# AXN capabilities and FAQ

TEC/NOT/092

This document is for readers already familiar with KAM-500 architecture who would like to know the differences from a feature and system architecture point of view between KAM-500 and AXN.

This document discusses aspects of AXN other than its smaller size, lower weight, and higher bandwidth as compared with KAM-500.

This paper is divided into the following sections:



## 61.1 AXN system architecture

The AXN/BCU/402 has an internal switch with two 1-Gbps ports; the internal switch also supports a 100-Mbps link. This allows various configurations such as the following:

- Daisy chain configuration with AXN
- Connecting 3rd party devices directly to an AXN/BCU/402 switch
- Daisy chain configuration with KAM-500

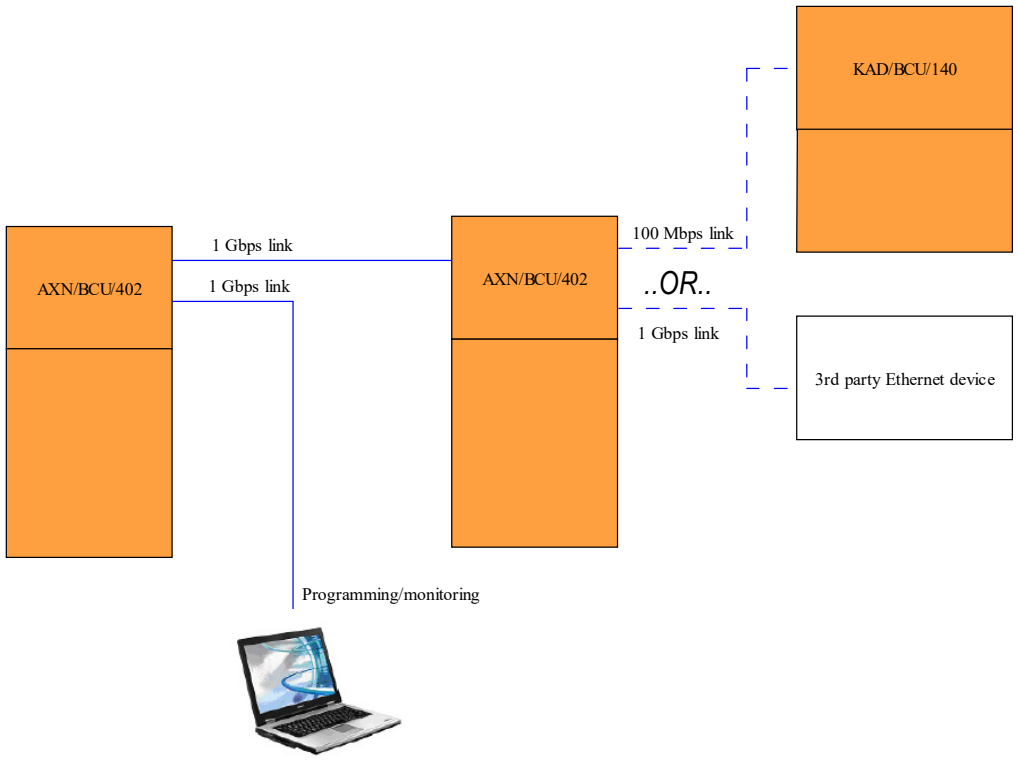


*Figure 61-1: AXN network system using the internal switch from the AXN/BCU/402*

**NOTE:** Daisy chain configuration is supported from the AXN/BCU/402/B onwards.
The AXN/BCU/402 has two ports, therefore, as the previous figure illustrates, either a KAD/BCU controller or a 3rd party device can be connected at a time; but not both.

The AXN/BCU/402 supports PTPv2 and PTPv1 Grandmaster allowing the system (see the following figure) to be synchronized. The AXN/TCG/401 connected to GNSS (GPS and GLONASS simultaneously) provides time to the system.

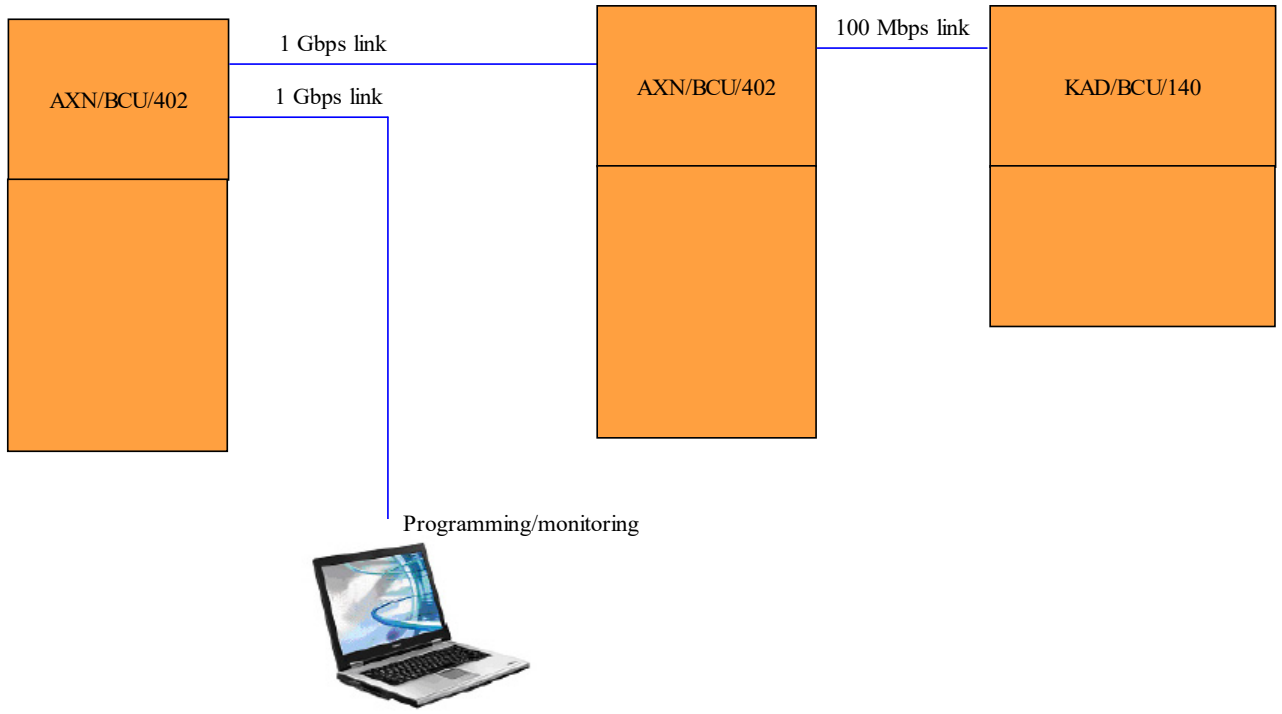


*Figure 61-2: AXN network system with the AXN/BCU/402 as a PTPv2 Grandmaster*

**NOTE:** Time code generation functionality is supported from the AXN/TCG/401/B onwards.

The AXN/ENC/402 can be used for telemetry. It can achieve 40 Mbps while the KAD/ENC/106 is limited to 20 Mbps.

Unlike KAM-500, the AXN/ENC/402 has a mini Ethernet bus monitor to allow parsing of remote chassis and 3rd party devices; an additional module such as the KAD/EBM/102 for the KAM-500 is not required to run the Multi Chassis Scheduler (MCS). It can also handle burst packets due to the deep buffer.

The AXN/ENC/402 is also capable of transmitting IRIG-106 Chapter 7 PCM streams containing wrapped Ethernet frames as well as IRIG-106 Chapter 4 PCM streams. These wrapped Ethernet frames include packetizers packets from remote chassis as shown in the following figure.

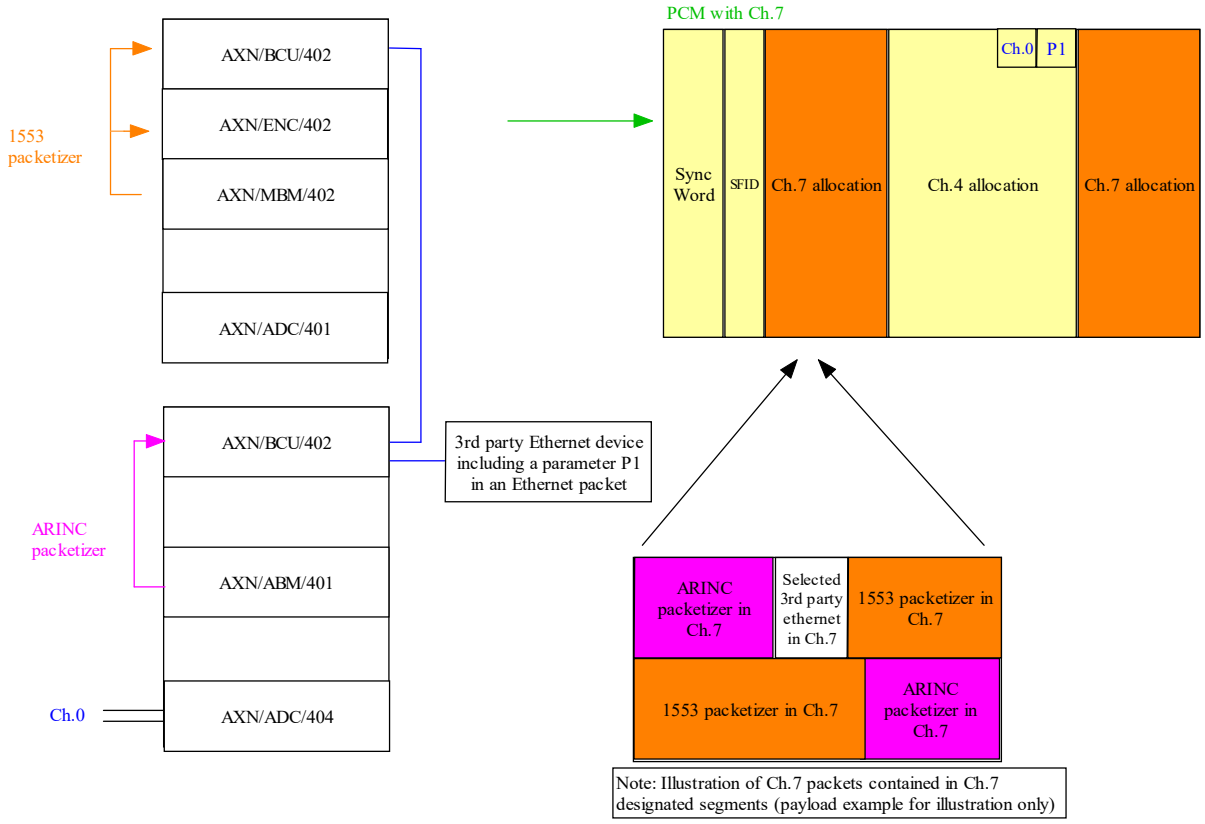


*Figure 61-3: AXN network system with the AXN/ENC/402 Chapter 7*

## 61.2 Axonite

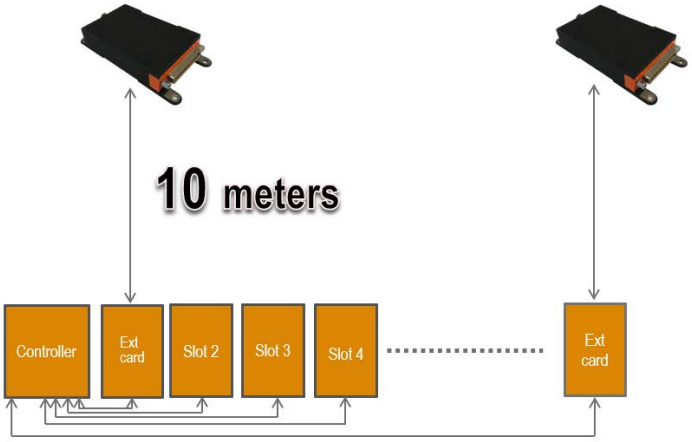


*Figure 61-4: Axonite ten meters away from an AXN chassis*

The Axonite (AXN/ITE/01U) allows AXN user modules to be housed remotely from the AXN chassis (up to ten meters) and include the following features:

- Designed to fit into compact spaces.
- Reduces heat generated in the chassis.
- Greater heat dissipation due to the greater relative surface area for the module to dissipate heat.
- Modules can be located closer to sensors resulting in a shorter connection between module and sensor.
- Reduced signal-to-noise ratio.
- Reduce system wiring.

There is no enforced software or hardware limit to the number of Axonites you can use in a chassis; the limiting factor is the available power.

## 61.3 ADC

AXN analog modules follow the same concept as analog modules in KAM-500, however AXN ADC modules have more capabilities as described in the following sections.

### 61.3.1 Multiple output data streams

Three output data streams per channel, which allow different settings per channel such as filter cutoff frequency (Fc) and filter type (IIR/FIR per streams and sampling frequencies [Fs]). These output data streams allow you to have different filtering schemes depending on the transmission such as the following examples:

Stream 1 to PCM for real time transmission to ground station at 32 Hz with Fc = Fs/4 so Fc = 8 Hz and Filter type = IIR8 (IIR8 has the lowest latency)

Stream 2 to onboard monitoring at 256 Hz with Fc = Fs/4 so Fc = 64 Hz and Filter type = IIR16

Stream 3 to recorder at 1024 Hz with Fc = Fs/4 so Fc = 256 Hz and Filter type = FIR (FIR has a constant delay, that is, 4/Fc on the AXN/ADC/401, which simplifies post processing parameter correlation compared to IIR8 or IIR16 for which the filter delay is dependent on the signal input frequency)

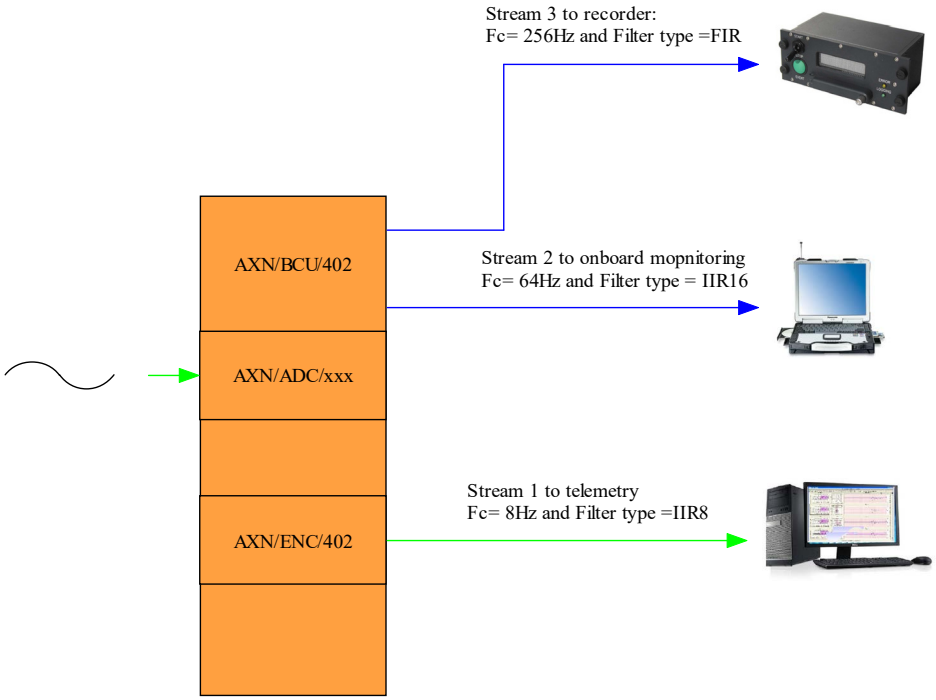


*Figure 61-5: Example of 3 streams per channel*

### 61.3.2 Auto-balance

Auto-balance is done digitally to speed up the balancing process; compare this to the balance current used on KAM-500, which requires reprogramming for each iteration. That is, AXN is faster than KAM-500 at balancing channels taking just a few seconds per module or several modules in parallel.

### 61.3.3 User compensation

User compensation per channel can be used to include user calibration/correction of module channels and external sensor/cabling errors compensation.

### 61.3.4 Linearization

Linearization URL per channel can be used to linearize a non-linear sensor.

### 61.3.5 Different IIR and Fc filtering

AXN ADC modules supports per stream FIR, IIR8 (8th order filter) and IIR16 (16th order filter). IIR8 is similar to the IIR used on the KAM-500 (passband is flatter and phase is different).

AXN ADC modules support the same KAM-500 Fc but also support additional Fc, such as Fc = Fs/2.5 or Fs/3. These cut-off frequencies are commonly used by products designed by Curtiss-Wright or for compatibility with non Curtiss-Wright DAUs.

### 61.3.6 BIT

AXN ADC modules have a built-in temperature sensor on the module motherboard that can be monitored via a parameter called ModuleTemperature indicating its temperature. This parameter can be used as a reference temperature for customer-defined linearization tables.

Most AXN ADC modules have a Temperature sensor on the top block of the module. This can be used as a cold junction for Thermocouple sensor operation.

Some AXN ADC modules have a REPORT word, which mentions if a channel is not responding.

## 61.4 Bus monitor

AXN bus monitor modules follow the same concept as bus modules in KAM-500 (parser and packetizer), however the AXN bus monitors modules have more capabilities as described in the following sections.

### 61.4.1 Packetizer filtering

You can specifically select messages you want to place/remove from the packetizer.

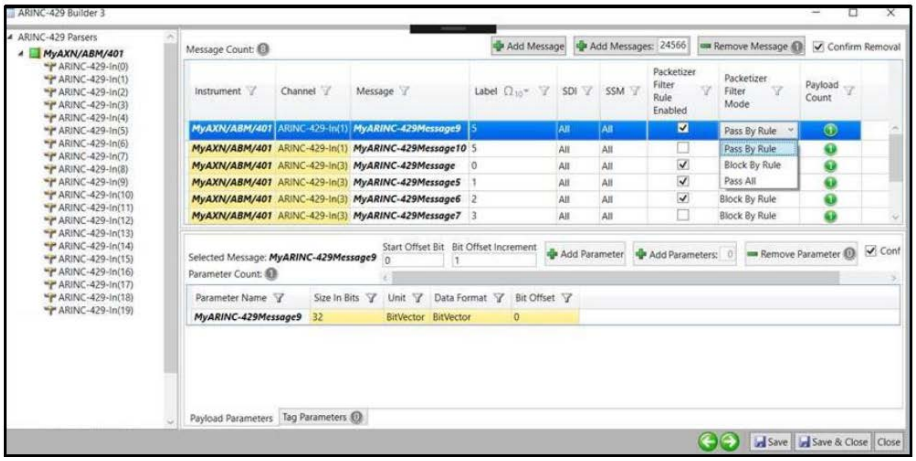


*Figure 61-6: DAS Studio ARINC-429 builder showing the messages to be filtered on the packetizer*

### 61.4.2 IENA/Chapter 10 packetizer

Unlike KAM-500, which only supported IENA P and iNET-X, most AXN bus monitors modules support Chapter 10 and IENA formats (such as D or N).

## 61.5 FAQ

| Question | Answer |
|---|---|
| Does AXN use the same connector as KAM-500? | AXN uses the same double-density connector as KAM-500. However the AXN/BCU/402 pin-out is different to the KAD/BCU/140; this is to allow a higher isolation voltage.<br>Also the power connector is different; the AXN power connector allows for a higher current up to 100W. |
| Does AXN support In Service Programming (ISP)? | AXN supports ISP. ISP allows customers to program firmware and the FPGA of AXN modules without the need to return modules to Curtiss-Wright for updates. |
| Why are AXN/BCU/xxx controllers not located closer to the AXN PSU as is the case with KAM-500? | The location of AXN/BCU/xxx controllers allows for better heat distribution. |
| What is the maximum power consumption on AXN? | The AXN backplane provides a single, shared, 15V power line to all user modules, with up to 100W of power available from the PSU (KAM-500 PSU is maximum 81W). This single power line (15V) offers greater flexibility for higher density of excitation channels in a single chassis compared to the split power rails of the KAM-500 design. This means on AXN, all unused power is available for excitation. |
| KAM-500 has a setting to adjust for leap seconds. Why does AXN not have this setting? | Leap seconds are adjusted automatically by AXN. AXN programs a serial EEPROM transparently when a leap second occurs. |
| KAM-500 supports snarfer. How is the same concept achieved with AXN? | AXN supports packetizer, which can be transmitted over telemetry using Chapter 7. |
| What is the bandwidth of AXN compared to KAM-500? | KAM-500 is limited to an access rate of 2 Msps (so 32 Mbit/s) using a KAD/BCU/140/D 100 Mbps link. The AXN/BCU/402/C supports Gigabit link with AXN user modules and 380 Mbps data throughput to external Ethernet connections. |
| Can KAM-500 and AXN work together? | Yes. Users already familiar with KAM-500 can seamlessly upgrade their systems by adding AXN. KAM-500 and AXN can be time synchronized on a network and produce coherent data. DAS Studio 3 allows setting up and programming of this type of hybrid system. IADS software also supports these configurations. |

## 61.6 Related documentation

To better understand this paper, read the following documents.

| Document | Description |
|---|---|
| DOC/DBK/011 | AXN Databook |
| TEC-NOT-089 | Using DAS Studio 3 to configure the AXN/ENC/402 |