SyncSystem 4380A
Input/Output and Measurement Modules

Summary

The Microchip SyncSystem 4380A is a scalable and flexible solution providing Input/Output (I/O) signaling types that can be easily configured using plug-in modules to accommodate end user's needs. The modules described in this document can be used in any combination, and like the hot-swappable power supplies, all modules are also hot-swappable and can be configured on the fly.

A single SyncSystem 4380A can be configured with up to 6 modules. Many of the modules provide multiple outputs or inputs (typically 4 ports). Below is a summary of the signal formats available followed by details of each module.

SyncSystem Modules --- Pulse	
Pulse output (e.g., PPS, DC-IRIG), 4 ports, BNC(F)	4394A
Pulse output (e.g., PPS, DC-IRIG), 4 ports, BNC(F) UTC Time & GPS Time	4334A
Code output, 4 ports, BNC(F), 0-8 Mbps range, 1 bps resolution	4391A
Code output, RS-422 Differential, 4 ports, BNC(Triax), 0-8 Mbps range, 1 bps resolution	4331A
Pulse output (e.g., PPS, DC-IRIG), RS-422 (4 outputs), DB15(F)	4376A
Pulse output (e.g., PPS, DC-IRIG, Havequick)), 4 ports, BNC(F)	4335A
Pulse output (1PPS at 10 Volts), 4 ports, BNC(F)	4344A

SyncSystem Modules --- Frequency	
1 MHz output (sine wave), 4 ports, BNC(F)	4395B-1
5 MHz output (sine wave), 4 ports, BNC(F)	4395B-5
10 MHz output (sine wave), 4 ports, BNC(F)	4395B-10

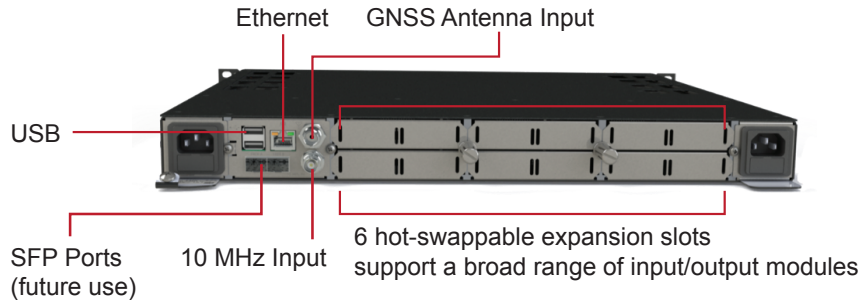| SyncSystem Modules --- AM IRIG	
Modulated IRIG output, 4 ports, BNC(F)	4387A or 4387A-1V (RMS) or 4387A-6V (Peak)
Epoch Adjusted Timecode (AM)	4337A
6V/3V, Quad AM IRIG output, 4 port EPOCH	4338A

SyncSystem Modules --- Telecom	
T1/E1 with DS1/E1 Framing, 4 ports, RJ45	4374A
TOD Output, IEC 8271, 4 ports, RJ45	4332A

SyncSystem Modules --- Input & Measurement	
Pulse input measurement (PPS), 4 ports, BNC(F)	4393A
IRIG input, 2 modulated IRIG input ports, 2 DC IRIG input ports, BNC(F)	4383A
Phase input measurement, 4 ports, BNC(F)	4382A

The rear of the SyncSystem 4380A is shown below. Modules can be operated in any of the six slots. The unit will automatically detect and configure the system based on the modules(s) installed. The module slots are identified by slot number so the operator can identify the modules' physical location in the chassis.

Ethernet   GNSS Antenna Input

USB

SFP Ports   10 MHz Input
(future use)

6 hot-swappable expansion slots
support a broad range of input/output modules

Pulse Output Modules

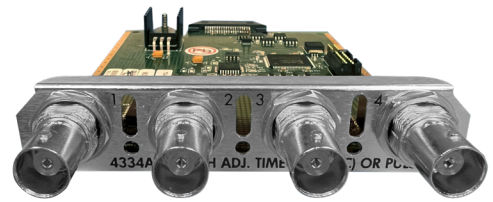### 4394A: Pulse output (e.g., PPS, DC-IRIG), 4 ports, BNC(F)

The 4394A module provides 4 pulse output ports. The output type of each port is individually user configurable. Users can change the signal types (PPS / DC IRIG), the PPS signal parameters, and the IRIG signal parameters. The 4394A module is tied to the UTC Epoch only.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω
Signals	PPS (2) & DC IRIG (2)
Levels	<0.8V low and >2.4V high into 50Ω
Rise Time	< 2 ns
Jitter	<100 ps
Skew	<±2 ns
PPS	
Intervals	10M 1M, 100K, 10K, 1K, 100, 10, and 1PPS
Pulse Width	Default ~100 µs ±10 µs. Pulse width is variable in integer counts of 100 MHz clock period
DC IRIG	
DC IRIG	Default: B000
Epoch	UTC Only
Types	A000, A003, A007, B000, B003, B007, D002, E002, G002, H002

4334A: Pulse output (e.g., PPS, DC-IRIG) - UTC Time and GPS Time

The 4334A module provides two 1PPS outputs and two DC IRIG (B000) outputs. Outputs 1 and 2 are 1PPS and outputs 3 and 4 are DC IRIG. Users can change the signal types (PPS/DC IRIG/Havequick), the PPS signal parameters, the IRIG signal types on individual output ports with 4 independent epochs, or Havequick (UTC Only). Users can select the output voltage on each port (0-3V or 0-5V) based on the configuration. By default, the module ships set to 3V.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω
Signals	PPS (2) & DC IRIG (2)
Levels	<0.8V low and >2.4V high into 50Ω
Rise Time	< 2 ns
Jitter	<200 ps
Skew	<±2 ns
PPS	
Intervals	10M 1M, 100K, 10K, 1K, 100, 10, and 1PPS
Pulse Width	Default ~100 µs ±10 µs. Pulse width is variable in integer counts of 100 MHz clock period
DC IRIG	
DC IRIG	Default: B000
Epoch	Default UTC. UTC, UTC+/- Offset, GPS, Local Time Zones. 1 Epoch per card
Types	A000, A003, A007, B000, B003, B007, D002, E002, G002, H002

4344A: 1PPS-10V Output Module

The factory default for this module provides four 1PPS outputs at 10V 0-PK. Valid PPS settings are 1PPS to 10MPPS. This module also allows configuration of the pulse period, pulse width and PPS rates.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50 Ω
Signals	1PPS Only
PPS	
Intervals	1PPS
Levels	10V ± 1.5V into 50 Ω
Pulse Width	Default - ~100 µs ±10 µs. Pulse width is variable in integer counts of 100 MHz clock period.
Rise Time	< 6.0 ns
Jitter	<200 ps
Skew	<±2 ns

4391A/4331A : Code Generators

The 4391A/4331A Code Generators can generate user defined bit streams with a known relationship to UTC. The code generation segment uses the local UTC estimate and a user-generated data file and produces a bit stream (derived from the user-generated file) whose first bit is aligned to within 1 ns of the local UTC estimate.

On the 4391A Ports 1 and 2 are TTL into 50Ω and Ports 3 and 4 are >2.4V peak-to-peak into 50Ω (NRZ). On the 4331A Ports 1 - 4 are RS422 (1.5 V to 5.5V into 100Ω differential Triax). All 4 ports of each module are in phase.

4391A: Code Generator Module

Characteristic	Description
Number of outputs	Four
Number of Clocks	Two per card
Output connectors	BNC(F)
Impedance	50Ω
Code Intervals	Default: 4MHz Square Wave (8,000,000 bits)
Code Levels (Ports 1 and 2)	TTL into 50Ω
Code Levels (Ports 3 and 4)	>2.4V peak to peak into 50Ω (NRZ)
Bit Rate	• Bit-rate programmable for 1 bps to 8 Mbps with 1 bps resolution • Up to 32 Mbits of user defined code stored in onboard SRAM memory for Time Code signal • Stored bit pattern is outputted at specified delay with desired bitrates • On-time delay per clock rate • Four different codes can be loaded • Play out repeats at end of code, Maximum 8192000 bit file per port which is also the maximum bit file size

4331A: RS-422 Code Generator Module

Characteristic	Description
Number of outputs	Four
Number of Clocks	Two per card
Output connectors	RJ-79 Triax
Impedance	100Ω Differential
Code Intervals	Default: 4MHz Square Wave (8,000,000 bits)
Code Levels	RS422 – 1.5 to 5.5V 100Ω Differential
Bit Rate	• Bit-rate programmable for 1 bps to 8 Mbps with 1 bps resolution • Up to 32 Mbits of user defined code stored in onboard SRAM memory for Time Code signal • Stored bit pattern is outputted at specified delay with desired bitrates • On-time delay per clock rate • Four different codes can be loaded • Play out repeats at end of code, Maximum 8192000 bit file per port which is also the maximum bit file size

4376A: Pulse Output Module (e.g., PPS, DC-IRIG), RS-422 (4 outputs), DB15(F)

The 4376A module factory default for this module provides four 1PPS outputs using a DB15 type connector. Users can change the PPS signal parameters on individual signal outputs.
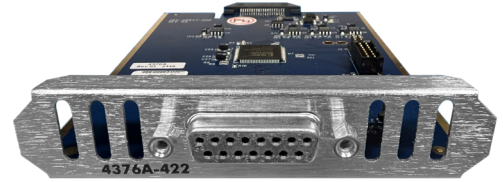
Characteristic	Description
Number of outputs	Four
Output connectors	DE-15(F)
Impedance	100Ω Differential
Pins	PPS1 (+1 and -9), PPS2 (+3 and -11), PPS3 (+5 and -13), PPS4 (+7 and -15)
Grounds	Pins 2, 4, 6, 8, 10, 12, 14
Intervals	Default: 1PPS, Valid PPS values are 10M, 1M, 100K, 10K, 1K, 100, 10, and 1
Levels	> 2V and < 2V into 100Ω, 1 <= Vcm <= 3.3V
Pulse Width	Default: ~100 μs ±1 μs. Pulse width is variable in integer counts of 100 MHz clock period
Rise/Fall Time	< 10ns
Jitter	<120 ps
Skew	<+/500ps

4335A: Pulse, Timecode, Have Quick Output Module

The 4335A module provides two 1PPS outputs and two DC IRIG (B000) Outputs. Outputs 1 and 2 are 1PPS and Outputs 3 and 4 are DC IRIG. The output types are user selectable/programmable. Users can change the signal types (PPS/DC IRIG/ Havequick), the PPS signal parameters, the IRIG signal types on individual output ports with 4 independent epochs, or Havequick (UTC Only). Users are able to select the output voltage on each port (0-3V or 0-5V) based on the configuration.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω
Signals	PPS (2) & DC IRIG (2)
Levels	<0.8V low and >2.4V high into 50Ω 0-3VP, (5V) 0-5VPk, user selectable per port
Rise Time	< 2 ns
Jitter	<200 ps
Skew	<±2 ns
PPS	
Intervals	10M 1M, 100K, 10K, 1K, 100, 10, and 1PPS
Pulse Width	Default ~100 μs ±10 μs. Pulse width is variable in integer counts of 100 MHz clock period
DC IRIG	
DC IRIG	Default: B000
Epoch	Default UTC. UTC, UTC+/- Offset, GPS, Local Time Zones. 1 Epoch per port
Types	A000, A003, A007, B000, B003, B007, D002, E002, G002, H002
Havequick	
Types	ICD_GPS 060A, STANAG 4246 HQI, STANAG 4246 HQII, STANAG 4372 HQIIA, STANAG 4430 HQX
Epoch	UTC Only

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Frequency Output Modules

The SyncSystem 4380A supports a variety of frequency outputs modules. All modules are all hot-swappable and do not require end user programming or configuration. The modules operate in any of the 6 module slots and output 10 MHz, 5 MHz or 1 MHz at +13 dbm.

4395B-1: 1 MHZ Module

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω
Amplitude	+13dbm ±2dBm
Signal	Sine Wave
Harmonics	< -40dBc
Phase Noise	1 Hz–130 dBc/Hz 10 Hz–145 dBc/Hz 100 Hz–154 dBc/Hz 1 kHz–158 dBc/Hz 10 kHz–160 dBc/Hz 100 kHz–160 dBc/Hz 1 MHz–160 bBc/Hz

4395B-5: 5 MHz Module

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω
Amplitude	+13 dBm ±2 dBm
Signal	Sine Wave
Harmonic	< –40 dBc
Phase Noise	1 Hz–116 dBc/Hz 10 Hz–138 dBc/Hz 100 Hz–150 dBc/Hz 1 kHz–155 dBc/Hz 10 kHz–157 dBc/Hz 100 kHz–157 dBc/Hz 1 Mhz–157 dBc/Hz

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Characteristic	Description	
Number of outputs	Four	
Output connectors	BNC(F)	
Impedance	50Ω	
Amplitude	+13dbm ±2 dBm	
Signal	Sine Wave	
Harmonics	< –40 dBc	
Phase Noise	ATS 6501B/6511C	ATS-6580A/SyncSystem 4380A
	.1 Hz–80 dBc/Hz	1 Hz–110 dBc/Hz
	1 Hz–110 dBc/Hz	10 Hz–132 dBc/Hz
	10 Hz–132 dBc/Hz	100 Hz–145 dBc/Hz
	100 Hz–136 dBc/Hz	1 kHz –150 dBc/Hz
	1 kHz–141 dBc/Hz	10 kHz –155 dBc/Hz
	10 kHz–141 dBc/Hz	100 kHz –155 dBc/Hz
	100 kHz–155 dBc/Hz	1 MHz –155 dBc/Hz
	1 MHz–155 dBc/Hz	

AM IRIG Modules

4387A: Amplitude Modulated (AM) IRIG Module

This module provides four Amplitude Modulated (AM) IRIG Outputs or the NASA36 Serial Time Code. Valid AM IRIG Codes are A (130, 133, 137), B (120, 123, 127), E (111, 112, 121), G (141, 142, 147), and H (111, 112, 121, 122, 127). The default time code is B120. The 4387A-6V module provides 6 Vpp output signals.

Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω
Amplitude into 50Ω	3.5 V$_{PP}$ (6 V$_{PP}$ for 4387A-6V) (2.8 V$_{PP}$ for 4387A-1V)
Modulation Ratio	10:3
IRIG types	Default: B120
Supported Types	A130, A133, A137, B120, B123, B127, E 111, E112, E121, E122, E127, G141, G142, G147, H111, H112, H121, H122, H127 or NASA36

4337A and 4338A: Epoch Adjusted Timecode (AM) IRIG Modules

This 4337A module provides four Amplitude Modulated (AM) IRIG Outputs tied to a single epoch where as the 4338A module allows each port to have its own unique epoch. The epoch can be user defined, UTC (default) [±offset], GPS time, or a configured time zone. Valid AM IRIG Codes are A (130, 133, 137), B (120, 123, 124, 127), E (111, 112, 121), G (141, 142, 147), and H (111, 112, 121, 122, 127). The default time code is B120. B120 and B124 support the IEEE-1344 Control Functions.

The [+/- offset] option with the UTC epoch allows users to add or subtract between 1 minute and 23 hours and 59 minutes from the current UTC Time. The GPS epoch outputs the GPS time scale (UTC with the current # of leap-seconds removed).

A Time Zone Epoch can be specified and the IRIG Outputs will be set to that Time Zone and if the Control Function is set to 1344 the offset bits will indicate the direction and amount of time off from UTC (except for the three time zones occurring 45 minutes after the hour) and the Time Zones east of the GMT meridian (positive) or west of the GMT meridian (negative). For local offset control bits to be correct, hours must be between -15 and +15, minutes must be 0 or 30, and seconds must be zero. When a local time zone is specified, daylight savings time rules (if any) are applied automatically.

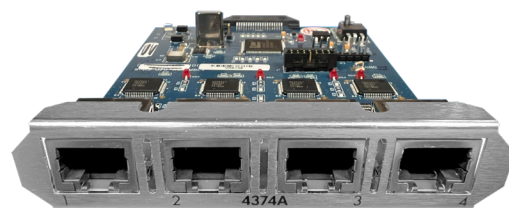| Characteristic	Description
Number of outputs	Four
Output connectors	BNC(F)
Impedance	50Ω (4337a) 3 V$_{PP}$ or 6 V$_{PP}$ per port (4338A)
Amplitude into 50Ω	3.5 V$_{PP}$
Modulation Ratio	10:3
IRIG types	Default: B120
Supported Types	A130, A133, A137, B120, B123, B127, E 111, E112, E121, E122, E127, G141, G142, G147, H111, H112, H121, H122, H127 or NASA36
Epochs	UTC, UTC+/- Offset, GPS, Local Time Zones, 127

Note: This 4337A module supports a single epoch on all 4 ports. The 4338A module supports up to four different epochs, one on each port.

Communication/Telecom Modules

4374A: T1/E1 Telecom Module

The 4374A module produces a 1.544 Mbps T1 (DS-1) or 2.048 Mbps compatible output. Each port can independently be set to one of four output configuration options:

0:      B8ZS, ESF packets

1:      1.544 MHz Square Wave

2:      B8ZS, D4 packets, All 1's

3:      B8ZS, D4 packets

4:      E1 HDB3 Framing

5:   2.048 MHz Square Wave

Characteristic	Description
Number of outputs	Four
Output connectors	RJ-45, Pin 4 TX Ring, Pin 5 TX tip
Impedance	100Ω
Signal	ANSI T1.102: Digital Hierarchy Electrical Interface
Supported Formats	B8ZS ESF, T1 Clock, B8ZS D4 (Ones), B8Zs D4, E1 HDB3, E1 Clock

4332A: Time-of-Day (TOD) Module

This 4-port module can be used to serve as a reference input to devices such as the BlueSky™ GNSS Firewall, TimeProvider® 4100, or other hardware. The outputs from this module support two sets of differential signals: 1PPS and Time-of-Day (TOD) as a serial time code. The default output format for the TOD card is ITU G8271.

The 1PPS signal is on Pins 3 and 6 (Ground on Pins 4 and 5) and the TOD Signal is on Pins 7 and 8 on each RJ-45 connection.
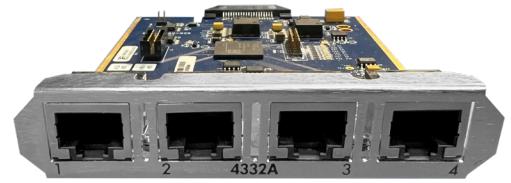
Characteristic	Description
Number of outputs	Four
Output connectors	RJ-45
Interface	RS-422
Impedance	100Ω
Pins	1PPS pins 3 and 6, TOD on pins 7 and 8, Ground on Pins 4 and 5
TOD Data Rate	9600, N, 8, 1 with Binary Encoding

Input and Measurement Modules

4382A: Phase Input Measurement Module

The 4382A is a four-channel phase measurement module capable of measuring the phase of 5 MHz or 10 MHz signals to high precision. The 4382A includes a multiple mixer measurement system all contained on a single plug-in card. The 4382A module measures the phase difference between an RF signal from the clock under test and a reference RF signal. The 4382A module can be configured to use the internal timebase of the SyncSystem 4380A or one of the four ports of the module can be configured as the reference RF signal. The SyncSystem 4380A uses measured IF phase differences to compute input phase at a resolution of better than 100 femtoseconds.

Characteristic	Description	
Number of inputs	Four	
Input connectors	SMA(F)	
Inputs	5 or 10 MHz (per card), +3 to +17 dbm	
Resolution	100 Femtoseconds for 10 MHz	
Allan Deviation (using one 10 MHz port as reference)	10 MHz	
	1s	2E-13
	10s	2E-14
	100s	2E-15
	1000s	4E-16
Temperature Sensitivity	4.25 ps sec/°C	

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4393A Time Interval Counter (TIC) Module

This module has four input ports that can be used to measure the time interval between the internal 1PPS and up to four external sources and will work in any of the 6 module slots. The averaging period for the measurements is configurable from 1, 10, 20, 60, to 300 seconds.

Characteristic	Description
Number of inputs	Four
Input connectors	BNC(F)
Impedance	50Ω
Input Voltage (50Ω)	5 Vpk
Minimum Input Pulse Width	10 µs
Maximum Input Pulse Width	500 ms
Resolution	< ±50 ps
Accuracy	< ±500 ps to internal 1 PPS across all inputs. Individual inputs can be calibrated using a calibrated cable delay. Contact factory for details.

4383A: Time Interval Counter (TIC) Module

This module has four input ports that can be used to recover time from an IRIG time source. Ports 1 and 2 support DC IRIG (Default B007) and Ports 3 and 4 support AM IRIG (Default B127).

Characteristic	Description
Number of inputs	Four
Input connectors	BNC(F)
Inputs	DC IRIG – Ports 1 and 2, AM IRIG Ports 3 and 4
Impedance	50Ω
DCLS Input Voltage (50Ω)	> 2 Vpk and < 5 Vpk.
AM Input Voltage (50Ω)	> 600 mV pk-pk and < 6.0 Vpk-pk.
Time Codes	B000 to B007 and B120 to B127
AM IRIG Ratio	2:1 to 4:1, Nominal 3:1

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