The FEI-Zyfer Family of Modular, GPS-Aided Time & Frequency Systems

- **Precise Time & Frequency Reference**

- **High Performance Position & Navigation Engine**

- **Flexible, Expandable, Upgradable**

- **Hot Swappable**

- **COTS for Military Applications**

- **Field Proven Design**

- **Upgradable to M-Code**

- **Suitable for Fixed, Ground Mobile, Airborne and Maritime Systems**
- **Flexible Choice of GNSS Receivers for Specific Applications**
- **Rubidium Atomic Clocks for High Precision Time & Frequency Outputs with Extended Holdover Performance when GPS is Degraded or Denied**
- **JASA Version 3, Annex 1, TFNG Compliant for SIGINT Applications**

**FEI-Zyfer**

FEATURES

- **Accuracy**
  - **Time: <50ns Peak (UTC) <25ns RMS**
  - **Frequency: 1E-12**
- **GPS Receivers**
  - Standard Civil C/A-Code (L1) Frequency
  - multi-GNSS
  - SAASM Military C/A-P(Y)-Codes (L1, L2)
- **User interface**
  - Standard RS-232
  - Keypad/display
  - Ethernet I/O (Telnet, SNMP)
  - Zyfer Monitor™ GUI
- **Time Server**
  - SNTP, NTP
  - PTPv2 IEEE 1588-2008
- **Standard Outputs**
  - 1PPS (front panel)
  - 10MHz (front panel)
  - 13 output slots (CS II)
  - 8 output slots (CS II-D)
  - Gigabit Ethernet with Fiber Options available
- **External synchronization and time inputs**
- **Automatic switchover in the event of a failure**
- **Expandable with distribution shelves**
- **Increased reliability due to fewer system components**
- **Shorter MTTR due to "hot swappable" spare modules**
- **Lower field maintenance costs due to less system complexity**
- **Lower training costs due to commonality across family**

CommSync II Model 385 Modular Time and Frequency System

- 3U Chassis
- Redundant and Field Replaceable GTF/DTF, I/O, Output, Power Modules
- 13 Rear Expansion Slots for Option Modules
- Field Upgradable to M-Code when available

CommSync II-D Model 407 Modular Time and Frequency System
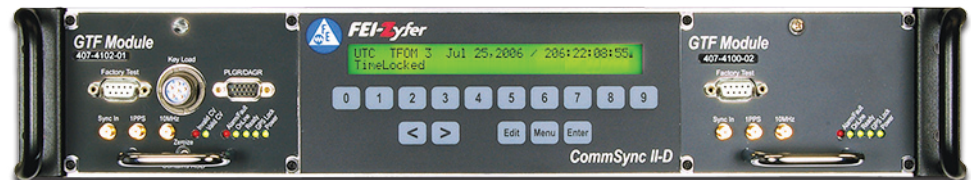
- 2U Chassis
- Redundant and Field Replaceable GTF/DTF, I/O, Output, Power Modules
- 8 Rear Expansion Slots for Option Modules
- Field Upgradable to M-Code when available

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Specifications

Output Specifications (GTF Front Panel)

After 24 hours of GPS locked operation, fixed antenna location, antenna delays entered.

Frequency Accuracy [a]

24 Hour average	Rubidium OSC	Quartz OSC
Locked to GPS	<1E-12	<1E-12
Holdover[a] – first 24 hours	<5E-11	<1E-10

Time Accuracy to UTC, for calibrated units[b]

	Rubidium OSC	Quartz OSC
Locked to GPS	<50ns Peak	<50ns Peak
Holdover[a] – first 24 hours	<3us	<7us

Short-Term Stability[c] typical

(Allan Deviation)	Rubidium OSC	Quartz OSC
1 sec	<3E-11	<1E-11
10 sec	<1E-11	<1E-11
100 sec	<3E-12	<1E-10

Phase Noise[c] typical

	Standard	Low Noise 5MHz
1 Hz	<–90 dBc/Hz	<–100 dBc/Hz
10 Hz	<–105 dBc/Hz	<–130 dBc/Hz
100 Hz	<–125 dBc/Hz	<–150 dBc/Hz
1 kHz	<–135 dBc/Hz	<–158 dBc/Hz

Input/Output (GTF Front Panel)

(1) 1PPS, 50 Ω, TTL level, SMA, External Sync input

(1) RS-232 I/O, DE-9 Connector

(1) 10MHz, 50 Ω, TTL level, SMA connector

(1) 1PPS, 50 Ω, TTL level, SMA connector

SAASM Option

(1) Key Load connector

(1) Hot Start connector

(1) Zeroize button

Power Options

CommSync II

• AC input (115-230 VAC)   100 to 240 VAC, 150 Watts max., 47-63 Hz

• DC input (24 VDC)   18-36 VDC, 150 Watts max.

• DC input (48 VDC)   36-76 VDC, 150 Watts max.

• DC input (12 VDC)   11.5 -18 VDC, 150 Watts max.

• DC input (28 VDC)   22-29 VDC, 150 Watts max.

CommSync II-D

• AC input (115/230 VAC)   100-120 and 200-240 VAC, 130 Watts max., 47-63 Hz

• DC input (24 VDC)   18-36 VDC, 100 Watts max.

• DC input (48 VDC)   36-76 VDC, 100 Watts max.

GPS Receiver Options

Standard GPS Receiver - Civil C/A-Code

Type	8-12 channel, independent tracking
Frequency	1575.42 MHz (L1)
Code	C/A only
Acquisition Time[b]	Warm Start: <2 min.
	Cold Start: <20 min.

Optional multi-GNSS Receiver Available

Type	GPS/GLONASS/BeiDou/ QZSS/Galileo

Upgradable to M-Code

SAASM GPS Receiver[d] - Military P(Y)-Code

Type

MPE-S GB-GRAM:	12 channel, independent tracking
FORCE 22E MRU:	24 channel, independent tracking
Frequency	1575.42 MHz and 1227.60 MHz (L1 & L2)
Code	C/A and P(Y)

Acquisition Time[b]

– Warm start:	<2 min.
– Hot / Cold Start:	Dependent on accuracy of initialization parameters from PLGR or DAGR handheld military GPS receivers, or other initialization devices
Key Load Interface:	DS-102

Physical

Height	134 mm (5.25") (3U) - CS II
	87 mm (3.50") (2U) - CS II-D
Width	448 mm (17.65") - CS II
	438 mm (17.25") - CS II-D
	Mounts in 19" EIA rack
Depth	381 mm (15") - CommSync II
	419 mm (16.5") - CommSync II-D
Weight	25lb. Max - CommSync II
	27lb. Max - CommSync II-D
Panel Color	Black Satin finish (Front Panel)

Environmental

Temperature

Operating	0°C to 50°C
Rate of Change	10°C/Hour
Storage	-40°C to +85°C
Relative Humidity	5% to 95%, non-condensing

Altitude

Operating	-60m to 4000m
Storage	-60m to 9000m

Specifications subject to change without notice.

Additional information on our website:

• CommSync II User Manual

• Option Module User Manual

• A list of detailed specifications of more than 200 time and frequency plug-in modules and network I/O modules

Visit www.fei-zyfer.com

Optional Accessories

• L1 Antenna Kit

• L1/L2 Antenna Kit

• Antenna Cables

• Antenna Inline Amplifier

• Fiber Optic Antenna Link

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FEATURES

- **Accuracy**
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    <25ns RMS
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- **GPS Receivers**
  - **Standard Civil C/A-Code (L1) Frequency**
  - **multi-GNSS**
  - **SAASM Military C/A-P(Y)-Codes (L1, L2)**
- **User interface**
  - **Standard RS-232**
  - **Keypad/display**
  - **Ethernet I/O**
  - **Zyfer Monitor™ GUI**
- **Time Server**
  - **SNTP, NTP**
  - **PTPv2 IEEE 1588-2008**
- **Standard Outputs**
  - **1PPS**
  - **10MHz**
  - **8 output slots (GSync II)**
  - **4 output slots (GSync)**
  - **Gigabit Ethernet with Fiber Options available**
- **Multi-purpose Embedded Ethernet supports:**
  - **NTP / PTP**
  - **SSH / Telnet**
  - **IPv4 / IPv6**
  - **SNMP**
  - **NMEA**
- **External synchronization and time inputs**

GSync II Model 402 Modular Time and Frequency System

- 2U Chassis
- Chassis Level 1PPS In/Output, Ethernet with NTP/PTP, RS-232, 10MHz
- 8 Rear Expansion Slots for Option Modules
- Factory Upgradable to M-Code when available

GSync Model 391 Modular Time and Frequency System

- 1U Chassis
- Chassis Level 1PPS In/Output, Ethernet with NTP/PTP, RS-232, 10MHz
- 4 Rear Expansion Slots for Option Modules
- Factory Upgradable to M-Code when available

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Specifications

Output Specifications

After 24 hours of GPS locked operation, fixed antenna location, antenna delays entered.

Frequency Accuracy [a]

24 Hour average	Rubidium OSC	Quartz OSC
Locked to GPS	<1E-12	<1E-12
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100 Hz	<–125 dBc/Hz	<–150 dBc/Hz
1 kHz	<–135 dBc/Hz	<–158 dBc/Hz

Input/Output (Rear Panel)

(1) 1PPS, 50 Ω, TTL level, BNC, External Sync input

(1) RS-232 I/O, DE-9 Connector

(1) GPS Antenna Connector, TNC

(1) 10MHz, 50 Ω, TTL level, BNC

(1) 1PPS, 50 Ω, TTL level, BNC

(1) RJ-45 10 / 100 Ethernet

SAASM Option (front panel)

(1) Key Load connector

(1) Hot Start connector

(1) Zeroize button

Power Options

GSync II

• AC input (115/230 VAC)	100-120 and 200-240 VAC, 130 Watts max., 47-63 Hz
• DC input (24 VDC)	18-36 VDC, 100 Watts max.
• DC input (48 VDC)	36-76 VDC, 100 Watts max.
• DC input (12 VDC)	11.5-18 VDC, 150 Watts max.

GSync

• AC input (115-230 VAC)	115-230 VAC, 100 Watts max., 47-63 Hz
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SAASM GPS Receiver[d] **- Military P(Y)-Code**

Type

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FORCE 22E MRU:	24 channel, independent tracking
Frequency	1575.42 MHz and 1227.60 MHz (L1 & L2)
Code	C/A and P(Y)

Acquisition Time[b]

– Warm start:	<2 min.
– Hot / Cold Start:	Dependent on accuracy of initialization parameters from PLGR or DAGR handheld military GPS receivers, or other initialization devices
Key Load Interface:	DS-102

Physical

Height	87 mm (3.50") (2U) - GSync II
	44 mm (1.75") (1U) - GSync
Width	438 mm (17.25") - GSync II
	448 mm (17.65") - GSync
	Mounts in 19" EIA rack
Depth	381 mm (15") - GSync II / GSync
Weight	15lb. Max - GSync II
	10lb. Max - GSync
Panel Color	Black Satin finish (Front Panel)

Environmental

Temperature

Operating	0°C to 50°C
Rate of Change	10°C/Hour
Storage	-40°C to +85°C
Relative Humidity	5% to 95%, non-condensing

Altitude

Operating	-60m to 4000m
Storage	-60m to 9000m

Specifications subject to change without notice.

Additional information on our website:

• GSync User Manual

• Option Module User Manual

• A list of detailed specifications of more than 200 time and frequency plug-in modules and network I/O modules

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Optional Accessories

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• L1/L2 Antenna Kit

• Antenna Cables

• Antenna Inline Amplifier

• Fiber Optic Antenna Link

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Design Concept

Customer requirements range from just one or two standard frequency (10 MHz) and/or time (1PPS) outputs to hundreds of outputs of various frequencies and time codes. Additional consideration must be given to:

- Redundancy
- Hot-swappable and hitless plug-in modules
- Phase coherent and/or aligned output signals
- Remotely upgradable software
- Remote monitoring and control
- Holdover performance in case of loss of GPS
- Various harsh environments

In response to such diverse demands, FEI-Zyfer integrated these design considerations and developed a family of 19" rack-mountable, modular products, 1U, 2U, and 3U high, to satisfy requests for:

- Redundant power supplies, both AC and DC
- Fully redundant GTF (GPS receiver with integrated OXCO or Rb oscillator)

- Expansion shelves/distribution systems locked to the master system/reference
- Ruggedization for transport or operation in harsh environments
- Fiber optic connectivity for antenna or master/slave for Tempest conditions

Applications include:

- Fully redundant Master Clock Systems for Satellite Ground Systems, Gateways, or Mobile SatCom Terminals
- Primary Reference Source for Telecom and Secure Communications and Data Networks
- Radar, C4ISR, and Air Traffic Control Systems
- Military Test Ranges and Calibration Laboratories, etc.

Most applications can be satisfied with a vast selection of hot-swappable Plug-In Modules, allowing easy and economical product configurations for GSync and CommSync II systems.

CommSync II Output Capability Diagram – Master/Slave Configuration
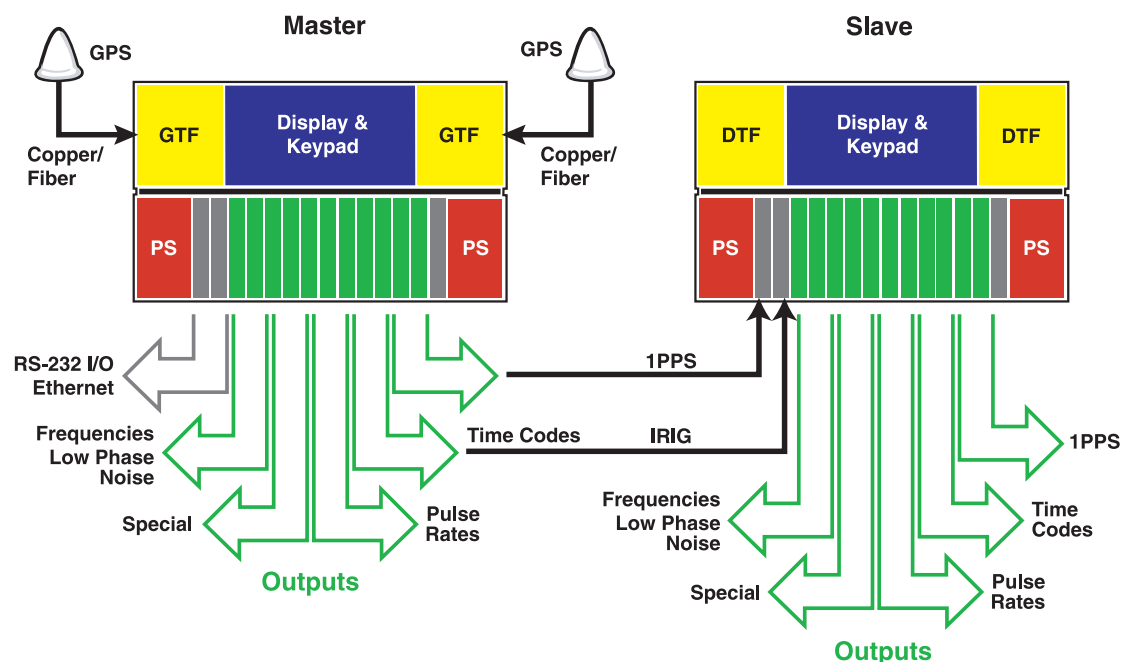
CommSync II rear panel showing vertical configuration and module locations

Power Input Module (must be in end slots)

I/O Modules (must be in these 2 slots) If no I/O Modules are used, the two slots are available for other time and frequency output modules.

Available Output Module slots

Wired GPS Antenna Panel (Not a Module)

Power Input Module (must be in end slots)

2U GSync II, rear panel Carries up to 8 modules horizontal

1U GSync, rear panel Carries up to 4 modules horizontal

CommSync II front view, showing GTF module locations

Sample Optional Plug-in Modules

Optional SAASM GTF Module

Ethernet Module

GPS Time & Frequency (GTF) Module

8 x BNC Low-Phase Noise Output Module

Time Code Output Module

Family of available Plug-In Modules:

- Power Supplies (DC and/or AC)

- Standard and Special Frequencies (1MHz to >100MHz)

- Time Codes (IRIG, HQ, PTTI) and Pulse Rates from
  1PPS to 10M PPS

- Clock Rates (programmable) from 1PPS to 54M PPS

- E1/T1 for Telecom Synchronization
  at Stratum 1

- Standard GPS C/A, multi-GNSS, and Military
  SAASM Receivers

- System Management and Control via RS-232 and/or
  Ethernet I/O (Telnet, SSH, and SNMP)

- Network Synchronization (NTPv4, PTPv2, IEEE-2008)

- Simple software upgrades via Ethernet

For special applications, FEI-Zyfer will ruggedize the product, perform ESS testing, calibrate to UTC or design new modules to meet customer's needs.

Additional information on our website:

- Product User Manuals

- **Option Module User Manual**

- **A list of detailed specifications of more than 200 time and frequency plug-in modules and network I/O modules**

Visit www.fei-zyfer.com

SAASM – Military GPS Receiver

The Chairman of the Joint Chiefs of Staff (CJCS) issued a mandate to begin SAASM GPS receiver deployment as of October 2002 and with full enforcement as of October 2006.

What is SAASM?

SAASM (Selective Availability Anti-Spoof Module) is the new generation military GPS receiver technology, providing a new security architecture and crypto key management infrastructure. Receiver hardware and software assets are protected by a tamper-resistant security module on the GPS receiver board. Crypto key security is protected by a new unclassified Black-Key infrastructure. Having unclassified hardware and key logistics greatly reduces the complexities of deploying military GPS.

What is Direct P(Y) acquisition?

The pre-SAASM GPS receiver technology requires the Civil C/A-Code signal to facilitate the acquisition of the crypto P(Y)-Code signal. In addition to a properly keyed receiver, the C/A signal provides the receiver with precision time and other parameters needed to acquire the P(Y) signal. The Hot Start acquisition functionality bypasses this need, able to come on-line in the absence of the Civil, in-the-clear C/A signal. This is a vital function of the SAASM receiver technology, because in today's tactical warfare scenarios, the C/A signal may not be available in the local area of conflict.

Why use GPS SAASM in time/frequency product applications?

Many existing communications and data networks used by the government and DoD receive precision time and frequency from GPS-C/A-aided synchronization products. GPS-C/A signals/receivers can be easily jammed or degraded, causing degradation or loss of synchronization and communications, unacceptable in vital applications. The use of GPS-SAASM receivers prevents such loss of synchronization.

Although GPS-SAASM receivers are "controlled items," they are not classified. Only the U.S. Government and its NATO partners are authorized to use such military receivers.

Are the systems upgradeable to M-Code?

Yes, when available.

CommSync II with SAASM configuration

Notes:
(a) After 48 hours of continuous operation.
(b) 2σ (95.5% probability).
(c) Detailed specifications for various frequency output modules: see "Option Module User Manual".
(d) SAASM receiver restrictions: *U.S. Government policy restricts the sale of Precise Positioning Service (PPS) equipment to those authorized by the U.S. Department of Defense. Non-U.S. authorized users must purchase PPS equipment through the Foreign Military Sales (FMS) process.*

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