</td>
<td>IRIG AM Input +</td>
<td>23</td>
<td>Ground</td>
</tr>
<tr>
<td>11</td>
<td>IRIG AM Input –</td>
<td>24</td>
<td>IRIG DCLS Input –</td>
</tr>
<tr>
<td>12</td>
<td>IRIG DCLS Output –</td>
<td>25</td>
<td>IRIG DCLS Input +</td>
</tr>
<tr>
<td>13</td>
<td>IRIG DCLS Output +</td>
<td>26</td>
<td>Shield</td>
</tr>
</tbody>
</table>

P1—Timing Connector
### Advanced Timing Connections

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>IRIG DCLS I/O (DB-9 Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ground</td>
<td>6</td>
<td>IRIG DCLS Output +</td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
<td>7</td>
<td>IRIG DCLS Output –</td>
</tr>
<tr>
<td>4</td>
<td>IRIG DCLS Input +</td>
<td>BS</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>IRIG DCLS Input –</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>P3—10MHz Output (BNC Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10 MHz Output</td>
<td>BS</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td><strong>P4—1PPS Output (BNC Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1PPS Output</td>
<td>BS</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td><strong>P5—IRIG AM Input (BNC Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>IRIG AM Input +</td>
<td>BS</td>
<td>IRIG AM Input –</td>
</tr>
<tr>
<td></td>
<td><strong>P6—IRIG AM Output (BNC Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>IRIG AM Output</td>
<td>BS</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td><strong>P7—1PPS Input (BNC Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>External 1PPS Input</td>
<td>BS</td>
<td>Ground</td>
</tr>
<tr>
<td></td>
<td><strong>P8—GP Input (DB-9 Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>GPIO Input 0</td>
<td>7</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>GPIO Input 1</td>
<td>8</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>GPIO Input 2</td>
<td>9</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>GPIO Input 3</td>
<td>BS</td>
<td>Ground</td>
</tr>
<tr>
<td>6</td>
<td>Ground</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>P9—GP Output (DB-9 Female)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>GPIO Output 0</td>
<td>7</td>
<td>Ground</td>
</tr>
<tr>
<td>2</td>
<td>GPIO Output 1</td>
<td>8</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>GPIO Output 2</td>
<td>9</td>
<td>Ground</td>
</tr>
<tr>
<td>4</td>
<td>GPIO Output 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Ground</td>
<td>BS</td>
<td>Ground</td>
</tr>
</tbody>
</table>
VelaSync High-Speed Enterprise Time Server includes a TSync Timing card with three LEDs that provide visual status information. See table LED Colors below for these indicator codes.

The LEDs operate in certain modes by default.

Table 2-5: LED colors

<table>
<thead>
<tr>
<th>LED Color</th>
<th>Function</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>green</td>
<td>SYNC</td>
<td>Unit is synchronized: A valid external time or 1PPS reference is present, disciplining the onboard oscillator.</td>
</tr>
<tr>
<td>yellow</td>
<td>HOLDOVER</td>
<td>Unit is in holdover: No valid external reference is present. The onboard oscillator is not disciplined by an external reference, but continues to provide time/frequency for the duration of the user-set holdover time (default = 7200 seconds [= 2 hours]).</td>
</tr>
<tr>
<td>red</td>
<td>ALARM</td>
<td>The unit does not provide a time or frequency signal.</td>
</tr>
</tbody>
</table>

During the states **power-on**, **self-test**, **wait-for-host**, and **download-from-host**, modes are directly allocated to the LEDs, as listed below.

Table 2-6: LED flash patterns

<table>
<thead>
<tr>
<th>State</th>
<th>Color/FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>green/SYNC</strong></td>
</tr>
<tr>
<td>Power-On</td>
<td>On</td>
</tr>
<tr>
<td>Self-Test</td>
<td>On</td>
</tr>
<tr>
<td>Waiting for Host</td>
<td>Blink</td>
</tr>
<tr>
<td>Download from Host</td>
<td>Strobe</td>
</tr>
<tr>
<td>Initialize</td>
<td>Off</td>
</tr>
<tr>
<td>Never Synchronized</td>
<td>Off</td>
</tr>
</tbody>
</table>
### 2.9 Configuring Network Settings

Before configuring the network settings, you need to setup access to VelaSync web user interface ("Web UI"). For more information, see "Configuring IP Address(es)" on page 32.

Login to the Web UI. For more information, see "Accessing the Web UI" on page 31.

To configure network settings, or monitor your network, navigate to VelaSync’s **Network Setup** screen.

To access the **Network Setup** screen:

> Navigate to **MANAGEMENT > Network Setup**. The **Network Setup** screen is divided into **three panels**:
The **Actions** panel provides:

- **General Settings**: Allows quick access to the primary network settings necessary to connect VelaSync to a network. See "General Network Settings" on the facing page.

- **Web Interface Settings**:
  - Web interface **timeout**: Determines how long a user can stay logged on. For more information, see "Web UI Timeout" on page 184.

- **Access Control**: Allows the configuration of access restrictions from assigned networks/nodes.

- **Login Banner**: Allows the administrator to configure a custom banner message to be displayed on the VelaSync Web UI login page and the CLI (Note: There is a 2000 character size limit).

- **SSH**: This button takes you to the **SSH Setup** window. For details on setting up SSH, see "SSH" on page 50.

- **IPMI**: Enable/Disable IPMI (ADMIN password required).

The **Network Services** panel is used to enable (ON) and disable (OFF) network services, as well as the Web UI display mode, details see: "Network Services" on page 48.

The **Ports** panel not only displays STATUS information, but is used also to set up and manage VelaSync’s network ports via two buttons:

- **INFO** button: Displays the Ethernet port Status window for review purposes.

- **GEAR** button: Displays the Ethernet port settings window for editing purposes.
2.9.1 General Network Settings

To expedite network setup, VelaSync provides the General Settings window, allowing quick access to the primary network settings.

To access the General Settings window:

1. Navigate to MANAGEMENT > Network Setup. In the Actions Panel on the left, click General Settings.

2. Populate the fields:

   ▶ **Hostname**: This is the server's identity on the network or IP address.

   ▶ **Default Port**: Unless you specify a specific Port to be used as Default Port, the factory default port eth0 will be used as the gateway (default gateway).

The General Settings window also displays the IPv4 Address and default IPv4 Gateway.
2.9.2  Network Ports

Ports act as communication endpoints in a network. The hardware configuration of your unit will determine which ports (e.g., Eth0, Eth1, ...) are available for use. Before using a port, it needs to be enabled and configured.

To enable & configure, or view a network port:

1. Navigate to MANAGEMENT > NETWORK: Network Setup.

2. The Ports panel on the right side of the screen lists the available Ethernet ports, and their connection STATUS:
   - **Green**: CONNECTED (showing the connection speed)
   - **Yellow**: CABLE UNPLUGGED (the port is enabled but there is no cable attached)
   - **Red**: DISABLED.

   Locate the port you want to configure and click the GEAR button to enable & configure the port, or the INFO button to view the port status.

3. If the port is not already enabled, in the Edit Ethernet Ports Settings window, click the Enable check box. The Edit Ethernet Ports Settings window will expand to show the options needed to complete the port setup.

   Fill in the fields as required:
   - **Enable eth0**: [Checkbox]
   - **Enable DHCPv4**: [Checkbox] Check this box to enable the delivery of IP addresses from a DHCP Server using the DHCPv4 protocol.
» **Static IPv4 Address**: This is the default, or the unique address assigned by the network administrator.

Table 2-8: Default IP addresses

<table>
<thead>
<tr>
<th>ETH port</th>
<th>Default &quot;static lease&quot; IP address</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETH0</td>
<td>192.168.1.1</td>
</tr>
<tr>
<td>ETH1</td>
<td>defaults to DHCP</td>
</tr>
<tr>
<td>ETH2</td>
<td>defaults to DHCP</td>
</tr>
<tr>
<td>ETH3</td>
<td>defaults to DHCP</td>
</tr>
</tbody>
</table>

The default subnet is: 255.255.0.0

» **Netmask**: This is the network subnet mask assigned by the network administrator. In the form “xxx.xxx.xxx.xxx.” See "Subnet Mask Values" on page 35 for a list of subnet mask values.

» **IPv4 Gateway**: The gateway (default router) address is needed if communication to the VelaSync is made outside of the local network. By default, the gateway is disabled.

» **Domain**: This is the domain name to be associated with this port.

» **DNS Primary**: This is the primary DNS address to be used for this port. Depending on how your DHCP server is configured, this is set automatically once DHCP is enabled. Alternatively, you may configure your DHCP server to NOT use a DNS address. When DHCP is disabled, DNS Primary is set manually, using the format "#.#.#.#" with no leading zeroes or spaces, where each ‘#' is a decimal integer from the range [0,255].

» **DNS Secondary**: This is the secondary DNS address to be used for this port. Depending on how your DHCP server is configured, this is set automatically once DHCP is enabled, or your DHCP server may be configured NOT to set a DNS address. When DHCP is disabled, DNS Secondary is set manually, using the format “#.#.#.#” with no leading zeroes or spaces, where each ‘#’ is a decimal integer from the range [0,255].

» **MTU**: Maximum Transmission Unit. Range (for Ethernet v2): Default: 1500 bytes. Smaller packages are recommended, if encapsulation is required e.g., to meet encryption needs, which would cause the maximum package size to be exceeded.

4. To apply your changes, click **Submit** (the window will close), or **Apply**.
2.9.3  Network Services

Several standard network services can be enabled or disabled via the easily accessible Network Services Panel under MANAGEMENT > Network Setup:

The Network Services panel has ON/OFF toggle switches for the following daemons and features:

- **SSH**: Secure Shell cryptographic network protocol for secure data communication
- **HTTP**: Hypertext Transfer Protocol
- **tcpdump**: A LINUX program that can be used to monitor network traffic by inspecting tcp packets. Default = ON.
  
  If not needed, or wanted (out of concern for potential security risks), tcpdump can be disabled permanently: Once toggled to OFF, and after executing a page reload, tcpdump will be deleted from the system: The toggle switch will be removed, and the function cannot be enabled again (even after a software upgrade).

2.9.4  Access Rules

Network access rules restrict access to only those assigned networks or nodes defined. If no access rules are defined, access will be granted to all networks and nodes.

*Note: In order to configure Access Rules, you need ADMINISTRATOR rights.*

To **configure** a new, or **delete** an existing access rule:

1. Navigate to the MANAGEMENT > Network Setup screen.
2. In the Actions panel on the left, click on Access Control.
3. The **Network Access Rules** window displays:

![Network Access Rules window](image)

4. In the **Allow From** field, enter a valid IP address. It is not possible, however, to add direct IP addresses, but instead they must be input as blocks, i.e. you need to add /32 at the end of an IP address to ensure that only that address is allowed. Example: 10.2.100.29/32 will allow only 10.2.100.29 access.

**IP address nomenclature:**

IPv4—10.10.0.0/16, where 10.10.0.0 is the IP address and 16 is the subnet mask in prefix form. See the table “Subnet Mask Values” on page 35 for a list of subnet mask values.


5. Click the **Add** button in the **Action** column to add the new rule.

6. The established rule appears in the **Network Access Rules** window. Click the **Delete** button next to an existing rule, if you want to delete it.
2.9.5 **IPMI Configuration**

The Intelligent Platform Management Interface (IPMI) is a protocol that allows for out-of-band management of computer systems, even when they are turned off. IPMI is active whenever the server is connected to power.

VelaSync has a dedicated IPMI Ethernet interface (see rear panel illustration, item no. 11 under "Rear Panel Overview" on page 12.) By default, the IPMI interface uses DHCP to obtain an IP address. A static IP address can also be set if DHCP is not desired.

The IPMI setup window is located in the Web UI under MANAGEMENT > Network Setup > Actions > IPMI. (It is also possible to change the login credentials from this screen.)

**Note:** You will need ADMINISTRATOR access to configure VelaSync IPMI in the Web UI. The default credentials are login: ADMIN; password: ADMIN.

To configure a static IP address or to view the current IP address assigned to the IPMI, un-check the DHCP box and the IP address, Gateway, and Netmask fields will be visible.

2.9.6 **SSH**

The SSH, or Secure Shell, protocol is a cryptographic network protocol, allowing secure remote login by establishing a secure channel between an SSH client and an SSH server. SSH can also be used to run CLI commands.

SSH uses **host keys** to uniquely identify each SSH server. Host keys are used for server authentication and identification. A secure unit permits users to create or delete RSA or DSA keys for the SSH2 protocol.

**Note:** Only SSH2 is supported due to vulnerabilities in the SSH1 protocol.

The SSH tools supported by VelaSync are:

- **SSH**: Secure Shell
- **SCP**: Secure Copy
- **SFTP**: Secure File Transfer Protocol

VelaSync implements the server components of SSH, SCP, and SFTP.

For more information on OpenSSH, please refer to [www.openssh.org](http://www.openssh.org).

To configure SSH:
1. Navigate to MANAGEMENT > NETWORK: SSH Setup. The SSH Setup window will display.

The window contains two tabs:

- **Host Keys**: SSH uses Host Keys to uniquely identify each SSH server. Host keys are used for server authentication and identification.
- **Public Key**: This is a text field interface that allows the user to edit the public key files authorized_keys file.

**Note:** Should you exit the SSH Setup window (by clicking X in the top right corner of the window, or by clicking anywhere outside of the window), while filling out the Certificate Request Parameters form before clicking Submit, any information you entered will be lost. When switching between tabs within the SSH Setup window, however, the information you have entered will be retained.

**Host Keys**

You may choose to delete individual RSA or DSA host keys. Should you decide to delete the RSA or DSA key, the SSH will function, but that form of server authentication will not be available. Should you delete both the RSA and DSA keys, SSH will not function. In addition, if SSH host keys are being generated at the time of deletion, the key generation processes are stopped, any keys created will be deleted, and all key bit sizes are set to 0.

You may choose to delete existing keys and request the creation of new keys, but it is often simpler to make these requests separately.

You can create individual RSA and DSA Host Public/Private Key pairs. Host keys must first be deleted before new Host Keys can be created.

VelaSync units have their initial host keys created at the factory. RSA host key sizes can vary between 768 and 4096 bits. The recommended key size is 1024. Though many key sizes are supported, it is recommended that users select key sizes that are powers of 2 or divisible by 2. The most popular sizes are 768, 1024, and 2048. Large key sizes of up to 4096 are supported, but may take 10 minutes or more to generate. DSA keys size support is limited to 1024 bits.

Host keys are generated in the background. Creating RSA and DSA keys, each with 1024 bits length, typically takes about 30 seconds. Keys are created in the order of RSA, DSA, RSA. When the keys are created, you can successfully make SSH client connections. If the unit is rebooted with host key creation in progress, or the unit is booted and no host keys exist, the key generation process is restarted. The key generation process uses either the previously specified key sizes or, if a key size is undefined, the default key bit length size used is 2048. A key with a zero length or blank key size field is not created.
The SSH client utilities SSH, SCP, and SFTP allow for several modes of user authentication. SSH allows you to remotely login or transfer files by identifying your account and the target machine’s IP address. As a user you can authenticate yourself by using your account password, or by using a Public Private Key Pair.

It is advisable to keep your private key secret within your workstation or network user account, and provide the VelaSync a copy of your public key. The modes of authentication supported include:

- Either Public Key with Passphrase or Login Account Password
- Login Account Password only
- Public Key with Passphrase only

SSH using public/private key authentication is the most secure authenticating method for SSH, SCP or SFTP sessions.

You are required to create private and public key pairs on your workstation or within a private area in your network account. These keys may be RSA or DSA and may be any key bit length as supported by the SSH client tool. These public keys are stored in a file in the .ssh directory named authorized_keys. The file is to be formatted such that the key is followed by the optional comment with only one key per line.

**Note:** The file format, line terminations, and other EOL or EOF characters should correspond to UNIX conventions, not Windows.

### Changing Key Length Values

You may change the key length of the RSA, DSA, ECDSA type host keys.

To change the key length of a host key:

1. Navigate to **MANAGEMENT > NETWORK: SSH Setup**. The SSH Setup window will open to the Host Keys tab by default.
2. Select the **Key Length** value for the key type you want to change.
   
   Key sizes that are powers of 2 or divisible by 2 are recommended. The most popular sizes are 768, 1024, and 2048. Large key sizes of up to 4096 are supported, but may take 10 minutes or more to generate. DSA keys size support is limited to 1024 bits. The key type ED25519 supports 256 bits.
3. Check the **Regenerate All Keys** box.
4. Click **Submit**. The new values will be saved.
Note: Changing the values and submitting them in this manner DOES NOT generate new host public/private key pairs. See "Creating Host Public/Private Key Pairs" below for information on how to create new host public/private key pairs.

Deleting Host Keys
You can delete individual host keys. To delete a key:

1. Navigate to MANAGEMENT > NETWORK: SSH Setup. The window will open to the Host Keys tab by default.
2. Select Delete in the field for the key you wish to delete, and click Submit.

Creating Host Public/Private Key Pairs
You may create individual Host Public/Private Key pairs. Host keys must first be deleted before new Host Keys can be created. To create a new set of host keys:

1. To access the SSH setup screen, navigate to MANAGEMENT > NETWORK: SSH Setup. The window will open to the Host Keys tab by default.
2. Should you want to change the key length of any host key, enter the desired length in the text field corresponding to the length you wish to change.
3. Check the Regenerate All Keys box.
4. Click Submit.
   The Key Type/Status/Action table will temporarily disappear while the VelaSync regenerates the keys. The Host keys are generated in the background. Creating RSA and DSA keys, each with 1024 bits length, typically takes about 30 seconds. Keys are created in the order of RSA, DSA, ECDSA, ED25519. VelaSync will generate all 4 host keys, RSA, DSA, ECDSA, and ED25519.
5. Delete any of the keys you do not want. See "Deleting Host Keys" above.

Note: If the unit is rebooted with host key creation in progress, or the unit is booted and no host keys exist, the key generation process is restarted. The key generation process uses the previously specified key sizes.
When you delete a host key and recreate a new one, SSH client sessions will warn you that the host key has changed for this particular IP address. You must then take one of the following actions:

1. Override the warning and accept the new Public Host Key and start a new connection. This is the default. This option allows users to login using either method. Whichever mode works is allowed for logging in. If the Public Key is not correct or the Passphrase is not valid the user is then prompted for the login account password.

2. Remove the old Host Public Key from their client system and accept the new Host Public Key. This option simply skips public/private key authentication and immediately prompts the user for password over a secure encrypted session avoiding sending passwords in the clear.

3. Load a public key into VelaSync. This public key must match the private key found in the users account and be accessible to the SSH, SCP, or SFTP client program. The user must then enter the Passphrase after authentication of the keys to provide the second factor for 2-factor authentication.

Please consult your specific SSH client's software's documentation.

Public Keys: Viewing, Editing, Loading

The authorized_keys file can be viewed and edited, so as to enable adding and deleting Public Keys. The user may also retrieve the authorized_keys file from the .ssh directory Using FTP, SCP, or SFTP.

If you want to completely control the public keys used for authentication, a correctly formatted authorized_keys file formatted as indicated in the OpenSSH web site can be loaded onto VelaSync. You can transfer a new public key file using the Web UI.

To view and edit the authorized_keys file:

1. Navigate to MANAGEMENT > NETWORK: SSH Setup. The SSH Setup window will open to the Host Keys tab by default.

2. Select the Public Key tab. The authorized_keys file appears in the Public Keys File window.
3. Edit the authorized_keys file as desired.
4. Click the Submit button or Apply button.

The file is to be formatted such that the key is followed by an optional comment, with only one key per line. The file format, line terminations, and other EOL or EOF characters should correspond to UNIX conventions, not Windows.

**Note:** If you delete ALL Public Keys, Public/Private Key authentication is disabled. If you have selected SSH authentication using the Public Key with Passphrase option, login and file transfers will be forbidden. You must select a method allowing the use of account password authentication to enable login or file transfers using SCP or SFTP.

### Editing the "authorized_key" File via CLI

Secure shell sessions using an SSH client can be performed using the admin or a user-defined account. The user may use Account Password or Public Key with Passphrase authentication. The OpenSSH tool SSH-KEYGEN may be used to create RSA and DSA keys used to identify and authenticate user login or file transfers.

The following command lines for OpenSSH SSH client tool are given as examples of how to create an SSH session.

**Creating an SSH session with Password Authentication for the admin account**

```bash
ssh spadmin@10.10.200.5
spadmin@10.10.200.5's password: admin123
```

You are now presented with boot up text and/or a “>” prompt which allows the use of the Spectracom command line interface.

**Creating an SSH session using Public Key with Passphrase Authentication for the admin account**
You must first provide the secure Spectracom product a RSA public key found typically in the OpenSSH id_rsa.pub file. Then you may attempt to create an SSH session.

```bash
ssh -i ./id_rsa spadmin@10.10.200.5
```

Enter passphrase for key './id_rsa': mysecretpassphrase

Please consult the SSH client tool's documentation for specifics on how to use the tool, select SSH protocols, and provide user private keys.

### Secure File Transfer Using SCP and SFTP

VelaSync provides secure file transfer capabilities using the SSH client tools SCP and SFTP. Authentication is performed using either Account Passwords or Public Key with Passphrase.

Example output from OpenSSH, SCP, and SFTP client commands are shown below.

#### Perform an SCP file transfer to the device using Account Password authentication

```bash
scp authorized_keys scp@10.10.200.5::.ssh
```

spadmin@10.10.200.135's password: admin123

publickeys 100% |************************************************************|
5 00:00

#### Perform an SCP file transfer to the device using Public Key with Passphrase authentication.

```bash
scp -i ./id_rsa spadmin@10.10.200.5::.ssh
```

Enter passphrase for key './id_rsa': mysecretpassphrase

publickeys 100% |************************************************************|
5 00:00

#### Perform an SFTP file transfer to the device using Account Password authentication.

```bash
sftp spadmin@10.10.200.5
```

spadmin@10.10.200.135's password: admin123

You will be presented with the SFTP prompt allowing interactive file transfer and directory navigation.
Perform an SFTP file transfer to the device using Public Key with Passphrase authentication

sftp -i ./id_rsa spadmin@10.10.200.5

Enter passphrase for key './id_rsa': mysecretpassphrase

You will be presented with the SFTP prompt allowing interactive file transfer and directory navigation.

Recommended SSH Client Tools

Spectracom does not make any recommendations for specific SSH clients, SCP clients, or SFTP client tools. However, there are many SSH based tools available to the user at low cost or free.

Two good, free examples of SSH tool suites are the command line based tool OpenSSH running on a Linux or OpenBSD x86 platform and the SSH tool suite PuTTY.

The OpenSSH tool suite in source code form is freely available at www.openssh.org though you must also provide an OpenSSL library, which can be found at www.openssl.org.

PuTTY can be found at: http://www.chiark.greenend.org.uk/~sgtatham/putty/.

SSH Timeout

The keep-SSH alive timeout is hard-set to 7200 seconds. This value is not configurable.

2.9.7 SNMP

SNMP (Simple Network Management Protocol) is a widely used application-layer protocol for managing and monitoring network elements. It has been defined by the Internet Architecture Board under RFC-1157 for exchanging management information between network devices, and is part of the TCP/IP protocol.

SNMP agents must be enabled and configured so that they can communicate with the network management system (NMS). The agent is also responsible for controlling the database of control variables defined in the Management Information Base (MIB).

VelaSync’s SNMP functionality supports SNMP versions V1, V2c and V3 (with SNMP Version 3 being a secure SNMP protocol).

Once SNMP is configured it will persist through reboot, and only needs to be reconfigured after performing a "clean" update process (thus restoring the factory default condition).

Note: In order to configure SNMP, you need ADMINISTRATOR rights.

To access the SNMP Setup screen:
Navigate to **MANAGEMENT > NETWORK: SNMP Setup**. The **SNMP** screen will display:

The **SNMP** screen is divided into 3 panels:

1. The **Main panel**, which is subdivided into 3 displays:
   - **SNMP V1/V2**: This panel allows configuration of SNMP v1 and v2c communities (used to restrict or allow access to SNMP). This tab allows the configurations for SNMP v1 and v2c, including the protocols allowed, permissions and Community names as well as the ability to permit or deny access to portions of the network. Clicking on the “+” symbol in the top-right corner opens the **SNMP V1/V2c** Settings for Access Screen. See "**SNMP V1/V2c** on page 61.
   - **SNMP V3**: This panel allows configuration of SNMP v3 functionality, including the user name, read/write permissions, authorization passwords as well as privilege Types and Passphrases. Clicking on the “+” symbol in the top-right corner opens the **SNMP V3** Screen. See "**SNMP V3** on page 63.
   - **SNMP Traps**: This panel allows you to define different SNMP Managers that SNMP traps can be sent to over the network. This allows for SNMP Managers in different geographical areas to receive the same SNMP traps that Managers in other areas also receive. Clicking the PLUS icon in the top-right corner opens the **SNMP Traps** Settings Screen. See also "**SNMP Traps** on page 65 and "**Setting Up SNMP Notifications**" on page 172.
2. The **Actions panel**, which contains the **Restore Default SNMP Configuration** button.

3. The **SNMP Status panel**, which offers:
   - An **SNMP ON/OFF switch**.
   - An **Authentication Error Trap ON/OFF switch**.
   - **SysObjID** — The System Object ID number. This is editable in the SNMP Status panel (see "Configuring the SNMP Status" below).
   - **Contact Information**—The email to contact for service. This is editable in the SNMP Status panel (see "Configuring the SNMP Status" below).
   - **Location**—The system location. This is editable in the SNMP Status panel (see "Configuring the SNMP Status" below).
   - **Description**—A simple product description. This is not editable in the SNMP Status.

### Restoring the Default SNMP Configuration

To restore the VelaSync to its default SNMP configuration:

1. Navigate to the **MANAGEMENT > NETWORK: SNMP Setup** screen.
2. In the **Actions** panel, click the **Restore Default SNMP Configuration** button.
3. Confirm that you want to restore the default settings in the pop-up message.

### Configuring the SNMP Status

The SNMP Status Settings are **sysObjectID**, **sysContact**, and **sysLocation**. To configure SNMP Status Settings:

1. Navigate to **MANAGEMENT > NETWORK: SNMP Setup**.
2. In the **SNMP Status** panel on the left, click the GEAR icon in the top-right corner of the panel.
3. The **SNMP Status** pop-up window will display:

![SNMP Status Pop-Up Window](image)

The following settings can be configured in this window:

- In the **sysObjectID** field, enter the SNMP system object ID.
- In the **sysContact** field, enter the e-mail information for the system contact you wish to use.
- In the **sysLocation** field, enter the system location of your VelaSync unit.

4. Click **Submit**, or cancel by clicking the **X**-icon in the top-right corner.

### Accessing the SNMP Support MIB Files

Spectracom's private enterprise MIB files can be extracted via File Transfer Protocol (FTP) from VelaSync, using an FTP client such as FileZilla or any other shareware/freeware FTP program.

To obtain the MIB files from VelaSync via FTP/SFTP:

1. Using an FTP program, log in as an administrator.
2. Through the FTP program, locate the Spectracom MIB files in the `/home/spec-tracom/mibs` directory.
3. FTP the files to the desired location on your PC for later transfer to the SNMP Manager.
4. Compile the MIB files onto the SNMP Manager.
Note: When compiling the MIB files, some SNMP Manager programs may require the MIB files to be named something other than the current names for the files. The MIB file names may be changed or edited as necessary to meet the requirements of the SNMP Manager. Refer to the SNMP Manager documentation for more information on these requirements.

Note: In addition to the Spectracom MIB files, there are also some net-snmp MIB files provided. Net-snmp is the embedded SNMP agent that is used in the VelaSync and it provides traps to notify the user when it starts, restarts, or shuts down. These MIB files may also be compiled into your SNMP manager, if they are not already present.

Spectracom's private enterprise MIB files can be requested and obtained from the Spectracom Customer Service department via email at techsupport@spectracom.com.

Note: By default, techsupport@spectracom.com is the address in the sysContact field of the SNMP Status panel of the SNMP Setup page.

2.9.7.1 SNMP V1/V2c

SNMP V1 is the first version of the SNMP protocol, as defined in the IETF (Internet Engineering Task Force) RFCs (Request for Comments) number 1155 and 1157. SNMP V2c is the revised protocol, but it also uses the V1 community based administration model.

Creating Communities

1. Navigate to MANAGEMENT > NETWORK: SNMP Setup.
2. In the SNMP V1/V2 panel click the PLUS icon in the top-right corner.
3. The SNMP V1/V2c Settings for Access window will display:
4. Enter the required information in the fields provided:
   - The IP Version field provides a choice of IPv4, IPv6 or both IPv4 and IPv6 (= default).
   - The choices offered below will change in context with the choice made in the IP Version field.
   - If no value is entered in the IPv4 and/or IPv6 field, VelaSync uses the system default address.
   - SNMP Community names should be between 4 and 32 characters in length.
   - Permissions may be Read Only or Read/Write.
   - The Version field provides a choice of V1 or V2c.

5. Click Submit. The created communities will appear in the SNMP V1/V2 panel:

**Editing and Deleting Communities**

To edit or delete a community you have created:

1. Navigate to MANAGEMENT > NETWORK: SNMP Setup.
2. Click the row of the SNMP V1/V2 panel that displays the community you wish to edit or delete. The cursor will change from an arrow icon to a pointing finger to indicate that the entry is clickable.
3. The **SNMP V1/V2c Settings for Access** window will display.

**Note:** The options available for editing in the SNMP V1/V2c Settings for Access window will vary contextually according to the information in the entry chosen.

4. To edit the settings, enter the new details you want to edit and click **Submit**. OR: To delete the entry, click **Delete**.

### 2.9.7.2 SNMP V3

SNMP V3 utilizes a user-based security model which, among other things, offer enhanced security over SNMP V1 and V2.

**Creating Users**

1. Navigate to **MANAGEMENT > NETWORK: SNMP Setup**.
2. In the **SNMP V3** panel, click the PLUS icon in the top-right corner.

3. The **SNMP V3 Settings** window will display.
4. Enter the required information in the fields provided.
   - **SNMP User Names** and passwords are independent of users that are configured on the **Tools/Users** page.
     - User names are arbitrary. **SNMP User Names** should be between 1 and 31 characters in length.
     - The **User Name** must be the same on VelaSync and on the management station.
   - The **Auth Type** field provides a choice between MD5 and SHA.
   - The **Auth Password** must be between 8 and 32 characters in length.
   - The **Priv Type** field provides a choice between AES and DES.
   - The **Priv Passphrase** must be between 8 and 32 characters in length.
   - The **Permissions** field provides a choice between Read/Write and Read Only.

5. Click **Submit**. The created user will appear in the **SNMP V3** panel:

### Editing and Deleting Users

To edit or delete a user you have created:

1. Navigate to **MANAGEMENT > NETWORK: SNMP Setup**.
2. Click the row of the **SNMP V3** panel that displays the community you wish to edit or delete. The cursor will change from an arrow icon to a pointing finger to indicate that the entry is clickable.
3. The **SNMP V3 Settings** window will display:
4. Apply your changes and click **Submit**. OR: Click **Delete** to remove the User.

### 2.9.7.3 SNMP Traps

SNMP traps allow for automatic event notification, and as such are one way to remotely monitor VelaSync's status.

SNMP traps indicate the status change that caused the trap to be sent and may also include one or more objects, referred to as variable-bindings, or **varbinds**. A varbind provides a current VelaSync data object that is related to the specific trap that was sent. For example, when a Holdover trap is sent because VelaSync either entered or exited the Holdover mode, the trap varbind will indicate that VelaSync is either currently in Holdover mode or not currently in Holdover mode.

For testing purposes, a command line interface command is provided. This command, `testevent`, allows one, several, or all of the traps defined in the VelaSync MIB to be generated. Refer to "CLI Commands" on page 216 for command details.

To define SNMP Traps (Notifications):

1. Navigate to **MANAGEMENT > NETWORK: SNMP Setup**.
2. In the **SNMP Traps** panel, click the PLUS icon in the top-right corner.

3. The **SNMP Traps Settings** window will display:
4. Enter the required information in the fields provided. (Note that the options will vary contextually according to your Version.)

5. 
   - The **Version** field provides a choice between v1, v2c, and v3 [= default]
   - The **Community** field for the SNMP Community string. [v1, v2c]
   - SNMP **User** names should be between 4 and 32 characters in length. [v3]
   - **Destination IP Version** is a choice between IPv4 and IPv6. [v1, v2c, v3]
   - **Destination IP** is destination address for the notification and password key to be sent. The default port is 162. [v1, v2c, v3]
   - The UDP **Port** number used by SNMP Traps [default = 162]. [v1, v2c]
   - **Engine Id** must be a hexadecimal number (such as 0x1234). The Id originates from the MIB Browser/SNMP Manager. [v3]¹
   - **Auth Type** provides a choice between MD5 (the default) and SHA. [v3]
   - The **Auth Password** must be between 8 and 32 characters in length. [v3]
   - The **Priv Type** field provides a choice between AES and DES. [v3]
   - The **Priv Passphrase** must be between 8 and 32 characters in length. [v3]

6. Click the **Submit** button at the bottom of the window. Cancel any changes by clicking the X-icon in the top-right corner (any information entered will be lost).

7. The SNMP trap you created will appear in the **SNMP Traps** panel:

---

¹Should you require the Engine ID of your unit in order to decode traps sent to an NNMI, you can use an SNMPv3 "get" value of .1.3.6.1.3.10.2.1.1 to poll your Engine ID.
Each row of the **SNMP Traps** panel includes the version of the SNMP functionality, the User/Community name for the trap, the IP address/Hostname of the SNMP Manager and values applicable only to SNMP v3, which include the Engine ID, the Authorization Type, the Privilege Type.

You may define different SNMP Managers to whom SNMP traps can be sent over the network. This allows for SNMP Managers in different geographical areas to receive the same SNMP traps.

**Note:** Spectracom has been assigned the enterprise identifier 18837 by the IANA (Internet Assigned Numbers Authority). Spectracom’s product MIBs reside under the enterprise identifier @18837.3.

For detailed descriptions of the objects and traps supported by the VelaSync, please refer to the Spectracom VelaSync MIB files. See "Accessing the **SNMP Support MIB Files**" on page 60.

### 2.9.8 VLAN Support

VLAN support in VelaSync allows you to assign a VLAN ID to a specific port to facilitate communication within your network. These VLAN interfaces have the same configuration options as the standard untagged Ethernet interfaces.

To set up VLAN interface identification tags:

1. Navigate to **MANAGEMENT > Network Setup**. In the **Actions** panel, select **VLAN**.
2. In the popup panel labeled **VLAN Setup**, click on the plus sign to add your VLAN interfaces. (You can also view or delete any configured VLAN tags from this panel).
3. Select the parent interface [eth0-eth5], type in your VLAN ID, and click submit. Repeat the process as necessary.

Your new VLAN interfaces will now be displayed in the VLAN Setup panel, listed as eth[#]. [VLAN ID].

2.10  Configure NTP

Network Time Protocol (NTP) and Simple Network Time Protocol (SNTP) are client-server protocols that are used to synchronize time on IP networks. NTP provides greater accuracy and better error checking capabilities than SNTP does, but requires more resources.

For many applications, it is not necessary to modify the NTP factory default configuration settings. It is possible, however, to change most of the settings in order to support specific NTP applications which may require a non-standard configuration:

These features include MD5 authentication to block NTP access to parts of the network and to broadcast NTP data to the network's broadcast address. NTP and SNTP are used to synchronize time on any computer equipment compatible with the Network Time Protocol. This includes Cisco routers and switches, UNIX machines, and Windows machines with suitable clients. To synchronize a single workstation, several freeware or shareware NTP clients are available on the Internet. The software running on the PC determines whether NTP or SNTP is used.

When the NTP service is enabled, VelaSync will “listen” for NTP request messages from NTP clients on the network. When an NTP request packet is received, VelaSync will send an NTP response time packet to the requesting client. Under typical conditions, VelaSync can service several thousand NTP requests per second without MD5 authentication enabled, and at a somewhat lower rate with MD5 authentication enabled.

You can either enable or completely disable the NTP Service. When NTP is disabled, no NTP time packets will be sent out to the network. When enabled, by default, the NTP Service operates in Unicast mode, i.e. the NTP Service responds to NTP requests only.
2.10.1 Checklist NTP Configuration

The following is a list of configuration settings you may want to consider as you setup your NTP Service. (Not all items may apply to your application, or there may be other considerations not included in this list.)

1. Did you setup your NTP Service and have it use the right Reference(s)?
   - See "NTP Reference Configuration" on page 75.

2. Does your NTP Service use the right Timescale?
   - See "NTP Output Timescale" on page 73.

3. If required, have you setup other NTP Servers and Peers for fallback purposes?
   - See "NTP Peers: Adding, Configuring, Removing" on page 79.

2.10.2 The NTP Setup Screen

The NTP Setup screen provides access to all NTP configuration settings.

To open the NTP Setup screen, navigate to MANAGEMENT > NTP Setup. The NTP Setup screen is divided into 5 panels:
The NTP Servers and Peers panels

... are located on the right-hand side of the NTP screen:

- **NTP Servers**: In this display you can view the NTP Servers that VelaSync detects in your network. It is through this display that you configure external NTP references. See "NTP Servers: Adding, Configuring, Removing" on page 77.

- **NTP Peers**: In this display you can view the NTP Peers that VelaSync detects in your network. It is through this display that you configure NTP Peer reference inputs. See "NTP Peers: Adding, Configuring, Removing" on page 79.

For more information on NTP servers, clients, and Stratusms see "NTP Servers and Peers" on page 75.

The Actions panel

... is in the top left-hand corner of the NTP screen comprise the following buttons:

- **Symmetric Keys**: Click here to set up your symmetric keys for MD5 authentication. For more information on Symmetric Keys, see "Configuring NTP Symmetric Keys" on page 81.

- **Access Restrictions**: Click here to view, change or delete access restrictions to the NTP network. (See also "NTP Access Restrictions" on page 84.) Fields in the NTP Access Restrictions table include:
The NTP Services panel

...is the second panel on the left-hand side of the NTP screen.

**NTP ON/OFF**: This switch enables and disables NTP. See "Dis-/Enabling NTP" on the next page.

**Note**: When applying any changes NTP will usually restart automatically. Use this switch only to force a restart.

Other **NTP Services** that can be configured via the NTP Services panel by clicking the GEAR icon are:

- **Stratum 1** (see "NTP Reference Configuration" on page 75)

The NTP Status Summary panel

...provides a real-time overview of your key NTP network parameters. For more information, see "NTP Status Monitoring" on page 191.
2.10.3 Dis-/Enabling NTP

If you applied NTP configuration changes e.g., added a new NTP Server, VelaSync usually will stop and re-start the NTP Service automatically once you clicked Submit. Changes made to NTP configurations will also take effect after VelaSync is either rebooted or power-cycled.

You can, however, also disable or enable the VelaSync NTP Service manually.

To disable and enable your NTP Service:

1. Navigate to MANAGEMENT > NETWORK: NTP Setup.
2. In the NTP Services panel, set the ON/OFF toggle switch to OFF.
3. A notification window will confirm the status change.
4. In the NTP Services panel, set the ON/OFF toggle switch to ON again.

Changes made will now take effect and NTP operation will be restored shortly after this operation is performed.

2.10.4 Viewing NTP Clients

To view the NTP clients being served by VelaSync:

1. Navigate to MANAGEMENT > NETWORK: NTP Setup.
2. In the NTP Actions panel, click View NTP Clients.
3. The NTP Clients window will display, showing a table of the clients that are synchronizing to VelaSync via NTP:
You can search any of the fields for specific information in the Search field at the top of the window.

A limit of 10 entries will appear on the screen at any one time. If you have more than 10 clients, you can move through the table using the First, Previous, Next and Last navigation buttons at the bottom of the screen.

2.10.5 Restoring the Default NTP Configuration

The VelaSync default NTP configuration can be restored at any time. It comprises basic settings such as Stratum 1 operation with no other servers or peers, no broadcasting and no access restrictions. External queries or modifications are not permitted, while generally all IPv4 and IPv6 client connections are allowed.

To restore VelaSync to its default NTP configuration:

1. Navigate to MANAGEMENT > NETWORK: NTP Setup.
2. In the NTP Actions panel, click Restore Default NTP Configuration.
3. In the dialog window that displays, click OK.

2.10.6 NTP Output Timescale

You can choose the timescale VelaSync will use for the time stamps it sends out to its NTP clients and network nodes. This is done by setting VelaSync System Time timescale. The options are UTC, TAI and GPS. Typically, UTC is used for network synchronization.
Note that the System Time affects not only NTP output, but also all other aspects of time management e.g., time distributed via channels other than NTP, logging, and time displayed in the Web UI.

If VelaSync is operated as a Stratum 2 server, i.e. as a client to a Stratum 1 server (see "NTP Stratum Synchronization" on page 1), the other server will override VelaSync’s System Timescale, should it be different.

**Note:** IMPORTANT: Make sure you select your desired timescale! Using the wrong timescale will inevitably result in an undesired time error in your NTP clients.

To change the system timescale VelaSync will use for its NTP output (and other outputs):

1. Navigate to MANAGEMENT > OTHER: Time Management:

2. In the System Time panel, click the GEAR icon.

3. In the Edit System Time window, select the System Timescale VelaSync will be in:
   - **UTC**: The network PCs will receive UTC time via NTP.
   - **TAI**: The network PCs will receive TAI time via NTP.
   - **GPS**: The network PCs will receive GPS time via NTP.

**Note:** When the Timescale is set to “GPS”, the GPS to UTC Offset must be set correctly. As of 2-Apr-2019, the offset between UTC and GPS is 18 seconds.
2.10.7 NTP Reference Configuration

VelaSync's NTP Service needs to be setup such that it utilizes the time source ("input reference") you want it to use. There are two options for an NTP Server to derive its time from:

a. The NTP Service uses VelaSync's System Time. System Time is the time derived from the internal Timing System. The Timing System is the time server's central time processing engine. It consumes and processes time and 1PPS obtained from an external input reference e.g., typically GNSS, i.e. typically the GNSS reference (or IRIG, ASCII data input, etc.), and distributes that time over the NTP network. This is called **Stratum 1 Operation**, because VelaSync will be the Stratum 1 (or primary) server. This is the most common configuration.

2.10.8 NTP Servers and Peers

VelaSync can be configured to receive time from one or more available NTP Servers (VelaSyncs or different models). This allows for NTP Servers on a timing network to be configured as potential (fallback) input time references for VelaSync System Time synchronization. In the event that a current reference becomes unavailable, VelaSync can fallback to the other NTP Servers available on the network.

A group of NTP servers at the same Stratum level (Stratum 1 time servers, for example) are considered as **NTP Peers** to each other.

**NTP Servers at the same Stratum level**

If VelaSync is configured to obtain time from other NTP Servers at the same Stratum level (i.e., NTP Peers) but is currently using a different input reference as its selected reference, VelaSync will report to the network (via the NTP time stamps) that it is a **Stratum 1** time server. Should, however, all input references except the other NTP server(s) become unavailable, VelaSync will then drop to a **Stratum 2** time server (with System Time being derived from the NTP time packets being received from the other NTP Peers).

**Holdover**

If VelaSync is synchronized to another NTP Server or reference, and that server or reference subsequently loses sync or becomes unavailable (with no other higher priority input references being present and valid), VelaSync will then go into the **Holdover** mode. It will remain in Holdover mode until any enabled and valid input reference becomes available again, or until the Holdover period expires, whichever occurs first.

During Holdover mode, NTP will remain at the same Stratum level it was before entering the Holdover mode and can continue to be the reference to the network. However, if no input reference becomes available before the Holdover period expires, Time Sync will be lost and shortly thereafter, NTP will report to the network that it is now at Stratum 15. A status of Stratum 15 will cause the network to ignore VelaSync as an NTP time reference.
2.10.8.1 The NTP Servers and NTP Peers Panels

The NTP Servers and NTP Peers panels display which servers in the network are set up at higher or equal Stratum levels (Servers or Peers, respectively), and their configurations. These panels are also used to add, configure, or remove NTP Servers and Peers.

Note: For information on how to view NTP Clients, see "Viewing NTP Clients" on page 72.

The NTP Servers and NTP Peers panels are part of the NTP Setup screen (see "The NTP Setup Screen" on page 69), which can be accessed via MANAGEMENT > NETWORK: NTP Setup.

Information provided in the NTP Servers and NTP Peers panels

The following columns are used to break down the status information for recognized NTP Servers and NTP Peers.

- **IP/HOST**: Name and real-time status (color-coded)
- **REF ID**: Identifies the type of Input REFerence e.g., GPS indicates the reference can use GPS for its synchronization. Below is a list of potential REF IDs reported by the VelaSync Timing System (other NTP Servers and Peers may report different references):

> Note: Servers will be displayed in the Status view only if they can be resolved. They will, however, always be displayed in the Setup view in order to reconfigure them, if necessary.
» **GPS**: GNSS reference  
» **IRIG**: IRIG reference  
» **HVQ**: HAVE QUICK reference  
» **FREQ**: Frequency reference  
» **PPS**: External 1PPS reference  
» **PTP**: PTP reference  
» **ATC**: ASCII time code reference  
» **USER**: User provided time  
» **LOCL**: Local reference (synced to itself)  
» **INIT**: NTP on server/peer is initializing  
» **STEP**: NTP on server/peer is performing initial synchronization step and restarting  

» **AUTH STATUS**: Indicates if the selected reference is using MD5 authentication. “None” indicates authentication not being used.

» **LAST**: The number of seconds that have expired since this reference was last polled for its time.

» **POLL**: The polling interval, i.e. how often VelaSync is polling this NTP reference for its time.

» **DELAY (ms)**: The measured one-way delay between VelaSync and its selected reference.

### 2.10.8.2 NTP Servers: Adding, Configuring, Removing

To add, configure, or remove an NTP Server:
1. Navigate to **MANAGEMENT > NETWORK: NTP Setup**.

2. The **NTP Setup** screen appears. The **NTP Servers** panel displays a list of recognized NTP servers. Click the GEAR icon in the upper right-hand corner of the **NTP Servers** panel.

3. The **NTP Servers** window opens. Should the list be empty, no servers have been added yet. In the event that added servers are not displayed in the NTP Setup screen/NTP Servers panel, they could not be resolved. Verify the IP address. Note that System servers cannot be edited or deleted.

   - To **ADD** a new server, click the PLUS icon in the upper right-hand corner, and proceed to the next step.

   - Note: In order for other NTP Servers to be a valid reference, “NTP” must be enabled as both the Time and 1PPS references in the Reference Priority table. See “Configuring Input Reference Priorities” on page 112.

   - To **EDIT** an existing server, click the corresponding ACTION GEAR button, and proceed to the next step.

   - To **REMOVE** a server (and its associated configurations), click the X-button next to it, then confirm by clicking OK.
4. The NTP Server Edit window displays. Enter the required information:
   - **Host**: The IP address for the server to be used as host.
   - **Min Poll Interval**: Select a value from the drop down (the default is 3 (8s)).
   - **Max Poll Interval**: Select a value from the drop down (the default is 3 (8s)). For both NTP Peers, and NTP Servers the Minimum and Maximum Poll rate for NTP packets can be configured.
   - **Enable Burst**: This tells NTP to send a burst to the remote server when the server is reachable.
   - **Enable Iburst**: The iburst function tells NTP to send a burst of queries instead of one when the remote server is not reachable for faster clock synchronization. This will occur if the connection was interrupted, or upon restart of the NTP daemon. For additional information, please refer to public NTP configuration documentation.
   - **Mark as Preferred**: Click here to make this server the preferred server. For more information, see "NTP Timing System: Reference Selection and Preference" page 1.

   ![Note] It is not normally recommended to select more than one NTP Server in the NTP Servers table as being Preferred. Typically, only one NTP server should be selected as Preferred.

5. Click Submit, or press Enter.

2.10.8.3 NTP Peers: Adding, Configuring, Removing

To add, configure, or remove an NTP Peer:

1. Navigate to MANAGEMENT > NETWORK: NTP Setup.
2. The NTP Setup screen appears. The NTP Peers panel displays a list of recognized NTP peers.

   ![Note] Should the list be empty, no servers have been added yet. In the event that added peers are not displayed, they could not be resolved. Verify the IP address

   To **EDIT** the settings of an NTP Peer, click the GEAR button next to it, and proceed to Step 3 below.
To **ADD** a new NTP Peer, click the PLUS icon in the top right corner of the NTP Peers panel.

To **REMOVE** an NTP Peer (and its associated configurations), click the X-button next to it.

3. The NTP Peers edit window opens:

4. Enter the required information into the fields:
   - **Host**: The IP address for the server to be used as host.
   - **Min Poll Interval**: Select a value from the drop down (the default is 3 (8s)).
   - **Max Poll Interval**: Select a value from the drop down (the default is 3 (8s)). For both NTP Peers, and NTP Servers the Minimum and Maximum Poll rate for NTP packets can be configured.
   - **Enable Symmetric Key**: Click the checkbox to enable/disable Symmetric Key. See also: "Configuring NTP Symmetric Keys" on the facing page.

   **Note**: Before you can edit the Key field, you must set up Symmetric Keys through the Actions Panel. See "NTP: Symmetric Keys (MD5) " on the facing page.

   - **Mark as Preferred**: Check this box to prefer this NTP Peer over other NTP Peers ("NTP Peer Preference"). This will result in VelaSync synchronizing more frequently with this Peer. For additional information on NTP Preferences, see "NTP Timing System: Reference Selection and Preference" on page 1.
5. Click Submit, or press Enter.

2.10.9 NTP Authentication

Since NTP information is distributed across entire networks, NTP poses a security risk: Falsified NTP time stamps or other NTP-related information can be exploited by an attacker. NTP authentication keys are used to authenticate time synchronization, thus detecting a fake time source before it can do harm.

2.10.9.1 NTP: Symmetric Keys (MD5)

Symmetric Keys are an encryption means that can be used with NTP for authentication purposes.

VelaSync supports authenticated NTP packets using an MD5 authenticator. This feature does not encrypt the time packets, but attaches an authenticator, which consists of a key identifier and an MD5 message digest, to the end of each packet. This can be used to guarantee that NTP packets came from a valid NTP client or server, and that they were not tampered with during transmission. The Symmetric Keys tab allows NTP to be configured to use MD5 authentication.

Configuring NTP Symmetric Keys

To create, edit, or delete Symmetric Keys (MD5 Authentication):

1. Navigate to MANAGEMENT > NETWORK: NTP Setup.
2. In the Actions panel, click the Symmetric Keys button:

   ![Actions Menu]

3. The NTP Symmetric Keys window will display:
To **CREATE** a Symmetric Key, click the PLUS icon in the top-right corner, and proceed to Step 4.

To **EDIT** an existing key pair, click the corresponding Change button, and proceed to Step 4.

To **DELETE** a key pair, click the corresponding Delete button, and click **OK** in the dialog box to confirm and complete the procedure.

4. The **NTP Symmetric Key** window will display:

![NTP Symmetric Key Window]

Fill in, or edit the fields:

- **Trusted** (checkbox)—Check this box to use MD5 authentication with trusted key ID.

**Note:** To use the MD5 authentication with trusted key ID, both the NTP client and the VelaSync must contain the same key ID/key string pair, the client must be set to use one of these MD5 pairs, and the key must be trusted.

- **Key ID**—The key ID must be a number between 1 and 65532.

- **Digest Scheme**—Choose one of the options from the drop-down list. The available options are:
» MD5 (the default)
» SHA1
» SHA
» MDC2
» MDC2
» RIPEMD160
» MD4

» **Key Str**—The key string must be readable ASCII and between 1 and 16 characters long.

5. Click the **Submit** button: The changes will be reflected in the table of the **NTP Symmetric Keys** window, which is displayed after clicking the **Submit** button.

6. The key(s) you have set up will now appear as options in the **Symmetric Key** field in both the **NTP Server** screen, and the **NTP Peer** screen.
NOTES:

Duplicate key IDs are not permitted. NTP requests received by that do not contain an authenticator containing a valid Key ID and MD5 message digest pair will be responded to, but no authentication will be performed. An NTP request with valid authenticators results in a valid NTP response with its own valid authenticator using the same Key ID provided in the NTP request.

You may define the trusted Symmetric Keys that must be entered on both VelaSync, and any network client with which VelaSync is to communicate. Only those keys for which the “Trusted” box has been checked will appear in the dropdown menus on the NTP References screen.

2.10.10 NTP Access Restrictions

Next to encrypted authentication by means of Symmetric Keys, NTP supports a list-based means of access restriction, the use of which is also recommended to prevent fraudulent or inadvertent manipulation of a time server.

To configure NTP Access Restrictions:

1. Navigate to MANAGEMENT > NETWORK: NTP Setup.
2. In the Actions panel, click Access Restrictions:
3. The **NTP Access Restrictions** Status window will display:

   ![NTP Access Restrictions window]

   ➤ To **ADD** or **EDIT** an access restriction, click the PLUS icon or the Change button, respectively, and proceed to Step 4. below.

   ➤ To **DELETE** an access restriction, click the corresponding Delete button, and confirm by clicking OK.

4. The **NTP Access Restrictions** window will display:

   ![NTP Access Restrictions window]

   ➤ Fill in the fields:

     ➤ **Restriction Type**—Choose either **Allow** or **Deny**. If you select “Deny”, the configured portion of the network will not have NTP access to VelaSync, but the rest of the network will have access to VelaSync. If you select “allow”, the configured portion of the network will have NTP access to VelaSync, but the rest of the network will not have access to VelaSync. By default, VelaSync allows all IPv4 and IPv6 connections.

     ➤ **IP Version**—Choose IPv4 or IPv6

     ➤ **IP Address**—Enter the appropriate hostname.

     ➤ **Subnet Mask**—Enter the appropriate IP mask.
2.11 Configuring PTP

- **Require Authentication** (checkbox)—Check this box if you want the additional security of authorized access. VelaSync to accept only authenticated requests (MD5) from this user or network segment.

- **Allow NTP Queries** (checkbox)—Check this box if you want to allow external NTP queries into VelaSync services.

5. Click the **Submit** button.

### 2.10.11 Spectracom Technical Support for NTP

Spectracom does not provide technical assistance for configuring and installing NTP on Unix-based applications. Please refer to [www.ntp.org](http://www.ntp.org) for NTP information and FAQs. Another helpful source is the Internet newsgroup at news://comp.protocols.time.ntp. Spectracom can provide support for Microsoft® Windows-based time synchronization. See [spectracom.com](http://spectracom.com) for additional information, or contact Spectracom Technical Support.

### 2.11 Configuring PTP

Precision Time Protocol (PTP) is a time protocol that can be used to synchronize computers on an Ethernet network. VelaSync supports PTP Version 1 and 2, as specified in the IEEE 1588-2002 and IEEE 1588-2008 standard, via four (4) Ethernet ports.

VelaSync currently can be configured as a PTP Master Clock only.

Next to PTP specifications, this topic describes the PTP menu items and settings, and outlines how to set up VelaSync as a PTP Master.

**PTP Specifications**

- **Inputs/Outputs**: (4) Port
- **Signal Type**: Ethernet
- **Management**: Web UI
- **Network Speeds**: 100 Mb/s, 1Gb/s, or 10Gb/s
- **PTP Version** supported: PTP 1 (IEEE 1588-2002) and 2 (IEEE 1588-2008)
- **PTP Profiles** supported: Default, Telecom, Enterprise
- **Transmission modes**: Unicast, Multicast (IPv4 and Ethernet), and Hybrid [default]
- **Timestamping**: VelaSync has PTP time stamp functionality which is set to use the UTC timescale.
2.11.1 The PTP Screen

The PTP screen provides PTP status information, and provides access to all configurable PTP settings.

To access the PTP screen, navigate to MANAGEMENT > NETWORK: PTP Setup. The PTP screen will open:

![PTP Screen Image]

For each Ethernet port (ETH0-ETH3) you can toggle PTP functionality **ON** or **OFF**.

You can also access the "Settings" panel and the "Statistics" panel for each port (see below).

2.11.1.1 The PTP Settings Panel

The Settings Panel provides access to the configuration settings, divided into three tabs, which are described below. Each tab allows you to **Restore defaults**.

**Note:** The Restore Defaults button in each PTP Settings panel will restore ALL the factory defaults for ALL Ethernet ports.
Settings changed by the user will be maintained when the PTP daemon is stopped and started, and between reboots and powercycles.

![Edit PTP Settings panel](image)

**Figure 2-11:** Edit PTP Settings panel

### Protocol tab

- **PTP version:** [1, 2] Select Version 1 or Version 2.
- **Domain:** [1 through 127] Sets the current PTP Domain Number, as defined in IEEE Std 1588-2008 Section 7.1
- **Communication Mode:** Select multicast, hybrid, or unicast mode.

**About PTP Transmission Modes**

The PTP Card is able to transmit the PTP packets in three transmission modes:

- **Multicast Mode:** PTP packets are transmitted to all PTP Clocks by means of Multicast IP addresses dedicated to the PTP protocol (224.0.1.129, 224.0.0.107). PTP packets received by the PTP Clocks are then filtered from the Domain Number, the Port Identity (Clock Identity + Port Number) of the transmitter. When the Master Clock is set in Multicast mode, this module will deny the requests from the Slaves Clocks to run in Unicast mode. When the Master Clock is set in Unicast mode, it doesn't transmit any PTP messages until a Slave has been granted to run in Unicast mode.

- **Unicast Mode:** This is a Point-to-Point transmission mode between two PTP Clocks by means of the unique IP address assigned to each PTP Clock.

- **Hybrid Mode:** [default] This mode uses Multicast messages for Sync, Follow-Up, and Announce packets from the Master. Slaves are expected to send Delay Request messages to the Master in Unicast, and the Master responds in Unicast. No Unicast Negotiation grants are necessary.
The Unicast mode is activated at the initiative of the Slaves. Each Slave, which wants to run in Unicast mode, shall first negotiate Unicast contracts with the Master.

- **Sync Rate**: The rate at which Sync messages are sent, in packets per second. [1 = 1 packet/sec.; 2 = 2 packets/sec.; 0.5 = 1 packet/2 sec.]
- **Announce Rate**: [see Sync Rate above] The rate at which Announce messages are sent, in packets per second.
- **Delay Req Rate**: Interval between request messages sent by the slave to the master.
- **Best Master Clock Algorithm**: [On or OFF] When set to ON, the Master will listen for traffic from other Masters and become passive if another master on the network has better credentials according to the Best Master Clock Algorithm (Section 9.3 of IEEE 1588-2008). A passive master will not transmit any protocol messages as long as another Master is active as the Best Master on the network. When set to OFF, the Master will act as an active master no matter whether or not other masters are present. This may be required for certain PTP profiles.
- **Clock Priority 1**: [0 to 255] (0 is highest priority. Default is 128 for both priority values. This is usually the priority value that a Slave is set to.) See IEEE 1588-2008, Section 8.10.1, 8.10.2.
- **Clock Priority 2**: [0 to 255] (same as above).
- **Current UTC Offset**: to convert to civil time.
- **Network Transport**: [Ethernet, IPv4/UDP] Selects the transport protocol used for PTP packets.

**Management Mechanism tab**

- **Request Peer Information**: [ON/OFF] Enable/disable management requests.
- **Request Peer Information Rate**: [0.2 = one request every five seconds] Request rate in seconds for PTP Management messages.

**Network tab**

- **Multicast Ttl**: [1 through 255] Time-to-live (packet lifespan) — Sets the TTL field for PTP packets except for Peer-to-Peer packets for which TTL is forced to 1 as specified in IEEE Std 1588-2008 Annex D.3.
2.11 Configuring PTP

» Unicast Ttl: [64] Time to live for Unicast packets.

2.11.1.2 The PTP Statistics Panel

This panel provides statistics for each Ethernet port. If the PTP is set to OFF for a specific port, this screen will not display any information.

All statistics shown are based on the traffic that is detectable by VelaSync, i.e. in a Unicast environment, VelaSync may only detect traffic that is addressed to it, based on switch configuration.

![PTP Statistics Panel](image)

**Figure 2-12:** PTP Statistics Panel

» PTP Node: IP address of PTP node.
» Clock Identity: [e.g., "a0:36:9f:ff:fe:37:b9:5d"]
» Domain: Domain number of the selected PTP node.
» Unicast: [0,1] OFF or ON (1)
» Last Time: [e.g., "2016-08-12 18:19:15"] The last time a packet was received.
» Average Rate: [e.g., "0.0624986091344933"] Indicates how often the selected message has been detected (in seconds e.g., "1.0" would mean once every second).

2.11.2 Enabling/Disabling PTP

To enable or disable PTP:

1. Navigate to MANAGEMENT > NETWORK: PTP Setup.
2. In the PTP panel, slide the toggle switch to ON or OFF for the desired Ethernet port.
2.11.3 Configuration — General Steps

Ensure that the Ethernet port used for PTP is connected to the network. Navigate to MANAGEMENT > NETWORK: Network Setup, and verify the STATUS in the Ports panel.

Be sure that valid time and 1PPS references are currently selected: Navigate to MANAGEMENT > OTHER: Reference Priority, and confirm Reference Priority configuration, and Reference Status. Note that in order to operate properly as a Master Clock, VelaSync must be synchronized to a non-PTP reference. The built-in GNSS reference provides all information needed with no user intervention. Should you, however, be using a different reference, ensure that it transmits the following information.

- The proper TAI or UTC time (including the current year).
- The current TAI to UTC offset (required even if the reference’s time is in TAI).
- Pending leap second information at least a day in advance.

2.12 PRISMA Compliance Setup

VelaSync can send information on well it is synchronized to a PRISMA Compliance Server. This requires the use of a terminal emulator; for information on the setup and use of a CLI, see "Command-Line Interface" on page 215.

Please see the PRISMA Compliance documentation for more information on the general operation of the PRISMA Compliance system.

Two main parameters can be controlled through the VelaSync CLI:

- the database.address is the IP address of the PRISMA Compliance database
- the device.identity is the name that will be used in the PRISMA Compliance database for this node (if this is left blank, PRISMA Compliance will use the device IP address).

To communicate with PRISMA Compliance, use the following CLI commands:

```
compliance-transmitter-config get
```

- show the current parameter values

```
compliance-transmitter-config set database.address <address>:<port>
```

- set the database address
- the database port must be included. In most installations, this will be port 2836
compliance-transmitter-config set device identity <name>
  » set the device identity

compliance-transmitter-config transmit-now
  » run the transmitter on demand

compliance-transmitter-config schedule <when>
  » add a scheduled job to cron as /etc/cron.d/compliance-transmitter
  » <when> is a quoted string in the format of the crontab file, where "* * * * *" represents
    » minute [0-59]
    » hour [0-23]
    » day of the month [1-31]
    » month of the year [1-12]
    » day of the week [1-7, 1 standing for Monday]
    » year [1900-3000]

  scheduling examples
  "0 0 * * *" would run every day at midnight
  "0 12 13 6 * *" would run on June 13th of every year at noon

  for more examples, see https://en.wikipedia.org/wiki/Cron

  » scheduled jobs will log output in the User Log
  » rerunning this command when a job is already scheduled will replace the existing
    scheduled cron job with the new one.

compliance-transmitter-config schedule-delete
  » delete the cron job

compliance-transmitter-config version
  » display the version of the CLI tool.
Managing Time

In this document, the notion of Managing Time refers not only to the concept of VelaSync’s System Time, but also to reference configuration, as well as distribution of time and frequency.

The following topics are included in this Chapter:

3.1 The Time Management Screen .........................94
3.2 System Time ..............................................95
3.3 Managing References .................................110
3.4 Managing the Oscillator ..............................152
3.1 The Time Management Screen

The Time Management screen is the point of entry for all System Time-related settings that are user-configurable.

To access the Time Management screen:

1. Navigate to MANAGEMENT > OTHER: Time Management.
2. The Time Management screen opens. It is divided into 4 panels:

   - **System Time panel**
     The System Time panel displays the time scale and the year, and allows access to the Edit System Time window via the GEAR icon in the top-right corner. This window is used to select the time scale, and to manually set a user-time, if so required.

     See "System Time" on page 96.

   - **Offsets panel**
     The Timescales UTC, TAI, and the GPS-supplied time are offset by several seconds, e.g. to accommodate leap seconds. The GPS offset may change over time, and can be managed via the GEAR icon in the top-right corner of this panel.

   - **Leap Second Info panel**
     From time to time, a leap second is applied to UTC, in order to adjust UTC to the actual position of the sun. Via the Leap Second Info panel, leap second corrections can be applied to
VelaSync's time keeping. It is also possible to enter the exact day and time when the leap second is to be applied, and to delete a leap second.

See also: "Leap Seconds" on page 104

Local Clocks panel

You can create multiple different Local Clocks, as needed. The names of all Local Clocks that have already been created are displayed in the Local Clocks panel.

See also "Local Clock(s), DST" on page 107.

3.2 System Time

The time that VelaSync maintains is referred to as the **System Time**. The System Time is used to supply time to all of the available time-of-day outputs (such as NTP time stamps, time stamps in the log entries, ASCII data outputs, etc.).

By default, the System Time is synchronized to VelaSync’s input references (such as GNSS, IRIG, ASCII data, NTP, PTP, etc.).

If a UTC-based time is not required, however, it is also possible to manually set the System Time to a desired time/date, or to use the unit’s battery backed time (Real Time Clock) as System Time (with an external 1PPS reference).

The flow chart below illustrates how VelaSync obtains the highest available and valid reference, depending on whether an external source is chosen as reference, or an internal (User[x], or Local System).
3.2.1 System Time

Several System Time parameters can be customized:

- The System Timescale can be changed.
- A user-defined time can be setup for e.g., for simulation purposes, or if no external reference is available.
- The battery-backed RTC time can be used as System Time, until an external reference become available.

3.2.1.1 Configuring the System Time

To configure the System Time:

1. Navigate to MANAGEMENT > OTHER: Time Management.

2. In the System Time panel located in the top-left corner of the Time Management screen, click the GEAR icon.

3. The Edit System Time pop-up window will display.
   - In the System Timescale field select a timescale from the drop-down list. The options are:
UTC: Coordinated Universal Time (Temps Universel Coordonné); your local time zone determines the difference between UTC and local time.

Note that UTC is not a time zone, but a time standard, i.e. it is not used anywhere in the world as the official local time, whereas GMT (Greenwich Mean Time) is a time zone that is used in several European and African countries as the official local time.

TAI: International Atomic Time (Temps Atomique International).

The TAI time scale is based on the SI second and is not adjusted for leap seconds. As of 2-Apr-2019, TAI is ahead of UTC by 37 seconds. TAI is always ahead of GPS by 19 seconds.

GPS: The Global Positioning System time is the timescale maintained by the GPS satellites.

Global Positioning System time is the time scale maintained by the GPS satellites. The time signal is provided by atomic clocks in the GPS ground control stations. The UTC–GPS offset as of 2-Apr-2019 is 18 seconds.

For more information on Timescales, see "Timescales" below.

4. If you want to override the system time with a manually set User Time, check the Manual Time Set checkbox. For information, see "Manually Setting the Time" on page 99.

5. Click Submit to update the System Time and close the window.

3.2.1.2 Timescales

The System Time can be configured to operate in one of several timescales, such as UTC, GPS and TAI (Temps Atomique International). These timescales are based on international time standards, and are offset from each other by varying numbers of seconds.

When configuring VelaSync, in most cases, UTC will be the desired timescale to select.

Note: UTC timescale is also referred to as “ZULU” time. GPS timescale is the raw GPS time as transmitted by the GNSS satellites (in 2018 the GPS time is currently 18 seconds ahead of UTC time. UTC timescale observes leap seconds while GPS timescale does not).
3.2 System Time

**Note:** The TAI timescale also does not observe leap seconds. The TAI timescale is fixed to always be 19 seconds ahead of GPS time. As of 2-Apr-2019 TAI time is 37 seconds ahead of UTC.

VelaSync’s System timescale is configured via the **MANAGEMENT > OTHER: Time Management** screen, see “System Time” on page 96.

**Input timescales**

Some of the inputs may not necessarily provide time to VelaSync in the same timescale selected in the System Time’s timescale field. These inputs have internal conversions that allow the timescale for the inputs to also be independently defined, so that they don’t have to be provided in the same timescale. For example, the System timescale can be configured as “UTC”, but the IRIG input data stream can provide VelaSync with “local” time, with no time jumps occurring when the reference is selected.

If an output reference is using the GPS or TAI timescale, and the System Time is set to “UTC”, then the GPS Offset box in the Edit GPS Offset window must be populated with the proper timescale offset value in order for the time on the output reference to be correct. Some references (like GNSS) provide the timescale offset to the system. In the event that the input reference being used does not provide this information, it must be set in through the **Offsets** panel of the **Time Management** page.

Since the GPS and TAI offsets have a fixed relationship, only the GPS offset can be set. If only the TAI offset is known, subtract 19 from it to get the GPS offset.

**Note:** If the System Time is set to the UTC timescale, and all output references either use the UTC or “local” timescale, then it is not necessary to set the GPS and TAI timescale Offsets.

**Caution:** It is imperative to configure any input reference’s timescales appropriately. Otherwise, a System Time error may occur!

**Output timescales**

Some of the available VelaSync outputs (such as the ASCII data module’s outputs, etc.) won’t necessarily output in the same timescale selected in the System Time’s timescale field. These outputs have internal conversions that allow the timescale for the outputs to also be independently defined, so that they don’t have to be provided in the same timescale.
Other VelaSync outputs will be provided in the same timescale that is selected in the System timescale field. The NTP output for network synchronization and the time stamps included in all log entries will be in the same timescale as the configured System timescale. For example, if “GPS” is selected as the System timescale, the log entries and the time distributed to the network will all be in GPS time (time broadcasted directly from the GNSS constellation).

### 3.2.1.3 Manually Setting the Time

For some applications, it may not be necessary to synchronize VelaSync to a UTC-based reference. Or, a GPS reference is not available yet (e.g., because the antenna is not yet installed), but the system has to be setup and tested.

In such cases, the System Time can be hand-set, and then used as a User [x]-set System Time. For more information on when to use this functionality, see "The "User/User" Reference" on page 116.

**Note:** If synchronization to UTC is NOT required, it is advisable to set a time in the past or future, so as to avoid users inadvertently considering the distributed time to be genuine.

**Caution:** Note that this mode of operation is intended for special use cases e.g., autonomous systems, where legally traceable time is not required: This time will be inaccurate/not traceable, since it is not tied to any reference.

To hand-set the System Time, and configure this time to be a valid reference:

1. Navigate to MANAGEMENT > OTHER: Time Management.
2. In the System Time panel on the left, click the GEAR icon.
3. Select Manual Time Set. Set your time & date, as needed:

   - **System Time** [DATE; TIME]: If you do not select **Set Year Only**, this box will show the current time in the format: Year-Month-Day Hour:Minute:Second. To set the time manually, click anywhere in the System Time field. A drop-down calendar with time-setting sliders will appear:
The time in the System Time field will default to the current date and time. To set the time, use the sliders. The time will display between the calendar and the sliders, and also next to the chosen date in the field directly above the calendar. To close the calendar, click anywhere in the Edit System Time window.

**NOTE:** Except for testing purposes, you should not choose a date other than the current day.

- **Set Year Only:** Some legacy time formats (e.g., IRIG) do not support years. Checking this box will open a data entry field to manually set the year. Spectracom recommends not to utilize this feature, unless the IRIG format you are using does not provide a YEAR field.

- **Synchronize to Battery Backed Time on Startup:** See "Using Battery Backed Time on Startup" on the facing page.

4. Click **Submit** at the precise moment desired.
5. Navigate to **MANAGEMENT > OTHER: Reference Priority**.
6. In order for the User time to be a considered a valid reference, verify that the Reference Priority table includes an "Enabled" User [x] Time, and 1PPS reference ("User-/User"). For more information, see "Input Reference Priorities" on page 110 and "The "User/User" Reference" on page 116.
7. Move (drag & drop) the User time to the top of table, and disable all other references.
8. Let Holdover expire. (Set it to a very short duration, if desired):
   i. Navigate to **MANGAGEMENT > OTHER: Disciplining**
   ii. In the Status panel, click the GEAR icon.
iii. In the Oscillator Settings window, set the Holdover Timeout.

9. Check on the HOME screen that User 0 is displayed, with a green STATUS. Note that the Disciplining State will remain yellow, once Holdover has expired, since the system time is not synchronized to a reference.

**Note:** Contrary to the User reference discussed above, the Local System reference can be used for Time, or 1PPS (but not both). For more information, see “The "Local System" Reference” on page 115.

### 3.2.1.4 Using Battery Backed Time on Startup

Upon system startup, by default VelaSync will not declare synchronization until one of the external references becomes available and valid.

This functionality can be overridden by enabling the Synchronize to Battery Backed Time on Startup, thus allowing the battery backed time to be used as System Time upon system startup. The Battery Backed Time is also referred to as the time maintained by the integrated Real Time Clock (RTC).

This will result in VelaSync providing a System Time before one of the external references becomes available and valid. This will happen automatically, i.e. without user intervention. As soon an external reference will become available, its time will take precedence over the battery backed time: The System Clock will adjust the System Time for any time difference.

**Note:** The Battery Backed Time is also referred to as the time maintained by the integrated Real-Time Clock (RTC).

#### Use Cases

Using the Battery Backed Time on Startup is typically used in these cases:

a. If the synchronization state is to be reached as quickly as possible, even if this means the time distributed initially will most likely be less accurate than an external time reference.

b. A system is intended to operate autonomously (i.e. without any external references) and
   - the hand-set time entered manually during commissioning of the system is sufficiently accurate
the system needs to be able to completely recover from a temporary power loss, or similar, without human intervention.

c. A system is used for simulation or testing purposes, and UTC traceability is not required.

The Accuracy of the Battery Backed Time ...

... depends on the accuracy of the hand-set time if the time is set manually in an autonomous system. In a non-autonomous system (i.e., when using external reference(s)) VelaSync's System Clock will regularly update the battery-backed time.

Another factor impacting the accuracy of the battery-backed time is how long a VelaSync unit is powered off: Any significant amount of time will cause the battery-backed RTC to drift, i.e., the battery-backed time will become increasingly inaccurate.

The battery used for the RTC is designed to last for the lifetime of the product.

Distributing battery-backed time over NTP

When distributing a hand-set, battery backed time via NTP, please set the time relatively close to UTC, so as to prevent NTP synchronization problems when transitioning from the hand-set time to a UTC-based external input reference. See also "Input Reference Priorities" on page 110.

To use the battery-backed time as the synchronized time at start-up:

1. Navigate to MANAGEMENT > OTHER: Time Management.
2. In the System Time panel click the GEAR icon.
3. The Edit System Time window will display. Select the checkbox Synchronize to Battery Backed Time on Startup:
4. Click the **Submit** button.

### 3.2.2 Timescale Offset(s)

Timescale offsets account for fixed differences between timescales, in seconds. Timescale offsets may change because of leap seconds, see "Leap Seconds" on the next page.

#### 3.2.2.1 Configuring a Timescale Offset

To configure a timescale offset to the System Time:

1. Navigate to **MANAGEMENT > OTHER: Time Management**.
2. In the **Offsets** panel on the left, click the GEAR icon in the top-right corner.
3. The **Edit GPS Offset** window will display. Enter the desired **GPS Offset** in seconds, and click **Submit**.

**Note:** Since the GPS Offset and the TAI Offset have a fixed relationship, only the GPS Offset can be set. If only the TAI offset is known, subtract 19 from it, in order to obtain the GPS offset.

Note that the data stream of GPS and several other external references includes information about a pending Leap Second, and as such automatically corrects for a Leap Second. Nevertheless, it is advisable to perform some testing in advance to ensure all system components will adjust flawlessly. For more information, see "Leap Seconds" on the next page.
3.2.3 Leap Seconds

3.2.3.1 Reasons for a Leap Second Correction

A Leap Second is an intercalary\(^1\) one-second adjustment that keeps broadcast standards for time of day close to mean solar time. Leap Seconds are required to synchronize time standards with civil calendars, thus keeping UTC time in sync with the earth's rotation.

Leap seconds can be introduced in UTC at the end of the months of December or June. The INTERNATIONAL EARTH ROTATION AND REFERENCE SYSTEMS SERVICE (IERS) publishes a bulletin every six months, either to announce a time step in UTC, or to confirm that there will be no time step at the next possible date. A Leap Second may be either added or removed, but in the past, the Leap Seconds have always been added because the earth's rotation is slowing down.

Historically, Leap Seconds have been inserted about every 18 months. However, the Earth's rotation rate is unpredictable in the long term, so it is not possible to predict the need for them more than six months in advance.

**Note:** Leap Seconds only apply to the UTC and Local timescales. Leap Seconds do NOT affect the GPS and TAI timescales. However, a Leap Second event will change the GPS to UTC, and TAI to UTC time offsets. When a Leap Second occurs, VelaSync will automatically change these offsets by the proper amount, no matter which timescale is currently being used by the system.

As of 2018 the GPS to UTC Offset is 18 seconds. The last Leap Second occurred on December 31, 2016.

VelaSync can be alerted of impending Leap Seconds by any of the following methods:

- **GNSS Receiver** (if available as an input reference): The GNSS satellite system transmits information regarding a Leap Second adjustment at a specific Time and Date an arbitrary number of months in advance.

- **Input references other than GNSS:** Some of the other available input references (e.g., IRIG, ASCII, NTP) can also contain pending Leap Second notification in their data streams (see chapter below).

- **Manual user input:** VelaSync can be manually configured with the date/time of the next pending Leap Second. On this date/time, the System Time will automatically

\[^1\]Intercalary: (of a day or a month) inserted in the calendar to harmonize it with the solar year, e.g., February 29 in leap years.
correct for the Leap Second (unless the System Time’s timescale is configured as either GPS or TAI).

### 3.2.3.2 Leap Second Alert Notification

VelaSync will announce a pending Leap Second adjustment by the following methods:

- **ASCII Data Formats**: ASCII Data Formats 2 and 7 (among other formats) from the ASCII Data option modules contain a Leap Second indicator. During the entire calendar month preceding a Leap Second adjustment, these Formats indicate that at the end of the current month a Leap Second Adjustment will be made by using the character ‘L’ rather than a ‘_ ‘ [space] in the data stream. Note that this does not indicate the direction of the adjustment as adding or removing seconds. These formats always assume that the Leap Second will be added, not removed.

- **NTP Packets**: NTP Packets contain two Leap Indicator Bits. In the 24 hours preceding a Leap Second Adjustment, the Leap Indicator Bits (2 bits) which normally are 00b for sync are 01b (1) for Add a Leap Second and 10b (2) for Remove a Leap Second. The bit pattern 11b (3) indicates out of sync and in this condition NTP does NOT indicate Leap Seconds. The Sync state indicates Leap Seconds by indicating sync can be 00b, 01b, or 10b.

- **PTP Packets**: PTP Packets provide leap indication with a 12-hour notification window.

- **Some IRIG formats**: Some IRIG formats provide leap second notification indicators.

**Note:** It is the responsibility of the client software utilizing either the Data Formats or NTP time stamps to correct for a Leap Second occurrence. VelaSync will make the correction at the right time. However, because computers and other systems may not utilize the time every second, the Leap Second correction may be delayed until the next scheduled interval, unless the software properly handles the advance notice of a pending Leap Second and applies the correction at the right time.

### 3.2.3.3 Leap Second Correction Sequence

The following is the time sequence pattern in seconds that VelaSync will output at UTC midnight on the scheduled day (Note: This is NOT local time midnight; the local time at which the adjustment is made will depend on which Time Zone you are located in).

A. **Sequence of seconds output when adding a second** (“positive Leap Second”):
   - 56, 57, 58, 59, 60, 0, 1, 2, 3 ...

B. **Sequence of seconds output when subtracting a second** (“negative Leap Second”):
3.2 System Time

3.2.3.4 Configuring a Leap Second

To manually correct the System Time for a leap second:

1. Navigate to MANAGEMENT> OTHER: Time Management. The Time Management screen will be displayed. In the lower left-hand corner, the Leap Second Information panel will show if a leap second is pending. This panel will be empty, unless:
   a. A leap second is pending, and VelaSync has obtained this information automatically from the GPS data stream.
   b. A leap second had been configured previously by a user via the Edit Leap Second window.

2. To access the Edit Leap Second information window, click the GEAR icon in the Leap Second Information panel.

3. The Edit Leap Second window will display:

4. In the Leap Second Offset field enter the desired GPS Offset.
5. In the Date and Time field, enter the date that the desired leap second should occur.
6. Click Submit.

To delete a leap second correction, click the Delete button.
3.2.4 Local Clock(s), DST

The Local Clock feature allows for maintaining one or several local times. These times will reflect a time offset, thereby accounting for Time Zone, and DST (Daylight Savings Time) correction.

3.2.4.1 Adding a Local Clock

To add a Local Clock:

1. Navigate to MANAGEMENT > OTHER: Time Management.
2. Click the PLUS icon in the Local Clocks panel in the Time Management screen.
3. The Local Clock pop-up window will display.
4. Enter a Name for your local clock.
   - The name must be between 1 and 64 characters long; spaces are allowed.
   - The name can be any meaningful name that helps you know your point of reference (for example: “NewYork”, “Paris” or “EasternHQ”, etc.).
   - This name will be used as cross-reference drop-down in the applicable Input or Output port configuration. Please note the following limitations apply to this option:
5. In the **UTC Offset** field, choose a **UTC Offset** from the drop-down list.

   - All of the **UTC Offset** drop-down selections are configured as UTC plus or minus a set number of hours.
   - Examples for the US: For **Eastern**, choose UTC–05:00; for **Central**, choose UTC–06:00; for **Mountain**, choose UTC–07:00; and for **Pacific**, choose UTC–08:00.
   - If you wish to use DST (Daylight Savings Time ["Summer Time"]) rules, click the **Use DST Rules** box. Otherwise the time for the local clock will always be standard time.
     DST options will appear in the **Local Clock** window:

6. **Set DST Rules by Region**: Check this box to apply regional DST rules. A regions drop-down menu with the following options will display:

   - **EU** (Europe): For locations complying with the European DST Rule. This rule differs from all other rules because the DST changes occur based on UTC time, not local time (all time zones in Europe change for DST at precisely the same time relative to UTC, rather than offset by local time zone).
   - **US-Canada**: For locations complying with the USA’s DST Rule (as it was changed to back in 2006, where the “DST into” date is the Second Sunday of
March and the “DST out” date is the first Sunday of November).

» **Australia.**

**Note:** If a pre-configured rule DST rule happens to be changed in the future (like the change to the US DST rule in 2006), this option allows the DST rules to be edited without the need to perform a software upgrade for a new DST rule to be defined. Select this drop-down and enter the DST parameters for the new rule.

7. **DST Start Date** and **DST End Date**: This option is provided for locations that do not follow any of the pre-configured DST rules. Click anywhere in either field to open a calendar, allowing you to enter any custom day & time rule.

8. **Offset**: In seconds. Use this field to manually define your local clock's DST offset e.g., 3600 seconds for a one hour offset.

9. **DST Reference**: When configuring a Local Clock that is synchronized to an input reference (e.g., IRIG input), VelaSync needs to know the timescale of the input time (Local Timescale, or UTC Timescale), in order to provide proper internal conversion from one Timescale to another. Select **Local** or **UTC**, depending on the Timescale of the Input reference this Local Clock is being used with. Additional Local Clocks may need to be created if multiple input Timescales are being submitted.

10. Click **Submit**. Your local clock will appear in the **Local Clocks** panel.

### 3.2.4.2 DST Examples

The following two examples illustrate the configuration of Daylight Savings Time (DST) for a Local Clock:

**Example 1:**

To create a Local Clock to UTC+1 with no DST rule:

1. Navigate to **MANAGEMENT > Time Management: Local Clocks > (+): Local Clock**
2. In the **Local Clock Name** field, assign a meaningful name to the new Local Clock.
3. From the **UTC Offset** pull down menu, select “UTC +01:00”.
4. Confirm that the **Use DST Rules** checkbox is not selected.
5. Review the changes made and click the Submit button.  
The unit will display the status of the change.

Example 2:
To create a Local Clock for a VelaSync installed in the Eastern Time Zone of the US, and desiring the Local Clock to automatically adjust for DST (using the post 2006 DST rules for the US).

1. In the MANAGEMENT > Time Management: Local Clocks > (+): Local Clock window:
2. Navigate to MANAGEMENT > Time Management: Local Clocks > (+): Local Clock.
3. From the UTC Offset pull-down menu, select “UTC -05:00”.
4. Select the Use DST Rules checkbox.
5. Select the Set DST Rules by Region checkbox.
6. From the DST Region drop-down list, select “US-Canada.”
7. Review the changes made and click the Submit button.

The unit will display the status of the change.

3.2.4.3 DST and UTC, GMT
Neither UTC, nor GMT ever change to Daylight Savings Time (DST). However, some of the countries that use GMT switch to a different time zone offset during their DST period. The United Kingdom is not on GMT all year, but uses British Summer Time (BST), which is one hour ahead of GMT, during the summer months.

Additional information about regional time zones and DST can be found on the following web sites: http://www.worldtimeserver.com/, http://webexhibits.org/daylightsaving/b.html.

3.3 Managing References

3.3.1 Input Reference Priorities
VelaSync can be synchronized to different time and frequency sources that are referred to as Input References, or just References.
References can be a GNSS receiver, or other sources delivered into your VelaSync unit via dedicated (mostly optional) inputs. It is also possible to enter a system time manually, which VelaSync then can synchronize to.

In order for VelaSync to declare synchronization, it needs both a valid 1PPS, and Time reference.

The concept of **Reference Priority** allows the ranking of multiple references for redundancy. This allows VelaSync to gracefully fall back upon a lower ranking 1PPS or Time reference without transitioning into Holdover, in case a reference becomes unavailable or invalid. The priority order you assign to your available references typically is a function of their accuracy and reliability.

**Note:** The References shown on your screen may look different from the ones in the illustration below, depending on your VelaSync High-Speed Enterprise Time Server model and hardware configuration.

Each available type of Time and 1PPS input reference is assigned a human-readable name or “title” that is used in the Reference Priority table, indicating the type of reference. The reference titles are listed in the following table:

**Table 3-1: Reference priority titles**

<table>
<thead>
<tr>
<th>Title</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCII Timecode</td>
<td>ASCII serial timecode input</td>
</tr>
<tr>
<td>External 1PPS input</td>
<td>External 1PPS input</td>
</tr>
</tbody>
</table>
### 3.3 Managing References

<table>
<thead>
<tr>
<th>Title</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>External Frequency input</td>
</tr>
<tr>
<td>GNSS</td>
<td>GNSS input</td>
</tr>
<tr>
<td>PTP</td>
<td>PTP input</td>
</tr>
<tr>
<td>IRIG</td>
<td>IRIG timecode input</td>
</tr>
<tr>
<td>Local System</td>
<td>Built-in clock OR internal 1PPS generation</td>
</tr>
<tr>
<td>NTP</td>
<td>NTP input</td>
</tr>
<tr>
<td>User</td>
<td>Host (time is manually set by the user)</td>
</tr>
<tr>
<td>HAVEQUICK</td>
<td>HAVEQUICK input</td>
</tr>
</tbody>
</table>

The number displayed indicates the number of feature inputs of that type presently installed in the VelaSync—starting with “0” representing the first feature input. For example:

- IRIG 0 = 1st IRIG input instance
- Frequency 1 = 2nd frequency input instance
- NTP 2 = 3rd NTP input instance

The columns of the **Reference Priority** table are defined as follows:

- **Priority**—Defines the order or priority for each index (row). The range is 1 to 16, with 1 being the highest priority and 16 being the lowest priority. The highest priority reference that is available and valid is the reference that is selected.
- **Time**—The reference selected to provide the necessary “Time” reference.
- **1PPS**—The reference selected to provide the necessary “1PPS” reference.
- **Enabled**—The reference is enabled.
- **Delete**—Removes the Index (row) from the Reference Priority table.

#### 3.3.1 Configuring Input Reference Priorities

VelaSync can use numerous external time sources, referred to as "references". As external time sources may be subject to different degrees of accuracy and reliability, you can determine in which order (= priority) VelaSync calls upon its external time and 1PPS references.

For additional information, see also "Input Reference Priorities" on page 110.

**Accessing the Reference Priority Screen**

To access the **Reference Priority Setup** screen:
1. Navigate to **MANAGEMENT > OTHER: Reference Priority**.

OR:

1. On the **HOME** screen, click the GEAR icon in the **Reference Status** panel:

![Reference Status panel](image)

2. The **Configure Reference Priorities** screen will display.

   The **Reference Priority** screen is divided into 3 areas:
   
   a. The **Actions** panel, which provides a single action:
      
      » Restore Factory Defaults
   
   b. The **Configure Reference Priorities** panel, which displays the priority of VelaSync’s references in a table form.
      
      In this panel you can:
      
      » Add and configure new references
      
      » Delete references
      
      » Enable/disable references
      
      » Reorder the priority of VelaSync’s references
   
   c. The **Reference Status** panel
      
      » The **Reference Status** panel provides a real time indicator of the status of the VelaSync’s references. It is the same as the **Reference Status** panel on the **HOME** screen of the Web UI.

**Adding an Entry to the Reference Status Table**

To add a new entry to the **Reference Status** table:

1. Navigate to the **Configure Reference Priorities** screen via **MANAGEMENT > OTHER: Reference Priority**.

2. Click the PLUS icon in the top right-hand corner of the **Configure Reference Priorities** table.

3. The **Add Reference** window will display:
4. In the **Add Reference** window, enter:
   - **Priority Level**: Assign a priority to the new reference.
   - **Time**: Select the time reference.
   - **PPS**: Select the PPS reference.
   - **Enabled**: Check this box to enable the new reference.

5. Click **Apply** or **Submit**. (**Submit** will close the window.)

**Deleting a Reference Entry**

To delete an entry from the **Reference Status** table:

1. Navigate to the **Configure Reference Priorities** screen via MANAGEMENT > OTHER: Reference Priority.
2. In the **Configure Reference Priorities** table click the **Delete** button on the right-hand side of the entry you wish to delete.
3. In the pop-up window that opens click **OK** to confirm.

**Reordering Reference Entries**

To reorder the priority of a reference entry:

1. Navigate to the **Configure Reference Priorities** screen via MANAGEMENT > OTHER: Reference Priority.
2. Click and hold on the item whose priority you wish to reorder.
3. Drag the item up or down to the desired place.
4. Click **Submit**.

### Resetting Reference Priorities to Factory Defaults

To reset all references in the Reference Priority table to their factory default priorities:

1. Navigate to the **Configure Reference Priorities** screen via **MANAGEMENT > OTHER: Reference Priority** menu.
2. In the **Actions** panel, click the **Restore Factory Defaults** button.

### 3.3.1.2 The "Local System" Reference

The **Local System** reference is a "Self" reference, i.e. VelaSync uses itself as an input reference for Time, or as a 1PPS reference. The **Local System** is a unique input reference in that it can be used as either the Time reference, or the 1PPS reference, but never both.

**Note:** For VelaSync to operate as a **Local System** reference, you must have either a valid external Time reference, or a valid external 1PPS reference.
When the Time reference is configured as **Local System**, VelaSync's System Time is considered a valid reference, as long as the external 1PPS input reference is valid.

Vice versa, when the 1PPS reference is configured as **Local System**, VelaSync's built-in oscillator is considered a valid reference, as long as the external Time reference is valid.

### Use case "Local System Time"

The **Local System** reference when used for **Time** allows VelaSync to operate using its current Time-of-Day (ToD) for Time, while synchronized to an external 1PPS reference.

While you may intentionally offset the time in this scenario, the second will be precisely aligned to the external 1PPS reference. Therefore, this use case qualifies as a legitimate, traceable time source.

Instead of an offset time, **Local System** can also be used as a backup Time reference (e.g., Priority "2"): Should the external Time reference become invalid, the **Local System** Time will become the valid backup reference, disciplined by the external 1PPS reference: VelaSync will transition to the **Local System** Time, without going into Holdover.

### Use case "Local System 1PPS"

The **Local System** reference can also be used for **1PPS**: This allows VelaSync to operate using an external ToD for time, while generating 1PPS from its own internal oscillator.

In this rare use case the 1PPS is NOT aligned to any standard, therefore the time may drift, and must be considered untraceable.

### 3.3.1.3 The "User/User" Reference

While it is normally not required, it is possible for you as the "User" to override the **System Time** (even if it is synchronized to a valid reference) with a manually set time, steered by an undisciplined oscillator, and use this manually set Time as an output reference. This concept is referred to as the **User/User** reference, because both the Time, and the 1PPS reference are not linked to any UTC-based external reference, but hand-set by you.

**Caution:** Since the **User/User** reference is not traceable to a valid reference, it does not qualify as a legitimate time source. Operating VelaSync with a manually set **User** time bears the risk of inadvertently outputting an illegitimate System Time thought to be a valid reference time.

### Use cases for the "User/User" reference

The **User/User** reference is provided for the following use cases:
a. No external references are available (yet), but you need a reference for testing or setup purposes. This may be the case e.g., while waiting for a GNSS antenna to be installed.

b. No external references are required e.g., if VelaSync is used solely to synchronize computers on a network, with no need for traceable UTC-based timing.

c. To utilize a backup reference as soon as possible after a power cycle or reboot of VelaSync, while waiting for the primary reference (e.g., GNSS) to become valid. To this end, in the Edit System Time window, the checkbox Synchronize to Battery Backed Time on Startup must be checked, AND the User/User reference is assigned a reference priority number other than "1". Note that a Time jump and/or 1PPS jump are likely to happen once the primary reference becomes valid.

Combining a User Time reference with a non-User 1PPS reference or vice versa is not a typical use case. Use the Local System reference instead, see "The "Local System" Reference" on page 115.

Built-in safety barrier

In order to "validate" (= green status lights) the User/User reference, the hand-set time must be manually submitted every time after VelaSync reboots or resets, or after the Holdover period has expired: In the Edit System Time window, the checkbox Manual Time Set must be checked. The System Time displayed in the field below will become valid the moment the Submit button is clicked.

See also below, "How long will the User/User reference be valid?": The notion of limiting the validity of the User/User reference also serves as a safety feature.

How long will the User/User reference be valid?

Since the User/User reference does not qualify as a legitimate, traceable time, it becomes invalid once VelaSync is reset, or power-cycles, or after the Holdover Time expires.
(whichever occurs first). It then needs to be set manually and submitted again (Edit System Time > Manual Time Set).

The only workaround for this is "Using Battery Backed Time on Startup" on page 101. This will allow VelaSync to apply the User/User reference after a power-cycle without manual intervention.

**How to setup the User/User Reference**

See "Manually Setting the Time" on page 99.

**Using the "User" Reference with Other References**

If the User/User reference is used in conjunction with other, external references (such as GNSS or IRIG), the System Time should be set as accurately as possible:

Otherwise, the large time correction that needs to be bridged when switching from a lost reference to a valid reference, or from a valid reference to a higher-priority reference that has become available again, will cause NTP to exit synchronization. If the difference is under 1 second, NTP will remain in sync and will "slew" (over a period of time) to the new reference time.

### 3.3.1.4 Reference Priorities: EXAMPLES

**Example 1 – GNSS as primary reference, IRIG as backup:**

In this use case, the objective is to use:

- GNSS as the primary Time, and 1PPS reference
- IRIG as the backup Time, and 1PPS reference.

**Step-by-step procedure:**

1. Move the reference which has “GPS 0” in the Time column and “GPS 0” in the 1PPS column to the top of the table, with a Priority value of 1. Click the Enabled checkbox.
2. Move the reference which has “GPS 0” in the Time column and “GPS 0” in the 1PPS column to the top of the table, with a Priority value of 1. Click the Enabled checkbox.
3. Move the reference which has “GPS 0” in the Time column and “GPS 0” in the 1PPS column to the top of the table, with a Priority value of 1. Click the Enabled checkbox.

Since both of these references are default references, no additional references need to be added to the Reference Priority table.
Example 2 – IRIG as primary reference, NTP input as backup

In this use case, the objective is to use:

- IRIG as the primary reference input
- Another NTP server as backup reference

Step-by-step procedure:

1. Move the reference which has “IRIG 0” in both the **Time** column and “IRIG 0” in the **1PPS** column to the top of the table, with a **Priority** value of 1. Click the **Enabled** checkbox.

2. Move the reference which has “NTP” in the **Time** column and “NTP” in the **1PPS** column to the second place in the table, with a **Priority** value of 2. Click the **Enabled** checkbox.

3. For all other references, uncheck the **Enabled** checkbox, so that they are all disabled.

Since both of these references are *default* references, no additional references need to be added to the **Reference Priority** table.

Example 3 – NTP input as the only available input (“NTP Stratum 2 operation”)

In this use case, the objective is to have NTP provided by another NTP server as the only available reference input, i.e. the unit to be configured is operated as a Stratum 2 server. For more information, see "Configuring "NTP Stratum Synchronization" on page 1.

Step-by-step procedure:

1. Move the reference which has “NTP” in the **Time** column and “NTP” in the **1PPS** column to the top of the table, with a **Priority** value of 1. Click the **Enabled** checkbox.

2. For all other references, uncheck the **Enabled** checkbox, so that they are all disabled.

3. Configure the NTP Service as described under "Configuring "NTP Stratum Synchronization"" on page 1.

**Note:** When selecting NTP as an input reference, do not select another reference (such as GNSS, IRIG, etc.) to work with NTP as a reference. NTP should always be selected as both the Time and 1PPS input when it is desired to use NTP as an input reference.
Example 4 – Time set manually by the User. Other references may or may not be available

**Note:** In order for a manually set time to be considered valid and used to synchronize VelaSync, a “User” needs to be created and enabled in the Reference Priority table. “The "User/User" Reference” on page 116.

In this use case, the objective is to use a hand-set time, in combination with VelaSync’s oscillator as a 1PPS source as valid references.

**Step-by-step procedure:**

1. If necessary (see NOTE above), create a “User.”
2. Move the reference which has “User 0” in the Time column and “User 0” in the 1PPS column to the top of the table, with a Priority value of 1. Click the Enabled checkbox.
3. For all other references, uncheck the Enabled checkbox, so that they are all disabled.

If the objective is to use a manually set time as a backup to other references (such as GNSS or IRIG):

1. Move the "User/User" reference to a place in the table that has a priority lower than the references the "User/User" reference will be backing up. Make sure the Enabled checkbox is selected.
2. With “User/User” enabled, if no other higher priority references are enabled or available (or if the higher priority references have since been lost), you can now manually set the System time to the desired value (MANAGEMENT > OTHER: Time Management > System Time > Manual Time Set). See "System Time" on page 96 for more information. VelaSync will go into synchronization using this set time once you click the Submit button.

**Note:** You will need to repeat this procedure each time VelaSync is power-cycled (with no other references available), unless you enabled the feature Synchronize to Battery Backed Time on Startup.

Example 5—Time at power-up ("Local System Time") to be considered "Valid". GNSS input to serve as 1PPS reference

The objective of this use case is to allow VelaSync to use itself as a valid reference. This is
referred to as “Local System” time.

In order for this to happen, VelaSync requires an external Time, or 1PPS reference. In other words, “Local System” cannot be both Time, and 1PPS. This makes "Local System" a legitimate, traceable reference.

Therefore the "Local System" does not have to be manually set ("validated") by the User after VelaSync was power cycled (as would be the case with a "User/User" reference).

Since “Local System” cannot be both Time, and 1PPS input together, in this example the GNSS input will be set as the 1PPS reference (other use cases may require using different references, e.g. IRIG.)

As there is no default entry for “Local System” and “GPS”, a new entry needs to be added to the Reference Priorities table in order to use this combination of references.

**Step-by-step procedure:**

1. Add a reference to the Reference Priority by clicking the PLUS icon. Use the following settings, then click Submit:
   - In the Priority Level text box, enter 1. This will give this reference the highest priority.
   - In the Time field, select “Local System”.
   - In the PPS field, select “GPS”.
   - Check the Enabled checkbox.

2. Confirm that the first reference in the Reference Priority table has “Local System” as the Time input and “GNSS” as the 1PPS input.

3. After a power cycle or reboot, as soon as GNSS is declared valid, the System Time will automatically be used as-is, with no manual intervention required.

### 3.3.2 Reference Qualification and Validation

#### 3.3.2.1 Reference Monitoring: Phase

The quality of input references can be assessed by comparing their phase offsets against the current system reference, and against each other. This is called Reference Monitoring.

Reference Monitoring helps to understand and predict system behavior, and is an interference mitigation tool. It can also be used to manually re-organize reference priorities e.g., by assigning a lower reference priority to a noisy reference or a reference with a significant phase offset, or to automatically failover to a different reference if certain quality thresholds are no longer met.
VelaSync allows Reference Monitoring by comparing the phase data of references against the System OnTime Point. The phase values shown are the filtered phase differences between each input reference 1PPS, and the internal disciplined 1PPS.

The data is plotted in a graph in real-time. The plot also allows you to display historic data, zoom in on any data range or on a specific reference. A data set can be exported, or deleted.

To monitor the quality of references, navigate to **TOOLS > SYSTEM: Reference Monitor**. The Reference Monitor screen will display:

![Reference Monitor Screen](image)

On the left side of the screen, **Status** information is displayed for the System and the References. Note that the **Reference Status** panel also displays the latest PHASE OFFSET reading (1) for active references against the System OnTime Point. The reading is updated every 30 seconds.

This Reference Phase Offset Data is plotted over time (abscissa) in the **Reference Monitor** panel in the center of the screen. Use the check boxes in the **References** panel (2) to select the reference(s) for which you want to plot the phase offset data. Use the handles (3) to zoom in on a time window.

The scale of the axis of ordinate (4) is determined by the largest amplitude of any of the references displayed in the current time window. Use the checkboxes in the **References** panel on the right to remove references from the graph, or add them to it.

### 3.3.3 The GNSS Reference

With most applications, VelaSync will be setup such that it utilizes a GNSS signal as the primary (if not the only) timing reference.

VelaSync's GNSS receiver utilizes the signal provided by the GNSS antenna.
The GNSS receiver analyzes the incoming GNSS data stream and supplies the GNSS time and 1PPS (Pulse-Per-Second) signal to VelaSync’s timing system. The timing system uses the data to control the System Time and discipline the oscillator.

While VelaSync’s default GNSS receiver configuration will likely be adequate for most applications, it is advisable that you review the options and change settings as needed, particularly if you are experiencing poor signal reception.

To access the GNSS Receiver settings:

1. Navigate to INTERFACES > REFERENCES: GNSS 0.

   Note: Typically, there will be only one GNSS reference, numbered "0".

2. The GNSS 0 status window will open. To open the configuration window, click Edit in the bottom-left corner.

OR:

1. Navigate to INTERFACES > REFERENCES: GNSS Reference.
2. Click on the INFO button, or the GEAR button to configure the GNSS settings, or review GNSS reference status information.

### 3.3.3.1 Reviewing the GNSS Reference Status

To view the current status of your GNSS reference:
1. Navigate to **INTERFACES > REFERENCES: GNSS Reference**.

2. Click the **INFO** button next to **GNSS 0**. The **GNSS 0** status window will display; it contains two tabs, explained in detail below: **Main** (= default), and **Satellite Data**.

**The "Main" tab**

Under the **Main** tab, the following information will display:

> **Note:** Detailed information on the different parameters can be found in the subsequent GNSS topics.
» Manufacturer/Model: The manufacturer and/or model of the GNSS receiver in your VelaSync unit.

» Validity: Status indicator lights for TIME and 1PPS signals: “On” (green) indicates a valid signal, “Off” (red) indicates that no valid signal is available. A yellow 1PPS light indicates that the monitored 1PPS value fell below a quality threshold and the unit is in flywheel mode.

» Receiver Mode:
  » Single Satellite: Used in areas with poor GNSS reception.
  » Standard: Default operating mode for the GNSS receiver.
  » Mobile: For non-stationary applications.

» Receiver Dynamics: (u-blox receivers only); see “Setting GNSS Receiver Dynamics” on page 132.

» Survey Progress: Real-time status:
  » ACQUIRING (x Satellites)—red
  » SURVEYING (x %)—yellow; remains at 1% if no satellites are in view
  » COMPLETE—green

» Number of Tracked Satellites: The number of satellites currently being tracked.

» Offset: As set by the user, in nanoseconds.

» Antenna Sense:
  » OK (green)
  » Open: Check the antenna for the presence of an open.
  » Short: Check the antenna for the presence of a short circuit.

» Position: VelaSync’s geographic position by:
  » Latitude: In degrees, minutes, seconds
  » Longitude: In degrees, minutes, seconds
  » Altitude: In meters MSL (Mean Sea Level)

» Receiver Constellation: GPS/GLONASS/Galileo/BeiDou/QZSS

» Client A-GPS Status: A-GPS is ENABLED and running, or DISABLED

» Client A-GPS Data: External A-GPS data is AVAILABLE, or UNAVAILABLE

» Server A-GNSS Status: The Rinex Server feature is ENABLED and running, or DISABLED

» Server A-GNSS Data: A-GPS data is AVAILABLE and can be downloaded by clients, or it is UNAVAILABLE
Identified Satellite Signal Strengths: Bar graphs for all satellites detected. Color indicates signal strength. With your mouse pointer, hover over a bar graph to display tool tip information about satellite constellation, satellite number, and signal strength.

<table>
<thead>
<tr>
<th>Letter Symbol</th>
<th>GNSS Constellation</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>GPS</td>
</tr>
<tr>
<td>R</td>
<td>GLONASS</td>
</tr>
<tr>
<td>E</td>
<td>Galileo</td>
</tr>
<tr>
<td>J</td>
<td>QZSS</td>
</tr>
<tr>
<td>C</td>
<td>BeiDou</td>
</tr>
<tr>
<td>I</td>
<td>IRNSS</td>
</tr>
</tbody>
</table>

The "Satellite Data" tab

Under the Satellite Data tab, there are two graphs:

- **Number of Satellites over Time**: A graphical track of how many satellites were being tracked over time.
- **SNR over Time**: A graphical track of maximum SNR, and minimum SNR.
In both graphs, to see a legend of the graphical data, and time-specific status data, click inside the graph, choosing the desired point in time. If necessary, increase the time resolution by dragging the time sliders. A pop-up window will display the legend for that graph, and the status information for the selected time.

3.3.3.2 Determining Your GNSS Receiver Model

**Note:** All VelaSync models are currently shipped with a u-blox M8T Receiver.

To determine which GNSS receiver model is installed in a VelaSync unit:

1. Navigate to **TOOLS > SYSTEM: Upgrade/Backup**.
2. In the **System Configuration** panel, locate the line item **GNSS Receiver**:

**GNSS Receiver Models**

Spectracom strives to equip VelaSync with current technology. Depending on the production date of your VelaSync unit, one of the following GNSS receiver models will be installed in your unit (if any):
3.3.3.3 Selecting a GNSS Receiver Mode

When connected to a GNSS antenna that receives a GNSS signal, VelaSync can use GNSS as an input reference. The factory default configuration allows GNSS satellites to be received/tracked with no additional user intervention required.

However, there are several user-configurable GNSS settings:
The Receiver Mode function allows the GNSS receiver to operate in either a stationary mode ("Standard" or "Single Satellite" modes), or in a mobile mode environment e.g., in a vehicle, ship or aircraft.

- **Offset [ns]**: to account for antenna cable delays and other latencies
- **Receiver dynamics**: to optimize performance for land, sea or air operation
- The ability to **delete** the stored GNSS position information (latitude, longitude and antenna height).
- The option to determine when a **resurvey** is to be performed (supported only by newer GNSS receivers).

To configure the GNSS Receiver Mode for your VelaSync unit:

1. Navigate to **INTERFACES > REFERENCES, GNSS 0**. The GNSS 0 Status panel will open.
2. Select **Edit** in the bottom-left corner. The GNSS 0 configuration window will open:

![GNSS 0 Configuration Window](image)

3. Select the desired Receiver Mode, and click **Submit**.

**GNSS Receiver Modes**

The receiver modes are:

**Standard GNSS Receiver Mode**

The default GNSS receiver mode is the **Standard Mode**: It is the most accurate, and hence the preferred GNSS receiver mode.

The Standard Mode can be used **only for stationary applications**, i.e. the VelaSync unit will not be moved. Also, it must be able to track initially at least four satellites in order to complete the survey. (Once the survey is completed, less than four satellites will provide a valid Time and 1PPS.)

In the Standard Mode the **GNSS survey** will initially be performed, once at least four GNSS satellites become available. The GNSS survey is used to determine the exact position and time; it takes 2000 seconds (33 minutes) to complete a survey. During the survey, the GNSS receiver must continue to track at least four satellites, otherwise the GNSS survey will not complete.
Upon completion of the GNSS survey the GNSS receiver will lock-in the calculated GNSS position and will enter **Standard Mode**. Once in **Standard Mode**, the GNSS survey will only be performed again if:

- the unit is halted or rebooted (see "Performing a GNSS Receiver Survey" on page 133).
- the equipment will be relocated to another location and the receiver detects this (applies to most Trimble receivers)
- you manually delete the GNSS position, see "Deleting the GNSS Receiver Position" on page 136.

In the event that VelaSync cannot complete a GNSS survey within 24 hours (e.g., the survey progress does not go beyond 99%), see "Single Satellite GNSS Receiver Mode" below.

### Single Satellite GNSS Receiver Mode

The **Single Satellite Mode** is designed for use cases in which it is not possible for the GNSS receiver to track at least **four GNSS satellites** for at least **33 minutes** continuously in a 12-hour time window so as to complete the GNSS survey, i.e. obtain a 3-D fix. In such cases, VelaSync cannot operate in **Standard Mode**. This occurs frequently in areas with limited view of the sky (e.g., "urban canyons").

In Single Satellite Mode, the GNSS receiver will be considered a valid input reference as long as:

a. the receiver was able to complete a survey during a time window with good satellite reception, OR you have manually entered a valid position for your antenna location (instructions can be found under "Manually Setting the GNSS Position" on page 138 and "Determining Your Position" on page 139.)

b. the GNSS receiver continues to track at least **one qualified satellite**.

Note that VelaSync is designed to provide the most accurate time in **Standard Mode**, hence the Single Satellite Mode should only be used if the GNSS receiver could not complete a survey. Note also that Single Satellite Mode can only be used if the VelaSync unit remains stationary at all times.

### Mobile GNSS Receiver Mode

In **Mobile Mode** no surveys will be carried out since the position status is updated in near real-time. VelaSync will go into synchronization shortly after beginning to track satellites.

The **Mobile Mode** should only be selected if your VelaSync unit will NOT remain stationary at all times, i.e. instead of being operated in a building, it is installed in a mobile platform (such as a vehicle, ship, plane, etc.).
3.3.3.4 Setting GNSS Receiver Dynamics

Receiver Dynamics further refine the reception characteristics for the individual receiver modes and determine if the receiver will automatically resurvey after a reboot.

Caution: If you select a setting that does NOT resurvey, and subsequently relocate your unit (antenna) by more than 100 m, u-blox M8T receivers will NOT detect the new position, and hence provide an incorrect time.

For more information about the GNSS Survey, see "Performing a GNSS Receiver Survey" on the facing page.

For more information on Receiver Modes, see "Selecting a GNSS Receiver Mode" on page 129.

To change/review the GNSS Receiver Dynamics:

1. Navigate to INTERFACES > REFERENCES: GNSS 0.
2. Under the Main tab of the GNSS 0 status window, the line item Receiver Dynamics will indicate the current setting.
3. To change the setting, click Edit in the bottom-left corner. The GNSS 0 configuration window will display:

4. Select a setting and click Submit.

The following table illustrates the interdependence between Receiver Dynamics, Receiver Mode (see "Selecting a GNSS Receiver Mode" on page 129) and receiver type:

<table>
<thead>
<tr>
<th>Receiver Mode</th>
<th>Receiver Dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Land (Resurvey)</td>
</tr>
<tr>
<td></td>
<td>Sea</td>
</tr>
<tr>
<td></td>
<td>Air</td>
</tr>
<tr>
<td></td>
<td>Stationary (No Resurvey)</td>
</tr>
<tr>
<td>Single Satellite</td>
<td>irrelevant</td>
</tr>
<tr>
<td></td>
<td>irrelevant</td>
</tr>
<tr>
<td></td>
<td>irrelevant</td>
</tr>
<tr>
<td></td>
<td>irrelevant</td>
</tr>
</tbody>
</table>
3.3.3.5 Performing a GNSS Receiver Survey

When VelaSync's integrated GNSS receiver performs a survey, it tries to determine or verify its geographic position with high accuracy. An accurate geographic position is required to calculate a precise system time from the GNSS reference.

During a GNSS survey, the position will be iteratively recalculated while gradually increasing the position accuracy. A survey can take up to 33 minutes, but typically VelaSync will synchronize earlier, i.e. offer a valid Time and 1PPS reference, once it has obtained a sufficiently accurate preliminary position.

Notes:

- The u-blox M8T receiver now uses Land to indicate it will RESURVEY on reboot, and Stationary to indicate it will not resurvey after reboot.

Verifying GNSS Survey Progress

To see if VelaSync's GNSS receiver is performing a survey and if so, verify its progress:
1. Navigate to **INTERFACES > REFERENCES: GNSS 0**.

2. The survey status (ACQUIRING, COMPLETE, or progress in percent) is displayed under the line item Survey Progress.

![GNSS 0 configuration window]

**Note:** Once a survey has been initiated, the Survey Progress may not be displayed right away until the receiver has completed its initialization process.

### 3.3.3.6 GNSS Receiver Offset

The **Offset** setting in the GNSS configuration window (**INTERFACES > GNSS 0 > “Edit”**) allows you to enter an offset to the GNSS time and 1PPS reference in order to account for antenna cable delays or other latencies (entered and displayed in nanoseconds).

By setting the correct **Offset** value, you can offset the system’s **on-time point** by the **Offset** value to compensate for the antenna and in-line amplifier delays. Under typical conditions, the expected cable and amplifier delays are negligible. You can calculate the delay based on the manufacture’s specifications.

The offset range is ±½ seconds (i.e. ±500 ms, or ±500 000 000 ns). The default value is 0 nanoseconds, and the resolution is 1 nanosecond.

**Configuring a GNSS receiver offset**

To configure the GNSS receiver offset:

1. Navigate to **Interfaces > References: GNSS Reference**

2. Click on the GEAR button next to the GNSS Reference. The **GNSS 0** window will open:
3. Locate the **Offset** field, and enter the desired value.
4. Click Submit.

### Calculating cable delay

The following formula can be used to calculate antenna cable delay:

\[
D = \frac{(L \times C)}{V}
\]

Where:
- \(D\) = Cable delay in nanoseconds
- \(L\) = Cable length in feet
- \(C\) = Constant derived from velocity of light: 1.016
- \(V\) = Nominal velocity of propagation expressed as decimal, i.e. %66 = 0.66 Value is provided by cable manufacturer.

When using Spectracom **LMR-400** or equivalent coaxial cable, this formula equates to approximately 1.2 nanoseconds of delay per every foot of cable. To calculate the Offset value (cable delay), multiply the length of the entire cable run by “1.2” and then enter this value into the Offset field.

#### Examples of LMR-400 (or equivalent) coax cable delays:

- 100 feet of cable = 120 nanoseconds of cable delay
- 200 feet of cable = 240 nanoseconds of cable delay
- 300 feet of cable = 360 nanoseconds of cable delay

### 3.3.3.7 Resetting the GNSS Receiver

The **Reset Receiver** command causes the GNSS receiver to execute a cold start: All data will be erased from the volatile receiver memory. Only non-volatile memory is preserved.
Caution: Resetting the GNSS receiver may become necessary in the rare event of internal communication issues, and is typically ONLY required if Spectracom Technical Support advises you to execute this command.

Note that resetting the GNSS receiver is not the same as "Deleting the GNSS Receiver Position" below.

To reset the GNSS Receiver:

1. Navigate to Interfaces > References: GNSS Reference
2. Click on the GEAR button next to the GNSS Reference. The GNSS 0 window opens:

3. Locate the Reset Receiver box, check it, and click Submit.

3.3.3.8 Deleting the GNSS Receiver Position

The VelaSync timing system requires the exact geographic position in order to calculate the exact system time from the GNSS signal.

The Delete Position command deletes the GNSS antenna position data that is stored in the non-volatile memory of the GNSS receiver.

The deletion of the position data will automatically initiate a new GNSS self survey, provided:

- a GNSS antenna is connected to VelaSync
- the GNSS receiver can track at least four satellites continuously
- and the GNSS receiver it is configured to operate in Standard Mode.

The objective of the GNSS Survey is to re-discover the current antenna position.

Note: A self survey will take at least 2000 seconds (33 minutes).
Relocating VelaSync

The **Delete Position** command may need to be used if a VelaSync system is physically moved, and it did not self-initiate a new survey automatically. Note that neglecting to delete the old position data and discover the new position data will cause VelaSync not to go into synchronization state.

Sanitization

The **Delete Position** command must also be used when **sanitizing** a VelaSync unit (ensuring that no trace of position data remains on the unit).

Deleting the GNSS position

To delete the GNSS position:

1. Disconnect the GNSS antenna from the VelaSync unit (this is required only when **sanitizing** the unit).
2. Navigate to **Interfaces > References: GNSS Reference**.
3. Click on the **GEAR** button next to the GNSS Reference (typically, there is only one reference, numbered “0”). The **GNSS 0** window will open:

   ![GNSS 0 Window]

   Locate the **Delete Position** box, check it, and click Submit.

4. VelaSync will initiate a GNSS self survey.

   **Note:** In **Mobile Receiver Mode**, it is NOT possible to delete the position and start the GNSS survey. This feature is only available in **Standard Mode** and in **Single Satellite Mode**. In Single Satellite Mode a GNSS survey may take up to 24 hours.
3.3.3.9 Manually Setting the GNSS Position

**Note:** This topic applies only to stationary applications, i.e. to Standard mode, or Single Satellite mode.

The exact geographic position (location and elevation) of the antenna your VelaSync unit—and thus its onboard GNSS receiver—is a major factor for VelaSync to calculate an accurate System Time from the GNSS reference.

**Note:** The elevation (altitude) should be set in accordance with the World Geodetic System 1984 (WGS 84), not Mean Sea Level (MSL).

Normally, the onboard GNSS receiver will track and adjust the antenna position during the so-called GNSS self survey, which is performed during initial commissioning of a VelaSync unit, or when rebooting a unit after it had been powered down for some time ("cold start"). Depending on where your GNSS antenna is installed and thus, how good the reception is, the self survey may be adequate for most applications.

Setting a Manual Position, however, i.e. manually applying your current geographic position data (Latitude, Longitude, and Altitude) may be necessary if your GNSS receiver could not complete its survey due to poor reception.

In some cases, setting the position manually may also help to reduce the amount of time needed for the initial position "fix", i.e. for VelaSync to synchronize with the satellites in view.

Note that this position will also be used if Apply A-GPS Data is checked.

To manually set your position:

1. Determine your geographic position. For more information, see "Determining Your Position" on the facing page.

2. Navigate to INTERFACES > REFERENCES: GNSS 0. In the GNSS 0 status window, click Edit in the lower left corner. The GNSS 0 window will open:
3. Under **Manual Position Set** accurately enter **latitude**, **longitude** (both in decimal degrees), and **altitude** (in meters [WGS 84]) of your GNSS antenna, VelaSync can use this data during the satellite tracking/adjustment process, which typically leads to a quicker "fix". It is recommended to enter the position as accurately as possible.

**Determining Your Position**

**To determine your GNSS position, using Google Maps™:**

2. In Google Maps, locate your building, and the location of your antenna.
3. Right-click on the location. Select **What's here?** At the bottom, you will see a card with the coordinates.
4. Take note of your **decimal** position (e.g., 43.083191, -77.589718).

**Note:** Should you prefer to determine your position in a different way, and as a result, have your latitude & longitude data in degrees/minutes/seconds, you need to convert this data to the decimal format e.g., by using a conversion tool, such as Earth Point [www.earthpoint.us](http://www.earthpoint.us), or [https://www.fcc.gov/media/radio/dms-decimal](https://www.fcc.gov/media/radio/dms-decimal).
5. Determine your altitude. To find the elevation of your location, search online for a Google Maps elevation finder tool. Do not forget to add the height above ground for your antenna.

If a more exact altitude is desired, the use of a topographical map is recommended. Applying the WGS 84 standard will likely yield the most accurate elevation.

### 3.3.3.10 GNSS Constellations

VelaSync allows you to select which GNSS constellations can be tracked. For example, you can determine if you want GLONASS satellites to be tracked (besides GPS).

**Selecting GNSS Constellations**

Your VelaSync is capable of tracking multiple GNSS constellations simultaneously.

To verify if satellite signals for the selected GNSS constellations are currently received, see "Determining Which GNSS Satellites Are Received" on page 142.

**Configuring GNSS Constellations**

To configure which GNSS constellations VelaSync's GNSS receiver shall track:

1. Navigate to INTERFACES > REFERENCES: GNSS Reference.
2. Click the GEAR button next to GNSS 0. The GNSS 0 window will open:
3. Under **Selected Constellations**, review which constellations are currently tracked, and apply your changes. Note the following:

» The **u-blox M8T** receiver is capable of receiving multiple GNSS constellations simultaneously; the table below shows which combinations are possible:

<table>
<thead>
<tr>
<th>GPS</th>
<th>Galileo</th>
<th>GLONASS</th>
<th>BeiDou</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>X</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>X</td>
<td>–</td>
</tr>
<tr>
<td>X</td>
<td>X</td>
<td>–</td>
<td>X</td>
</tr>
<tr>
<td>X</td>
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<td>X</td>
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<tr>
<td>–</td>
<td>–</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**Note:** The augmentation systems SBAS and QZSS can be enabled only if GPS operation is enabled.
About QZSS

QZSS is disabled by default. In order to receive QZSS signals, you must either be located in the Japan region, or use a GNSS simulator (such as Spectracom GSG-5 or -6 Series).

QZSS is not considered a standalone constellation and while VelaSync allows you to enable QZSS by itself, it is recommended to use it in combination with GPS.

Determining Which GNSS Satellites Are Received

To see which GNSS satellites your VelaSync is currently receiving:

1. Navigate to INTERFACES > REFERENCES: GNSS 0.
2. The GNSS 0 status window will open:

![GNSS 0 status window]

3. Under Identified Satellite Signal Strengths hover with your cursor over the bars:

The letter in the tooltip window displayed for each signal bar indicates which
3.3.3.11 A-GPS

A-GPS stands for Assisted GPS. This widely-used technology involves providing additional data to the GNSS receiver by an alternative means of communication (e.g., via IP, or by manual data entry), thereby reducing the time for the receiver to acquire and track the actual satellite signals. This may lead to a significantly shorter time for VelaSync to deliver a GNSS-based timing signal upon a “cold start” of the unit.

A-GPS client

The A-GPS client is used to send assistance data to the GPS receiver. This is most useful in areas with poor GPS reception.

A-GNSS server

An A-GNSS server allows a VelaSync unit to operate as a server, thus providing A-GNSS ephemeris and almanac data to other client devices e.g., a Spectracom GSG-series GNSS simulator.

Caution: Do NOT use GLONASS when operating VelaSync as an A-GNSS server, since this will likely crash the A-GNSS software.

Configuring A-GPS

To review or configure VelaSync’s A-GPS settings:
1. Navigate to **INTERFACES: REFERENCES > GNSS Reference**. The GNSS screen will be displayed.

2. In the **GNSS Reference** panel on the right, click the GEAR button next to **GNSS 0**.

3. In the **GNSS 0** window, locate the **A-GPS** panel at the bottom.

4. Configure the menu options as required:

   **Enable A-GPS Client**
   This feature will schedule assistance data to be collected and updated every hour. On start-up, if data is present, it will be sent to the receiver.

   **Apply A-GPS Data**
   If this option is selected, VelaSync will **immediately** apply the time, position and satellite data to the receiver once you click **Submit**.
   Time and position are user-configurable via the next two menu options; VelaSync collects A-GPS satellite data from an external source automatically.

   **Note:** The options displayed on your screen depend on your system configuration.
**Note:** Once you click **Submit**, any parameters entered under **Apply A-GPS Data** will override the System time and position data. Exercise caution when using this feature, since it could negatively impact the GNSS receiver operation.

---

**Use Current System Time**

Apply VelaSync's currently used System time to the GNSS receiver.

**Set System Time**

Enter a specific date and time, instead of the System time. This may be useful if the System time is known to be incorrect, or if you need a time in the past or future e.g., for simulation purposes. Enter the date and time by using the displayed calendar and time sliders.

**Manual Position Set**

By accurately entering **latitude**, **longitude** (both in decimal degrees), and **altitude** (in meters, WGS-84) of your antenna, VelaSync can use this data during the satellite tracking/adjustment process, which typically leads to a quicker "fix". It is recommended to enter the position as accurately as possible. For more information, see "Manually Setting the GNSS Position" on page 138.

**Note:** When manually setting a position, VelaSync must be in one of the stationary modes, **Standard** or **Single Satellite** (see "Receiver Mode" above).

---

**Generate RINEX/YUMA Files**

**Note:** Regardless of which receiver is installed in your unit, the **GNSS [x] Status** window will display the text "Server A-GNSS Status/Data", even though RES-SMT GG receivers support only GPS server functionality.

---

**M8T receiver**

If the option RINEX Server License (**OPT-AGP**) and a **u-blox M8T** GNSS receiver are installed on your VelaSync, it can be operated as an **A-GNSS server** by providing you the option to select not just GPS, but also Galileo and/or BeiDou, thus allowing the collection of RINEX3 navigation files and almanac files for the GPS, Galileo and/or BeiDou constellations. At this time the GLONASS constellation is NOT supported.
Caution: Do NOT use GLONASS when operating VelaSync as an A-GNSS server, since this will likely crash the A-GNSS software.

Based on accessible and valid GNSS data, VelaSync generates its own ephemeris and almanac data, and stores it in RINEX files and YUMA files, respectively.

Note: RINEX files (ephemeris data) must be updated no later than every 2 hours, because the ephemeris data is valid for 4 hours.

You can also determine how often, or at what time each day the YUMA almanac files will be created. Also, you can assign a 4-character Station Name to be used in the files generated by this unit so that their location can later be identified. Under Record Duration, you can determine after how many days the history files will be overwritten.

Note: YUMA files (almanac data) are valid for day.

The files can be remotely accessed via the /pub path on the VelaSync or via the mapped drive.

Confirming that the A-GPS RINEX Server License is installed on your unit

» Navigate to TOOLS > SYSTEM: Upgrade/Backup. In the System Configuration panel the option OPT-AGP A-GPS RINEX Server must be present.

Activating the A-GPS RINEX Server License functionality

If an A-GPS RINEX Server License is installed on your unit, you have to activate it:

1. Navigate to INTERFACES > GNSS Reference, and click the GEAR button next to GNSS 0.
2. In the A-GPS panel, check the box Generate RINEX/YUMA Files and populate the following options:
» Trimble RES-SMT GG receivers only: RINEX File Every: [default = 10 s]

» Generate YUMA once a day:
  » If checked [default], enter the desired-time-of-day in the field YUMA File At [default = 12:00].
  » If unchecked, determine how often a YUMA file is generated under YUMA File Every [default=10 s; range = 10 s to 86400 s (1/day)].

» Station Name: Enter an alphanumeric 4-letter station name for the server [default: spec]. The names of the files generated will include the station name.

» Record Duration: Determine the duration for how long to keep the generated data before it gets overwritten [default: 7 days; range = between 2 and 400 days]

3. Click Submit to start logging ephemeris and almanac data.

4. Once you submitted the changes, verify that the setup was successful by clicking on Status, and confirming that the indicator lamp for Server A-GPS Status is green/ENABLED. The Server A-GPS Data indicator will be green if the RINEX server is running and the GPS receiver is valid in time and PPS.

**Downloading RINEX/YUMA data**

Any device that can use RINEX data, can be directed to the locations where they are stored. For example, Spectracom’s GSG-series GNSS simulators allow for a server location to be set. With other equipment, you can also download the data to your computer, and then move the files to where they are needed.

To download the data to a client computer, point your computer's web browser to the following address:

» For hourly ephemeris data:
  http://[IP address of your unit]/files/pub/gps/data/hourly/[YYYY]/[ZZZ]/hour[ZZZ]0.15n.Z

» For daily ephemeris data:
  http://[IP address of your unit]/files/pub/gps/data/daily/[YYYY]/[ZZZ]/15n/spec[ZZZ]0.15n.Z
For almanac data:
http://[IP address of your unit]/files/pub/gps/data/almanac/[YYYY]/[ZZZ]/[ZZZ].alm

Where: YYYY: Year (Example: "2017"), and ZZZ: Day of year (Example: "050" for 19-February)

### 3.3.4 Holdover Mode

When input references have been supplying input to VelaSync and input from all the references has been lost, VelaSync will not immediately declare loss of time synchronization, but first will go into Holdover mode. While the unit is in Holdover mode, the time outputs are derived from the internal 10 MHz oscillator incrementing the System Time, but the oscillator is not disciplined/steered by the external reference e.g., GNSS.

Because of the stability of the internal oscillator, accurate time can still be derived even after all the primary references are no longer valid or present. The more stable the oscillator is without an external reference, the longer this holdover period can be and have it still maintain very accurate outputs. The benefit of Holdover is that time synchronization and the availability of the time outputs is not immediately lost when input references are no longer available.

While VelaSync is in Holdover, the only difference is the Holdover and associated Minor alarm are asserted. There are no changes to NTP or any of the other outputs, i.e. while in Holdover mode, NTP inside VelaSync continues to be at the same Stratum level it was at before going into Holdover mode (such as Stratum 1 when synced to GPS). Should the Holdover period expire, however, or the unit is rebooted, the NTP Stratum will go to 16, preventing any clients from being able to sync with VelaSync until GPS or another reference has been restored.

**How long will the unit remain in Holdover mode?**
VelaSync will remain in Holdover mode until either:

a. Any enabled and valid input reference becomes available again: If one or more references return and are declared valid before the Holdover period has expired (even momentarily, i.e. for at least one second), VelaSync exits the Holdover mode and returns to its fully synchronized state.

b. The Holdover Timeout period expires. In this case, VelaSync will declare loss of synchronization.

Note that Holdover mode does not persist through reboots or power cycles. If a reboot or power cycle occurs while VelaSync is in Holdover mode, it will power-up and remain in a "not synchronized" state until at least one valid Time and 1PPS input reference becomes available again. While in this state, NTP will be Stratum 15 and outputs will not be usable. If the input references are restored and then lost or declared not valid again, VelaSync will then go back into Holdover mode.

What is "Holdover Timeout"?

Holdover Timeout is the user-configurable allowable time period in which VelaSync remains in Holdover mode before it declares loss of synchronization. Holdover Timeout can be adjusted according to application-specific requirements and preferences. See below for recommendations on how long (short) the Holdover Timeout should be.

How to configure Holdover Timeout

To set the Holdover Timeout value:

» Navigate to MANAGEMENT > OTHER: Disciplining, and click the GEAR icon in the Status panel:
For more information on the TFOM value and Phase Error Limit, see "Configuring the Oscillator" on page 153.

**Note:** Changes made to the Holdover Timeout always take effect immediately. If VelaSync is in Holdover and the Holdover timeout is changed to a value that is less than the current time period that VelaSync has been in Holdover Mode, the unit will immediately declare loss of synchronization.

**What is the recommended setting for the Holdover Timeout period?**

The factory default Holdover period is **2 hours (7200 seconds)**. The value can be increased to up to 5 years. During this time period, VelaSync will be usable by its NTP clients (or other consumers) after GNSS reception has been lost.

The length of time is really based on the type of oscillator installed in a unit, and what the typical accuracy requirements are for the NTP clients. The longer it can run in Holdover mode before it expires, the longer it can continue being a central time source for all of its clients. But the longer VelaSync runs in Holdover, the larger the offset to true UTC time will become, because the undisciplined oscillator will drift over time:

The better the type of oscillator installed, the more stable it is while in Holdover and therefore, the less its time will drift away from true UTC time. This results in more accurate timing, over extended durations upon the loss of GPS input. For instance, a Rubidium oscillator will maintain significantly better time over a longer Holdover duration than a TCXO oscillator (TCXOs are considerably less stable than a Rb oscillator).
Oscillator Phase Drift

The chart below provides typical stability performance for the oscillator types that can be
found in VelaSync units. These numbers are based on the oscillator being locked to a ref-
ference for two weeks, but then loses GPS reception for an extended period of time, while
the ambient temperature remains stable.

This data can help you determine how long of a Holdover period can be tolerated, based on
how much time drift may occur after GPS input is lost. The larger the time error that can be
tolerated by VelaSync clients, based on the oscillator installed, the larger the Holdover
timeout period can be set to.

### Table 3-3: Estimated Phase Drifts

<table>
<thead>
<tr>
<th>1PPS Phase Drift in Holdover (no reference available)</th>
<th>TCXO</th>
<th>OCXO</th>
<th>Low Phase Noise OCXO</th>
<th>Rubidium</th>
<th>Low Phase Noise Rubidium</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 4 hours</td>
<td>12 µs</td>
<td>1µs</td>
<td>0.5 µs</td>
<td>0.2 µs</td>
<td>0.2 µs</td>
</tr>
<tr>
<td>After 24 hours</td>
<td>450 µs</td>
<td>25 µs</td>
<td>10 µs</td>
<td>1µs</td>
<td>1µs</td>
</tr>
<tr>
<td>After 7 days</td>
<td>3150 µs (3.1 ms)</td>
<td>175 µs</td>
<td>70 µs</td>
<td>7 µs</td>
<td>7 µs</td>
</tr>
<tr>
<td>After 30 days</td>
<td>13950 µs</td>
<td>775 µs</td>
<td>310 µs</td>
<td>31 µs</td>
<td>31 µs</td>
</tr>
</tbody>
</table>

To find out which type of oscillator is installed in your VelaSync, navigate to
MANAGEMENT > OTHER: Disciplining, and look for the line item Oscillator Type in the
Status panel.

**Typical Holdover lengths**

The length of the allowed Holdover Timeout period is displayed and configured in seconds.
The table below provides example conversions for typically desired Holdover periods.

### Table 3-4: Typical Holdover lengths in seconds

<table>
<thead>
<tr>
<th>Desired Holdover Length</th>
<th>Holdover Length (in seconds) to be entered</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 hours</td>
<td>7200 seconds (default value)</td>
</tr>
<tr>
<td>24 hours</td>
<td>86 400</td>
</tr>
<tr>
<td>7 days</td>
<td>604 800</td>
</tr>
<tr>
<td>30 days</td>
<td>2 419 200</td>
</tr>
<tr>
<td>1 year</td>
<td>29 030 400</td>
</tr>
</tbody>
</table>
3.4 Managing the Oscillator

The purpose of the built-in oscillator is to provide VelaSync with an accurate and very stable internal frequency source. This allows VelaSync to go into a holdover mode in the event that external time or frequency references are lost or become invalid. However, the oscillator can also be used as a legitimate 1PPS reference during normal operation, in conjunction with an external time reference (for more information, see "Configuring Input Reference Priorities" on page 112.).
VelaSync's internal oscillator is normally disciplined to an input reference (such as GNSS, IRIG input, 1PPS input, etc.) in order to provide the highest degree of oscillator accuracy and to account for oscillator drift. While disciplining (with a 1PPS input reference input present and valid), the oscillator's output frequency is monitored and based on the measured frequency, the oscillator is steered to maintain a very accurate 10 MHz output. If no valid 1PPS input references are present (or input references are present but not considered valid), the oscillator will be in Freerun mode instead.

If no external input reference such as GNSS, IRIG, etc. is available (or is temporarily lost), VelaSync may become an NTP Stratum 2 or higher reference. If so configured, VelaSync can use a reference such as an NTP daemon, referred to as a Host Reference. If the Host Reference becomes active, it will automatically take over the disciplining of the oscillator. This built-in functionality is referred to as Host Disciplining.

3.4.1 Configuring the Oscillator

VelaSync is equipped with an internal oscillator. To configure the oscillator settings:

Note: Host disciplining is NOT supported by VelaSync units that are equipped with a Rubidium oscillator.
1. Navigate to **MANAGEMENT > OTHER: Disciplining**.

2. Click the GEAR icon at the top of the **Status** panel. The **Oscillators Settings** window will display:

![Oscillators Settings Window]

3. Populate the fields:

   - **Maximum TFOM for Sync**: When TFOM (Time Figure of Merit, see also "Time Figure of Merit (TFOM)" on the facing page) is greater than Max TFOM, disciplining will still be attempted against the selected reference to improve the TFOM. If the condition persists, the system will transition to holdover, and eventually out of sync. When disciplining is performed such that TFOM is no longer greater than max TFOM, the system will transition back into sync.

   - **Holdover Timeout(s)**: The default is 7200 s (= 2 hours).
     For more information on holdover timeouts, see "Typical Holdover lengths in seconds" on page 151. For additional information on holdover, see "What is Holdover Timeout?" on page 149.

   - **Phase Error Limit**: [Default=0 (disables this feature)]. Setting a Limit (valid for +/-) for the Phase Error between an external 1PPS reference and the System 1PPS will cause the disciplining tracking to restart automatically (after a few minutes delay) if that limit is exceeded. This will help to quickly re-align the System 1PPS with a reference.

     When using a Host Reference as a primary or backup reference, for improved performance it is recommended to set the phase error limit for NTP to a suggested value of 100000 ns (= 1 µ second). Adjust this value as needed, based on your accuracy requirements.
» **Restart Tracking**: Check this box, and click Submit if you want to manually restart disciplining tracking. This option causes the disciplining algorithm to stop tracking the input reference and start over (as if it was just acquired). This can be useful if there is a large phase offset between reference 1PPS and system 1PPS, as it may occur when going back into sync to the external reference after a long holdover. A Restart Tracking will re-align the system 1PPS with the reference 1PPS very quickly, but may cause the 1PPS output to jump.

» **Recalibrate**: In rare cases, existing calibration data may no longer be suitable to calibrate the oscillator. This function will delete the existing calibration data, and begin a new calibration process (not applicable for low phase-noise Rubidium oscillators).

4. Click Submit.

### 3.4.1.1 Time Figure of Merit (TFOM)

The TFOM reflects the estimated error range values between the reference 1PPS (such as GPS 1PPS) and the System 1PPS which is being aligned to the 1PPS. The estimated error is referred to as the 1PPS Phase error. TFOM values are ranges of these phase errors. The larger the phase error estimate, the larger the TFOM value will be. For example, TFOM 3 is reported when the estimated phase error is any value between 10 ns to less than 100 ns of the offset between the selected 1PPS reference and the system’s 1PPS.

TFOM is VelaSync’s estimation of how accurately it is synchronized with its time and 1PPS reference inputs, based on several factors, known as the Estimated Time Error or ETE. The larger the TFOM value, the less accurate VelaSync believes it is aligned with its 1PPS input that is used to perform disciplining. If this estimated error is too large, it could adversely affect the performance of oscillator disciplining. The available TFOM range is 1 through 15. You may refer to the following for the TFOM to ETE conversions:

<table>
<thead>
<tr>
<th>Reported TFOM Value</th>
<th>Estimated Time Error (ETE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;= 1 nsec</td>
</tr>
<tr>
<td>2</td>
<td>1 nsec &lt; ETE &lt;= 10 nsec</td>
</tr>
<tr>
<td>3</td>
<td>10 nsec &lt; ETE &lt;= 100 nsec</td>
</tr>
<tr>
<td>4</td>
<td>100 nsec &lt; ETE &lt;= 1 μsec</td>
</tr>
<tr>
<td>5</td>
<td>1 μsec &lt; ETE &lt;= 10 μsec</td>
</tr>
<tr>
<td>6</td>
<td>10 μsec &lt; ETE &lt;= 100 μsec</td>
</tr>
<tr>
<td>7</td>
<td>100 μsec &lt; ETE &lt;= 1 msec</td>
</tr>
</tbody>
</table>
### 3.4 Managing the Oscillator

#### 3.4.2 Monitoring the Oscillator

The Oscillator Management screen provides current and history status information on disciplining state and accuracy.

To access the Oscillator Management screen:

<table>
<thead>
<tr>
<th>Reported TFOM Value</th>
<th>Estimated Time Error (ETE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1 msec &lt; ETE &lt;= 10 msec</td>
</tr>
<tr>
<td>9</td>
<td>10 msec &lt; ETE &lt;= 100 msec</td>
</tr>
<tr>
<td>10</td>
<td>100 msec &lt; ETE &lt;= 1 sec</td>
</tr>
<tr>
<td>11</td>
<td>1 sec &lt; ETE &lt;= 10 sec</td>
</tr>
<tr>
<td>12</td>
<td>10 sec &lt; ETE &lt;= 100 sec</td>
</tr>
<tr>
<td>13</td>
<td>100 sec &lt; ETE &lt;= 10000 sec</td>
</tr>
<tr>
<td>14</td>
<td>ETE &gt; 10000 sec</td>
</tr>
</tbody>
</table>

**Example**

TFOM is a value between 1 and 15. TFOM can never exceed the default MaxTFOM value of 15.

Typically the MaxTFOM requires no adjustment, but in some instances it may be advisable to decrease MaxTFOM so that TFOM can potentially exceed it: For example, by lowering the MaxTFOM to “5” it is now possible for TFOM to be always higher than the MaxTFOM value:

Assuming the MaxTFOM is set to 5 and the TFOM happens to go to a 6, i.e. TFOM is now exceeding MaxTFOM. This condition will cause a 1PPS out of specification alarm to be asserted and the oscillator disciplining will change in order to speed-up the alignment of the system 1PPS to the selected reference (causing it to take less time getting closer into alignment with the reference):

This will cause the TFOM to start to decrease faster. Once TFOM no longer exceeds MaxTFOM because the System 1PPS is now much closer to the reference 1PPS, the disciplining slows back down again as the system 1PPS continues to be brought into alignment with the selected 1PPS input.
1. Navigate to **MANAGEMENT > OTHER: Disciplining**.

2. The **Oscillator Management** screen will display. It consists of two panels:

   ![Oscillator Panels](image)

### The Oscillator Status Panel

This panel provides comprehensive information on the current status of VelaSync's timing state.

- **Oscillator Type**: Type of oscillator installed in the unit.

- **Disciplining State**: State of oscillator control and disciplining; indicates whether or not the internal oscillator is currently being disciplined (steered to an input reference). The states are: "Warm up", "Calibration", "Tracking Setup", "Lock State", "Freerun", and "Fault".

- **1PPS Phase Error**: A tracking measurement [scaled time, in ns, or ms] of the internal 1PPSs' phase error with respect to the selected input reference. Long holdover periods or an input reference with excessive jitter will cause the phase error to be high. The oscillator disciplining control will gradually reduce the phase error over time. Alternatively, restarting the tracking manually (see "Restart Tracking" under "Configuring the Oscillator" on page 153), or automatically via a pre-set Phase Error Limit, will quickly reduce the phase error.

- **10 MHz Frequency Error**: An internal estimated calculation (in Hertz) of the internal oscillator's frequency error, based on the phase accuracy error at the beginning and end of a frequency measurement window (the length of this window will vary...
depending upon the type of oscillator installed and the oscillator adjustment algorithm).

- **Current DAC Setting**: Current DAC value, as determined by the oscillator disciplining system. The value is converted into a voltage that is used to discipline the oscillator. A stable value over time is desirable and suggests steady oscillator performance (see also the graph in the History Panel).

- **DAC Step**: Step size for adjustments to the internal oscillator, as determined by the oscillator disciplining system. Larger steps = quicker, but coarser adjustments. The step size is mainly determined by the type of oscillator.

- **TFOM**: The Time Figure of Merit is VelaSync’s estimation of how accurately the unit is synchronized with its time and 1PPS reference inputs, based on several factors, known as the Estimated Time Error or ETE. The larger the TFOM value, the less accurate VelaSync believes it is aligned with its 1PPS input that is used to perform disciplining. If this estimated error is too large, it could adversely affect the performance of oscillator disciplining. The available TFOM range is 1 through 15.

- **Max TFOM for Sync**: Value, as set under "Configuring the Oscillator" on page 153

- **Temperature(s)**: Three temperatures are displayed:
  - **Oscillator** temperature, which has an effect on oscillator accuracy, and therefore can be used to interpret oscillator performance.
  - **Board** temperature (measured on the main board, sometimes also referred to as ‘System temperature’)
  - **CPU** temperature

  **Note**: Oscillator temperature is plotted over time in the History panel on the right, while graphs for board and CPU temperature can be found under TOOLS > SYSTEM: System Monitor.

- **Last Time Reference Change**: [Timestamp: Last occurrence]
- **Last 1PPS Reference Change**: [Timestamp: Last occurrence]
- **Last TFOM Change**: [Timestamp: Last occurrence]
- **Last Sync State Change**: [Timestamp: Last occurrence]
- **Last Holdover State Change**: [Timestamp: Last occurrence]

**The Oscillator History Panel**

The **Oscillator History Panel** offers real-time graphical monitoring of VelaSync’s internal
timing. The following graphs plot key oscillator-relevant data over time::

- **Phase Error Magnitude**: See [1PPS Phase Error](#).
- **Frequency Error**: See [10_MHz_Frequency_Error](#).
- **Scaled DAC Value**: See [DAC Step](#).
- **Oscillator Temperature**, which has an effect on oscillator accuracy, and therefore can be used to interpret oscillator performance.

You can zoom in on any of the graphs by grabbing the handles at either end and pulling them inwards. The graph will focus in on the time interval you choose in real time.

Clicking on the Delete icon in the top-right hand corner will erase all current oscillator log data.

Clicking on the Download arrow icon will download the latest oscillator log data as a .csv file.

### 3.4.3 Oscillator Logs

To export, or delete the oscillator logs:

1. Navigate to **MANAGEMENT > OTHER: Disciplining**.
2. To **download** the log file: In the **History** panel, click the downwards pointing ARROW icon in the top-right corner:

   ![Download Arrow Icon](#)

3. The log file will be downloaded onto your local computer. Its name is oscillatorStatusLog.csv. Depending on the operating system you can open the file, or save it locally.
To **delete** the log file, click the TRASH CAN icon, and confirm.
System Administration

The following topics are included in this Chapter:

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4.2 Rebooting the System ........................................ 163
4.3 Hardware Tasks ........................................ 163
4.4 Notifications ........................................ 166
4.5 Managing Users and Security ........................................ 175
4.6 Miscellaneous Typical Configuration Tasks .......... 184
4.7 Quality Management ........................................ 187
4.8 Updates and Licenses ........................................ 204
4.1 Issuing the HALT Command Before Removing Power

Gracefully shutting down VelaSync by using the HALT command offers the following advantages over shutting the unit down by interrupting the power supply:

- The shutdown process will be logged
- The System Clock will update the Real Time Clock with the latest System Time.
- VelaSync’s file system will be synchronized, which under some circumstances will allow for faster startup next time the unit will be powered up.

Note: Wait 30 seconds after entering the HALT command before removing power.

Issuing a HALT Command via the Web UI

1. Navigate to TOOLS > SYSTEM: Reboot/Halt.
2. The Reboot/Halt window will display. Select the Shutdown the Unit checkbox.
3. Click Submit.
4. Wait 30 seconds after entering the HALT command before disconnecting power from the unit.

Issuing a HALT Command via SerialPort/Telnet/SSH:

With a serial connection to the front panel serial port, telnet connection or SSH connection, type `halt <Enter>` to halt the unit for shutdown. For more information on VelaSync commands, see "CLI Commands" on page 216.

Note: After issuing the HALT command wait 30 seconds before you remove power.

Once you have halted your VelaSync, power must be removed and reapplied in order to restart the unit.
4.2 Rebooting the System

To reboot VelaSync via the Web UI:

1. Navigate to TOOLS > SYSTEM: Reboot/Halt.
2. Select the Restart after Shutdown box in the Reboot/Halt window.
3. VelaSync will now be rebooted and be accessible again shortly thereafter.

Rebooting via USB Port, Telnet, SSH, SNMP

With a serial connection to the USB port, telnet connection or SSH connection, type `reboot` <Enter> to reboot VelaSync.

Reboot is also available to be performed through an `snmpset` operation. For more information on VelaSync commands, see "CLI Commands" on page 216.

4.3 Hardware Tasks

4.3.1 Replacing a Power Supply

For redundancy purposes, the server is equipped with two hot-swap power supply modules. Should either of the modules fail, the other will take the full load, and supply power without interruption to the server.

Since the power supplies can be hot-swapped, the VelaSync unit does not have to be shut down, in order to replace the defective power supply.

Caution: Allow the power supply modules to cool before touching.

1. To determine which of the two power supplies failed, on the back side of the server check the LED located on either power supply. The LED of a failed power supply will not light up.
2. Unplug the power cord of the defective power supply.
3. To remove the power supply module from the VelaSync unit, push the release tab to the side, and then pull the module straight out.

![Power supply removal](image)

**Figure 4-1:** Power supply removal

4. Replace the failed power supply module with a replacement unit.

   **Note:** Only use the approved type of power supply, for more information, see "Maintenance and Service" on page 235.

   Simply push the new power supply module into the empty bay until you hear a click.

5. Plug the AC power cord back into the new power supply.

   **Note:** For additional information on the power supplies, see [https://www.supermicro.com/manuals/superserver/1U/MNL-1771.pdf](https://www.supermicro.com/manuals/superserver/1U/MNL-1771.pdf), Chapter 2 on page 2-1.

### 4.3.2 Removing/Installing a Hard Disk Drive

Since the SATA Hard Disk Drives (HDDs) are hot-swappable, and they are RAID configured, either of the two drives can be removed from the front of the VelaSync chassis, without the need to open the chassis, or shut down VelaSync.

**Caution:** Allow the hard disk drives to cool before touching.
Proceed as follows:

**Removing the bezel**

- Remove the front bezel from the chassis, by unlocking it with the key, then pressing the red release knob, then removing the bezel with both hands. While the bezel is removed, check if the filter requires cleaning or replacement.

![Figure 4-2: Removing the front bezel](image)

**Removing the HDD carrier**

1. The HDDs are installed in carriers. To release a carrier, press down its red release button next to the drive LEDs. The handle will be released.
2. Swing the handle out all the way.
3. Pull out the carrier from the chassis, using the handle.

![Figure 4-3: Removing a HDD carrier](image)
4.4 Notifications

If an event occurs e.g., VelaSync transitions into Holdover, or a short is detected in the GNSS antenna, VelaSync can automatically notify users that a specific event has occurred.

In some situations, two events are generated. One event occurs in the transition to a specified state and then another event occurs when transitioning back to the original state. Examples of these are losing sync and then regaining sync, or going into Holdover mode and then going out of Holdover mode. Other situations may only consist of one event. An example of this situation is switching from one input reference to another.

Notifications of each event that may occur can be via alarms, via SNMP Traps being sent to one or more SNMP Managers, via an email being sent to a specified email recipient, or a combination of the three. The Notifications page allows a user to configure whether the occurrence of each event automatically triggers an alarm to be generated, an SNMP trap to be sent out, an email to be sent out, or a combination of the three.

Also, this page allows the desired email recipient’s address for that particular event to be specified. Each event can be configured with the desired email address that is specific to just that one event only. Note that only one email address can be specified in each Email Address field. If desired, the same email address can be used in all of the fields, or different addresses can be used for different events.
All available VelaSync events that can generate a notification to be sent are located under different tabs in the Notification Events panel: **Timing**, **GPS**, and **System**.

The VelaSync Events that can automatically trigger a notification are listed in the **Event** column. It is possible to:

- Mask the alarm generation for specific events (prevent the alarm)
- Enable “SNMP” (to send out an SNMP trap)
- Send an email to the address specified in the corresponding “Email Address” column.

### 4.4.1 Configuring Notifications

To configure Notifications:

1. Navigate to **MANAGEMENT > OTHER: Notifications**. The **Notifications** screen will display:

   ![Notification Screen](image)

   It is divided into two panels:

   - The **Actions** panel, featuring:
     - The **SNMP Setup** button: See “SNMP” on page 57.
     - The **Email Setup** button: Configure VelaSync’s interface settings for Exchange email servers and Gmail.

   For more information on this subject, see the Spectracom Technical Note **Email Notification Setup**.
The **Events** panel, offering three tabs:

- **Timing**: Events for Sync Status and Holdover, Frequency error, Input references and the internal oscillator.
- **GPS**: Events related to the GNSS receiver, including antenna cabling, tracking less than the minimum number of satellites and GNSS receiver faults.
- **Systems**: Events related to the system operation, including minor and major alarms being asserted, reboot, timing system errors and option cards.

2. In the **Events** panel, choose the **Timing**, **GPS** or **System** tab. Configure your Notifications (see below), and click Submit.

The columns under each tab are:

- **Event**—This is the event that will trigger the notification. The events under each tab will vary according to context.

- **Mask Alarm**—Check here to enable an alarm mask. Enabling an alarm mask for a given notification will prevent that notification from generating an alarm condition. Other notifications for that event and logging of the event will still occur.

- **SNMP Trap**—Check here to configure the event to trigger an SNMP Trap.

- **Email**—Check here to configure the event to trigger an email notification.

- **Email Address**—Enter the address to which the email should be sent when triggered by the event.
Each event can be configured with the desired email address that is specific to just that one event only. Note that only one email address can be specified in each Email Address field.

For each event choose the notification you want and an email address – if any – to which you want the notification to be sent. For more information, see "SNMP" on page 57 and "Setting Up Email Notifications" on page 172.

For each event, only the notification options available can be configured. For example, a mask alarm can be set for an In-Sync event, and a Not-in-Sync event, but not for an In-Holdover event.

4.4.2 Notification Event Types
The following types of events can be used to trigger notifications:

4.4.2.1 Timing Tab: Events
- In Sync
- Not In Sync
- In Holdover
- No Longer in Holdover
- Frequency Error
- Frequency Error Cleared
- 1PPS Not In Specification
- 1PPS Restored to Specification
- Oscillator Alarm
- Oscillator Alarm Cleared
- Reference Change (Cleared)
- Reference Change

4.4.2.2 GPS Tab: Events
- Too Few GPS Sat, Minor Alarm
- Too Few GPS Sat, Minor, Cleared
- Too Few GPS Sat, Major Alarm
4.4 Notifications

- Too Few GPS Sat, Major, Cleared
- GPS Antenna Problem
- GPS Antenna OK
- GPS Receiver Fault
- GPS Receiver Fault Cleared

Under the GPS Events tab, you can also configure Minor and Major Alarm Thresholds for GNSS fault events; see "Configuring GPS Notification Alarm Thresholds" below.

4.4.2.3 System Tab: Events

- Minor Alarm Active
- Minor Alarm Inactive
- Major Alarm Active
- Major Alarm Inactive
- Unit Reboot
- Timing System Software Error
- Timing System Hardware Error
- High Temperature Temperature alarms are based on the CPU temperature., Minor Alarm
- High Temperature, Minor, Cleared
- High Temperature, Major Alarm
- High Temperature, Major, Cleared

4.4.3 Configuring GPS Notification Alarm Thresholds

VelaSync allows you to configure Minor and Major alarm thresholds for the GNSS receiver. This is done by setting the minimum number of satellites the receiver can track for a set time before an alarm is triggered. If both conditions are met, i.e. the reception quality falls below the set number of satellites for the set amount of time, an alarm is triggered.

The alarm notification feature described below allows you to be notified of a potential reception issue BEFORE the GNSS reference becomes invalid. This may be useful e.g., to notify system operators of a deteriorating signal reception before VelaSync loses the GNSS reference.

Note that VelaSync itself has a pre-defined minimum number of satellites that must be tracked in order for GNSS to be considered a valid reference. The minimum number of satellites depends e.g., on your receiver mode, the GNSS signal reception in the area where your antenna is located, and the type of receiver in your unit. In Stationary mode,
and for SAASM units, the minimum number of satellites is normally 4 (four). Hence, it would be prudent to set the Minor Alarm Threshold to 8, and the Major Alarm Threshold to 6.

Note: While GPS Notification Alarms can be used in Mobile GNSS receiver mode, it is not advisable.

To determine how many satellites your VelaSync unit is currently receiving, navigate to INTERFACES > REFERENCES: GNSS 0. See also “Reviewing the GNSS Reference Status” on page 123.

To set the GPS Alarm Thresholds:

1. Navigate to MANAGEMENT > OTHER: Notifications, and choose the GPS tab.
2. At the bottom of the window, locate the ALARM THRESHOLD panel:

3. In the Minimum Satellites fields enter the minimum number of satellites that must be available before the alarm is triggered. The alarm will be triggered when the number of satellites available is BELOW this number.

4. In the Duration Below Threshold (s) fields, enter the time in seconds that the system must be below the threshold set in the Minimum Satellites field before an alarm is triggered. The alarm will be triggered when this time is reached. By default, this timeout value is set to 0 seconds. As soon as the receiver drops below the minimum number of satellites, the associated alarm is triggered. A delay of e.g., 5 seconds, however, would not trigger an alarm if the number of received satellites drops below the specified number for only 3 seconds.

You can configure this event to cause either a Minor alarm, or a Major alarm, or both. To learn more about Minor and Major alarms, see “Minor and Major Alarms” on page 208.

Note that the GNSS receiver must initially be tracking more than the configured number of satellites in order for this alarm to be triggered (the alarm is triggered when the receiver falls below the number of Minimum Satellites you specified above).
4.4.4 Setting Up SNMP Notifications
SNMP Notifications are SNMP traps that occur on a change of a monitored event.
To configure SNMP notifications:
1. Navigate to MANAGEMENT > OTHER: Notifications.
2. In the Actions panel, click SNMP Setup.

For more information on SNMP, see “SNMP” on page 57.

4.4.5 Setting Up Email Notifications
The Email Setup window provides a means to configure VelaSync with the necessary settings to interface it with Exchange email servers and Gmail.
To set up Notification Emails:
1. Navigate to MANAGEMENT> OTHER: Notifications.
2. In the Actions panel of the Notifications screen, click Email Setup.
3. The Email Setup window will display:

![Email Setup Window](image)

The Email Configuration box provides two example configuration files. One is for interfacing VelaSync with an Email Exchange server; and the other is for sending emails via Gmail:

4. To configure the applicable example email configuration, delete the comments ("#") from each line and replace the "<>" with the appropriate values for your particular email server (such as the user name and password for your Email server).

**Example I: SMTP interface to MS Exchange**

```plaintext
set smtp=outlook.office365.com
set smtp-auth-user=ryan.johnson@orolia.com>
set from="ryan.johnson@orolia.com"
set smtp-auth-password=PASSWORD
set smtp-auth=login
set ssl-verify=ignore
set smtp-use-starttls
```

**Example II: SMTP interface to Gmail**

```plaintext
set smtp=smtp.gmail.com:587
set smtp-use-starttls
set ssl-verify=ignore
```
5. Click the **Submit** button at the bottom of the window.

6. To test your settings:
   - In the **Test Email Address** field, enter an email address.
   - Click the **Send Test Email** button.
   - A notification that your email has been sent will appear at the top of the window.
4.5 Managing Users and Security

4.5.1 Managing User Accounts

Users need to authenticate as the login to VelaSync. The system administrator is responsible for maintaining a list of user accounts (user names, passwords etc.) via the MANAGEMENT > OTHER: Authentication screen of the VelaSync Web UI (HTTP/HTTPS). Note that user accounts CANNOT be created or edited via CLI commands using telnet or SSH.

4.5.1.1 Types of Accounts

There are three types of accounts:

<table>
<thead>
<tr>
<th>Account Type</th>
<th>Permissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;user&quot;</td>
<td>These accounts are intended for users only e.g., operators. These &quot;user&quot; accounts are read-only accounts, i.e. they do not allow any editing rights and are restricted to reviewing status-related information. The Web UI will not show (or gray-out) any editing functionality.</td>
</tr>
<tr>
<td>&quot;admin&quot;</td>
<td>Administrator accounts are intended to be used by system administrators. These accounts have writing access. You can add additional admin accounts to the pre-installed administrator account spadmin.</td>
</tr>
<tr>
<td>&quot;factory&quot;</td>
<td>The default factory account with the username spfactory is meant to provide access to Spectracom technical support personnel. You can delete this account, if you so prefer. Note, however, that executing the Clean and Halt command (see Cleaning the Configuration Files and Halting the System) will recreate the Factory account.</td>
</tr>
</tbody>
</table>

4.5.1.2 About "user" Account Permissions

As outlined above – unlike "administrator" accounts – "user" accounts are read-only accounts, i.e. they do not allow any editing rights and are restricted to reviewing status-related information. Otherwise, the privileges assigned to admin groups are exactly the same whether logging in via the Web UI, or connecting via SSH.

Account Differences, General

While most menus look the same to "admin" and "user" type accounts(except the MANAGEMENT menu, see below), the screens and panels located below the main menus will differ in such that the "user" UI will show fewer (if any) configuration options:
The status information presented, however, will be largely identical.
The most significant differences are visible in the MANAGEMENT menu, since most of the Setup menus are hidden from "user" accounts:

**Account Differences, by Menu**

**INTERFACES Menu**
"user" and "admin" accounts can view and modify all settings in these pages (can view/edit GNSS receiver, Outputs, and Option Cards).

**MANAGEMENT Menu**

**Network**: While the toggle switches in the Network Services panel are displayed, "user" cannot modify any of the network-related configurations (such as telnet, FTP, SSH and HTTP/HTTPS). The switches can be moved, but an error message will be displayed shortly thereafter.
Authentication: "user" can access this page but can only change his/her own password. Users cannot create any new accounts and cannot modify any accounts.

Reference Priority: "user" can access this page and modify settings.

Notifications: "user" can access this page and modify settings.

Time Management: "user" can access this page and modify settings.

Front panel: "user" can access this page and modify settings.

Log Configuration: "user" can access this page and modify settings.

Disciplining: "user" can access this page and modify settings.

Change my password: "user" can access this page and change only their password.

TOOLS Menu

Logs: "user" can view only the listed logs

Upgrade/Backup: "user" cannot perform any updates.

Reboot/Halt: "user" cannot reboot/shutdown/halt the unit.

4.5.1.3 Rules for Usernames

» Length: Usernames can be between 3 and 32 characters long.

» Accepted characters:
  » All letters, including the first, must be lower-case.
  » Numbers, underscores and dashes are accepted.
  » Next to punctuation symbols, the following special characters are NOT accepted: ! @ # $ % ^ & * ( )

4.5.1.4 Adding/Deleting/Changing User Accounts

To access the Users list, and the Password Security panel:

1. Navigate to MANAGEMENT > OTHER: Authentication.

2. The Users panel on the right shows a list of all user accounts, including their Username, the Group to which that user account is assigned to, and any Notes about
the user account:

![User Account Window]

VelaSync units are shipped with two default accounts:

i. The "administrator" account (spadmin), and

ii. The "factory" service account (spfactory).

Additional accounts may be added and deleted as desired. The number of accounts that can be setup is virtually unlimited.

**Note:** The password for the spadmin account can be changed (and it is recommended to do so for security reasons). However, the spadmin account name cannot be changed, and the account cannot be removed from VelaSync.

**Note:** The spfactory account is for use by Spectracom service personnel. While the spfactory account can be deleted by an administrator, it should be noted that this may potentially limit remotely provided technical support.

User accounts can be created to have either limited user or full administrator rights. Each user can be assigned his own login password.

- To **ADD** a user account, click the PLUS icon in the top-right corner of the Users screen.
- To **DELETE** a user account, click the Delete button in that account’s entry on the Users screen.
- To **APPLY CHANGES** to a user account, click the Change button next to the desired user account.

When either the Change button or the PLUS icon is clicked, the Add or Change User window appears:
To add a user account:

1. Enter a **Username**. (For rules, see "Rules for Usernames" on page 177.)
2. Enter a **Password**. The password requirements are configurable, see "Managing Passwords" on the next page. By default a password can be any combination of upper- and lower-case characters. Minimum password length = 8 characters, maximum length = 32 characters.
3. Repeat the new **Password**.
4. In the **Group** field, choose the permission group to which you want the user to belong to: **user** or **admin**. The **user** permission level assigns permission to access and change all settings, with the following **exceptions** that are limited to the **admin** accounts:
   - Changing network settings
   - Adding and deleting user accounts
   - Web Interface Settings
   - Upgrading VelaSync system software
   - Resetting the VelaSync configuration
   - Clearing log files
   - Changing Disciplining Setup options
   - Changing configuration options for the following protocols or features:
     - NTP
     - HTTPS, SSH
     - LDAP/RADIUS
     - SNMP (with the exception of configuring SNMP notifications).
To change a user account:

1. In the Add or Change User window the Username field will be populated.
   a. To change it, type the new name.
   b. To change the user account’s password, type the new password in the Password field and confirm it in the Repeat New Password field. Note that the password requirements are configurable, see "Managing Passwords" below.
   c. To change the user account’s user permission group, select the group from the drop-down menu.

For more information, see also "Managing Passwords" below.

4.5.2 Managing Passwords

| Caution: | For security reasons, it is advisable to change the default credentials. |

4.5.2.1 Configuring Password Policies

To configure password requirements e.g., rules for minimum password length and special characters:

1. Navigate to MANAGEMENT > OTHER: Authentication.
2. In the Actions panel, click Security Policy.

3. The Password Security window will display. Fill in the self-explanatory fields and
4.5.2.2 The Administrator Password

The factory default administrator login password value of admin123 can be changed from the default value to any desired value. If the current password is known, it can be changed using the VelaSync Web UI.

**Note:** To follow this procedure, you must be logged in as the spadmin user. If you are unable to login as spadmin, follow the procedure outlined in "Lost Password" on the next page.

If the password has already been changed from the default value, but the current value is no longer known, the administrator password can be reset back to the factory default value, see "Lost Password" on the next page. Once reset, it can then be changed to a new desired value via the Web UI.

**Changing the admin password**

To change the admin password from a known value to another desired value:

1. Navigate to MANAGEMENT > OTHER: Change My Password.
2. The Change Password window will display.
3. In the **Old Password** field, type the current password.

4. In the **New Password** field, type the new password.

   **Note:** The new password can be from 8 to 32 characters in length.

5. In the **Repeat New Password** field, retype the new password.

6. Click **Submit**.

   For more information, see also "Managing User Accounts" on page 175.

### 4.5.2.3 Lost Password

If the current *spadmin* account password has been changed from the default value and has been forgotten or lost, you can reset the *spadmin* password back to the factory default value of *admin123*.

Resetting the *spadmin* account password does not reset any user-created account passwords. This process only resets the *spadmin* account password.

Any user with administrator rights can reset the *spadmin* password through the **MANAGEMENT > OTHER: Authentication** window.

If you do not know the password for any user with administrator rights, your only options are:

- contact customer service to request a password reset.

**Changing the "spadmin" password via Web UI**

To change the *spadmin* password:

1. Navigate to the **MANAGEMENT > OTHER: Authentication** window.
2. Locate the *spadmin* entry in the **Users** table.
3. Click the CHANGE button.

4. In the Add or Change User window:
   1. Enter a new password.
      
      ![Note: The new password can be from 8 to 32 characters in length.](image)

   2. Confirm the new password.

   3. Click Submit.

To reset the "spadmin" account password via the serial port, or SSH:

1. Connect a PC to the port, and log in using an account with admin group rights (such as the spadmin account).

2. Type: resetpw <Enter>. The spadmin account password is now reset.

After resetting the password follow the procedure above to change the spadmin password in the MANAGEMENT > OTHER: Authentication window.
4.5.3 Web UI Timeout

For security reasons, the Web UI will automatically timeout after a set number of minutes, i.e. you will be logged out by the system, regardless of activity, and need to actively login again.

- Minimum timeout duration: 10 minutes
- Maximum timeout duration: 1440 minutes (24 hours)
- Default timeout duration: 60 minutes.

To change the time after which the Web UI will timeout:

1. Navigate to the MANAGEMENT > Network Setup screen.
2. In the Actions panel on the left, click on Web Interface Settings.
3. In the Web Interface Settings window, enter the desired value in minutes.

In order for a new setting to take effect, you need to log off, and then log back in again. This setting affects all users, not just the user changing the value.

4.6 Miscellaneous Typical Configuration Tasks

4.6.1 REST API Configuration

REST (Representational State Transfer) API offers many benefits for customers who require additional configuration access. Any functionality that can be done manually through the Web UI can be scripted, creating machine-to-machine automation and communication.

Common tasks that would ordinarily require manual interaction with the Web UI can be scheduled and automated.

REST API is free and available on any VelaSync with Web UI communication.

For detailed instructions on REST API configuration and to obtain access, contact your local sales or service representative.
4.6.2 Creating a Login Banner

A login banner is a customizable banner message displayed on the login page of the VelaSync Web UI. The login banner can be used, for example, to identify a unit.

Figure 4-4: Login banner (example)

To configure a login banner:

1. Navigate to the MANAGEMENT > Network Setup screen.
2. In the Actions panel on the left, click Login Banner.
3. The Network Access Banner window will display. Check the box Enable Custom Banner.
4. In the Plain Text Banner text box, type in your custom text.

**Note:** The Plain Text Banner is used to create a message for all interactive login interfaces (Web UI, telnet, SSH, FTP, SFTP, serial, etc.). It is not required to include HTML tags.

5. Optionally, you may also use the Web Interface Banner text box.

**Note:** Enabling and using the Web Interface Banner text box will allow you to apply HTML formatting tags to your message (e.g., colors). Note that this functionality is limited to browser-based Web UI.
6. To test your new banner, click **Apply** to see a preview at the bottom of the window. OR, click **Submit**, and log out of the Web UI, and back in so as to see the banner on the actual login page.

### 4.6.3 Show Clock

Instead of the Web UI, a large digital clock can be displayed on your computer screen. Next to the system status, the screen clock will display the UTC time, and the VelaSync time.

To display the screen clock instead of the Web UI:
1. Navigate to **TOOLS > SYSTEM: Show Clock**:

2. To return to the standard Web UI, click **Home**.

### 4.6.4 Synchronizing Network PCs

Frequently, network PCs have to be synchronized to VelaSync via the Ethernet port, using NTP (Network Time Protocol). A detailed description on how to synchronize Windows PCs can be found online in the Spectracom Technical Note *Synchronizing Windows Computers* on the Spectracom website. This document also contains information and details about using the Spectracom **PresenTense** NTP client software.

### 4.7 Quality Management

#### 4.7.1 System Monitoring

#### 4.7.1.1 Status Monitoring via the Web UI

Status information can be accessed via the VelaSync **Web UI**, such as:

- Time synchronization status, including references
- GNSS satellites currently being tracked
- NTP sync status and current Stratum level
- Estimated time errors
- Oscillator disciplining
- Temperature monitoring

The **HOME** screen provides time server status information, while the **TOOLS > System Monitor** screen also displays hardware status data, e.g. temperature curves.
Status Monitoring via the HOME Screen

The HOME screen of the VelaSync Web UI provides a system status overview (see also "The Web UI HOME Screen" on page 13).

The HOME screen is divided into four panels:

![HOME Screen Screenshot](image)

**System Status panel**

- **Reference**—Indicates the status of the current synchronizing reference, if any.
- **Power**—Indicates whether the power is on.
- **Status**—Indicates the status of the network’s timing. There are three indicators in the Status field:
  - **Sync**—Indicates whether VelaSync is synchronized to its selected input references.
    - **Green** indicates VelaSync is currently synchronized to its references.
    - **Orange** indicates VelaSync is not currently synchronized to its references.
  - **Hold**—When lit, VelaSync is in Holdover mode.
  - **Fault**—Indicates a fault in the operation of the VelaSync. See "Troubleshooting via Web UI Status Page" on page 210 for instructions for troubleshooting faults.
- **Alarm Status**: If a major or minor alarm is present, it will be displayed here.
- **NTP**—Current STRATUM status of this VelaSync unit.
Temperature—The current board temperature will be displayed here.

Reference Status panel

- **REFERENCE**: Indicates the name type of each reference. These are determined by the inputs set up for the VelaSync.
- **PRIORITY**: Indicates the priority of each reference. This number will be between 1 and 15. References in this panel appear in their order of priority. See "Configuring Input Reference Priorities" on page 112 for more information.
- **STATUS**: Indicates which available input reference is acting as the Time reference and which available input reference is acting as the 1PPS reference.
  - **Green** indicates that the reference is present and has been declared valid.
  - **Orange** indicates the input reference is not currently present or is not currently valid.

Performance panel

- **Disciplining State**: Indicates whether or not the internal oscillator is currently being disciplined (steered to an input reference).
- **1PPS Phase Error**: An internal measurement (in nanoseconds) of the internal 1PPSs’ phase error with respect to the selected input reference (if the input reference has excessive jitter, phase error will be higher).
- **10 MHz Frequency Error**: An internal estimated calculation (in Hertz) of the internal oscillator’s frequency error, based on the phase accuracy error at the beginning and end of a frequency measurement window (the length of this window will vary depending upon the type of oscillator installed and the oscillator adjustment algorithm).

Events panel

The Events panel in the bottom-left corner of the HOME screen is a log of VelaSync’s recent activity. It updates in real time.

**Note:** If you know the individual reference or output whose status you wish to see, you can access the Status window of that reference or output directly through the INTERFACES > REFERENCES or INTERFACES > OUTPUTS drop-down menu.
Status Monitoring via the System Monitor Screen

To display status information pertaining mainly to VelaSync’s current hardware status, navigate to TOOLS > SYSTEM > System Monitor.

The information provided on the System Monitor Screen is subdivided into three panels:

System Status panel
This is identical with the HOME screen “System Status panel” on page 188.

Disk Status panel
This panel displays:
- Total: [MB]
- Used: [MB]
- Free: [MB]
- Percent: [%]

The last item refers to system storage. If you need to update the System Software, and this number is **70% or higher**, it is recommended to clear logs and stats in order to free up memory space. (Navigate to TOOLS > SYSTEM: Upgrade/Backup, and click the corresponding buttons in the lower left-hand corner.)

System Monitor panel
Graphs are displayed for:
- Board Temperature
- CPU Temperature
- Memory Used
- CPU Used.

To delete the logged data used to generate the displayed graphs, click the TRASHCAN icon. (Note that re-populating the graphs with fresh data generated at a 1/min. rate will take several minutes.)

To download the logged data in .csv format, click the ARROW icon.

4.7.1.2 Ethernet Monitoring

To monitor Ethernet status and traffic:
1. Navigate to **TOOLS > SYSTEM: Ethernet Monitor**. The Ethernet monitoring screen opens:

![Ethernet Monitor Screen](image)

The data displayed is linked to a specific Ethernet port e.g., ETH0. If you enable additional Ethernet ports, their throughput data will also be displayed.

In the **Traffic** pane on the right the traffic throughput in Bytes per second is displayed in two graphs. Drag the handles at the bottom of the graphs to zoom in on a particular time frame.

In the **Actions** panel on the left, you can clear or download monitoring data.

In the **Status** panel on the left, information pertaining to the given Ethernet port is displayed, including throughput statistics and error statistics. The Mode field indicates which transmission mode is being used for the given Ethernet port:

- **FULL** duplex, or
- **HALF** duplex.

Note that the Mode is auto-negotiated by VelaSync. It can be changed only via the switch VelaSync is connected to, not by using the VelaSync Web UI.

### 4.7.1.3 NTP Status Monitoring

VelaSync's **NTP Status Summary** provides a means to monitor NTP status and performance parameters relevant to your VelaSync at a glance.
1. To access the **NTP Status Summary** panel, navigate to **MANAGEMENT > NETWORK: NTP Setup**.

![NTP Status Summary Panel]

2. The **NTP Status Summary** panel is at the lower left of the screen. The panel contains the following information:

   - **Selected Ref** — The reference VelaSync is currently using.
   - **Stratum** — This is the stratum level at which VelaSync is operating.
   - **Leap Indicator** — The leap indicator bits (usually 00). See "Leap Second Alert Notification" on page 105.
   - **Delay (ms)** — The measured one-way delay between VelaSync and its selected reference.
   - **Offset (ms)** — Displays the configured 1PPS offset values.
   - **Jitter (ms)** — Variance (in milliseconds) occurring in the reference input time (from one poll to the next).

### 4.7.1.4 Monitoring the Oscillator

The Oscillator Management screen provides current and history status information on disciplining state and accuracy.

To access the **Oscillator Management** screen:
1. Navigate to **MANAGEMENT > OTHER: Disciplining**.

2. The **Oscillator Management** screen will display. It consists of two panels:

   ![Oscillator Management Screen](image)

   **The Oscillator Status Panel**

   This panel provides comprehensive information on the current status of VelaSync's timing state.

   - **Oscillator Type**: Type of oscillator installed in the unit.
   - **Disciplining State**: State of oscillator control and disciplining; indicates whether or not the internal oscillator is currently being disciplined (steered to an input reference). The states are: "Warm up", "Calibration", "Tracking Setup", "Lock State", "Freerun", and "Fault".
   - **1PPS Phase Error**: A tracking measurement [scaled time, in ns, or ms] of the internal 1PPSs' phase error with respect to the selected input reference. Long holdover periods or an input reference with excessive jitter will cause the phase error to be high. The oscillator disciplining control will gradually reduce the phase error over time. Alternatively, restarting the tracking manually (see "Restart Tracking" under "Configuring the Oscillator" on page 153), or automatically via a pre-set Phase Error Limit, will quickly reduce the phase error.
   - **10 MHz Frequency Error**: An internal estimated calculation (in Hertz) of the internal oscillator's frequency error, based on the phase accuracy error at the beginning and end of a frequency measurement window (the length of this window will vary...
depending upon the type of oscillator installed and the oscillator adjustment algorithm).

- **Current DAC Setting**: Current DAC value, as determined by the oscillator disciplining system. The value is converted into a voltage that is used to discipline the oscillator. A stable value over time is desirable and suggests steady oscillator performance (see also the graph in the History Panel).

- **DAC Step**: Step size for adjustments to the internal oscillator, as determined by the oscillator disciplining system. Larger steps = quicker, but coarser adjustments. The step size is mainly determined by the type of oscillator.

- **TFOM**: The Time Figure of Merit is VelaSync’s estimation of how accurately the unit is synchronized with its time and 1PPS reference inputs, based on several factors, known as the Estimated Time Error or ETE. The larger the TFOM value, the less accurate VelaSync believes it is aligned with its 1PPS input that is used to perform disciplining. If this estimated error is too large, it could adversely affect the performance of oscillator disciplining. The available TFOM range is 1 through 15.

- **Max TFOM for Sync**: Value, as set under "Configuring the Oscillator" on page 153

- **Temperature(s)**: Three temperatures are displayed:
  - **Oscillator** temperature, which has an effect on oscillator accuracy, and therefore can be used to interpret oscillator performance.
  - **Board** temperature (measured on the main board, sometimes also referred to as ‘System temperature’)
  - **CPU** temperature

  **Note**: Oscillator temperature is plotted over time in the History panel on the right, while graphs for board and CPU temperature can be found under TOOLS > SYSTEM: System Monitor.

- **Last Time Reference Change**: [Timestamp: Last occurrence]
- **Last 1PPS Reference Change**: [Timestamp: Last occurrence]
- **Last TFOM Change**: [Timestamp: Last occurrence]
- **Last Sync State Change**: [Timestamp: Last occurrence]
- **Last Holdover State Change**: [Timestamp: Last occurrence]

**The Oscillator History Panel**

The Oscillator History Panel offers real-time graphical monitoring of VelaSync’s internal
timing. The following graphs plot key oscillator-relevant data over time:

- **Phase Error Magnitude**: See [1PPS Phase Error](#).
- **Frequency Error**: See [10 MHz Frequency Error](#).
- **Scaled DAC Value**: See [DAC Step](#).
- **Oscillator Temperature**, which has an effect on oscillator accuracy, and therefore can be used to interpret oscillator performance.

You can zoom in on any of the graphs by grabbing the handles at either end and pulling them inwards. The graph will focus in on the time interval you choose in real time.

Clicking on the Delete icon in the top-right hand corner will erase all current oscillator log data.

Clicking on the Download arrow icon will download the latest oscillator log data as a .csv file.

### 4.7.2 Logs

VelaSync maintains different types of event logs (see below) to allow for traceability, and for record keeping. Should you ever require technical support from Spectracom, you may be asked for a copy of your logs to facilitate remote diagnosis.

Logs stored internally are being kept automatically, while the storage of log files in a remote location has to be set up by the user.

For each type of log, four 75 KB files are maintained internally on a revolving basis, i.e. the oldest file will be overwritten, as soon as all four files have filled up with event data. The life expectancy of a log file depends on the amount of data accumulating over time: Some types of logs will fill up within days, while others can take months until they have reached their maximum storage capacity.

You can delete logs at any time, see “Clearing All Logs” on page 204.

#### 4.7.2.1 Types of Logs

VelaSync generates log files for the following event categories:

**Alarms Log**

Displays log entries for the Timing System, for example:

- **The Unit has Rebooted**: VelaSync was either rebooted or power cycled.
- **In Holdover**: Input references were available, but all input references have since been lost. If the references are not restored before the Holdover period expires, time sync will be lost.
No longer in Holdover: Input references were lost at one point (or declared not valid), but have since been restored OR the Input references were not restored before the Holdover period expired (Time Sync alarm is asserted).

In Sync: VelaSync is synchronized to its selected Time and 1PPS reference inputs.

Not In Sync: VelaSync is not synchronized to its Time and 1PPS inputs and is not currently in Holdover. NTP will indicate to the network that it is Stratum 15 and so the time server likely be ignored as a time reference.

Frequency Error: The oscillator’s frequency was measured and the frequency error was too large. Or, the frequency couldn’t be measured because a valid input reference was not available.

Reference change: VelaSync has selected a different Time and 1PPS input reference for synchronization. Either the previously selected input reference was declared not valid (or was lost), so a lower priority reference (as defined by the Reference Priority Setup table) is now selected for synchronization OR a valid reference with higher priority than the previous reference is now selected for synchronization.

**Example:**

GNSS is the highest priority reference with IRIG input being a lower priority. VelaSync is synced to GNSS and so GNSS is the selected reference. The GNSS antenna is disconnected and IRIG becomes the selected reference. The Reference change entry is added to this log.

Authentication Log

Displays log entries for authentication events (e.g., unsuccessful login attempts, an incorrectly entered password, etc.) that are made to VelaSync’s command line interfaces (such as telnet, SSH, FTP, etc.).

Events Log

Displays log entries related to GNSS reception status changes, Sync/Holdover state changes, SNMP traps being sent, etc. Examples include:

- **Reference Change:** VelaSync has switched from one input reference to another (for example, IRIG was the selected input being used, but now GNSS is the selected reference).

- **GPS Antenna Problem:** The GPS Antenna Problem alarm indicates the GNSS receiver has detected an over-current or undercurrent condition (an open or short exists in the GNSS antenna cable, or the GNSS antenna is not connected to VelaSync). The receiver will attempt to continue the normal acquisition and tracking process regardless of the antenna status. The current draw measurements that will indicate an antenna problem are:
Under-current indication < 8 mA
Over-current indication > 80 mA

**Note:** This alarm condition will also be present if a GNSS antenna splitter that does not contain a load to simulate an antenna being present is being used.

- **GPS Antenna OK:** The antenna coax cable was just connected or an open or short in the antenna cable was being detected but is no longer being detected.
- **Frequency Error:** The oscillator’s frequency was measured and the frequency error was too large. Or, the frequency couldn’t be measured because a valid input reference was not available.
- **Frequency Error cleared:** The Frequency Error alarm was asserted but was then cleared.
- **In Holdover:** Input references were available, but all input references have since been lost. If the references are not restored before the Holdover period expires, time sync will be lost.
- **No longer in Holdover:** Input references were lost at one point (or declared not valid), but have since been restored OR the Input references were not restored before the Holdover period expired (Time Sync alarm is asserted).
- **In Sync:** VelaSync is synchronized to its Time and 1PPS inputs.
- **Not In Sync:** VelaSync is not synchronized to its Time and 1PPS inputs and is not currently in Holdover. NTP will indicate to the network that it is Stratum 15 and so the time server likely be ignored as a time reference.
- **Sending trap for event 1 (SNMPSAD):** An SNMP trap was sent by the SNMP agent to the SNMP Manager. The event number in this entry indicates which SNMP trap was sent.
- **The Unit has Rebooted:** VelaSync was either rebooted or power cycled.

**Journal Log**
Displays log entries created for all configuration changes that have occurred (such as creating a new user account, for example).

**NTP Log**
The NTP log displays operational information about the NTP daemon, as well as NTP throughput statistics (e.g., packets/sec.). Examples for entries in this log include indications for when NTP was synchronized to its configured references (e.g., it became a Stratum 1 time server), as well as stratum level of the NTP references.
The NTP throughput statistics data can be utilized to calculate mean values and the standard deviation.

Example log entries include:

» **Synchronized to (IP address), stratum=1**: NTP is synchronizing to another Stratum 1 NTP server.

» **ntp exiting on signal 15**: This log entry indicates NTP is now indicating to the network that it is a Stratum 15 time server because it is not synchronized to its selected reference.

» **Time reset xxxxx s**: These entries indicate time corrections (in seconds) applied to NTP.

» **No servers reachable**: NTP cannot locate any of its configured NTP servers.

» **Synchronized to PPS(0), stratum=0**: NTP is synchronized using the PPS reference clock driver (which provides more stable NTP synchronization).

**Oscillator Log**

Displays log entries related to oscillator disciplining. Provides the calculated frequency error periodically while synchronizing to a reference.

**GPS Qualification Log**

If VelaSync is connected to a GNSS antenna and is tracking satellites, this log contains a running hourly count of the number of GNSS satellites tracked each hour. This history data can be used to determine if a GNSS reception problem exists and whether this is a continuous or intermittent reception issue.

GNSS reception may be displayed as cyclic in nature. A cyclic 12 hour pattern of decreased GNSS reception typically indicates that the GNSS antenna has an obstructed view of the horizon. The GNSS satellites are in a 12-hour orbit, so if part of the sky is blocked by large obstructions, at the same time every day (at approximately 12 hour intervals), the GNSS reception may be reduced or may vanish altogether. If this occurs, the antenna should be relocated to afford it an unobstructed view of the sky.

Every hour (displayed in the log as UTC time), VelaSync counts the total number of satellites that were tracked during that hour. The GNSS qualification log shows the number of satellites that were tracked followed by the number of seconds that the particular number of satellites were tracked during the hour (3600 seconds indicates a full hour). The number to the left of the “=” sign indicates the number of satellites tracked and the number to the right of the “=” sign indicates the number of seconds (out of a total of 3600 seconds in an hour) that the unit was tracking that number of satellites. For example, “0=3600” indicates the unit was tracking 0 satellites for the entire hour, while “0=2700 1=900” indicates the unit was tracking one satellite for 900 seconds, but for the remaining portion of the hour it was tracking zero satellites.
Every hourly entry in the log also contains a quality value, represented by “Q= xxxx” (where x can be any number from 0000 through 3600). The Qualification log records how many satellites were tracked over a given hour. If for every second of the hour a tracked satellite was in view, the Quality value will equal 3600. For every second VelaSync tracked less than the minimum number of satellites, the value will be less than 3600. The minimum requirement is one satellite at all times after the unit has completed the GNSS survey and indicates “Stationary”. A minimum of four satellites are required in order for the GNSS survey to be initially completed.

If all entries in the qualification log are displayed as “0=3600”, a constant GNSS reception problem exists, so the cause of the reception issue is continuous. If the unit occasionally shows 0=3600 but at other times shows that 1 through 12 have numbers of other than “0000”, the reception is intermittent, so the cause of the reception issue is intermittent. If the Quality value normally equals 3600 but drops to lower than 3600 about every 12 hours, the issue is likely caused by the GNSS antenna having an obstructed view of the sky.

**Example GPS Qualification Log Entry:**

\[
6 = 151 \quad 7 = 1894 \quad 8 = 480 \quad 9 = 534 \quad 10 = 433 \quad 12 = 108 \quad Q = 3600
\]

In this example, VelaSync tracked no less that 6 satellites for the entire hour. Out of the entire hour, it was tracking 6 satellites for a cumulative total of 151 seconds (not necessarily in a row). For the duration of the hour, it was tracking, 7, 8, 9, 10 and 12 satellites for a period of time. Because it was tracking at least at least one satellite for the entire hour, this Quality value is Q=3600.

**Note:** If VelaSync is not connected to a GNSS antenna, this log will remain empty.

**System Log**

Displays log entries related to the Timing System events and daemon events (such as the Alarms, Monitor, Notification, or SNMP daemons starting or stopping, etc.)

**Timing Log**

Displays log entries related to Input reference state changes (for example, IRIG input is not considered valid), antenna cable status. Examples include:

- **GRGR = GNSS Reference 1 antenna fault:** The GNSS Antenna Problem alarm indicates the GNSS receiver has detected an over-current or undercurrent

1^GR = GNSS Reference
condition (an open or short exists in the GNSS antenna cable, or the GNSS antenna is not connected to VelaSync). The receiver will attempt to continue the normal acquisition and tracking process regardless of the antenna status.

» **GR antenna ok**: The antenna coax cable was connected at this time or an open or short in the antenna cabling was occurring but is no longer being detected.

**Update Log**

Displays log entries related to software updates that have been performed.

### 4.7.2.2 The Logs Screen

The **Logs** Screen provides access to settings that apply to all logs.

To access the Logs Screen:

1. Navigate to **MANAGEMENT > OTHER: Log Configuration**.
2. The **Logs** screen will appear. It is divided into two panels:

#### The Logs Actions panel

The **Actions** panel on the upper-left corner of the **Logs** screen allows you to perform batch actions on your logs:

» **Save and Download All Logs**—Save and download all the logs on VelaSync.

» **Clear All Logs**—Clear all the logs on VelaSync.

#### The Remote Log Server panel

The **Remote Log Server** panel, which is where you set up and manage logs on one or more remote locations. See also: "Setting up a Remote Log Server" on page 202.

### 4.7.2.3 Displaying Individual Logs

To access individual VelaSync logs:
1. From the **TOOLS** drop-down menu, select the desired **Logs** category (for example, “Alarms”, or “Events”) from the right-hand column.

4.7.2.4 **Saving and Downloading Logs**

The VelaSync Web UI offers a convenient way to save, bundle, and download all logs in one simple step. This feature may be useful when archiving logs, for example, or for troubleshooting technical problems: Spectracom Technical Support/Customer Service may ask you to send them the bundled logs to remotely investigate a technical concern.

To save, bundle, and download all logs:

1. Navigate to **MANAGEMENT > OTHER: Log Configuration**.

2. On the left side of the screen, in the **Actions** panel, click on the **Save and Download All Logs** button.

3. Select the log bundle save location. The file name is `logs.tar.gz`.

4. If so asked by Spectracom Technical Support, attach the bundled log files (typically together with the oscillator status log, see: "Saving and Downloading the Oscillator Log” on the next page) to your email addressed to Spectracom Technical Support.
Saving and Downloading the Oscillator Log

The oscillator status log captures oscillator performance data, such as frequency error and phase error. The data can be retrieved as a comma-separated .csv file that can be read and edited with a spreadsheet software, such as Microsoft Excel®. You may want to review and/or keep this data for your own records, or you may be asked by Spectracom Technical Support to download and send the oscillator status log in the event of technical problems.

To download the oscillator status log:

1. Navigate to MANAGEMENT > OTHER: Disciplining.
2. Click on the ARROW icon in the top-right corner of the screen. Save the .csv file to your computer.
3. If so asked by Spectracom Technical Support, attach the oscillator status log file (typically together with the bundled VelaSync log files, see: “Saving and Downloading Logs” on the previous page) to your email addressed to Spectracom Technical Support.

4.7.2.5 Setting up a Remote Log Server

Storing log files on a remote log server supports advanced logging functionality.

Adding a remote log server:

1. Navigate to MANAGEMENT > OTHER: Log Configuration.
2. In the Remote Log Server panel, click on the PLUS icon in the top-right corner of the panel. The Add Remote Log Servers window displays.
3. Enter the IP address or host server name (e.g., “MyDomain.com”) you want to use as a remote log server.
4. Click the **Submit** button.
5. Your remote log server will appear in the **Remote Log Server** panel.
6. This action will configure all logs to be sent to the remote server together.

**Changing or deleting a remote log server:**

1. Navigate to **MANAGEMENT > OTHER: Log Configuration**.
2. In the **Remote Log Server** panel locate the remote server you wish to change or delete.
3. Choose the **MINUS** button to delete the remote log server. Confirm by clicking **OK** in the message window.
   —OR—
3. In the **Remote Log Server** panel, click the **GEAR** button to change the remote log server. Type in a new IP address or host domain server (e.g., MyDomain.com).
4.7.2.6 Clearing All Logs

Note: Authentication logs and NTP logs cannot be cleared.

All local logs in the home/spectracom directory will be logged. Other logs e.g., located on Syslog Servers, must be maintained by the user.

To clear all locally stored log files:

1. Navigate to MANAGEMENT > OTHER: Log Configuration.
2. In the Actions panel, click Clear All Logs:
3. In the grey confirmation window, click OK.

4.8 Updates and Licenses

4.8.1 Software Updates

Spectracom periodically releases new versions of software for VelaSync. These updates\(^1\) are offered for free and made available for download from the Spectracom website. If you register your product, you will be notified of software updates.

To carry out a software update:

1. In the Web UI, navigate to Tools > Upgrade/Backup.
2. Determine your System software version in the System Configuration panel; Proceed to the next step if it is lower than the software version you plan on installing.
3. Free up disk space, if needed:
   - Under Tools > Upgrade/Backup > Disk Status, check Percent Used: If the number is greater than 70\%, free up disk space.
   - (NOTE: If required, existing logs can be archived; for details see "Saving and

\(^1\)The terms update and upgrade are both used throughout Spectracom technical literature, as software releases may include fixes and enhancements, as well as new features.
To free up disk space:

a. Delete old log files: **Tools > Upgrade/Backup > Disk Status > Clear All Logs**.

b. Delete old statistics files: **Tools > Upgrade/Backup > Clear All Stats**.

c. Delete previous Upgrade files: **Tools > Upgrade/Backup > Actions > Update System > Delete Upgrade File(s)**. Note that **Delete Upgrade File** and **Update System** cannot be selected at the same time.

4. Download the latest upgrade software bundle from the Spectracom website onto your PC.

5. Perform the actual upgrade by navigating to **TOOLS > Upgrade/Backup > Actions: Update System Software**. Upload the upgrade software bundle previously downloaded onto your PC (updateXYZ.tar.gz). Once you have uploaded the software bundle, the following checkbox options will be presented:

   - **Remove software bundle**: Cancel the upgrade, and remove the uploaded software bundle from the system.
   - **Perform update**: Perform the software upgrade.
   - **Perform clean update**: Factory settings will be applied during the upgrade; any custom settings you may have applied previously will be overwritten! This also includes the unit’s static IP address (if you applied one); it will be replaced by the default DHCP address (i.e., 0.0.0.0). Also note that the browser session will terminate: After reconfiguring the unit’s IP address, you will need to login to the Web UI in a new browser session.

6. Click **Submit** to carry out the update. A progress bar will provide real-time status information:

7. Verify that the update was successful: Navigate to **Tools > Upgrade/Backup**, and confirm the new SW version in the **System Configuration** panel.

**Note**: Should you use DHCP, a new IP address may be assigned to your unit, and you may have to point your web browser to it.
Note: In the event that the update failed, see “Troubleshooting Software Update” on page 214.
Appendix

The following topics are included in this Chapter:

5.1 Troubleshooting ........................................208
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5.5 Maintenance and Service ............................235
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5.9 Return Shipments ...................................237
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5.13 Document Revision History .....................251
5.1 Troubleshooting

This section is intended to assist you with troubleshooting VelaSync.

The WebUI provides status information that can be used to help troubleshoot failure symptoms that may occur.

Please also consult the OEM documentation for Supermicro™ SuperO® SuperServer 5018R-WR which can be found online under:

https://www.supermicro.com/manuals/superserver/1U/MNL-1771.pdf

For Technical Support contact information see “Technical Support” on page 237.

5.1.1 Minor and Major Alarms

Minor Alarm

There are several conditions that can cause the Web UI status lights to indicate a Minor alarm has been asserted. These conditions include:

» Too few GPS satellites, 1st threshold: The GNSS receiver has been tracking less than the minimum number of satellites for too long of a duration. Refer to "Troubleshooting GNSS Reception" on page 212 for information on troubleshooting GNSS reception issues.

Major Alarm

There are several conditions that can cause the Web UI status lights to indicate a Major alarm has been asserted. These conditions include:

» Frequency error: Indicates a jump in the oscillator's output frequency has been detected. Contact Tech Support for additional information.

» 1PPS is not in specification: The 1PPS input reference is either not present or is not qualified.

» Not In Sync: A Major alarm is asserted when the Timing System is not in sync (Input references are not available and the unit is not in Holdover). Examples of not being synced include:
When the Timing System has just booted-up and has not yet synced to a reference.

When all input references were lost and Holdover Mode has since expired.

**Timing System Error:** A problem has occurred in the Timing System. Contact Spectracom technical support if the error continues.

### 5.1.2 Troubleshooting: System Configuration

One of the first tasks when troubleshooting a unit is to read out the current system configuration (you may also be asked for this when contacting Spectracom Technical Support.)

Select **TOOLS > Upgrade/Backup**: The screen displayed will provide information on:

- System configuration
- Disk status, memory status
- Software versions, and
- Recent log entries.

### 5.1.2.1 System Troubleshooting: Browser Support

Spectracom recommends using one of the following Web browsers to run the VelaSyncWeb UI on: Google Chrome, Mozilla Firefox, Internet Explorer > Ver. 8.

Using different or older browsers may lead to some incompatibility issues.

### 5.1.3 Troubleshooting – Unable to Open Web UI

With VelaSync connected to either a stand-alone or networked PC and with the network configuration correct, it should be possible to connect to the Web UI.
<table>
<thead>
<tr>
<th>Verify</th>
<th>Current Status</th>
<th>Indication</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEDs on network connector</td>
<td>Green “Good link” is not solid green</td>
<td>VelaSync ICMP test is failing. VelaSync is not connected to PC via Ethernet connection</td>
<td></td>
</tr>
</tbody>
</table>
|                               |                                       | 1) Verify one end of standard network cable is connected to VelaSync's Ethernet port and other end is connected to a hub/switch. Or a network cable is connected to VelaSync and a stand-alone PC.  
2) Verify network settings of VelaSync are valid for the network/PC it is connected with (IP address is on the same subnet as the other PC). |
|                               | Green “Good Link” is solid green on both VelaSync and other end of network cable. | VelaSync ICMP test is passing. VelaSync is connected to PC via Ethernet connection | 1) Disconnect VelaSync’s network cable and ping its assigned address to ensure no response (no duplicate IP addresses on the network).  
2) Try accessing VelaSync from another PC on the same network.  
3) Network Routing/firewall issue. Try connecting directly with a PC and network cable. |

**Table 5-1:** Troubleshooting network connection issues

### 5.1.4 Troubleshooting via Web UI Status Page

VelaSync’s Web UI includes pages that provide current “remote” status information about VelaSync. The following table includes information that can be used as a troubleshooting guidance if status fault indications or conditions occur.
<table>
<thead>
<tr>
<th>Web UI Page location</th>
<th>Current Status</th>
<th>Indication</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOME page, System Status panel, Status row</td>
<td>SYNC indicator is not &quot;lit&quot; (not Green), HOLD indicator is &quot;lit&quot; (Orange).—OR—FAULT indicator is &quot;lit&quot; (Red). Below the System Status panel there is an Out of Sync alarm statement</td>
<td>VelaSync is in Holdover mode—OR—VelaSync is now out of Time Sync</td>
<td>All available Input References have been lost. The Reference Status table on the HOME page will show the current status of all inputs (Green is valid and Red is invalid or not present). 1. Make sure the Input Reference Priority table still has the desired reference inputs Enabled, based on the desired priority. See &quot;Configuring Input Reference Priorities&quot; on page 112. 2. Make sure the desired input references are still connected to the correct input port of VelaSync. 3. Verify GNSS antenna installation (if applicable). See &quot;Troubleshooting GNSS Reception&quot; on the next page.</td>
</tr>
<tr>
<td>MANAGEMENT/ NTP Setup page NTP Status Summary panel Stratum row</td>
<td>Stratum 15</td>
<td>NTP is not synchronized to its available input references (VelaSync may have been in Holdover mode, but Holdover has since expired without the return of valid inputs)</td>
<td>Note: If VelaSync was just recently powered-up or rebooted and input references are applied, no troubleshooting may be necessary. Allow at least 10-20 minutes for the input references to be declared valid and NTP to align to the System Time (allow an additional 35-40 minutes for a new install with GNSS input). 1. Verify in the Configure Reference Priorities table that all available references enabled. See &quot;Configuring Input Reference Priorities&quot; on page 112. 2. Verify that the Reference Status on the HOME page shows “OK” (Green) for all available references. 3. Verify NTP is enabled and configured correctly. See &quot;NTP Reference Configuration&quot; on page 75.</td>
</tr>
</tbody>
</table>
### Troubleshooting using the Web UI Status indications

<table>
<thead>
<tr>
<th>Web UI Page location</th>
<th>Current Status</th>
<th>Indication</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANAGEMENT/NETWORK page</td>
<td>Cannot login or access the Web UI.</td>
<td>The following error message is displayed: “Forbidden You don’t have permission to access/ on this server”</td>
<td>This message is displayed when any value has been added to the Network Access Rules table and your PC is not listed in the table as an Allow From IP address. To restore access to the Web UI, either 1. Login from a PC that is listed as an Allow From in this table; or 2. If it is unknown what PCs have been listed in the Access table, perform an <code>unrestrict</code> command to remove all entries from the Network Access Rules table. This will allow all PCs to be able to access the Web UI.</td>
</tr>
</tbody>
</table>

Table 5-2: Troubleshooting using the Web UI Status indications

### 5.1.5 Troubleshooting GNSS Reception

If VelaSync reports GPS, Holdover, and/or Time Sync Alarms caused by insufficient GNSS reception:

When a GNSS receiver is installed in VelaSync, a GNSS antenna can be connected to the rear panel antenna connector via a coax cable to allow it to track several satellites in order for GNSS to be an available input reference. Many factors can prevent the ability for the GNSS receiver to be able to track the minimum number of satellites.

With the GNSS antenna installed outdoors, with a good view of the sky (the view of the sky is not being blocked by obstructions), VelaSync will typically track between 5-10 satellites (the maximum possible is 12 satellites). If the antenna's view of the sky is hindered, or if there is a problem with the GNSS antenna installation, the GNSS receiver may only be able to a few satellites or may not be able to track any satellites at all.

When GNSS is a configured time or 1PPS input reference, if the GNSS receiver is unable to continuously track at least four satellites (until the initial GNSS survey has been completed) or at least one satellite thereafter, the GNSS signal will not be considered valid. If no other inputs are enabled and available, VelaSync may not initially be able to go into time sync. Or, if GNSS reception is subsequently lost after initially achieving time sync, VelaSync will go into the Holdover mode. If GNSS reception is not restored before the Holdover period expires (and no other input references become available) VelaSync will go out of sync. The GNSS reception issue needs to be troubleshooting in order to regain time sync.
For additional information on troubleshooting GNSS reception issues with VelaSync, please refer to the GNSS Reception Troubleshooting Guide, available here on the Spectracom website.

5.1.6 Troubleshooting Hardware Issues

<table>
<thead>
<tr>
<th>Failure Mode Symptom</th>
<th>Failure Mode Diagnosis</th>
<th>Failure Mode Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Info LED on front panel blinks slowly. System status window on HOME screen of Web UI lists a power supply alarm.</td>
<td>One of the two redundant power supplies is defective.</td>
<td>Replace defect power supply. See “Replacing a Power Supply” on page 163.</td>
</tr>
<tr>
<td>Info LED on front panel blinks fast (1x/sec)</td>
<td>Fan failure</td>
<td>Contact Spectracom Service.</td>
</tr>
<tr>
<td>Info LED is permanently red.</td>
<td>CPU overheat</td>
<td>Check environment temperature. Ensure the front bezel is installed. Check bezel filter for contamination (see “Maintenance and Service” on page 235).</td>
</tr>
<tr>
<td>System Status window on HOME screen of Web UI lists RAID failure.</td>
<td>One of the two RAID harddisks is defect.</td>
<td>Replace harddisk. See &quot;Removing/Installing a Hard Disk Drive&quot; on page 164. (Note: Replacement harddisks are available from Spectracom).</td>
</tr>
</tbody>
</table>

5.1.6.1 Power Supply Failure

If either of the two redundant power supply modules fail, the other module will take over without service interruption. The UID LED on the front panel (see “Front Panel Overview” on page 10) will blink slowly until the failed module has been replaced.

Do not user power supplies other than the original model installed in the unit. Replacement power supplies can be procured directly from Spectracom (part no. PS09R-070J-SL01), or from the OEM manufacturer, Supermicro Computer (model PWS-651-1R).

To find out how to replace a power supply, see “Replacing a Power Supply” on page 163.

5.1.7 Troubleshooting – Network PCs Cannot Sync

In order for clients on the network to be able to sync to VelaSync, several requirements must be met:
1. The PC(s) must be routable to VelaSync. Make sure you can access VelaSync Web UI from a PC that is not syncing. If the PC cannot access the Web UI, a network issue likely exists. Verify the network configuration.

2. The network clients have to be configured to synchronize to VelaSync’s address. For additional information on syncing Windows PC’s, see [https://spectracom.com/documents/synchronizing-windows-computers](https://spectracom.com/documents/synchronizing-windows-computers). The last section of this document also contains troubleshooting assistance for Windows synchronization. For UNIX/Linux computer synchronization, please visit [http://www.ntp.org/](http://www.ntp.org/).

3. If at least one PC can sync to VelaSync, the issue is likely not with VelaSync itself. The only VelaSync configurations that can prevent certain PCs from syncing to the time server are the NTP Access table and MD5 authentication. See "Configuring NTP Symmetric Keys" on page 81. A network or PC issue likely exists. A firewall may be blocking Port 123 (NTP traffic), for example.

4. NTP in VelaSync must be “in sync” and at a higher Stratum level than Stratum 15 (such as Stratum 1 or 2, for example). This requires VelaSync to be either synced to its input references or in Holdover mode. Verify the current NTP stratum level and the sync status.

5.1.8 Troubleshooting Software Update

When experiencing slow data transmission rates, or other network issues, it may be possible that a system software update will be aborted due to a web server timeout during the transfer.

In such an event, the Upload New File window will disappear, and the Upgrade System Software window will be displayed again instead.

- Should this happen repeatedly, you can transfer the update file using a file transfer protocol such as scp, sftp or ftp, if security is not a concern. The update can then be initiated from the Web UI or Command Line.

- Disk Status: In the event of an aborted update process, under Tools > Upgrade/Backup > Disk Status, check Percent Used: If the number is greater than 70%, free up disk space, before starting another attempt to update the System Software.
5.2 Command-Line Interface

A terminal emulation program is used to emulate a video terminal, so as to access VelaSync's CLI (Command-Line Interface) remotely via a serial cable. This may be required if no other means of remotely accessing VelaSync are available, for example if Ethernet ports are used otherwise or have been disabled (e.g., for security reasons).

5.2.1 Setting up a Terminal Emulator

If no other means are available to access VelaSync, a terminal emulation program can be used to carry out certain configuration changes by accessing VelaSync's CLI (command-line interface) via a serial port connection. An application example for this scenario is to enable a network port so that the VelaSync Web UI can be used. While it is also possible to retrieve selected logs, a terminal emulator does not replace the VelaSync Web UI.

Spectracom does not distribute or support its own terminal emulator, and newer Microsoft operating systems no longer include HyperTerminal. However, there are several third-party open-source programs available, such as TeraTerm® or PuTTY®. The example below illustrates the use of TeraTerm. The setup procedure is similar when using other terminal emulation programs.

Procedure:

1. Connect the personal computer to the serial port interface, using a pinned null-modem standard DB9F to DB9M serial cable.

2. Configure your terminal emulation program, using the following settings:
   - **Port**: COM1
   - **Bits per second**: 9600
   - **Data bits**: 8
   - **Parity**: None
   - **Stop bits**: 1
   - **Flow control**: None

3. Depending on which network protocol you are using (SSH, Telnet), you will need to enter authentication upon establishment of the connection either in a separate authentication window, or the Terminal window: The default username is `spadmin`, and the password `admin123`. 
4. Using the Terminal window, you can now submit commands.

5.2.2 CLI Commands

VelaSync features a suite of command-line interface (CLI) commands that can be used to configure parameters and retrieve status information or log files via a remote connection, using the telnet or ssh (if enabled) protocol.

This section includes a list of some of the supported commands.

Notes:

a. The command "helpcli" will provide a list of all available commands and their syntax (Note: Typing "help" will output bash shell help only and will not provide useful information).

b. You can scroll up or scroll down through the output by using the Page Up/Page down keys, or the arrow keys.

c. Type "q" (lower-case) to quit.

d. Pressing the up/down keys scrolls through previously typed commands.

e. Commands need to be typed in all lower-case letters.

f. Where eth0 is the base network port and eth1 (and higher) are used with the optional Gigabit Ethernet module for multiple network interfaces.

g. User accounts with “user” group permissions can perform “get” commands but cannot perform any “set” commands or change/reset passwords. Only user accounts with “admin” group permissions can perform “set” commands or change/reset password. Refer to "Adding/Deleting/Changing User Accounts" on page 177 for user account setup information.

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>clean</td>
<td>Restores VelaSync configuration to factory defaults and reboots</td>
</tr>
<tr>
<td>cleanhalt</td>
<td>Restores VelaSync configuration to factory defaults and halts</td>
</tr>
<tr>
<td>clearlogs</td>
<td>Clears all logs</td>
</tr>
<tr>
<td>clearstats</td>
<td>Clears all statistical data (NTP, and oscillator/disciplining)</td>
</tr>
<tr>
<td>dateget</td>
<td>Displays current date (for example, 15 APR 2015)</td>
</tr>
<tr>
<td>dateset</td>
<td>Used to set the current date</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>defcert</td>
<td>Used to create a new Spectracom self-signed SSL certificate for HTTPS in case of expiration of the original certificate</td>
</tr>
<tr>
<td>dhcp4get</td>
<td>Displays whether DHCP is enabled</td>
</tr>
<tr>
<td>dhcp4set</td>
<td>Used to enable or disable DHCP</td>
</tr>
<tr>
<td>dns4get</td>
<td>Displays the configured DNS servers</td>
</tr>
<tr>
<td>dns4set</td>
<td>Used to configure the DNS servers</td>
</tr>
<tr>
<td>dhcp6get</td>
<td>Displays whether DHCPv6 is enabled</td>
</tr>
<tr>
<td>dhcp6set</td>
<td>Used to enable or disable DHCPv6</td>
</tr>
<tr>
<td>doyget</td>
<td>Used to obtain the current Day of Year</td>
</tr>
<tr>
<td>doyset</td>
<td>Used to set the current Day of Year</td>
</tr>
<tr>
<td>gpsdop</td>
<td>Displays GNSS receiver positional accuracy estimates</td>
</tr>
<tr>
<td>gpsdserviceportget</td>
<td>Displays the GPSD service port</td>
</tr>
<tr>
<td>gpsdserviceportset</td>
<td>Sets the GPSD service port</td>
</tr>
<tr>
<td>gpsinfo</td>
<td>Displays GNSS latitude, longitude and antenna height</td>
</tr>
<tr>
<td>gpsmdl</td>
<td>Displays the GNSS Manufacturer and Model</td>
</tr>
<tr>
<td>gpssat</td>
<td>Displays GNSS satellites tracked and maximum signal strength being received</td>
</tr>
<tr>
<td>gw4get</td>
<td>Displays configured IPv4 gateway addresses</td>
</tr>
<tr>
<td>gw4set</td>
<td>Used to configure the IPv4 gateway addresses</td>
</tr>
<tr>
<td>gw6get</td>
<td>Displays configured IPv6 gateway address</td>
</tr>
<tr>
<td>gw6set</td>
<td>Used to configure the IPv6 gateway address</td>
</tr>
<tr>
<td>halt</td>
<td>Used to Halt the system for shutdown</td>
</tr>
<tr>
<td>helpcli</td>
<td>Provides list of available commands and syntax</td>
</tr>
<tr>
<td>hostget</td>
<td>Displays the DNS hostname</td>
</tr>
<tr>
<td>hostset</td>
<td>Sets the DNS hostname</td>
</tr>
<tr>
<td>hotstart</td>
<td>Initiate a hot start operation on the SAASM GPS receiver</td>
</tr>
<tr>
<td>ip4get</td>
<td>Displays IPv4 Ethernet port settings information (IP address net mask and gateway)</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>ip4set</strong></td>
<td>Used to set IPv4 Ethernet port settings information (IP address net mask and gateway)</td>
</tr>
<tr>
<td><strong>ip6add</strong></td>
<td>Used to add IPv6 Ethernet port settings information (IP address net mask and gateway)</td>
</tr>
<tr>
<td><strong>ip6del</strong></td>
<td>Used to delete IPv6 IP address</td>
</tr>
<tr>
<td><strong>ip6get</strong></td>
<td>Used to obtain the IPv6 IP address</td>
</tr>
<tr>
<td><strong>iptables</strong></td>
<td>See for more information.</td>
</tr>
<tr>
<td><strong>licenses</strong></td>
<td>Displays configured licenses installed (if any)</td>
</tr>
<tr>
<td><strong>list</strong></td>
<td>Outputs a list of commands</td>
</tr>
<tr>
<td><strong>loadconf</strong></td>
<td>Restore a saved configuration and reboot</td>
</tr>
<tr>
<td><strong>localget</strong></td>
<td>Used to obtain the configured local clock</td>
</tr>
<tr>
<td><strong>localist</strong></td>
<td>Used to display local clocks</td>
</tr>
<tr>
<td><strong>localset</strong></td>
<td>Used to configure local clocks</td>
</tr>
<tr>
<td><strong>model</strong></td>
<td>Displays the Serial Number of the unit</td>
</tr>
<tr>
<td><strong>net</strong></td>
<td>Displays network status</td>
</tr>
<tr>
<td><strong>netnum</strong></td>
<td>Displays the number of general-purpose network interfaces</td>
</tr>
<tr>
<td><strong>net4</strong></td>
<td>Displays IPv4 network status</td>
</tr>
<tr>
<td><strong>net6</strong></td>
<td>Displays IPv6 network status</td>
</tr>
<tr>
<td><strong>options</strong></td>
<td>Displays configured options installed (if any)</td>
</tr>
<tr>
<td><strong>oscget</strong></td>
<td>Displays the installed system oscillator</td>
</tr>
<tr>
<td><strong>portget</strong></td>
<td>Display whether network port is enabled (for example, &quot;portget ETH2&quot;)</td>
</tr>
<tr>
<td><strong>portset</strong></td>
<td>Enable or disable a network port: &quot;portset x on&quot; where &quot;x&quot; is the port number (for example, &quot;ETH2&quot;) &quot;portset X off&quot; [NOTE: Available since Web UI Revision no. 5.1.2]</td>
</tr>
<tr>
<td><strong>portstate</strong></td>
<td>Display the current state for a network port</td>
</tr>
<tr>
<td><strong>ppsctrl</strong></td>
<td>Enable/disable individual 1PPS output signals</td>
</tr>
<tr>
<td><strong>priorset</strong></td>
<td>Sets the priority of an entry in the reference priority table</td>
</tr>
<tr>
<td><strong>radius setretry</strong></td>
<td>&lt;value&gt; Sets how many radius login retries will be attempted</td>
</tr>
<tr>
<td><strong>radius getretry</strong></td>
<td>&lt;value&gt; Gets the number of radius login retry attempts</td>
</tr>
<tr>
<td>Command</td>
<td>Description</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>radius server list</td>
<td>Lists radius servers</td>
</tr>
<tr>
<td>radius server add</td>
<td>&lt;host&gt; &lt;port&gt; &lt;key&gt; &lt;timeout&gt; Adds radius server</td>
</tr>
<tr>
<td>radius server del</td>
<td>&lt;id&gt; Deletes radius server number &lt;id&gt;</td>
</tr>
<tr>
<td>reboot</td>
<td>Used to warm-boot the unit without having to disconnect or reconnect power</td>
</tr>
<tr>
<td>reftable</td>
<td>Displays reference priority table</td>
</tr>
<tr>
<td>release4</td>
<td>Used with DHCP to release the IPv4 address</td>
</tr>
<tr>
<td>release6</td>
<td>Used with DHCPv6 to release the IPv6 address</td>
</tr>
<tr>
<td>renew4</td>
<td>Used with DHCP to renew the assigned IPv4 address</td>
</tr>
<tr>
<td>renew6</td>
<td>Used with DHCPv6 to renew the assigned IPv6 address</td>
</tr>
<tr>
<td>resetpw</td>
<td>Resets the administrator account (spadmin) password back to the default value</td>
</tr>
<tr>
<td>routes4</td>
<td>Displays the current IPv4 routing table(s)</td>
</tr>
<tr>
<td>routes6</td>
<td>Displays the current IPv6 routing table(s)</td>
</tr>
<tr>
<td>rt4add</td>
<td>Adds an IPv4 static route</td>
</tr>
<tr>
<td>rt4del</td>
<td>Deletes an IPv4 static route</td>
</tr>
<tr>
<td>rt4get</td>
<td>Displays the configured IPv4 static routes</td>
</tr>
<tr>
<td>rt6add</td>
<td>Adds an IPv6 static route</td>
</tr>
<tr>
<td>rt6del</td>
<td>Deletes an IPv6 static route</td>
</tr>
<tr>
<td>rt6get</td>
<td>Displays the configured IPv6 static routes</td>
</tr>
<tr>
<td>saveconf</td>
<td>Generate archive of current configuration</td>
</tr>
<tr>
<td>savelog</td>
<td>Generate archive of all log files</td>
</tr>
<tr>
<td>scaleget</td>
<td>Displays configured system timescale</td>
</tr>
<tr>
<td>scaleset</td>
<td>Used to configure the system timescale</td>
</tr>
<tr>
<td>services</td>
<td>Displays the state of services (enabled/disabled)</td>
</tr>
<tr>
<td>servget</td>
<td>Displays the state of individual services</td>
</tr>
<tr>
<td>servset</td>
<td>Enable or disable specific services</td>
</tr>
<tr>
<td>slaacget</td>
<td>Displays whether SLAAC is enabled</td>
</tr>
<tr>
<td>slaacset</td>
<td>Used to enable or disable SLAAC</td>
</tr>
</tbody>
</table>
### Command Table

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>stateset</td>
<td>Enable or disable an entry in the reference priority table. index = 0..15, state = 0 (disable), 1 (enable)</td>
</tr>
<tr>
<td>status</td>
<td>Displays information about the oscillator disciplining</td>
</tr>
<tr>
<td>syncstate</td>
<td>Display timing system synchronization state</td>
</tr>
<tr>
<td>sysupgrade</td>
<td>Performs system upgrade using the update bundle provided</td>
</tr>
<tr>
<td>testevent</td>
<td>Generates SNMP events in the enterprise MIB</td>
</tr>
<tr>
<td>tfomget</td>
<td>Displays current estimated system time error (TFOM – Time Figure of Merit)</td>
</tr>
<tr>
<td>timeget</td>
<td>Displays current system time (time is displayed in the configured timescale – See scaleget command to retrieve the configured timescale)</td>
</tr>
<tr>
<td>timeset</td>
<td>Used to manually set the current time (hours, minutes in seconds); time is entered based on the configured timescale – See scaleget command to retrieve the configured timescale</td>
</tr>
<tr>
<td>unrestrict</td>
<td>Used for clearing access control restrictions to VelaSync</td>
</tr>
<tr>
<td>version</td>
<td>Displays the installed main VelaSync and timing system software versions</td>
</tr>
<tr>
<td>yearget</td>
<td>Displays the current year</td>
</tr>
<tr>
<td>yearset</td>
<td>Used to set the current year</td>
</tr>
<tr>
<td>zeroize</td>
<td>Applicable to SAASM-equipped VelaSync units only</td>
</tr>
</tbody>
</table>

### 5.3 IRIG Standards and Specifications

#### 5.3.1 About the IRIG Output Resolution

The IRIG output signals are generated from VelaSync’s System Time, which can be synced to one or more external input references (such as GPS, IRIG, PTP, etc). The accuracy of the System time to true UTC time is dependent upon what the selected external reference is (with GPS typically being the most accurate reference for the system to sync with).

IRIG AM synchronization of a device to its IRIG source is typically measured in the tens of microseconds, while synchronization using a IRIG DCLS signal can typically provide around 100 nanoseconds or so (plus the cable delays between VelaSync and the other device, as well as the processing delays of the other system itself).

IRIG AM functionality is available through an option card.
Note that all IRIG outputs has its own available ‘offset’ capability, which is configurable via VelaSync’s Web UI, to help account for cabling and processing delays of the device each output is connected with.

### 5.3.2 IRIG Carrier Frequencies

Each IRIG code specifies a carrier frequency that is modulated to encode date and time, as well as control bits to time-stamp events. Initially, IRIG applications were primarily military and government associated. Today, IRIG is commonly used to synchronize voice loggers, recall recorders, and sequential event loggers found in emergency dispatch centers and power utilities.

**Table 5-3: Available IRIG output signals**

<table>
<thead>
<tr>
<th>Format</th>
<th>Encoding</th>
<th>Modulation</th>
<th>Carrier</th>
<th>Coded Expressions</th>
<th>Bit Rate</th>
<th>Time Frame Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRIG-A</td>
<td>A000</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, CF and SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A001</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, CF</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A002</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A003</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A004</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, BCDYEAR, CF and SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A005</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, BCDYEAR, and CF</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A006</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, BCDYEAR</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A007</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCD_TOY, BCDYEAR, and SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A130</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCD_TOY, CF and SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A131</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCD_TOY, CF</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A132</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCD_TOY</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
</tbody>
</table>
## APPENDIX

<table>
<thead>
<tr>
<th>Format</th>
<th>Encoding</th>
<th>Modulation</th>
<th>Carrier</th>
<th>Coded Expressions</th>
<th>Bit rate</th>
<th>Time Frame Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRIG-A</td>
<td>A133</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCDTOY, SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A134</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCDTOY, BCDYEAR, CF and SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A135</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCDTOY, BCDYEAR, and CF</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
<td>A136</td>
<td>AM</td>
<td>10 kHz</td>
<td>BCDTOY, BCDYEAR</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-A</td>
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<td>AM</td>
<td>10 kHz</td>
<td>BCDTOY, BCDYEAR, and SBS</td>
<td>1000 pps</td>
<td>0.1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B000</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, CF and SBS</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B001</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, CF</td>
<td>100 pps</td>
<td>1 sec</td>
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<tr>
<td>IRIG-B</td>
<td>B002</td>
<td>DCLS</td>
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<td>BCDTOY</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B003</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, SBS</td>
<td>100 pps</td>
<td>1 sec</td>
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<tr>
<td>IRIG-B</td>
<td>B004</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR, CF and SBS</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B005</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR, and CF</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B006</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR</td>
<td>100 pps</td>
<td>1 sec</td>
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<tr>
<td>IRIG-B</td>
<td>B007</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR, and SBS</td>
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<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B120</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, CF and SBS</td>
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<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B121</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, CF</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B122</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B123</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, SBS</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B124</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, BCDYEAR, CF and SBS</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B125</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, BCDYEAR, and CF</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-B</td>
<td>B126</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, BCDYEAR</td>
<td>100 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>Format</td>
<td>Encoding</td>
<td>Modulation</td>
<td>Carrier</td>
<td>Coded Expressions</td>
<td>Bit rate</td>
<td>Time Frame Interval</td>
</tr>
<tr>
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<td>------------</td>
<td>---------</td>
<td>------------------------------------</td>
<td>----------</td>
<td>---------------------</td>
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<tr>
<td>IRIG-B</td>
<td>B127</td>
<td>AM</td>
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<td>BCDTOY, BCDYEAR, and SBS</td>
<td>100 pps</td>
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</table>

**IRIG-E**

<table>
<thead>
<tr>
<th>IRIG-E</th>
<th>E000</th>
<th>DCLS</th>
<th>N/A</th>
<th>BCDTOY, CF and SBS</th>
<th>10 pps</th>
<th>1 sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRIG-E</td>
<td>E001</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, CF</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E002</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E003</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E004</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR, CF and SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E005</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR, and CF</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E006</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E007</td>
<td>DCLS</td>
<td>N/A</td>
<td>BCDTOY, BCDYEAR, and SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E110</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, CF and SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E111</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, CF</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E112</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E113</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E114</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, BCDYEAR, CF and SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E115</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, BCDYEAR, and CF</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E116</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, BCDYEAR</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E117</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, BCDYEAR, and SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E120</td>
<td>AM</td>
<td>100 Hz</td>
<td>BCDTOY, CF and SBS</td>
<td>10 pps</td>
<td>1 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E121</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, CF</td>
<td>10 pps</td>
<td>10 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E122</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY</td>
<td>10 pps</td>
<td>10 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E123</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, SBS</td>
<td>10 pps</td>
<td>10 sec</td>
</tr>
<tr>
<td>IRIG-E</td>
<td>E124</td>
<td>AM</td>
<td>1 kHz</td>
<td>BCDTOY, BCDYEAR, CF and SBS</td>
<td>10 pps</td>
<td>10 sec</td>
</tr>
</tbody>
</table>
The Spectracom IRIG formats use the control functions for BCD year information and a Time Sync Status bit and in format E the control functions are used for straight binary seconds (SBS). Refer to individual IRIG Time Code description figures and text. IRIG Standard 200-98 format B had 27 control bits and format E had 45 bits for control functions. These control bits could be used for any use and there was no defined function. Spectracom used the control function element at index count 55 as the TIME SYNC STATUS and the sub-frame after position identifiers P6 and P7 as the year info and for format E the sub-frame after P8 and P9 for the straight binary seconds (SBS). The position of the BCD year information does not conform to the newer IRIG Standard 200-04. IRIG Standard
200-04 incorporated the year information after P5 and reduced the allocated control bits to 18 for format B and 36 for format E.

**Note:** DCLS is DC Level Shifted output, pulse width modulated with a position identifier having a positive pulse width equal to 0.8 of the reciprocal of the bit rate, a binary one (1) having a positive pulse width equal to 0.5 of the reciprocal of the bit rate and a binary zero (0) having a positive pulse width equal to 0.2 of the reciprocal of the bit rate.

VelaSync can provide IRIG A, IRIG B, IRIG E and IRIG G code in amplitude modulated (AM) or pulse width coded (TTL) formats. A signature control feature may be enabled for any IRIG output. Signature control removes the modulation code when a Time Sync Alarm is asserted.

### 5.3.3 IRIG B Output

The IRIG B Time Code description follows.

![IRIG B Time Code Description](image)

**Figure 5-1:** IRIG B time code description
The IRIG B code contains the Binary Coded Decimal (BCD) time of year, Control Function (CF) field and the Straight Binary Seconds time of day. The following figure illustrates the IRIG B data structure. The BCD time of year provides the day of the year, 1-366, and the time of day including seconds. The hour of the day is expressed in 24 hour format. The SBS time is the number of seconds elapsed since midnight. The Control Function field contains year information and a time synchronization status bit.

1. Time frame: 1.0 seconds.

2. Code digit weighting:
   A. Binary Coded Decimal time-of-year.
      » Code word - 30 binary digits.
      » Seconds, minutes hours, and days.
      » Recycles yearly.
   B. Straight Binary Seconds time-of-day.
      » Code word - 17 binary digits.
      » Seconds only, recycles daily.

3. Code word structure:
   » **BCD**: Word seconds digits begin at index count 1. Binary coded elements occur between position identifier elements P0 and P5 (7 for seconds, 7 for minutes, 6 for hours, and 10 for days) until the code word is complete. An index marker occurs between decimal digits in each group to provide separation for visual resolution. Least significant digit occurs first.

   » **CF**: IRIG formats reserve a set of elements known as Control Functions (CF) for the encoding of various control, identification, or other special purpose functions. IRIG B has 27 Control Functions located between elements 50 and 78. The VelaSync uses the Control Functions to encode year information and time synchronization status.

The table below lists the Control Function Field and the function of each element.

- Element 55 is the time synchronization status bit. Element 55 is a Binary 1 when the unit is in sync, and a Binary 0 when it is not.
- Year information consists of the last two digits of the current year (i.e. 97, 98, 99 etc.). Elements 60 through 63 contain the binary equivalent of year units. Elements 65 through 68 contain the binary equivalent of tens of years. In keeping with IRIG
formats, the least significant bit occurs first. All unused Control Functions are filled with a space (Binary 0).

**SBS:** Word begins at index count 80. Seventeen Straight Binary Coded elements occur with a position identifier between the 9th and 10th binary coded elements. Least significant digit occurs first.

- **Pulse rates:**
  - Element rate: 100 per second.
  - Position identifier rate: 10 per second.
  - Reference marker rate: 1 per second.

- **Element identification:** The "on time" reference point for all elements is the pulse leading edge.
  - Index marker (Binary 0 or uncoded element): 2 millisecond duration.
  - Code digit (Binary 1): 5 millisecond duration.
  - Position identifier: 8 millisecond duration.

- **Reference marker:** 1 per second. The reference marker appears as two consecutive position identifiers. The second position identifier marks the on-time point for the succeeding code word.

- **Resolution:**
  - Pulse width coded signal: 10 milliseconds.
  - Amplitude modulated signal: 1 millisecond.

- **Carrier frequency:** 1kHz when modulated.

<table>
<thead>
<tr>
<th>C.F. Element #</th>
<th>Digit #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1</td>
<td>Space</td>
</tr>
<tr>
<td>51</td>
<td>2</td>
<td>Space</td>
</tr>
<tr>
<td>52</td>
<td>3</td>
<td>Space</td>
</tr>
<tr>
<td>53</td>
<td>4</td>
<td>Space</td>
</tr>
<tr>
<td>54</td>
<td>5</td>
<td>Space</td>
</tr>
<tr>
<td>55</td>
<td>6</td>
<td>Time Sync Status</td>
</tr>
<tr>
<td>56</td>
<td>7</td>
<td>Space</td>
</tr>
</tbody>
</table>
### 5.3.4 IRIG E Output

The **IRIG E** code contains the Binary Coded Decimal (BCD) time of year and Control Functions. The figure IRIG E Time Code Description illustrates the IRIG E data structure. The BCD time of year provides the day of year, 1-366, and time of day to tens of seconds. The hour of the day is expressed in 24 hour format. The Control Function field includes a time synchronization status bit, year information and SBS time of day.

<table>
<thead>
<tr>
<th>C.F. Element #</th>
<th>Digit #</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>8</td>
<td>Space</td>
</tr>
<tr>
<td>58</td>
<td>9</td>
<td>Space</td>
</tr>
<tr>
<td>59</td>
<td>PID P6</td>
<td>Position Identifier</td>
</tr>
<tr>
<td>60</td>
<td>10</td>
<td>Years Units Y1</td>
</tr>
<tr>
<td>61</td>
<td>11</td>
<td>Years Units Y2</td>
</tr>
<tr>
<td>62</td>
<td>12</td>
<td>Years Units Y4</td>
</tr>
<tr>
<td>63</td>
<td>13</td>
<td>Years Units Y8</td>
</tr>
<tr>
<td>64</td>
<td>14</td>
<td>Space</td>
</tr>
<tr>
<td>65</td>
<td>15</td>
<td>Years Tens Y10</td>
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<tr>
<td>66</td>
<td>16</td>
<td>Years Tens Y20</td>
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<tr>
<td>67</td>
<td>17</td>
<td>Years Tens Y40</td>
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<tr>
<td>68</td>
<td>18</td>
<td>Years Tens Y80</td>
</tr>
<tr>
<td>69</td>
<td>PID P7</td>
<td>Position Identifier</td>
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<tr>
<td>70</td>
<td>19</td>
<td>Space</td>
</tr>
<tr>
<td>71</td>
<td>20</td>
<td>Space</td>
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<td>72</td>
<td>21</td>
<td>Space</td>
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<td>73</td>
<td>22</td>
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<td>74</td>
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<td>75</td>
<td>24</td>
<td>Space</td>
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<tr>
<td>76</td>
<td>25</td>
<td>Space</td>
</tr>
<tr>
<td>77</td>
<td>26</td>
<td>Space</td>
</tr>
<tr>
<td>78</td>
<td>27</td>
<td>Space</td>
</tr>
</tbody>
</table>
» **Time frame**: 10 seconds.

» **Code Digit Weighting**:
  - Binary Coded Decimal time of year.
  - Code world - 26 binary digits.
  - Tens of seconds, minutes, hours, and days.
  - Recycles yearly.

» **Code Word Structure**: BCD word tens of seconds digits begin at index count 6. Binary coded elements occur between position identifier elements P0 and P5 (3 for seconds, 7 for minutes, 6 for hours, and 10 for days) until the code word is complete. An index marker occurs between decimal digits in each group to provide separation for visual resolution. Least significant digit occurs first.

» **Control Functions**: IRIG formats reserve a set of elements known as Control Functions (CF) for the encoding of various control, identification, or other special purpose functions. IRIG E has 45 Control Functions located between elements 50 and 98. The VelaSync uses the Control Function field to encode year data, time synchronization status, and SBS time data. Table B-2 lists the Control Function Field and each element’s function.

  Element 55 is the time synchronization status bit. Element 55 is a Binary 1 when the front panel time synchronization lamp is green, and a Binary 0 when the lamp is red.

  Year information consists of the last two digits of the current year (i.e. 98, 99, etc.). Elements 60 through 63 contain the binary equivalent of year units. Elements 65 through 68 contain the binary equivalent of tens of years. In keeping with IRIG formats, the least significant bit occurs first.

  Elements 80 through 97 are encoded with the Straight Binary Seconds (SBS) time data. The SBS time data is incremented in 10-second steps and recycles every 24 hours.

  » **Pulse rates**:
    - Element rate: 10 per second.
    - Position identifier rate: 1 per second.
    - Reference marker rate: 1 per 10 seconds.

  » **Element identification**: The "on time" reference point for all elements is the pulse leading edge.

  » **Index marker** (Binary 0 or uncoded element): 20 millisecond duration.
Code digit (Binary 1): 50 millisecond duration.

Position identifier: 80 millisecond duration.

Reference marker: 80 millisecond duration, 1 per 10 seconds. The reference marker appears as two consecutive position identifiers. The second position identifier or reference marker is the on-time point for the succeeding code word.

**Figure 5-2: IRIG E time code description**

**Additional information**

The beginning of each 10 second time frame is identified by two consecutive 80 ms elements (P₀ and Pᵣ). The leading edge of the second 80 ms element (Pᵣ) is the “on time” reference point for the succeeding time code. 1PPS position identifiers P₀, P₁ ... P₉ (80 ms duration) occur 0.1 s before 1PPS "on time" and refer to the leading edge of the succeeding element.

The time code word and the control functions presented during the time frame are pulse-width coded. The binary "zero" and index markers have a duration of 20 ms, and the binary "one" has a duration of 50 ms. The leading edge is the 10 pps “on time” reference point for all elements.

The binary coded decimal (BCD) time-of-year code word consists of 26 digits beginning at index count 6. The binary coded subword elements occur between position identifiers P₀ and P₅ (3 for seconds; 7 for minutes; 6 for hours; 10 for days) until the code word is
complete. An index marker occurs between the decimal digits in each subword to provide separation for visual resolution. The least significant digit occurs first. The BCD code recycles yearly.

Forty-five control functions occur between position identifiers P₅ and P₀. Any control function element for combination of control function elements can be programmed to read a binary "one" during any specified number of time frames. Each control element is identified on the Control Function Field Table.

Table 5-5: IRIG E control function field

<table>
<thead>
<tr>
<th>BIT No.</th>
<th>CF ELEMENT No.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>1</td>
<td>SPACE</td>
</tr>
<tr>
<td>51</td>
<td>2</td>
<td>SPACE</td>
</tr>
<tr>
<td>52</td>
<td>3</td>
<td>SPACE</td>
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<tr>
<td>53</td>
<td>4</td>
<td>SPACE</td>
</tr>
<tr>
<td>54</td>
<td>5</td>
<td>SPACE</td>
</tr>
<tr>
<td>55</td>
<td>6</td>
<td>TIME SYNC_STATUS</td>
</tr>
<tr>
<td>56</td>
<td>7</td>
<td>SPACE</td>
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<tr>
<td>57</td>
<td>8</td>
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<td>58</td>
<td>9</td>
<td>SPACE</td>
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<td>PID P6</td>
<td>POSITION IDENTIFIER</td>
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<td>10</td>
<td>YEAR UNITS Y1</td>
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<tr>
<td>61</td>
<td>11</td>
<td>YEAR UNITS Y2</td>
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<tr>
<td>62</td>
<td>12</td>
<td>YEAR UNITS Y4</td>
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<tr>
<td>63</td>
<td>13</td>
<td>YEAR UNITS Y8</td>
</tr>
<tr>
<td>64</td>
<td>14</td>
<td>SPACE</td>
</tr>
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5.3.5 **IRIG Output Accuracy Specifications**

The IRIG outputs deliver signals with the following 1PPS accuracy:

**IRIG DCLS**

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<th>Measured Accuracy</th>
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<tr>
<td>IRIG B</td>
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<td>IRIG G</td>
<td>30 ns</td>
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<td>IRIG NASA</td>
<td>30 ns</td>
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<tr>
<td>IRIG E</td>
<td>30 ns</td>
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</table>

**IRIG AM**

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<th>Signal Category</th>
<th>Measured Accuracy</th>
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</thead>
<tbody>
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<td>200 ns</td>
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<tr>
<td>IRIG B</td>
<td>800 ns</td>
</tr>
<tr>
<td>IRIG G</td>
<td>200 ns</td>
</tr>
<tr>
<td>IRIG NASA</td>
<td>800 ns</td>
</tr>
<tr>
<td>IRIG E</td>
<td>1.5 μs</td>
</tr>
</tbody>
</table>

5.4 **Choosing a GNSS Antenna Location**

Listed below are requirements for selecting an optimal installation location for your GNSS antenna. For instructions on how to install a GPS/GNSS antenna, the signal cable, and accessories such as surge protectors, weatherproofing kits, or amplifiers, refer to the documentation that came with the respective equipment.
Regarding the selection of a suitable **antenna location**, the following recommendations generally apply:

- **A clear view of the sky down to the horizon** in all directions is recommended for the most optimal satellite reception. The mounting location of the external GNSS antenna should be free of objects that could obstruct satellite visibility from straight overhead to within 20 degrees of the horizon in all directions.

  To optimize timing accuracy, the GNSS receiver attempts to track satellites that are spread out as far as possible across the sky. The GNSS receiver must track at least four satellites in order to obtain time synchronization. Obstructions that block a significant portion of the sky result in degraded performance.

- **GPS antennas need to be separated from surrounding metallic materials.** Any metal in the area changes the shape of the reception pattern of the antenna. Any buildings or metallic materials close to the antenna can create shadows which can shield the antenna from receiving in that particular direction.

- **Separation between multiple antennas:** If the antennas are installed too close together there could potentially be interaction between the antennas and a resulting loss of sensitivity. This could also adversely affect the search pattern of the antennas, resulting in fewer satellites being tracked.

  - Ideally, antennas should be separated as much as physically possible, so as to help isolate them from being simultaneously affected by the same anomaly (such as a nearby lightning strike or a falling object, for example). The minimum GNSS antenna-to-antenna distance is 39 inches (1 meter).

  - GPS antennas are receive-only antennas which do not intentionally transmit any signals. Even though this reduces the amount of separation needed between multiple antennas, a few meters of separation are recommended to isolate the antennas from each other, in order to limit any possible EMI interference caused by the active components inside the antennas.
If a noticeable decrease in sensitivity (resulting in weak signal strengths) and/or very few satellites being tracked is noted, try repositioning the antennas to improve the satellite reception.

Mount the antenna at the desired location. Connect the supplied cable to the antenna. Take appropriate lightning precautions as necessary. The GNSS antenna must be mounted such that the antenna points to the sky, i.e. the connector side pointing down.

**Note:** Spectracom recommends applying an appropriate silicon grease to the cable connection at the GNSS antenna in order to protect the connection from moisture. An additional weatherproofing kit (P/N 221213) containing butyl rubber and plastic tape is also available from Andrews Corporation, USA, phone +1.800.255.1479.

5.5 Maintenance and Service

We recommend to clean the front *bezel filter* regularly:

- Remove the front bezel by unlocking it with the key, then pressing the red release knob, then removing the bezel with both hands. While the bezel is removed, check if the filter requires cleaning.

It is recommended that you keep a maintenance log of filter cleaning/replacement, since its condition will affect the airflow throughout the whole system.

**Note:** When using a cabinet-style rack, close the cabinet doors after completion of the maintenance work, to maintain proper cooling.

5.6 Product Registration

Spectracom recommends that you register your VelaSync so as to allow our Customer Service and Technical Support to notify you of important software updates, or send you service bulletins, if required.
Upon initial start of the VelaSync Web UI, you will be prompted to register your new product. It is also possible to register at a later time via the HELP menu item, or directly on the Spectracom website: register.spectracom.com

5.7 Links to External Information

To learn more about the following hardware-related subjects, see the Server OEM User’s Manual at https://www.supermicro.com/manuals/superserver/1U/MNL-1771.pdf:

- System safety
- Server setup
- Rack mounting
- System Interface
- Motherboard
- Chassis
- System fans
- Hard disks
- Power supplies
- Advanced setup
- BIOS setup
- BIOS error beep codes
- Chipset
- Server management
- System specifications
5.8 **Technical Support**

To request technical support for your VelaSync unit, please go to the "Support" page of the Spectracom Corporate website, where you can not only submit a support request, but also find additional technical documentation.

Phone support is available during regular office hours under the telephone numbers listed below.

To speed up the diagnosis of your VelaSync, please send us:

- the current **product configuration** (navigate to TOOLS > Upgrade/Backup > System Configuration panel), and
- the **events log**.

Thank you for your cooperation.

5.8.1 **Regional Contact**

Spectracom operates globally and has offices in several locations around the world. Our main offices are listed below:

<table>
<thead>
<tr>
<th>Table 5-6: Spectracom contact information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Country</strong></td>
</tr>
</tbody>
</table>
| France      | Les Ulis     | +33 (0)1 64 53 39 80 | Spectracom France  
Parc Technopolis – Bat. Sigma  
3, Avenue du Canada  
91974 Les Ulis Cedex |
| USA         | Rochester, NY | +1 585 321 5800   | Spectracom USA  
1565 Jefferson Road, Suite 460  
Rochester, NY 14623 |

Additional regional contact information can be found on the [Contact page](#) of the Spectracom website.

5.9 **Return Shipments**

Please contact Spectracom Technical Support before returning any equipment to Spectracom. Technical Support must provide you with a Return Material Authorization Number (RMA#) prior to shipment.
When contacting Technical Support, please be prepared to provide your equipment serial number(s) and a description of the failure symptoms or issues you would like resolved. Freight to Spectracom is to be prepaid by the customer.

**Note:** Should there be a need to return equipment to Spectracom, it must be shipped in its original packing material. Save all packaging material for this purpose.

### 5.10 License Notices

#### 5.10.1 Chrony v3.0

Chrony is published under GPLv2

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Version 2, June 1991

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GMP is no longer used, and instead we call BN code from OpenSSL
Zlib is now external, in a library
The make-ssh-known-hosts script is no longer included
TSS has been removed
MD5 is now external, in the OpenSSL library
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Blowfish is now external, in the OpenSSL library

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<td>191</td>
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<td>Added reference monitoring, VLAN support. Specifications errata. Branding changes.</td>
<td>Sept 2018</td>
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<td>3.0</td>
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