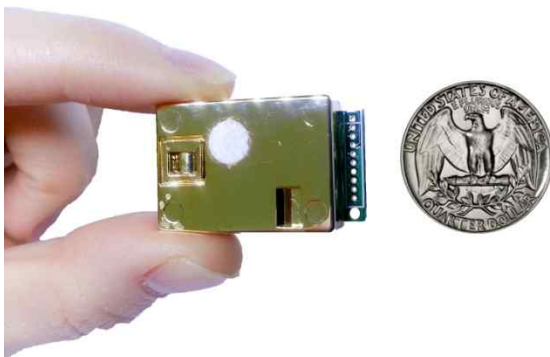


General

Version 1.2

T-110 series is the world's smallest CO₂ sensor module. T-110 is much favored by customers due to its Temperature independence besides the long life cycle.

ELT Sensor Data Sheet for T-110



Features

- Non-Dispersive Infrared (NDIR) technology used to measure CO₂ levels.
- The world's smallest size
- Pre-calibrated
- Available output : TTL-UART, I2C, ALARM, PWM/Analog Voltage.
- Gold-plated sensor provides long-term calibration stability.
- Installed re-calibration function
- Operate as ACDL mode (Automatic Calibration in Dimming Light mode).
- Manual Re-Calibration function is executable.
-
- Size : 19mmx29.3mmx8.5mm
- Weight : 5 grams

T-110 Specifications

General Performance

- Operating Temperature : 0 ~ 45°C
- Operating Humidity : 0 ~ 85% RH (Non-condensing)
- Operating Environment : Residential, Commercial spaces
- Storage Temperature : -30°C ~ 70°C

CO₂ Measurement

- Sensing Method : NDIR (Non-dispersive Infrared)
- Measurement Range : 0 ~ 2,000/3,000/5,000/10,000 ppm (2/3/5/10% is optional)
- Accuracy : ±70ppm ±3% of reading (T-110A: ±50ppm ± 3% of reading) for 0~10,000 ppm
(±200ppm ± 3% of reading up to 5%, ±200ppm ± 5% of reading up to 10%)
- Step Response Time (90%) : 3 minutes
- Sampling Interval : 5 seconds
- Warming-up Time : 3 minutes

Electrical Data

- Power Input : 5.0V ± 5%
- Current Consumption : Normal mode : 20mA, Peak : 200mA, Sleep: 0.5mA

Product Derivatives with Functions

Products	Option List
T-110A	ACDL software,10'MCDL, UART, ALARM, Analog Voltage or PWM, 10pin,
T-110L	Low Power, 10' MCDL UART, ALARM, Analog Voltage or PWM, 10pin,
T-110M	10' MCDL, UART, ALARM, Analog Voltage or PWM, 10pin,
T-110G	Resistant to 99% Humidity for Green House,10' MCDL, UART, ALARM, Analog Voltage or PWM, 10pin,

10 minute MCDL (Manual Calibration in Dimming Light) Function is executable in all T-100 Series.

T-110G is for Greenhouse and Stock Raising which need to be resistant to humidity while as T-100L is Low Power model, consumes less than 0.5mA in Sleep mode.

T-110A has ACDL (Automatic Calibration in Dimming Light) software in Sensor for Indoor Air-Quality Monitoring which could face ambient status with period. (2day at first, and every week as default).

'**Technical Datasheet for T-110 series**' could be provided by contacting on Sales Rep.

Output Pin Map

Pin No.	T-110A	T-110A(PWM Option)
1	+5V VCC	
2	GND	
3	UART-RX	
4	No Output	PWM (Pulse Width Modulation)
5	UART-TX	
6	Alarm (Open Collector)	
7	Analog Voltage Output	No Output
8	SCL	
9	SDA	
10	MCDL	

UART

38,400BPS, 8bit, No parity, 1 stop bit, TTL Level Voltage (for inspection use)

I2C (J-12:P3&P4)

Slave mode only, Internal pull up resistor

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

PWM

$t_H = 2 \text{ msec (Start)} + 1,000 \text{ msec} \times (\text{Measurement}_{(\text{ppm})} / \text{Range}_{(\text{ppm})})$,

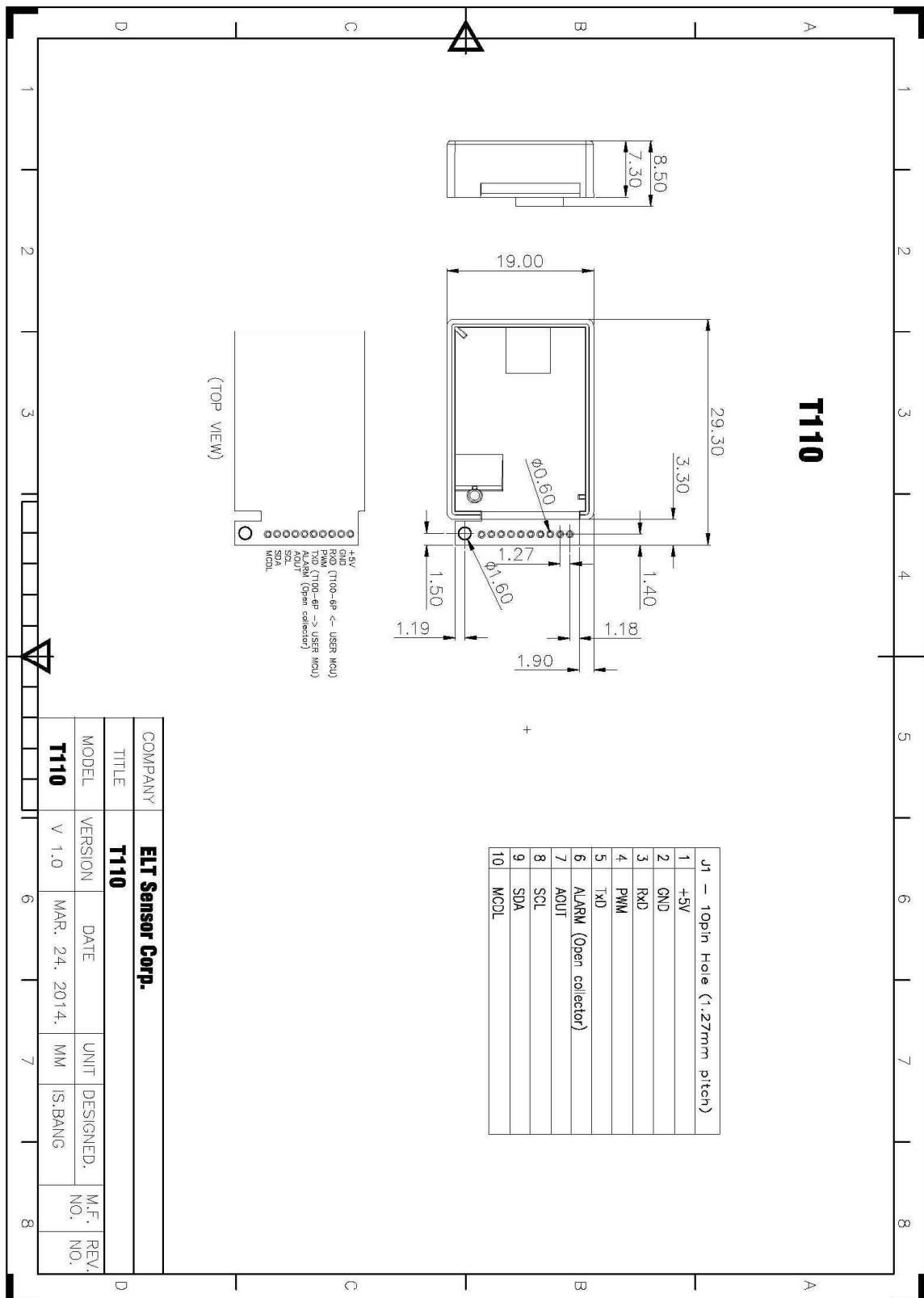
$t_L = 2,000 \text{ ppm} - t_H$, (Period : 2,000 ppm)

Analog Voltage: 0.5~4.5V

ALARM

Open Collector type, $1,000 \text{ ppm} \leq \text{Alarm ON}$, $800 \text{ ppm} \geq \text{Alarm OFF}$

Cavity Dimensions (unit : mm)



10 minute Manual Re-Calibration Function.

ACDL mode (Automatic Re-Calibration in Dimming light with period)

Automatic Re-Calibration software is installed for T-110A, recommended for Indoor Air-Quality Monitoring which could face ambient status with period. (2day at first, and every week as default)

10 minute Manual Re-Calibration Function (10' MCDL function).

Method 1. Apply TTL Low signal to pin-10 for 10 minutes, or

※To activate MCDL function, the user's application must be designed to give Low Active Signal to pin-10

Method 2. Let Sensor install on Jig Board (**TRB-100: Test and Recalibration Board**) with ambient air-flow condition and execute by moving jumper following Manual, which is downloadable on the website.

Method 3. Send String command set below to RXD-pin of Sensor on Emulation program.

DK-100 (Download kit, with Emulation program 'ELTWSO') is available.

Output Descriptions

Analog Voltage Output Descriptions

Measured Voltage 0.5V~4.5V match proportionally to 0~ 2,000 each for 2,000 ppm scale sensor

And any of 0~3,000 or 5,000 or 10,000 ppm scale sensor could be set by designating on sale.

Therefore 4.5V will match 2,000 or 3,000 or 4,000 or 10,000 ppm or 2% or 3% or 5% or 10% each.

UART Descriptions

Data Format

SP	D6	D5	D4	D3	D2	D1	SP	'p'	'p'	'm'	CR	LF
----	----	----	----	----	----	----	----	-----	-----	-----	----	----

SP	Space: 0x20
D6 ~ D1	6 byte CO2 density string
SP	Space: 0x20
'ppm'	'ppm' string
CR	Carriage return : 0x0D
LF	Line feed : 0x0A

Above 13byte consist by <SP>,6 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 0x20 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 resistor

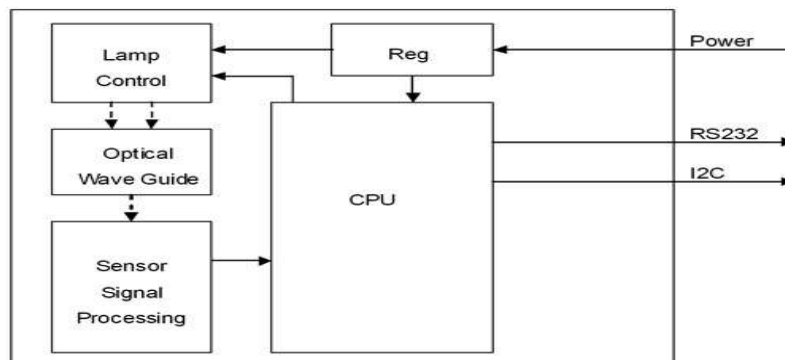
Slave Address: 0x31, Slave Address Byte: Slave Address(0x31) 7 Bit + R/W 1 Bit

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.

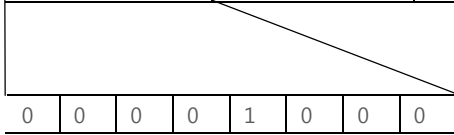
Block Diagram



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

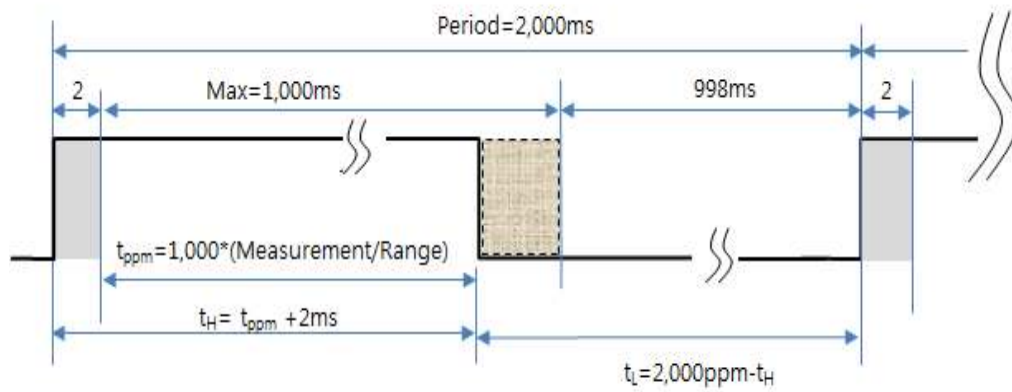


In need of detail protocol specification and time sequence, 'I2C programming guide' could be provided by contacting Sales Rep.

PWM Descriptions

* Measurement_(ppm) = (t_H-2msec)/1000msec x Range_(ppm) (t_H : High Pulse Width)

* Range_(ppm) : 2,000/3,000/5,000/10,000 ppm (20,000/30,000/50,000/100,000 is optional.)



EX) t_H (High Pulse Width) calculation for 400 ppm in 2,000 ppm Range.

* Measurement_(ppm) = 400 ppm = (t_H-2ms)/2,000msec x Range_(ppm) ,

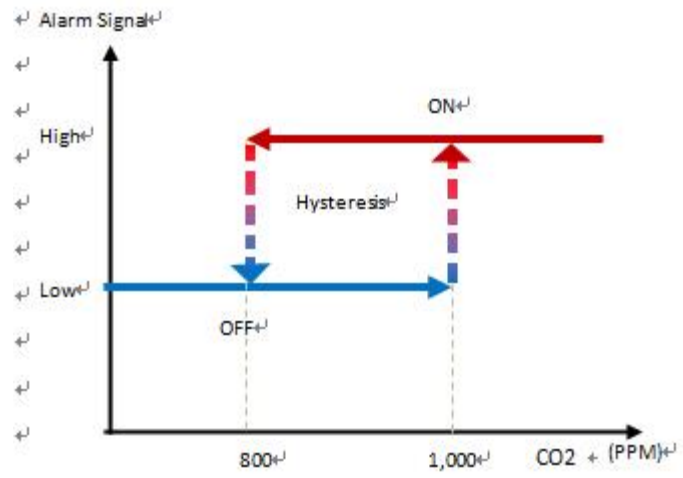
* t_H = 1,000 msec * (400 ppm / 2,000 ppm) + 2msec = 202msec

(cf: T_L = Period - t_H = 2,000 ppm - 202 msec = 1,798 msec.)

Alarm Descriptions

Alarm signal operates as Open Collector type and send TTL on signal since CO₂ measured value beyond 1,000 ppm until it go down to 800 ppm. It is designed to be activated when CO₂ measured value surpass 1,000 ppm and deactivated down to 800 ppm to avoid unwanted rapid switching by hysteresis effect.

1,000 ppm ≤ Alarm ON, 800 ppm ≥ Alarm OFF



DK-100 series is available for customer to enable to change alarm activation & deactivation point.

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