DA720 Digital to Analog cards in a Kuper system

Please note:

This document details installation and use of the Real Time Devices DA720 D-to-A cards in a Kuper system.

It was originally written back in 1995, when when it as common to use such cards to control analog dimmers.

These days, DMX equipment is a much simpler solution. We strongly suggest that you consider DMX for lighting applications.

The equipment is inexpensive and the digital DMX512 protocol is much more reliable and robust in the high-noise environment of a film set.

This document is provided as an archival reference for those individuals who are still running legacy analog systems, or still need analog voltages for their specialty applications.

Everything you never wanted to know
about Kuper DAC card installation
(but didn't know who to ask)

Or, how to buy, install and operate a DAC card while retaining your composure, sanity, and production schedule.

- Step 1, buy and install your DAC card.

  Contact Rhonda at

  > Real Time Devices
  > PO Box 906
  > State College PA 16804
  >
  > (814) 234-8087 (phone)
  > (814) 234-5218 (fax)

  The preferred DAC card is currently the DA720, an eight channel, twelve bit card. List price as of 1/95 is $325.

  They will ship COD, FEDex, but they have a burn in policy whereby they test a card for 24 hours before they allow it to ship. Please allow for this when you place an order. No amount of pleading (or yelling) seems to get them to ship early.

  The card arrives with an extremely detailed instruction manual and a diagnostic disk. Installation is well detailed in the manual and very straightforward. The only decision you need to make during installation is the choice of base address and output voltage range.

  The card may be installed in any open expansion slot.

- Setting output voltage range

  There are 16 range and polarity jumpers in 8 groups of 4 on the board; one group for each channel. As the board comes from the factory it is configured for -5 to +5 volt operation.

  This means that the highest voltage you can get out of the board is +5 volts, the lowest voltage is -5 volts. Virtually all commercial analog dimmer boards however, use a nominal control voltage of 0 to 10 volts.

  If you want 0 to 10 volts out, you must change the polarity jumper for each channel from bipolar (marked +/- 5) to unipolar (marked just plain 5), and change the range jumper of each channel to 0 to 10 volts (marked 2X).

You will need to change all 16 jumpers.

- Setting address space

    There are "preferred" base address spaces for your DAC card. In these addresses the card is least likely to conflict with another piece of equipment inside the PC. These preferred base address are 2C0, 2D0, 270 and 280, hex, in order.

    If that sentence didn't make much sense, don't worry. just remember you're trying to set the first card to 2C0, using the dip switches. Set the second card to 2D0, and so forth.

    The right dip switch settings are;

1)	2C0 hex (704 dec)	s1 cl; s2 cl; s3 op; s4 op; s5 cl
2)	2D0 hex (720 dec)	s1 op; s2 cl; s3 op; s4 op; s5 cl
3)	270 hex (624 dec)	s1 cl; s2 op; s3 op; s4 cl; s5 cl
4)	280 hex (640 dec)	s1 cl; s2 cl; s3 cl; s4 op; s5 cl

    Double check the switch settings, it's a little confusing which is switch one and which is five, and which way is closed and what is open. Read the markings on the card carefully.

    If your particular PC requires it, you can map the DAC boards to other addresses, but do not map the card into 300 thru 30F (the Kuper RTMC card uses this space) or 310 thru 31F space (the Kuper creature card uses this space).

    Once you determine address, and set and install your card, you should run the RTD diagnostic program, 720DIAG.EXE. This program is found on the manufacturers disk that came with the card. Toggle the D/A's up and down and look at the outputs with a voltmeter.

- Necessary files

    RTMC130 uses 2 files to identify and operate the DAC board. These are DA720 and DACADDR. The filenames are not case sensitive and have no "." extensions. Both files must exist in the same directory as the copy of RTMC or KRJ that you're running.

    DA720 is used to tell RTMC130 that one or more DA720's are installed in the system. The actual contents of the file are irrelevant, its mere existence is all that matters.

    Use the DOS EDIT or other word processor to create the file.

If you don't have EDIT or a word processor on your computer, the easiest way to create this file from DOS is to go into the right directory and directly copy it in from the keyboard. Use the Copy (from) CONsole command.

    Type...
        COPY CON DA720<return>
        <space><return>
        <ctrl-Z><return>

DACADDR gives the Kuper software information about the interface settings on the DAC boards, specifically their bus address (see the last section).

This file contains the base address of each board, in order, in hexadecimal, separated by spaces, no characters after the last address. (Whew!) The board whose address you list first responds as channels 1 through 8, the second address listed responds as channel 9 through 16, and so forth.

If you use the Kuper recommended addresses, this file has one line in it, and it is

        2C0<space>2D0<space>270<space>280

Use the EDIT command or a word processor to create the file. When you go to save this file you must select the ASCII or PLAIN TEXT save option, since most word processors insert formatting commands into their text. DOS EDIT inserts no extraneous characters, so normal save is fine.

If you don't have EDIT or a word processor on your computer, the easiest way to create this file from DOS is to go into the right directory and directly copy it in from the keyboard. Use the Copy (from) CONsole command.

    Type...
        COPY CON DACADDR<return>
        2C0<space>2D0<space>270<space>280<return>
        <ctrl-Z><return>

• Operation with RTMC130

Most versions of RTMC130, except for very early Beta programs, support several DAC related functions including Patch Dac and Enable Dac, and most versions after October '94 offer software scaling options.

You will have to configure your setup using the Patch Dac and Enable Dac functions. These remap the arbitrary axis names and order to the actual DAC hardware, and its selected DAC address space.

If you're already familiar with Patch Motor, just skip the next few paragraphs.

- Operation with RTMC119

  Don't. Contact Kuper Controls and have Bill send you a current copy of RTMC130. If correctly configured, it will operate just fine with one of the older RTMC16 cards and even though you don't get some of the spiffy new hardware features, it's still worth it to have the updated software goodies.

  Contact Kuper at:

  Kuper Controls / General Lift LLC.
  Office Hours   9:00AM ~ 6:00PM, Pacific Time.
  Mailing Address

  209 East El Segundo Blvd.
  El Segundo, CA 90245
  Tel: 310-414-0701
  Fax: 310-414-0705
  Email: techsupport@kupercontrols.com

- Patch Dac functions

  This function will, for example, allow you to control the first channel of a fader, with, say axis number 15, which you've named "flicker", the second fader channel with axis 12, "flame", and so forth. It's useful because you seldom want your DAC channels to be the first 8 things listed on your screen.

  You will find Patch Dac under the Mouse Jog submenu. Click on it and it will give you an information screen, hot button strip, and further instructions.

  For our theoretical example above, you would first want to Patch Dac 1 to respond to what's going on in axis 15.

  To do this, grab DAC 01: (in the blue column), and drag it down the blue column until it's opposite axis 15. let go. It will stick, and whatever DAC was in that spot will go to wherever DAC 01: came from.

  In out example you'd then continue with DAC 02, dragging it down to axis 12, and so forth, until you're done patching all the channels you plan to use.

- Enabling DAC channels

  DAC channels <u>will</u> <u>not</u> <u>respond</u> until they have been enabled. To enable an axis, go again into the Patch Dac menu, but this time click on the axis number, directly to the left of the name. It will highlight. When a channel is enabled, the number will turn yellow.

- Software Scaling

    Most RTMC130 versions prior to October 94 have only one output scaling, an axis position of zero or less gives 0 volts out of the DAC, a position of 10 or more gives fullscale, typically 10 volts out of the DAC, and it's linear in between. That is, a position of 7.5 gave you 7.5 volts out.

    As of the October releases, you can rescale the axis position numbers so that they're more meaningful. For example, you might set a light dimmer to read as 0 to 120 volts out, or maybe 0 to 100 percent.

    Even if you liked the old 0 to 10 scaling, you have to change it from the factory defaults anyway, which are something like -100000 to + 100000.

    You can setup the number range you'd like in the Software Position Limits submenu, found under the Hard Set menu.

    Opposite each axis name are two columns, plus and minus software limits, and plus and minus joystick limits. Range is set in the software limit columns.

    The minus limit column sets the bottom end of the DAC range, the plus column sets the top end of the DAC range. For example, if you want your numbers to go from 0 to 100 percent, set zero as the negative limit and 100 as the positive limit.

    Do not enable the limits. Just enter the top and bottom numbers in, but don't click the middle mouse key to actually enable the limit checking (The numbers should be black, not red).

    The software will sometimes attempt to preroll or postroll past the set limits. If software limits are enabled, the channels can lockup and not run. The DACs can't overrun their physical voltage limits anyway, so don't worry about it.

- Bizarre Problems

    If you've gotten this far, you've survived installation. Congratulations. Now you're into debug. Though by no means an extensive list, there are a few problems that occur with great regularity.

- DAC's don't respond at all

    Start with the RTD diagnostic disk. this will at least eliminate physical problems, address space problems, and the like.

    Take a voltmeter, set the range to 30VDC, and check the outputs right where they come out of the back of the computer. You don't have to get both probes into the connector, have a helper hold the black lead to the bare metal case and read the meter.

    Voltages fine? check them again at the far end of the cable.

If the DAC responds well to the diagnostic disk and voltages are OK, then the problem is in RTMC130. First check for the necessary support files, and make sure that they're in the same directory that you're actually running RTMC130 from. Many systems have multiple versions of RTMC floating around in different directories, and if you're running a batch file you may be rerouted.

If you're getting a constant, steady 4.99 volts out, see the section above about software scaling.

- My dimmers flicker badly, or they won't go past about halfway up, or they're stuck at 50%.

  You most likely have a ground loop problem. Check to see that there's a really good common (return) connection between your equipment. Often it helps to connect case grounds together.

  Usually, if there's a flicker you need to carefully examine your case grounds and the return signal line, if you can't get past 50% look for floating grounds in your AC power supply.

  Unplug the computer from the dimmer pack. take a voltmeter set to AC Volts, an read the standing voltage between the two cases. If it's more than a few volts AC you've got floating grounds, or poor neutrals.

  This can easily happen on stages where the MoCo and the lighting are running off of two very separate power supplies. In fact, the common practice of running everything from different power sources is probably he number one source of DAC failure.

  The absolute best solution to this problem is to request your gaffer put both your computer and the dimmer packs on your own separate, quiet power leg. Yes, I know that this runs counter to the conventional wisdom, but modern computer power supplies are very noise immune, and the advantages of having everything on one ground far outweigh the noise problems you're actually likely to suffer.

- I command my dimmers to 50% but my lamps go down 3 stops

  Many loads are highly non-linear, especially lamps. On my last job, I found that the curve on one 5K lamp went something like;

100%	120v	full on
81%	96v	- 1 stop
64%	77v	- 2 stops
27%	33v	- 3 stops

  if you want to think in terms of 50% = 1 stop, 25% = 2 stops, etc., then find the control voltages on your dimmer that give you these settings. Then use these points to create a tabled axis, with the dimmer slaving to a master channel through a table. The master channel is the one you program, the dimmer axis comes along fort he ride.

Also, remember that while the lamp is changing intensity, it's also changing color temperature, it can go down to 1000K at - 3 stops.

- ## And Now... DAC Warnings!

  Most of the previous information assumed that you're using DACs to control dimmers, as most people do.

  If you're using a DAC output to control a physical thing, like an hydraulic cylinder or positioning servo, you need to be aware of several additional things;

  When you first start RTMC the axis values will jump to zero. Depending on the software scaling, the actual DAC outputs might therefore jump to a non-zero value. For example, if you're scaled +20 inches to -10 inches, then upon startup, the DAC output will suddenly be 5 volts, the actuator will jump to +5 inches

  When you disable a DAC channel, it will stay at whatever voltage was there when you turned it off. It will not go to zero or any other known value.

  When you repatch a DAC channel, subsequent operations can make it jump suddenly (just once) to whatever value the other channel was sitting at.

  When you leave RTMC130, the DACs stay at whatever voltage was there when you turned it off. It will not go to zero or any other known value.

• Dimmer board data

   The following is a partial list of common dimmer box interface configurations;

   · <u>Rank CD80 (CPC connector)</u>

   Interface connector

   AMP CPC37 (black circular plastic, 2" diam.)
   Male on dimmer pack

   Mating connector

   AMP P/N   Connector - 206151-2 (receptacle/sockets)
                    backshell - 206512-1

   Pinout

   Pin 1   Ch 1, 0-10 v
   .   .
   .   .
   .   .
   Pin 24 Ch 24, 0-10 v
   Pin 25 Analog Common

   · <u>Rank CD80 (DMX/Analog board option)</u>

   Interface connector

   DB15 (standard 2 row)
   Female on dimmer pack

   Mating connector

   P/N DB 15 M (standard 2 row)

Pinout

    Pin 1   Ch 1, 0-10 v
    .   .
    .   .
    .   .
    Pin 12 Ch 12, 0-10 v
    Pin 13&14   Analog Common (connect both)
    Pin 15 +12VDC out, do not connect

· <u>Mole 10K (w/ remote option)</u>

Interface connector

    Hubble 2 pin (black circular plastic, 1" diam.)
    Male on dimmer pack

Mating connector

    Hubble "midget twistlock" series
    P/N 3464V (usually marked for 125V/15A service)

Pinout

    Large Brass Pin   Ch 1, 0-10 v

    Small Nickel Pin   Analog Common