



Luminance meter CM-P100

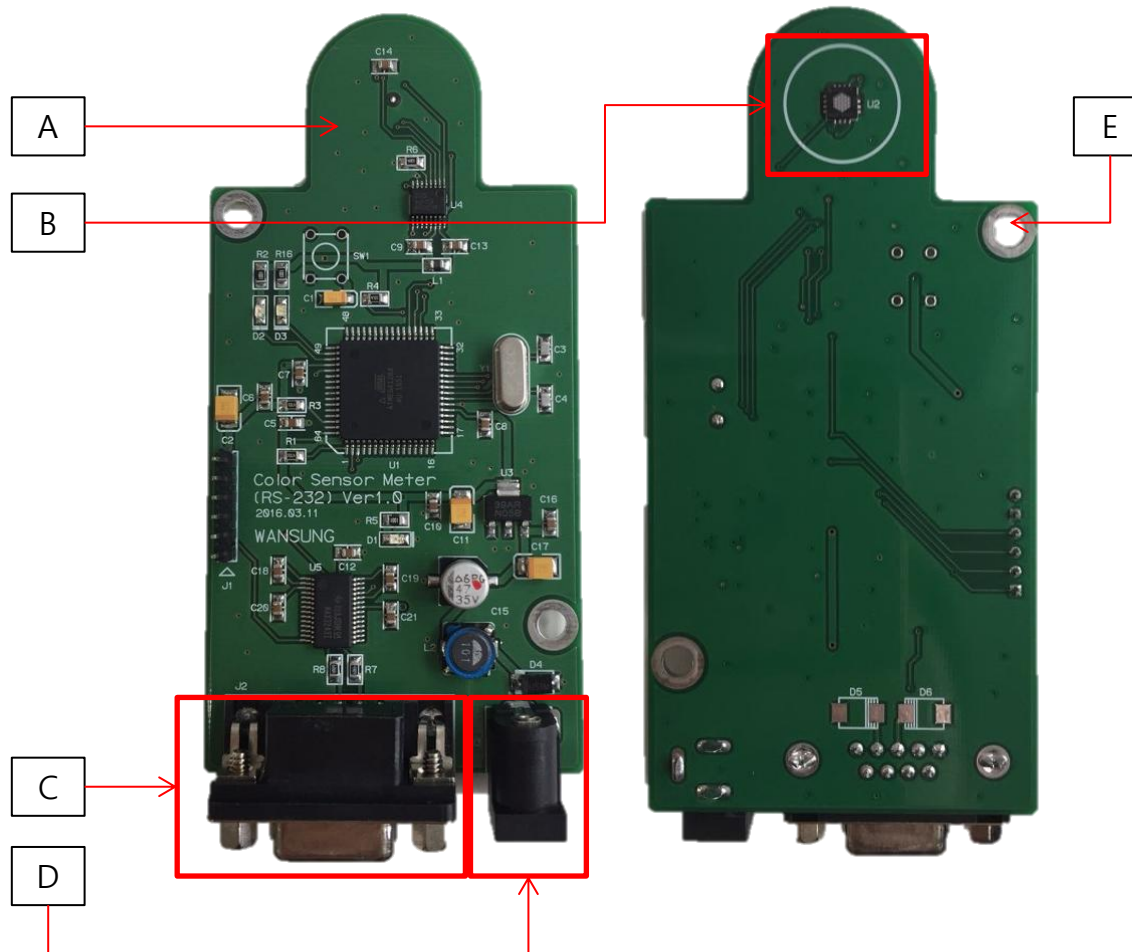
Customized board manual

KISlab

Korea Imaging Spectroscopy Laboratory

www.kislab.kr

Main board



A. Main PCB

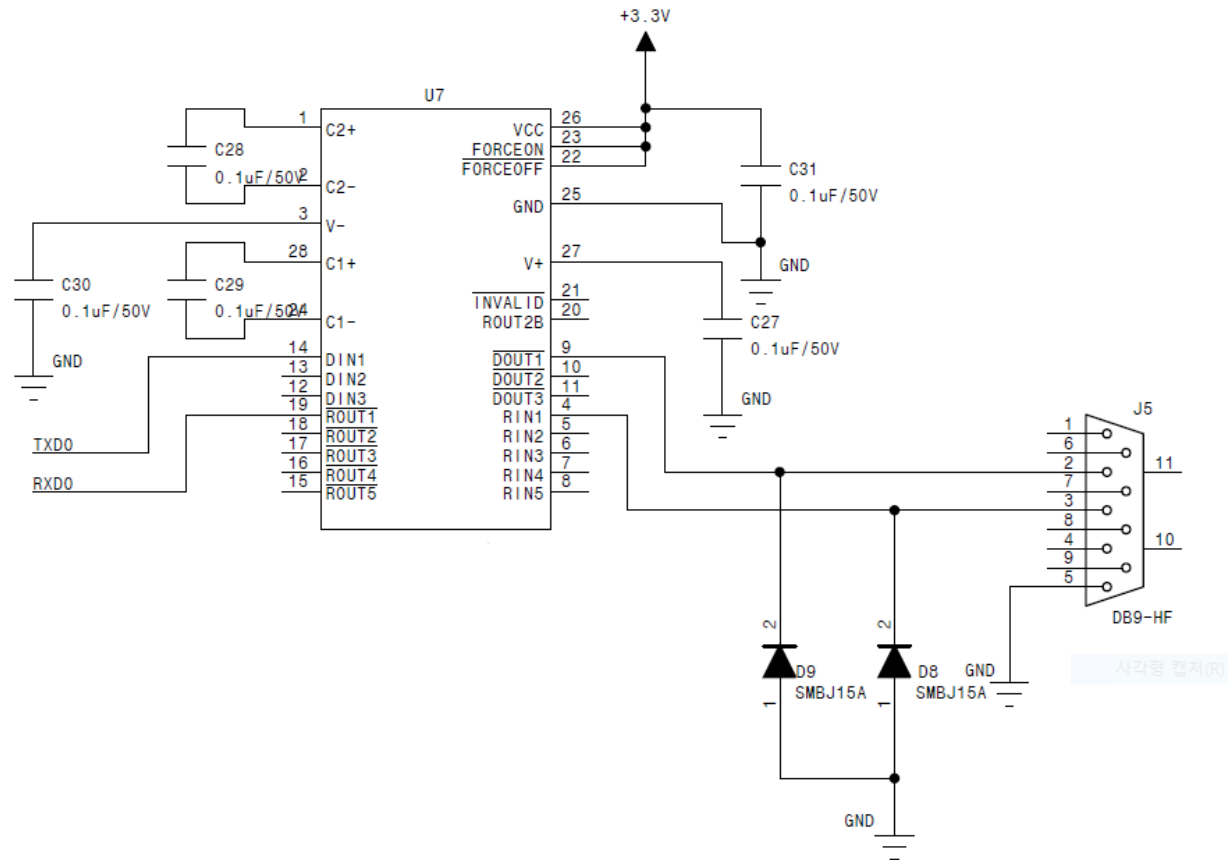
B. True color sensor

C. RS-232C connector

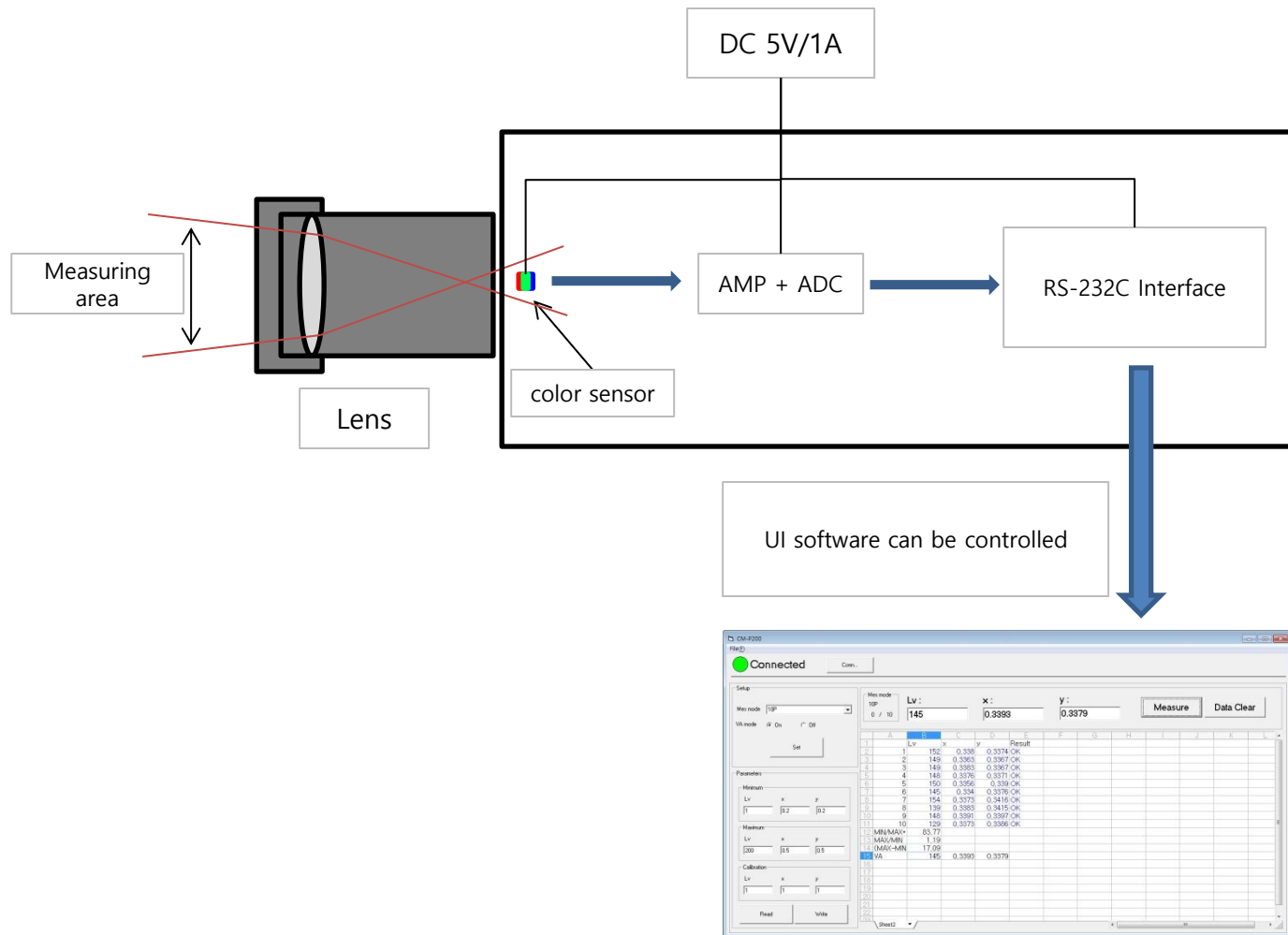
D. DC5V power connector

E. Mount hole

Circuit diagram



Schematic diagram



Communication protocol

- Parameters
 - Baudrate : 9600
 - parity : n
 - data bit : 8
 - stop bit : 1
- STX = 0x02
- ETX = 0x03
- CR = 0x0d
- Data format
 - STX + Command + ETX + Checksum + CR
- Commnads
 - MeaWB
 - MeaRB
 - SetM
 - SetU
 - SetV
 - MinR, MaxR, CalR
 - MinW, MaxW, CalW
 - SNOK
 - SNNG
 - Comtest
 - Ucal

Calibration

Calibration steps :

1. Measure Target data T and Sensor data S :

$$T = \begin{pmatrix} X_1 & X_t \\ Y_1 & \dots & Y_t \\ Z_1 & Z_t \end{pmatrix} \quad t = \text{number of targets}$$

$$S = \begin{pmatrix} X_{ADC1} & X_{ADCt} \\ Y_{ADC1} & \dots & Y_{ADCt} \\ Z_{ADC1} & Z_{ADCt} \end{pmatrix} \quad t = \text{number of targets}$$

2a. Measure the electronic offset :

Cover the sensor and read out the ADC values. Save them as $XYZ_{ADCOffset}$:

$$\begin{pmatrix} X_{ADCOffset} \\ Y_{ADCOffset} \\ Z_{ADCOffset} \end{pmatrix}$$

2b. Adjust Sensor data with $XYZ_{ADCOffset}$.

$$S' = S - \begin{pmatrix} X_{ADCOffset} \\ Y_{ADCOffset} \\ Z_{ADCOffset} \end{pmatrix}$$

3a. Calculate the black - white offset :

I. Search the min and max values of Sensor data S' :

$$\begin{pmatrix} X_{ADCmin} \\ Y_{ADCmin} \\ Z_{ADCmin} \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} X_{ADCmax} \\ Y_{ADCmax} \\ Z_{ADCmax} \end{pmatrix}$$

II. Copy the corresponding values out of Target data T :

$$\begin{pmatrix} X_{min} \\ Y_{min} \\ Z_{min} \end{pmatrix} \quad \text{and} \quad \begin{pmatrix} X_{max} \\ Y_{max} \\ Z_{max} \end{pmatrix}$$

III. Calculate the black - white offset (y - axis intercept) RGB_{Offset} :

$$X_{Offset} = X_{ADCmin} - \frac{X_{ADCmax} - X_{ADCmin}}{X_{max} - X_{min}} \cdot X_{min}$$

$$Y_{Offset} = Y_{ADCmin} - \frac{Y_{ADCmax} - Y_{ADCmin}}{Y_{max} - Y_{min}} \cdot Y_{min}$$

$$Z_{Offset} = Z_{ADCmin} - \frac{Z_{ADCmax} - Z_{ADCmin}}{Z_{max} - Z_{min}} \cdot Z_{min}$$

3b. Adjust Sensor data with RGB_{Offset} .

$$S'' = S' - \begin{pmatrix} X_{Offset} \\ Y_{Offset} \\ Z_{Offset} \end{pmatrix}$$

4. Calculate the (3, 3) matrix for linear transformation :

$$K = (T \cdot S''^{trans}) \cdot (S'' \cdot S''^{trans})^{-1}$$

trans = transpose of matrix

-1 = inverse

UI Software example

CM-P100(DSC)

File(E)

 Connected Conn...

Setup

Mes mode: 5P

VA mode: ☐ On ☒ Off

Set

Parameters

Minimum

Lv: 1 x: 0.1 y: 0.1

Maximum

Lv: 500 x: 0.6 y: 0.6

Calibration

Lv: 1 x: 1 y: 1

Load from saved file Read from CM-P100

Save to file Write to CM-P100

Mes mode: 5P
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Lv: 188 x: 0.3512 y: 0.3416

Measure Data Clear

	A	B	C	D	E	F	G	H	I	J	K	L
1		Lv	x	y	duv	CCT	Result					
2	1	0.08	-0.0662	-0.0854	0.502622		0 NG					
3	2	0.08	-0.0662	-0.0854	0.502622		0 NG					
4	3	0.08	-0.0662	-0.0854	0.502622		0 NG					
5	4	188	0.3512	0.3416	-0.007559	4718	OK					
6	5											
7	MIN/MAX*100											
8	MAX/MIN											
9	(MAX-MIN)/AVE(ALL)*100											
10	VA											
11												
12												
13												
14												
15												
16												
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Sheet2