



# TECHNICAL DESCRIPTION

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**MODEL 6115G-3  
GPS SYNCHRONIZED IRIG B  
TIME CODE GENERATOR**

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MODEL 6115G-3  
GPS SYNCHRONIZED IRIG B TIME CODE GENERATOR

**1.0 GENERAL**

The Model 6115G-3 is a twelve channel GPS synchronized IRIG B time code generator designed to provide a precise IRIG B serial time code output as well as a 1PPS time pulse. The unit 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-3 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.

In the event that a GPS signal is not available the 6115G-3 can be locked to an external IRIG B serial time code signal. The selection of GPS or IRIG as the synchronization source is via a front panel switch or it may be done remotely via a TTL signal or contact closure.

The 6115G-3 may also be synchronized to an external 1 PPS such as a time mark signal from another timing device. When applied, the 6115G-3 internal clock will be reset to the closest second. It is therefore necessary to have previously set the clock recently enough to be certain that the drift would be less than one half second.

The 6115G-3 may also be used as a stand-alone unit to generate an IRIG B signal. The time-of-year may be set by the user via front panel switches. An alphanumeric LED readout displays the days, hours, minutes and seconds. In the event of a power failure the 6115G-3 will no longer output a serial time code however the time will continue to advance by automatically switching to a battery backed-up internal clock. The IRIG output will resume, without resetting, upon reapplication of power.

The unit has five buffered IRIG B outputs as well as status and synchronized clock signal outputs.

## **2.0 CHARACTERISTICS**

### **2.1 TIME CODE SYNCHRONIZATION**

The 6115G-3 can use either GPS or an applied IRIG B time reference as selected by a front panel switch. Additionally, in the absence of either GPS or IRIG B, an applied 1PPS time reference can be used. When the Time Reference select switch is set to remote, the selection can be made by an external TTL signal or contact closure to ground. When GPS is selected, the 6115G-3 internal clock is automatically synchronized to GPS upon receipt of a valid GPS signal. If the unit loses the GPS lock after initial synchronization, it will continue to operate on the internal clock which also generates a 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 GPS presence and lock status are displayed on front panel indicators and are available on the remote output connector located on the rear panel. The TIME REF LOCKED indicator is lit when the unit is fixed to the GPS satellite(s). The TIME CODE SYNCHRONIZED indicator is lit one second after unit is locked and remains lit until either the time is changed via the front panel switches after the input GPS signal is removed or until power to the unit is turned OFF.

When IRIG is selected as the time reference the 6115G-3 synchronization follows the same scenario as with GPS.

If it is desired to synchronize the unit to an external 1 PPS signal such as a time mark signal from another timing device, the external signal may be connected to the "Clock Input" connector. This input is active in both GPS and IRIG B modes but will only have an effect when the selected signal (GPS or IRIG) is absent. When applied, the 6115G-3 internal clock will be reset to the closest second. For precise calibration it is therefore necessary to have previously set the clock to within one half second prior to application of the external 1 PPS signal. An "1PPS" indicator will illuminate when the 6115G-3 is using the 1PPS reference. See Table 1 for a matrix of the Time Reference Status indicators.

TABLE 1  
Model 6115G-3 Status Indicator Matrix

External Signals			Status Indicators		
GPS	IRIG B	1PPS	TRL	TCS	1PPS
NP	NP	NP	OFF	OFF	OFF
NP	NP	P	OFF	OFF	ON
P	NS	NP	ON	ON	OFF
NP	NS	NP	OFF	ON	OFF
P	NS	P	ON	ON	OFF
NP	NS	P	OFF	ON	ON
NS	P	NP	ON	ON	OFF
NS	NP	NP	OFF	ON	OFF
NS	P	P	ON	ON	OFF
NS	NP	P	OFF	ON	ON
MR	NS	NP	OFF	OFF	OFF
MR	NS	P	OFF	OFF	ON
NS	MR	NP	OFF	OFF	OFF
NS	MR	P	OFF	OFF	ON

**KEY:**  
 NP - Not Present  
 P - Present  
 NS - Not Selected  
 MR - Manually Reset (After Synchronization)

## 2.2 USER PROGRAMMING

Programming (time-of-year set) of the 6115G-3 is performed by the user via front panel switches. The process is prompted by an alphanumeric LED display. The user may select days, hours, minutes or seconds using the SELECT switch. The value can then be set using the SET switch. The LED display shows the status at each stage of the process.

An onboard Dip Switch (S1) allows the user to set a  $\pm 12$  hour offset. If the offset is 0, then the time is UTC time and display will read UTC DDD:HH:MM:SS. If the offset is set to any value other than zero then the display will read LOC DDD:HH:MM:SS (see Table 2, Time Offset).

## 2.3 STATUS/CONTROL I/O

The Status/Control connector provides the capability to remotely monitor the GPS or IRIG lock (TRL), Time Code Sync (TCS) and 1HZ (1PPS) signals and provide for remote control of the GPS/IRIG selection.

When the front panel time reference switch is set to REMOTE, the 6115G-3 defaults to GPS as a reference when the input remote select line is high or not grounded. When the line is set to ground or has a TTL low signal applied, IRIG is selected.

Four synchronization signals are output, 1 Hz, 10 Hz, 100 Hz, and 1 KHz. These signals have the same characteristics as CLOCK OUT which corresponds to clock selected by the front panel select switch.

## 2.4 DYNAMICS MODE

The 6115G-8AD has a programmable Dynamics Mode feature which may be set by the operator. A list of the mode descriptions is shown in Table 2. The mode value is entered via the RS-232 port. Once entered the value is stored in non-volatile memory.

**Table 2**  
**Dynamics 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 RS-232C OUTPUT

The RS-232C interface provides an alternative means of reading the unit status by providing ASCII data for external use on demand.

Upon receipt of ASCII code "DC3" (13 hexadecimal) also known as "CTL-S", the unit shall return a 2 byte status string defined as follows:

⟨SOH⟩⟨STATUS⟩

Upon receipt of ASCII code "DC4" (14 hexadecimal) also known as "CTL-T", the unit shall return the current time of year (14 bytes) as follows:

⟨STX⟩⟨STATUS⟩⟨TIME⟩

Time data output begins at the next 1 second time interval (after receipt of the "DC4").

⟨SOH⟩ = (01 Hexadecimal)

⟨STX⟩ = (02H Hexadecimal)

⟨TIME⟩ = ASCII string "DDD:HH:MM:SS."

⟨STATUS⟩ = ASCII "0" (30h) - TRL false, TCS false, 1PPS false.

ASCII "1" (31H) - TRL true, TCS false. 1PPS NA

ASCII "2" (32H) - TRL false, TCS true, 1PPS false.

ASCII "3" (33H) - TRL true, TCS true. 1PPS NA

ASCII "4" (34H) - TRL false, TCS false, 1PPS true.

ASCII "5" (35H) - TRL false, TCS true, 1PPS true.

TABLE 3  
TIME OFFSET

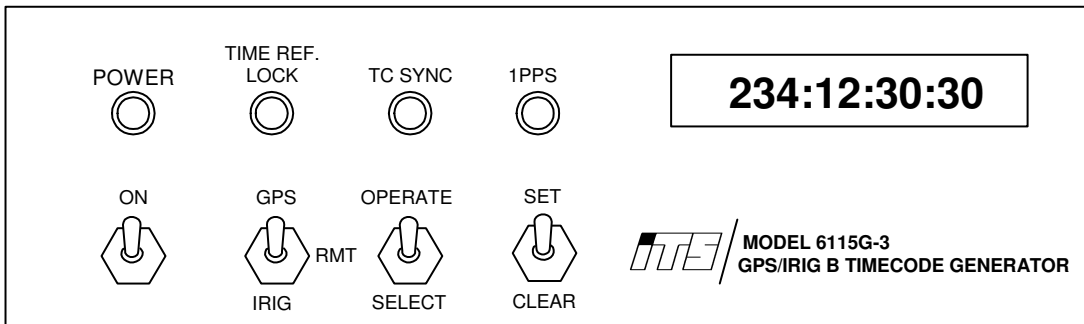
Offset	1	2	3	4	5
-12	on	on	off	off	off
-11	off	off	on	off	off
-10	on	off	on	off	off
-9	off	on	on	off	off
-8	on	on	on	off	off
-7	off	off	off	on	off
-6	on	off	off	on	off
-5	off	on	off	on	off
-4	on	on	off	on	off
-3	off	off	on	on	off
-2	on	off	on	on	off
-1	off	on	on	on	off
0	on	on	on	on	on
1	off	on	on	on	on
2	on	off	on	on	on
3	off	off	on	on	on
4	on	on	off	on	on
5	off	on	off	on	on
6	on	off	off	on	on
7	off	off	off	on	on
8	on	on	on	off	on
9	off	on	on	off	on
10	on	off	on	off	on
11	off	off	on	off	on
12	on	on	off	off	on

### 3.0 MECHANICAL CONFIGURATION

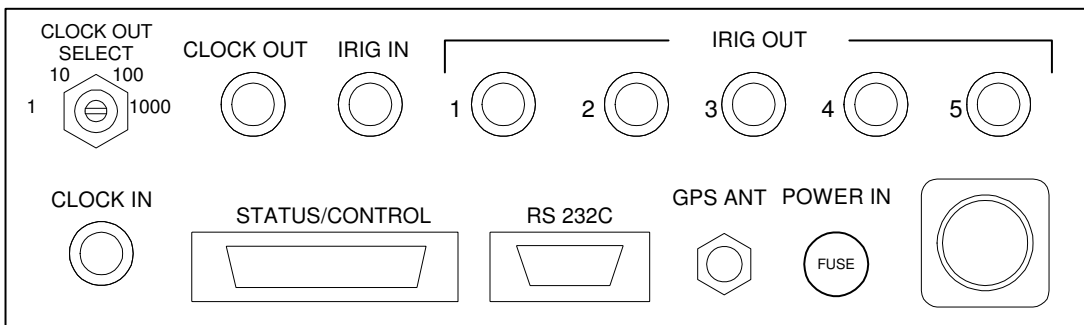
The 6115G-3 is housed in a ruggedized, aluminum enclosure, 8.5" wide x 8.5" deep x 2.5" high. (See fig 1). All circuitry is on two printed wiring boards. All connections are via mating connectors, no edge connectors are used.

All connectors are on the rear of the enclosure and all controls and indicators with the exception of the "clock out select" switch are on the front panel.

FIGURE 1  
MODEL 6115G-3 ENCLOSURE

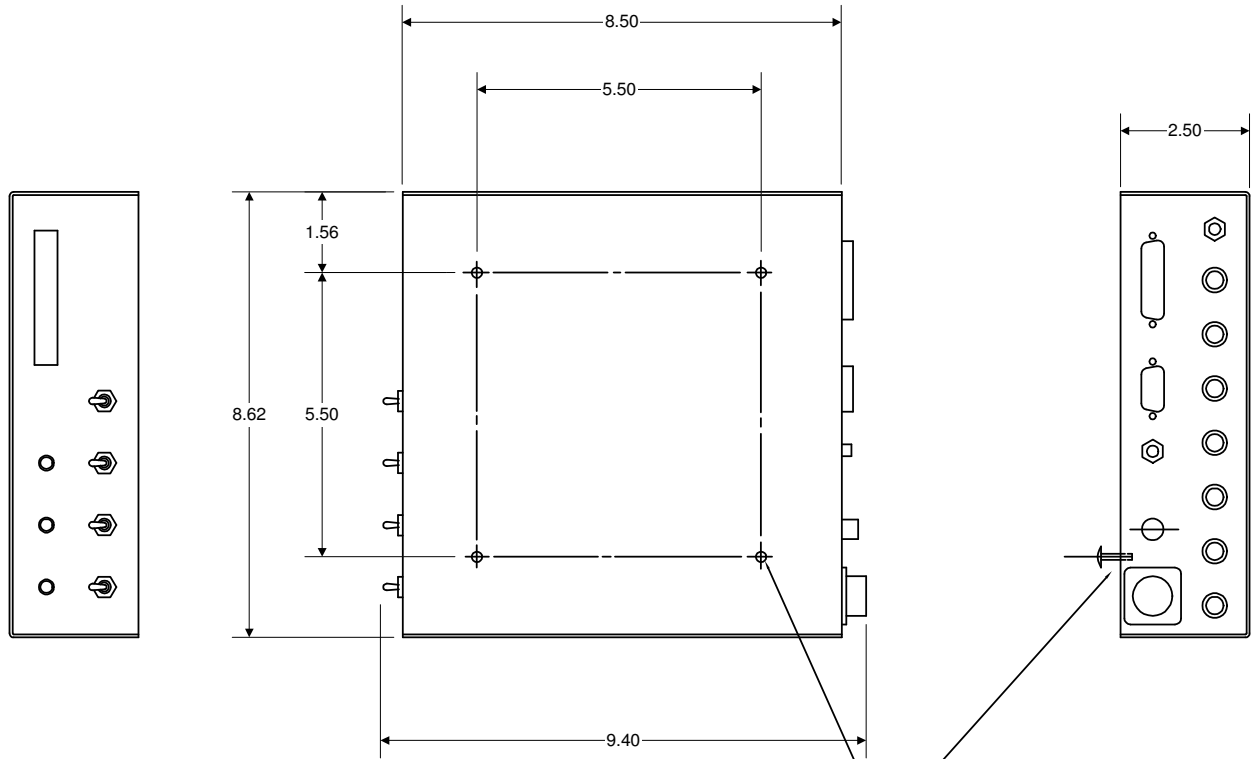


FRONT PANEL



REAR PANEL

# 6115G-3 Outline Drawing



MOUNT WITH #8-32 SCREWS-4PL  
NOTE: SCREWS MAY NOT EXTEND  
BEYOND .200" INTO BOTTOM OF  
ENCLOSURE

## **4.0 CONTROLS AND INDICATORS (See Figure 1)**

- |      |                       |  |
|------|-----------------------|--|
| 4.1  | Power                 | 2 Position Toggle Switch -<br>Selects power ON/OFF. LED illuminates when external power is applied.  |
| 4.2  | Select                | Momentary Toggle Switch -<br>Selects operate or program mode.  |
| 4.3  | Set                   | Momentary Toggle Switch -<br>Provides means to set internal clock in absence of IRIG time input.   |
| 4.4  | Time Reference Select | Three position Toggle Switch -<br>Selects GPS or IRIG B input time reference. The "RMT" position provides for remote selection of the time reference.  |
| 4.5  | Output Clock Select   | Four position Rotary Switch -<br>Selects clock output of 1, 10, 100 or 1000pps.  |
| 4.6  | Time Reference Lock   | Green LED Indicator -<br>Illuminates when GPS signal is present and satellite acquired or IRIG is present as selected.   |
| 4.7  | TC Sync               | Yellow LED Indicator -<br>Illuminates when 6115G-3 is or has been Synchronized to the GPS receiver or applied IRIG B signal. Resets to off condition when power is turned off or time is reset manually. |
| 4.8  | 1PPS Sync             | Green LED Indicator -<br>Illuminates when 6115G-3 is synchronized to 1PPS input signal and both GPS and IRIG B are not present.  |
| 4.9  | GPS antenna           | SMA Connector -<br>Receives signal from GPS antenna.   |
| 4.10 | IRIG B Input          | BNC Connector -<br>Receives IRIG B serial time reference signal.   |
| 4.11 | IRIG B Output         | Five BNC Connectors -<br>Outputs five buffered serial IRIG B signals.  |



#### 4.0 CONTROLS AND INDICATORS (continued)

##### 4.15 RS-232C Output

9 Pin D (Male)

Outputs time and lock status messages

	<u>Function</u>	<u>Notes</u>
Pin 1	NC	
Pin 2	RXD	Received data
Pin 3	TXD	Transmit data
Pin 4	NC	
Pin 5	GND	
Pin 6	NC	
Pin 7	RTS	Set high
Pin 8	CTS	Not implemented
Pin 9	NC	

##### 4.16 Baud Rate Select

Internal DIP Switch -

Selects RS-232 serial data baud rate in accordance with the following settings.

<u>Baud</u>	<u>S1-8</u>	<u>S1-7</u>	<u>S1-6</u>
300	on	on	on
600	on	on	off
1200	on	off	on
2400	on	off	off
4000	off	on	on
9600	off	on	off
19.2K	off	off	on
38.4	off	off	off

##### 4.17 Power

KPT02A8-4P Connector -  
28VDC external power.

Pinout is as follows:

- A - 28VDC
- B - 28VDC return
- C - Chassis ground
- D - n/u

## 5.0 SPECIFICATIONS

### 5.1 Frequency Stability

When powered  
1 part in  $10^6$ . (0 to +55°C)  
2.5 parts in  $10^6$  (-30 to 70°C)

On Battery backup  
1 part in  $10^4$ . (0 to +55°C)

5.2 Clock backup life (un-powered) 1 year minimum

### 5.3 GPS Performance

Channels: 12 Parallel channels, tracks all satellites in view

Time-to-first-fix  
<15 seconds typical (warm start), <90 seconds  
typical (cold start)

UTC Time Mark Synchronized with Global Reference Standard

Reacquisition: 2 seconds typical

5.4 IRIG B Output Standard IRIG B serial time code IAW IRIG  
Standard 200-98.

5.5 Status and Clock Outputs TTL = Standard TTL levels.  
OC (open collector) Mosfet, Max voltage: 100V,  
Max current: 1.3A, On resistance @ 1.3A: 0.3 Ohm,  
Max Drain-Source leakage: 500 nA.

5.6 External Clock Input TTL, positive 1PPS signal.

5.7 RS-232 Port EIA RS-232C, 8 bit, no parity, 1 stop bit.  
Baud Rate selectable from 300 to 38400, default to  
9600.

5.8 Power 28VDC IAW MIL-STD-704, 4 Watts

5.9 Temperature, Operating -40°C to +70°C

5.10 Humidity 95%

5.11 Package

Size 8.5" wide x 8.5" deep x 2.5" high  
Weight 3 lbs.

## 6.0 OPERATION

The Model 6115G-3 generates an IRIG time code automatically upon turn on from the time saved in its internal battery backed up real time clock. The system will automatically correct its internal clock when the GPS antenna is connected and a GPS satellite signal is acquired and locked or when an IRIG B signal is applied and the IRIG reference is selected. The lockup time for GPS acquisition varies depending on how long the unit has been OFF and how far the unit is from the site at which it was operated last. These times can vary from about 15 seconds to several minutes (warm start to cold start respectively). The user must provide a GPS antenna connected to the 6115G-3 with an appropriate length of low-loss coaxial cable for proper operation of the system. The 6115G-3 is factory shipped to operate with a 5 volt powered antenna. An internal jumper plug on the PC assembly may be changed for operation with 5 volt, 12 volt, or passive antennas.

*DO NOT USE A PASSIVE ANTENNA OR SHORT THE ANTENNA INPUT IF A POWERED ANTENNA IS SELECTED AS THIS MAY DAMAGE OR DESTROY THE GPS RECEIVER. OPERATION USING THE 12 VOLT SELECTION WITH A 5 VOLT ANTENNA MAY DAMAGE EITHER THE ANTENNA, THE RECEIVER, OR BOTH.*

The internal 6115G-3 time is continuously displayed on the front panel alphanumeric LED Display. If the unit is not locked to a GPS signal, the front panel TIME REF LOCK LED will be off. If a GPS signal is received, the time code output will automatically lock to it and the internal time clock will be reset to match it. When locked to GPS, the front panel TIME REF LOCK and TC SYNC LED's will light. The SYNC LED indicates that the unit has been synchronized to a time reference. The SYNC LED will go out if the power is turned off or if the time is changed manually. The manual time set mode will not operate if the system is currently locked to an external GPS signal or when selected, IRIG B signal. If there is no time reference

## 6.0 OPERATION (continued)

signal applied, the user may set the time via the front panel switches. To set the time, press the OPERATE/SELECT switch DOWN. The display will first indicate the year (LS two digits only) which is currently set preceded by the words SET YEAR. The cursor indicates the current digit to be set (10's of years). The indicated digit may be cleared by pressing the SET/CLEAR switch DOWN or incremented by pressing the SET/CLEAR switch UP. To advance to the next digit, press the OPERATE/SELECT switch DOWN. When completed with the year, press the OPERATE/SELECT switch UP. The display will next indicate the time when the switch was pressed preceded by the word SET, and a cursor indicating the first digit to be set (100's of days). Pressing the SET/CLEAR switch UP will advance the selected digit. Pressing the SET/CLEAR switch DOWN will clear the selected digit. Pressing the OPERATE/SELECT switch DOWN will advance to the next digit to the right. Pressing the OPERATE/SELECT switch UP will accept the time set on the display and return to the Operate mode and output the corrected time.

NOTE: Although the year is not required in the IRIG B data format, it is required in the system to calculate the Julian day due to leap year. This is the only purpose for the year set, so the year 2000 poses no problems.