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65.1 Module overview

The AXN/PCM/401 is a 2-channel IRIG-106 PCM decoder/merger and packetizer. It can parse and/or packetize each channel at the same time. The AXN/PCM/401 parser is a triple buffer and a minor-frame decoder only.

Screen shots and descriptions of settings shown in this technical note are from DAS Studio 3 software. DAS Studio 3 is used to create a configuration, which contains the various elements that 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, refer to the *DAS Studio 3 User Manual*.

65.2 Module Settings tab

65.2.1 Setting up the incoming PCM signal

In this section you define the signal type of the incoming data for that channel.

The following figure shows PCM In settings and are described in the table that follows.

PCM In					
Source Name	Pcm Code	Clock Phase	Auto Invert	Sync Word Mask	Fill Value
PCM-In(0)	NRZ-L	0	Do Not Invert	FFFFFFF	5555

Figure 65-1: PCM settings on channel 0

Setting	Description
Pcm Code	PCM encoding used for the incoming signal.
Clock Phase	Phase of the PCM data clock. Some incoming signals may need to be 180 degrees to achieve PCM lock.
Auto Invert	Invert or Do Not Invert data polarity used to transmit data. The option Invert If Inverse Syncword found is also possible.
Syncword Mask	Indicates which bits are deemed significant in the sync word and therefore should be matched. For a 12-bit PCM, the sync word is usually 24 bits (in Baker code value of FAF320 in hex code) and the Sync Word mask should be set to FFFFFFF in hex code.
Fill Value	Value that should be read from empty parser slots.

65.2.2 Global parameters settings

Like most bus monitors, the AXN/PCM/401 has global parameters, which can be used for debugging. Refer to **Global Parameters** in the Parameter definitions table of the *AXN/PCM/401* data sheet for details.

Parameter Type	Parameter Name	Range Maximum	Range Minimum
ReadCounter	P_AXN_PCM_401_0_ReadCounter		
ModuleTemperature	P_AXN_PCM_401_0_ModuleTemperature	125	-55

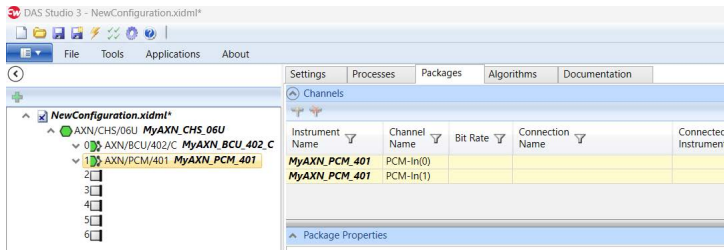
Figure 65-2: Global parameters in DAS Studio 3 Settings tab

The Report parameter is the most important parameter which needs to be monitored. This is achieved by first “65.3 Defining incoming PCM shape/rate” on page 2 and then “65.4 Adding a Report parameter” on page 3.

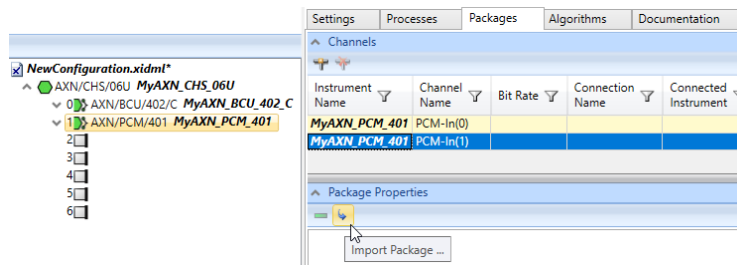
65.3 Defining incoming PCM shape/rate

In order to decode/merge or use packetizer, the incoming PCM frame shape/rate must first be defined as described below.

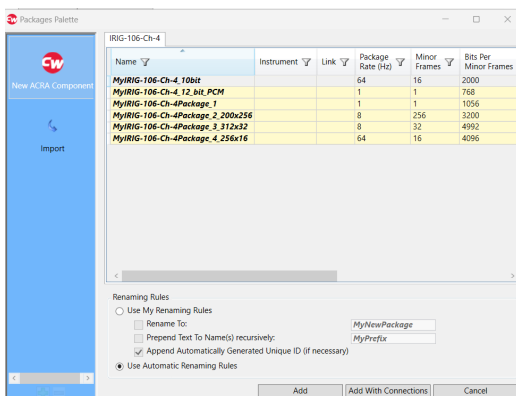
1. Select the AXN/PCM/401 in the Navigator and then click the **Packages** tab.



2. Select the bus to which the incoming PCM is connected and then click the **Import Package** button.



3. Do one of the following:
 - Select an existing PCM then modify it to match the shape/rate of the incoming PCM.



- Click the **Import** button and import a XidML for which the PCM you want to decode/package is already defined.

WARNING: The AXN/PCM/401 is a minor-frame decoder only, therefore the number of minor frames per major frame should be one.

You cannot use an SFID to reconstruct major frames in hardware. Thus, major frame reconstruction must take place at the ground station.

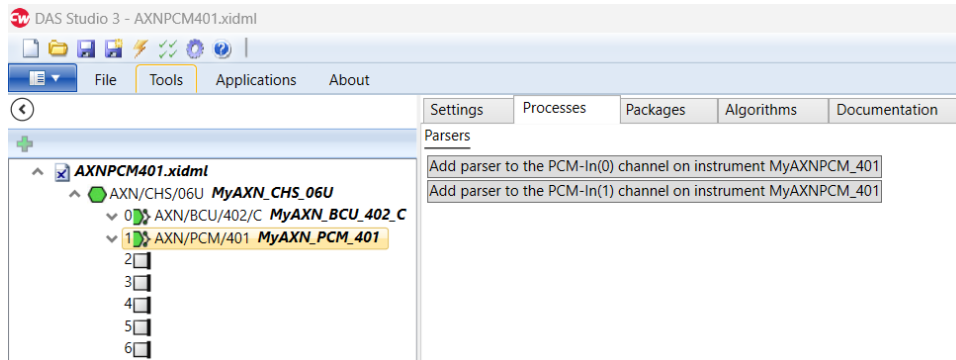
If the size of the major frame is less than the maximum number of words per minor frame (4096 words), then define the entire major frame as one minor frame to help in capturing it. However, some unique sync word must be defined. Sub (super) commutated data must be processed on the ground station for proper reconstruction. A way around for a sub-commutated parameter is to mimic the major frame into one minor frame.

65.4 Adding a Report parameter

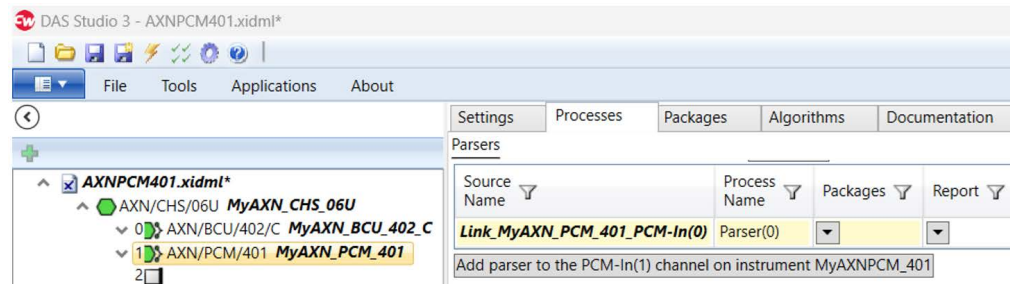
The Report parameter is useful for status monitoring. It reports information such as skip (one or more minor frame loss) and stale (repeated minor frames).

To add a Report parameter, the PCM must already be defined as described in the previous section. Refer to the following.

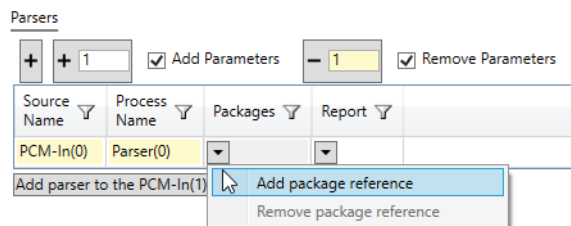
1. With the AXN/PCM/401 selected in the Navigator click the **Processes** tab.



2. Click **Add parser to the PCM-In(0) channel on Instrument**.
A Parser(0) process is added.

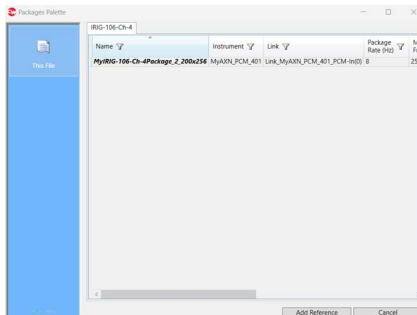


3. Click the **Packages** arrow and then click **Add package reference**.

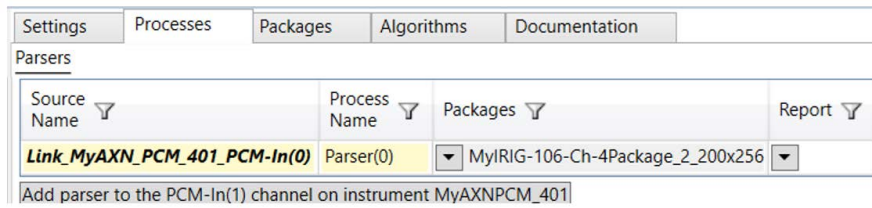


The **Packages Palette** dialog box opens showing the PCM frame(s) created in the **Packages** tab.

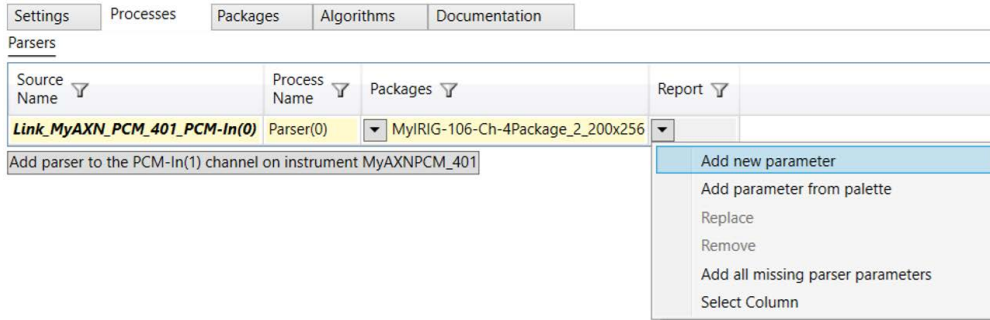
4. Select the desired PCM frame and then click **Add Reference**.



The PCM frame appears in the **Packages** field.



- Click the **Report** arrow and then click **Add new parameter**.

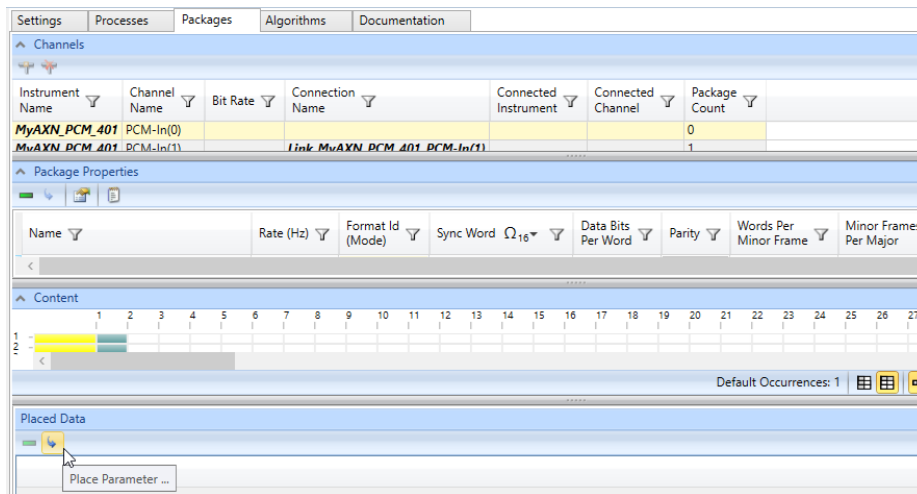


A Report parameter (default name MyReport) is added.

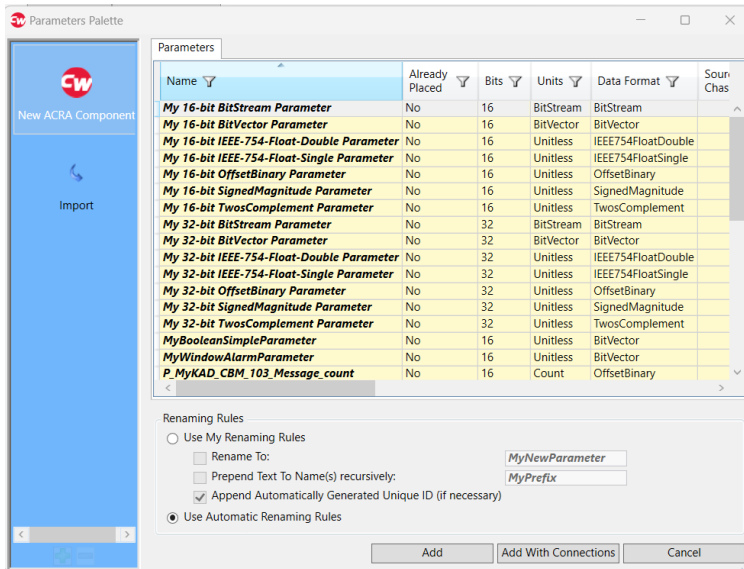
65.5 Decode/merge operation

If when following “65.3 Defining incoming PCM shape/rate” on page 2, you did not import an existing PCM, then you need to define the parameters as shown here.

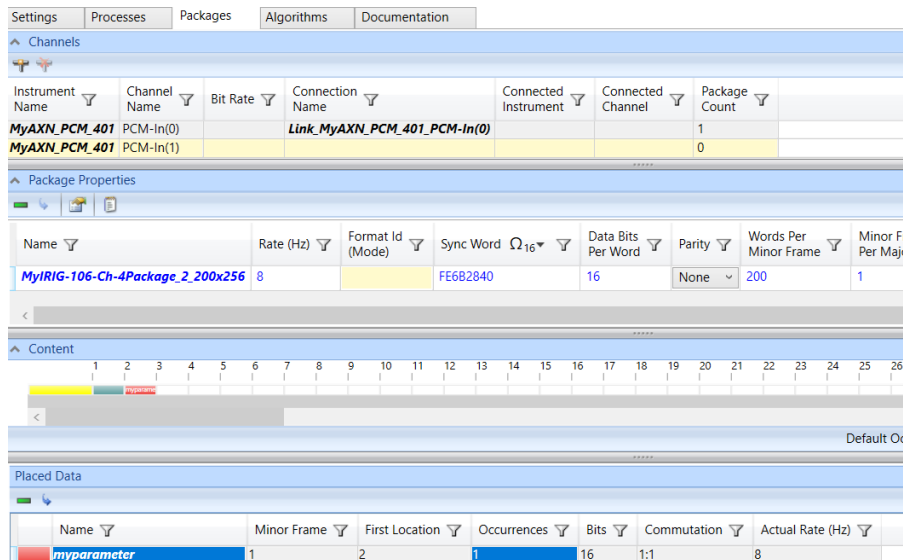
- With the AXN/PCM/401 in context, select the **Packages** tab and then click the **Placed Data** arrow.



2. In **Parameters Palette**, select a parameter and then click **Add**.



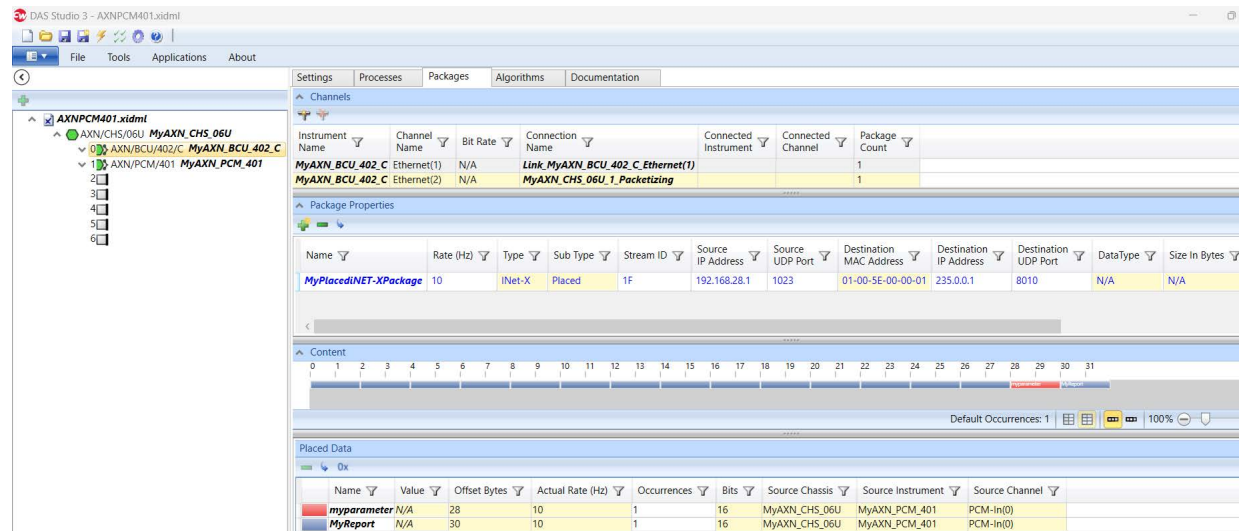
3. Rename the parameter and change its word position as required.



NOTE: The AXN/PCM/401 decodes asynchronously the incoming PCM. As per any bus monitor, to avoid data loss (skipped samples), it is recommended to read the resulting parameter faster (by oversampling) than the asynchronous incoming data rate. For this reason, you should monitor the Report word to identify stale samples (repeated data).

The following figure shows an example of the parameter decoded by the AXN/PCM/401 being received at 8 Hz but read on the AXN/BCU/402 at 10 Hz to ensure no data drops. The expected result is eight valid samples and two samples reported

as stale (repeated data).



65.6 Packetizer operation

Independently of the parser, when packetizer is enabled, a packet stream is generated for each channel. For iNET-X, all received bytes are encapsulated in an iNET-X bit-aligned payload structure. These bit-aligned packets may be transmitted aperiodically to optimize network bandwidth utilization and memory usage when recording serial traffic.

There are many settings available to configure or tune packetizer behavior. The packetizer settings are shown in the following figure and described in the table that follows.

Source Name	Packetizer Format	Stream Id	IENA Key	Packetization Enabled	Packetization Sink	Channel Id	UDP Transfer Header Format	Source Id	IENA Type	Max Packet Payload Size
Link MyAXN_PCM_401_PCM-In(0)	iNET-X	12	0	<input checked="" type="checkbox"/>	All	FFFF	N/A	FF	Q	511
PCM-In(1)	iNET-X	FFFFFFF	0	<input type="checkbox"/>	All	FFFF	N/A	FF	Q	511

Figure 65-3: Packetizer settings

Setting	Description
Source Name	Channel to packetize.
Packetizer Format	iNET-X, IENA or Chapter 10. This setting defines the packetizer format for all channels.
Stream ID	iNET-X stream identifier for selected channel.
Channel ID	Chapter 10 channel ID for selected channel.
UDP Transfer Header Format	UDP transfer header format used to wrap Chapter 10 packets for streaming.
SourceID	Source ID used when streaming Chapter 10 packets in UDP transfer header format 3.
IENA Type	Q - Describes the IENA parameter type of the packet payload.
IENA Key	IENA Key for selected channel.
Max Packet Payload Size	The number of words in the packet buffer, ranges from 200 words to 722 words for iNET-X packets and from 200 words to 710 words for IENA and Chapter 10 packets.
Packetization Enabled	Enables the generation of a stream of packets containing messages from this channel. DAS Studio 3 automatically creates a packetizer packet after verification/programming.

For further information regarding iNET-X packets used by the packetizer refer to *TEC/NOT/067 - IENA and iNET-X packet payload formats*.

NOTE: Since data in the packetizer packet is bit-aligned, no alignment to the sync word is enforced. Therefore, when monitoring incoming packets with a software tool such as Wireshark, the sync word may not show up in the expected pattern 0xFE6B2840, but for example, as 1 bit shifted; that is, 0x7F35 9420 or 0xFCFCD 65080.

Curtiss-Wright IADS is currently working on providing support for iNET-X bit-aligned packets in IADS.

NOTE: IADS does not currently support this Chapter 10 format nor IENA Q/M.

65.7 Enabling packetizer

To turn on packetizer operation on any channel, define a unique stream ID for that channel and then select the Packetization Enabled check box for that channel as shown in the following figure. The packetizer is enabled the next time the module is programmed.

Source Name	Packetizer Format	Stream Id	IENA Key	Packetization Enabled	Packetization Sink	Channel Id	UDP Transfer Header Format	Source Id	IENA Type	Max Packet Payload Size
Link_MyAXN_PCM_401_PCM-In(0)	iNET-X	1212	0	<input checked="" type="checkbox"/>	All	FFFF	N/A	FF	Q	511
PCM-In(1)	iNET-X	FFFFFFFF	0	<input type="checkbox"/>	All	FFFF	N/A	FF	Q	511

Figure 65-4: Packetization Enabled setting

NOTE: DAS Studio automatically creates packetizer packets on the aperiodic transmitter (such as the AXN/BCU/402). The bit-rate is always N/A. This value is not used by the Axon hardware.

Instrument Name	Channel Name	Bit Rate	Connection Name	Connected Instrument	Connected Channel	Package Count
MyAXN_BCU_402_C	Ethernet(1)	N/A	Link_MyAXN_BCU_402_C_Ethernet(1)			1
MyAXN_BCU_402_C	Ethernet(2)	N/A	MyAXN_CHS_06U_1_Packetizing			1

Name	Rate (Hz)	Type	Sub Type	Stream ID	Source IP Address	Source UDP Port	Destination MAC Address	Destination IP Address	Destination UDP Port	Data Type	Size In Bytes	Target Size
AXNPCM401_1212	N/A	iNET-X	Parser aligned	1212	192.168.28.1	1023	01-00-5E-00-00-02	235.0.0.2	8010	PCM	N/A	1036

Figure 65-5: AXN/BCU/402 packages showing a packetizer created by DAS Studio after verification/programming

65.8 Appendix

65.8.1 Troubleshooting

If you get the Fill Value for the AXN/PCM/401 decoded parameters, it means the module is not receiving the incoming PCM. In this case, try the following:

1. Monitor the Report parameter. The PCM is in lock if bit 13 is at 1.
2. If NRZ-L or any clocked line codes are used, enable packetizer to check if packets are being received with Wireshark.
3. Check if the incoming PCM shares the same ground (GND) as the Axon system.
4. Use an oscilloscope to check that DATA+, DATA-, DCLK+ and DCLK- are referenced to GND (unipolar) at the mating connector going to the AXN/PCM/401 module.
5. Ensure the number of bits per minor frame, bit-rate and PCM code match the incoming PCM.
6. Invert the clock phase.

65.8.2 Fragmentation

Fragmented parameters are not handled automatically. For example, a 16-bit parameter placed on a fixed word size PCM of 12 bits, is fragmented into two words. You must define these two words in DAS Studio and concatenate them in order to reconstruct the 16-bit parameter on post processing.

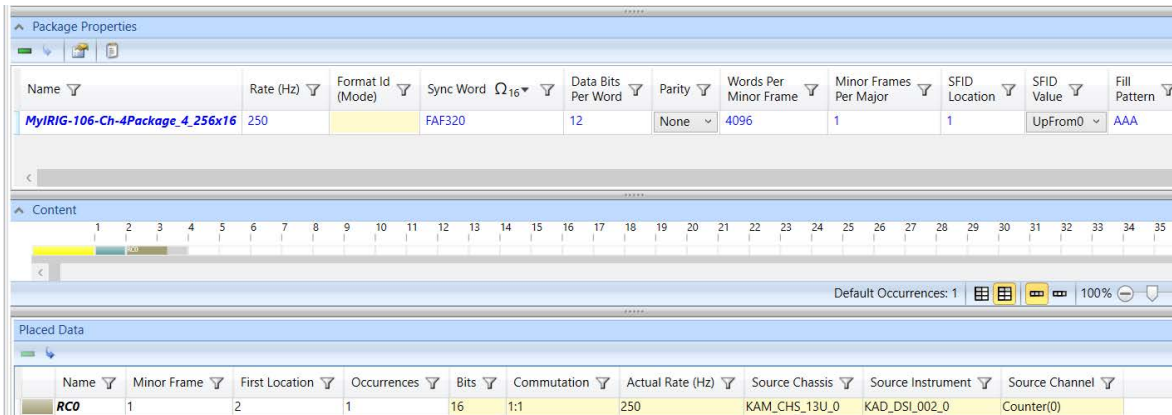


Figure 65-6: Example of a 16-bit parameter placed on a 12-bit word size PCM

After you import the above PCM to the AXN/PCM/401, the following screen is shown.

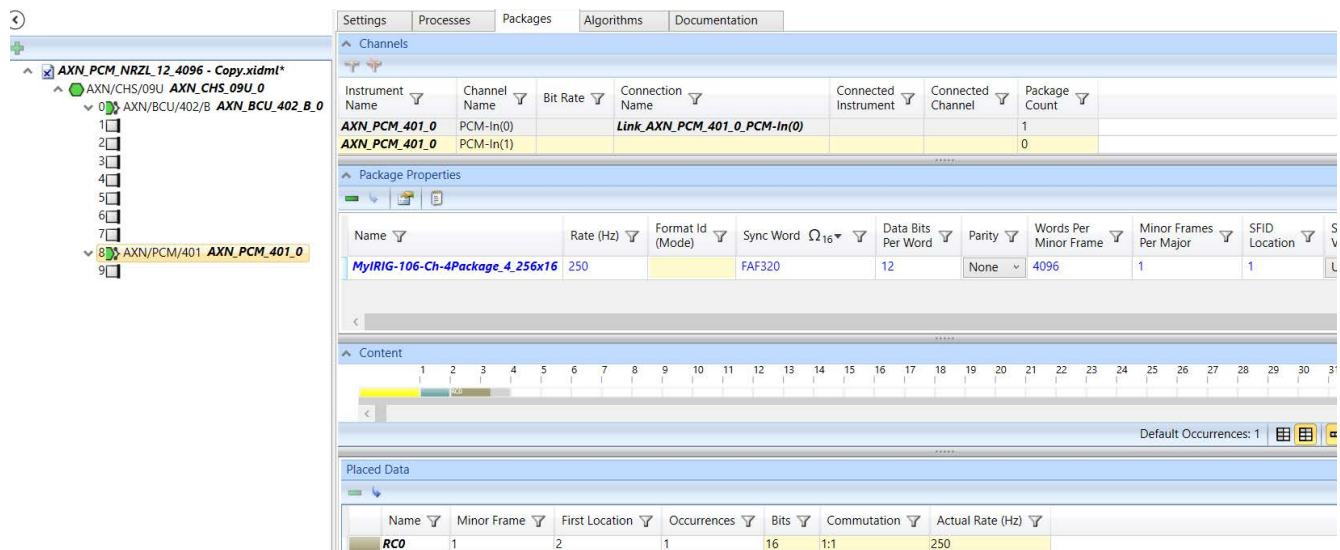


Figure 65-7: Showing a 16-bit parameter from a 12-bit word size PCM imported to the AXN/PCM/401

The four LSBs of the parameter RC0 will read 0s. You need to remove the parameter and add 2 × 12-bit parameters in order to capture the whole 16-bit parameter, then process it as shown in the following figure.

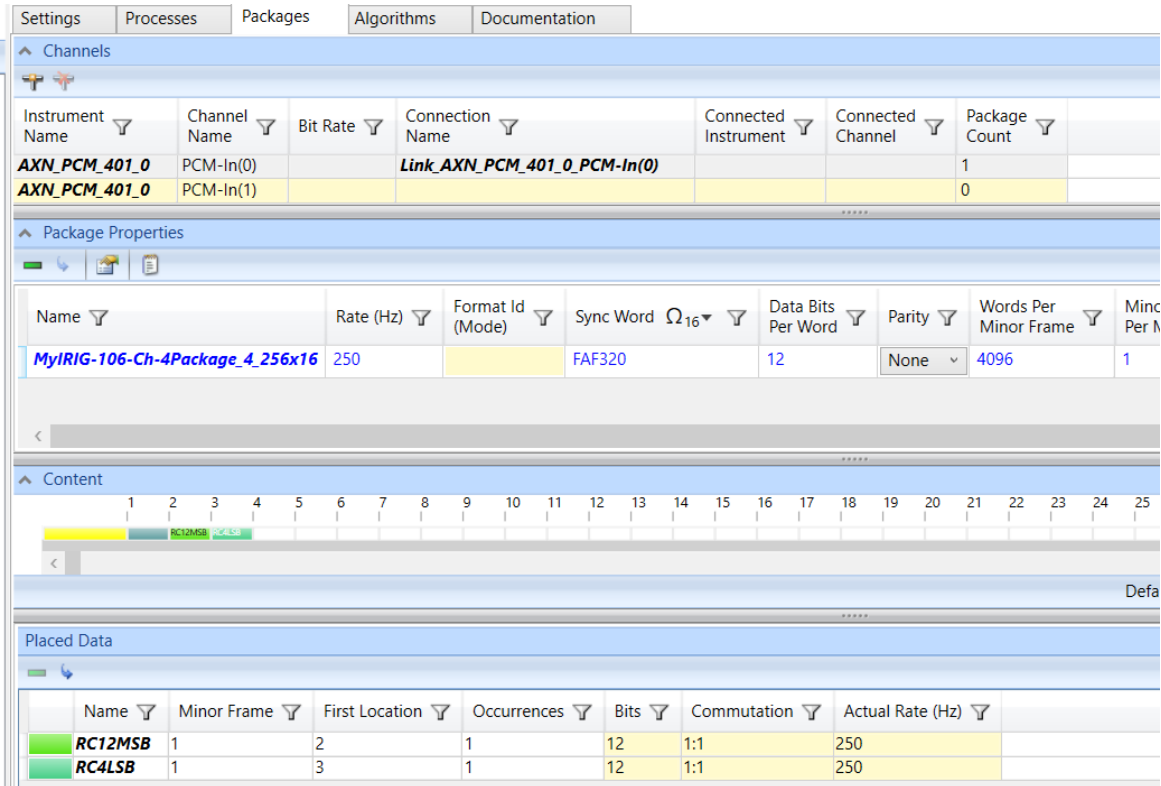


Figure 65-8: Showing a 16-bit parameter being fully captured from a 12-bit word size PCM

65.8.3 Recommended reading

To better understand this paper, read the following documents.

Table 65-1: Data sheets

Document	Description
AXN/PCM/401	IRIG-106 PCM decoder/merger and packetizer (40 Mbps) - 2ch

Table 65-2: Technical notes

Document	Description
TEC/NOT/063	Grounding and shielding of the Axon and Acra KAM-500
TEC/NOT/067	IENA and iNET-X packet payload formats

Table 65-3: User manual

Document	Description
DOC/MAN/030	DAS Studio 3 User Manual

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