VIRUS CCD Controller and MUX Command List

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Headers: ss = controller1 ID or source ID
dd = controller2 ID or destination ID
the last byte has the number of words in the command

ALL MUX command words (header, command, args) require the
0xBC000000 preamble instead of the normal 0xAC000000 preamble.

Most commands reply with a 'DON' = 0x444F4E on successful execution.

General Controller and System Commands

'TDL' – Test Data Link (0x54444C)

This command is processed by controller's FPGA, and replies with the value sent as the command argument.

```
0xssdd03 'TVL' <24-bit number>
```

'TVL' – Test Virus Link (0x54564C)

Same as standard 'TDL' (Test Data Link) command, except this command is processed by the timing board DSP instead of the FPGA. This command will only succeed if the DSP timing file (.lod) has been successfully loaded. The reply will be the value sent as the command argument.

```
0xssdd03 'TVL' <24-bit number>
```

'SIM' – Synthetic IMage control (0x53494D)

Enables synthetic image mode, either fixed or ramp mode. **Fixed image mode** produces fixed values for each channel (0 to 3). The fixed value itself is set issuing a series of four 'SIM' commands to each controller. The arguments to these commands will specify the channel number and the fixed 16-bit value to use. **Ramp image mode** will produce data that increments from 0 to 65535 with each pixel, then repeats this sequence over and over until the end of the image.

To **disable** synthetic image mode:

```
0xssdd03 'SIM' 0
```

To **enable fixed** synthetic image mode:

```
0xssdd05 'SIM'   2   <0, 1, 2, or 3>   <16-bit value>
```

To **enable ramp** synthetic image mode:

```
0xssdd03 'SIM' 3
```

To **reset** the ramp mode incrementing counter:

```
0xssdd02 'SIM' 4
```

'GID' – Get ID (0x524944)

Returns the controller ID. This is read from the one-wire device installed in the spectrograph slot address position.

```
0xssdd02 'RID'
```

'ACT' – Activate Controller Tester (0x414354)

Activate the controller tester. Detailed directions are given separately in a dedicated document.

```
0xssdd02 'ACT'
```

'STC' – Set Test Channel (0x535443)

Select the channel (0 to 3) to test. Their voltage levels and timing are selected to mimic the CCD video signal to produce a range of image counts. Four sets of clock signals selected by the argument sample all 16 clocks signals used in the controller. The controller software is set up so the image counts increase from the lower left quadrant going counter-clockwise, and as the channel number increases from 0 to 3. The de-interlacing should be selected as CCD quad.

```
0xssdd03  'STC'  <0, 1, 2, or 3>
```

'SMC' – Set Multiple Controllers (0x534D43)

Sets the controller to return the one-wire controller ID within all reply headers. If this is set to zero, then all reply headers will be in broadcast (0x020002) mode.

```
0xssdd03 'SMC' <on=1, off=0>
```

'SRS' – Set Reply Status (0x535253)

Informs the controller to return a reply for any future command received. Or not.

```
0xssdd03 'SRS' <reply=1, no reply=0>
```

'RRS' – Read Reply Status (0x525253)

Returns the current value of the reply status from each controller. All controllers will respond regardless of the current reply status.

```
0xssdd02 'RSS'
```

'PON' – Power ON (0x504F4E)

Turns the controller analog power supplies ON.

```
0xssdd02 'PON'
```

'POF' – Power OFF (0x504F46)

Turns the controller analog power supplies OFF.

```
0xssdd02 'POF'
```

'POK' – Power OK (0x504F4B)

Checks the analog power state of a controller. Returns a 1 if the controller is powered on, 0 otherwise.

```
0xssdd02 'POK'
```

'TLO' – Turn LEDs Off (0x544C4F)

Turns off the controller LED power lights. The lights can only be turned back on with the 'PON' command.

```
0xssdd02 'TLO'
```

'SBN' – Set Bias Number (0x53424E)

Write the "value" to the indicated DAC number on either the clock driver or the video board. This is used to set the DC bias, clock driver and video offset voltages. The encoding of "value" is described in a separate document.

```
0xssdd04 'SBN'   <arg1>    <arg2>

arg1 = 'CLK' or 'VID
arg2 = value to be written to the selected DAC
```

Exposure and Readout

'AES' – Await Exposure Start (0x414553)

Informs the controller to prepare for image readout via a sync signal from the MUX. This command must be sent before the 'SEX' command to the MUX.

```
0xssdd02 'AES'
```

'SPS' – Set Pixel Speed (0x535053)

Sets the pixel readout speed (pixel time). Slow should be used for telescope operation, while fast may be used in the lab.

```
0xssdd03 'SPS' <slow=0, fast=1>
```

'SRR' – Set Reverse Readout (0x535252)

Sets the direction of serial readout to reverse to read the Lower Right and Upper Left corners instead of the default Lower Left and Upper Right. The Flex cables must be jumpered in the alternate configuration for this to work properly.

```
0xssdd03 'SAR' <arg>

arg = 0     Default direction for both sides A and B
arg = '__A' Reverse direction for side A only
arg = '__B' Reverse direction for side B only
arg = '_AB' Reverse direction for both sides A and B
```

'SBP' – Set Binning Parameter (0x534250)

Select the serial binning parameters in the serial and parallel direction. The default startup is serial binning of two columns and no parallel binning of rows.

```
0xssdd04 'SBP' <ncols>  <nrows>
```

'SOS' – Select Output Source (0x534F53)

Selects from which of four amplifier(s) image data will be transmitted to the host computer.

```
0xssdd03 'SOS' <arg>
```

arg = 'ALL'	Read out all four amplifiers
arg = '__A'	Both amplifiers from side A
arg = '__B'	Both amplifiers from side B
arg = 0	Side A, bottom amplifier only
arg = 1	Side A, top amplifier only
arg = 2	Side B, bottom amplifier only
arg = 3	Side B, top amplifier only

'ABR' – Abort the current exposure or readout (0x414252)

Immediately terminate the current exposure or readout.

```
0xssdd02 'ABR'
```

CCD Temperature Control

'CDT' – Control Detector Temperature (0x434454)

Enable and control the detector temperature to the specified adu value for either the left or right side.

```
0xssdd04 'CDT' <left=0, right=1> <adu>
```

where <adu> is a 16-bit value calculated as follows:

```
adu = ( temperature + 168.7 ) / 0.004186
```

Set <adu> to 0xFFFFFF to disable temperature control.

'RDT' – Read Detector Temperature (0x524454)

Reads the detector temperature for the specified side (left or right). The actual value returned is the adu value for the temperature. The actual temperature can be calculated from the following:

```
temperature = ( -1.0 * 168.7 ) + ( 0.004186 * adu )
```

```
0xssdd03 'RDT' <left=0, right=1>
```

'SHV' – Set Heater Voltage (0x534856)

Sets the heater voltage for the specified side (left or right).

```
0xssdd04 'SHV' <left=0, right=1> <16-bit value>
```

'RHV' – Read Heater Voltage (0x524856)

Read the heater voltage for the specified side (left or right).

```
0xssdd03 'RHV' <left=0, right=1>
```

One-Wire (Serial ID) Commands

'IOW' – Initialize One Wire (0x494F57)

Initializes all 1-wire devices. No reply is returned.

```
0xssdd02 'IOW'
```

'FAD' – Find All Devices (0x464144)

Finds all active 1-wire devices on a controller. Returns the number of devices found.

```
0xssdd02 'FAD'
```

'SDN' – Set Device Number (0x53444E)

Set the 1-wire device number (0 to 12) to access (read from / write to).

```
0xssdd03 'SDN' <device number>
```

'ROR' – Read One ROM (0x524F52)

Read one byte of the 1-wire device ROM value.

```
0xssdd02 'ROR'
```

'ROM' – Read One Memory (0x524F4D)

Read one byte from a 1-wire device. The device to be accessed is selected by the previously issued 'SDN' (Set Device Number) command.

```
0xssdd02 'ROM'
```

'WOM' – Write One Memory (0x574F4D)

Write data to a 1-wire device's programmable memory. The device to be accessed is selected by the previously issued 'SDN' (Set Device Number) command.

```
0xssdd05 'WOM' <block #> <b0b1b2> <b3b4b5> <b6b7xx>
```

where <block #> is from 0 to 15, <b0b1b2> are the first three bytes to write, <b3b4b5> are the next three bytes, and <b6b7xx> are the last two bytes. The 'xx' byte is ignored.

'RCT' – Read Controller Temperature (0x524354)

Read the controller temperature from the 1-Wire device installed on the clock driver board. The value is returned as a 16-bit twos complement number, in degrees Celsius.

```
0xssdd02 'RCT'
```

VIRUS Multiplexer Commands

The following list of commands will be executed by the VIRUS multiplexer (VMUX) only.

'COM' – Set Command Mode (0x434F4D)

Sets the VMUX into command mode. This is the default state and must be called after image readout to return to normal command processing mode.

```
0x000402 'COM'
```

'MID' – MUX ID (0x4D4944)

Returns the MUX ID. The ID is set by jumpers on each VMUX.

```
0x000402 'MID'
```

'RMM' – Read Master MUX (0x524D4D)

Returns 'MST' (0x4D5354) if the MUX is designated as master. Returns 'SLV' (0x534C56) if the MUX is designated as a slave board. The Master/Slave designation is set by a jumper on each VMUX board.

```
0x000402 'RMM'
```

'EEX' – End Exposure (0x454558)

Informs the controller to start image readout via a sync signal from the MUX. This command results in the MUX setting the sync signal low. The master MUX is designated via a jumper on the VMUX board.

```
0x000402 'EEX'
```