# Interface Control Document for Monitor and Control System Data Recorder (MCS-DR) Ver. 1.1

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# 1 Description

## 1.1 Purpose

The purpose of this document is to define the interface between Monitor and Control System Data Recorder (MCS-DR) and other Long Wavelength Array (LWA) station subsystems. The MCS-DR subsystem records output of the Digital Processing (DP) subsystem and is controlled by the Monitor and Control System (MCS). Whereas station architecture and subsystem ICDs may refer to the MCS-DR as a whole, this ICD applies to a single MCS-DR PC.

## 1.2 Scope

This ICD shall describe the MCS-DR's physical and electrical connections, software interfacing and control methods.

## 1.3 Related Documents and Drawings

LWA Station Architecture [1]
MCS Architecture [2]
MCS Subsystem Definition [3]
MCS Common ICD [4]
DP ICD [5]
MCS - Data Recorder Preliminary Design & Verification [6]
MCS-DR Storage Unit [7]

# 2 Document Conventions

## 2.1 Abbreviations and Acronyms

| | |
|---|---|
| DP | Digital Signal Processing |
| DRX | Digital Receiver |
| LWA | Long Wavelength Array |
| MIB | Management Information Base |
| MCS | Monitor and Control System |
| MCS-DR | Monitor and Control System - Data Recorder |
| TBN | Transient Narrowband Buffer |
| TBW | Transient Wideband Buffer |
| U | Rack Units (1.75 inches) |

## 2.2   Command Parameter Types

| | |
|---|---|
| uint8 | unsigned integer, 8 bits |
| ASCII-XXX-# | An ASCII string exactly XXX characters in length which is interpreted as a number. Valid characters are numbers and right-padding spaces only. |
| ASCII-XXX-A | An ASCII string exactly XXX characters in length which is interpreted as a text string. Unless otherwise noted, valid characters are letters, numbers, the underscore character, and periods. |

## 2.3   Mark-up Conventions

| Symbol/Mark-up | Meaning | Example |
|---|---|---|
| *italics* | Italics indicate a variable, parameter, or response element name. | *Start MPM* |
| `Bold Fixed-width` | Text in this font indicates a particular parameter or response format. A single quote character appearing in a literal format should be interpreted as a space. | "AB'_" would indicate a literal "A" followed by a literal "B", followed by a space, followed by a literal "_". |
| `<...>` | Text appearing in these brackets indicates a parameter or variable substitution to a format specification. The brackets themselves are omitted from the format. | "A<B>_" would indicate a literal "A" followed by the variable *B*, followed by a literal "_". |

## 2.4   Numeric Representation Convention

Numbers, units, and their associated prefixes and suffixes conform to the standard of IEC 60027-2 [8]. Specifically, the prefixes Ki, Mi, Gi, and Ti refer to $2^{10}$, $2^{20}$, $2^{30}$, and $2^{40}$, respectively. Likewise, the prefixes K, M, G, and T refer to $10^3$, $10^6$, $10^9$, and $10^{12}$, respectively. If a unit specifies a binary size or rate, an uppercase B represents a byte, whereas a lowercase b indicates an individual bit ( i.e. MB = Megabyte, or 1,000,000 bytes, and Kb = kibibit or 1,024 bits ).

# 3 Physical System Interfaces

## 3.1 Mechanical Interface

Figure 1 shows the MCS-DR mounted in one possible configuration. The MCS-DR consists of a PC and a RAID storage unit. The PC is mounted in a 6U EIA 19" shelf rack, and the storage unit requires 1U of rack space. The PC and storage unit may be mounted anywhere within the shelter so long as they are within cable's reach of each other ( approx. 1 m ). For more details on the 1U storage unit, see "MCS-DR Storage Unit" ([7]).



Figure 1: An MCS-DR PC and storage unit mounted on a 19" rack

## 3.2 Electrical and Electronic Interfaces

The PC will be powered by a 3-prong, grounded, 110 Volts RMS outlet, and power usage will not exceed 500 Watts. The storage unit will be powered by a 3-prong, grounded, 110 Volts RMS outlet, and power usage will not exceed 250W.

## 3.3   Electronic Interface

Figure 2 illustrates the electrical and electronic connections between the MCS-DR PC, MCS-DR storage unit, station power, and station subsystems. The insets of Figure 2 show expanded rear views of the MCS-DR PC and storage unit.



Figure 2: Diagram of electrical connections
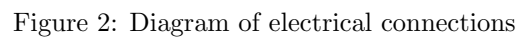
# 4  System Configuration

MCS-DR operating software is primarily controlled and configured through the network. However, several system configuration parameters are required before interaction with MCS is possible. These parameters define IP addresses, UDP port numbers, and other essential or possibly security-relevant aspects of the system. These values are defined in a configuration file "defaults.cfg" which is read upon start of the application or when manually reinitialized ( see "INI" command in section 5.7.1 ). Table 1 lists all currently required configuration parameters and what they are used for.

| Parameter Name | Parameter Format | Description |
| --- | --- | --- |
| SelfIP | An IP address of the form xxx.xxx.xxx.xxx | This parameter specifies the MCS-DRPC's 1GbE adapter's LAN IP address. |
| MyReferenceDesignator | Three character subsystem reference designator | Determines which messages are intended for MCS-DRPC. Messages received with reference designators that do not match this parameter or "ALL" will be ignored. |
| MessageInPort | An integer UDP port number | Determines which UDP port number MCS-DR will open to listen for MCS messages. |
| MessageOutPort | An integer UDP port number | Determines which UDP port number will be used when responding to MCS. |
| MessageOutURL | An IP address or hostname | Specifies the IP address of MCS, which determines where MCS-DR sends response messages to. |
| DataInPort | An integer UDP port number | Determines which UDP port number MCS-DR will open to record data from DP. |
| TimeAuthority | An IP address or hostname | Specifies the IP address or hostname of NTP time authority. This value is used upon initialization or when manually synching MCS-DR to station time ( see "SYN" command in section 5.7.13 ). |
| Version | Textual, single-line | Identifies the software version in use on the MCS-DRPC. |
| MySerialNumber | Textual, single-line | Identifies the serial number of the MCS-DRPC. |

Table 1: MCS-DR configuration parameters.

# 5 Monitor and Control Interface

## 5.1 Overview

Control and monitoring of the MCS-DR is performed by the exchange of two different classes of messages. The first class of messages are monitoring messages which request system status information from the MCS-DR, while the second class of messages – command messages – request that the MCS-DR execute some action. The format of monitoring messages are all the same, while command messages may have formats that differ with respect to the specific command. Each monitoring message requests some part of the MCS-DR's Management Information Base (MIB). The following sections describe in detail each of the MIB entries and command actions that the MCS-DR supports, as well as the format of the response that the MCS-DR will return. If the MCS-DR cannot comply with the request, then a rejection response will be sent with an error message as defined in section 5.8.

## 5.2 Time Synchronization Considerations

MCS-DR does not use NTPD for time synchronization, but will synchronize its internal clock to station time each boot-up. Additionally, the SYN command ( described in sec. 5.7.13 ), will explicitly synchronize time, as will the INI command ( described in sec. 5.7.1 ). NTPD, while reliable in general, is overkill for the MCS-DR since explicit synchronizing is fast and cheap. Also, not using NTPD frees up memory and CPU time.

## 5.3 Timing Restrictions

The MCS-DR supports up to 100 commands per second. Commands which schedule recording must allow at least 5 seconds between the receipt of the command, and the start of recording. Additionally, recordings may not be scheduled to begin within 5 seconds of the termination of a prior recording session.

## 5.4 MIB

| Index | Label | Description | Section |
|---|---|---|---|
| 2 | CURRENT-OPERATION | | |
| 2.1 | OP-TYPE | Type of operation currently being performed by the MCS-DR. | 5.5.1 |
| 2.2 | OP-SCHEDULE | | |
| 2.2.1 | OP-START | Start time of the current operation. | 5.5.2 |
| 2.2.2 | OP-STOP | Scheduled stop time of the current operation. | 5.5.3 |
| 2.3 | OP-REFERENCE | MCS-assigned reference number of the command message which initiated the current operation. | 5.5.4 |
| 2.4 | OP-FILEINFO-INTERNAL | | |
| 2.4.1 | OP-TAG | Internal storage tag uniquely identifying the file in use by the current operation. | 5.5.5 |
| 2.4.2 | OP-FORMAT | Data format of the file in use by the current operation. | 5.5.6 |
| 2.4.3 | OP-POSITION | File position information of the internal file in use by the current operation. | 5.5.7 |
| 2.5 | OP-FILEINFO-EXTERNAL | | |
| 2.5.1 | OP-FILENAME | File name and device id of the external storage file in use by the current operation. | 5.5.8 |
| 2.5.2 | OP-FILEINDEX | Indicates which file of a external storage file series is currently being written to. | 5.5.9 |
| 3 | SCHEDULE | | |
| 3.1 | SCHEDULE-COUNT | A count of all scheduled recordings. | 5.5.10 |
| 3.2 | SCHEDULE-ENTRIES | | |
| 3.2.X | SCHEDULE-ENTRY-X | The $X^{th}$ entry in the schedule of recordings with start time, durations, and data formats. | 5.5.11 |
| 4 | DIRECTORY | | |
| 4.1 | DIRECTORY-COUNT | A count of recordings stored on internal storage. | 5.5.12 |
| 4.2 | DIRECTORY-ENTRIES | | |
| 4.2.X | DIRECTORY-ENTRY-X | The $X^{th}$ entry in the list of recordings with pertinent data. | 5.5.13 |
| 5 | STORAGE-INFO | | |
| 5.1 | TOTAL-STORAGE | Total storage capacity in bytes | 5.5.14 |
| 5.2 | REMAINING-STORAGE | Available storage capacity in bytes | 5.5.15 |

Table 2: MCS-DR MIB structure

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| Index | Label | Description | Section |
|---|---|---|---|
| 6 | REMOVABLE-DEVICES | | |
| 6.1 | DEVICE-COUNT | The number of additional storage devices which may be used in conjunction with commands to retrieve a recordings' contents. | 5.5.16 |
| 6.2 | DEVICE-IDS | | |
| 6.2.X | DEVICE-ID-X | The device id of the $X^{th}$ discovered removable device. | 5.5.17 |
| 6.3 | DEVICE-STORAGES | | |
| 6.3.X | DEVICE-STORAGE-X | The remaining storage space on the $X^{th}$ discovered removable device. | 5.5.18 |
| 7 | CPU-INFO | | |
| 7.1 | CPU-COUNT | Number of CPU cores | 5.5.19 |
| 7.2 | CPU-TEMPS | | |
| 7.2.X | CPU-TEMP-X | Temperature in degrees Celsius of CPU core X. | 5.5.20 |
| 8 | HDD-INFO | | |
| 8.1 | HDD-COUNT | Number of hard drives comprising internal storage | 5.5.21 |
| 8.2 | HDD-TEMPS | | |
| 8.2.X | HDD-TEMP-X | Temperature in degrees Celsius of HDD X. | 5.5.22 |
| 9 | DATA-FORMATS | | |
| 9.1 | FORMAT-COUNT | Count of available, configured data recording modes. | 5.5.23 |
| 9.2 | FORMAT-NAMES | | |
| 9.2.X | FORMAT-NAME-X | Name of the $X^{th}$ data recording mode. | 5.5.24 |
| 9.3 | FORMAT-PAYLOADS | | |
| 9.3.X | FORMAT-PAYLOAD-X | UDP Payload Size of the $X^{th}$ data recording mode. | 5.5.25 |
| 9.4 | FORMAT-RATES | | |
| 9.4.X | FORMAT-RATE-X | Rate of the $X^{th}$ data recording mode. | 5.5.26 |
| 9.5 | FORMAT-SPECS | | |
| 9.5.X | FORMAT-SPEC-X | Format specification of the $X^{th}$ data recording mode. | 5.5.27 |
| 10 | LOG | | |
| 10.1 | LOG-COUNT | The number of entries in the system log. | 5.5.28 |
| 10.2 | LOG-ENTRIES | | |
| 10.2.X | LOG-ENTRY-X | The $X^{th}$ entry in the system log. | 5.5.29 |
| 11 | LIVE-BUFFER | | |
| 11.1 | BUFFER | Retrieve contents of live capture buffer. | 5.5.30 |
| 11.2 | BUFFER-RESTRICT | Retrieve contents of live capture buffer, one packet at-a-time. | 5.5.31 |
| 12 | DRSU-STATUS | | |
| 12.1 | DRSU-COUNT | The number of DRSUs detected. | 5.5.32 |
| 12.2 | DRSU-SELECTED | Report the currently selected DRSU. | 5.5.33 |
| 12.3 | DRSU-INFO | | |
| 12.3.X | DRSU-INFO-X | Report information regarding the $X^{th}$ detected DRSU. | 5.5.34 |

Table 3: MCS-DR MIB structure *(Continued)*

## 5.5 MIB Entries in Detail

### 5.5.1 OP-TYPE

MIB Entry:        Operation Type
Index:        2.1
Label:        OP-TYPE
Description:        OP-TYPE reports the current operation type. If no operation is in progress, it indicates the idle state.
Response Format:        `<Operation Type>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Operation Type* | (ASCII-11-A) | One of "Idle", "Record", "Copy", "Dump", "Format". |

| Operation Type | Meaning |
|---|---|
| "Idle" | The system is not currently performing any operation. |
| "Record" | The system is currently recording data. |
| "Copy" | The system is currently offloading a single region of recorded data to external storage. |
| "Dump" | The system is currently offloading blocks of recorded data to external storage. |
| "Format" | The system is currently formatting either internal or external external storage. |

### 5.5.2 OP-START

MIB Entry:        Current Operation Start-time
Index:        2.2.1
Label:        OP-START
Description:        OP-START reports the time at which the current operation began. This MIB entry is not valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Idle", or "Down".
Response Format:        `<Start MJD>'<Start MPM>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Start MJD* | (ASCII-6-#) | MJD at which the operation began. |
| *Start MPM* | (ASCII-9-#) | MPM at which the operation began. |

### 5.5.3 OP-STOP

MIB Entry:        Current Operation Expected Stop-time
Index:        2.2.2
Label:        OP-STOP
Description:        OP-STOP reports the scheduled or expected end-time of the current operation. This MIB entry is only valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Record", "Copy", or "Dump".
Response Format:        `<Stop MJD>'<Stop MPM>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Stop MJD* | (ASCII-6-#) | MJD at which the operation will end. |
| *Stop MPM* | (ASCII-9-#) | MPM at which the operation will end. |

### 5.5.4 OP-REFERENCE

| | |
|---|---|
| MIB Entry: | Current Operation Reference Number |
| Index: | 2.3 |
| Label: | OP-REFERENCE |
| Description: | OP-REFERENCE reports the reference number of the command message which initiated or scheduled the current operation. This MIB entry is not valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Idle". |
| Response Format: | `<Reference Number>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Reference Number* | (ASCII-9-#) | Reference number of the command message which initiated or scheduled the current operation. |

### 5.5.5 OP-TAG

| | |
|---|---|
| MIB Entry: | Current Operation File Tag |
| Index: | 2.4.1 |
| Label: | OP-TAG |
| Description: | OP-TAG reports the tag value used to identify the file in use by current operation. The file may be in read or write mode, depending on whether the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Record", "Copy", or "Dump". This MIB entry is only valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Record", "Copy", or "Dump". |
| Response Format: | `<Tag>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Tag* | (ASCII-16-A) | Filename tag in use by the current operation; They are `<MJD>_<Reference Number>`–including the literal underscore. |

### 5.5.6 OP-FORMAT

| | |
|---|---|
| MIB Entry: | Current Operation File Data Format |
| Index: | 2.4.2 |
| Label: | OP-FORMAT |
| Description: | OP-FORMAT reports the data format in use current operation. If the operation type as reported by MIB 2.1 *Operation Type* is "Record", then *Data Format* is the format which the MCS-DR is currently recording. If the operation type is "Copy", "Dump", then this MIB entry is the data format specified by the "REC" command which initiated or scheduled the recording. For all other operation types, this entry is invalid. |
| Response Format: | `<Data Format>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Data Format* | (ASCII-32-A) | Data format in use. See the "REC" control command for more information on data formats. |

### 5.5.7 OP-FILEPOSITION

| | |
|---|---|
| MIB Entry: | Current Operation File Position Information |
| Index: | 2.4.3 |
| Label: | OP-FILEPOSITION |
| Description: | OP-FILEPOSITION reports the start position, length, and current position of reading or writing with respect to the file in use by current operation ( as reported by MIB 2.1 *Operation Type* ). The *Current Position* value is always an offset relative to *Start Position*. This MIB entry is only valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Record", "Copy", or "Dump". |
| Response Format: | `<Start Position>'<Length>'<Current Position>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Start Position* | (ASCII-15-#) | The position of the first byte to be copied or dumped to external storage; is always 0 for Recording operations. |
| *Length* | (ASCII-15-#) | Copy: The number of bytes to copy; Dump: Size of each file chunk. Record: The expected size of the file. |
| *Current Position* | (ASCII-15-#) | The position of the most recent byte to be copied, dumped, or recorded. |

### 5.5.8 OP-FILENAME

| | |
|---|---|
| MIB Entry: | Current Operation External File Information |
| Index: | 2.5.1 |
| Label: | OP-FILENAME |
| Description: | OP-FILENAME reports the file name and external storage device id in use by current operation. This MIB entry is only valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Copy" or "Dump". If the operation is "Dump", the returned file name is the name of the series, and individual files will be named as specified in the "DMP" command. |
| Response Format: | `<Storage ID>'<Filename>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Storage ID* | (ASCII-64-A) | Linux partition ( e.g. /dev/sdf1 ) of an attached external storage device. The device/partition must be formatted with the EXT2 file system to be properly recognized and usable. |
| *Filename* | (ASCII-128-A) | The name of a file or file series in use by the current operation. If the current operation is using a file series, then each file, including the first, will be named `<Filename>.X`, where X is a zero-padded serial identifier. The width – in characters – of X will be determined by the number of digits required to represent the largest id generated, and subject to the name length restriction of 128 characters. |

### 5.5.9  OP-FILEINDEX

| | |
|---|---|
| MIB Entry: | Current Operation |
| Index: | 2.5.2 |
| Label: | OP-FILEINDEX |
| Description: | OP-FILEINDEX reports which file of the file series is being written to. This MIB entry is only valid if the current operation ( as reported by MIB 2.1 *Operation Type* ) is "Dump". |
| Response Format: | `<Storage ID>'<File index>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *File index* | (ASCII-9-#) | Indicates which file of the series is being dumped to. |

### 5.5.10  SCHEDULE-COUNT

| | |
|---|---|
| MIB Entry: | Schedule Count |
| Index: | 3.1 |
| Label: | SCHEDULE-COUNT |
| Description: | SCHEDULE-COUNT reports a count of all scheduled operations, including the current operation if one is in progress. |
| Response Format: | The output format is a comma separated list of: `<Count>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Count* | (ASCII-6-#) | The number of scheduled recordings. |

### 5.5.11  SCHEDULE-ENTRY-X

| | |
|---|---|
| MIB Entry: | Schedule Entry X |
| Index: | 3.2.X |
| Label: | SCHEDULE-ENTRY-X |
| Description: | SCHEDULE-ENTRY-X reports relevant information for the Xth scheduled operation. |
| Response Format: | `<Reference Number>'<Start MJD>'<Start MPM>'<Stop MJD>'<Stop MPM>'<Data Format>` |

| Response Element | Type and Size | Description |
|---|---|---|
| *Reference Number* | (ASCII-9-#) | Reference number of the command which scheduled the recording. |
| *Start MJD* | (ASCII-6-#) | MJD at which the recording will begin. |
| *Start MPM* | (ASCII-9-#) | MPM at which the recording will begin. |
| *Stop MJD* | (ASCII-6-#) | MJD at which the recording will end. |
| *Stop MPM* | (ASCII-9-#) | MPM at which the recording will end. |
| *Format Name* | (ASCII-32-A) | The data format of the scheduled operation. Must include only numbers, letters, and the underscore character. |

### 5.5.12 DIRECTORY-COUNT

MIB Entry:    Directory File Count
Index:    4.1
Label:    DIRECTORY-COUNT
Description:    DIRECTORY-COUNT reports the number of recordings contained on internal storage.
Response Format:    `<Count>`

| Response Element | Type and Size | Description |
|---|---|---|
| Count | (ASCII-6-#) | The number of recordings. |

### 5.5.13 DIRECTORY-ENTRY-X

MIB Entry:    Directory Entry X
Index:    4.2.X
Label:    DIRECTORY-ENTRY-X
Description:    DIRECTORY-ENTRY-X reports pertinent information for the [th] recording contained on internal storage.
Response Format:    `<Tag>'<Start_MPM>'<Stop_MJD>'<Stop_MPM>'<Data Format>'` `<Size>'<Disk Usage>'<Complete>`

| Response Element | Type and Size | Description |
|---|---|---|
| Tag | (ASCII-16-A) | Filename tag which uniquely identifies the file; They are of the form "`<MJD>_<Reference Number>`" – including the literal underscore, where MJD is the MJD when the recording began, and Reference Number is the Reference Number of the REC command which initiated/scheduled the recording. |
| Start MPM | (ASCII-9-#) | MPM at which the recording was started. |
| Stop MJD | (ASCII-6-#) | MJD at which the recording was stopped. |
| Stop MPM | (ASCII-9-#) | MPM at which the recording was stopped. |
| Data Format | (ASCII-32-A) | Data format which was used when the file was recorded. See the "REC" control commands for more information. |
| Size | (ASCII-15-#) | Size of the recording in bytes. This number reflects the actual number of bytes written to disk, but not the amount of space used by the file. |
| Disk Usage | (ASCII-15-#) | The total number of bytes occupied by the file on disk. Incomplete recordings will occupy an amount of space determined by the scheduled recording operation and data format. Bytes allocated in such a fashion will not be freed until the file is deleted. |
| Complete | (ASCII-3-A) | Either "YES" or "NO " depending on whether the recording completed without being interrupted or aborted. |

### 5.5.14  TOTAL-STORAGE

MIB Entry:        Total Storage
Index:            5.1
Label:            TOTAL-STORAGE
Description:      TOTAL-STORAGE reports the total storage capacity of internal
                  storage in bytes.
Response Format:  `<Size>`

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Size* | (ASCII-15#) | Total size of internal storage in bytes. This number does not reflect the number of bytes unavailable due to formatting and file system usage. This will be 0 when internal storage has been taken offline, or if a problem prevents the internal storage from being used. |

### 5.5.15  REMAINING-STORAGE

MIB Entry:        Remaining Storage
Index:            5.2
Label:            REMAINING-STORAGE
Description:      REMAINING-STORAGE reports the number of available bytes on
                  internal storage.
Response Format:  `<Available>`

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Available* | (ASCII-15#) | Total size of unused portion of internal storage in bytes. This number does not reflect the number of bytes unavailable due to formatting and file system usage. Each recording requires 4096 bytes in the file table, 512 kB of start and stop tags, and 256 kB of header information in addition to the actual file size, which is rounded up in units of 256 kB. |

### 5.5.16  DEVICE-COUNT

MIB Entry:        Removable Device Count
Index:            6.1
Label:            DEVICE-COUNT
Description:      DEVICE-COUNT reports a the number of available external stor-
                  age devices.
Response Format:  `<Count>`

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Count* | (ASCII-6-#) | The number of devices detected. |

### 5.5.17  DEVICE-ID-X

MIB Entry:        Removable Device ID X
Index:            6.2.X
Label:            DEVICE-ID-X
Description:      DEVICE-ID-X reports the device id of the X$^{\text{th}}$ external storage
                  device.
Response Format:  `<Storage ID>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Storage ID* | (ASCII-64-A) | Linux partition ( e.g. /dev/sdf1 ) of detected storage device. The device/partition must be formatted with the EXT2 file system to be properly recognized and usable. |

### 5.5.18  DEVICE-STORAGE-X

MIB Entry:        Removable Device X Remaining Storage
Index:            6.3.X
Label:            DEVICE-STORAGE-X
Description:      DEVICE-STORAGE-X reports the free storage space on the X$^{\text{th}}$
                  external storage device.
Response Format:  `<Available>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Available* | (ASCII-15-#) | Total size of unused portion in bytes of external storage specified by *Storage ID* in MIB entry 6.2.X. This number does not reflect the number of bytes unavailable due to formatting and file system usage. If this number is 0, it indicates that a removable device was detected, but is not formatted properly, or contains an unsupported file system. |

### 5.5.19  CPU-COUNT

MIB Entry:        CPU Count
Index:            7.1
Label:            CPU-COUNT
Description:      CPU-COUNT reports the number of CPU cores present in the
                  MCS DR. Typically this value will be 8, but to support the possi-
                  bility of future hardware changes, this MIB entry is included.
Response Format:  `<Count>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Count* | (ASCII-3-#) | The number of CPU cores. |

### 5.5.20 CPU-TEMP-X

MIB Entry:         CPU Temperatures
Index:               7.2.X
Label:               CPU-TEMP-X
Description:        CPU-TEMP-X reports temperature of the of core X.
Response Format:   `<Core X Temp>`

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Core X Temp* | (ASCII-3-#) | Temperature in degrees Celsius of core X. |

### 5.5.21 HDD-COUNT

MIB Entry:         HDD Count
Index:               8.1
Label:               HDD-COUNT
Description:        HDD-COUNT reports the number of hard drives comprising internal storage. Typically this value will be 5, but to support the possibility of future hardware changes, this MIB entry is included.
Response Format:   `<Count>`

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Count* | (ASCII-3-#) | The number of hard disk drives. |

### 5.5.22 HDD-TEMP-X

MIB Entry:         Hard Disk Drive Temperatures
Index:               8.X
Label:               HDD-TEMP-X
Description:        HDD-TEMP-X reports temperature of the $X^{th}$ hard drive in the internal storage RAID array. Depending on the hardware used in each MCS-DRPC, collecting temperature for a specific drive may not be supported. In such cases, the corresponding RPT command will be accepted but the response will be empty. Specifically, this is noted in the Dell T1500-based MCS-DRPCs.
Response Format:   `<HDD X Temp>`

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *HDD X Temp* | (ASCII-3-#) | Temperature in degrees Celsius of drive X in the array. |

### 5.5.23 FORMAT-COUNT

MIB Entry:    Data Formats Count
Index:          9.1
Label:          FORMAT-COUNT
Description:    FORMAT-COUNT returns the number of recording formats supported.

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Count* | (ASCII-6-#) | The number of formats supported. |

### 5.5.24 FORMAT-NAME-X

MIB Entry:    Data Format X Name
Index:        9.2.X
Label:        FORMAT-NAME-X
Description:  FORMAT-NAME-X returns the name of the X<sup>th</sup> recording format.

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Format Name* | (ASCII-32-A) | The name assigned to the format. Must include only numbers, letters, and the underscore character. Data formats should be named appropriately. e.g.: TBN_1024_112 for a TBN packet of 1024 bytes at a rate of 112 MiB/s. |

### 5.5.25 FORMAT-PAYLOAD-X

MIB Entry:    Data Format X UDP Packet Payload Size
Index:        9.3.X
Label:        FORMAT-PAYLOAD-X
Description:  FORMAT-PAYLOAD-X returns the UDP Packet Payload Size of
             the X<sup>th</sup> recording format.

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *UDP Payload Size* | (ASCII-4-#) | The size in bytes of the payload portion of UDP packets for this format. Typically this will be 1024 for TBN, 1224 for TBW, or 4128 for DRX. See the DP Common ICD ([5]) for more information. |

### 5.5.26 FORMAT-RATE-X

MIB Entry:    Data Format X Rate
Index:        9.4.X
Label:        FORMAT-RATE-X
Description:  FORMAT-RATE-X returns the data rate of the X<sup>th</sup> recording format.

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Rate* | (ASCII-9-#) | Overall data rate once formatting has been taken into consideration. Specifically, this is the rate used in calculating the amount of space a recording will require on disk. If the entire UDP payload is recorded to disk, then this rate will equal the transmission rate. Likewise, if the format requires that portions of the payload will be discarded, then this number will be less than the actual transfer rate. Note that the MAC and UDP packet headers should not be considered in this rate as they are discarded automatically. |

### 5.5.27  FORMAT-SPEC-X

MIB Entry:    Data Format X specification
Index:    9.5.X
Label:    FORMAT-SPEC-X
Description:    FORMAT-SPEC-X returns the specification of the $X^{th}$ recording format. This specification is an ordered list of Keep or Drop operations to be performed on portions of the received data packet. This feature's primary use is in conserving storage space by discarding portions of a packet that may not be needed before the packet is written to disk.

| Response Element | Type and Size | Description |
|---|---|---|
| *Format* | (ASCII-256-A) | The format is defined as an ordered list of terms Kxxxx or Dyyyy where Kxxx means that xxxx bytes should be kept, and Dyyyy means that yyyy bytes should be dropped. For instance, the pattern "D0024K0512D0488" reads as "Drop the first 24 bytes, keep the next 512, and drop the 488 subsequent bytes. All xxxx and yyyy will add up to the specified UDP packet payload size, so for the example shown, the UDP packet payload size is 1024. These formats are predefined based on data formats specified in the DP ICD. |

### 5.5.28  LOG-COUNT

MIB Entry:    System Log Length
Index:    10.1
Label:    LOG-COUNT
Description:    LOG-COUNT reports the number of system log entries.
Response Format:    `<Count>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Count* | (ASCII-6-#) | The number of entries in the system log. |

### 5.5.29  LOG-ENTRY-X

MIB Entry:    System Log Entry X
Index:    10.2.X
Label:    LOG-ENTRY-X
Description:    LOG-ENTRY-X reports the $X^{th}$ entry in the system log.
Response Format:    `<MJD>'<MPM>'<Message Class>'<Message>`

| Response Element | Type and Size | Description |
|---|---|---|
| *MJD* | (ASCII-6-#) | MJD when the entry was logged. |
| *MPM* | (ASCII-9-#) | MPM when the entry was logged. |
| *Message Class* | (ASCII-7-A) | One of: "info...", "warning", or "error.." ( periods indicate padding spaces ) |
| *Status* | (ASCII-234-A) | A human readable string of at most 234 characters, padded with spaces, describing an event of interest. |

### 5.5.30 BUFFER

| | |
|---|---|
| MIB Entry: | Live Capture Buffer Retrieval |
| Index: | 11.1 |
| Label: | BUFFER |
| Description: | BUFFER returns contents of the live capture buffer. The live capture buffer captures DP output streams for periods up to 100ms. The live capture buffer is defined by issuing a BUF command ( see sec. 5.7.12 ). The BUFFER MIB entry returns as many data packets as will fit in a single response message. The number returned depends on the data format of the recording; for TBN's 1024 byte packets, seven packets will fit in the response. The total size of the response's data field will be 55 ASCII bytes followed by ( Size x Count ) bytes of binary data. |
| Response Format: | `<Reference>'<MJD>'<MPM>'<Offset>'<Size>'<Count><<<Data>>>` |

| Response Element | Type and Size | Description |
|---|---|---|
| Reference | (ASCII-9-#) | Reference number of the recording whose data is in the buffer. |
| MJD | (ASCII-6-#) | MJD when the recording started. |
| MPM | (ASCII-9-#) | MPM when the recording started. |
| Offset | (ASCII-18-# *float*) | floating point offset in ms of the first packet returned. This is accurate to ±1 packet's period, but is based on the time the packet is received as opposed to the time slice that the sample corresponds to. |
| Size | (ASCII-4-#) | The size, in bytes, of each packet in the buffer |
| Count | (ASCII-4-#) | The number of packets returned in this response |
| Data | (Binary, variable length) | *Count* packets of binary data packed back to back |

### 5.5.31 BUFFER-RESTRICT

| | |
|---|---|
| MIB Entry: | Live Capture Buffer Retrieval, Restricted |
| Index: | 11.2 |
| Label: | BUFFER-RESTRICT |
| Description: | BUFFER-RESTRICT returns contents of the live capture buffer, but limits responses to one data packet. Otherwise, this behaves exactly as the BUFFER MIB entry ( see sec. 5.5.30 ). |
| Response Format: | `<Reference>'<MJD>'<MPM>'<Offset>'<Size>'<Count><<<Data>>>` |

| Response Element | Type and Size | Description |
|---|---|---|
| Reference | (ASCII-9-#) | Reference number of the recording whose data is in the buffer. |
| MJD | (ASCII-6-#) | MJD when the recording started. |
| MPM | (ASCII-9-#) | MPM when the recording started. |
| Offset | (ASCII-18-# *float*) | floating point offset in ms of the first packet returned. This is accurate to ±1 packet's period, but is based on the time the packet is received as opposed to the time slice that the sample corresponds to. |
| Size | (ASCII-4-#) | The size, in bytes, of each packet in the buffer |
| Count | (ASCII-4-#) | Always 1 |
| Data | (Binary, variable length) | *Count* packets of binary data packed back to back |

### 5.5.32  DRSU-COUNT

MIB Entry:          DRSU Count
Index:              12.1
Label:              DRSU-COUNT
Description:        DRSU-COUNT reports the number of detected DRSUs.
Response Format:    `<Count>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Count* | (ASCII-2-#) | The number of detected DRSUs. |

### 5.5.33  DRSU-SELECTED

MIB Entry:          Currently Selected DRSU
Index:              12.2
Label:              DRSU-SELECTED
Description:        DRSU-SELECTED reports which DRSU is currently active.  If internal storage is down, this will reflect the last valid selection.
Response Format:    `<DRSU Number>`

| Response Element | Type and Size | Description |
|---|---|---|
| *DRSU Number* | (ASCII-2-#) | The number of the selected DRSU. |

### 5.5.34  DRSU-INFO-X

MIB Entry:          DRSU info
Index:              12.3.X
Label:              DRSU-INFO-X
Description:        DRSU-INFO-X reports information on the X$^{\text{th}}$ detected DRSU.
Response Format:    `<Name>'<Partition>'<Unformatted Size>`

| Response Element | Type and Size | Description |
|---|---|---|
| *Name* | (ASCII-6-A) | The DRSU's name ( e.g. DRSU00, DRSU01, etc. ). |
| *Partition* | (ASCII-64-A) | The multi-disk partition on which resides on the DRSU |
| *Unformatted Size* | (ASCII-16-#) | The size in bytes of the DRSU before formatting. |

## 5.6 Control Commands

| Command Name | Description | Section |
|---|---|---|
| INI | Initialize or restore the MCS-DR to its initial boot-up state. | 5.7.1 |
| REC | Schedule a recording operation with the start-time, duration, and data format specified. | 5.7.2 |
| DEL | Delete existing recording specified by a supplied tag-value | 5.7.3 |
| STP | Stop the recording specified by a supplied tag-value, halting if in-progress, and canceling if not yet begun. | 5.7.4 |
| GET | Retrieve a portion of the recording specified by a supplied tag-value, a byte-offset, and number of bytes. | 5.7.5 |
| CPY | Copy a portion of the recording specified by a supplied tag-value, a byte-offset, and number of bytes to a file on a removable storage device. | 5.7.6 |
| DMP | Dump a portion of the recording specified by a supplied tag-value, a byte-offset, and number of bytes to a series of files on a removable storage device. | 5.7.7 |
| FMT | Format internal or external storage device. | 5.7.8 |
| DWN | Bring internal storage to an offline state suitable for removal/replacement. | 5.7.9 |
| UP | Scan for internal storage and bring to an online state if possible. | 5.7.10 |
| SEL | Select DRSU to use as internal storage. | 5.7.11 |
| SYN | Synchronize MCS-DR with NTP server time. | 5.7.13 |
| TST | Perform a system self-test. | 5.7.14 |
| BUF | Prepare live capture buffer for on-the-fly packet capture. | 5.7.12 |

Table 4: MCS-DR Commands

## 5.7 Control Commands in Detail

Each of the following commands specifies a list of arguments and their meanings, the response format returned if the command can be successfully executed. If the specification does not include a list of arguments, then none are required. If a description of the response format is not included, then the "R-COMMENT" field of the response shall be empty upon successful execution. In all commands below, the response format assumes the "R-RESPONSE" and "R-SUMMARY" as defined in the MCS Common ICD [4]. The response format listed for each command describes the contents of "R-COMMENT". Commands which cannot be executed will return a "R" in "R-RESPONSE", and "R-COMMENT" will be set to the corresponding error message. No commands will be rejected without returning a human-readable description of the reason in the "R-COMMENT" field. Possible error messages and their meanings are listed in section 5.8.

### 5.7.1 INI

| | |
|---|---|
| Command: | Initialize |
| Description: | Initialize restores the MCS-DR to the initial boot-up state in all regards except for the system log and the contents of internal storage. |
| Argument Format: | `<Flags>` |

| Argument | Type and Size | Description |
|---:|---|---|
| *Flags* | (ASCII-256-A) | To force re-initialization of the system log, specify the flag "`--flush-log`" or "-L". To force re-initialization of internal RAID storage, specify the flag "`--flush-data`" or "-D". Field need not be padded with spaces, and order of flags appearance does not matter. |

### 5.7.2 REC

| | |
|---|---|
| Command: | Record |
| Description: | This command schedules or initiates a recording of output from the DP subsystem. Upon successful execution of the REC command, a tag value will be returned which will uniquely identify the file. A file will have been created on the file-system which is large enough to accommodate the recording. If an operation is in progress which prohibits writing to the disk, the file creation will only exist in memory until the disk is available for writing. A request to shutdown with the SCRAM option before such a file has been written to the drive will discard the file. |
| Argument Format: | `<Start MJD>'<Start MPM>'<Length>'<Data Format>` |
| Response Format: | `<Tag>` |

| Argument | Type and Size | Description |
|---:|---|---|
| *Start MJD* | (ASCII-6-#) | Modified Julian Day to begin the recording. Must not be more than 24 hours into the future. |
| *Start MPM* | (ASCII-9-#) | Milliseconds Past Midnight to begin the recording. Must not be within 5 seconds of the termination of another operation. |
| *Length* | (ASCII-9-#) | The number of milliseconds to record. Must not terminate within 5 seconds of another scheduled operation, nor can any portion of the time period overlap any other scheduled operation. Note that the recording remains active for a short time afterwards to accommodate packets which have not been delivered yet. Consequently, additional data may be included past the end of the specified period. The length of this grace period is TBD. |
| *Data Format* | (ASCII-32-A) | The name of the pre-configured data format to use. See section 5.5.27 for details regarding data formats. |

| Response Element | Type and Size | Description |
| --- | --- | --- |
| *Tag* | (ASCII-16-A) | A file name of the form `<MJD>_<Reference Number>`, where MJD is the MJD on which recording is scheduled to begin, and Reference number is the reference number of the command message which scheduled the recording. |

### 5.7.3   DEL

Command:              Delete
Description:          This command deletes a recording from internal storage.
Argument Format:     `<Tag>`

| Argument | Type and Size | Description |
| --- | --- | --- |
| *Tag* | (ASCII-16-A) | A file name of the form `<MJD>_<Reference Number>`. See section 5.7.2 for more information. |

### 5.7.4   STP

Command:              Stop
Description:          This command halts or prevents the specified recording. If the recording is scheduled but not in-progress, it is deleted from the schedule and the corresponding hard drive space is freed. If the recording is in progress, it is halted and the corresponding file is closed, but not deleted.
Argument Format:     `<Tag>`

| Argument | Type and Size | Description |
| --- | --- | --- |
| *Tag* | (ASCII-16-A) | A file name of the form `<MJD>_<Reference Number>`. See section 5.7.2 for more information. |

### 5.7.5   GET

Command:              Get
Description:          The Get command retrieves a portion of a specified recording.
Argument Format:     `<Tag>'<Start Byte>'<Length>`
Response Format:     `<Data>`

| Argument | Type and Size | Description |
| --- | --- | --- |
| *Tag* | (ASCII-16-A) | A file name of the form `<MJD>_<Reference Number>`. See section 5.7.2 for more information. |
| *Start Byte* | (ASCII-15-#) | The byte offset within the file to start retrieval at. |
| *Length* | (ASCII-15-#) | The number of bytes to return. This is limited to the maximum size of a R-COMMENT field in a command response, or 8146 bytes. |

| Response Element | Type and Size | Description |
|---|---|---|
| *Data* | (uint8)x*Length* | On success, this field will contain *Length* bytes of data from the specified position in the file. |

### 5.7.6  CPY

| | |
|---|---|
| Command: | Copy |
| Description: | The Copy command copies portions of a recording to a file an external storage device. If the file already exists, it will be overwritten without warning or notification. The Copy and Dump commands are not available if there are any recordings scheduled. |
| Argument Format: | `<Tag>'<Start Byte>'<Length>'<Device ID>'<Filename>` |

| Argument | Type and Size | Description |
|---|---|---|
| *Tag* | (ASCII-16-A) | A file name of the form `<MJD>_<Reference Number>`. See section 5.7.2 for more information. |
| *Start Byte* | (ASCII-15-#) | The byte offset within the file to start retrieval at. |
| *Length* | (ASCII-15-#) | The number of bytes to copy. This is limited to the free space on the target removable storage device. |
| *Storage ID* | (ASCII-64-A) | Linux partition ( e.g. /dev/sdf1 ) of an attached external storage device. The device/partition must be formatted with the EXT2 file system to be properly recognized and usable. |
| *Filename* | (ASCII-128-A) | The name of a file to create. Acceptable characters are letters, numbers, the underscore and period. |

### 5.7.7 DMP

Command:           Dump

Description:         The Dump command copies blocks of data from a recording to a series of files on an external storage device. If any of the files already exist, they will be overwritten without warning or notification. The Copy and Dump commands are not available if there are any recordings scheduled.

Argument Format:     `<Tag>'<Start Byte>'<Length>'<Block Size>'`
                           `<Device ID>'<Filename>`

| Argument | Type and Size | Description |
|---|---|---|
| *Tag* | (ASCII-16-A) | A file name of the form `<MJD>_<Reference Number>`. See section 5.7.2 for more information. |
| *Start Byte* | (ASCII-15-#) | The byte offset within the file to start retrieval at. |
| *Length* | (ASCII-15-#) | The number of bytes to copy. This is limited to the free space on the target removable storage device. |
| *Block Size* | (ASCII-15-#) | The number of bytes to copy before moving on to the next file. The files created by this command will be exactly Block Size bytes with the exception of the last, which will be determined by the *Length* specified. |
| *Storage ID* | (ASCII-64-A) | Linux partition ( e.g. /dev/sdf1 ) of an attached external storage device. The device/partition must be formatted with the EXT2 file system to be properly recognized and usable. |
| *Filename* | (ASCII-128-A) | The name of a file series to create. Acceptable characters are letters, numbers, the underscore and period. Each file, including the first, will be named `<Filename>.X`, where X is a zero-padded serial identifier. The width – in characters – of X will be determined by the number of digits required to represent the largest id generated, and subject to the name length restriction of 128 characters. |

### 5.7.8 FMT

Command:         Format

Description:      This command formats either internal storage, or an attached external storage device. When formatting an external device, the operation can require a substantial amount of time, proportional to the size of the device. To determine whether a format command completed, poll the OP-INFO MIB entry until it no longer indicates that an operation is in progress, and then request the REMOVABLE-DEVICES MIB entry. If the command was successful, the available space on the device will reflect the formatted size. If unsuccessful, the reported size will be 0.

Argument Format:    `<Storage ID>`*optional*

| Argument | Type and Size | Description |
|----------|---------------|-------------|
| *Storage ID* | (ASCII-64-A) | Optional argument specifying an external storage device's partition. If omitted, the command will format internal storage. In both cases, it is a destructive operation and all data on the target is erased. Formatting unpartitioned devices is not supported, though it may be in the future. |

### 5.7.9 DWN

Command:         Down (internal storage)

Description:      This command prepares the MCS-DR's internal storage for removal/replacement. The command is executed immediately, but requires a few seconds to complete. Storage device must not be disconnected within this time as data may be lost. It is recommended to wait at least a full minute after the DWN command has been issued before disconnecting the storage device.

### 5.7.10 UP

Command:         Up (internal storage)

Description:      This command brings internal storage back online. If the MCS-DR cannot determine necessary file system information, this command will be rejected and no changes will be made.

### 5.7.11 SEL

Command:              Select DRSU (internal storage)

Description:         This command selects an alternate DRSU to use as internal storage. Current hardware limits the number of DRSUs to two. The MCS-DR must be idle with no scheduled operations, and the DRSU's must be previously prepared and detected by DROS. Detected DRSUs will have an MIB entry under DRSU-INFO-X.

Argument Format:  `<DRSU Number>`

| Argument | Type and Size | Description |
|---|---|---|
| *DRSU Number* | (ASCII-2-#) | Specifies which DRSU to activate. The first is 0, second is 1, etc. These numbers correspond to X in MIB entries DRSU-INFO-X. |

### 5.7.12 BUF

Command:           Live Capture Buffer Set-up

Description:      The BUF command initializes the live capture buffer parameters to take effect at the start of the next recording. The live capture buffer can store upto 100ms of data and can be triggered once or periodically. The dimensions of the buffer can be specified in milliseconds or in integral packet increments. The parameters which define the buffer may be reused with subsequent recordings or may be tied to the length of the recording, as needed. The contents of the buffer are overwritten unless retrieval using the 'BUFFER' or 'BUFFER-RESTRICT' MIB entries. In this case, the contents are held until the entire buffer is retrieved, and captures triggered meanwhile are written to a shadow buffer.

Example:           " `TTAAH 0000000000000021 0000000000000050  0000000000000500`"
Buffer the first 50 ms of each 500 ms of data, starting 21 ms into the recording, and to hold the data until a new recording starts.

Argument Format:  `<OffsetType><WidthType><Retrigger><Order>`
                       `<Behaviour>'<Offset>'<Width>'<Interval>`

| Argument | Type and Size | Description |
|---|---|---|
| *OffsetType* | (ASCII-1-A) | Specifies whether *Offset* and *Interval* are measured in milliseconds ( 'T' ) or in packet counts ( 'I' ). |
| *WidthType* | (ASCII-1-A) | Specifies whether *Width* is measured in milliseconds ( 'T' ) or in packet counts ( 'I' ). |
| *Retrigger* | (ASCII-1-A) | Specifies whether capture is periodic ( 'A' ) or one-shot ( 'N' ). If 'N' and settings are reused, then capture will trigger once each new recording. |
| *Order* | (ASCII-1-A) | Specifies whether packets are captured before ( 'B' ) data formatting is applied or after ( 'A' ). See MIB branch 7 regarding data formats. |
| *Behaviour* | (ASCII-1-A) | Determines behaviour when a recording ends. There are three possibilities: 'D' - delete contents, reuse settings; 'H' - hold contents, reuse settings; and 'R' - hold contents, no reuse. The first deletes any buffered data between each recording and recreates/resizes the buffer for each subsequent recording. The second option holds the buffer's contents until a new recording is started. The last option hold's the buffer's contents indefinitely and stops live capture until a BUF command is issued. |
| *Offset* | (ASCII-16-#) | Offset from the beginning of the recording to trigger the first ( and possibly only ) capture. Indicates a number of milliseconds or number of packets, interpretation is determined by *OffsetType*. |
| *Width* | (ASCII-16-#) | Determines capture length in milliseconds or packets interpretation is determined by *WidthType*. |
| *Interval* | (ASCII-16-#) | Determines interval, in milliseconds or packets, between subsequent captures when *Retrigger* is set to always. Interpretation is determined by *OffsetType*. Must be much greater than *Width* to facilitate retrieval ( preferably on the order of seconds or minutes ). |

### 5.7.13 SYN

Command:       Synchronize
Description:   This command explicitly synchronizes the MCS-DR with the station NTP time server. Executing this command while operations are scheduled or in progress may result in recording more or less data than desired, as well as shifting the times at which they occur. Such deviations should be minor, but no guarantees are made to that effect.

### 5.7.14 TST

Command:            Self Test
Description:        Perform a system self-test. This command is used solely for development purposes and is not supported by this ICD. This command will be removed from release systems.
Argument Format:   N/A
Response Format:   N/A

## 5.8 Error Messages

| Error Message | Error Description |
| --- | --- |
| Operation not permitted | Operations scheduled or in progress prevent the execution of this command. |
| Invalid Name | The specified *Format Name* contains illegal characters. |
| Format Already Defined | The specified *Format Name* is already in use. |
| Invalid Size | Specified *UDP Packet Payload Size* exceeds the maximum allowable size–determined by the Ethernet Jumbo Frames MTU less MAC, IP, and UDP header data. Specified limit is 8192 bytes. |
| Invalid Rate | The *Rate* specified exceeds the capabilities of the system, or the calculated actual rate exceeds the capabilities of the system. Currently this threshold is set at 120 MiB/s, and rates above 115 MiB/s are not supported and can not guarantee data will be recorded successfully. |
| Already Up | Internal storage is already online. |
| Not Detected | Internal storage was not detected. |
| Cannot Start | File system information was not detected on the device. |
| Already Down | Internal storage is already offline. |
| Invalid Storage ID | The *Storage ID* specified does not exist in the system. |
| File not found | The *Tag* value supplied does not refer to any file on internal storage. |
| Invalid Filename | The *Filename* specified contains illegal characters. |
| Invalid Position | The requested *Start Byte* and *Length* exceeds the size of the file. |
| Invalid Range | The requested *Length* exceeds response size limitations. |
| Not Scheduled | The specified *Tag* neither refers to any scheduled recording, nor to any existing recordings. |
| Already Stopped | The *Tag* value refers to a recording which has already completed. |
| Invalid Time | The requested time frame is either in the past or too far into the future. |
| Time Conflict: `<Operation>` | The requested time frame overlaps a scheduled operation. *Operation* lists the first scheduled operation which causes a conflict, and is formatted as with the SCHEDULE-ENTRY-X MIB entry ( see section 5.5.11 ). |
| Unknown Format: `<Format>` | The specified *Format* has not been defined and cannot be used. |
| Insufficient Drive Space | The amount of storage space required for the requested recording exceeds the remaining space on internal storage, or it exceeds the amount of the largest contiguous block of free-space. |
| Component Not Available: `<X>` | Some internal component *X* of the MCS-DR is unavailable, unusable, or malfunctioning. |

# 6 Control and Monitoring Session Examples

The following examples walk through a usage scenario and demonstrate the types of command and monitor messages needed to operate the MCS-DR as well as the responses and error messages that might be generated. It should be noted that the error conditions in the scenario are atypical, and are included for the sake of demonstrating the interface. In the following examples, a single quote is used to denote spaces appearing in arguments and responses. Subsystem ID is assumed to be "MD1" in these examples.

The example starts by checking system status to which the MCS-DR responds that it is booting. MCS then requests initialization but MCS-DR discovers that internal storage is missing and responds to that effect. MCS issues an UP command to bring storage online, and the MCS-DR is able to comply and fix the problem. MCS then schedules a recording and checks to verify that the recording was scheduled. Once the recording begins, the MCS checks the status of the operation. Once the operation is complete, MCS requests that the MCS-DR copy a portion of the new recording to an external storage device.

## 6.1 Checking System Status

### Message:

Type
Reference
Sender
Destination

Data Length
MJD
MPM
Data

| MD1 | MCS | PNG | `````1234 | ```0 | `54828 | `12345678 | ` |

*<empty>*
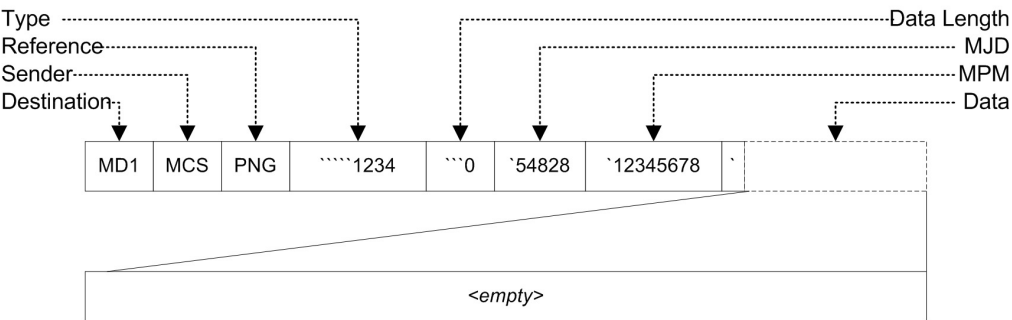
Description: MCS sends a "PNG" request to MCS-DR PC #1 with reference designator "MD1". The data field is empty and consequently, the Data Length field is set to 0.

### Response:

Data Length
Type
Reference
Sender
Destination

MJD
MPM
R-Response
R-Summary
R-Comment

| MCS | MD1 | PNG | `````1234 | ```8 | `54828 | `12345679 | ` | A | BOOTING |

<empty>
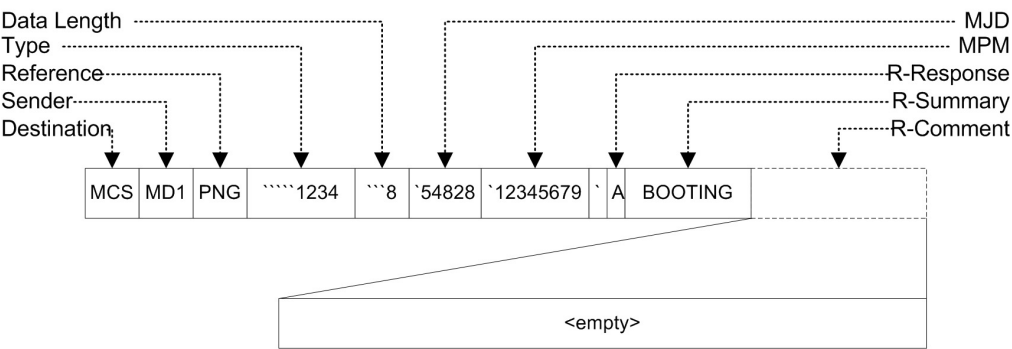
Description: MCS-DR PC #1 responds, acknowledging acceptance of the message, and with the status of "BOOTING". R-Comment is empty, and thus the Data Length returned is 1+7, or 8.

Figure 3: Example of checking system status

## 6.2 Requesting Initialization ( w/ Error Response )

Message:
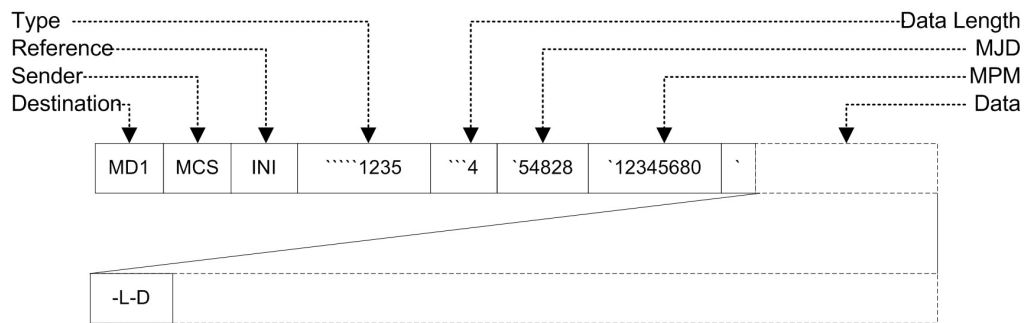
| Type | | | | | | | | | Data Length |
| Reference | | | | | | | | | MJD |
| Sender | | | | | | | | | MPM |
| Destination | | | | | | | | | Data |

| MD1 | MCS | INI | `````1235 | ```4 | `54828 | `12345680 | ` | |

| -L-D | |

Description: MCS requests initialization of the system with the "-L" and "-D" options. The options specified request that the MCS-DR clear its internal log and any previously recorded data.

Response:

| Data Length | | | | | | | | | MJD |
| Type | | | | | | | | | MPM |
| Reference | | | | | | | | | R-Response |
| Sender | | | | | | | | | R-Summary |
| Destination | | | | | | | | | R-Comment |

| MCS | MD1 | INI | `````1235 | ``49 | `54828 | `12345681 | ` | R | WARNING | |

| Component Not Available: Internal Storage | |
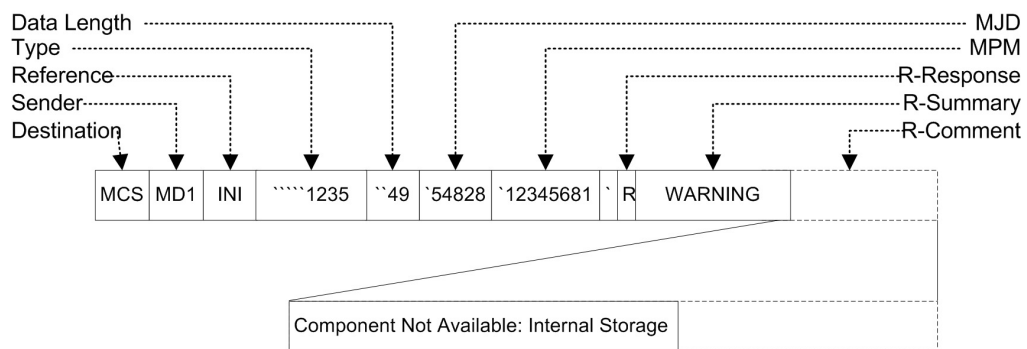
Description: The MCS-DR is not able to comply with the request, and a rejection response is sent. In this scenario, previous commands had taken the internal storage offline for replacement. The storage had since been replaced, but no request to "UP" the storage had been made.

Figure 4: Example of requesting initialization ( w/ Error Response )

## 6.3   Up-ing Internal Storage

### Message:

Type ---------------------------------------------- Data Length
Reference -------------------------------------------- MJD
Sender ------------------------------------------------ MPM
Destination ------------------------------------------- Data

| MD1 | MCS | UP` | `````1236 | ```0 | `54828 | `12345682 | ` |
|-----|-----|-----|-----------|------|--------|-----------|---|

| *<empty>* |
|-----------|

**Description:**   MCS is requesting that the MCS-DR bring the internal storage online with this message.

### Response:

Data Length --------------------------------------------------------- MJD
Type ---------------------------------------------------------------- MPM
Reference ------------------------------------------------- R-Response
Sender -------------------------------------------------------- R-Summary
Destination --------------------------------------------------- R-Comment

| MCS | MD1 | UP` | `````1236 | ``23 | `54828 | `12345683 | ` | A | NORMAL |
|-----|-----|-----|-----------|------|--------|-----------|---|---|--------|

| ``4810963102655 |
|-----------------|
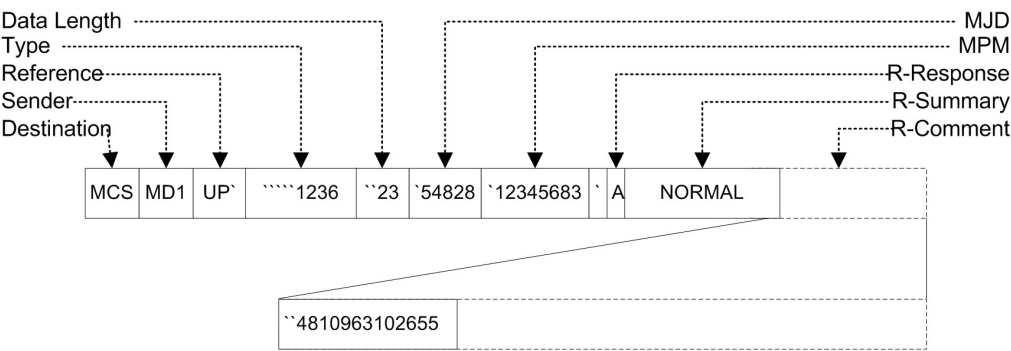
**Description:**   MCS-DR responds with an acceptance message, and internal storage is brought online. The R-Comment field contains the amount of storage space available in bytes— in this case, just under 5 TB.

Figure 5: Example of bringing internal storage online

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## 6.4 Requesting Initialization

### Message:
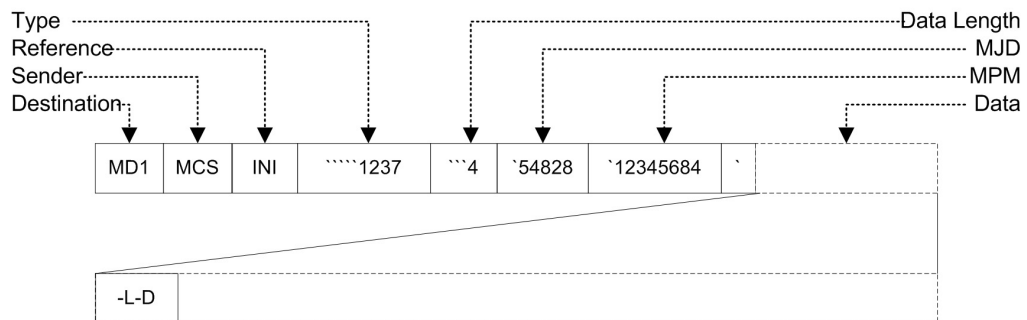
Type — — — — — — — — — — — — — — — — — — — — — — — — — — Data Length
Reference — — — — — — — — — — — — — — — — — — — — — — — — — MJD
Sender — — — — — — — — — — — — — — — — — — — — — — — — MPM
Destination — — — — — — — — — — — — — — — — — — — — — Data

| MD1 | MCS | INI | `````1237 | ```4 | `54828 | `12345684 | ` |

| -L-D |

**Description:** MCS requests initialization of the system with the "-L" and "-D" options. The options specified request that the MCS-DR clear its internal log and any previously recorded data.
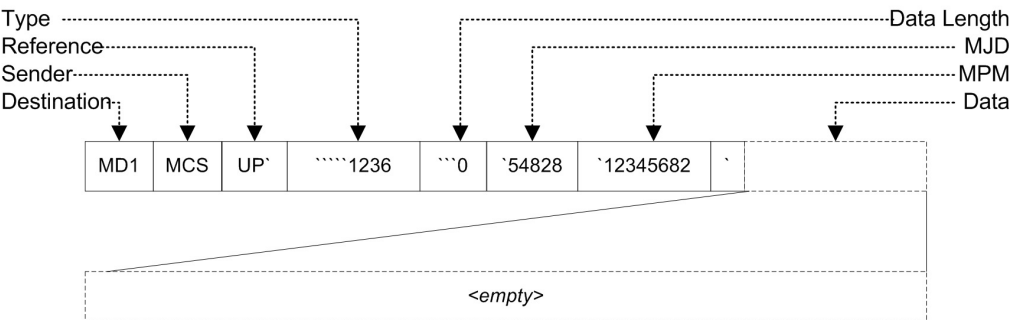
### Response:

Data Length — — — — — — — — — — — — — — — — — — — — — — — MJD
Type — — — — — — — — — — — — — — — — — — — — — — — — — MPM
Reference — — — — — — — — — — — — — — — — — — — — — — R-Response
Sender — — — — — — — — — — — — — — — — — — — — — R-Summary
Destination — — — — — — — — — — — — — — — — — — R-Comment

| MCS | MD1 | INI | `````1237 | ```8 | `54828 | `12345685 | ` | A | NORMAL |

| *<empty>* |
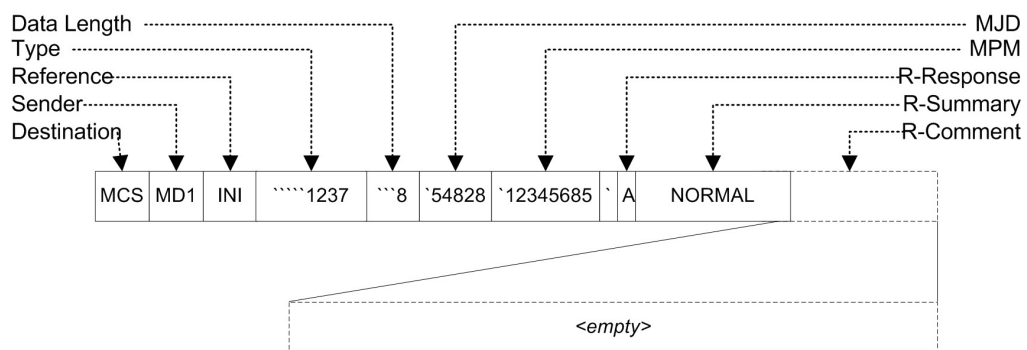
**Description:** This time, the MCS-DR is able to comply, and has started the initialization process, responding with an acceptance message. The initialization process may take several minutes, and the status can be checked by requesting MIB entry 2.1 (not demonstrated in this scenario).

Figure 6: Example of requesting initialization

## 6.5   Scheduling a Recording

### Message:

Type ........................................................... Data Length
Reference ........................................... MJD
Sender ............................................ MPM
Destination ................................... Data

| MD1 | MCS | REC | `````1238 | ``39 | `54828 | `12345686 | ` |
|-----|-----|-----|-----------|------|--------|-----------|---|

| `54828 | ` | `12380000 | ` | ````20000 | ` | TBN_1024_112 |
|--------|---|-----------|---|-----------|---|--------------|

**Description:**   Here, the MCS is requesting that the MCS-DR schedule a recording of 20000 ms of data starting at MPM=12380000 using the TBN_1024_112 format.

### Response:

Data Length ........................................ MJD
Type ........................................ MPM
Reference ................................ R-Response
Sender ............................... R-Summary
Destination ...................... R-Comment

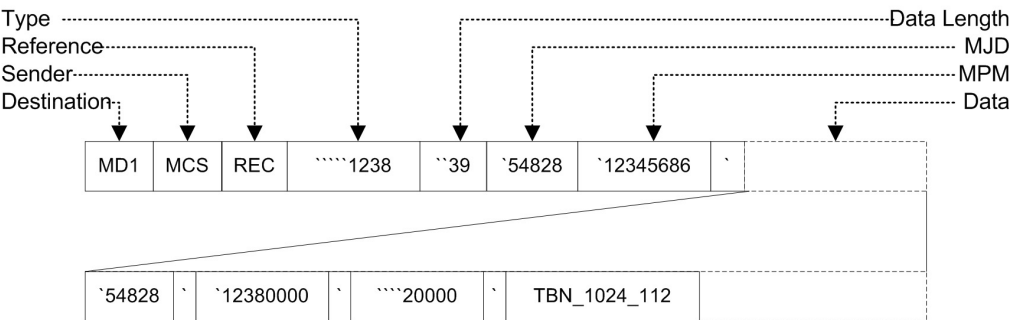| MCS | MD1 | REC | `````1238 | ``24 | `54828 | `12345687 | ` | A | NORMAL |
|-----|-----|-----|-----------|------|--------|-----------|---|---|--------|

| 054828_000001238 |
|------------------|
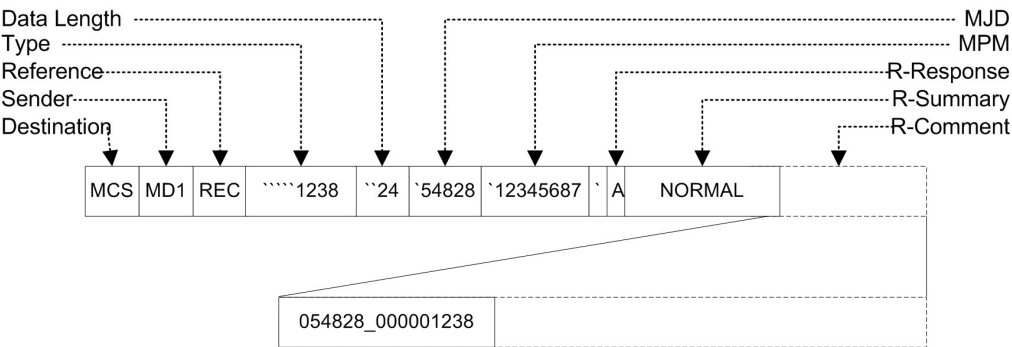
**Description:**   The MCS-DR responds with an acceptance message indicating the recording has been successfully scheduled. The content of the R-Comment field indicates a *Tag* value which can later be used to identify the file in conjunction with other commands.

Figure 7: Example of scheduling a recording

## 6.6   Checking Scheduled Operations

## Message:

Type ----------------------------------------------------------------- Data Length
Reference------------------------------------------------------------- MJD
Sender----------------------------------------------------------------- MPM
Destination------------------------------------------------------------ Data

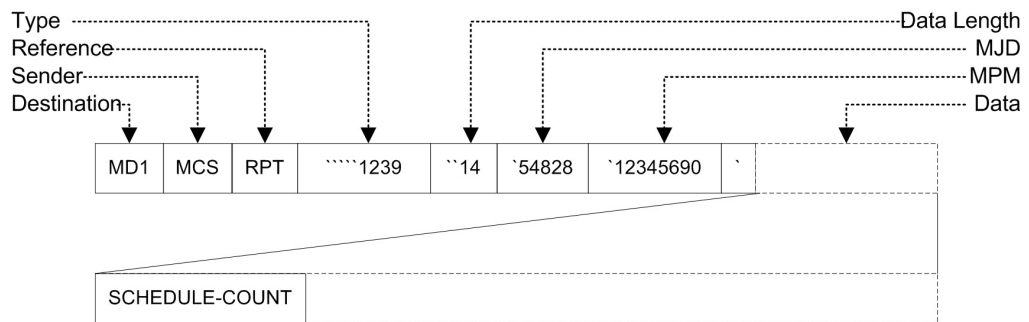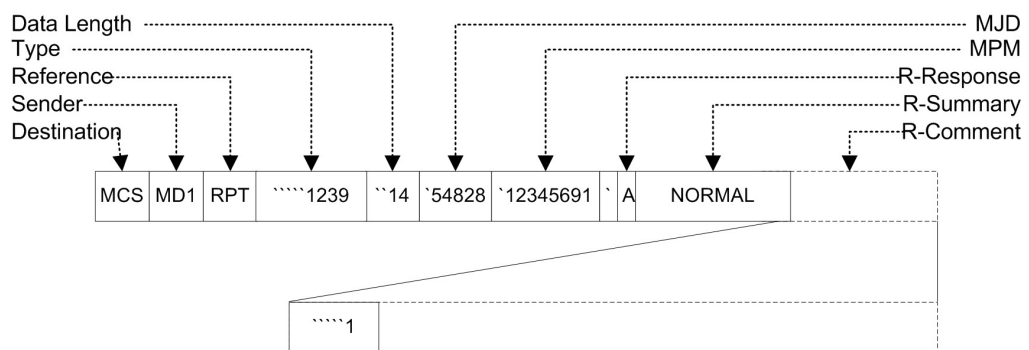| MD1 | MCS | RPT | `````1239 | ``14 | `54828 | `12345690 | ` |
|-----|-----|-----|-----------|------|--------|-----------|---|

| SCHEDULE-COUNT |
|----------------|

**Description:**   Here, the MCS is making sure the recording is scheduled by checking the number of scheduled recordings (MIB entry 3.1).

## Response:

Data Length ------------------------------------------------------------ MJD
Type ------------------------------------------------------------------- MPM
Reference-------------------------------------------------------------- R-Response
Sender----------------------------------------------------------------- R-Summary
Destination------------------------------------------------------------ R-Comment

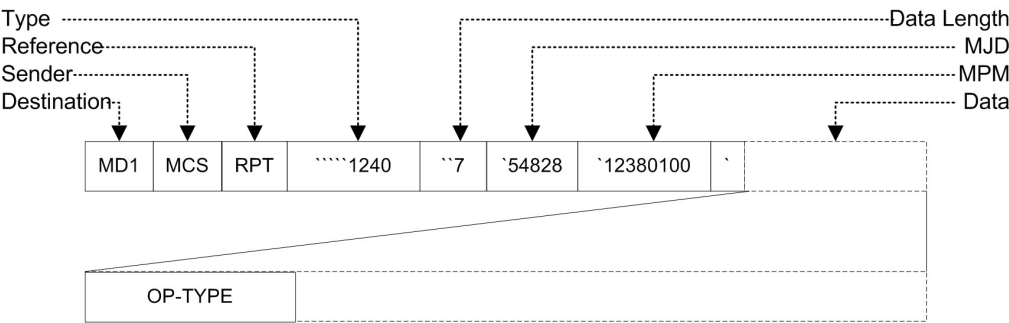| MCS | MD1 | RPT | `````1239 | ``14 | `54828 | `12345691 | ` | A | NORMAL |
|-----|-----|-----|-----------|------|--------|-----------|---|---|--------|

| `````1 |
|--------|

**Description:**   MCS-DR reports that there are 1 operations scheduled. Requesting additional MIB entries under the SCHEDULE branch will provide details of the specific operation, but that is not demonstrated in this scenario.

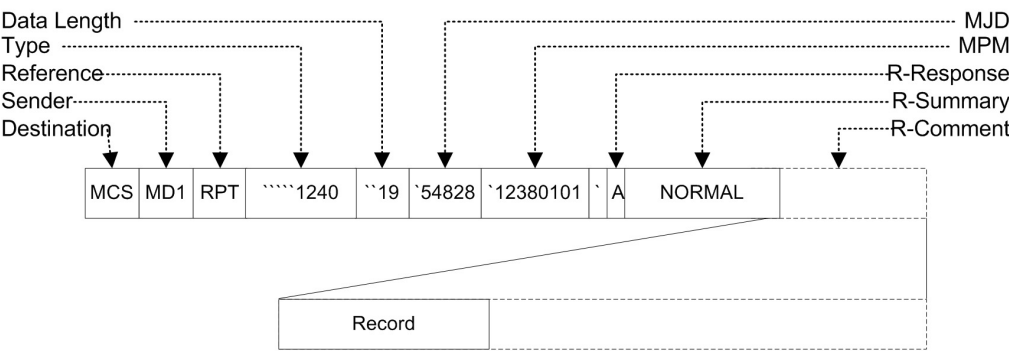Figure 8: Example of checking the recording schedule

## 6.7 Checking An Operation's Progress

Message:

Type ----------------------------------------------------------------------------------- Data Length
Reference----------------------------------------------------------------- MJD
Sender------------------------------------------------- MPM
Destination------------- Data

| MD1 | MCS | RPT | `````1240 | ``7 | `54828 | `12380100 | ` |
|-----|-----|-----|-----------|-----|--------|-----------|---|

| OP-TYPE | |
|---------|---|

Description: While the recording is running, MCS verifies that the MCS-DR is recording by requesting MIB entry 2.1, expecting the response "Record".

Response:

Data Length ------------------------------------------------------------------------ MJD
Type ----------------------------------------------------------------------- MPM
Reference---------------------------------------------------- R-Response
Sender----------------------------------------- R-Summary
Destination------------------- R-Comment

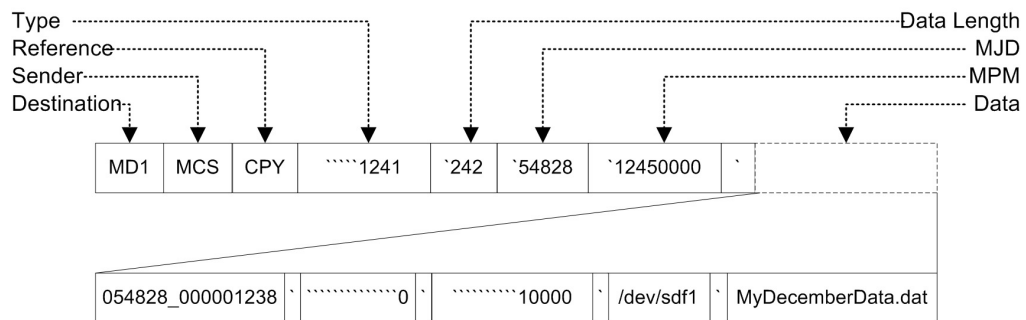| MCS | MD1 | RPT | `````1240 | ``19 | `54828 | `12380101 | ` | A | NORMAL |
|-----|-----|-----|-----------|------|--------|-----------|---|---|--------|

| Record | |
|--------|---|

Description: MCS-DR responds with "Record" indicating that an operation is in progress, and it is a recording operation. More information regarding the current operation can be retrieved by requesting other branch 2 MIB entries, but they are not shown in this scenario.

Figure 9: Example of checking that an operation is in progress as scheduled
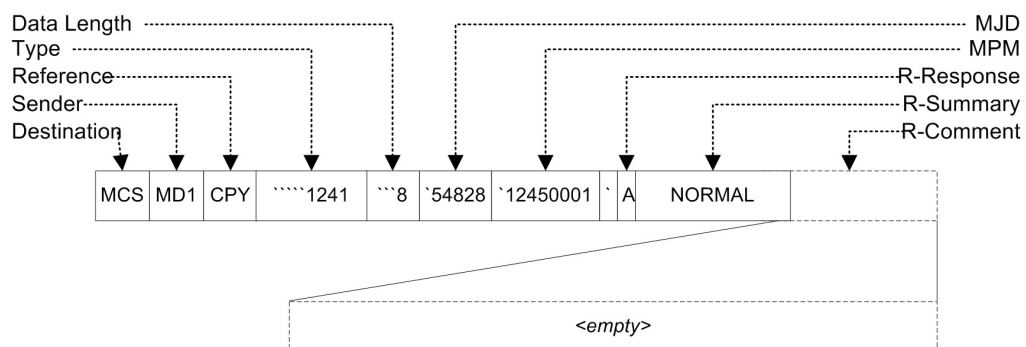
## 6.8 Retrieving Recorded Data

### Message:

Type, Reference, Sender, Destination, Data Length, MJD, MPM, Data

| MD1 | MCS | CPY | `````1241 | `242 | `54828 | `12450000 | ` |

| 054828_000001238 | ` | ``````````0 | ` | `````````10000 | ` | /dev/sdf1 | ` | MyDecemberData.dat |

**Description:** Here, the MCS is requesting that data be copied from recording 054828_000001238 to "/dev/sdf1/ MyDecemberData.dat" starting with the first byte and continuing for 10000 bytes. *Note that padding spaces are not shown for Storage ID and Filename, but either left or right padding spaces are fine.* Spaces contained between the first and last non-space character are interpreted as part of the filename or storage id. Rules and semantics concerning such spaces are defined by the Ubuntu Linux operating system.

### Response:

Data Length, Type, Reference, Sender, Destination, MJD, MPM, R-Response, R-Summary, R-Comment

| MCS | MD1 | CPY | `````1241 | ```8 | `54828 | `12450001 | ` | A | NORMAL |

| *<empty>* |

**Description:** The MCS-DR returns an acceptance response and begins copying the data.

Figure 10: Example of using the copy command to retrieve data

# 7   Change Record

| Version | Date | Affected Section(s) | Reason/Description |
|---|---|---|---|
| 1.1 | 2010-07-02 | 4 (inserted), 5.4, 5.5, 5.9 | Fixed typos. UP command response no longer returns TOTAL-STORAGE nor supports the "-F" option. DWN command completes faster. HDD-TEMP-X command description updated to reflect non-reporting hardware in some MCS-DRPCs. |
| 1.0 | 2010-02-21 | MIB, MIB Detail, Command, Command Detail | Added commands: 'BUF', 'SEL'. Added MIB entries: 'DRSU-COUNT', 'DRSU-SELECTED', 'DRSU-INFO-X', 'BUFFER', 'BUFFER-RESTRICT'. Added description of NTP synching behaviour. Fixed couple of formatting issues. |
| 0.5 | 2010-01-28 | MIB, MIB Detail, Command, Command Detail | Final draft of document, removed EJT command and OP-ERROR. |
| 0.4 | 2009-10-10 | All | Fourth draft of document, removed image matte, removed references to development-stage diagnostics except "TST", revised electrical connections view to not imply a specific mounting requirement, updated argument and response formats to separate all parameters with spaces, updated use-case example to reflect new formats, rewrote FORMAT-SPEC-X description to remove ambiguity. |
| 0.3 | 2009-10-04 | All | Third draft of document, restructured MIB to remove the "MORE" entry. Removed the "DFD" command. Added mechanical and electrical figures and use-case scenario examples. |
| 0.2 | 2009-09-24 | All | Second draft of document, corrected typos and removed extraneous material. |
| 0.1 | 2009-09-12 | All | Initial draft of document. |

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