**Configuring Jetson Expansion Headers**

**1. Overview**

* **Purpose: Configure I/O pins on Jetson expansion headers (40-pin, CSI, M.2 Key E) for GPIO or SFIO functions.**
* **Tools:**
  + **Jetson-IO (GUI Python script)**
  + **Command-line utilities:**
    - **config-by-pin.py**
    - **config-by-function.py**
    - **config-by-hardware.py**

**2. Getting Started**

**Launch Jetson-IO GUI using command:**

**sudo /opt/nvidia/jetson-io/jetson-io.py**

**Key Headers by Device**

* **AGX Xavier:**
  + **40-pin header: Supported**
  + **M.2 Key E: Supported**
  + **CSI Connector: Supported**
* **Xavier NX:**
  + **40-pin header: Supported**
  + **M.2 Key E: Supported**
  + **CSI Connector (30-pin): Supported**
* **AGX Orin:**
  + **40-pin header: Supported**
  + **M.2 Key E: Supported**
  + **CSI Connector: Supported**

**3. GUI Configuration Workflow**

**Main Screen**

* **Lists available headers**
* **Options include:**
  + **Configure 40-pin Header**
  + **Configure M.2 Key E Slot**
  + **Configure CSI Connector**

**Header Screen**

* **Two configuration modes:**
  + **Compatible Hardware: Select from predefined modules (e.g., Adafruit SPH0645LM4H)**
  + **Manual Pin Configuration: Toggle SFIO functions per pin**

**Example: 40-pin Header**

* **Current Configuration:**
  + **Pin 3: GPIO**
  + **Pin 5: I2C**
* **Options:**
  + **Configure for compatible hardware**
  + **Configure header pins manually**

**4. Command-Line Tools**

**Key Utilities**

* **config-by-pin.py: View pin configurations**
* **config-by-function.py: Configure via special functions**
* **config-by-hardware.py: Apply predefined hardware profiles**

**Common Use Cases**

**A] List Enabled Functions using command:**

**sudo /opt/nvidia/jetson-io/config-by-function.py -l enabled**

**b] Enable SPI on Header 1 using command:**

**sudo /opt/nvidia/jetson-io/config-by-function.py -o dtb spi1**

**c] Apply Adafruit Audio Profile using command:**

**sudo /opt/nvidia/jetson-io/config-by-hardware.py -n "Adafruit SPH0645LM4H"**

**5. Custom Hardware Support**

**Device Tree Overlay Requirements**

* **Example overlay snippet:**

**text**

**/dts-v1/;**

**/plugin/;**

**/ {**

**overlay-name = "Custom Overlay";**

**jetson-header-name = "Jetson 40pin Header";**

**compatible = "nvidia,p2822-0000+p2888-0001";**

**fragment@0 {**

**target-path = "/";**

**\_\_overlay\_\_ {**

**new\_property = "value";**

**};**

**};**

**};**

**Compilation & Deployment using command:**

**dtc -O dtb -o custom.dtbo -@ custom.dts**

**sudo cp custom.dtbo /boot**

**6. Key Configuration Files**

* **extlinux.conf: Boot configuration, located in /boot/extlinux/**
* **\*.dtbo: Device tree overlays, located in /boot/**
* **nv\_tegra\_release: Jetson SW version, located in /etc/**

**7. Troubleshooting**

**Common Issues**

* **Configuration not applied:**
  + **Verify CRC-8 checksum in EEPROM**
* **Pins not responding:**
  + **Check kernel messages using command:**

**dmesg | grep -i tegra**

* **Overlay not recognized:**
  + **Validate the compatible property in your overlay**

**Debug Commands :**

***A] # Verify pin states* using command:**

**sudo /opt/nvidia/jetson-io/config-by-pin.py -p 7**

***B] # Check applied overlays* using command:**

**fdtdump /boot/tegra194-p3668-all-p3509-0000-fe-pi-audio.dtbo**

**8. Reference Tables**

**jetson-header-name Values**

* **40-pin header: Jetson 40pin Header**
* **M.2 Key E: Jetson M.2 Key E Slot**
* **CSI (Xavier NX): Jetson AGX Xavier CSI Connector**

**compatible Property Values**

* **Xavier NX DevKit: nvidia,p3509-0+p3668-0000**
* **AGX Xavier: nvidia,p2822-0000+p2888-0001**
* **AGX Orin: nvidia,p3737-0000+p3701-0000**

**Optimized for RAG**

* **Hierarchical structure with clear section headers**
* **Code blocks for all executable commands**
* **Bullet points instead of tables for easy chunking**
* **Explicit troubleshooting steps and debug commands**
* **Consistent terminology matching NVIDIA documentation**