



Time & Frequency Solutions



SHORT FORM CATALOG

AS9100D with ISO 9001:2015



Time & Frequency Solutions

Brandywine Communications, a premiere synchronization company, manufactures ultra-precise time & frequency products and solutions that deliver reliable and precise performance in the harshest conditions for advanced communication and timing systems.

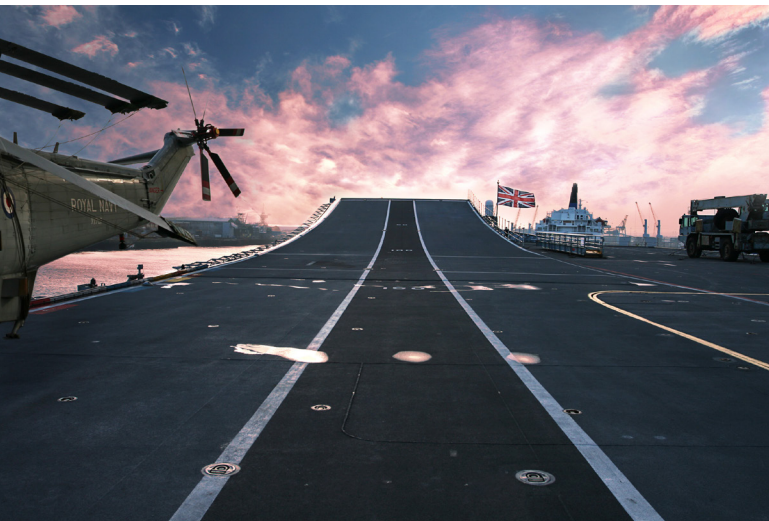
Offering the next generation solutions for government/aerospace & defense, telecom, power utilities and public safety, Brandywine has a wide offering of products to fit your critical timing needs. Based in Tustin, California, with manufacturing facilities in Santa Ana, California and Witham, UK, our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

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

A close-up photograph of a digital clock display with red LED numbers. The display shows the time 308 10:50:29. The numbers are large and segmented, typical of a digital clock. The background is dark and slightly blurred, suggesting a technical or industrial setting.

AEROSPACE & DEFENSE

We supply secure and precise synchronized communication for the Aerospace and Defense market sector. We provide assured timing technologies that deliver critical Positioning, Navigation, and Timing (PNT) solutions that are at the core of global navigation, tracking and monitoring applications, enabling the safe and efficient execution of mission-critical operations.



NAVY

Submarines (US, UK)

- AN/BSQ-9 – Time & Frequency Distribution System
- Outfit FSG

Surface Ships

- Multiple Programs addressing Signal Intelligence and Communications
- GPS Navigation and Timing System

Aircraft

- Patrol Aircrafts
- UAVs
- Airborne Command Post and Communications Support Network



AIR FORCE

Aircraft

- AWACS – Airborne Warning and Control System

Space

- SCNC – Satellite Control Network



ARMY

Satcom Terminals

- MET/PTR – Modernization of Enterprise Terminals/ Precision Timing Rack
- WIN-T – Warfighter Information Network – Tactical
- SGT Terminals – Satcom Transportable Terminals
- DKET Terminals

TRANSPORTATION

We provide synchronization, distribution and monitoring solutions that deliver reliable, efficient timing to general infrastructure and public transportation such as Air Traffic Control, Train and Bus Stations.

Brandywine Communications designs and manufactures precise Time Displays. We offer digital clocks to meet and fit your requirements with options such as IRIG-B, GPS or NTP synchronization. Brandywine's time displays also have optional date messages with sizes ranging from 6 inches up to 8 feet in size.



Public Transportation

- New York (GCT)
- Hong Kong
- Singapore
- Jakarta
- Ho Chi Minh City
- London Underground

Air Traffic Control

- FAA STARS
- UK
- Europe
- India
- Hong Kong





COMMUNICATIONS & PUBLIC SAFETY

Brandywine Communications provides the critical timing solutions that deliver the assurance of accurate timing for critical communication and public safety applications. It is essential to have a trusted time source that supplies accurate and synchronized timing and reliable time-stamping sequences to production and distribution networks that ensure safe and successful operations.

Applications

- Emergency Call Centers
- Public Safety Communications
- Telecom Network Synchronization
- Data Centers



POWER UTILITIES & INDUSTRIAL

Brandywine Communications provides accurate timing solutions for coordination, assurance and protection of power utility timing systems. Smart Grid applications require precision and reliability in fault detection, event time stamping and synchrophasor measurement to monitor network stability.



Industrial

- Production Platforms
- Off-shore Platforms
- Survival Time Hubs
- Chemical Plants
- Fault Location
- Command & Control
- Public Information Systems
- Smart Grid Locks

Utilities

- Power Stations
- Energy Management
- Electricity Sub-Stations
- Line Frequency Control
- Oil and Gas Refineries

MODULAR TIMING SYSTEMS



MMC

Brandywine's Modular Master Clock (MMC) represents the next generation of modular timing systems. MMC provides assured timing capabilities using Brandywine's Timewall™ technology incorporating multiple clock inputs from GPS/M-code, cesium to two-way satellite time and frequency transfer (TWSTFT).

FEATURES:

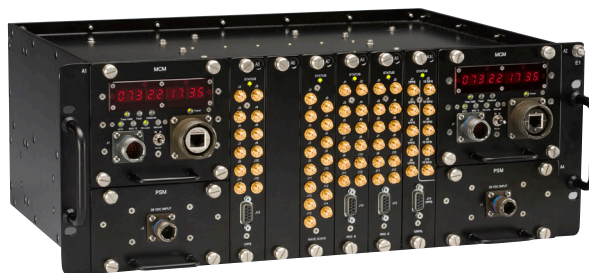
- Designed for high availability operation with redundant power supplies and timing modules with automatic failover
- 12 Output Signal Module slots
- Unique optical crosslink architecture for either Master-Slave hierarchical setups or Master-Master crosschecking and failover
- Operated by an intuitive 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
- Available in 2U and 1U form factors

At the center of the system are Brandywine's powerful dual-redundant Master Clock Modules. They are capable of receiving time from a GPS signal, either from a M-Code 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 assembled clock.



M212

Brandywine's M212 Master Clock System offers COTs timing capabilities. Built as a commercial derivative of the highly successful ruggedized Modular Master Clock, the M212 is available with many output signal modules (Have Quick, BCD, 1PPS), low phase noise frequency, IRIG A, B, G, H and NASA 36, optical crosslink, NTP and IEEE-1588 PTP.



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 and ground station applications.

brandywine
COMMUNICATIONS



TIME AND FREQUENCY REFERENCE PRODUCTS



NFS-220 & NFS-220 Plus

- GNSS Input Support
- 4x 10 MHz Outputs
- 3x 1PPS outputs
- IRIG, Have Quick and NTP outputs support
- Configurable Propagation Delay Compensation for individual outputs
- Time of Day display on NFS-220 Plus



RTG-510

- Universal Time Code Processor
- Accepts time code input from GNSS, IRIG A, B, E & G, NASA 36 and Have Quick
- GNSS receiver
- Web browser interface
- Dual hot-swappable power supplies
- Outputs IRIG A, B, E & G, NASA 36, Have Quick and 1PPS



PTU

- Portable Battery Operated Unit
- NTP, IRIG, Have Quick, and 1PPS outputs
- Rugged Weatherproof case



Frequency Reference Products



QFS-106

- Free Running Frequency Reference
- 6X10MHZ low phase noise outputs
- Available with either HSOXCXO or Rubidium



RFS-700D

- Compact Enclosure for DIN Rail systems
- 7 x 10 MHz Outputs
- Rubidium Frequency Reference



RG-2111

- Redundant Frequency Generator
- Dual Hot Swappable Power Supplies
- Dual Hot Swappable GNSS Receiver modules with automatic failover switching
- 10 MHz, 1PPS and NTP Output
- Monitoring and Control via SNMP



Flight Qualified Products



CATU

- Compact Ruggedized Unit
- Airborne environment qualified
- Low phase noise 10 MHz Outputs
- GNSS, SAASM, M-Code Options
- CSAC Oscillator for GPS Denied Environments



TCP-AS & TCP-AM

- Compact Ruggedized Unit
- Synced to external time codes and GNSS
- Outputs IRIG-B, Have Quick, NTP and PTP/IEEE 1588

Cesium References

OSA-3230

- Magnetic Cesium Frequency Reference
- Frequency Accuracy of $\pm 1 \times 10^{-12}$
- 5 MHz and 10 MHz direct frequency outputs
- Optional Long Life Tube for longer lifetime



OSA-3350 ePRC+

- Optical Cesium Frequency Reference
- Frequency Accuracy of $\pm 1 \times 10^{-13}$
- Efficient reuse of Cesium atoms means much longer lifespan than traditional Magnetic Cesium clocks

M-Code/SAASM Units



PTS-M

- GNSS, SAASM, or M-Code
- Outputs 10MHz, 1PPS, IRIG B, Have Quick, and NTP
- Half Width 2U Form Factor



FRU-M

- GNSS, SAASM, or M-Code
- Outputs 10MHz, 1PPS, IRIG B, Have Quick, and NTP
- 1U Form Factor












OSA-5422M


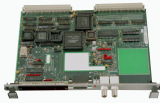
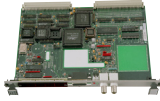


- GNSS, and M-Code
- PTP Grandmaster, Boundary Clock, APTS, and NTP server support
- Multiple 1G/10G Ethernet ports
- Expansion card options include T1/E1, 2.048 Khz, 5 & 10 MHz, 1PPS, 1 GB fiber, IRIG, and more

EMBEDDED PRODUCTS

Brandywine Communications indisputably offers the widest range of timing plug-in board-form factors in the business. From the classic PCI to our Advanced VPX Timing Card, these boards offer the latest technology as well as the most extensive list of standard features and options available.

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, and multiple output codes.

Product		Form Factor	Inputs	Outputs	Features
Advance Mezzanine Card Bus					
AMC SyncClock32		Advanced Mezzanine Card	IRIG A, IRIG B, IEEE-1344, NASA 36	Host Bus Synchronization	Zero Latency to Host system, Automatic source selection
PCI Express					
Mini PCI Express SyncClock		Mini PCI Express	IRIG A, IRIG B, NASA 36, 1PPS, Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Compact Size and Form Factor ideal for embedded applications that use mPCIe.
PCIEX-SyncClock		PCI Express	IRIG A, IRIG B, NASA 36, 1PPS, Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Compact Size and Form Factor ideal for embedded applications that use mPCIe.
PCIe SyncClock LP		PCI Express	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.)	Host Bus Synchronization, IRIG B (opt.)	Half-Height Card for Low Profile Systems, Support for Linux and Windows
PCI Bus					
GPCI SyncClock32		Compact PCI Card	IRIG A, IRIG B, NASA 36, 1PPS, Have Quick (opt.), GPS (opt.)	Host Bus Synchronization, IRIG B	3U and 6U form factors available
PCI SyncClock32		PCI Bus	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	3/4 Length Board, Zero Latency Time Reads, External Event Input, Support for Linux and Windows
PMC SyncClock32		PCI Mezzanine Card Bus	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Zero Latency Time Reads, External Event Input, Support for Linux and Windows
PMC SyncClock32 CC		PCI Mezzanine Card Bus	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Conduction Cooled, Zero Latency Time Reads, External Event Input, Support for Linux and Windows
XMC SyncClock32		XMC Mezzanine Card	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Zero Latency Time Reads, External Event Input, Support for Linux and Windows

Product	Form Factor	Inputs	Outputs	Features	
PC/104					
PC104-Plus SyncClock32		PC/104Plus 2.0 Embedded Standard	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	GPS Input maintains single slot form factor
VME Bus					
VME SyncClock32		6U Single Slot VME Form Factor	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Zero Latency Time Reads, External Event Input
VME635091 SyncClock		6U Single Slot VME Form Factor	IRIG A, IRIG B, NASA 36, 1 PPS, GPS (opt.), Have Quick (opt.)	Host Bus Synchronization, IRIG B (opt.)	Zero Latency Time Reads, External Event Input, Drop-in replacement for Legacy VME Bus Applications
OpenVPX					
VPX Timing Card		OpenVPX Backplane	External GPS Receiver	VITA 67.3C Backplane	Conduction Cooled, SOSA Aligned, SAASM GPS Receiver (opt.), Ruggedized Design, Chip Scale Atomic Clock (opt.)
Standalone Embedded Modules					
GPSDO		Embedded Module	GPS	1PPS, 10MHz	4.1" x 2.75" x 1" Footprint





EMBEDDED PRODUCT OPTIONS

There are over 350 options for Brandywine's board-level products to customize to fit our customers' needs. On the following page 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**INPUT OPTION**

12 CHANNEL GPS RECEIVER
TRANSFORMER COUPLED INPUT
IRIG G INPUT
IRIG B DC LEVEL SHIFT INPUT
DC CODE I/P @ RS422 LEVELS
GPS-ICD-150 TM 3 INOUT
STANAG4430 TIME CODE INPUT
HAVE QUICK TIME CODE INPUT
HAVE QUICK TIME CODE I/P (RS422)
EXTERNAL 10 MHz SINEWAVE INOUT
IEEE-1344 INOUT
TD1 TIME CODE INPUT

OSCILLATOR OPTIONS

DISCIPLINED CSAC
DISCIPLINED OCXO
DISCIPLINED TCXO
DISCIPLINED RUBIDIUM OSCILLATOR

OUTPUT OPTIONS

MODULATED IRIG B OUTPUT
6 OUTPUTS, 1 PPS, HQ, BCD TIME CODE
HAVE QUICK TIME CODE OUTPUT
STANAG4430 TIME CODE OUTPUT
IRIG H DC LEVEL SHIFT OUT
IRIG G OUTPUT

DESCRIPTION**OUTPUT OPTIONS**

10 MHZ SINE OUTPUT
10 MHZ SQUARE WAVE OUTPUT ON BNC
ITIG A,B,G NASA 36 OUTPUT
50 BITS/S BCD PER ICD-GPS-060 OUTPUT
GENERATE IRIG B CONTROL FUNCTIONS

TIME TAG/EVENT OPTIONS

8 CHANNEL TIME TAG INPUT
8 CH TIME TAG W/ INDEPENDENT REG.
20 CHANNEL TIME TAG W/FIFO
3 CH TIME TAG W/ RS422 INPUTS
8 EXTENDED MATCH REGISTERS

BUILD OPTIONS

ON BOARD BATTERY BACKUP RTC
37 BIT BINARY TIME REGISTERS
INDUSTRIAL TEMPERATURE RANGE
ADD CONFORMAL COATING
ROHS COMPLIANT SOLDER



TIME CODE DISTRIBUTION UNITS



IBU-160i

- Dual Redundant IRIG A, B or G inputs
- 16 x IRIG outputs
- Isolated outputs
- Automatic changeover between input sources
- Web browser control for individual output level selection



IBU-240

- Dual IRIG A, B, E & G Inputs
- 24 outputs
- Transformer isolated outputs



TDU-310

- Dual 1PPS, Have Quick, and BCD Inputs
- 10 x 1PPS, Have Quick, and BCD outputs
- Automatic fault monitoring and changeover
- Configurable with AC or DC power supply
- Optional optical isolation of outputs

RUGGEDIZED TIME CODE DISTRIBUTION



HQ5

- Compact Ruggedized Unit
- 1x Have Quick and 1PPS Input
- 6x Have Quick and 1PPS Outputs
- Tested for ship board and airborne use
- Qualified to MIL-STD-461, MIL-STD-167-1, MIL-STD-810F
- 1,000,000 Hours MTBF

PULSE DISTRIBUTION UNITS



PDU-240

- Dual IRIG A, B, E & G Inputs
- 24 outputs
- Transformer isolated outputs



FTSU-100D

- 2 x 1PPS, 10 MHz inputs
- 8 x 1PPS and 10 MHz outputs
- Hitless switching between reference inputs
- Low Phase Noise

FREQUENCY DISTRIBUTION UNITS



FDU-160i

- 2 x 10 MHz Input
- 16 x 10 MHz Output
- Automatic Changeover
- Web browser control for individual output level selection
- Dual Redundant Power Supplies










FDU-240

- Dual Redundant Frequency Inputs
- 24 Frequency Outputs
- Factory Configurable between 5 MHz or 10 MHz
- Transformer Coupled Outputs
- Automatic Changeover

Model	Input Redundancy	Input Reference	No. of outputs	Power	Form Factor	Setup	SNMP Supported	SNMP Version	Cleanup Oscillator
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
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
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
FDU-240	1x	5 MHz, 10 MHz	24	Single AC 100-265 VAC	1U	-	No	-	Optional
FOA-160	1x	GPS Antenna	16	Dual AC or DC 100-265 VAC 18-36 VDC 36-72 VDC	1U	-	No	-	No
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
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
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
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
TDU-310	2x	1 PPS, Have Quick, BCD time code	10 ea.	Single AC 100-265 VAC	1U	-	No	-	No

NETWORK TIMING PRODUCTS

Product		Speed	Form Factor	SNMP Version	Input Reference	No. of Ports	Oscillator Options	Special Features
NTP Servers								
NTV-100		10/100 Base T	1U, Desk Mount	V1	GPS, RS232, IRIG (opt)	1 port	Crystal	Low Cost
ENTA II		10/100 Base T	1U	V1	GPS, IRIG B	2 ports	OCXO	Dual NTP servers
ENTA-R		10/100 Base T	1U	V1	GPS, IRIG B	2 ports	OCXO	Dual NTP servers, Ruggedized, Dual redundant power supplies
NTP-80plus		10/100 Base T	1U	V1	GPS, IRIG B, MSF, DCF-77, WWVB	3 ports	TCXO (st), OCXO, Rb	Ruggedized, Configurable, Distribution
NTP-800		10/100/1000 Base T	1U	V3	GNSS, IRIG, Peer/Peer, Serial, 10 MHz, SAASM GPS (opt.)	4 ports	TCXO (st), OCXO, Rb	Redundant Power Supplies, Ruggedized, Configurable, Distribution SAASM (opt)
PTP Servers								
PTP-800		10/100/1000 Base T	1U	V3	GNSS, IRIG, Peer/Peer Serial, 10 MHz,	4 ports	TCXO (st), OCXO, Rb	Redundant Power Supplies, Ruggedized, Configurable, Distribution
PTP-8080		10/100/1000 Base T	1U	v1, v2c, v3	PTP, GNSS, IRIG	8 ports	OCXO	PTP Grandmaster with NTP Capability

NETWORK TIME DISPLAYS

tfs Time & Frequency Solutions

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. 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).

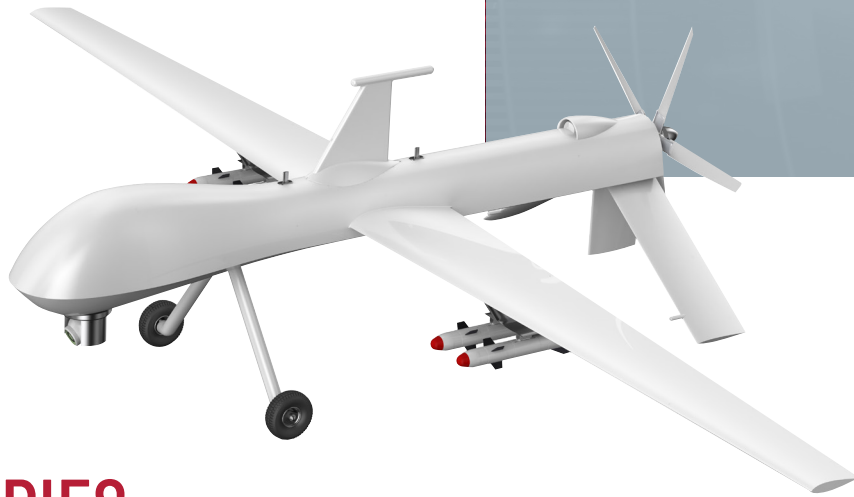
For Analogue Clocks, diameters of 12 inches (300mm), 15 inches (400mm) and twenty-four inches (600mm) are available. On both Analogue and Digital products, different time zone setting is available for user selection.



M355

The M355 Digital Time Display is a configurable clock display that can display the current time of day from a network time server. Available in 4, 6, or 9 digits and in Red, Green and Yellow display colors. The M355 can be perfectly customized to suit any indoor application.





ANCILLARIES



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 freerunning clocks and timing systems, which are synchronized from untraceable sources, such as television and radio broadcasts, electrical power lines and the internet.



GPS Antennas

Brandywine Communications offers a wide variety of GPS antennas to accompany our products for a variety of applications. Contact your Brandywine Sales representative with your requirements so that we can help choose the right antenna for the job.





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.



Satisfied Customers

Argon Boeing	Datapath	Kongsberg	NAVICP	Raytheon
Asia Broadcast Satellite	Defense Supply Center	L3 Harris Technologies GCSD	New South Wales Road Traffic	SAAB Sensis Corporation
Aselsan	DRS Land Electronics	L3 Harris Technologies PSCP	New York City Transit	SAIC
Atlas Elektronik	Edwards AFB	Lockheed Martin	NIWC	SERCO
Australian Department of Defense	FAA	Malibu Research	NOAA	Sierra Nevada Corp
Azure	Finnish Navy	MBDA	NUWC	Thales
Babcock International Group	General Dynamics Mission Systems	MIT	Northrop Grumman	US Air Force
BAE Systems	Havelsan	Mitsubishi Electric Company	NPR	US Army
Boeing IDS	Honeywell	Molonglo Radio Observatory	NSWC	US Navy
CACI	Intelsat	NASA	NOAA	USNO
Cessna	Interstate Electronics Corp.	NAWC	Pacific Communications	US Space Force
Collins Aerospace	Johns Hopkins APL	NAVAIR	Qualcomm	Viasat

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