VLBI Software Documentation
Field System

SNAP Commands

W. E. Himwich and N. R. Vandenberg
NVI, Inc./GSFC

Operations Manual

Table of Contents

1.0 SNAP Command Syntax

This manual contains detailed descriptions of the SNAP commands available in the Field System. Each command is described on a separate page. Commands are ordered alphabetically.

Please refer to the **SNAP Language** manual for the specifications of the language itself, including a description of control commands and general syntax.

The subsections of this first section contain reference information that applies to many commands.

1.1 Command Descriptions

In this manual, each command is described on a separate page. For each command, the information is provided:

command - function (equipment)

>The command name and a few words that describe its function are given at the top of each page. If the command is restricted to certain types of equipment, that information is given in parentheses. For example, the **bbc***nn* command is applicable only to **VLBA** and **VLBA4** racks, and the title will include the words **(VLBA, VLBA4 racks)**. Many commands don't have restrictions because they are general FS commands, such as **schedule** or **echo**. Commands that interact with the equipment may be general as well. This may be because the command is in fact implemented for all types of equipment. In fact some commands that have no restrictions have very limited functionality beyond some specific equipment configurations. Except for one command: **pcal**, all commands are restricted by either the rack or the recorder that is used, but not by both (this will be corrected for **pcal** at a later date). All of the currently existing rack restrictions are listed below:
>
>**K4K3 racks**
>**Mark III racks**
>**Mark III, Mark IV racks**
>**Mark III, Mark IV, VLBA, VLBA4 racks**
>**Mark III, Mark IV, all K4 racks**

Mark IV, VLBA4, K4MK4 racks
Mark IV, VLBA, VLBA4, K4MK4 racks
VLBA racks
VLBA, VLBA4 racks
all K4 racks
all racks

These restrictions all correspond to rack types that can be specified in `equip.ctl`, except for the restrictions involving K4 racks: **all K4**, **K4K3**, **K4MK4**, **VLBA**, and in addition: **all** racks. For the **all K4** restriction, all K4 types are included irrespective of K4 VC sub-type and including all K4K3 and K4MK4 types irrespective of K4 VC sub-types. The **K4K3** restriction includes all K4 racks with a K3 formatter, irrespective of K4 VC sub-type. The **K4MK4** restriction includes all K4 racks with a Mark IV formatter, irrespective of K4 VC sub-type . The **VLBA** restriction includes both the `vlba` and `vlbag` rack types. The **all** restriction indicates that this command works for all racks, i.e., the only rack for which it does not work is `none`.

All of the currently existing recorder restrictions are listed below:

K4 drives
Mark III drives
Mark III, Mark IV drives
Mark IV drives
VLBA, VLBA4 drives
S2 drives
all drives
longitudinal drives

These restrictions generally include more than one recorder sub-type that can be specified in `equip.ctl`. The **K4** restriction includes all K4 drive types with and without the DMS. The **Mark IV** restriction includes both the `mk4` and `mk4b` sub-types. The **VLBA** restriction include `vlba`, `vlba2`, and `vlbab` sub-types. The **all** restriction indicates that this command works for all recorders, i.e., the only recorder type for which it does not work is `none`. The **longitudinal** restriction indicates that it includes all of Mark III, Mark IV, VLBA (including VLBA2), and VLBA4 recorders. All other restrictions: **Mark III**, **VLBA4**, and **S2** all apply to just those simple types.

Syntax: **command=***list of parameters*

The command syntax is shown first. The command name and the list of parameters are shown. The various forms of the command are described in the Comments section. Any combination of upper case and lower case letters may be used in typing a command. All commands are converted to lower case before they are processed.

Response: command/*list of response parameters*

The response (if any) to the command is given with the list of parameters appearing in the response. Normally the response to a command has an identical list of parameters to the command itself, followed by any monitor parameters. All responses to commands are displayed in lower case letters only.

Settable parameters:

This part of the page describes each parameter in the "Syntax" line that can be specified by the operator. The allowable range of values for each parameter is given. The default value, if any, is given. A default value is obtained by entering a null for a particular parameter. The parameter value specified in the previous issuing of this command may be obtained by entering ***** instead of a value. Entering **?** as the first parameter results in a response containing the parameters specified in the most recent issuance of this command. If any parameter value is found to be invalid, command interpretation stops at that point and an error message is generated.

Monitor-only parameters:

Each parameter in the "Response" that does not appear in the "Syntax" is described in this section. These are parameters that cannot be specified by the operator, but are monitored or calculated by the Field System.

Comments:

The final section of the page provides further descriptions of the way in which the command works. These comments often describe the algorithm that was used in implementing the command, and outline specific conditions under which the command should be used.

1.2 Dual Recorder Support

The FS supports sequential recording on two recorders (or drives).With the exception that K4 and S2 recorders are only supported as recorder number 1, any and all recorders (including `none`) can be used either as recorder 1 or recorder 2. When the FS operates in dual recorder mode, all commands that refer to recorders come in two forms. They either have a numeral **1** or a numeral **2** appended to the normal single recorder version of the command depending on whether they refer to recorder 1 or recorder 2. The single recorder version of the commands are the ones documented in the SNAP command manual pages. As an example, if recorder 1 is a VLBA drive and recorder 2 is Mark III drive, the tape command that refers to recorder 1 would be the VLBA drive tape command with a **1** appended: **tape1**. Likewise for recorder 2, the tape command would be the Mark III drive tape command with a **2** appended: **tape2**. For all tape recorder commands (those that have some drive restriction specified in their command -function title line of the SNAP command description page) a numeral at the end distinguishes which drive they refer to.

There are also some rack oriented commands that need to know which recorder is in use. In addition the `monit` and `chekr` programs need to know which recorder is in use. The **select** command allows the drive being used for data recording to be specified. `drudg` does this automatically for schedules that use two drives. Please note that the recorder that is not being used for recording can be manipulated by the operator using the appropriate commands to complete tasks such as prepassing and mounting the next tape. The **mount1** command is not available for K4 and or S2 recorders. All other aspects of two recorder operation with a K4 or S2 recorder as recorder 1 are implemented.

If only one tape drive is used, the drive type of either recorder 1 or recorder 2 in `equip.ctl` must be `none`. In this case all of the recorder specific commands are used without a numeral suffix and they refer to the recorder that is not specified as `none`. This appears as normal one tape drive operation as used in older versions of the FS, except that it is possible to select which of two drives will be used by just changing the `equip.ctl` file and restarting the FS. Please note that the **mount** command is only available for dual recorder configurations, i.e., the version without a numeral appended is never available.

1.3 MAT Module Functions

The phrase "MAT module functions available" in the comments section means that the following additional types of parameters may be used. This is available for those Mark III modules that have MAT communications.

module=**test/reset**   Issues an MAT reset to this module only.

module=**alarm**   Resets the alarm on this module.

1.4 MCB Module Functions

The following syntax is valid for those commands which state that "MCB module functions are available" in the Comments section of the command description.

module=**addr**   Sends the module its base address and length. This sets the module's MCB address space.

module=**test**   Checks the module's address. An error message in response to this command indicates that the module needs to be sent its address space.

1.5 Module and Detector Mnemonics

The Field System makes use of mnemonics for Mark III, Mark IV, S2, VLBA, and VLBA4 equipment in SNAP commands. No mnemonics are defined for K4 modules or detectors at this time. Displays of mnemonics are always two characters, but many forms of module names are allowed when entering commands. This is a convenience for the operator who does not have to remember the exact two-character mnemonic.

The SNAP commands that pertain to total power radiometry allow the operator to specify different detectors in the equipment. Detectors are specified by using a mnemonic. When the Field System displays mnemonics they are always two characters, but different forms of the detector names are allowed when entering commands. This is a convenience for the operator who does not have to remember the exact two-character mnemonic.

Valid mnemonics for modules and detectors are listed in the tables on the following pages.

The **u5** and **u6** detector mnemonics are used for station specific detectors that implemented via the antcn program. Currently they are not completely supported. They may be used in the **fivept** and **onoff** commands for all rack types (including none). They may also be use in the **tpi**, **tpical**, **tpzero**, and **tsys***X* commands for rack types other than Mark III, Mark IV, VLBA, and VLBA4 .

Field System Module Mnemonics		
Module	Standard mnemonic	Other allowed mnemonics (* indicates mnemonics available only when only one drive is defined)
Mark III modules		
video converters	v*n*, *n*=1-f	vc*n*, *n*=1-15, 1-f
IF distributor	if	ifd
formatter	fm	form
tape transport 1	r1	rec1, tape1, rc*, tp*
tape transport 2	r2	rec2, tape2, rc*, tp*
high density heads transport 1	h1	hd*
high density heads transport 2	h2	hd*
S/X receiver	rx	
IF3 distributor	i3	if3,ifd3
S2 modules		
tape recorder 1	r1	rec1, tape1, rc*, tp*
VLBA modules		
baseband converters	b*n*, *n*=1-f	bc*n*, bbc*n*, *n*=1-15, 1-f
IF distributor 1, channels A&B	ia	ifa, ifb, ib, ifab
IF distributor 2, channels C&D	ic	ifc, ifd, ic, ifcd
formatter	fm	form
tape recorder 1 (except heads)	r1	rec1, tape1, rc*, tp*
tape recorder 1 (except heads)	r2	rec2, tape2, rc*, tp*
high density heads recorder 1	h1	hd*
high density heads recorder 2	h2	hd*
Groups of modules		
all modules which have been set up		all
odd video or baseband converters		odd
even video or baseband converters		even

Field System Detector Mnemonics		
Detector	Standard mnemonic	Other allowed mnemonics
Mark III detectors		
formatter selected VCs	`formvc`	
IFs feeding formatter selected VCs	`formif`	
video converters	`v`*n*, *n*=`1-f`	`vc`*n*, *n*=`1-15,1-f`
IF distributor channel 1	`i1`	`if1`
IF distributor channel 2	`i2`	`if2`
IF3 distributor	`i3`	`if3`
S2 detectors		
none		
VLBA detectors		
formatter selected BBCs	`formbbc`	
IFs feeding formatter selected BBCs	`formif`	
baseband converters, USB	*n*`u`, *n*=`1-f`	`b`*n*`u`, `bc`*n*`u`, `bbc`*n*`u`, *n*=`1-15,1-f`
baseband converters, LSB	*n*`l`, *n*=`1-f`	`b`*n*`l`, `bc`*n*`l`, `bbc`*n*`l`, *n*=`1-15,1-f`
IF distributor 1, channel A	`ia`	`ifa`
IF distributor 1, channel B	`ib`	`ifb`
IF distributor 2, channel C	`ic`	`ifc`
IF distributor 2, channel D	`id`	`ifd`
Station Dependent Detectors		
Detector 1 (IF "chain" 5)	`u5`	
Detector 2 (IF "chain" 6)	`u6`	
Groups of detectors		
all non-station dependent detectors		`all`
all odd video converters		`odd`
all even video converters		`even`
all odd baseband converters USB		`oddu`
all odd baseband converters LSB		`oddl`
all even baseband converters USB		`evenu`
all even baseband converters LSB		`evenl`

2.0 On-Line Help

The entire documentation for each command is available as on-line help in the Field System. The **help** command will display the information for a specified command on the screen during Field System operations. The information that is listed is identical to that found on the pages of this manual.

Refer to the page with the **help** command description.

3.0 SNAP Command Descriptions

antenna - direct line to the antenna

Syntax: **antenna=***message,message, ...*

Response: antenna/*response,response, ...*

Settable parameters:

message   message to be sent to the antenna in the exact form required by the pointing
              software. Each message between commas will be sent separately.

Monitor-only parameters:

response   response of the antenna to the message. This response is either ack or an error
              message sent by the antenna.

azeloff - az-el source position offset

Syntax: **azeloff=**_az,el_

Response: azeloff/_az,el_

Settable parameters:

_az_   Offset in azimuth, in numeric angle/degrees format. Response is in decimal degrees.

_el_   Offset in elevation, in numeric angle/degrees format. Response is in decimal degrees.

Monitor-only parameters: none

Comments:

The antenna will move to the offset position when this command is issued. To return to the on-source position, issue this command with zero offsets.

bbcnn - baseband converter (VLBA, VLBA4 racks)

Syntax: **bbc***nn=freq,ifsource,bwu,bwl,avper,gainmode,gainu,gainl*

Response: bbc*nn/freq,ifsource,bwu,bwl,avper,gainmode,gainu,gainl,*
                 lock,USBpwr,LSBpwr,serno,err

nn is the BBC index number corresponding to its position in the rack, **01** to **14**. Not all racks have all BBCs.

Settable Parameters:

freq	L.O. frequency in MHz, between **450.00** and **1050.00**, inclusive. No default. This frequency range is greater than the normal range over which the BBC is specified to lock (500 to 1000 MHz) to allow for testing.
ifsource	I.F. input source, one of **A, B, C, D**. No default.
bwu	Bandwidth for USB in MHz. One of **0.0625**, **0.125**, **0.25**, **0.5**, **1**, **2**, **4**, **8**, **16**. Default **2**.
bwl	Bandwidth for LSB in MHz. One of **0.0625**, **0.125**, **0.25**, **0.5**, **1**, **2**, **4**, **8**, **16**. Default *bwu*.
avper	Averaging period in seconds for TPI. May be **0**, **1**, **2**, **4**, **10**, **20**, **40**, or **60** seconds. A value of **0** results in 1/80 sec averaging time. Default **1**. The averaging period is common to both upper and lower sideband. The averaging period is synchronous with the 1 pps.
gainmode	Gain control mode, either **agc** or **man**. Use **agc** (default) for automatic gain control, **man** to set a gain value. The gain mode is common to both sidebands.
gainu	Gain value for USB in dB. This is a valid parameter only if *gainmode* is **man**. May be any value between **-18.0** dB and **12.0** dB. Step size is linear in voltage. The actual gain setting is reported as a monitor value and may go as low -99.99 dB. Default is the current USB gain level. This parameter is currently only available as a monitor-only parameter.
gainl	Gain value for LSB in dB. This is a valid parameter only if *gainmode* is **man**. May be any value between **-18.0** dB and **12.0** dB. Step size is linear in voltage. The actual gain setting is reported as a monitor value and may go as low as -99.99 dB. Default is the current LSB gain level. This parameter is currently only available as a monitor-only parameter.

Monitor-only Parameters:

lock	L.O. lock status, `lock` or `unlock`.
USBpwr	Power in upper sideband in counts. Range `0` to `65535`, nominal operating level is `16000`.
LSBpwr	Power in lower sideband in counts. Range `0` to `65535`, nominal operating level is `16000`.
serno	Module serial number, decimal.
err	Module timing error indication, `1pps` or `no_1pps`.

Comments:

This command sets up the baseband converters in the VLBA rack. This command is analogous to the Mark III vc*nn* commands.

Unlike the output of most other commands which have no embedded blanks, the output for this command is organized in columns for easy reading of gains and power levels.

MCB module functions are available. See section 1.0 of this manual.

The power-up setting for the gain control is manual control with a value of +6 dB. If the IF level is nominal coming in to the BBC then the operating level for the AGC is +6 dB. Normal setting during an experiment is **agc**.

To hold the gain at a given value, switch to **man** gain control. The gain value will stay at the value it had when the AGC was changed to **man**. Then use **agc** to return to AGC control. This method is used for radiometry by `onoff` and `fivpt`.

On terminals wired like the geodetic (VLBAG) racks, the following table shows which BBCs have which IF inputs available. Essentially all VLBA racks controlled by the FS are wired in this way.

Geodetic (VLBAG) Rack BBC-to-IF input availability	
BBC numbers	IF input channels
1, 2	A, B, C, D
3, 4, 5, 6, 7, 8	A, C
9, 10, 11, 12, 13, 14	B, D

CAUTION: This command does not check whether you have specified a valid IF source for the BBC.

beam - set beamsize for flux command

Syntax: **beam1=***angle*
               beam2=*angle*
               beam3=*angle*
               beama=*angle*
               beamb=*angle*
               beamc=*angle*
               beamd=*angle*
               beam5=*angle*
               beam6=*angle*

Response: beam1/*angle*
               beam2/*angle*
               beam3/*angle*
               beama/*angle*
               beamb/*angle*
               beamc/*angle*
               beamd/*angle*
               beam5/*angle*
               beam6/*angle*

Settable parameters:
angle   full-width half maximum beam size, displayed in decimal degrees of arc.

Monitor-only parameters: none

Comments:
The **beam1**/**2**/**3** and **beama**/**b**/**c**/**d** commands are applicable for Mark III (and Mark IV) and VLBA (and VLBA4) systems, respectively. The command pairs **beam1/a**, **beam2/b**, and **beam3**/**c** are synonymous.

The beam size for the sky frequency for each IF channel may be specified with these commands. The commands **flux1**/**2**/**3** and **fluxa**/**b**/**c**/**d** use the sizes specified as **beam1**/**2**/**3** and **beama**/**b**/**c**/**d**, respectively, to calculate the apparent flux.

There is no default for the beam size unless the appropriate IF distributor command (**ifd** or **if3** for Mark III (and Mark IV) systems, **ifab** or **ifcd** for VLBA (and VLBA4) systems) and the **lo** commands have been issued. There is no default for **beam5**/**6**, see below for more detail. If these commands have been issued, then the beam size will default to the beam size calculated from the appropriate LO frequencies and the antenna diameter found in the antenna.ctl control file. The formula is:

$$\text{beam size (radians)} = 1.05 * c / (freq * diaman)$$

Issuing a **beam**X**=...** command will change the calculated values of the **flux**X command to invalid quantities. Reissue a correct **flux**X**=...** command to recalculate fluxes.

The **beam5**/**6** commands are used for station specific detectors **u5** and **u6**. They do not correspond to a standard IF channel, but instead to whatever IF is being supplied to the corresponding station detector.

bit_density - recording bit density (VLBA, VLBA4 drives)

Syntax: **bit_density=***bpi*

Response: bit_density/*bpi*

Settable parameters:
bpi   Bit density in bits per inch.

Monitor-only parameters: none

Comments:

This command specifies the total bit density including all header and parity bits. The specified bit density and the formatter set-up determine the default speed for the **st** command.

The bit density can be set to any positive value less than 2^{32}. Useful values for standard density are **33333** for Mark III/IV data-replacement format and **34020** for the VLBA non-data-replacement format; for high density, **56250** Mark III/IV data-replacement format and **56700** for the VLBA non-data-replacement format.

When calculating speeds from bit densities it is useful to remember that for a nominal per track bit data rate of 4 MBit/sec, the Mark III data-replacement format actually generates 4.5 MBit/sec and the VLBA non-data-replacement format generates 4.536 MBit/sec.

break - stop the current procedure

Syntax: **break**

Response: none

Comments: The currently-executing procedure is stopped after the current command is finished. The procedure stack is popped to the next higher level. This is an immediate execution command.

NOTE: This command is not implemented.

cable - get the cable cal reading

Syntax: **cable=***message*

Response: cable/*value*

Settable parameters:
message   ASCII character to be sent to counter.

Monitor-only parameters:
value   cable cal reading

Comments:
When issued with no parameters this command sends a request for a reading to the HPIB counter
which is connected to the phase cal cable measurement system.

The ibad.ctl control file must contain an entry with mnemonic CA and the device name.

If your counter returns a non-standard response, you can control the parsing of the response by
placing the uncommented line below in your stcmd.ctl file:

```
*command      seg sbpa bo eq
cable         qkr 13xx 01 FFFFFF
```

where xx is the number of the character position to begin decoding at. The first character
position is counted as position 1. If the value of xx is 00 decoding will begin at the first character
from the left that could be part of a number in scientific notation ("0123456789.+-Ee"). The FS
uses a value of 04 for xx by default.

Please see also the **cablediff** and **cablelong** commands.

cablediff - calculate cable change and sign

Syntax: **cablediff**

Response: cablediff/*change,sign*

Settable parameters: None

Monitor-only parameters:

change   The absolute value of the difference between the last cable and cablelong measurements, in seconds. The value is printed in scaled scientific notation so that the digit before the decimal point is microseconds. If the value is greater than 1.0 seconds the scaling is different.

sign   The sign of the difference between the last cable and cablelong measurements absolute value of the difference between the last cable and cablelong measurements, corresponding to *change*. Values are **+**, **-**, or the value **0** if change is less than 0.05 microseconds.

Comments:

This command is used to automatically calculate the change in the cable counter reading when a short cable extension is added to check the performance of the system and sign of the change. This command provides a standard format for recording the results in the log.

Please see also the **cablediff** and **cablelong** commands.

cablelong - get the cable cal long reading

Syntax: **cablelong=***message*

Response: cablelong/*value*

Settable parameters:
message   ASCII character to be sent to counter.

Monitor-only parameters:
value   cable cal long reading

Comments:
When issued with no parameters this command sends a request for a reading to the HPIB counter which is connected to the phase cal cable measurement system.

The **cablelong** command is identical to the **cable** command. It is intended to be used for the "long" cable measurement when checking the sign of the cable counter before and after an experiment. If **cablelong** is used for the measurements, auto-scaled plots of the cable/ output will have reasonable resolution. It also provides a "long" cable measurement for **cablediff** to use to calculate the change and sign.

The ibad.ctl control file must contain an entry with mnemonic CA and the device name.

If your counter returns a non-standard response, you can control the parsing of the response by placing the uncommented line below in your stcmd.ctl file:

```
*command      seg sbpa bo eq
cablelong     qkr 76xx 01 FFFFFF
```

where xx is the number of the character position to begin decoding at. The first character position is counted as position 1. If the value of xx is 00 decoding will begin at the first character from the left that could be part of a number in scientific notation ("0123456789.+-Ee"). The FS uses a value of 04 for xx by default.

Please see also the **cable** and **cablediff** commands.

cal - turn cal signal on or off

Syntax: **cal=***on/off*

Response: none

Settable parameters:
on/off   **on** to turn cal on, **off** to turn off. No default.

Monitor-only parameters: none

Comments: This command sets a VHF switch on the HPIB. The ASCII message is A1 to turn cal on, A2 to turn cal off. The `ibad.ctl` control file must contain an entry with the mnemonic `CL` and the device name.

caltemp - set noise cal temperatures

Syntax: **caltemp1=***temp*
         caltemp2=*temp*
         caltemp3=*temp*
         caltempa=*temp*
         caltempb=*temp*
         caltempc=*temp*
         caltempd=*temp*
         caltemp5=*temp*
         caltemp6=*temp*

Response: caltemp1/*temp*
           caltemp2/*temp*
           caltemp3/*temp*
           caltempa/*temp*
           caltempb/*temp*
           caltempc/*temp*
           caltempd/*temp*
           caltemp5/*temp*
           caltemp6/*temp*

Settable parameters:
temp   temperature of cal signal, in degrees K.

Monitor-only parameters: none

Comments:
Calibration temperatures, for either Mark III (and Mark IV) or VLBA (and VLBA4) systems, may be specified with the **caltemp1**/**2**/**3** and **caltempa**/**b**/**c**/**d** commands, respectively. The commands **tsys1**/**2**/**3** and **tsysa**/**b**/**c**/**d** use the temperatures specified as **caltemp1**/**2**/**3** and **caltempa**/**b**/**c**/**d** respectively. The command pairs **caltemp1**/**a**, **caltemp2**/**b**, and **caltemp3**/**c** are synonymous.

The **caltemp5/6** commands are used for defining the calibration temperatures used with station dependent detectors **u5** and **u6**.

check - modules to be checked by `chekr`

Syntax: **check=***list*

Response: check/*list*

Settable parameters:

list   The list of mnemonics for modules to be checked. Only mnemonics for the equipment identified in the `equip.ctl` control file are valid in this command. Standard module mnemonics are allowed. If the list of modules to be checked is empty, then `chekr` will not check any modules.

Monitor-only parameters: none

Comments:

As modules are set up by SNAP commands, they are automatically added to the list of modules being checked by `chekr`. This command can be used to remove and reinstate modules on the list.

The entire list of modules to be checked may always be specified by listing the appropriate modules. However, the list of modules already being checked may also be modified by entering ***** as the first parameter, followed by the list of modules to be added or deleted from the existing list. Deletion is indicated by a leading minus sign. For example,

check=*,ifd,-rc

will cause the IF distributor to be added to the list of modules being checked and the tape transport to be removed from the list, while the check status of all other modules remain unchanged.

If no modules are currently being checked then the word `disabled` is displayed.

The displayed list of modules always consists of the standard 2-character mnemonic, i.e. the ones listed on the reference page at the front of this manual. Station-specific mnemonics may be used for station-specific modules.

Note: In the current Field System version, for VLBA systems, the head position is checked but only some of the DAR module and REC functions are checked.

cont - continue schedule execution after a halt

Syntax: cont

Response: none

Parameters: none

Comments:
This command must be issued after a **halt** to get the schedule going again. It has no effect if no **halt** was actually issued. This is an immediate execution operator command.

data_valid - data valid flag control

Syntax: **data_valid=***record*,*playback*

Response: data_valid/*record,playback*

Settable parameters:
record   Flag is **on** (default) or **off**.
playback   Playback enable is **use** (default) or **ignore**. S2 recorders only.

Monitor-only parameters: None.

Comments:
For S2 recorders, this command can be used to set and monitor the value of the data valid and playback enable flags written to the tape.

For non-S2 recorders, this command just sets an internal software flag in the FS indicating that data is valid. Depending on how the pcald has been set-up this may turn automatic phase-cal extraction on or off.

For all equipment types, this command is used to indicate in the log when the data is expected to valid based on the slewing algorithms of the scheduling program.

date - display year and day-of-year

Syntax: **date**

Response: date/*year,doy*

Settable Parmeters: None

Monitor-only Parameters:
year   4 digit year
doy   Day of year, 1-366

Comments:
This command is implemented by a special logging function assure that the year and day-of-year are consistent, i.e., that they both come from the same year.

decode - Mark III decoder control and monitor

Syntax: **decode=**_channel,mode,counter_

Response: decode/_channel,mode,data_

Settable parameters:

channel   Channel **a** (default) or **b** to be decoded.

mode   Type of data to be read. Choices are **aux**illiary data, **syn**ch, **crc** word, **time**,
                data bits, or **err**or counts (default).

counter   Error counter control: **byte** (default), **frame**, **reset**.

Monitor-only parameters:

data   Data returned according to mode specified in control command.

	err	sspppppp (s=synch errors, p=parity errors) Note that monitored error values are error counts, not rates.
	syn	8 - character synch word
	time	two words: ydddhhmm and sssssccc, where ccc = checksum
	data	three sets of 32 data bits
	aux	two sets of 8 characters of auxiliary data
	crc	pass/fail for CRC check

Comments:

MAT module functions available. See section 1.0 of this manual.

CRC check is reliable only in bypass reproduce mode.

This command is for the old style Mark III decoder which may be installed in any of the Mark III, Mark IV, or VLBA4 rack types, but this command will work decoder if it is installed with other rack types as well.

Most Mark III drives cannot decode in double speed, so this command will probably fail in this mode. Old VLBA drives that use the Mark III bit synchronizer may have this problem also.

decode4 - Mark IV decoder low-level control

Syntax: **decode4=***command*

Response: decode/*response*

Settable parameters:
command   any legal command for Mark IV decoder. The terminating "$" character is appended before sending the command.

Monitor-only parameters:
data   response to *command*.

Comments:
This command is a simple feed-through to the Mark IV decoder. No checking is done on the command, no action is taken for any response. This form of the command is temporary while it is determined what standard parameters are desired.

The *command* is sent to the MAT bus just as if the operator had used the **mat** command. No modifications are made before the command is sent on the bus.

This command is for the new Mark IV decoder which may be installed in any of the Mark III, Mark IV, or VLBA4 rack types, but this command will work decoder if it is installed with other rack types as well.

disc_check - check Mark V recorded data

Syntax: **disc_check**

Response: disc_check/*format,tracks,time,pos,period,??,*

Settable parameters:

command   any legal command for Mark IV decoder. The terminating "$" character is
              appended before sending the command.

Monitor-only parameters:

format   Data format: mark4, vlba, test, or ?
tracks   Track mode: 8, 16, 32, 64
time   Data time tag read from first encountered header
pos   Byte position of header
period   Track frame period (seconds)
??   unknown

Comments:

If *format* is ?, the remaining fields are not valid.

This command sets the read pointer 1 mega-byte before the current write pointer location and
attempts to the use the low-level Mark 5 data_check command. The displayed parameters are
the output of is command. A future version will allow the position of the read pointer to be set
explicitly, but this can be done with a **mk5** SNAP command. To check at positon "***pos***", use:

mk5=play off *pos*,data_check?

disc_end - end Mark V recording

Syntax: **disc_end**

Response: none

Comments:
Stops recording.

disc_pos - Mark V byte position pointers

Syntax: **disc_pos**

Response: disc_pos/*write_pointer, read_pointer*

Monitor-only parameters:
write_pointer   Current write pointer byte position
read_pointer   Current read pointer byte position

Comments:
This command reports the current position of the write and read pointers.

This command sets the read pointer 1 mega-byte before the current write pointer location and attempts to the use the low-level Mark 5 data_check command. The displayed parameters are the output of is command. A future version will allow the position of the read pointer to be set explicitly, but this can be done with a **mk5** SNAP command. To check at positon "***pos***", use:

mk5=play off *pos*,data_check?

disc_serial - Mark V byte position pointers

Syntax: **disc_serial**

Response: disc_pos/*serial1,serial2,...,serial16,*

Monitor-only parameters:
serialX̂   Serial number of disc *X*, null if no disk is installed in that slot

Comments:
This command reports the serial numbers of the installed disks.

disc_start - Start Mark V recording

Syntax: **disc_start=*on,scan_name***
                disc_start

Response: disc_start/*on/off*

Settable Parameters:
on   Turn recording on, only **on** is allowed
scan_name   String of up to 16 characters, default is current scan name defined by the
                scan_name SNAP command

Monitor-only parameters:
on/off   on (recording) or off (nor recording)

Comments:
This command may be given only with either one parameter **on** to start recording or with no
parameter to monitor whether recording is on or off. To stop recording use the **disc_end**
SNAP command.

Normally **scan_name** is taken by default as the scan name defined by the most recent
scan_name=... command. The **scan_name** parameter allows the value used for this recording
to over-riddden. It does not change the actual scan name. The scan is sent to the Mark 5 to
identify the scan being recorded.

dqa - data quality analyzer (VLBA racks)

Syntax: **dqa=***duration*
                 vdqa=*duration*

Response: dqa / *duration,Asampler,Atrack,Aparity,Aresync,Anosync,Acalamp,*
                 Acalphs,Bsampler,Btrack,Bparity,Bresync,Bnosync,Bcalamp,Bcalphs
                 vdqa / *duration,Asampler,Atrack,Aparity,Aresync,Anosync,Acalamp,*
                 Acalphs,Bsampler,Btrack,Bparity,Bresync,Bnosync,Bcalamp,Bcalphs

Settable Parameters:

duration   The duration of the analysis in seconds. Default **1** sec, max **5** seconds. Set up the command with **dqa=***duration*. Subsequent commands **dqa** will make a measurement. For each measurement, the DQA module is started, allowed to run for *duration* and then stopped. The accumulated counters are then read out.

Monitor-only Parameters:

Asampler   Sampler for the A channel signal, 0 if unknown or in the form *nnsd*, *nn*=baseband converter number, *s*=sideband u or l, *d*=data sample bit *m* or *s*.
Atrack   Track with the A channel signal on it, as set up in the **repro** command.
Aparity   Measured parity error rate for A channel, per Mbyte.
Aresync   Measured resync rate for A channel, per Mbyte.
Anosync   Measured nosync rate for A channel, per Mbyte.
Acalamp   Measured phase calibrator amplitude for A channel, in units of voltage percentage.
Acalphs   Measured phase calibrator phase for A channel, degrees.
Bsampler   Sampler of the B channel signal, 0 if unknown or in the form *nnsd*, *nn*=baseband converter number, *s*=sideband u or l, *d*=data sample bit *m* or *s*.
Btrack   Track with the B channel signal on it, as set up in the **repro** command.
Bparity   Measured parity error rate for B channel, per Mbyte.
Bresync   Measured resync rate for B channel, per Mbyte.
Bnosync   Measured nosync rate for B channel, per Mbyte.
Bcalamp   Measured phase calibrator amplitude for B channel, in units of voltage percentage.
Bcalphs   Measured phase calibrator phase for B channel, degrees.

Comments:

The data quality analyzer (DQA) is a formatter sub-module. It measures parity, re-synch, and no-synch errors and extracts phase cal (Mark III/IV format only). The **dqa** command is comparable to the Mark III decode command plus the capabilities of program pcalr. For readback parity checks, you would normally use the **check**(**80**|**135**)(**f**|**r**) procedures.

Channels A and B are the recorded tracks as specified in the **repro** command. To measure parity errors, the tape should be moving (use the **st** command) with record disabled. The phase cal can be measured in bypass or reproduce mode. For bypass measurements, the group enables must be turned on with the **enable** command, and the general record enable must be turned on with the **st** command.

The formatter tape clock (a combination of the sample rate, fan-out or fan-in, and format) must be specified with the **form=**... and agree with reproduce rate before the DQA command will work.

The sampler reported for a track is determined from the set-up of the cross-point switch by the **form** command. If barrel-rolling and/or fan-in or -out are enabled, the displayed source will be the nominal source for that track, but may not actually correspond to the data analyzed. If fan-out is being used in a system with an analog cross-point switch, the reported source will be zero for tracks beyond the first in a fan-out group.

Phase-cal results will be meaningless for the following cases: fan-out, fan-in, barrel-rolling enabled, VLBA format, tracks that contain magnitude bits.

Normally, this command is used only with VLBA racks. However if the DQA module is connected it can be used as the **vdqa** command with any type of rack, including VLBA and VLBA4. The **vform=**... command must be used to specify the formatter tape clock if the rack type is not VLBA4. The **vdqa** and **vform** comands are particular useful for writting rack independent procedures for stations that switch between VLBA and VLBA4 rack types.

The output from this command is organized in columns for easy reading when there are no errors, i.e., in bypass mode.

echo - echo communications

Syntax: **echo=**_set_

Response: none

Settable parameters:
set   **on** to turn echo on, **off** to turn off (default). Any external communications are echoed in the log display window.

Monitor-only parameters: none

Comments:
Immediate execution operator command for MAT and/or MCB and/or RCL communications and, at some stations, antenna communications also.

For MCB communications, each byte is displayed as

    bytes sent to the MCB   [_nxx_]
    bytes received from the MCB   <_nxx_>

where _n_ is normally a blank. _n_ is + for the first byte of the address when data is being written to the module. The address or data is _xx_, represented as two hex characters. MCB control bytes are displayed with special 3-letter mnemonics:

    [SYN]   hex 16   synchronization byte
    <ACK>   hex 06   acknowledge
    <NAK>   hex 15   not acknowledge
    <DC1>   hex 11   data control 1
    <DC2>   hex 12   data control 2

For MAT communications, most of the data bytes are printable ASCII characters which are displayed simply as the character. The unprintable ASCII characters are displayed as [_xxx_], where _xxx_ is shown in the table below. The "del" character (127) is displayed as [del].

```
   0   1   2   3   4   5   6   7   8   9
   nul soh stx etx eot enq ack bel bs  ht
 1 lf  vt  ff  cr  so  si  dle dc1 dc2 dc3
 2 dc4 nak syn etb can em  sub esc fs  gs
 3 rs  us
```

For RCL communications, each piece of information is displayed as

> information sent to the RCL   [*xxx*]
> information received from the RCL   <*xxx*>

where *xxx* is a representation of the data in an appropriate format. Information going to the RCL is always displayed in order of: the name of the command being sent followed by the parameters for that command. Information returned by the RCL is always displayed in the order of: the error response code, and if there is no error, the parameter values returned in the response. The names of the commands, and the order of the parameters sent and received is the same as that in ISTS's **S2-RT User's Manual, Appendix A**. In addition whenever possible menomonics are substituted for numeric parameters. Error and parameter menonics correspond closely to those in the appendix of ISTS's manual. Remote errors are displayed as numeric values until a successful ERROR_DECODE command has been completed for that error code. Effectively this means that the mnemomic is not used in the display of remote errors until the second time the error is encountered after the most recent Field System start. If the value of a parameter that is normally displayed as menomic doesn't correspond to the value of a known mnemonic for that parameter, the hex value will be displayed.

For the TIME_READ command the Field System's raw times immediately before and after the call to rcl_time_read are displayed in curly braces { } immediately after the returned data. The Field System's raw time is the number of centiseconds since the last boot.

For GPIB and Mark V communications, commands sent to the device are placed in square brackets "[]" and responses are displayed in angle brackets "<>".

enable - enable recording heads (Mark III drives)

Syntax: **enable=***track1,track2, ... trackn*

Response: enable/*track1,track2, ... trackn*

Settable parameters:

track1, ... n   List of tracks to be enabled/disabled. Mark III track numbers between **1** and
                28, and by group. Groups specified by **g***n*, *n*=**1** to **4**:
                    g1 includes tracks 1,3,5,7,11,13.
                    g2 includes tracks 2,4,6,8,10,12,14.
                    g3 includes tracks 15,17,19,21,23,25,27.
                    g4 includes tracks 16,18,20,22,24,26,28.
                    A null list (i.e. **enable=**) disables all tracks.

Monitor-only parameters: none

Comments:
MAT module functions available. See section 1.0 of this manual.

The use of ***** as a parameter is not supported by this command.

Note that a VLBA or Mark IV track number equals the Mark III track number plus 3. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Setup** manual. Also VLBA group numbers equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses Mark III track and group numbers.

enable - enable recording heads (VLBA, VLBA4 drives)

Syntax: **enable=**_list-of-groups_

Response: enable/_list-of-groups_

Settable parameters:

list-of-groups   List of head groups to be enabled/disabled. Groups are specified by **g**_n_, _n_=**0** to **3**. In addition, for VLBAB or VLBA4 drives, groups in headstack two can specified by **g**_n_, _n_=**4** to **7**. A null list (i.e. **enable=**) disables all heads. For mode D, the group containing a single track to be recorded may be indicated by setting _list-of-groups_ to **d**_n_, _n_ = **1** to **28**. The group within which Mark III track _n_ occurs will be enabled. In addition, for VLBAB and VLBA4 drives, the group in headstack two containing a single track to be recorded may be indicated by setting _list-of-groups_ to **d**_n_, _n_ = **101** to **128**.

Monitor-only parameters: none

Comments:

The use of ***** as a parameter is not supported by this command.

This command enables groups of heads in the VLBA recorder. Heads may not be individually enabled. The **form** command sets up which data goes to which head with the cross-point switch.

In mode D, an entire group of heads is enabled. The VLBA rack **form** (and **trackform** and **tracks**) command must be used to send data to a specific head so that only it has data going to it. It is not possible to record in mode D for a Mark III (or IV) rack/VLBA (or VLBAB or VLBA4) drive combination.

> **g0** includes Mark III heads 1,3,5,7,11,13.
> **g1** includes Mark III heads 2,4,6,8,10,12,14.
> **g2** includes Mark III heads 15,17,19,21,23,25,27.
> **g3** includes Mark III heads 16,18,20,22,24,26,28.

Note that a VLBA or Mark IV track number equals the Mark III track number plus 3. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Setup** manual. Also VLBA group numbers

equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses VLBA track and group numbers.

The groups **g4**, **g5**, **g6**, and **g7** correspond to groups 0, 1, 2, and 3 on head 2. The parameters, *dn*, *n* = **101** to **128**, correspond to the Mark III heads in headstack two given by *n-100*. The command accepts these parameters, but normally a VLBA4 drive is not wired so that this has will have any practical effect. However for a VLBAB these parameters may be useful.

enable - enable recording heads (Mark IV drives)

Syntax: **enable=***stack1,stack2*

Response: enable/*stack1,stack2*

Settable parameters:
stack1,stack2   Stack to be enabled. May be **s1** (**stack1**), **s2** (**stack2**), or null.

Monitor-only parameters: none

Comments:
MAT module functions available. See section 1.0 of this manual.

The use of ***** as a parameter is not supported by this command.

et - end recording on tape drive (all drives)

Syntax: **et**

Response: et/*acknowledgement*

Parameters: none

Comments:
Tape motion is stopped when this command is issued.

For Mark III/IV drives the record bit is disabled. For VLBA and VLBA4 drives the groups are disabled. For Mark IV and VLBA4 racks the formatter output is disabled.

For S2, the selected transports are stopped.

ff - fast-forward the tape (all drives)

Syntax: **ff**

Response: ff/*acknowledgement*

Parameters: none

Comments:
The tape is moved forward at high speed. For Mark III, the record bit is disabled and the low tape sensor is turned on. For VLBA, all track groups are disabled and the low tape sensor is turned on.

For S2 drives, the selected transports are moved forward at the transport's fast forward speed.

For drives other that the K4 and S2, the tape is moved at the "schedule" speed value as specified in the appropriate drive control file. This is the speed assumed in the SNAP schedule file for positioning the tape with the **fastf** procedure.

Use the **sff** command and **sfastf** procedure for possibly faster tape motion of non-K4, S2 drives.

fivept - five or more point source scan

Syntax: **fivept=***axis,rep,pts,stp,intp,dev*

Response: fivept/ *axis,rep,pts,stp,intp,dev,cal,beam,flux,chain*

Settable parameters:

axis   Axis system for scan.
> **hadc** = Hour Angle/Declination **(default)**
> **azel** = Azimuth/Elevation
> **xyns** = X/Y, +X East
> **xyew** = X/Y, +X South (unimplemented)

rep   Number of repetitions: **-10** to **-1** and **1** to **10** allowed. Default is **-2**. Negative repetition counts are described in the **fivpt** manual. The absolute value implies a maximum repetitions count, but once the scans are well s\centered on bth axes, additional repetitions will be skipped.

pts   Number of points on each axis, if even, it is increased by 1. *pts* must be between **-31** to **-3** or **3** to **31**, inclusive. Default is **7**. Negative point counts cause the system temperature measurement to be skipped. The absolute value is used as the number of points.

stp   Step size for distance between points, in multiples of a beamwidth. Default is **0.5**.

intp   Integration period, **1** to **32** seconds.

dev   Mnemonic for the device to be used as the detector. Standard devices are allowed. Note that for Mark III equipment, the whether the video converter USB or LSB detector is used is determined by the **vc** command. The module which has the specified detector must have been set up. The IF distributor must be set up and, for Mark III, must be in remote. Default detector is **i1** for Mark III/IV, **ia** for VLBA/4. Station dependent detectors **u5** and **u6** may be available.

Display-only parameters:

cal   Calibration noise source temperature in degrees K. This is determined from the last **caltemp***x* commands in conjunction with the **patch** (Mark III/IV) or **bbc** (VLBA/4) command for the specified device.

beam   The full width half maximum beam size degrees. This is determined from the last **beam***x* commands in conjunction with the **patch** (Mark III/IV) or **bbc** (VLBA/4) command.

flux   The apparent flux of the source. This is determined from the last **flux***x*
              commands in conjunction with the **patch** (Mark III/IV) or **bbc** (VLBA/4)
              command.

chain   The IF chain, **1**-**6**, that the detector is on. Chains **5** and **6** are for station specific
              detectors **u5** and **u6**. Mark III/IV racks use IFs **1**-**3**. IFs **1**-**4** correspond to IFs
              a-d for VLBA/4 racks.

Comments:

The parameters should be setup with a **fivept=***…* command. A scan is started by issuing a
simple **fivept** command (i.e. with no parameters), this will determine the current values of the
display only parameters and then schedule an external program, fivpt, which then uses the Field
System to perform the necessary measurements. See the **fivept** manual in Volume 2.

The scan is performed about the current commanded position. Any offsets that are in use are
included. If the scan is successful the total offsets for the selected axis type are updated.

It is recommended that nothing else be done, e.g. running a schedule, while this command is
executing. Since this command may run for an extended period of time, a mechanism has been
supplied for aborting: enter **sy=brk fivpt &** as a SNAP command. The program will return
the antenna to the last good offset for each axis. If there was no good offset measurement on an
axis, then the original offset is used.

In order for this command to work, the following conditions must be met: (1) the detector device
has been setup by the Field System, (2) the appropriate **lo=...** command has been issued, (3) the
IF distributor or IF3 module has been setup by the Field System and is in remote (Mark III/IV
only), (4) the appropriate **beam***X***=...** and **caltemp***X***=...**. must have been issued. If a Mark
III/IV video converter is used as the detector then the appropriate **patch=...** command must
have been issued as well. For a VLBA/4 rack with a BBC selected as a detector the appropriate
BBC IF input must be selected with a **bbc***XX***=...** command. If estimates of performance based
on the source flux are desired, then the appropriate **flux***X***=...** command must have been issued
as well.

If the noise diode temperature is less than zero, it is assumed that there is no noise diode to use.
All power measurements will be made assuming the absolute value of the diode temperature is
the system temperature. Thus if the noise diode temperature is -100, the power measurements will
come out as a percentage of the system temperature.

If the noise diode temperature is greater than zero, then two procedures must be available:
calonfp and **calofffp**, which are used by fivpt to turn the noise diode on and off
respectively. The recommended form for these procedures is:

```
CALONFP:  calon
          !+1s
          sy=go fivpt &

CALOFFFP: caloff
          !+1s
          sy=go fivpt &
```

calon and **caloff** are local procedures that do whatever is necessary to turn the noise source on and off, respectively.

If station dependent detectors **u5** or **u6** are used, then two procedures must be available: **sigonfp** and **sigofffp**, which are used by fivpt to turn the signal to the station dependent detectors on and off, respectively. The recommended form for these procedures is:

```
SIGONFP:  sigon
          !+1s
          sy=go fivpt &

SIGOFFFP: sigoff
          !+1s
          sy=go fivpt &
```

sigon and **sugoff** are local procedures that turn the signal to the station dependent detectors on and off, respectively.

There is a known bug in the use of these procedures: **calonfp**, **calofffp**, **sigonfp**, and **sigofffp**, that may require the last two lines to be repeated in each procedure. In other words after the first line each procedure should contain:

```
          !+1s
          sy=go fivpt &
          !+1s
          sy=go fivpt &
```

The indication that this is needed is if fivpt seems to hang after executing one of these procedures. Please see the "Known Bugs" section of the latest update notice for more details.

A negative value for the number of *pts* will disable the initial system temperature measuement. A nominal conversion factor of unit and offset of zero is assumed in converting from detector counts to displayed antenna temperature, i.e., measurements are reported in detector units with an assumed zero offset.

flush - flush operator command stream

Syntax: **flush**

Response: none

Parameters: none

Comments:
This command re-initializes the operator procedure stack, unblocks the operator command stream, and terminates execution of the current procedure in the operator stream. There is no effect on the schedule command stream. This is an immediate execution operator command.

flux - set flux parameters for a source

Syntax: **flux1=**_model,flux1,angle1,angle2,flux2,angle3,angle4_
               flux2=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               flux3=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               fluxa=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               fluxb=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               fluxc=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               fluxd=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               flux5=_model,flux1,angle1,angle2,flux2,angle3,angle4_
               flux6=_model,flux1,angle1,angle2,flux2,angle3,angle4_

Response: flux1/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               flux2/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               flux3/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               fluxa/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               fluxb/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               fluxc/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               fluxd/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               flux5/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_
               flux6/_model,flux1,angle1,angle2,flux2,angle3,angle4,corr,aflux_

Settable parameters:

model	source model, one of **gaussian**, **disk**, **twopoints**
flux1	flux density of the first source component, Janskys
angle1	first angular dimension of the first component
angel2	second angular dimension of the first component
flux2	flux density of the second source component, Janskys
angle3	first angular dimension of the second component
angle4	second angular dimension of the second component

Monitor-only parameters:

corr	correction divisor
aflux	apparent flux density

Comments:

Source models, for either Mark III (and Mark IV) or VLBA (and VLBA4) systems, may be specified with the **flux1/2/3** and **fluxa/b/c/d** commands, respectively. The pairs of commands **flux1/a**, **flux2/b**, and **flux3/c** are synonymous.

The commands **flux*x*** use the source model and the beam size specified by the corresponding **beam*x*** to calculate the apparent flux density. The parameter *model* determines which model is used and which parameters have meaning. Parameters which have no meaning for a given model will not be displayed before the *corr* parameter.

The **flux5/6** commands are used to specify flux models for station dependent detectors **u5** and **u6**.

If *model* is **gaussian**, then the source is assumed to consist of up to two, possibly elliptical, Gaussian brightness distributions. *flux1* gives the flux density value for the first component. *angle1* and *angle2* specify the diameters along the two principal axes. *angle2* defaults to *angel1*. *flux2* gives the flux density value for a second concentric optional Gaussian distribution, default value **0**. *angle3* and *angle4* give the principal axes of the second component. *angle4* defaults to *angle3*.

If *model* is **twopoints**, then the source is assumed to consist of two equally bright points. *flux1* is the total flux density of the two points. *angel1* is their angular separation.

If *model* is **disk**, then the source is assumed to consist of a uniform circular disk brightness distribution. *flux1* is the total flux density. *angel1* is the diameter of the disk.

Once the model is specified, the **flux*x*** command will use the appropriate beam size to calculate the apparent flux density of the source when the beam is *centered* on the brightness distribution. The approximations given in Dave Shaffer's antenna check-out memo (see the **Antenna Performance** manual) are used to compensate for the finite size of the sources relative to the beam. Note that these are only approximations and become very poor as the correction divisor approaches a value of two. Further note that very few sources are correctly represented by one of these three models. This command gives a crude approximation to the true apparent flux density.

Issuing a **source=...** or a **beam*x*=...** command will automatically change the value of the *aflux* parameters to be a negative, invalid, number until a correct **flux*x*=...** command is issued again. It is recommended that procedures that include the **source=...** command and the appropriate **flux*x*=...** commands be used to command sources when doing flux density measurements.

See the description of the **fivept** and **onoff** commands for more details on the use of the apparent flux density values.

form - formatter control and monitor (K4K3 racks)

Syntax: **form=***mode*,*rate*,*input*,*aux*,*synch*,*aux_start*,*output*

Response: form/*mode*,*rate*,*input*,*aux*,*synch*,*aux_start*,*output*,*daytime*,*st1*,*st2*,*st3*

Settable Parameters:

mode	**A**, **B**, **C**, **D**. No default.
rate	**0.25**, **0.50**, **1.00**, **2.00**, **4.00** (default), **8.00** Mbit/sec
input	**nor** (default), **ext**, **crc**, **low**, **high**
aux	up to 12 hex digits, default is no change
synch	synch test **on** (default) or **off**
aux_start	start new aux on next **frm** (default) or **1PPS**
output	**nor** (default), **low**, or **high**

Monitor-only Parameters:

st1	status byte 1, hex
st2	status byte 2, hex
st3	status byte 3, hex
st4	status byte 4, hex

Comments:

The status of the formatter is not checked so it is necessary to visual verify that the formatter is in remote. A future implementation will have a different response:

> form/*mode*,*rate*,*input*,*aux*,*synch*,*aux_start*,*output*,*test*,*sign*,*run/set*,*rem/lcl* ,*pwr*,*daytime*,*threshold*,*pend*,*1pps*,*frame*,*data*,*tape*,*plo*,*srq*

test	fail or ok
sign	synch polarity: + or –
run/set	time set switch: run or set
rem/lcl	remote/local switch: rem or lcl
pwr	power interrupted: ok or pwr
daytime	date and time in format *yydddhhmmss.sss*
threshold	synch test threshold: nanseconds (values of 13.9x1,2,4,8,16,32)
pend	sample rate update: pend or ok
1pps	external 1 PPS: 1pps or ok

frame	clock: `frame` or `ok`
data	clock: `data` or `ok`
tape	clock: `slip` or `ok`
plo	`lock` or `unlocked`
srq	`srq` or `ok`

For longitudinal drives, the correlators can not reproduce recordings made at speeds below 40 ips, but this limitation is subject to change in the future. This limitation is functionally equivalent to a minimum per track data rate of 2 Mbit/sec.

form - formatter control and monitor (Mark III racks)

Syntax: **form=***mode,rate,input,aux,synch*

Response: form/mode,rate,input,synch,test,sign,run/set,rem/lcl,
                      pwr,daytime

Settable parameters:
mode   Matrix output mode to tape. Choices are **a**, **b**, **c**, **d**. No default.
rate   Sample rate in Mbits/sec. Choices are **0.125**, **0.25**, **0.5**, **1.0**, **2.0**, **4.0**,
                      8.0. Default **4.0**.
input   Source of data. Choices are **nor** (default), **ext**, **crc**.
aux   Auxiliary data, up to 12 hex characters. Default is no change. If more than 12
                      characters are given, only the first 12 are used. If aux has been specified either
                      now or implicitly by a pass, lvdt, or stack command, then the parity command will
                      check its validity.
synch   Synch test **on** (default) or **off**.

Monitor-only parameters:
test   synch test fail or ok
sign   synch voltage + or -
run/set   switch setting run or set
rem/lcl   switch setting, rem or lcl
pwr   power interrupt detected, ok or pwr
daytime   clock reading in format: ydddhhmmss.ss

Comments:
MAT module functions available. See section 1.0 of this manual.

It may take the formatter up to 4 seconds to re-synch itself if a change is made to a low sample
rate. During this time the read-back may not be accurate. This module must be reset manually
using the front panel pushbutton in order to clear error conditions; then turn off alarm remotely.
The eight LEDS on the rear panel of the formatter give some error conditions which are not
available remotely.

The auxiliary data field for the formatter is automatically filled with the tape head offset by the
pass, **lvdt**, and **stack** commands.

The Mark III formatter time must be set manually from the front panel. After setting or resynching the formatter time and if the time model in `time.ctl` is **offset** or **rate**, issue the command:

sy=run setcl offset &

to reset the Field System time.

For longitudinal drives, the correlators can not reproduce recordings made at speeds below 40 ips, but this limitation is subject to change in the future. This limitation is functionally equivalent to a minimum per track data rate of 2 Mbit/sec.

form - formatter setup (Mark IV, VLBA4, K4MK4 racks)

Syntax: **form=***mode,rate,fan,barrel,modulate,synch*

Response: form/*mode,rate,fan,barrel,modulate,synch,test,rev,rack,error*

Settable Parameters:

mode   The recording mode. Choices for the *mode* are **m**, **a**, **b1**, **b2**, **c1**, **c2**, **e1**, **e2**, **e3**, **e4**, and **d***n*, where *n*=1 to 28. No default. Modes **a**, **b**, **b1**, **b2**, **c1**, **c2**, **e1**, **e2**, **e3**, **e4**, and **d***n* correspond to the traditional Mark III modes. For the **b***x* and **c***x* modes, *x* corresponds to the sub-pass recorded (odd Mark III tracks for **b1** and **c1**, even Mark III tracks for **b2** and **c2**). For the **d***n* modes, *n* corresponds to the Mark III track number recorded. For the **e***x* modes, *x* corresponds to the Mark III group number recorded. Mode **m** uses the sampler track assignments and formatter track enables specified by the **trackform** and **tracks** commands.

rate   Sample rate in Mbits/sec. Choices are **0.125**, **0.25**, **0.5**, **1**, **2**, **4**, **8**, **16**, and **32**. Default **4**. For Nyquist sampling this selection must be twice the bandwidth set-up used in the **bbc** commands

fan   The fan-in or fan-out ratio. Choices are **1:4**, **1:2**, **2:1**, where on a per channel or track basis, the number before the colon is the number of sampled channels and the number after is the number of tracks. Default **1:1**.

barrel   Barrel-roll mode: **off** (default), **8**, **16**, or **m**. Old firmware does not support anything but **off**. Barrel **m** uses the roll maps defined by the **rollform** command.

modulate   Data modulation: **on** or **off** (default). Old firmware does not support anything but **off**. Monitor display is null because it cannot be read back.

synch   Synch test tolerance. Choices are **0-16** (multiples of 62.5 nanoseconds) or **off**. Default is **3**. The meaning of **0** is unknown, but may be the same as **1**. Monitor displayed is null for formatters with old firmware revision because it cannot be read back.

Monitor-only Parameters:

test   Synch test result: pass or fail.

rev   Formatter firmware revision number, displayed as an integer.

rack   Rack ID, reported as a hex value.

error   Error status, okay or the hex value.

Comments:

The Mark IV formatter clock is set with the `fmset` program. If the formatter time is set or re-synched, the `fmset` program will automatically reset the FS time if the time model in `time.ctl` is **offset** or **rate**. If you change the time in some other way and the time model in `time.ctl` is **offset** or rate, issue the command

sy=run setcl offset &

to reset the Field System time.

Since the Mark IV recorder does not include group enables, some of the traditional Mark III mode names used in *mode* have numbers appended to them to distinguish which sub-pass, group, or track is being recorded.

Some combinations of *rate* and *fan* cannot be accommodated by the formatter. No output that would require more than 16 MHz nominal data rate per track is supported. Specifically a *rate* of **32** and a *fan* of **1:1** is impossible. Some combinations of *fan* and *rate* cannot be accommodated by the recorder. Any combination of *rate* and *fan* that would imply a nominal data rate per track of **0.125** Mbit/sec or less for is not supported.

For a *fan* of **1:4**, the magnitude bits of VC9-14 are not available.

The *rate* of **0.25** Mbit/sec is supported by the formatter, but for this rate to generate correct time tags, the formatter requires the "/con 0" configuration command that sets it up to be issued during an odd second of the time of day, e.g. 00:00:01 and 09:23:35, but not 09:23:36. No provision is made by the **form** command to meet this timing requirement.

For longitudinal drives, the correlators can not reproduce recordings made at speeds below 40 ips, but this limitation is subject to change in the future. This limitation is functionally equivalent to a minimum per track data rate of 2 Mbit/sec.

`Chekr` does not currently support checking of the formatter. However, the setup of the formatter can be monitored by entering a **form** command. If any of the displayed values do not agree with the last value commanded, then the formatter is not in the last commanded state. In particular the `BAD_VALUE` response indicates that the formatter state does agree with what was commanded.

The default value of **3** for *synch* is the most lenient value, 3*62.5=187.5 nanoseconds, that will catch a slip of 5 MHz. The formatter on power-on itself defaults to **8**.

Old formatter firmware versions are less than 40, newer versions are greater than 40. The value returned by the formatter must agree with what is in the `equip.ctl` file.

form - formatter setup (VLBA racks)

Syntax: **form=***mode,rate,fan,barrel,dqa*
                 vform=*mode,rate,fan,barrel,dqa*

Response: form/*mode,rate,fan,barrel,dqa,rev,genstat,mcbstat,*
                 hdwstat,sfwstat,intstat
                 vform/*mode,rate,fan,barrel,dqa,rev,genstat,mcbstat,*
                 hdwstat,sfwstat,intstat

Settable Parameters:

mode   The recording mode, **reboot** (see below) to reboot the CPU, or **configure**
                 to cause the formatter to perform a hardware configuration. Choices for the
                 mode are **prn**, **v**, **m**, **a**, **b**, **b1**, **b2**, **c**, **c1**, **c2,** and **d***n*, where *n*=1 to 28. No
                 default. Modes **prn**, **m**, **a**, **b**, **b1**, **b2**, **c**, **c1**, **c2**, and **d***n* imply Mark III data
                 replacement format. **prn** selects pseudo random noise to be sent to all tracks
                 including system tracks. Modes **a**, **b**, and **c** correspond to the traditional Mark III
                 modes. Mode **d***n* is the same as Mark III mode D, where *n* corresponds to which
                 Mark III track that would be written. Mode **v** implies VLBA non-data
                 replacement format. Modes **b1** and **c1** are the same as the forward passes (even
                 VLBA recorder heads) of modes **b** and **c** respectively; **b2** and **c2** for reverse
                 passes (odd VLBA recorder heads). Modes **m** and **v** use the sampler track
                 assignments and formatter track enables specified by the **trackform** and tracks
                 commands. The system tracks are disabled except in **prn** mode.
rate   Sample rate in Mbits/sec. Choices are **0.25**, **0.5**, **1**, **2**, **4**, **8**, **16**, and **32**.
                 Default **4**. For Nyquist sampling this selection must be twice the bandwidth set-up
                 used in the **bbc** commands
fan   The fan-in or fan-out ratio. Choices are **1:4**, **1:2**, **1:1**, **2:1**, and **4:1**, where
                 on a per channel or track basis, the number before the colon is the number of
                 sampled channels and the number after is the number of tracks. Other, not
                 commonly used, choices are available: **x0**, **x1**, and **x7**. Default **1:1**.
barrel   Barrel-roll mode. Choices are: **off**, **8:1**, and **16:1**, where the number before
                 the colon is the number of tracks to roll-over and the number after is the number
                 of tracks to step per frame. Other, not commonly used, choices are available:
                 8:2, **8:4**, **off4**, **16:2**, and **16:4**. Default **off**.

dqa   DQA module recorder input select: **1** or **2**. Default is the recorder specified by the
                     select command or whichever recorder is installed if there is only or recorder
                     1 if **select** command hasn't been used to specify a recorder yet.

Monitor-only Parameters:
rev   Formatter firmware revision number, displayed as x.xx.
genstat   General status, ok or the hex value of hex address 20.
mcbstat   Communications status, ok or the hex value of hex address 21.
hdwstat   Hardware status, ok or the hex value of hex address 22.
sfwstat   Software status, ok or the hex value of hex address 23.
intstat   Internal status, ok or the hex value of hex address 24.

Comments:
MCB functions are available. See section 1.0 of this manual.

The formatter CPU can be reset manually. After manual reset you must issue the command
form=addr to re-initialize the module.

CAUTION: Issuing this command with an equals, **=**, causes a formatter reconfiguration which
will put the formatter into a busy state for up to 8 seconds.

 rate and *fan* combinations that imply more than 8 Mbits/sec of data per tape track or less than
0.25 Mbits/second of data per tape track are not permitted. The tape clock rate is set to be 9/8
of the implied data bit rate per track for Mark III modes, and 9.072/8 of the impled bit-rate per
track in VLBA mode.

The VLBA formatter clock is set with the fmset program. If the formatter time is set or re-
synched, the fmset program will automatically reset the FS time if the time model in
time.ctl is **offset** or **rate**. If you change the time in some other way and the time model
in time.ctl is **offset** or rate, issue the command

                    sy=run setcl offset &

to reset the Field System time.

In VLBA mode the serial status register is loaded with the hardware ID (from equip.ctl) in
the most significant byte and the micron position of the head is stored in BCD in the two least
significant bytes; negative values are indicated by the highest order bit of these two bytes being
turned on. In Mark III modes the hardware ID is placed in the second most significant byte of the
serial status register.

If the requested sampler track assignments and formatter track enables would imply use of only odd or even recorder tracks only and the head.ctl control files indicates that only **even** or **odd** tracks are to be used, the sampler assignments and enables are automatically mapped to the corresponding even or odd tracks. If both odd and even tracks are used and/or the head.ctl specifies **all** heads are to be used, no mapping takes place. The Mark III modes **prn**, **a**, **b**, **c**, **d*n*** assign samplers to and enable all the odd and even tracks required, so no mapping is required for these modes.

The **vform** command is provided for use with all types of racks that use a VLBA DQA module for a decoder. The **vform=...** works with all racks types, including VLBA and VLBA4. The **vform=…** command must be used to specify the formatter tape clock if the rack type is not VLBA. The **vdqa** and **vform** comands are particular useful for writting rack independent procedures for stations that switch between VLBA and VLBA4 rack types.

For longitudinal drives, the correlators can not reproduce recordings made at speeds below 40 ips, but this limitation is subject to change in the future. This limitation is functionally equivalent to a minimum per track data rate of 2 Mbit/sec.

form4 - Mark IV formatter low-level control

Syntax: **form4=***command*

Response: form/*response*

Settable parameters:

command   any legal command sentence as described in the Mark IV Formatter Vocabulary
                manual. The characters \r\n (carriage-return, line-feed) are appended before
                sending the command.

Monitor-only parameters:

response   response to *command*. The >\r\n at the end of the response is not included in
                the Field System log. For accepted commands, which have only >\r\n as the
                response, the Field System logs ack.

Comments:

Refer to the Mark IV Formatter Vocabulary manual for a description of all valid commands and
their syntax.

This command is a simple feed-through to the Mark IV formatter. No checking is done on the
command, no action is taken for any response. This form of the command is temporary while it
is determined what standard parameters are desired.

The *command* is sent to the MAT bus just as if the operator had used the **mat** command. No
modifications are made before the command is sent on the bus.

fsversion - get field system version

Syntax: **fsversion**

Response: fsversion/version

Monitor-only parameters:
version   field system version number.

Comments:
Used to display and log version number of the currently running field system.

halt - halt execution of a schedule

Syntax: halt

Response: none

Comments:
This command halts execution of the schedule until a **cont** command is issued by the operator. Once the current schedule command is finished, no further commands of any kind will be read from the schedule command stream while the **halt** is in effect. Interactive commands from the operator command stream will still be processed. This is an immediate execution operator command.

hdata - head positioner A/D readout (longitudinal drives)

Syntax: **hdata**

Response: hdata/*hd0p,hd1p,hd0t,hd1t,vac,oddpwr,evpwr,ref*

Settable parameters: none

Monitor-only parameters:
hd0p	Head 0 position.
hd1p	Head 1 position
hd0t	Head 0 temperature
hd1t	Head 1 temperature
vac	Vacuum sensor
oddpwr	Odd reproduce power
evpwr	Even reproduce power
ref	Reference voltage

Comments:
MAT module functions available for Mark III/IV. No MCB functions available for VLBA/4. See section 1.0 of this manual.

This command reads the head positioner A/D channels, all values are reported in units of volts. Data from all channels are reported regardless of whether anything is hooked up to them or not. In particular, most stations do not use the temperature channels, the vacuum sensor, and normally only one of the reproduce power channels is hooked up.

The position voltages (and all others) are reported with the LVDT off. Use the **lvdt** command to measure positions with the LVDT on.

All parameters except *oddpwr* and *evpwr* are null if the drive type specified in the equip.ctl control file is **vlba2**.

hdcalc - stack calibration calculation (longitudinal drives)

Syntax: **hdcalc**
                 hdcalc=clear

Response: hdcalc/*writeF,readF,writeR,readR,writeS,readS*

Settable parameters:
none, however **hdcalc=clear** will delete previously calculated values

Monitor-only parameters:
writeF   Forward absolute offset for the write head
readF   Forward absolute offset for the read head, null for VLBA
writeR   Reverse relative offset for the write head
readR   Reverse relative offset for the read head, null for VLBA
writeS   Write head scale
readS   Read head scale, null for VLBA

Comments:
This command will calculate new calibration parameters based on the voltages saved with the **savev** command. See the **Narrow Track Calibration** manual for a description of the calculations. Only one scale factor is calculated for each head.

Any parameters which cannot be calculated because **savev** has not saved a complete set of voltages will be reported as null, i.e. empty.

The VLBA recorder has only one head. Its parameters are reported as the write head parameters and the read head parameters are null.

hecho - head communications echo (longitudinal drives)

Syntax: **hecho=***on/off*

Response: hecho/*on/off*

Settable parameters:
on/off   ON to turn echo on, OFF to turn echo off.

Monitor-only parameters: none

Comments:
This command prints debug information for commands that use the head positioner (**peak** and **locate**).

help or ? - display on-line help information

Syntax: **help=***command*
                 ?=*command*

Response: *displays information on the screen*

Settable Parameters:
command   The name of any SNAP command.

Comments:
This command displays available information on the specified SNAP command. Either the word
help or the question mark may be used. Typing **help** or **?** alone gives help on **help**. The help
information is essentially the listing of the manual page for the SNAP command.

The Field System **help** command opens a new xterm window and uses the less pager to
display the requested help text one screen-full at a time. At the bottom of the window you will
see a prompt in inverse video that includes the name of the file being displayed(which you can
ignore). If you want to continue the listing, press the space bar and the next screen-full will be
displayed. To exit from the command, type the letter **q** (not echoed on the screen). For help with
less, type the letter **h** to the prompt. The full options of less are available including texte
searches and scrolling back.

In some cases statistics about where in the file the current screen-full comes from may be
displayed in the prompt. In some cases, less will display only a colon : prompt.

When you see (END) in inverse video in the prompt at the bottom of the screen, you have
reached the end of the help information on this topic. Press the letter **q** to exit. When you press
q, the help xterm window will close automatically. While the text is displayed in the window
you can also use the xterm scroll bar to move around within the text.

The help information is kept in files in the directory /usr2/fs/help, one file per command.
Versions for different configurations are distinguished by the two characters in the file extension
for the type of hardware. The first character is for the type of rack and second is for the type of
recorder. The characters used are m for Mark III, v for VLBA, 4 for Mark IV, u for VLBA4and
_ for any. In addition, for racks there are j for Mark IV, VLBA, k for Mark III, VLBA4, and
l for Mark IV, VLBA4; for recorders there are s for S2 and x for non-S2. Some letters may not

be used. The content of the files is the ASCII version of the pages in this manual. Station-dependent help files are found in `/usr2/st/help`.

If no help is available for a command, a message to that effect will be displayed in the log output window. You will also receive the message if you request help for a command that is not defined for your equipment.

hpib - general HP interface bus communications

Syntax: **hpib=**_mn,data_

Response: hpib/_data_

Settable parameters:

_mn_   2-character mnemonic of the module to be addressed, as found in the ibad.ctl
             control file.
data   complete message to be sent to module, if any. Talk-only modules do not accept
             data.

Monitor-only parameters:

data   response of module, if any. Listen-only modules do not generate any response.

ifadjust - adjust IF attenuators (Mark IV racks)

Syntax: **ifadjust=***target*
                 ifadjust

Response: ifadjust/*target,att1,att2,att3*

Settable Parameters:
target   Settable target levels for TPI counts. 3300 counts (default).

Monitor-only Parameter.
att1   IF1 attenuator settings.
att2   IF2 attenuator settings.
att3   IF3 attenuator settings.

Comments:
This command will attempt to automatically adjust the IF attenuators in a Mark IV rack. It may be useful for determining the correct IF attenuator settings for each mode before an experiment begins. The resulting values can be edited into the IF set-up procedure for the corresponding mode. It should however not be used during an experiment because: (1) the length of time require to execute the command may disrupt the schedule and (2) it may change the attenuator settings between scans which will introduce unnecessary delay jumps in the data.

In order to run **ifadjust**, set the rack up with the set-up procedure to be used for recording, e.g., **sx2ca=1**, then the adjustment process can be started by specifying a target level with **ifadjust=…** or just typing **ifadjust** to reuse the last *target*. If there has not been measurement made since the last FS start, the default *target* value is used.

The **ifadjust** command attempts to optimize the IF attenuator settings for all data channels that are specified as being recorded by the current formatter set-up as specified by the **trackform** command. A *data channel* is a USB or LSB channel of an individual VC, i.e., each VC has two possible data channels. The patching of the VCs as specified by the **patch** command is used to determine which VCs are connected to which IF channels. Only IF channels that are specified as being patched are adjusted. The **patch** command must accurately reflect the patching or this command will not work well. Data channels may be deleted by removing them from the formatter set-up.

The **ifadjust** command makes one adjustment pass for each VC side-band in use. Any mode that uses at least one LSB and at least one USB channel will require two passes. The LSB channels are handled in the first pass; the USB, in the second. The **ifadjust** command starts with the currently commanded attenuator settings and then attempts a binary search over the remaining range of the possible attenuator values, 0-63 dB, to locate the optimal value. This is done in parallel for each IF channel in use. In the worst case, it may take up to 16 seconds per pass. If the command successfully converges to an optimal value for all sidebands in use, the monitor response above is printed with the final values. Logged output messages are printed as progress reports at each step. The attenuators are left set to the final values and these become the default (null) and previous "*" values for these parameters.

The optimal setting for each IF attenuator is defined as the maximum amount of attenuation that keeps all TPI levels for data channels connected to that IF at least *target* counts above the TPZERO level.

If the adjustment process fails to converge, possible causes include: an inconsistency between the patching specified by the **patch** command and the actual patching, variable RFI that makes the readings unstable, and IF bandpass signal roll-off or stable RFI that causes the TPI levels to exceed the available dynamic range, about 12 dB. If the range of TPI levels in the active sidebands for a given IF channel exceeds 6 dB a warning message will printed even if the adjustment process converges. Likewise if any channel's TPI level exceeds 20000 counts at the final settings a warning message will be printed. These warning messages do not necessarily mean that there is a problem, but it would prudent to examine your system more closely if you get them as there could well be a potential problem.

Please note that for Mark IV VCs the 10 dB pads in each sideband of the converter should be on, i.e., in the signal path, at all times. The automatic level setting and correct data recording depends on this.

ifd - IF distributor control (Mark III, Mark IV racks)

Syntax: **ifd=***atten1,atten2,input1,input2*

Response: ifd/*atten1,atten2,input1,input2,rem/lcl,TP1,TP2*

Settable parameters:

atten1   IF1 attenuator setting in db, range **0** (default) to **63** db. Enter a numerical value preceeded by **+** or **−** to indicate relative change. Other options are **max**, or **old** to restore the previous value after a **max**.

atten2   IF2 attenuator setting in db, range **0** (default) to **63** db. Enter a numerical value preceeded by **+** or **−** to indicate relative change. Other options are **max**, or **old** to restore the previous value after a **max**.

input1   IF1 input, **nor** (default) or **alt**.
input2   IF2 input, **nor** (default) or **alt**.

Monitor-only parameters:

rem/lcl   switch setting, remote or local
TP1   IF1 total power reading
TP2   IF2 total power reading

Comments:

MAT module functions available. See section 1.0 of this manual.

The **max** and **old** values for the attenuator parameters allow the attenuators to set to the maximum value of 63, and then returned to their previous values.

if3 - IF3 distributor (Mark III, Mark IV racks)

Syntax: **if3=***atten,mixer,sw1,sw2,sw3,sw4,pcal*

Response: if3/*atten,mixer,sw1,sw2,sw3,sw4,pcl,switch,cntrl,freq,rem/lcl,LOlock, TPI*

Settable parameters:

atten   Attenuation in dB, range **0-63**, default **0**. Enter an integer value preceded by **+** or **-** to indicate a relative change. Other options are: **max**, or **old** to restore the previous value after **max**.

mixer   Downconverter **in** or **out** of the signal path, default **out**. In response only: 11 or 00.

sw1   Switch 1 state: output to port **1** (default) or port **2**.
sw2   Switch 1 state: output to port **1** (default) or port **2**.
sw3   Switch 1 state: output to port **1** (default) or port **2**.
sw4   Switch 1 state: output to port **1** (default) or port **2**.
pcl   Phase-cal control setting **on** (default) or **off**.

Monitor-only parameters:

switch   external switch, present or missing.
cntrl   phase-cal control modification, present or missing.
freq   Synthesizer frequency in MHz.
rem/lcl   Switch setting, rem or lcl
LOlock   LO lock/unlock status, lock or unlock
TPI   Total power integrator reading, decimal, 0-65535.

Comments:

MAT module functions are available. See section 1.0 of this manual.

The **max** and **old** values for *atten* can be used to switch in the maximum attenuation and then restore the previous (old) attenuation. This is primarily useful for system temperature measurements. See the **sxcts** procedure in the **Standard Procedure** manual for an example.

The mixer state commanded by this command and the down converter frequency specified in the equip.ctl control file are used by the **pcal** command to calculate the frequencies of the

phase-cal tones for the video converters that are specified as connected to IF3 with the **patch** command. The **beam3** command also uses this information to calculate the default beam size.

If the switch for the mixer is an undefined state, the *mixer* response is **11** or **00** depending on which incorrect state the mixer is in, see the **MAT Protocol** manual for details.

The monitor values of the switch settings *sw1-sw4* are null (empty) if the equip.ctl file shows the switch as not connected. Only switches that have been identified as connected can be commanded. The *switch* monitor-only parameter indicates whether the switch box itself is installed.

The external switch settings *sw1-sw4* commanded are not used to calculate the patching. The effect of the switch settings, i.e., which video converters are connected to which inputs, must be specified in the appropriate **patch** command.

Unless low-pass filters have been installed in some of the output channels, the IF3 module should only be used to distribute "high" 170-500 MHz IF frequencies to the video converters.

The *cntrl* parameter is only displayed if **if3** is set as the phase-cal control type in equip.ctl.

Some racks may not have the IF3 module installed.

ifdab - IF distributors, A & B (VLBA, VLBA4 racks)

Syntax: **ifdab=***attenA,attenB,inputA,inputB,avper*

Response: ifdab/*attenA,attenB,inputA,inputB,avper,TPA,TPB,serno,err*

Settable Parameters:

attenA   Attenuator setting for IF channel A. **0** (default) or **20** db. Normally this attenuator should be set to **0** so that the 20 db can be used for radiometry.

attenB   Attenuator setting for IF channel B. **0** (default) or **20** db. Normally this attenuator should be set to **0** so that the 20 db can be used for radiometry.

inputA   Input source for IF channel A. **nor** (default) for normal input, **ext** for front panel IF input.

inputB   Input source for IF channel B. **nor** (default) for normal input, **ext** for front panel IF input.

avper   Averaging period in seconds for the total power integrator. May be **0**, **1**, **2**, **4**, **10**, **20**, **40**, or **60** seconds. A value of **0** results in 1/80 sec averaging time. Default **1**. The averaging period is synchronous with 1 pps.

Monitor-only Parameters:

TPA   Total power in IF channel A in counts. Range 0 to 66535, nominal operating level = 16000.

TPB   Total power in IF channel B in counts. Range 0 to 65535, nominal operating level = 16000.

serno   Module serial number.

err   Module timing error indication, 1pps or no_1pps.

Comments:

This command sets up the IF distributor module that is connected to channels A and B. Use the ifdcd command to set up channels C and D. This command is analogous to the Mark III **ifd** command.

MCB module functions are available. See section 1.0 of this manual.

The nominal input level to the rack is -20 dBm. If this level is present then the total power will be at the nominal value and no extra attenuation will be needed.

ifdcd - IF distributors, C & D (VLBA, VLBA4 racks)

Syntax: **ifdcd=***attenC,attenD,inputC,inputD,avper*

Response: ifdcd/*attenC,attenD,inputC,inputD,avper,TPC,TPD,serno,err*

Settable Parameters:

attenC   Attenuator setting for IF channel C. **0** (default) or **20** db. Normally this
                  attenuator should be set to **0** so that the 20 db can be used for radiometry.
attenD   Attenuator setting for IF channel A. **0** (default) or **20** db. Normally this
                  attenuator should be set to **0** so that the 20 db can be used for radiometry.
inputC   Input source for IF channel C. **nor** (default) for normal input, **ext** for front
                  panel IF input.
inputD   Input source for IF channel D. **nor** (default) for normal input, **ext** for front
                  panel IF input.
avper   Averaging period in seconds for the total power integrator. May be **0**, **1**, **2**, **4**,
                  10, **20**, **40**, or **60** seconds. A value of **0** results in 1/80 sec averaging time.
                  Default **1**. The averaging period is synchronous with 1 pps.

Monitor-only Parameters:

TPA   Total power in IF channel A in counts. Range 0 to 66535, nominal operating
                  level = 16000.
TPB   Total power in IF channel B in counts. Range 0 to 65535, nominal operating
                  level = 16000.
serno   Module serial number.
err   Module timing error indication, 1pps or no_1pps.

Comments:

This command sets up the IF distributor module that is connected to channels A and B. Use the
ifdab command to set up channels A and B. This command is analogous to the Mark III **ifd**
command.

MCB module functions are available. See section 1.0 of this manual.

The nominal input level to the rack is -20 dBm. If this level is present then the total power will
be at the nominal value and no extra attenuation will be needed.

k4ib - K4 IB Communications

Syntax: **k4ib=***device,command,mode,format,length*

Response: k4ib/*data*

Settable parameters:

device   mnemonic of device on K-4 bus from ibad.ctl to send data to, may be null if
                mode=**poll** and must be null for *mode*=**status**
command   data to send, null if *mode*=**poll** or **status** or **read**
mode   Function: **normal** (default), **read**, **write**, **write/read**, **poll**, or **status**
format   response format: **normal** (default), **ascii**, or **binary**
length   response length: **normal** (default), *decimal value*

Comments:

The *mode*, *format*, and *length* parameters are organized so that as often as possible they can
be omitted.

If *mode* is **normal**, the interpretation depends on the command sent: if *command* contains a
? or is **stat**, **rd**, **lc**, or **lv**, the *mode* defaults to **write/read**, otherwise if *command* is
null it defaults to **read**, non-null **write**.

If *format* is **normal**, the interpretation depends on the command sent: if *command* contains
stat or **err?** or if *mode* is **poll** or **status**, the *format* defaults to **binary**, otherwise to
ascii

If *length* is **normal**, the interpretation depends on the command sent: if *command* is **rd** the
length defaults to 192, if **lv** to 143, otherwise to 22,. The *length* is meaningless if *command*
is **poll** or **status.**

If the device is omitted and the *mode* is **poll**, all devices are polled and, their status bytes are
returned in the order of ascending ib addresses. If a device times-out on a poll operation, a "-1"
is
reported for its status byte.

If the *mode* is **status**, the response returns the bus status.

In general mroe than one command can be sent if they are separated by semicolons, but do not mix *command*s that require different modes or more than one response in a single command.

See the documentation of the K4 devices for information on what commands are available.

k4pcalports - phase cal extraction ports

Syntax: **pcalports=***pca,pcb*

Response: pcalports/*pca,pcb,ampa,ampb,phasea,phaseb*

Settable Parameters:
pca   Channel A input port number: **1**-**4** or **9**-**12**
pcb   Channel B input port number **5**-**8** or **13**-**16**

Monitor-only parameters:
ampa   Channel A amplitude in voltage percent, uncorrected for digital sampling
ampb   Channel B amplitude in voltage percent, uncorrected for digital sampling
phasea   Channel A phase in degrees
phaseb   Channel B phase in degrees

Comments:
This command is available even if a K4 recorder is not being used for recording. This allows the phase-cal extraction features of the K4, if present, to be utilized at all times.

Some day it will possible to specify the phase-cal extraction port may be specified as the port number or as the VC and sideband to be used. At that time, the VC and sideband will only be displayed if the **recpatch** command has been used to specify which port that VC sideband has been connected to. If **recpatch** command will have specified a VC sideband for the requested port, this will be shown in the response rather than the port number.

label - enter Volume Serial Number (K4 drives)

Syntax: **label=**_vsn_

Response: label/_vsn_

Settable Parameters:
vsn   8 character tape Volume Serial Number (VSN), no default

Comments:
No check is made to ensure assure label accuracy.

If a schedule is halted when the label is entered, its execution will continue.

label - enter tape VSN, check-label (longitudinal drives)

Syntax: **label=***vsn,check,type*

Response: label/*vsn,check,type*

Settable parameters:

vsn   8 or 10-character tape Volume Serial Number (VSN), e.g. **HS001234**.

check   4-character check-label corresponding to VSN, e.g. **8E45**. If no check label appears
            on the tape, run program labck to generate it.

type   **thick** or **thin**, defaults to type implied by VSN. For monitor, this value only
            appears until the tape is loaded with a **rec=load** command. This parameter is not
            available unless vacuum switching is enabled in sw.ctl control file.

Comments:

Normally used after **newtape** command has halted the schedule. There are two different modes
of operation depending on whether the Volume Serial Number (VSN) has 8 or 10 characters.
When the **label** command is entered directly by the operator, 8-character VSNs are used. Tape
number and check label must correspond or execution of the schedule will not continue. The
effect of this command is the same as that of **cont**. Digit zeros "0" and letters "O" are both
treated as zeros in both number and check for operator convenience.

The ten-character mode will normally be used only by the rwand program. In this mode, the first
eight characters of *vsn* correspond to the tape number, while the tenth character is used for a
checksum. Any other parameters are ignored. A fake, but correct, check-label code will be
generated if the checksum is correct. Please note a trailing comma is necessary if the tenth
character (checksum) is a space.

For VLBA and VLBA4 drives and specially-equipped Mark IV drives that use vacuum switching,
this command is used to specify whether the thick or thin vacuum level (and for VLBA and
VLBA4 drives the thickness parameters as well) are commanded. Please see the **rec** command
for more details.

Labels starting with the following strings (letters "O" replaced by numerals "0") are assumed to
be thin by default: **0VLB**, **3MTHN**, **CMVA**, **DSCP**, **EVNT**, **GIFT00**, **HST**, **ISAS**, **JIVE**, **MPIT**,
NAIC, **NASA**, **SAMP**, **SVLB**, **THNINT**, **UNQU**, **USN01**, and **VLBA**. All others are assumed to be

thick. There are no known deviations from this at this time. However, the *type* parameter can be used to override the default if necessary.

label - enter tape VSN and type (S2 drives)

Syntax: **label=***vsn,type,code*

Response: label=*vsn,type,code*

Settable parameters:

vsn   up to 20 character Volume Serial Number (VSN), e.g. **CA-1-0012305**.

type   one or six character tape type, e.g. **1**, or **010020**. This field may be omitted if *code* is **csa**. If not omitted and *code* is **csa**, it must agree with the type specified in the *vsn*.

code   tape label format, an arbitrary string up to 32 characters, default is **csa**.

Comments:

Normally used after **newtape** command has halted the schedule.

If *code* is **casa**, *vsn* is interpreted as a CSA format, "XX-T-YYYYYZZ-N" label. The "XX-T-YYYYZZ" part of the label uniquely identifies this as a set of eight tapes. The check-sum is checked. If *type* is specified it must agree with the "T" type from the *vsn*, unless six characters are specified for *type*. If *type* is not specified, the single character "T" from the *vsn* is used as the typ. The suffix "-N" must be omitted if all eight tapes in a set are loaded, even if they will not all be recorded as one group. If fewer than eight tapes are loaded, which tapes are inserted and the order of their insertion in the transports should be specified in the suffix. For example if the first four tapes in a set are inserted in order the suffix "-0123" should be used. When fewer than eight tapes are inserted they should be inserted in ascending order and must go into consecutive transports in ascending order starting with transport 0. Loading the tapes in this way and using the suffix as described is necessary in order for the correlator to load the tapes for playback based only on information available in the log. In addition, if the tapes are not inserted in consecutive transports beginning with transport 0, the schedule will probably fail.

For all other values of *code*, *vsn* may be an arbitrary string up to 20 characters long, but *type* must be specified in this case.

If the recorder is already recording and a tape type different than what is in use is requested, no change will be made and an error will be reported.

list - display portion of currently active schedule

Syntax: **list=**start,#lines

Response: *display of 10 lines of schedule*

Settable parameters:

start   place in the schedule to begin listing. May be one of the following:

                null to start two lines before the line currently being executed

                #*line*, where *line* is the starting line number, to start at a particular line number in a schedule

                time, in standard SNAP time format, to start at the line which has a time equal to or later than *time*

#lines   number of lines to list, default **10**

Monitor-only parameters: none

Comments: Ten lines of the current schedule, with line numbers, are listed on the terminal. If the current executing line of the schedule is included in the range listed, it is identified by a leading right arrow >. Only the active schedule may be listed with this command. This is a display-only response - no information is logged.

lo - LO frequencies (all racks)

Syntax: **lo=***chan,freq,sb,pol,pcspace,pcoff*

Response: lo/*chan,freq,sb,pol,pcspace,pcoff*

Settable parameters:

chan   **loX**, where **X** is one of **1**, **2**, or **3** for Mark III/IV and K-4 or **a**, **b**, **c**, or **d** for VLBA/4. No default.

freq   LO frequency for this channel, MHz. No default. No previous value available.

sb   Net sideband for this channel, **unknown, usb** or **lsb**. Default is **unknown**..

pol   Polarization for this channel, unknown, rcp, or lcp. Default is **unknown**.

pcspace   Spacing of phase-cal rails for this channel, MHz, **unknown**, or **off**. Default is **unknown**.

pcoff   First phase-cal rail frequency for this IF if not equal to the spacing, MHz. Default 0.0. This offset is specified relative to DC in the IF.

Monitor-only Parameters: none

Comments:

This command specifies the characteristics of each IF channel. It is an information only command in its standard implementation, but may be implemented as a station command to provide hardware control.

The values should represent the net of effect of all stages of conversion before the signal enters the rack. In other words any upconverter should be included. The values for the Mark III/IV IF3 channel should not include the effect of the internal IF3 mixer, but instead should specify the input to the IF3 module.

The LO frequencies are used by the pcalr and pcald programs to calculate the frequencies of the phase calibrator tones. Pcalr has not been tested with spacings other than 1 MHz. The **beamX** commands use the LO frequencies to calculate default beamwidths.

An **lo=** with no parameters clears all LO values.

The monitor form of **lo** shows all defined LO values.

In the future, for K4 type 1, the range of LO values should be **1-4**, for K4 type 2, **1-16**.

locate - locate head stack position (longitudinal drives)

Syntax: **locate=***range,nsamples,step,stack*

Response: locate/*range,nsamples,step,stack,peakv,mper,vltlc*

Settable parameters:

range   ± range to search over in microns. Default is **200**.

nsamples   Number of power samples for each measurement position. Default is **1**.

step   Micron step size between measurement positions. Default is **40**.

stack   Head stack to move: **1**, **2**, **w**rite or **r**ead. Default is **2** for Mark III/IV and VLBA4, and **1** for VLBA. Only 1 is valid for VLBA and MK3B recorders. The value **w**rite is synonymous with **1** and **r**ead is synonymous with **2**, even if the heads are wired differently. Only the first character for **w**rite and **r**ead is checked; these possibilities are provided for backward compatibility only.

Monitor-only parameters:

peakv   peak measured voltage from power detector

mper   minimum sample voltage as a percentage of peakv

vltlc   location of the peak in positioner voltage

Comments:

This command performs a coarse grid search for the largest detected power over the search range. The search is performed over a range of ±*range* microns about the initial head position. The number of positions sampled is ((2*range)/step*)+1. The actual positions at which measurements are made are not exactly *step* microns part. The head stack will be positioned within ±5 microns of the nominal positions. This approximation is used to reduce the time moving the head stacks by not over-refining the positions of what is a coarse search anyway. In the worst (too coarse) case two positions might be *step*+10 microns apart.

After sampling over the complete range, **locate** returns the head stack to the position that gave the highest power level, makes a new measurement and reports these values for the *peakv*, *mper*, and *vltlc* parameters.

This command requires that the reproduce power detector be hooked-up with a reasonable amount of attenuation and that the head.ctl control file correctly identify which detector (odd or even) is in use. This command must be issued once with parameters to set it up. Issuing the

command subsequently without parameters will start a search. The tape must moving and there must be recorded data to reproduce for this command to do something useful.

See the **Narrow Track Calibration** manual.

log - start a new log file

Syntax: **log=**_name_

Response: log/_name_

Settable parameters:

name   name of log file to be opened. If no directory path is specified, /log is
                assumed. If no extension is specified, .log is assumed.

Monitor-only parameters: none

Comments:

When the Field System is initialized, log file station.log was opened or created in directory
/usr2/log. If the log file requested by this command cannot be opened or created, the Field
System returns to using the log file previously in use. If no log file can be successfully opened,
execution of the schedule continues, but an error message is displayed on the screen every time
an attempt is made to write into the log.

logout - set log output units

This command is not implemented

Syntax: **logout=***dev,dev,...*

Response: none

Settable parameters:
dev   Device name for display of log entries. Up to 5 devices may be specified.
                 Default device is the log/display window.

Comments:
Log entries are always written into the log file, this command is only for display during operations. All log entry display may be suppressed by issuing the command **logout=/dev/null**.

An example of the use of this command is to specify a file name as the device in order to record a portion of the log file into a separate file. Another example would be to have the log display appear on a different terminal from the console screen.

You must have permission to write to any device or file that you specify. If you specify a device which you do not have permission to write to, an error will be generated when the Field System attempts to open that device.

NOTE: This command is not implemented.

lvdt - positioning by LVDT voltage (longitudinal drives)

Syntax: **lvdt=**_cmdVw,cmdVr_

Response: lvdt/_cmdVw,cmdVr,actVw,actVr,deltaVw,deltaVr_

Settable parameters:

cmdVw   Command position voltage for the write head stack, default is don't move. For Mark IV this parameter refers to head stack 1.

cmdVr   command position voltage for read head stack, default is don't move. This parameter is not valid for VLBA recorders. For Mark IV this parameter refers to head stack 2.

Monitor-only parameters:

actVw   Actual position voltage for write head stack (Mark IV stack 1)

actVr   Actual position voltage for read head stack (Mark IV stack 2), null for VLBA

deltaVw   voltage difference between actual and commanded write head stack position (Mark IV stack 1).

deltaVr   Voltage difference between actual and commanded read head stack position (Mark IV stack 2), null for VLBA

Comments:

This command is used to position the head stacks in voltage units. An individual stack may be moved by not specifying a command voltage for the other stack. The commanded positions are uncalibrated.

VLBA recorders have only one head stack. Its positioning is specified by using the first (write) stack parameter. Monitor parameters for the read head stack are reported as null.

For Mark IV recorders, the write head stack parameters correspond to head stack 1, the read head stack parameters to head stack 2.

The _deltaVx_ parameters are reported with the sign of actual minus commanded.

The command positions reported by the **lvdt**, **pass**, and **stack** commands are consistent. See the description of the **pass** command for more information.

If the write head stack position is commanded, the auxiliary data field is set to reflect the commanded position, see the **pass** command for more information. (Not yet implemented for VLBA.)

For VLBA2 drives, the voltage units are actually in kÅ (0.1 microns) of head position. This implies that the scale is expanded by a factor of about 1500 over the LVDT voltage scale of other drives.

mat - general communications with ASCII Transceivers

Syntax: **mat=***data,data,...*

Response: mat/*data,data,...*

Settable parameters:

data   complete message to be sent to MAT system, including actual hex address and all
                other protocol. No checking is done. Each message between commas is sent
                separately. All special non-printing characters, such as escape, should be typed
                directly on the keyboard or they will be sent as typed. EXCEPTION: The
                character enq will be substituted for any TAB encountered in the message.

Monitor-only parameters:

data   response of MAT system, if any, to each message.

matload - download 8080 code to MAT

Syntax: **matload=**_unit addr,mem addr,data_

Response: matload/_acknowledgement_

Settable parameters:
unit addr   the hex address of the MAT to receive the code.
mem addr   the hex location for the start of the load, 4 characters.
data   the hex data bytes to be transmitted, must be an even number of them.

Comments:
The message to the unit that is sent:

                    #unit addr:nnmem addr00datacc

where nn=number of data bytes, cc=check sum. Remember that 2-byte data values are sent least significant, most significant.

mk5 - Low-level Mark V interface

Syntax: **mk5=***command,...*

Response: mk5 / *response,...*

Settable parameters:
command   low-level Mark 5 command or query

Monitor-only parameters:
response   response from the Mark 5.

Comments:
Multiple *command*s can be sent with one **mk5** command by separating them with commas. The *response*s for each command are separated by commas.

Please refer to the Mark V command sent document for details on available commands and their responses.

mk5close - Close the Mark V connection

Syntax: **mk5close**

Response: none

Comments:
This command can be used to close the connection to a Mark V5 recorder. It is recommended that this be done prior to shutting down the Mark V control program for a disc swap. The connection can be re-opened with the **mk5relink** command.

mk5relink - re-establish the Mark V connection

Syntax: **mk5relink**

Response: none

Comments:
This command can be used to open a new connection to the Mark 5 recorder. If the connection is already open, it will be closed and new one established. Opening a new connection is needed after after the Mark V's control program has been restarted or its power has been cycled. This may happen for example for a disc swap.

If a schedule is running, but **halt**ed, this command will release the halt if a connection is successfully re-established.

mount - pre-mount tape (longitudinal drives)

Syntax: **mount=**_vsn,check,type_

Response: mount/_vsn,check,type_

Settable parameters:
vsn   8 or 10-character tape Volume Serial Number (VSN), e.g. **HS001234**.
check   4-character check-label corresponding to VSN, e.g. **8E45**. If no check label appears
            on the tape, run program labck to generate it.
type   **thick** or **thin**, defaults to type implied by VSN. For monitor, this value only
            appears until the tape is loaded with a **rec=load** command. This parameter is not
            available unless vacuum switching is enabled in sw.ctl control file.

Comments:
This command is similar to the **label** command, except that it does not release a schedule that
is halted and in addition it issues a command to cause the SNAP procedure **mounter** to
execute.

The **mounter** SNAP procedure is included in experiment procedure files. For all drive types
except VLBA and VLBA4 the procedure is empty. For VLBA and VLBA4 the procedure
contains only **rec=load**.

This command only comes in the dual recorder forms, **mount1** (with **mounter1**) or **mount2**
(with **mounter2**). It is not available for single recorder systems, hence the generic form **mount**
(with **mounter**) does not exist.

This command is used to pre-mount a tape in advance of a tape change in a two recorder system.
Only the currently un-selected drive (see the **select** command) may have its tape pre-mounted.
The intent is that this command can be use to inform the FS about the tape will be used next on
the drive that is not in use thus freeing the operator from having to be physically present at the
tape change. When the FS is ready to load a new tape at the next tape change it will remember
the presence of the new tape and not halt the schedule with the **newtape** commmand is
encountered. If a tape has not been pre-mounted, **newtape** will stop the schedule as usual.

After issuing this command the operator should take whatever steps are necessary to load the
tape. For the VLBA and VLBA this is automated through the **mounter** SNAP procedure. For

other recorders there is no standardized way to automatically load the tape, so the operator must take appropriate action.

All other details of this command are the same as those of the label, please refer to thatcommand for further information.

mcb - MCB Communications

Syntax: **mcb=***module,reladdr,value*

Response: `mcb`/*value*

Settable Parameters:

module   Module mnemonic indicating which module is to be addressed. Only standard module mnemonics allowed. Use null to indicate that the following address is an absolute address.

reladdr   Relative MCB address (hex), i.e. the offset from the module's base address. This is the address to be read if a value is not given. This is the address to write to if a value is given. If *module* is null, then this is an absolute address.

value   Value (hex) to be written into *reladdr*. Omit this parameter if you want to read *reladdr*.

Monitor-only Parameters:

value   Value (hex) that was read from *reladdr*, if a value was not specified in the command. If a value was specified in the command, then the response is the status of the write: OK, BUSY, ERR.

Comments:

This command is analgous to the Mark III mat command. This command is used to read values from or write values to a specific MCB address.

If the command is issued as **mcb=***module,reladdr* then the response is the hex value at *reladdr*.

If the command is issued as **mcb=***module,reladdr,value* then the value is downloaded into *reladdr* and the response is the status.

newtape - halt schedule until tape is mounted (all drives)

Syntax: **newtape=**_tape_

Response: newtape/"To continue, use LABEL command"
               newtape/LABEL=_label_

Settable Parameters:

tape   Used for a K4 drive with DMS only: Tape number for the DMS to load, **1-24**.
               Default is to not use the DMS.

Monitor-only Parameters:

label   Used for a K4 drive with DMS only: the label read when the tape was loaded

Comments:

If a tape number is specified, the DMS is instructed to insert the tape specified from the DMS into the recorder. The DMS is instructed to read the label bar-code on the tape. The response shows the label read. The "To continue response does not appear. If a schedule is halted, its execution continyes

If no tape number is specified (i.e., if **newtape=…**, or **newtape** is entered) for a non-K4 drive or for a K4 drive without a DMS installed, the response will be displayed and the schedule will be halted until a label is entered. The LABEL= response does not appear.

For non-K4 drives or for a K4 with no DMS, this command in effect is the same as the **halt** command. Execution will continue after the **label** command has been successfully completed. If you are in a rush, the **cont** command will also work to continue execution of the schedule

oldtape - unload tape to DMS (K4 drives)

Syntax: **oldtape=**_tape_

Response: oldtape/"Dismount this tape now"

Settable Parameters:

tape   Tape number position for the DMS to return the tape to, **1-24**. Default is to not
                use the DMS.

Comments:

If a tape number is specified, the DMS is instructed to return a tape (that has already been ejected from the drive) to the specified position in the DMS.

If no tape number is specified (i.e., if **oldtape**= or **oldtape** is entered) or a DMS is not installed, the response will be displayed.

onoff - on-off radiometry

Syntax: **onoff=***rep,intp,dev1,dev2,cutoff,stp*

Response: onoff/*rep,intp,dev1,dev2,cutoff,stp,cal1,cal2,
               beam1,beam2,flux1,flux2,chain1,chain2*

Settable parameters:

rep	Number of repetitions, **1** to **99**. Default is **2**.
intp	Integration period, **1** to **10** seconds. Default is **1**.
dev1	Device to be used as detector 1. Standard detector mnemonics are allowed. Default is **i1** for Mark III/IV, **ia** for VLBA/4. Station dependent detectors **u5** and **u6** may be available.
dev2	Device to be used as detector 2. Standard detector mnemonics are allowed. Default is **i1** for Mark III/IV, **ib** for VLBA/4. Station dependent detectors **u5** and **u6** may be available.
cutoff	Elevation above which to step in elevation rather than azimuth, in degrees, default **60**.
stp	Distance off source for off source and calibration points, in multiples of a beamwidth. Default is **5.0**.

Monitor-only parameters:

cal1	Calibration noise source temperature in degrees K for detector 1. This is determined from the last **caltemp***X* command in conjunction with the **patch** (Mark III/IV) or **bbc** (VLBA/4) command.
cal2	Calibration noise source temperature in degrees K for detector 2. This is determined from the last **caltemp***X* command in conjunction with the **patch** (Mark III/IV) or **bbd** (VLBA/4) command.
beam1	The full width half maximum beam size (degrees) for device 1. It is determined from the **beam***X* command and the **patch** (Mark III/IV) or **bbc** (VLBA/4) command.
beam2	The full width half maximum beam size (degrees) for device 2. It is determined from the **beam***X* command and the **patch** (Mark III/IV) or **bbc** (VLBA/4) command.
flux1	The apparent source flux for device 1, based on the **flux***X* command and the **patch** (Mark III/IV) or **bbc** (VLBA/4) command.

flux2	The apparent source flux for device 2, based on the **flux*X*** command and the **patch** (Mark III/IV) or **bbc** (VLBA/4) command.
chain1	The IF chain, **1**-**6**, that device 1 is on. Chains **5** and **6** are for station specific detectors **u5** and **u6**. Mark III/IV racks use IFs **1**-**3**. IFs **1**-**4** corresponds to IFs a-d for VLBA/4 racks.
chain2	The IF chain, **1**-**6**, that device 2 is on. Chains **5** and **6** are for station specific detectors **u5** and **u6**. Mark III/IV racks use IFs **1**-**3**. IFs **1**-**4** corresponds to IFs a-d for VLBA/4 racks.

Comments:

The parameters should be setup by issuing a **onoff=**... command. A measurement is started by issuing a simple **onoff**. This will recover the current values for the display only parameters and schedule an external program onoff. See the **onoff** manual in Volume 2.

The current command antenna position including offsets is assumed to be 'onsource.'

It is recommended that nothing else be done, e.g. running a schedule, while this command is executing. Since this command may run for an extended period of time, a mechanism has been supplied for aborting: enter **sy=brk onoff &** as a SNAP command. After aborting, the offsets will be returned to their original values.

In order for this command to work, the following conditions must be met: (1) the detector devices have been set up by the Field System, (2) the appropriate **lo=**... commands have been issued, (3) the IF distributors have been set up by the Field System and it must be in remote (Mark III only), and (4) the appropriate **beam*x*=**... commands have been issued. Additionally, for a Mark III/IV rack, if a video converter is used as a detector, the appropriate **patch=**... command must have been issued. For a VLBA/4 rack with a BBC as a detector, the appropriate BBC IF input must be selected with a **bbc*XX*=**... command. If system performance is to be estimated based on the source's apparent flux, then the appropriate **flux*X*=**... command must have been issued.

If a noise diode temperature is less than zero, it is assumed that there is no noise diode to use for that detector. All measurements for that channel will be made assuming the absolute value of the diode temperature is the system temperature. Thus if the noise diode temperature is -100, the power measurements will come out as a percentage of the system temperature.

If either noise diode temperature is greater than zero, then two procedures must be available: **calonnf** and **caloffnf**, which are used to turn the noise diode on and off respectively. The recommended form for these procedures is:

```
CALONNF:   calon
           !+1s
           sy=go onoff &

CALOFFNF:  caloff
           !+1s
           sy=go onoff &
```

calon and **caloff** are local procedures that do whatever is necessary to turn the noise source on and off, respectively.

If station dependent detectors **u5** and/or **u6** are used, two additional procedures must be available to turn the signal on and off to the detectors. The recommended form of this procedures is:

```
SIGONNF:   sigon
           !+1s
           sy=go onoff &

SIGOFFNF:  sigoff
           !+1s
           sy=go onoff &
```

sigon and **sigoff** are local procedures that do whatever is necessary to turn the signal to the station dependent detectors on and off, respectively.

There is a known bug in the use of these procedures: **calonnf**, **caloffnf**, **sigonnf**, and **sigoffnf**, that may require the last two lines to be repeated in each procedure. In other words after the first line, each procedure should contain:

```
           !+1s
           sy=go onoff &
           !+1s
           sy=go onoff &
```

The indication that this is needed is if onoff seems to hang after executing one of these procedures. Please see the "Known Bugs" section of the latest update notice for more details.

onsource - get antenna pointing status

Syntax: **onsource**

Response: onsource/*status*

Settable Parameters: none

Monitor-only Parameters:
status   tracking or slewing, depending on the errors in pointing.

op - operator identification

Syntax: **op=***name*

Response: none

Settable Parameters:

name   Operator name or initials, maximum of 12 characters. Embedded blanks are
                allowed.

op_stream - place command in operator stream

Syntax: **op_stream=**_command_

Response: none

Settable Parameters:
command   The command to be placed in the operator command stream.

Comments:
This command can be used from the schedule to enter commands into the operator stream. This is useful because a time-scheduled command entered from the schedule stream will be blocked when the schedule is executing a timed wait.

This command might be used to periodically record TIP values during an observation. For example, the following procedures might be used to sample TIP values every 10 seconds during an observation:

MIDOB: **op_stream=start**
                      ...

START: **collect@!,10s**

COLLECT: **tpi=odd,even,if1,if2**

POSTOB: **collect@**

A great deal of care needs to be exercised when using this command. In particular, _command_ should not cause any long timed waits to occur since this will block the operator stream (in a pinch, the operator stream can be freed from a long wait by using the **flush** command). Also no command that might cause interference with the execution of the schedule should be used. In partiular this would mean avoiding the use of tape motion commands.

Note that any use of **@** in _command_ is interpreted to apply to the **opstream=...** command itself and is removed from the _command_ before what is left is placed in the operator stream. This is the reason that the START procedure was necessary in the example above.

This command is considered experimental. It creates a new type of interaction between the schedule and operator streams. It may be necessary to modify or remove this feature if some unanticipated consequence proves to be a problem.

parity - check parity errors (longitudinal drives)

Syntax: **parity=***pemax,syncmax,channel,aux,tracks*
                 parity

Response: parity/*parity-errors*
                 parity/*re-sync-errors*

Settable Parameters:

pemax   Maximum allowable parity errors per channel per megabyte of data. Default is
                 600. If errors exceed threshold, an error message is issued.
syncmax   Default is **12**. Otherwise handled the same as parity error threshold.
channel   Decoder channel. Can be **a**, **b**, or **ab** (default).
aux   Aux data check, **on** (default) or **off**. Not supported for VLBA DQA decoder.
tracks   List of recorder tracks on which to measure errors. Default is the currently
                 enabled tracks. For Mark III drives, tracks and must be between **1** and **28**, and/or
                 may be specified by groups (**g1**, **g2**, **g3**, **g4**) as in the **enable** command. For
                 Mark IV, and VLBA/4 drives, tracks must be between **0** and **35**, or specified by
                 groups (**g0**, **g1**, **g2**, **g3**) as in the **enable** command, or specified as non-system
                 tracks in the VLBA groups (**v0**, **v1**, **v2**, **v3**),or specified as the Mark III tracks
                 in the VLBA groups (**m0**, **m1**, **m2**, **m3**).

Monitor-only parameters:

parity-errors For each track in the list, the corresponding parity error rates per megabyte of
                 data per track.
re-sync-errors For each track in the list, the corresponding re-sync error rates per megabyte
                 of data per track.

Comments:

Issuing this command with an equal sign without or without a list of parameters sets up the
command. Issuing the command with no equal sign then measures the error rates.

A **repro=...** must be issued before the parity command will work. For Mark IV and VLBA/4
this specifies the bit rate. For Mark III this specifies the next best thing, the reproduce bandwidth.

This command assumes the read head stack is positioned appropriately for the tracks that will be
read. The heads that are used to reproduce data are automatically mapped from even to odd or

vice-versa depending on the reproduce electronics specified in the `head.ctl` control file. For VLBA and VLBA2 drives the write head parameter controls which heads are used. If a mixture odd and even heads are requested no mapping is done.

If the auxiliary data field was set using the **form** or head positioning commands, then it is checked for accuracy, unless the *aux* parameter is **off**. An error message is issued if the auxiliary data on the tape does not agree with the value last sent to the formatter.

If the log entry for the error rates is too long to fit in one line, then additional log entries are generated as necessary. Parity error rates are listed first followed by synch error rates. The parity error rate log entries include decimal points in the numbers to distinguished them from the synch error log entries which do not.

The decoder channels used to read the data can be specified, either **a**, **b**, or both **a** and **b** reproduce channels can be used. If `pcalr` is running, it should be suspended before starting this command so that there's no competition for the **b** channel.

The data stream is sampled for an amount of time that should be equivalent to 1 megabyte of data per channel and the effective error rates per megabyte of data are reported. For the typical reproduce bit rate of 4 Mbits/sec/track, 1 megabyte corresponds to 2 seconds. For slower bit rates it will take longer.

The decoder type (**mk3**, **mk4**, **dqa**, or **none**) must specified on the second line of the `sw.ctl` control file. If the type is **none**, the tracks are cycled through with a pause of 2 seconds between changes to allow visual inspection of the eye-pattern (and perhaps a K3 decoder if available) even if no supported decoder is available.

Note that a VLBA or Mark IV track number equals the Mark III track number plus three. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Set-up** Manual. Also VLBA group numbers equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses VLBA, Mark IV, or Mark III track and VLBA or Mark III group numbers depending on the type of drive in use.

pass - positioning by pass number (longitudinal drives)

Syntax: **pass=***cmdPw,cmdPr,woffset*

Response: pass/*cmdPw,cmdPr,woffset,cmdMw,cmdMr,actMw,actMr,*
                   deltaMw,deltaMr

Settable parameters:
cmdPw   Command pass number for write head stack (Mark IV stack 1), range **1-100** for
                   Mark III and VLBA, **1-112** for Mark IV. Default is to not move the write head
                   stack. For Mark IV recorders, if the parameter is **stack2**, then stack 1 is moved
                   to the most recently commanded stack 2 position.
cmdPr   Command pass number for read head stack (Mark IV stack 2), same range as for
                   write head stack. This parameter may not be specified for VLBA recorders. If the
                   parameter is **same**, the read pass will be same as the write pass. For Mark IV, if
                   the parameter is **mk4**, then stack 2 is positioned to 100 plus the pass number for
                   stack 1. Default is to not move the read head stack.
woffset   Type of offset for the write head. **auto** (default) or **none**. Only the first
                   character is checked. For **auto**, the head stack position is automatically adjusted
                   according to the write head type parameter in the head.ctl control file. For
                   none, no adjustments are made. Use **none** for Mark IV recording and for all
                   mode A recording. The read head is always adjusted.

Monitor-only parameters:
cmdMw   Microns corresponding to command write head pass number.
cmdMr   Microns corresponding to command read head pass number, null for VLBA.
actMw   Microns corresponding to actual write head pass number.
actMr   Microns corresponding to actual read head pass number, null for VLBA.
deltaMw   Micron error between actual and commanded write head position.
deltaMr   Micron error between actual and commanded read head position, null for
                   VLBA.

Comments:
This command moves the read and/or write head stacks to the position for the commanded
passes. The correspondence of pass numbers to a priori micron positions is established by the
tapeform command. The requested pass must have been set-up by the **tapeform** command
to be used. Odd pass numbers are used for forward passes, even for reverse.

Only the write head stack parameters in this command are used for VLBA recorders. The read head stack parameters are reported as nulls. For Mark IV, the write head stack parameters refer to head stack 1, the read head stack parameters refer to the head stack 2.

The head stack position in microns is determined by

position = tapeform offset + absolute offset   (forward pass)
position = tapeform offset + absolute offset + for/rev offset   (reverse pass)

where *tapeform offset* is the a priori offset as specified with the **tapeform** command, and the *absolute offset* and *forward/reverse offset* are specified in the head.ctl control file.

If *woffset* is **auto**, and the commanded pass is a reverse pass, and the write head stack is defined as **odd** in the head.ctl control file, then an offset of 698.5 microns is added to the write head stack position.

If *woffset* is **auto**, and the commanded pass is a forward pass, and the write head stack is defined as **even** in the head.ctl control file, then an offset of 698.5 microns is subtracted from the write head stack position.

If *woffset* is **none**, then no offset is applied to the a priori offset for the write head. The read head is always adjusted.

An individual head stack can be moved by not specifying a command pass number for the other head stack. The read (stack 2) command pass can be **same**, which causes it to be the same as the write head stack pass number. This feature is useful for setting both head stacks to the same pass number in set-up procedures. The read (stack 2) command pass can be **mk4**, which causes head stack 2 to be positioned to the position for the pass number specified for head stack 1 plus 100. This feature is useful for positioning both Mark IV head stacks using a single pass number in set-up procedures. Also for Mark IV, the write (stack 1) command pass can be **stack2**, which causes head stack 1 to be positioned to the most recently commanded position of stack 2. This feature is useful for positioning stack 1 (the only stack that can play back) to read tracks that were just recorded with stack 2.

The *deltaM* parameters are reported with the sign of actual minus commanded.

The commanded positions of the **lvdt**, **pass**, and **stack** commands are reported consistently. For example, if you command the head stack positions with the **stack** or **pass** command, you can determine the corresponding command voltage with **lvdt**. And vice-versa, the micron

position corresponding to a voltage position commanded with **lvdt** can be determined with **stack** or **pass**.

The commanded pass numbers reported by **pass** are given special values if either **lvdt** or **stack** last commanded the positions. If **lvdt** or **stack** is used with uncalibrated positions, the commanded pass number will be reported as 0. If the **stack** command with forward calibrated positions was used, -1 will be reported for the pass number, for reverse calibrations -2 will be reported.

For Mark III fromatters, when the write head is moved by either **pass**, **stack**, or **lvdt**, the auxiliary data field used by the formatter is set to reflect the commanded position. The twelve characters of the auxiliary data field are set as:

xxwxwxyzyzff

xx	ff for forward calibration (odd passes)
	fe for reverse calibration (even passes)
	fd for uncalibrated positions.
wxyz	0000-3999 for positive micron positions
	4000-7999 for negative micron positions
ff	hex characters ff

The positions occupied by *wxyz* are the four digits of the commanded micron write head position. In the auxiliary data field the digits are repeated two at a time. The negative positions are represented as the 4000+ absolute value of the position. The *xx* field is used to identify which type of calibration was used to set the position. The last two digits of the auxiliary data are fixed with the value ff.

For VLBA fomatters, the auxiliary data field depends on the format used. For "data replacement format", the auxilary data field for the Mark III formatter is used. For VLBA format, the contents of the auxilary data field are controlled by the formatter. The FS writes the station hardware ID to formatter address 0xA6 and the micron head position in BCD (with the most significant bit in the most significant digit on for negative values) to address 0xA7.

For Mark IV, there are eight characters (32 bits) available for auxiliary data. They are set as:

abcdwxyz

abcd	head stack 0 position in microns
wxyz	head stack 1 position in microns

Characters *a* and *w* have the following bit structure:

bit 0   thousands digit for the micron position, usually 0
bit 1   0 for forward calibration (odd passes), 1 for uncalibrated
bit 2   0 for reverse calibration (even passes), 1 for uncalibrated
bit 3   sign of the position, 0 for positive, 1 for negative

patch - IF patching (Mark III, Mark IV, all K4 racks)

Syntax: **patch=***lon,vc#horl,...*

Response: none

Settable Parameters:

lon   First LO. One of **lo1**, **lo2**, or **lo3**. No default.

vc#horl   Video converter. For Mark III or Mark IV, Video converter number with the character **h** or **l** appended, e.g. **1h** or **3l**. **h** indicates the high band of the channel, and **l** the low. For K4 type 1: **1-4**, **5-8**, **9-12**, or **13-16** for K4 type 2: **a1**, ..., **a8**, **b1**, ..., **b8**. No default.

Comments:

For Mark III and Mark IV, this command stores the patching information for access by program `pcalr` and the antenna calibration programs. This command identifies which video converters are patched to channel 1, which to channel 2. This command is not needed for VLBA systems because the **bbc** command specifies the connections. This command is for information only, it does not physically make any connections.

The **lo** command should be used to specify the LO frequencies.

pcal - set up/activate pcalr (Mark III racks and drives)

Syntax: **`pcal=#cycles,pause,repro,#blocks,debug,track, ...`**

Response: none

Settable parameters:

#cycles   Number of times to cycle through tracks. **0** = run continuously (default).

pause   Time to pause between cycles, seconds. Default is **60** seconds.

repro   Type of reproduce mode:

  fs = use current mode set up by Field System

  by = use bypass mode

  rw = use read after write mode

  ab = use split mode (implies bypass mode too)

  If an experiment is in progress (i.e. if a schedule file is active) then **fs** is the recommended mode. Attempts to force read-after-write or bypass may result in compromising execution of the schedule.

#blocks   Number of blocks to average, default **25**. The default gives 5 degrees rms phase noise or an SNR of 10.

debug   **0** for no debug printout (default). A value of **+1** prints the data buffer status each time it responds. A value of **+2** will print the actual data and more detailed status information. The values **−1** and **−2** will simply test communications with the data buffer and then quit.

tracks   Tape recorder track(s) to use. **0** = use all tracks for current mode (default). A list of track numbers may be given. A list of video converters may be specified by preceding each number with **v**. The words **all**, **even**, **odd** referring to tracks and **vall**, **veven**, **vodd** referring to VCs may be used. Split mode will be set up for the outer channels in the frequency sequence, if bypass mode is set up.

Comments:

Invoking this command with no parameters activates pcalr. To stop pcalr, use the command **sy=brk pcal**. Before starting pcalr, specify LO frequencies with the **lo** and **upconv** commands, set up IF3 with the **if3** command, and specify patching with the **patch** command.

This command only works with a Mark III drive.

pcald - pcal (Mark III, Mark IV, VLBA, VLBA4 racks)

Syntax: **pcald=**_cont,bits,int_
                 pcald=stop
                 pcald=?

Response: pcald/_cont,bits,int_
                 pcald/_chan,tone,tone,…_

Settable parameters:

cont   Whether to extract continuously or not: **no** (default) or **yes**. If **no**, extraction is stopped and started by the **data_valid=**_…_ command.

bits   Number of bits to use in extraction: **1**, **2**, or **auto** (default). If **auto**, the number of bits to extract is determined by the pcald extraction daemon.

int   Number of centiseconds to integrate for. The default is **0**, which is interpreted by the pcald daemon as "best effort".

Monitor-only parameters:

chan   Channel of the form _ns_, where _n_ is **1**,..,**14** (decimal) or **1**,...,**e** (hex) and _s_ is **u** or **l** for upper and lower sideband respectively. No default.

tone   Tone to extract, given in MHz or if state counting then state_counting.

Comments:

The currently implemented daemon is a stub. It doesn't do anything, but all the set-up for which tones to extract and how often is provided.

This command should support K4, K4K3, and K4MK4 racks, but does not do so at present.

The form pcald is used to start the extraction. The form **pcald=stop** is used to halt it. **pcald=?** displays the current settable parameters and the currently selected tones. If a channel requires more than one log entry to display all its tones, the tones will continue on following lines.

If pcald is being controlled by the **data_valid** command, it begins and stops extracting and recording data within one second of a request to do so. In other words within one second of the execution of a **data_valid=**_…_ command.

If the number of *bits* is requested as **auto**, the number of bits to be used is left to the discretion of the pcald and could conceivable be different for every tone. Likewise when *int* is zero, the pcald program determines the length of time to integrate.

The parameters should be modified only when pcald is stopped. When the parameters are set, the tones to extract are determined from the **pcalform** command parameters. If any tone numbers were specified in **pcalform**, the approproate hardware must have been set-up so that the corresponding frequencies can be determined. For Mark III/IV this would include setting up the **lo**, **patch**, **vc***XX* and possibly **if3** commands. For VLBA/4 the **lo** and **bbc***XX* commands must be set-up.

pcalform - specify tones for pcal extraction

Syntax: **pcalform=***chan,tone,tone,…*
                pcalform=

Response: pcalform/*chan,tone,tone,…*

Settable parameters:

chan   Channel of the form *ns*, where *n* is **1**,..,**14** (decimal) or **1**,...,**e** (hex) and *s* is **u**
                or **l** for upper and lower sideband respectively. No default.

tone   Tone to extract, either given in MHz or a pound sign # followed by an integer,
                e.g. #1, to indicate the number of the tone to extract. If the integer is positive, it
                indicates the tone above DC. If the integer is negative, it indicates the tone below
                the nominal top of the bandpass of the channel. If the integer is zero it indicates
                state counting.

Comments:

The form **pcalform=** will remove all definitions.

The form **pcalform=***…* allows entry of a table of tones to be extracted by channel. Up to 17
tones may be specified for each channel. A new specification for a channel overrides any
previous specification for that channel.

The display form lists all the currently selected tones by channel. If a channel requires more than
one log entry to display all its tones, the tones will continue on following lines.

pcalports - pcal output (Mark IV, VLBA4, K4MK4 racks)

Syntax: **pcalports=***PORTx,PORTy*

Response: pcalports/*PORTx,PORTy*

Settable parameters:

PORTx   VC for the first pcal output port, one of **1**, **2**, **3**, **4**, **9**, **10**, **11**, or **12**. No default.

PORTy   VC for the second pcal output port, one of **5**, **6**, **7**, **8**, **13**, **14**, **15**, or **16**. No default.

Comments:

This command selects which VCs have their output placed on the phase-cal output ports of the Mark IV Formatter. These are called phase-cal ports because they are intended for phase-cal monitoring. Each port provides the two bit sampled version of the data stream from both sidebands of the selected VC.

The Mark IV Decoder labels the two ports "x" and "y". That nomenclature is adopted here because it corresponds with the labeling on the front panel.

The unusual mapping of VCs to ports is determined by which VCs are routed to which of the two Altera PLDs:

```
PORT:              x        y
Altera PLD:      U37      U35
VCs:             1-4      5-8
VCs:             9-12     13-16
```

peak - peak up tape reproduce power (longitudinal drives)

Syntax:　　　　**peak=**_nsamp,iter,stack,vmin_
　　　　　　　　peak

Response:　　　peak/_nsamp,iter,stack,vmin,peakv,mper,t/f,vltlc_

Settable parameters:

nsamp　　　Number of samples to take at each position. Default is **3**.

iter　　　　Number of times to iterate peak finding. Default is **1**.

stack　　　Head stack to move for peaking: **1**, **2**, **w**rite or **r**ead. Default is **2** for Mark III/IV and VLBA4, and **1** for VLBA. Only 1 is valid for VLBA and MK3B recorders. The value **w**rite is synonymous with **1** and **r**ead is synonymous with **2**, even if the heads are wired differently. Only the first character for **w**rite and **r**ead is checked; they are provided only for backward compatibility.

vmin　　　The minimum peak voltage that is required before the peak is considered "real". Default is **0.2** volts.

Monitor-only parameters:

peakv　　　The voltage measured at the calculated peak position.

mper　　　The minimum voltage measured at the peak as a percentage of peakv.

_t/f_　　　　t (true) if the peak is strong enough to be considered a real peak and the middle of the last three measured positions is within 5.4 microns of the calculated peak, f (false) otherwise.

vltlc　　　voltage position of the calculated peak response

Comments:

This command attempts to find the head stack position that gives the peak response from a track. This should work if the head stack is already positioned so that there is some reproduce power coming from the track. The algorithm is:

(1)　　Measure the reproduce power at the current position.

(2)　　Move 8 microns toward the plate (in) and measure the power again.

(3)　　If the power at position two is greater than that at position one, move another 8 microns in and measure the power again. If the power at position two is lower than the power at position one, go out from position one 8 microns and measure the power again.

(4)   Continue moving the stack 8 microns at a time in the direction that increases the power until there are three measurement with the highest power in the middle position. No more than 5 additional measurements are made.

(5)   Fit the final three positions to a triangular model for the response.

(6)   Move the stack to the calculated peak position. Measure the final power level.

When positioning the 8 micron step size is only approximate. The positioning is done with 2.7 micron tolerance to avoid spending too much time refining the position.

This command requires that the reproduce power detector be hooked-up with a reasonable amount of attenuation and that the head.ctl configuration file correctly identify which detector (odd or even) is in use.

A reproduce track must be selected with the **repro** command in order to peak the power. Depending on the cabling, either channel A or B should be used. Setting both channels to the same track is sure to work unless the detector isn't connected.

In order to identify possibly false peaks, **peak** requires two conditions be met before a peak is accepted: (1) the voltage read-out of the power level must exceed the set minimum and (2) the calculated peak position must be within ±5.4 microns of the middle position of the last three sample values. The first attempt to peak on a track may fail because of the second criteria. A second attempt should succeed if that was the problem.

It may be necessary to raise or lower the minimum voltage if the noise level is higher than normal or the peak response is lower than normal.

This command must be issued once with parameters to set it up. Issuing the command subsequently without parameters will start a peaking operation. The tape must moving and there must be recorded data to reproduce for this command to do something useful.

This command differs from the **locate** command in two ways. The first is that **locate** is intended to do a coarse search only. **peak** searches with smaller and more precise steps. Secondly, **locate** will return the head to the position of the largest measured voltage. **peak** will make measurements until it has straddled the peak and then will move to an interpolated peak position.

See the **Narrow Track Calibration** manual.

perr - sample parity errors (Mark III drives)

Syntax: **perr=***track,chan,#samples,period,mode*

Response: perr/*track,chan,#samples,period,mode,error,synerr*

Settable parameters:

track	Track to be decoded. No default.
chan	Decoder channel **A** (default) or **B**.
#samples	Number of samples to average, maximum **10**, default **2**.
period	Time between samples in seconds, maximum **2**, default **0.5**.
mode	**rec** or **play**, default **rec.**

Monitor-only parameters:

error	Average number of parity errors.
synerr	Total number of sync errors.

Comments:

This command sets up the appropriate track for reproduce, and then reads the decoder one more than the specified number of times with the specified amount of time between samples. Differences between successive readings are averaged to calculate error. The difference between the first and last synch error readings is synerr. In **rec** mode, track must be enabled, the tape must be moving forward, record must be enabled, and reproduce must be in read-after-write mode. In **play** mode, only read-after-write and moving tape are checked. In either mode, if the measurement of parity errors is precluded by the tape status, then nothing is done and no error message appears. (See also **parity** command.)

This command requires a Mark III decoder.

proc - open new schedule procedure library

Syntax: **proc=***name*

Response: proc/*name*

Settable parameters:

name   name of procedure file to open. If no directory path is specified, /usr2/proc
                is assumed. If no extension is specified, .prc is assumed. This procedure library
                is opened as the schedule library, and all procedure names are read.

Monitor-only parameters: none

Comments:

When a new procedure library is opened, any time-scheduled procedures from the previous
procedure library are canceled. See section 8.0 of the **SNAP Language** manual for details.
Refer to the **pfmed** manual for information on editing procedure libraries.

radecoff - ra/dec source position offsets

Syntax: **radecoff=***ra,dec*

Response: radecoff/*ra,dec*

Settable parameters:

ra   Right ascension offset, in numeric angle/hours format. The response is in numeric angle/hours format.

dec   Declination offset, in numeric angle/degrees format. The response is in numeric angle/degrees format.

Monitor-only parameters: none

Comments:

The antenna will move to the offset position when this command is issued. To return to the on-source position, issue this command with zero for the offset.

rcl - RCL communications

Syntax: **rcl=***device,command,parameters,...*

Response: rcl=*response*

Settable Parameters:

device   The two character module mnemonic for the device to communicate with as defined in the rclad.ctl control file, e.g. **rc** for the S2 recorder.

command   Name of RCL command function.

parameters   Command delimited additional parameters required for this RCL command function.

Monitor-only Parameters:

response   Result of communication, may displayed on multiple lines for ease of reading.

Comments:

This command implements access to all the low-level functions of the RCL interface. Check ISTS's **S2-RT User's Manual, Appendix A** for detailed information about the command names, their parameters, and the responses. The following table lists very briefly the commands and the parameters, if any, that the **rcl** command expects for each. For parameters that have values that consist of choice among fixed items, it is possible to enter a numeric value as well, in which case it is passed directly to RCL interface without checking.

Command	Parameters
align	**absolute**,*year,day,hour,min,sec,nanosec*
	relative, **+** or **-**, *hour,min,sec,nanosec*
	re-align or **self-align**
barrel_roll_read	
barrel_roll_set	**on** or **off**
bercd	**fmber** or **uiber** or **uidcb**, *chan*, *measurement time*
consolecmd	*command string*
delay_read	
delay_set	**absolute** or **relative**, *nanoseconds*
delaym_read	

diag	*value*
eject	
errmess	*samples*
esterr_read	**transport** or **channel**
ff	
group_read	
group_set	*group number*
ident	
mk3_form_read	
mk3_form_set	**enable** or **disable**
mode_read	
mode_set	*mode string*
pause	
pdv_read	**transport** or **channel**
ping	*time-out*
play	
position_read	**overall** or **individual**
position_set	**absolute** or **relative** or **preset,1,***position*
	absolute or **relative** or **preset,8,***8-comma-separated positions*
	re-establish
postime_read	*transport*
record	
rewind	
speed_read	
speed_read_pb	
speed_set	**lp** or **slp**
state_read	
station_info_read	
stop	
tapeid_read	
tapeid_read_pb	
tapeid_set	*tapeid string*
tapeinfo_read_pb	
tapetype_read	
tapetype_set	*tape type character or string*
time_read	
time_read_pb	

```
time_set              year,day,hours,minutes,seconds
transport_times
unpause
user_dv_read
user_dv_read_pb
user_dv_set           true or false, ignore or use
user_info_read        field number, field or label
user_info_read_pb     field number, field or label
user_info_set         field number, field or label,string
spcll_mode_set        xtal or manual or refclk or 1hz or errmes
status
status_decode         status code, true or false
status_detail         status code, true or false, true or false
version
```

rec - tape recorder control (S2 drives)

Syntax: **rec=***list*

Response: rec/*position,variance,date/time,valid,version*

Settable Parameters:

list   One of: **eject** (or **unload**) which may have a following parameter **all**, a
               position to move all selected transports to, or a list of eight comma-separated
               positions to move the individual transports to. Positions are in units of seconds.
               In a list of eight positions, **uns** must be used for transports that are not currently
               selected.

Monitor-only Parameters:

position   overall absolute position of select transports, unk if unknown.
variance   linear variance of position of select transports, unk if unknown.
date/time   S2 date and time in format yyy/ddd.hh:mm:ss
valid   valid if S2 time is valid, not-valid if S2 time is not valid
version   ROS software version information string

Comments:

This command is used to move the selected transports to another position.

For **eject** (or **unload**), only the selected transports are ejected, unless there is an optional
following parameter **,all** which causes all the transports to be ejected.

rec - tape recorder control (Mark III, Mark IV drives)

Syntax: **rec=**_action_

Response: none

Settable Parameters:

action   A key word specifying what you want the recorder to do. Choices are:

load   Load a tape into the vacuum columns. This is similar to pressing the stop button, but also guarantees that the low tape sensor has not been tripped. On Mark IV drives with vacuum switching it also commands the vacuum level based on the most recent label command before attempting to load the tape.

novac   On Mark IV drives with vacuum switching this removes the vacuum.

Comments:

For Mark III and Mark IV drives without vacuum switching, this command can only be used to load the tape.

For Mark IV drives with vacuum switching, the **rec=load** command sets the vacuum level based on the tape thickness selected by the most recent **label** command. For these drives there is an added restriction that the tape thickness be must specified with a new **label** command before every **rec=load** command. This is intended to reduce the likelihood that the incorrect vacuum level will be set. Please try to avoid removing the vacuum with **rec=novac** if the tape is moving. Doing so may well damage the tape.

rec - tape recorder control (VLBA, VLBA4 drives)

Syntax: **rec=**_action_

Response: `rec/`_feet,supply,takeup,length,revno_

Settable Parameters:

action   A key word specifying what you want the recorder to do. Choices are:

reboot	Reboot the microprocessor in the recorder. See comments below.
load	Load a tape into the vacuum columns. This acts like the stop button on the Mark III recorders. Brakes are released. The parameters in `equip.ctl` are downloaded to the recorder.
unload	Move the tape at high speed to the low tape point near BOT then slowly wind the tape off the reel.
bot	Move tape at high speed to BOT (beginning of tape) at stop.
eot	Move tape at high speed to EOT (end of tape) at stop.
release	Release the reel brakes. Drop the vacuum and then issue this command before trying to thread a tape.
feet	Move the tape to the specified footage.
feet	Set the tape footage counter. The supply and takeup reel packs in feet are read back and the footage counter is set to the takeup reel pack. These values are accurate to about 50 feet.
zero	Reset footage counter to zero.

Monitor-only Parameters:

feet	The current footage counter reading.
supply	Footage left on the supply reel.
takeup	Footage left on the takeup reel.
length	Total length of the tape, supply+takeup.
revno	Software revision number.

Comments:

The *feet* option of this command is analagous to the Mark III **tapepos** command. The **zero** option is analagous to the Mark III **tape=low,reset** command. The other options are unique to the VLBA recorder.

MCB functions are available.

The recorder can be re-booted manually by pressing the red button. After manual reset you must issue the command **rec=addr** to re-initialize the module.

Before the *actions* **unload, bot, eot,** or *feet* are taken, the recorder vacuum is checked. If the vacuum is not ready, an error is logged and the action is not taken.

rec - tape recorder control (K4 drives)

Syntax: **rec=**_action_

Response: rec/_position_,_drum_,_synch_test_,_synch_,_stat1_,_stat2_

Settable parameters:
action   **eject** (or **unload**) to eject the tape
                init (or **ini**) to initialize recorder
                synch to synchronize INT and EXT 1 PPS
                _id_ maximum seven digit ID point to move tape to
                drum_on to turn on the drum
                drum_off to turn off the drum
                synch_on to turn on the synch test
                synch_off to turn off the synch test

Monitor-only parameters:
position   sequence number id of the current position
drum   drum status, on or off
_synch_test_   synch test status, on or off
synch   number of times synch was lost
stat1   status byte 1 in hex
stat2   status byte 2 in hex

Comments:
The meaning of the _synch_ parameter is unclear.

rec_mode - recording mode (S2 drives)

Syntax: **rec_mode=**_mode,group,roll_

Response: rec_mode/_mode,group,roll,numgroups_

Settable Parameters:

mode   The string that identifies the mode, 20 characters maximum, a null value is not permitted. No default.

group   The group to be recorded, nominally **0-7**, but many modes have fewer groups.

roll   Roll configuration: **on** or **off**. Default **on**.

Monitor-only Parameters:

numgroups   The number of groups in mode display as the monitor value.

Comments:

This command selects the recording mode and groups to be used for an S2 recorder.

rec_mode - recording mode (K4 drives)

Syntax: **rec_mode=***bw,bits,chan,im,nm*

Response: rec_mode/bw,bits,chan,form,ts,im,nm,ta,pb

Settable Parameters:
bw   overall recording bandwidth in MHz, **64** (default) , **128**, or **256**
bits   number of bits per sample: **1** (default), **2**, **4**, or **8**
chan   channels recorded: **1**, **2**, **4**, **8**, or **16** (default)
im   insertion mode for time stamp: **FB** (fixed bit) or **FT** (fixed time). Default **FB** for **256**
          MHz *bw*, **FT** for all others.
nm   insertion frequency for time-stamp: **0** to **30**, or **99** (**0** no insertion, **99** for continuous).
          Default **15** for **128** MHz *bw*, 30 for **256** MHz *bw*, **0** for all others.

Monitor-only parameters:
form   recording format: OLD or NEW
ts   time stamp: ON or OFF
ta   TAP setting mode: 0 or 1
pb   pass-band setting: 0 to 16

Comments:
This command is only for DFC2100. This command sets the recording mode and may require up
to 17 seconds to be completed due to digital filter set-up.

recpatch - recorder input patching (K4 drives)

Syntax: **recpatch=***port*,*channel*,*port*,*channel*,…
                recpatch=

Response: recpatch/*port*,*channel*,*port*,*channel*,…

Settable Parameters:
port   K4 recorder input port, **1**-**16**
channel   *ns* where *n*=**1**-**14** for Mark III/IV/VLBA/VLBA4 racks
                where *n*=**1**-**16** for K4 type 1 rack and rack type "none"
                where *n*=**a1**-**a8** or **b1**-**b8** (two characters) for K4 type 2 rack
                where *s*=**u** or **l** for upper or lower sideband

Comments:
This command specifies the wiring of the VCs to the K-4 input ports. This command has no effect on the hardware. It is an "information only" command.

A **recpatch=** clears any pre-existing definition.

The monitor response may consist of more than one line, but each line ends with a *channel* entry.

repro - set up reproduce tracks (Mark III drives)

Syntax: **repro=***bypass,trackA,trackB,bandwidth,equalizer*

Response: repro/*bypass,trackA,trackB,bandwidth,equalizer*

Settable parameters:
bypass   **byp** (default) for bypass, **raw** for read-after-write.
trackA   Track for decoder channel A, default **1**; **0-28** allowed.
trackB   Track for decoder channel B, default **1**; **0-28** allowed.
bandwidth   Bandwidth for decoding , MHz, default **2**; **0.0625**, **0.125**, **0.25**, **0.5**, **1**, **2**,
                and **4** MHz allowed or actual tape speed **4.21875**, **8.4375**, **16.875**, **33.75**,
                67.5, **135**, and **270** ips allowed
equalizer   Equalizer for reproduce, MHz, defaults to *bandwidth*; **0.0625**, **0.125**, **0.25**,
                0.5, **1**, **2**, and **4** MHz allowed or actual tape speed **4.21875**, **8.4375**,
                16.875, **33.75**, **67.5**, **135**, and **270** ips allowed

Monitor-only parameters: none

Comments:
MAT module functions available for Mark III.

The **raw** mode normally is used only when checking parity errors on the tape.

Selection of track **0** for a decoder channel will disable that channel until another track is selected.

Note that a VLBA or Mark IV track number equals the Mark III track number plus three. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Set-up** manual. Also VLBA group numbers equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses Mark III track numbers.

repro - set up reproduce tracks (VLBA, VLBA4 drives)

Syntax: **repro=***modeA,trackA,trackB,modeB,equA,equB,bitrate*

Response: repro/*modeA,trackA,trackB,modeB,equA,equB,bitrate*

Settable parameters:

modeA   Reproduce mode for channel A. **byp** (default) for bypass, **raw** or **read** for read (playback).

trackA   Track for decoder channel A, default **4**. **0-35** allowed for VLBA, in addition **100-135** are allowed for VLBA4.

trackB   Track for decoder channel B, default **4**. **0-35** allowed for VLBA, in addition **100-135** are allowed for VLBA4.

modeB   Reproduce mode for channel B. **byp** for bypass, **raw** or **read** for read (playback). Default is *modeA*.

equA   Equalizer to use for decoding channel A: **std**, **alt1**, **alt2**, **dis** (disable) or reproduce speed **80**, **135**, **160**, **270** ips or **0**, **1**, **2**, or **3** equalizer number. For VLBA recorders: **alt1** (default) for normal speed (**135** or **80** ips), **alt2** for double speed (**270** ips), and **std** for thin tape double speed (**160** ips). For VLBA2 recorders: **std** (default) for normal speed (**135** ips), **alt1** for double speed (**270** ips), **alt2** unspecified. For VLBA2 recorders, thin tape speeds **80** and **160** ips are not accepted.

equB   Equalizer to use for decoding channel B: **std**, **alt1**, **alt2**, **dis** (disable) or reproduce speed **80**, **135**, **160**, or **270** ips or **0**, **1**, **2**, or **3** equalizer number. For VLBA recorders: **alt1** (default) for normal speed (**135** or **80** ips), **alt2** for double speed (**270** ips), and **std** for thin tape double speed (**160** ips). For VLBA2 recorders: **std** (default) for normal speed (**135** ips), **alt1** for double speed (**270** ips), **alt2** unspecified. For VLBA2 recorders, thin tape speeds **80** and **160** ips are not accepted.

bitrate   Nominal bit rate per track in Mbits/second: **16**, **8**, **4**, **2**, **1**, or **0.5**. The default corresponds to the nominal bitrate for the *equA* setting.

Monitor-only parameters: none

Comments:

The **raw** or **read** mode normally is used only when checking parity errors on the tape. This is also known as "playback" mode.

This *bitrate* parameter determines the set-up of the clock recovery chip. The nominal bit rate for the 135/80 ips (VLBA) or 135 ips (VLBA2) equalizer is 4 Mb/sec (2 MHz track bandwidth) set-up. The nominal bit rate for the 270 and 160 ips equalizers is 8 Mb/sec (4 MHz track bandwidth) set-up. The other bit rates have no corresponding equalizer and are useful only in `byp` mode. The other bit rates have not been tested with the VLBA2 drive.

Note that a VLBA or Mark IV track number equals the Mark III track number plus three. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Set-up** manual. Also VLBA group numbers equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses VLBA track numbers.

repro - set up reproduce tracks (Mark IV drives)

Syntax: **repro=***mode,trackA,trackB,equalizer,bitrate*

Response: repro/*mode,trackA,trackB,equalizer,bitrate*

Settable parameters:

mode   Reproduce mode, **byp** (default) for bypass, **read** or **raw** for playback.

trackA   track for decoder channel A, between **0** and **35**, default **2**. For tracks on head
                stack 2, add 100 to the desired track number. If *mode* is **read**, only tracks from
                head stack 1 may be specified.

trackB   track for decoder channel B, between **0** and **35**, default **3**. For tracks on head
                stack 2, add 100 to the desired track number. If *mode* is **read**, only tracks from
                head stack 1 may be specified.

equalizer   **0**, **1**, **2** (default if *mode* is **read**), **3** or **dis** (default if *mode* is **byp**) to select
                the equalizer installed at location 0, 1, 2, or 3 in the recorder. Use **80, 135,
                160, 270** to select the equalizer by playback rate according to the following
                table:

Location 0	test/special
Location 1	135 or 80 ips (normally used for 4 MHz playback)
Location 2	160/270 ips (normally used for 8 MHz playback)
Location 3	disable reproduce (used for bypass mode)

bitrate   Clock recovery bit rate, Mb/s. Choices are **16, 8, 4, 2**, or **1**. Default is the
                bit rate that corresponds to the selected equalizer. For equalizer **80** or **135**,
                default is **4**; for equalizers **160** and **270** default is **8**. If *equalizer* is **dis**, this
                parameter is undefined but is set to have the legal value of **4**.

Monitor-only parameters: none

Comments:

This command sets up the reproduce electronics in the tape drive. MAT module functions
available for Mark IV.

Tracks are Mark IV/VLBA track numbers.

The **read** mode normally is used only when checking parity errors on the tape.

Bypass mode looks at the output of the write drivers, therefore it only works if the selected track is enabled and the general record is on. Use the command **`st=for,0,on`** to set up the write drivers for bypass mode.

Note that a VLBA or Mark IV track number equals the Mark III track number plus three. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Set-up** manual. Also VLBA group numbers equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses Mark IV track numbers.

reset - reset the MAT bus

Syntax: **reset=***baud*

Response: reset/*baud*

Settable parameters:

baud   baud rate. MATs support **110, 300, 600, 1200, 2400, 4800,** and
                   9600 baud.

Monitor-only parameters: none

Comments:
The old MATs (NRAO only) support **2400** baud only. Recommended rate is **9600**. A system
reset is sent (break character), then the baud rate is changed, then some U's to synch up the
MATs.

rollform - (Mark IV, VLBA4, K4MK4 racks)

Syntax: **rollform=**_head,home,output,..._
               rollform=

Response: rollform/_head,home,output, ..._

Settable parameters:

head   Headstack of _home_ track, **1** or **2**.

home   Home track. The **trackform** track number to assign output roll map to, **2**-**33**
              inclusive.

output   A list of up to 16 output tracks for this home track. Values **−1**, **2**-**33** inclusive.
              A null value indicates that this map is not used. A value of -1 indicates that this
              map is used, but the entry is empty.

Comments:

Each **rollform** command defines the roll map for one home track as defined in **trackform**.
There are 16 maps. Each _home_ track has an entry in each map. To leave a _home_ track empty
in a map, use **−1** as the output track. If a value of _output_ is null (blank), that map entry is
undefined for that _home_ track. All maps after the last supplied _output_ track are undefined for
that _home_ track. The smallest contiguous subset of maps that include at least empty or non-
empty (but not undefined) map entry is used.Thus by use of nulls, any contiguous subset of maps
can be used for rolling.

The **rollform=** command clears the rolling definition. Further **rollform=...** commands
increment the definition of the roll maps. When the **form=...** command is entered with **m** for
the roll parameter, the currently defined roll will be used. If the rolling definition is cleared at that
time, no roll will be used.

rvac - recorder vacuum (VLBA, VLBA4 drives)

Syntax: **rvac=***cmd*

Response: rvac/*cmd*,*mon*

Settable Parameters:
cmd   vacuum level to command, inches. No default

Monitor-only Parameters:
mon   vacuum level measured, inches.

Comments:
This command sets the vacuum level of the recorder. However it is only for test purposes. A vacuum level set by the **rvac** command will replaced by the default vacuum level from the control file the next time a **rec=load** is executed.

The *cmd* and *mon* values are converted to and from the voltages used by the tape drive using the conversion coefficients in the tape recorder control file, vdrive1.ctl or vdrive2.ctl. In particular this means that the *cmd* value uses the same conversion as the specified default vacuum level in the control file.

There is no previous value (selected by using ***** as the parameter) for *cmd* until it has been commanded at least once since the last time the FS was started.

rw - rewind tape (all drives)

Syntax: **rw**

Response: rw/*acknowledgement*

Settable Parameters: none

Comments:
The tape is moved in reverse at high speed. For Mark III, the record bit is disabled and the low tape sensor is turned on. For VLBA, all track groups are disabled and the low tape sensor is turned on.

The tape is moved at the "schedule" value as specified in the equip.ctl control file. This is the speed assumed in the SNAP schedule file for positioning the tape with the **fastr** procedure.

Use the **srw** command and **sfastr** procedure for possibly faster tape motion.

rx - receiver monitor and control

Syntax: **rx=**_channel,dcal,box,S,X,K,cal_

Response: rx/_channel,dcal,box,S,X,K,cal,lostat,value_

Settable parameters:

channel   Hex value or code word (next page). No default.
dcal   Delay cal heater, **on** (default) or **off**.
box   Box heaters. Turn on with **A** (default) or **B** (for the A or B controller), or **off**.
_S,X,K_   IF amplifier controls, **on** (default) or **off**.
cal   Noise cal control. May be **on**, **off** (default), **oon** (Override on), **oof** (override off), or **ext**ernal modulation.

Monitor-only parameters:

lostat   Status of LO, locked or unlocked.
value   Reading in A/D channel shown in first parameter. Units are appropriate for channel in use.

Comments:

This command is used to control and monitor a standard cryogenic CDP S/X receiver.

MAT module functions are available.

Channel assignments for the "standard" receiver are on the next page. Your station's channel assignments are in the rxdef.ctl file. Details of the MAT protocol are in the **MAT Communications** manual.

The mnemonic RX and the receiver's address must be specified in matad.ctl control file.

```
               Standard Receiver A/D converter channels

channel  code   Voltage          Description
# (hex)  name   Div. Ratio
    00   FRONT    1        Temperature probe: box front
    01   REAR     1        Temperature probe: box rear
    02   LO       1        Temperature probe: LO
    03   DCAL     1        Temperature probe: delay cal
    04   INLET    1        Temperature probe: inlet air
                           (after heat)
    05   RET      1        Temperature probe: return air
    06   SUP      1        Temperature probe: supply air (cold)
    07   2.73V    2        -2.73 volt ref. for temperature probes
    08   SIF      1        S-band IF power level
    09   XIF      1        X-band IF power level
    0A   KIF      1        Secondary S-band IF power level
    0B   SLO      1        S-band LO power level
    0C   XLO      1        X-band LO power level
    0D   KLO      1        Secondary S-band 2020 MHz LO power level
    0E   LO5MHZ   1        5 MHz power level to LO
    0F            1        spare
    10   28V      101      +28 volt power supply voltage
    11   24V      101      +24 volt power supply voltage
                           (delay cal)
    12   20V      11       +20 volt power supply voltage (LO)
    13   15V      11       +15 volt power supply voltage
    14   5V       11       + 5 volt power supply
    15   -15V     11       -15 volt power supply voltage
    16   GROUND   1        ground reference
    17   PRES     4.9      dewar pressure
    18   X1BIAS   4.9      1st stage X-band FET bias current
    19   X2BIAS   4.9      2nd stage X-band FET bias current
    1A   X3BIAS   4.9      3rd stage X-band FET bias current
    1B   S1BIAS   4.9      1st stage S-band FET bias current
    1C   S2BIAS   4.9      2nd stage S-band FET bias current
    1D   S3BIAS   4.9      3rd stage S-band FET bias current
    1E   20K      1        temperature diode on 20K station
                           in dewar
    1F   70K      1        temperature diode on 70K station
                           in dewar
```

Note: This table applies only to standard S/X receivers. Channel assignments for your station's receiver may be found in control file `rxdef.ctl`. Conversion from volts to temperature for channels 0 through 6 is 100 deg C/V.

save_file - save/retrieve string from a file

Syntax: **save_file=***file,string*

Response: none

Settable parameters:

file   name of file in /usr2/control to read from or write to. If the leading
                character is **+**, it is removed from the file name and interpreted as a flag meaning
                "append" for writing or "read all lines" for reading

string   string to write to *file*, up to 512 characters

Comments:

This command allows a user to store a *string* in a file. The contents of the first line or all lines of
file can be executed as commands by omitting the *string* parameter. This might be used for
example to store the name of a set-up SNAP procedure for a receiver in a file. The set-up
procedure can then be invoked by the **initi** procedure when the FS is started. This will
effectively make the receiver set-up commanded in the **initi** procedure variable without having
to modify **initi** itself for each receiver change.

If *file* does not start with **+**, then for reading only the first line of the file will be read and
executed. For writing, if the file already exists its contents will unceremoniously overwritten
unless there is a permission conflict that prevents it.

If *file* starts with **+**, it is removed from the file name and interpreted as a flag meaning "append"
for writing or "read all lines" for reading. This can be used to append additional commands to
an existing file (although it will create the file if it doesn't exist). It will cause all lines in a file to
be executed as commands when reading from the file.

savev - save voltage position of stack (longitudinal drives)

Syntax: **savev=***parm1,volts*
                 savev

Response: savev/ *VrevW,V15rev,V15for,V15scale,V13,V15flip,Vw0,Vw8*

Settable parameters:

parm1   Voltage to save, possible values are: **vrevw**, **v15rev**, **v15for**, **v15scale**, **v13**, **v15flip**, **vw0**, or **vw8**. No default. **clear** will delete all saved voltages.

volts   The voltage value to save. Default is to use the current write position for **vw0** and **vw8**, if the write head has been successfully positioned. For all others, use the last peaked voltage location from the **peak** command. If the write head has not been positioned or the last **peak** failed, no value is stored.

Monitor-only parameters:

The first six monitor parameters are read head position voltages for peak response while reproducing tracks in various configurations. The table below summaries the parameters and the configuration: the track used to reproduce, the reproduce tape orientation, read direction, the direction the track was written in, and the write head position when the track was written. All tracks are written with head 15 with the tape in the normal orientation. (All track numbers are Mark III track numbers.)

	Reproduce Track	Reproduce Tape Orientation	Read Direction	Write Direction	Write Position
VrevW	15	Normal	Forward	Reverse	Vw0
V15rev	15	Normal	Reverse	Forward	Vw0
V15for	15	Normal	Forward	Forward	Vw0
V15scale	15	Normal	Forward	Forward	Vw8
V13	13	Normal	Forward	Forward	Vw0
V15flip	15	Flipped	Forward	Forward	Vw0

The last two parameters are write head position voltages at which the tracks corresponding to the above read positions were written. These parameters are not used for VLBA drives.

Vw0   Voltage near tape center

Vw8   Voltage approximately 8 volts toward the deck plate from Vw0.

Comments:

This command is used to save the voltage positions of the read and write heads for head calibration. This command is not very useful by itself. It is designed to facilitate calculation of the calibration parameters by storing all the values. The **hdcalc** command is used to perform the actual calculation. See the **Narrow Track Calibration** manual for more information.

The description of the monitor only parameters above is written assuming odd tracks will be used for both read and write. If odd tracks are not available, the corresponding even tracks, 16 for write, 14 and 16 for read can be used instead (note Mark III track numbers).

The response form of the command will only show values for voltages that have been successfully saved. This feature is useful for determining which parameters have not been successfully measured during automated calibration.

scan_name - set scan name

Syntax: **scan_name=***name*

Response: scan_name/*name*

Settable Parameters:

name   The scan name, any string up to 16 characters in length. Typically *ddd–hhmm*,
                which encodes the day of year (*ddd*), hour (*hh*), and minute (*mm*) of the scan.
                If there is more than one subnet in a schedule that would have the same scan name
                otherwise, they are distinguished by appending a single alphabetic character. All
                stations in a given subnet use the same scan name, which is distinct from that from
                all other subnets.

Comments:

The scan name is used by the correlator to help organize the processing of the data. It is the most
useful way to refer to scans in e-mail messages and log entries about problems.

The scan name is supplied by drudg which places the **scan_name=***…* command in the
schedule before the **source=***…* command. The **scan_name=***…* command defines the start of
each scan. If a schedule is started in the middle it should be started at this command for that scan.

schedule - start a new schedule file

Syntax: **schedule=**_name,start,#lines_

Response: schedule/_name,line_

Settable parameters:

name   Name of schedule file to be started. If no directory path is specified, /usr2/sched assumed. If no extension is specified, .snp is assumed. Any currently-executing schedule file is closed, and the new schedule file is opened. If the new file cannot be opened, there will be no schedule active. When a valid schedule is started, a **cont** command may be necessary.

start   Place in the schedule to begin executing. May be one of the following:
   null to start with the observation beginning no earlier than 5 minutes from now.
   #_line_ for a line number in the file, should be a **source** command.
   time to start with the observation beginning no earlier than this time. _time_ is in standard SNAP format.

#lines   Number of lines to execute before automatically halting. Default is the remainder of the schedule.

Monitor-only parameters:

line   The line number to be executed next.

Comments:

If the schedule is started successfully, a log file having the same name as the schedule is automatically started, and the procedure file having the same name as the schedule is automatically established as the schedule procedure library. Any previously time-scheduled procedures from this library are cancelled. If a # of lines is specified, an automatic **halt** will be issued after execution of these lines. The schedule may then be continued using the **cont** command.

Note: If the schedule file is larger than 100,000 lines, execution will **halt** after 100,000 lines.

select - select recorder

Syntax: **select=***drive*

Response: select/*drive*

Settable Parameters:
drive   The drive to use: **1** or **2**. No default.

Comments:
This command is used to select which recorder is active in a two recorder system. Most commands that refer to a recorder explicitly refer to the recorder in the command name, but some commands that refer primarily to the rack need to know implicit which recorder is in use. These commands depend on this command to specify which drive is in use. In particular the **pass** command needs to know which head position to encode in the AUX data field and the VLBA **form** command needs to know which recorder to use for DQA input. In addition, the chekr and monit programs need to know which recorder is in use to check and display the status of.

sff - super fast-forward (longitudinal drives)

Syntax: **sff**

Response: sff/*acknowledgement*

Parameters: none

Comments:
The tape is started moving forward at super high speed. For Mark III and Mark IV drives, the record bit is disabled and the low tape sensor is turned on. For VLBA and VLBA4 drives, all track groups are disabled and the low tape sensor is turned on. For Mark IV and VLBA4 racks the formatter output is disabled

The tape is moved at the "super" speed value as specified in the equip.ctl control file. This is the fastest speed that your tape drive can manage, normally 330 ips.

Use the **ff** command and **fastf** procedure for positioning the tape during a schedule.

source - source name and position

Syntax: **source=***name,ra,dec,epoch*

Response: source/*name,ra,dec,epoch,ranow,decnow,today*

Settable parameters:

name   Source name, up to 10 characters. No default. Special source names are recognized
           by many antenna interface programs. Some names and their meaning are:

> **azel**   true corrected coordinates
> **azeluncr**   encoder units
> **xy**   encoder units

           Other specialized names are described in the comments below. If *name* is **sun** or
           moon, no position is required, and if given it will be ignored.

ra   Right ascension, in numeric angle/hours format. No default. If *name* is **azel** or
           azeluncr, this parameter is interpreted as an azimuth. If *name* is **xy**, this
           parameter is interpreted as an X position.

dec   Declination, in numeric angle/degrees format. No default. If *name* is **azel** or
           azeluncr, this parameter is interpreted as an elevation. If *name* is **xy**, this
           parameter is interpreted as an Y position.

epoch   Epoch in years. Default **1950.0**. This field is checked only if the specified angles
           are right ascension and declination. A value of **-1** inhibits precession.

Monitor-only parameters:

ranow   Right ascension precessed to today's date.

decnow   Declination precessed to today's date.

today   Epoch of precession.

Comments:

The antenna will begin moving to the new source when this command is issued. At some
antennas, if the source name is given as **azel** or **azeluncr**, then the ra and dec are recognized
as azimuth and elevation in degrees; if the source name is **xy**, then the next two fields are
recognized as x and y in degrees. If the source name is **sun** or **moon**, the appropriate coordinates
will be calculated by the Field System based on the current time and the site position as specified
in the location.ctl file.

Issuing a **source=...** command will invalidate the calculated values for the **fluxn=** commands. To indicate this their values are set to negative numbers.

Typical interpretations of special names may or may not be supported at any given station. These are typical meanings:

stow	Pre-defined stow position.
service	Pre-defined service position.
disable	Stops antenna communications. This is useful to stop error messages when here is a problem.
idle	Monitor the antenna position, but do not command it. This is the normal start-up state for the Field System.
hold	Maintain the current antenna position.
setup	Prepare antenna for track
track	Re-enable antenna tracking

srw - super fast-rewind (longitudinal drives)

Syntax: **srw**

Response: srw/*acknowledgement*

Parameters: none

Comments:
The tape is started moving in reverse at super high speed. For Mark III, the record bit is disabled and the low tape sensor is turned on. For VLBA, all track groups are disabled and the low tape sensor is turned on.

The tape is moved at the "super" speed value as specified in the equip.ctl control file. This is the fastest speed that your tape drive can manage, normally 330 ips.

Use the **rw** command and **fastr** procedure for positioning the tape during a schedule.

st - start tape recording (all drives)

Syntax: **st=***direction,speed,record*

Response: st / *direction,speed,record*

Settable parameters:

direction   For non-S2 and K-4 drives: **for** to move tape forward, **rev** to move in reverse.
                rev is not permitted for S2 drives, but **for** is. For K-4 drives: **record** (or **on**) or
                play (or **off**). No default, except for S2 which defaults to **for**, and K4 which
                defaults to **record**. When the tape is stopped, this parameter is displayed in the
                response as rev for Mark III and IV. Additional display values for K-4:
                ejecting, ff, rewind, loading, stop, and NULL

speed   Tape speed in inches per second, either nominal or actual. For Mark III & IV and
                VLBA/4 drives, choices are: (for thick tape) **8.4375, 16.875, 33.75,
                67.5, 135, 270** or (for thin tape) **5, 10, 20, 40, 80, 160, 320**. A
                speed of **0** is acceptable as well. Mark III/IV drives may also be commanded to
                4.21875. For S2 drives, the only choices are **slp** and **lp**. Also for S2 drives there
                are additional monitor only values of: sp, unknown, or a reported hex value that
                doesn't correspond to a known speed. For Mark III/IV drives the default speed is
                135 ips. There is a default speed for VLBA/4 or VLBA2) drives only when the
                bit_density and **form** commands have been issued. the default speed is
                calculated from these commands. No default for S2 drives. Note used for K4.

record   **on** to record; **off** to disable recording. Default is **on**. For S2 recorders, **record** and
                play are synonymous with **on** and **off**, respectively. Also for S2 recorders there are
                additional monitor only values of rewind, ff, stop, ppause, rpause, cue,
                review, notape, and position. Note used for K4.

Monitor-only parameters: none

Comments:

The tape is started moving. For Mark III, the record bit is enabled if *record* is **on**. For Mark IV,
the general record bit is enabled and the record bit for each enabled stack is enabled if *record* is
on. For VLBA, the track groups are enabled if *record* is **on**; they are disabled if *record* is **off**.
For all systems, reproduce mode is not changed and the state of the low tape sensor is not
changed. In the Mark III/IV drives for Mark III speeds, the rate generator is set to 720 for the

"actual" speed. For "thin" speeds it is set to 853. For **5** ips, the rate generator is set to 427 and the **7.5** ips button is selected.

For the Mark III/IV drives, the speed **4.21875** ips does not move the tape. It implements a "load" function.

The nominal track bit rates for longitudinal drives depend on the tape thickness. For thick tapes the speeds are normally 135 ips/(4 Mbit/sec/track), so-called low density recording. For thin tape they are normally 80 ips/(4 Mbit/sec/track), so-called high density recording. Sometimes in the past, the thick tape speeds were used with thin tapes. This is normally not done anymore.

For longitudinal drives, the vacuum (drive ready for VLBA2 drives) is checked before the command is issued to the recorder. If the vacuum state (drive state for VLBA2 drives) is not `ready`, no further commands are sent. Vacuum (drive ready for VLBA2 drives) is not checked if *speed* is **0**. A given tape speed of **0** does not move tape but does allow the write heads to enabled accord to the *record* parameter, thus making bypass mode useful. To see the time displayed on the decoder front panel while the tape is stopped, set up the desired reproduce tracks with the **repro** command and then issue the command **st=for,0,on**.

For S2 drives, if the recorder is already recording and a speed different than what is in use is requested, no change will be made and an error will be reported.

For backward compatibility, several other values of the *speed* parameter are possible for the longitudinal drives. Nominal speeds (multiply by 9/8 to get the actual speed) are: **3.75**, **7.5**, **15**, **30**, **60**, **120**, and **240**. Obsolete "VLBA speeds" for data replacement format on think tape are: **8.33**, **16.66**, **33.33**, **66.66, 133.33**, and **266.66**. For backward compatibility with an error in an earlier version of the FS, actual values **4.21875** may also be selected by using values **3** and **3.375**; **8.4375** may selected using values **7** and **7.875**. These additional nominal values are deprecated as are the "VLBA speeds" since they are no longer used. All these deprecated speeds will be removed in a future version. Since the VLBA drives only have speed resolution of 0.01 ips, the actual speeds are **4.22**, **8.44**, and **16.88** instead of **4.21875**, **8.4375**, and **16.875**, respectively, but either may be entered in a command.

For longitudinal drives, the correlators can not reproduce recordings made at speeds below 40 ips, but this limitation is subject to change in the future. This limitation is functionally equivalent to a minimum per track data rate of 2 Mbit/sec.

For K4 type 2 (DFC2100) drives, the **rec_mode** SNAP command must be set-up first to define the time stamp insertion parameters.

stack - stack positioning by microns (longitudinal drives)

Syntax: **stack=***cmdMw,cmdMr,calW,calR,woffset*

Response: stack/*cmdMw,cmdMr,calW,calR,woffset,actMw,actMr,*
                deltaMw,deltaMr

Settable parameters:

cmdMw   Write head stack (stack 1) command position in microns. Default is not to move.
cmdMr   Read head stack (stack 2) command position in microns. Default is not to move.
              May not be specified for VLBA.
calW   Write head stack (stack 1) calibration to use: **F**orward, **R**everse, or **U**ncalibrated.
              Only the first letter is checked. Default is **U**ncalibrated.
calR   Read head stack (stack 2) calibration to use: **F**orward, **R**everse, or **U**ncalibrated.
              Only the first letter is checked. Default is **U**ncalibrated. May not be specified for
              VLBA.
woffset   Write head type offset. **auto** (default) to automatically adjust the head stack
              positions according to the write head type parameter in the head.ctl control
              file. For **none** no adjustments are made. The read head is always adjusted.

Monitor-only parameters:

actMw   Actual write head stack (stack 1) position, microns.
actMr   Actual read head stack (stack 2) position, microns. Null for VLBA.
deltaMw   Difference of actual and commanded position for write head stack (stack 1),
              microns.
deltaMr   Difference of actual and commanded position for read head stack (stack 2),
              microns. Null for VLBA.

Comments:

This command is used to position the head stacks in micron units. An individual head stack may
be moved by not specifying the command position and calibration to use for the other head stack.
For VLBA recorders, only the write head stack parameters are used; read head stack parameters
are reported as null. For Mark IV, the write parameters refer to head stack 1, read parameters
refer to head stack 2.

The *deltam* parameters are reported with the sign of actual minus commanded.

The command positions reported by the **lvdt**, **pass**, and **stack** commands are consistent. See the description of the **pass** command for more information.

The head stack position in microns is determined by

position = cmdM + absolute offset   (**F**orward calibration)
position = cmdM + absolute offset + for/rev offset   (**R**everse calibration)
position = cmdM   (**U**ncalibrated)

where *cmdM* is the commanded position and the *absolute offset* and *forward/reverse offset* are specified in the head.ctl control file.

If *woffset* is **auto**, and the calibration is **R**everse, and the write head stack is defined as **odd** in the head.ctl control file, then an offset of 698.5 microns is added to the write head stack position.

If *woffset* is **auto**, and the calibration is **F**orward, and the write head stack is defined as **even** in the head.ctl control file, then an offset of 698.5 microns is subtracted from the write head stack position.

If *woffset* is **none**, no offset is applied to the write head. The read head is always adjusted.

If the head stacks were last positioned with the **pass** or **lvdt** commands, the response *calw* and *calr* will correctly identify the calibration used. Odd pass numbers will be reported as **forward** calibrations, even passes as **reverse** calibrations. Positions commanded with the **lvdt** command are **uncalibrated**.

If the write head stack position is commanded, the auxiliary data field is set to reflect the commanded position, see the **pass** command for more information.

See the **Narrow Track Calibration** manual.

status - display current schedule status information

Syntax: **status**

Response: display of information

Settable parameters: none

Comments:
A self-explanatory display of information concerning the status of the current active schedule is
listed on the terminal, in the following format:

```
Active schedule is: name (name of current schedule)
TIME                 EVENT
-------              ---------
yyyy.ddd.hh:mm:ss.ss  Now
yyyy.ddd.hh:mm:ss.ss  Start of next observation
yyyy.ddd.hh:mm:ss.ss  End of next observation
yyyy.ddd.hh:mm:ss.ss  End of current tape
yyyy.ddd.hh:mm:ss.ss  Start of next tape
Schedule is (not) HALTed
Schedule   stream   is   (not)   time-blocked(until
yyyy.ddd.hh:mm:ss.ss)
Operator    stream   is   (not)   time-blocked  (until
yyyy.ddd.hh:mm:ss.ss)
Current line of schedule is:
#nnn  copy of current schedule line
```

sy - send a system command

Syntax: **sy=***command*

Response: none

Settable parameters:
command   The command to be sent to the system.

Comments:

This command is used to execute UNIX systems from within the Field System. The UNIX command is executed under your default shell. Any response or error from the command will be displayed in the Field System Log and Display widow, the response will not go in the log.

Normally, if you need to execute a UNIX command, use the operator menu to open a new window temporarily and type your commands and see the output there. The **sy** command should be used only if there is a need for a system command in a procedure or schedule.

Any valid UNIX command that does not require input may be used. There is no facility for accepting user input when you use the **sy** command.

Since commands could take some time to execute and therefore tie up the Field System, it is recommended that commands used with **sy** be executed in the background. To have a command run in background and not wait for its completion, append an **&** to the command. If you do want to wait until the command finishes, do not use the **&**.

systracks - system track set-up (VLBA, VLBA4 drives)

Syntax: **systracks=***st0,st1,st34,st35*

Response: systracks/*st0,st1,st34,st35*

Settable parameters:

stX   The recorder track that will have its output from the formatter placed on recorder track *X*, where *X* is one of the system tracks: *0*, *1*, *34*, or *35*. Default is itself, i.e., for *st0* the default is 0, for *st1* the default is 1, for *st34* the default is 34, and for *st35* the default is 35.

Comments:

This command is used to define what data will be recorded on the system tracks. This can be used to duplicate data from one of the normal data tracks if that track has failed. Under Field System control, the formatter will not normally send any data to the system tracks, therefore if the default is used for any parameter's value, normally no data will be written to that track.

tacd - Totally Accurate Clock (TAC) data

Syntax: **tacd=***action*
                tacd

Response: tacd/status,*host,port,file,state*
                tacd/time,*age,ddddd.ffffff,ss,aa,g.ggg.c.cccc,t.tttt*
                tacd/average,*age,ddddd.ffffff,sec,rms,max,min,average*

Settable Parameters:

action   A key word specifying what you want from the TAC:

        status   Return TAC status, also **?**.

        time   Return time.

        average Return average counters.

        cont   Retrieve information from TAC every 100 centiseconds.

        stop   Stop tacd from connecting to the TAC and stop giving errors.

        start   Undo the **stop** command, and does a restart.

      Default (null) is to undo the effect of **cont** command.

Monitor-only Parameter:

status:

host   Computer that is hosting the TAC.

port   IP port being used to connect to TAC.

file   Name of the file being used to on *host* to record measurements.

state   Status of file (open or closed).

time:

age   OLD or NEW result. OLD indicates a previously logged result.

ddddd.fffff   The *ddddd* field may be yyddd or MJD or Excel date (days since 1900.0). The *ffffff* field is always the time in fractions of a day.

ss   ONCORE receiver's ± 52 nanosecond sawtooth correction to the GPS 1PPS (nanoseconds).

aa   An estimate of the accuracy of the GPS tick (nanoseconds).

g.ggg   Amount by which the GPS receiver's 1PPS output has been intentionally biased (microseconds).

c.cccc   Corrected (cooked) counter reading after applying the *ss* and *g.ggg* corrections (microseconds).

t.tttt   Raw counter reading (microseconds).

```
average:
```
age   OLD or NEW result. OLD indicates a previously logged result.

ddddd.fffff The *ddddd* field may be yyddd or MJD or Excel date (days since 1900.0). The *fffff*
           field is always the time in fractions of a day.

sec   Number of seconds of data going into average.

rms   RMS scatter of the *sec* data points about the *average* (microseconds).

max   The extreme maximum of the *sec* points (microseconds).

min   The extreme minimum of the *sec* points (microseconds).Comments:

average   Average counter reading (microseconds).

Comments:

A simple **tacd** command (with no **=**) causes either the current raw or current averaged
measurement, depending on the last set-up of the **tacd** command, to be logged. If the command
has not been set-up previously, a raw measurement is logged.

Since the time and average output records can contain values previously logged, values of
OLD or NEW for *age* are used to distinguish previously logged and new results. This is intended
to assist in identifying independent measurements for plotting (use NEW as the string in logpl).

It will startup with the Field System the tacd program gets the host and port assignment from
the tacd.ctl control file. If no control file is available it will give a one time error and not
attempt to open any host connections. If a control file is available and is empty tacd will sleep
until a control file is provided and a start command is issued. If the file is not empty it will attempt
to establish connection and then retrieve data every 30 seconds. If connection fails, it will keep
on trying every 30 seconds until a connection is made.

The contents of *file* on the TAC *host* may contain averaged or un-averaged data depending on
the set-up of the TAC.

tape - tape recorder monitor and control (K4 drives)

Syntax: **tape=reset**

Response: tape/*position,drum,synch_test,synch,stat1,stat2*

Settable Parameters:
reset   this causes the position to be reset and a small amount of tape recorded leaving
                 the recorder at a squence number of approximately 50

Monitor-only Parameters:
position   current sequence number
drum   on or off
synch_test   on or off
synch   number lost
stat1   status byte 1 in hex
stat2   status byte 2 in hex

tape - tape recorder (Mark III, Mark IV drives)

Syntax: **tape=***lowset,reset*

Response: `tape/`*lowsense,footage,fast,capstan,stop,tach,*
                 ready,lcl/rem

Settable parameters:

lowset   If **off**, tape may run off end of reel. If **low** (default), end of tape will be sensed.
reset   **reset** to reset footage counter to 0, blank to leave counter alone.

Monitor-only parameters:

lowsense   As monitor, this tells whether tape is actually at the low-tape point, i.e. `off` means not at low-tape.
footage   Actual footage counter reading, 5 digits with leading zeroes.
fast   Fast tape switch on front panel, `fast` or `nor`.
capstan   Capstan is `moving`, or `stop` has been completed.
stop   `stop` has been issued, or `nonstop`.
tach   Tach is `locked` or `unlocked`, i.e. tape is up to speed.
ready   Tape drive vacuum is `ready` or `notready`.
lcl/rem   Switch setting, `rem` or `lcl`.

Comments:
MAT module functions available.

tape - tape positions (S2 drives)

Syntax: **tape=***list*

Response: tape/*pos0,pos1,pos2,pos3,pos4,pos5,pos6,pos7*

Settable parameters:

list   One of **reset**, one position, or list of eight comma separated positions. Positions are in units of seconds. **unk** maybe used to specify a position as unknown. **uns** must be used for transports that are not currently selected in lists of eight positions. **reset** is equivalent to specifying one value of **0.**

Monitor-only parameters:

posX   The position in units of second for transport *X*. unk is displayed for transpoorts with unknown positions. uns is displayed for drives not currently selected.

Comments:

This command sets ("presets") or reports the position of the transports. It does not cause the tapes to move.

tape - tape recorder parameters (VLBA, VLBA4 drives)

Syntax: **tape=***lowset,footage*

Response: tape/*lowset,footage,lowsense,capstan,tach,ready,*
                vacuum,chassis,err

Settable Parameters:

lowset   **low** (default) to turn on low tape sensor, **off** to turn off. Normally this sensor is always left on.

footage   If **reset**, set footage counter to 0, otherwise set footage counter to *footage*.

Monitor-only Parameters:

footage   Current tape footage counter, 5 digits with leading zeroes. Use the rec command to move the tape to a desired footage or to determine the footage.

lowsense   low indicates tape is at the low tape point, otherwise off.

capstan   Capstan is moving or stop has been completed.

tach   Tach is locked or unlocked, i.e. tape is up to speed.

ready   Tape drive vacuum is ready or notready. Null for VLBA2 drives.

vacuum   Tape vacuum, inches of water.

chassis   Chassis serial number.

error   Error flag, hex. okay if no errors, otherwise the error flag bits represent certain error conditions. Refer to MCB protocol, word 74 for recorder.

Comments:

This command is analagous to the Mark III tape command. The footage count as recorded in the log file will be found in the same location for both Mark III and VLBA systems.

If the drive type specified in the equip.ctl control file is **vlba2**, the *footage* parameter is not supported and the *vacuum* parameter is reported as null.

tapeform - specify tape format (longitudinal drives)

Syntax: **tapeform=**_pass,offset,pass,offset, ..._

Response: tapeform/_pass,offset,pass,offset, ..._

Settable parameters:

pass   The pass number whose offset follows, must be between **1** and **100** for Mark III and
             VLBA, between **1** and **112** for Mark IV.

offset   The a priori offset, in microns, for the preceding pass, must be between **1** and
             ±4000.

Comments:

The passes and offsets must appear in pairs. Multiple commands are allowed because all of the
pairs will not fit on a single line. The offsets are are used by the **pass** command to position the
head stack(s) by pass number.

These commands appear in standard procedures named **tapeforma**, **tapeformb**,
tapeformc, **tapeformd**, one for each recording mode. The appropriate procedure is invoked
in the setup procedure. For example, **sx2c1** and **sx2c2** invoke **tapeformc**.

For Mark IV modes, passes for stack 1 should be between **1** and **12**. For stack 2 passes, add **100**
to the pass number for stack 1.

tapepos - position tape (Mark III, Mark IV drives)

Syntax: **tapepos=**_footage_

Response: tapepos/_footage_

Settable parameters:

footage   The actual tape footage (as read on the counter) at which to position the tape.

Comments:

This command starts the tape moving at fast forward or reverse speed (via an immediate **ff** or **rw** command) and time-schedules an **et** command such that the tape will coast to a stop at the requested footage count (approximately). If the request is less than 100 feet off, then nothing is done. The model used is:

$$\text{dt} = \textit{tacc}*0.01 + \textit{dfeet}/22.5$$

where

_dt_   time between the **ff** or **rw** command and the **et** command

dfeet   number of feet to move

tacc   a parameter which accounts for acceleration and deceleration. The nominal value for _tacc_ is 100, and is taken from the drivem1.ctl or drivem2.ctl file, depending on which drive is in use.

The correct value of _tacc_ can be measured on an unloaded computer by issuing a **tapepos=...** command to position the tape. If the drive overshoots the command footage by _efeet_ (negative for undershoot), the corrected value for _tacc_, rounded to the nearest integer, is:

$$\textit{tacc}_{\text{new}} = \textit{tacc}_{\text{old}} - \textit{efeet}/0.225$$

Tape drives that will not position consistently within a few feet may require adjustment.

For VLBA recorders, use the **rec** command.

terminate - end field system operation

Syntax: **terminate**

Response: none

Settabel Parameters: none

Comments:
This is the graceful way to end operation of the Field System. Schedule execution is ended, log and schedule files are closed, all programs are removed from the system by oprin.

ti - list time-scheduled commands

Syntax: **ti**

Response: `display of list`

Settable Parameters: none

Comments:
The current time-scheduled commands are listed on the terminal. Format:

ts nn @ yyyy.ddd.hh:mm:ss.ss command

nn	command or procedure index
t	type
s	: for schedule or ; for operator stream
yyyy.ddd.hh:mm:ss.ss	time the command will be executed
command	the time-scheduled command.

This is a display-only command for debugging purposes.

tnx - thanks for the error report

Syntax: **tnx=***mnemonic,number,off/on*

Response: tnx/*list*

Settable parameters:
mnemonic   Two character error code, e.g., **sp**.
number   Error message number, e.g., **-999**.
off/on   Display status **on** or **off** (default).

Monitor-only parameters:
list   List of error messages for which display is turned off, in format:
                mnemonic,number, one log entry per error.

Comments:
This command can be used to suppress the display of an error message on the FS display. Even
if the error message is suppressed for display, it is still written to the log.

This command is intended to provide a way to turn off display of specific error messages if the
operator determines that nothing can be done to correct the problem. For example if one
parameter of a module's set-up is being reported incorrectly by the hardware, but has been
checked and is known to be correct, the operator can suppress that one error message rather than
unchecking the entire module.

If the *off/on* parameter is **on** display of the message can be reenabled.

This command must be used with great care. If misused it may turn off important error messages
that the operator needs to know about. Consequently, its use is block if it is executed from a
procedure, schedule, or time-list. This command must be entered interactively. The list of
suppressed error messages is cleared every time the FS is started. Turning off an error message
is not the same as correcting the underlying problem, which is the preferred method of dealing
with a problem.

If the command is given with no arguments a list of the error messages that are suppressed from
display is given. Each error is listed in a separate log entry.

This command can't distinguish between the different error messages with the same mnemonic and number, but different additional information, such as which VC or BBC is causing the error. If a message like that is suppressed, it will be suppressed in all cases. This may be corrected in a future version.

tpi - read back total power integrators, cal off

Syntax: **tpi=**_list_

Response: tpi/_readings_

Settable parameters:

list   List of total power integrators to read back. Standard detector mnemonics allowed.

Monitor-only parameters:

readings   List of readings, counts. These values are stored for use by the **tsys/5/6** commands.

Comments:

Except for station defined detectors, the results are returned grouped in pairs of detector mnemonic,value, the output is collected into lines by IF channel. Detectors that have no IF assigned are displayed first followed by IFs 1-3 (Mark III/IV) and a-d (VLBA/VLBA4). If the output for an IF would make a long output line, the output is split into more than one line. For station defined detectors the results are just displayed in order: u5, u6.

A time-out or other error on one more devices for a Mark III/IV or VLBA/VLBA4 detector will not prevent results from other detectors from being displayed. A negative integer will be shown for each channel that had an error that prevented an actual measurement from being displayed. An overflow value, 65535, is displayed as dollar signs, $$$$$.

For Mark III/IV racks the detector mnemonics for the VC are displayed as _hs_, where _h_ is the VC number as hex and _s_ is for the detector is use: d (dual for upper/lower), u (upper), l (lower), or a digit 4-7 for other detectors.

It is assumed the noise calibration signal is off.

tpical - read total power integrators, cal on

Syntax: **tpical=***list*

Response: tpical/*readings*

Settable parameters:

list   List of total power integrators to be read back. Standard detector mnemonics allowed.

Monitor-only parameters:

readings   List of readings, counts. These values are stored for use by the **tsys/5/6** commands.

Comments:

Except for station defined detectors, the results are returned grouped in pairs of detector mnemonic,value, the output is collected into lines by IF channel. Detectors that have no IF assigned are displayed first followed by IFs 1-3 (Mark III/IV) and a-d (VLBA/VLBA4). If the output for an IF would make a long output line, the output is split into more than one line. For station defined detectors the results are just displayed in order: u5, u6.

A time-out or other error on one more devices for a Mark III/IV or VLBA/VLBA4 detector will not prevent results from other detectors from being displayed. A negative integer will be shown for each channel that had an error that prevented an actual measurement from being displayed. An overflow value, 65535, is displayed as dollar signs, $$$$.

For Mark III/IV racks the detector mnemonics for the VC are displayed as *hs*, where *h* is the VC number as hex and *s* is for the detector is use: d (dual for upper/lower), u (upper), l (lower), or a digit 4-7 for other detectors.

It is assumed the noise calibration signal is on.

tpicd - tpi (Mark III, Mark IV, VLBA, VLBA4 racks)

Syntax: **tpicd=***cont,cycle*
                 tpid=stop
                 tpicd=?

Response: tpicd/*cont,cycle*
                 tpicd/*detector list*

Settable parameters:

cont   Whether to sample continuously or not: **no** (default) or **yes**. If **no**, samplng
                 is stopped and started by the **data_valid=***...* command.

cylce   Number of centiseconds per cycle, 0 disables sampling.

Monitor-only parameters:

detector list List of detectors to be sampled, grouped by IF channel as in the **tpi,
                 tpical, tpzero, tpgain,** and **tsys** commands. The list is
                 constructed from the VCs selected by the formatter and the IFs that feed them
                 when the **pcal=...** command is issued.

Comments:

The form **pcald** is used to start the extraction. The form **pcald=stop** is used to halt it. The
form **tpicd=?** returns the current set-up information.

If tpic is being controlled by the **data_valid** command, it begins and stops sampling and
recording data within one second of a request to do so. In other words within one second of the
execution of a **data_valid=***...* command.

This command controls the tpicd TPI measurement daemon. The remaining comments
describe the daemon.

The daemon measures the TPI values (Mark III/IV racks) and BBC channels gains and IF channel
TPI values (VLBA/VLBA4 racks). For Mark III/IV racks the values appear in the log as
#tpicd#tpi/ entries. For VLBA/VLBA4 racks the values appear in the log as
#tpicd#tpgain/ entries. Neither are displayed to the operator. They only go in the log. IF
TPI values for the VLBA/VLBA4 racks are reported in tpgain/ records even though they are
not gains.

The `tpicd` daemon results are returned grouped in pairs of `detector mnemonic,value`, the output is collected into lines by IF channel. Detectors that have no IF assigned are displayed first followed by IFs 1-3 (Mark III/IV) and a-d (VLBA/VLBA4). If the output for an IF would make a long output line, the output is split into more than one line.

A time-out or other error on one more devices for a Mark III/IV or VLBA/VLBA4 detector will not prevent results from other detectors from being displayed. A negative integer will be shown for each channel that had an error that prevented an actual measurement from being displayed. An overflow value, 65535, is displayed as dollar signs, `$$$$`, (for gains an overflow is 255).

For Mark III/IV racks the detector mnemonics for the VC are displayed as *hs*, where *h* is the VC number as hex and *s* is for the detector is use: `d` (dual for upper/lower), `u` (upper), `l` (lower), or a digit `4-7` for other detectors.

tpgain - measure gain levels (VLBA, VLBA4 racks)

Syntax: **tpgain=**_list_

Response: tpgain/_gain levels_

Settable parameters:

list   List of modules for which gain levels are to be measured. Standard detector mnemonics allowed, but no station detectors.

Monitor-only parameters:

zero levels   List of gain levels, counts. These values are needed for post processing of stored for use by the **tsys/5/6**.

Comments:

Except for station defined detectors, the results are returned grouped in pairs of detector mnemonic,value, the output is collected into lines by IF channel. Detectors that have no IF assigned are displayed first followed by IFs 1-3 (Mark III/IV) and a-d (VLBA/VLBA4). If the output for an IF would make a long output line, the output is split into more than one line. For station defined detectors the results are just displayed in order: u5, u6.

A time-out or other error on one more devices for a Mark III/IV or VLBA/VLBA4 detector will not prevent results from other detectors from being displayed. A negative integer will be shown for each channel that had an error that prevented an actual measurement from being displayed. An overflow value, 255, is displayed as dollar signs, $$$.

For Mark III/IV racks the detector mnemonics for the VC are displayed as _hs_, where _h_ is the VC number as hex and _s_ is for the detector is use: d (dual for upper/lower), u (upper), l (lower), or a digit 4-7 for other detectors.

It is assumed that the gain is locked in manual get a stable level.

tpzero - measure zero levels

Syntax: **tpzero=***list*

Response: tpzero/*zero levels*

Settable parameters:

list   List of modules for which zero levels are to be measured. Standard detector mnemonics allowed.

Monitor-only parameters:

zero levels   List of zero levels, counts. These values are stored for use by the **tsys/5/6**.

Comments:

Except for station defined detectors, the results are returned grouped in pairs of detector mnemonic,value, the output is collected into lines by IF channel. Detectors that have no IF assigned are displayed first followed by Ifs 1-3 (Mark III/IV) and a-d (VLBA/VLBA4). If the output for an IF would make a long output line, the output is split into more than one line. For station defined detectors the results are just displayed in order: u5, u6.

A time-out or other error on one more devices for a Mark III/IV or VLBA/VLBA4 detector will not prevent results from other detectors from being displayed. A negative integer will be shown for each channel that had an error that prevented an actual measurement from being displayed. An overflow value, 65535, is displayed as dollar signs, $$$$$.

For Mark III/IV racks the detector mnemonics for the VC are displayed as *hs*, where *h* is the VC number as hex and *s* is for the detector is use: d (dual for upper/lower), u (upper), l (lower), or a digit 4-7 for other detectors.

It is assumed the noise calibration signal is off and attenuations is at a maximum or the signal is somehow turn-off.

These zero levels are subtracted from all readings taken on the same module before system temperatures are computed.

track - display antenna tracking information

Syntax: **track**

Response: tr *yy/ddd.hh:mm:ss   cmd1   cmd2   delta1   delta2*
             pr   *prd1   prd2   praz   prel*
             co   *cor1   cor2   eqeq   refr*

Settable Parameters: none

Monitor-only parameters:

The tr line contains information from the tracking computer (all angles are in degrees):
yy/ddd.hh:m:ss year day and time of tracking computer
cmd1   first antenna command angle, x, azimuth, or hour angle
cmd2   second antenna command angle, y, elevation, or declination
delta1   tracking error for first command angle
delta2   tracking error for second command angle

The pr line contains predicted command angles based on time in tr line (all angles are in degrees):
prd1   predicted first command angle
prd2   predicted second command angle
praz   predicted azimuth
prel   predicted elevation

The co line contains calculated correction information (all angles are in degrees):
cor1   pointing correction for first command angle
cor2   pointing correction for second command angle
eqeq   approximate Equation of the Equinoxes, seconds of time
refr   refraction correction

Comments:
This command is implemented as a special mode of antcn, which may not be available at all stations. The format of the output is station dependent and may differ, some entries may be missing, and there may be additional entries. This output is normally produced by antcn and each entry will begin with #antcn#.

The typical `tr` line is intended to display information about the tracking computer. The time, command angles, and deltas normally all refer to the same epoch and the deltas are displayed with the sign of command minus actual. The time can be compared roughly to the time field of the log entry.

The typical `pr` line contains the command angles and azimuth and elevation that `antcn` would have predicted at the time in the `tr` line. These angles can be compared to those in `tr`. If `antcn` faithfully replicates the command angle calculation of the pointing computer, the numbers should agree well. At some stations this may only be approximate. Some stations may not have this line if the command angles are calculated in the same computer as the Field System runs in.

The typical `co` line contains the pointing corrections that correspond to the current predicted command angles. The *cor1* and *cor2* fields are the pointing model corrections for the two angles. The *eqeq* field is the equation of the equinoxes which is a small correction to sidereal time. The refr value gives the refraction correction for the current command angles.

Additional lines of locally defined information may be displayed.

trackform - (Mark IV, VLBA, VLBA4, K4MK4 racks)

Syntax: **trackform=***track,sampler,track,sampler, ...*

Response: trackform/*track,sampler,track,sampler, ...*

Settable parameters:

track   VLBA or Mark IV recorder track number whose sampler assignment will follow, must be between **2** and **33**. For Mark IV add 100 to the track number for stack 2.

sampler   For VLBA racks , the sampler that will be mapped to the preceding track, **0**, or in the form *nnsd*, where *nn*=bbc number (**1** through **14**), *s*=sideband (**u** for upper or **l** for lower), *d* is the data bit (**s** for sign bit or **m** for magnitude bit). For Mark IV racks, the same syntax can be used as for VLBA racks. In addition the *nnsd* sampler code can have *nn* values of **15** and **16**, and also a *+m* can be appended, where *m* is the lag **0**, **1**, **2**, or **3** when fan out is being used.

Comments:

The tracks and samplers must appear in pairs. Multiple commands are allowed because all of the pairs may not fit on a single line. The first trackform command after a **form=***...* command resets all the unspecified tracks to **0**. This command specifies the how the samplers will be assigned in the next form=*...* command that uses either mode **m** or **v**. Please note that although tracks are specified as recorder tracks, this command assigns the samplers to tracks in the formatter.

The samplers that can be selected are determined by the rack type specified in the equip.ctl control file. For rack type **vlba**, only the first eight BBCs can be used. For rack type **vlbag**, up to fourteen BBCs can be used, but only the sign bit is available. For Mark IV two bits for each of 16 VCs can be used.

For both VLBA and Mark IV racks, only the first track of a VLBA style fan-out group needs to have a sampler assigned. For a Mark IV rack, the lags can be assigned to specific tracks. It is an error to assign a lag that is not generated by the fan mode selected. This error will be reported when the formmater is set-up with the **form=***...* command. For example lag **+3** cannot be requested for **1:2** fan-out.

Note that a VLBA or Mark IV track number equals the Mark III track number plus three. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Set-up** Manual. Also VLBA group numbers

equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses VLBA or Mark IV track numbers.

tracks - enables (Mark IV, VLBA, VLBA4, K4MK4 racks)

Syntax: **tracks=***list*

Response: tracks/*list*

Settable parameters:

list   list of VLBA or Mark IV recorder tracks for which to enable the corresponding formatter tracks. The tracks may specified as values of **2**–**33**, as the VLBA "groups" of tracks not including the system tracks, **v0**, **v1**, **v2**, **v3**, or as the Mark III tracks in with the corresponding VLBA "groups", **m0**, **m1**, **m2**, **m3**. For Mark IV stack 2 tracks add 100 to the track number and use groups **v4**, **v5**, **v6**, **v7** and **m4**, **m5**, **m6**, **m7**. For Mark IV/VLBA4/K4MK4 racks only (i.e., all except VLBA), the first parameter may be an asterisk, "*", to add to previously enabled tracks.

Comments:

This command specifies which formatter tracks will be enabled in the next form=... command that uses either mode **m** or **v**. Please note that although tracks are specified as recorder tracks, this command actually enables the corresponding tracks in formatter. Recorder enables (**enable** command) must also be turned on for data to be recorded.

Note that a VLBA or Mark IV track number equals the Mark III track number plus three. Consequently, odd Mark III tracks are even VLBA or Mark IV track numbers and vice-versa. See the Track Assignment Tables in the **System Set-up** Manual. Also VLBA group numbers equal Mark III group numbers minus one, but the VLBA groups include additional tracks. Note that this command uses VLBA or Mark IV track and group numbers.

For Mark IV/VLBA4/K4MK4 racks only (i.e., all except VLBA), if the first parameter is asterisk, "*", the groups and/or tracks provided as subsequent parameters will be enabled in addition to those already enabled.

tsys - compute and display system temps

Syntax: **tsys=**_list_
               tsys5=_list_
               tsys6=_list_

Response: tsys/_systemps_
               tsys5/_systemps_
               tsys6/_systemps_

Settable parameters:

list   List of modules for which Tsys will be computed. Standard mnemonics allowed.

Monitor-only parameters:

systemps   List of system temperatures, computed from values retrieved by the **tpi**, **tpical**, and **tpzero** commands. **-1.0** means no caltemp could be found for this detector.

Comments:

This command calculates and displays system temperatures for the different video and IF channels.The formula is:

$$tsys = (tpi - tpzero) * (caltemp/(tpical-tpi))$$

tsys   system temperature, as reported in **tsys** command
tpi   cal-off reading, from **tpi** command
tpzero   zero-level reading, from **tpzero** command
tpical   cal-on reading, from **tpical** command
caltemp   noise calibration source temperature, from **caltemp** command.

Except for station defined detectors, the results are returned grouped in pairs of detector mnemonic,value, the output is collected into lines by IF channel. Detectors that have no IF assigned are displayed first followed by Ifs 1-3 (Mark III/IV) and a-d (VLBA/VLBA4). If the output for an IF would make a long output line, the output is split into more than one line. For station defined detectors the results are just displayed in order: u5, u6.

A time-out or other error on one more devices for a Mark III/IV or VLBA/VLBA4 detector will not prevent results from other detectors from being displayed. A negative integer will be shown for each channel that had an error that prevented an actual measurement from being displayed. An overflow value, larger than 999999.9 is displayed as dollar signs, $$$$$$$.

For Mark III/IV racks the detector mnemonics for the VC are displayed as *hs*, where *h* is the VC number as hex and *s* is for the detector is use: d (dual for upper/lower), u (upper), l (lower), or a digit 4-7 for other detectors.

For station dependent detectors, the **tsys5** and **tsys6** commands are used to match the detectors to the corresponding **caltemp5** and **caltemp6**.

user_info - user info set and monitor (S2 drives)

Syntax: **user_info=***field,label,string,auto*

Response: user_info/*field,label,string*

Settable parameters:
field   Field number, **1**-**4**. No default.
label   **field** or **label**, to indicate which to update. Default **field**.
string   An arbitrary string with contents for field or label. No default unless *auto* is **auto**
                and *field* is **1** or **2**, see comments below.
auto   **auto** or **literal**. Default **literal**.

Monitor-only Parameters: none

Comments:
This command sets the specified "User Info" field or label. If *auto* is **auto**, and *string* is null,
and if *field* is **1**, then field 1 is set to the station name (specified in the location.ctl control
file) or if *field* is **2**, then field 2 is set to the source name (specified by the **source=** command).

The usable length of *string* for all labels and fields **1** and **2** is 16 characters, for field **3** it is 32
characters, for field **4** it is 48 characters.

vx - video converter set-up (all K4 racks)

Syntax: **vc=***vc*,*high/low*,*det*
             vx=*vc*,*att*,*det*

Response: vc/*vc,high/low,det,yes/no,upwr,lpwr*
             vx/*vc,att,det,yes/no,upwr,lpwr*

Settable Parameters:

vc   VC channel to set parameters for, **1-16** for K4 type 1, **1-8** for K4 type 2, or **alarm**, no default

high/low   IF selection **high** or **low**, default according to VCLO frequency if *vc*'s LO has been set-up, for K4 type 1 only

att   attenuator, **0-15** dB, default **0**, for K4 type 2 only

det   front panel power detector display **upper** or **lower** sideband, default **upper**

Monitor-only:

yes/no   VC is present, **yes** or **no**

upwr   upper sideband power in counts, 0-99, the nominal range is 10-90

lpwr   lower sideband power in counts, 0-99, the nominal range is 10-90

Comments:
The **vc** form is used for K4 type 1 VCs. For K4 type 2 VCs the "**x**" in the command is replaced with "**a**" or "**b**" for the first and second bank of VCs respectively. The form of the command is different for type 1 and type 2 VCs.

Only one channel in each bank of VCs can be commanded at a time, but the monitor response consists of several lines, one for each channel in the bank.

The power levels for type 1 VCs are:

```
|OUTPUT LEVEL(dBm)|+3|+2|+1| 0|-1|-2|-3|-4|-5|
-----------------------------------------------
|LEVEL MONITOR    |78|68|59|50|43|37|32|27|23|
```

For type 2 VCs, (7631A):

```
|OUTPUT LEVEL(dBm)|+3|+2|+1| 0|-1|-2|-3|-6|-10|
```

```
 ------------------------------------------------
|LEVEL MONITOR     |90|75|60|50|40|32|24|10|  4|
```

vcbw - video converter bandwidth (all K4 racks)

Syntax: **vcbw=***bw*

Response: vcbw/*bw*

Settable Parameters:

bw   either **alarm** or VC bandwidth in MHz, possible values for different VC types:
                for K4-1A   either **2** (default) or **4**
                for K4-2   either **2** (default) or **32**
                for K4-2A   either **2** (default) or **16**
                for K4-2B   either **8** or **16** (default)

Comments:
This bandwidth is not settable for K4-1 racks, but is displayed as 2.

vcif - video converter IF attenuators (all K4 racks)

Syntax: **vcif=***att1*,*att2*,*att3*,*att4*

Response: vcif/*att1*,*att2*,*att3*,*att4*

Settable Parameters:

att1   Attenuator setting for VC channels 1-4, values of **0**-**15** dB, default **0**
att1   Attenuator setting for VC channels 5-8, values of **0**-**15** dB, default **0**
att1   Attenuator setting for VC channels 9-12, values of **0**-**15** dB, default **0**
att1   Attenuator setting for VC channels 13-46, values of **0**-**15** dB, default **0**

Comments:
This command is only used for K4-1 and K4-11A racks.

vcnn - video converter (Mark III, Mark IV racks)

Syntax: **vcnn=***freq,bandwidth,TPIsel,attenU,attenl*

Response: vcnn/*freq,bandwidth,TPIsel,attenU,attenl,*
                 rem/lcl,LOlock,TP

Settable parameters:

freq   Synthesizer frequency in MHz, value must be less than **500.00** MHz. No default.

bandwidth   Final filter bandwidth in MHz, default **2**. Choices for Mark III are:
                 0.125, **0.25**, **0.5**, **1.0**, **2.0**, **4.0**, **0** (external filter).
                 Choices for Mark IV are:
                 0.125, **0.5**, **2.0**, **4.0**, **8.0**, **16.0**, **0** (external filter).
                 Value may be integer for bandwidths of **1**, **2**, **4**, **8**, or **16** MHz.

TPIsel   Total power integrator selection. Choices are **ul**, **l**, **u**, **if**, **lo**, **gr** (ground). Default **u**.

attenU   USB attenuator, **0** or **10** db (default) only.

attenL   LSB attenuator, **0** or **10** db (default) only.

Monitor-only parameters:

rem/lcl   switch setting, rem or lcl.

LOlock   LO lock/unlock staus, lock or unlock.

TP   total power reading, decimal.

Comments:

MAT module functions available. See section 1.0 of this manual.

The total power counts returned can be related to the front panel voltage using the relation that 1 volt on the front panel is approximately equivalent to 32768 counts.

For Mark IV, the seldom used internal 0.25 and 1 MHz filters were replaced with 16 and 8 MHz filters, respectively, to increase the maximum bandwidth.

For Mark III, a power level of 32768 counts corresponds to 1 volt on the front panel and 0 ± 1 dBm output. The detector is linear to better than 2% from 5% of full scale to full scale.

For Mark IV, the output level is controlled by AGC at 0±0.5 dBm if the sideband power level is anywhere from approximately 1638 counts (0.05 volts) above the zero offset to up to saturation, with the 10 dB attenuators in. However, internal noise considerations make 3300 a better lower signal level limit. Mark IV VCs should always be operated with the 10 dB attenuators in. The Mark IV sideband power levels reflect the relative input power, i.e., before the AGC. The Mark IV detector is linear to about 1% over the full range.

vxlo - video converter LO frequency (all K4 racks)

Syntax: **vxlo=**_vc_,_freq_

Response: vxlo/vc,freq,yes/no,lock

Settable Parameters:

_vc_   VC channel to set the LO of, **1**-**16** for K4 type 1, **1**-**8** for K4 type 2, or one of
                 alarm, **hold_on**, or **hold_off**, no default
freq   LO frequency in MHz, 99.99-511.99 for K4 type 1, 499.99-999.99 for K4 type
                 2, no default.

Monitor-only Parameters:

yes/no   LO is present, yes or no
lock   lock or unlock or missing

Comments:

The "**x**" in the command is replaced with "**c**" for K4 type 1 VC. For K4 type 2 VCs the "**x**" is
replaced with "**a**" or "**b**" for the first and second bank of VCs respectively.

Only one LO in each bank of VCs can be commanded at a time, but the monitor response consists
of several lines, one for each LO in the bank.

wakeup - ring bells to alert operator

Syntax: **wakeup**

Response: none

Settable Parameters: none

Comments:
This command rings the internal bell on the terminal to alert the operator. At Haystack and Westford, *ERROR* appears on the video screen.

worm - estimate inchworm velocities (longitudinal drives)

Syntax: **worm=***stack,scale*

Response: worm/*stack,scale,fo,so,fi,si*

Settable parameters:

stack   Head stack to measure the speed of: **1**, **2**, **w**rite or **r**ead. Default is **2** for Mark III/IV and VLBA4, and **1** for VLBA. Only **1** is valid for VLBA and MK4B recorders. The value **w**rite is synonymous with **1** and **r**ead is synonymous with **2**, even if the heads are wired differently. Only the first character for **w**rite and **r**ead is checked.; they are provided only for backward compatibility.

scale   Scale to use for speed measurement, **o**ld (default), **n**ew, or **u**pdate. Only the first character is checked. The **u**pdate mode uses the old scale and updates the speed in use.

Monitor-only parameters:

fo   Fast out speed.
so   Slow out speed.
fi   Fast in speed.
si   Slow in speed.

Comments:

This command measures the inchworm speeds. It must be issued once with parameters to set it up. Issuing the command without parameters will start a measurement.

Measurements are made by moving the head stack for 1 second at slow speeds and 0.1 seconds at fast speeds in each direction. The before and after voltages are compared and the voltage scale for that head stack is used to calculate the speed. This scheme works best if the inchworm starts well away from the limits of its motion. For typical voltage scale factors (170 microns/volt), the fast speeds measured by this command tend be quantized in units slightly smaller than 10; the slow in units of about 1.

Either the current (old) or the new voltage scales can be used. The old scale is the one most recently read on Field System start-up from the head.ctl control file. The new scale is the most recently determined scale factor calculated by the **hdcalc** command.

wvolt - head write voltage (VLBA, VLBA4 drives)

Syntax: **wvolt=***volt1,volt2*

Response: wvolt/*volt1,volt2*

Settable parameters:

volt1   Write voltage for stack 1. No default.
volt2   Write voltage for stack 2. No default. For VLBA4 drives only.

Comments:

This command sets and reads the write voltage for heads. However it is only for testing purposes. The next **rec=load** will return the write voltage to the values set in the vdrive1.ctl or vdrive2.ctl control file.

wx - get current weather parameters

Syntax: **wx**

Response: wx / *temp,press,humid*

Settable parameters: none

Monitor-only parameters:
temp   current temperature, degrees C.
press   current barometric pressure, mbars.
humid   current humidity, %.

Comments:
In the standard version of this command, used when the standard met sensor package is available, temperature, barometric pressure and relative humidity are automatically read from the met sensor, displayed at the operator's terminal and written to the Field System log.

If a nonstandard met package is used, a special station-specific version of this command may be available.

If no electronic met sensor is available, a manual version of the command may be implemented. It may prompt for the required information as follows:

```
Enter current outdoor temperature (C):
Enter current barometric pressure (mbars):
Enter current humidity (%):
```

When the manual version of the command is used, the value for pressure is checked to make sure it's greater than zero, and humidity is checked to make sure it is between 0 and 100. A **wakeup** command should be issued before manual **wx** when included in a procedure in order to gain the operator's attention.

xdisp - extended display

Syntax: **xdisp=***on/off*

Response: none

Settable parameters:

on/off   on to turn on extended display, **off** (default) to turn off. When **off**, commands issued from within procedures are not displayed and ack responses from modules are not displayed. All responses are always displayed. When **on**, all commands and responses are displayed.

Monitor-only parameters: none

Comments:
Immediate execution operator command.

xlog - extended logging

Syntax: **xlog=***on/off*

Response: none

Settable parameters:

on/off   **on** to turn on extended logging, **off** (default) to turn off. When **off**, commands issued from within procedures are not logged and ack responses from modules are not logged. All responses are always logged. When **on**, all commands and responses are logged.

Comments:
Immediate execution operator command.

xyoff - x-y source position offset

Syntax: **xyoff=***xoff,yoff*

Response: xyoff/*xoff,yoff*

Settable parameters:
x   offset in X coordinate, in numeric angle/degrees format. Response is in degrees.
y   offset in Y coordinate, in numeric angle/degrees format. Response is in degrees.

Monitor-only parameters: none

Comments:
The antenna will move to the offset position when this command is issued. To return to the on-source position, issue this command with zero offsets.