

**MODEL 6115G-8V4  
GPS SYNCHRONIZED  
MINIATURE TIME CODE GENERATOR  
With Video Insertion**

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**Model 6115G-8V4**  
**GPS SYNCHRONIZED MINIATURE TIME CODE GENERATOR**  
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**1.0 GENERAL**

The Model 6115G-8V4 GPS Synchronized Miniature Time Code Generator provides an IRIG B time code output derived from GPS. The time code output is synchronized with UTC time unless a time offset has been programmed. A twelve-channel GPS receiver automatically acquires all in-view satellites upon power up and locks an internal IRIG B time code generator to the GPS time reference. If the GPS lock is lost the 6115G-8V4 will automatically switch to an internal clock and continue generating the output IRIG B signal. No discernible change in the IRIG B output will occur due to this transition. The GPS receiver is also configurable for a range of dynamics from fixed to aircraft motions.

The 6115G-8V4 includes four video insertion channels that provide for the insertion of a time message into applied NTSC or RS0170 video (The PAL version is 6115GP-8V6). Also available are two and six channel versions, 6115G-8V2 and 6115G-8V6 respectively. Major features include:

- 1. Twelve Channel GPS Receiver with Dynamics Mode Settings*
- 2. IRIG B time code generator.*
- 3. Battery backed up internal clock, maintains time during power loss.*
- 4. Four Channels of Video Time Insertion.*
- 5. UTC time mark output.*
- 6. RS-232C serial port.*
- 7. Outputs Time and Latitude & Longitude via serial port.*
- 8. Time offset input via serial port.*
- 9. Event trigger input.*
- 10. Non-Volatile Memory.*
- 11. Includes active GPS antenna.*

The 6115G-8V4 is housed in an aluminum enclosure, 7.5 inches long (including mounting flanges), 4.25 inches wide and 2.81 inches high. It is powered by 9 to 36 Volts DC.

## **2.0 CHARACTERISTICS**

### **2.1 TIME CODE SYNCHRONIZATION**

The 6115G-8V4 internal IRIG B clock is automatically synchronized to GPS generated UTC time mark upon receipt of a valid number of GPS satellite signals. If the unit loses the GPS lock after initial synchronization, it will continue to operate on the internal clock which continues to generate the serial IRIG B signal output. No discernible change in the IRIG B output will occur when the GPS signal lock is lost after synchronization. The lock status is shown on a front panel LED. By use of the dynamics mode settings (see paragraph 2.4), accurate time synchronization can be achieved even while the system is subjected to aircraft motions.

### **2.2 TIME OFFSET**

The 6115G-8V4 features a programmable time offset to convert the time from the GPS receiver from UTC time to local time. The time offset is entered via the RS-232 port. NOTE: The internal IRIG clock will not respond to the programmed time offset unless the 6115G-8V4 is locked to GPS. If the 6115G-8V4 time offset is programmed while the unit is not locked to GPS, it will respond the next time GPS lock is acquired. After the initial GPS lock, following entry of the offset value, the corrected offset time will remain even if lock is lost. Once entered, the data will be stored in non-volatile memory until overwritten. The time offset command format is shown in Table 2.

### **2.3 VIDEO INSERTION**

#### **2.3.1 Inserted Characters**

The displayed characters are generated on a 5 x 7 dot matrix. When "Small" is selected a "dot" or pixel is two scan lines high and an equivalent measure in width. The displayed height of the characters therefore is approximately 3% of the height of the total display. When "Large" is selected the size of the pixel is doubled to four scan lines. This doubles the size of the characters both horizontally and vertically. The distance between characters horizontally is the equivalent of 3 pixels.

### 2.3.2 Video Insertion Method

The generated video is added to the input video using the relative or constant contrast method. This method provides a pleasing display over a wide range of original video light levels. A level set by an intensity control is added to the existing level of the original video.

The contrast between the original video and the "added" generated video is therefore constant. This helps prevent wash out at the high levels and assures a non-glaring display at the low levels. An additional feature of this method is that the generated video does not obscure features on the existing video. Elements as small as one pixel can be seen through inserted video.

### 2.4 DYNAMIC MODE

The 6115G-8V4 has a programmable Dynamic Mode feature which may be set by the operator. A list of the mode descriptions is shown in Table 1. The mode value is entered via the RS-232 port. Once entered the value is stored in non-volatile memory.

**Table 1**

**Dynamic Mode Descriptions**

0	=	Fixed base station, maximum time and frequency accuracy.
1	=	Stationary, but unknown position.
2	=	Man pack / Walking
3	=	Automotive / Land Vehicle
4	=	Marine
5	=	Airborne, Low dynamics (<1g)

### 2.5 SERIAL DATA I/O

The 6115G-8V4 has an asynchronous RS-232C port, which provides a means of configuring the unit, as well as reading the time, event, and location information. The output messages for time/location and events are individually controlled. The Time/Location message may be set to OFF or AUTO. When set to AUTO messages are sent at one second intervals. The Event message may also be turned off, or may be set to respond only to a Query or set to send automatically until the event buffer is empty. Note that if both the Event and Time/Location messages are set to AUTO, there may be an additional worse case Time/Location message latency of up to 8.33ms depending upon the event status. The command set is shown in Table 2. The serial output data formats are shown in Table 3.

**Table 2**  
**6115G-8V4, SERIAL CONTROL COMMANDS**

<u>Command</u>	<u>Description</u>
<i>Ex</i>	Event Polarity, where:  E = ASCII character <i>x</i> = 0 Low going edge <i>x</i> = 1 High going edge
<i>Qx</i>	Event Control, where:  Q = ASCII character <i>x</i> = 0 Disable events; clear pending events. <i>x</i> = 1 Enable queuing of events; do nothing until Query or Auto. <i>x</i> = 2 Enable queuing of events and Auto send event message as soon as data is available. <i>x</i> = 3 Enable queuing of events and respond immediately with Event Message. If no data is queued message will indicate empty status. (See Table 2)
<i>Tx</i>	Time/Location output control, where:  T = ASCII character <i>x</i> = 0 Time/Location “send” OFF <i>x</i> = 1 Time/Location “send” ON, send at one second intervals.
<i>snn</i>	Time Zone offset, where:  <i>s</i> = sign of + or – <i>nn</i> = hours of 00 to 12
<i>S</i>	Status Request, where:  S = ASCII Character
<i>Dx</i>	Dynamic Mode Set/Query, where: D = ASCII Character <i>x</i> = 0 to 5 (Set Mode) ? = Query mode
<i>V?</i>	Firmware Version Query Request Returns both the 6115G-8 and NavSync receiver firmware versions.

**Table 3**  
**6115G-8V4 SERIAL DATA OUTPUT FORMAT**

**Time/Location Message**

The Time/Location message is formatted as a 35 byte serial ASCII message that includes UTC time, and Latitude & Longitude. In the absence of GPS lock the serial data will continue with the time derived from the internal clock. The latitude and longitude, however, will be forced to zeros and the signs will be forced to positive. The message format is:

*Tdddhhmmss,Sddmm.fff,Sdddmm.fff* <CR><LF> where:

T = ASCII character "T" which indicates start of message and designates the time at which the previous time message is valid. If all latencies are considered, the receipt of this character can be used to define the time to within approximately 0.55 milliseconds with a serial data rate of 19.2K baud. An additional latency of up to 8.33ms may occur if an event message is currently being output. If greater accuracy is desired RTS may be monitored. This signal drops (high to low) at the precise time of the UTC time mark produced by the GPS receiver.

*ddd* = Days  
*hh* = Hours  
*mm* = Minutes  
*ss* = Seconds  
, = delimiter  
*S* = Sign +/- (N/S)  
*dd* = degrees of latitude  
*mm* = minutes of latitude  
*.fff* = fractional minutes of latitude  
, = delimiter  
*S* = sign +/- (E/W)  
*ddd* = degrees of longitude  
*mm* = minutes of longitude  
*.fff* = fractional minutes of longitude  
<CR> <LF>= Carriage return/Line feed

**Table 3**  
**6115G-8V4 SERIAL DATA OUTPUT FORMAT**  
**(continued)**

**Event Message**

The Event message is formatted as a 16 byte serial ASCII message that includes the event time to a 0.1ms resolution. When the message is set to “Auto Send Events”, it will be sent whenever data is available. When set to “Query Events” the message will be sent immediately upon receipt of the query. (See Table 1) The message format is:

*Qdddhhmmssffff*<CR><LF> where:

*Q* = ASCII character  
*ddd* = Event Days  
*hh* = Event Hours  
*mm* = Event Minutes  
*ss* = Event Seconds  
*ffff* = Event Milliseconds (0.1 msec resolution)  
 <CR><LF> = Carriage return/Line feed

Note that if there is no data available and a Query is sent, the unit will respond with:

*Q*<CR><LF> This message indicates that the event buffer is empty.

**Status Request Message**

When a Status Request is sent to the 6115G-8V4 (See Table 1), the unit will respond with the following message:

*S±zztpe*<CR><LF> where:

*S* = ASCII Character  
*±zz* = Time Zone Offset  
*t* = 0 Time/Location “send” set to OFF  
*t* = 1 Time/Location “send” set to ON  
*p* = 0 Trigger polarity set to low going edge  
*p* = 1 Trigger polarity set to high going edge  
*e* = 0 Event queuing set to “Disabled”  
*e* = 1 Event queuing set to “Enabled”.  
*e* = 2 Event queuing set to “Enabled” and Auto Send set to “Enabled”  
 <CR><LF> = Carriage return/Line feed

**Table 3**

## **6115G-8V4 SERIAL DATA OUTPUT FORMAT (continued)**

### **Dynamic Mode Query Message**

When a Dynamic Mode Query is sent to the 6115G-8V4 (See Table 2), the unit will respond with the following message:

Dn<CR><LF> where:  
n = Dynamic Mode setting

### **Firmware Version Query Message**

When a Firmware Version Query is sent to the 6115G-8V4 (See table 2), the unit will respond with the following message:

V:Rev\_K,CW25-TIM-IT1,1.79-00.14.04,Sep\_13\_2007,10:37:23<CR><LF>

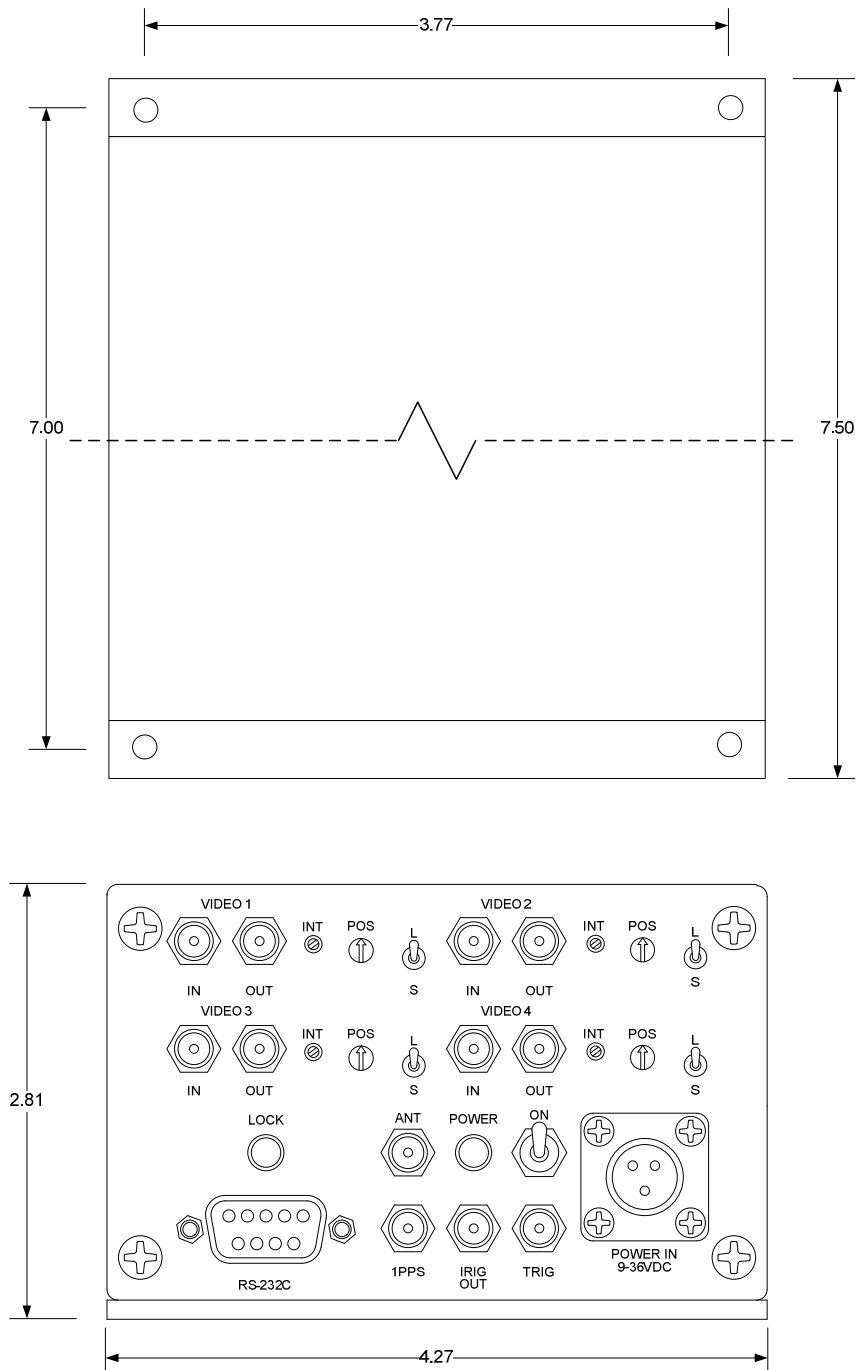
The “Rev\_K” field refers to the 6115G-8V4 firmware version. The remaining fields refer to the receiver firmware version.

NOTE: This message will vary depending on changes in firmware versions.

### 3.0 MECHANICAL CONFIGURATION

The 6115G-8V4 is housed in an aluminum enclosure, 7.5 inches long (including mounting flanges), 4.27 inches wide and 2.81 inches high. All controls, connectors and indicators are on the front panel. (See figure 1)

**Figure 1**  
**6115G-8V4 Enclosure**



## 4.0 CONTROLS, INDICATORS AND CONNECTORS

- 4.1 Power ON Toggle Switch -  
Turns power on and off.
- 4.2 POWER Green LED Indicator –  
Illuminated when power is on.
- 4.3 POWER IN PT02A8-3P Connector -  
9 to 36 VDC external power.  
Pinout is as follows:  
A - +9 to 36VDC  
B - VDC return  
C - Chassis ground
- 4.4 GPS ANTENNA SMA Connector -  
Connects to external active antenna. Do not attach a passive antenna to this connector unless it includes a DC block. The unit is set to interface with active antennas utilizing 5 volt power. Damage to the GPS receiver can occur if an incompatible antenna is used.
- 4.5 IRIG OUT SMA Connector -  
Outputs serial IRIG B signal. 3:1 modulation ratio. Factory set to 3V peak to peak.
- 4.6 LOCK Yellow LED Indicator –  
Illuminates when GPS lock is acquired and Time Code generator is synchronized to GPS.
- 4.7 VIDEO In 1 - 6 Four (4) SMA Connectors -  
Receives four independent 525 line RS-170 or NTSC video signals
- 4.8 VIDEO Out 1- 6 Four (4) SMA Connectors -  
Outputs each of the four corresponding applied video signals with time message inserted
- 4.9 INT (Display Intensity) Four Rotary Potentiometers -  
Controls intensity of generated display for each video channel.
- 4.10 POSITION Four, 16 Position Rotary Switches -  
Selects one of fifteen display locations for the IRIG time message. The 16th position turns inserted display off. Independently controls each channel

#### 4.0 CONTROLS, INDICATORS AND CONNECTORS (continued)

4.11 SIZE L/S Four Toggle Switches -  
Select size of inserted characters independently for each video channel.

4.12 RS-232 DE-9S connector -  
Outputs time, latitude, longitude and event time. Receives configuration and control commands. Also outputs UTC time mark on the RTS output.

<u>Pin</u>	<u>Mnemonic</u>	<u>Function</u>
2	RxD	Receive data input
3	TxD	Transmit data output
5	Gnd	Signal ground
7	RTS	(1pps time mark)
8	CTS	Clear-to-send input (n/u)

4.13 1PPS SMA Connector -  
Outputs UTC Time Mark, TTL

4.14 TRIG SMA Connector -  
Receives TTL Event Trigger.

4.15 IRIG B Output Level Internal Potentiometer -  
Sets the level of IRIG B output. Range is 0 to 5V peak to peak unloaded. Factory set to 3V peak to peak.

## 5.0 SPECIFICATIONS

### 5.1 Internal Frequency Stability

When GPS locked	+/- 25 nsec (Dynamics mode 1, Fixed)
When not locked	2.5 parts in $10^6$
When not powered	2.5 parts in $10^5$

### 5.2 IRIG B Output

Standard IRIG B serial time code IAW IRIG Standard 200-98 (synchronized with time code generator).

### 5.3 1PPS Output

Low true TTL signal, negative going edge corresponds to UTC time mark.

### 5.4 Trigger Input

TTL signal, captures event on rising or falling edge, as selected. Maximum burst event input rate = 100KHz. Max stored events = 127. Note: When "Auto Send Events" is enabled, the sustained event trigger rate is limited to an average of 120 Hz to avoid buffer overflow. This rate assumes that the Auto Send of the Time/Location message is OFF.

### 5.5 GPS Performance

Channels:	12 Parallel channels, tracks all satellites in view.
Time-to-first-fix:	<15 seconds typical (warm start), <150 seconds typical (cold start).
UTC Time Mark:	Synchronized with Global Reference Standard $\pm 25$ ns when Dynamics set to 1, Fixed.
Reacquisition:	2 seconds typical.
Dynamics Mode:	Five settings: Fixed, Walking, Land Vehicle, Marine, Airborne. Timing accuracy varies from <25nsec (Fixed) to <100nsec (Airborne). Factory default setting is 3 (Land Vehicle).
Datum:	WGS 84

### 5.6 GPS Antenna

Active Magnetic Mount Patch Antenna, 5 VDC power provided via antenna cable. Gain: 26 db  $\pm$  2 db. Noise figure: 1.5 db Max.

### 5.7 Video In 1, 2, 3, 4

Standard 525/60 composite video 2:1 interlace, black negative per EIA RS-170 or NTSC. 75-ohm input impedance. (PAL/CCIR optional)

5.8	Video Out 1, 2, 3, 4	Identical to video input except with time message inserted and DC restored, 75-ohm impedance (output as specified when terminated by 75-ohm load).
5.9	Video Amplifier Bandwidth	>20MHz $\pm$ 1 db
5.10	Time Display Format	0.1 milliseconds resolution, Display Format is: *DDD:HH:MM:SS.mmmm. Note: leading asterisk is displayed when IRIG Lock is lost and display is generated from internal clock.
5.11	Serial Interface	EIA RS-232C, Asynchronous, 19200 baud, 8 data bits, 1 start bit, 1 stop bit, no parity, no flow control. Note that the RTS output pin is not used for handshake but instead outputs the 1Hz UTC Time mark.
5.12	Temperature	
	Operating:	-20°C to +60°C
	Non-operating:	-30 to +70
5.13	Humidity	95% non-condensing
5.14	Package	Aluminum enclosure, 7.5 inches long (including mounting flanges), 4.27 inches wide and 2.81 inches high.
	Weight:	2.0 lbs.
5.15	Power	9 to 36 Volts DC, 5.9 Watts

## 6.0 SETUP VIA CONFIGURATION UTILITY

Included with the 6115G-8V4 is a CDROM containing a self-installing utility program for setting up the unit via a Graphical User Interface (GUI) from a Windows™ computer.

The program will run under Windows 9x, 2000, NT, ME and XP operating systems. The user must connect the 6115G-8V4 to one of the computer's COM ports. All setup data is saved in non-volatile RAM. (see figure 2).

### 6.1 OPEN PORT

This button, when active, allows the user to open the respective COM port on which the 6115G-8V4 is connected. This button will be grayed out when it has been pressed, and the **Close Port** button will be active. The port must be opened before commands to the board are accepted. The user should avoid selecting a COM port that might be used for another purpose, ie., COM 1 often used for the mouse.

### 6.2 CLOSE PORT

This button, when active, deactivates the COM port preventing further communication with the 6115G-8V4. The port is automatically closed when you exit the program.

### 6.3 READ STATUS

Clicking the READ STATUS button will return the status of the current configuration of the unit including: time offset, event control status, event trigger polarity and time/location "auto send" status

### 6.4 SET TIME OFFSET

To change the time to local time, click the drop down list on the Time Offset box and select the desired offset value. Press the **Enter Value** button to accept the value.

### 6.5 SET DYNAMIC MODE

To change dynamic mode, click the drop down list on the Dynamic Mode box and select the desired mode value. (see Table 1) Press the **Enter Value** button to accept the value.

## 6.6 TIME/LOCATION

When the 6115G-8V4 is locked to GPS, the Time, Latitude & Longitude may be displayed in the respective boxes by clicking the “Auto Send ON” button. The display will continue to update at a one second interval until the “Auto Send OFF” button is selected. The default selection is “Auto Send OFF”

## 6.7 EVENT CONTROL

### 6.7.1 Trigger Polarity

When “Trigger on Positive” is selected the event time will be captured on the positive going edge of the event trigger. Conversely, when “Trigger on Negative” is selected the capture occurs on the negative going edge. The default selection is “Trigger on Positive”

### 6.7.2 Event Enabling

When “Events Enabled” is selected the trigger is active however no data output will occur unless “Auto Send” or “Query” is activated. When “Events Disabled” is selected, the event trigger is disabled and all events are cleared from the buffer. The default selection is “Events Disabled”

### 6.7.3 Auto Send

When the “Auto Send” button is clicked the event trigger is automatically enabled and event time data is received and displayed in the “EVENTS” window. The unit will continue to send event information as long as there is data available.

### 6.7.4 Query

When the “Query” button is clicked the event trigger is automatically enabled and a single event message is received. If there is no event data in the buffer there will be no action.

FIGURE 2

Model 6115G-8V4 Configuration Utility

