

# Table of Contents

|                                                                                    |        |
|------------------------------------------------------------------------------------|--------|
| 1. Overview .....                                                                  | 1 - 1  |
| 2. Hardware Specifications .....                                                   | 2 - 1  |
| 2.1 Peripheral Circuit Diagrams .....                                              | 2 - 1  |
| 2.2 Pin Connection Table .....                                                     | 2 - 2  |
| 2.3 LCD Layout .....                                                               | 2 - 3  |
| 3. Operation Specifications .....                                                  | 3 - 1  |
| 3.1 Status Transition Diagram .....                                                | 3 - 1  |
| 3.2 Operation Table .....                                                          | 3 - 2  |
| 3.3 Initial Mode .....                                                             | 3 - 3  |
| 3.4 Normal Time Mode .....                                                         | 3 - 4  |
| 3.4.1 Time Display State .....                                                     | 3 - 4  |
| 3.4.2 Time Correction State .....                                                  | 3 - 5  |
| 3.5 Alarm Mode .....                                                               | 3 - 8  |
| 3.5.1 Alarm Display State .....                                                    | 3 - 8  |
| 3.5.2 Alarm Setting State .....                                                    | 3 - 9  |
| 3.6 Atmospheric Pressure Adjustment Mode .....                                     | 3 - 10 |
| 4. Display Specifications .....                                                    | 4 - 1  |
| 4.1 Display Table .....                                                            | 4 - 1  |
| 4.2 Display RAM Map .....                                                          | 4 - 5  |
| 5. Functional Specifications .....                                                 | 5 - 1  |
| 5.1 Normal Time and Calendar Functions .....                                       | 5 - 1  |
| 5.2 Alarm Function .....                                                           | 5 - 1  |
| 5.3 Temperature, Humidity, and Atmospheric Pressure<br>Measurement Functions ..... | 5 - 2  |
| 5.3.1 Temperature Measurement .....                                                | 5 - 2  |
| 5.3.2 Humidity Measurement .....                                                   | 5 - 2  |
| 5.3.3 Atmospheric Pressure Measurement .....                                       | 5 - 2  |
| 5.4 Uncomfortable Index Determination Function .....                               | 5 - 3  |
| 5.5 Weather Forecasting Function .....                                             | 5 - 4  |
| 5.5.1 Weather Pattern .....                                                        | 5 - 4  |
| 5.5.2 Initial Weather Display .....                                                | 5 - 5  |
| 5.6 Serial Transmission Function .....                                             | 5 - 6  |
| 5.6.1 Transmission Data .....                                                      | 5 - 6  |
| 5.6.2 Serial Communication Specifications .....                                    | 5 - 7  |

|                                |       |
|--------------------------------|-------|
| 6. Sensor Specifications ..... | 6 - 1 |
| 6.1 Temperature Sensor.....    | 6 - 1 |
| 6.2 Humidity Sensor .....      | 6 - 3 |
| 6.3 Pressure Sensor .....      | 6 - 4 |

# 1. Overview

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX:0755-83376182 E-MAIL:szss20@163.com

This manual explains the functional specifications, programming specifications, and operations of the standard clock program with built-in weather forecasting function, which uses the SS0204 GS-K/Chip (hereafter referred to as "MCU").

This MCU function is as follows.

(1) Time & calendar functions:

12-hour/24-hour clock, calendars for 1993 - 2023 and time signal output.

(2) Alarm function:

(3) Temperature, humidity, and atmospheric pressure measurement functions:

Temperature measurement:

-20.0~+70.0°C, displayed in increments of 0.1°C

-58.0~+158.0°F, displayed in increments of 0.1°F

Humidity measurement:

20~90%, displayed in increments of 1%

Atmospheric pressure measurement:

850~1050 hPa, displayed in increments of 1 hPa

Sensor measurement time: Selectable

(4) Uncomfortable index determination function:

Uncomfortable index levels: 6

(5) Weather forecasting function:

Weather forecast levels: 4 (Fine, Fine becoming cloudy, Cloudy, and Rain)

(6) Serial transmission function:

The data of calendar, time, temperature, humidity and atmospheric pressure are serially transmitted to the external.

11-bit UART system/clock synchronous system: Selectable

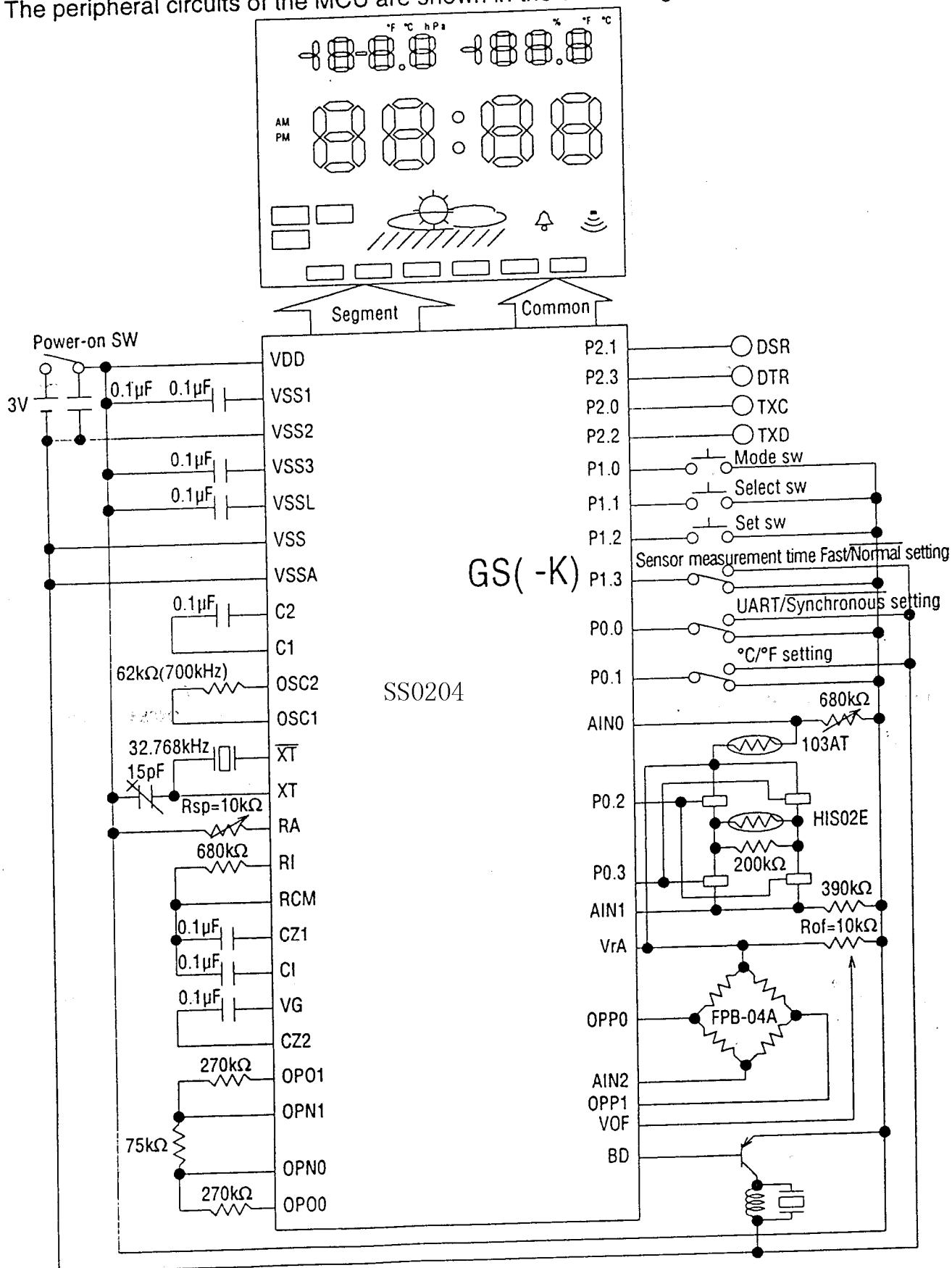
## 2. Hardware Specifications

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX:0755-83376182 E-MAIL:szss20@163.com

The hardware specifications of the MCU are shown below.

### 2.1 Peripheral Circuit Diagrams

The peripheral circuits of the MCU are shown in the circuit diagram.



SUNSTAR半导体集成电路 <http://www.icasic.com/> TEL: 0755-83387016 FAX:0755-83376182 E-MAIL:szss20@163.com

## 2.2 Pin Connection Table

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX:0755-83376182 E-MAIL:szss20@163.com

The pin connections of the MCU are shown in the table below.

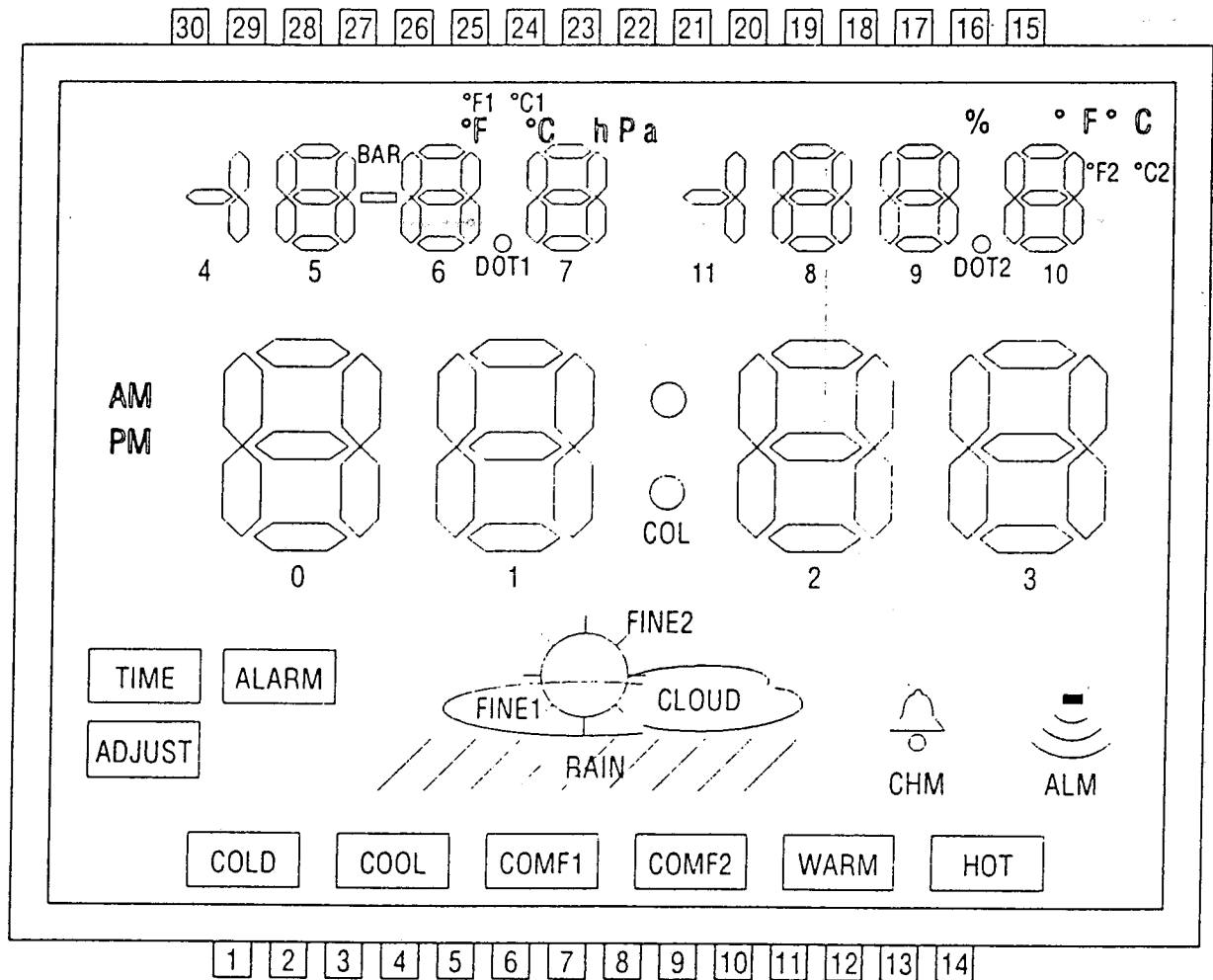
| Pin No. | Pin Name | Description                                               | I/O | Active Level | Pin No. | Pin Name | Description                                                                         | I/O | Active Level |
|---------|----------|-----------------------------------------------------------|-----|--------------|---------|----------|-------------------------------------------------------------------------------------|-----|--------------|
| 1       | L2       | Common 2 output                                           | 0   | —            | 44      | VSSL     | Negative power supply for internal logic                                            | —   | —            |
| 2       | L3       | Common 1 output                                           | 0   | —            | 45      | VOF      | Connection to reference voltage adjustment resistor for atmospheric pressure sensor | —   | —            |
| 3       | L4       | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 4       | L5       | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 5       | L6       | Segment output                                            | 0   | —            | 46      | VDDA     | 0V power supply for analog                                                          | —   | —            |
| 6       | L7       | Segment output                                            | 0   | —            | 47      | VrA      | Reference output for sensor                                                         | 0   | —            |
| 7       | L8       | Segment output                                            | 0   | —            | 48      | AIN0     | Temperature sensor analog input                                                     | I   | —            |
| 8       | L9       | Segment output                                            | 0   | —            | 49      | AIN1     | Humidity sensor analog input                                                        | I   | —            |
| 9       | L10      | Segment output                                            | 0   | —            | 50      | AIN2     | Unused (open)                                                                       | —   | —            |
| 10      | L11      | Segment output                                            | 0   | —            | 51      | AIN3     | Atmospheric pressure sensor analog input (internal)                                 | I   | —            |
| 11      | L12      | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 12      | L13      | Segment output                                            | 0   | —            | 52      | RA       | Connection to constant current adjustment resistor for atmospheric pressure sensor  | —   | —            |
| 13      | L14      | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 14      | L15      | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 15      | L16      | Segment output                                            | 0   | —            | 53      | RI       | Connection to resistor for integration                                              |     | —            |
| 16      | L17      | Segment output                                            | 0   | —            | 54      | RCM      | Resistor capacitor common for integration                                           |     | —            |
| 17      | L18      | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 18      | L19      | Segment output                                            | 0   | —            | 55      | CZ1      | Connection to capacitor for offset correction                                       | —   | —            |
| 19      | L20      | Segment output                                            | 0   | —            |         |          |                                                                                     |     |              |
| 20      | L21      | Segment output                                            | 0   | —            | 56      | CI       | Connection to capacitor for integration                                             | —   | —            |
| 21      | L22      | Segment output                                            | 0   | —            | 57      | CZ2      | Connection to capacitor for offset correction                                       | —   | —            |
| 22      | L23      | Segment output                                            | 0   | —            | 58      | VG       |                                                                                     | —   | —            |
| 23      | L24      | Segment output                                            | 0   | —            | 59      | OP00     |                                                                                     | —   | —            |
| 24      | L25      | Segment output                                            | 0   | —            | 60      | OPN0     | Connection to voltage amplifier adjustment resistor for pressure sensor             | —   | —            |
| 25      | L26      | Segment output                                            | 0   | —            | 61      | OPP0     |                                                                                     | —   | —            |
| 26      | L27      | Segment output                                            | 0   | —            | 62      | OP01     |                                                                                     | —   | —            |
| 27      | L28      | Segment output                                            | 0   | —            | 63      | OPN1     |                                                                                     | —   | —            |
| 28      | L29      | Segment output                                            | 0   | —            | 64      | OPP1     |                                                                                     | —   | —            |
| 29      | L30      | Unused (open)                                             | 0   | —            |         |          |                                                                                     |     |              |
| 30      | OSC2     | High-speed oscillation output (700kHz)                    | 0   | —            | 65      | VSSA     | Analog power supply                                                                 | —   | —            |
|         |          |                                                           |     |              | 66      | VSS      | 0V power supply for connecting external logic                                       | —   | —            |
| 31      | OSC1     | High-speed oscillation input (700kHz)                     | I   | —            | 67      | P0.0     | Switch for UART/Clock synchronous                                                   | I   | "H/L"        |
| 32      | VDD      | 0V power supply                                           | —   | —            | 68      | P0.1     | Switch for °C/°F                                                                    | I   | "H/L"        |
| 33      | XT       | Low-speed oscillation output (32.768kHz)                  | 0   | —            | 69      | P0.2     | Analog SW1 for humidity sensor AC                                                   | 0   | "H"          |
|         |          |                                                           |     |              | 70      | P0.3     | Analog SW2 for humidity sensor AC                                                   | 0   | "H"          |
| 34      | XT       | Low-speed oscillation input (32.768kHz)                   | I   | —            | 71      | P1.0     | Mode SW                                                                             | I   | "H"          |
|         |          |                                                           |     |              | 72      | P1.1     | Select SW                                                                           | I   | "H"          |
| 35      | VSS2     | —3V power supply                                          | —   | —            | 73      | P1.2     | Set SW                                                                              | I   | "H"          |
| 36      | C2       | Connection to capacitor for generating bias for LCD drive | —   | —            | 74      | P1.3     | Switch for sensor measurement time Fast/Normal                                      | I   | "H/L"        |
| 37      | C1       |                                                           | —   | —            |         |          |                                                                                     |     |              |
| 38      | VSS3     | Bias output for LCD drive                                 | —   | —            | 75      | P2.0     | TXC (clock synchronous)                                                             | 0   | —            |
| 39      | VSS1     | Bias output for LCD drive                                 | —   | —            | 76      | P2.1     | DSR (Clock synchronous/UART)                                                        | I   | "H"          |
| 40      | BD       | Buzzer driver output                                      | —   | "H"          | 77      | P2.2     | TXD (Clock synchronous/UART)                                                        | 0   | —            |
| 41      | TST1     | Unused (open)                                             | —   | —            | 78      | P2.3     | DTR (Clock synchronous)                                                             | I   | "H"          |
| 42      | TST2     | Unused (open)                                             | —   | —            | 79      | L0       | Common 4 output                                                                     | 0   | —            |
| 43      | RESET    | Reset input (L→H)                                         | I   | "L"          | 80      | L1       | Common 3 output                                                                     | 0   | —            |

SUNSTAR半导体集成电路 <http://www.icasic.com/> TEL: 0755-83387016 FAX:0755-83376182 E-MAIL:szss20@163.com

## 2.3 LCD Layout

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX:0755-83376182 E-MAIL:szss20@163.com

The LCD layout used in the MCU is shown below.



Segment Assign Table

LCD panel  
Maker: Citizen Watch Co., Ltd.  
Type: LM-1240C

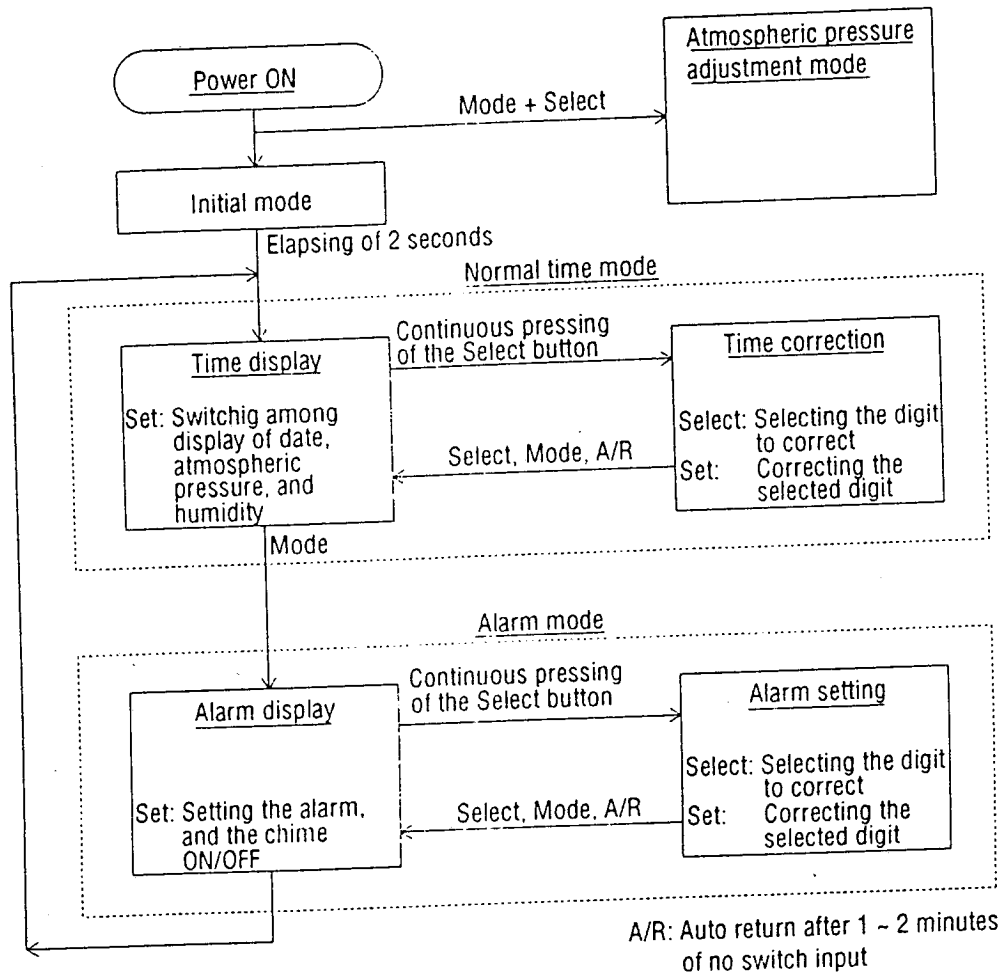
| PIN No. | Signal |       |       |      | PIN No. | Signal |      |      |      | PIN No. | Signal |      |      |      |
|---------|--------|-------|-------|------|---------|--------|------|------|------|---------|--------|------|------|------|
|         | COM1   | COM2  | COM3  | COM4 |         | COM1   | COM2 | COM3 | COM4 |         | COM1   | COM2 | COM3 | COM4 |
| 1       | .      | .     | .     | COM4 | 11      | COMF2  | 2D   | 2G   | 2A   | 21      | 8F     | 8G   | 8E   | 1A   |
| 2       | .      | .     | COM3  | .    | 12      | WARM   | CHM  | 2C   | 2B   | 22      | 11A    | 11B  | hPA  | 7D   |
| 3       | .      | COM2  | .     | .    | 13      | HOT    | .    | 3E   | 3F   | 23      | °C1    | 7B   | 7G   | 7C   |
| 4       | COM1   | .     | .     | .    | 14      | ALM    | 3D   | 3G   | 3A   | 24      | °F1    | 7A   | 7F   | 7E   |
| 5       | ADJUST | TIME  | 0D    | 0E   | 15      | °F2    | °C2  | 3C   | 3B   | 25      | 6A     | 6B   | 6C   | DOT1 |
| 6       | .      | ALARM | 0C    | 0G   | 16      | 10A    | 10B  | 10C  | 10D  | 26      | 6F     | 6G   | 6D   | 0B   |
| 7       | COLD   | 1E    | 1G    | 1F   | 17      | %      | 10F  | 10G  | 10E  | 27      | 5B     | BAR  | 6E   | 0A   |
| 8       | COOL   | 1D    | 1C    | 1B   | 18      | 9A     | 9B   | 9C   | DOT2 | 28      | 5A     | 5G   | 5C   | 0F   |
| 9       | COMF1  | FINE2 | COL   | 2F   | 19      | 9F     | 9G   | 9E   | 9D   | 29      | 5F     | 5E   | 5D   | AM   |
| 10      | RAIN   | CLOUD | FINE1 | 2E   | 20      | 8A     | 8B   | 8C   | 8D   | 30      | 4A     | 4B   | PM   | .    |

### 3. Operation Specifications

The contents on the operation and display of the MCU are explained below.

#### 3.1 Status Transition Diagram

The operation modes and status implemented by the MCU are shown in the transition diagram below.



(Items common to all modes)

- If the time coincides with the alarm time when the alarm has been set, the alarm will sound for 20 seconds.
- If the hour digit is updated through a carry of the minute digit when the chime has been set, the time signal will sound.
- If any switch is operated when the alarm is going off, the alarm will stop, and the previously-set function will be canceled.

## 3.2 Operation Table

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX: 0755-83376182 E-MAIL: szss20@163.com

The operations implemented with the MCU are listed in the table below:

| Mode                            |                       |                                    | No input                                         | Mode                        | Select                                                          | Set                                    |
|---------------------------------|-----------------------|------------------------------------|--------------------------------------------------|-----------------------------|-----------------------------------------------------------------|----------------------------------------|
| Initial mode                    |                       |                                    | —                                                | Invalid                     | Invalid                                                         | Invalid                                |
| Normal time                     | Time display state    | Atmospheric pressure & temperature | —                                                | To alarm mode display state | Continuous pressing:                                            | To month, day, & temperature           |
|                                 |                       | Month, day, & temperature          |                                                  |                             | Correction state is changed to correction of the second column. | To temperature & humidity              |
|                                 |                       | Temperature & humidity             |                                                  |                             |                                                                 | To atmospheric pressure & temperature  |
|                                 | Time correction state | Second column correction           | Changes to Time display state within 1~2 minutes | To hour display state       | To minute column correction                                     | Second clearing                        |
|                                 |                       | Minute column correction           |                                                  |                             | To hour column correction                                       | (1 PUSH): +1 correction                |
|                                 |                       | Hour column correction             |                                                  |                             | To year column correction                                       | (Continuous pressing): 8Hz+ correction |
|                                 |                       | Year column correction             |                                                  |                             | To month column correction                                      |                                        |
|                                 |                       | Month column correction            |                                                  |                             | To day column correction                                        |                                        |
|                                 |                       | Day column correction              |                                                  |                             | To setting of 12 or 24                                          |                                        |
|                                 |                       | Setting of 12 or 24                |                                                  |                             | To display state                                                | 12 ← → 24                              |
| Alarm                           | Alarm display state   | Alarm/Chime OFF                    | —                                                | To timer mode display state | Continuous pressing:                                            | Alarm ON                               |
|                                 |                       | Alarm ON                           |                                                  |                             | to minute column setting state                                  | Chime ON                               |
|                                 |                       | Chime ON                           |                                                  |                             |                                                                 | Alarm/Chime ON                         |
|                                 |                       | Alarm/Chime ON                     |                                                  |                             |                                                                 | Alarm/Chime OFF                        |
|                                 | Alarm-setting state   | Minute digit setting               | To alarm display state within 1~2 minutes        | To alarm display state      | To hour column setting                                          | (1-PUSH): +1 correction                |
|                                 |                       | Hour digit setting                 |                                                  |                             | To display state                                                | (Continuous pressing): 8Hz+ correction |
| Atmospheric Pressure Adjustment |                       |                                    | —                                                | Invalid                     | Invalid                                                         | Invalid                                |
| Alarm sound being output        |                       |                                    | —                                                | Alarm stopped               | Alarm stopped                                                   | Alarm stopped                          |

### 3.3 Initial Mode

SUNSTAR单片机专用电路 <http://www.icshic.com/> TEL: 0755-83387030 FAX: 0755-83376182 E-MAIL: szss20@163.com

After power-on, the mode is shifted to this mode

- All LCD segments display for 2 seconds
- Initial setting of respective data

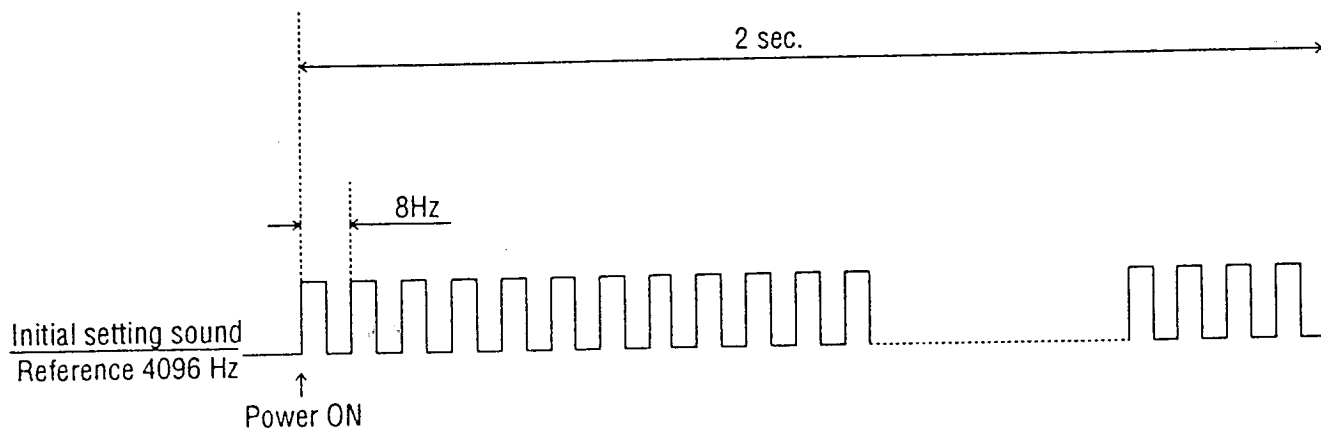
[Initial Settings]

Normal time: AM 12:00:00

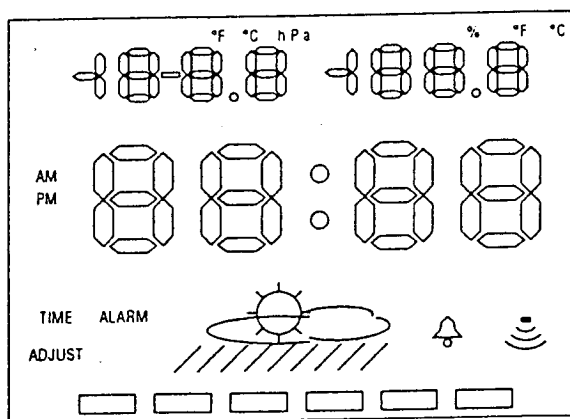
Calendar: 1-JAN-1993

Alarm: AM 12:00 (alarm/chime off)

- Temperature, humidity, and atmospheric pressure are measured. (for display)
- Output of the initial setting sound



After 2 seconds, the mode is shifted to a Normal time mode and time display state (atmospheric pressure and temperature).



All segment display

## 3.4 Normal Time Mode

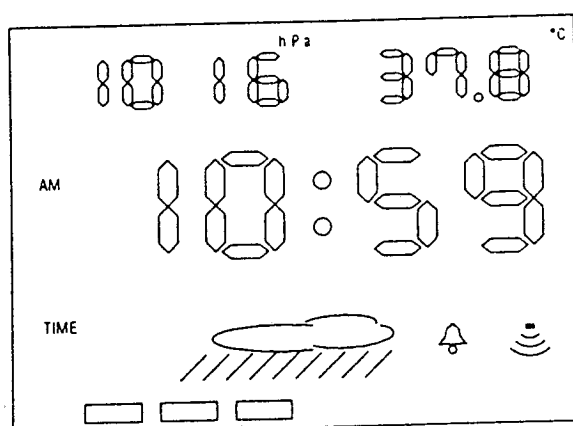
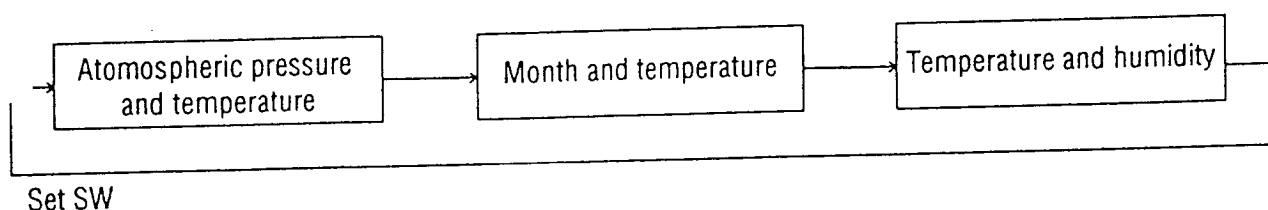
SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387016 FAX: 0755-83376182 E-MAIL: szss20@163.com

The normal time mode consists of the time display state and the time correction state.

- A colon (:) is flashed at 0.5 Hz frequency.
- If the normal time coincides with the alarm time when the alarm has been set, the alarm will sound for 20 seconds.
- If any switch is pressed while the alarm sound is being output, the alarm will stop, and the previously-set function will be canceled.

### 3.4.1 Time Display State

- The Mode SW is used to shift to the Alarm display state.
- Continuous pressing of the Select SW is used to shift to the second correction function of the time correction state.
- The Set SW is used to switch to the following displays.



Time display that shows the atmospheric pressure and temperature

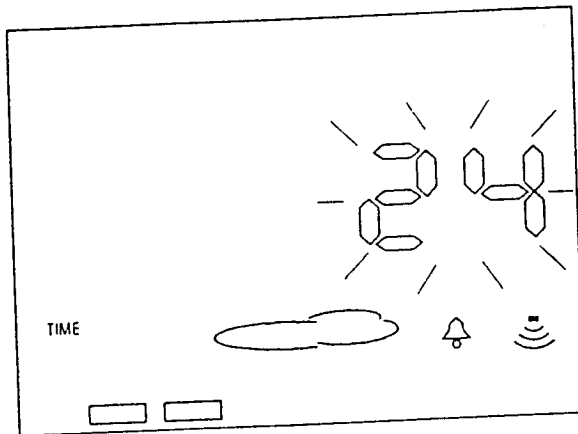
### 3.4.2 Time Correction State

The time correction state consists of the correction functions for second, minute, hour, day, month, and year.

- The time display state goes into effect through the use of the Mode SW, or through auto return after 1~2 minutes of no input.

(Second correction) The second digits flashes at 1 Hz frequency. Clock, month and day are displayed.

- Shift to the minute correction function using the Select SW.
  - Clear the second digits using the Set SW.
- (1 PUSH: Second columns = 00) (Continuous pressing: Invalid)



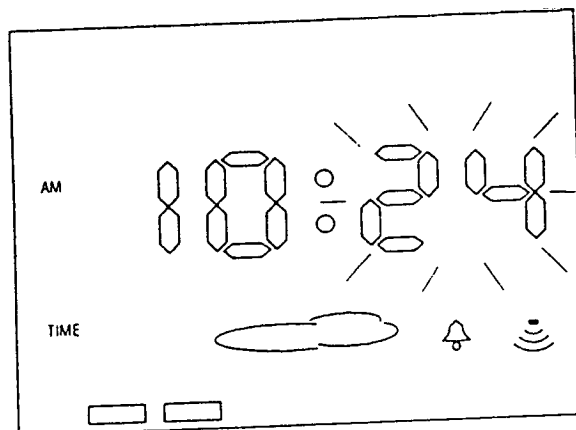
Second correction display

(Minute correction) The minute digits flash at 1 Hz frequency.

- Shift to the hour correction function using the Select SW.
  - Correct the minute columns using the Set SW.
- (1 PUSH: Minute digits + 1) (Continuous pressing: Minute digits fast-forwarded at 8 Hz)
- 00 through 59, 00 minutes: No carry.

(Hour correction) The hour digits flash at 1 Hz frequency.

- Shift to the day correction function using the Select SW.
  - Correct the hour columns using the Set SW.
- (1 PUSH: Hour digits + 1) (Continuous pressing: Hour digits fast-forwarded at 8 Hz)
- (24-hour system) 00 through 23, 00: No carry.
- (12-hour system) AM12, AM1 through AM11, PM12, PM1 through PM11, AM12: No carry.

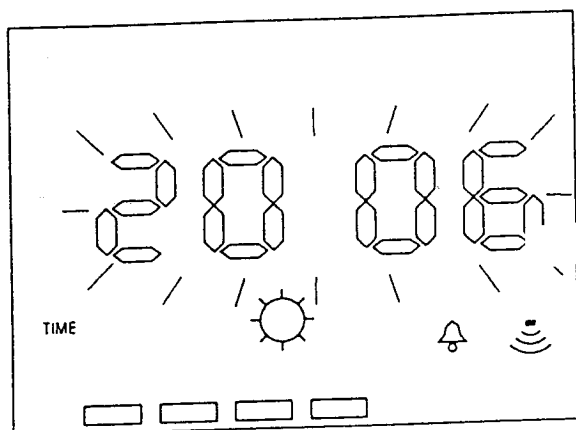


Minute correction display

(Year correction) Year digits flash at 1 Hz frequency.

- Shift to the month correction function using the Select SW.

- Use the Set SW to move the year digits forward for correction  
(1 PUSH: Year digits + 1) (Continuous pressing: Year digits fast-forwarded at 8 Hz)  
1993 through 2023, 1993



Year correction display

(Month correction) The month digits flash at 1 Hz frequency.

- Shift to the day correction function using the Select SW.

- Correct the month columns using the Set SW.

(1 PUSH: Month digits + 1) (Continuous pressing: Month digits fast-forwarded at 8 Hz)  
1 through 12, 1: No carry.

(Day correction) The day digits flash at 1 Hz frequency.

- Shift to the time display state using the Select SW.

- Correct the day columns using the Set SW.

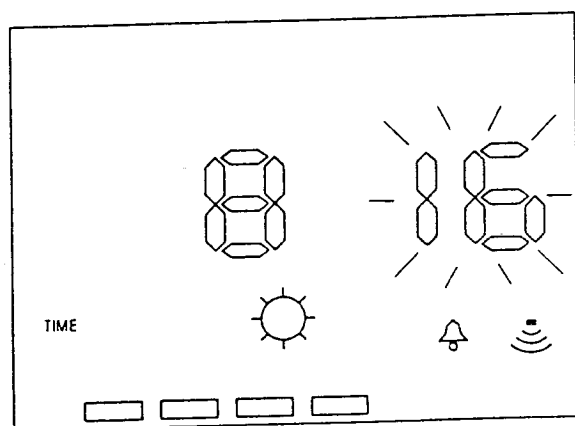
(1 PUSH: Day digits + 1) (Continuous pressing: Day digits fast-forwarded at 8 Hz)

(Longer months) 1 through 31: No carry. No nonexistent days.

(Shorter months) 1 through 30: No carry. No nonexistent days.

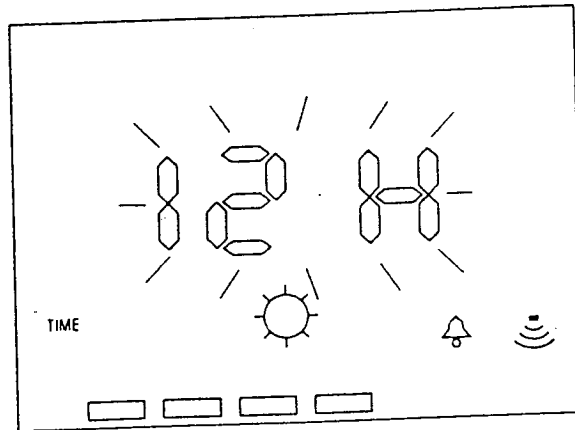
(February in ordinary years) 1 through 28: No carry. No nonexistent days.

(February in leap years) 1 through 29: No carry. No nonexistent days.



Day correction display

- (12/24 hour system setting) 12H or 24H is set
- Shift to the time display state using the Select SW.
  - Correct the time system using the Set SW.
- (1 PUSH: 12H  $\leftrightarrow$  24H) (Continuous pressing: Invalid)



12H/24H setting display

### 3.5 Alarm Mode

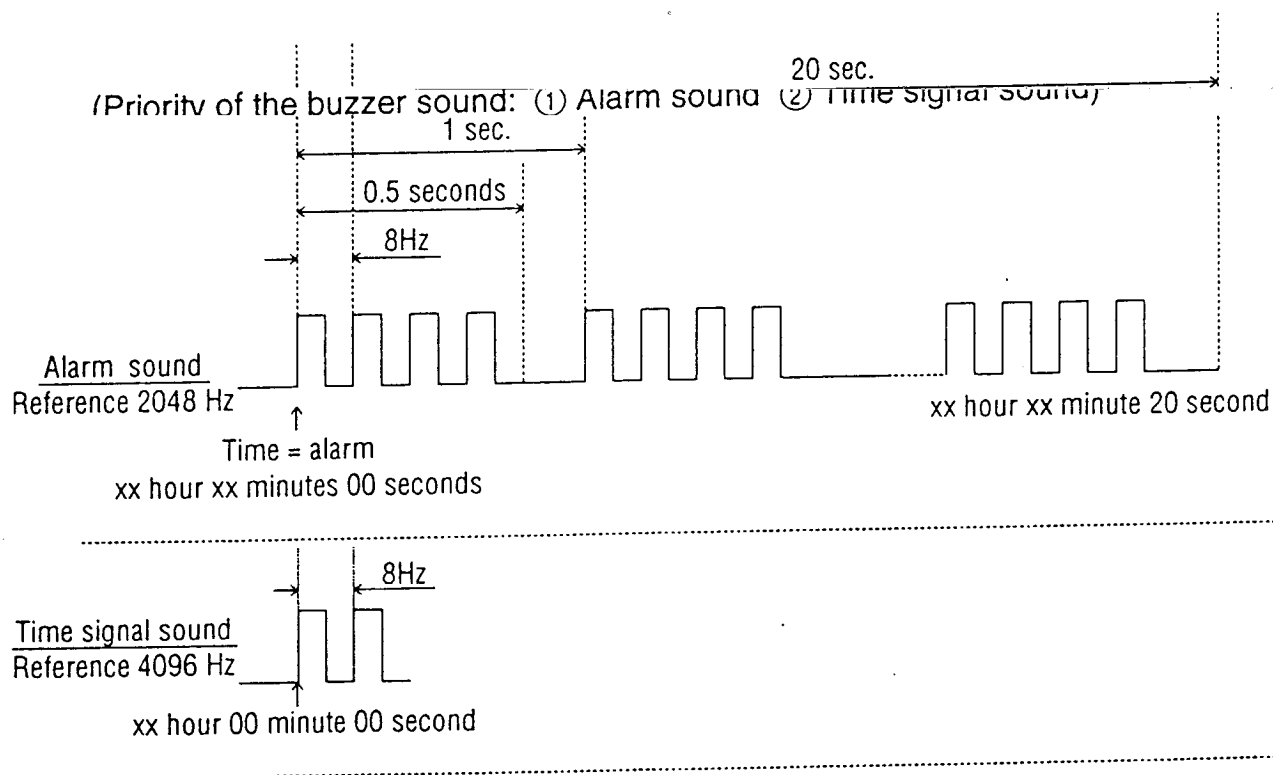
The alarm mode consists of the alarm display state and the alarm setting state.

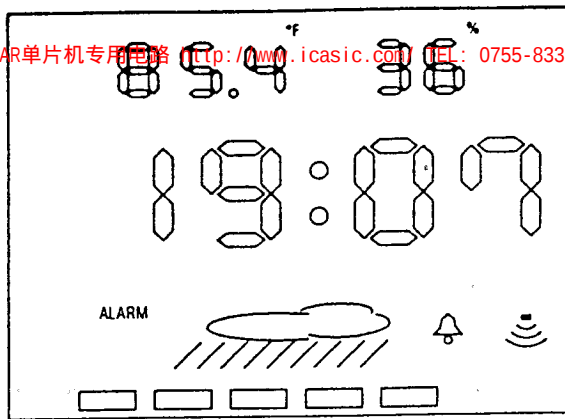
- If the Normal time coincides with the alarm time when the alarm has been set, the alarm will sound for 20 seconds.
- If any switch is pressed while the alarm sound is being output, the alarm will stop, and the previously-set function will be canceled.

#### 3.5.1 Alarm Display State

- A colon (:) is lit.
- Shift to the time display state of the Normal time mode using the Select SW.
- Shift to the Minute setting function of the alarm setting state by continuously pressing the Select SW.
- Set the alarm/chime using the Set SW.  
(1 PUSH: ON/OFF setting) (Continuous pressing: Invalid)  
(Priority of the buzzer sound: ① Alarm sound ② Time signal sound)

| Alarm | Chime |
|-------|-------|
| Off   | Off   |
| On    | Off   |
| Off   | On    |
| On    | On    |





Alarm display that shows the temperature and humidity.

### 3.5.2 Alarm Setting State

The alarm setting state consists of the Hour setting and the minute setting functions.

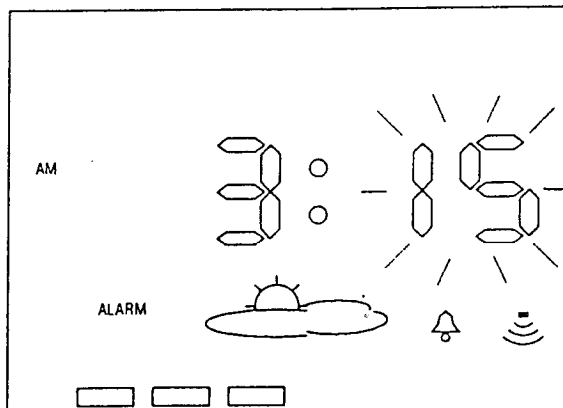
- The alarm display state goes into effect through the use of the Mode SW, or through auto return after 1~2 minutes of no input.

(Minute setting) The minute digits flash at 1 Hz frequency.

- Shift to the minute setting function using the Select SW.
- Correct the minute digits using the Set SW.  
(1 PUSH: Minute digits + 1) (Continuous pressing: Minute digits fast-forwarded at 8 Hz)  
00 through 59, 00 minutes: No carry.

(Hour setting) The hour digits flash at 1 Hz frequency, displaying the alarm time.

- Shift to the alarm display state using the Select SW.
- Set the hour digits using the Set SW.  
(1 PUSH: Hour digits + 1) (Continuous pressing: Hour digits fast-forwarded at 8 Hz)  
(24-hour system) 00 through 23, 00: No carry.  
(12-hour system) AM12, AM1 through AM11, PM12, PM1 through PM11, AM12: No carry.



Display of the alarm minute setting

### 3.6 Atmospheric pressure Adjustment Mode

In the power-on, when the mode SW and select SW are simultaneously pressed, all the LCD segments light for one second and the mode is shifted to this mode.

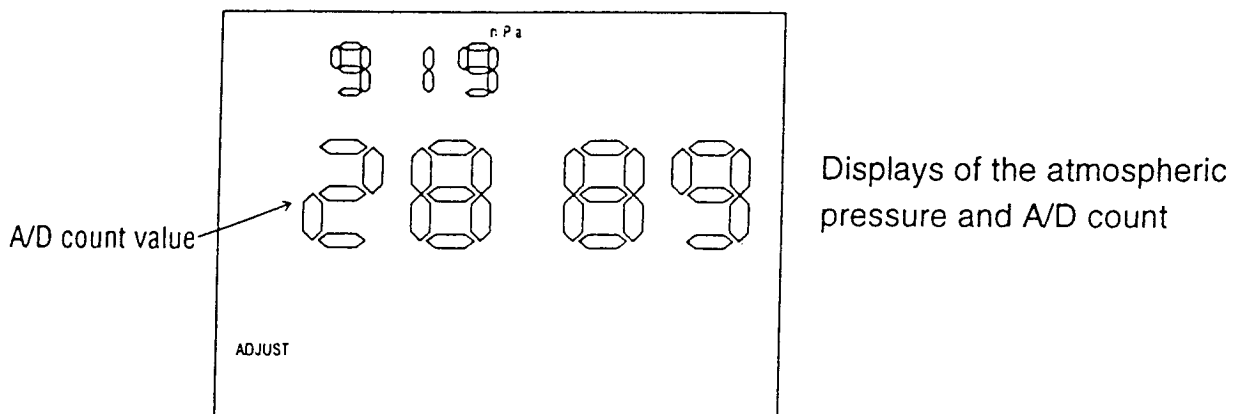
- The atmospheric pressure is measured every one second.
- The key input is invalid.

The atmospheric pressure adjustment method is shown below.

The atmospheric pressure adjustment is performed by varying variable resistors Rsp and Rof.

- 1 Add the atmospheric pressure of 621hPa.
- 2 Fit the A/D count value to 3256 by varying the Rof value.
- 3 Add the atmospheric pressure of 1111hPa.
- 4 Fit the A/D count value to 2652 by varying the Rsp value.
- 5 When the A/D count value is 3256 after adding the atmospheric pressure of 621hPa, the atmospheric pressure adjustment finishes. When the A/D count value is different from 3256, readjust items from 1 to 4.

This mode finishes by the power-off.



## SUNSTAR 深圳市商斯达电子有限公司

SHENZHEN SUNSTAR ELECTRONICS CO.,LTD.

集成电路  
单片机

地址(Add):深圳福田区福华路福庆街鸿图大厦1602室  
RM 1602,Hongtu Bldg,Fuhua Rd, Futian Region,Shenzhen China  
电话(Tel):0755-3600718 3758073 邮编(PC):518033  
传真(Fax):0755-3376182 E-mail:szsunstr@public.szptt.net.cn  
网址: Http://www.sunstare.com/ 手机:(0)13902971329  
西安办事处电话:(0)13609291696 191-8454356  
北京办事处电话:(0)13501189838 191-8886650  
上海办事处电话:(0)13701955389 191-3789221

## 4. Display Specifications

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX:0755-83376182 E-MAIL:szss20@163.com

### 4.1 Display Table

The displays implemented with the MCU are listed in the table below.

| Mode                            | Segment               |                                   | Mark             |                       |                            | 7 segments |           |            |          | Mark   |        |             |             |             |   |
|---------------------------------|-----------------------|-----------------------------------|------------------|-----------------------|----------------------------|------------|-----------|------------|----------|--------|--------|-------------|-------------|-------------|---|
|                                 |                       |                                   | T<br>I<br>M<br>E | A<br>L<br>A<br>R<br>M | A<br>D<br>J<br>U<br>S<br>T | 0          | 1         | 2          | 3        | A<br>M | P<br>M | C<br>O<br>L | C<br>H<br>M | A<br>L<br>M |   |
| State                           |                       |                                   |                  |                       |                            |            |           |            |          |        |        |             |             |             |   |
| Initial mode                    |                       |                                   | ●                | ●                     | ●                          | 8          | 8         | 8          | 8        | ●      | ●      | ●           | ●           | ●           | ● |
| Normal time                     | Time display          | Atmospheric pressure, temperature | ●                | Off                   | Off                        | 10 o'clock | 1 o'clock | 10 minutes | 1 minute | AM/PM  | ○      |             |             |             |   |
|                                 |                       | Month, day, temperature           | ↑                | ↑                     | ↑                          | ↑          | ↑         | ↑          | ↑        | ↑      | ↑      |             |             |             |   |
|                                 |                       | Temperature, humidity             | ↑                | ↑                     | ↑                          | ↑          | ↑         | ↑          | ↑        | ↑      | ↑      |             |             |             |   |
|                                 | Time correction state | Second column                     | ↑                | ↑                     | ↑                          | Off        | Off       | 10 seconds | 1 second | Off    | Off    | Off         |             |             |   |
|                                 |                       | Minute column                     | ↑                | ↑                     | ↑                          | 10 o'clock | 1 o'clock | 10 minutes | 1 minute | AM/PM  | ●      |             |             |             |   |
|                                 |                       | Hour column                       | ↑                | ↑                     | ↑                          | 10 o'clock | 1 o'clock | 10 minutes | 1 minute | AM/PM  | ●      |             |             |             |   |
|                                 |                       | Year column                       | ↑                | ↑                     | ↑                          | 1000       | 100       | 10 years   | 1 year   | Off    | Off    | Off         |             |             |   |
|                                 |                       | Month column                      | ↑                | ↑                     | ↑                          | October    | January   | the 10th   | the 1st  | ↑      | ↑      | ↑           |             |             |   |
|                                 |                       | Day column                        | ↑                | ↑                     | ↑                          | October    | January   | the 10th   | the 1st  | ↑      | ↑      | ↑           |             |             |   |
|                                 |                       | 12/24                             | ↑                | ↑                     | ↑                          | 10 o'clock | 1 o'clock | H          | Off      | ↑      | ↑      | ↑           |             |             |   |
| Alarm                           | Alarm display         | Alarm/Chime OFF                   | Off              | ●                     | Off                        | 10 o'clock | 1 o'clock | 10 minutes | 1 minute | AM/PM  | ●      |             |             |             |   |
|                                 |                       | Alarm ON/Chime OFF                | ↑                | ↑                     | ↑                          | ↑          | ↑         | ↑          | ↑        | ↑      | ↑      |             |             |             |   |
|                                 |                       | Alarm OFF/Chime ON                | ↑                | ↑                     | ↑                          | ↑          | ↑         | ↑          | ↑        | ↑      | ↑      |             |             |             |   |
|                                 |                       | Alarm/Chime ON                    | ↑                | ↑                     | ↑                          | ↑          | ↑         | ↑          | ↑        | ↑      | ↑      |             |             |             |   |
|                                 | Alarm setting state   | Hour column                       | ↑                | ↑                     | ↑                          | 10 o'clock | 1 o'clock | ↑          | ↑        | AM/PM  | ↑      |             |             |             |   |
|                                 |                       | Minute column                     | ↑                | ↑                     | ↑                          | 10 o'clock | 1 o'clock | 10 minutes | 1 minute | AM/PM  | ↑      |             |             |             |   |
| Atmospheric pressure adjustment |                       |                                   | Off              | Off                   | ●                          | 1000AD     | 100AD     | 10AD       | 1AD      | Off    | Off    | Off         | -           | -           | - |

Note: The AM/PM mark will always be off in the 24 hour system.

Outlined characters indicate flashing at 1 Hz frequency.

● indicates ON

○ indicates flashing at 1 Hz frequency

| Mode                            | Segment                 |                                   | 3 segments                             | 7 segments |          |            | Mark |                  |     |         |     |
|---------------------------------|-------------------------|-----------------------------------|----------------------------------------|------------|----------|------------|------|------------------|-----|---------|-----|
|                                 |                         |                                   | 4A4B                                   | 5          | 6        | 7          | BAR  | DOT <sub>1</sub> | hPa | °C1     | °F1 |
| Initial mode                    |                         |                                   | -1                                     | 8          | 8        | 8          | ●    | ●                | ●   | ●       | ●   |
| Normal time                     | Time display            | Atmospheric pressure, temperature | 1000hPa                                | 100hPa     | 10hPa    | 1hPa       | Off  | Off              | ●   | Off     | Off |
|                                 | Month, day, temperature |                                   | 10months                               | 1 month    | 10 days  | 1 day      | ●    | ↑                | Off | ↑       | ↑   |
|                                 | Temperature, humidity   |                                   | 100degrees                             | 10degrees  | 1 degree | 0.1degrees | Off  | ●                | ↑   | ° C/° F |     |
|                                 | Time correction state   | Second column                     | Off                                    | Off        | Off      | Off        | ↑    | Off              | ↑   | Off     | Off |
|                                 |                         |                                   | Minute column                          | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
|                                 |                         |                                   | Hour column                            | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
|                                 |                         |                                   | Year column                            | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
|                                 |                         |                                   | Month column                           | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
|                                 |                         |                                   | Day column                             | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
|                                 |                         |                                   | 12/24                                  | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
| Alarm                           | Alarm display           | Alarm/Chime OFF                   | Follows the state set in clock display |            |          |            |      |                  |     |         |     |
|                                 | Alarm ON/Chime OFF      |                                   | ↑                                      |            |          |            |      |                  |     |         |     |
|                                 | Alarm OFF/Chime ON      |                                   | ↑                                      |            |          |            |      |                  |     |         |     |
|                                 | Alarm/Chime ON          |                                   | ↑                                      |            |          |            |      |                  |     |         |     |
|                                 | Alarm setting state     | Hour column                       | Off                                    | Off        | Off      | Off        | Off  | Off              | Off | Off     | Off |
|                                 |                         |                                   | Minute column                          | ↑          | ↑        | ↑          | ↑    | ↑                | ↑   | ↑       | ↑   |
| Atmospheric pressure adjustment |                         |                                   | 1000hPa                                | 100hPa     | 10hPa    | 1hPa       | Off  | Off              | ●   | Off     | Off |

● indicates ON

| Mode                            | Segment               |                                   | 3 segments                             | 7 segments |          |            | Mark     |     |         |         |
|---------------------------------|-----------------------|-----------------------------------|----------------------------------------|------------|----------|------------|----------|-----|---------|---------|
|                                 | State                 |                                   | 11A11B                                 | 5          | 6        | 7          | DOT<br>2 | %   | °C<br>2 | °F<br>2 |
| Initial mode                    |                       |                                   | -1                                     | 8          | 8        | 8          | ●        | ●   | ●       | ●       |
| Normal time                     | Time display          | Atmospheric pressure, temperature | 100degrees                             | 10degrees  | 1 degree | 0.1degrees | ●        | Off | °C/°F   |         |
|                                 |                       | Month, day, temperature           | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       |         |
|                                 |                       | Temperature, humidity             | 100%                                   | 10%        | 1%       | Off        | Off      | ●   | Off     | Off     |
|                                 | Time correction state | Second column                     | Off                                    | Off        | Off      | Off        | Off      | Off | Off     | Off     |
|                                 |                       | Minute column                     | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
|                                 |                       | Hour column                       | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
|                                 |                       | Year column                       | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
|                                 |                       | Month column                      | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
|                                 |                       | Day column                        | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
|                                 |                       | 12/24                             | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
| Alarm                           | Alarm display         | Alarm/Chime OFF                   | Follows the state set in clock display |            |          |            |          |     |         |         |
|                                 |                       | Alarm ON/Chime OFF                | ↑                                      |            |          |            |          |     |         |         |
|                                 |                       | Alarm OFF/Chime ON                | ↑                                      |            |          |            |          |     |         |         |
|                                 |                       | Alarm/Chime ON                    | ↑                                      |            |          |            |          |     |         |         |
|                                 | Alarm setting state   | Hour column                       | Off                                    | Off        | Off      | Off        | Off      | Off | Off     | Off     |
|                                 |                       | Minute column                     | ↑                                      | ↑          | ↑        | ↑          | ↑        | ↑   | ↑       | ↑       |
| Atmospheric pressure adjustment |                       |                                   | Off                                    | Off        | Off      | Off        | Off      | Off | Off     | Off     |

● indicates ON

| Mode                                                                    |         | Segment | FINE2 | FINE1 | CLOUD | RAIN |
|-------------------------------------------------------------------------|---------|---------|-------|-------|-------|------|
| Initial mode                                                            |         |         | ●     | ●     | ●     | ●    |
| Weather forecasting level<br>in modes or states other<br>than the above | Level 1 |         | ●     | ●     |       |      |
|                                                                         | Level 2 |         | ●     |       | ●     |      |
|                                                                         | Level 3 |         |       |       | ●     |      |
|                                                                         | Level 4 |         |       |       | ●     | ●    |

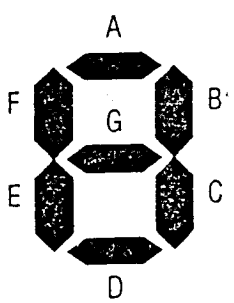
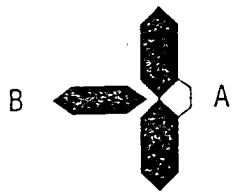
| Mode                                                                 |         | Segment | COLD | COOL | CONF1 | CONF2 | WARM | HOT |
|----------------------------------------------------------------------|---------|---------|------|------|-------|-------|------|-----|
| Initial mode                                                         |         |         | ●    | ●    | ●     | ●     | ●    | ●   |
| Discomfort index level<br>in modes or states other<br>than the above | Level 1 |         | ●    |      |       |       |      |     |
|                                                                      | Level 2 |         | ●    | ●    |       |       |      |     |
|                                                                      | Level 3 |         | ●    | ●    | ●     |       |      |     |
|                                                                      | Level 4 |         | ●    | ●    | ●     | ●     |      |     |
|                                                                      | Level 5 |         | ●    | ●    | ●     | ●     | ●    |     |
|                                                                      | Level 6 |         | ●    | ●    | ●     | ●     | ●    | ●   |

## 4.2 Display RAM Map

The display RAM map which corresponds to the LCD layout is shown below.

| Display register<br>[SFR address] | bit3 | bit2 | bit1 | bit0 | Display register<br>[SFR address] | bit3   | bit2  | bit1  | bit0 |
|-----------------------------------|------|------|------|------|-----------------------------------|--------|-------|-------|------|
| DSPR00[40h]                       | 8D   | 8C   | 8B   | 8A   | DSPR16[50h]                       | 0D     | 0C    | 0B    | 0A   |
| DSPR01[41h]                       |      | 8G   | 8F   | 8E   | DSPR17[51h]                       |        | 0G    | 0F    | 0E   |
| DSPR02[42h]                       | 9E   | 9C   | 9B   | 9A   | DSPR18[52h]                       | 1D     | 1C    | 1B    | 1A   |
| DSPR03[43h]                       |      | 9G   | 9F   | 9E   | DSPR19[53h]                       |        | 1G    | 1F    | 1E   |
| DSPR04[44h]                       | 10D  | 10C  | 10B  | 10A  | DSPR20[54h]                       | 2D     | 2C    | 2B    | 2A   |
| DSPR05[45h]                       |      | 10G  | 10F  | 10E  | DSPR21[55h]                       |        | 2G    | 2F    | 2E   |
| DSPR06[46h]                       |      |      | %    | 11A  | DSPR22[56h]                       | 3D     | 3C    | 3B    | 3A   |
| DSPR07[47h]                       | 11B  | ° F2 | ° C2 | DOT2 | DSPR23[57h]                       |        | 3G    | 3F    | 3E   |
| DSPR08[48h]                       | 5D   | 5C   | 5B   | 5A   | DSPR24[58h]                       | ADJUST |       | ALARM | TIME |
| DSPR09[49h]                       |      | 5G   | 5F   | 5E   | DSPR25[59h]                       |        | PM    | AM    | COL  |
| DSPR10[4ah]                       | 6D   | 6C   | 6B   | 6A   | DSPR26[5ah]                       | COMF2  | COMF1 | COOL  | COLD |
| DSPR11[4bh]                       |      | 6G   | 6F   | 6E   | DSPR27[5bh]                       |        |       | HOT   | WARM |
| DSPR12[4ch]                       | 7D   | 7C   | 7B   | 7A   | DSPR28[5ch]                       | FINE2  | FINE1 | CLOUD | RAIN |
| DSPR13[4dh]                       |      | 7G   | 7F   | 7E   | DSPR29[5dh]                       |        |       |       |      |
| DSPR14[4eh]                       |      | hPa  | BAR  | 4A   | DSPR30[5eh]                       | CHM    | ALM   |       |      |
| DSPR15[4fh]                       | 4B   | ° F1 | ° C1 | DOT1 |                                   |        |       |       |      |

### LCD Display Pattern

| 7 SEG                                                   |                                                                                     | 3 SEG                           |                                                                                       |
|---------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------|
| – Applicable columns –<br>0, 1, 2, 3, 5, 6, 7, 8, 9, 10 |  | – Applicable columns –<br>4, 11 |  |

| NO      | 7SEG |   |   |   |   |   |   |   |   |   | 3SEG  |   |
|---------|------|---|---|---|---|---|---|---|---|---|-------|---|
|         | 0    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | minus | 1 |
| Pattern |      |   |   |   |   |   |   |   |   |   |       |   |

## 5. Functional Specifications

The functions implemented with the MCU are explained here.

### 5.1 Normal Time and Calendar Functions

The normal time is based on the AM/PM 12-hour system. The calendar covers 1993 through 2023 (with automatic calculation of leap years), and the time is updated every second.

| Timing              | Content           | Range                                                                                       |
|---------------------|-------------------|---------------------------------------------------------------------------------------------|
| Every second        | Second column + 1 | 00 ~ 59 seconds → 00 seconds ( second column carry )                                        |
| Second column carry | Minute column + 1 | 00 ~ 59 seconds → 00 minutes ( minute column carry )                                        |
| Minute column carry | Hour column + 1   | ( 12-hour system )<br>AM12 → AM1 ~ AM11 → PM12 → PM1 ~ PM11 → AM12<br>( hour column carry ) |
|                     |                   | ( 24-hour system ) 00 ~ 23 o'clock → 00 o'clock (hour column carry )                        |
| Hour column carry   | Day column + 1    | Long months: 1 ~ 31 → 1( day column carry)                                                  |
|                     |                   | Short months: 1 ~ 30 → 1( day column carry)                                                 |
|                     |                   | February in ordinary year: 1 ~ 28 → 1( day column carry )                                   |
|                     |                   | February in leap year: 1 ~ 29 → 1( day column carry )                                       |
| Day column carry    | Month column + 1  | 1 ~ 12 → 1( month column carry )                                                            |
| Month column carry  | Year column + 1   | 1993 ~ 2023 → 1993                                                                          |

Individual columns of the normal time and calendar can be adjusted separately in the time correction mode.

Note that in the time signal setting, the time signal sound is output synchronously with a minute column carry.

### 5.2 Alarm Function

The alarm function checks every minute for a match between the hour and minute columns of the normal time and those of the alarm. When there is a match while the alarm is set, the alarm sound is output for 20 seconds (between 00 and 19 seconds of the normal time). This checking will not be performed while the clock is being adjusted or the alarm is being set.

The hour and minute columns of the alarm can be adjusted in the alarm mode. The alarm can also be set to ON or OFF in this mode.

### 5.3 Temperature, Humidity, and Atmospheric Pressure Measurement Functions

The analog readings of temperature, humidity, and atmospheric pressure are read by the A/D converters at specified time intervals. Those readings are then converted into appropriate temperature, humidity, and atmospheric pressure values, using certain calculation equations.

#### 5.3.1 Temperature Measurement

- Temperature measurements are taken every 10 seconds(sensor measurement time=Normal) / 1 second(sensor measurement time=Fast).
- The temperature measurement range is  $-50.0\sim+70.0^{\circ}\text{C}$  ( $-58.0\sim+158.0^{\circ}\text{F}$ ).
- When the temperature measurement exceeds, the temperature range flashes at 0.5 sec.
- The temperature unit increment is  $0.1^{\circ}\text{C}$  ( $0.1^{\circ}\text{F}$ ).

#### 5.3.2 Humidity Measurement

- Humidity measurements are taken every 1 minute(sensor measurement time=Normal) / 10 seconds(sensor measurement time=Fast).
- The humidity measurement range is 20~90%.
- The humidity unit increment is 1%.
- When the measurement range exceeds, the humidity value flashes at 0.5 sec.
- When the temperature range to be used exceeds, the bar display (— %) is shown.
- Humidity values are calculated using several linear approximation formulas, depending on temperature and humidity range.

#### 5.3.3 Atmospheric Pressure Measurement

- Atmospheric pressure measurements are taken every 5 minutes(sensor measurement time=Normal) / 1 minute(sensor measurement time=Fast).
- The atmospheric pressure measurement range is 850~1050 hPa
- The atmospheric pressure unit increment is 1 hPa.
- When the atmospheric pressure range exceeds, the atmospheric pressure value flashes at 0.5 sec.
- When the measurement range to be used exceeds, the bar display (---- hPa) is shown.

## 5.4 Uncomfortable Index Determination Function

The uncomfortable index is a gauge for measuring the degree of heat or cold. The uncomfortable index is calculated based on temperature and humidity values, and one of the 6 levels is displayed after humidity measurement.

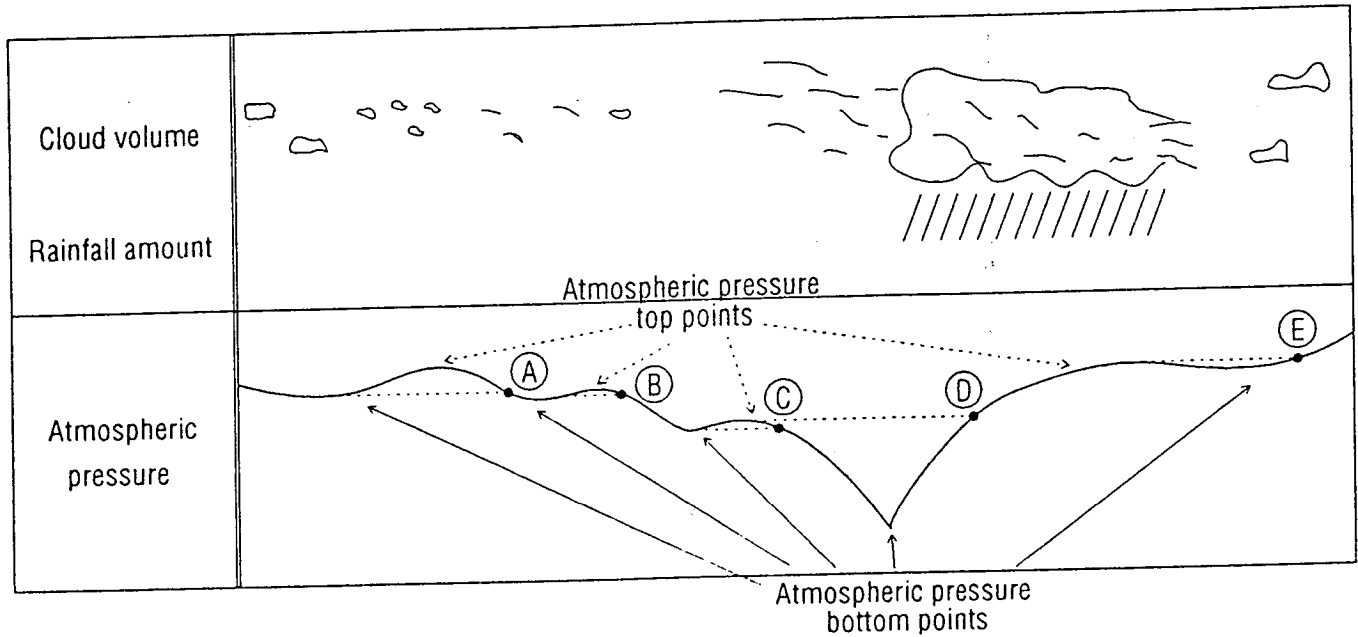
$$\text{Uncomfortable index value} = 0.81 \cdot \text{Temperature } (^{\circ}\text{C}) + 0.01 \cdot \text{Humidity} (0.99 \cdot \text{Temperature } (^{\circ}\text{C}) - 14.3) + 46.3$$

| Level | Uncomfortable index value (x) |
|-------|-------------------------------|
| 1     | $X \leq 60$                   |
| 2     | $60 < X \leq 65$              |
| 3     | $65 < X \leq 70$              |
| 4     | $70 < X \leq 75$              |
| 5     | $75 < X \leq 80$              |
| 6     | $80 < X$                      |

## 5.5 Weather Forecasting Function

The weather forecasting function forecasts weather changes, based on changes in atmospheric pressure.

### 5.5.1 Weather Pattern ( Atmospheric Pressure Changes and Approach to Weather)



When weather becomes good. .... Atmospheric pressure value goes higher than its most recent top point.

When weather becomes bad. .... Atmospheric pressure value goes lower than its most recent bottom point.

It is judged that the weathers at (A) , (B) and (C) portions become bad.

It is judged that the weathers at (D) and (E) portions become good.

### 5.5.2 Initial Weather Display

After the power-on, all the weather display sections light. (atmospheric pressure top point = its bottom point)  
As shown below, the weather displays vary with the changes in atmospheric pressure.

| Atmospheric pressure change |        |       | Weather display |
|-----------------------------|--------|-------|-----------------|
| First                       | Second | Third |                 |
| ↑                           | ↑      | ↑     | Fine            |
| ↑                           | ↑      | ↓     | Fine and cloud  |
| ↑                           | ↓      | ↑     | Fine            |
| ↑                           | ↓      | ↓     | Cloud           |
| ↓                           | ↑      | ↑     | Fine and cloud  |
| ↓                           | ↑      | ↓     | Rain            |
| ↓                           | ↓      | ↑     | Cloud           |
| ↓                           | ↓      | ↓     | Rain            |

- ↑: This shows that the atmospheric pressure value has gone higher than most recent atmospheric pressure top point.  
↓: This shows that the atmospheric pressure value has gone lower than most recent atmospheric pressure bottom point.

The serial transmission function transmits through the serial port, the values for the calendar, time, temperature, humidity, and atmospheric pressure, at the time when the hour column is updated in the normal time.

### 5.6.1 Transmission Data

The calendar, time, temperature, humidity, and atmospheric pressure data are transmitted in this order.

- (1) All data must be ASCII format 8-bit data.
- (2) A space code is transmitted as a delimiter between each piece of data, and a CR code is transmitted after all data have been sent.
- (3) The calendar months are expressed as three-digit alphanumeric characters.  
January: JAN, February: FEB, March: MAR, April: APR, May: MAY, June: JUN, July: JUL, August: AUG, September: SEP, October: OCT, November: NOV, December: DEC
- (4) If the tens column of the day, hour, and humidity values is "0", a blank space will be transmitted for that column. If the tens and/or hundreds columns of the temperature value are "0", a blank space will be transmitted for the empty column(s).
- (5) "°C" or "°F" is transmitted as the unit of temperature.
- (6) When the temperature exceeds the range to be used, the digits of humidity and temperature transmit respectively bar codes (-).  
(Humidity: -- %, atmospheric pressure: ---- hPa)

Transmission Example (December 31, 1999; 12:00 o'clock; Temperature of 8.6°C; Humidity of 40%; Atmospheric pressure of 1008 hPa)

31-DEC-1999 □ 12 : 00 □ □ □ 8.6° C □ 40 % □ 1008hPa △

Date            Time    Temperature    Humidity    Atmospheric pressure

□ : Indicates a space    △ : Indicates a CR

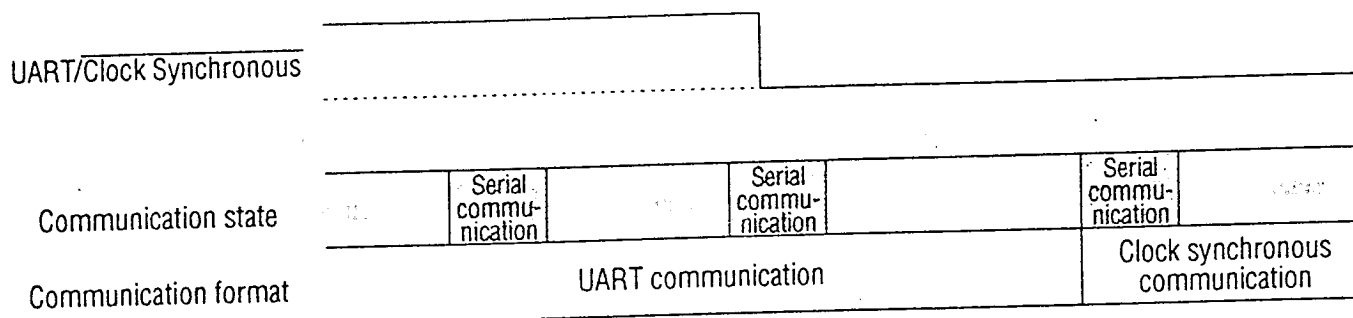
### Transmission Data Code Table

Each piece of data is to be transmitted in ASCII-format 8-bit code, as shown below.

| Special data |            | Numerical data |            | Character data |            |      |            |
|--------------|------------|----------------|------------|----------------|------------|------|------------|
| Data         | Code (hex) | Data           | Code (hex) | Data           | Code (hex) | Data | Code (hex) |
| Space        | 20h        | 0              | 30h        | A              | 41h        | O    | 4Fh        |
| CR           | 0Dh        | 1              | 31h        | B              | 42h        | P    | 50h        |
| :            | 3Ah        | 2              | 32h        | C              | 43h        | R    | 52h        |
| BAR(-)       | 2Dh        | 3              | 33h        | D              | 44h        | S    | 53h        |
| .            | 2Eh        | 4              | 34h        | E              | 45h        | T    | 54h        |
| %            | 25h        | 5              | 35h        | F              | 46h        | U    | 55h        |
| °            | DFh        | 6              | 36h        | G              | 47h        | V    | 56h        |
|              |            | 7              | 37h        | J              | 4Ah        | Y    | 59h        |
|              |            | 8              | 38h        | L              | 4Ch        | a    | 61h        |
|              |            | 9              | 39h        | N              | 4Eh        | h    | 68h        |

## 5.6.2 Serial Communication Specifications

The Serial Communication Format UART/Clock Synchronous setting switch (P0.0) sets a flag when a level change occurs, and switches to the next timing.

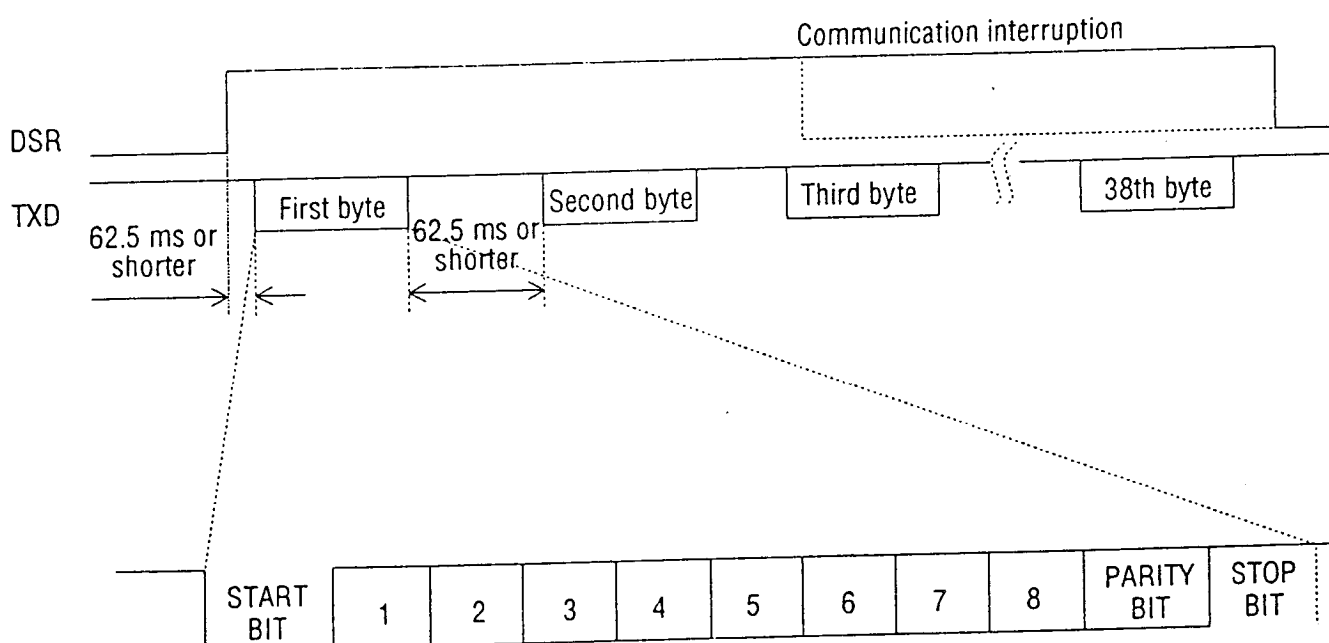


The 38 bytes of data containing the calendar, time, temperature, humidity, and atmospheric pressure taken when DSR rises, is serially transmitted to an outside destination, using the 11-bit UART format or clock synchronous.

### 11-Bit UART Format Communication

The 11-bit UART format is an asynchronous communication format in which one communication unit consists of "the start bit + 8 data bits + the parity bit + the stop bit", and the communication speed is fixed at 9600 bps.

### UART Format Timing Chart



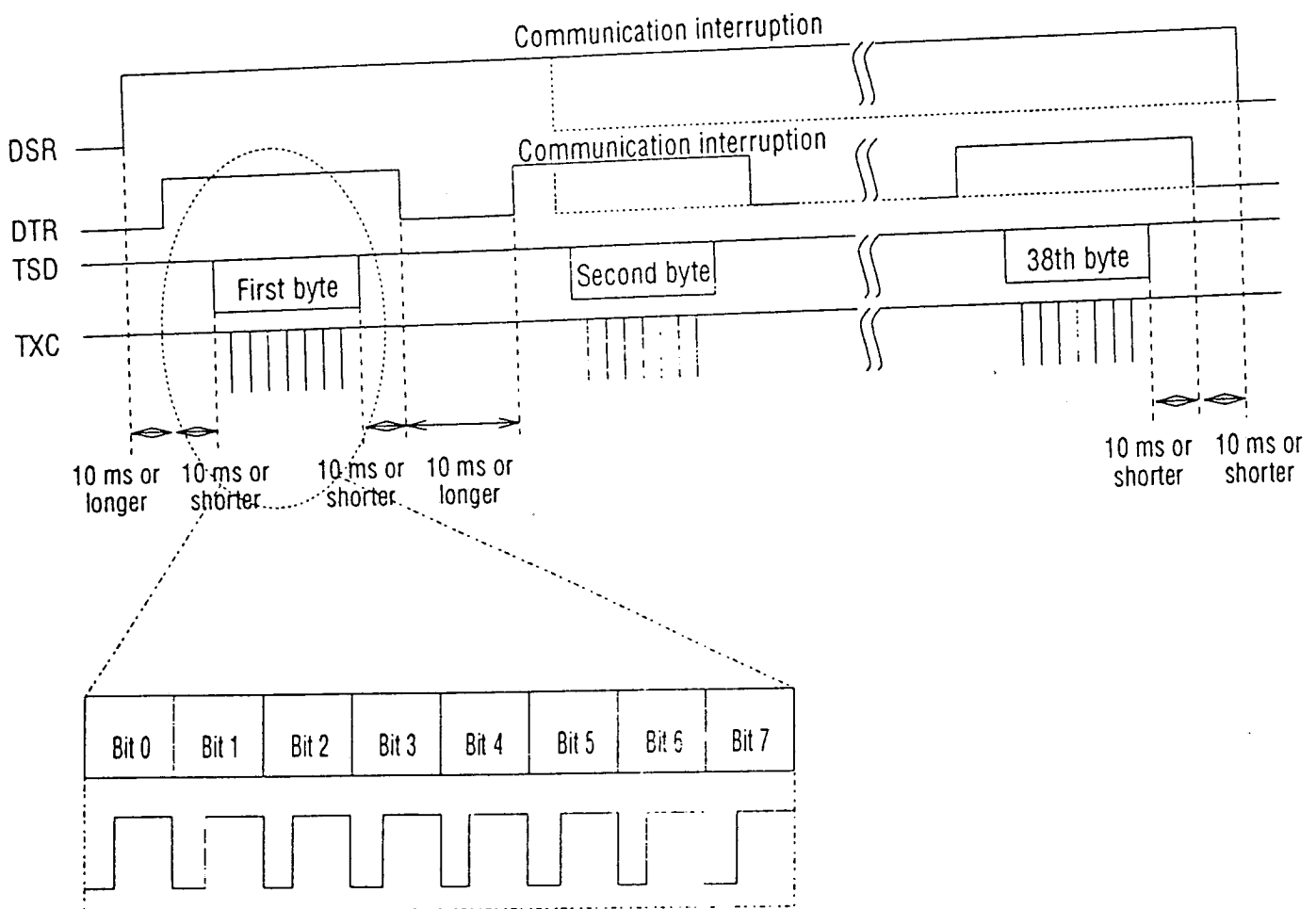
## [UART Communication]

- (1) Communication start:  
Communication is considered to start when DSR rises.
- (2) Data transmission:  
11-bit UART format communication is performed for every byte.
- (3) Normal termination of communication:  
The point at which the 38 bytes have been transmitted is regarded as the end of communication.
- (4) Abnormal termination of communication:  
If DSR falls during communication, the communication will be abnormally terminated.

## Clock Synchronous Format Communication

The clock synchronous format is a communication format in which one communication unit consists of "8 data bits", and clock-synchronized (TXC) data is transmitted using an external control signal (DSR, DTR). The communication speed of one bit is fixed at 32 KHz.

### **Clock Synchronous Format Transmission Timing Chart**



### [Clock Synchronous Communication]

- (1) Communication start:  
Communication is considered to start when DSR rises.
- (2) 1-byte communication preparation 1:  
Communication preparation is made before DTR rises(within 10 ms).
- (3) 1-byte data communication:  
1-byte clock synchronous communication is started when DTR rises.  
If DTR does not rise within 10 ms, the result is abnormal termination.
- (4) 1-byte communication termination:  
After 1-byte is sent, DTR falls within 10 ms.  
If DTR does not fall within 10 ms, the result is abnormal termination.
- (5) 38-byte communication:  
The processes in (2) through (4) are repeated for 38 bytes.
- (6) Normal termination of communication:  
When DSR falls within 10 ms after 38 bytes have been sent, communication terminates normally.
- (7) Abnormal termination of communication:  
If DSR falls before the end of communication, the communication is abnormally terminated.

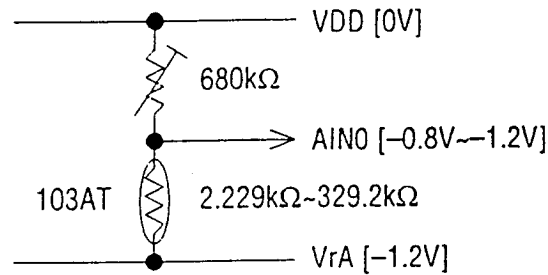
Note: For both normal and abnormal terminations, the system immediately ends the communication, and waits for DSR to rise.

## 6. Sensor Specifications

This section explains the sensors used by the MCU.

### 6.1 Temperature Sensor

The temperature sensor used is the Thermistor "103AT" made by Ishizuka Electronics.  
Block Diagram



Temperature/Resistance Correspondence Table

| Temperature<br>°C | Resistance<br>kΩ | Temperature<br>°C | Resistance<br>kΩ | Temperature<br>°C | Resistance<br>kΩ | Temperature<br>°C | Resistance<br>kΩ |
|-------------------|------------------|-------------------|------------------|-------------------|------------------|-------------------|------------------|
| -50               | 329.2            | -30               | 111.3            | -10               | 42.45            | 10                | 17.96            |
| -49               | 310.7            | -29               | 105.7            | -9                | 40.56            | 11                | 17.24            |
| -48               | 293.3            | -28               | 100.4            | -8                | 38.76            | 12                | 16.55            |
| -47               | 277.0            | -27               | 95.47            | -7                | 37.05            | 13                | 15.90            |
| -46               | 261.8            | -26               | 90.80            | -6                | 35.43            | 14                | 15.28            |
| -45               | 247.5            | -25               | 86.39            | -5                | 33.89            | 15                | 14.68            |
| -44               | 234.1            | -24               | 82.22            | -4                | 32.43            | 16                | 14.12            |
| -43               | 221.6            | -23               | 78.29            | -3                | 31.04            | 17                | 13.57            |
| -42               | 209.8            | -22               | 74.58            | -2                | 29.72            | 18                | 13.06            |
| -41               | 198.7            | -21               | 71.07            | -1                | 28.47            | 19                | 12.56            |
| -40               | 188.4            | -20               | 67.74            | 0                 | 27.28            | 20                | 12.09            |
| -39               | 178.3            | -19               | 64.54            | 1                 | 26.13            | 21                | 11.63            |
| -38               | 168.9            | -18               | 61.52            | 2                 | 25.03            | 22                | 11.20            |
| -37               | 160.1            | -17               | 58.66            | 3                 | 23.99            | 23                | 10.78            |
| -36               | 151.8            | -16               | 55.95            | 4                 | 22.99            | 24                | 10.38            |
| -35               | 144.0            | -15               | 53.39            | 5                 | 22.05            | 25                | 10.00            |
| -34               | 136.6            | -14               | 50.96            | 6                 | 21.15            | 26                | 9.632            |
| -33               | 129.7            | -13               | 48.66            | 7                 | 20.29            | 27                | 9.281            |
| -32               | 123.2            | -12               | 46.48            | 8                 | 19.48            | 28                | 8.994            |
| -31               | 117.1            | -11               | 44.41            | 9                 | 18.70            | 29                | 8.622            |

| Temperature<br>°C | Resistance<br>kΩ | Temperature<br>°C | Resistance<br>kΩ | Temperature<br>°C | Resistance<br>kΩ |
|-------------------|------------------|-------------------|------------------|-------------------|------------------|
| 30                | 8.313            | 50                | 4.161            | 70                | 2.229            |
| 31                | 8.015            | 51                | 4.026            |                   |                  |
| 32                | 7.729            | 52                | 3.897            |                   |                  |
| 33                | 7.455            | 53                | 3.772            |                   |                  |
| 34                | 7.192            | 54                | 3.652            |                   |                  |
| 35                | 6.941            | 55                | 3.537            |                   |                  |
| 36                | 6.699            | 56                | 3.426            |                   |                  |
| 37                | 6.468            | 57                | 3.319            |                   |                  |
| 38                | 6.246            | 58                | 3.216            |                   |                  |
| 39                | 6.033            | 59                | 3.116            |                   |                  |
| 40                | 5.828            | 60                | 3.021            |                   |                  |
| 41                | 5.630            | 61                | 2.928            |                   |                  |
| 42                | 5.439            | 62                | 2.838            |                   |                  |
| 43                | 5.256            | 63                | 2.752            |                   |                  |
| 44                | 5.080            | 64                | 2.669            |                   |                  |
| 45                | 4.912            | 65                | 2.589            |                   |                  |
| 46                | 4.749            | 66                | 2.512            |                   |                  |
| 47                | 4.594            | 67                | 2.437            |                   |                  |
| 48                | 4.444            | 68                | 2.365            |                   |                  |
| 49                | 4.300            | 69                | 2.296            |                   |                  |

SUNSTAR单片机专用电路 <http://www.icasic.com/> TEL: 0755-83387030 FAX:0755-83376182 E-MAIL:szss20@163.com

Frequency: 50 Hz~1 kHz

[illegible]

**Humidity/Sensor/Resistance/TOTAL Resistance Correspondence  
Table at Specified Temperatures**

| 5°C        |                                      | 15°C       |                                      | 25°C       |                                      | 35°C       |                                      | 45°C       |                                      |
|------------|--------------------------------------|------------|--------------------------------------|------------|--------------------------------------|------------|--------------------------------------|------------|--------------------------------------|
| Humidity % | HIS resistance [TOTAL resistance] kΩ | Humidity % | HIS resistance [TOTAL resistance] kΩ | Humidity % | HIS resistance [TOTAL resistance] kΩ | Humidity % | HIS resistance [TOTAL resistance] kΩ | Humidity % | HIS resistance [TOTAL resistance] kΩ |
| 30         | 11239[196.4]                         | 30         | 3038[187.88]                         | 30         | 888[163.64]                          | 30         | 355[128.57]                          | 30         | 132[78.79]                           |
| 35         | 4200[190.91]                         | 35         | 1300[173.33]                         | 35         | 400[133.3]                           | 35         | 170[91.89]                           | 35         | 68[50.75]                            |
| 40         | 1800[180.0]                          | 40         | 550[146.67]                          | 40         | 190[97.44]                           | 40         | 85[59.65]                            | 40         | 38[31.93]                            |
| 45         | 820[160.78]                          | 45         | 280[116.67]                          | 45         | 100[66.67]                           | 45         | 46[37.40]                            | 45         | 22[19.82]                            |
| 50         | 447[138.46]                          | 50         | 140[82.35]                           | 50         | 55.4[43.14]                          | 50         | 26.8[24.56]                          | 50         | 13.6[13.08]                          |
| 55         | 230[106.98]                          | 55         | 75[54.55]                            | 55         | 32[27.59]                            | 55         | 17[15.67]                            | 55         | 8.5[8.15]                            |
| 60         | 130[78.79]                           | 60         | 45[36.73]                            | 60         | 19[17.35]                            | 60         | 10[9.52]                             | 60         | 5.7[5.54]                            |
| 65         | 75[54.55]                            | 65         | 28[24.56]                            | 65         | 12[11.32]                            | 65         | 6.5[6.30]                            | 65         | 3.8[3.73]                            |
| 70         | 45.2[36.73]                          | 70         | 17.7[16.51]                          | 70         | 8.23[7.88]                           | 70         | 4.54[4.50]                           | 70         | 2.65[2.66]                           |
| 75         | 28[24.56]                            | 75         | 11[10.43]                            | 75         | 5.4[5.26]                            | 75         | 3.0[2.96]                            | 75         | 1.9[1.88]                            |
| 80         | 18[16.51]                            | 80         | 7.1[6.86]                            | 80         | 3.6[3.54]                            | 80         | 2.0[1.98]                            | 80         | 1.3[1.29]                            |
| 85         | 11[10.43]                            | 85         | 4.8[4.69]                            | 85         | 2.4[2.37]                            | 85         | 1.4[1.39]                            | 85         | 0.9[0.9]                             |
| 90         | 7.32[6.95]                           | 90         | 3.09[3.05]                           | 90         | 1.56[1.49]                           | 90         | 0.944[0.95]                          | 90         | 0.650[0.65]                          |

### 3.3 Pressure Sensor

The pressure sensor used is the "FPB-04A" sensor made by Fujikura.

Pressure range: 633.2~1133.2 g/cm<sup>2</sup>

Drive current: 0.15 mA

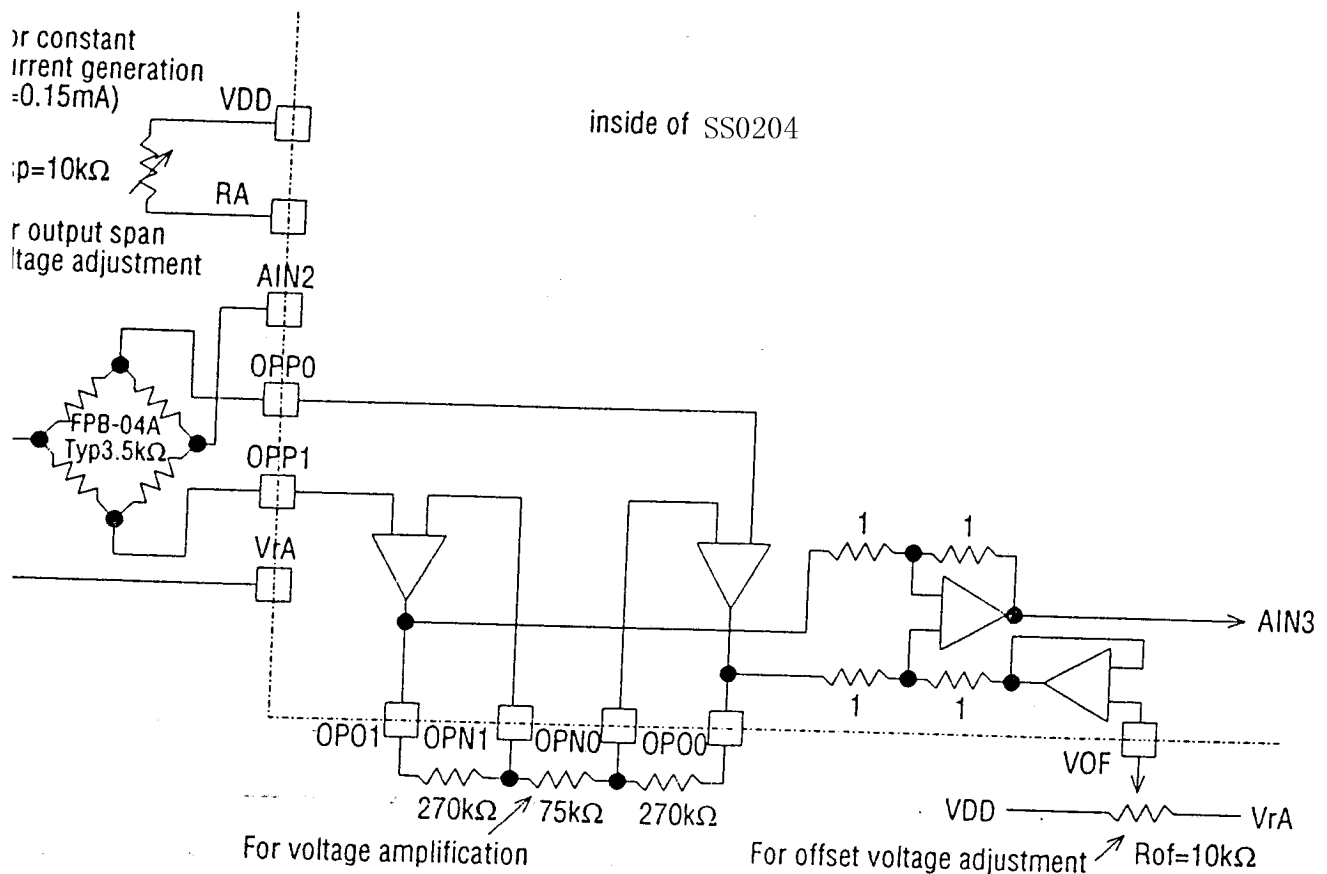
Operating temperature: -10~65°C

Offset voltage: 2~10 mV

Bridge resistance: 2500~4500 Ω

Output span voltage: 2.4~7.2 mV (633.2~1133.2 g/cm<sup>2</sup>)

#### Block Diagram



The pressure-output voltage characteristics of the pressure sensor are different due to each sensor. Therefore, the pressure is adjusted by varying the offset voltage and output span voltage (the variable resistor shown in the above diagram) and make sure so that the pressure-output voltage characteristics of all the sensors can keep constant.

欢迎索取免费详细资料、设计选型指南和光盘、样品；产品繁多未能尽录，欢迎来电查询。

[中国传感器科技信息网：HTTP：//WWW.SENSOR-IC.COM/](http://WWW.SENSOR-IC.COM/)

[工控安防网：HTTP：//WWW.PC-PS.NET/](http://WWW.PC-PS.NET/)

[消费电子专用电路网：HTTP://WWW.SUNSTARE.COM/](http://WWW.SUNSTARE.COM/)

E-MAIL：[xjr5@163.com](mailto:xjr5@163.com) [szss20@163.com](mailto:szss20@163.com)

MSN：[suns8888@hotmail.com](mailto:suns8888@hotmail.com)

QQ：195847376

地址：深圳市福田区福华路福庆街鸿图大厦 1602 室

电话：0755-83376549 83376489 83387030 83387016

传真：0755-83376182 83338339 邮编：518033 手机：(0)13902971329

深圳展销部：深圳华强北路赛格电子市场 2583 号 TEL/FAX：  
0755-83665529 25059422

北京分公司：北京海淀区知春路 132 号中发电子大厦 3097 号

TEL：010-81159046 82615020 13501189838 FAX：010-82613476

上海分公司：上海市北京东路 668 号上海赛格电子市场 2B35 号

TEL：021-28311762 56703037 13701955389 FAX：021-56703037

西安分公司：西安高新开发区 20 所(中国电子科技集团导航技术研究所)  
西安劳动南路 88 号电子商城二楼 D23 号

TEL：029-81022619 13072977981 FAX:029-88789382

成都：TEL:(0)13717066236

技术支持：0755-83394033 13501568376