

This technical note discusses the following topics:

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39.1 KAD/DEC/103 overview

The KAD/DEC/103 is a dual PCM decommutator that can accept two independent PCM streams. Data from each stream is individually parsed into a minor frame buffer from which it can be read coherently over the backplane.

The KAD/DEC/103 has two modes of operation: synchronous and asynchronous, which are described in section “39.2 KAD/DEC/103 in synchronous mode” on page 1 and section “39.4 KAD/DEC/103 in asynchronous mode” on page 6.

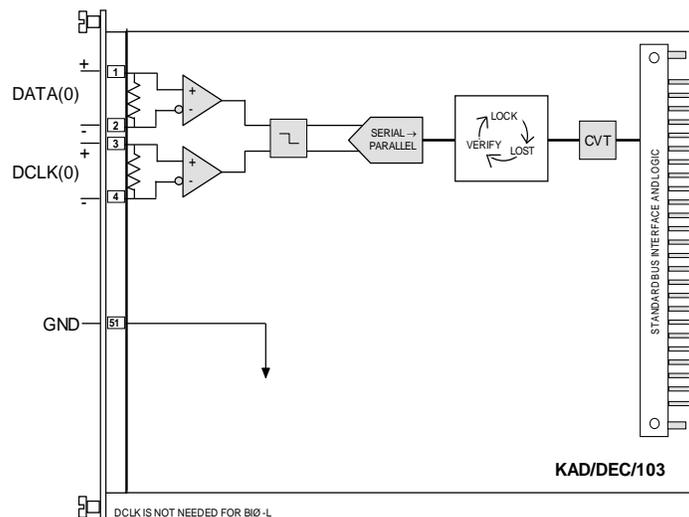


Figure 39-1: KAD/DEC/103 overview

NOTE: The KAD/DEC/003 has the same functionality as the KAD/DEC/103. However, the access rate in the backplane of the KAD/DEC/103 is faster. Also, for synchronous operation in a distributed Acra KAM-500 chassis, the maximum inter-chassis bit-rate for the KAD/DEC/003 is 3.2 Mbps, using NRZ-L PCM code; whereas the KAD/DEC/103 is limited to 8 Mbps.

39.2 KAD/DEC/103 in synchronous mode

The KAD/DEC/103 can merge two PCM streams in a distributed acquisition system with a star configuration. In a typical distributed acquisition system where each Acra KAM-500 chassis operates synchronously, the KAD/DEC/103 runs in synchronous mode. Data is decommutated by the decoder before it is read over the backplane.

39.2.1 Operation

Using the KAD/DEC/103 in synchronous mode means each Acra KAM-500 system is operating synchronously. An X_SYNC connection is required for this, as explained in the “Equipment interface” section of the *Acra KAM-500 Databook*.

In chassis ID 0, the bus controller module (KAD/BCU/101 in this example), provides X_SYNC to all the slave chassis to allow synchronization. X_SYNC is a proprietary Curtiss-Wright protocol through an RS-422 line at 1 Mbps using BIØ-L.

39.2.1.1 Setup in KSM-500

In a master/slave system, the task file in kSetup is similar to that shown in the following figure. All chassis in a master/slave system must be represented in the same task file.

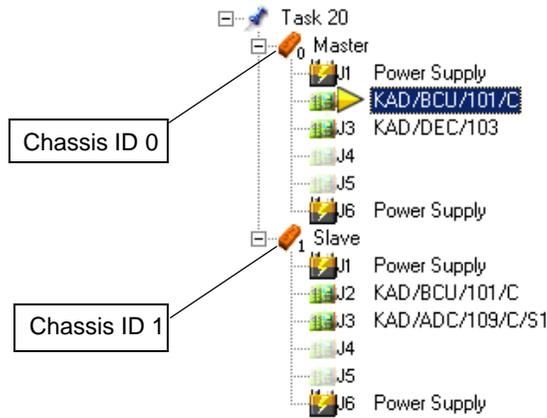


Figure 39-2: Example master/slave task in kSetup

NOTE: In kSetup, the chassis ID increments automatically for each new chassis added in the system. You can edit the ID by double-clicking on the chassis itself.

39.2.2 Bus setup

The KAD/DEC/103 has two busses. Bus setup allows an incoming PCM to be connected to the KAD/DEC/103 bus. To display options for bus setup, as shown in the following figure, double-click KAD/DEC/103. On the tabs displayed, complete the fields described in the following table.

Parameter Name	Mode	Incoming Bits	Incoming Rate	Packages	Comment
DEC_0_J3_Ch0	SW_SINCE_STATUS	N/A	N/A	None	

Figure 39-3: Bus setup

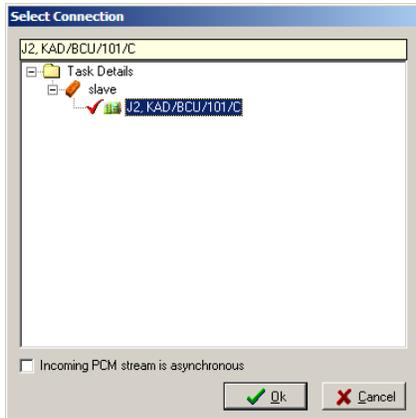
Table 39-1: Parameter settings on Bus setup

Field name	Description
Parameter Name	Name of the parameter.
Mode	Read only field. Refer to the output registers from the module data sheet for further information on the register column. The status indicates the lock from the incoming PCM. It is vital to check if an issue is seen on a parameter from the incoming PCM.
Incoming Bits	Not available in synchronous mode.
Incoming Rate	Not available in synchronous mode.
Packages	When the parameter is placed in a PCM frame, click the Packages cell to display transmission details.
Comment	User-defined text relating to the parameter.

NOTE: The KAD/DEC/103 status register checks the lock for all the incoming minor frames. To ensure you get lock for all the minor frames in the major frame, we recommend transmitting this status register at the minor frame rate of the incoming PCM. In synchronous mode, the status of the bus controller module, such as the KAD/BCU/101, must be checked to ensure X_SYNC is also in lock.

39.2.2.1 Connection

1. Click the browse button  beside the **Connection** field.
This allows the PCM encoder modules in a slave chassis to be connected in order to merge incoming PCMs streams from a slave chassis.
The following dialog box opens indicating which incoming PCMs to merge with the KAD/DEC/103 bus.



2. Select the PCM encoder module on the appropriate slave chassis, in this example KAD/BCU/101, as shown in the following figure.



39.2.2.2 Propagation delay

The propagation delay is the delay associated with the cable length used between the KAD/DEC/103 and the PCM encoder module. kSetup already compensates by setting a transparent default of 20 meters. Using a value greater than the real cable length for the propagation delay does not affect the master/slave operation.

In a standard Cat 4 cable, the propagation delay is 7 ns per meter.

X_SYNC cable length should also be taken into account when calculating the propagation delay as shown in the following example.

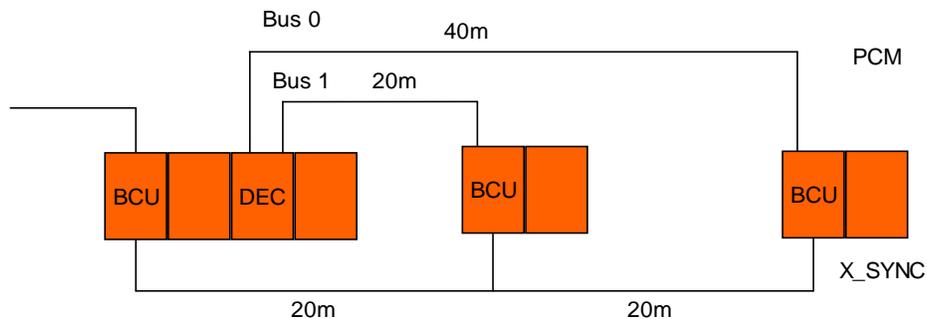


Figure 39-4: Example of a star master/slave PCM system

Consider a star master/slave PCM system with two slave chassis (see the previous figure).
Propagation Delay Bus 0: 40m PCM + 40m X_SYNC = 80m, 80m x 7 ns per meter = 560 ns.
Propagation Delay Bus 0 should be set to 560 / 125 = 5.

Propagation Delay Bus 1: 20m PCM + 20m X_SYNC = 40m, 40m x 7 ns per meter = 280 ns.

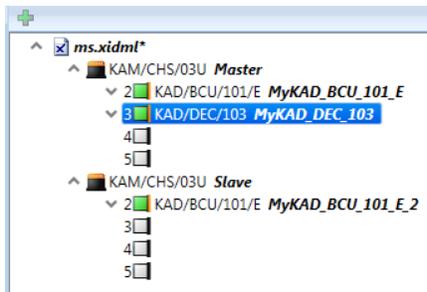
Propagation Delay Bus 0 should be set to 280 / 125 = 3.

NOTE: Using the propagation delay with a long cable could cause the KAD/DEC/103 to read the wrong minor frame, that is, it could read the wrong parameter.

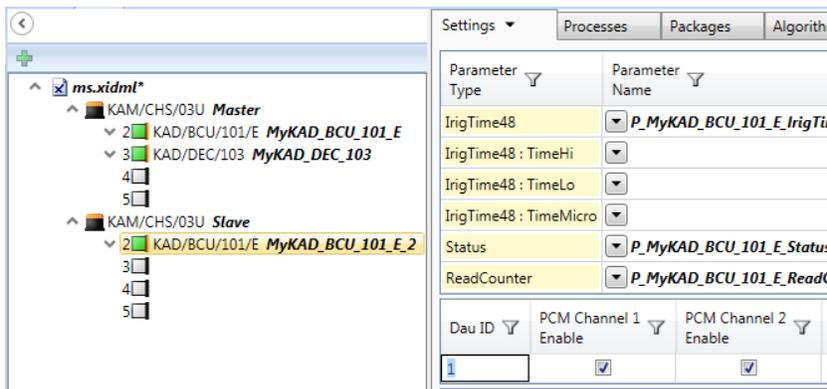
39.2.2.3 Setup in DAS Studio 3

All chassis in a master/slave system must be represented in the same XidML task file. For identification purposes, rename the chassis to Master/Slave. Then assign DAU IDs to each controller to identify the source of traffic.

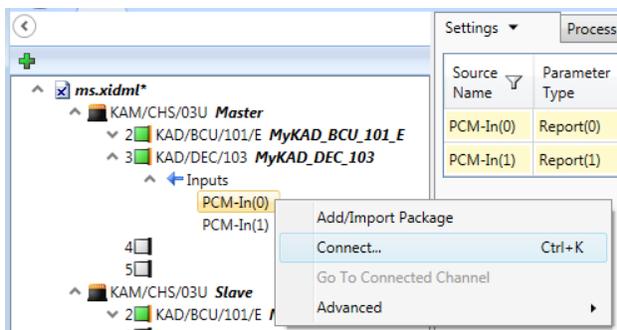
1. Configure your task file with two chassis each containing a controller module (for example KAD/BCU/101).
2. Add a KAD/DEC/103 to the first master chassis as shown below.



3. In the Navigator, click the **KAD/BCU/101** module in the **Slave** chassis and set the DAU ID to 1. (The DAU ID on the KAD/BCU/101 in the master chassis should be left at the default 0.)

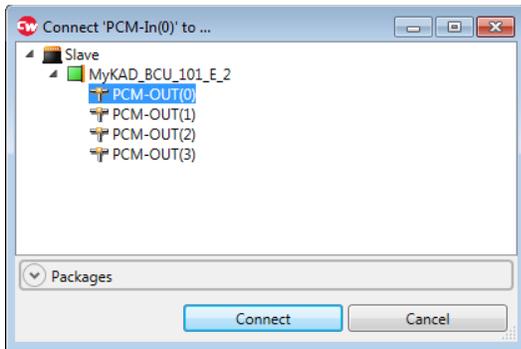


4. In the Navigator, double-click the **KAD/DEC/103** node to expand it and then double-click the **Inputs** node to expand that.
5. Right-click **PCM-In(0)** and then click **Connect**.

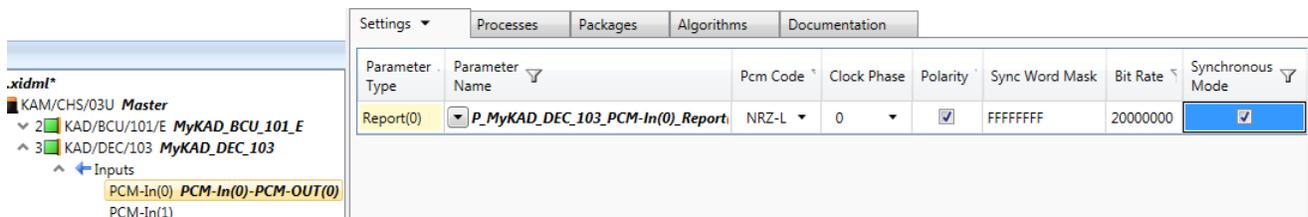


The 'Connect PCM-In' dialog box opens allowing you to connect a PCM-OUT option.

- On the **Slave**, KAD/BCU/101, select **PCM-OUT(0)** and then click **Connect**.



- On the KAD/DEC/103 **Settings** tab, ensure **Synchronous Mode** is enabled. (The **Bit Rate** setting can be ignored as this is automatically calculated by the Multi Chassis Scheduler (MCS) during compilation.)



- In the KAD/BCU/101 of the Master DAU, build your PCM frame. (Refer to the *DAS Studio 3 User Manual*.)

NOTE: The KAD/DEC/103 report register checks the lock for all the incoming minor frames. To ensure you get lock for all the minor frames in the major frame, we recommend transmitting this status register at the minor frame rate of the incoming PCM. In Synchronous Mode, the status of the bus controller module, such as the KAD/BCU/101, must be checked to ensure X_SYNC is also in lock.

39.2.2.4 PCM Stream

NRZ-L or BIØ-L can be selected as the PCM Stream. BIØ-L allows only DATA± to be wired.

39.3 Tips and troubleshooting in synchronous mode

39.3.1 Slave PCMs

KSM-500 and DAS Studio 3 software build the PCM frame between the slave chassis and the KAD/DEC/103 automatically. Care must be taken when transmitting a parameter from the slave into the master PCM. For details, see *TEC/NOT/035 - Rules of PCM placement*.

39.3.2 Daisy chain PCMs

We do not recommend the use of PCM daisy chain configuration, that is, placing a KAD/DEC/103 in synchronous mode in a slave chassis.

39.3.3 Status

In BIØ-L, the lock bit in the status remains at 1 if the KAD/DEC/103 goes out of lock. It is essential to check if the bit *Sync word since last read* is also set to 1.

39.3.4 Bus controller module and KAD/DEC/103 status

It is important to check if the KAD/DEC/103 status is in lock. It is also important to check if the bus controller module status has X_SYNC lock. The X_SYNC status not being in lock could cause the KAD/DEC/103 to go out of lock. If you don't transmit the KAD/DEC/103 status at the PCM incoming minor frame rate, you may not see the KAD/DEC/103 going out of lock.

39.3.5 RS-422

Great care must be taken when grounding (GND) a master/slave system. The PCM encoder module-to-KAD/DEC/103 connection is made via RS-422. If the GND is floating, you may damage the KAD/DEC/103 or PCM encoder RS-422 driver. For details, see *TEC/NOT/063 - Grounding and shielding of the Acra KAM-500*.

39.3.6 Out of lock

Check the KAD/DEC/103 lock and the bus controller module lock.

Ensure X_SYNC is correctly connected. Check the following with a multimeter from the master X_SYNC cable:

- that the 120 ohms between X_SYNC+ and X_SYNC- is present.
- that infinite ohms exist from X_SYNC+ and GND.
- that infinite ohms exist from X_SYNC- and GND.

Check, with an oscilloscope, X_SYNC± from the last slave getting X_SYNC. You should see a BIØ-L stream at 1 Mbps. Note that lots of AAAA in hexadecimal are transmitted so your oscilloscope may display 500 kbps.

Ensure PCM is correctly connected. Check with a multimeter from the KAD/DEC/103 cable that the DATA± and DCLK± are all connected to the PCM encoder module.

Check with an oscilloscope DCLK± and DATA± coming from the PCM encoder module.

Try to reprogram the system. This ensures the chassis ID from the slave chassis is still correct. If two chassis are set to chassis ID 0, the parameters become corrupt.

39.4 KAD/DEC/103 in asynchronous mode

When decommutating data from an encoder running asynchronously, data is parsed into a coherent buffer. All parameters that are read are guaranteed to be from the same minor frame.

39.4.1 Operation

Support for asynchronous PCM stream collection is based on the understanding that the source of the PCM stream is another Curtiss-Wright PCM encoder system.

However, support for PCM streams, which originate from third party PCM systems is possible when the frame from the third party PCM source is duplicated with a dummy Acra KAM-500 system, which emulates the third party source.

This process is described in the following steps:

1. Define a dummy Acra KAM-500 system in a new task. Build a frame on the dummy system to represent your asynchronous PCM frame from the third party PCM source.
2. Connect the PCM output of the dummy system to the appropriate bus input of the KAD/DEC/103 PCM decoder module in the main (merger) Acra KAM-500 acquisition system.
3. Transmit the asynchronous parameters on your Acra KAM-500 system, which includes PCM words, which have been merged from the asynchronous third party system.

NOTE: The KAD/DEC/103 decodes only minor frames, so there can be only one minor frame per major frame. You cannot use an SFID to reconstruct major frames in hardware. Thus, major frame reconstruction must take place at the ground station. If the size of the major frame is less than the maximum number of words per minor frame (4,096 words), we could define the entire major frame as one minor frame to help in capturing it. However, some unique syncword must be defined. Sub (super) commutated data must be processed on the ground station for proper reconstruction. A way around for a sub-commutated parameter is to mimic the major frame into one minor frame.

39.4.1.1 Example of emulating a third party source using KSM-500

Step 1: Defining a dummy Acra KAM-500 system representing the asynchronous PCM frame

Consider the following PCM:

- All data words are 10 bits long.
- The sync word is 20 bits, Barker code.
- Eight words per minor frame.
- Two minor frames per major frame.

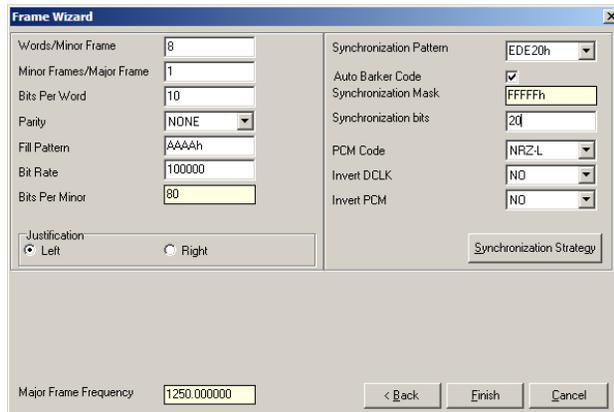
- The baud rate is 100 kbps.

See the PCM representation displayed in the following figure.

SYNC1	SYNC2	SFID	A	B	C	E	A
SYNC1	SYNC2	SFID	A	B	D		A

Figure 39-5: PCM system representation

1. Create a dummy task using a PCM encoder module.
2. Generate parameters from the PCM encoder module which contain fixed data.
3. Rename the parameters **A1**, **B**, **CD**, **E** and **A2**.
4. In the task file, double-click the **PCM encoder module** and click **Frame Builder**.
5. Build the frame setup as in the following figure.

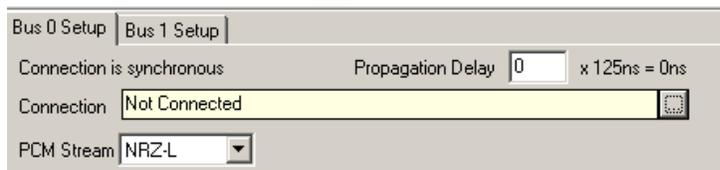


6. Place the parameters in the PCM to represent the asynchronous PCM as shown in the following figure.

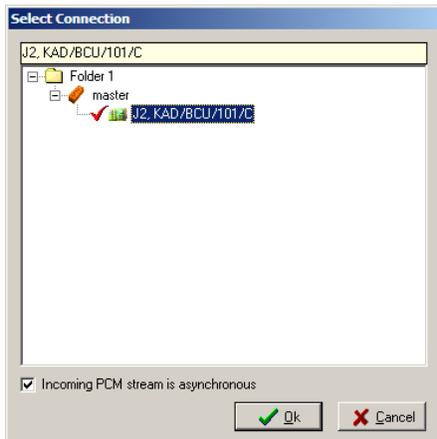
0	1	2	3	4	5	6	7
SFID	A1	B	CD	E	A2	SYNCw	ORD

Step 2: Connecting the main Acra KAM-500 to the asynchronous PCM frame

1. On your physical system task, double-click the **KAD/DEC/103** to display bus setup options, then click the browse button beside the **Connection** field **...**.



- Select the Incoming PCM stream is asynchronous field check box. Select the dummy task created in step 1 and select the corresponding dummy PCM encoder module, KAD/BCU/101 in this example.



- Click **Ok** to make any parameter set up in the dummy PCM available to the KAD/DEC/103 as a parameter as shown in the following screen.

Parameter Name	Mode	Incoming Bits	Incoming Rate	Packages	Comment
*	*	*	*	*	*
A1	ASYNCHRONOUS	10	1250	None	
A2	ASYNCHRONOUS	10	1250	None	
B	ASYNCHRONOUS	10	1250	None	
CD	ASYNCHRONOUS	10	1250	None	
DEC_0_J3_Ch0	SW_SINCE_STATUS	N/A	N/A	None	
E	ASYNCHRONOUS	10	1250	None	
SYNC_3_0_0	ASYNCHRONOUS	10	1250	None	
SYNC_3_0_1	ASYNCHRONOUS	10	1250	None	
WORD_3_0_2	ASYNCHRONOUS	10	1250	None	

Step 3: Transmitting the asynchronous parameters from your Acra KAM-500 system

All parameters (or any subset of those parameters) created on the KAD/DEC/103 can be placed in any sink module such as a KAM/MEM/103, PCM encoder, or an Ethernet transmitter.

The parameters appearing in the stream should be sampled at a frequency equal to, or greater than, the frequency at which they appear, to ensure they are all recorded. If the parameter is sampled at a lower rate, then values are skipped. Respectively, the parameter is stale if the frequency is higher.

39.4.1.2 Example of emulating a third party source using DAS Studio 3

Step 1: Defining a dummy Acra KAM-500 system representing the asynchronous PCM frame

Consider the following PCM:

- All data words are 10 bits long.
- The sync word is 20 bits, Barker code.
- Eight words per minor frame.
- Two minor frames per major frame.
- The baud rate is 100 kbps.

See the PCM representation displayed in the following figure.

SYNC1	SYNC2	SFID	A	B	C	E	A
SYNC1	SYNC2	SFID	A	B	D		A

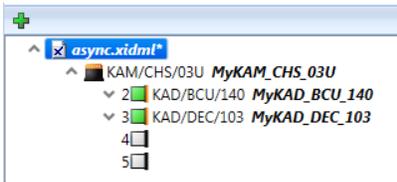
Figure 39-6: PCM system representation

1. Create a dummy task using a PCM encoder module.
2. Generate parameters from the PCM encoder module, which contain fixed data. (Refer to the DAS Studio 3 User Manual to set up fixed data.)
3. Rename the parameters **A1**, **B**, **CD**, **E** and **A2**.
4. Set up the PCM as shown in the following screen.

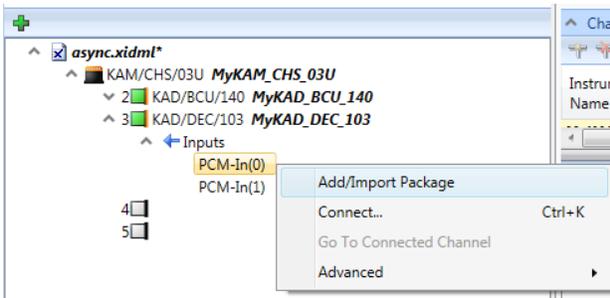
Name	Minor Frame	Value	First Location	Occurrences	Commutation	Actual Rate (Hz)	Bits	Source Chassis	Source Instrument	Source Channel
A1[15:6]	1	n/a	2	1	1:1	1250	10	MyKAM_CHS_03U	MyKAD_BCU_101_E	
B[15:6]	1	n/a	3	1	1:1	1250	10	MyKAM_CHS_03U	MyKAD_BCU_101_E	
CD[15:6]	1	n/a	4	1	1:1	1250	10	MyKAM_CHS_03U	MyKAD_BCU_101_E	
E[15:6]	1	n/a	5	1	1:1	1250	10	MyKAM_CHS_03U	MyKAD_BCU_101_E	
A2[15:6]	1	n/a	6	1	1:1	1250	10	MyKAM_CHS_03U	MyKAD_BCU_101_E	

Connecting the main Acra KAM-500 to the asynchronous PCM frame

1. Create a configuration XidML file (for example async.xidml) with the following instruments.

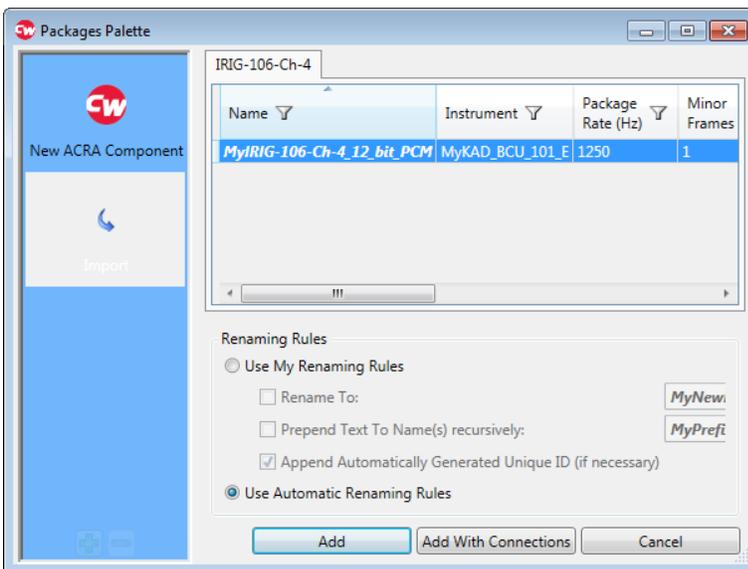


2. In the Navigator, double-click the **KAD/DEC/103** node to expand it and then double-click the **Inputs** node to expand that. In this example, channel 0 [PCM-In(0)] on the KAD/DEC/103 is used to decommutate the third party PCM from the dummy.xidml which we defined in the previous Step 1 section.
3. Right-click **PCM-In(0)** and then click **Add/Import Package**.

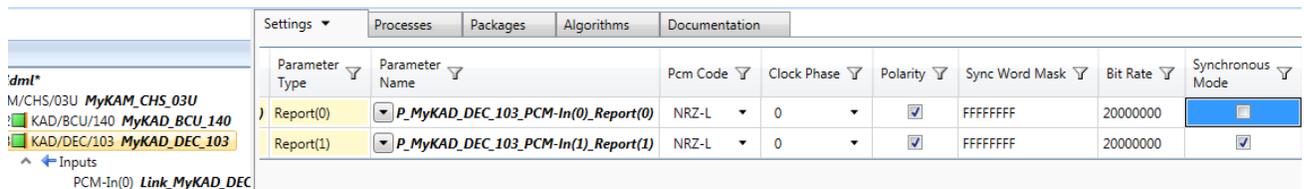


The **Packages Palette** opens.

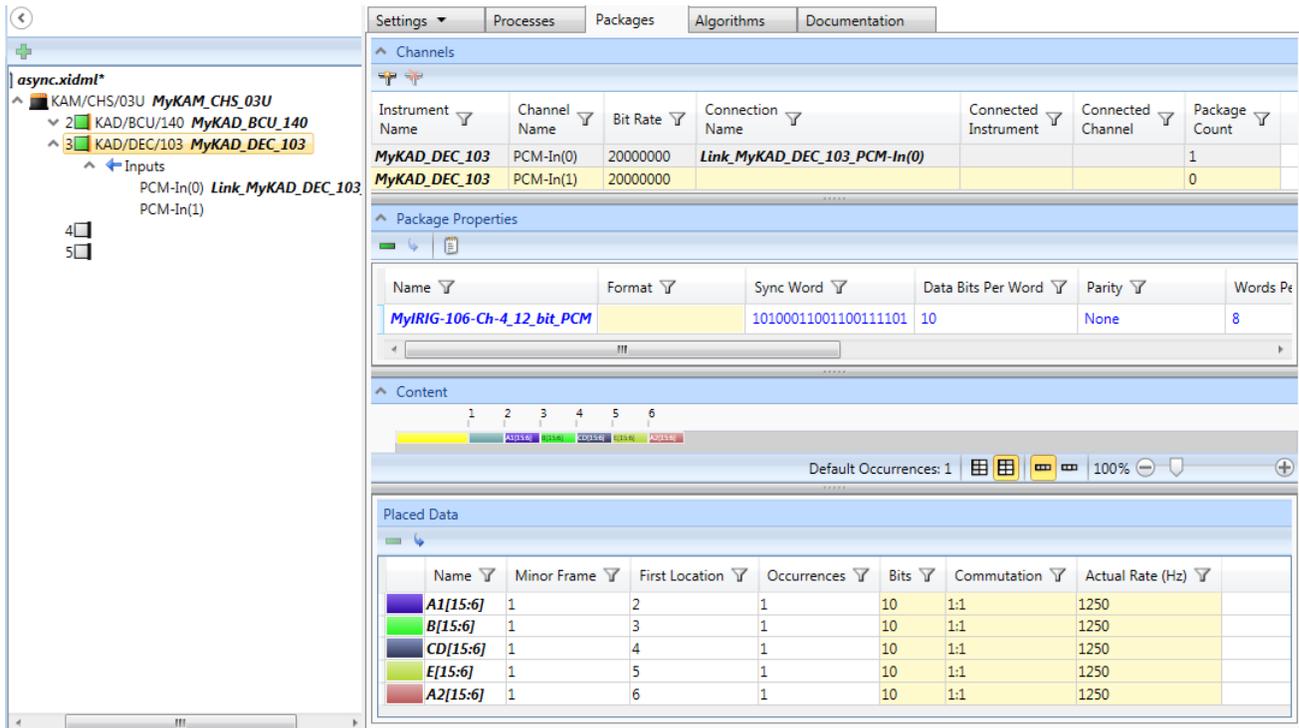
4. Click the **Import** library button and then browse to the dummy.xidml file.



5. Select the PCM package and click **Add With Connections**.
6. In the Navigator, click **KAD/DEC/103** and then click the **Settings** tab. Ensure that **Synchronous Mode** is not enabled.



- Now click the **Packages** tab. The package and parameters that were defined in the dummy.xidml are now shown in the **Package Properties** and **Content/Placed Data** panes.



Transmitting the asynchronous parameters from your Acra KAM-500 system

All parameters (or any subset of those parameters) created on the KAD/DEC/103 can be placed in any sink module such as a KAM/MEM/103, PCM encoder, or an Ethernet transmitter.

The parameters appearing in the stream should be sampled at a frequency equal to, or greater than, the frequency at which they appear, to ensure they are all recorded. If the parameter is sampled at a lower rate, then values are skipped. Respectively, the parameter is stale if the frequency is higher.

39.5 Tips for operating in asynchronous mode

39.5.1 Parameter subset

You can use all of the parameters from an asynchronous stream, or any subset of those parameters.

39.5.2 Placing asynchronous parameters

Asynchronous parameters can be placed anywhere in the main system's major frame. You can also transmit them through Ethernet or store them into a memory module.

39.5.3 Coherency

Samples from an asynchronous stream are *minor frame coherent*. In other words, samples from a frame have been sampled simultaneously, and samples from subsequent frames are also sampled simultaneously at subsequent time intervals. The KAD/DEC/103 Current Value Table (CVT) is updated only when all parameters of interest from a particular minor frame have been read.

The KAD/DEC/103 is a bus monitor in asynchronous mode. Like all the bus monitors, it uses a triple buffer.

39.5.4 Rate

Asynchronous parameters should be read slightly faster than the rate at which they arrive to ensure no loss of data, otherwise this leads to occasional stale data.

39.5.5 Status

Stale and skipped data can be identified by reading the STATUS words from the KAD/DEC/103.

Ensure that the KAD/DEC/103 is in lock, there are no errors and a synchronization word was received since the last read. If the KAD/DEC/103 is receiving data correctly, the status word displays a 6xxx in hexadecimal.