# CA-410
# Communication Specifications

[Version 1.01]

KONICA MINOLTA

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**CA-410 Communication Specifications**

● **Revision History**

| Version | Date | Details |
|---------|------|---------|
| 0.90 | 2018/2/27 | First revision |
| 1.01 | 2018/3/7 | Writing error correction |

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**CA-410 Communication Specifications**

# Introduction

This manual describes the communication specifications for controlling the **CA-410**.

# 1. Communication Protocols

## 1.1. Communication Means

USB and RS-232C can be used as the means of communication for CA-410 probes. USB, RS-232C, Bluetooth, and Ethernet can be used as the means of communication for the CA-410 data processor. Communications with each of these types of instruments is performed with the following specifications.

### 1.1.1. USB

USB conforms to a CDC class that can use the standard Windows and macOS device driver. Therefore, the PC can communicate with the instrument as a COM port when controlling the instrument with a PC. The specification is as follows.

| Driver files (Not required for macOS ) | ☐ KMMIUSB.INF ☐ KMMIUSB.CAT | |
|---|---|---|
| Communication specifications | Baud rate | 38400 |
| | Data length | 7bit |
| | Parity | Even |
| | Stop bit | 2bit |
| | Flow control | Hardware (RTS/CTS) |

### 1.1.2. RS-232C

When using RS-232C, the PC can communicate with the instrument as a COM port when controlling the instrument with a PC.
The specification is as follows.

| Driver files | None | |
|---|---|---|
| Communication specifications | Baud rate | 38400 (default) |
| | Data length | 7bit |
| | Parity | Even |
| | Stop bit | 2bit |
| | Flow control | Hardware (RTS/CTS) |

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### 1.1.3. Bluetooth

SPP (Serial Port Profile) is available for Bluetooth. Therefore, the PC can communicate with the instrument as a COM port when controlling the instrument with a PC.

The specification is as follows.

| Driver files | Depends on the Bluetooth module that is used on the PC | |
|---|---|---|
| Communication specifications | Baud rate | 38400 |
| | Data length | 7bit |
| | Parity | Even |
| | Stop bit | 2bit |
| | Flow control | Hardware (RTS/CTS) |

### 1.1.4. Ethernet

Ethernet uses the TCP/IP protocol.

The specification is as follows.

| Item | Category | Description |
|---|---|---|
| PC | Connection type | Client |
| CA-410 Data Processor | Connection type | Server |
| | Maximum number of connected hosts | 1 |
| | Port number | 49152 |

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## 1.2. Communication Methods

Communication is performed using the master and slave handshake method.
The master (host) is the PC, and the slave is the instrument.

### 1.2.1. Delimiter

Commands from the PC to the product must add CR (carriage return) as the delimiter.
Commands will not be correctly recognized if the delimiter code is missing.
In the same manner, the CR (carriage return) delimiter is added to command responses from the product to the PC.

### 1.2.2. Ethernet Transmission Format

This section describes the transmission format when the connection is Ethernet. This format is little-endian.

| 1byte | 1byte | 2byte | 1 to 65536 bytes |
|-------|-------|-------|------------------|
| KND | Res | SIZE | DATA |

| KND | Identifier0 = Request DATA<br>1 = Response DATA |
|------|-------------------------------------------------|
| Reserved | 0 (fixed) |
| SIZE | Size of DATA is 1 to 65,536 bytes |
| DATA | Details of the command |

The ASCII code of the command is converted to a hexadecimal value and that data is transmitted.
The following data is transmitted when sending "COM,1".

[0x00] [0x00] [0x06] [0x00] [0x43] [0x4F] [0x4D] [0x2C] [0x31] [0x0D]

The following data is obtained when receiving "OK00".

[0x01] [0x00] [0x05] [0x00] [0x4F] [0x4B] [0x30] [0x30] [0x0D]

### 1.2.3. Ethernet Timeout

If there is no communication between the host and data processor for 30 seconds, the Ethernet connection will be disconnected. Keep alive processing is required to avoid disconnections due to this timeout.

## 1.2.4.    Precautions for Communications

The assumed behavior of the CA-410 is that a command will be received and a response will be returned, except when using trigger mode. For this reason, the CA-410 cannot correctly process a new command until after a response to the previous command that was received has been completed. Ensure that the host always waits for the response from the CA-410 before sending the next command.

If CA-410 probes are connected via both USB and RS-232C, communication via USB is given priority.

The CA-410 data processor cannot be connected to probes using a mix of USB and RS-232C.

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## 1.3.  **Timeout Duration**

This section describes the calculation method of the necessary timeout duration in measurements.

When Taking Individual Measurements:

Timeout duration = (time for one measurement [sec] × maximum number of retries A + total retry
time + calculation time [sec]) × maximum number of retries B × number of
averaged measurements + communication time

| Measurement type | Time for one measurement | Maximum number of retries A | Total retry time | Calculation time | Maximum number of retries B | Number of averaged measurements | Communication time |
|---|---|---|---|---|---|---|---|
| Color | Selection from table A/1000 | 1 | 0 | 0.01 | 7 | 1 | 1.5 |
| FMA | Selection from table B/1000 | 7 | 0.6 | 0.01 | 1 | 1 | 1.5 |
| JEITA | 1/Sampling frequency | 5 | 0.6 | 1 | 1 | 1 | 1.5 |

When Taking Simultaneous Color & Flicker Measurements:

When taking simultaneous color and flicker measurements, the necessary timeout duration is the longer of the two timeout durations.

A: Measurement time for color measurement [msec]

| | | Measurement speed setting | | | |
|---|---|---|---|---|---|
| | | FAST | SLOW | LTD.AUTO | AUTO |
| Synchro nization settings | NTSC | 33.37 | 166.83 | 166.83 | 834.17 |
| | PAL | 40.00 | 200.00 | 200.00 | 1000.00 |
| | UNIVERSAL | 100.00 | 500.00 | 500.00 | 2000.00 |
| | INTERNAL | 4000.00 | 4000.00 | 4000.00 | 4000.00 |
| | EXTERNAL | 4000.00 | 4000.00 | 4000.00 | 4000.00 |
| | MANUAL | Set time | Set time | Set time | Set time |

B: Measurement time for FMA method flicker measurement [msec]

| Synchro nization settings | NTSC | 33.37 |
|---|---|---|
| | PAL | 40.00 |
| | UNIVERSAL | 100.00 |
| | INTERNAL | 4000.00 |
| | EXTERNAL | 4000.00 |
| | MANUAL | Set time |

# 2. Command Flow

This section provides an example of using communication commands in key functions.

DP: Data Processor

## 2.1. Measurement

### 2.1.1. Color/FMA Measurement

This example takes a measurement with the following settings.

Since these settings may vary according to the previous state, it is recommended that the settings be configured each time.

Synchronization mode: INTERNAL

Synchronization frequency: 60.00 Hz

Measurement speed: FAST

Simultaneous control: Color & flicker

Display mode: Lv,x,y

Flicker method: FMA

Calibration channel: CH00

Luminance unit: $cd/m^2$

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "SCS,4,60.00" + delimiter | "OK00" + delimiter | Set synchronization mode to INTERNAL and frequency to 60.00 Hz. |
| 3 | "FSC,1" + delimiter | "OK00" + delimiter | Set measurement speed to FAST. |
| 4 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1. |
| 5 | "MMS,0" + delimiter | "OK00" + delimiter | Execute simultaneous color & flicker measurement. |
| 6 | "FMS,0" + delimiter | "OK00" + delimiter | FMA method |
| 7 | "MDS,0" + delimiter | "OK00" + delimiter | x,y,Lv display |
| 8 | "MCH,0" + delimiter | "OK00" + delimiter | Calibration channel 00 |
| 9 | "LUS,1" +delimiter | "OK00" + delimiter | Luminance unit cd/m |
| 10 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. $^2$ |
| 11 | "MES,1" + delimiter | "OK00,P1,0,0.3274345,0.4191236,4.8075729, +0.39,2.1047971" + delimiter | Execute measurement |
| 12 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor. |

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### 2.1.2. JEITA Measurement

This example takes a measurement with the following settings.

Since these settings may vary according to the previous state, it is recommend ed that the settings be configured each time.

Simultaneous control: Color & flicker

Flicker method: JEITA

Sampling frequency: 0.1 Hz

Number of samples: 2048

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1. |
| 3 | "MMS,0" + delimiter | "OK00" +  delimiter | Set simultaneous color & flicker measurement. |
| 4 | "FMS,1" + delimiter | "OK00" + delimiter | JEITA method |
| 5 | "MDS,6" + delimiter | "OK00" + delimiter | Flicker display |
| 6 | "JCS,0.1,11" + delimiter | "OK00,0.6,65,0.1" + delimiter | JEITA measurement conditions<br>Sampling frequency: 0.1 Hz<br>Number of samples: 2048 |
| 7 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. |
| 8 | "MES,1" + delimiter | "OK00,P1,0,0.3257699,0.4187873,4.6931974, +0.10,-99999999" + delimiter | Execute measurement. |
| 9 | "JDR,1,0" + delimiter | "OK00,P1,11,-72.51485,0.6,0.6,65,0.1" + delimiter | Get JEITA measurement value. |
| 10 | "JDR,1,1" + delimiter | "OK00,P1,-72.51485,-90.42969,-77.69852,-79.48573,-92.28257,-79.91670,-82.19910,-102.6252,-102.9693,-89.87499,-108.9390,-88.14883,-81.88348,-81.49242,-84.04678,-80.93971,-84.31668,-89.08257,-88.24252,-89.36047,-97.42973,-94.67172,-100.5372,-88.57868,-89.09100,-88.10684,-86.86649,-86.13819,-87.70374,-87.37514,-102.6095,-84.73613,-86.46592,-84.57969,-80.76064,-90.00802,-85.52370,-80.09032,-78.27528,-82.29698,-88.34878,-93.24754,-86.52904,-90.56447,-89.02432,-91.66516,-85.44003,-85.72418,-81.47530,-81.23893,-87.43819,-102.7018,-93.13391,-85.92044,-89.93111,-89.65168,-89.21304,-90.20789,-82.49582,-82.44225,-96.09941,-88.04225,-84.33906,-90.22614" + delimiter | Get JEITA spectrum. |
| ...        ... | ... | Get JEITA spectrum JDR must be sent 11 times after the response in step 9. (In this explanation, "JDR,1,1" to "JDR,1,10" have been omitted.) |

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| 20 | "JDR,1,11" + delimiter | "OK00,P1,-154.6020,-149.3122,-160.4262,-169.1912,-999.0000" + delimiter | Get JEITA spectrum |
|---|---|---|---|
| 21 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor |

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## 2.1.3.　Trigger Measurement (DP)

This example takes a measurement with the following settings.

Since these settings may vary according to the previous state, it is recommended that the settings be configured each time.

Synchronization mode: INTERNAL

Synchronization frequency: 60.00 Hz

Measurement speed: FAST

Simultaneous control: Color & flicker

Display mode: Lv,x,y

Flicker method: FMA

Calibration channel: CH00

Luminance unit: cd/m$^2$

Trigger delay time: 0 ms

Interval mode: OFF

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "SCS,4,60.00" + delimiter | "OK00" + delimiter | Set synchronization mode to INTERNAL and frequency to 60.00 Hz. |
| 3 | "FSC,1" + delimiter | "OK00" + delimiter | Set measurement speed to FAST. |
| 4 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1. |
| 5 | "MMS,0" + delimiter | "OK00" + delimiter | Execute simultaneous color & flicker measurement. |
| 6 | "FMS,0" + delimiter | "OK00" + delimiter | FMA method |
| 7 | "MDS,0" +  delimiter | "OK00" + delimiter | x,y,Lv display |
| 8 | "IMS,0" + delimiter | "OK00" + delimiter | Interval mode OFF |
| 9 | "MCH,0" + delimiter | "OK00" + delimiter | Calibration channel 00 |
| 10 | "LUS,1" +delimiter | "OK00" + delimiter | Luminance unit cd/m |
| 11 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. $^2$ |
| 12 | "TDS,0" + delimiter | "OK00" + delimiter | Trigger delay time 0 ms |
| 13 | "TMS,1" + delimiter | "OK00" + delimiter | Trigger mode ON |
| 14 | "MES,2" + delimiter | "OK00" + delimiter | Execute measurement. |
| 15 | | | Trigger signal standby status |
| 16 | | "OK00,P1, 0,0.3800163,0.3932068,1.6343512,+0.17,2.3083632,1.5795251,1.6343512,0.9425910" + delimiter | Measurement response after trigger signal detected |
| 17 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor. |

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## 2.1.4. Trigger Measurement (Probe)

This example takes a measurement with the following settings.

Since these settings may vary according to the previous state, it is recommended that the settings be configured each time.

Synchronization mode: INTERNAL

Synchronization frequency: 60.00 Hz

Measurement speed: FAST

Simultaneous control: Color & flicker

Display mode: Lv,x,y

Flicker method: FMA

Calibration channel: CH00

Luminance unit: $cd/m^2$

Trigger delay time: 0 ms

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "SCS,4,60.00" + delimiter | "OK00" + delimiter | Set synchronization mode to INTERNAL and frequency to 60.00 Hz. |
| 2 | "FSC,1" + delimiter | "OK00" + delimiter | Set measurement speed to FAST |
| 3 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1 |
| 4 | "MMS,0" + delimiter | "OK00" + delimiter | Set simultaneous color & flicker measurement. |
| 5 | "FMS,0" + delimiter | "OK00" + delimiter | FMA method |
| 6 | "MDS,0" + delimiter | "OK00" + delimiter | x,y,Lv display |
| 7 | "MCH,0" + delimiter | "OK00" + delimiter | Calibration channel 00 |
| 8 | "LUS,1" +delimiter | "OK00" + delimiter | Luminance unit $cd/m^2$ |
| 9 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. |
| 10 | "TDS,0" + delimiter | "OK00" + delimiter | Trigger delay time 0 ms |
| 11 | "TMS,1" + delimiter | "OK00" + delimiter | Trigger mode ON |
| 12 | | | Trigger signal standby status |
| 13 | | "OK00,P1, 0,0.3800163,0.3932068,1.6343512,+0.17,2.3083632,1.5795251,1.6343512,0.9425910" + delimiter | Measurement response after trigger signal detected |

## 2.2. <u>Calibration Channel</u>

### 2.2.1. Register Color Difference Target Values by Measurement

The following commands must be used to register color difference target values by measurement.

<u>UCS</u>→ <u>MES</u>→ <u>ETR</u>

This example takes a measurement with the following settings.

Since these settings may vary according to the previous state, it is recommended that the settings be configured each time.

Synchronization mode: INTERNAL

Synchronization frequency: 60.00 Hz

Measurement speed: FAST

Simultaneous control: Color & flicker

Display mode: Lv,x,y

Flicker method: FMA

Calibration channel: CH01

Luminance unit: cd/m$^2$

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "SCS,4,60.00" + delimiter | "OK00" + delimiter | Set synchronization mode to INTERNAL and frequency to 60.00 Hz. |
| 3 | "FSC,1" + delimiter | "OK00" + delimiter | Set measurement speed to FAST. |
| 4 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1. |
| 5 | "DPR,1" + delimiter | "OK00" + delimiter | Set display probe (registration target) to P1. |
| 6 | "MDS,0" + delimiter | "OK00" + delimiter | x,y,Lv display |
| 7 | "MCH,1" + delimiter | "OK00" + delimiter | Set calibration channel 1 as the target calibration channel. |
| 8 | "LUS,1" +delimiter | "OK00" + delimiter | Luminance unit cd/m$^2$ |
| 9 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. |
| 10 | "UCS,0" + delimiter | "OK00" + delimiter | Calibration mode OFF |
| 11 | "MES,1" + delimiter | "OK00,P1,0,0.3274345,0.4191236,4.8075729, +0.39,2.1047971" + delimiter | Execute measurement. |
| 12 | "ETR,1,2017,1,1,0,0,0" + delimiter | "OK00" + delimiter | Register measurement results of step 10 as color difference target values. |
| 13 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor. |

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## 2.2.2.    Register Color Difference Target Values by Input

The following command must be used to register color difference target values by input.

UWT

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "DPR,1" + delimiter | "OK00" + delimiter | Set display probe (registration target) to P1. |
| 3 | "UCS,0" + delimiter | "OK00" + delimiter | Calibration mode OFF |
| 4 | "UWT,1,0,0.3000000,0.300000,100.00000,2017,1,1,0,0,0" + delimiter | "OK00" + delimiter | Register the color difference target values to calibration channel 1. |
| 5 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor. |

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## 2.2.3. RGB+W Matrix Calibration

The following commands must be used for RGB+W calibration.
UCS→ MES→ UWT→ MES→ URD→ MES→ UGR→ MES→ UBL→ ETR

This example takes a measurement with the following settings.
Since these settings may vary according to the previous state, it is recommended that the settings be configured each time.

Synchronization mode: INTERNAL

Synchronization frequency: 60.00 Hz

Measurement speed: FAST

Simultaneous control: Color & flicker

Display mode: Lv,x,y

Flicker method: FMA

Calibration channel: CH01

Luminance unit: $cd/m^2$

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "SCS,4,60.00" + delimiter | "OK00" + delimiter | Set synchronization mode to INTERNAL and frequency to 60.00 Hz. |
| 3 | "FSC,1" + delimiter | "OK00" + delimiter | Set measurement speed to FAST. |
| 4 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1. |
| 5 | "DPR,1" + delimiter | "OK00" + delimiter | Set display probe (calibration target) to P1. |
| 6 | "MDS,0" + delimiter | "OK00" + delimiter | x,y,Lv display |
| 7 | "MCH,1" + delimiter | "OK00" + delimiter | Calibrate calibration channel 1 |
| 8 | "LUS,1" +delimiter | "OK00" + delimiter | Luminance unit cd/m |
| 9 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. $^2$ |
| 10 | "UCS,1" + delimiter | "OK00" + delimiter | Calibration mode ON |
| 11 | "MES,1" + delimiter | "OK00,P1,0,0.3072411,0.3164649,75.287143, +0.03,0.9472149" + delimiter | Execute white measurement. |
| 12 | "UWT,0,0.3333333,0.3333333 ,100.00000" + delimiter | "OK00" + delimiter | Input white calibration target value. |
| 13 | "MES,1" + delimiter | "OK00,P1,0,0.5483457,0.3465548,18.183179,- 0.63,1.1644410" + delimiter | Execute red measurement. |
| 14 | "URD,0,0.5500000,0.3500000 ,20.000000" + delimiter | "OK00" + delimiter | Input red calibration target value. |
| 15 | "MES,1" + delimiter | "OK00,P1,0,0.3330135,0.5379556,46.164661,- 0.64,1.1435609" + delimiter | Execute green measurement. |
| 16 | "UGR,0,0.3300000,0.5500000 ,45.000000" + delimiter | "OK00" + delimiter | Input green calibration target value. |

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| 17 | "MES,1" + delimiter | "OK00,P1,0,0.1673931,0.1213722,13.202796,-0.63,1.1759775" + delimiter | Execute blue measurement. |
|----|---------------------|----------------------------------------------------------------------|---------------------------|
| 18 | "UBL,0,0.1600000,0.1200000, 10.000000" + delimiter | "OK00" + delimiter | Input blue calibration target value. |
| 19 | "ETR,1,2017,1,1,0,0,0" + delimiter | "OK00" + delimiter | Confirm the RGB+W matrix calibration from the measurement results in 10, 12, 14, and 16 and the target values in 11, 13, 15, and 17. |
| 20 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor. |

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## 2.2.4. Single point calibration

The following commands must be used for RGB+W calibration.

UCS→ MES→ UWT→ ETR

This example takes a measurement with the following settings.

Since these settings may vary according to the previous state, it is recommended that the settings be configured each time.

Synchronization mode: INTERNAL

Synchronization frequency: 60.00 Hz

Measurement speed: FAST

Simultaneous control: Color & flicker

Display mode: Lv,x,y

Flicker method: FMA

Calibration channel: CH01

Luminance unit: cd/m$^2$

| Order | Transmit | Receive | Meaning |
|---|---|---|---|
| 1 | "COM,1" + delimiter | "OK00" + delimiter | Start communications with data processor. |
| 2 | "SCS,4,60.00" + delimiter | "OK00" + delimiter | Set synchronization mode to INTERNAL and frequency to 60.00 Hz. |
| 3 | "FSC,1" + delimiter | "OK00" + delimiter | Set measurement speed to FAST. |
| 4 | "OPR,1" + delimiter | "OK00" + delimiter | Set output probe to P1. |
| 5 | "DPR,1" + delimiter | "OK00" + delimiter | Set display probe (calibration target) to P1. |
| 6 | "MDS,0" + delimiter | "OK00" + delimiter | x,y,Lv display |
| 7 | "MCH,1" + delimiter | "OK00" + delimiter | Calibrate calibration channel 1. |
| 8 | "LUS,1" +delimiter | "OK00" + delimiter | Luminance unit cd/m$^2$ |
| 9 | "ZRC" + delimiter | "OK00" + delimiter | Execute zero calibration. |
| 10 | "UCS,1" + delimiter | "OK00" + delimiter | Calibration mode ON |
| 11 | "MES,1" + delimiter | "OK00,P1,0,0.3072411,0.3164649,75.287143, +0.03,0.9472149" + delimiter | Execute measurement. |
| 12 | "UWT,0,0.3333333,0.3333333 ,100.00000" + delimiter | "OK00" + delimiter | Input the calibration target values. |
| 13 | "ETR,1,2017,1,1,0,0,0" + delimiter | "OK00" + delimiter | Confirm the Single point calibration from the measurement result in 10 and the target value in 11. |
| 14 | "COM,0" + delimiter | "OK00" + delimiter | End communications with data processor. |

# 3. Command Descriptions

## 3.1. Command List

The commands listed in this section are executed for all probes when the data processor is connected from the host.

Commands exclusively for the data processor, such as the backlight settings and interval mode settings, will result in an error if used on probes.

| Command | Overview |
|---|---|
| [Communication] | |
| COM | Starts and ends communications with the CA-410 data processor. |
| BPS | Sets the baud rate between the host and device. |
| BPR | Gets the baud rate between the host and device. |
| [Device information] | |
| IDO | Gets information unique to the device, such as serial number and model name. |
| RST | Initializes the measurement conditions and device settings. |
| [Device settings] | |
| MDS | Sets the display mode (color space). |
| DPR | Sets the display probe. You can use this command to set the user calibration target probe. |
| OPR | Sets the output probe. |
| LDS | Sets the LED display of the CA-410 probe. |
| LDR | Gets the LED display of the CA-410 probe. |
| BLS | Sets the backlight of the CA-410 data processor. |
| BLR | Gets the backlight setting of the CA-410 data processor. |
| CDS | Sets the usage start date of the CA-410 probe. |
| [Measurement conditions] | |
| SCS | Sets the synchronization mode and synchronization frequency. |
| FSC | Sets the measurement speed. |
| TMS | Turns trigger mode ON and OFF. |
| TDS | Sets the delay time for trigger mode. |
| MMS | Sets simultaneous control of color and flicker measurements. |
| FMS | Sets the flicker measurement method. |
| JCS | Sets the JEITA flicker measurement conditions in the flicker measurement sensor. |
| IMS | Sets the interval mode of the CA-410 data processor. |
| IMR | Gets the interval mode of the CA-410 data processor. |
| STR | Gets the measurement conditions and device settings. |
| RGS | Sets the measurement range. |
| RGR | Gets the measurement range. |
| LUS | Sets the luminance unit |
| [Calibration] | |

## CA-410 Communication Specifications

| | |
|---|---|
| ZRC | Executes zero calibration. |
| MCH | Sets the calibration channel used for measurements. |
| TDR | Gets calibration channel information. |
| UCS | Turns calibration mode ON and OFF. |
| UWT | Inputs the user calibration target values for the color difference target values/white. |
| URD | Inputs the red user calibration target values. |
| UGR | Inputs the green user calibration target values. |
| UBL | Inputs the blue user calibration target values. |
| ETR | Confirms color difference target values settings by measurement/user calibration. |
| IDS | Sets an ID name for the calibration channel. |
| MCS | Sets a comment for the calibration channel. |
| MCR | Gets the comment for the calibration channel. |
| MAD | Initializes all calibration channels. |
| MDD | Initializes the calibration channel of the specified number. |
| TAD | Initializes target values data in all calibration channels. |
| TDD | Initializes target values data in the calibration channel of the specified number. |
| [Measurement] | |
| MES | Executes measurement. |
| JDR | Gets the JEITA flicker measurement results. |
| FDR | Gets the JEITA flicker measurement results as AD count values. |

## 3.2.  Command Reference Notation Rules

The commands are described using the following format.

---

**Command:**

The string that is specified as the command.

**Transmit Format:**

This section describes the format when transmitting a command.

Details about the transmitted parameters are described in the following table.

Type indicates the  type of device that is  connected from the host  in the description of the  parameter. Type is DP when the device is the data processor, P when the device is a probe, and C when the parameter is common to both the data processor and probe.

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Receive Format:**

This section describes the format when receiving a command response.

Details about the received parameters are described in the following table.

Type indicates the  type of device that  is connected from the host  in the description of the  parameter. Type is DP when the device is the data processor, P when the device is a probe, and C when the parameter is common to both the data processor and probe.

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

For configuration functions, this section notes  whether settings are saved (non-volatile) or reset  to the default value (volatile) when the power supply to the probe or data processor is turned OFF.

This section describes necessary information and precautions when using the command.

**Error Code:**

This section describes error codes that are received.

Details about the error codes are described in the following table.

Type indicates the  type of device that is  connected from the host  in the description of the  parameter. Type is DP when the device is the data processor, P when the device is a probe, and C when the parameter is common to both the data processor and probe.

| Code | Type | Meaning |
|------|------|---------|
|      |      |         |

---

**CA-410 Communication Specifications**

# 3.3.   Command Reference

## 3.3.1.   Communication

### 3.3.1.1.   COM [Start and End Communications with CA-410 Data Processor]

**Command:**

COM

**Transmit Format:**

"COM,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Remote mode | 1 digit (fixed) | C | 0: Remote OFF<br>1: Remote ON |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This command switches the remote status with the CA-410 data processor.

This command does not need to be used for the CA-410 probe. Communications are possible with the CA-410 without using this command and in the remote OFF status.

The data processor will not return a response in the remote OFF status.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER99 | C | Firmware error |

**CA-410 Communication Specifications**

### 3.3.1.2. BPS [Set Baud Rate between Host and Device]

**Command:**

BPS

**Transmit Format:**

"BPS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Baud rate | 3 to 6 digits (variable) | DP | 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400[bps] |
| [1] | Baud rate | 3 to 6 digits (variable) | P | 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 [bps] |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| | | | | |

**Description:**

This setting is volatile for the probe.

This setting is non-volatile for the data processor.

This command sets the baud rate between the host and device.

The settable range is different for the data processor and a probe.

The response for this command is returned at the baud rate before the setting was changed. Change the baud rate of the host after the response is received.

Wait 50 ms after the host has received the response before starting communications after changing the baud rate of the host.

For the CA-410 probe, the setting is reset to 38,400 [bps] (default) when the power supply is turned OFF.

For the CA-410 data processor, the set baud rate is saved, even when the power supply is turned OFF.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER99 | C | Firmware error |

**CA-410 Communication Specifications**

### 3.3.1.3. BPR [Get Baud Rate between Host and Device]

**Command:**

BPR

**Transmit Format:**

"BPR" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Receive Format:**

"Error code",[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Baud rate | 3 to 6 digits (variable) | DP | 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400 |
| [1] | Baud rate | 3 to 6 digits (variable) | P | 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600 |

**Description:**

This command gets the baud rate between the host and device.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER99 | C | Firmware error |

## 3.3.2. Device Information

### 3.3.2.1. IDO [Get Unique Device Information]

**Command:**

IDO

**Transmit Format:**

"IDO,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | Device from which to get the information<br>0: Data Processor<br>1 to 10: Number of probe connected to the data processor |
| [1] | ~~Probe No.~~ | 1 to 2 digits (variable) | P | 0 to 10: Must be input, but has no meaning for the probe |
| [2] | Expanded format | 1 digit (fixed) | C | 1 (fixed) |

**Receive Format:**

"Error code,[1],[2],[3],[4],[5],[6]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Product name | 6 digit (fixed) | C | CA-410 |
| [2] | Variation code | 5 digit (fixed) | C | 00000 to 99999 |
| [3] | Model name | 16 digit (fixed) | C | Refer to Description<br>Model names less than 16 characters are left-aligned and the unused portion is filled with spaces. |
| [4] | Firmware version No. | 13 digit (fixed) | C | Ver.X.XX.XXXX<br>(X is substituted with the version numbers) |
| [5] | Serial number | 8 digit (fixed) | C | 00000000 to 99999999 |
| [6] | Custom No. | 0 to 16 digits (variable) | C | 0 characters if not set |

**Description:**

This command gets information unique to the device, such as the CA-410 serial number and model name.

The correct information cannot be obtained if transmit format [1] is omitted.

The model name and variation code in the receive format correspond as given in the following table.

| | Model name | Variation code |
|---|---|---|
| CA-410 φ10 mini probe | CA-MP410 | 00830/00832 |
| CA-410 φ10 mini high-luminance probe | CA-MP410H | 00831/00833 |
| CA-410 φ27 probe | CA-P427 | 00810/00812 |
| CA-410 φ27 high-luminance probe | CA-P427H | 00811/00813 |
| CA-410 φ10 probe | CA-P410 | 00890/00892 |

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| CA-410  φ10 high-luminance probe | CA-P410H | 00891/00893 |
|---|---|---|
| CA-410  φ27 high-sensitivity probe | CA-VP427 | 00840/00842 |
| CA-410  φ10 high-sensitivity probe | CA-VP410 | 00850/00852 |
| CA-410 Data Processor | CA-DP40 | 00100 |

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER99 | C | Firmware error |

**CA-410 Communication Specifications**

### 3.3.2.2. RST [Initialize Settings]

**Command:**

RST

**Transmit Format:**

"RST,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | Device to initialize<br>0: Data Processor<br>1 to 10: Number of probe connected to the data processor |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 0 to 10: Must be input, but has no meaning for the probe |
| [2] | Initialization target | 1 digit (fixed) | DP | If [1] is 0<br>0: Saved data, log data, measurement conditions, and device settings on data processor and probes<br>1: Saved data and log data<br>2: Measurement conditions on data processor and probes<br>3: Device settings on data processor and probes<br>If [1] is 1 to 10<br>0: Calibration channel data, measurement conditions, and device settings on probe<br>1: Calibration channel data<br>2: Measurement conditions on probe<br>3: Device settings on probe |
| [2] | Initialization target | 1 digit (fixed) | P | 0: Calibration channel data, measurement conditions, and device settings on probe<br>1: Calibration channel data<br>2: Measurement conditions on probe<br>3: Device settings on probe |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This command initializes CA-410 data, measurement conditions, and device settings.

When the CA-410 data processor is used, the probe settings are set to the same settings as the data processor after initialization.

If transmit parameter [1] is omitted, the probe and initialization target will be incorrect.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |

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| ER10 | C | Command error |
|------|---|---------------|
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

**CA-410 Communication Specifications**

### 3.3.3.    Device Settings

#### 3.3.3.1.    MDS [Set Display Mode (Color Space)]

**Command:**

MDS


**Transmit Format:**

"MDS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Display mode | 1 digit (fixed) | C | 0: x,y,Lv<br>1: Tcp,duv,Lv<br>5: u',v',Lv<br>6: Flicker mode<br>7: X,Y,Z<br>8: λd,Pe,Lv |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is non-volatile.

This command sets the display mode (color space) of the CA-410.

The color space value returned by the "MES" command and the color space value displayed  on the data processor are changed with this command.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.2.    DPR [Set Display Probe]

**Command:**

DPR

**Transmit Format:**

"DPR,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Display probe number | 1 to 2 digits (variable) | DP | 1 to 10: Number of the probe to set as the display probe |
| [1] | Display probe number | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| | | | | |

**Description:**

This setting is volatile.

This command sets the display probe on the CA-410 data processor.

The focus on the screen is changed with this command.

The probe on which to execute user calibration is the probe set with this command.

If a probe is selected that is not connected, "ER10" will be returned.

This command has no meaning for CA-410 probes.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.3.　OPR [Set Output Probe]

**Command:**

OPR

**Transmit Format:**

"OPR,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Output probe number | 1 to 11 digits (variable) | DP | Number of the probe to set as the output probe<br>0: All probes connected to the data processor<br>1 to 12345678910: Probe connected to the data processor |
| [1] | Output probe number | 1 to 11 digits (variable) | P | 0 to 12345678910: Must be input, but has no meaning for the probe |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This setting is volatile.

This command sets the output probe(s) on the CA-410 data processor.

The probe(s) that respond to the MES and TDR commands are changed with this command.

If a probe is selected that is not connected, "ER10" will be returned.

Example

"OPR,2": Only the P2 probe is output

"OPR,134": The P1, P3, and P4 probes are output

"OPR,0": All connected probes are output

This command has no meaning for CA-410 probes.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.4.   LDS [Set LED Display of CA-410 Probe]

**Command:**

LDS

**Transmit Format:**

"LDS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | LED ON/OFF setting | 1 digit (fixed) | C | 0: LED display disabled<br>1: LED display enabled |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is non-volatile.

This command turns the LED display of the CA-410 probe ON and OFF.

The LED is always OFF when the LED display is disabled.

The LED will turn OFF during a measurement, even when the LED displayed is enabled, so normally it is not necessary to disable the LED. However, the LED will be ON when the probe is not taking measurements and may interfere with other devices, so execute this command as necessary.

This setting is saved when the probe's power supply is turned OFF. If the LED display is disabled, the LED will remain OFF the next time the probe is started.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.5.    LDR [Get LED Display Setting of CA-410 Probe]

**Command:**

LDR

**Transmit Format:**

"LDR" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Receive Format:**

"Error code",[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | LED ON/OFF setting | 1 digit (fixed) | C | 0: LED display disabled<br>1: LED display enabled |

**Description:**

This command gets the LED display setting of the CA-410 probe.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.6.    BLS [Set Backlight of CA-410 Data Processor]

**Command:**

BLS

**Transmit Format:**

"BLS,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Backlight ON/OFF setting | 1 digit (fixed) | DP | 0: Backlight OFF<br>1: Backlight ON |
| [2] | Backlight brightness setting | 1 digit (fixed) | DP | 1: Level 1 (dark)<br>2: Level 2<br>3: Level 3 (standard)<br>4: Level 4<br>5: Level 5 (bright) |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

The ON/OFF setting is volatile.

The brightness setting is non-volatile.

This command sets the backlight of the CA-410 data processor.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.7.    BLR [Get Backlight Setting of CA-410 Data Processor]

**Command:**

BLR

**Transmit Format:**

"BLR" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Receive Format:**

"Error code",[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Backlight ON/OFF setting | 1 digit (fixed) | DP | 0: Backlight OFF<br>1: Backlight ON |
| [2] | Backlight brightness setting | 1 digit (fixed) | DP | 1: Level 1 (dark)<br>2: Level 2<br>3: Level 3 (standard)<br>4: Level 4<br>5: Level 5 (bright) |

**Description:**

This command gets the backlight settings of the CA-410 data processor.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.3.8.    CDS [Set Usage Start Date of CA-410 Probe]

**Command:**

CDS

**Transmit Format:**

"CDS,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Usage start year | 4 digit (fixed) | C | 2000 to 2099 |
| [2] | Usage start month | 1 to 2 digits (variable) | C | 1 to 12 |
| [3] | Usage start day | 1 to 2 digits (variable) | C | 1 to 31 |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This setting is non-volatile.

This command sets the usage start date of the CA-410 probe.

This command allows you to obtain the periodical calibration recommended date using "STR,25" with the "STR" command.

The CA-410 calculates the periodical calibration recommended date from the usage start date saved with this command.

Only the first usage start date sent with this command is saved. Dates can be sent multiple times, but the usage start date will not be updated.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.4. Measurement Conditions

#### 3.3.4.1. SCS [Set Synchronization Mode and Synchronization Frequency]

**Command:**

SCS

**Transmit Format:**

"SCS,[1],[2]" + delimiter

"SCS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Synchronization mode | 1 digit (fixed) | C | 0: NTSC<br>1: PAL<br>2: EXTERNAL<br>3: UNIVERSAL<br>4: INTERNAL<br>5: MANUAL |
| [2] | Synchronization frequency or measurement time | 1 to 6 characters (variable) | C | If [1] is 0 to 3<br>This parameter must not be entered.<br>If the parameter is entered, "ER10" will be returned.<br>If [1] is 4<br>0.50 to 240.00: 1 vsync frequency [Hz]<br>The value from the third digit after the decimal point is ignored<br>If [1] is 5<br>4.0 to 4000.0: Measurement time (exposure time) [msec]<br>The value from the second digit after the decimal point is ignored |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This setting is non-volatile.

This command sets the synchronization mode and synchronization frequency or measurement time.

For EXTERNAL mode and INTERNAL mode, the measurement time will be an even multiple of the set synchronization frequency.

Parameter [2] can be omitted in all synchronization modes. In this case, the previously set synchronization frequency or measurement time will be applied.

Measurements with EXTERNAL and trigger mode ("TMS" command) cannot be combined. To take a measurement with trigger mode when set to EXTERNAL mode, take the measurement is taken with UNIVERSAL mode.

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When using the data processor, the EXTERNAL synchronization signal cannot be input directly to probes. Any EXTERNAL synchronization signal input directly to probes is ignored.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.2. FSC [Set Measurement Speed]

**Command:**

FSC

**Transmit Format:**

"FSC,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Measurement speed | 1 digit (fixed) | C | 0: SLOW<br>1: FAST<br>2: LTD.AUTO<br>3: AUTO |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This setting is non-volatile.

This command sets the measurement speed.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.3.   TMS [Turn Trigger Mode ON and OFF]

**Command:**

TMS

**Transmit Format:**

"TMS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Trigger mode ON/OFF | 1 digit (fixed) | C | 0: Clear trigger mode<br>1: Enable trigger mode |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is volatile for the probe.

This setting is non-volatile for the data processor.

This command turns trigger mode ON and OFF.

When the synchronization mode ("SCS" command) is set to EXTERNAL mode, measurements by trigger mode are executed in UNIVERSAL mode.

The trigger mode usage method is different depending on whether the CA-410 device  to which the host is connected is a probe or the data processor.


For Probes:

If trigger mode is enabled for a probe, a measurement is taken each time the trigger signal is received, and the probe returns the  measurement results to the host as the response. The  receive format of the measurement results for  the host at this time  is the receive format  when "MES,2"  is transmitted with the "MES"  command.

Trigger mode is cleared when the power supply to the probe is turned OFF.


For the Data Processor:

For the  data processor,  trigger measurements cannot  be executed  simply by  enabling trigger  mode. When trigger mode is enabled, enter the trigger signal standby status by transmitting  "MES,2" with the "MES" command. If the trigger signal is received in the  trigger signal standby status, the measurement is executed, and the measurement results  are returned as the response for  "MES,2". The trigger signal standby  status will  end when the measurement has  completed. To once again take  a trigger measurement, "MES,2" must be transmitted again.

Commands will  not be processed  correctly if sent  during the trigger  signal standby status.  Command

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operation is not guaranteed in this case.

If no trigger signal is input after a certain amount of time elapses in the trigger signal standby status, a timeout will occur and "ER10" will be returned.

- If interval mode ("IMS" command) is ON, trigger measurements cannot be executed.

- If the data processor and probe are not connected via RS-232C, trigger measurements cannot be executed.

If either of the above two items is applicable, trigger mode will be ON on the MENU screen of the data processor, but measurements by trigger mode cannot actually be executed. The actual trigger enabled status can be checked with the trigger mode icon on the data processor's LCD or obtained by transmitting "STR,18" with the "STR" command.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.4.    TDS [Set Trigger Mode Delay Time]

**Command:**

TDS

**Transmit Format:**

"TDS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Trigger mode delay time | 1 to 4 digits (fixed) | C | 0 to 1000: Trigger mode delay time [msec] |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is non-volatile.

This command sets the delay time for trigger mode.

The delay time sets the time from when the trigger signal is detected to when the measurement is started.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.5.  MMS [Set Simultaneous Control of Color and Flicker Measurements]

**Command:**

MMS

**Transmit Format:**

"MMS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Simultaneous control setting | 1 digit (fixed) | C | 0: Simultaneous color/flicker measurements<br>1: Color measurement only<br>2: Flicker measurement only |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This setting is non-volatile for the probe.

This setting is volatile for the data processor.

This command sets whether or not to simultaneously perform color and flicker measurements.

There are two types of flicker measurements: FMA method and JEITA method.

When simultaneous color/flicker measurements are set  for the CA-VP427 and CA-VP410, the operation is color measurement only.

If the  range setting with the "RGS" command is  auto and color/flicker  are simultaneously performed, there may be a  delay in obtaining the measurement  results due to changing the ranges  for both color measurement and flicker measurement.

When color measurement and JEITA  flicker measurement are simultaneously performed, there may  be a delay in obtaining the color measurement result due to the JEITA measurement time.

When using the data processor, simultaneous measurements are set when remote is set to OFF.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.6.    FMS [Set Flicker Measurement Method]

**Command:**

FMS

**Transmit Format:**

"FMS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Flicker measurement method | 1 digit (fixed) | C | 0: FMA method (contrast method)<br>1: JEITA method |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This setting is non-volatile.

This command sets the flicker measurement method.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.7.    JCS [Set JEITA Flicker Measurement Conditions in Flicker Measurement Sensor]

**Command:**

JCS

**Transmit Format:**

"JCS,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Sampling frequency | 1 to 4 digits (variable) | C | Frequency [Hz]<br>0.07 to 0.09    Increments of 0.01 [Hz]<br>0.1 to 0.9        Increments of 0.1 [Hz]<br>1 to 10            Increments of 1 [Hz] |
| [2] | Number of samples | 1 to 2 digits (variable) | C | Set the sampling frequency as the exponent of 2<br>Range 6 to 11<br>6: 64<br>7: 128<br>8: 256<br>9: 512<br>10: 1024<br>11: 2048 |

**Receive Format:**

"Error code,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Minimum frequency | 1 to 5 digits (variable) | C | Lower limit value of measurement frequency range of JEITA measurement [Hz]<br>0.02 to 65 |
| [2] | Maximum frequency | 1 to 5 digits (variable) | C | Upper limit value of measurement frequency range of JEITA measurement [Hz]<br>0.02 to 65 |
| [3] | Frequency pitch | 1 to 4 digits (variable) | C | Frequency resolution of JEITA measurement [Hz]<br>0.07 to 10 |

**Description:**

This setting is non-volatile.

This command sets the JEITA flicker measurement conditions in the flicker sensor. After the measurement conditions have been set, the JEITA flicker spectrum frequency range and frequency pitch will be returned.

The following table gives the frequency range [Hz] of JEITA flicker measurement results that can be obtained with this setting. Cells that have been crossed out with a diagonal line cannot be set.

When using the data processor and remote is OFF, the number of samples is set to the value in **bold** according to the sampling frequency setting.

| | Number of samples | | | | | |
|---|---|---|---|---|---|---|
| | 2^6 | 2^7 | 2^8 | 2^9 | 2^10 | 2^11 |

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| Sampling frequency [Hz] | | | | | | |
|---|---|---|---|---|---|---|
| 0.07 | 0.42-2.24 | 0.42-4.48 | 0.42-8.96 | 0.42-17.92 | 0.42-35.84 | **0.42-64.96** |
| 0.08 | 0.48-2.56 | 0.48-5.12 | 0.48-10.24 | 0.48-20.48 | 0.48-40.96 | **0.48-64.96** |
| 0.09 | 0.54-2.88 | 0.54-5.76 | 0.54-11.52 | 0.54-23.04 | 0.54-46.08 | **0.54-64.98** |
| 0.1 | 0.6-3.2 | 0.6-6.4 | 0.6-12.8 | 0.6-25.6 | 0.6-51.2 | **0.6-65** |
| 0.2 | 1.2-6.4 | 1.2-12.8 | 1.2-25.6 | 1.2-51.2 | 1.2-65 | **1.2-65** |
| 0.3 | 1.8-9.6 | 1.8-19.2 | 1.8-38.4 | 1.8-64.8 | 1.8-64.8 | **1.8-64.8** |
| 0.4 | 2.4-12.8 | 2.4-25.6 | 2.4-51.2 | 2.4-64.8 | 2.4-64.8 | **2.4-64.8** |
| 0.5 | 3-16 | 3-32 | 3-64 | 3-65 | 3-65 | **3-65** |
| 0.6 | 3.6-19.2 | 3.6-38.4 | 3.6-64.8 | 3.6-64.8 | **3.6-64.8** | |
| 0.7 | 4.2-22.4 | 4.2-44.8 | 4.2-64.4 | 4.2-64.4 | **4.2-64.4** | |
| 0.8 | 4.8-25.6 | 4.8-51.2 | 4.8-64.8 | 4.8-64.8 | **4.8-64.8** | |
| 0.9 | 5.4-28.8 | 5.4-57.6 | 5.4-64.8 | 5.4-64.8 | **5.4-64.8** | |
| 1 | 6-32 | 6-64 | 6-65 | 6-65 | **6-65** | |
| 2 | 12-64 | 12-64 | 12-64 | **12-64** | | |
| 3 | 18-63 | 18-63 | **18-63** | | | |
| 4 | 24-64 | 24-64 | **24-64** | | | |
| 5 | 30-65 | **30-65** | | | | |
| 6 | 36-60 | **36-60** | | | | |
| 7 | 42-63 | **42-63** | | | | |
| 8 | 48-64 | **48-64** | | | | |
| 9 | **54-63** | | | | | |
| 10 | **60-60** | | | | | |

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.8. IMS [Set Data Processor Interval Mode]

**Command:**

IMS

**Transmit Format:**

"IMS,[1]" + delimiter

"IMS,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Interval mode ON/OFF | 1 digit (fixed) | DP | 0: Interval mode OFF<br>1: Interval mode ON |
| [2] | Interval time | 2 to 4 digits (variable) | DP | When [1] is 0, this parameter cannot be entered.<br>Interval measurement time [sec]<br>10 to 3600 |
| [3] | Number of intervals | 1 to 4 digits (variable) | DP | When [1] is 0, this parameter cannot be entered.<br>1 to 6144<br>However, the maximum value may decrease according to free space for log data |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is non-volatile.

This command sets the interval mode of the CA-410 data processor.

If interval mode is turned ON, measurements in trigger mode ("TMS" command) cannot be executed.

Normal measurements will be executed instead.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.4.9.    IMR [Get Data Processor Interval Mode]

**Command:**

IMR

**Transmit Format:**

"IMR" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Receive Format:**

"Error code,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Interval mode   ON/OFF | 1 digit (fixed) | DP | 0: Interval mode OFF<br>1: Interval mode ON |
| [2] | Interval time | 2 to 4 digits (variable) | DP | Interval measurement time [sec]<br>10 to 3600 |
| [3] | Number of intervals | 1 to 4 digits (variable) | DP | 1 to 6144 |

**Description:**

This command gets the interval mode of the CA-410 data processor.

If interval mode  is turned ON, measurements  in trigger mode ("TMS"  command) cannot be  executed.

Normal measurements will be executed instead.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.4.10.  STR [Get Measurement Conditions and Device Settings]

**Command:**

STR

**Transmit Format:**

"STR,[1]" + delimiter

"STR,[2],[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Item to obtain | 1 to 2 digits (variable) | C | 0: Get display mode<br>1: Get synchronization mode<br>3: Get calibration channel number<br>4: Get calibration channel ID<br>6: Get luminance unit<br>7: Get measurement speed<br>11: Get display probe number<br>12: Get output probe number<br>15: Get temperature shift from zero calibration<br>16: Get EXTERNAL frequency<br>17: Get MANUAL measurement time<br>18: Get trigger mode ON/OFF<br>19: Get trigger mode delay time<br>20: Get flicker measurement method<br>21: Get JEITA sampling frequency<br>22: Get JEITA number of samples<br>23: Get zero calibration status<br>25: Get periodical calibration recommended date<br>26: Get color/flicker simultaneous control<br>28: Get INTERNAL frequency |
| [2] | Probe No. | 1 to 2 digits (variable) | DP | Probe number from which to obtain the information<br>1 to 10<br>This parameter must be entered when using the data processor and specifying the following information in parameter [1]<br>3, 4, 15, 23, 25, 26 |

**Receive Format:**

"Error code",[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Information | Variable | C | Refer to "Description" below. |

**Description:**

This command gets CA-410 measurement conditions and device settings.

The information  that can be obtained  depends on the  value specified in  parameter [1] of  the transmit format.

The operation of the command is not guaranteed if a  value other than those listed under  "Details/Range

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" is specified for parameter [1].

The following table gives the relationship between transmit parameter [1] and the content in receive parameter [1].

| Transmit Parameter [1] | Receive Parameter [1] Content | Digits/Length | Details/Range |
|---|---|---|---|
| 0 | Display mode | 1 digit (fixed) | Display mode set with "MDS" command<br>0: x,y,Lv<br>1: Tcp,duv,Lv<br>5: u',v',Lv<br>6: Flicker mode<br>7: X,Y,Z<br>8: λd,Pe,Lv |
| 1 | Synchronization mode | 1 digit (fixed) | Synchronization mode set with "SCS" command<br>0: NTSC<br>1: PAL<br>2: EXTERNAL<br>3: UNIVERSAL<br>4: INTERNAL<br>5: MANUAL |
| 3 | Calibration channel number | 2 digit (fixed) | Calibration channel number set with "MCH" command<br>00 to 99 |
| 4 | Calibration Channel ID | 12 digit (fixed) | Calibration channel ID set with "IDS" command<br>'[' is added before, and ']' is added after a 10-character ID name.<br>A space is added to the end if less than 10 characters. |
| 6 | Luminance unit | 1 digit (fixed) | Luminance unit set with "LUS" command<br>0: fL<br>1: cd/m$^2$ |
| 7 | Measurement speed | 1 digit (fixed) | Measurement speed set with "FSC" command<br>0: SLOW<br>1: FAST<br>2: LTD.AUTO<br>3: AUTO |
| 11 | Display probe number | 1 to 2 digits (variable) | Display probe number set with "DPR" command<br>1 to 10 |
| 12 | Output probe number | 5 to 11 digits (variable) | Output probe number set with "OPR" command<br>Left-aligned and spaces added to the end if less than 5 characters |
| 15 | Temperature shift from zero calibration | 5 to 6 digits (variable) | Difference between temperature when zero calibration was executed and current temperature [°C]<br>-99.99 to +99.99 |

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| 16 | EXTERNAL frequency | 4 to 6 digits (variable) | 1 vsync frequency [Hz] input to the CA-410 when set to EXTERNAL mode with "SCS" command<br>0.50 to 240.00<br>"ER20" will be returned if set to a mode other than EXTERNAL mode. |
|---|---|---|---|
| 17 | MANUAL measurement time | 3 to 5 digits (variable) | MANUAL mode measurement time [msec] set with "SCS" command<br>4.0 to 4000.0 |
| 18 | Trigger mode ON/OFF | 1 digit (fixed) | Trigger mode setting set with "TMS" command<br>0: OFF<br>1: ON<br>0 will be returned if using the data processor and trigger mode cannot be executed |
| 19 | Trigger delay time | 1 to 4 digits (variable) | Trigger delay time [msec] set with "TDS" command<br>0 to 1000 |
| 20 | Flicker measurement method | 1 digit (fixed) | Flicker measurement method set with "FMS" command<br>0: FMA method (contrast method)<br>1: JETIA method |
| 21 | JEITA sampling frequency | 1 to 4 digits (variable) | JEITA sampling frequency [Hz] in flicker sensor set with "JCS" command<br>0.07 to 10 |
| 22 | JEITA number of samples | 1 to 2 digits (variable) | JEITA number of samples in flicker sensor set with "JCS" command<br>6 to 11 |
| 23 | Zero calibration status | 1 digit (fixed) | Zero calibration status<br>0: Not executed<br>1: Zero calibration recommended<br>2: Zero calibration completed |
| 25 | Periodical calibration recommended date | 8 digit (fixed) | Periodical calibration recommended date YYYYMMDD format<br>Approximately 1 year after starting use of a CA-410 probe, we recommend returning the probe for service. The periodical calibration recommended date is 1 month before this time.<br>"ER91" will be returned if the periodical calibration recommended date is not set. In this case, the usage start date must be set with the "CDS" command. |
| 26 | Simultaneous measurement control | 1 digit (fixed) | Simultaneous measurement control setting set with "MMS" command<br>0: Simultaneous color/flicker measurements<br>1: Color measurement only<br>2: Flicker measurement only |
| 28 | INTERNAL frequency | 4 to 6 digits (variable) | 1 vsync frequency [Hz] of INTERNAL mode set with "SCS" command<br>0.50 to 240.00 |

**Error Code:**

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| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER20 | C | Not set to EXTERNAL mode<br>EXTERNAL signal not input or outside range |
| ER31 | C | Memory error |
| ER32 | C | Memory error |
| ER91 | C | Periodical calibration recommended date not set |
| ER99 | C | Firmware error |

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### 3.3.4.11.  RGS [Set Measurement Range]

**Command:**

RGS

**Transmit Format:**

"RGS,[1],[2],[3],[4]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 0: Set measurement range of all probes<br>1 to 10: Probe number to set |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 0 to 10: Must be input, but has no meaning for the probe |
| [2] | Range to set | 1 digit (fixed) | DP | Range to set<br>0: Color measurement range<br>1: Flicker measurement range |
| [2] | Range to set | 1 digit (fixed) | P | Range to set<br>0: Color measurement range<br>1: Flicker measurement range |
| [3] | Range switching mode | 1 digit (fixed) | C | 0: Auto range switching<br>1: Fixed range |
| [4] | Range No. | 1 digit (fixed) | DP | If [2] is 0, 1 to 6<br>If [2] is 1, 1 to 4<br>High-luminance measurements are supported with higher range numbers<br>If [3] is 0, this parameter can be omitted |
| [4] | Range No. | 1 digit (fixed) | P | If [2] is 0, 1 to 6<br>If [2] is 1, 1 to 4<br>If [2] is 2, 1 to 3<br>High-luminance measurements are supported with higher range numbers<br>If [3] is 0, this parameter can be omitted |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This setting is volatile.

This command sets the measurement range of the CA-410 probe.

The switching mode  is reset to auto  when the power supply is  turned OFF and by  setting remote OFF when using the data processor.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |

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| ER31 | C | Memory error |
|------|---|--------------|
| ER99 | C | Firmware error |

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### 3.3.4.12. RGR [Get Measurement Range]

**Command:**

RGR

**Transmit Format:**

"RGR,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number to set |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 0 to 10: Must be input, but has no meaning for the probe |
| [2] | Range to obtain | 1 digit (fixed) | DP | Range settings to obtain<br>0: Color measurement range<br>1: Flicker measurement range |
| [2] | Range to obtain | 1 digit (fixed) | P | Range settings to obtain<br>0: Color measurement range<br>1: Flicker measurement range |

**Receive Format:**

"Error code",[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Range switching mode | 1 digit (fixed) | C | 0: Auto range switching<br>1: Fixed range |
| [2] | Range No. | 1 digit (fixed) | C | If transmit parameter [2] is 0, 1 to 6<br>If transmit parameter [2] is 1, 1 to 4<br>If transmit parameter [2] is 2, 1 to 3<br>High-luminance measurements are supported with higher range numbers |

**Description:**

This command gets the measurement range of the CA-410 probe.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.4.13. LUS [Set Luminance Unit]

**Command:**

LUS

**Transmit Format:**

"LUS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 digit (fixed) | C | 0: fL<br>1: cd/m$^2$ |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is non-volatile.

This command sets the CA-410 luminance unit.

The Lv value in communication commands and the display value of the data processor are changed with this command.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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## 3.3.5. Calibration

### 3.3.5.1. ZRC [Execute Zero Calibration]

**Command:**

ZRC

**Transmit Format:**

"ZRC" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This command executes zero calibration.

The light-blocking shutter is closed and then reopened after zero calibration has completed.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER21 | C | Zero calibration error (light not fully blocked) |
| ER31 | C | Memory error |
| ER32 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.2.    MCH [Set Calibration Channel]

**Command:**

MCH

**Transmit Format:**

"MCH,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe on which the calibration channel will be set |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe |
| [2] | Calibration channel No. | 1 to 2 digits (variable) | C | 0 to 99: Calibration channel used for measurements |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This setting is non-volatile.

This command sets the calibration channel used for measurements.

User calibration and color difference target values are registered to the calibration channel.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.3.   TDR [Get Calibration Channel Information]

**Command:**

TDR

**Transmit Format:**

"IDR,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Calibration channel No. | 1 to 2 digits (variable) | C | 0 to 99: Calibration channel from which to obtain the information |
| [2] | Expanded format | 1 digit (fixed) | C | 1 (fixed) |
| [3] | Display mode | 1 digit (fixed) | C | 0 (fixed) |

**Receive Format:**

"Error code

,[1],[2],[3],[4],[5],[6],[7],[8],[9],[10],[11],[12],[13],[14],[15],[16],[17],[18],[19],[20],[21],[22],[23],[24],[25],[26],[27],[28],[29],[30],[31],[32],[33],[34],[35],[36],[37],[38],[39],[40],[41],[42]" +

delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Calibration channel No. | 4 digit (fixed) | C | 00 to 99: Calibration channel from which to obtain the information<br><br>"CH" is added before the calibration channel number. |
| [2] | Probe No. | 2 to 3 digits (variable) | C | 1 to 10: Probe number from which to obtain the information<br><br>"P" is added before the calibration channel number. |
| [3] | User calibration execution serial number | 8 digit (fixed) | C | Serial number of probe on which user calibration was executed<br>00000000 to 99999999 |
| [4] | Color difference target registration serial number | 8 digit (fixed) | C | Serial number of probe on which color difference target values were registered<br>00000000 to 99999999 |
| [5] | Model name | 16 digit (fixed) | C | Model name of probe on which user calibration was executed<br><br>For details, refer to "Description" of "IDO" command. |
| [6] | User calibration type | 1 digit (fixed) | C | 0: Konica Minolta factory calibration<br>1: Single point calibration<br>2: RGB+W matrix calibration<br>3: Correction factor |
| [7] | Calibration Channel ID | 10 digit (fixed) | C | Calibration channel ID set with "IDS" command<br><br>Spaces are added to the end if less than 10 characters. |
| [8] | Calibration channel comment | 50 digit (fixed) | C | Calibration channel comment set with "MCS" command<br><br>Spaces are added to the end if less than 50 characters. |

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| | | | | | |
|---|---|---|---|---|---|
| [9] | Display mode | 1 digit (fixed) | C | 0: x,y,Lv |
| [10] | Color difference target value x | 9 digit (fixed) | C | Color difference target value x<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [11] | Color difference target value y | 9 digit (fixed) | C | Color difference target value y<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [12] | Color difference target value Lv | 9 digit (fixed) | C | Color difference target value Lv<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [13] | User calibration target value white x | 9 digit (fixed) | C | White calibration target value x for RGB+W matrix calibration<br>Or calibration target value x for Single point calibration<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [14] | User calibration target value white y | 9 digit (fixed) | C | White calibration target value y for RGB+W matrix calibration<br>Or calibration target value y for Single point calibration<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [15] | User calibration target value white Lv | 9 digit (fixed) | C | White calibration target value Lv for RGB+W matrix calibration<br>Or calibration target value Lv for Single point calibration<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [16] | User calibration target value red x | 9 digit (fixed) | C | Red calibration target value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [17] | User calibration target value red y | 9 digit (fixed) | C | Red calibration target value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

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| [18] | User calibration target value red Lv | 9 digit (fixed) | C | Red calibration target value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
|---|---|---|---|---|
| [19] | User calibration target value green x | 9 digit (fixed) | C | Green calibration target value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [20] | User calibration target value green y | 9 digit (fixed) | C | Green calibration target value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [21] | User calibration target value green Lv | 9 digit (fixed) | C | Green calibration target value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [22] | User calibration target value blue x | 9 digit (fixed) | C | Blue calibration target value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [23] | User calibration target value blue y | 9 digit (fixed) | C | Blue calibration target value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [24] | User calibration target value blue Lv | 9 digit (fixed) | C | Blue calibration target value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [25] | User calibration measurement value white x | 9 digit (fixed) | C | White calibration measurement value x for RGB+W matrix calibration<br>Or calibration measurement value x for Single point calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [26] | User calibration measurement value white y | 9 digit (fixed) | C | White calibration measurement value y for RGB+W matrix calibration<br>Or calibration measurement value y for Single point calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces)<br>0.0000001 to 999999999 |

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| | | | | |
|---|---|---|---|---|
| [27] | User calibration measurement value white Lv | 9 digit (fixed) | C | White calibration measurement value Lv for RGB+W matrix calibration<br>Or calibration measurement value Lv for Single point calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [28] | User calibration measurement value red x | 9 digit (fixed) | C | Red calibration measurement value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [29] | User calibration measurement value red y | 9 digit (fixed) | C | Red calibration measurement value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [30] | User calibration measurement value red Lv | 9 digit (fixed) | C | Red calibration measurement value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [31] | User calibration measurement value green x | 9 digit (fixed) | C | Green calibration measurement value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [32] | User calibration measurement value green y | 9 digit (fixed) | C | Green calibration measurement value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [33] | User calibration measurement value green Lv | 9 digit (fixed) | C | Green calibration measurement value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [34] | User calibration measurement value blue x | 9 digit (fixed) | C | Blue calibration measurement value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [35] | User calibration measurement value blue y | 9 digit (fixed) | C | Blue calibration measurement value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

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| | | | | |
|---|---|---|---|---|
| [36] | User calibration measurement value blue Lv | 9 digit (fixed) | C | Blue calibration measurement value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>     0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [37] | User calibration execution year | 4 digit (fixed) | C | Year of user calibration execution or color difference target value registration<br>2000 to 2099 |
| [38] | User calibration execution month | 2 digit (fixed) | C | Month of user calibration execution or color difference target value registration<br>01 to 12 |
| [39] | User calibration execution day | 2 digit (fixed) | C | Day of user calibration execution or color difference target value registration<br>01 to 31 |
| [40] | User calibration execution hours | 2 digit (fixed) | C | Hour of user calibration execution or color difference target value registration<br>00 to 23 |
| [41] | User calibration execution minutes | 2 digit (fixed) | C | Minute of user calibration execution or color difference target value registration<br>00 to 59 |
| [42] | User calibration execution seconds | 2 digit (fixed) | C | Second of user calibration execution or color difference target value registration<br>00 to 59 |

**Description:**

This command gets calibration channel information.

When using the data processor, the results are output for only the output probe numbers that are set with the "OPR" command. With multiple probes, the responses between probes will be separated by the delimiter.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.4. UCS [Turn Calibration Mode ON and OFF]

**Command:**

UCS

**Transmit Format:**

"UCS,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Calibration mode | 1 digit (fixed) | C | 0: User calibration mode ON<br>1: User calibration mode OFF |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This setting is volatile.

This command sets user calibration mode.

Set to ON  when executing user calibration, and  set to OFF when  setting color difference target  values and executing normal measurements.

When using the data  processor, the probe that is  the target for this command is  the display probe set with the "DPR"  command.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.5.    UWT [Input Color Difference Target Values/User Calibration Target Values]

**Command:**

UWT

**Transmit Format:**

"UWT,[1],[2],[3],[4]" + delimiter

"UWT,[5],[1],[2],[3],[4],[6],[7],[8],[9],[10],[11]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Display mode | 1 digit (fixed) | C | 0 (fixed) |
| [2] | User calibration target value x<br>Color difference target value x | 9 digit (fixed) | C | White calibration target value x for RGB+W matrix calibration<br>Or Single point calibration target value x<br>Or color difference target value x<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [3] | User calibration target value y<br>Color difference target value y | 9 digit (fixed) | C | White calibration target value y for   RGB+W matrix calibration<br>Or Single point calibration target value y<br>Or color difference target value y<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [4] | User calibration target value Lv<br>Color difference target value Lv | 9 digit (fixed) | C | White calibration target value Lv for RGB+W matrix calibration<br>Or Single point calibration target value Lv<br>Or color difference target value Lv<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [5] | Calibration channel No. | 1 to 2 digits (variable) | C | Calibration channel number to which the color difference target values values will be registered<br>0 to 99 |
| [6] | Color difference target values registration year | 4 digit (fixed) | C | 2000 to 2099 |
| [7] | Color difference target values registration month | 1 to 2 digits (variable) | C | 1 to 12 |
| [8] | Color difference target values registration year | 1 to 2 digits (variable) | C | 1 to 31 |
| [9] | Color difference target values registration hour | 1 to 2 digits (variable) | C | 0 to 23 |
| [10] | Color difference target values registration minute | 1 to 2 digits (variable) | C | 0 to 59 |
| [11] | Color difference target values registration second | 1 to 2 digits (variable) | C | 0 to 59 |

**Receive Format:**

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"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This command inputs color difference  target values, white target values for  RGB+W matrix calibration, or Single point calibration target values.

To input color difference target values, first turn OFF calibration mode with the "UCS"  command,

and then use the "UWT,[5],[1],[2],[3],[4],[6],[7],[8],[9],[10],[11]"  format.

To input user calibration target values, first turn ON calibration mode with the "UCS" command, execute a measurement with the "MES" command, and then use the "UWT,[1],[2],[3],[4]"  format.

To complete the user calibration, use the "ETR"  command.

For how to  set target values  and execute user calibration,  refer to "Calibration  Channel" in Command Flow.

When using the data  processor, the probe that is  the target for this command is  the display probe set with the "DPR"  command.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER03 | C | Target value input error |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.6. URD [Input RGB+W Matrix Red Calibration Target Values]

**Command:**

URD

**Transmit Format:**

"URD,[1],[2],[3],[4]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Display mode | 1 digit (fixed) | C | 0 (fixed) |
| [2] | User calibration target value red x | 9 digit (fixed) | C | Red calibration target value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>   0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [3] | User calibration target value red y | 9 digit (fixed) | C | Red calibration target value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>   0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [4] | User calibration target value red Lv | 9 digit (fixed) | C | Red calibration target value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>   0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This command inputs red calibration target values for RGB+W matrix calibration.

Prior to this command, turn ON calibration mode with the "UCS" command, and then execute a measurement with the "MES" command.

To complete the user calibration, use the "ETR" command.

For how to execute user calibration, refer to "Calibration Channel" in Command Flow.

When using the data processor, the probe that is the target for this command is the display probe set with the "DPR" command.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER03 | C | Target value input error |

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| ER10 | C | Command error |
|------|---|---------------|
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.5.7.    UGR [Input RGB+W Matrix Green Calibration Target Values]

**Command:**

UGR

**Transmit Format:**

"UGR,[1],[2],[3],[4]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Display mode | 1 digit (fixed) | C | 0 (fixed) |
| [2] | User calibration target value green x | 9 digit (fixed) | C | Green calibration target value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>　　0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [3] | User calibration target value green y | 9 digit (fixed) | C | Green calibration target value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>　　0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [4] | User calibration target value green Lv | 9 digit (fixed) | C | Green calibration target value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>　　0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This command inputs green calibration target values for RGB+W matrix calibration.

Prior to this command, turn ON calibration mode with the "UCS" command, and then execute a measurement with the "MES" command.

To complete the user calibration, use the "ETR" command.

For how to execute user calibration, refer to "Calibration Channel" in Command Flow.

When using the data processor, the probe that is the target for this command is the display probe set with the "DPR" command.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER03 | C | Target value input error |

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| ER10 | C | Command error |
|------|---|---------------|
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.5.8.    UBL [Input RGB+W Matrix Blue Calibration Target Values]

**Command:**

UBL

**Transmit Format:**

"UBL,[1],[2],[3],[4]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Display mode | 1 digit (fixed) | C | 0 (fixed) |
| [2] | User calibration target value blue x | 9 digit (fixed) | C | Blue calibration target value x for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [3] | User calibration target value blue y | 9 digit (fixed) | C | Blue calibration target value y for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [4] | User calibration target value blue Lv | 9 digit (fixed) | C | Blue calibration target value Lv for RGB+W matrix calibration<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This command inputs blue calibration target values for RGB+W matrix calibration.

Prior to this command, turn ON calibration mode with the "UCS" command, and then execute a measurement with the "MES" command.

To complete the user calibration, use the "ETR" command.

For how to execute user calibration, refer to "Calibration Channel" in Command Flow.

When using the data processor, the probe that is the target for this command is the display probe set with the "DPR" command.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER03 | C | Target value input error |

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| ER10 | C | Command error |
|------|---|---------------|
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.9. ETR [Register Color Difference Target Values by Measurement/Confirm User Calibration]

**Command:**

ETR

**Transmit Format:**

"ETR,[1],[2],[3],[4],[5],[6],[7]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Calibration channel No. | 1 to 2 digits (variable) | C | Calibration channel number to which the color difference target color values will be registered or for which user calibration will be executed<br>For color difference target values 0 to 99<br>For user calibration 1 to 99 |
| [2] | Color difference target values registration/user calibration year | 4 digit (fixed) | C | 2000 to 2099 |
| [3] | Color difference target values registration/user calibration month | 1 to 2 digits (variable) | C | 1 to 12 |
| [4] | Color difference target values registration/user calibration day | 1 to 2 digits (variable) | C | 1 to 31 |
| [5] | Color difference target values registration/user calibration hour | 1 to 2 digits (variable) | C | 0 to 23 |
| [6] | Color difference target values registration/user calibration minute | 1 to 2 digits (variable) | C | 0 to 59 |
| [7] | Color difference target values registration/user calibration second | 1 to 2 digits (variable) | C | 0 to 59 |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This command confirms inputting color difference target values by measurement or user calibration.

To input color difference target values by measurement, first turn OFF calibration mode with the "UCS" command, execute a measurement with the "MES" command, and then execute this command.

To perform user calibration, first turn ON calibration mode with the "UCS" command, execute the "UWT", "URD", "UGR", and "UBL" commands after measurements, and then execute this command.

When user calibration is complete, the color difference target values data are overwritten with the calibration target values data input with the "UWT" command.

For how to register color difference target values or execute user calibration, refer to "Calibration

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Channel" in Command Flow.

When using the data processor, the probe that is the target for this command is the display probe set with the "DPR" command.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER05 | C | One or more items of WRGB measurement data are invalid |
| ER06 | C | RGB+W matrix calibration calculation error |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.5.10. IDS [Set Calibration Channel ID Name]

**Command:**

IDS

**Transmit Format:**

"IDS,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Probe No. | 2 digit (fixed) | DP | 01 to 10: Probe number to which the ID will be set |
| [1] | Probe No. | 2 digit (fixed) | P | 01 to 10: Must be input, but has no meaning for the probe. |
| [2] | Calibration channel No. | 2 digit (fixed) | C | Calibration channel 00 to 99: Calibration channel number to which the ID will be set |
| [3] | ID name | 0 to 10 digits (variable) | C | ID name to set<br>Enter as an ASCII string<br>Space character (' ', 0x20) to tilde character ('~', 0x7E) |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This setting is non-volatile.

This command sets an ID name for the calibration channel.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.5.11.  MCS [Set Calibration Channel Comment]

**Command:**

MCS

**Transmit Format:**

"MCS,[1],[2],[3]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Probe No. | 2 digit (fixed) | DP | 01 to 10: Probe number to which the comment will be set |
| [1] | Probe No. | 2 digit (fixed) | P | 01 to 10: Must be input, but has no meaning for the probe. |
| [2] | Calibration channel No. | 2 digit (fixed) | C | Calibration channel 00 to 99: Calibration channel number to which the comment will be set |
| [3] | Comment | 0 to 50 digits (variable) | C | Comment to set<br>Enter as an ASCII string<br>Space character (' ', 0x20) to tilde character ('~', 0x7E) |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This setting is non-volatile.

This command sets a comment for the calibration channel.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.12. MCR [Get Calibration Channel Comment]

**Command:**

MCR

**Transmit Format:**

"MCS,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number to which the comment will be set |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |
| [2] | Calibration channel No. | 1 to 2 digits (variable) | C | Calibration channel 0 to 99: Calibration channel number to which the comment will be set |

**Receive Format:**

"Error code",[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Comment | 0 to 50 digits (variable) | C | Comment that was set for the calibration channel |

**Description:**

This command gets the comment for the calibration channel.

"OK00" will be returned if the comment is 0 characters or if the comment has not been set.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.13. MAD [Initialize All Calibration Channels]

**Command:**

MAD

**Transmit Format:**

"MAD,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number with the calibration channels to initialize |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This command initializes all calibration channels of a probe.

The IDs, comments, user calibration data, and color difference target values data are initialized.

If transmit parameter [1] is omitted, the calibration channels of the wrong probe may be initialized.

When user calibration data is initialized, it is initialized to the Konica Minolta factory calibration.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

### 3.3.5.14. MDD [Initialize the Specified Calibration Channel]

**Command:**

MDD

**Transmit Format:**

"MDD,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number with the calibration channels to initialize |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |
| [2] | Calibration channel No. | 1 to 2 digits (variable) | C | Calibration channel 0 to 99: Calibration channel number to initialize |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|  |  |  |  |  |

**Description:**

This command initializes the specified calibration channel of a probe.

The IDs, comments, user calibration data, and color difference target values data are initialized.

If transmit parameter [1] is omitted, the wrong probe and calibration channel may be initialized.

When user calibration data is initialized, it is initialized to the Konica Minolta factory calibration.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.15.  TAD [Initialize Color Difference Target Values Data of All Calibration Channels]

**Command:**

TAD

**Transmit Format:**

"TAD,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number with the color difference target values to initialize |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
|  |  |  |  |  |

**Description:**

This command initializes the color difference target values of all calibration channels of a probe.

The color difference values are reset to the user calibration target values of white.

If transmit parameter [1] is omitted, the calibration channels of the wrong probe may be initialized.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

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### 3.3.5.16. TDD [Initialize Color Difference Target Values Data of Specified Calibration Channel]

**Command:**

TDD

**Transmit Format:**

"TDD,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number with the color difference target values to initialize |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |
| [2] | Calibration channel No. | 1 to 2 digits (variable) | C | Calibration channel 0 to 99: Calibration channel number to initialize |

**Receive Format:**

"Error code" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
|     |      |               |      |               |

**Description:**

This command initializes the color difference target values of the specified calibration channel of a probe.

The color difference values are reset to the user calibration target value of white.

If transmit parameter [1] is omitted, the wrong probe and calibration channel may be initialized.

**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER31 | C | Memory error |
| ER99 | C | Firmware error |

**CA-410 Communication Specifications**

## 3.3.6. Measurement

### 3.3.6.1. MES [Execute Measurement]

**Command:**

MES

**Transmit Format:**

"MES,[1]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Expanded format | 1 digit (fixed) | C | Parameter that changes the receive format 1 to 2<br>If 2 is selected, the XYZ values are added to the receive format |

**Receive Format:**

When expanded format 1 -> "Error code,[1],[2],[3],[4],[5],[6],[7]" + delimiter

When expanded format 2 -> "Error code,[1],[2],[3],[4],[5],[6],[7],[8],[9],[10]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 2 to 3 digits (variable) | C | Probe number from which the measurement values will be returned<br>'P' is added before the probe number |
| [2] | Display mode | 1 digit (fixed) | C<br><br><br><br><br><br>C | Display mode set with "MDS" command<br>However, this is 0 when set to flicker mode<br>0: x,y,Lv<br>1: Tcp,duv,Lv<br>5: u',v',Lv<br>7: X,Y,Z<br>8: λd,Pe,Lv |
| [3] | Color space value 1 | 9 digit (fixed) | | When parameter [2] is 0 -> measurement result x<br>When parameter [2] is 1 -> measurement result Tcp<br>When parameter [2] is 5 -> measurement result u'<br>When parameter [2] is 7 -> measurement result X<br>When parameter [2] is 8 -> measurement result  λd<br>Range:<br>-99999999 to -0.000001<br>     0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

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| | | | | |
|---|---|---|---|---|
| [4] | Color space value 2 | 9 digit (fixed) | C | When parameter [2] is 0 -> measurement result y<br>When parameter [2] is 1 -> measurement result duv<br>When parameter [2] is 5 -> measurement result v'<br>When parameter [2] is 7 -> measurement result Y<br>When parameter [2] is 8 -> measurement result Pe<br>Range:<br>-99999999 to -0.000001<br>    0.0 (<- Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [5] | Color space value 3 | 9 digit (fixed) | C | When parameter [2] is 0 -> measurement result Lv<br>When parameter [2] is 1 -> measurement result Lv<br>When parameter [2] is 5 -> measurement result Lv<br>When parameter [2] is 7 -> measurement result Z<br>When parameter [2] is 8 -> measurement result Lv<br>Range:<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [6] | Temperature shift from zero calibration | 5 to 6 digits (variable) | C | Difference between temperature when zero calibration was executed and current temperature [°C]<br>-99.99 to +99.99 |
| [7] | FMA flicker value | 9 digit (fixed) | C | FMA method (contrast method) measurement result flicker value [%]<br>This parameter is -99999999 when the JEITA method is set with the "FMS" command.<br>Range:<br>0.0000001 to 999999999<br>    0.0 (<-Right-aligned with spaces inserted) |
| [8] | X value | 9 digit (fixed) | C | This parameter is output only when 2 is selected for transmit parameter [1]<br>Measurement result X<br>Range:<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

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| | | | | |
|---|---|---|---|---|
| [9] | Y value | 9 digit (fixed) | C | This parameter is output only when 2 is selected for transmit parameter [1] Measurement result Y Range: -99999999 to -0.000001     0.0 (<-Right-aligned with spaces          inserted) 0.0000001 to 999999999 |
| [10] | Z value | 9 digit (fixed) | C | This parameter is output only when 2 is selected for transmit parameter [1] Measurement result Z Range: -99999999 to -0.000001     0.0 (<-Right-aligned with spaces          inserted) 0.0000001 to 999999999 |

**Description:**

This command executes a measurement and gets the measurement results.

When control mode is set to simultaneous control of color/flicker with the "MMS" command, errors related to flicker may appear in the results, even if the display mode is not flicker mode.

Measurement results for trigger mode have the same receive format as when 2 is selected for transmit parameter [1].

"ER10" will be returned if zero calibration has not been executed.


When Using the Data Processor:

Measurement results for only the output probe numbers set with the "OPR" command are returned separated by the delimiter. The response is obtained from only probes set as output probes, but measurements are executed on all probes connected to the data processor.

The data processor returns the response after all probes have completed measurements, so if there are probes that take a long time to measure, the results can be obtained only after those probes have completed measurements.


In trigger mode ("TMS" command), use the "MES,2" format of this command to enter the trigger signal standby status.

When trigger mode is ON and "MES,2" is sent, the data processor enters the trigger signal standby status, and the measurement will be executed when the trigger signal is received. When the measurement has been completed, the measurement results are returned in the "MES,2" format, and the trigger signal standby status is ended.

If the trigger signal is not input after a certain amount of time elapses from when the trigger standby status was entered, a timeout will occur, the trigger standby status will end, and "ER10" will be returned.

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**Error Code:**

| Code | Type | Meaning |
|------|------|---------|
| OK00 | C | Normal completion |
| OK01 | C | The probe to which user calibration or color difference target values were registered is different |
| OK02 | C | The temperature shifted greatly from when zero calibration was executed |
| OK03 | C | OK01 + OK02 |
| OK04 | C | The measurement value was below the guaranteed measurement range |
| OK05 | C | OK01 + OK04 |
| OK06 | C | OK02 + OK04 |
| OK07 | C | OK01 + OK02 + OK04 |
| OK64 | DP | Battery low |
| OK65 | DP | OK64 + OK01 |
| OK66 | DP | OK64 + OK02 |
| OK67 | DP | OK64 + OK01 + OK02 |
| OK68 | DP | OK64 + OK04 |
| OK69 | DP | OK64 + OK01 + OK04 |
| OK70 | DP | OK64 + OK02 + OK04 |
| OK71 | DP | OK64 + OK01 + OK02 + OK04 |
| ER10 | C | Command error or trigger signal standby status timeout |
| ER20 | C | EXTERNAL signal not input or outside range |
| ER22 | C | The measurement target exceeded the measurable range |
| ER24 | C | Correlated color temperature (Tcp) or dominant wavelength ($\lambda$d) cannot be calculated |
| ER31 | C | Memory error |
| ER32 | C | Memory error |
| ER50 | C | 999.9% was exceeded with the FMA method (contrast method) flicker measurement |
| ER51 | C | The synchronization frequency was out of range in the FMA method (contrast method) flicker measurement (0.50 to 130.00 Hz) |
| ER53 | C | A probe that cannot measure flicker is set for flicker measurement |
| ER99 | C | Firmware error |

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### 3.3.6.2. JDR [Get JEITA Flicker Measurement Values]

**Command:**

JDR

**Transmit Format:**

"JDR,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number from which to obtain the measurement values |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |
| [2] | Command execution count | 1 to 2 digits (variable) | C | The operation is different when 0 is selected and when other values are selected. 0: Get JEITA flicker measurement values and command execution count to get spectrum 1 to 99: Command execution count to obtain the spectrum |

**Receive Format:**

When command execution count is 0 -> "Error code,[1],[2],[3],[4],[5],[6],[7]" + delimiter

When command execution count is 1 to 99 -> "Error code,[1],[8],[9],...,[k]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|-----|------|---------------|------|---------------|
| [1] | Probe No. | 2 to 3 digits (variable) | C | Probe number from which the measurement values will be returned 'P' is added before the probe number |
| [2] | JDR command execution count | 1 to 2 digits (variable) | C | Number of times to execute this command when getting the JEITA flicker spectrum 1 to 99 |
| [3] | JEITA flicker value | 9 digit (fixed) | C | JEITA flicker value [dB] Range: -99999999 to -0.000001      0.0 (<-Right-aligned with spaces          inserted) 0.0000001 to 999999999 |
| [4] | JEITA flicker frequency | 1 to 5 digits (variable) | C | JEITA flicker frequency [Hz] 0.02 to 65 |
| [5] | JEITA measurement minimum frequency | 1 to 5 digits (variable) | C | Lower limit of measurement range during JEITA flicker measurement [Hz] 0.02 to 65 |
| [6] | JEITA measurement maximum frequency | 1 to 5 digits (variable) | C | Upper limit of measurement range during JEITA flicker measurement [Hz] 0.02 to 65 |
| [7] | Frequency pitch | 1 to 5 digits (variable) | C | Frequency resolution during JEITA flicker measurement [Hz] 0.02 to 10 |

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| | | | | |
|---|---|---|---|---|
| [8] to<br><br>[k] | JEITA flicker spectrum | 9 digit (fixed) | C | JEITA flicker spectrum [dB]<br>These parameters indicate the JEITA flicker values No. 1 to No. k in each frequency that corresponds to the frequencies in [5] to [7] in order from the lowest frequency<br>Range:<br>-99999999 to -0.000001<br>    0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |

**Description:**

This command gets the JEITA method flicker measurement results in the flicker sensor.

Select the JEITA method with the "FMS" command, and  then execute a JEITA flicker measurement with the "MES"  command.

You can get the JEITA flicker value and JEITA flicker frequency by transmitting  "JDR,0".

To get the JEITA  flicker spectrum for the frequency, transmit  "JDR,command execution count" for only the number of times  obtained by "JDR,0". Each  JEITA flicker value can be obtained  by frequency pitch [7] starting from the minimum frequency [5] obtained with "JDR,0".

The JEITA flicker value at  65 [Hz] cannot be calculated due to the  sensitivity calculation, so -999.0000 will be output.

Even when the data processor is used, the JEITA value will not be displayed on the screen in the remote status.

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER99 | C | Firmware error |

### 3.3.6.3.    FDR [Get JEITA Flicker AD Count Values]

**Command:**

FDR

**Transmit Format:**

"FDR,[1],[2]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Probe No. | 1 to 2 digits (variable) | DP | 1 to 10: Probe number from which to obtain the measurement values |
| [1] | Probe No. | 1 to 2 digits (variable) | P | 1 to 10: Must be input, but has no meaning for the probe. |
| [2] | Command execution count | 1 to 2 digits (variable) | C | The operation is different when 0 is selected and when other values are selected.<br>0: Get JEITA flicker AD count values and command execution count to get spectrum<br>1 to 99: Command execution count to obtain the spectrum |

**Receive Format:**

When command execution count is 0 -> "Error code,[1],[2],[3],[4],[5],[6],[7]" + delimiter

When command execution count is 1 to 99 -> "Error code,[1],[8],[9],...,[k]" + delimiter

| No. | Name | Digits/Length | Type | Details/Range |
|---|---|---|---|---|
| [1] | Probe No. | 2 to 3 digits (variable) | C | Probe number from which the measurement values will be returned<br>'P' is added before the probe number |
| [2] | FDR command execution count | 1 to 2 digits (variable) | C | Number of times to execute this command when getting the JEITA flicker spectrum<br>1 to 99 |
| [3] | Sampling frequency | 1 to 4 digits (variable)<br>20 digits (fixed) | C | Sampling Frequency [Hz]<br>(The reciprocal of the sampling frequency is the total exposure time in the flicker measurement.)<br>[JEITA measurement]<br>0.07 to 0.09    Increments of 0.01 [Hz]<br>0.1 to 0.9        Increments of 0.1 [Hz]<br>1 to 10            Increments of 1 [Hz] |
| [4] | Number of samples | 1 to 2 digits (variable) | C | Set the sampling frequency as the exponent of 2<br>Range 6 to 11<br>6: 64<br>7: 128<br>8: 256<br>9: 512<br>10: 1024<br>11: 2048 |
| [5] | Dark count value | 9 digit (fixed) | C | -99999999 to -0.000001<br>        0.0 (<Right-aligned with spaces inserted) |

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| | | | | |
|---|---|---|---|---|
| [6] | Lv value | 9 digit (fixed) | C | -99999999 to -0.000001<br>0.0 (<-Right-aligned with spaces inserted)<br>0.0000001 to 999999999 |
| [7] | Range No. | 1 digit (fixed) | C | 1 to 4: Range number of flicker sensor |
| [8] to<br>[k] | JEITA flicker AD count value | 1 to 5 digits (fixed) | C | JEITA flicker spectrum<br>These parameters indicate the JEITA flicker AD count values No. 1 to No. k arranged in chronological order<br>Range:<br>0 to 65535 |

**Description:**

This commands gets the JEITA method flicker AD count values.

You can use this command to get the waveform measurement results in the flicker sensor.

1. Select the JEITA method with the "FMS" command.
2. Then execute a JEITA flicker measurement with the "MES" command.
3. Transmit "FDR,command execution count" for only the number of times to execute the command obtained by transmitting "FDR,0".

The measurement values obtained when No.3 is executed reflects user calibration by the luminance unit and the selected calibration channel. Please make settings before running Step 2 if necessary.

When the setting change is made between Step 2 and Step 3, the measurement value obtained in Step 3 is reflected in the luminance unit, but the user calibration is not reflected.

The waveform data can be calculated with the following equation.

$$w(i) = ((c(i) - d) / (cav - d)) Lv$$

$w(i)$: Waveform data

$i$: Number of samples (the same as the number of values from 1 to k of JEITA flicker AD count values in the receive parameters)

$c$: JEITA flicker AD count values (receive parameter [8] to [k])

$cav$: Averaged value of c above

$d$: Dark count value (receive parameter [5])

$Lv$: Luminance value (receive parameter [6])

**Error Code:**

| Code | Type | Meaning |
|---|---|---|
| OK00 | C | Normal completion |
| OK64 | DP | Battery low |
| ER10 | C | Command error |
| ER99 | C | Firmware error |

# 4. Error Codes List

There are two types of error codes, those that begin with OK and those that begin with ER.

Errors that begin with OK mean they are warnings, and errors that begin with ER mean they are failures.

| Error code | Meaning/Cause | Action |
|---|---|---|
| OK00 | Normal completion | |
| OK01 | The data set on another probe is being used for the user calibration data or color difference target values data in the currently selected calibration channel. | The instrument can continue to be used if, for example, you intentionally copy and use the data of another probe. Execute the following as necessary.<br>(1) Change the calibration channel number.<br>   "MCH" command<br>(2) Redo user calibration.<br>   "UCS" command<br>(3) Reset the color difference target values.<br>   "UWT" command or "ETR" command<br>(4) Delete the calibration channel data.<br>   "MDD" command or "MAD" command |
| OK02 | The internal probe temperature has shifted 6°C or more from when zero calibration was executed. Zero calibration is recommended because the zero point will have shifted and an error will occur. | The instrument can continue to be used, but execute zero calibration as necessary.<br>   "ZRC" command |
| OK03 | OK01+OK02 | Take the actions listed for each error code. |
| OK04 | In color measurements, the brightness of the measurement target has fallen below the measurable range of the instrument. | The instrument can continue to be used, but be aware that the measured value will be outside the instrument's guaranteed range. |
| OK05 | OK01+OK04 | Take the actions listed for each error code. |
| OK06 | OK02+OK04 | Take the actions listed for each error code. |
| OK07 | OK01+OK02+OK04 | Take the actions listed for each error code. |
| OK64 | Data processor battery low | Charge the battery or use the AC adapter. |
| OK65 | OK64+OK01 | Take the actions listed for each error code. |
| OK66 | OK64+OK02 | Take the actions listed for each error code. |
| OK67 | OK64+OK01+OK02 | Take the actions listed for each error code. |
| OK68 | OK64+OK04 | Take the actions listed for each error code. |
| OK69 | OK64+OK01+OK04 | Take the actions listed for each error code. |
| OK70 | OK64+OK02+OK04 | Take the actions listed for each error code. |
| OK71 | OK64+OK01+OK02+OK04 | Take the actions listed for each error code. |
| ER03 | A value failed to be set because the wrong value was input as the color difference target values or user calibration target values. | Check the setting value and redo the setting. If the same error continues to occur, the instrument cannot be set with that value. |

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| ER05 | User calibration failed because the measurement values or user calibration target values were insufficiently input in user calibration. | The steps for user calibration were incorrect. Redo user calibration from the beginning.<br> UCS command |
|---|---|---|
| ER06 | User calibration failed because a wrong value was input as a measurement value or user calibration target values in user calibration. | Be careful of the following points and redo user calibration from the beginning.<br> "UCS" command<br>(1) Check if the measurement target and color can be correctly measured.<br>(2) Check for mistakes in the user calibration target values. |
| ER10 | The command is incorrect | Be careful of the following points and resend the command.<br>(1) Check the command string.<br>(2) Check the delimiter.<br>(3) Check the number of transmit parameters.<br>(4) Check the format and range of each transmit parameter. |
| ER16 | Failed to write because the wrong data was input when writing the calibration channel data. | Retry the write.<br>If the same error continues to occur, that data cannot be written. The data may be corrupted. |
| ER20 | When performing color measurements with EXTERNAL as the measurement frequency mode, the vertical synchronization signal was not input, or the frequency of the vertical synchronization signal was outside the range that can be input to the instrument. The measurement failed for this reason. or there was a failure in obtaining the frequency. | Be careful of the following points and redo the measurement.<br>(1) Correctly connect the RS cable and input the vertical synchronization signal.<br>(2) Check the frequency of the vertical synchronization signal that is input. In color measurements, the frequency of the vertical synchronization signal is 0.5 to 240.0 Hz.<br>(3) If it is difficult to input a suitable vertical synchronization signal, change the measurement frequency mode to a mode other than EXTERNAL.<br> "SCS" command |

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| ER21 | When performing zero calibration, the light was not fully blocked, so zero calibration failed. | Ensure that the brightness of the measurement target (and/or brightness of the area around the instrument) does not exceed the measurable range of the instrument, and redo zero calibration. If possible, turn the power supply OFF and then ON again, and then redo zero calibration. <br> "ZRC" command <br> If the same error continues to occur, the light receiving circuit section of the instrument has failed. Or if the result is normal when the light receiving section at the tip of the probe is blocked and zero calibration is executed, the light blocking shutter built into the probe has failed. Contact KONICA MINOLTA-authorized service facility. |
|---|---|---|
| ER22 | When performing measurements, the brightness of the measurement target exceeds the measurable range of the instrument, so the measurement failed. | Perform either of the following items. <br> (1) If the measurement range is fixed, increase the measurement range. <br> or <br> (2) If the measurement range is auto, decrease the brightness of the measurement target. |
| ER24 <br><br> ER31 | When performing color measurements, the correlated color temperature or dominant wavelength of the measurement target could not be calculated. | Redo the measurement. <br> If the same error continues to occur, change the display mode to a mode other than Tcp,duv,Lv or λd,Pe,Lv. <br> "MDS" command |
| | Failed to write data to the memory built into the probe or failed to read data. <br> Failed to write data to the memory of the data processor or failed to read data. | Turn the power supply OFF and then ON again. If the same error continues to occur after the power supply is turned OFF and then ON again, perform either of the following items. <br> (1) Initialize the memory condition settings/data processor settings. <br> (2) Delete the log data and save data. <br> (3) Contact a KONICA MINOLTA-authorized service facility. |

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| | | |
|---|---|---|
| ER32 | Failed to write data to the memory built into the probe or failed to read data. | Turn the power supply OFF and then ON again. If the same error continues to occur after the power supply is turned OFF and then ON again, contact Konica Minolta for service. |
| ER50 | When performing flicker measurements with the contrast method, 999.9% (the measurable range of the instrument) was exceeded, so the measurement failed. | Adjust the measurement target and decrease the flicker, and then redo the measurement. |
| ER51 | When performing flicker measurements with the contrast method, the vertical synchronization signal frequency was outside the range that can be input to the instrument. The measurement failed for this reason. | Be careful of the following points and redo the measurement. When executing measurements with EXTERNAL as the measurement frequency mode: (1) Correctly connect the RS cable and input the vertical synchronization signal. (2) Check the frequency of the vertical synchronization signal that is input. The frequencies of the vertical synchronization signal that can be input in contrast method flicker measurements are given below. • Flicker sensor: 0.50 to 130.00 Hz (3) If it is difficult to input a suitable vertical synchronization signal, change the measurement frequency mode to a mode other than EXTERNAL. "SCS" command  When executing measurements with INTERNAL as the measurement frequency mode: (1) Check the set synchronization frequency. The frequencies of the vertical synchronization signal that can be input in contrast method flicker measurements are given below. • Flicker sensor: 0.50 to 130.00 Hz (2) If it is difficult to set a suitable vertical synchronization signal, change the measurement frequency mode to a mode other than INTERNAL. "SCS" command |
| ER53 | When performing flicker measurements, a probe was used that cannot measure flicker, so the measurement failed. | Flicker measurements cannot be executed with the flicker sensor using the following probes. • φ27 high-sensitivity probe (CA-VP427) • φ10 high-sensitivity probe (CA-VP410) Use another probe to execute flicker measurements. |

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| ER91 | When getting the periodical calibration recommended date, the usage start date of the instrument was not saved, so getting the periodical calibration recommended date failed. | Set the current date to save the usage start date of the instrument. |
|---|---|---|
| ER99 | An error occurred in the program inside the instrument. | Download a firmware update from the Konica Minolta website and update the firmware of the instrument.<br><br>If the problem is not fixed by updating the firmware of the instrument, contact Konica Minolta for service. |

# 5. Appendix

## 5.1. Flicker Measurement

### 5.1.1. Flicker Measurement Types

There are two types of flicker measurements: FMA method (contrast method) and JEITA method.

[FMA]

The change in the luminance level of the measurement target is captured as the synthesis of DC and AC components, and the ratio of both components [%] is obtained as the flicker value.

Flicker is measured according to the synchronization frequency [Hz] (1 vsync) input with the synchronization setting.

This method can be used to learn the relative size of flicker.

[JEITA]

The change in the luminance level of the measurement target is broken down into frequency components, and the flicker value [dB] and flicker frequency [Hz] are obtained from the ratio of DC and maximum AC components.

This method can be used to learn the absolute value of flicker.

The flicker value takes into consideration VESA standard sensitivity.

Measurements are not executed according to the synchronization frequency with the JEITA method.