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brandywine communications

Precision Time and Frequency Solutions

Short Form Catalog

AS9100D with ISO 9001:2015

Brandywine Communications is the leader in providing ultra-precise Time and Frequency products. Offering the next generation solutions for government/aerospace & defense, telecom, power utilities and public safety. Brandywine has a wide offering of products to fit your critical timing need. Based in Tustin, California with manufacturing facilities in Santa Ana, California and Witham UK, our staff of dedicated professionals strive to provide the newest technology customized to fit your application with excellent before and after sales service.

Our products range from component-level products such as our GPSDO to complete master clock systems such as the top of the line Modular Master Clock (MMC) for solutions requiring Assured PNT.

Please visit our website at www.brandywinecomm.com or call one of our regional offices for more information.

Shipboard Solutions

Brandywine timing equipment is widely deployed across land, sea, and airborne platforms on many military programs such as the US Navy's GPNTS system for surface combatants and the TFDS system for submarines. Brandywine supports the environmental testing and specific interface standards needed for simple integration with military hardware.

Airborne Solutions

Brandywine has developed precise, flight-qualified, time and frequency products that fit the requirements for airborne applications. Low phase noise frequency references that are coherently locked to precise time of day and position from GPS allow ultra high performance signal detection and processing. Brandywine systems are embedded in major airborne systems.

Ground-Based Timing

Brandywine has developed a customized, rugged timing assembly used to provide precise timing signals for a US Marine Corps ground based tactical radar system.

Strategic Communications

Brandywine is the Frequency and Time Subsystem supplier on a major upgrade program for US Army satellite ground stations. Brandywine's ability to offer an innovative network-centric architecture with outstanding availability was a key factor in being selected for building this critical communication infrastructure.

Battlefield Communications

Brandywine has fielded over 1500 low phase-noise frequency standards to support battlefield satellite communication nodes. Brandywine's expertise in building low noise frequency standards provides our customers with exceptional performance in a low cost product.

Test Ranges

Brandywine's test range products include GPS time code generators, time code translators, portable timing units, video transmission equipment and time displays. A unique time measuring instrument, TimeSpy, is an essential tool for quality control and troubleshooting on test ranges.

Air Traffic Control

Brandywine offers a family of FAA and EUROCONTROL approved Network Time Servers for synchronization of Air Traffic Control Systems. From master clock systems all the way to down to clock displays, we have made it our business to understand the individual requirements of the Air Traffic Control industry.

Power Utilities

Brandywine supplied a redundant master clock system for a major Pacific Northwest hydropower utility. This system provides network time synchronization as well as system-wide frequency and time deviation measurement in a hardened, high-availability system. The network management system for this hydropower facility enables remote management of systems installed at multiple locations.

Airports, Railways, and Infrastructure

Brandywine offers a family of master clock systems and clock displays that are ideal for use in airports, railway stations and other forms of transit. Brandywine's timing systems are used to keep the clocks in some of the world's busiest train stations on time.

NEXT GENERATION NETWORK SOLUTIONS

The demand for more bandwidth at lower costs is increasing each year. Brandywine offers wireline and wireless telecommunication solutions for this fast paced growing need. Brandywine has joined forces with ADVA/Oscilloquartz, a world-wide leader in telecom equipment, to offer the latest technology and excellent service for the telecommunications world.

Back Haul Synchronization

Brandywine offers a full suite of products that bring the critical accuracy and speed needed for backhaul synchronization over IP, using IEEE-1588 precise time protocol.

Wireline Solutions

Brandywine offers Carrier Class Synchronization solutions with a family of Timing Signal Generators that are scalable from small edge devices to CO equipment with up to 1000 protected outputs. Our TSG's are supported by world class Enterprise Network Management solutions.

5G Network Synchronization

Brandywine supplies OEM time and frequency modules for LTE base stations, the 5th generation of wireless networks.

MODULAR TIME & FREQUENCY SYSTEMS

MMC2U

Brandywine's MMC2U represents the next generation of modular timing systems. Built on the highly successful High Performance Timing System, the MMC2U is a leap forward in design.

FEATURES:

- Redundant design with multiple signal paths for high-availability.
- 12 Output Signal Module slots
- Unique optical crosslink architecture for either Master-Slave hierarchical setups or Master-Master crosschecking and failover
- Operated by an intuitive touch-screen interface, a first for any master clock system.
- All components are hot-swappable and are dual redundant.
- The Output Signal Modules are hot-swappable from the front and minimize the need to disconnect cables.

At the center of the system are Brandywine's powerful dual-redundant Master Clock Modules, which are capable of receiving time from a GPS signal, either from a SAASM or standard CA code receiver, or can be synchronized from a standard time code input such as IRIG-B or HaveQuick with 1PPS. Multiple input references may be selected in priority order, or optionally combined into an ensembled clock.

The output signals for the MMC2U are generated by up to 12 hot-swappable Output Signal Modules (OSM), and are ideal for custom solutions or future expansion. Available modules include NTP, low-phase-noise frequency, IEEE-1588 PTP, time code modules such as IRIG A, B, G, H, NASA 36 and pulse rate, as well as optical crosslink.

http://bwine.me/mmc

MMC1U

The MMC1U has been designed from the ground up for ruggedized and shipboard usage in a smaller and more lightweight form factor than the MMC2U. The MMC1U has dual-redundant hot-swappable power supplies to allow for high-reliability and high-availability usage. Every modular board is designed to be removed from one of the 5 slots on the front, without disconnecting any cables from the rear of the unit, reducing wear and tear. Available Output Signal Modules for the MMC1U include PTTI formats: (Have Quick, BCD, 1PPS) low phase noise frequency, IRIG A, B, G, H and NASA 36, optical crosslink, NTP and IEEE-1588 PTP.

http://bwine.me/mmc

M212

Brandywine's M212 Master Clock System represents the next generation of modular timing systems. Built as a commercial derivative of the highly successful ruggedized Modular Master Clock, the M212 provides assured timing capabilities using Brandywine's Timewall™ technology. Available Output Signal Modules for the M212 include PTTI formats: (Have Quick, BCD, 1PPS) low phase noise frequency, IRIG A, B, G, H and NASA 36, optical crosslink, NTP and IEEE-1588 PTP. http://bwine.me/m212

MMC OUTPUT SIGNAL MODULES

Universal Output Signal Module

The Universal OSM provides the ultimate in flexibility. The Universal OSM has 4 outputs, each of which is user-programmable to a wide variety of time code or pulse outputs. This flexibility ensures that an MMC can be reconfigured as requirements change, and fewer modules are needed in comparison to designs where modules are single function. Time code outputs can be configured independently for local time. Passive rear transition modules are available for single ended BNC, or differential connectors. Each output is individually adjustable for propagation delay, ensuring that for high accuracy synchronization different cable lengths can be accommodated.

Supported formats: 1 PPS & 1 PPM, HaveQuick, IRIG A, B, E, G, H, XR3, 2137.

PTP Module

The PTP Grandmaster Module provides full PTP functionality to the MMC. Two GbE ports are provided. One port may be used as a slave clock, enabling the MMC to be configured as a Boundary Clock, or implement Assisted Partial Timing Support functionality

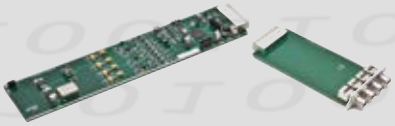
NTP Module

The NTP Server module enables the Modular Master Clock to act as an NTP server over an Ethernet network. Designed with security in mind, the NTP server module uses a custom network stack that enables it to ONLY act as an NTP server, and prevent it from being used as a gateway to compromise the entire system.

Optical Crosslink Module

The Optical Crosslink Module is a unique feature of the MMC. When installed, it allows a second MMC to be synchronized as a slave chassis. If both chassis have a primary reference installed (e.g. GPS) then the two MCM's operate as peers. Peering provides additional redundancy, as well as providing additional references to detect failures.

When a duplex cable is provided, the optical link provides seamless and automatic propagation delay compensation. A security mode allows the optical link to be operated in a single direction from Master to Slave over a single fiber.



Low Phase Noise Analog Module

The Analog Low Phase Noise Module provides 4 low phase noise reference frequency outputs at either 1, 5, or 10MHz.

Synthesizer Module

The Synthesizer Module provides 4 programmable output frequencies on the range 250 Hz to 33 MHz. The frequency scheme ensures that telecom frequencies on multiples of 8 kHz are exact.

FRONT ACCESS HOT SWAP

The MMC2U and MMC1U Modular Master Clocks feature Brandywine's unique front access hot swap feature. The Master Clock Modules and the Output Signal Modules are designed to be fully removable from the front of the unit by opening up the front panel access door, removing the need to remove the system from its rack in order to replace or upgrade components, ensuring high levels of availability and reliability for permanently powered applications.

Because the MMC1U and MMC2U modules are swappable from the front, the cable connections at the back of the system are unaffected by routine maintenance, reducing the wear and tear on the cabling connected to the system, reducing the risk of cable interference or crosstalk compared to other modular timing systems.

GNSS TIME & FREQUENCY REFERENCES

NFS-220 & NFS-220 Plus

The NFS-220 is a general purpose precision time and frequency standard for use in Wi-Fi, Wi-Max, satellite communications, telecommunications, and military communications. This unit utilizes a high performance GPS receiver with automatic position-averaging that enables the best use of GNSS when operating in a fixed location. The NFS-220 includes 4 low phase noise 10MHz outputs, 3 1PPS outputs with individual propagation delay compensation, IRIG, Have Quick, and NTP outputs. The NFS-220 can also be synchronized to an external GPS receiver using 1PPS and/ or Have Quick time code. While the OCXO is standard a variety of internal oscillator options are available.

http://bwine.me/nfs220

http://bwine.me/nfs220plus

TIME AND FREQUENCY REFERENCES TRU-CA, FRU-CA

The Time Reference Unit TRU-CA and Frequency Reference Unit (FRU-CA) are complete master clocks containing a GPS Disciplined Oscillator in a 1U housing. The FRU offers a full suite of low phase noise outputs, including: 10MHz and 1PPS. The TRU offers multiple IRIG B, HaveQuick, and 1PPS. Both units include dual network ports with Network Time Server function. A PC hosted application provides status information about the GPS system, monitoring of internal time errors and user access to a number of alarm thresholds.

http://bwine.me/tru

http://bwine.me/fru

RG-2100, RG-2111

The RG-2100 is a redundant reference frequency generator that uses Global Navigation Satellite System (GNSS) to steer internal low phase noise OCXO. Each GNSS Disciplined Module provides 3 low phase noise 10MHz, 1PPS, monitor and control interface. Dual redundant hot swappable power supplies make RG-2100 perfect for military communications, telecommunications and satcom telecommunications. The RG-2111 includes redundant NTP outputs and SNMP control.

http://bwine.me/rg2100

http://bwine.me/rg2111

NTP SERVERS

NTP-800 - 4 Ports, 1GbE

The NTP800 provides highly accurate yet economic time distribution over local area networks (LAN) using Network Time Protocol (NTP). It features 4 gigabit Ethernet ports, allowing it to synchronize 4 discrete networks simultaneously, without allowing data to pass from one network to another. The NTP-800 also features dual redundant power supplies, allowing continuous service.

http://bwine.me/ntp800

NTP-80 PLUS - 3 Ports

The NTP80 Plus provides 3 port highly accurate yet economic time distribution over local area networks (LAN) using Network Time Protocol (NTP), the industry-standard means of time distribution over networks. It is available with different oscillator options

http://bwine.me/ntp80

NTV-100RG - 1 Port

Brandywine Communications Network Time Device provides a low cost convenient and flexible means to accurately time synchronize computers, time displays, PBX's, and a wide variety of other equipment. The NTV-100RG is a small, rack mounted Network Time Server with integrated 8 channel GPS receiver. The NTV-100RG can also output serial time messages for synchronizing external devices such as time displays.

http://bwine.me/ntv100rg

ENTA II - 2 Ports

Brandywine's Enhanced Network Time Appliance (ENTA) is a full function Master Clock that offers the user precision time and frequencies in addition to the GPS synchronized Network time server. This unit is fully compliant with the NENA requirements of a Master clock and includes dual network ports. The ENTA has multiple time code outputs available: IRIG B, IRIG E, and Have Quick. Five independently programmable serial ports provide flexibility in synchronizing external equipment. Four independent timing channels may be configured to drive user equipment.

http://bwine.me/enta2

NTP SERVER COMPARISON MATRIX

Our Wide Range of Products that Offer NTP

Model	Speed	Form Factor	Display	Setup	SNMP	Input Reference	IRIG out	No. of ports	Osc. Options	Special Features
IDC-100	100 BaseT	1U	Yes	RS232 Console	Yes v1	IRIG B	No	1	Crystal	Low cost
NTV100RG NTV100DC	100 BaseT	1U Desk Mount	Yes	Browser	Yes v1	GPS RS232 IRIG B (opt)	No	1	Crystal	Low Cost
ENTA II	100 BaseT	1U	Yes	Browser Telnet	Yes v1	GPS IRIG B	Yes	2	OCXO	Dual NTP Servers
NTP80	100 BaseT	1U	Yes	Browser SNMP Keypad	Yes v1	GNSS IRIG B Peer/Peer Serial MSF WWVB DCF	No	3	TCXO (St) OCXO Rb	Ruggedized Configurable Distribution SAASM (opt)
NTP800	10/100/1000 BaseT	1U	Yes	Browser SNMP Keypad	Yes v3	GNSS IRIG Peer/Peer Serial 10MHz SAASM GPS (opt.)	Yes	4	TCXO (St) OCXO Rb	Redundant Power Supplies Ruggedized Configurable Distribution SAASM (opt)
FRU-SAASM	100 BaseT	1U	No	SNMP, Windows app.	Yes v1	GPS/HaveQuick	Opt	2	OCXO, Rb	Frequency Reference with NTP capability
TRU-SAASM	100 BaseT	1U	No	SNMP, Windows app.	Yes v1	GPS/HaveQuick	Yes	2	OCXO, Rb	Timing Reference with NTP capability
Modular Master Clock NTP Module	100 BaseT	1U or 2U Module	Touch Screen	SNMP, Touch Screen	Yes v3	GPS, IRIG, HaveQuick, Optical	Opt	Modular, up to 24	OCXO, CSAC, Rb	Ultra Flexible Modular System. Enhanced Stability
PTP-8080	10/100/1000 BaseT	1U	No	SNMP, Windows app, Browser	Yes v1, v2c, v3	PTP, GNSS, IRIG	Yes	8	OCXO	PTP GrandMaster with NTP capabilty

PTP – IEEE1588 SOLUTIONS

PTP-800 - 4 Ports, 1GbE

The PTP800 provides highly accurate yet economic time distribution over local area networks (LAN) using Precise Time Protocol (PTP), the industry-standard means of time and frequency distribution over discrete networks. It also features 4 gigabit Ethernet ports, allowing it to synchronize 4 discrete networks simultaneously.

http://bwine.me/ptp800

PTP-8080 GM/Transparent/Boundary Clock

The PTP-8080 is a GPS Network Time Server (NTS) for NTP or PTP IEEE 1588 that provides secure, accurate and reliable time synchronization for networks and offers integrated fully managed switch capabilities for 8 (10/100/1000BASET) Gigabit Ethernet ports along with multiport FIBS compliance. The PTP-8080 can be used for data centers, test facilities, military installations, federal or municipal agencies, financial services and technology firms, and many other enterprises which need precision timing to support their network operations.

http://bwine.me/ptp8080

Modular PTP Solutions
MMC, M212

The functionality of the an IEEE-1588 GrandMaster Clock is also available as a module for the Modular Master Clock and M212.

OSA-5401 SFP-Pluggable PTP Grandmaster

The optimized dual-frequency GNSS receiver on our OSA 5401 achieves excellent performance, even in urban canyons where small cells are often deployed. Generating phenomenal PTP phase and frequency synchronization for traditional base station and small cell network deployments, the technology gives network operators a cost-effective migration path for deploying strong synchronization deep in radio access networks. It also integrates with existing network elements. Its small form factor and rich feature set enable a versatile range of deployment options for enhanced synchronization network performance.

OSA-5420 Mid-Size PTP Grandmaster Featuring SyncJack™

Exact network timing has become even more critical as more mobile network operators seek to upgrade their network to support LTE-A and onwards to 5G. Our OSA 5420 Series is a family of advanced grandmaster clock synchronization devices engineered for excellent performance even in the most extreme conditions. This solution enables timing to be distributed and assured throughout the network and meets stringent frequency and phase synchronization requirements. What's more, despite its compact footprint, the OSA 5420 delivers the best holdover performance on the market.

OSA-5430 Carrier-Grade PTP Grandmaster Featuring SyncJack™

With our OSA 5430, a carrier-grade IEEE 1588v2 grandmaster clock supporting 10 Gbit/s. as well as 1 Gbit/s. interfaces with hardware timestamping, cost-effective and accurate synchronization distribution for next-generation technologies such as LTE-A and 5G is no longer a challenge. What's more, its NTP server, multiple BITS outputs and GNSS receiver capabilities, make it also ideal for the smooth upgrade of legacy synchronization architectures. And with its ability to deliver precise timing to DOCSIS 3.1 remote PHY devices, the OSA 5430 is also a powerful tool to help cable operators tackle booming demand. With a modular, scalable and fully redundant design, our OSA 5430 offers the highest configuration flexibility and reliability. In addition, our integrated SyncJack™ technology enables in-service synchronization monitoring and assurance without the need for expensive test equipment.

PCIE-1588

The PCIe-1588 Universal Timing Card provides an ultra-flexible means of providing precise time synchronization to a host computer, or a variety of external equipment. The PCIe-1588 is unmatched in the industry for its flexibility and features, while maintaining a compact low-profile PCIe form factor. The PCIe-1588 can be configured as a grandmaster and a slave. http://bwine.me/pcie1588

PTP Testing and Validation

See TimeSpy – page 15

TIMEWALL™ ASSURED TIMING PROTECTION

TimeWall™ is Brandywine's technology initiative to ensure that every device receiving time of day from a Brandywine time server has the correct time and that the time server is performing multiple crosschecks to ensure that the time of day is correct, even if GPS is currently being subjected to jamming or spoofing.

With the next generation of information warfare at hand, a determined opponent can use GNSS spoofing to drag a ship off course, disrupt train scheduling, or even cause power outages. Brandywine's unique TimeWall™ protection offers a way to ensure that timing is not disrupted in the event of a spoofing or jamming attack.

Products Featuring TimeWall™

MMC2U

Brandywine's MMC2U has been designed with high availability and high reliability performance in mind, the MMC2U contains sophisticated technology in order to detect when GPS is being jammed or spoofed, and to continue to operate in a holdover mode until the jamming and spoofing stops, at which point it will return to normal operation. The MMC2U model in particular features a rubidium oscillator to ensure the highest level of precision and minimal levels of drift.

http://bwine.me/mmc

MMC1U

Brandywine's MMC1U is the next generation of modular timing systems in half the space. Designed with high availability and high reliability performance in mind, the MMC1U contains the same sophisticated technology as the larger MMC2U in order to detect when GPS is being jammed or spoofed, and will operate in a holdover mode until the jamming and spoofing stops, at which point it will return to normal operation.

http://bwine.me/mmc

PTP-800 - 4 Ports, 1GbE

The PTP800 provides highly accurate yet economic time distribution over local area networks (LAN) using Precise Time Protocol (PTP), the industry-standard means of time and frequency distribution over discrete networks. It also features 4 gigabit Ethernet ports, allowing it to synchronize 4 discrete networks simultaneously.

http://bwine.me/ntp800

NTP-800 - 4 Ports, 1GbE

The NTP800 provides highly accurate yet economic time distribution over local area networks (LAN) using Network Time Protocol (NTP), the industry-standard means of time distribution over discrete networks. It also features 4 gigabit Ethernet ports, allowing it to synchronize 4 discrete networks simultaneously.

http://bwine.me/ntp800

BUS LEVEL TIMING

Brandywine Communications indisputably offers the widest range of timing plug-in board form factors in the business. From the classic PCI to our advanced conduction cooled PMC model these boards offer the latest technology as well as the most extensive list of standard features and options available. Most boards include IRIG, NASA, and 1PPS sync inputs as well as optional GPS synchronization. Zero latency time to the microsecond, external event time capture to 100ns, and three programmable rate generators are standard on most models.

A variety of options are available. Some of the more common options are: GPS Synchronization, extended temperature range, eight external event inputs, TCXO and OCXO time bases, multiple output codes.

PCI Express

PCIe-5905 Universal Timing Board (PCIe-SDU)

The PCIe-5905 Universal Timing Card provides an ultra-flexible means of providing precise time synchronization to a host computer, or a variety of external equipment. The PCIe-5905 is unmatched in the industry for its flexibility and features, while maintaining a compact ½ height PCIe form factor.

http://bwine.me/pcie5905

PCIe-SyncClock32

The PCI-Express SyncClock provides precision time with zero latency to the host computer through a PCI Express x1, x2, x4, x8, x16 or x32 slot. An on-board microprocessor automatically synchronizes the clock to reference signal inputs. The reference signal inputs can be 1PPS, IRIG or NASA time codes and optionally, GPS or HaveQuick.

http://bwine.me/pciesyncclock

Mini PCIe SyncClock32

Ideal for mobile and small form factor installations, the Mini PCIe SyncClock32 provides precision time with low latency to the host in the mini PCIe form factor. Capable of receiving time from 1PPS, IRIG or NASA time codes.

http://bwine.me/pciesyncclock

PC-104

PC104 Plus

ROHS Compliant Latest PC104 offering features 32 bit universal PCI performance in PC/104 form factor. GPS available and maintains single slot configurations. Many options available.

http://bwine.me/pc104plussyncclock32

VME Family

VME-SyncClock32

Tried and true hardware & software, easy to program, many features including on-board GPS option.

http://bwine.me/vmesyncclock32

VME635-SyncClock32

Single slot 6U, 32-bit precision timing card compatible with VME computers. Drop-in replacement to support legacy VMEbus applications.

http://bwine.me/vme635syncclock32

PCI Family

PCI-SyncClock 32

Models are available to support all PCI bus variants. Time code synchronization is standard, GPS sync is optional.

http://bwine.me/pcisyncclock3266

PMC-SyncClock32

PMC Models support all variants of PMC form factors. A version is available that supports onboard GPS. http://bwine.me/pmcsyncclock32gps

Conduction Cooled PMC-GPS Clock

Latest conduction cooling technology and many of the same features and options as the other PMC products, including on-board GPS.

http://bwine.me/pmcsyncclock32cc

CPCI-SyncClock32 3U

Supports all standard SyncClock features and options in both 3U and 6U form factors, including onboard GPS. Compliant with RoHS.

http://bwine.me/cpcisyncclock323u

BOARD LEVEL OPTIONS

There are over 350 options for Brandywine's board level products to customize each product to fit our customers' needs. Below is a list of the most frequently used options on our boards. Check with your sales manager for valid option combinations and to get a price quote.

Description	Part Number
INPUT OPTIONS	
12 CHANNEL GPS RECEIVER	012000009
TRANSFORMER COUPLED INPUT	012000024
IRIG G INPUT	012000055
IRIG B DC LEVEL SHIFT INPUT	012000061
DC CODE I/P @ RS422 LEVELS	012000074
GPS-ICD-150 TM 3 INPUT	012000173
STANAG4430 TIME CODE INPUT	012000048
HAVE QUICK TIME CODE INPUT	012000013
HAVE QUICK TIME CODE I/P (RS422)	012000065
EXTERNAL 10 MHz SINEWAVE INPUT	012000220
IEEE-1344 INPUT	012000179
TD1 TIMECODE INPUT	012000256
OSCILLATOR OPTIONS	
DISCIPLINED CSAC OSC	012000270
DISCIPLINED EXTERNAL RUBIDIUM OSC	012000005
DISCIPLINED OCXO	012000006
DISCIPLINED TCXO	012000026
OUTPUT OPTIONS	
MODULATED IRIG B OUTPUT	012000004
6 OUTPUTS, 1PPS, HQ, BCD TIME CODE	012000000
HAVE QUICK TIME CODE OUTPUT	012000019
STANAG4430 TIME CODE OUTPUT	012000049
IRIG H DC LEVEL SHIFT OUT	012000054
IRIG G OUTPUT	012000058

Description	Part Number
OUTPUT OPTIONS	
10 MHZ SINE OUTPUT	012000080
10 MHZ SQUARE WAVE OUTPUT ON BNC	012000139
IRIG A,B,G NASA 36 OUTPUT	012000149
50 BIT/S BCD PER ICD-GPS-060 OUTPUT	012000207
GENERATE IRIG B CONTROL FUNCTIONS	012000032
TIME TAG/EVENT OPTIONS	
8 CHANNEL TIME TAG INPUT	012000028
8 CH TIME TAG W/ INDEPENDENT REG.	012000122
20 CHANNEL TIME TAG W/FIFO	012000096
3 CH TIME TAG W/ RS422 INPUTS	012000135
8 EXTENDED MATCH REGISTERS.	012000072
VIDEO OPTIONS	
VIDEO ANNOTATOR - TIME ONLY	012000021
VIDEO ANNOTATOR MATRIX OVERLAY	012000022
TIME /POS INSERTION FOR PC/104 PLUS	012000232
VIDEO ANNOTATOR OVERLAY PC104PLUS	012000233
BUILD OPTIONS	
ON BOARD BATTERY BACKUP RTC	012000034
37 BIT BINARY TIME REGISTERS	012000075
INDUSTRIAL TEMPERATURE RANGE	012000140
ADD CONFORMAL COATING	012000171
ROHS COMPLIANT SOLDER	012000199

Driver Support

Operating System	PCI-bus	PCI-Express	VME	PCI-Express + Ethernet
Product Family	PCI-SyncClock, cPCI-SyncClock32, PMC-SyncClock, PMC Conduction Cooled, PMC GPS	PCI-Express,	VME-SyncClock	PCIe-1588
Windows 64 Bit	Yes	Yes	No	Yes
Windows 32 Bit	Yes	Yes		Yes
Linux 32 bit Linux 64 bit	Yes Yes	Yes Yes	No No	Yes Yes

MILITARY & RUGGED PRODUCTS

FLIGHT QUALIFIED UNITS

HPTS

Brandywine Communications High Performance Timing System is the most accurate system currently available, with inherent 10ns accuracy. This next generation, dual redundant, network-centric, modular system includes a novel architecture that allows automatic compensation of propagation delay. Input synchronization sources include GPS, SAASM GPS, Have Quick, 1PPS, IRIG A, IRIG B, IRIG G, 10MHz, and NTP. Outputs include Have Quick, 1PPS, IRIG A, IRIG B, IRIG G, 10MHz, and NTP. The HPTS is fully qualified for airborne, shipboard, and land mobile applications.

http://bwine.me/hpts

Compact Airborne Timing Unit

The CATU unit is designed to provide precise time and frequency outputs in a rugged, flight qualified enclosure. Packaging options include a 3 slot 3U CC Compact PCI form factor or standalone module. Options include low phase noise 10 MHz outputs with vibration compensation for high vibration environments, built in GNSS, SAASM or M-Code GPS options, along with a CSAC oscillator for GPS denied environments. A 10/100/1000 Ethernet port provides secure management, as well as NTP time services.

http://bwine.me/catu

SHIPBOARD QUALIFIED UNITS

TFD8000 – AN/BSQ-9 (V)

The TFD8000 is a militarized time and frequency system that has been qualified to rigorous military standards and uses modular construction to ensure complete flexibility and easy maintenance. The TFD8000 is the US Navy's program of record Time and Frequency Distribution System (TFDS) and is fully supported by the Navy's supply system. Single, dual and triple redundant models are available. Over thirty standard options are available. Cesium, Rubidium, and Quartz time bases are available. All types are disciplined to the GPS satellite system.

http://bwine.me/tfd8000

Modular Master Clock

The Modular Master Clock is shipboard qualified against MIL-STD-810F for shock and vibration, making it an ideal choice for shipboard installations.

http://bwine.me/mmc

GROUND MOBILE UNITS

Tactical Timing Unit

Brandywine's Rugged Military Qualified Tactical Timing Unit (TTU) is a battery backed portable timing system designed to provide precision time signals in any tactical environment. The TTU can be synchronized from an external GPS signal and provides 1PPS, NTP, and RS232 signals. System control can be implemented through either RS232 or SNMP making it ideal for military applications.

http://bwine.me/ttu

Portable Timing Unit - PTU

The Portable Timing Unit (PTU) is a battery operated, transportable timing system that provides precise time of day at point of use. It may be automatically synchronized by means of either GPS signals, or a serial time code. Outputs include: NTP, IRIG, Have Quick, and 1PPS. Built in a rugged, weather-proof case, the PTU is transportable to any location and can be used in all weather conditions.

http://bwine.me/ptu

MILITARY SATCOM

PTS-SAASM

The GPS Wing Approved PTS-SAASM is a complete master clock containing a GPS Rubidium Oscillator. This unit offers a full suite of low phase noise outputs including: 10MHz, 1PPS, IRIG B, Have Quick, serial time and navigation messages and provides a complete Network Time Server. The built-in web browser provides status information about the GPS system, monitoring of internal time errors and user access to a number of alarm thresholds. Both single and dual redundant models are available.

http://bwine.me/pts-saasm

FRU-SAASM

Based on the PTS-SAASM, the GPS Wing Approved FRU-SAASM is a complete master clock containing a GPS Disciplined Oscillator in a 1U housing. This unit offers a full suite of low phase noise outputs, including: 10MHz, 1PPS, IRIG B, HaveQuick, serial time and navigation messages, and a complete Network Time Server. A PC hosted application provides status information about the GPS system, monitoring of internal time errors and user access to a number of alarm thresholds. Frequency outputs are compliant with MIL-STD-188-164A.

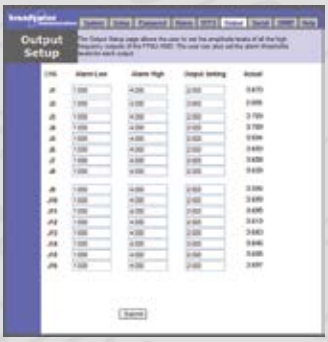
http://bwine.me/fru

Satellite Ground Stations

Typical of Brandywine's expertise in the field of Satellite terminal timing and frequency references is the system Brandywine supplies the U.S. Army's Modernization of Enterprise Terminals (MET) program, managed by the project Manager, Defense Communications and Army Transmission Systems (PM DCATS) in Fort Belvoir, VA. Brandywine's network-centric advanced time and frequency subsystem provides the U.S. army with a hardened, high reliability, high availability source of ultra accurate frequency and time. The FTSS utilizes redundant cesium frequency standards that are automatically calibrated and synchronized by comparison to a SAASM GPS receiver (Brandywine PTS-SAASM).

These Primary Reference Standards (PRS) in turn are used to drive an advanced modular distribution system, based on Brandywine's High Performance Timing System (HPTS). This frequency and time distribution amplifier provides hitless reference switching and generates a wide variety of low phase noise outputs to the customers' specifications.

INTELLIGENT DISTRIBUTION AMPLIFIERS



Online screen shot of FTSU-100D

FTSU-100 Family

The FTSU-100 family is Brandywine's advanced network enabled distribution amplifier. The FTSU-100 will accept 1PPS and a reference frequency such as 10MHz from two sources. A second output frequency can be synthesized internally. 8 channels each of the 10MHz reference, the synthesized frequency and 1PPS are generated. Input reference failure results in hitless switchover. The output frequencies have programmable amplitude and PPS propagation delay compensation.

http://bwine.me/ftsu100d

FDU-160i

The FDU-160i is the first in a line of Brandywine's next-generation distribution amplifiers, bringing the distribution amplifier into the Internet of Things. The FDU-160i uses Brandywine's next-generation HTML5 web interface to enable the unit to be monitored and controlled from any PC, smartphone, or tablet. The FDU-160i accepts frequency inputs from two sources and can automatically switch over to a secondary input if the primary fails. The unique web interface allows for each frequency output to be individually set and adjusted, without affecting the other outputs. With dual-redundant power-supplies standard, the FDU-160i is designed for high-reliability and high-availability applications, such as satellite ground stations, secure military communications, facility reference distribution, and range timing.

http://bwine.me/fdu160i

FDU-180i

Built on the FDU-160i, the FDU-180i expands the capabilities of the FDU-160i by incorporating a clean-up oscillator, reducing phase noise while allowing the unit to maintain frequency synchronization. A high-performance tracking loop ensures phase continuity of the outputs when switching references for true hitless switching.

http://bwine.me/fdu180i

IBU-160i

Bringing the next-generation of distribution amplifiers to time code distribution is the IBU-160i. Converting dual-redundant IRIG A, B or G time code inputs into 16 isolated outputs, the IBU-160i fits into a 1U chassis. The IBU-160i incorporates Brandywine's next-generation HTML5 interface to allow it to be monitored and controlled from any PC, tablet or smartphone.

http://bwine.me/ibu160i

FDA-160i

The FDA-160i is Brandywine's newest wideband frequency distribution unit, built on the versatile platform of Brandywine's FDU-160i, the FDA-160i distributes dual-redundant wideband frequency signals between 1 and 30 MHz across sixteen outputs. Each output is individually adjustable for voltage level.

http://bwine.me/fda160i

Tactical Have Quick/ 1PPS Distribution Amplifier

The Model HQS is capable of accepting Have Quick and 1PPS inputs and outputting up to six signals per each input for a maximum of twelve signals total. All signals are per ICD-GPS-060. Brandywine will pre-configure for customers at the time of order.

The voltage range is 18-36VDC, 36-72VDC or 145-162VDC. The HQS uses no more than 5 watts of power. The unit is approximately 4"h x 4"w by 4"d with MIL-DTL-38999, Series III Connectors. The unit has a calculated MTBF of over 1,000,000 hours. The unit has been tested for ship board use and is qualified to MIL-STD-461, MIL-STD-167-1, MIL-STD-810.

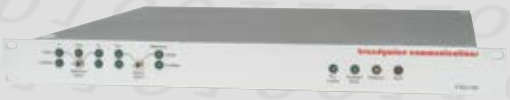
http://bwine.me/hqs

DISTRIBUTION AMPLIFIERS

TDU-310

The TDU-310 is a high output count, high performance time signal distribution amplifier. Designed to distribute the precise time signals generated by military GPS receivers compliant with ICD-GPS-060, the TDU-310 provides 10 output channels of each of three signals – 1PPS, Have Quick, and 50 bit/sec. BCD time code.

http://bwine.me/tdu310



IBU-240

The IBU-240 is a dual input to 24 output low frequency distribution amplifier that is designed for distributing IRIG A, B, E, G modulated time codes in a 1U 19" rack mount chassis. Each of the 24 outputs is a faithful reproduction of the time code input. All outputs are transformer isolated. Applications include satellite ground stations, secure military communications and range timing.

http://bwine.me/ibu240

FDU-240

The FDU-240 is a high output count and high performance frequency distribution amplifier. The FDU-240 provides 24 output channels of 5 MHz or 10 MHz with very low phase noise.

http://bwine.me/fdu240

PDU-240

The PDU-240 is a high output count and high performance pulse distribution amplifier. The PDU-240 provides 24 output channels of a single reference pulse, typically 1 PPS.

http://bwine.me/pdu240

DISTRIBUTION AMPLIFIER MATRIX

Model	Input Redundancy	Input Reference	No. of outputs	Power	Form Factor	Setup	SNMP	Cleanup Oscillator	Special Features
FDU-160i	2x	10 MHz	16	Dual AC or DC 100-265 VAC 18-36 VDC 36-72 VDC	1U	Web UI	Yes v1	No	HTML5 Web UI
FDA-160i	2x	1-30 MHz	16	Dual AC or DC 100-265 VAC 18-36 VDC 36-72 VDC	1U	Web UI	Yes v1	No	HTML5 Web UI
IBU-160i	2x	IRIG A, B, G	16	Dual AC or DC 100-265 VAC 18-36 VDC 36-72 VDC	1U	Web UI	Yes v1	No	HTML5 Web UI
FDU-180i	2x	10 MHz	16	Dual AC or DC 100-265 VAC 18-36 VDC 36-72 VDC	1U	Web UI	Yes v1	Yes	HTML5 Web UI, Hitless Switching
TDU-310	2x	1 PPS, Have Quick, BCD time code	10 ea.	Single AC 100-265 VAC	1U	-	No	No	ICD-GPS-060 Compliant
FDU-240	1x	5 MHz, 10 MHz	24	Single AC 100-265 VAC	1U	-	No	Optional	
IBU-240	1x	IRIG A, B, E, G	24	Single AC 100-265 VAC	1U	-	No	Optional	
PDU-240	1x	1 PPS	24	Single AC 100-265 VAC	1U	-	No	Optional	
HQS	1x	Have Quick, 1PPS	6 ea. 1 PPS 6 ea. HQ	18-36 VDC 36-72 VDC 145-162 VDC	4" x 4" x 2.5"	-	No	No	Supports both single-ended and differential
FTSU-100	2x	5MHz, 10 MHz, 1PPS	8x 5/10 MHz 5x 1PPS	Single AC 100-265 VAC	1U	Web UI	Yes v1	No	
FTSU-100D	2x	10 MHz, 1PPS	8 ea.	Single AC 100-265 VAC	1U	Web UI	Yes v1	No	
FOA-160	1x	GPS Antenna	16	Dual AC or DC 100-265 VAC 18-36 VDC 36-72 VDC	1U	-	No	No	Splits GPS Antenna Signal and Distributes over Fiber Optical wiring.

OEM PRODUCTS (EMBEDDED MODULES)

GPS Disciplined Oscillator Module (GPSDO)

The GPS Disciplined Oscillator Module is a small Commercial Off-the-Shelf (COTS) GPSDO that has been designed to meet military requirements such as MIL-STD-188-164A. At only 4.1" x 2.75" x 1" (104.0 x 70.0 x 26.0 mm) in size, the unit provides Stratum 1 performance. The GPSDO supplies three isolated, low noise precision 10 MHz frequency reference signal outputs. These outputs are accurate to $1x10^{-12}$ when connected to a GPS antenna.

This frequency standard is also able to slave to an external 1PPS signal to steer and hold the internal oscillator and clock system precisely in time. Time and frequency information maintains its high accuracy with the internal oscillator even when no satellites can be tracked. A serial data port is provided to report time, date, position, and GPS satellite health and signal strength. The GPSDO module also has dual power supply inputs and can operate off either supply input.

Optional capabilities include automatic interface to an external military GPS receiver such as the Defense Advanced GPS Receiver (DAGR), Ethernet Interface for NTP time service and SNMP status monitoring. Standard frequency output is 10 MHz, but other frequencies are available.

http://bwine.me/gpsdo

Miniature GPS Disciplined Oscillator

Brandywine's miniature GPS Disciplined Oscillator combines the power of our existing disciplined oscillators in a footprint the size of an OCXO. Designed with interoperability in mind, the Miniature GPS Disciplined Oscillator meets military requirements such as MIL-STD-188-164A. The GPSDO supplies a low noise, precision 10 MHz frequency reference signal output. This output is accurate to $1x10^{-12}$ when connected to a GPS antenna.

http://bwine.me/gpsdomini

RFS-700D Compact Free Running Rubidium Frequency Standard

Brandywine's RFS-700D is a miniaturized Rubidium Frequency Reference in a compact ruggedized package designed for mounting on a DIN rail system. The RFS-700D is capable of outputting 7x 10MHz frequency reference with low phase noise. The unit has been qualified under MIL-STD-810F for operation in demanding environments.

http://bwine.me/gpsdomini

CUSTOM SOLUTIONS

At Brandywine Communications our goal is to give our customers the product they need. We specialize in creating custom solutions for our customers who have specialized needs or specific requirements. Whether it means taking an existing product and refining it or creating a completely new product, we have a team of engineers who will do what it takes to create a custom solution that meets your exact requirements.

Please contact your sales manager to see how we can help fulfill your timing needs.

TRANSPORTATION

Clock Management Server

Clock Management Systems

The CMS Clock Management Server is a sophisticated Linux-based server that allows the user to monitor and control Brandywine products from a remote or central location via an Ethernet network.

- Centralised or remote monitoring and control of Brandywine Timing System and constituent parts such as Submaster Clocks and time displays.
- User-friendly graphical interface, accessible by web browser, allows monitoring in overview or detail mode
- Access via multiple web browser interfaces allows many users to simultaneously access the CMS
- Web browser interface allows user access to the CMS from any location with Ethernet connectivity to the CMS
- Visual representation of equipment controls
- Monitoring Status e.g. Equipment identity, Equipment configuration, Alarms, Software and Hardware Faults, Errors, and many other details
- Fault log reporting on errors occurring in the Timing System
- Delivered on a pre-configured PC.
- SMS text alerts when alarms are triggered

NETWORK TIME DISPLAYS

Brandywine Communications offers a full line of Network Time Displays that are synchronized over an Ethernet network using NTP protocol. These advanced technology displays utilize industry standard structured cabling systems, all that is needed is a network drop and power source. Using the browser interface simply enter the IP address of the time source, one of the Brandywine Network Time Servers, or any other source of NTP time and you are ready to go.

Outdoor

Many different styles and formats are available in both Digital and Analogue Clocks including single/double sided, AC or PoE power, hours and minutes or hours minutes and seconds time indication. For Digital Clocks, date, day of the month, year can also be offered and digit sizes are available from one-half inch (13mm) to 8 inches (200mm). For Analogue Clocks, diameters of 12 inches (300mm), 15 inches (400mm) and twenty four inches (600mm) are available. On both Analogue and Digital products, different time zone setting is available for user selection.

Indoor

http://bwine.me/displays

RANGE TIMING SOLUTIONS

Test Range Time Code Generator/ Translator
RTG-510

Brandywine's RTG-510 allows any timing input in (IRIG A, B, G, Have Quick, GPS, etc…) and simultaneously outputs IRIG A, B, G, Have Quick, 1PPS, dual NTP and RS232 to your system. This unit has a 9 digit time display, a built-in web browser for easy use, and has dual redundant power supply for reliability. Built with either TCXO or OCXO, the RTG-510 has the ability to track incoming time code over +/- 200 ppm to allow timecode conversion from legacy tape playback systems.

http://bwine.me/rtg510

AIRBORNE TIMECODE GENERATORS

Miniature Airborne Timecode Processor

Brandywine Communications' Miniature Airborne Time Code Processor (TCP-AM), is an extremely accurate and robust instrument that can be synchronized to a variety of external time sources and is a source of IRIG-B, GNSS, Have Quick, NTP or IEEE 1588 time code.

http://bwine.me/tcpam

Airborne Timecode Processor

Brandywine Communications' Airborne Time Code Processor (TCP-AS), is an extremely accurate and robust instrument that can be synchronized to a variety of external time sources and is a source of IRIG-B, GNSS, Have Quick, NTP or IEEE 1588 time code.

http://bwine.me/tcpas

TIME MEASUREMENT & CALIBRATION/VALIDATION

TimeSpy

The TimeSpy precisely measures the time accuracy of a wide range of inputs (such as: PTP, NTP, IRIG B, 1PPS, and ASCII) against an internal precision GPS-controlled oscillator, displayed on the large, full color windows-based touch screen. The TimeSpy can precisely measure the time error at the point of use for systems where time is distributed over large distances. The TimeSpy can also measure free-running clocks and timing systems which are synchronized from untraceable sources, such as television and radio broadcasts, electrical power lines and the internet.

http://bwine.me/timespy

TELECOM SYNCHRONIZATION

Wireline – BITS/ TSG

Telecom networks which are out of synchronization often suffer from bit errors and slow transmission rates. Without precise timing, transmissions can lose some information during transport, particularly in the realm of optical transport data network and broadband systems.

OSA-3230 Cesium Clock

The OSA-3230 Cesium Clock is specifically designed and produced with the latest technology in a very compact and reduced size. This compact OSA-3230 offers a set of operation features and performance without comparison on the market.

Available in two different versions, the long life cesium tube will meet the requirements where performances is needed over a long period of time whereas the high performance version will meet the most demanding applications.

OSA-5548C TSG BITS Timing Signal Generator

Brandywine's OSA-5548C Timing Signal Generator (TSG) is designed to provide telecom operators with reliable synchronization, using the latest in hardware and software and technology. The 5548C system provides a scalable synchronization solution ranging from 20 unprotected up to thousands of 1:1 protected outputs.

The OSA-5548C can be a Stratum 1 redundant source if you decide to include one of two possible GPS cards (this does not change the number of inputs or outputs available). There are 10 main output slots. In addition to the DS1 and Composite Clock (CC) output cards, the OSA-5548C can be equipped with time distribution modules (NTP, PTP or IRIG-B) or with DS1 re-timing cards. With it's complete and consistent family (6U: 200 outputs, 3U: 60 outputs, expansion chassis), the 5548C is the TSG of choice when you need high accuracy with minimal space. Each card is only 4 inches tall, contributing to a higher overall port/volume ratio, and therefore reducing the size of the OSA-5548C 6U shelf design to accommodate overcrowded Telecom Hub Rooms and Switching Center rack spaces. This flexibility makes the OSA-5548C the most versatile TSG in the marketplace. The 5548C is fully NEBS-3 compliant.

OSA-5430 Carrier-Grade PTP Grandmaster Featuring SyncJack™

With our OSA 5430, a carrier-grade IEEE 1588v2 grandmaster clock supporting 10 Gbit/s. as well as 1 Gbit/s. interfaces with hardware timestamping, cost-effective and accurate synchronization distribution for next-generation technologies such as LTE-A and 5G is no longer a challenge. What's more, its NTP server, multiple BITS outputs and GNSS receiver capabilities, make it also ideal for the smooth upgrade of legacy synchronization architectures. And with its ability to deliver precise timing to DOCSIS 3.1 remote PHY devices, the OSA 5430 is also a powerful tool to help cable operators tackle booming demand. With a modular, scalable and fully redundant design, our OSA 5430 offers the highest configuration flexibility and reliability. In addition, our integrated SyncJack™ technology enables in-service synchronization monitoring and assurance without the need for expensive test equipment.

OSA-5440 High Capacity PTP Grandmaster Featuring SyncJack™

With multiple legacy and next-generation fan-out options, our OSA 5440 is ideal for deployment in legacy synchronization architectures as well as packet-based networks. It provides space for 10 line cards and can support PTP, NTP, and SyncE over 48 Ethernet ports, delivering unrivaled line rates of up to 10 Gbit/s. Due to its adaptability and modular architecture, our OSA 5440 is the ultimate future-proof solution able to provide that crucial link between legacy and emerging technologies such as LTE-A and 5G.

SATISFIED CUSTOMERS

Alcatel – Lucent
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Atlas Electronik
Australian Department of Defence
Babcock PLC
BAE Systems
Boeing IDS
Bonneville Power Administration
Cessna
Collins Aerospace
CSIC
Defense Supply Center
Denel Overberg Test Range
Edwards AFB
FAA
Finnish Navy
GE
GeoEye
Great Lakes Wire and Cable
Hanwha
Honeywell
Intelsat
Interstate Electronics
L3 Harris GCSD
L3 Harris PSPC
Leonardo DRS
Lockheed Martin
Malibu Research
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Molonglo Radio Observatory
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NAWC
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NPR
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Plus many others, both domestic and international.

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