Remote Communication

1.36

Contents

Chapter 1

Introduction

The following sections forms the Remote Communications user manual:

- Section Remote Communication discusses how to download install drivers for your platform.
- Section Getting Started tells you how to generate your first piece of communication quickly.
- Section Remote Commands lists all the available commands and it's uses.

Chapter 2

Remote Communication

The CRI colorimeters comes standard with a well documented, easy to learn, pseudo english language based, command interpreter to control all aspects of it's operation using a computer, tablet or a smart device, making it a easy for customers to create their own software dedicated to perform specific measurement tasks or for inclusion in an Automated Test Environment. In addition, a fully documented communication and calculation libraries with numerous real world sample templates are included as starting points for building your own software tools using any of the modern computer development environments such as Visual Studio, Xcode etc.

2.1 Installing Drivers

On some platforms a device driver is necessary for the instrument to be recognized by the operating system. This will be available as part of your installer.

2.1.1 Windows

To identify the Serial Port assigned,

1. Click on the Start Orb or button. 

2. In the Start Search box type: device manager and then press enter and you should see something similar to the below example.

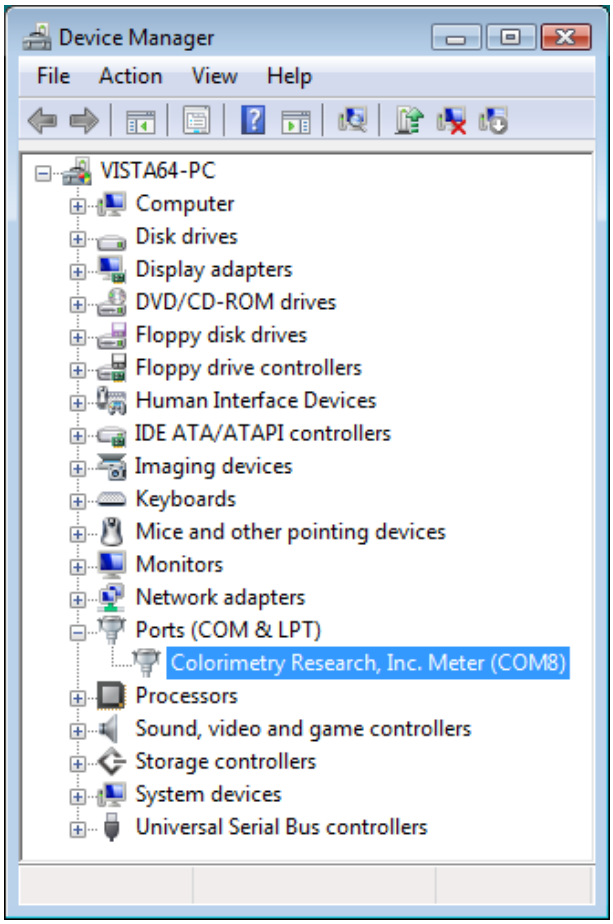

Figure 2.1: Device Manager

2.1.2 OSX

There is no USB drivers required for use with OSX

2.2 Remote Communication

A remote message consists of a *command* and an optional *key/value* followed by a [CF] or [LF] or [CF][LF] which is represented by a ← in this documentation. A command must begin with a root character. A root character also represents a command category.

Note

Remote messages are case-sensitive.

A format of a complete remote message is

`[ROOT][EXTENSION] [KEY] [VALUE]←`

There are four different command formats

- **Primary command**

A primary command consists of only the root character

Examples of primary commands are

E←

and

M←.

- **Secondary command**

Secondary command consists of root and extension characters.

Examples of a secondary command is

MF←

- **Tertiary command**

Tertiary commands consists of a secondary command followed by a **space** and a **key**.

Examples of tertiary commands are

>RC Time←

- **Complex command**

A complex command is a secondary command followed by a **key** and a **value** pair seperated by **spaces**.

Example of complex command is

>SM Accessory 0←

The response of a remote message is detailed in Response

Detailed descriptions of remote messages explaining the *root*, *extension*, *key*, *value(s)* are described in the Remote Commands section.

Sample Command Syntax

>R__ K,V1,V2←

The following table summarizes the high level categories in the Remote communication language.

Root	Description
E	Echo Command
S	Setup Commands
R	Read Commands
M	Measure Commands

2.2.1 Response

Every message is reciprocated with a success or a failure response.

Success

A successful message returns with the following response along with the message result if any.

OK:***code***:***response***←

Examples:

For the message
>SM Accessory 0←
your response would be as follows
OK:0:Accessory:No errors

Failure

Error responses are in the following format

`ER:`***`code`***`:`***`description`***`:`***`message`***`←`

Examples:

For the message
`>SM Accessory←`
if you typed incorrectly
`>SM Accessory1←` your response would be as follows
`ER:-500:Invalid command:Accessory1←`

2.2.2 Coding

The preferred method of dispatching commands to the instrument is sequential and polling to verify the command returns with a valid result or an error. Each command should return fairly quickly except for the measurement commands. For the measurement command the time out should be a multiple of the exposure time and the exposure multiplier/average. If an event driven approach is taken certain commands causes the command queue to ignore commands till the commands are processed. Care should be taken as a limited buffer is available to queue incoming commands. For eg. the M command ignores all other M command till it finishes the current measurement. Also another example is the RM Spectrum command, here a small delay is required preferrable 200ms to allow the command to finish processing before a new command is queued.

Chapter 3

Getting Started

3.1 Getting started with the Terminal Software

3.1.1 Windows®

Windows PowerShell

```
C:\>powershell
PS> Get-WMIObject Win32_SerialPort | Select-Object Name,DeviceID,Description
```

Windows Management Instrumentation Command-line (WMIC)

```
C:\>wmic path Win32_SerialPort Where "Caption LIKE '%COM%'" Get DeviceID
```

3.1.1.1 Hyper Terminal

```
Hyper Terminal
```

3.1.1.2 Windows®: PuTTY

```
PuTTY
```

3.1.2 OS X

3.1.2.1 screen

```
screen
```

Note

While using screen you will have to close the screen session by using Ctrl + A + k or Ctrl + A + \ to disconnect free up any serial port resources.

OS X terminal, list the available serial devices

```
ls /dev/cu*
```

3.2 Getting started with Remote messaging

As soon as a connection is established in any of the terminal applications or using a programming language, the instrument is ready to accept commands.

If you are running in an interactive shell it's best if you turn on duplex mode using the Echo Command. This command will prompt >.

The remote command

>M

Takes a measurement.

See Also

M

>RM xy

Reports a measurement's CIE 1931 xy parameters.

See Also

Read Measurement Commands

Chapter 4

Remote Commands

4.1 Echo Command

Since

Firmware 1.03.

When typing out commands on a terminal sometimes sss hard to know what you type. To make communication intuitive the instrument can be instructed to remotely echo the sent commands received back to the sender. The E command toggles the ECHO of characters from the remote instrument.

To turn on/off ECHO send the E character

E←

Result: ECHO is **ON** the > prompt is echoed on to the terminal. ECHO is **OFF** nothing is echoed on the terminal.

Warning

When communicating with an automated system ensure that the ECHO is turned OFF in order to prevent confusing the controlling software.

4.2 Setup Commands

The setup command set is used to specify measurement and hardware (instrument) properties.

See Also

Read Commands.

S Commands	Description
SM	Measurement Setup Commands
SH	Hardware Setup Commands
SC	Computation Setup Commands

4.2.1 Measurement Setup Commands

The measurement setup command set is used to specify measurement properties.

Quick Reference

Key	Description
Accessory	Selects the accessory using its identifier
Filter1	Selects the 1st filter using its identifier
Filter2	Selects the 2nd filter using its identifier
Filter3	Selects the 3rd filter using its identifier
Aperture	Selects the aperture using its identifier
Mode	Selects the instrument mode
ExposureMode	Selects the exposure mode
Exposure	Selects the exposure
MaxAutoExposure	Selects the maximum auto exposure limit
RangeMode	Selects the range mode
Range	Selects the range
SyncMode	Selects the sync mode
SyncFreq	Selects the Sync Frequency
ExposureX	Selects the exposure multiplier
MatrixMode	Selects the matrix mode. *Deprecated as of Firmware 1.16.*
UserCalibMode	Selects the user calibration mode.
Matrix	Selects the calibration matrix
Match	Selects the match calibration
Speed	Selects the speed
SamplingRate	Selects the sampling rate
MaxFreqFlickerSearch	Sets the Maximum Frequency Flicker Search
CMF	Selects the color matching function
Reset	Resets the instrument setup parameters to factory defaults.

4.2.1.1 SM Accessory

Syntax

```
SM Accessory [ID]←
```

Selects the accessory using its ID.

See Also

RC Accessory lists all available accessories and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Accessory 0
OK:0:Accessory:No errors
>SM Accessory -1
ER:-506:Accessory:Index doesn't select an Accessory
```

4.2.1.2 SM Filter1

Syntax

```
SM Filter1 [ID]←
```

Selects the 1st filter using its ID.

See Also

RC Filter lists all available filters and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Filter1 3
OK:0:Filter1:No errors
>SM Filter1 0
ER:-507:Filter1:Index doesn't select a Filter
```

4.2.1.3 SM Filter2

Syntax

```
SM Filter2 [ID]←
```

Selects the 2nd filter using its ID.

See Also

RC Filter lists all available filters and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Filter2 3
OK:0:Filter2:No errors
```

4.2.1.4 SM Filter3

Syntax

```
SM Filter3 [ID]←
```

Selects the 3rd filter using its ID.

See Also

RC Filter lists all available filters and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Filter3 3
OK:0:Filter3:No errors
```

4.2.1.5 SM Aperture

Syntax

```
SM Aperture [ID]←
```

Selects the aperture using its ID.

See Also

RC Aperture lists all available apertures and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Aperture 0
OK:0:SM Aperture:No errors
>SM Aperture -1
ER:-554:SM Aperture:Invalid argument:-1
>SM Aperture 1
ER:-515:SM Aperture:Index doesn't select an Aperture
```

4.2.1.6 SM Mode

Syntax

```
SM Mode [ID]←
```

Selects the Instrument Mode using its ID.

See Also

RC Mode lists all available instrument modes and their IDs.

Since

Firmware 1.16.

Examples

```
>SM Mode 0
OK:0:SM Mode:No errors
>SM Mode -1
ER:-560:SM Mode:Invalid Instrument Mode
```

4.2.1.7 SM ExposureMode

Syntax

```
SM ExposureMode [ID]←
```

Selects the exposure mode using its ID.

See Also

RC ExposureMode lists all available exposure modes and their IDs.

Since

Firmware 1.04.

Examples

```
>SM ExposureMode 0
OK:0:ExposureMode:No errors
>SM ExposureMode -1
ER:-518:ExposureMode:Invalid Exposure Mode
```

4.2.1.8 SM Exposure

Syntax

```
SM Exposure [exposure in msecs]←
```

Selects the exposure in msecs. This exposure is used only when the Exposure Mode is set to manual.

See Also

RC MinExposure and RC MaxExposure provides the range of exposures.

Since

Firmware 1.04.

Examples

```
>SM Exposure 10
OK:0:Exposure:No errors
>SM Exposure 1000000
ER:-519:Exposure:Invalid Exposure value
```

4.2.1.9 SM MaxAutoExposure

Syntax

```
SM MaxAutoExposure [exposure in msecs]←
```

Selects the maximum auto exposure limit in msecs. The exposure is limited to the maximum auto exposure limit when the Exposure Mode is set to auto.

See Also

RC MinExposure and RC MaxExposure provides the range of max auto exposure limit.

Since

Firmware 1.26.

Examples

```
>SM MaxAutoExposure 400
OK:0:MaxAutoExposure:No errors
```

4.2.1.10 SM RangeMode

Syntax

```
SM RangeMode [ID]←
```

Selects the range mode using its ID.

See Also

RC RangeMode lists all available range modes and their IDs.

Since

Firmware 1.04.

Examples

```
>SM RangeMode 0
OK:0:RangeMode:No errors
>SM RangeMode -1
ER:-512:RangeMode:Invalid Range mode
```

4.2.1.11 SM Range

Syntax

```
SM Range [ID]←
```

Selects the range using its ID. This is used only when the Range Mode is set to manual.

See Also

RC Range lists all available ranges and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Range 1
OK:0:Range:No errors
>SM Range -1
ER:-513:Range:Invalid Range index
```

4.2.1.12 SM SyncMode

Syntax

```
SM SyncMode [ID]←
```

Selects the sync mode using its ID.

See Also

RC SyncMode lists all available sync modes and their IDs.

Since

Firmware 1.04.

Examples

```
>SM SyncMode 0
OK:0:SyncMode:No errors
>SM SyncMode -1
ER:-521:SyncMode:Invalid Sync Mode
```

4.2.1.13 SM SyncFreq

Syntax

```
SM SyncMode [frequency in Hz.]←
```

Selects the Sync Frequency in Hz. This is used only when the Sync Mode is set to manual.

Since

Firmware 1.04.

Examples

```
>SM SyncFreq 10
OK:0:SyncFreq:No errors
>SM SyncFreq 0
ER:-522:SyncFreq:Invalid User Sync Frequency
```

4.2.1.14 SM ExposureX

Syntax

```
SM ExposureX [exposure multiplier]←
```

Selects the exposure multiplier.

See Also

RC MinExposureX and RC MaxExposureX provides the range of values that can be set.

Since

Firmware 1.04.

Examples

```
>SM ExposureX 1
OK:0:ExposureX:No errors
>SM ExposureX 0
ER:-514:ExposureX:Invalid Exposure Multiplier
```

4.2.1.15 SM MatrixMode

Syntax

```
SM MatrixMode [ID]←
```

Selects the matrix mode using its ID.

Matrix Mode values

- **0**: Disabled
- **1**: Enabled

Since

Firmware 1.04.

Deprecated SM MatrixMode has been deprecated for SM UserCalibMode as of Firmware 1.16

Examples

```
>SM MatrixMode 0
OK:0:MatrixMode:No errors
>SM MatrixMode -1
ER:-552:MatrixMode:Invalid Matrix Mode
```

4.2.1.16 SM UserCalibMode

Syntax

```
SM UserCalibMode [ID]←
```

Selects the user calibration mode using its ID.

User Calibration Mode values

- **0**: None or Disabled
- **1**: Matrix Calibration
- **2**: Match Calibration

Since

Firmware 1.16.

Examples

```
>SM UserCalibMode 0
OK:0:UserCalibMode:No errors
>SM UserCalibMode -1
ER:-552:SM UserCalibMode:Invalid User Calibration Mode
```

4.2.1.17 SM Matrix

Syntax

```
SM Matrix [ID]←
```

Selects the calibration matrix by its ID.

See Also

RC MatrixCalib lists all available matrices and their IDs.

Since

Firmware 1.04.

Examples

```
>SM Matrix 0
OK:0:Matrix:No errors
>SM Matrix -1
ER:-553:SM Matrix:Invalid Matrix ID
```

4.2.1.18 SM Match

Syntax

```
SM Match [ID]←
```

Selects the Match Calibration set to be used by its ID.

See Also

RC MatchCalib lists all available match calibrations and their IDs.

Since

Firmware 1.16.

Examples

```
>SM Match 0
OK:0:Match:No errors
>SM Match -1
ER:-557:SM Match:Invalid Match ID
```

4.2.1.19 SM Speed

Syntax

```
SM Speed [ID]←
```

Selects the Speed to be used by its ID.

See Also

RC Speed lists all available speeds and their IDs.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.17.

Examples

```
>SM Speed 0
OK:0:Speed:No errors
>SM Speed -1
ER:-557:SM Speed:Invalid Speed ID
```

4.2.1.20 SM SamplingRate

Syntax

```
SM SamplingRate [frequency in Hz.]←
```

Selects the Sampling Rate in Hz. This is used only when the Instrument Mode is set to Flicker or Response Time.

Since

Firmware 1.19

Examples

```
>SM SamplingRate 220
OK:0:SamplingRate:No errors
>SM SamplingRate 0
ER:-522:SamplingRate:Invalid Sampling Rate
```

4.2.1.21 SM MaxFreqFlickerSearch

Syntax

```
SM MaxFreqFlickerSearch [frequency in Hz.]←
```

Selects the Maximum Frequency Flicker Search in Hz.

Since

Firmware 1.19

Examples

```
>SM MaxFreqFlickerSearch 220
OK:0:SM MaxFreqFlickerSearch:No errors
>SM MaxFreqFlickerSearch -1
ER:-524:SM MaxFreqFlickerSearch:Invalid MaxFreqFlickerSearch
```

4.2.1.22 SM CMF

Syntax

```
SM CMF [index]←
```

Selects the Color Matching Function to be used for the measurement calculations.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.26

Examples

```
>SM CMF 1
OK:0:CMF:No errors
```

4.2.1.23 SM Reset

v

Syntax

`SM Reset←` Resets the instrument setup parameters to factory defaults.

Since

Firmware 1.36

Examples

```
>SM Reset
OK:0:SM Reset:No errors
```

For the CR-100, the measurement Setup Reset command "SM Reset" is equivalent to the following SM commands-:

Command	Reset value
SM Mode	0 = Colorimeter
SM Accessory	0 = Installed objective lens
SM Filter1	0 = No filter selected
SM Filter2	0 = No filter selected
SM Filter3	0 = No filter selected
SM SyncMode	0 = No synchronization
SM SyncFreq	60 Hz
SM RangeMode	0 = Automatic
SM Range	0 = Range A
SM Exposure	1 = 1 millisecond exposure
SM MaxAutoExposure	500 = 500 milliseconds
SM ExposureX	1
SM UserCalibMode	0 = None
SM SamplingRate	1000 Hz
SM MaxFreqFlickerSearch	120 Hz

4.2.2 Hardware Setup Commands

The hardware setup command set is used to specify instrument properties. This section is reserved for future expansion.

Quick Reference

Key	Description

4.2.3 Computation Setup Commands

The compuation setup command set is used to specify computation properties. This section is reserved for future expansion.

Quick Reference

Key	Description
CMF	Selects the color matching function

4.2.3.1 SC CMF

Syntax

`SC CMF [index]←`

Selects the Color Matching Function table index.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).
This command also recalculates and modifies the current measurement.

CMF indices are as follows

- **0**: default CIE 1931.
- **1**: user CMF 1.
- **2**: user CMF 2.
- **3**: user CMF 3.

Since

Firmware 1.26

Examples

```
>SC CMF 0
OK:0:SC CMF:No errors
```

4.3 Read Commands

The read command set is used to retrieve properties from the instrument.

R Commands	Description
RM	Read Measurement Commands
RS	Read Setup Commands
RC	Read Configuration Commands

4.3.1 Read Measurement Commands

The read measurement command set is used to retrieve properties from the last measurement.

Warning

The following commands are only valid after a measurement using a M or MT

Quick Reference

Key	Description
ID	Instrument Identifier (Serial Number)
Model	Instrument Model
Time	Date and Time stamp of measurement
Accessory	Accessories used during capture
Filter	Filters used during capture
Aperture	Aperture used during capture
Mode	Instrument Mode
ExposureMode	Exposure Mode

Exposure	Exposure time in milliseconds
MaxAutoExposure	Maximum auto exposure limit in milliseconds
RangeMode	Range Mode
Range	Range used during capture
SyncMode	Sync Mode during capture
SyncFreq	Sync Frequency
ExposureX	Exposure Multiplier
MatrixMode	Calibration matrix enabled/disabled. *Deprecated as of Firmware 1.16.*
UserCalibMode	User Calibration mode selection.
Matrix	Current calibration matrix ID
Match	Current match calibration ID
Speed	Speed used during capture
X	2°Tristimulus X
X10	10°Tristimulus X
Y	2°Tristimulus Y
Y10	10°Tristimulus Y
Z	2°Tristimulus Z
Z10	10°Tristimulus Z
XYZ	2°Tristimulus data
XYZ10	10°Tristimulus data
xy	CIE 1931 xy data (2°)
xy10	CIE 1964 xy data (10°)
uv	CIE 1960 uv data
upvp	CIE 1976 u' v' data
CCT	Correlated color temperature (CCT) in °Kelvin and uv Deviation from the planckian locus.
Warnings	Measurement warnings
Ye	
Yv	
Radiometric	
Spectrum	Spectral response
Speed	Speed settings
Temporal	Temporal response
TemporalY	Corrected temporal response
SamplingRate	Sampling rate
CMF	Color matching function used

4.3.1.1 RM ID

Syntax

```
RM ID←
```

Retrieves the instrument identifier (Serial Number) stored during the last capture.

Since

Firmware 1.04.

Examples

```
>RM ID
OK:0:RM ID:A00102
```

4.3.1.2 RM Model

Syntax

```
RM Model←
```

Retrieves the instrument model stored during the last capture.

Since

Firmware 1.04.

Examples

```
>RM Model
OK:0:RM Model:CR-100
```

4.3.1.3 RM Time

Syntax

```
RM Time←
```

Retrieves the date and time stamp of measurement

Since

Firmware 1.04.

Examples

```
>RM Time
OK:0:RM Time:NA
```

4.3.1.4 RM Accessory

Syntax

```
RM Accessory←
```

Retrieves the name of the accessory used during the last capture.

See Also

RC Filter to get the accessory attributes.

Since

Firmware 1.04.

Examples

```
>RM Accessory
OK:0:RM Accessory:Standard
```

4.3.1.5 RM Filter

Syntax

```
RM Filter←
```

Retrieves the names of the filters used during the last capture, as a comma separated values.

See Also

RC Filter to get the filter attributes.

Since

Firmware 1.04.

Examples

```
>RM Filter
OK:0:RM Filter:None
>RM Filter
OK:0:RM Filter:ND-100-1,ND-100-3
```

4.3.1.6 RM Aperture

Syntax

```
RM Aperture←
```

Retrieves the name of the aperture used during last capture.

See Also

RC Aperture to get the aperture attributes.

Since

Firmware 1.04.

Examples

```
>RM Aperture
OK:0:RM Aperture:5 deg
```

4.3.1.7 RM Mode

Syntax

```
RM Mode←
```

Retrieves the name of the instrument mode used during last capture.

Since

Firmware 1.16.

Examples

```
>RM Mode
OK:0:RM Mode:Colorimeter
```

4.3.1.8 RM ExposureMode

Syntax

```
RM ExposureMode←
```

Retrieves the name of the exposure mode used during last capture.

See Also

RC ExposureMode to get the exposure mode attributes.

Since

Firmware 1.04.

Examples

```
>RM ExposureMode
OK:0:RM ExposureMode:Auto
```

4.3.1.9 RM Exposure

Syntax

```
RM Exposure←
```

Exposure time in milliseconds

Since

Firmware 1.04.

Examples

```
>RM Exposure
OK:0:RM Exposure:111.622 msec
```

4.3.1.10 RM MaxAutoExposure

Syntax

```
RM MaxAutoExposure←
```

Maximum auto exposure limit in milliseconds

Since

Firmware 1.26.

Examples

```
>RM MaxAutoExposure
OK:0:RM MaxAutoExposure:449.999 msec
```

4.3.1.11 RM RangeMode

Syntax

```
RM RangeMode←
```

Retrieves the name of the range mode used during last capture.

See Also

RC RangeMode to get the range mode attributes.

Since

Firmware 1.04.

Examples

```
>RM RangeMode
OK:0:RM RangeMode:Auto
```

4.3.1.12 RM Range

Syntax

```
RM Range←
```

Retrieves the name of the range used during last capture.

See Also

RC Range to get the range attributes.

Since

Firmware 1.04.

Examples

```
>RM Range
OK:0:RM Range:D
```

4.3.1.13 RM SyncMode

Syntax

```
RM SyncMode←
```

Retrieves the name of the sync mode used during last capture.

See Also

RC SyncMode to get the sync mode attributes.

Since

Firmware 1.04.

Examples

```
>RM SyncMode
OK:0:RM SyncMode:None
```

4.3.1.14 RM SyncFreq

Syntax

```
RM SyncFreq←
```

Retrieves the sync frequency during last capture.

Warning

This command should not be used if the RM SyncMode command returns ***None***.

Since

Firmware 1.04.

Examples

```
>RM SyncFreq
OK:0:RM SyncFreq:0.00 Hz
```

4.3.1.15 RM ExposureX

Syntax

```
RM ExposureX←
```

Retrieves the exposure multiplier used during last capture.

Since

Firmware 1.04.

Examples

```
>RM ExposureX
OK:0:RM ExposureX:1
```

4.3.1.16 RM MatrixMode

Syntax

```
RM MatrixMode←
```

Retrieves the matrix mode used during last capture. If matrix mode is enabled then a calibration matrix was applied the data. RM Matrix will retrieve the calibration matrix ID.

Since

Firmware 1.04.

Deprecated RM MatrixMode has been deprecated for RM UserCalibMode as of Firmware 1.16

Examples

```
>RM MatrixMode
OK:0:RM MatrixMode:Disabled
```

4.3.1.17 RM UserCalibMode

Syntax

```
RM UserCalibMode←
```

Reports the User Calibration Mode that was in effect when the last measurement was taken.

If user calibration mode is set to **Matrix** then a calibration matrix was applied the data. RM Matrix will retrieve the calibration matrix ID. If user calibration mode is set to **Match** then a match calibration was applied the data. RM Match will retrieve the match calibration ID.

Since

Firmware 1.16.

Examples

```
>RM UserCalibMode
OK:0:RM UserCalibMode:None
```

4.3.1.18 RM Matrix

Syntax

```
RM Matrix←
```

Retrieves the matrix calibration ID used during last capture.

Warning

This command should be used if the RM UserCalibMode is ***Match***.

Since

Firmware 1.04.

Examples

```
>RM Matrix
OK:0:RM Matrix:N
>RM Matrix
OK:0:RM Matrix:1
```

4.3.1.19 RM Match

Syntax

```
RM Match←
```

Reports the Match Calibration set ID that was in effect when the last measurement was taken.

Warning

This command should be used if the RM UserCalibMode is ***Match***.

Since

Firmware 1.16.

Examples

```
>RM Match
OK:0:RM Match:0
>RM Match
OK:0:RM Match:1
```

4.3.1.20 RM Speed

Syntax

```
RM Speed←
```

Retrieves the name of the speed used during last capture.

See Also

RC Speed to get the speed attributes.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.17.

Examples

```
>RM Speed
OK:0:RM Speed:Normal
```

4.3.1.21 RM X

Syntax

```
RM X←
```

Retrieves the (2°) tristimulus X data of the last capture.

Since

Firmware 1.04.

Examples

```
>RM X
OK:0:RM X:1.737e+00
```

4.3.1.22 RM X10

Syntax

```
RM X10←
```

Retrieves the (10°) tristimulus X data of the last capture.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.18.

Examples

```
>RM X10
OK:0:RM X10:1.737e+00
```

4.3.1.23 RM Y

Syntax

```
RM Y←
```

Retrieves the (2°) tristimulus Y data of the last capture.

Since

Firmware 1.04.

Examples

```
>RM Y
OK:0:RM Y:1.685e+00
```

4.3.1.24 RM Y10

Syntax

```
RM Y10←
```

Retrieves the (10°) tristimulus Y data of the last capture.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.18.

Examples

```
>RM Y10
OK:0:RM Y10:1.685e+00
```

4.3.1.25 RM Z

Syntax

```
RM Z←
```

Retrieves the (2°) tristimulus Z data of the last capture.

Since

Firmware 1.04.

Examples

```
>RM Z
OK:0:RM Z:1.830e+00
```

4.3.1.26 RM Z10

Syntax

```
RM Z10←
```

Retrieves the (10°) tristimulus Z data of the last capture.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.18.

Examples

```
>RM Z10
OK:0:RM Z10:1.830e+00
```

4.3.1.27 RM XYZ

Syntax

```
RM XYZ←
```

Retrieves the (2°) tristimulus XYZ data of the last capture as comma separated values.

Since

Firmware 1.04.

Examples

```
>RM XYZ
OK:0:RM XYZ:1.737e+00,1.685e+00,1.830e+00
```

4.3.1.28 RM XYZ10

Syntax

```
RM XYZ10←
```

Retrieves the (10°) tristimulus XYZ data of the last capture as comma separated values.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.18.

Examples

```
>RM XYZ10
OK:0:RM XYZ10:1.737e+00,1.685e+00,1.830e+00
```

4.3.1.29 RM xy

Syntax

```
RM xy←
```

Retrieves the CIE 1931 xy data (2°) of the last capture as comma separated values.

Since

Firmware 1.04.

Examples

```
>RM xy
OK:0:RM xy:0.3308,0.3208
```

4.3.1.30 RM xy10

Syntax

```
RM xy10←
```

Retrieves the CIE 1964 xy data (10°) of the last capture as comma separated values.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.18.

Examples

```
>RM xy
OK:0:RM xy:0.3308,0.3208
```

4.3.1.31 RM uv

Syntax

```
RM uv←
```

Retrieves the CIE 1960 uv data of the last capture as comma separated values.

Since

Firmware 1.04.

Examples

```
>RM uv
OK:0:RM uv:0.2138,0.3110
```

4.3.1.32 RM upvp

Syntax

```
RM upvp←
```

Retrieves the CIE 1976 u' v&prime data of the last capture as comma separated values.

Since

Firmware 1.04.

Examples

```
>RM upvp
OK:0:RM upvp:0.2138,0.4666
```

4.3.1.33 RM CCT

Syntax

```
RM CCT←
```

Retrieves the correlated color temperature (CCT) in °Kelvin and the uv deviation from the planck's locus of the last capture as comma separated values.

Since

Firmware 1.04.

Examples

```
>RM CCT
OK:0:RM CCT:5577,-0.0100
```

4.3.1.34 RM Warnings

Syntax

```
RM Warnings←
```

Since

Firmware 1.04.

Retrieves the measurement warnings reported during the last capture.

Examples

```
>RM Warnings
OK:0:RM Warnings:0
```

4.3.1.35 RM Yv

Syntax

```
RM Yv←
```

Since

Firmware 1.17.

Retrieves the scotopic Luminance.

Examples

```
>RM Yv
OK:0:RM Yv:0
```

4.3.1.36 RM Radiometric

Syntax

```
RM Radiometric←
```

Since

Firmware 1.17.

Retrieves the Units of radiometric data, Radiometric power and Photon Radiometric power.

values for radiometric types are

- **0**: Radiance.
- **1**: Irradiance.
- **2**: Radiant Intensity.
- **3**: Radiant Flux.

Examples

```
>RM Radiometric
OK:0:RM Radiometric:0,3.209e-01,8.835e+17
```

4.3.1.37 RM Spectrum

Syntax

```
RM Spectrum←
```

Since

Firmware 1.17.

Retrieves the spectral measurement. If a valid spectral reading is present the first line will indicate start, end, delta wavelenghts and the number of points. Followed by a spectral point on each line.

Note

After issuing this command a small delay (200ms) is required before another command is issued. The preferred method of commands is polling to see if the command returns but in case an event driven approach is taken this delay is required.

Examples

```
>RM Spectrum
OK:0:RM Spectrum:380.0,780.0,2.0,201
2.119e-24
1.913e-24
.
.
.
```

4.3.1.38 RM Temporal

Syntax

```
RM Temporal←
```

Since

Firmware 1.19.

Retrieves the temporal measurement. If a valid temporal reading is present the first line will indicate sampling rate and the number of points. Followed by a temporal point on each line.

Note

After issuing this command a small delay (200ms) is required before another command is issued. The preferred method of commands is polling to see if the command returns but in case an event driven approach is taken this delay is required.

Examples

```
>RM Temporal
OK:0:RM Temporal:220.0,1024
20827
20841
20851
.
.
.
```

4.3.1.39 RM TemporalY

Syntax

```
RM TemporalY←
```

Since

Firmware 1.20.

Retrieves the calibrated temporal measurement. If a valid temporal reading is present the first line will indicate sampling rate and the number of points. Followed by a calibrated temporal point on each line.

Note

After issuing this command a small delay (200ms) is required before another command is issued. The preferred method of commands is polling to see if the command returns but in case an event driven approach is taken this delay is required.

Examples

```
>RM TemporalY
OK:0:RM TemporalY:220.0,1024
1.838e+00
1.826e+00
1.855e+00
.
.
.
```

4.3.1.40 RM SamplingRate

Syntax

```
RM SamplingRate←
```

Since

Firmware 1.19.

Retrieves the sampling rate used during the temporal measurement.

Note

After issuing this command a small delay (200ms) is required before another command is issued. The preferred method of commands is polling to see if the command returns but in case an event driven approach is taken this delay is required.

Examples

```
>RM SamplingRate
OK:0:RM SamplingRate:200.0
```

4.3.1.41 RM CMF

Syntax

```
RM CMFv←
```

Since

Firmware 1.26.

Retrieves the Color Matching Function used for calculations.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Examples

```
>RM CMF
OK:0:RM CMF:0
```

4.3.2 Read Configuration Commands

Quick Reference

Key	Description
ID	Instrument Identifier/Serial Number
Model	Instrument Model Number
InstrumentType	Instrument type
Accessory	Available accessories
Filter	Available filters
Aperture	Available apertures
ExposureMode	Available exposure modes
RangeMode	Available range modes
Range	Available ranges
SyncMode	Available sync modes
Firmware	Firmware version
MatrixMode	Available matrix modes. *Deprecated as of Firmware 1.16.*
Matrix	Available matrix calibrations
MatrixCalibration	Available matrix calibration factors
MinExposure	Minimum exposure time

`MaxExposure`	Maximum exposure time
`MinSyncFreq`	Minimum user selectable sync frequency
`MaxSyncFreq`	Maximum user selectable sync frequency
`MinExposureX`	Minimum exposure multiplier
`MaxExposureX`	Maximum exposure multiplier
`Speed`	Speed
`MinSamplingRate`	Minimum sampling rate
`MaxSamplingRate`	Maximum sampling rate

4.3.2.1 RC ID

Syntax

```
RC ID←
```

Reads the instrument Identifier (Serial Number) from the configuration.

Since

Firmware 1.04.

Examples

```
>RC ID
OK:0:RC ID:A00102
```

4.3.2.2 RC Model

Syntax

```
RC Model←
```

Reads the instrument Model from the configuration.

Since

Firmware 1.04.

Examples

```
>RC Model
OK:0:RC Model:CR-100
```

4.3.2.3 RC InstrumentType

Syntax

```
RC InstrumentType←
```

Reads the instrument type from the configuration.

values for instrument types are

- **0**: Photometer.
- **1**: Colorimeter.
- **2**: Spectroradiometer.

Since

Firmware 1.17.

Examples

```
>RC InstrumentType
OK:0:RC InstrumentType:2
```

4.3.2.4 RC Accessory

Syntax

```
RC Accessory←
```

List the available accessories that are configured.

The response returns the number of accessories in the last parameter (4^{th}) of the first line. Every line after that lists the accessory ID, name and type.

Accessory types

- **Radiance:** Radiance
- **Irradiance:** Irradiance
- **Rad**. Flux: Radiant Flux
- **Rad**. Intensity: Radiant Intensity
- **NA:** Not applicable
- **Unassigned:** Unassigned

Since

Firmware 1.04.

Examples

```
>RC Accessory
OK:0:RC Accessory:3
0,Standard,Radiance
1,IR-100,Irradiance
2,IS-101,Rad.  Flux
```

4.3.2.5 RC Filter

Syntax

```
RC Filter←
```

Lists the available filters that are configured.

The response returns the number of filters in the last parameter(4^{th}) of the first line. Every line after that lists the filter ID, name and type.

Filter types

- **Radiance:** Radiance
- **Irradiance:** Irradiance
- **Rad**. Flux: Radiant Flux
- **Rad**. Intensity: Radiant Intensity
- **NA:** Not applicable
- **Unassigned:** Unassigned

Since

Firmware 1.04.

Examples

```
>RC Filter
OK:0:RC Filter:5
3,ND-100-1,Radiance
4,ND-100-2,Radiance
5,ND-100-3,Radiance
6,ND-100-0.3,Radiance
7,ND-100-0.7,Radiance
```

4.3.2.6 RC Aperture

Syntax

```
RC Aperture←
```

Lists the available apertures that are configured.

The response returns the number of apertures in the last parameter(4^{th}) of the first line. Every line after that lists the aperture ID and name.

Since

Firmware 1.04.

Examples

```
>RC Aperture
OK:0:RC Aperture:1
0,5 deg
```

4.3.2.7 RC Mode

Syntax

```
RC Mode←
```

List the available Instrument Modes available.

The response returns the number of instruments modes in the last parameter(4^{th}) of the first line. Every line after that lists the instrument mode ID and name.

Since

Firmware 1.16.

Exposure Modes

- Colorimeter
- Flicker
- Response Time

Examples

```
>RC Mode
OK:0:RC Mode:3
0,Colorimeter
1,Flicker
2,Response Time
```

4.3.2.8 RC ExposureMode

Syntax

```
RC ExposureMode←
```

List the available Exposure Modes configured.

The response returns the number of exposure modes in the last parameter(4^{th}) of the first line. Every line after that lists the exposure mode ID and name.

Since

Firmware 1.04.

Exposure Modes

- Auto
- Fixed

Examples

```
>RC ExposureMode
OK:0:RC ExposureMode:2
0,Auto
1,Fixed
```

4.3.2.9 RC RangeMode

Syntax

```
RC RangeMode←
```

Lists the available range modes configured.

The response returns the number of range modes in the last parameter(4^{th}) of the first line. Every line after that lists the range mode ID and name.

Range Modes

- Auto
- Fixed

Since

Firmware 1.04.

Examples

```
>RC RangeMode
OK:0:RC RangeMode:2
0,Auto
1,Fixed
```

4.3.2.10 RC Range

Syntax

```
RC Range←
```

Lists the available ranges configured.

The response returns the number of ranges in the last parameter(4^{th}) of the first line. Every line after that lists the range ID and name.

Since

Firmware 1.04.

Examples

```
>RC Range
OK:0:RC Range:4
0,A
1,B
2,C
3,D
```

4.3.2.11 RC SyncMode

Syntax

```
RC SyncMode←
```

Lists the available Sync Modes configured.

The response returns the number of sync modes in the last parameter(4^{th}) of the first line. Every line after that lists the sync mode ID and name.

SyncModes

- **None:** The instrument will not sync to the light source.
- **Auto:** The instrument syncs to the light source automatically.
- **Manual:** The instrument will sync to the frequency specified by RS SyncFreq.

Since

Firmware 1.04.

Additional Sync modes to allow for easy selection based on the display technology

- **NTSC**
- **PAL**
- **CINEMA**

Since

Firmware 1.32

Examples

```
>RC SyncMode
OK:0:RC SyncMode:3
0,None
1,Auto
2,Manual
```

```
>RC SyncMode
OK:0:RC SyncMode:3
0,None
1,Auto
2,Manual
3,NTSC
4,PAL
5,CINEMA
```

4.3.2.12 RC Firmware

Syntax

```
RC Firmware←
```

Reports the current Firmware version

Note

Use the firmware version to verify supported commands

Since

Firmware 1.04.

Examples

```
>RC Firmware
OK:0:RC Firmware:1.04
```

4.3.2.13 RC MatrixMode

Syntax

```
RC MatrixMode←
```

Lists the available Matrix Modes configured.

The response returns the number of matrix modes in the last parameter(4^{th}) of the first line. Every line after that lists the matrix mode ID and name.

MatrixModes

- **Disabled:** The instrument will not apply matrix calibration to the captured data.
- **Enabled:** The instrument will apply matrix calibation to the captured specified by RS Matrix.

Since

Firmware 1.04.

Deprecated RC MatrixMode has been deprecated for RC UserCalibMode as of Firmware 1.16

Examples

```
>RC MatrixMode
OK:0:RC MatrixMode:2
0,Disabled
1,Enabled
```

4.3.2.14 RC UserCalibMode

Syntax

```
RC UserCalibMode←
```

Lists the available user calibration modes configured for the current instrument.

The response returns the number of user calibration modes in the last parameter(4^{th}) of the first line. Every line after that lists the user calibration mode ID and name.

User Calibration Modes

- **None:** The instrument will not apply matrix calibration to the captured data.
- **Matrix:** The instrument will apply matrix calibation to the captured specified by RS Matrix.
- **Match:** The instrument will apply calibation match to the captured specified by RS Match.

Since

Firmware 1.16.

Examples

```
>RC UserCalibMode
OK:0:RC UserCalibMode:3
0,None
1,Matrix
2,Match
```

4.3.2.15 RC Matrix

Syntax

```
RC Matrix←
```

Lists the available matrix calibrations for the current selected accessory.

Since

Firmware 1.04.

Examples

```
>RC Matrix
OK:0:RC Matrix:None
>RC Matrix
OK:0:RC Matrix:1
0,Display Test
```

4.3.2.16 RC Match

Syntax

```
RC Match←
```

Lists the available match calibration sets for the current instrument.

Since

Firmware 1.16.

Examples

```
>RC Match
OK:0:RC Match:None
>RC Match
OK:0:RC Match:1
0,Test
```

4.3.2.17 RC MatrixCalibration

Syntax

```
RC MatrixCalibration←
```

Lists the available Matrix Calibration sets.

Since

Firmware 1.04.

Deprecated RC MatrixCalibration has been deprecated for RC MatrixCalib as of Firmware 1.16

Examples

```
>RC MatrixCalibration
OK:0:RC MatrixCalibration:None
>RC MatrixCalibration
OK:0:RC MatrixCalibration:1
0,Display Test,1.030e+00,-1.363e-02,-8.051e-03,-2.175e-02,1.072e+00,1.-
203e-02,5.340e-02,3.940e-03,1.058e+00
```

4.3.2.18 RC MatrixCalib

Syntax

```
RC MatrixCalibration←
```

Lists the available Matrix Calibration sets.

Since

Firmware 1.16.

Examples

```
>RC MatrixCalib
OK:0:RC MatrixCalib:None
>RC MatrixCalib
OK:0:RC MatrixCalib:1
0,Display Test,1.030e+00,-1.363e-02,-8.051e-03,-2.175e-02,1.072e+00,1.-
203e-02,5.340e-02,3.940e-03,1.058e+00
```

4.3.2.19 RC MatchCalib

Syntax

```
RC MatchCalib←
```

Lists the available Match Calibration sets and factors.

Since

Firmware 1.16.

Examples

```
>RC MatchCalib
OK:0:RC MatchCalib:None
>RC MatchCalib
OK:0:RC MatchCalib:1
0,Test,5.292e-01,8.048e-01,7.837e-01
```

4.3.2.20 RC MinExposure

Syntax

```
RC MinExposure←
```

Lower limit of the exposure reported in milliseconds.

See Also

RC MaxExposure for upper limit for the exposure for Fixed exposure mode.

Since

Firmware 1.04.

Examples

```
>RC MinExposure
OK:0:RC MinExposure:1.0 msec
```

4.3.2.21 RC MaxExposure

Syntax

```
RC MaxExposure←
```

Upper limit of the exposure reported in milliseconds.

See Also

RC MinExposure for lower limit for the exposure for Fixed exposure mode.

Since

Firmware 1.04.

Examples

```
>RC MaxExposure
OK:0:RC MaxExposure:500.0 msec
```

4.3.2.22 RC MinSyncFreq

Syntax

```
RC MinSyncFreq←
```

Lower limit of the sync frequency reported in Hertz.

See Also

RC MaxSyncFreq for upper limit of the sync frequency for Manual sync mode.

Since

Firmware 1.04.

Examples

```
>RC MinSyncFreq
OK:0:RC MinSyncFreq:10.00 Hz
```

4.3.2.23 RC MaxSyncFreq

Syntax

```
RC MaxSyncFreq←
```

Upper limit of the sync frequency reported in Hertz.

See Also

RC MinSyncFreq for lower limit of the sync frequency for Manual sync mode.

Since

Firmware 1.04.

Examples

```
>RC MaxSyncFreq
OK:0:RC MaxSyncFreq:10000.00 Hz
```

4.3.2.24 RC MinExposureX

Syntax

```
RC ID←
```

Lower limit of the exposure multiplier.

See Also

RC MaxExposureX for upper limit of the exposure multiplier.

Since

Firmware 1.04.

Examples

```
>RC MinExposureX
OK:0:RC MinExposureX:1
```

4.3.2.25 RC MaxExposureX

Syntax

```
RC MaxExposureX←
```

Upper limit of the exposure multiplier.

See Also

RC MinExposureX for lower limit of the exposure multiplier.

Since

Firmware 1.04.

Examples

```
>RC MaxExposureX
OK:0:RC MaxExposureX:50
```

4.3.2.26 RC Speed

Syntax

```
RC Speed←
```

Lists the available speeds configured.

The response returns the number of speeds in the last parameter(4^{th}) of the first line. Every line after that lists the speed ID and name.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.17.

Examples

```
>RC Speed
OK:0:RC Speed:4
0,Slow
1,Normal
2,Fast
3,2x Fast
```

4.3.2.27 RC MinSamplingRate

Syntax

```
RC MinSamplingRate←
```

Lower limit of the sampling rate reported in Hertz.

See Also

RC MaxSamplingRate for upper limit of sampling rate.

Since

Firmware 1.19.

Examples

```
>RC MinSamplingRate
OK:0:RC MinSamplingRate:200.0 Hz
```

4.3.2.28 RC MaxSamplingRate

Syntax

```
RC MaxSamplingRate←
```

Upper limit of the sampling rate reported in Hertz.

See Also

RC MinSamplingRate for lower limit of the sampling rate.

Since

Firmware 1.19.

Examples

```
>RC MaxSamplingRate
OK:0:RC MaxSamplingRate:1600.0 Hz
```

4.3.3 Read Setup Commands

The read setup command set is used to retrieve measurement properties from the instrument.

Quick Reference

Key	Description
`Accessory`	Current accessory
`Filter`	Current filters
`Aperture`	Current aperture
`Mode`	Current instrument mode
`RangeMode`	Current range mode
`Range`	Current range
`ExposureMode`	Current exposure mode
`Exposure`	Current exposure
`SyncMode`	Current sync mode
`SyncFreq`	Current sync frequency
`ExposureX`	Current exposure multiplier
`MatrixMode`	Current matrix mode *Deprecated as of Firmware 1.16.*
`UserCalibMode`	Current user calibration mode
`Matrix`	Current matrix calibration
`Match`	Current match calibration

Speed	Current speed
SamplingRate	Current sampling rate
MaxFreqFlickerSearch	Current Maximum Frequecny flicker search
CMF	Current color matching function

4.3.3.1 RS Accessory

Syntax

```
RS Accessory←
```

Retrieves the name of the current accessory.

Since

Firmware 1.04.

Examples

```
>RS Accessory
OK:0:RS Accessory:Standard
```

4.3.3.2 RS Filter

Syntax

```
RS Filter←
```

Retrieves the names of the current filters as a comma separated value.

Since

Firmware 1.04.

Examples

```
>RS Filter
OK:0:RS Filter:ND-100-1,None,None
```

4.3.3.3 RS Aperture

Syntax

```
RS Aperture←
```

Retrieves the name of the current aperture.

Since

Firmware 1.04.

Examples

```
>RS Aperture
OK:0:RS Aperture:5 deg
```

4.3.3.4 RS Mode

Syntax

```
RS Mode←
```

Retrieves the name of the current instrument mode.

Since

Firmware 1.16.

Examples

```
>RS Mode
OK:0:RS Mode:Colorimeter
```

4.3.3.5 RS RangeMode

Syntax

```
RS RangeMode←
```

Retrieves the name of the current range mode.

Since

Firmware 1.04.

Examples

```
>RS RangeMode
OK:0:RS RangeMode:Auto
```

4.3.3.6 RS Range

Syntax

```
RS Range←
```

Retrieves the name of the current range. This is used only if the Range Mode retrieved by RS RangeMode is **Manual**.

Since

Firmware 1.04.

Examples

```
>RS Range
OK:0:RS Range:A
```

4.3.3.7 RS ExposureMode

Syntax

```
RS ExposureMode←
```

Retrieves the name of the current exposure mode.

Since

Firmware 1.04.

Examples

```
>RS ExposureMode
OK:0:RS ExposureMode:Auto
```

4.3.3.8 RS Exposure

Syntax

```
RS Exposure←
```

Retrieves the current exposure in msecs. This is used only if the Exposure Mode retrieved by RS ExposureMode is **Fixed**.

Since

Firmware 1.04.

Examples

```
>RS Exposure
OK:0:RS Exposure:1.000 msec
```

4.3.3.9 RS SyncMode

Syntax

```
RS SyncMode←
```

Retrieves the current sync mode.

Since

Firmware 1.04.

Examples

```
>RS SyncMode
OK:0:RS SyncMode:None
```

4.3.3.10 RS SyncFreq

Syntax

```
RS SyncFreq←
```

Retrieves the current sync frequency. This is used only if the Sync Mode retrieved by RS SyncMode is **Manual**.

Since

Firmware 1.04.

Examples

```
>RS SyncFreq
OK:0:RS SyncFreq:60.00 Hz
```

4.3.3.11 RS ExposureX

Syntax

```
RS ExposureX←
```

Retrieves the current exposure multiplier.

Since

Firmware 1.04.

Examples

```
>RS ExposureX
OK:0:RS ExposureX:1
```

4.3.3.12 RS MatrixMode

Syntax

```
RS MatrixMode←
```

Retrieves the current matrix mode.

Since

Firmware 1.04.

Deprecated RS MatrixMode has been deprecated for RS UserCalibMode as of Firmware 1.16

Examples

```
>RS MatrixMode
OK:0:RS Matrix:Disabled
```

4.3.3.13 RS UserCalibMode

Syntax

```
RS UserCalibMode←
```

Reports the current user caibration mode set by the command SM UserCalibMode.

Since

Firmware 1.16.

Examples

```
>RS UserCalibMode
OK:0:RS UserCalibMode:None
```

4.3.3.14 RS Matrix

Syntax

```
RS Matrix←
```

Retrieves the current calibration matrix ID. This is used only if the user calibration mode retrieved by RS UserCalibMode is **Matrix**.

Since

Firmware 1.04.

Examples

```
>RS Matrix
OK:0:RS Matrix:0
```

4.3.3.15 RS Match

Syntax

```
RS Match←
```

Reports the current match calibration set ID which is selected by the command SM Match. This is used only if the user calibration mode retrieved by RS UserCalibMode is **Match**.

Since

Firmware 1.16.

Examples

```
>RS Match
OK:0:RS Match:0
```

4.3.3.16 RS Speed

Syntax

```
RS Speed←
```

Retrieves the name of the current speed.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.17.

Examples

```
>RS Speed
OK:0:RS Speed:Normal
```

4.3.3.17 RS SamplingRate

Syntax

```
RS SamplingRate←
```

Retrieves the current measurement sampling rate.

Since

Firmware 1.19.

Examples

```
>RS SamplingRate
OK:0:RS SamplingRate:200.0 Hz
```

4.3.3.18 RS MaxFreqFlickerSearch

Syntax

```
RS MaxFreqFlickerSearch←
```

Retrieves the current maximum frequency flicker search.

Since

Firmware 1.19.

Examples

```
>RS MaxFreqFlickerSearch
OK:0:RS MaxFreqFlickerSearch:200.0 Hz
```

4.3.3.19 RS CMF

Syntax

```
RS CMF←
```

Retrieves the current Color Matching Function Index.

Note

This command is only valid if the RC InstrumentType is 2 (Spectroradiometer).

Since

Firmware 1.26.

Examples

```
>RS CMF
OK:0:RS CMF:0
```

note This

4.3.4 Measure Commands

The measure command set is used to capture data from the instrument.

Quick Reference

M Commands	Description
M	Capture a measurement
MT	Trigger a measurement
MA	Aborts a measurement in progress
MF	Measure the sync frequency

4.3.4.1 M

Syntax

```
M←
```

Capture a measurement and returns after the measurement is completed or an error has occured.

Note

This command does not require a command extension

Since

Firmware 1.04.

See Also

Refer 300 range Response Codes section.

Examples

```
>M
ER:-305:M:Light intensity too low or unmeasurable
>M
OK:0:M:No errors
```

4.3.4.2 MT

Syntax

```
MT←
```

Trigger a measurement and returns immediately without waiting for the response.

Note

This is used for asynchronous capture of measurements.
This command is reserved for future implementation.

4.3.4.3 MA

Syntax

```
MA←
```

Aborts a measurement in progress.

Note

This is used for asynchronous capture of measurements.
This command is reserved for future implementation.

4.3.4.4 MF

Syntax

```
MF←
```

Measures the sync frequency of the light source.

Note

This command is reserved for future implementation.

4.4 Configure Commands

The configure command set is used to configure the instrument.

C Commands	Description
CC	Configure Calibration Commands

4.4.1 Configure Calibration Commands

The configure calibration command set is used to specify instrument calibration configuration properties.

Quick Reference

Key	Description
Matrix	Configures a new calibration matrix
Match	Configures a new match calibration

4.4.1.1 CC Matrix

Syntax

```
CC Matrix AccIndex,MatrixID,MatrixName,R00,R01,R02,R10,R11,R12,R20,R21,R22←
```

Adds or updates a calibration matrix to the list of calibration matrices, where *AccIndex* is the index of the accessory, *MatrixID* is the index of the added or updated calibration matrix in the list, *MatrixName* is a description for the calibration matrix and *Rxy* are the elements of the matrix.

Since

Firmware 1.05.

Examples

```
>CC Matrix 0,0,Display Test,1.030e+00,-1.363e-02,-8.051e-03,-2.175e-02,1.-
072e+00,1.203e-02,5.340e-02,3.940e-03,1.058e+00
OK:0:CC Matrix:No errors
```

See Also

RC MatrixCalib.

4.4.1.2 CC Match

Syntax

```
CC Match MatchID,MatchName,cfX,cfY,fcZ2←
```

Adds or updates a Match Calibration set to the list of match calibration sets, where *MatchID* is the index of the added or updated Match Calibration set in the list, *MatchName* is a description for the Match Calibration set and *cfX*, *cfY* and *cfZ* are the correction factor for the CIE tristimulus values X, Y, Z.

Since

Firmware 1.16.

Examples

```
>CC Match 0,Display Test,1.030e+00,-1.363e-02,-8.051e-03←
OK:0:CC Match:No errors
```

See Also

RC MatchCalib.

4.5 Response Codes

Following is a comprehensive list of response codes and their description.

Note

Negative numbers are errors while positive numbers indicate warnings. 0 indicates no errors.
300 range is measurement errors.
500 range is general command errors

Error/Warning Code	Description
100	Light intensity too low for automatic sync
101	Cannot sync to constant light source
102	Cannot find sync, max limit selected
103	Sync level too low for reliable sync
−300	Invalid Sync mode
−301	Invalid Sync period
−302	Can not sync to light
−303	Light intensity is fluctuating
−304	Light intensity too low for range
−305	Light intensity too low or unmeasurable
−306	Light intensity too high for range
−307 to −330	Reserved
−331	Hardware malfunction
−332	Matrix version mismatch
−333	Invalid matrix index
−334	Uninitialized CIE tables
−335	Uninitialized CMF tables
−336	No Matrix exists for given ID
−500	Invalid command
−501	Reserved
−502	Reserved
−503	Reserved
−504	Reserved
−505	Duplicate Filter selection
−506	Index doesn’t select an Accessory
−507	Index doesn’t select a Filter
−508	Index not valid for Accessory
−509	Index not valid for Filter
−510	Index not valid for Filter
−511	Index not valid for Filter
−512	Invalid Range mode
−513	Invalid Range index
−514	Invalid Exposure Multiplier
−515	Index doesn’t select an Aperture
−516	Reserved

-517	Reserved
-518	Invalid Exposure Mode
-519	Invalid Exposure value
-520	Reserved
-521	Invalid Sync Mode
-522	Invalid User Sync Frequency
-523	Reserved
-524	Reserved
-525	Reserved
-526	Reserved
-527	Reserved
-528	Reserved
-529	Reserved
-530	Reserved
-531	Reserved
-532	Reserved
-533	Reserved
-534	Reserved
-535	Reserved
-536	Reserved
-537	Reserved
-538	Reserved
-539	Reserved
-540	Reserved
-541	Reserved
-542	Reserved
-543	Reserved
-544	Reserved
-545	Reserved
-546	Reserved
-547	Reserved
-548	Reserved
-549	Reserved
-550	Reserved
-551	Reserved
-552	Invalid Matrix Mode
-553	Invalid Matrix ID
-555	Invalid Matrix name/description
-556	Error saving Matrix to FLASH
-557	Invalid Match ID
-558	Invalid Match name/description
-559	Error saving Match to FLASH
-560	Invalid User Calibration Mode

Chapter 5

Deprecated List

Page Remote Commands

SM MatrixMode has been deprecated for SM UserCalibMode as of Firmware 1.16

RM MatrixMode has been deprecated for RM UserCalibMode as of Firmware 1.16

RC MatrixMode has been deprecated for RC UserCalibMode as of Firmware 1.16

RC MatrixCalibration has been deprecated for RC MatrixCalib as of Firmware 1.16

RS MatrixMode has been deprecated for RS UserCalibMode as of Firmware 1.16