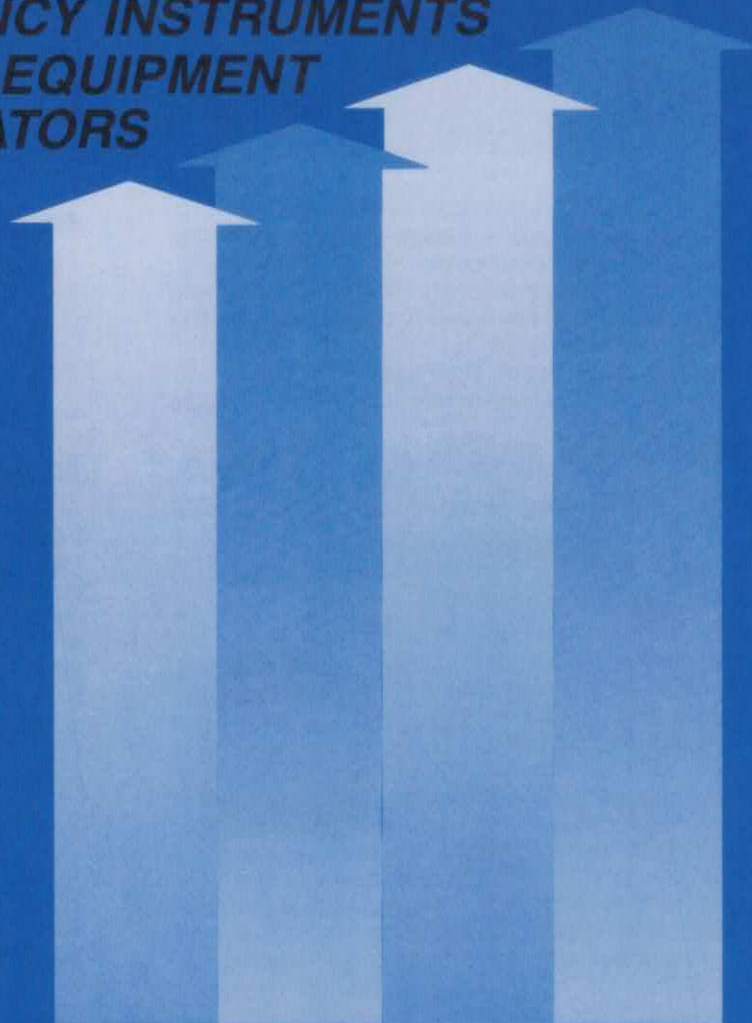


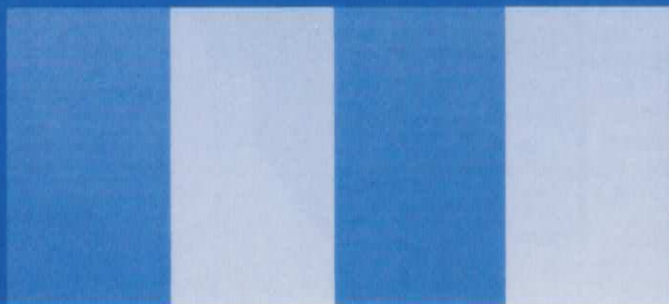
U.S. DOMESTIC

## SHORT FORM CATALOG

**INTEGRATED SYSTEMS**  
**TIME & FREQUENCY INSTRUMENTS**  
**TIME CODE EQUIPMENT**  
**CRYSTAL OSCILLATORS**



**AUSTRON** *INC.*



## MODEL 1100

Combines high stability with low power drain in a small, lightweight, plug-in package. This hermetically sealed crystal oscillator finds application whenever space is at a premium and performance cannot be compromised.

OUTPUT FREQUENCY: 5 MHz Standard  
AGING RATE: 5, 2 or  $1 \times 10^{-9}/24$  Hrs.  
after 72 hours continuous operation

AMBIENT TEMPERATURE STABILITY:  
 $< 2.5 \times 10^{-8}$  from  $-20^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$

MECHANICAL: Size:  $1.25 \times 1.75 \times 3.25$  inches



## MODEL 1120

A compact, rugged crystal oscillator designed for a wide range of applications. This unit is available at many different frequencies, input voltages, and mechanical configurations.

OUTPUT FREQUENCY: 1MHz thru 10 MHz

AGING RATE: 5, 2 or  $1 \times 10^{-9}/24$  Hrs.  
after 72 hours continuous operation

AMBIENT TEMPERATURE STABILITY:  
 $< 2 \times 10^{-8}$  from  $-20^{\circ}\text{C}$  to  $+65^{\circ}\text{C}$

MECHANICAL: Size:  $2.27 \times 2.14 \times 4$  inches



## MODEL 1105

A low profile solid-state crystal oscillator designed to provide a highly stable 1 MHz logic output for IC applications. Operates from a 5 volt power supply. The size, weight and stability performance have been packaged in a configuration for the IC instrument designer.

OUTPUT FREQUENCY: 1MHz; TTL Logic

AGING RATE: 10, 5, 2, or  $1 \times 10^{-9}/24$  hours after 72 hours operation

AMBIENT TEMPERATURE STABILITY:  $< 2 \times 10^{-8}$  from  $0^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$

MECHANICAL: Size:  $1.25 \times 1.75 \times 3.25$  inches

## MODEL 1111—NEW PRODUCT

A compact, fast warm-up, low phase noise oscillator specifically developed for both mechanical and electrical replacement of the discontinued HP10811.

OUTPUT FREQUENCY: 10 MHz

AGING RATE:  $< 5 \times 10^{-10}/24$  hours after warm-up with less than 24 hours off time

AMBIENT TEMPERATURE STABILITY:  
 $< 4.5 \times 10^{-9}$  ( $-55^{\circ}\text{C}$  to  $+71^{\circ}\text{C}$ )  
 $< 2.5 \times 10^{-9}$  ( $0^{\circ}\text{C}$  to  $+71^{\circ}\text{C}$ )

MECHANICAL: Size:  $2.06 \times 2.83 \times 2.45$  inches



## MODEL 1115

5 MHz Oscillator specifically designed for undersea applications where high stability and minimal power drain are of prime importance.

OUTPUT FREQUENCY: 5 MHz

AGING RATE:  $3 \times 10^{-9}/24$  hours after 72 hours operation  
 $1 \times 10^{-9}/24$  hours after 30 days operation

AMBIENT TEMPERATURE STABILITY:  
 $< 5 \times 10^{-9}$  from  $-2^{\circ}\text{C}$  to  $+25^{\circ}\text{C}$

NOTE: Higher temperature models available

MECHANICAL: Size: Cylinder 2" diameter, 5.5" long



## MODEL 1120L

Features extremely low phase noise performance.

PHASE NOISE (5 MHz Output):  $-135$  dB, 10 Hz (1 Hz BW)  
 $-155$  dB, 100 Hz  
 $-160$  dB, 1 kHz

(NOTE: For 10 MHz Output add 6 dB degradation.)

## MODEL 1150

A very rugged, high precision crystal oscillator which was specifically developed for use in satellite navigation systems. Has application whenever system requirements demand a precise time base or frequency reference. Technical features include an ultimate aging of  $5 \times 10^{-11}/\text{day}$ , low phase noise, and a standard frequency of 5 MHz.

OUTPUT FREQUENCY: 5 MHz Standard  
AGING RATE:  $5 \times 10^{-10}/24$  hrs after 72 hours operation

$1 \times 10^{-10}/24$  hrs after 30 days operation

Ultimate drift is typically  $5 \times 10^{-11}$  after 90 days operation

AMBIENT TEMPERATURE STABILITY:

$< 2 \times 10^{-9}$  from  $-55^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$

$< 5 \times 10^{-10}$  from  $0^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$

MECHANICAL: Size:  $2.37 \times 3.18 \times 5.0$  inches





## MODEL 1250A CRYSTAL FREQUENCY STANDARD



Provides the user with 5 MHz, 1 MHz, and 100 kHz sine-wave outputs. The instrument also supplies a 1 MHz or 100 kHz clock output. The Model 1250A offers ultimate long term stability of  $5 \times 10^{-11}$ /day. The unit includes front panel frequency adjustments and a meter for monitoring critical functions including condition of internal standby battery.

## MODEL 1250B CRYSTAL FREQUENCY STANDARD



Provides sixteen 5 MHz outputs with a long-term stability of  $5 \times 10^{-11}$ /day. The output frequencies have extremely low phase noise, therefore, well suited for SATCOM applications. The instrument was designed with no front panel controls that could interrupt operation. An internal standby battery supply is included.

## MODEL 2110 DISCIPLINED FREQUENCY STANDARD



A state-of-the-art, microprocessor controlled system that automatically locks the frequency of its precision ovenized crystal oscillator to that of an externally applied reference having superior long-term stability. With the use of a third-order servo technique, the instrument is able to correct the frequen-

cy offset and aging of the internal oscillator. If the externally applied reference is removed or fails, the Model 2110 will continue to apply corrections to the internal oscillator in an effort to eliminate its aging and thereby hold it on frequency. Typically the unit can limit the frequency offset to parts in  $10^{11}$  for several days following reference loss.

## MODEL 2112—NEW PRODUCT DISCIPLINED RUBIDIUM STANDARD



Similar to the Model 2110, the Model 2112 Disciplined Rubidium Standard takes advantage of the slower aging rate of the rubidium oscillator. Microprocessor controlled, the Model 2112 uses a third order servo technique to correct the frequency offset and aging of the rubidium oscillator. If the external reference is removed, the Model 2112 will continue to apply corrections to account for aging and to maintain frequency stability.

## MODEL 2310—NEW PRODUCT DISCIPLINED CESIUM STANDARD



Combines the convenience of microprocessor control with the accuracy and stability of its internal atomic standard. The Model 2310 can precisely adjust its output frequency without changing the magnetic field of the cesium beam. This nonmagnetic settability feature allows the Model 2310 to automatically match its output frequency to that of an external reference. Should this reference be non-atomic, the Model 2310 will calculate and display its aging rate.

# PORTABLE CRYSTAL CLOCKS

## MODEL 1210D SERIES

Clocks used to transfer precise time from one geographic location to another. They are packaged in a rugged carrying case approximately  $8\frac{1}{2}$  inches high,  $8\frac{1}{2}$  inches wide and 14 inches long, permitting upright storage under the passenger seat found in most commercial aircraft.

The 1210D Series contain a precision quartz oscillator and a series of dividers which reduce the oscillator rate to one pulse per second. A digital phase shifter having 0.2 microsecond resolution is included at the head of the divider chain to allow the timing pulses to be synchronized to a master clock.





## MODEL 2200 – NEW PRODUCT GPS RECEIVER



Designed to capture the ultimate accuracy of the GPS NAVSTAR satellite Link 1, C/A code transmissions, this low cost receiver will provide the best possible time and frequency comparisons between two remote frequency standards and clocks which require synchronization to a common timebase. Synchronization of time to the Coordinated Universal Time (UTC) scale is possible through the GPS master clock system to accuracies better than 200 nanoseconds.

The receiver is fully microprocessor controlled and will permit the user to compare his local 1 PPS, using the internal time interval counter, to GPS time or UTC time. If a local 1 PPS is not present, the 2200 will generate a 1 PPS which is locked to GPS or UTC time while tracking a satellite. The 2200 will also accept input frequencies of 1, 5, or 10 MHz from the user's local frequency standard.

## LORAN-C GROUNDWAVE

Today, engineers are universally familiar with RF, LF, and VLF methods of frequency calibration and comparison. Not yet widely known, however, is the fact that most standard frequency users may now take advantage of the superior performance and convenience offered by synchronized LORAN-C groundwave. By making use of the extremely stable, strong groundwave that exists within a range of approximately 1000 nautical miles over land (or 1400 nautical miles on an all-sea path) of a LORAN-C reference, frequency calibration with a resolution of better than  $1 \times 10^{-12}$  may be made when 24 hour averaging is employed. Unlike skywave, LORAN-C groundwave has no diurnal shift and troublesome "cycle skips" due to the mode interference. Thus, the skywave method of averaging for 24 hours when maximum accuracy is desired is not necessary; measurements may be taken for most purposes without regard to time-of-day, with random noise due to atmospheric electricity and local man-made interference setting the principal limits on measurement resolution.

## TRACEABILITY

Daily phase corrections are available to allow the user of synchronized LORAN-C groundwave to refer his frequency measurements to the time base of the United States Master Clock, maintained by the United States Naval Observatory (USNO) and the National Bureau of Standards (NBS).

## MODEL 2100 LORAN-C TIMING RECEIVER



An automatic acquisition, tracking and time synchronizing receiver providing a traceable reference for time recovery as well as frequency calibration and control. This state-of-the-art device has remotely programmable control capabilities. Those who are vitally interested in high resolution time determination and frequency management will appreciate the improved sensitivity, automated features and simplicity of operation of this new receiver. The operation of this receiver, using LORAN-C groundwave signals, will permit time epoch determination to an accuracy of one microsecond and frequency calibration measurements to within an accuracy of one or two parts in  $10^{-12}$  for one-day averaging. The receiver allows the unskilled operator to obtain precise results for time measurement and frequency calibration by using an almost totally automatic approach with the most current equipment of the highest reliability.

## MODEL 2100F LORAN-C FREQUENCY MONITOR



An automatic acquisition and automatic tracking LORAN-C receiver, with remotely programmable control capabilities that provides a traceable reference for frequency management, calibration and control. Standards laboratories, atomic standards research groups, telecommunications groups, and others who are vitally interested in high resolution frequency measurement and intercomparison will appreciate the improved sensitivity and ease of operation of this automatic receiver. After the operator enters the Group Repetition Interval for the LORAN-C chain nearest his site, the Model 2100F automatically acquires a suitable station and settles to the track mode. The relative phase difference between the LORAN-C station and the local frequency reference is provided as a 0 to 1 volt analog signal to drive an external chart recorder for a permanent record, and in numerical form on the LCD display on the front panel. The frequency offset of the local reference with respect to the LORAN-C station is also calculated and can be displayed on the LCD display. Indicators on the front panel show at a glance the status of the receiver (acquire, track, or servo locked modes) and the status of the LORAN-C signal (station blinking or low signal-to-noise ratio). The front panel controls can also be locked out to prevent accidental interruption of service.

## MODEL 2100R LORAN-C REFERENCE RECEIVER



An automatic acquisition LORAN-C Receiver capable of tracking any LORAN-C station in the user's area for the purpose of comparing a local frequency source to the cesium standard used by the LORAN-C station. A modified version of the Model 2100F, the unit is designed to act as a stable reference frequency source for disciplined frequency standards in communications systems and other applications where a minimum of operator interface is desired.



## AUSTRON'S PRODUCT LINE

Austron's Time Code product line consists of a large variety of instruments and options that are capable of solving the most demanding Time Code applications. Computer interfaces and time distribution equipment are available as standard units with options.

### 8100 SERIES

The 8100 Series of Austron Time Code Instruments are system oriented units requiring only 3½ inches of vertical space in a standard 19 inch rack.



The **Model 8120 Time Code Generator** is a precise digital clock which generates a serial time code for recording a time reference on magnetic tape or for timing distribution applications.



The **Model 8132 Time Code Reader** is designed to translate an IRIG B modulated time code format in terms of BCD hours, minutes and seconds. Decoded time information is supplied for use with a digital recorder or for computer interface applications.



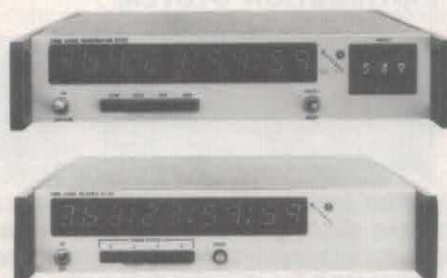
The **Model 8154 Time Code Generator / Reader / Tape Search and Control unit** is capable, with the appropriate options, of automatically performing a computer controlled magnetic tape search operation.

### MODEL 8526 PORTABLE TIME CODE GENERATOR



A MIL SPEC unit in an ATR configuration. Synchronization with WWV, IRIG B output code and AC/DC operation are standard features of the Austron Model 8526. Optional internal battery operation provides up to 25 hours continuous use.

### 8700 SERIES



The 8700 Series of Time Code Instruments are 1¾" high by 8½" wide by 12" deep. The pictures above show a **Model 8720 Time Code Generator** and a **Model 8730 Time Code Reader** in bench mount configuration. They can also be mounted side by side in a standard 19" rack. This arrangement provides simultaneous generate and read with separate displays for each function. The units may be powered by 115/230 Vac, 48-440 Hz or 12 Vdc.

### REMOTE TIME DISPLAYS



The **Model 8781 Serial Remote Display** decodes a modulated serial time code and presents the decoded time on six digit .55" high gas-planar discharge displays. The display can be easily read at a distance of 25 feet.



The **Model 8181 Single Line Readout / Display** operates directly from any time code generator supplying an IRIG A or IRIG B modulated time code. The nine-digit 1" high gas-planar discharge displays have a rated viewing distance of 50 feet.

### MODEL 5581/5582 SINGLE-LINE READOUT DISPLAY



The Model 5581 Single-Line Readout Display is a nine-digit (days, hours, minutes, seconds) time display. The Model 5582 is a five-digit display (total seconds in a day). The 2" gas discharge display segments are visible over long distances and either unit can read a standard IRIG A or IRIG B time code signal. Both displays have count-up, count-down capability using CFE 10 and 11 and both have leading zero blanking.



## MODEL 1295D — NEW PRODUCT TIMING DISTRIBUTION SYSTEM

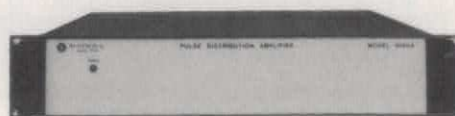


Completely redesigned, the Model 1295D features a new user configurable bus allowing for changes to be made to the bus without system interruption. New integrated and greatly simplified power modules are also featured.

Up to four different frequencies can be supplied to the outputs in multiples of four per each frequency. Output frequencies can be the input frequency, or, they can be scaled or synthesized from the input signal.

Input/Output modules are available for sine or square wave signals, balanced and unbalanced; RS422, time code, crystal or rubidium oscillators, and fiber optic transmitters or receivers. Any combination of I/O modules may be used to a total of 11 to provide up to 40 outputs.

## MODEL 8190A PULSE DISTRIBUTION AMPLIFIER



Designed for applications requiring distribution of pulse rates from 1 pps to 5M pps. Card cage construction allows flexibility to configure the I/O to meet customer requirements.

The 8190A has 36 rear panel BNC connectors; 4 for inputs and 32 for outputs. Each output is independently buffered and adjustable.

The Quad Input Buffer board follows the incoming signal, maintaining the characteristics (duty cycle) of the pulse and, via one of four signal busses, drives one or more Quad Output Buffer boards. The output board provides the drive and level capabilities to provide 4 outputs. Up to 32 outputs can be provided from a single input.

# AUXILIARY EQUIPMENT FOR PRECISION TIME & FREQUENCY USERS

## MODEL 2055A PHASE MICROSTEPPER



Designed to provide a mechanism for correcting small errors in atomic frequency standards, the device will allow the operator of an atomic clock system to make small phase and frequency corrections at a regular rate in order to preclude the necessity for making C field adjustments on the atomic standard. The Phase Microstepper accepts a 1 or 5 MHz standard time base signal and shifts its phase in accordance with a digitally programmed instruction. The phase change may be a single step, or may occur at an essentially uniform rate. Digital control of the phase step or rate is effected by setting a six-digit thumbwheel switch, or by means of a six-decade BCD input. Phase equivalent rate span of the Model 2055A extends from 0.00000 ns/second to  $\pm 9.99999$  ns/sec. Digitally exact time base frequency adjustments having a resolution of  $1 \times 10^{-14}$  may be made.

## MODEL 1201B LINEAR PHASE RECORDER



Produces a chart record that is directly proportional to the phase difference between two sinusoidal or square wave inputs from 100 Hz — 5 MHz. Consider, for example, a system containing two 1 MHz frequency standards and the Model 1201B. If the frequency standards remain at exactly the same frequency, the chart record of phase vs time will be a straight line having zero slope. If there is any frequency offset the time gained or lost may be read directly with a resolution of about 100 nanoseconds. Full scale deflection of the recorder will correspond to 360° or 1 microsecond. The slope of the chart recording is proportional to the frequency offset.

## MODEL 1290A STANDBY POWER SUPPLY



Intended for applications where power must be maintained in the event of extended AC power failure. The 1290A will provide 24 Vdc at a maximum current of three amperes with a total capacity of 19 ampere-hours with fully charged batteries. Internal batteries are of the sealed cell type and require no periodic maintenance. Electronic circuits provide automatic transient free switchover from AC line to standby power and back to AC. In addition to the internal batteries, provision is also made for use of an external DC power source of 24 to 28 Vdc. If use is made of this feature, the internal batteries would only be used in the event of failure of both AC and external DC. Up to six back panel connectors are available for supplying power to several equipments.

## MODEL 2084 MULTIFILTER



The Austron Model 2080 Multicoupler and Model 2084 Multifilter distribute Loran-C signals to as many as four separate receivers. The 2080 provides three, and the 2084 provides eight, notch filters to reduce CW interference. The filters are individually switch selectable and independently adjustable from 70—170 kHz. These compact units require only 3.5" of vertical (19") rack space and offer low power consumption. DC standby power can be provided by the 1290A above.



In recent years, the normal requirements in time and frequency measurement and calibration have become so complex that in many applications an assemblage of general purpose instruments is no longer adequate. To meet the more demanding situations, Austron offers complete systems—groups of instruments fully integrated to provide a total solution to a specific time and frequency management need. During the past ten years Austron has been developing systems to solve the most complex customer requirements. Whether your need is to synchronize a data communications system, provide precise time and frequency for radar ranges, missile test ranges, or control the frequency and phase of communications sites spread all over the world, Austron has a system that will do the job.

What does it take to become one of the leading suppliers of frequency and timing systems? You start with ten years of experience in the design of electronic time and frequency measurement and dissemination equipment. To this you add the knowledge of how to integrate a system with the highest order of precision while preserving and sometimes enhancing the performance characteristics of the individual devices. You

also work closely with the Precision Time and Time Interval community, commercial and Government laboratories worldwide. Your equipment assists in the management of time and frequency in virtually every major clock system in use today.

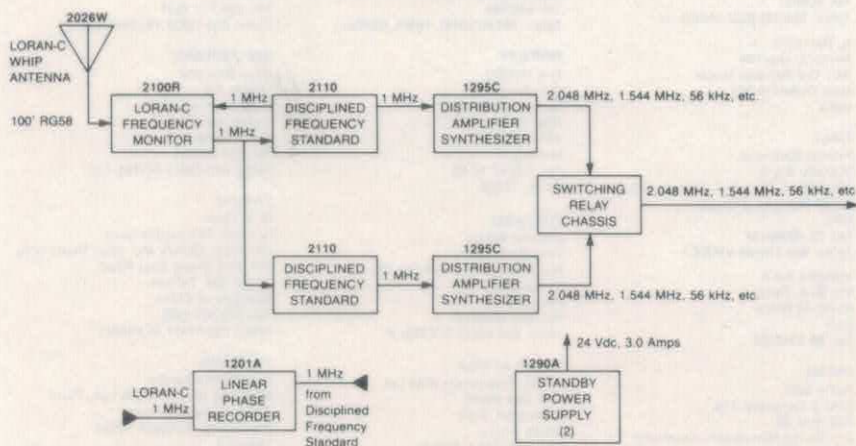
But technical excellence is not enough! You must listen carefully to your customer's needs, create basic systems with broad usefulness, then build an engineering/manufacturing facility capable of tailoring these systems to meet your customer's specific, unique needs. You also create fast responding sales and service facilities so that your customer will help you sell future systems because he remains satisfied before, during, and after the sale.

When you have done these things and are continuing to make major contributions to the state-of-the-art for the industry, you are one of the world's leading suppliers of time and frequency management systems and equipment. Austron welcomes the opportunity to discuss your systems requirements and the opportunity to make a contribution in solving your systems needs.

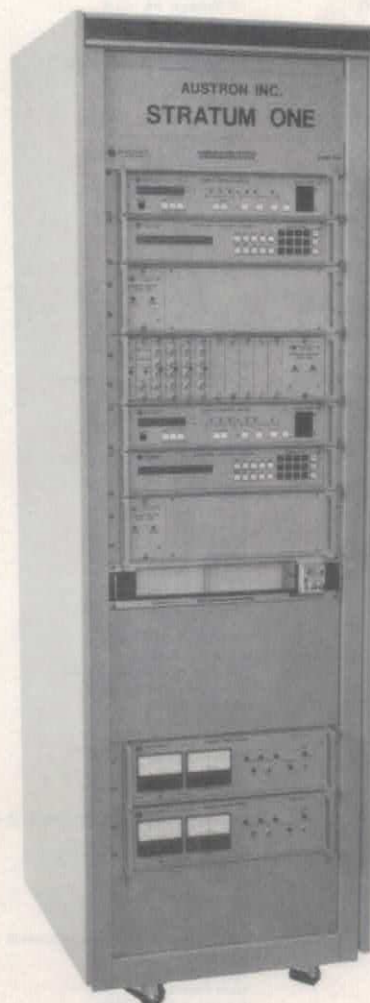
## MODEL 3150 STRATUM ONE COMMUNICATIONS NETWORK SYNCHRONIZATION SYSTEM

Designed to automatically receive the LORAN-C Navigation System's carrier signal and utilize it as a reference through which the system's disciplined frequency standard(s) may automatically synchronize itself. The disciplined frequency standard is capable of providing a phase-stable clock source to operate the system's clock synthesizer/distribution amplifier. The clock output frequencies depend upon the particular needs of the network. A few examples include 1.544 MHz, 2.048 MHz, 308 kHz and 56 kHz. There are several system configurations available primarily based on redundancy requirements. A fully redundant system is available which includes dual LORAN-C receivers, disciplined frequency standards and distribution amplifiers. Austron also provides standby power via the Austron Model 1290A Standby Power Supply.

Typical System Configuration



Redundant Communications Network Synchronization System with one LORAN-C Receiver





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U.S. DOMESTIC

**PRICE LIST**  
**October 1988**

**INTEGRATED SYSTEMS**  
**TIME & FREQUENCY INSTRUMENTS**  
**TIME CODE EQUIPMENT**  
**CRYSTAL OSCILLATORS**



**AUSTRON** *INC.*  
a DATUM company



TIME CODE INSTRUMENTS

| MODEL                              | DESCRIPTION  | UNIT PRICE                           |
|------------------------------------|--|--------------------------------------|
| 5281                               | Remote Display, D/H/M/S UP/DN .43" Digit                   | \$1,140.00                           |
| 5282                               | Remote Display, Total Seconds UP/DN .43" Digit             | \$1,140.00                           |
| 5483                               | Remote Display, D/H/M/S and Total Seconds UP/DN .43" Digit | \$2,160.00                           |
| 5581                               | Remote Display, D/H/M/S UP/DN 2" Digit                     | \$2,640.00                           |
| 5582                               | Remote Display, Total Seconds UP/DN, 2" Digit              | \$2,575.00                           |
| 8100 SERIES                        |  |                                      |
| 8110                               | Digital Clock  | \$2,565.00                           |
| 8120                               | Time Code Generator  | \$3,180.00                           |
| 8132                               | Time Code Reader   | \$3,650.00                           |
| 8134                               | Time Code Reader/Tape Search Unit                          | \$5,940.00                           |
| 8152                               | Time Code Generator/Reader                                 | \$4,315.00                           |
| 8154                               | Time Code Generator/Reader/Tape Search                     | \$7,565.00                           |
| 8155                               | Synchronized Time Code Generator                           | \$4,995.00                           |
| 8180                               | Remote Display, H/M/S 1" Digit                             | \$1,695.00                           |
| 8181                               | Remote Display, H/M/S 1" Digit                             | \$1,505.00                           |
| 8190A                              | Pulse Distribution Amplifier                               | \$1,920.00                           |
| 10308672                           | Quad Input Buffer for 8190A                                | \$ 600.00                            |
| 10308673                           | Quad Output Buffer for 8190A                               | \$ 600.00                            |
| OPTIONS FOR 8100 SERIES            |  |                                      |
| A12A                               | Type A Slow Code (H/M/S)                                   | Note: Prices available upon request. |
| A12B                               | Type B Slow Code (D/H/M/S)                                 |                                      |
| A15                                | Buffers, Input/Output, H/M/S for Model 8180                |                                      |
| A15A                               | Buffers, Input/Output, D/H/M/S for Model 8180              |                                      |
| A16                                | Control Bit Insertion (45 Bits)                            |                                      |
| A16C                               | Control Bit Translation (45 Bits)                          |                                      |
| A16D                               | Control Bit Translation & Display                          |                                      |
| A17                                | Coincidence Out, 6 Digit, H/M/S                            |                                      |
| A17B                               | Coincidence Out, 9 Digit, D/H/M/S                          |                                      |
| A17C                               | Coincidence Out, 12 Digit, D/H/M/S/Millisec                |                                      |
| A21                                | Computer Read Command                                      |                                      |
| B11                                | Oscillator, Crystal (Except Model 8154)                    |                                      |
| B12                                | Oscillator, Crystal (8110)                                 |                                      |
| B13                                | Oscillator, Crystal (Except Model 8154)                    |                                      |
| B14                                | Oscillator, Zero Warm-up                                   |                                      |
| B17                                | Flywheel Oscillator  |                                      |
| C11                                | IRIG A/10 kHz in Lieu of IRIG B                            |                                      |
| C11Q                               | IRIG A Output Code for Model 8155                          |                                      |
| C12A                               | IRIG B/17-Bit Binary Seconds                               |                                      |
| C12B                               | Parallel Binary Seconds Out                                |                                      |
| C12Q                               | IRIG B Output Code for Model 8155                          |                                      |
| C17                                | NASA 28-Bit Code in Lieu of IRIG B                         |                                      |
| C17Q                               | NASA 28-Bit Output Code for Model 8155                     |                                      |
| C18                                | NASA 36-Bit Code in Lieu of IRIG B                         |                                      |
| C18Q                               | NASA 36-Bit Output Code for Model 8155                     |                                      |
| C26                                | XR3 250 Hz Code in Lieu of IRIG B                          |                                      |
| C26A                               | XR3 1 kHz Code in Lieu of IRIG B                           |                                      |
| C26P                               | XR3 1 kHz Output Code for Model 8155                       |                                      |
| C26Q                               | XR3 250 Hz Output Code for Model 8155                      |                                      |
| C41                                | Switch Selectable IRIG A/B Codes                           |                                      |
| C47                                | Switch Selectable XR3 250 Hz/1 kHz Codes                   |                                      |
| C48                                | IRIG H 100 Hz Code in Lieu of IRIG B                       |                                      |
| C48A                               | IRIG H 1 kHz Code in Lieu of IRIG B                        |                                      |
| C48P                               | IRIG H 1 kHz Output Code for Model 8155                    |                                      |
| C48Q                               | IRIG H 100 Hz Output Code for Model 8155                   |                                      |
| C49                                | Universal IRIG Codes                                       |                                      |
| C50                                | WWVB Code in Lieu of IRIG B for Model 8155 Input           |                                      |
| D11                                | Parallel BCD Output H/M/S (For Model 8181)                 |                                      |
| D11D                               | Parallel BCD Output D/H/M/S (For Model 8181)               |                                      |
| D14-X                              | 20-Bit Buffer Register                                     |                                      |
| D15                                | BCD Outputs, H/M/S   |                                      |
| D15A                               | BCD Outputs, Days/ID                                       |                                      |
| IEEE-488 INTERFACE, TIME ON DEMAND |  |                                      |
| D20                                | Hr, Min, Sec   | Note: Prices available upon request. |
| D21                                | Hr, Min, Sec, & Millisec                                   |                                      |
| D22                                | Day, Hr, Min, & Sec  |                                      |
| D23                                | Day, Hr, Min, Sec, & Millisec                              |                                      |
| RS232 INTERFACE, TIME ON DEMAND    |  |                                      |
| D30                                | Hr, Min, & Sec   | Note: Prices available upon request. |
| D31                                | Hr, Min, Sec, & Millisec                                   |                                      |
| D32                                | Day, Hr, Min, & Sec  |                                      |
| D33                                | Day, Hr, Min, Sec, & Millisec                              |                                      |
| E13                                | Days/ID Number   | Note: Prices available upon request. |
| E14                                | Parallel BCD Output—Millisec                               |                                      |
| E14A                               | Parallel BCD Output—Millisec for Model 8134 & Model 8154   |                                      |

TIME CODE INSTRUMENTS (Continued)

| MODEL  | DESCRIPTION                                    | UNIT PRICE                           |
|--|--|--------------------------------------|
| RS232 INTERFACE, TIME ON DEMAND (Continued)                      |  |                                      |
| E14  | Search to Millisec For Model 8134 & Model 8154 |                                      |
| E16  | Remote Tape Speed Select                       |                                      |
| E17  | Simultaneous Generate/Read, 6-Digit            |                                      |
| E17A   | Simultaneous Generate/Read, 9-Digit            |                                      |
| E19  | Search for TOD/DOY/Both (Must Have Opt E13)    |                                      |
| E20  | Days for Model 8155                            |                                      |
| E22  | Generate Preset for Model 8155 (H/M/S)         |                                      |
| E22A   | Generate Preset for Model 8155 (D/H/M/S)       |                                      |
| E25  | Calendar Clock for Model 8110                  |                                      |
| COMPUTER INTERFACE, SEARCH<br>(SPECIFY COMPUTER I/O ARRANGEMENT) |  |                                      |
| FC6H   | Hr, Min, & Sec                                 |                                      |
| FC9H   | Hr, Min, Sec, & Millisec                       |                                      |
| FC9D   | Day, Hr, Min, & Sec                            |                                      |
| FC12D  | Day, Hr, Min, Sec, & Millisec                  |                                      |
| IEEE-488 INTERFACE, SEARCH                                       |  |                                      |
| FE6H   | Hr, Min, & Sec                                 |                                      |
| FE9H   | Hr, Min, Sec, & Millisec                       |                                      |
| FE9D   | Day, Hr, Min, & Sec                            |                                      |
| FE12D  | Day, Hr, Min, Sec, & Millisec                  |                                      |
| L13  | 20-50 Vdc Power                                |                                      |
| M16  | Ceiling/Wall Mount for Model 8180 & Model 8181 |                                      |
| S11  | EXT Synchronization                            |                                      |
| S11A   | WWV SYNC, W/Prop Delay                         |                                      |
| S12  | Propagation Delay for Model 8155               |                                      |
| S13  | Analog Filter, Manual                          |                                      |
| S14  | Analog Filter, Remote                          |                                      |
| ACCESSORIES FOR 8100 SERIES                                      |  |                                      |
| 8198-4   | Battery Pack, 4 Amp Hrs                        | \$2,380.00                           |
| 8198-0401  | Battery Pack                                   | \$2,515.00                           |
| 8198-8   | Battery Pack, 8 Amp Hrs                        | \$2,960.00                           |
| 8198-12  | Battery Pack, 12 Amp Hrs                       | \$3,525.00                           |
| 11400453   | Chassis Slides                                 | \$ 160.00                            |
| 11008613-( )   | Mounting Plate                                 | \$ 190.00                            |
| 8500 SERIES  |  |                                      |
| 8526   | Portable Time Code Generator                   | \$5,255.00                           |
| OPTIONS FOR 8526 SERIES  |  |                                      |
| A11E   | IRIG E DC Code Output                          | Note: Prices available upon request. |
| A12B   | Type B Slow Code, One Rate                     |                                      |
| B14  | Oscillator, Zero Warm-up                       |                                      |
| C11  | IRIG A in Lieu of IRIG B                       |                                      |
| C26  | XR3/250 Hz in Lieu of IRIG B                   |                                      |
| C26A   | XR3/1 kHz in Lieu of IRIG B                    |                                      |
| C41  | IRIG A/IRIG B Sw. Select                       |                                      |
| C48  | IRIG H 100 Hz in Lieu of IRIG B                |                                      |
| C48A   | IRIG H 1 kHz in Lieu of IRIG B                 |                                      |
| E14  | Parallel BCD Output, Millisec                  |                                      |
| E15  | Parallel BCD Output, D/H/M/S                   | Note: Prices available upon request. |
| L14A   | Internal Battery                               |                                      |
| L14B   | Dual Internal Battery                          |                                      |
| M13  | Airborne Package                               |                                      |
| S11  | Advance Retard Control                         |                                      |
| S19A   | IRIG B Synchronize                             |                                      |
| 8700 SERIES<br>(SPECIFY TIME CODE<br>AND MOUNTING ARRANGEMENT)   |  |                                      |
| 8720   | Compact Time Code Generator                    | \$2,190.00                           |
| 8730   | Compact Time Code Reader                       | \$2,190.00                           |
| 8720/8730  | Time Code Generator/Reader                     | \$4,160.00                           |
| 8781   | Serial Remote Display                          | \$ 995.00                            |
| OPTIONS AND ACCESSORIES FOR 8700 SERIES                          |  |                                      |
| A17  | Coincident Outputs                             | Note: Prices available upon request. |
| D15  | Parallel BCD Output, D/H/M/S                   |                                      |
| E14  | Parallel BCD Output, Millisec                  |                                      |
| L14  | Internal Battery Pack for Model 8720           |                                      |



## 1295D DISTRIBUTION CHASSIS

| PART NUMBER  | DESCRIPTION   | UNIT PRICE |
|--|---|------------|
| <b>MAINFRAMES</b>  |   |            |
| 30411392   | Mainframe With AC/DC Single Regulator                   | \$2,155.00 |
| 30411392-1   | Mainframe With DC-Only, Negative Ground                 | \$1,995.00 |
| 30411392-2   | Mainframe With AC/DC Dual Regulator                     | \$2,820.00 |
| 30411392-3   | Mainframe With DC-Only, Dual Regulator, Negative Ground | \$2,660.00 |
| 30411392-4   | Mainframe With DC-Only, Positive Ground                 | \$1,995.00 |
| 30411392-5   | Mainframe With DC-Only, Dual Regulator, Positive Ground | \$2,820.00 |
| <b>ADDITIONAL POWER/REGULATOR/ALARM MODULES FOR MAINFRAMES ABOVE</b> |   |            |
| 23411342   | Regulator Module  | \$ 665.00  |
| 23411350   | AC/DC Power Input Module                                | \$ 630.00  |
| 23411355   | DC-Only Power Input Module, Negative Ground             | \$ 525.00  |
| 23411355-1   | DC-Only Power Input Module, Positive Ground             | \$ 525.00  |
| 10911487   | Alarm Indicator Assembly                                | \$1,155.00 |
| 10911487-1   | Alarm Indicator Assembly for Dual Supply                | \$1,155.00 |
| <b>OUTPUT MODULES</b>  |   |            |
| 23499396   | Mod Assy, Quad WB Amplifier (100k-10 MHz) (BUS/BNC) 1-3 | \$ 635.00  |
| 23499396-1   | Mod Assy, Quad WB Amplifier (Lo Freq) (BUS/BNC) 4-6     | \$ 570.00  |
| 23499396-2   | Mod Assy, Quad WB Amplifier (BUS/TWX) 7-Up              | \$ 505.00  |
| 23499396-3   | Mod Assy, Quad WB Amplifier (BUS/TWX)                   |            |
| 23499396-4   | Mod Assy, Quad WB Amplifier (BUS/BNC)                   |            |
| 23499396-10  | Mod Assy, Quad WB Amplifier (BUS/WW)                    |            |
| 23499396-12  | Mod Assy, Quad WB Amplifier (BUS/WW)                    |            |
| 23499396-13  | Mod Assy, Quad WB Amplifier (BUS/WW)                    |            |
| 23410093   | Mod Assy, Quad Time Code Output (BUS/BNC)               |            |
| 23410140   | Mod Assy, Quad RS422 Output (BUS/TWX)                   |            |
| 23410140-1   | Mod Assy, Quad RS422 Output (BUS/WW)                    |            |
| 23411085-1   | Mod Assy, Composite Clock Out (BUS/TWX)                 |            |
| 23411085-2   | Mod Assy, Composite Clock Out (BUS/WW)                  |            |
| 23411123   | Mod Assy, Quad V.35 Output (BUS/TWX)                    |            |
| 23411123-1   | Mod Assy, Quad V.35 Output (BUS/WW)                     |            |
| 23411560   | Mod Assy, Quad High Isolation (SMA/SMA)                 |            |
| 23411589   | Mod Assy, Quad G.703 (BUS/TWX)                          |            |
| 23411589-1   | Mod Assy, Quad G.703 (BUS/WW)                           |            |
| 23411589-2   | Mod Assy, Quad G.703 (BUS/BNC)                          |            |
| 23411632   | Mod Assy, Quad TTL (BUS/BNC)                            |            |
| <b>INPUT MODULES</b>   |   |            |
| 23498935   | Mod Assy, Low Noise Wideband Input (BNC/BUS)            | \$ 510.00  |
| 23498935-1   | Mod Assy, Dual Low Noise Wideband Input (BNC/BUS)       | \$ 685.00  |
| 23499757   | Mod Assy, Time Code Input (BNC/BUS)                     | \$1,030.00 |
| 23499757-1   | Mod Assy, Time Code Input Non-AGC (BNC/BUS)             | \$ 685.00  |
| 23499880   | Mod Assy, 10dB Combiner (BNC/BNC)                       | \$ 535.00  |
| <b>CONVERTER/BUFFER MODULES</b>                                      |   |            |
| 23410774-1   | Mod Assy, Converter/Buffer (BI-P/422) (BNC/BUS)         | \$ 685.00  |
| 23410774-2   | Mod Assy, Converter/Buffer (AMI/422) (TWX/BUS)          | \$ 685.00  |
| 23410774-3   | Mod Assy, Converter/Buffer (422/422) (TWX/TWX)          | \$ 685.00  |
| 23410774-4   | Mod Assy, Converter/Buffer (BI-P/BI-P) (BNC/BUS)        | \$ 685.00  |
| 23410774-5   | Mod Assy, Converter/Buffer (AMI/BI-P) (TWX/BUS)         | \$ 685.00  |
| 23410774-6   | Mod Assy, Converter/Buffer (422/BI-P) (TWX/BUS)         | \$ 685.00  |
| 23410774-7   | Mod Assy, Converter/Buffer (BI-P/AMI) (BNC/BUS)         | \$ 685.00  |
| 23410774-8   | Mod Assy, Converter/Buffer (AMI/AMI) (TWX/BUS)          | \$ 685.00  |
| 23410774-9   | Mod Assy, Converter/Buffer (422/AMI) (TWX/BUS)          | \$ 685.00  |
| <b>SCALER/BUFFER MODULES</b>   |   |            |
| 23498217   | Mod Assy, 1/1 MHz Scaler (BNC/BUS)                      | \$ 685.00  |
| 23498441   | Mod Assy, 5/5 & 1 MHz Scaler/Buffer (BNC/BUS)           | \$ 685.00  |
| 23498448   | Mod Assy, 5/10 & 5 MHz Scaler/Buffer (BNC/BUS)          | \$ 685.00  |
| 23498612   | Mod Assy, 1.544 MHz Buffer (BNC/BUS)                    | \$ 685.00  |
| 23498619   | Mod Assy, 5 & 1 MHz Dual Buffer (BNC/BUS)               | \$ 685.00  |
| 23498644   | Mod Assy, 5/10 & 1 MHz Scaler/Buffer (BNC/BUS)          | \$ 685.00  |
| 23498661   | Mod Assy, 10 & 1 MHz Dual Buffer (BNC/BUS)              | \$ 685.00  |
| 23498774   | Mod Assy, 1 MHz Buffer (BNC/BUS)                        | \$ 685.00  |
| 23498778   | Mod Assy, 5 MHz Buffer (BNC/BUS)                        | \$ 685.00  |
| 23498870   | Mod Assy, 10 MHz Buffer (BNC/BUS)                       | \$ 685.00  |
| 23498874   | Mod Assy, 10/1 MHz Scaler (BNC/BUS)                     | \$ 685.00  |
| 23498878   | Mod Assy, 1 MHz/1 kHz Scaler (BNC/BUS)                  | \$ 685.00  |
| 23498886   | Mod Assy, 10/10 & 1 MHz Scaler (BNC/BUS)                | \$ 685.00  |
| 23410478   | Mod Assy, 10/5 MHz Scaler (BNC/BUS)                     | \$ 685.00  |
| 23411444   | Mod Assy, 1 MHz/2 MHz Scaler (BNC/BUS)                  | \$ 685.00  |
| <b>GENERATOR/CLOCK RECOVERY MODULES</b>                              |   |            |
| 23410947   | Mod Assy, Composite Clock Generator (BUS/BUS)           | \$1,030.00 |
| 23410947-1   | Mod Assy, Composite Clock Generator (BNC/BUS)           | \$1,030.00 |
| 23410947-2   | Mod Assy, Composite Clock Generator (TWX/BUS)           | \$1,030.00 |
| 23411072   | Mod Assy, Framed T1 Generator (TTJ/BUS)                 | \$1,030.00 |
| 23411072-1   | Mod Assy, Framed T1 Generator (BNC/BUS)                 | \$1,030.00 |
| 23411072-2   | Mod Assy, Framed T1 Generator (TWX/BUS)                 | \$1,030.00 |
| 23411072-3   | Mod Assy, Framed T1 Generator (BUS/BUS)                 | \$1,030.00 |
| 23411078   | Mod Assy, Clock Recovery (TTJ/BUS)                      | \$1,030.00 |
| 23411078-1   | Mod Assy, Clock Recovery (TTJ/BNC)                      | \$1,030.00 |
| 23411078-2   | Mod Assy, Clock Recovery (TTJ/IO)                       | \$1,030.00 |
| 23411078-3   | Mod Assy, Clock Recovery (TWX/BUS)                      | \$1,030.00 |
| 23411078-4   | Mod Assy, Clock Recovery (TWX/TWX)                      | \$1,030.00 |
| 23411078-5   | Mod Assy, Clock Recovery (TWX/BNC)                      | \$1,030.00 |
| 23411078-6   | Mod Assy, Clock Recovery (BRIDGED BANTAMS)              | \$1,030.00 |
| 23411078-7   | Mod Assy, Clock Recovery (BRIDGED TWXs)                 | \$1,030.00 |

## 1295D DISTRIBUTION CHASSIS (Continued)

| PART NUMBER                    | DESCRIPTION   | UNIT PRICE |
|--------------------------------|---|------------|
| <b>AUTO SWITCHOVER MODULES</b> |   |            |
| 23410202                       | Mod Assy, Auto Switchover (BNC/BNC)                 | \$ 505.00  |
| 23410202-1                     | Mod Assy, Auto Switchover (BNC/BUS)                 | \$ 505.00  |
| 23410202-2                     | Mod Assy, Auto Switchover (BUS/BUS)                 | \$ 505.00  |
| 23410202-3                     | Mod Assy, Auto Switchover (BUS/BNC)                 | \$ 505.00  |
| 23410202-4                     | Mod Assy, Auto Switchover Balanced Line (TWX/TWX)   | \$ 505.00  |
| 23410202-5                     | Mod Assy, Auto SW Balanced (BUS/BUS)                | \$ 505.00  |
| 23410202-6                     | Mod Assy, Auto SW Balanced (TWX/BUS)                | \$ 505.00  |
| 23410202-7                     | Mod Assy, Auto SW Balanced (BUS/TWX)                | \$ 505.00  |
| 23410836                       | Mod Assy, Auto Switchover/Remote Control (BNC/BNC)  | \$ 685.00  |
| 23410836-1                     | Mod Assy, Auto SW Rmt Control (BNC/BUS) 2 Slots     | \$ 685.00  |
| 23410836-2                     | Mod Assy, Auto SW Rmt Control (BUS/BUS) 2 Slots     | \$ 685.00  |
| 23410836-3                     | Mod Assy, Auto SW Rmt Control (BUS/BNC) 2 Slots     | \$ 685.00  |
| 23410836-4                     | Mod Assy, Auto SW Rmt Control Bal (TWX/TWX) 2 Slots | \$ 685.00  |
| 23410836-5                     | Mod Assy, Auto SW Rmt Control Bal (BUS/BUS) 2 Slots | \$ 685.00  |
| 23410836-6                     | Mod Assy, Auto SW Rmt Control Bal (TWX/BUS) 2 Slots | \$ 685.00  |
| 23410836-7                     | Mod Assy, Auto SW Rmt Control Bal (BUS/TWX) 2 Slots | \$ 685.00  |
| <b>SYNTHESIZER MODULES</b>     |   |            |
| 23498882                       | Mod Assy, Synthesizer 1/1.544 (BNC/BUS)             | \$1,030.00 |
| 23498882-1                     | Mod Assy, Synthesizer 1/1.544 DS1-AMI (BNC/BUS)     | \$1,030.00 |
| 23499033                       | Mod Assy, Synthesizer 5/1.544 (BNC/BUS)             | \$1,030.00 |
| 23499033-1                     | Mod Assy, Synthesizer 5/1.544 DS1-AMI (BNC/BUS)     | \$1,030.00 |
| 23499034                       | Mod Assy, Synthesizer 10/1.544 (BNC/BUS)            | \$1,030.00 |
| 23499034-1                     | Mod Assy, Synthesizer 10/1.544 AMI (BNC/BUS)        | \$1,030.00 |
| 23499035                       | Mod Assy, Synthesizer 308 kHz/1 (BNC/BUS)           | \$1,030.00 |
| 23499401                       | Mod Assy, Synthesizer 1/564 kHz (BNC/BUS)           | \$1,030.00 |
| 23499793                       | Mod Assy, Synthesizer 128 kHz/5 (BNC/BUS)           | \$1,030.00 |
| 23499871                       | Mod Assy, Synthesizer 1/1.024 (BNC/BUS)             | \$1,030.00 |
| 23410125                       | Mod Assy, Synthesizer RS422 1/12.928 (BNC/BUS)      | \$1,030.00 |
| 23410125-1                     | Mod Assy, Synthesizer RS422 1/9.696 (BNC/BUS)       | \$1,030.00 |
| 23410125-2                     | Mod Assy, Synthesizer RS422 1/6.464 (BNC/BUS)       | \$1,030.00 |
| 23410125-3                     | Mod Assy, Synthesizer RS422 1/3.232 (BNC/BUS)       | \$1,030.00 |
| 23410125-4                     | Mod Assy, Synthesizer RS422 1/5 (BNC/BUS)           | \$1,030.00 |
| 23410125-5                     | Mod Assy, Synthesizer RS422 1/2.048 (BNC/BUS)       | \$1,030.00 |
| 23410125-6                     | Mod Assy, Synthesizer RS422 1/1.544 (BNC/BUS)       | \$1,030.00 |
| 23410125-7                     | Mod Assy, Synthesizer RS422 10/2.048 (BNC/BUS)      | \$1,030.00 |
| 23410125-8                     | Mod Assy, Synthesizer RS422 10/1.544 (BNC/BUS)      | \$1,030.00 |
| 23410125-9                     | Mod Assy, Synthesizer RS422 5/2.048 (BNC/BUS)       | \$1,030.00 |
| 23410125-10                    | Mod Assy, Synthesizer RS422 5/1.544 (BNC/BUS)       | \$1,030.00 |
| 23410125-11                    | Mod Assy, Synthesizer RS422 10/1.024 (BNC/BUS)      | \$1,030.00 |
| 23410125-12                    | Mod Assy, Synthesizer RS422 10/512 kHz (BNC/BUS)    | \$1,030.00 |
| 23410125-13                    | Mod Assy, Synthesizer RS422 10/772 kHz (BNC/BUS)    | \$1,030.00 |
| 23410125-14                    | Mod Assy, Synthesizer RS422 10/1.536 (BNC/BUS)      | \$1,030.00 |
| 23410125-15                    | Mod Assy, Synthesizer RS422 10/1.152 (BNC/BUS)      | \$1,030.00 |
| 23410236                       | Mod Assy, Synthesizer RS422 1/64 kHz (BNC/BUS)      | \$1,030.00 |
| 23410236-1                     | Mod Assy, Synthesizer RS422 1/56 kHz (BNC/BUS)      | \$1,030.00 |
| 23410236-2                     | Mod Assy, Synthesizer RS422 1/19.2 kHz (BNC/BUS)    | \$1,030.00 |
| 23410236-3                     | Mod Assy, Synthesizer RS422 1/16.8 kHz (BNC/BUS)    | \$1,030.00 |
| 23410236-4                     | Mod Assy, Synthesizer RS422 1/14.4 kHz (BNC/BUS)    | \$1,030.00 |
| 23410236-5                     | Mod Assy, Synthesizer RS422 1/9.6 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-6                     | Mod Assy, Synthesizer RS422 1/256 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-7                     | Mod Assy, Synthesizer RS422 1/4 kHz (BNC/BUS)       | \$1,030.00 |
| 23410236-8                     | Mod Assy, Synthesizer RS422 1/128 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-9                     | Mod Assy, Synthesizer RS422 1/4.8 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-10                    | Mod Assy, Synthesizer RS422 1/2.4 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-11                    | Mod Assy, Synthesizer RS422 1/1.2 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-12                    | Mod Assy, Synthesizer RS422 1/224 kHz (BNC/BUS)     | \$1,030.00 |
| 23410236-13                    | Mod Assy, Synthesizer RS422 1/280 kHz (BNC/BUS)     | \$1,030.00 |
| 23410382                       | Mod Assy, Synthesizer 1/2.048 (BNC/BUS)             | \$1,030.00 |
| 23410382-1                     | Mod Assy, Synthesizer 1/2.048 AMI (BNC/BUS)         | \$1,030.00 |
| 23410432                       | Mod Assy, Synthesizer 56 kHz/1 (BNC/BUS)            | \$1,030.00 |
| 23410432-1                     | Mod Assy, Synthesizer 56 kHz/5 (BNC/BUS)            | \$1,030.00 |
| 23410434                       | Mod Assy, Synthesizer 1.544/1 (BNC/BUS)             | \$1,030.00 |
| 23410434-1                     | Mod Assy, Synthesizer 1.544/5 (BNC/BUS)             | \$1,030.00 |
| 23410796                       | Mod Assy, Synthesizer RS422 5/56 kHz (BNC/BUS)      | \$1,030.00 |
| 23410796-1                     | Mod Assy, Synthesizer RS422 5/8 kHz (BNC/BUS)       | \$1,030.00 |
| 23410796-2                     | Mod Assy, Synthesizer RS422 5/60 kHz (BNC/BUS)      | \$1,030.00 |
| 23410812                       | Mod Assy, Synthesizer 8 kHz/5 (BNC/BUS)             | \$1,030.00 |
| 23411037                       | Mod Assy, Synthesizer RS422 10/64 kHz (BNC/BUS)     | \$1,030.00 |
| 23411037-1                     | Mod Assy, Synthesizer RS422 10/56 kHz (BNC/BUS)     | \$1,030.00 |
| 23411037-2                     | Mod Assy, Synthesizer RS422 10/256 kHz (BNC/BUS)    | \$1,030.00 |
| 23411037-3                     | Mod Assy, Synthesizer RS422 10/9.6 kHz (BNC/BUS)    | \$1,030.00 |
| 23411037-4                     | Mod Assy, Synthesizer RS422 10/224 kHz (BNC/BUS)    | \$1,030.00 |
| 23411037-5                     | Mod Assy, Synthesizer RS422 10/280 kHz (BNC/BUS)    | \$1,030.00 |
| 23411096                       | Mod Assy, Synthesizer Framed T1 (TTJ/BUS)           | \$1,030.00 |
| 23411096-1                     | Mod Assy, Synthesizer Framed T1 (BNC/BUS)           | \$1,030.00 |
| 23411096-2                     | Mod Assy, Synthesizer Framed T1 (TWX/BUS)           | \$1,030.00 |
| 23411096-3                     | Mod Assy, Synthesizer Framed T1 (BUS/BUS)           | \$1,030.00 |
| 23411106                       | Mod Assy, Synthesizer T2 (6.312 MHz) (BNC/BUS)      | \$1,030.00 |
| 23411321                       | Mod Assy, Synthesizer 10/768 kHz (BNC/BUS)          | \$1,030.00 |
| 23411322                       | Mod Assy, Synthesizer 1/308 kHz (BNC/BUS)           | \$1,030.00 |
| 23411644                       | Mod Assy, Synthesizer 10/64 kHz (BNC/TWX)           | \$1,030.00 |
| 23411644-1                     | Mod Assy, Synthesizer 10/56 kHz (BNC/TWX)           | \$1,030.00 |
| 23411644-2                     | Mod Assy, Synthesizer 10/256 kHz (BNC/TWX)          | \$1,030.00 |
| 23411644-3                     | Mod Assy, Synthesizer 10/9.6 kHz (BNC/TWX)          | \$1,030.00 |
| 23411644-4                     | Mod Assy, Synthesizer 10/224 kHz (BNC/TWX)          | \$1,030.00 |
| 23411644-5                     | Mod Assy, Synthesizer 10/280 kHz (BNC/TWX)          | \$1,030.00 |
| 23411645                       | Mod Assy, Synthesizer RS422 10/2.048 (BNC/TWX)      | \$1,030.00 |
| 23411645-1                     | Mod Assy, Synthesizer RS422 10/1.544 (BNC/TWX)      | \$1,030.00 |



## 1295D DISTRIBUTION CHASSIS (Continued)

| PART NUMBER                                 | DESCRIPTION  | UNIT PRICE |
|---|--|------------|
| <b>OSCILLATOR/PHASE LOCKED LOOP MODULES</b> |  |            |
| 23411419                                    | Mod Assy, Rubidium Oscillator (BUS or BNC Output) 3 Slots        | \$5,040.00 |
| 23411532                                    | Mod Assy, 10 MHz Digital Hold PLL (BUS or BNC Output) 3 Slots    | \$2,520.00 |
| 23411532-1                                  | Mod Assy, 5 MHz Digital Hold PLL (BUS or BNC Output) 3 Slots     | \$2,520.00 |
| 23411532-2                                  | Mod Assy, 6.312 MHz Digital Hold PLL (BUS or BNC Output) 3 Slots | \$2,520.00 |
| 23411549                                    | Mod Assy, Rubidium PLL (BUS or BNC Output) 4 Slots               | \$5,460.00 |
| 23411619                                    | Mod Assy, 1.544 MHz 1121 PLL (BUS or BNC Output) 3 Slots         | \$2,850.00 |
| 23411619-1                                  | Mod Assy, 2.148 MHz 1121 PLL (BUS or BNC Output) 3 Slots         | \$2,850.00 |
| <b>FIBER OPTIC MODULES</b>                  |  |            |
| 23411259                                    | Mod Assy, Digital Fiber Optic Transmitter (BUS/FO)               | \$1,030.00 |
| 23411259-1                                  | Mod Assy, Digital Fiber Optic Transmitter (BNC/FO)               | \$1,030.00 |
| 23411261                                    | Mod Assy, Digital Fiber Optic Receiver (FO/BUS)                  | \$1,030.00 |
| 23411261-1                                  | Mod Assy, Digital Fiber Optic Receiver (FO/BNC)                  | \$1,030.00 |
| <b>FILTER MODULES</b>                       |  |            |
| 23410127                                    | Mod Assy, Filter 564 kHz (BUS/BUS)                               | \$ 510.00  |
| 23410127-1                                  | Mod Assy, Filter 308 kHz (BUS/BUS)                               | \$ 510.00  |

## TIME/FREQUENCY INSTRUMENTS

| MODEL      | DESCRIPTION   | UNIT PRICE           |
|------------|---|----------------------|
| 1048       | Converter, 50 to 60 Hz (for 1201A or 1201B Recorder Motor Only) | \$ 820.00            |
| 1201B      | Linear Phase Recorder, 60 Hz                                    | \$ 2,415.00          |
| 1201B      | Linear Phase Recorder, 50/60 Hz                                 | \$ 2,975.00          |
| 1210D(-)   | Portable Crystal Clock  | \$ 8,685.00          |
| 1250A      | Crystal Frequency Standard                                      | \$ 6,285.00          |
| 1250B      | Crystal Frequency Standard                                      | \$ 6,505.00          |
| 1270A      | Alarm Panel   | \$ 1,735.00          |
| 1290A      | Standby Power Supply  | \$ 4,410.00          |
| 1295D      | Distribution Amplifier  | See 1295D Price List |
| 1324       | DC/DC Converter   | \$ 3,310.00          |
| 1324-1     | DC/DC Converter   | \$ 3,310.00          |
| 2000C      | Loran-C Receiver  | \$13,440.00          |
| 2010B      | Disciplined Frequency Standard                                  | \$ 7,530.00          |
| 2021L      | Loran-C Loop Antenna  | \$ 335.00            |
| 2026W      | Loran-C Whip Antenna  | \$ 430.00            |
| 2055A      | Phase Microstepper  | \$ 7,825.00          |
| 2080       | VLF/LF Multicoupler (Unbalanced)                                | \$ 3,140.00          |
| 2084       | LF Multifilter  | \$ 4,085.00          |
| 2100       | Loran-C Automatic Timing Receiver                               | \$11,550.00          |
| 2100F      | Loran-C Automatic Frequency Monitor                             | \$ 7,180.00          |
| 2100R      | Loran-C Automatic Frequency Reference                           | \$ 6,615.00          |
| OPTIONAL   | IEEE-488 Bus Option for 2100, 2100F, or 2100R                   | \$ 605.00            |
| 2110       | Disciplined Frequency Standard                                  | \$10,070.00          |
| 2112       | Disciplined Rubidium Frequency Standard                         | \$13,220.00          |
| OPTIONAL   | IEEE-488 Bus Option for 2110 & 2112                             | \$ 605.00            |
| OPTIONAL   | Dual Reference Input Option for 2110 & 2112                     | \$ 1,365.00          |
| OPTIONAL   | Internal Battery Backup Option for 2110 & 2112                  | \$ 315.00            |
| OPTIONAL   | 100 kHz Sine Wave Output Option for 2110 & 2112                 | \$ 1,050.00          |
| 2310       | Disciplined Cesium Beam Frequency Standard                      | \$36,750.00          |
| Option 001 | Stand-By Power Supply   | \$ 1,050.00          |
| Option 002 | Low Phase Noise Option  | \$ 3,360.00          |
| Option 003 | RS232 Interface   | \$ 605.00            |
| Option 004 | IEEE-488 Interface  | \$ 605.00            |
| Option 005 | Special Frequencies   | On Request           |
| 6014       | Frequency Multiplier  | \$ 5,015.00          |
| 6014B      | Frequency Multiplier  | \$ 8,715.00          |
| 6016       | Frequency Multiplier  | \$ 4,925.00          |

AUSTRON, Inc.  
P.O. Box 14766  
Austin, TX 78761-4766  
(512) 251-2313  
TWX (910) 874-1356  
FAX (512) 251-9685

AUSTRON, Inc.  
1930 Isaac Newton Sq.  
Suite 111  
Reston, VA 22909  
(703) 471-7963  
FAX (703) 689-4648

**Represented by:**

## HIGH STABILITY CRYSTAL OSCILLATORS

| MODEL   | DESCRIPTION  | UNIT PRICE |
|---------|--|------------|
| 1100-5  | 1 MHz or 5 MHz Compact 5 x 10 <sup>-9</sup> Aging    | \$ 705.00  |
| 1100-2  | 1 MHz or 5 MHz Compact 2 x 10 <sup>-9</sup> Aging    | \$ 750.00  |
| 1100-1  | 1 MHz or 5 MHz Compact 1 x 10 <sup>-9</sup> Aging    | \$ 825.00  |
| 1105-5  | 1 MHz TTL Logic Output 5 x 10 <sup>-9</sup> Aging    | \$ 705.00  |
| 1105-2  | 1 MHz TTL Logic Output 2 x 10 <sup>-9</sup> Aging    | \$ 750.00  |
| 1105-1  | 1 MHz TTL Logic Output 1 x 10 <sup>-9</sup> Aging    | \$ 825.00  |
| 1111    | 10 MHz, Compact, Low Phase Noise, Fast Warm-up       | \$1,575.00 |
| 1115    | 5 MHz Minimal Power Drain                            | \$ 900.00  |
| 1120-5  | 1, 5, or 10 MHz Versatile 5 x 10 <sup>-9</sup> Aging | \$ 705.00  |
| 1120-2  | 1, 5, or 10 MHz Versatile 2 x 10 <sup>-9</sup> Aging | \$ 750.00  |
| 1120-1  | 1, 5, or 10 MHz Versatile 1 x 10 <sup>-9</sup> Aging | \$ 825.00  |
| 1120FW  | 5 MHz Fast Warm-up 5 x 10 <sup>-9</sup> Aging        | \$ 880.00  |
| 1120L   | 5 MHz or 10 MHz Low Phase Noise                      | \$1,150.00 |
| 1120PLL | 5 MHz Phase Locked Loop                              | \$ 880.00  |
| 1150    | 5 MHz Maximum Stability Crystal Oscillator           | \$2,590.00 |
| 1151    | 10 MHz Maximum Stability Crystal Oscillator          | \$1,325.00 |

NOTE: These prices are for Austron standard frequency oscillators (1, 5, or 10 MHz) manufactured to Austron standard part number specifications. For any nonstandard frequency, wiring, size, environmental, or testing requirements, contact Product Marketing Manager for pricing.

## CONNECTOR CODES

BNC = BNC  
BUS = INTERNAL 1295D BUS  
TWX = TWIN BNC  
FO = FIBER OPTIC, SMA-TYPE  
W/W = WIRE WRAP  
TTJ = BANTAM PHONE JACK

DELIVERY: F.O.B. Austin, Texas

TERMS: Net 30 Days (With Established Credit)

Effective October 15, 1988

Supersedes All Previous Price Lists

Subject To Change Without Notice

## Standard Government Charges

DD250 Preparation: \$100.00 Per Contract

Government Source Inspection: \$250.00 Per Contract

Bar Code (Logmars): \$75.00 Per Contract

Military Packaging (Barrier Bag): \$20.00 Per Item

FREQUENCY AND TIME SYSTEMS, INC.  
34 Tozer Rd.  
Beverly, MA 01915-5510  
Toll Free: 1-800-544-0233  
(508) 927-8220



## Frequency standard holds drift to $10^{-11}$ /day, can use 2 external references

**T**he first microprocessor-controlled frequency standard automatically locks the frequency of its ovenized quartz-crystal oscillator onto an externally applied reference of 1, 5, or 10 MHz (100 kHz optional) and drifts no more than 1 part in  $10^{11}$  per day without an external reference.

Because it is microprocessor-controlled, the unit, called the 2110 disciplined frequency standard by its maker, Austron, offers several unique features. Probably the most important is the optional ability to make use of two references at the same time. Others are a third-order servo oscillator control system, an eight-character liquid-crystal display, continuous correction after the reference is removed, and an

IEEE-488 interface.

By being able to handle two references at once, the 2110 ensures greater reliability than other frequency standards, since its ability to deal with noise is enhanced. For example, the primary/secondary mode uses the primary reference until a fault is perceived, at which time the 2110 will lock onto the secondary reference. In the statistical combination mode, both references are used at all times and statistical computations determine by weight which reference should be followed more closely. These modes also increase the overall reliability of the system.

Thanks to its highly precise ovenized crystal-controlled oscillator, the standard also has impressive open-loop performance. Its guaranteed drift rate of 1 part in  $10^{11}$  per

day after the external reference fails or is removed contrasts sharply with a guaranteed rate of less than 5 parts in  $10^{11}$  per day for other units.

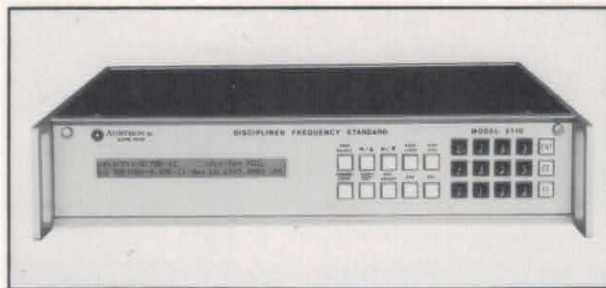
The microprocessor performs third-order integration, creating a third-order servo oscillator control system. Other systems stop at first- or second-order integration control. (This system accuracy is the key to continuous correction of the oscillator frequency even with the external reference removed.)

The LCD, which replaces the traditional meter, shows such information as statistical measurement and status parameters, making it easy to detect a failure. It also prompts the user for the inputs required and shows multiple pages that the user may scroll up and down. Function switches and a front-panel keyboard program the display.

The frequency standard is available in 120 days and costs \$8700. The dual-reference input costs \$1300, and the 100-kHz sine-wave output option \$1000.

*Austron Inc., PO Box 14766, Austin, Texas 78761; (512) 251-2313.*

Heather Bryce





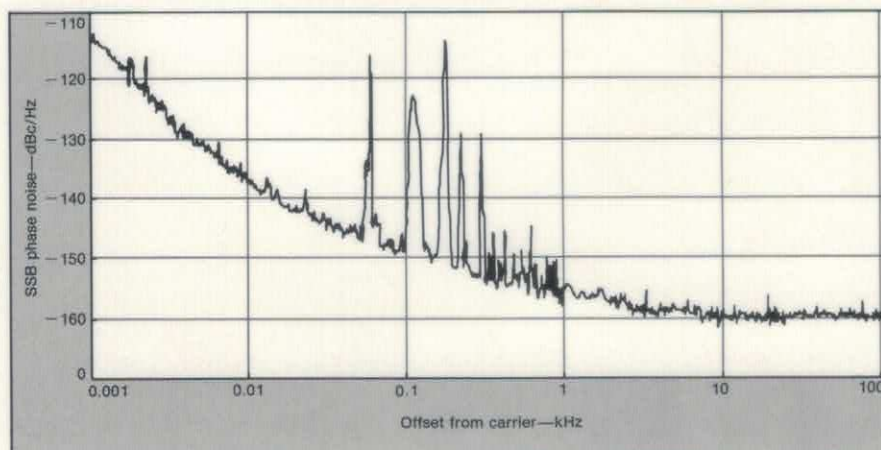
## Oscillator offers reference retrofit

This 10-MHz crystal oscillator replaces the old HP 10811A reference source with improved SSB phase-noise performance.

**T**HE model 1111 reference oscillator from Austron, Inc., is an excellent replacement for the discontinued Hewlett-Packard HP 10811A. The new oscillator combines advanced crystal technology with an efficient oven design for fast warmups and good frequency stability with temperature. A standard model 1111 operates at 10 MHz, although other frequencies are optional. It stabilizes to within  $5 \times 10^{-9}$  of its final frequency after only a 10-min warmup.

The crystal oscillator has superb SSB phase-noise performance (as measured on the Hewlett-Packard HP 3047A test set), even at offsets as close as 1 Hz (Fig. 1). The manufacturer specifies the phase noise as  $-120$  dBc/Hz for 10-Hz offsets and  $-160$  dBc/Hz for 10-kHz offsets.

The model 1111 generates output voltages of  $0.55 \pm 0.50$  V RMS into a 50- $\Omega$  load and  $1.0 \pm 0.2$  V RMS into a 1-k $\Omega$  load, exactly matching the voltage specifications of the HP 10811A. The aging rate of the 1111 is better than  $5 \times 10^{-10}$  after a 24-hr warmup period. The 10-MHz frequency changes less than  $1 \times 10^{-10}$  for a 1-percent variation in the oscillator supply voltage. The frequency stability is rated as less than  $5 \times 10^{-10}$  for a 10-percent variation in the oven supply voltage. The frequency stability with temperature is better than  $4.5 \times$



**1. The SSB phase noise** characteristics of the model 1111 crystal oscillator are specified at  $-120$  dBc/Hz for 10-Hz offsets and  $-160$  dBc/Hz for 10-kHz offsets.

$10^{-9}$  from  $-55$  to  $+71^\circ\text{C}$  and better than  $2.5 \times 10^{-9}$  from  $0$  to  $+71^\circ\text{C}$ . The oscillator's output frequency changes less than  $5 \times 10^{-10}$  for a  $\pm 10$ -percent load change into 50  $\Omega$ .

The reference source requires an oscillator supply of 11.0 to 13.5 VDC at 22 mA (30 mA maximum) and an oven supply of  $+20$  to  $+340$  VDC maximum, with 15-W power consumption during warmup and 2-W power consumption when operating at  $+25^\circ\text{C}$  after warmup. The oscillator is equipped with an 18-turn control for mechanical tuning over a  $\pm 10$ -Hz range. P&A: \$1500; 60 days.

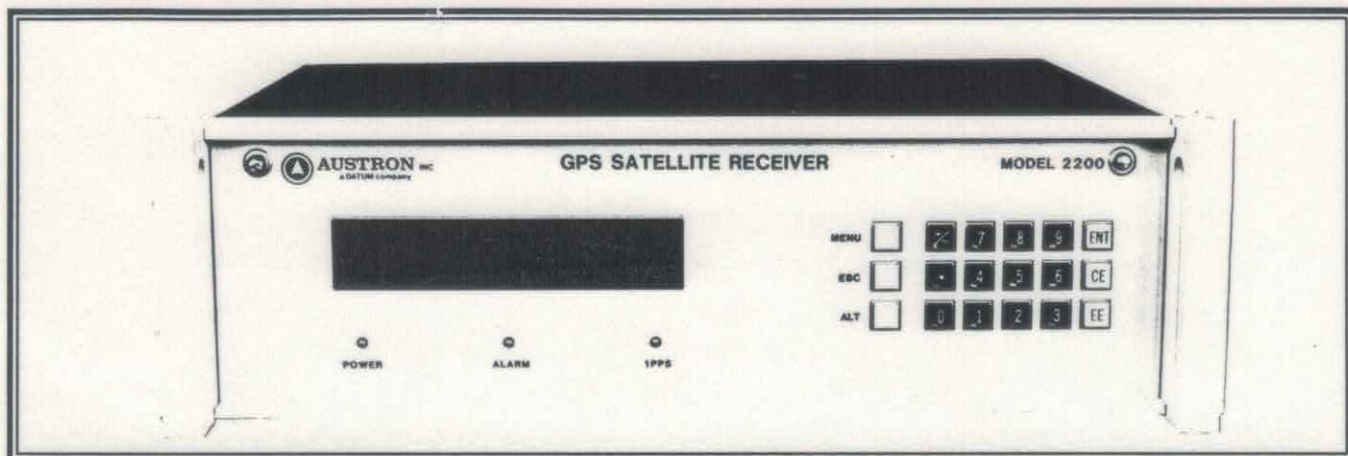
**Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766; (512) 251-2313, TWX: 910-874-1356.**



**2. The model 1111** measures  $2.06 \times 2.83 \times 2.45$  in. and provides a precise electrical and mechanical retrofit for the discontinued HP 10811A source.

Ron Myers, Product Manager, Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766; (512) 251-2313, TWX: 910-874-1356





## INTRODUCING THE AUSTRON MODEL 2200 GPS SATELLITE RECEIVER

The Austron Model 2200 GPS Satellite Receiver captures the ultimate accuracy of the GPS NAVSTAR satellite L<sub>1</sub>, C/A code transmissions. This state-of-the-art receiver provides the best possible time and frequency comparisons between two remote frequency standards and clocks which require synchronization to a common time base. Synchronization of time to the Coordinated Universal Time (UTC) scale is possible through the GPS master clock system to accuracies better than 140 ns\*.

### State-of-the-art GPS Receiver provides ultimate satellite-driven accuracy in a flexible, user-friendly package.

The Austron Model 2200 GPS Receiver utilizes two 16-bit microprocessors to derive maximum accuracy from the GPS satellite, providing ease of use and flexibility for the operator. Data input/output and receiver set-up are by menu selections from the front panel keyboard or through optional data busses. The user can set up the receiver for fully automatic or semiautomatic operation.

The Model 2200 internal oscillator is either an ovenized quartz crystal oscillator or a rubidium oscillator (option-

al). An external reference of 1 MHz, 5 MHz, or 10 MHz from a more stable source may be connected to the receiver for increased timing stability.

The accuracy of the external 1 pps signal as compared to UTC or GPS is measured and displayed by the receiver.

### APPLICATIONS

- **Metrology:** Used in combination with Austron Frequency Monitoring Equipment, the Model 2200 provides stable frequencies to parts in  $10^{12}$  accuracy traceable to the National Bureau of Standards (NBS) and United States Naval Observatory (USNO).
- **Clock Systems:** The Model 2200 acts as an accurate, stable clock for timing applications providing a 1 pps signal synchronized to within 140 ns of UTC.
- **Communications Systems:** The Model 2200 acts as a frequency source providing reliable timing signals to drive high speed digital communications.

### FEATURES

- Global reception of NAVSTAR GPS date, time and correction parameters

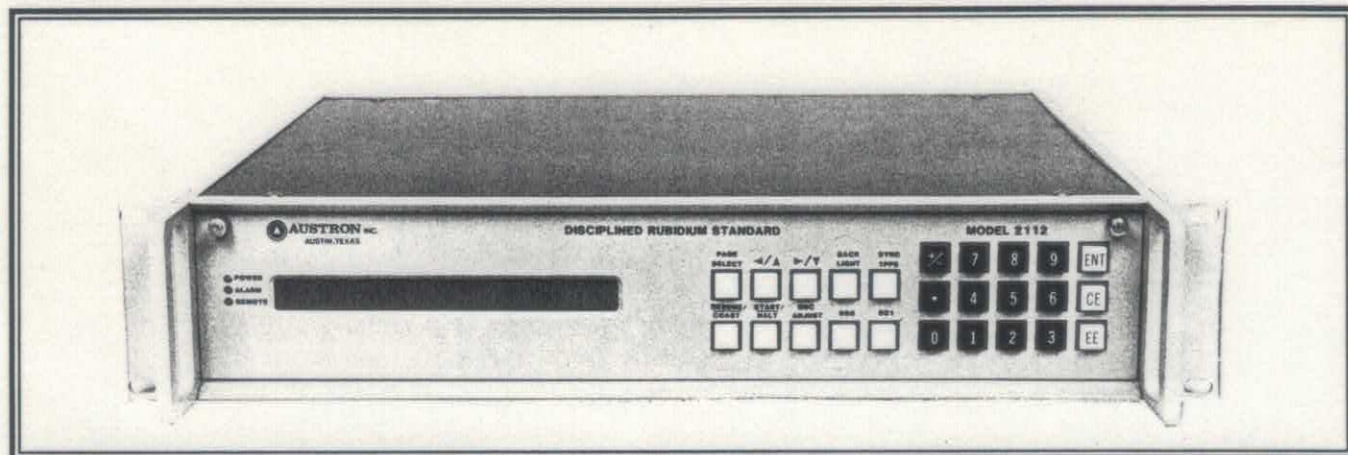
- Two 16-bit microprocessors
- Internal ovenized high-stability oscillator
- 4-line X 40-character alphanumeric LCD, programmable via front panel keyboard and function switches
- 1 pps/1 ppm outputs accurate to within 100 ns of GPS, to within 140 ns of UTC (based on undegraded C/A code transmissions)
- Front-panel displays accuracy of external 1 pps vs UTC/GPS
- TTL compatible square wave outputs of 0.1 MHz, 1 MHz, 5 MHz, 10 MHz
- LED indicators provide power, alarm and 1pps status

### OPTIONAL FEATURES

- Remote control via IEEE-488 bus, RS-232 bus, and/or 1200 baud modem port
- Long-term, high-stability Rubidium oscillator package
- Centronix-compatible parallel port

\*C/A code not degraded.





## INTRODUCING THE AUSTRON MODEL 2112 DISCIPLINED RUBIDIUM FREQUENCY STANDARD

The Austron Model 2112 Disciplined Rubidium Standard is a state-of-the-art, microprocessor-controlled system that automatically locks the frequency of its precision Rubidium oscillator to that of an externally applied reference having superior long-term stability. With the use of a second order servo technique, the instrument is able to correct the frequency offset and aging of the internal oscillator. If the externally applied reference is removed or fails, the Model 2112 freezes the electronic tuning voltage to the internal oscillator thereby holding its last frequency. Typically the unit can limit the frequency offset to parts in  $10^{11}$  for several weeks following reference loss.

### APPLICATIONS

**Metrology:** When used in combination with Austron Frequency Monitoring Equipment, the Model 2112 will provide stable frequencies to parts in  $10^{12}$  accuracy traceable to the National Bureau of Standards (NBS) and United States Naval Observatory (USNO).

**Clock Systems:** The Model 2112 acts as an accurate, stable clock for timing applications requiring accuracies to 100 ns, providing an accurate and stable 1 PPS synchronizable to an ex-

ternal atomic clock or an Austron timing receiver.

**Communications Systems:** The Model 2112 allows selection of either of two stable sources without phase or frequency perturbation in the output and provides a backup frequency on loss of reference.

**Rubidium Frequency  
Standard beats  
quartz-based standards  
providing better overall  
performance, faster  
warm-up, better retrace  
characteristics and  
long-term stability.**

### FEATURES

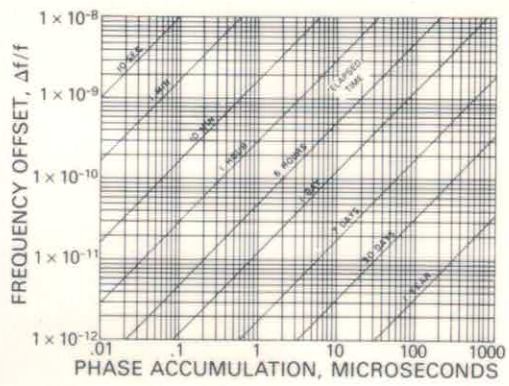
- Microprocessor-controlled
- 80-character alphanumeric liquid crystal display, programmable via front panel keyboard and function switches
- Long-term, high-stability internal rubidium oscillator
- Front panel selectability of TTL outputs of 1 MHz, 5 MHz, 10 MHz or 100 kHz

- Sinewave output signals of 1 MHz, 5 MHz and 10 MHz
- Internal ability to measure frequency offset of the external reference vs the internal oscillator
- 1 PPS clock output (externally synchronizable)
- Second order servo oscillator control system
- Frequency and phase offset-stability
- Alarm signal and LED for unit monitoring

### OPTIONAL FEATURES

- Dual reference input: front panel selectable primary/secondary or statistically combined modes
- IEEE-488 Bus interface
- Internal battery back-up







# FREQUENCY CONVERSION FACTORS

$$1 \text{ min} = 60 \text{ sec} = 6 \times 10^7 \mu\text{s}$$

$$1 \text{ hr} = 3600 \text{ sec} = 3.6 \times 10^9 \mu\text{s}$$

$$1 \text{ day} = 8.64 \times 10^4 \text{ sec} = 8.64 \times 10^{10} \mu\text{s}$$

$$1 \text{ microsecond/min} = 1.667 \times 10^{-8}$$

$$1 \text{ microsecond/hr} = 2.78 \times 10^{-10}$$

$$1 \text{ microsecond/day} = 1.16 \times 10^{-11}$$

$$\text{Fractional Frequency error, } \frac{\Delta f}{f} = \frac{\Delta t}{t} =$$

$$\frac{\text{difference in microseconds}}{\text{elapsed time in seconds}} \times 10^{-6}$$

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