Chapter 56

Using the KAM/TCG/105 and KAM/TCG/106

TEC/NOT/085

The KAM/TCG/105 is a time-code generator with GPS/IRIG input and internal battery backup. The KAM/TCG/106 is based on the KAM/TCG/105; the main difference being the external battery backup for applications in which using an internal battery is not optimal.

This technical note introduces the KAM/TCG/105 module, and describes how to set it up, as well as troubleshoot GPS. This paper is divided into the following sections:

Throughout this document, where the KAM/TCG/105 is mentioned, the same information and settings are valid for the KAM/TCG/106. Any exceptions are indicated in specific notes.

56.1 Time code modules

The following table describes Acra KAM-500 time code modules.

Table 56-1: Different time code modules

Module	Description
KAM/TCG/001	IRIG-B time code reader and generator with external battery. The KAM/TCG/001/C version provides an option to use an external battery. This product is discontinued.
KAM/RTC/003	RTC generator with memory status outputs. This module does not have any time input capabilities other that its own real time clock; it works with an internal battery only.
KAM/TCG/102	Combined GPS and IRIG input. This module is the predecessor of the KAM/TCG/105. The KAM/TCG/102 supports an external battery only and does not feature memory status outputs. This product is obsolete.
KAM/TCG/105	Time-code generator with GPS/IRIG input and battery backup. This product is recommended for new programs.
KAM/TCG/106	Time-code generator with GPS/IRIG input and external battery backup. This product is recommended for new programs.

56.2 Module overview

The KAM/TCG/105 is a time-code generator with GPS/IRIG inputs, which incorporates a number of improvements over the KAM/TCG/102, principally the inclusion of an RTC with built-in battery backup.

The KAM/TCG/105 can accept time from an IRIG-B time source, from its onboard GPS receiver (external antenna required), or from an external GPS receiver outputting NMEA messages and a one PPS signal. The received time is written to an internal timer.

On power-up of the Acra KAM-500, the KAM/TCG/105's timer is seeded with time from the RTC. When powered down, the battery maintains time on the RTC.

On subsequent power-ups, time is loaded from the RTC and the RTC time is updated when a time source (GPS or IRIG) is locked. If the module is in slave mode, the RTC time is updated with time from the master module.

Alternatively, the initial time can be set from the PC using either Time Seeder or kTimeseed. Refer to the *KAM/TCG/105* data sheet for more information.

56.3 Setting up the KAM/TCG/105 using KSM-500

kSetup software can be used to configure the KAM/TCG/105. kSetup is included in the KSM-500 suite of tools.

56.3.1 Setting parameters

The Parameters tab (see the following figure) displays all parameters available from the module. To select parameters from the KAM/TCG/105, select the module in the Task Explorer pane of kSetup. From the Parameters tab, complete the fields described in Table 56-2 on page 2. For more information on using kSetup, contact Curtiss-Wright support (acra-support@curtisswright.com).

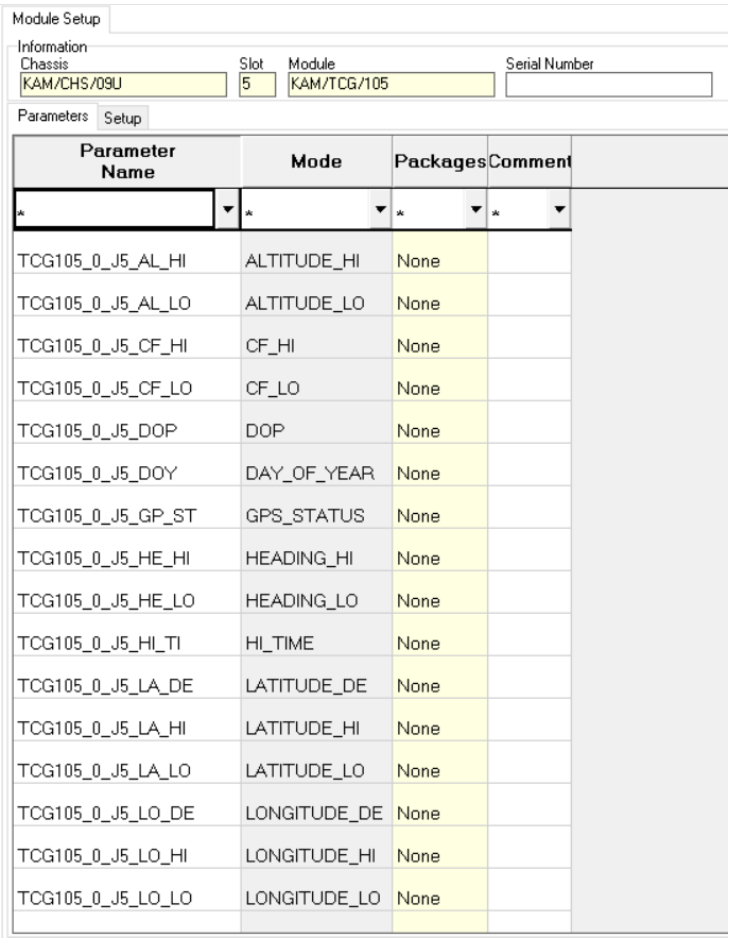


Figure 56-1: Parameters tab in kSetup

Table 56-2: Parameters tab settings

Field name	Description
Parameter Name	Name of the parameter.
Mode	Time or navigation data such as position, altitude, velocity and heading. For more information on the Mode column values, see the Parameter definition table in the *KAM/TCG/105* data sheet.
Packages	When you place the parameter in a PCM frame, you can double-click a Packages cell. A window displays the transmission details in the PCM frame, such as the transmission rate.
Comment	User-defined text relating to the parameter.

56.3.2 Setup tab settings

Fields on the Setup tab (see the following figure) allow you to configure available settings for the KAM/TCG/105. For more information on Setup definition, see the *KAM/TCG/105* data sheet.

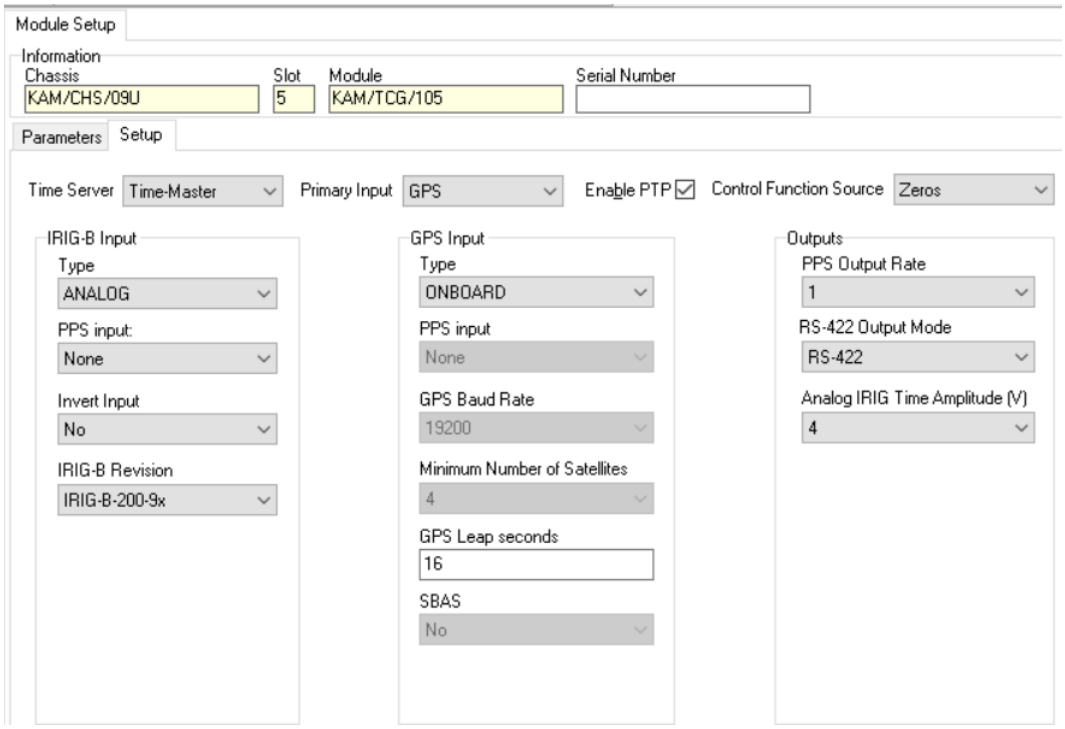


Figure 56-2: Setup tab in kSetup

The data sheet mentions two fields which are not configurable in KSM-500.

Current Year: The current year is automatically set by the software during programming. This is used when there is no other source of year. For example, when IRIG-B-200-9x is the input; this IRIG format does not carry year information.

MEM_Status: KSM-500 automatically sets the KAM/MEM/003, KAM/MEM/103, or KAD/MEM/004 report register into this KAM/TCG/105 register in order to drive the MEM_STATUS(1:0) outputs.

NOTE: The KAM/TCG/106 only supports one MEM_STATUS output showing whether the MEM is logging or not.
Parsing of NMEA messages is not supported by KSM-500.
Enable PTP is reserved. Enabling or disabling it does not have any effect.

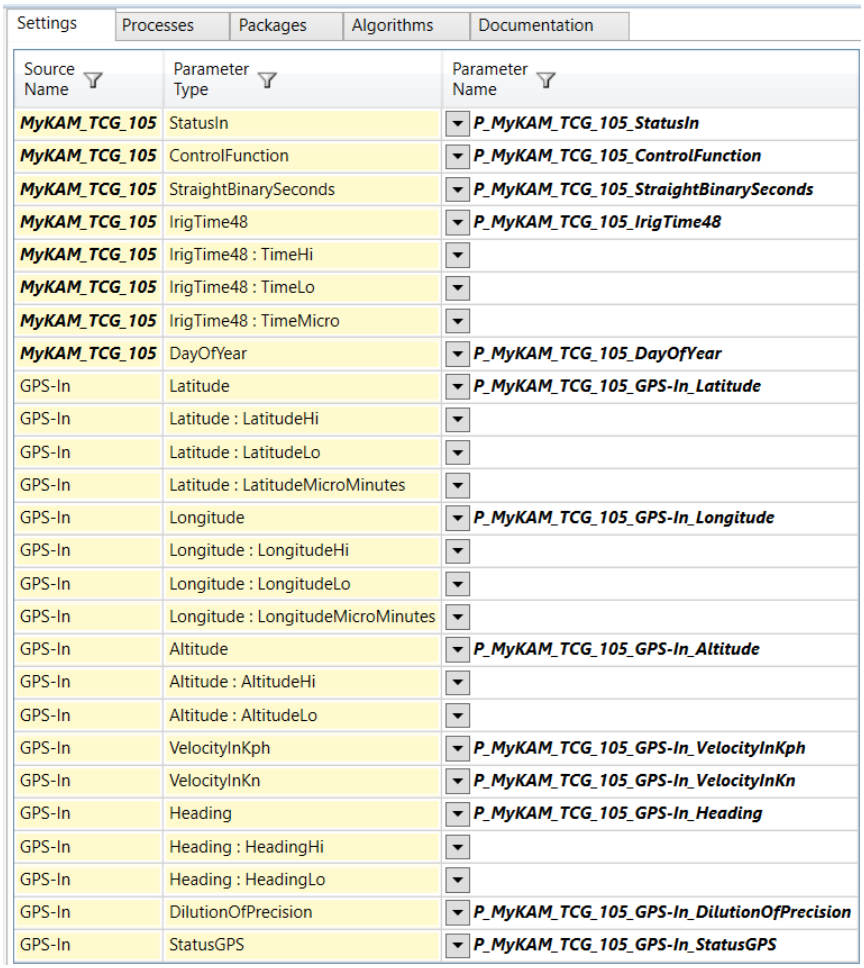
56.4 Setting up the KAM/TCG/105 using DAS Studio 3

You can use DAS Studio 3 software to configure the KAM/TCG/105. Features that can be set up include configuring channels, setting messages, and adding data words to messages. More information on these settings can be found in the “Setting up packages” and “Setting up datalinks” sections of the *KAM/TCG/105* data sheet.

DAS Studio 3 is used to create a configuration file which contains the various elements which make up your data acquisition system. You then use this configuration file to manage and program these elements. To see how hardware is represented in the DAS Studio 3 graphical user interface, see Figure 1 in the *DAS Studio 3 User Manual*.

56.4.1 Settings tab

The Settings tab as shown in the following figure, shows available parameters for the module. The parameters shown in the Settings tab are defined in the *KAM/TCG/105* data sheet.



Settings | Processes | Packages | Algorithms | Documentation

Source Name	Parameter Type	Parameter Name
MyKAM_TCG_105	StatusIn	***P_MyKAM_TCG_105_StatusIn***
MyKAM_TCG_105	ControlFunction	***P_MyKAM_TCG_105_ControlFunction***
MyKAM_TCG_105	StraightBinarySeconds	***P_MyKAM_TCG_105_StraightBinarySeconds***
MyKAM_TCG_105	IrigTime48	***P_MyKAM_TCG_105_IrigTime48***
MyKAM_TCG_105	IrigTime48 : TimeHi	
MyKAM_TCG_105	IrigTime48 : TimeLo	
MyKAM_TCG_105	IrigTime48 : TimeMicro	
MyKAM_TCG_105	DayOfYear	***P_MyKAM_TCG_105_DayOfYear***
GPS-In	Latitude	***P_MyKAM_TCG_105_GPS-In_Latitude***
GPS-In	Latitude : LatitudeHi	
GPS-In	Latitude : LatitudeLo	
GPS-In	Latitude : LatitudeMicroMinutes	
GPS-In	Longitude	***P_MyKAM_TCG_105_GPS-In_Longitude***
GPS-In	Longitude : LongitudeHi	
GPS-In	Longitude : LongitudeLo	
GPS-In	Longitude : LongitudeMicroMinutes	
GPS-In	Altitude	***P_MyKAM_TCG_105_GPS-In_Altitude***
GPS-In	Altitude : AltitudeHi	
GPS-In	Altitude : AltitudeLo	
GPS-In	VelocityInKph	***P_MyKAM_TCG_105_GPS-In_VelocityInKph***
GPS-In	VelocityInKn	***P_MyKAM_TCG_105_GPS-In_VelocityInKn***
GPS-In	Heading	***P_MyKAM_TCG_105_GPS-In_Heading***
GPS-In	Heading : HeadingHi	
GPS-In	Heading : HeadingLo	
GPS-In	DilutionOfPrecision	***P_MyKAM_TCG_105_GPS-In_DilutionOfPrecision***
GPS-In	StatusGPS	***P_MyKAM_TCG_105_GPS-In_StatusGPS***

Figure 56-3: Settings tab showing available parameters

NOTE: To see module settings, the module must be in context in the Navigator. Refer to the *DAS Studio 3 User Manual* for more information.

The Settings tab as shown in the following figure, shows available settings for the module. These settings are defined in the *KAM/TCG/105* data sheet.

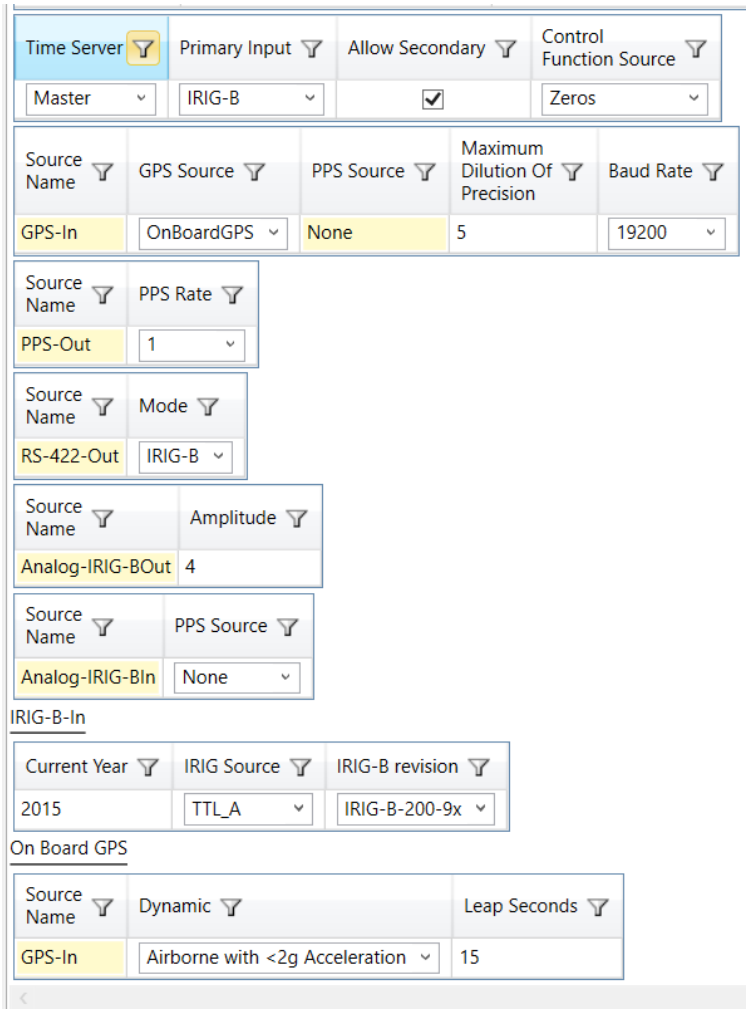


Figure 56-4: Settings tab showing available settings

56.4.2 Processes tab

The following Processes tab shows available processes for the module. The processes shown in the Processes tab are defined in the *KAM/TCG/105* data sheet.

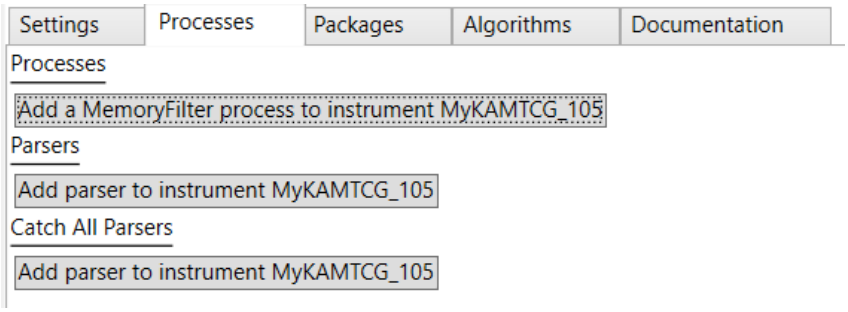


Figure 56-5: Processes tab showing available processes

NOTE: MessageInfo, Parsers, and Catch All Parsers are not supported.

56.4.2.1 MemoryFilter

The MemoryFilter process drives the MEM_STATUS(1:0) outputs of the KAM/TCG/105 by assigning the MEM Status register to it. To carry out this process, a KAM/MEM/003, KAM/MEM/103, or KAM/MEM/004 is required in the chassis where the KAM/TCG/105 is located. For further details on how to use a process, refer to the “Processes tab” section in the *DAS Studio User Manual*. As shown in the following figure, the default name of MEM Status parameter is FlashCard_Status and can be selected from the palette.

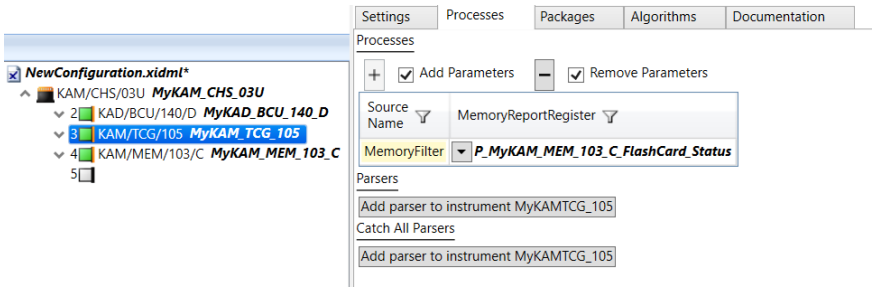


Figure 56-6: Processes tab example showing the KAM/MEM/103/C Status to drive the TCG/105 MEM_STATUS(1:0)

NOTE: The KAM/TCG/106 only supports one MEM_STATUS output showing whether the MEM is logging or not.

56.4.2.2 Catch All Parsers

Any package that is not assigned to a parser is sent to this catchall parser where it can be sampled if required. Unlike Parsers, Catch All Parsers automatically sets 41 words and MessageInfo.

This feature is not recommended and should be used as a debug tool only.

56.5 Example configurations

56.5.1 External GPS receiving NMEA messages over RS-422

The setup for an external GPS receiving NMEA RS-422 at 19,200 bps is shown in the following three figures.

NOTE: For the following three sample configurations, it is assumed that the secondary input IRIG is not used.

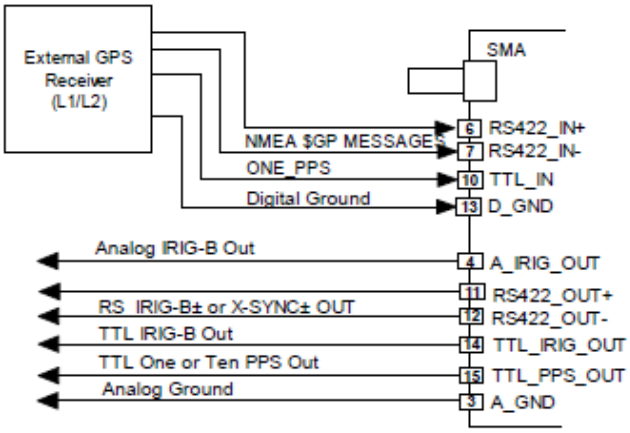


Figure 56-7: Setup for external GPS receiving RS-422

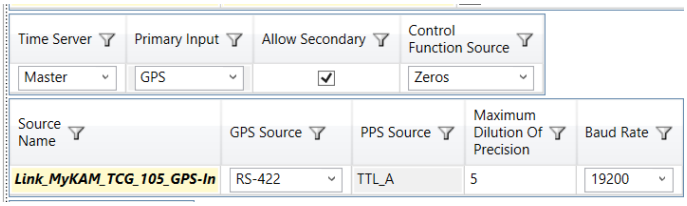


Figure 56-8: Example of setup for external GPS receiving RS-422 in DAS Studio 3

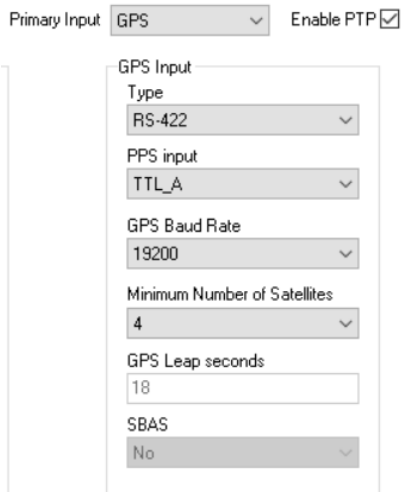


Figure 56-9: Example of setup for external GPS receiving RS-422 in kSetup

NOTE: ONE_PPS is required for the KAM/TCG/105 to synchronize its time with the minimum set of external NMEA messages.

56.5.2 Active GPS antenna

The setup for an active GPS antenna is shown in the following three figures.

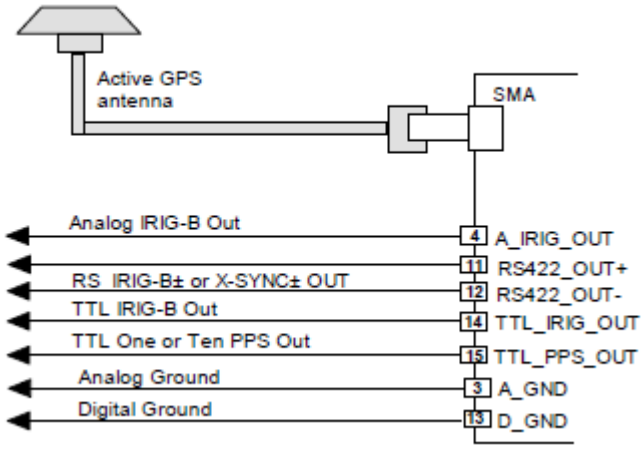


Figure 56-10: Setup for active GPS antenna

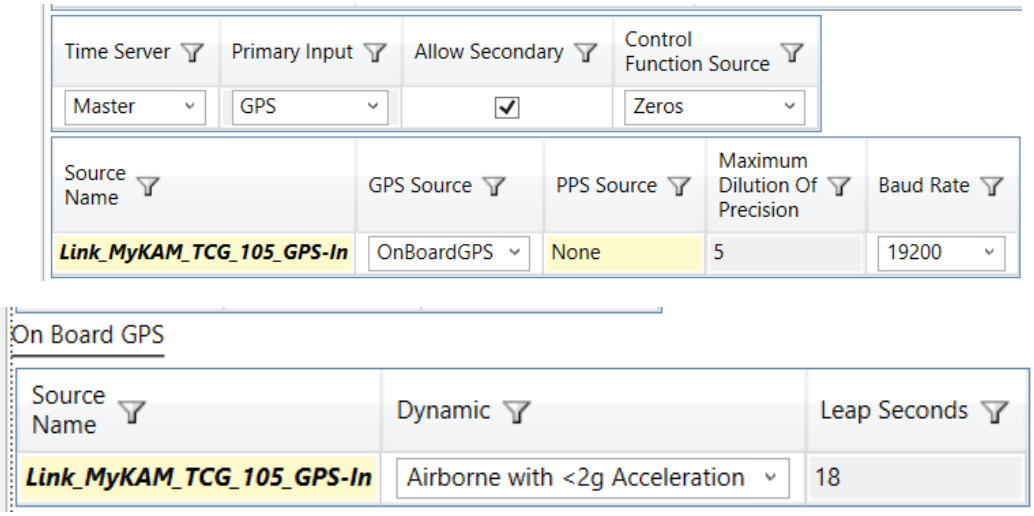


Figure 56-11: Example of setup for active GPS antenna in DAS Studio 3

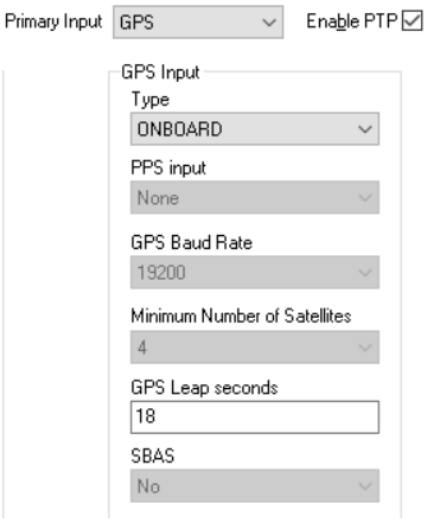


Figure 56-12: Example of setup for active GPS antenna in kSetup

NOTE: Leap Seconds is an important setting when GPS onboard is used. Refer to *TEC/NOT/072 — Time and leap seconds*. Baud Rate is not used when the GPS Source is set to OnBoard GPS.

56.5.3 External GPS receiver using NMEA messages over RS-232 and one PPS TTL

The setup for an external GPS receiver using NMEA RS-232 at 19,200bps and TTL_IN_A one PPS is shown in the following three figures.

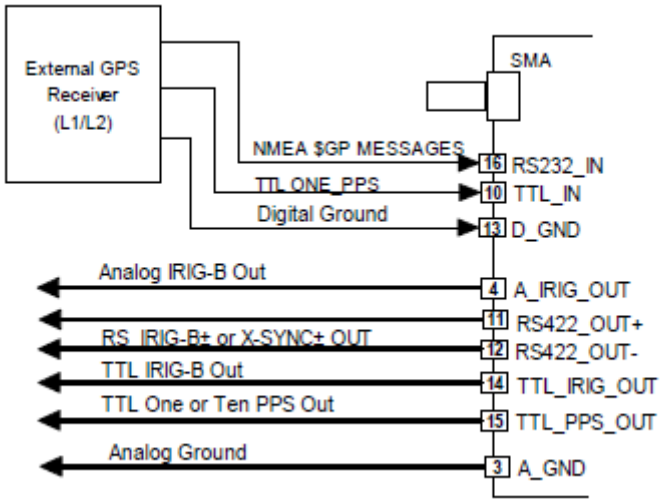


Figure 56-13: Setup for external GPS receiver using RS-232 and TTL PPS

Time Server	Primary Input	Allow Secondary	Control Function Source
Master	GPS	☐	Zeros

Source Name	GPS Source	PPS Source	Maximum Dilution Of Precision	Baud Rate
Link_MyKAM_TCG_105_GPS-In	RS-232	TTL_A	5	19200

Figure 56-14: Example of setup for external GPS receiver using RS-232 and TTL in DAS Studio 3

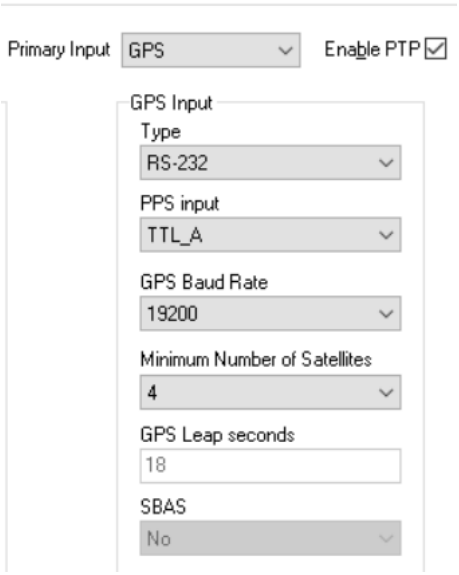


Figure 56-15: Example of setup for external GPS receiver using RS-232 and TTL in kSetup

56.5.4 Analog IRIG-B input

The setup for an analog IRIG-B input is shown in the following three figures.

NOTE: Analog IRIG-B only support 1 PPS signal over pin 9 TTL_IN_B.

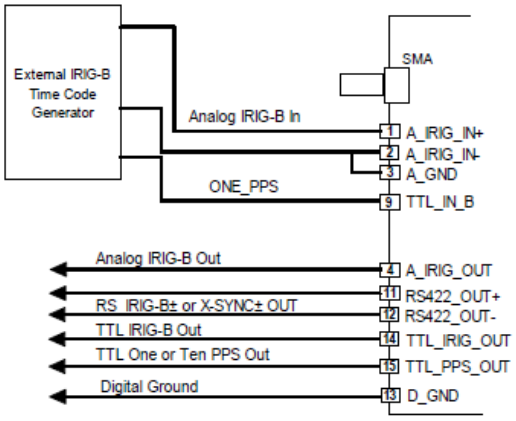


Figure 56-16: Setup for analog IRIG-B input with 1 TTL PPS

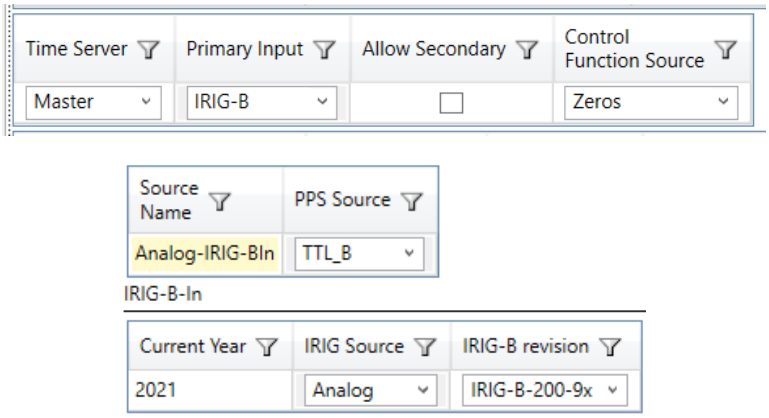


Figure 56-17: Example of setup for analog IRIG-B input with 1 PPS in DAS Studio 3

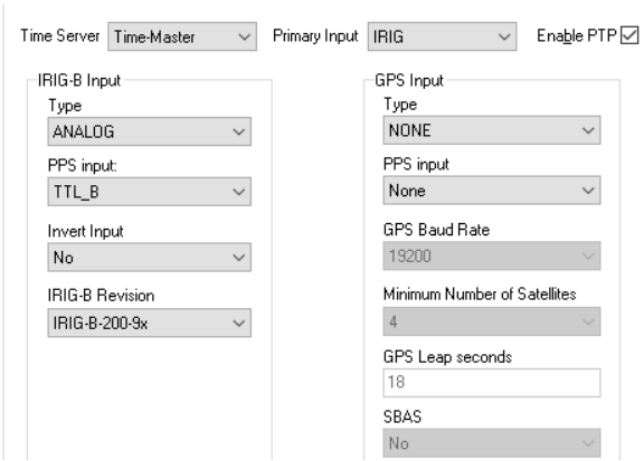


Figure 56-18: Example of setup for analog IRIG-B with 1 PPS input in kSetup

NOTE: ONE_PPS connection is optional on the previous figure, however it is recommended in order to increase accuracy. When IRIG-B-200-04 is selected, the module decodes the year from the control function (CF) bits, however IRIG-B-200-9x does not contain year information.

56.5.5 Digital IRIG-B input - TTL

The setup for a digital IRIG-B input is shown in the following three figures.

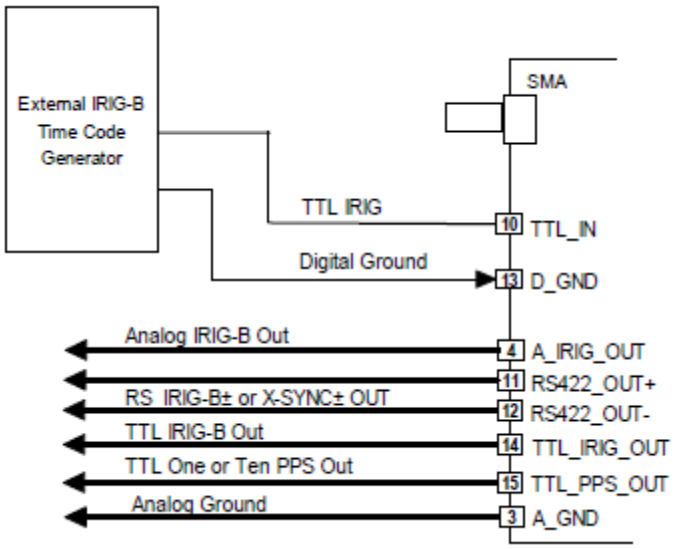


Figure 56-19: Setup for digital IRIG-B input

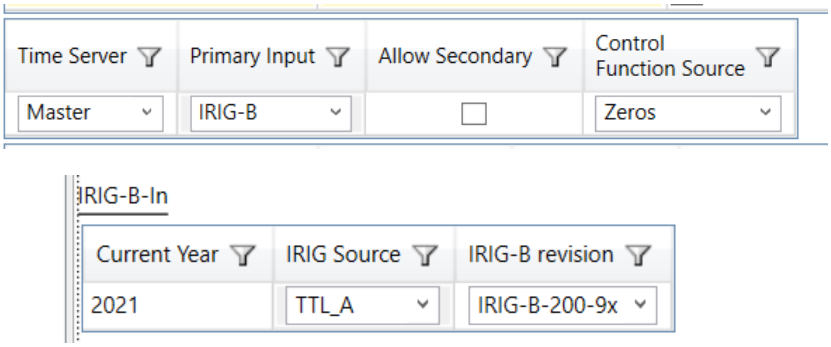


Figure 56-20: Example of setup for digital IRIG-B input in DAS Studio 3

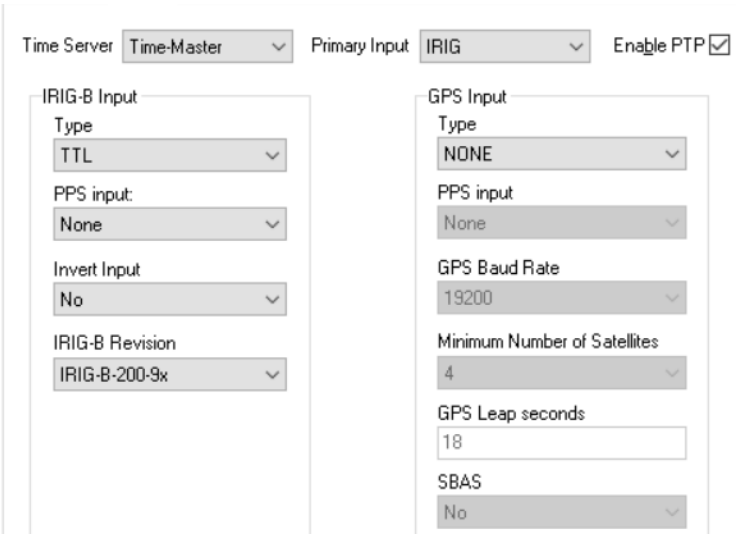


Figure 56-21: Example of setup for digital IRIG-B input in kSetup

56.5.6 Digital IRIG-B input - RS-422

The setup for a RS-422 IRIG-B input is shown in the following three figures.

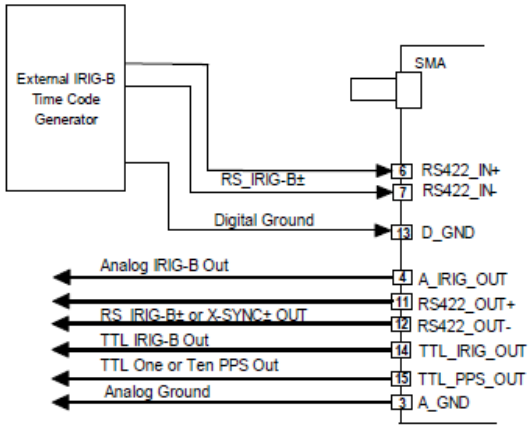


Figure 56-22: Setup for RS-422 IRIG-B input

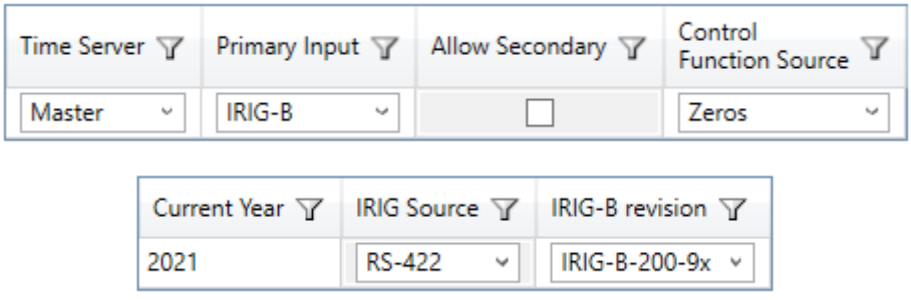


Figure 56-23: Example of setup for RS-422 IRIG-B input in DAS Studio 3

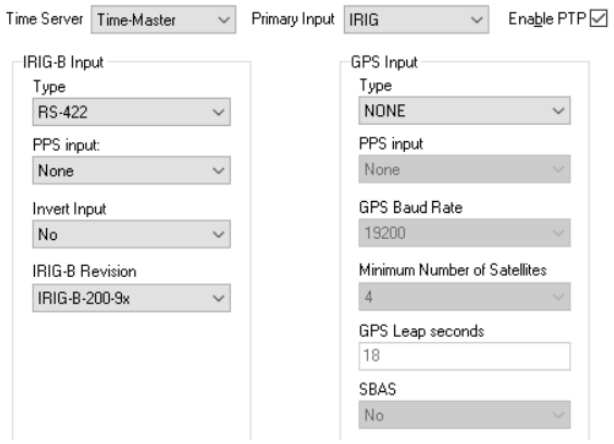


Figure 56-24: Example of setup for RS-422 IRIG-B input in kSetup

56.5.7 RTC input

When the module is set to RTC, the seeded time is loaded from the RTC. The initial time can be set from the PC using either Time Seeder (refer to the *DAS Studio User Manual*) or kTimeseed (KSM-500 tool)

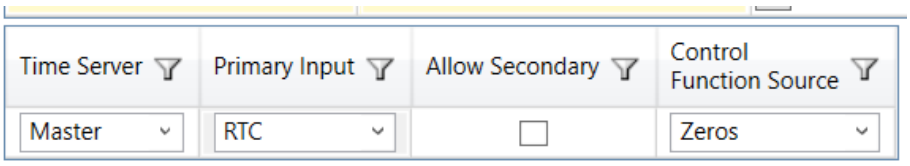


Figure 56-25: Example of setup for RTC DAS Studio 3

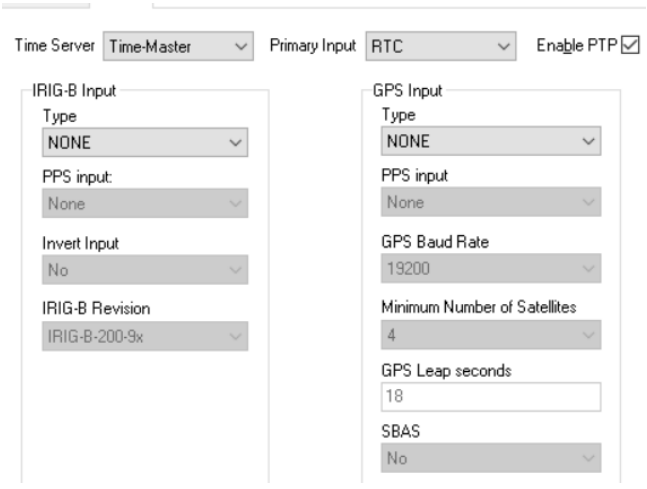


Figure 56-26: Example of setup for RTC in kSetup

NOTE: Time Seeder and kTimeSeed also support the KAM/TCG/106.
In RTC mode, the KAM/TCG/105 does not get GPS nor IRIG information even if they are physically connected.

56.6 Troubleshooting GPS

This section explains the most common issues with GPS. For GPS antenna recommendations, see the *KAM/TCG/105* data sheet.

56.6.1 GPS not in lock

Check the StatusGPS parameter. This parameter provides information on the current GPS status, such as GPS lock, Dilution of Precision (DOP) in and out of range, and number of satellites in use.

NOTE: Bit 15 of the StatusGPS parameter defaults to 0, which indicates the module does not have GPS lock. Bit 15 is only set to 1 when the GPS receiver has achieved GPS lock.

If bit 15 remains at 0, the module is unable to achieve GPS lock and there are problems with satellite coverage. This may be due to poor satellite coverage or issues with the GPS antenna or cabling.

If bit 15 is set to 1 (GPS lock) but the position is incorrect, check bit 11. If bit 11 of the StatusGPS parameter is set to 1, this indicates that the DOP figures are out of range. The actual DOP figures can be read from the DilutionOfPrecision parameter.

Also, check the number of satellites in view (StatusGPS[7:4]) and the number of satellites in use (StatusGPS[3:0]). If the number of satellites in view is less than four, try the other troubleshooting hints in this section.

NOTE: The antenna must be connected before powering up the Acra KAM-500 chassis with the KAM/TCG/105.

56.6.2 Multipath errors

A multipath environment exists if GPS signals arrive at the antenna directly from the satellite and also from reflective surfaces, for example water or building walls (see Multipath environment).

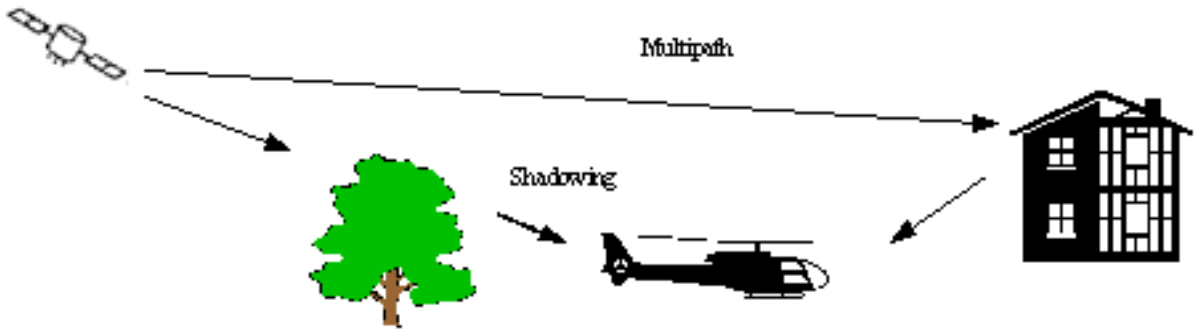


Figure 56-27: Multipath environment

If there is a direct path in addition to the reflected path available, the receiver can usually detect the situation and compensate to some extent. If there is no direct line of sight, but only reflections, the receiver is not able to detect the situation.

Under multipath conditions, range measurement to the satellite provides incorrect information to the navigation solution, resulting in less accurate positioning. If there are few satellites in view, the navigation solution might be wrong by several hundred meters.

Location of the antenna close to a vertical metal surface can be harmful owing to the fact that metal is an almost perfect reflector. When mounting an antenna on top of a reflective surface, the antenna should be mounted as close to the surface as possible. Then, the reflective surface acts as an extension of the antennas ground place and not as a source multipath.

56.6.3 Antenna shortcomings

Although GPS can work with a weak signal, to have a reliable GPS system the antenna selection and location should be considered carefully as inappropriate selection and poor location degrades GPS performance. Factors which degrade the GPS performance include the following:

- Inadequate gain of the GPS antenna
- Poor directivity of the GPS antenna
- Improper orientation of the antenna to the sky
- Poor matching of antenna, cable, and receiver impedance
- Poor noise performance of the input stage of the antenna amplifier
- GPS antenna is connected to the module after the KAM-500 is powered up.

For more information on getting the most from the antenna, see the *KAM/TCG/105* data sheet.

56.7 Tips

56.7.1 Battery backup

The battery duration is specified to a maximum of four years on the KAM/TCG/105. To replace the battery, the unit must be returned to Curtiss-Wright.

The KAM/TCG/106 is designed for use with an external battery; therefore the unit does not need to be returned to Curtiss-Wright for replacement.

56.7.2 Battery model

Contact Curtiss-Wright support (acra-support@curtisswright.com) for details.

56.7.3 Representing GPS position in GS Works

Contact Curtiss-Wright support (acra-support@curtisswright.com) to obtain a copy of technical document *TSD/AC/005 GS Works derive equation for TCG Altitude Latitude Longitude Heading.*

Latitude/Longitude are specified in degrees/minutes/seconds (DMS) in the *KAM/TCG/105* data sheet while some GPS localization system may express it in Decimal Degrees (DD).

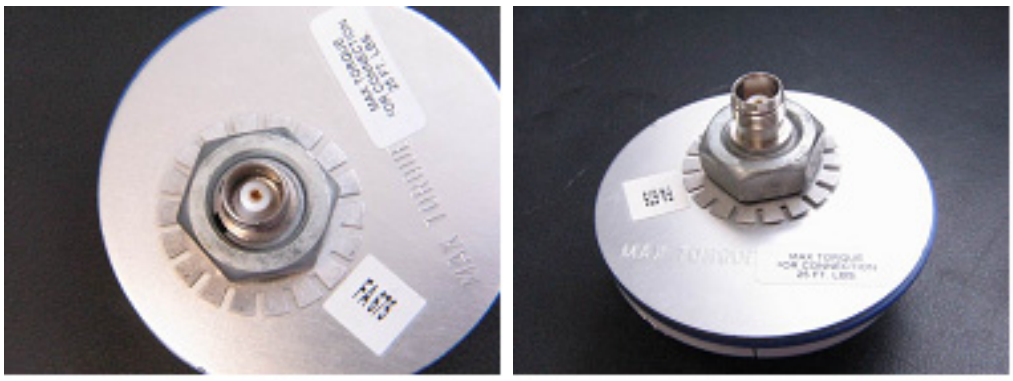
56.7.4 Pulses Per Second (PPS)

No more than one PPS should be used with the KAM/TCG/105 as the Phase Locked Loop has been designed to work with one PPS only.

The PPS output is driven by the internal time on the KAM/TCG/105 so you always have 1 PPS regardless of the time source and even if there's no time connected such as GPS or IRIG that is using the battery backup.

56.7.5 RFE/AEG/001

There are no special accessories required to mount this antenna; it is shipped complete for mounting. The antenna in this series is hard-mounted through a unique single hole feed structure and includes gaskets to prevent air and water leaks. The mounting is a through hole 5/8-18UNC-2A thread.



56.7.6 SMA torque setting

The recommended torque setting for the SMA connector on the KAM/TCG/105 is 0.45 Nm (0.33 foot pound-force).

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