

GPS-100

MASTER CLOCK

SMPTE TIME CODE GENERATOR



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DISCLAIMER

The information contained in this document is subject to change without notice.

W Clark & Associates, Ltd. (hereinafter C&A) makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

C&A shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

See important *limited warranty* information starting on page 8.

**NOTICE CONCERNING
GPS SATELLITE SYSTEM AND THE GPS-100
TIME CODE GENERATOR**

Depending on many factors beyond the control of C&A the signals that are received from the GPS Satellites **are subject to interference, fading, satellite failure and other influences that could cause** the GPS-100 to generate erroneous time and/or date information **and, under some conditions, could prevent** it from generating a time code signal.

It is the responsibility of the user to determine the adequacy and suitability of this device for the intended use.

INTRODUCTION

The GPS-100 is a precision SMPTE time code generator that provides a source of very stable SMPTE time code and accurate time and date information. It receives reference time information from Atomic Clocks in the GPS (Global Positioning System) satellites.

GPS Satellites

The GPS satellites are operated and maintained by the US Department of Defense and allow for the precise determination of local time and location at any point on (or above) the Earth. This is accomplished via the transmission of very accurate timing information from a series of satellites that provide coverage of the entire planet.

The GPS-100 extracts timing reference from these signals and generates SMPTE time code that is synchronized to within less than 100 microsecond (typically less than 10 us) of UTC (Universal Coordinated or Greenwich mean time).

UTC/ Greenwich Time

UTC is the local time at the prime reference meridian at Greenwich, England. At a given location on the planet, local time can be displaced (referenced to UTC) by -11 to +12 hours. North and South America are from -3 to -11 hours delayed; most of Europe and Africa and all of Asia and Australia are advanced by +1 to +12 hours.

Daylight Saving Time

Local time in the US and some other countries can also be offset by Daylight Saving Time (DST) whereby the local time is advanced by 1 hour in the Spring of the year and set-back in the Fall. UTC is not affected or changed by any of these local variations.

The GPS-100 does not provide for offset to local time; such offsets must be accomplished via external devices such as the TCR-200 or TCI-232 (from C&A) which allows an offset of -11 to +12 hours to be specified. The TCR-200 and TCI-232 also allows for the automatic advance and set-back to accommodate DST (as is defined in the US).

INITIAL OPERATION

The GPS-100 was thoroughly tested with its external power supply (PS) and antenna prior to shipment. Installation and setup is simply a matter of connecting the antenna and PS.

Operating The GPS-100 For The First Time

When the GPS-100 is initially powered up, after having been shipped to a new location, the time to first fix (time the unit takes to acquire satellites and extract correct local time) could be up to 25 minutes although it is typically 5 - 15 minutes. Factors such as atmospheric conditions, type of antenna, antenna location, and antenna cable length will affect the time to first fix.

The GPS-100 has a Lithium battery that maintains startup data when the unit is powered down. If, when starting up, the location, time and number of satellites that the unit can receive has not changed significantly since last power down then the unit will startup much faster.

Antenna Location

The standard GPS-100 antenna is approximately the size and shape of a biscuit - 2" (5cm) in diameter by 3/4" (2cm) thick and weighs 5 oz (120g). The antenna coaxial cable is 10' (3m) long and 1/8" (3mm) in diameter. It has a magnetic base for attaching to metal surfaces.

The process for determining if a given (inside) antenna location will work is not technical or difficult but since each installation is somewhat different it can best be determined empirically.

In most installations the standard 10' coaxial cable is long enough to allow the antenna to be located where an adequate signal can be found. The antenna should be placed (magnetic base down) on top of an equipment rack, shelf or other location where it will be as high as possible and where it and the coaxial cable will not be accidentally moved or damaged. If the GPS-100 does not function at the first location the antenna should be moved and tried at other locations separated by 3 - 4 ft.

Depending on the type of building where the GPS-100 is located and obstructions that may block reception of signals from the GPS satellites, the antenna may have to be located where it has an unobstructed view of the sky. In some cases this can be accomplished by placing the antenna adjacent to a window. In others it may require mounting it outside of the building or on a roof.

If a longer cable is required, cables of various lengths (up to 400') with pre-amplified antennas are available from C&A.

In the worse case, the basic requirement for assured system operation is that the antenna module have a clear and unobstructed view of the sky for initial satellite acquisition and lock (generation of time code by the GPS-100). It is possible that the system will operate indoors and under other obstructions however this can only be determined empirically; it is not guaranteed.

Bringing the GPS-100 up for the first time with an indoor antenna, especially a passive antenna, may prevent or significantly increase the time to first fix.

Time Code Interconnect Cable

The SMPTE time code signal is an audio signal similar to that of a Modem. It can be routed over unshielded wire like a telephone or, if desired, over a RG-58/59 coaxial cable. The GPS-100 has a BNC output connector.

The necessary connectors and wire can be purchased at a Radio Shack or other electronic supply store or from C&A. Check with factory for details.

Initial Operations and I/O Connections

1. Locate the antenna in a suitable area so that the top of the antenna module has a clear view of the sky. Do not move it until after the GPS-100 has initiated TC generation (explained below).
2. Connect the antenna coax to the TNC connector on the rear of the unit.
3. Connect your time code reader system to the BNC connector on the rear of the GPS-100. (The output of the GPS-100 is approximately 1.25 volt PP, impedance is less than 50 ohms and the output is unbalanced.)
4. Apply power by inserting the PS module into an appropriate AC power source and the XLR power connector into the male XLR socket on the rear of the unit.
5. If desired the unit can be operated from a nominal 12 VDC battery (9-18 VDC range). Observe voltage polarity - printed on the rear panel.
6. When power is first applied the initial sequence of the front panel LED is:
 - LED on for one-two second
 - LED off for one second
 - LED steady on.
7. The unit first calculates coordinates and distances for acquisition of GPS satellites. The LED will remain on until satellites are acquired and precise location and timing references are established.

NORMAL OPERATION

After acquisition of satellites the GPS-100 will begin generating time code and the LED will blink on and off once each second; the start of each on period is in precise time alignment with UTC and the beginning of frame 0 of the SMPTE signal.

FREEWHEELING

During continuous on-going operation it is possible that the unit will experience outages and loss of satellite reference time. This can be caused by atmospheric and many other outside conditions which are essentially unavoidable with a simplex

system. Such signal losses can last from a few minutes to several hours. When the condition disappears and the unit re-acquires satellite timing reference it will automatically resync to the satellite time reference.

During such outages the GPS-100 will continue to generate time code referenced to the last available satellite timing information. This mode is referred to as freewheeling.

Freewheeling/Non Locked LED Indication

During a freewheeling period the front panel LED will flash twice each second.

Satellite Re-Acquisition

As soon as the satellite time reference signal is re-acquired the GPS100 will stop generating TC for one second and then continue normally, locked to the satellite time reference.

HARDWARE

Operating Environment

The GPS-100 is not water or moisture proof. Treat it as you would any other delicate electronic device and do not expose it to water, excessive heat or physical abuse, particularly when using the unit as a portable TC generator.

Access to PC Board

In order to gain access to the pin jumpers and battery it is necessary to remove the case from the GPS-100. This is accomplished as follows:

First disconnect the power and antenna cable from the unit. Even though the highest voltage inside the GPS-100 is 12 VDC (which is generally not dangerous to touch), accidentally shorting a trace or wire inside the unit with power-on could destroy or damage any one of the extremely sensitive electronic modules. **Accidentally shorting a wire or trace or subjecting the unit to a static discharge, even for a very small fraction of a second, can destroy these modules. Such damage is not covered by the warranty.**

Remove the two outside Phillips screws in the rear panel (this is the end with the XLR power and antenna socket - do not remove the screws from the XLR connector). Holding the case of the unit in one hand, slide the rear panel assembly outward from the rear. The entire rear panel assembly and PC board will slide out.

As was mentioned above, the PC board is sensitive to any electrical signal including static discharge. Do not touch the PC board with any external wiring and, whenever possible, handle the unit by the rear panel or on the edge of the PC board as you would a Compact Disk. When not changing the jumpers or battery, always keep the PC board installed in the case.

When reassembling the unit take care that the PC board is properly fitted into the slots in the base of the chassis. When properly inserted, the PC board and rear panel assembly will slide easily into the case, no force is necessary. The warranty does not cover damage caused to the unit while removing or reassembling the PC board.

OPERATIONAL MODES

There are two operational modes for the GPS-100, either 25 or 30 frames per second (fps) SMPTE time code. Normally the unit is shipped for the appropriate frame rate as specified at the time of order. Should it be necessary to change the frame rate, this is accomplished by changing jumper J1 on the PC board inside the unit. (See hardware section for details of gaining access to the PC Board.) Location of pin jumpers, battery and other components are shown on Figure 1 - page 6.

25/30 FPS Select

J1 is a 2 pin jumper located at the lower edge of the PC board just below IC5. For 30 fps the jumper is not installed. For 25 fps the jumper should be installed (both pins connected together).

BATTERY

Battery Type

The GPS-100 is shipped with a 3 Volt Lithium battery (Panasonic BR2325 or equivalent) installed. This battery is used to maintain information concerning the last group of satellites that were received. When the GPS-100 is powered off & on it will start generating TC much more rapidly if it has satellite information in memory.

These batteries can be obtained at electronic supply stores including most Radio Shacks. The normal range of battery voltage over which the memory will retain information is approximately 2.6 - 3 volts. If you notice that the GPS-100 is taking longer than usual to start TC generation when first powered on, then you may want to change the battery.

Battery Not Necessary For Operation

The battery is not necessary for operation and the GPS-100 will generate TC without one. However, each time the unit is powered down it will have to go through a complete acquisition process before generating TC (a 2 to 25 minute process).

Depending on the relative on/off time for the unit the battery should last several years. If the GPS-100 is to be stored for any significant period of time (more than a several months) you may want to remove the battery.

PASSIVE AND PRE-AMPLIFIED ANTENNA

The GPS-100 will operate with either a passive or pre-amplified antenna. Normally a passive antenna can be used with up to 10' (3m) of coaxial cable. A longer cable will probably require a preamplified antenna.

The unit is tested and shipped with the appropriate cable for the antenna that was ordered. Should you require a longer antenna cable we recommend that you contact C&A so that a properly matched cable and antenna can be supplied.

Antenna Pre-Amp Power Jumper

Jumper J5 on the PC board is available to supply power to a pre-amplified antenna. Either 0, 5 or 12 VDC can be selected. The unit was tested and shipped with the appropriate jumper selection for the antenna that was supplied. Should you choose to change types of antenna then you should make absolutely sure that the voltage selected by J5 matches the rated voltage of the antenna. **Application of the wrong voltage or application of either 5 or 12 VDC to a passive antenna could destroy the GPS receiver module. This is a major repair cost which is not covered by warranty.**

Although changing the GPS antenna or coaxial cable is not technically difficult, you are on your own should you decide to make such changes. We do not warrant or support operation with any hardware not installed or supplied by us.

Antenna Coaxial Cable

The coaxial cable should not be crushed, crimped or bent at a sharp angle nor should it be strained by pulling. Any damage to the cable could result in the GPS-100 not functioning properly.

If the cable is to be coiled for storage, the coil diameter should be at least 4".

PROBLEMS - TROUBLE SHOOTING

All GPS-100 units are checked for proper operation before shipment and unless physical damage is found, the unit is probably functional.

Please remember for an initial startup at a new location the unit could take up to 20-25 minutes. After the unit has acquired satellites at the new location the startup time is greatly reduced to anywhere from a few seconds to several minutes.

If the antenna (and coaxial cable) has not been damaged and has an unobstructed view of the sky, the power connector is properly installed and the front panel LED follows the startup sequence described earlier (on, off & then on) the unit will probably work.

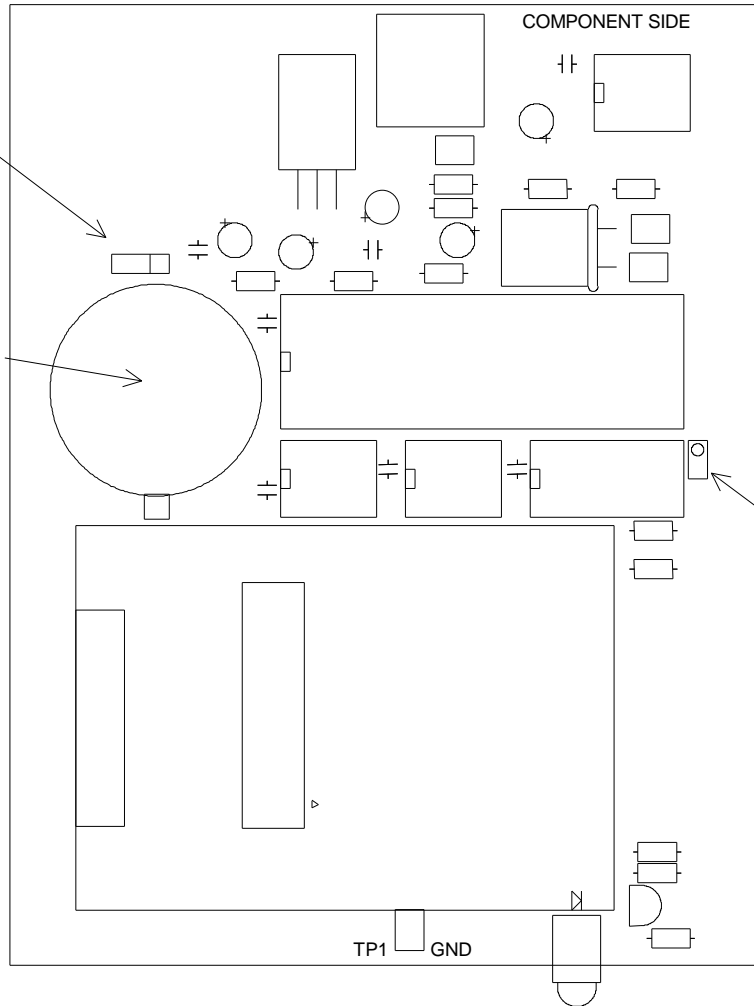
If, after the startup sequence has been observed and after (at least) one hour, the unit still does not work properly, then remove the backup battery mounted on the PC board. (See previous section for removing the PC board.) After 3-4 minutes replace the battery and reassemble the unit. Removing the battery completely erases all traces of "Almanac Data" that the unit may have retained and insures a total restart/re-calibration of the system.

Allow another 30 minutes for the unit to acquire satellites and generate time code.

If you continue to have problems even after the above precautions have been noted, please contact the factory.

FIGURE 1

PC Board Layout



SPECIFICATIONS

Output

Format:.....SMPTE - 25 or 30 fps
Level:Approx. - 1.25 Vpp (0 db/600 W)
Impedance:< 50 ohm
Connector:.....BNC male

Output Time

Reference:.....UTC/GMT - non offset
Date:.....included in user bits
Short term accuracy.....± < 100 μs, typically <10 μs
Long term stability.....same as GPS atomic clock

Power Supply Requirements

Input Voltage.....12 VDC
Input Power Connector4 pin XLR male

Pin 4 +12 VDC
Pin 1 Ground

Power Consumption - @ 12V With passive antenna
@ 200 ma (2.4 W)
With pre-amplified antenna
@ 220 ma (2.64W)

Antenna

Passive

Frequency 1575 MHz \pm 5 MHz
Polarization Right Hand Circular
Impedance 50 Ohm
Weight..... 3.2 Oz (90 gr.)

Pre-Amplified

Frequency 1575 MHz \pm 10 MHz
Polarization Right Hand Circular
Impedance 50 Ohm
Weight..... 11 Oz (311 gr.)
Voltage..... 5 VDC
Power Consumption..... @ 20 ma (.24W)
Gain 26 db Standard
Temperature -40 to +70°

Coaxial Cable

Type 51 Ohm low loss
RG-174 /U (Belden 8216 or equivalent) 10 ft - 3m coax with TNC connector is
supplied with basic system)

Physical

Size: 1.5 x 4.1 x 5.5 in. (3.8 x 10.4 x
14 cm)
Weight..... 17 oz. (480 gr.)

Battery

Configuration/Setup..... 3 Volt Lithium Battery
(Panasonic BR2325 or equiv)

Operating Temperature

Temperature 0 to +70 °

LIMITED WARRANTY & SERVICE

This W Clark & Associates, Ltd. (hereinafter C&A) product warranty extends to the original purchaser.

C&A warrants the GPS-100 against defects in materials and workmanship for a period of one year from date of sale. If C&A receives notice of such defects during the warranty period, C&A will, at its option, either repair or replace products which prove to be defective.

Should C&A be unable to repair or replace the product within a reasonable amount of time, the customer's alternate remedy shall be a refund of the purchase price upon return of the product to C&A. This warranty gives the customer specific legal rights. Other rights, which vary from state to state or province to province, may be available.

Exclusions

The above warranty shall not apply to defects resulting from improper or inadequate maintenance by the customer, customer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product or improper site preparation and maintenance (if applicable).

Warranty Limitations

C&A MAKES NO OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, WITH RESPECT TO THIS PRODUCT. C&A SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In any state or province which does not allow the foregoing disclaimer, any implied warranty of merchantability or fitness for a particular purpose imposed by law in those states or provinces is limited to the one-year duration of the written warranty.

Exclusive Remedies

THE REMEDIES PROVIDED HEREIN ARE THE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT SHALL C&A BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

In any state or province which does not allow the foregoing exclusion or limitation of incidental or consequential damages, the customer may have other remedies.

Hardware Service

You may return your GPS-100 to C&A for repair service. Please contact the factory for return authorization before returning the unit. When you return your GPS-100 for service, you must prepay all shipping charges, duty, and taxes. Except for products returned by the customer from another country, C&A will pay for return shipment of products to the customer.