OEM Preamplifiers for Amptek X-Ray Detectors

NOTE: If you are using the Amptek DP5/PC5 with the PA-210/PA-230 you do not need any of the information in this document. All the power supplies, connections, and grounding are taken care of by those two boards. This is an advantage of using the DP5/PC5.

The AXR/PA210 or AXR/PA-230 alone, is for experts/OEMs in the field. Any Amptek detector can be used (Si-PIN, SDD, or CdTe). There are many options for this configuration as can be seen in the pictures below.

The customer needs to provide custom heat-sinking and a custom enclosure for the AXR/PA210 or AXR/PA210. If the PA210/PA230 Housings are used, additional heat-sinking to the Housings will be needed.

Additionally, the customer must provide several external power supplies, a shaping amplifier and MCA, or digital processor, and communication with the host computer.

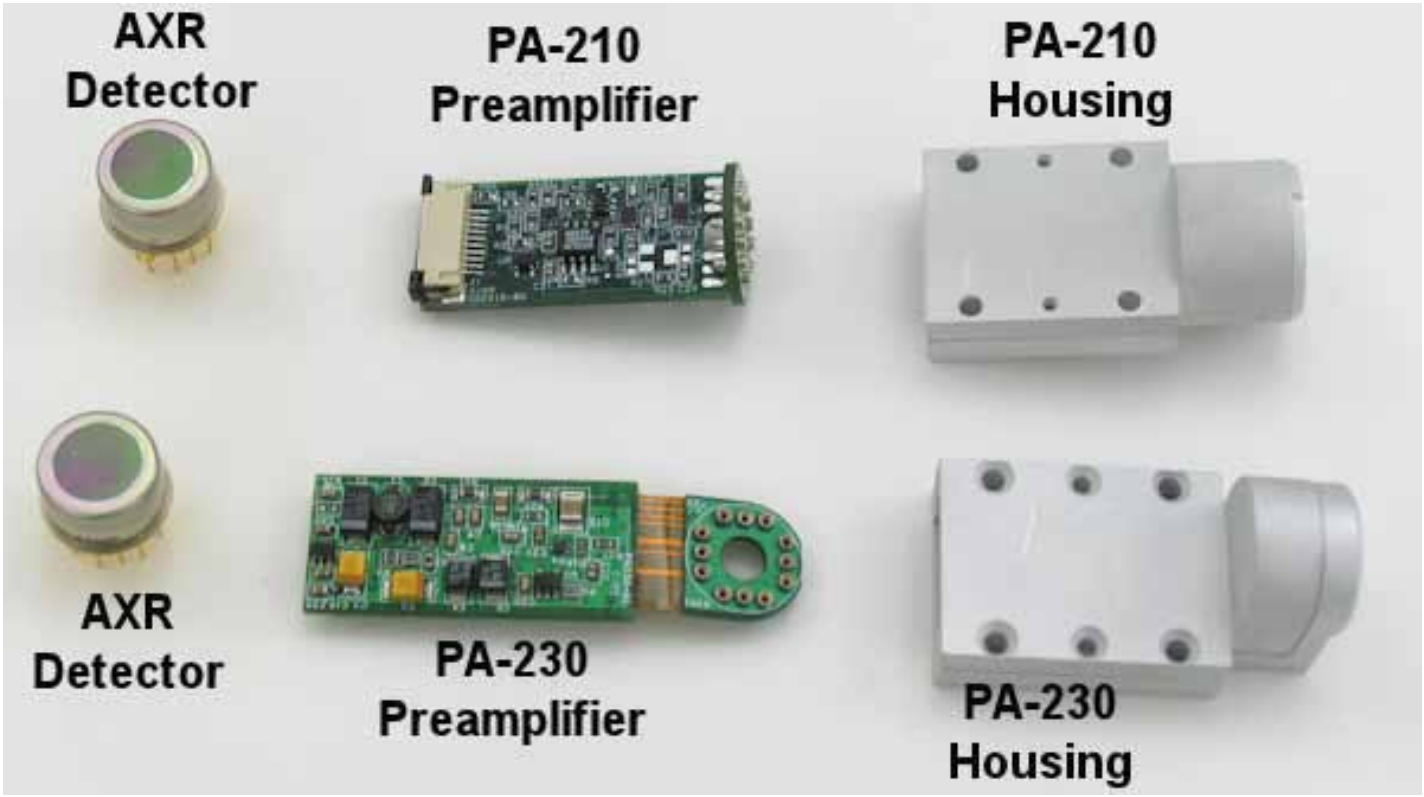

Figure 1. AXR Detector, PA-210 or PA-230, Housing.

PA-210 and PA-230 Electrical Connections

Notes

- The electrical diagram and pin connections below are for both the PA-210 and PA-230.
- The Si-PIN Detectors require positive High Voltage (+HV) and produce a negative output pulse.
- The Silicon Drift Detectors (SDD) require negative High Voltage (-HV) and produce a positive output pulse.
- Make sure to use the correct High Voltage polarity for the appropriate detector.
- The connector does not have contacts on both sides. Connect the flex cable accordingly such that the contacts on the flex cable connect to the contacts in the connector.

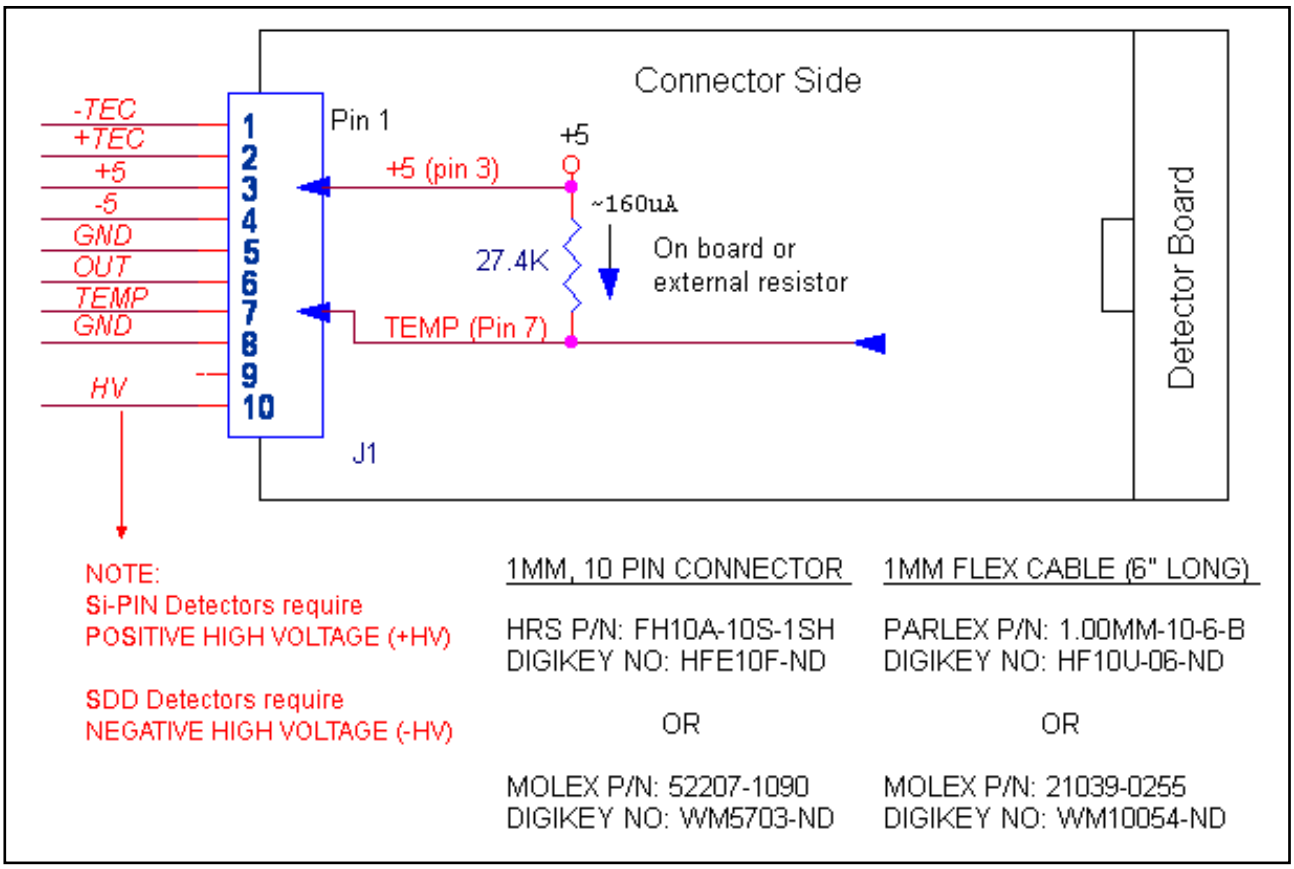

Figure 2. PA-210/PA-230 Connection Diagram.

Pin Connections

Pin 1	Cooler Return	Best to connect to ground at cooler power supply
Pin 2	Cooler Supply	Current = 350 mA maximum Voltage = 3.6 V maximum with <100 mV peak-to-peak noise
Pin 3	Preamp +5 V DC	+5 V DC, 15 mA with no more than 50 mV peak-to-peak noise
Pin 4	Preamp -5 V DC	-5 V DC, 15 mA with no more than 50 mV peak-to-peak noise
Pin 5	Ground (signal return)	Connect to signal return (processor/shaping amplifier ground)
Pin 6	Signal Out	Connect to input of shaping amplifier or digital processor
Pin 7	Temp	Temperature diode, see figure 3 below
Pin 8	Ground	Chassis Ground
Pin 9	N/C	N/C
Pin 10	High Voltage (HV)	Si-PIN (positive HV): +100 to +200 V @ 1 µA (varies for different detector types) very stable <0.1% variation SDD (negative HV): -85 to -200 V @ 25 µA (varies for different detector types) very stable <0.1% variation

PA-210 and PA-230 Electrical Connections (con't)

Temperature Diode and Cooler Control

Pin 3 to Pin 7 resistor (R19) is to supply current to the temperature diode.

- The 27.4K (R19) resistor can be external to the PA210/PA230, or on the board. It will supply 160 uA to the diode. See Figure 3 for conversion of mV to temperature for this current.
- If connected to the DP5/PC5 the resistor is not needed. The DP5/PC5 supplies its own current to the diode and reports the temperature in Kelvin in the software.
- The user must use the temperature diode for close loop control of the cooler, not just to read out the temperature of the detector.
- The detector must be kept at a constant temperature to ensure stable operation.
- The cooler has a maximum temperature differential of 85 °C.
- At a minimum the OEM should regulate the temperature to 230 K (-43 °C). This will give roughly 10 to 15 degrees of headroom. This means that the instrument temperature plus room temperature can rise 10 to 15 degrees and the detector will stay at 230 K. This would accommodate an ambient temperature of about 30 to 35 °C. If the instrument needs to be run in even warmer environments, then the detector must be operated warmer in order to maintain stability.

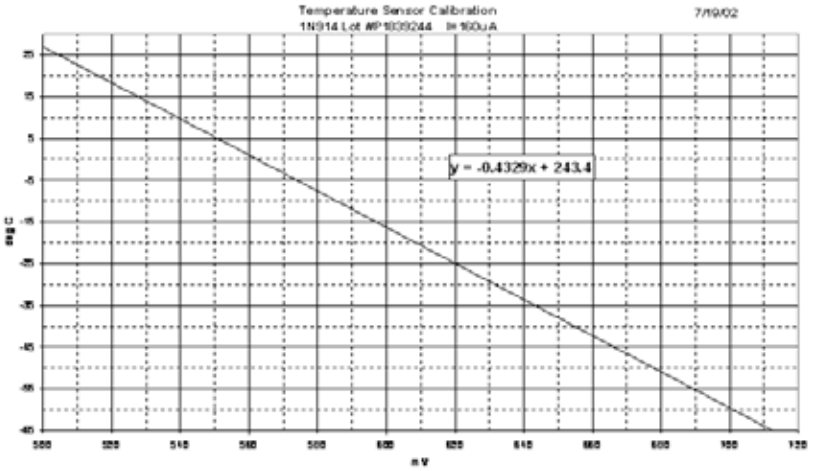

Figure 3. Temperature diode calibration curve for I = 160 µA.

Example Temperature Controller

Below is an example temperature controller circuit. It supplies 160 µA through the temperature diode, corresponding to the Temperature Diode Calibration Curve for I=160 uA. If this circuit is used to control the PA-210/PA-230 preamp, DO NOT install R19 on the preamplifier since the current is set through R1 on the temperature controller circuit. Instead, connect Pin 7 on the PA-210/PA-230 to the input of the temperature controller circuit as shown in this schematic.

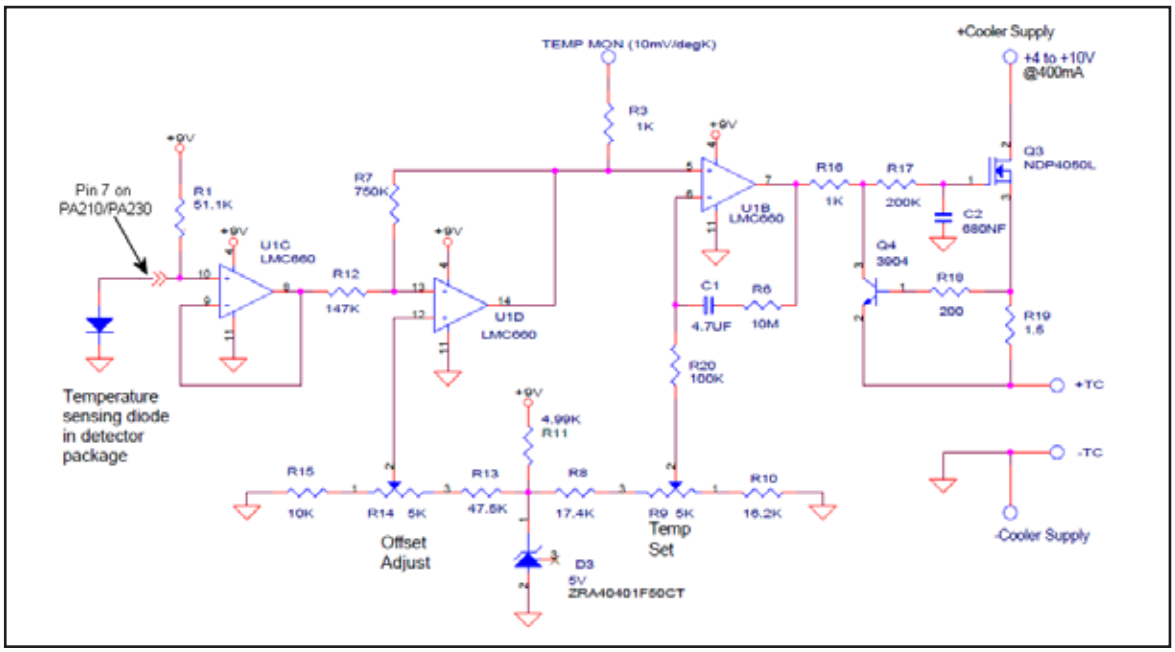

Figure 4. Example temperature controller.

Right Angle Heat Sink Mechanical Dimensions (supplied with OEM components)

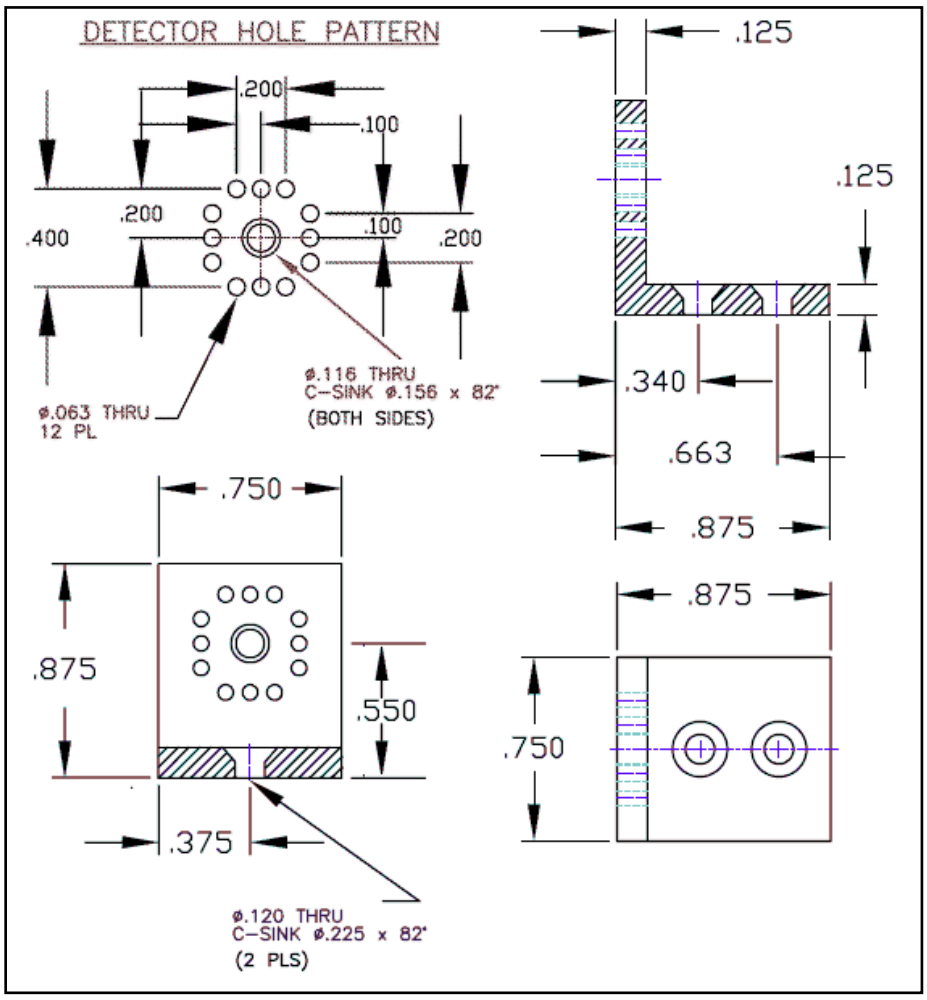

Figure 5. All dimensions in inches ±0.005.

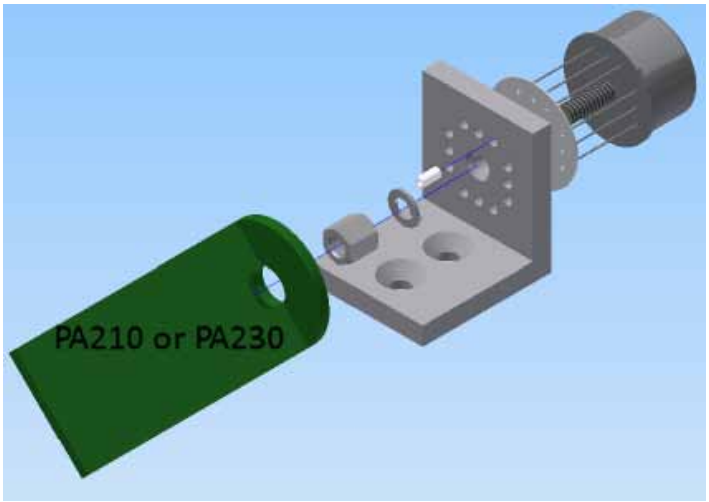

Figure 6. Detector, PA210 or PA230 preamplifier, and heat sink assembly.

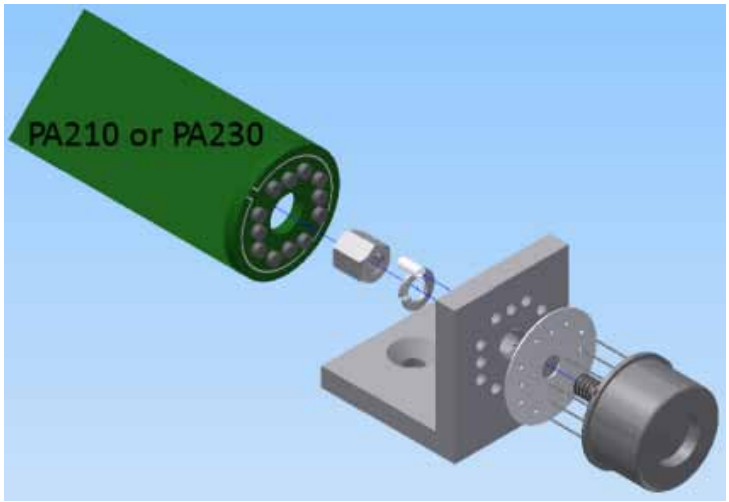

Figure 7. Detector, PA210 or PA230 preamplifier, and heat sink assembly.

Figure 8. PA210 preamplifier, 18 mm Diameter x 40 mm long.

Figure 9. PA-210 Housing. The PA-210 can be ordered with a housing that completely shields the detector and preamplifier and provides heat-sinking and mounting holes. This optional housing saves the OEM the design time of fabricating a custom enclosure.

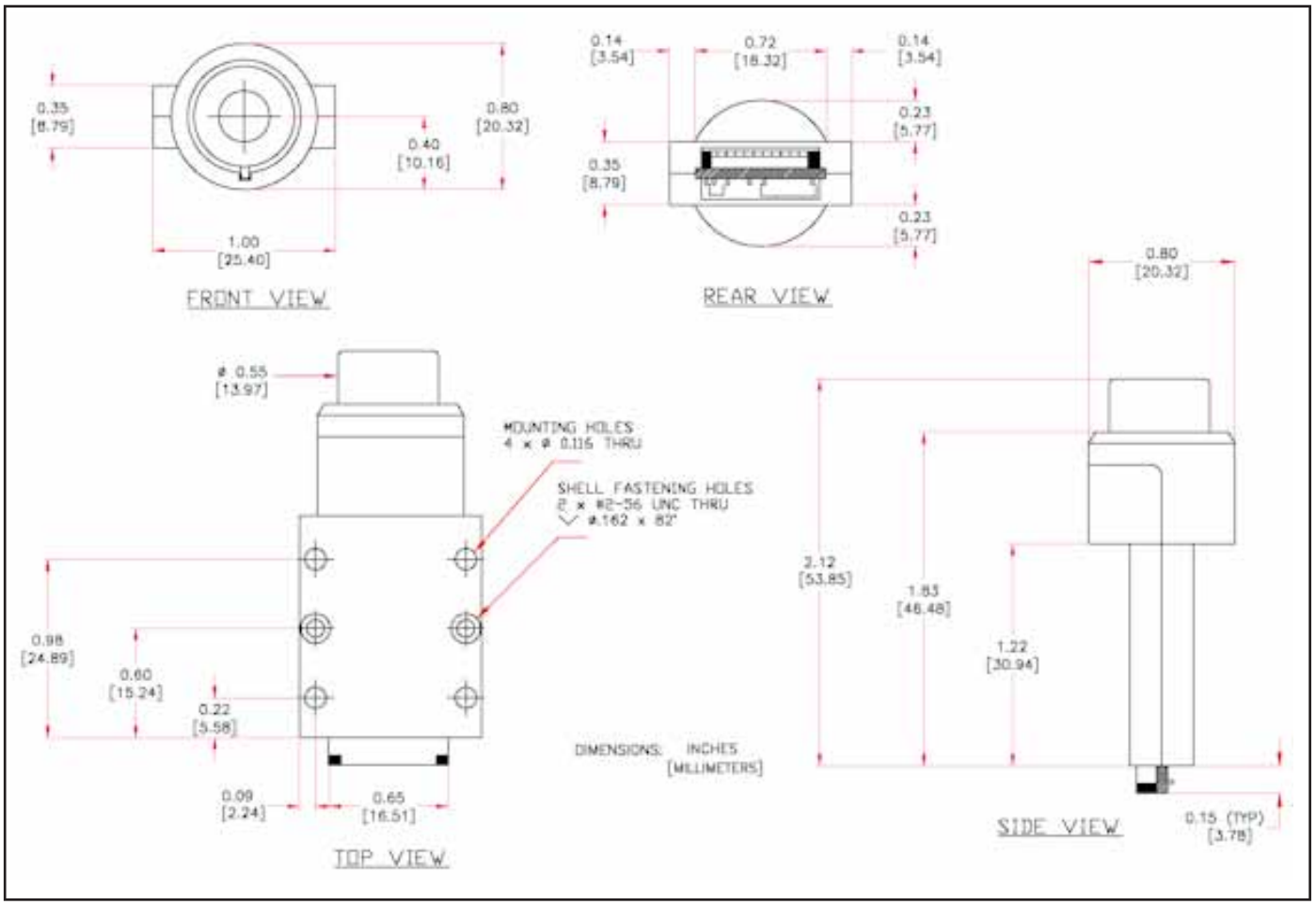

Figure 10. AXR/PA-210 and Housing. Mechanical dimensions; all Measurements in inches [mm].

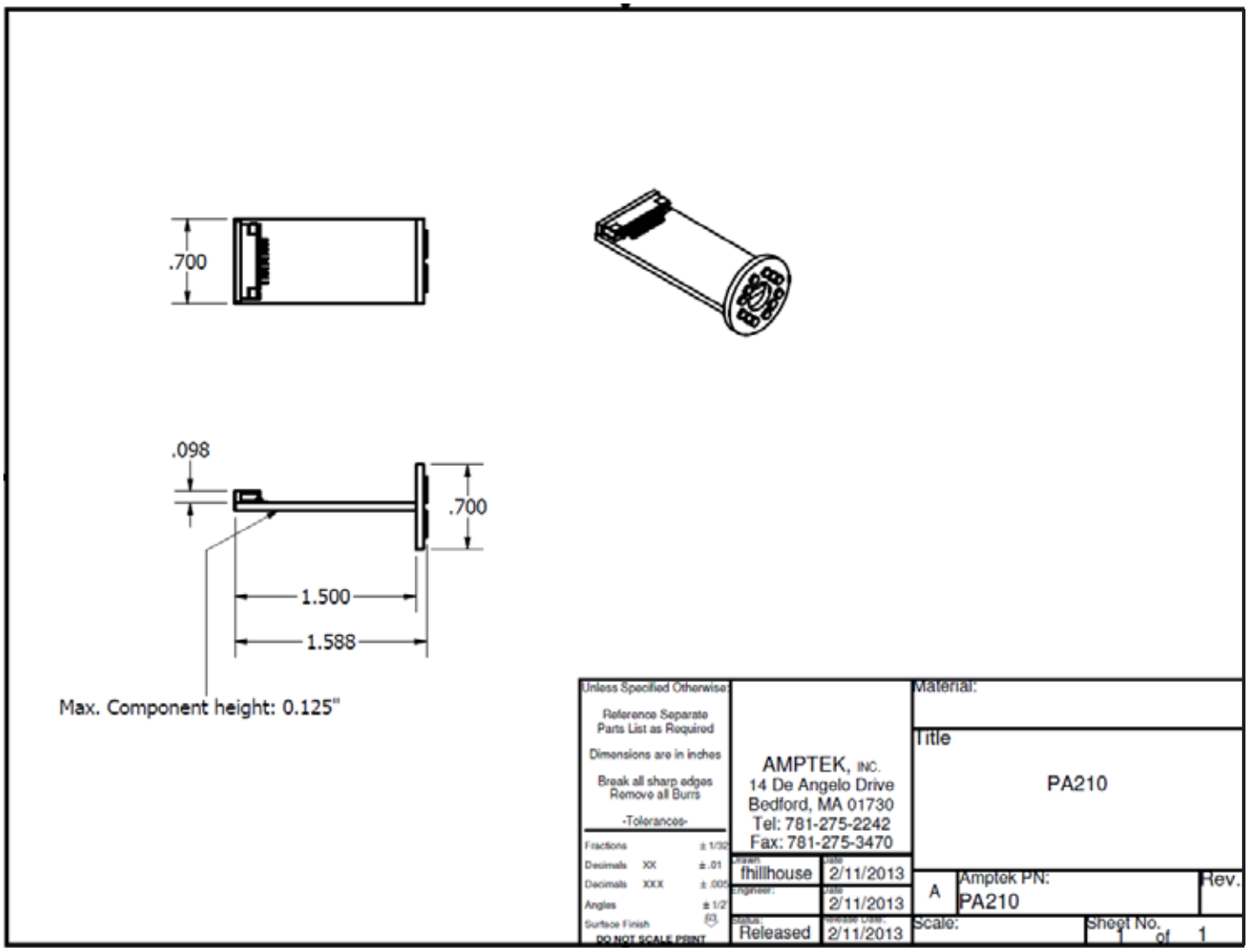

Figure 11. PA-210 Mechanical Dimensions, All Measurements in Inches.

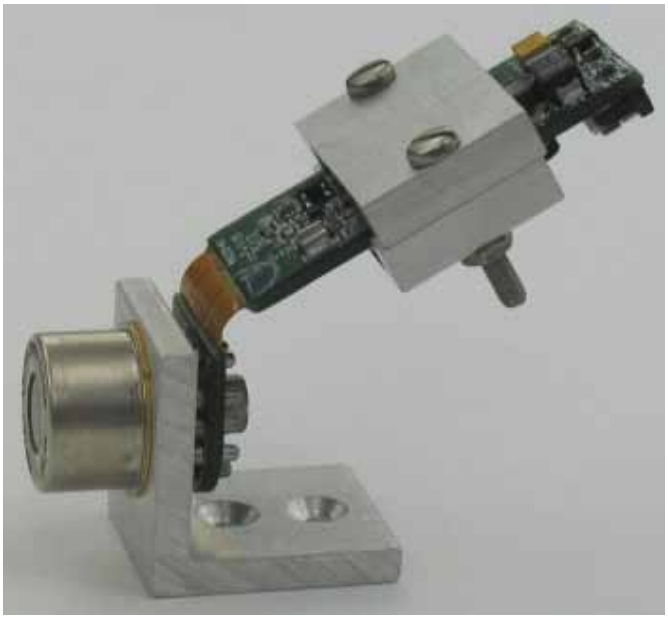

Figure 12. PA230 flexible preamplifier with detector, heat-sink, and mounting hardware.

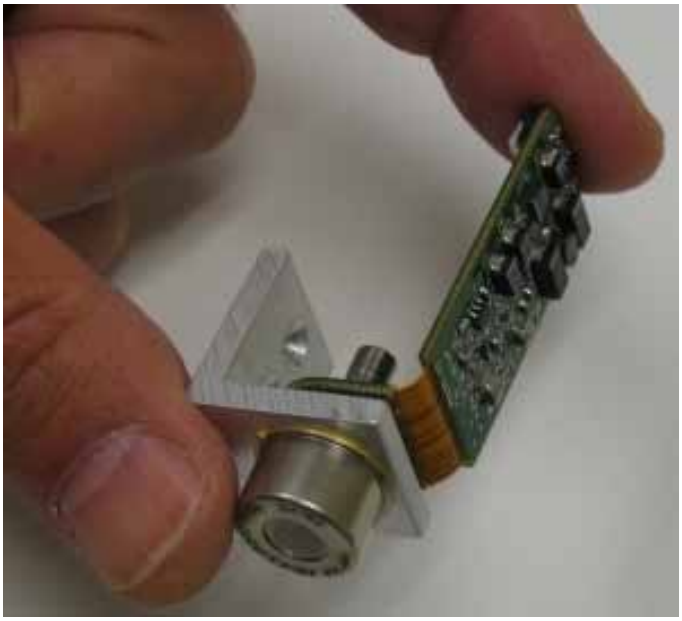

Figure 13. PA230 flexible preamplifier with detector and heat-sink.

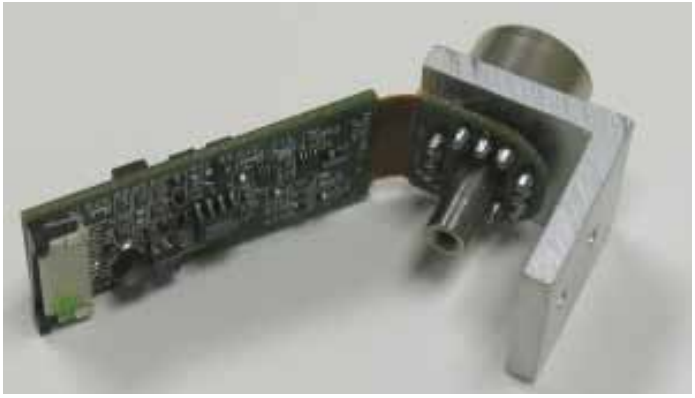

Figure 14. PA230 flexible preamplifier with detector and heat-sink.

Figure 15. PA-230 Housing. The PA-230 can be ordered with a housing that completely shields the detector and preamplifier and provides heat-sinking and mounting holes. This optional housing saves the OEM the design time of fabricating a custom enclosure.

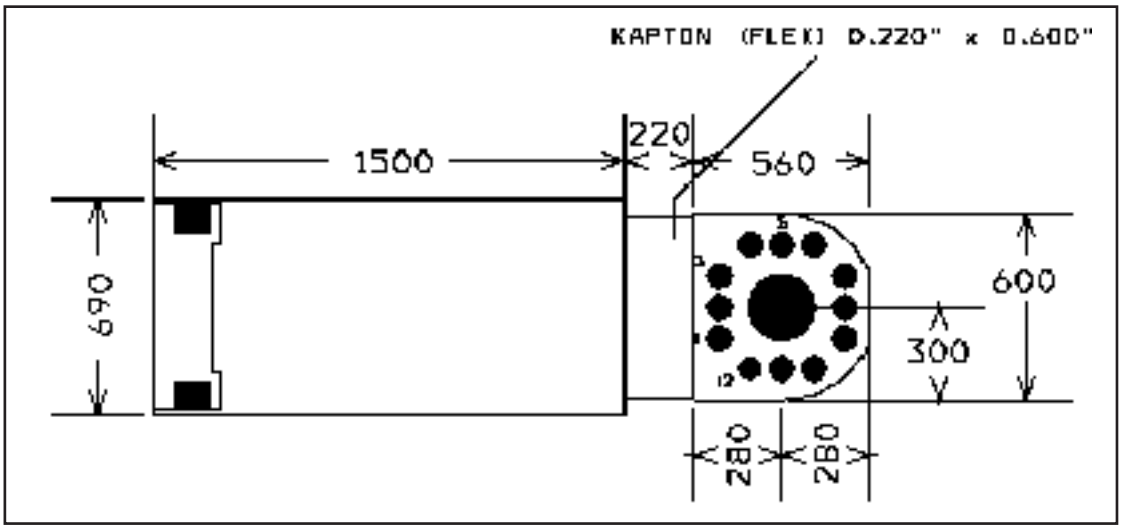

Figure 16. PA-230 Mechanical Dimensions, All Measurements in Inches

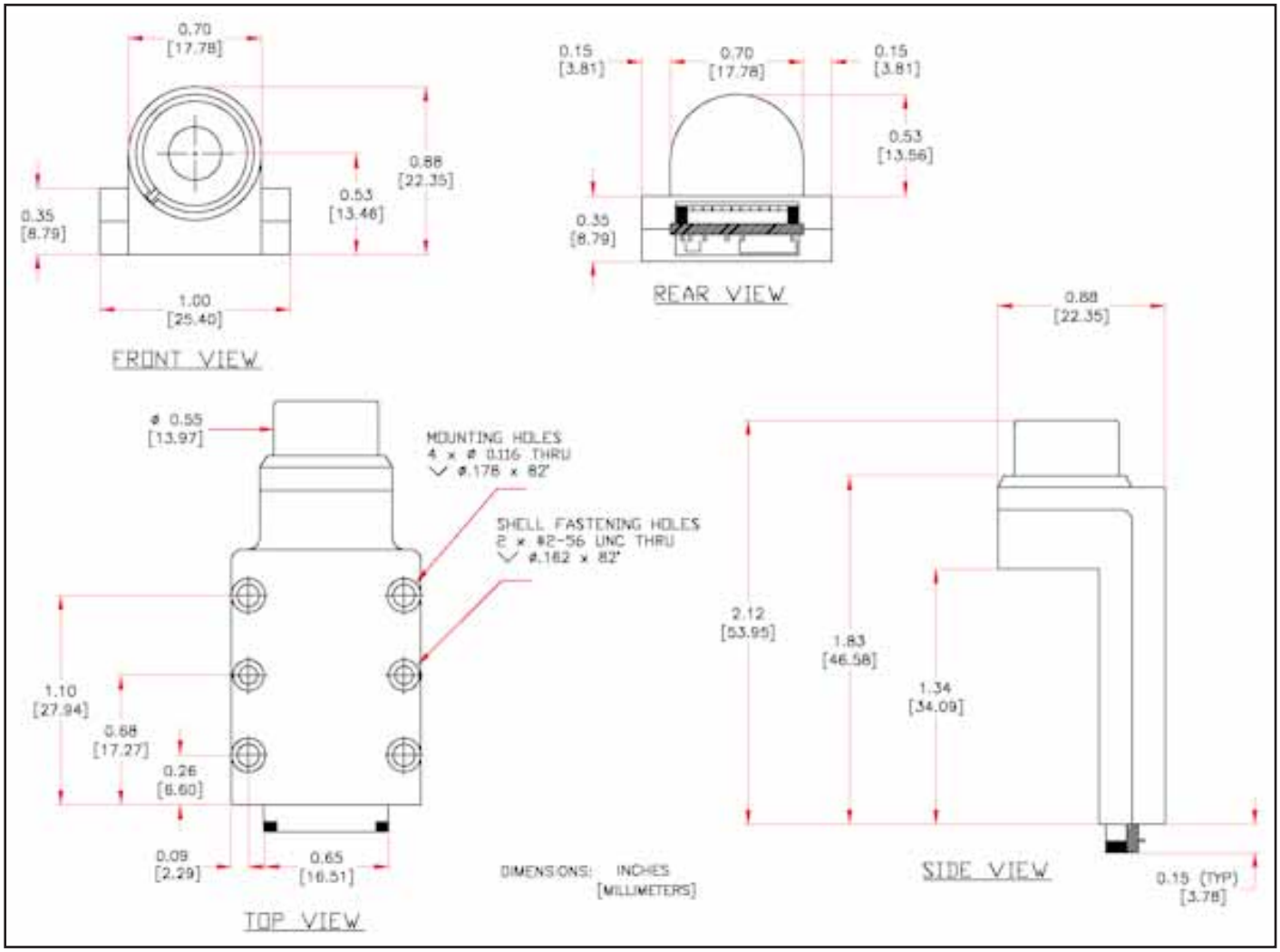

FIgure 17. AXR Detector with PA-230 and Housing, Mechanical Dimensions; all Measurements in Inches [mm]