General

S-110 is one of the world's smallest models, of which Persistent stability and Temperature Effect Resistance besides various outputs are much favored by customers in stocks raising, greenhouse, scientific projects, etc.

S-110A has Automatic calibration software turned for HVAC customers who want easier monitoring with less management cost, etc.

Carbon Dioxide (CO₂)Module

Model :S-110

Features

• Non-Dispersive Infrared (NDIR) technology used to measure CO_2 levels.

• Pre-calibrated

• Available outputs : Analog Voltage, TTL-UART, I2C.

• Gold-plated sensor provides long-term calibration stability.

• Installed Calibration function

• Periodic Automatic Calibration (ACDL) and

Non-Periodic Manual Re-Calibration (MCDL) are available.

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• Size : 33mmx33mmx13mm.

• Weight: 10g.

S-110 Specifications

General Performance

Operating Temperature range : -5 ~ 55℃

Operating Humidity range : 0 ~ 95% RH (Non-condensing)

Storage Temperature : -30℃ ~70℃

CO_2 Measurement

Sensing Method NDIR (Non-dispersive Infrared)

Measurement Range : 0 to 2,000/3,000/5,000/10,000 ppm

Accuracy : ±50ppm ±3%

Response Time(90%) : 60 seconds

Sampling Interval : 3 seconds

Electrical Data

Input Power : 4.85~5.15V (5.0V±3% Regulation)

Power Consumption : Normal :20mA, Max :380mA at lamp on peak

Output connector : 4 pin, 10 pin (2mm pitch Socket)

Output Signal

UART : 38,400BPS, 8bit, No parity, 1 stop bit TTL Level

I2C : Slave mode only, Internal pull up resister, Under 30kHz Clock

TTL Level Voltage : $0 \leq V_{IL} \leq 1.2$, $3.5 \leq V_{IH} \leq 5.0$(Volt), $0 \leq V_{OL} \leq 0.4$, $4.2 \leq V_{OH} \leq 5$(Volt)

Analog : VDC 0.5 ~ 4.5V

Pin Description for S-110

Pin No.	S-110	S-110A (ACDL Software)
1/3	+5V VCC	
2/4/9	GND	
5	TTL RXD (MCU→S-110)	
6	TTL TXD (MCU←S-110)	
7	I2C SCL	
8	I2C SDA	
10	Analog Output (0.5~4.5V)	
11	H/W based ACDL initiation	Should be kept 'High' or disconnected
12	Reserved	
13	10 min. Manual Calibration (H/W based MCDL)	
14	Reset (Low Active)	

Product Derivatives and Relative Functions

Products	Option List
S-110	Calibration: H/W based MCDL & H/W based ACDL, Output: UART,I2C, Analog Voltage
S-110A (ACDL S/W)	Periodic Automatic Calibration Software is added on S-110.

S-110 has Hardware based Periodic Automatic Calibration (ACDL, Low signal to pin-11), and Non-Periodic Manual Calibration (MCDL, Low signal to pin-13). S-110A, which has Software based Periodic Calibration in sensor, is also selectable on sale for customer whose application is Indoor Air-Quality Monitoring, operates with Periodic Automatic Calibration all the time except for times when Hardware based Non-Periodic Manual Calibration (MCDL, Low signal to pin-13) is being done.

Non-Periodic Manual Calibration (10 minutes MCDL) for S-110

Method 1. Apply TTL Low signal to pin 13 of S-110 or S-110A for 10 minutes, or

2. TRB-100S (Test and Recalibration Board) or EK-100SL (Evaluation Kit, with Emulation program 'ELTWSD') is on sale.

Status Table of S-110

Pin-11	Pin-13	Status	Notes
Low	High	**H/W ACDL**	Calibrate weekly after 2 days since power-on
High	High	**Normal**	Operate with Pre-calibrated value in Factory or previous state.
High	Low	**H/W MCDL**	Manual Recalibration – sensor should be located in 400ppm environment (outside) for 10 minutes and 'Low' signal to pin 13 should be done no later than 18 minutes.

※ pin-11 and pin-13 shouldn't have 'Low' at a time.

Status Table of S-110A

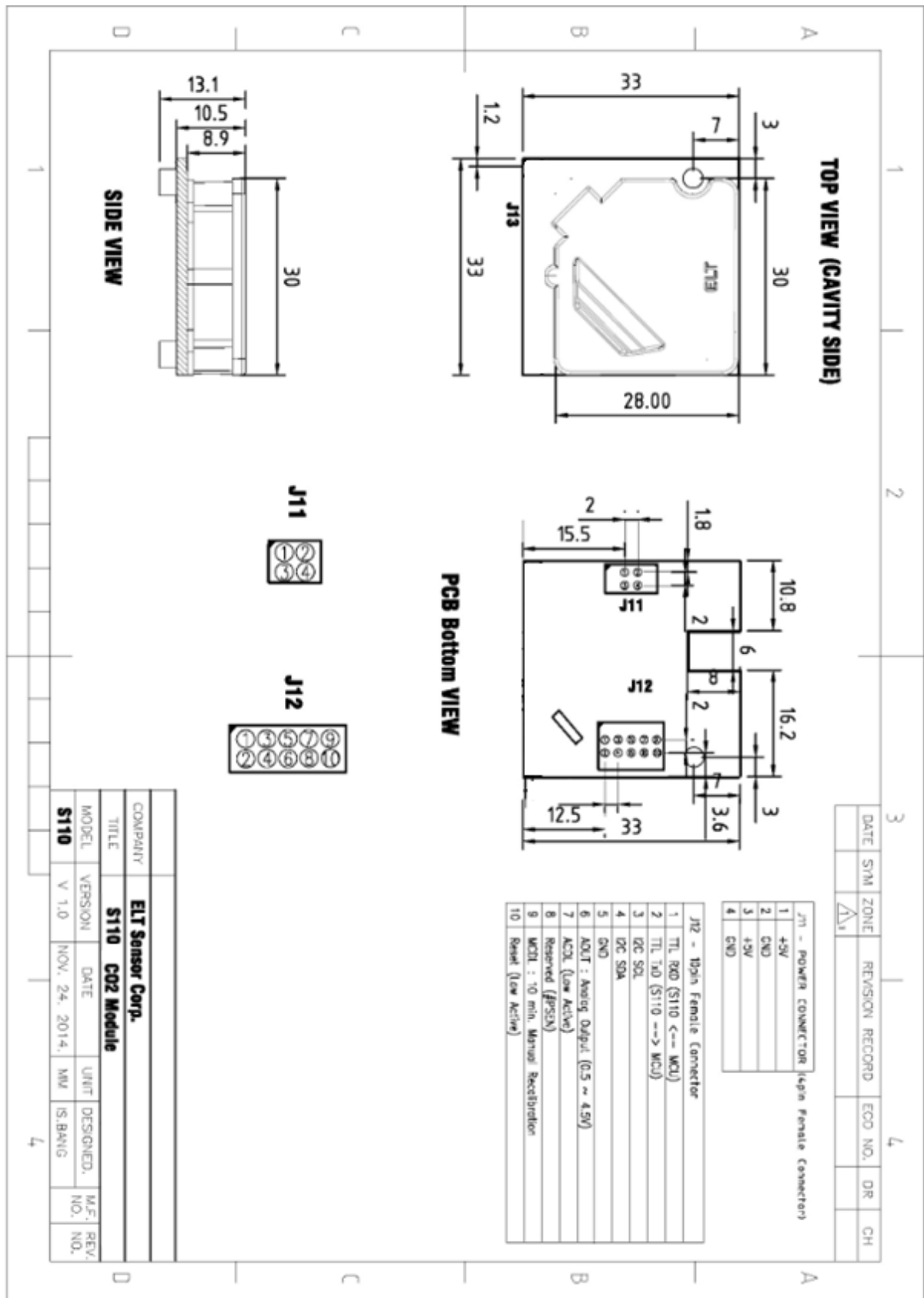| Pin-11	Pin-13	Status	Notes
High or disconnect	High	**S/W ACDL**	Calibrate weekly after 2 days since power-on
	Low	**H/W MCDL**	Manual Recalibration sensor should be located in 400ppm environment (outside) for 10 minutes and 'Low' signal to pin 13 should be done no later than 18 minutes.

※ pin-11 shouldn't have 'Low' at any time.

Comparison Table between S-110 and S-110A

No.	S-110			S-110A (Software ACDL is default)		
	Pin-11	Pin-13	Status	Pin 11 State	Pin 13 State	Status
1	**Low**	High	**H/W ACDL**	Low	High	Reserved
2	High	High	**Normal**	High or disconnect	High	**S/W ACDL**
3	High	**Low**	**H/W MCDL**		Low	**H/W MCDL**
4	Low	Low	Reserved	Low	Low	Reserved

※ 'Normal' status is the same as previous state.

Dimensions (unit : mm)

SIDE VIEW

13.1
10.5
8.9
30

TOP VIEW (CAVITY SIDE)

33
1.2
7
3
30
33
28.00
J13
ELT

PCB Bottom VIEW

2
15.5
1.8
10.8
2
J11
6
8
J12
2
16.2
12.5
33
7
3.6
3

J11
① ②
③ ④

J12
① ③ ⑤ ⑦ ⑨
② ④ ⑥ ⑧ ⑩

J11 - POWER CONNECTOR (4pin Female Connector)

ZONE		
1	+5V	
2	GND	
3	+5V	
4	GND	

J12 - 10pin Female Connector

1	TTL RXD (S110 <-- MCU)	
2	TTL TxD (S110 --> MCU)	
3	I2C SCL	
4	I2C SDA	
5	GND	
6	AOUT : Analog Output (0.5 ~ 4.5V)	
7	ACAL (Low Active)	
8	Reserved (PPSIN)	
9	MCAL : 10 min. Manual Recalibration	
10	Reset (Low Active)	

ZONE	SYM	DATE
REVISION RECORD		

COMPANY	ELT Sensor Corp.	
TITLE	S110 CO2 Module	
MODEL	S110	
VERSION	V 1.0	
DATE	NOV. 24, 2014	
UNIT	MM	
DESIGNED.	IS.BANG	

Recommended Contact Pin

COMPANY	ELT Sensor Corp.				
TITLE	S110				
MODEL	VERSION	DATE	UNIT	DESIGNED.	M.F. NO.
S110	V 1.0	NOV. 24, 2014.	MM	IS.BANG	REV. NO.

Output Voltage Descriptions

UART Descriptions

Data Transmit

Interval : 3 seconds

Handshake protocol : None (Data is transmitted to outer device periodically)

Data Format

D5	D4	D3	D2	D1	SP	'p'	'p'	'm'	CR	LF

D1 ~ D5	5 byte CO2 density string
SP	Space: 0x20
'ppm'	'ppm' string
CR	Carriage return : 0x0D
LF	Line feed : 0x0A

Above 11byte consist of 5 byte hexadecimal digits,<SP>,0x70 0x70 0x6D, <CR><LF> , where decimal '0' (corresponds to hexadecimal digit '0x30') is replaced by space (corresponds to hexadecimal digit '0x20'),

EX) 1,255 ppm, results '0x20 0x31 0x32 0x35 0x35 0x20 0x70 0x70 0x6D 0x0D 0x0A', which displays '_1255_ppm<CR><LF>'on screen.

I2C Communication (Only Slave Mode Operation)
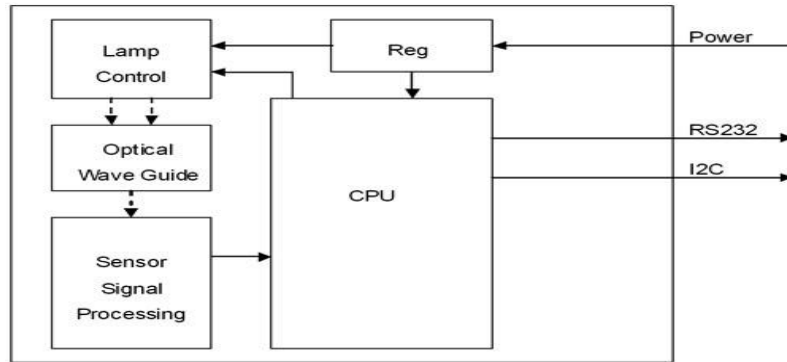
Internal pull up resister

Slave Address: 0x31, Slave Address Byte: Slave Address(0x31) 7 Bit + R/W 1 Bit

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	1	1	0	0	0	1	R/W Bit

R/W Bit : Read = 1/Write = 0

When reading the data, Slave Address Byte is 0x63, When writing the data, Slave Address Byte is 0x62.

Block Diagram

Transmission Sequence in Master

1) I2C Start Condition

2) Write Command(Slave Address + R/W Bit(0) = 0x62) Transmission and Check Acknowledge

3) Write Command(ASCII 'R' : 0x52) Transmission and Check Acknowledge

4) I2C Stop Command

5) I2C Start Command

6) Read Command(Slave Address + R/W Bit(1) = 0x63) Transmission and Check Acknowledge

7) Read 7 Byte Receiving Data from Module and Send Acknowledge

   (Delay at least 1ms for reading each byte)

Configuration	CO_2	reserved	reserved	reserved	reserved
1 Byte	2 Byte	0x00	0x00	0x00	0x00

0	0	0	0	1	0	0	0

   In need of detail protocol specification and time sequence, I2C programming guide is providable by contacting Sales Rep.