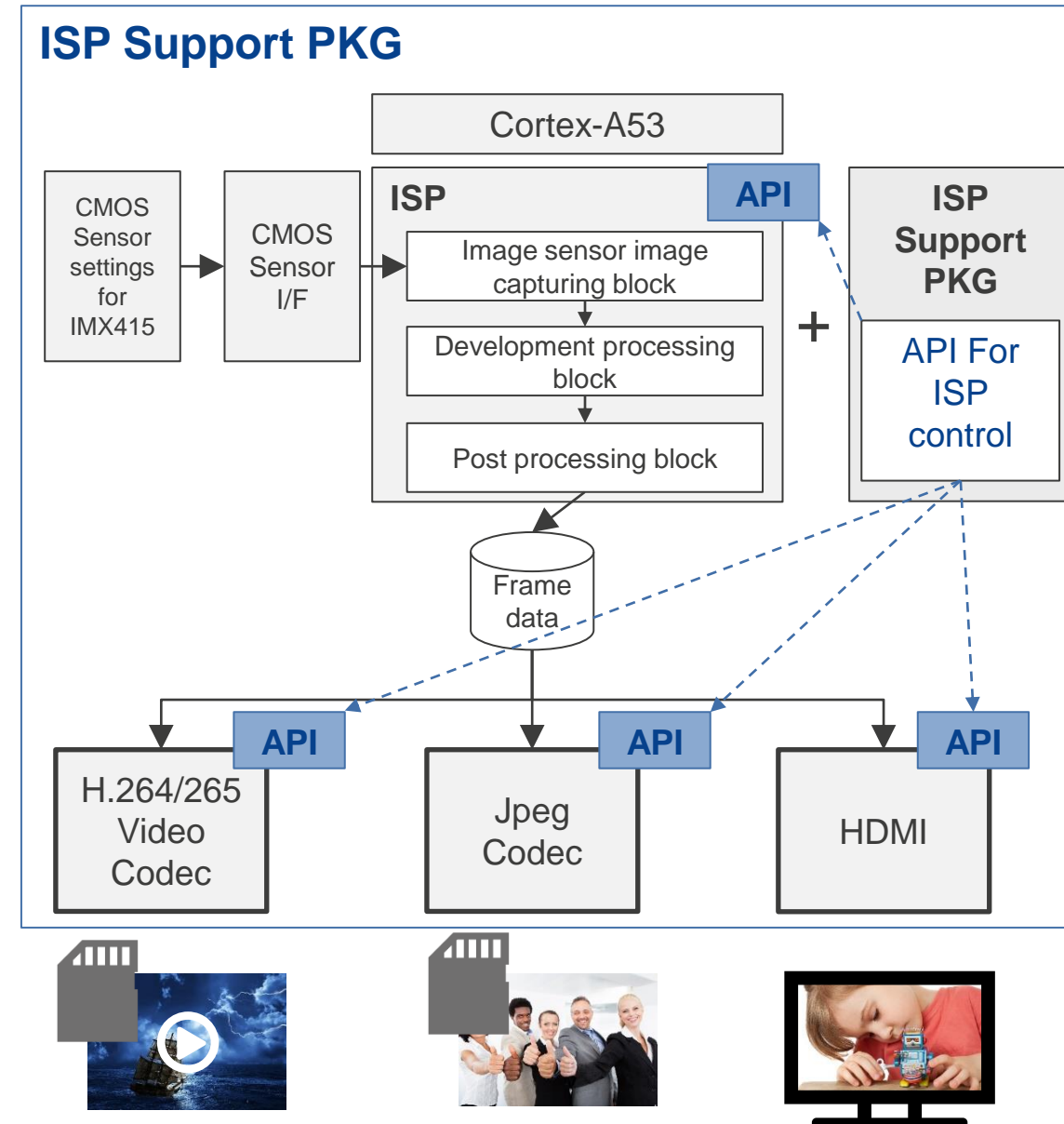


**“EMBEDDED AI MPU”
RZ/V2M
ISP SUPPORT PACKAGE
FOR IMAGE QUALITY TUNING**

MPU BUSINESS DEVELOPMENT DEPARTMENT
ENTERPRISE INFRASTRUCTURE BUSINESS DIVISION
IOT & INFRASTRUCTURE BUSINESS UNIT
RENESAS ELECTRONICS CORPORATION

MULTIMEDIA SUPPORT BY API

- Multimedia features are operated by ISP support PKG (ISP control software) submitted by Renesas.
- Functions can be controlled by API.
- One Cortex-A53 core is dedicated to control the camera ISP function.
- Main function supported by ISP Support Package
 - MIPI-CSI
 - ISP
 - H.264/265 Video Codec
 - HDMI output



ISP FUNCTION SUPPORT LIST

- ISP supports not only basic ISP function but also supports WDR, 2D and 3D noise reduction.

Image sensor image capturing block

Captures data and applies optical and sensor correction.

- Exposure
- White balance
- Black level correction
- Sensor defective pixel correction
- Digital gain
- Shading correction

Development processing block

Handles Bayer to YUV conversion and color correction.

- Demosaicing
- Wide Dynamic Range
- 2D noise reduction
- Gamma correction
- Custom color correction
- Edge enhancement
- Aberration correction
- **Tone Mapping**
- **Color space conversion**

Post processing block

Handles processing of YUV images.

- Resize
- 3D noise reduction
- Optical Distortion correction
- **Rotate**
- **Crop(Trimming)**

Bold: Supported on ver.1.1

API DETAILS

IMAGING SYSTEM (IMAGE QUALITY PARAMETERS)

WHITE BALANCE SETTINGS

Overview:

Select white balance setting
It can select auto white balance or manual white balance.

Description:

Parameter info:
Parameter of level has following:.

- Auto white balance
- Manual white balance

2D NOISE REDUCTION FOR COLOR

Overview:

This API selects enable or disable of the 2D noise reduction for color plane.
Also, it can select the level of noise reduction.

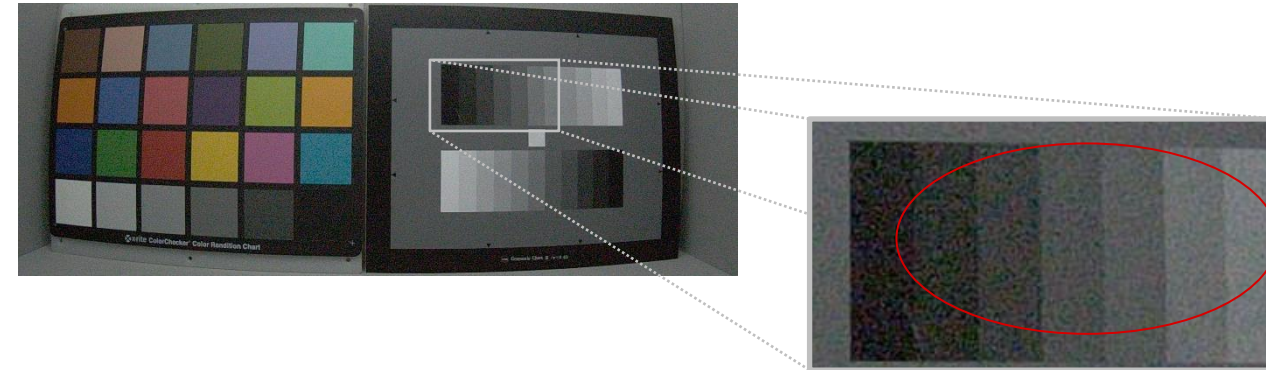
Description:

Parameter info:

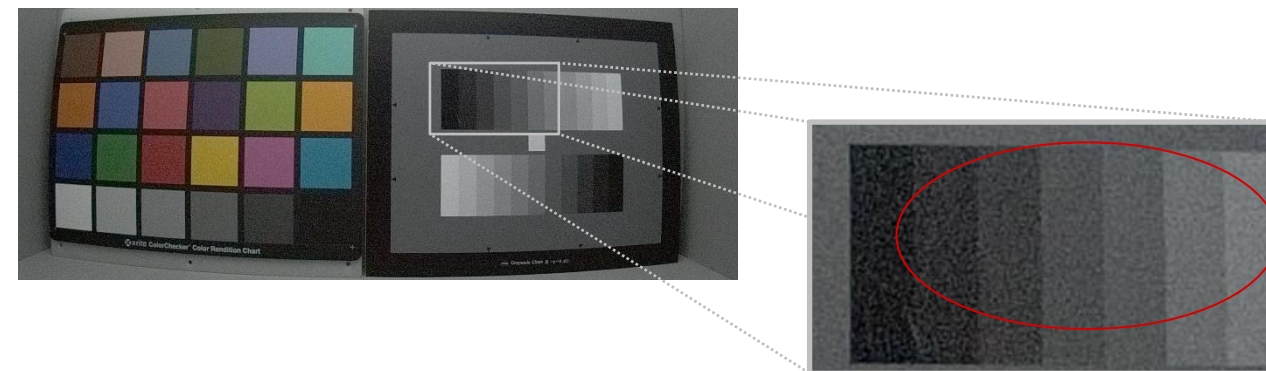
You can select level as follows:

- D_IMAGE_2DCNR_LEVEL_0: disabled
- D_IMAGE_2DCNR_LEVEL_1: enabled(level1)
- :
- D_IMAGE_2DCNR_LEVEL_10: enabled(level10)

D_IMAGE_2DCNR_LEVEL_0 : Disabled



D_IMAGE_2DCNR_LEVEL_5 : LEVEL5



Condition: Exposure Time: 1/3600.

2D NOISE REDUCTION FOR LUMINANCE

Overview:

This API selects enable or disable of the 2D noise reduction for luminance plane.
Also, it can select the level of noise reduction.

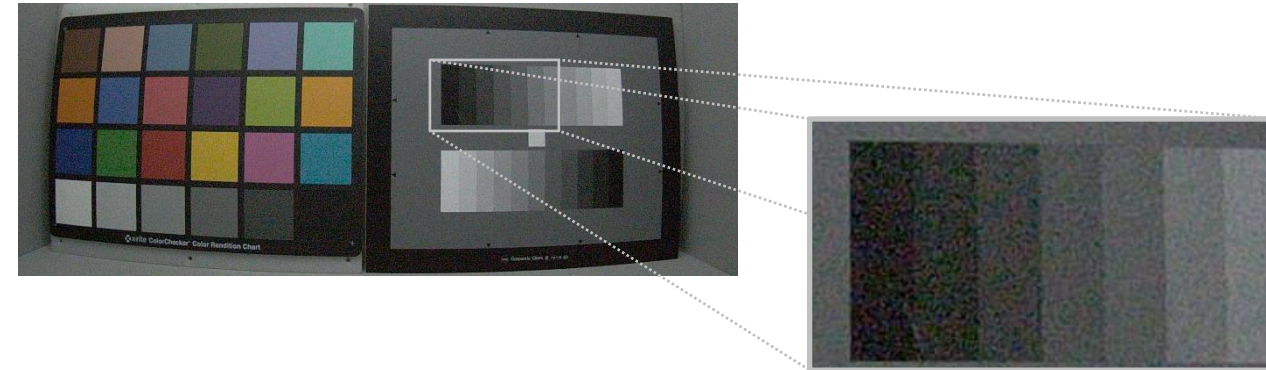
Description:

Parameter info:

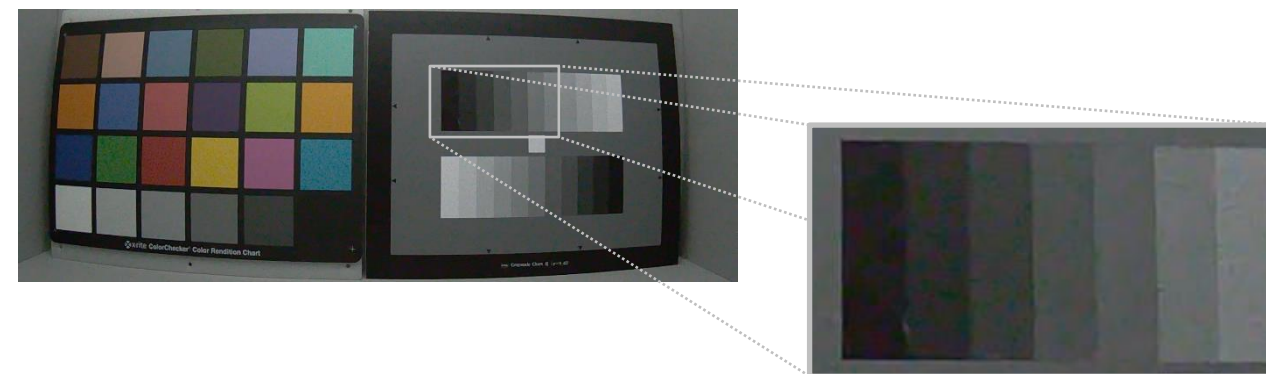
You can select level as follows:

- D_IMAGE_2DYNR_LEVEL_0: disabled
- D_IMAGE_2DYNR_LEVEL_1: enabled(level1)
- :
- D_IMAGE_2DYNR_LEVEL_10: enabled(level10)

D_IMAGE_2DYNR_LEVEL_0 : Disabled



D_IMAGE_2DYNR_LEVEL_5 : LEVEL5



Condition: Exposure Time: 1/3600.

RELATIONSHIP BY YNR AND CNR SETTINGS

YNR == 0

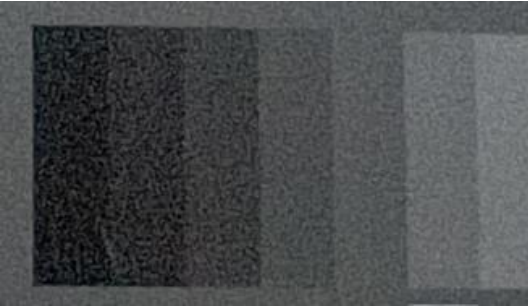
YNR == 5

YNR == 10

CNR == 0

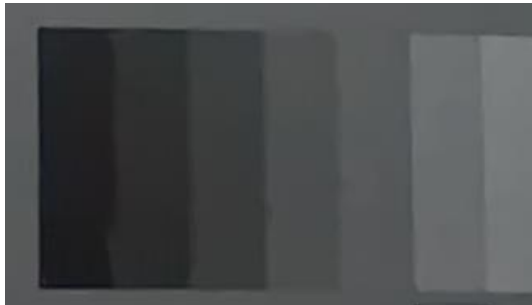


CNR == 5



CNR == 10

No Image



CONTRAST SETTINGS

Overview:

This API controls the intensity of contrast.
Also, it can select the level of contrast.

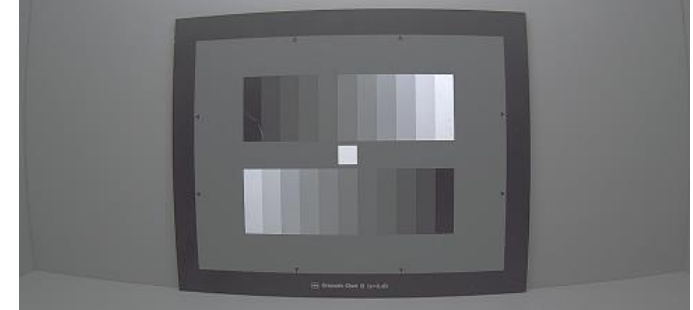
Description:

Parameter info:

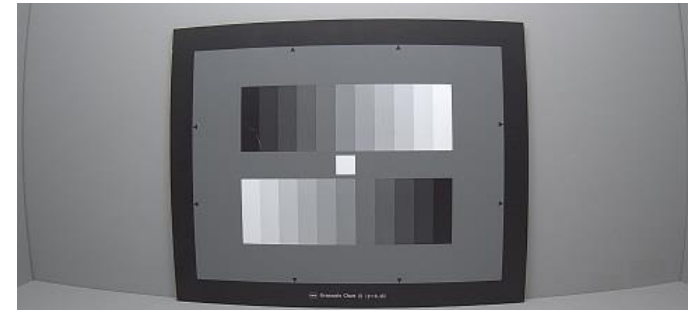
You can select level as follows:

- D_IMAGE_CONTRAST_LOW_5: Lower level of contrast (level5)
:
- D_IMAGE_CONTRAST_LOW_1: Lower level of contrast (level1)
- D_IMAGE_CONTRAST_NORMAL: Reference setting
- D_IMAGE_CONTRAST_HIGH_1: Higher level of contrast(level1)
:
- D_IMAGE_CONTRAST_HIGH_5: Higher level of contrast(level5)

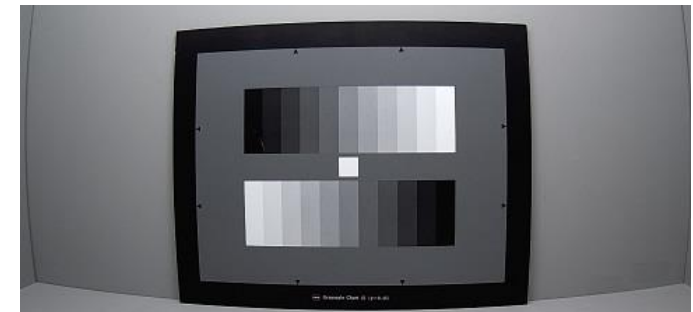
D_IMAGE_CONTRAST_LOW : LEVEL1



D_IMAGE_CONTRAST_NORMAL



D_IMAGE_CONTRAST_HIGH : LEVEL5



SATURATION SETTINGS

Overview:

Sets the saturation of the monitoring.

Description:

Parameter info:

You can select level as follows:

- D_IMAGE_SATURATION_LOW_5: Weakest level (level5)
:
- D_IMAGE_SATURATION_LOW_1: Weaker level (level1)
- D_IMAGE_SATURATION_NORMAL: default
- D_IMAGE_SATURATION_HIGH_1: Stronger level (level1)
:
- D_IMAGE_SATURATION_HIGH_5: Strongest level (level5)

D_IMAGE_SATURATION_LOW : LOW5



D_IMAGE_SATURATION_NORMAL : default



D_IMAGE_SATURATION_HIGH : HIGH5



SHARPNESS SETTINGS

Overview:

Sets the sharpness of monitoring

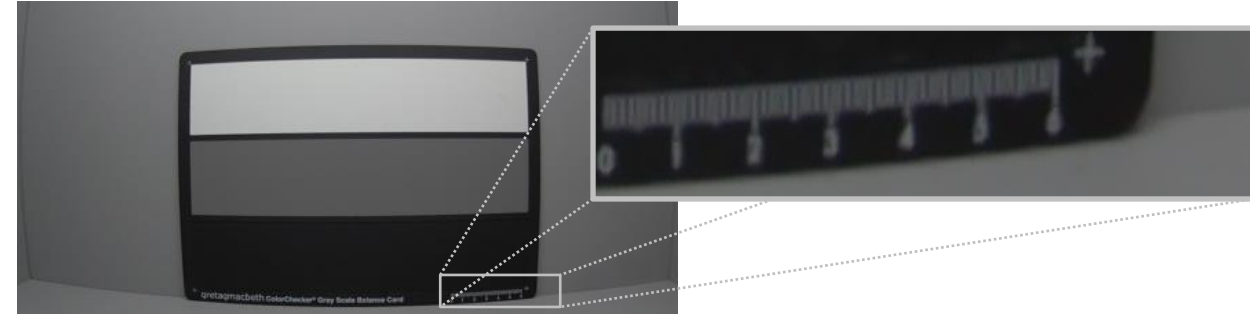
Description:

Parameter info:

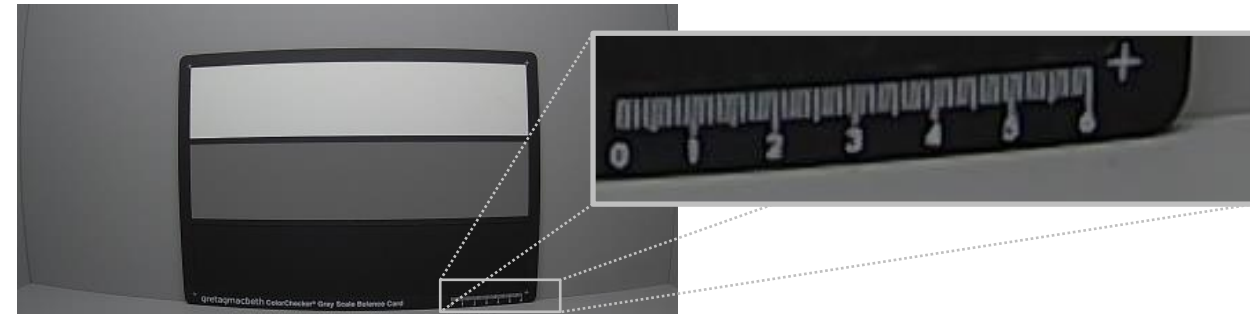
You can select level as follows:

- D_IMAGE_SATURATION_LOW_5: off
- D_IMAGE_SHARPNESS_LEVEL_0: Off Weakest level
- D_IMAGE_SHARPNESS_LEVEL_1: Level 1
- :
- D_IMAGE_SHARPNESS_LEVEL_10: Level 10 Strongest level

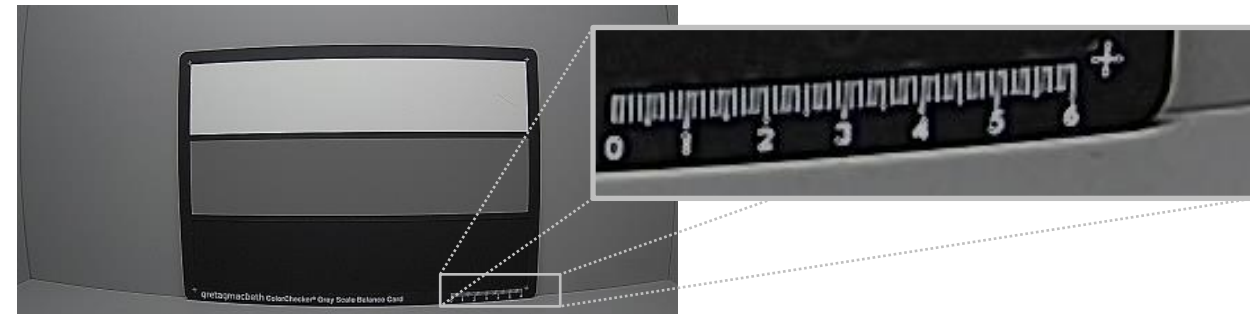
D_IMAGE_SHARPNESS_LEVEL_0 : Off



D_IMAGE_SHARPNESS_LEVEL_5 : LEVEL5



D_IMAGE_SHARPNESS_LEVEL_10 : LEVEL10



EXPOSURE CORRECTION SETTINGS

Overview:

Sets the exposure compensation value

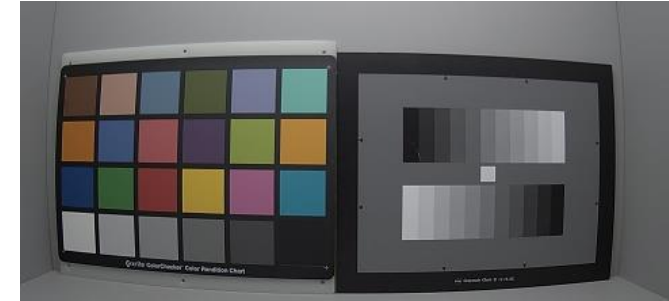
Description:

Parameter info:

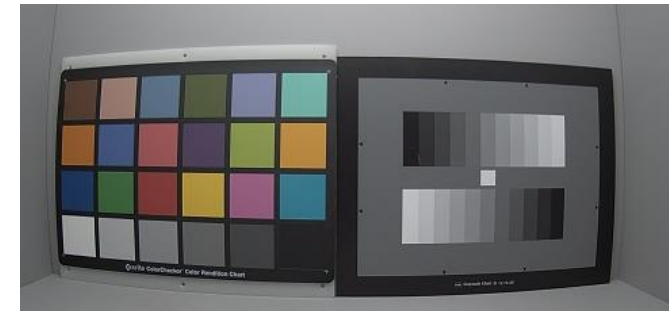
You can select level as follows:

- | | |
|-------------------------|-----|
| - D_IMAGE_EXPOCRCT_M10: | -10 |
| ⋮ | |
| - D_IMAGE_EXPOCRCT_M1: | -1 |
| - D_IMAGE_EXPOCRCT_N: | 0 |
| - D_IMAGE_EXPOCRCT_P1: | +1 |
| ⋮ | |
| - D_IMAGE_EXPOCRCT_P10: | +10 |

Compensation=-5



Compensation=0



Compensation=+5



EXPOSURE TIME SETTINGS

Overview:

Sets the exposure time

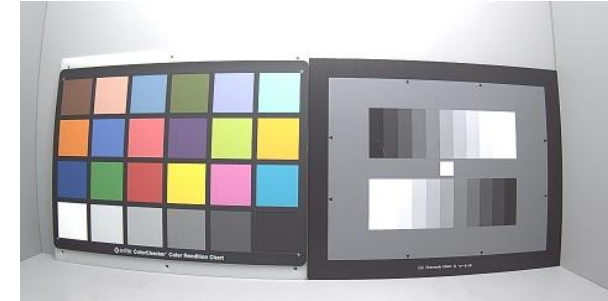
Description:

Parameter info:

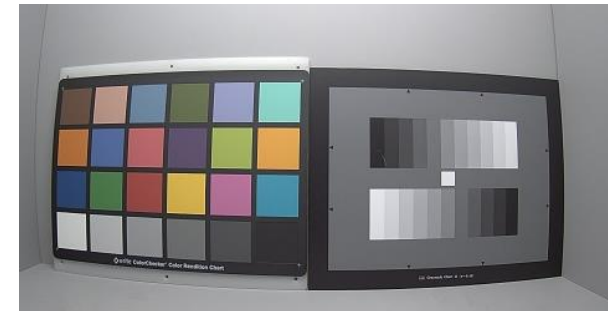
You can select level as follows:

- D_IMAGE_EXPOTIME_1_64000: 1/64000
- ⋮
- D_IMAGE_EXPOTIME_1_1: 1
- ⋮
- D_IMAGE_EXPOTIME_500_1: 500

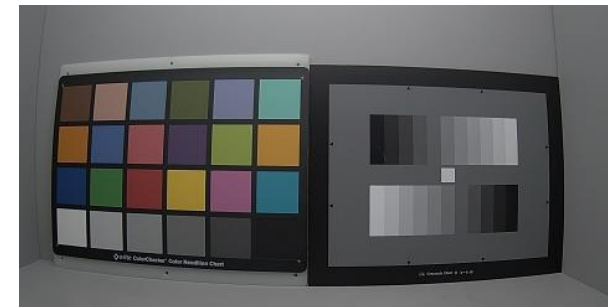
Exposure Time=1/60



Exposure Time=1/125



Exposure Time=1/250



SENSOR GAIN SETTINGS

Overview:

Sets the gain

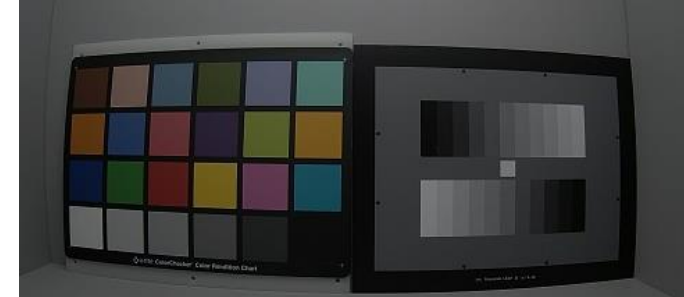
Description:

Parameter info:

You can select level as follows:

- D_IMAGE_GAIN_AUTO: auto
- D_IMAGE_GAIN_0dB: Base gain
- D_IMAGE_GAIN_1dB: Base gain +1 dB
- :
- D_IMAGE_GAIN_64dB: Base gain +64 dB

Gain=+12dB



Gain=+18dB



Gain=+24dB



tone mapping settings

Overview:

Switches tone mapping in monitoring on or off and sets its level.

Description:

Parameter info:

You can select level as follows:

- | | |
|------------------------|--------|
| - D_IMAGE_TM_LEVEL_0: | 0(Off) |
| - D_IMAGE_TM_LEVEL_1: | 1 |
| : | |
| - D_IMAGE_TM_LEVEL_10: | 10 |