HRPD Sample Changer – Serial Protocol Manual

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HRPD Sample Changer Serial Protocol

1. Introduction

This unit has serial communication incorporated to allow and provide status and control.

There are several commands that are intended for computer group but can be used from a dumb terminal, e.g. hyper-terminal or putty.

There are several commands that are intended for dumb terminal only.

All commands are described in section 3

There are some unsolicited or broadcast message intended for dumb terminal that can be enabled as detailed in section 0

2. Settings and Connection

The unit is configured to run RS232c at 38400 baud, 8N1.

The terminating character is ascii 10 (CR)

Connection is made to the female 9-way D-type connector on the front of the cabinet.

The port is configured as DCE (Data Communications Equipment).

3. Commands

The command set has been designed to be as compatible with GEM and POLARIS as reasonably possible. Some changes had to be made to reflect the new hardware and abilities, also some additional commands have been provided. All lines need a carriage return character to be sent.

Purging the current line can be done by putting an exclamation mark "!" at the end of the line before the carriage return.

The serial input is buffered and only processed when the carriage return is received. If the buffer size exceeds 29 characters or there is an excessive gap in the serial stream then the buffer contents will be discarded an information message produced.

Any line that is not recognised will be ignored responded with two question marks.

3.1. Information Commands

Shown in alphabetical order

The input command is shown bold with the response field descriptions, followed by a typical system response.

```
db                  Debug Inputs
In(0)  = Motor 1 Up/Down      = Disabled
In(1)  = Motor 0  Rotate      = Disabled
In(2)  = Interface Loop       = On
In(3)  = Unused               = Off
In(4)  = Unused               = Off
In(5)  = Insertion Arm UP     = Yes
In(6)  = Drive 0 Rotate Fail  = No
In(7)  = At Index Position    = Yes
In(8)  = At Position 1        = No
```

```
In(9)  = Sample Rod Up       = Yes
In(10) = Sample Rod Down     = No
In(11) = Step 1 Up/Down      = Low
In(12) = Direction 1 Up/Down = Raise
In(13) = Drive 1 Up/Down Fail= No
In(14) = Step 0 Rotate       = Low
In(15) = Direction 0 Rotate  = Forward
Op(8)  = Cardcheck           = High
Op(10) = Drv 1 Up/Down Reset = Low
Op(13) = Drv 0 Rotate Reset  = Low
Op(14) = Motor 0 Rotate      = Disabled
Op(15) = Motor 1 Up/Down     = Disabled
Insertion Arm  Motor         = Stopped
Rotary Indexer Motor         = Stopped
Last Error Number was        =  0
Rotating Carousel Position   = 17
```

hp   Help – show commands

Valid commands are:-
db(rtn) to debug inputs
hp(rtn) show commands
id(rtn) to give PnP identity
st(rtn) to give status
po(rtn) to give positionin(rtn) to initialise carousel
ma[nn](rtn) move to position [nn] and lower
mn[nn](rtn) move to position [nn] but not lower
ra(rtn) to raise arm.
lo(rtn) to lower arm
fw(rtn) move up 1 position
bk(rtn) move down 1 position
sa(rtn) show sample status
rt(rtn) retrieve dropped sample
ht(rtn) halt all movement, in required
r0(rtn) reset drive 0
r1(rtn) reset drive 1
vr[nnnn] show memory vr contents

Error 1 = Can't find 'any index' sensor
Error 2 = Can't find index position 1 after 20 tries
Error 3 = Can't lower arm if not at index
Error 4 = Insertion arm Retract FAILED
Error 5 = Invalid Destination
Error 6 = Rotary index not Initialised
Error 7 = Sample arm has dropped
Error 8 = Sample arm is not down
Error 9 = Busy or unsafe
Error 10 = Cannot Rotate when Actuator not up
Error 11 = Can't Rotate if not up
Error 12 = Halt executed
Error 13 = No SD Card

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Error 20 = Drive 0 Rotate fail
Error 21 = Drive 1 Up/Down fail
Error 22 = No interface card
Error 24 = Too fast or dropped sample
Error 25 = Too fast
Error 30 = Process Stopped ---Monitor
Error 31 = Process Stopped ---Polaris1
Error 32 = Process Stopped ---Logging
Error 33 = Process Stopped ---Motors
Error 34 = Process Stopped ---Moveabs
Error 40 = Monitor Basic Error
Error 41 = Polaris1 Basic Error
Error 42 = Logging Basic Error
Error 43 = Motors Basic Error
Error 44 = Moveabs Basic Error

id   Unit Identity
0001 0001 ISIS HRPD Sample Changer V1.00

po   Carrousel Positon, 1-20 or -1 for unknown.
Position = 20

sa   Sample Status 1 to 20
UUUUUU?UUUU??U?UUxxU
              Where
                   x = not tested
                   ? = dropped
                   U = up
                   D = down
                   ! = up and down
                   # = bad combination of bits

st   Status of system
1110011111001100 00 01
              The first 16 characters are the 16 inputs used by the controller these are:
                   0 Motor 1 (Up/Down)   0 = Enabled   1 = Disabled
                   1 Motor 0 (Rotate)   0 = Enabled   1 = Disabled
                   2 Interface Card Check   0 or 1 No significance
                   3 Unused
                   4 Unused
                   5 Actuator Arm Position   0 = Not Up   1 = Up
                   6 Drive 0 (Rotate) Status   0 = Working   1 = Error
                   7 Carrousel at Index   0 = Off Index   1 = At Index
                   8 Carrousel at Position 1   0 = Off 1   1 = At Position 1
                   9 Sample Arm Up   0 = Not Up   1 = Up
                   10 Sample Arm Down   0 = Not Down   1 = Down
                   11 Step 1 (Up/Down)   toggles during movement

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12 Direction 1 (up/Down)	0 = Lower	1 = Raise
13 Drive 1 (Up/Down)	0 = Working	1 = Error
14 Step 0 (Rotate)	toggles during movement	
15 Direction 0 (Rotate)	0 = Forward	1 = Backward

The next 2 shows motor activity

| Motor 1 (Up/Down) | 0 = Idle | 1 = Active |
| Motor 0 (Rotate) | 0 = Idle | 1 = Active |

The Next 2 shows error

0 = No error
1 = Can't find 'any index' sensor
2 = Can't find index position 1 after 20 tries
3 = Can't lower arm if not at index
4 = Insertion arm Retract FAILED
5 = Invalid Destination
6 = Rotary index not Initialised
7 = Sample arm has dropped
8 = Sample arm is not down
9 = Busy or unsafe
10 = Cannot Rotate when Actuator not up
11 = Can't Rotate if not up
12 = Halt executed
13 = No SD Card
20 = Drive 0 Rotate fail
21 = Drive 1 Up/Down fail
22 = No interface card
24 = Too fast or dropped sample
25 = Too fast
30 = Process Stopped ---Monitor
31 = Process Stopped ---Polaris1
32 = Process Stopped ---Logging
33 = Process Stopped ---Motors
34 = Process Stopped ---Moveabs
40 = Monitor Basic Error
41 = Polaris1 Basic Error
42 = Logging Basic Error
43 = Motors Basic Error
44 = Moveabs Basic Error

The final 1 is carousel position 1-20 or -1 for unknown

vr0011   Read any Variable, in this case 0011 which is carrousel position. The content is shown in decimal and hexadecimal formats as well as its polarity. A selection are shown in 0 on page 9. Further locations can be provided on request.

+ VR   11 =   17 hx 11

3.2. Parameter Setting and Control Commands:

The following commands can be keyed in and a description is given of the full sequence that should follow. These are shown in alphabetical order. The unit will respond with either "ok" if accepted or "rj-xx" if reject, xx is numerical for cause identification purposes.

bk   Backward Carousel
                  This function will cause the rotary carousel to move one position anticlockwise as viewed from the top.

fw   Forward Carousel
                  This function will cause the rotary carousel to move one position clockwise as viewed from the top.

ht   Halt
                  This will immediately halt all movements, positional integrity will be lost, sample information will be initialised, operation after this command cannot be guaranteed. The "in" command will be needed to continue. **This command should only be used if there is a severe problem, it should not be used to clear a command being executed.**

r0   Reset Drive 0, rotate
                  This will reset drive 0; any pending move operations will be effected. This should only be used if the drive is showing an error.

r1   Reset Drive 1, Up/down
                  This will reset drive 1; any pending move operations will be effected. This should only be used if the drive is showing an error.

in   Initialisation
                  This function causes the actuator arm to rise, if required, and then the carousel will be rotated until position 1 is found.

lo   Lower sample arm
                  This function causes the actuator arm to go downwards. This will push the selected sample arm down, and place the sample in the beam.

ma07   Move to Absolute Position, sample 7 in this case.
                  This function will cause the full sequence of events needed to select a new sample.
                  It will raise the existing sample from the beam, if required, move via the quickest route to the new required sample and lower that sample into the beam.

mn06   Move Without Lowering to Absolute Positon, sample 6 in this case.
                  This is similar to ma above but it will not lower the selected sample into the beam.

ra   Raise Sample Arm

This function causes the actuator arm to lift. This will draw the selected sample arm upwards until it is parked in a detent, at which point the magnetic coupling will be forced to break as the actuator arm rises a little further.

rt   Retrieve Dropped Sample Arm

This Function causes the actuator arm to go downwards beyond the beam position and to the bottom of the tube. The "ra" or "lo" commands can then be used to raise the sample from this position to either the top or the beam position respectively.

4. Unsolicited or Broadcast Messages

These are produced to show system status and progress, they are essential to check system operation and in any fault diagnosis. They show operational information, input and status changes.

As they occur they are stored for writing to the sd card on the Euro 404 controller card every few seconds. If selected they will also appear on the serial port.

The memory will only hold 40 records prior to sd card writing, if any more are generated within the writing cycle they will be counted but lost, This count will be included in the information stored on the sd card. When the information is written to the sd card it will also appear on the serial port if selected.

The system will operate without an sd card or broadcast enabled and captured, however activity will not be logged and therefore any unexpected behaviour cannot be debugged, supported or any faults diagnosed.
".

Control from the Unit.
These can be switched on or off from the Communications Screen. They can be switched off only from the User screen.

Control from the serial port
bn   Broadcast Mode On
INF 32 Broadcast ON

bf   Broadcast Mode Off
INF 33 Broadcast Off

The messages are:

 INF 01 Event Overflow --- The number show is a count of the events that were not logged as the memory is full, the memory capacity is 40.
 INF 02 Drive 0 reset --- The reset signal on drive 0 (rotate) is active by HMI button
 INF 03 Drive 0 release --- The reset signal on drive 0 (rotate) is released by HMI button
 INF 04 Drive 1 reset --- The reset signal on drive 1 (up/down) is active by HMI button
 INF 05 Drive 1 release --- The reset signal on drive 1 (up/down) is released by HMI button
 INF 06 Clock Change………. --- the clock has changed
 INF 07 Bad Clock Change…. --- the clock change request was rejected due to a stated value being out of range.
INF 08 Serial Drive 0 reset 500 mS --- The reset signal on drive 0 (rotate) is active for 500mS by serial command.
INF 09 Serial Drive 0 release --- The reset signal on drive 0 (rotate) has been released after timeout
INF 10 Serial Drive 1 reset 500 mS --- The reset signal on drive 1 (up/down) is active for 500mS by serial command
INF 11 Serial Drive 1 release --- The reset signal on drive 1 (up/down) has been released after timeout

 INF 13 Manual Forward --- is being performed
 INF 14 Manual Backward --- is being performed

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INF 15 Manual Raise --- is being performed
INF 16 Manual Lower ...... --- is being performed
INF 17 Manual Retrieve .... --- is being performed

INF 19 Manual init--- is being performed
INF 20 Auto Init--- is being performed
INF 21 Auto Move Absolute….--- is being performed
INF 22 Auto Move Absolute No Lower…..--- is being performed
INF 23 Auto Forward--- is being performed
INF 24 Auto Backward--- is being performed
INF 25 Auto Raise --- is being performed
INF 26 Auto Lower…… --- is being performed
INF 27 Auto Retrieve…… --- is being performed

INF 29 At Position.. was... ---carousel has moved
INF 30 At Position.. was... ---carousel has moved
INF 31 config.................. --- configuration information at start up
INF 32 Broadcast on --- broadcast mode has been switched on
INF 33 Broadcast off ---broadcast mode has been switched off

INF 35 Manual Mode --- the unit has been but into manual mode
INF 36 Auto Mode --- the unit has been put into automatic mode
INF 37 ID check --- the units identification has be queried serially

INF 38 Serial String too long --- the received serial string is already too long and will be discarded.
 INF 39 Serial Time-out --- an excessive gap was detected in the serial command, it has been discarded.

INF 43 Misc .... --- miscellaneous information from the monitor process
INF 44 Misc .... --- miscellaneous information from the polaris1 process
INF 45 Misc .... --- miscellaneous information from the logging process
INF 46 Misc .... --- miscellaneous information from the motor process
INF 47 Misc .... --- miscellaneous information from the moveabs process

INF 50 Error .. cleared by monitor --- an error has been cleared
INF 51 Error .. cleared by Polaris1 --- an error has been cleared
INF 52 Error .. cleared by Logging --- an error has been cleared
INF 53 Error .. cleared by Motor --- an error has been cleared
INF 54 Error .. cleared by Moveabs --- an error has been cleared

INF 60 Monitor Started on: ... --- process started
INF 61 Polaris1 Started on: ... --- process started
INF 62 Logging Started on: ... --- process started
INF 63 Motor Started on: ... --- process started
INF 64 MoveABS Started on: … --- process started
INF 65 Logging Restarted on: ... --- process started

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INF 70 1-Process Stopped   Monitor
INF 71 1-Process Stopped   Polaris1
INF 72 1-Process Stopped   Logging
INF 73 1-Process Stopped   Motor
INF 74 1-Process Stopped   Moveabs

INF 80 1-Process Restarted Monitor
INF 81 1-Process Restarted Polaris1
INF 82 1-Process Restarted Logging
INF 83 1-Process Restarted Motor
INF 84 1-Process Restarted Moveabs

BER 10 Monitor Basic Error --- a basic error was encountered and a system reset is required
BER 11 Polaris1 Basic Error --- a basic error was encountered and a system reset is required
BER 12 Logging Basic Error --- a basic error was encountered and a system reset is required
                            Some basic errors relating to sd card will self reset the process
BER 13 Motor Basic Error --- a basic error was encountered and a system reset is required
BER 14 Moveabs Basic Error --- a basic error was encountered and a system reset is required

INP   199 PREV 8391 UP   0 DOWN 8192 ,D1F
changes to the inputs selected in section 3 on page 5 will be logged as shown with mnemonics,
subject to line space.
The mnemonics are:
- IFL --- Interface card loop test
- D1F --- Drive 1 (up/down) failure
- D0F --- Drive 0 (rotate) failure
- SAD --- Sample Arm Down
- SAP --- Sample Arm Up
- ATH --- Carousel at home position 1
- IDX --- Carousel at an Index position
- AAU ---Actuator Arm Up
- DR0 --- Direction 0 (rotate)
- ST0 --- Step 0 (rotate)
- M0E --- Motor 0 (rotate) enable
- DR1 --- Direction 1 (up/down)
- ST1 --- Step 1 (up/down)
- M1E --- Motor 1 (up/down) enable
- IN4 --- Input 4 not used
- IN3 --- Input 3 not used

ERR any error message as described in the Error section of the user manual will produce a logged
message.

5. VR Memory Locations

A selection of memory locations:

0033   HMI page number

0040   Axis 0 (rotate) speed
0042   Axis 0 (rotate) step position /100
0043   Lower depth target thousands
0044   Lower depth target units
0045   Retrieve depth target thousands
0046   Retrieve depth target units

0050   Axis 1 (up/down) speed
0052   Axis 0 (up/down) -step position /100

0061   RTC Hour
0062   RTC Minutes
0063   RTC Seconds
0064   RTC Day
0065   RTC Month
0066   RTC Year

0110   Logging file number

0350   Logging write count 0 to 40
0352   Logging overflow count

0363   Input Logging Mask