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Isaac Newton Group

INS–DAS–11

User manual for the Sparc based Data–Acquisition system

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1 Overview of the DAS

1.1 Context

The *data–acquisition system* (DAS) is the collection of hardware and software used by the observers to obtain and store science images from the detectors. As a secondary function, the DAS also collects and stores a description of each observation and maintains a log of observations throughout the night.

1.2 Scope of this Manual

This manual describes the facilities available from the DAS and the commands used to invoke them. The remainder of this section is a tour of the hardware and software facilities. Observers new to the ING may find it useful to read this information. Section 2 describes, ”in cook–book” style, how to use the system. Section 3 is a reference guide to the full command set.

This manual has been prepared using Interleaf. It can be found on the ING Web server, as INS–DAS–11

1.3 References

[1] *Implementation of the Data–acquisition Server*
RGO/ING document **INS–DAS–9** by Guy Rixon.

[2] *User Requirements for the INT DAS*
RGO/ING document **INT–DAS–1** by Guy Rixon and Daniel Matthews.

[3] *Controls for the INT PFC: User Requirements*
RGO/ING document **INT–PF–1** by Guy Rixon.

[4] *Controls for the INT PFc: System Requirements*
RGO/ING document **INT–PF–4** by Guy Rixon.

[5] *Utility net protocol*
RGO/ING document **ER412**

[6] *WHT CCD controller Network Messages*
RGO/ING document **WHT–CCD–1** by J F Maclean.

1.4 General description

The data–acquisition system can be divided into the following components:

The CCD detectors themselves, mounted onto the focal station in use

The CCD controller, also mounted on the telescope, near to the detector. This controls the CCD, and produces the pixel data which is sent off the telescope on a fibre optic.

The interface to the system computer, situated near to the system computer, also known as the FOX chassis. This receives the pixel data and transfers them to the system computer.

The system computer itself. This receives the pixel data as the CCD is read out. At the end of a readout, the pixel data is merged with the FITs descriptors and then archived.

1.5 CCDs and their controllers

Most observations at the ING are carried out using a CCD as the detector. Several different types are available, with different formats, pixel sizes, sensitivity and readout noise. The properties of these are described in detail in La Palma Technical Notes 55, 79 and 93. The most up to date information on the detectors can be found in the CCD characteristic sheets, available on the ING Web site. (http://ing.iac.es/)

Each CCD is mounted in a cryostat (often referred to as the camera head), this is filled with liquid nitrogen to keep the CCD at its operating temperature (typically 150 or 170 Kelvin).

The electronics required to operate the CCD comprises a CCD controller, mounted on the telescope, and the preamplifier, mounted on the cryostat. Briefly the CCD controller usually carries out the following functions:

Operation of the CCD shutter (except in the INT prime focus mosaic)

Monitoring of the CCD telemetry (operating temperature, bias voltages etc)

Generation of the clock voltages required to clear and readout the CCD

Amplification and analogue to digital conversion of the signal from the CCD preamplifier

The CCD controller used was specially developed for the ING and is described in some detail in *Bregman & Doorduin 1986 (proc SPIE vol 627 p616), Bregman & Waltham 1986 (ESO/OHP workshop proc vol25, p127), Jorden 1990 (proc SPIE vol 1235, p790).*

Normal operation is with one controller per detector.

The CCD controller receives commands from the system computer over a serial port, simulating the utility network. The pixel data produced by the controller is transmitted over a dedicated fibre–optic link to the FOX chassis, which forwards it on to the system computer.

1.6 The system computer

The system computer has four principal roles as part of the data–acquisition system:

The system computer, running the Data Acquisition system, is responsible for coordinating the entire data–acquisition process.

The data acquisition system writes the data to files of the data disk, ready to be archived

The system computer hosts the tape drives and runs the software that allows the data to be archived

The rapid, on–line evaluation of the data, using standard reduction software.

On completion of an exposure, the image data is stored on the system computer. The FITS–header information associated with that data will have been collected, either during the exposure or on the completion of the exposure. Data and headers are then merged into a data file on the system computer data disk. Finally two copies of the data are written to tape: a FITS format tape (the *D–tape*) for the La Palma archive, and either a FITS tape or a backup tape (the *C–tape*) for the observer.

The system computer is networked to various SPARCs. If desired, data can be copied, using ftp, across to any other machine for more in–depth data analysis.

1.7 Notation for commands

The following conventions have been used more–or–less consistently throughout this manual:

Examples of commands entered at the terminal are in courier font: **`bin 1 1`**, as are messages from the computer;

Angle brackets denote parameter values or character strings: **`<readout-speed>`**;

Square brackets denote optional input: *e.g.* **`[title]`**; all other parameters are obligatory;

All commands are case sensitive and should be used in the case given, but parameter values are not unless specifically stated.

1.8 Disk files for observations

Observations saved by the system computer are stored in the FITS format, which can be read by most major reduction packages, eg Iraf and Figaro.

Naming conventions are used to identify image files: r80200.fit is a FITS file containing run 80200; s3.fit is a FITS file containing scratch exposure number 3. DAS1.fit is the glance file generated on DAS channel 1.

The image contains a 16–bit unsigned–integer datum for each pixel. The headers are standard FITS header type, which is an array of 80–byte character strings, each string containing one FITS record.

2 Using the DAS

This section contains practical advice on how to drive the DAS. General information on the functions of the system is in section 1, and detailed information on the command set is in section 3.

2.1 Access to the DAS

As an observer, you can control the data–acquisition system from a single console; this is the SPARCstation in the control room identified as the system computer. From the SPARCstation, you can enter commands in the terminal window and receive feedback information both as messages to the terminal window and on the status display, also on the SPARCstation screen. The command window is running a unix t–shell, so all the standard unix commands are also available, as well as the ability to write scripts (type **`man csh`** for help on this)

There is also a terminal with which you control the instruments. Relevant commands can be found elsewhere. This may be an **`xterm`** window on the SPARCstation, or a separate VT220 terminal.

Data assessment can be carried out in an **`xgterm`** window, running for example IRAF, in association with SAOimage or **`ximtool`**. Note also that saoimage alone can be used to view the data, by entering the fits filename under the etc/new menu. It can be found at /star/bin/saoimage or on the window manager program menu. To access starlink type **starlink** at the command prompt.

On the INT data reduction is carried out on the Sparc20 lpss13, using the int_guest account.

On the JKT data reduction is carried out on the DAS Sparc lpss10 using the observer account.

If you wish to use the SunOS cluster you will first need to obtain a guest account. Ask your support astronomer how to set this up.

2.2 Help

There are two main sources of help, firstly the various manuals in the control rooms and secondly the web. The on line help pages are:

INT: http://ing.iac.es/Onhelp/INThelp.html

JKT: http://ing.iac.es/Onhelp/JKThelp.html

In addition you will find a lot of other information relating to CCDs, instrument user manuals setting up observations by searching from our home page at http://ing.iac.es.

Unix does not give you much help, the main system is **man** (for manual). There are no man pages for the observing system but it is useful for unix commands. To use man:

```
observer@lpss10> man ls
```

Which will display a manual page on the ls command (a directory listing). Or to search for entries about jobs, type:

```
observer@lpss10> man -k jobs
```

2.3 Starting up the system

To start the DAS first log into the system computer using the observer account (password on the console).

Once you are logged in you should define the observing system you wish to use, enter the command:

```
observer@lpss10> obssys
```

Note that lpss10 is the machine name in the JKT – for the INT the prompt is **observer@lpss12>**

You will be asked to enter a number corresponding to the instrument configuration and version of the operating system in use. These configurations will vary from time to time. Check with your support astronomer or the white board for the system in use tonight. For example on the JKT:

```
----------------------------
Observing systems available:
----------------------------
6: JAG with PE ICS (s2.2j no patches)
5: RBS with PE ICS (s2.2j no patches)
0: give up and exit.

Please choose a system > 6


----------------------------------------------------------
Telescope in use: JKT   Instrument in use: JAG
System in use: s2.2j    Patches:
Give the command startobssys to start/restart the system.
Use shutdownobssys to close it down after use.
----------------------------------------------------------
```

On the INT the results look like:

```
obsever@lpss12> obssys

----------------------------
Observing systems available:
----------------------------
7: Unix ICS for IDS with new CCD autoguider (s4.1 no patches)
2: PE ICS for Prime and IDS (s2.2 p 1 3 4)
1: Unix ICS for IDS with old autoguider (s2.1 p 3 4)
0: give up and exit.

Please choose a system > 7
INT messages

---------------------------------------------------------
Telescope in use: INT   Instrument in use: IDS
System in use: s4.1     Patches:
Give the command startobssys to start/restart the system.
Use shutdownobssys to close it down after use.
---------------------------------------------------------

observer@lpss12>
```

Depending on the system in use you may get a description of any patches selected and a display of messages pertinent to the night's observing. If you wish to review the messages then type:

```
observer@lpss12> more /ing/etc/motd
```

If you wish to change the observing system, or any of the patches – you should shut the system down, exit the xterm and start a new xterm and re–issue the obssys command. To start the observing system that has been defined with the above command, issue the following command:

```
observer@lpss10> startobssys
```

The first command, `obssys` defines environment variables so that the most recent version of the observing system is loaded when you type `startobssys.` The various windows that open up are labelled according to their use, you may not get all of those listed below, depending on your telescope configuration:

CCD Status shows the current status of the CCD, including readout speed, binning and window parameters, and state of your current run.

Talker reports messages to the user from the various tasks running during normal operation.

xterm or the terminal you started the system from, is used for entering the DAS commands.

Instrument Control is the connection to the Perkin Elmer instrument control system.

Header Transfer is used for transferring headers from the Pekin Elmer instrument computer for inclusion in the FITS header.

Log shows the log of the exposures taken, as theys are generated+ See appendix 1 for instructions on starting up the instrument control with the interim DAS, ie with the Perkin Elmer controlling the instruments.

2.4 Entering DAS commands

DAS commands are entered on the **`xterm`** that you started the system from, at the shell prompt which will be the time of day: **`23:47:25>`** If you don't see this prompt the system is not ready for DAS commands.

Most commands take parameters, which you must give on the command line. *e.g.*

```
01:33:22> <command> <p1> <p2 <p3>
```

If you leave out a parameter, the system will reject the command and indicate the correct usage. The parameters are passed by relative position on the command line so you cannot omit parameters from the middle of the command.

The commands are case sensitive and should all be entered in lower case. Parameters however are not. Titles and commentary will have mixed case preserved in the observing log

You will be informed, by a message on the Talker screen, when each DAS command finishes. All commands can be executed in the shell background, by appending a **&** to the command. Some commands can be overlapped and carried out in parallel, but those that can not will return an error message indicating why. For example, entering:

```
02:34:45> run 500 ”S1 500s” &
```

will allow the course of the run to be changed using the `finish`, `pause`, `newtime` or `abort` commands (see below).

If you forget to put a command into the background, you can do so by typing <ctrlZ> and then `bg`.

If your system has more than one detector in operation, it will be necessary to define to which detector each command should be sent. This is done by adding the –D option. For example:

```
01:34:21> run –D red  5 ”5s red  std” &
01:34:24> run –D blue 5 ”5s blue std” &
```

starts a 5 second exposure on the red channel and a 5 second exposure on the blue channel.

2.5 Setting up, and resetting the CCD

Before any other commands can be issued the CCD must be setup. Check the whiteboard for which CCD is in use. For example:

```
18:25:53> setup_ccd tek3
```

This will cause most of the items on the status display to be updated, as the configuration file for the CCD is read, and the default values set in the CCD controller. This command can also be used to setup the controller after it has been reset or powered down, or to return to the default configuration when you think there may have been a problem. It kills most commands, so can be used if the system “locks–up”.

It is then possible to set up the windowing and binning. For example:

```
18:31:00> window 1 1100 350 0 350
18:31:50> bin 1 2
```

If the detector is in an unknown state, the controller can be reset, but the `setup_ccd` command will have to be issued again before any other commands are accepted. It is important to give the CCD controller enough time to reset – wait for the shutter to toggle. The reset commnand, unlike most, will return before the CCD controller has completed it’s action. For example:

```
18:20:10> reset
18:20:55> setup_ccd tek3
```

2.6 Starting up Adam on the Perkin Elmer (INT)

This section is not relevant if you are using the unix Instrument Control for IDS or the Wide Field Camera at prime. Both systems can be recognised by their large graphical mimics on the system console.

However, if you are using the 'interim' DAS, you will still have to control the instrument (IDS or Prime) from ADAM and must set up the link to transfer the header information from the Perkin Elmer (PE) to the DAS.

Go to the **Header Transfer** window and sign into the Perkin Elmer as HXFER, *using the same account number as you intend to use for the Adam session:*

```
* SI HXFER,3,3
```

When the * prompt returns, start the server by typing `hxserver`:

```
* hxserver
hxserver ok: listening for requests
```

The terminal for running ADAM is labelled **Instrument Control**. Sign is as before – check with your support astronomer if you are not sure how to start up Adam, using the same account number as for the hxfer sign in. Basically type:

```
* adam
```

If using the IDS select option 3 "IDS and A&G only" to stop the Perkin Elmer (PE) loading any of it's CCD software.

At Prime, select option 1 – "CCD imaging", and give TEK3 as the detector (even if it isn't) and ignore the warning messages from ADAM. If it gets stuck and does not give the adam prompt within about 4 minutes then type:

```
<control-B>
* send con:
```

And you should then get the response:

```
SEND: ADAM fatal error: Break-in on stream using: CON:
Adam:>
```

Note that this is NOT as fatal as it sounds.

Once ADAM is running and you instrument configuration verified, you should get the

```
Adam:>
```

If using the IDS, type the following:

```
Adam:> get ccdagsp
```

If using the Prime focus, type

```
Adam:> get ccdpfcu
```

Finally start up the header collection task as follows:

```
Adam:> batch talk
Adam:> stream dotalk con: dotalk.log
```

The first of these command may take 2 minutes to complete. It is possible to check that ADAM is running the “talk” program as follows:

```
Adam:> show streams /all
```

Which should show that there is a stream with input device DOTALK.PRC. (If there is more than one stream with this name then you will have to shutdown the header transfer protocol in the Header Transfer window). This has now set up the Perkin Elmer instrument computer to send both instrument and telescope headers to the observing system when requested. It is probably worth iconising the **Header Transfer** window now as you will not need to see it again. If the header server fails and exits, it should be restarted in the header transfer window and the dotalk stream started again.

WARNING: It is important that there are no keypresses left on either of the PE windows as this can stop the header logging. To ensure this doesn’t happen, it is a good idea to iconise BOTH when not needed.

2.7 Starting up Adam on the Perkin Elmer (JKT)

If you are at the JKT you are using the 'interim' DAS and you will still have to control the instrument from ADAM as before and must set up the link to transfer the header information from the Perkin Elmer (PE) to the DAS.

Go to the **Header Transfer** window and sign into the Perkin Elmer as HXFER, *using the same account number as you intend to use for the Adam session:*

```
* si hxfer,3,3
```

When the * prompt returns, start the server by typing `hxserver`:

```
* hxserver
hxserver ok: listening for requests
```

The terminal for running ADAM is labelled **Instrument Control**. Sign is as before – check with your support astronomer if you are not sure how to start up Adam, using your initials and the same account number as for the hxfer sign in. Basically type:

```
* si jae,3,3
* adam
```

Select option 1 "Cassegrain F/15 Focus".

If using the JAG select option 1 – "A&G box and CCD direct imaging", and give TEK4 as the detector (even if it isn't) and ignore the warning messages from ADAM. Ignore any telemetry errors. If it gets stuck and does not give the adam prompt within about 4 minutes then type:

```
<control-B>
* send con:
```

And you should then get the response:

```
SEND: ADAM fatal error: Break-in on stream using: CON:
Adam:>
```

Note that this is NOT as fatal as it sounds.

Once ADAM is running and you instrument configuration verified, you should get the

```
Adam:>
```

Finally start up the header collection task as follows:

```
Adam:> batch talk
Adam:> stream dotalk con: dotalk.log
```

The first of these command may take 2 minutes to complete. It is possible to check that ADAM is running the "talk" program as follows:

```
Adam:> show streams /all
```

Which should show that there is a stream with input device DOTALK.PRC. (If there is more than one stream with this name then you will have to shutdown the header transfer protocol in the

Header Transfer window). This has now set up the Perkin Elmer instrument computer to send both instrument and telescope headers to the observing system when requested. It is probably worth iconising the **Header Transfer** window now as you will not need to see it again. If the header server fails and exits, it should be restarted in the header transfer window and the dotalk stream started again.

WARNING: It is important that there are no keypresses left on either of the PE windows as this can stop the header logging. To ensure this doesn't happen, it is a good idea to iconise BOTH when not needed.

2.8 Changing CCD settings

The readout format of the CCD images obtained by the DAS are highly flexible. The size of the basic CCD frame is fixed by the chip type, but the volume of data can be reduced by windowing and binning.

The default image size – *full–frame read–out* – is set to be the full area of the CCD chip plus some extra pixels – *overscan* and *underscan* – which can be used to indicate the bias level.

The ING CCDs can perform binned read–out on either axis or on both at once. You invoke binning by specifying the number of pixels binned together on each axis. The binning factors may be different on each axis but each factor must be an integer from one to ten inclusive and must be compatible with any windows you have set up (see below). Binning reduces the readout time by the product of the binning factors, but if you bin in x you lose the benefit of faster read–out speeds: the CCD drops back to STANDARD speed. To turn off binning, set the binning factors back to (1,1).

You can also reduce the size of your images, and the read–out times, by setting windows for the read–out: only the pixels within the windows pass through the CCD electronics into the system computer. Up to 4 windows maybe set at one time, but windows may not overlap and no window may extend beyond the CCD full–frame (ie the frame that includes theunder and overscan regions).

Windows and binning may be combined in the same read–out, but parameters must be made compatible. The size and position of the windows in specified in terms of ***un–binned*** **CCD pixels** and the size of each window must be a multiple of the binning factor in each axis.

You can choose the speed at which the CCD reads out to suit your observing programme. Faster read–outs have higher noise and you should consult your support astronomer (or the ING WWW server) for the most recent figures. The allowed read–out speeds are: SLOW, STANDARD, QUICK and TURBO. A fifth speed, NONASTRO, is only useful for engineering work and instrument setup.

To bin up CCD data, use commands such as:

```
01:33:24> bin 2 2
03:33:21> bin 2 1
```

To set a window on a CCD, use the `WINDOW` command. For example, when using a spectrograph with a 1124 x 1124 pixel CCD and the spectrum running in the x direction you might use:

```
01:22:20> window 1 1124 200 0 350
```

to capture a 200 pixel strip about the spectrum that runs the full length of the chip. The parameters are, in order: window number, window x–size, window y–size, window x–offset and window y–offset. The offsets are the number of pixels by which the window is displaced from the origin of the CCD, ie a window with offset (0,0) includes part of the first row and column of the CCD. The window number can be from 1 to 4 and you can reuse a window number – eliminating the previously defined window of that number from the system. The window size and offset should both be integer multiples of the binning factor in that dimension. For example if binning by 2 in Y, the window size in Y should be even, and so should the offset to the start of the window.

You can temporarily disable windowing, return to reading out the whole CCD, and then re–enable the windows as follows:

```
01:33:43> disable_win
01:33:45> run 0
01:34:10> enable_win
```

Note that enabling and disabling the windows does not change the binning. You can remove a window by setting the X size to zero.

To change speed, you may either use the command `rspeed`:

```
02:34:45> rspeed standard
02:35:00> rspeed quick
```

or you can just use the name of the speed as the command:

```
02:34:45> standard
02:35:00> quick
```

The normal exposure cycle for CCDs includes a preflash, but the available CCD chips do not need such a preflash, so the preflash length is usually set to zero. However if you do need to preflash, the length of the flash is set with the command `preflash`:

```
01:38:02> preflash 0.05
```

where the parameter is the preflash time in seconds. This command does not illuminate the CCD, but all subsequent exposures will include the preflash. The preflash can be cleared by setting the length to zero. It is always reset to zero when a setup_ccd is performed

2.9 Taking Exposures

2.9.1 Simple exposures

Most observations are started with one of the commands `run`, `flat`, `arc` or `bias`. Each of these commands:

produces a single data–set from a single CCD;

saves the data to disk for later export on FITS tape;

records the observation in the observation log

The command names correspond to the intended use of the image and are recorded in the FITS header under the keyword OBSTYPE. The commands `flat` and `arc` can also be used and are similar to `run`. `Dark` and `bias` do not open the detector's shutter. `Bias` takes a bias frame, and is equivalent to `run 0`. All exposure commands preflash the CCD if a non–zero time has been set for the preflash time. If a title is provided, it will be recorded in the FITS header under the keyword OBJECT. For example:

```
02:37:48> run 100 "NGC 1068"
```

requests a run of length 100 seconds. The title "NGC 1068" appears in the observing log. The system will allocate a run number to the run and will report this number. All the runs for a given night appear in the same directory.

2.9.2 Multiple sequential exposures

For each single–exposure command there is a multiple–exposure equivalent that takes a series of similar frames. For example:

```
03:43:12> multrun 5 30 ”Time sequence 1”
```

starts a series of 5 30–second observations. Each observation will be logged with the same title. Other multiple exposure commands available: multarc, multbias, multdark, multflash, multflat, multsky – with each carrying multiples of the corresponding single exposure command.

2.9.3 Quick look and instrument setup exposures

To make an observation that you do not intend to archive, use the `scratch command`:

```
19:45:32> scratch 1 10 ”Left Hartmann”
```

Takes a 10 second image, and writes the data (plus header) to a scratch file s1.fit, in the currently used data directory (eg /obsdata/lpss10a/yymmdd).

Scratch files have headers but are not allocated run numbers. They are temporary files that should not be exported.

Any number of scratch files may be created by substituting another file number for the 1 in the command. If you re–use the scratch file number, the new data overwrites the old, which cannot be recovered.

If you later find that you want to keep a scratch file, you can convert it to a proper run using the `promote` command:

```
01:35:45> promote 1
```

causes scratch file 1 to be allocated a run number.

For faster acquisition, at the cost of the complete header collection, use the `glance` command:

```
12:45:12> glance 5
```

This takes a 5 second exposure, and writes creates a glance file in the currently used data diectory. The file name depends on the DAS channel in use, for example the file will be DAS1.fit from channel 1. The fits file will contain all the headers that can be collected quickly, but not the slow ones. This means that if instrumnet control is from the Perkin Elmer, the instrument and Telescope header packets will not get saved. A glance file can be converted to a proper run, using the promote command with no file number (see above). It should be remembered though that the final fits run file will not have the instrument and telescope descriptors if these come from the Perkin Elmer.

2.9.4 Pausing and stopping exposures

There is a set of commands for changing the course of an exposure.

If you did not start the run with for example **run 1 test &** to put this run in the background then you will need to put the foreground job RUN into the background by:

```
<control-z>
bg
```

WARNING: that you will cause serious problems if you don't do the bg.

If you don't understand unix job management please ask your support astronomer or try typing:

```
01:20:21> man jobs
```

If you need to pause and then restart a CCD exposure, do so using the following commands:

```
01:30:21> pause
01:39:18> continue
```

If you need to abort a CCD exposure or readout before the pre–set exposure time has elapsed, do so using the following command:

```
01:42:10> abort
```

This will stop a run – but it should be remembered that a new run cannot be started until the CCD controller has finished reading the chip out.

If you wish to stop an exposure, and read out immeadiately, use the following command:

```
01:46:23> finish
```

This commands must be given when the CCD is still exposing, and will fail if it has started reading out already.

The command `newtime` sets a new exposure time for an observation:

```
05:42:31> newtime 1000
```

changes the exposure time to 1000 seconds. If you specify a time less than that already exposed the command will fail.

2.10 The observing log

Each time a normal observation is made (with the commands run, bias etc) an entry is made by the system in the observing log. This entry is distilled from a sub–set of the FITS headers, and avoids the need to keep the log manually.

The data recorded automatically in the log for each observation are those most likely to change from exposure to exposure. The entries are in order of increasing run number. See OBS–LOG–3 for details.

The Logger window displays a copy of the log, as well as useful information such as space left on disk.

2.11 Shutting down

To shutdown the observing system, use the `shutdownobssys` command:

```
07:32:12> shutdownobssys
```

If using the interim DAS, with the Perkin Elmer / adam instrument control, you should also shutdown the Perkin Elmer sessions (Instrument control and Header transfer). In the Instrument control window type the following commands:

```
Adam:> kill dotalk.prc
Adam:> shutdown
Adam:> <control-B>
* cancel
* so
```

You should be able to avoid the `control-B/cancel` if shutdown completes OK. If **cancel** does not work try **ca** instead. On the JKT you may be asked what the CCD chip name is – answer `rca`.

In the Header Transfer window type the following commands:

```
<Control-B>
* send stop
* so
```

If this does not shut down the hxserver task in 5 seconds, then use:

```
<control-B>
* cancel
* so
```

2.12 System Recovery

If there is a problem with the system, such a locked run, or an stuck command, the following should be tried in turn until the fault is rectified:

2.12.1 Abort

If a run has not completed, the prompt can be returned by putting it in the background as follows:

```
<control-Z>
12:03:34:> bg
```

Typing `abort` should free up a stuck run. You can recover any data with the `promote` command.

2.12.2 Setup

Typing `setup_ccd` should kill most hung actions. The next level is to try dasreset and then `setup_ccd`.

2.12.3 Shutdown and startup

As a last resort, the system should be shut down and restarted. Using the following sequence will ensure that the maximum system information is logged to allow the problem to be investigated:

Use “save to file” option on “talker”

`shutdownobssys` – kills all the tasks

`cp $SCCD_LOGS/* ~` – copies the logs to you home directory

`startobssys` – restarts the observering system

Support staff should be informed of the occurance and the location of the log files, but the system should be back up in 2 or 3 minutes.

2.13 Shell scripts

You can do more complex multiple exposures using shell scripts. These should be stored in your a sub directory named with your initials in the observer account. If you wish to save these for another observing session then you will need to take them home. See the manual pages on `cshrc` (by typing `man csh`) for information on how this should be done.

2.14 Writing the disk files to tape

The commands that make exposures do not write the observations to tape and it is the observer’s responsibility to control the tape writing. The useful commands are fitsinit, fitsout and fitsin. See the How to in the control room book “HOW TO write your fits files to a DAT tape”. Document WHT–FITS–2 discusses RGO’s policy for the use of tapes and explains how to drive the other tape writing programs.

3 Command Reference

This section is a reference section, describing all commands concerned with the data acquisition. Commands are first listed alphabetically, then listed by function, then are defined in detail (in alphabetical order).

Commands for operating the telescope are listed in the telescope users manual, and those for operating different instruments are summarised in the instrument manuals.

Notation used in this section

Examples of commands entered at the terminal are in courier font: `promote`

Angle brackets denote parameter values or character strings: `<x-offset>`

Square brackets denote optional input: `[title]`; all other parameters are obligatory

3.1 Commands listed alphabetically

abort	Abort an observation, discarding and associated data
arc	take an exposure and save it, with the OBSTYPE defined as ARC
bias	take a bias frame, and save it with the OBSTYPE defined as BIAS
bin	select binned readout of the detector
clear_speed	set the clear speed
continue	restart an exposure suspended by **pause** (q.v.)
dark	take a dark frame and save it with the OBSTYPE defined as DARK
disable_win	suspend the effect of windowing on a CCD
enable_win	resume windowing after **disable_win** (q.v.)
finish	terminate an exposure immediately; saving the data
flash	take an exposure and save it, with the OBSTYPE defined as FLASH
flat	take an exposure and save it, with the OBSTYPE defined as FLAT
glance	take one exposure and leave as the glance file
killmultrun	stop the last exposure
multarc	make multiple exposures, all with OBSTYPE defined as ARC
multbias	make multiple exposures, all with OBSTYPE defined as BIAS
multdark	make multiple exposures, all with OBSTYPE defined as DARK
multflash	make multiple exposures, all with OBSTYPE defined as FLASH
multflat	make multiple exposures, all with OBSTYPE defined as FLAT
multrun	make multiple exposures, all with OBSTYPE defined as RUN
multsky	make multiple exposures, all with OBSTYPE defined as SKY
newtime	change the length of an exposure
nonastro	change the readout speed to NONASTRO
pause	suspend an exposure
preflash	set the length of a CCD preflash
promote	promote a scratch file to a normal run
quick	set the readout speed to QUICK
readout_speed	change the read–put speed of the CCD
reset	reset the CCD controller

rspeed	synonym of readout_speed
rtcsync	synchronise the CCD controller's real time clock
run	take one exposure and save it, OBSTYPE will be defined as RUN
scratch	take one exposure and save it to a scratch file
setup_ccd	prepare channel, needed before any other command is accepted
shutter	move or unjam the shutter
sky	take an exposure and save it, with the OBSTYPE defined as SKY
slow	change the readout speed to SLOW
standard	change the readout speed to STANDARD
turbo	change the readout speed to TURBO
unbin	change the binning parameters to (1,1)
window	define a read–out window on a CCD

3.2 Commands listed by function

3.2.1 Normal exposures

arc	take an exposure and save it, with the OBSTYPE defined as ARC
bias	take a bias frame, and save it, with OBSTYPE defined as BIAS
dark	take a dark frame and save it, with OBSTYPE defined as DARK
flash	take an exposure and save it, with the OBSTYPE defined as FLASH
flat	take an exposure and save it, with the OBSTYPE defined as FLAT
run	take an exposure and save it, with the OBSTYPE defined as RUN
sky	take an exposure and save it, with the OBSTYPE defined as SKY

3.2.2 Multiple exposure sequences

multarc	make multiple exposures, all with OBSTYPE defined as ARC
multbias	make multiple exposures, all with OBSTYPE defined as BIAS
multdark	make multiple exposures, all with OBSTYPE defined as DARK
multflash	make multiple exposures, all with OBSTYPE defined as FLASH
multflat	make multiple exposures, all with OBSTYPE defined as FLAT
multrun	make multiple exposures, all with OBSTYPE defined as RUN
multsky	make multiple exposures, all with OBSTYPE defined as SKY

3.2.3 Test exposures

promote	promote a scratch file to a normal run
scratch	take one exposure and save it to a scratch file
glance	take one exposure and leave in the glance file

3.2.4 Changing image size

bin	select binned readout of the detector
disable_win	suspend the effect of windowing on a CCD

enable_win	resume windowing after **disable_win** (q.v.)
window	define a read–out window on a CCD

3.2.5 Changing CCD speed

quick	set the readout speed to QUICK
nonastro	change the readout speed to NONASTRO
readout_speed	change the read–put speed of the CCD
rspeed	synonym of readout_speed
slow	change the readout speed to SLOW
standard	change the readout speed to STANDARD
turbo	change the readout speed to TURBO
clear_speed	set the clear speed, to STANDARD to QUICK

3.2.6 Interrupting an exposure

abort	Abort an observation, discarding and associated data
continue	restart an exposure suspended by **pause** (q.v.)
finish	terminate an exposure immediately; saving the data
newtime	change the length of an exposure
pause	suspend an exposure

3.2.7 Housekeeping

preflash	set the length of a CCD preflash
setup_ccd	prepare channel, needed before any other command is accepted
shutter	move or unjam the shutter
reset	Reset the CCD controller
rtcsync	Synchronize the real time clock on the CCD controller

3.3 Command descriptions

3.3.1 abort

Format:	`abort`
Comments:	Aborts an exposure. This can be used to clear a hung run, when a pixel has been lost for example. If the CCD is reading out, it will not be possible to start another run until the readout completes.

3.3.2 arc

Format:	`arc <time> ["<title>"]`
time:	The exposure time in seconds
title:	A title for the observation, defaults to ”ARC”

Example: `arc 5.5 ”CuNe 5.5s”`

Comments: This is equivalent to the **`run`** command, but sets the FITS header packet OBSTYPE to ARC.

3.3.3 bias

Format: `bias [”<title>”]`

title: A title for the observation, defaults to ”BIAS”

Example: `bias ”Bias TEK4 Turbo”`

Comments: This is equivalent to the **`run`** command, with a zero second exposure time, and sets the FITS header packet OBSTYPE to BIAS. The CCD is read out immediately after clearing without opening the shutter. If the preflash time is not set to zero, the preflash LEDs are used between the clear and the readout.

3.3.4 bin

Format: `bin <xbin> <ybin>`

xbin: The binning factor in X. This must be an integer in the range 1 to 10

ybin: The binning factor in Y. This must be an integer in the range 1 to 10

Example: `bin 2 2`

Comments: This command sets the binning factors in both X and Y. Binning factors that do not divide exactly into the current window sizes will be rejected. Binning in x forces the read–out speed back to STANDARD; the speed is not automatically changed if the x–binning is set back to 1. To clear binning enter binning factors of (1,1).

3.3.5 clear_speed

Format: `clear_speed <speed>`

speed: Clear speed , `standard` or `quick`

Comments: This command sets the speed the CCD will clear. Quick is the default and standard is rarely used.

3.3.6 continue

Format: `continue`

Comments: This command resumes a paused CCD exposure, opening the shutter. The shutter will not however be opened if it wasn’t open when the pause was issues, for example when doing a dark exposure. This command will be rejected if there is no paused exposure currently in progress.

3.3.7 dark

Format: `dark <time> [”<title>”]`

time: The exposure time in seconds

title: A title for the observation, defaults to ”DARK”

Example: `dark 200 ”200s DARK”`
Comments: This is equivalent to the **run** command, except the shutter doesn't open for the exposure. It also sets the FITS header packet OBSTYPE to DARK.

3.3.8 disable_win

Format: `disable_win`
Comments: This command disables windowing of the CCD. The command does not delete the definition of the windows however, it only stops them from being applied. This command does not affect binning.

3.3.9 enable_win

Format: `enable_win`
Comments: Where windowing has been disabled using the `disable_win` command, this command re–enables them.

3.3.10 finish

Format: `finish`
Comments: This command terminates the current CCD exposure, saving the exposure as if it had completed normally.

3.3.11 flash

Format: `flash <time> [”<title>”]`
time: The exposure time in seconds
title: A title for the observation, defaults to ”FLASH”
Example: `flash 5.5 ”5.5s with preflash”`
Comments: This is equivalent to the **run** command, but sets the FITS header packet OBSTYPE to FLASH.

3.3.12 flat

Format: `flat <time> [”<title>”]`
time: The exposure time in seconds
title: A title for the observation, defaults to ”FLAT”
Example: `flat 20 ”B flat 20s”`
Comments: This is equivalent to the **run** command, but sets the FITS header packet OBSTYPE to FLAT.

3.3.13 glance

Format: `glance <time>`
time: The exposure time in seconds

Example: `glance 5.5`
Comments: This carries out an exposure, collects the fast (local) headers, and creates a fits file in the glance file for the channel in use, but does not copy it over into a scratch or run file. This means it will be over written by the next exposure – be it a run, scratch or glance. The local headers do not include any headers from the Perkin Elmer – such as instrument and telesocpe headers if the Perkin Elmer is being used. This can be promoted to a run file using the promote command with no argument, but the resulting run will not have instrumnet and telescope header packets.

3.3.14 multrun

Format: *multrun* `<number> <time> ["<title>"]`
number Number of multiple exposures requested. Must be higher than 1
time: The exposure time in seconds
title: A title for the observation, defaults to "RUN"
Example: `multrun 5 20 "multiple 20s"`
Comments: This is carries out multiple exposures, equivalent to typing the **`run`** command repeatedly. Use <controlC> to kill – the current run will complete. Other multiple exposure commands available: multarc, multbias,multdark, multflash, multflat and multsky.

3.3.15 killmultrun

Format: *killmultrun*
Example: `killmultrun`
Comments: This stops the current run of a multrun and all pending multrun jobs. Use <controlC> to kill – the current run only.

3.3.16 newtime

Format: `newtime <time>`
time: The new exposure time in seconds
Example: `newtime 400`
Comments: If the specified time is less than that already exposed, the command is rejected, otherwise the exposure time for the current exposure is changed to that requested.

3.3.17 nonastro

Format: `nonastro`
Comments: This command sets the readout speed of the the CCD to NONASTRO. The command will be rejected if the CCD is binned in X.

3.3.18 pause

Format: `pause`
Comments: This command suspends the current CCD exposure, closing the CCD shutter. The command is rejected if there is no exposure in progress.

3.3.19 preflash

Format: `preflash <flash-time>`
flash–time: The length of the preflash, in seconds
Example: preflash 0.05
Comments: This command sets the length of the preflash for all subsequent exposures. Please note that the preflash command itself does not illuminate the CCD, the preflash occurs as part of subsequent exposure commands. Remember to set back to 0.0 when finished.

3.3.20 promote

Format: `promote [<filenum>]`
filenum: The number of the scratch file to be saved
Example: `promote 5`
Comments: Promotes a scratch datafile to the main data–area on the system computer, assigning it a run number, which will be reported to the user. If no filenum is given, the latest glance file is promoted to a run, if it exists.

3.3.21 quick

Format: `quick`
Comments: This command sets the readout speed of the the CCD to QUICK. The command will be rejected if the CCD is binned in X.

3.3.22 readout_speed

Format: `readout_speed <speed>`
speed: The readout speed to be set: slow, standard, quick,turbo, nonastro
Example: `readout_speed slow`
Comments: This command sets the readout speed of the the CCD to that requested. The command will be rejected if the CCD is binned in X. See also `rspeed.`

3.3.23 reset

Format: `reset`
Comments: This command resets the CCD controller, causing all setup information to be lost. Before any further commands are accepted, `setup_ccd` command must be issued to ensure that the status of all parameters in the controller are known..

3.3.24 rspeed

synonym for `readout_speed` (*q.v.*)

3.3.25 rtcsync

Format: `rtcsync`
Comments: This command synchronises the clock on the CCD controller with that of the host Sparc. Can take up to 70 seconds to complete.

3.3.26 run

Format:	`run <time> ["<title>"]`
time:	The exposure time in seconds
title:	A title for the observation. Defaults to "RUN"
Example:	`run 1.5 "MGC1068 nucleus"`
Comments:	This command takes a single exposure, of an astronomical target, collects the header information related to that exposure, and transfers both the data and the headers into a FITS file on the system computer. During the observation the system will report the run number allocated, and announce the end of the exposure.

3.3.27 scratch

Format:	`scratch <filenum> <time> ["<title>"]`
filenum:	The file number to be used for the scratch file
time:	the exposure time in seconds
title:	A title for the observation, defaults to "SCRATCH"
Example:	`scratch 5 60`
Comments:	As for the `run` command, except that the data is not written to a run file, but to a scratch file, in the main data area of the system computer. The scratch file will be named sn.fit where n is the filenum given in the argument. This command is intended primarily for use with set–up procedures. However files can be promoted to standard runs using the promote command – see below.

3.3.28 setup_ccd

Format:	`setup_ccd <detector-name>`
detector–name:	The name of the detector to be set up
Example:	`setup_ccd TEK3`
Comments:	Once the DAS has started, or the CCD controller has been reset, no commands are accepted until the DAS has been setup with this command. This resets the image format for the CCD exposures, and prepares the DAS for taking data,

3.3.29 shutter

Format:	`shutter <state>`
state:	Open, close or unjam
Example:	`shutter open`
Comments:	Moves the shutter to the desired position, or unjams it. After an unjam, the shutter should be in the closed state.

3.3.30 slow

Format:	`slow`
Comments:	This command sets the readout speed of the the CCD to SLOW. The command will be rejected if the CCD is binned in X.

3.3.31 standard

Format:	`standard`
Comments:	This command sets the readout speed of the the CCD to STANDARD. The command will be rejected if the CCD is binned in X.

3.3.32 turbo

Format:	`turbo`
Comments:	This command sets the readout speed of the the CCD to TURBO. The command will be rejected if the CCD is binned in X.

3.3.33 window

Format:	`window <windowNo> <Xsize> <Ysize> <Xoffset> <Yoffset>`
windowNo:	Number of the window to be set (from 1 to 4)
Xsize:	X size of the window in CCD pixels
Ysize:	Y size of the window in CCD pixels
Xoffset:	X offset of the origin of the window in pixels
Yoffset	Y offset of the origin of the window in pixels
Example:	`window 1 1280 200 0 400`
Comments:	Sets a readout window on the CCD. The size and position of a window must be given in *un–binned* CCD–pixels. Setting an Xsize of zero deletes a readout window. Offsets of zero align the window with the left/bottom edge of the image. The command enables any windows that were previously disabled.

3.3.34 unbin

Format:	`unbin`
Comments:	This command sets the binning factors to (1,1)

Appendix A. Engineering interfaces

Connect to the engineering port of the CCD connected to serial port B of the system computer, using the unix “tip” utility. To leave tip issue <RETURN>~.<RETURN>. On a new xterminal type:

```
observer@lpss10> tip CCD
```

If a run fails to complete, put it into the background, and look at it’s status as follows:

```
<control-Z>
12:34:45> bg
12:34:45> cmd -g DAS1 RUN
```

This will list the status of the various action requred for a run. If the image and fox actions are complete, the run can be salvaged for the scratch (DAS1.fit) using promote.

Some useful windows are:

Chip/Use	Window definition
Any for Prime star focus iamges	1 256 256 420 390
TEK for spectroscopy	1 1124 384 0 340
TEK for spectroscopy	1 1124 256 0 400
Loral for spectroscopy	1 2148 768 0 600
TEK Full frame	1 1124 1120 0 0

If the FOX is reported as flooded, to reset the DAS issue the command: “dasreset”

If data from an unexpected source arrives, you may find error messages from the DataCell card driver gets written over the screen. these can be cleared by “refreshing” it.

To sign back into the Perkin–Elmer: start a new xterm and then telnet to intpe or jktpe, sign in as normal.

Appendix B. Document History

Issue	0.1	20/11/95	First draft release for review
Issue	0.2	12/09/95	Second draft, interleaf format.
Issue	1.0	06/04/96	First release.
Issue	1.1	05/05/96	GLANCE added, and other minor mopdifications.
Issue	1.2	26/06/96	Updated with operational experience
Issue	2.0	09/04/97	Updated for the JKT and some additional info added