

ADAM & ADAM-CS

Master Controller & AIO Cards

In general, firmware is just software that is embedded in a device.

In the ADAM intercom family, such firmware is contained in the Master Controller (MC) and Analog Input/Output cards (AIO).

The MC firmware controls the operation of the MC cards. The AIO firmware controls the operation of the AIO cards. The MC and AIO cards talk using a high-speed serial protocol on the backplane via a set of connections called the control bus.

MC U2 & U4 store firmware (downloadable via AZedit, or programmed in an FLASH EPROM programmer) is storing the operating system for the MC's.

MC U3 & U5 store configuration information (setup files, editable uploadable / downloadable via AZedit)

AIO: U21 stores firmware (downloadable via AZedit, or programmed in an FLASH EPROM programmer) that handles the basic operating system for the AIO cards.

The Active MC tells each AIO card which timeslots to drive onto the audio backplane, as well as which timeslots to pull from the backplane. It tells the AIO card how to mix the timeslots it has pulled and which ports to send the mixes to. The MC sends key assignments and other keypanel information to the keypanels by relaying messages through the AIO cards. The AIO cards poll the keypanels to determine whether they are connected or not, keeps the key status up-to-date, and sends key state changes to the MC for processing.

AIO cards talk to keypanels via frame ports to the outside world.

Stating it another way; there is usually two MC cards in a frame to provide redundancy of control operations. One MC is Active, and the other is Standby. The active MC is the “brains” of the intercom. This MC controls all of the functionality of the intercom, providing simple point-to-point audio connections, as well as more complex operations such as party lines, IFB's and ISO functions, etc.

The **Standby MC** is continually being updated by the Active MC thereby making it ready to assume immediate command if a changeover is required.

The MC does not deal with audio, but rather sends commands to the AIO cards to control their mixers and audio functions. The MC monitors reports from the AIO cards regarding the keypanel states, configures the keypanels according to a saved configuration file, and acts on events, such as key press notifications it receives from the AIO cards

The MC also talks externally with other devices such as the UIO, PAP, LCP, Trunking and AZedit via connectors on rear matrix breakout panel. AZedit is used to configure and monitor the intercom, and is useful to keep on line, but not required once the intercom is configured and running.

Analog I/O (AIO) cards support 8 external input and output ports for connecting keypanels, or other audio devices, to the intercom. The AIO card communicates with intercom keypanels and collects and reports key status to the intercom controller (MC card). The AIO card accepts analog audio from the keypanel or other device, digitizes the audio, and puts it on the backplane in the appropriate TDM timeslot so that other AIO cards on the backplane may access the audio. The AIO card also provides outgoing audio to a keypanel or other device. The AIO card pulls the appropriate TDM audio timeslots from the backplane, performs the audio mixing (as instructed by the intercom controller), converts the digital audio signal to analog and sends it to the external devices.

The AIO card is essentially an A/D and D/A card for external audio, as well as a digital audio mixer, and data controller for keypanel devices. The AIO card performs these operations under the control of the MC card.

Each card contains a CPU. Motorola 68340 for the MC and Intel 80196 for the AIO cards. They also have a Field Programmable Gate Array "FPGA" (Xylinx for the AIO card, and Alteras for the MC's. The MC's have static or dynamic RAM, and FLASH EPROM's for firmware and configuration information. The AIO cards, however have no configuration FLASH, just the basic operating system FLASH.

The FLASH devices are typically AMD 29F010/F040 or equivalent. The firmware FLASH on each card is field upgradeable and can be downloaded via AZedit software. The intercom configuration is stored in FLASH on the MC card and can be uploaded and saved to file using AZedit. AZedit is also used to create and download the initial configuration for the intercom.

The FPGA's control the address decoding and peripheral access on each card (including control of the audio ASIC's, control bus communications, and other peripherals. The AIO's Xylinx FPGA is downloaded from the AIO firmware, and can be upgraded by downloading new firmware to the AIO card. The MC Altera FPGA's are seldom, if ever, upgraded.

Two of the AIO cards in an ADAM frame also serve as redundant system clocks. These cards are located in slots 8 & 9 in ADAM frame and slots 4 & 5 in ADAM-CS frame. While each clock slot is uniquely identified by its position in the frame, clock pins on all other cards are not connected.

Clock cards are positioned as close to the center of their respective frames as allowable. This positioning is important due to propagation delay considerations across the TDM backplane.

There must be an AIO card in either or both of the clock slots or the system simply will not function.

For example, if a frame is configured for only 8 ports (1 AIO card) then that card must reside in slot 8 or 9 of an ADAM frame or slot 4 or 5 of an ADAM-CS frame. Panel cables to the frame breakout panels must be shifted to pick up ports 57-64 or 65-72 (ADAM), ports 25-32 or 33-40 (ADAM-CS).

Downloading firmware: In order to be able to download firmware to an AIO or MC card from AZedit, the card must already have valid firmware (of a previous version) installed, so that it can receive the new firmware and re-program itself when it has received it all. New AIO and MC cards must be populated with FLASH chips that have had the firmware burned into them using a FLASH EPROM programmer

Dual Bus Expanders (DBX) systems change the rules significantly. When DBX cards are used to expand the number of frames in a system, the MC cards in frame 1 become Peripheral Controllers and the DBX cards, now replace the AIO/clock cards in frame 1 clock slots. The DBX cards now also become the MC cards in the system. There are no MC cards in the other system frames, as the ones once there must be removed.