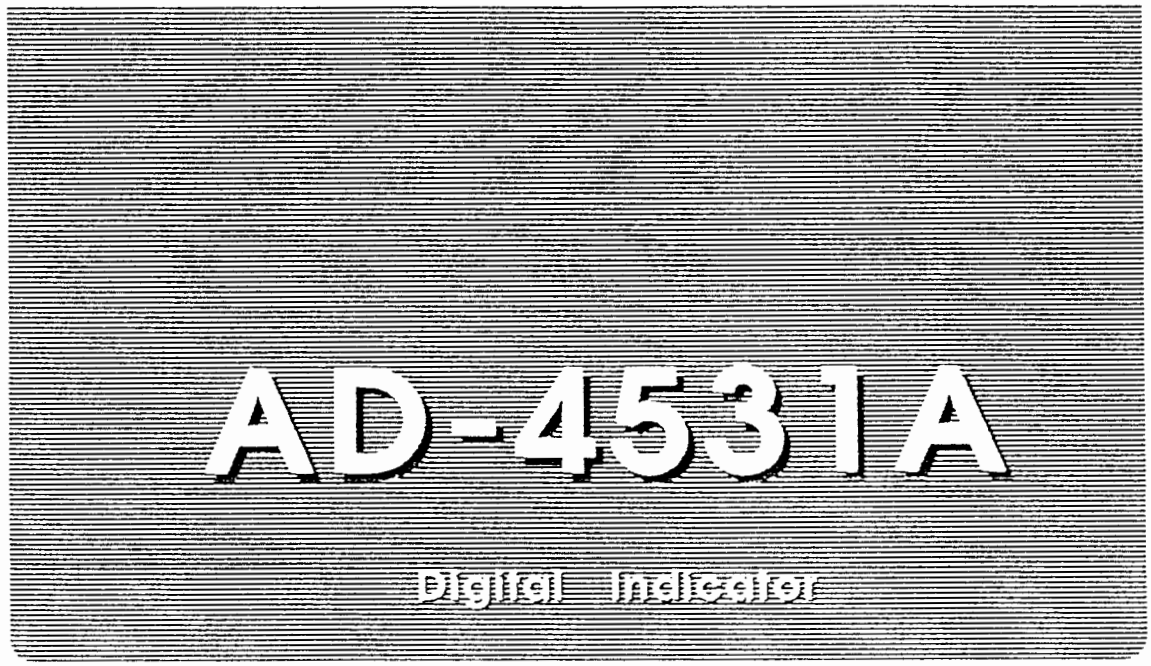



# INSTRUCTION MANUAL

Instruction-AD-4531A v.2.a '94.05.07

Digital Indicator

A&D Company, Limited

# Contents

# 1. Features

Thank your for purchasing the AD-4531A.

The AD-4531A is a digital indicator used to observe output voltage signals from bridge type sensors.

It has the following features:

1. High-speed conversion

   A 16 times-per-second high-speed A/D converter is used for inputs from the sensors.

   A 16 times-per-second high-speed D/A converter is used for analog outputs.

2. Calibration without an actual load

   Keying in a sensor's rated output voltage (mV/V) allows calibration to be performed without using an actual load.

3. Hold and peak hold function

   Both the measured value on the display panel and analog output can be held without any drooping, which would alter the held value.

4. Easy replacement of parts

   The circuit board and display panel can be removed and replaced without rewiring.

5. Comparison function

   Comparison results (HI and LO) are output as display data and also as contact signals.

6. The zero calibration value, upper and lower limit values are held in nonvolatile memory, so that they remain even after the AD-4531A has been switched off.

7. Electromagnetic compatibility (EMC)

8. Display stability and response speeds for various applications

   The adjustable filter for the display is used to ensure a stable display and to obtain response speeds suited to different applications for your AD-4531A.

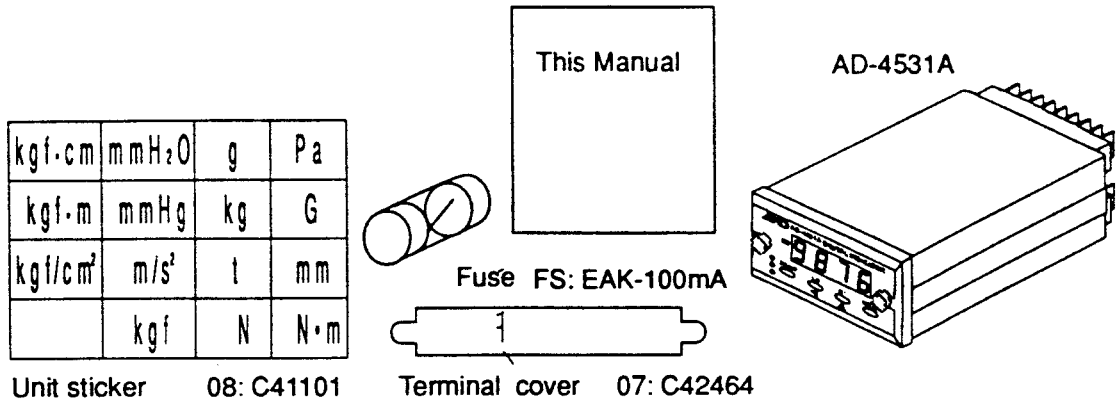
9. Various data output terminals

   Analog and comparator outputs are standard with the AD-4531A.

   The AD-4531A offers averaging data, digital peak hold data and comparison results (after hysteresis compensation). Serial interface (RS-232C) and 4-20mA analog output options are available.

# 2. Items in Carton (Be Sure to Read Before Use)

**The carton in which the AD-4531A is delivered contains:**




### Notes before Use

To get the most from your AD-4531A, please read the notes below thoroughly. Points which are specific to the AD-4531A are given below.

- Avoid water or moisture.
- Avoid vibration, shock, extremely high temperature and humidity, direct sunlight, dust, and air containing salt or corrosive gases.
- Do not use your AD-4531A in places exposed to flammable gases, vapors, or dust.
- Connect the ground terminal to an earth ground.
- Connect a non-inductive load of 5 kΩ or more to the analog output terminals.
- Use 4 wire shielded cables to connect sensors. Keep these cables away from power cables and other electrically noisy cables. Since 4 wire sensors are used, connecting long cables to the sensors can increase the total cable resistance and may cause measurement errors.

### Notes during Operation

- Do not attempt to modify your AD-4531A.
- In any hold mode, the data is stored in a digital manner, there will be no drooping of the value displayed on the display panel or the analog output. Note that the hold function is released when the AD-4531A is switched off.
- When the command mode is selected, no serial output will appear until an external command is received.
- If the hysteresis time is set to 0, the hysteresis function is disabled.
- If a key has not been pressed within 20 seconds during upper/lower limit setting, the data will not be read and the normal measurement mode will be selected automatically.
- During calibration, both no-load input and actual load input must be stable. If the inputs are unstable during calibration, a calibration error will occur.

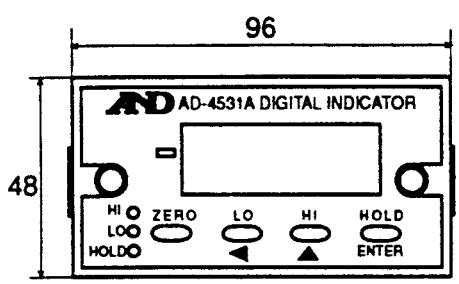
# 3. Basic Specifications

| | |
|---|---|
| Number of measurement points | 1 |
| Sensor type | Bridge type strain gauge sensors with a resistance of 120 or 350Ω |
| Sensor power supply | |
| (1) 350Ω sensor | Voltage applied: 5 VDC (Up to four sensors can be connected.) |
| (2) 120Ω sensor | Voltage applied: 5 VDC (Only one sensor can be connected.) |
| Calibration method | Full Digital Calibration™ (calibration by internal operation) |

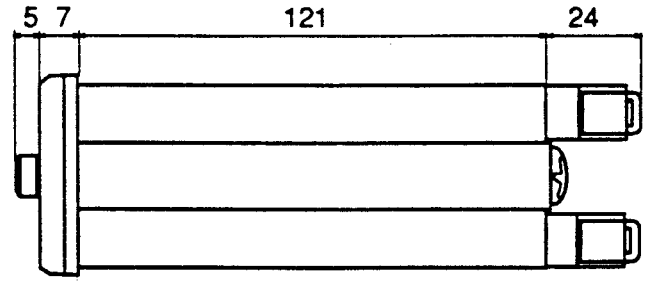
| Classification | Name | Method |
|---|---|---|
| Method not using an actual span load | Digital span | The sensor's rated span data is keyed in and zero is calibrated by sampling. |
| Method using an actual span load | CAL mode | An actual load is used for zero and span calibration. |
| | FCAL mode | The minimum division and maximum weighing capacity are set and zero and span calibration is performed using an actual load. |

| | |
|---|---|
| Measurement ranges | |
| Zero calibration range | - 0.3 to 3.0 mV/V |
| Span calibration range | 0.5 to 3 mV/V |
| Minimum guaranteed input sensitivity | 1.2 μV/d |
| Maximum input voltage | 3.0mV/V |
| Maximum display | 9999 |
| Linearity | 0.1% F.S. ± 1 digit |
| A/D conversion | 16 times/s |
| Temperature characteristics | |
| Zero | 0.5 μV/°C (Typ.) |
| Span | 30 ppm/°C (Typ.) |
| Display panel | |
| Measurement data display | 7-segment, 4-digit, red LED screen with 14 mm character size. One polarity indicator LED. |
| Status indicator LEDs | Three red LEDs representing measurement states (HI, LO, and HOLD) |
| Keys | Four |

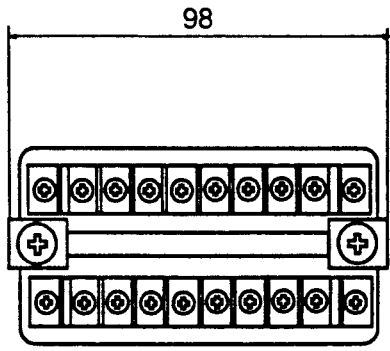
| | |
|---|---|
| **Functions** | |
| Comparator function | Allows upper and lower limits to be set and HI and LO signals to be output(Open collector output) |
| | Contact capacity: 40mA at 30VDC |
| Hold modes | Select from digital peak hold or sample hold modes. |
| Analog output | 0 to 2V (Scaling is enabled by setting values.) |
| Output resolution | Max. 1/2000 |
| Temperature coefficient | 100 ppm/°C |
| Others | Zero calibration and key disabling functions are also available. |
| **Options** | |
| OP-04 | RS-232C output |
| OP-05 | Current loop output |
| OP-07 | 4-20 mA analog output |
| **General Specifications** | |
| Power requirements | 100, 120, 220, 240 VAC +10%, - 15% (factory set), 50/60 Hz at 10 VA |
| Operating temperature and humidity | -5°C to +40°C, Max. 85% RH (noncondensing) |
| External dimensions | 96 x 48 x 157mm (W/H/D) (Panel cut: 92 x 45) |
| Weight | Approx. 500 g |



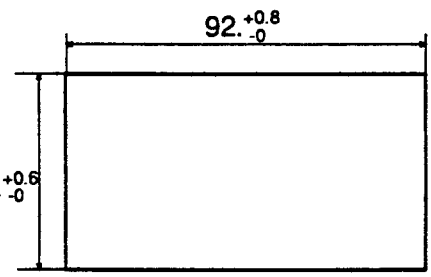

Front Panel




Side

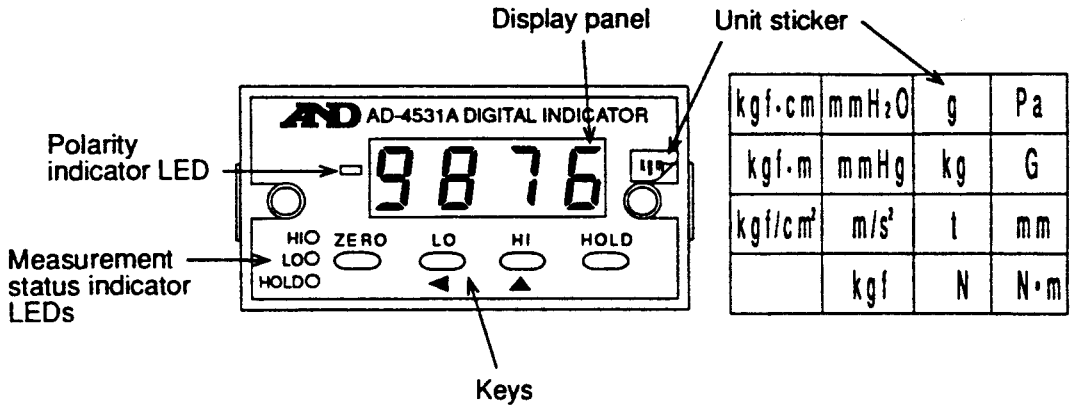



Rear Panel




Panel Cut

# 4. Front Panel




Display panel — Displays a measured value or set value. To set a decimal point, use function F-01.

"E(-E)" will be displayed either when the input voltage exceeds the specified measurement range or when the display value exceeds ±9999.

Measurement status indicator LEDs

LO ○ — Lights when the measured value is less than the set lower limit (LO).

HI ○ — Lights when the measured value exceeds the set upper limit (HI).

HOLD ○ — Lights when the measured value is held displayed or peak holding starts.

Keys

ZERO — When this key is pressed for more than 1 second, the measured value is assumed to be at the zero point and the displayed value is reset to zero.

Note — Turning on the AD-4531A with the ZERO key pressed will cancel the zero calibration function.

LO ◀ — Pressing this key will display the set lower limit value to allow you to change it.

This key is also used as a ◀ key to move the blinking cursor to the digit to be set when setting an upper or lower limit is enabled.

HI ▲ — Pressing this key will display the set upper limit value to allow you to change it.

This key is also used as a ▲ key to increment the digit at the blinking cursor when setting an upper or lower limit is enabled.


Pressing this key will start holding and turn on the HOLD LED. A hold mode can be set in the function mode.

Pressing this key again will stop holding.

This key is also used as an ENTER key to store the set value when setting an upper or lower limit is enabled.

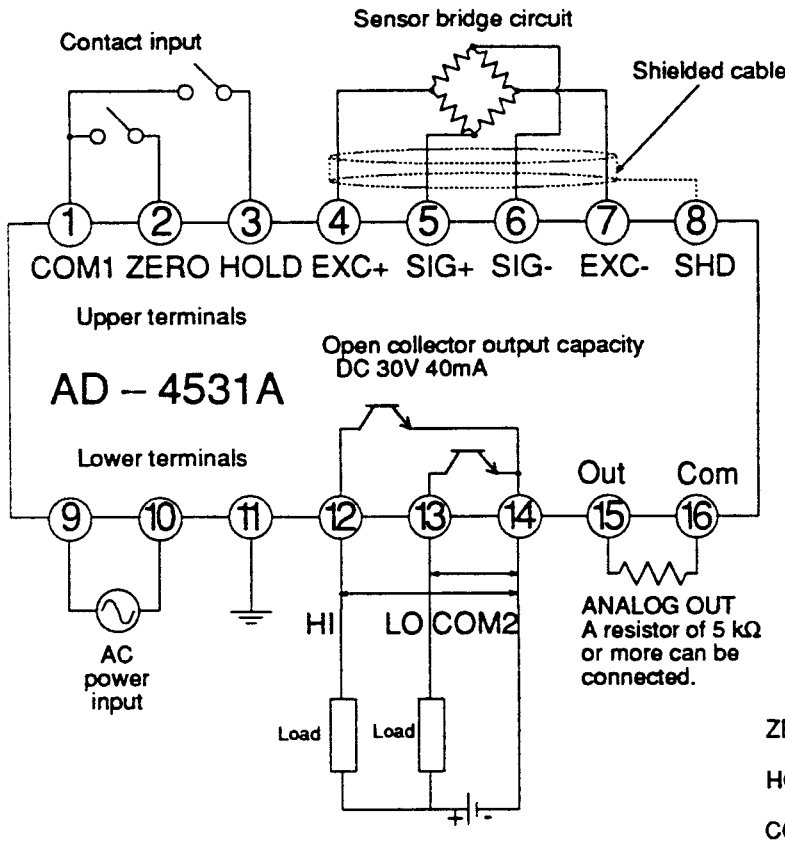
The zero calibration, upper and lower limit values are stored in nonvolatile memory and remain even after the AD-4531A has been switched off.

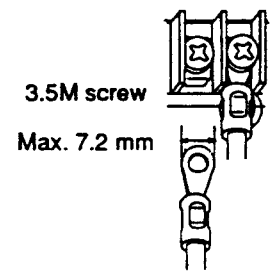
Place the unit sticker onto the right-hand side of the display panel.

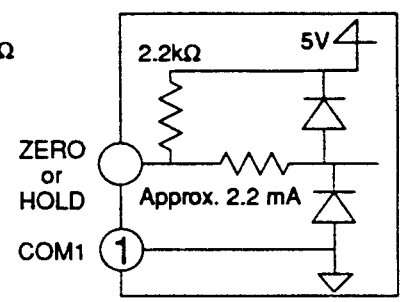
# 5. Rear Panel and Wiring (Connecting Sensors)

This chapter explains the terminals on the rear panel and how to connect sensors.

Note: Keep cables sensitive to electrical noise away from power cables and other sources of electrical noise..




1. Turn off the AD-4531A and all other units connected to it.

2. Connect the ground terminal (11) to the ground with a relatively heavy cable to protect the internal circuits against surges.

3. Connect cables to contact input terminals (1) COM1, (2) ZERO, and (3) HOLD.

Contact input terminals

(1) COM1: Remote input common.

(2) ZERO: Remote ZERO input which sets the measured value to zero when connected to COM1 for 200 ms or longer.

(3) HOLD: Remote HOLD input which holds the measured value when connected to COM1 for 200 ms or longer.

4 Connect cables to the following open collector output terminals:

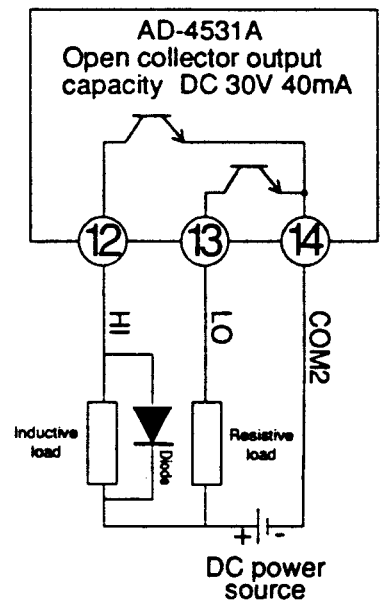
⑫ HI: HI limit relay output which is switched on when the measured value meets the set HI limit.

⑬ LO: LO limit relay output which is switched off when the measured value meets the set LO limit.

⑭ COM2: Relay output common.

Notes: The rated capacities of the open collector outputs should not be exceeded to prevent damage.

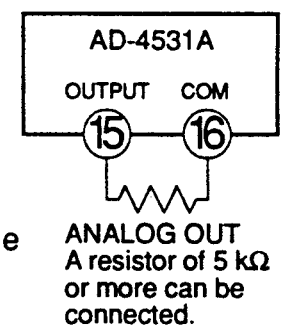
Inductive loads such as relays should have spile supression diodes across the coil terminals as shown in the drawing.




5 Connect a load to the following analog output terminals.

⑮ Analog output terminal

⑯ Common terminal for analog output




Note: Connect a non-inductive load of 5 kΩ or more to the analog output terminals.

Procedure

1. Connect a load to the analog output terminals.
2. Check the input filter setting.
3. Carry out input calibration.
4. In the function mode, set the analog output.

6 Connect the sensors by the following procedure:

Connect the cables to the sensor terminals ④ to ⑧.

Terminal

④ EXC+: Positive excitation voltage terminal for the sensor

⑤ SIG+: Positive signal input terminal for the sensor

⑥ SIG-: Negative signal input terminal for the sensor

⑦ EXC-: Negative excitation voltage terminal for the sensor

⑧ SHD: Shielded cable connection terminal

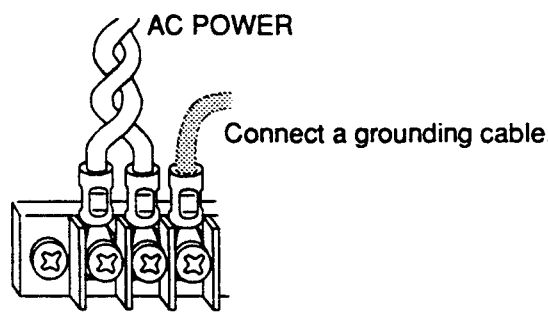
Notes: Use 4-wire shielded cable to connect sensors. Keep these cables away from power cables and other sources of electrical noise. Since 4-wire sensors are used, connecting long cables to the sensors can increase the total cable resistance and may cause measurement errors.

Connect the power supply cables and a grounding cable to the following terminals:

Terminal

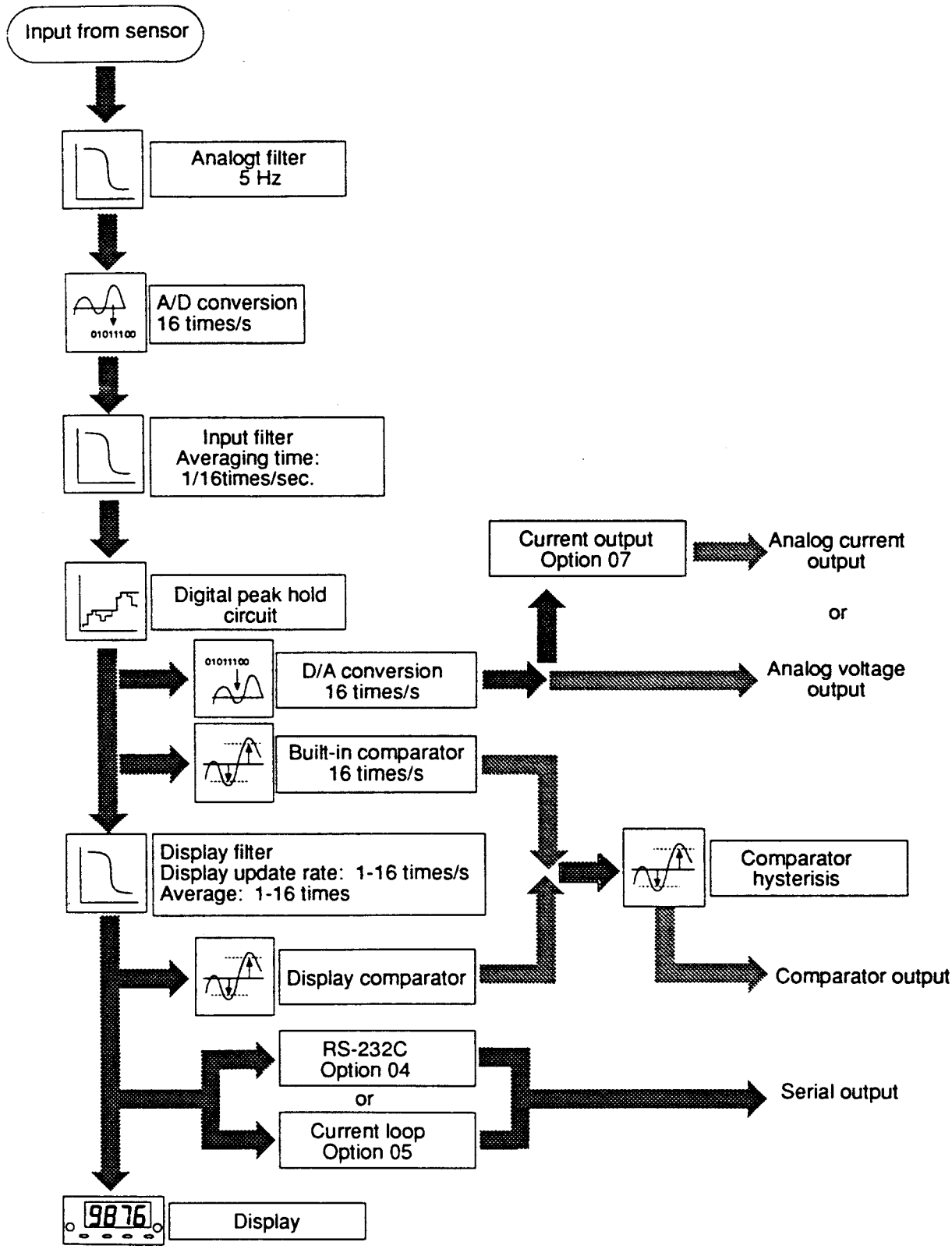
⑨, ⑩: Connect the power supply cables with crimp terminals.

⑪: Connect a grounding cable. Use a relatively heavy cable to protect the internal circuits against impulse voltage and surges.



# 6. Components and Functions

The following flowchart show how the functions of the AD-4531A are executed:




**Flowchart**

| | |
|---|---|
| Analog filter | An analog low-pass filter which removes noise in the inputs from the sensors. The pass band is to 5Hz. |
| Input filter | Input filter stabilizes the measured value. Averaging time can be selected in function mode.(F-02) |
| Digital peak hold circuit | A peak hold circuit that allows digital processing. The digital peak hold circuit can hold the peaks of the signals described below. Peak hold samples are limited to the A/D conversion rate of 16 times per second. Therefore, the AD-4531 peak hold is ideally used for non breaking applications, such as tests that ramp up then down slowly<br>❑ Holding peaks of signals (positive signals only)<br>❑ Holding bottoms of signals (negative signals only)<br>❑ Holding peaks of both positive and negative signals (absolute value data)<br>A hold mode can be selected in the function mode. (F-06) |
| Note: | In any hold mode, the hold value is stored in a digital manner, causing no drooping of the value displayed on the display panel or the analog output. Note that the hold function is disabled when the AD-4531A is switched off. |
| Display filter | A filter to stabilize the display. An averaging time and display update rate can be selected in the function mode. (F-03, F-04) |
| Comparators | The display comparator outputs comparison results.<br>An internal comparator outputs the result of comparisons made 16 times per second.<br>Either the display comparator or internal comparator can be selected in function mode. (F-07)<br>The condition of open collector output can be selected infunction mode .(F-17,F-18) |
| See note below<br>Analog output | The measured value from the sensors is processed according to the values set in function mode, then it is output to the analog output terminals as a voltage after D/A conversion. Connect a recorder, etc. to the analog output terminals to observe the voltage waveform from the sensors. The result being held is reflected in the voltage waveform as it is. The analog output response speed depends on the input filter setting. |
| RS-232C option (OP-04) | A RS-232C option allowing display data to be output serially each time the display is refreshed. (F-14, F-15, F-16, F-20) |
| Current loop option (OP-05) | A current loop option allowing display data to be output serially each time the display is refreshed. |
| Analog output option (OP-07) | An option for converting analog outputs to a current (4-20 mA) |

**Note: Only one option can be selected from 04,05, or 07.**
**Installing an option disables the standard voltage output function.**

# 6.1 Using Filters

Input filter

An input filter which removes noise from the inputs from the sensors. The respose speed can be set from 1 sec. to 1/16 sec. in function mode (F-02).

Refer to the following table:

| | 1Sec. | | 1/16Sec. |
|---|---|---|---|
| Noise resistivity | Normal | ⟷ | High |
| Response speed | Slow | | Fast |

Display filter

A filter to stabilize the display. An averaging time and display update rate can be selected in function mode. (F-03, F-04)

The display data is also output to the display comparator and RS-232C connector, so the averaging time and display update rate must be selected with respect to the response speed, timing, and stability.

| Averaging time [sec] | Write count [time/sec] 1 | 2 | 3 | 4 | 8 | 16 | 32 |
|---|---|---|---|---|---|---|---|
| 1/1<br>1/2<br>1/4<br>1/8<br>1/16 | Slow display<br>Intermittent display | | | | | | Continuous display<br>Fast display |

# 6.2 Using Hold (Peak Hold) Modes

**Hold modes**

There are three hold modes.

- Sample hold mode in which the display data and analog output are held immediately after receiving a hold input
- Digital peak (or bottom) hold mode in which the display data and analog output are held at the peak measured value. (A/D converted digital value) reaches the peak (or bottom) after receivng a hold input
- Digital peak positive and negative hold mode in which the display data and analog output are held at the absolute value. Holds the value of the digital data after receivng a hold input.

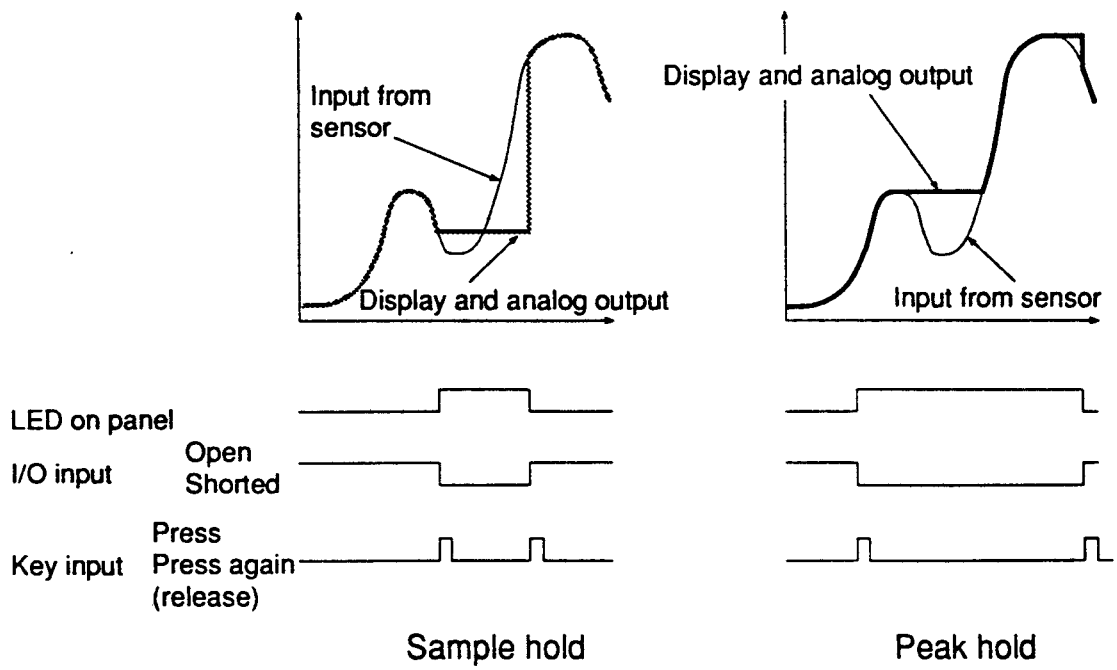
**Holding a peak**

Two type of inputs are used for (peak) holding.

- Contact input from the I/O input terminal. The sensor output is held when I/O input terminal COM1 and the HOLD terminal are connected, and released when they are disconnected.
- Input from the HOLD key on the panel. Pressing the HOLD key once holds the sensor output, and pressing the HOLD key again releases the sensor output.

**Priority**

A Hold signal from the I/O input terminal is given priority over HOLD key input. If the I/O terminal is shorted, sensor output will not be released even if the HOLD key is pressed.



# 6.3 Using Comparator Outputs

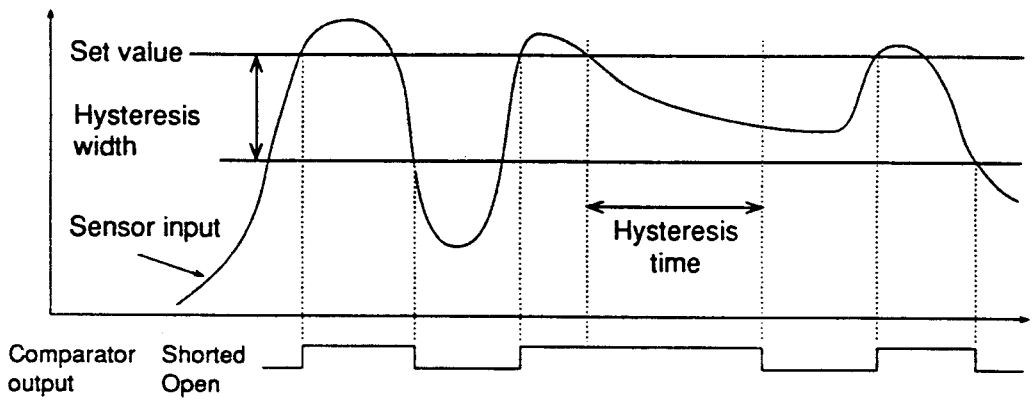
Comparator outputs

Comparison results are output each time the display is refreshed by an internal comparator that compares 16 times per second or by a display comparator that compares the display data that passed through a display filter. Either the display comparator or the high-speed comparator can be selected in function mode. (F-07)

Comparator output hysteresis

A hysteresis width and time is provided for the external relay on/off timing to prevent chattering.

When the measured value exceeds the set value, the output transistor is turned on. If the measured value falls below the set value and it is further reduced by the hysteresis width, or if the hysteresis time has lapsed, the output transistor is turned off. See the diagrams on the next page.




You can select the hysteresis direction, time and width in function mode. (F- 08, F-09, F10)

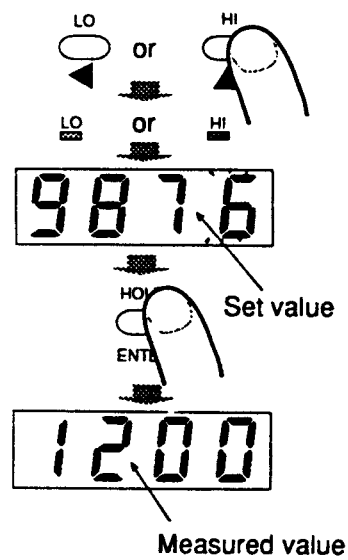
Note: The above function is disabled when the hysteresis time is set to 0.

Displaying and changing a set upper or lower value

Monitoring a set value

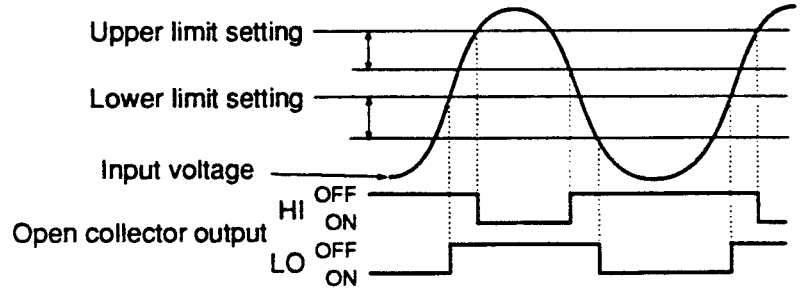
When you press the HI key, the HI LED blinks and the set upper value is displayed. When you press the LO key, the LO LED blinks and the set lower value is displayed. To display a set upper or lower value without changing it, press the ENTER key; the measured value will be displayed and normal measurement mode will be selected automatically.

Note: During monitoring data, "Comparison"is available but "Hold" is released.

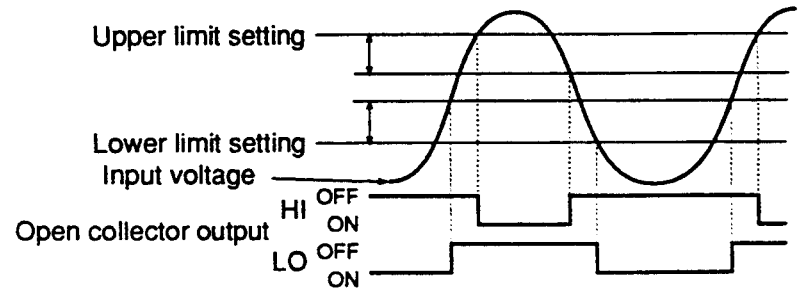


There are three hysterisis modes. The operation of each is shown in the diagrams below

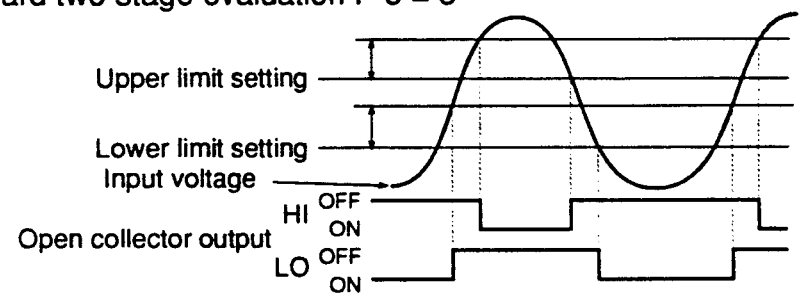
Upward two stage evaluation F-8 = 1




Upper and lower limit evaluation F-8 = 2




Downward two stage evaluation F-8 = 3



# 6.4 Setting Comparator Functions

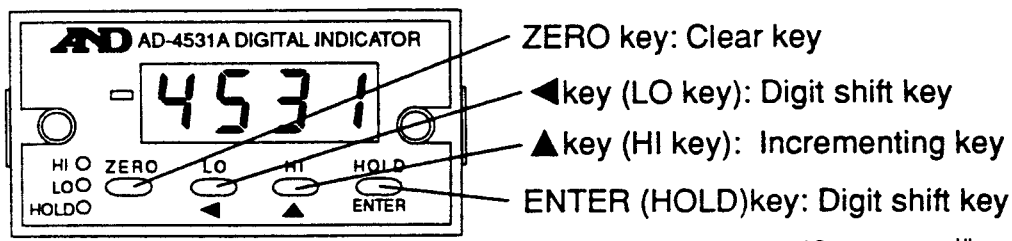
When a set value is displayed, the front panel keys function as follows:

◀ Key: Moves the blinking cursor to the next digit.

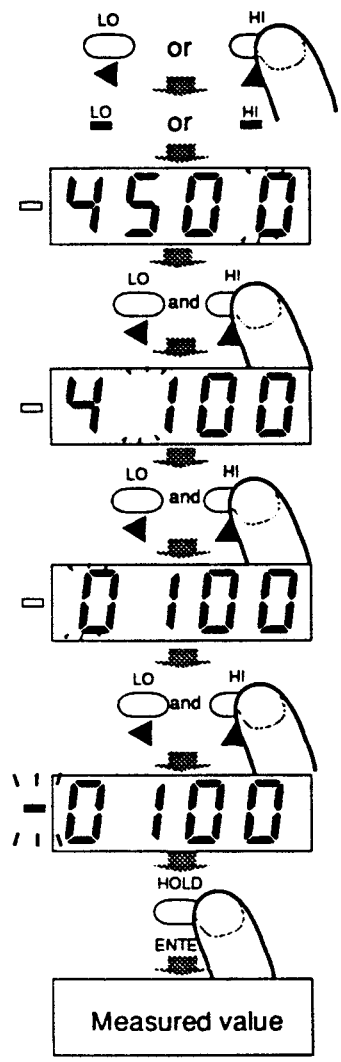
▲ Key: Increments the digit at the blinking cursor.

ENTER key: Reads the data. Pressing the ENTER key allows new data to be read and normal measurement mode to be selected.

ZERO key: Clears the data. If you press the ZERO key before pressing the ENTER key, the input data will be cleared and the previous data will be displayed again.




Example: Changing the set value from 4500 to -100




1. Press the HI or LO key to select the value to be changed.
2. Press the ◀ key to move the blinking cursor to the digit to be changed.
3. Press the ▲ key to change the digit at the blinking cursor to the desired value.
4. Repeat steps 2. and 3. to change all the digits to the desired values.
5. After setting the most significant digit, press the ◀ key to set the polarity. The polarity indicator LED does not blink when the current polarity is positive. It blinks when the current polarity is negative. Press the ▲ key to select the desired polarity.
6. Press the ENTER key to read new data. Then normal measurement mode will be selected again.

**Note: If no key is pressed for 20 seconds during upper/lower limit setting, data will not be read and the normal measurement mode will be selected automatically.**

# 6.5 Using Analog Outputs

Analog outputs

The input from the sensor is processed according to the values set in function mode, then are output to the analog output terminals as a voltage after D/A conversion. Connect a recorder, etc. to the analog output terminal to observe the voltage waveform from the sensors. The results held is reflected in the voltage waveform as it is. The analog output response speed depends on the input filter setting.

Note: Connect a non-inductive load of 5 kΩ or more to the analog output terminals.

Procedure

1. Connect a load to the analog output terminals.
2. Check the input filter setting.
3. Carry out input calibration.
4. In the function mode, set the analog output.

When a set value is displayed, the front panel keys function as follows:

◀ key: Moves the blinking cursor to the next digit.

▲ key: Increments the digit at the blinking cursor.

ENTER key: Reads set data. Pressing the ENTER key allows new data to be read and the normal measurement mode to be selected.

F-12 (Analog output offset)

When "0000" (the factory setting) is displayed, you can set an analog output voltage with four digits for values ranging from -9.999V to 9.999V.

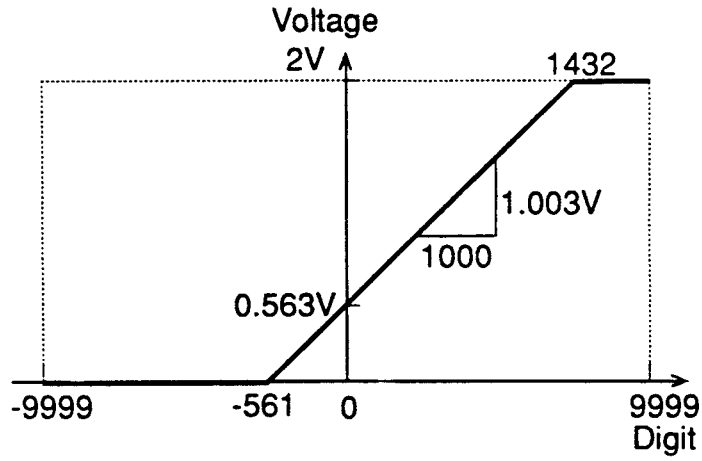
Example: To set 0.563 V, enter 0563.

F-13 (Analog output scaling)

Set the change in the analog output voltage per 1000 (display data). You can set from -9.999 to 9.999 (V).

Example: To set 1.003 V, enter 1003.

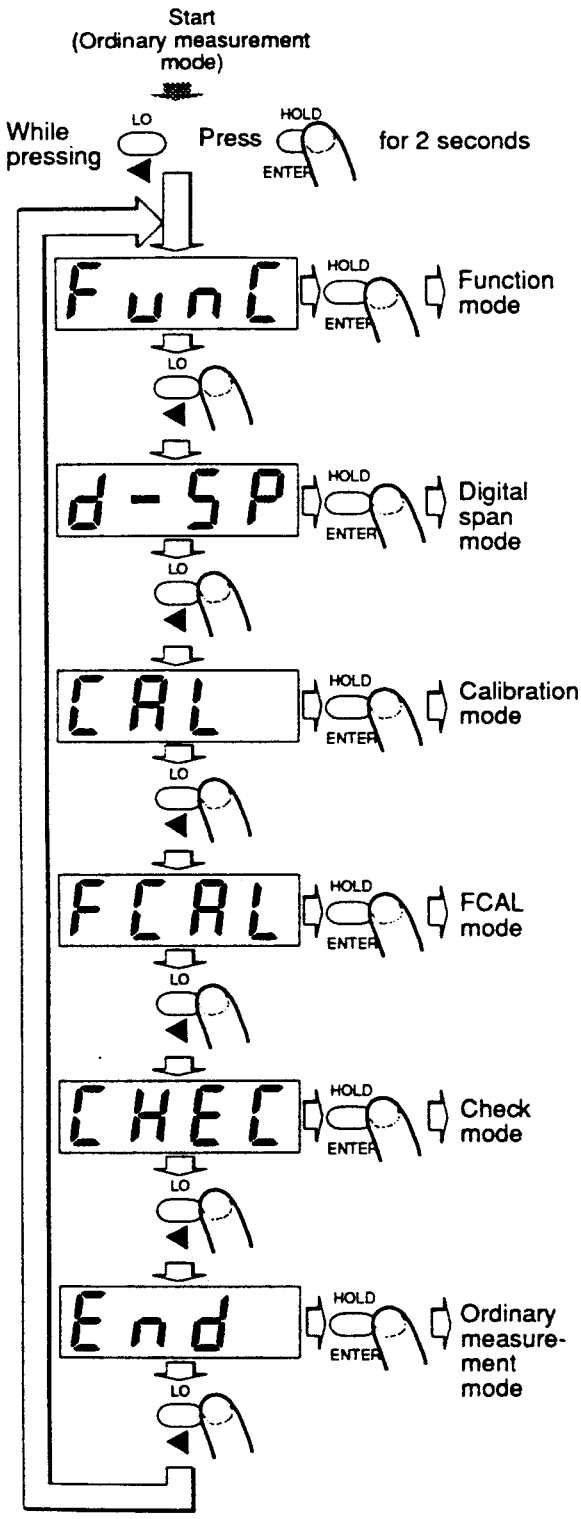
Note: The analog output voltage cannot exceed the measurement range; it is only permissible within the displayable range. The analog output voltage must be between 0V to 2V.



# 7. Setting Modes

## 7.1 Mode Types and Entering Modes

There are six types of modes.




| | |
|---|---|
| FunC | Function mode in which various functions and types of data are set |
| d-SP | Digital span mode in which the sensor's rated data is keyed in and calibration performed without using an actual load |
| CAL | Calibration mode in which zero and span calibration is carried out using an actual load |
| FCAL | Calibration mode in which zero and span calibration is performed using an actual load after setting the minimum division and maximum measured value. |
| CHEC | Check mode in which the display, keys, analog output, and I/O are checked |
| End | Mode setting is terminated and ordinary measurement mode is selected again. |

Note: The function data and calibration data are stored in nonvolatile memory, so they will not be erased even when the AD-4531A is switched off.

Procedure

1. Pressing the HOLD key for at least 2 seconds with the LO key held pressed will allow you to select a mode.

   Comparator transistor output is turned off.

   The hold function is canceled.

2. Press the ◀ key to display the desired mode, then press the ENTER key to select the desired mode.

3. When End is displayed, pressing the ENTER key will allow you to return to the normal measurement mode.

# 7.2 Function Mode

By selecting a function mode, you can set various function and data.

List of Function Mode

| Name | Function | Settings | Factory setting |
|---|---|---|---|
| F-01 | Decimal point adjustment | None, or after second, third, or fourth digit from the right | None |
| F-02 | Input filter | None, or averaging time of 1/8 sec., 1/4 sec., 1/2 sec., or 1sec. | 1/2 sec. |
| F-03 | Display filter | None, or averaging time of 1/8 sec., 1/4 sec., 1/2 sec., or 1sec. | 1/2 sec. |
| F-04 | Display update rate | 1, 2, 4, 8, 16, or 32 times/sec. | 8 |
| F-05 | Zero calibration range | 2, 10, 20, 30% | 30 |
| F-06 | Hold mode | Display SH, Internal SH, DPH(+), DPH(-), DPH(A):Absolute hold | Display SH |
| F-07 | Comparison mode | Internal comparison , Display comparison | Display comparison |
| F-08 | Hysteresis mode | Upward two-stage evaluation, upper and lower limit evaluation, downward two-stage evaluation. | Upper and lower limit evaluation |
| F-09 | Hysteresis time | 0, 0.06, 0.13, 0.25, or 0.50 second | 0 |
| F-10 | Hysteresis width | 0-99 digit | 0 |
| F-11 | Key disabling | ZERO key, HOLD key, upper and lower limit monitoring, and upper and lower limit setting | 0000 |
| F-12 | Analog output offset | -9.999V]to 9.999V | 0.000 |
| F-13 | Analog output | -9.999[V/1000Digit] to 9.999[V/1000Digit] | 1.000 |
| F-14 | Baud rate | 600 / 2400 | 2400 |
| F-15 | Data bit | 7E, 8N | 7E |
| F-16 | Option | None, 04, 05, or 07 | None |
| F-17 | LO Open collector output | above the upper or lower llimit,,or between the upper or lower limit ,or below the upper or lower limit | 001 |
| F-18 | HI Open collector output | above the upper or lower llimit,,or between the upper or lower limit ,or below the upper or lower limit | 100 |
| F-19 | Zero track | 9 (Digit/0.5 sec.) ~ OFF ~1 (Digit/2 sec.) | OFF |
| F-20 | Units for serial output | 15 different units are available for output with the data | N/A |

DPH : Digital Peak Hold , SH: Sample Hold

Keys Used

▲ Key: The ▲ key is used to select the next item or data.

ENTER key: When an item is displayed, pressing the ENTER key to select the data for this item. When an item is displayed, pressing the ENTER key allows the data be read as a set value and allows you to select the next item. Data is not stored in memory until the ENTER key is pressed with the ◀ key held pressed.

◀ Key + ENTER key: When an item is displayed, pressing the ENTER key with the ◀ key held down writes data to the nonvolatile memory. When data is displayed, pressing the ENTER key with the ◀ key held down will invalidate the data displayed currently and the measured value will be displayed.

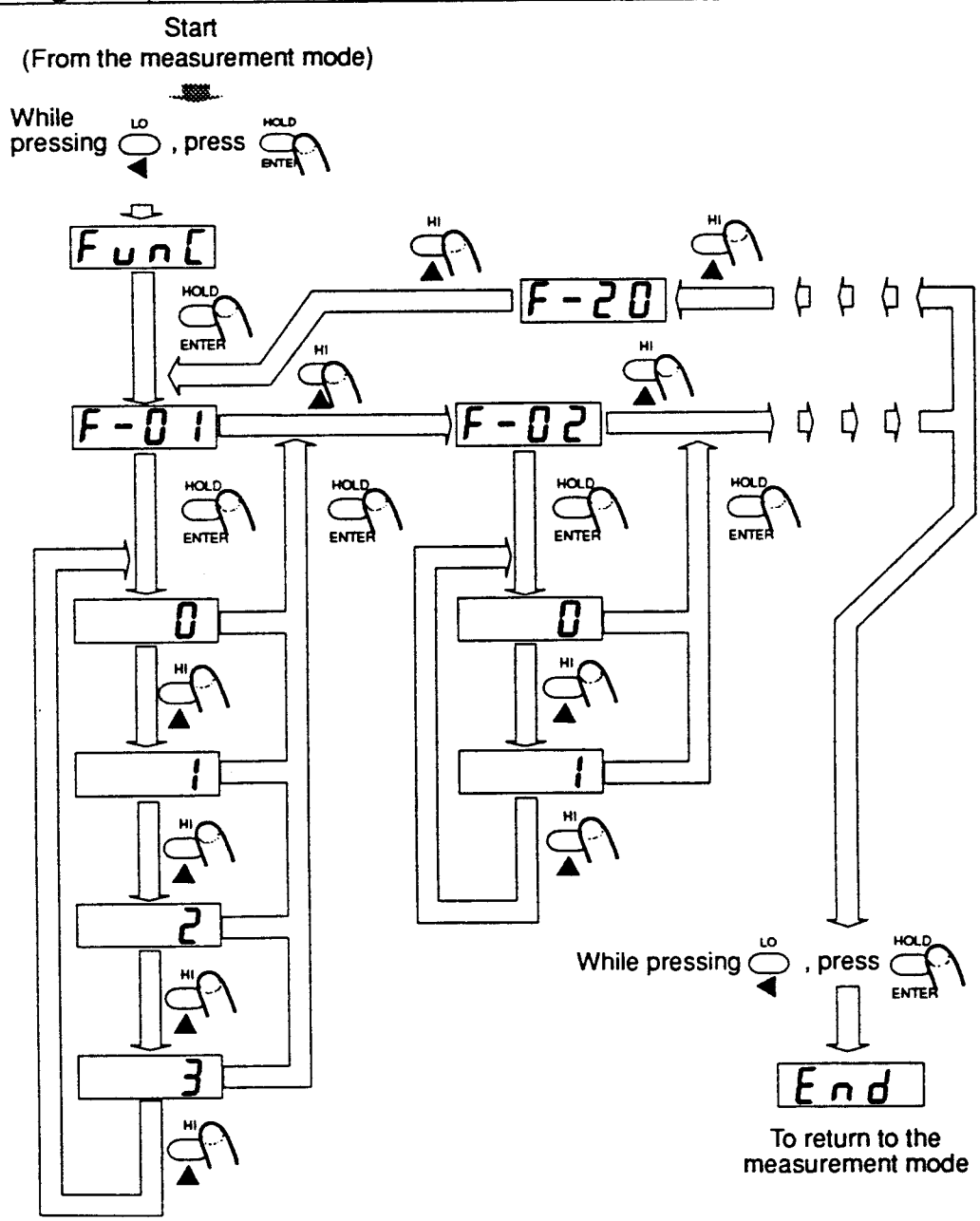
## Settings Related to Basic Operations

F-01 Decimal point adjustment (Factory setting: 0)

| Display data | Setting | |
|---|---|---|
| 0 | 0000 | No decimal point |
| 1 | 000.0 | After second digit from right |
| 2 | 00.00 | After third digit from right |
| 3 | 0.000 | After fourth digit from right |

F-02 Averaging time of input filter (Factory setting: 8)

| Display data | Setting |
|---|---|
| 0 | No filtering |
| 2 | Averaging time of 1/8 second |
| 4 | Averaging time of 1/4 second |
| 8 | Averaging time of 1/2 second |
| 16 | Averaging time of 1 second |



F-03 Averaging time of display filter (Factory setting: 8)

| Display data | Setting |
|---|---|
| 0 | No filtering |
| 2 | Averaging time of 1/8 second |
| 4 | Averaging time of 1/4 second |
| 8 | Averaging time of 1/2 second |
| 16 | Averaging time of 1 second |

F-04 Display update rate (Factory setting: 8)

| Display data | Setting |
|---|---|
| 1 | 1 time/second |
| 2 | 2 times/second |
| 4 | 4 times/second |
| 8 | 8 times/second |
| 16 | 16 times/second |

F-05 Zero calibration range (3% of maximum capacity) (Factory setting: 2)

| Display data | Setting |
|---|---|
| 2 | ± 2% |
| 10 | ± 10% |
| 20 | ± 20% |
| 30 | ± 30% |

F-06 Hold mode selection (Factory setting: 0)

| Display data | Setting |
|---|---|
| 0 | Display Sample hold. Holds the value displayed when a HOLD signal is input. |
| 1 | High-speed sample hold. Holds the sampling value when a HOLD signal is input.<br>Holds the display when a HOLD signal is input or if the HOLD key is pressed. |
| 2 | Digital peak holding.<br>Holds the maximum value of the digital data when a HOLD signal is input. |
| 3 | Digital bottom holding.<br>Holds the minimum value of the digital data when a HOLD signal is input. |
| 4 | Digital peak holding for positive and negative signals.<br>Holds the absolute value of the digital data when a HOLD signal is input. |

F-07 Comparison mode (Factory setting: 1)

| Display data | Setting |
|---|---|
| 0 | Internal comparison<br>Makes comparison at a sampling rate of 16 times/second. |
| 1 | Display comparison<br>Makes a comparison at the display update rate set by function F-04. |

F-08 Comparator hysteresis mode (Factory setting: 2)

| Display data | Setting |
|---|---|
| 1 | Upward two-stage evaluation |
| 2 | Upper and lower limit evaluation |
| 3 | Downward two-stage evaluation |

F-09 Comparator hysteresis time (Factory setting: 0)

| Display data | Setting |
|---|---|
| 0 | 0 second (Comparator hysteresis is not used.) |
| 006 | 0.06 second |
| 013 | 0.13 second |
| 025 | 0.25 second |
| 050 | 0.50 second |
| 100 | 1.00 second |

F-10 Comparator hysteresis width (Factory setting: 00)

| Display data | Setting |
|---|---|
| 00 | 00: Hysteresis is not used.<br>Range: 0-99 |
| 99 | 99 digit |

F-11 Key disabling (Factory setting: 0000)

| Display data | Setting |
|---|---|
| | To disable a function, set the corresponding digit to 1. |
| 0 0 0 0 | Disables the clearing function of the ZERO key.<br>Disables the holding function of the HOLD key.<br>Disables monitoring of upper and lower limit values.<br>Disables modification upper and lower limit values. |
| | Example: |
| 1 0 0 1 | To disable the function of the ZERO key and modification of upper and lower limit values, set 1001. |

F-12 Analog output offset (Factory setting: 0000)

| Display data | Setting |
|---|---|
| | When 0 (the factory setting) is displayed, you can set an analog output voltage with four digits. To set it, use the ◀, ▲, ENTER, and ZERO keys. See Section 6.5. The setting range is from -9999 to 9999. |
| | Example: |
| 0563 | To set 0.563 V, enter 0563. |

F-13 Analog output scaling (Factory setting: 1000)

| Display data | Setting |
|---|---|
| | Set the change in the analog output voltage per 1000 (display data) with four digits. |
| | To set it, use the ◀, ▲, ENTER, and ZERO keys. See Section 6.5. |
| | The setting range is from -9999 to 9999. |
| | Example: |
| 1003 | To set 1.003 V, enter 1003. |

⚠ Analog output voltage can presents the voltage between 0V and 2V.

$$\text{(Analog output voltage) [V]} = \frac{\text{(display)}}{1000\ \text{[digit]}} \times F13 + F12$$

If the value caluclated the above formula is minus, analog output voltage is 0V. If the value caluclated the above formula exceeds beyond 2V, analog output voltage is 2V.

F-14 Baud rate (Factory setting: 2400)

| Display data | Setting |
|---|---|
| 600 | 600bps |
| 2400 | 2400bps |

F-15 Data bit length and parity (Factory setting: 7E)

| Display data | Setting |
|---|---|
| 7E | 7 bits, even parity |
| 8n | 8 bits, no parity |

F-16 Option (Factory setting: 0)

| Display data | Setting |
|---|---|
| 0 | None |
| 04 | OP-04 (RS-232C Output) |
| 05 | OP-05 (Current loop Output) |
| 07 | OP-07 (4-20mA Current loop Output) |

F-17 LO open collector (Factory setting: 001)

| Display data | Setting |
|---|---|

Select from among the followings and set "1" to turn on.

000

- The open collector is turned on
- 1 when the measured value is below the lower limit(LO).
- 1 when the measured value is between the upper(HI) and lower limit(LO).
- 1 when the measured value is above the upper limit(HI).

Example 011 The output is turned on when the measured value is above the LO limit.

101 The output is turned on when the measured value is above the HI limit or below the LO limit.

F-18 HI open collector (Factory setting: 100)

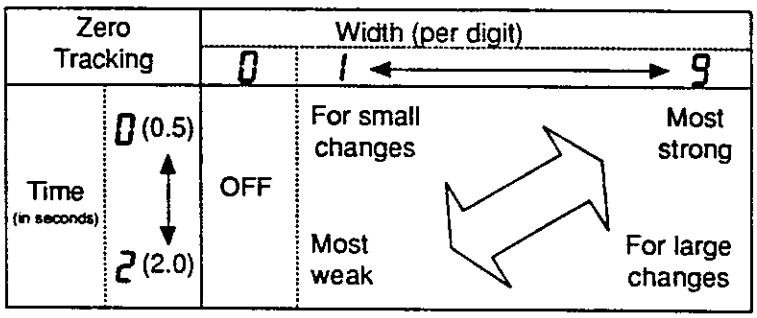
| Display data | Setting |
|---|---|
| Select from among the followings and set "1" to turn on.<br>000<br>The open collector is turned on<br>1 when the measured value is below the lower limit(LO).<br>1 when the measured value is between the upper(HI) and lower limit(LO).<br>1 when the measured value is above the upper limit(HI).<br>Example 110 The output is turned on when the measured value is above the LO limit. | |

F-19 Zero tracking Factory setting: 00

| Display data | Setting |
|---|---|
| 00<br>0 ~ 9 of $10^0$ | The setting, 0 ~ 9, sets the width (divisions) over which zero tracking works |
| 00<br>0 ~ 2 of $10^1$ | The setting, 0 ~ 2, sets the time over which zero tracking detects a change |

The AD-4531A tracks and can correct for zero drift caused by changes in temperature, humidity, air pressure, etc. If the drift is very small, set for weaker tracking.

Example: A setting of 09 will correct for 9 digits of drift in 0.5 seconds.




⚠ If you are measuring a very small force, or adding force to the measuring system in increments less than the width setting, zero tracking may zero off the change. Either set to 20 or 00, this will turn off the zero tracking.

F-20 Unit used for serial output Factory setting: 0

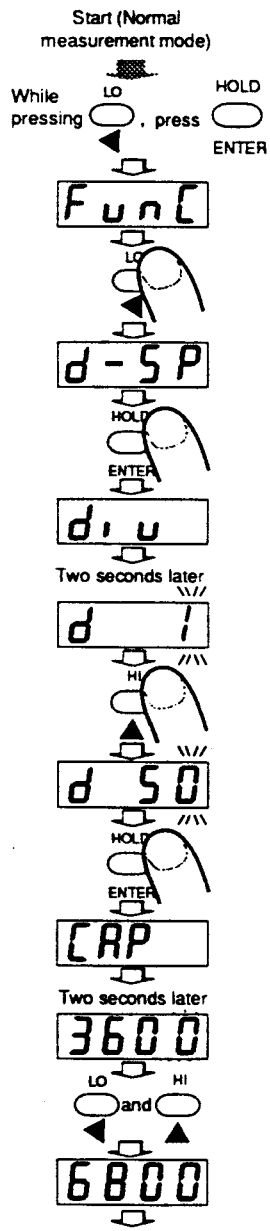
| Display data | Setting | Display data | Setting | |
|---|---|---|---|---|
| 0 | None | 8 | kgf | |
| 1 | ␣␣g | 9 | ␣␣G | ␣ = a space |
| 2 | ␣kg | 10 | kgfcm | Settings 10 ~ 15 can not be used with the AD-8121 printer |
| 3 | ␣␣t | 11 | kgfm | |
| 4 | ␣␣N | 12 | mmHg | |
| 5 | ␣Pa | 13 | mmH2o | |
| 6 | ␣mm | 14 | m/s/s | |
| 7 | ␣Nm | 15 | kgf/cm/cm | |

# 7.3 Calibration

There are three calibration modes.

- d-SP Digital span mode in which the sensor's rated data is keyed in and calibration is performed without using an actual load
- CAL Calibration mode in which zero and span calibration are carried out using an actual load
- FCAL Calibration mode in which zero and span calibration are carried out using an actual load after the minimum division value and maximum measured value have been calibrated.

### 7.3.1 Digital span mode




Example: Changing the maximum measured value from 3600 to 6800

While pressing the ◀ key, press the ENTER key for at least 2 seconds to allow you to select a mode.

Press the ◀ key to display d-SP .

Press the ENTER key to select d-SP mode.

When the d-SP mode is selected, di u is displayed for 2 seconds. Then, the current minimum division setting value is displayed, waiting for you to enter a new minimum division value.

Using the ▲ key, select a minimum division value from among 1, 2, 5, 10, 20, and 50, and then press the ENTER key.

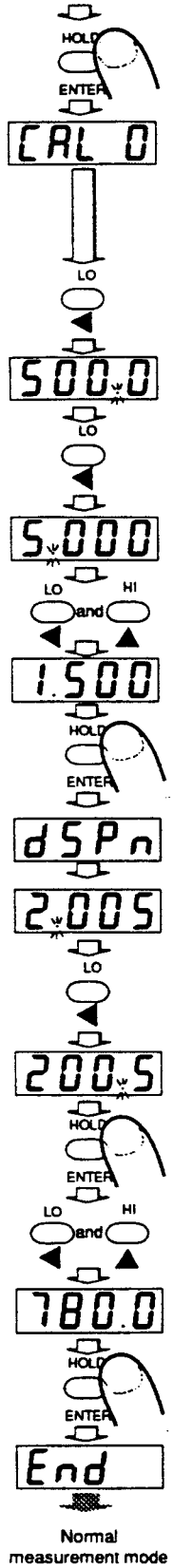
Example: Changing the minimum division value from 1 to 50

After CAP is displayed for two seconds, the current maximum measured value is displayed automatically, waiting for you to enter a new maximum measured value.

Using the ◀ and ▲ keys, enter the maximum measured value and press the ENTER key. (To change only the minimum division value, press the ZERO key. End will be displayed, then ordinary measurement mode will be selected automatically.)

**Note: Follow the formula below and calibrate the AD4531A. When the setting is wrong, it automatically goes back to the procedure where the minimum division is set.**

$$\frac{\text{Maximum measured value}}{\text{Minimum division}} \leq 2000$$




CAL 0 is displayed and the AD-4531A enters the zero calibration mode.

(If you do not want to calibrate the zero point, press the ZERO key, the AD-4531A will switch to the digital span mode)

Press the ◀ key. The AD-4531A will display the current zero point voltage.

Press the ◀ key to select the decimal point position.

If the zero point voltage is 1.000 mV/V or higher, select "*.***[mV/V]". If the zero point voltage is less than 1.000 mV/V, select "***.* [μV/V]". The selected decimal point position will blink.

Using the ◀ and ▲ keys, enter the new zero point voltage. Then, press the ENTER key. 1.500 mV/V was entered as the new zero point.

The AD-4531A will then display dSPn. Then the current maximum input voltage.

Press the ◀ key to select the decimal point position, then press the ENTER key.

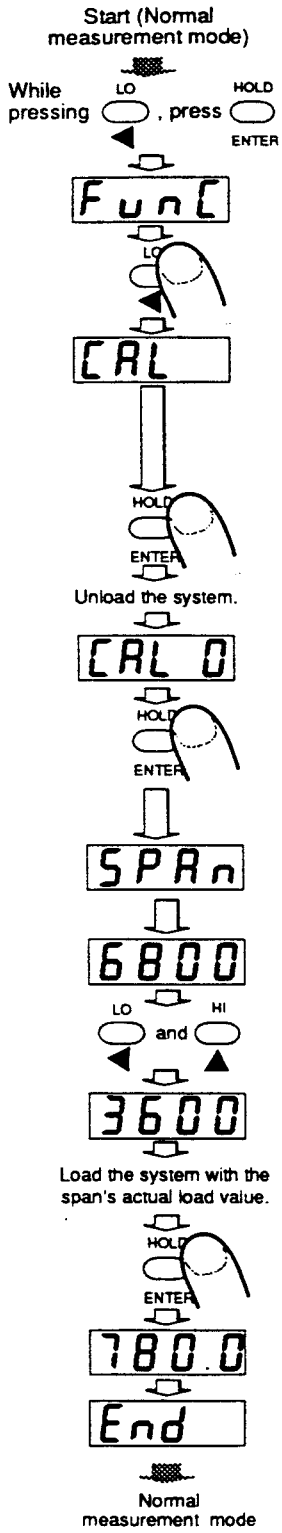
If the maximum input voltage is 1.000 mV/V or higher, select "*.***[mV/V]". If the maximum input voltage is less than 1.000 mV/V, select "***.* [μV/V]". The selected decimal point position will blink.

Using the ◀ and ▲ keys, enter the new maximum input voltage. Then, press the ENTER key. 780.0 μV/V was entered as the new maximum input voltage.

End is displayed, the new value is stored in nonvolatile memory, and ordinary measurement mode is selected again.

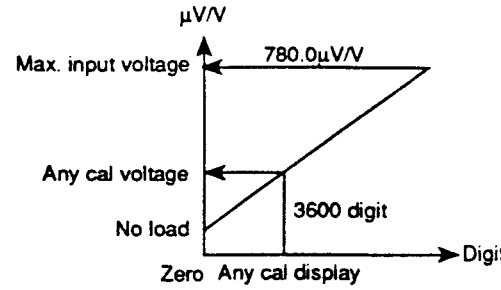
### 7.3.2 CAL Mode

In the CAL mode, zero and span calibration are carried out using an actual load.




While pressing the ◀ key, press the ENTER key for at least 2 seconds to allow you to select a mode.

Press the ◀ key twice to display CAL.




Press the ENTER key to select CAL mode. A few seconds later CAL 0 will be displayed.

After putting the input into the no-load state, press the ENTER key. Zero calibration will start automatically. Maintain the no-load state during zero calibration.

**(If you do not need zero calibration, press the ZERO key.** Span calibration will start without carrying out zero calibration. The span calibration is then performed with reference to the zero point adjusted previously.)

SPAn is displayed for two seconds, then the current span value is displayed, waiting for your to enter the next data. **(If you do not need span calibration, press the ZERO key.** "End" will be displayed without performing span calibration.)

Enter the measurement value to be displayed when an actual load value is entered using the ◀ and ▲ keys.

Example: Changing 6800 to3600

Load the system with the span's actual load value and allow the display to stabilize.

Press the ENTER key. Maintain the input until End is displayed.

The calibrated span value is stored in nonvolatile memory and the span voltage is displayed for about 4 seconds. Then End will be displayed.

After End is displayed, the span input stops and the normal measurement mode is selected automatically.

Note:

During calibration, the no-load input and actual load input must be stable. If the no-load input is unstable from the moment the ENTER key is pressed up to the moment SPAn is displayed, a calibration error may occur. If the load input is unstable from the moment the ENTER key is pressed up to the moment End is displayed, a calibration error may occur.

### 7.3.3 FCAL mode

In the FCAL mode, zero and span calibration are carried out using an actual load after the minimum division value and maximum weighing capacity have been calibrated.

Start (Normal measurement mode)

While pressing LO, press HOLD ENTER

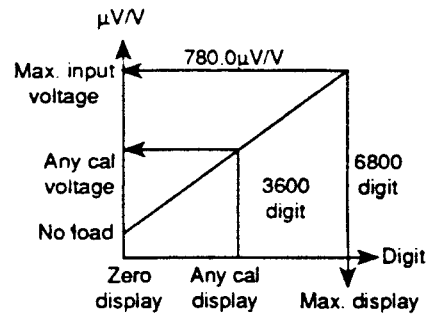
While pressing the ◀ key, press the ENTER key for at least 2 seconds to allow you to select a mode.

FunC

Press the ◀ key three times to display FCAL.

FCAL

Press the ENTER key to select the FCAL mode.




di u

di u is displayed for two seconds, then the current minimum division setting value is displayed, waiting for you to enter a new minimum division value.

2 seconds later

d 1

Using the ▲ key, select a minimum division value from among 1, 2, 5, 10, 20, and 50, then press the ENTER key.

Example: Changing the minimum division from 1 to 50

d 50

CAP

After CAP is displayed for two seconds, the current maximum capacity is displayed automatically, waiting for you to enter a new maximum capacity.

2 seconds later

3600

LO and HI

Using ◀ and ▲ keys, enter your desired maximum capacity and press the ENTER key.

6800

(To change only the minimum division value, press the ZERO key. End will be displayed, then ordinary measurement mode will be selected automatically.)
Example: Changing the maximum capacity from 3600 to 6800

CAL 0

CAL 0 is displayed, then zero calibration mode is selected.

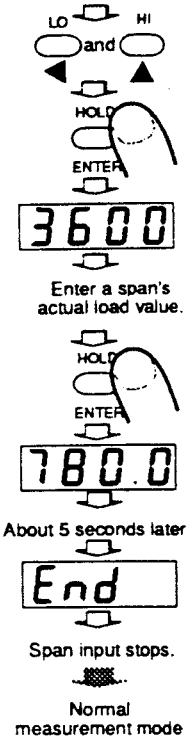
Put the input into the no-load state.

After putting the input in the no-load state, press the ENTER key. Zero calibration will start automatically. Maintain the no-load state during zero calibration. (If you do not need zero calibration, press the ZERO key.)

SPAn

6800

SPAn is displayed for two seconds, then the current span value is displayed, waiting for your to enter the next data. (If you do not need span calibration, press the ZERO key. End will be displayed without performing span calibration.)




Using ◀ and ▲ key, enter your desired span value and press the ENTER key.

Example: Changing from 6800 to 3600.

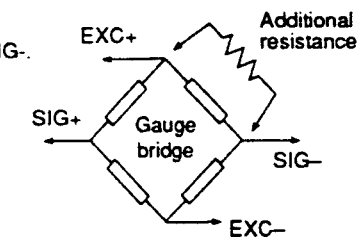
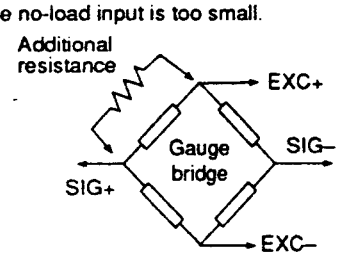
Enter a span's actual load value.

Press the ENTER key. Maintain the input until End is displayed.
The calibrated span value is stored in nonvolatile memory and displayed for about 4 seconds.

Example: Maximum input voltage is 780.0 μV/V.

After End is displayed, the span input stops and the normal measurement mode is selected automatically.

## 7.3.4 Calibration Errors

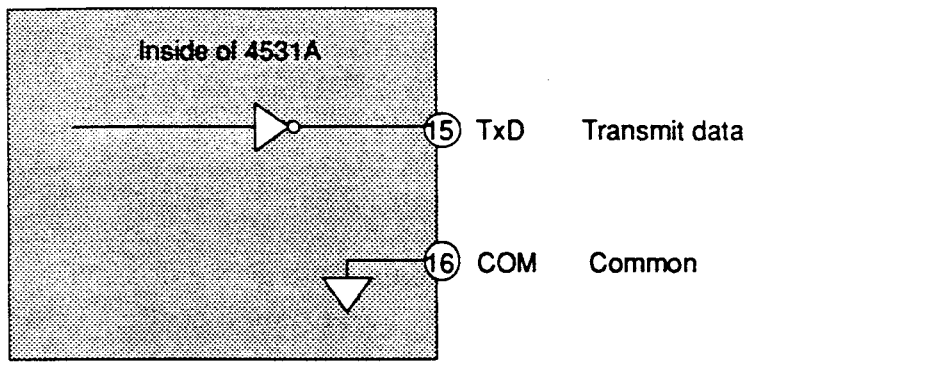
| Code | Explanation and countermeasure |
|---|---|
| Err 1 | The zero calibration range is exceeded in a positive direction. The no-load input is too large.<br>Countermeasure:<br>Connect a resistor of several hundreds kilohms between EXC+ and SIG-.<br>Gauge resistance r = 350 [Ω]<br>Additional resistance m = 300 [kΩ]<br>Voltage applied to bridge E = 5 [V]<br>Compensated voltage m [mV]<br>$w = \left(\frac{m+r}{2m+r} - \frac{1}{2}\right)\ E = \left(\frac{300k+350}{2 \cdot 300k+350} - \frac{1}{2}\right) \cdot 5 = 1.46\ [mV]$<br>  |
| Err 2 | The zero calibration range has been exceeded in a negative direction. The no-load input is too small.<br>Countermeasure:<br>Connect a resistor of several hundreds kilohms between EXC+ and SIG-.<br>Gauge resistance r = 350 [Ω]<br>Additional resistance m = 300 [kΩ]<br>Voltage applied to bridge E = 5 [V]<br>Compensated voltage m [mV]<br>$w = \left(\frac{1}{2} - \frac{m+r}{2m+r}\right)\ E = \left(\frac{1}{2} - \frac{300k+350}{2 \cdot 300k+350}\right) \cdot 5 = -1.46\ [mV]$<br>  |
| Err 3 | The input sensitivity is lower than the minimum input sensitivity of 1.2 μV<br>Increase the input sensitivity.<br>Countermeasure:<br>Change the minimum division setting value. |
| Err 4 | The maximum input voltage exceeds the span calibration range.<br>Countermeasure:<br>Change the maximum measured value. |

If any error occurs during calibration, the AD-4531A will ask you to enter the data again. Enter the data again or switch off the AD-4531A and check the wiring and sensor circuits. When the AD-4531A is switched on again, ordinary measurement mode will be selected automatically.

# 8. Options

## 8.1 OP-04 (RS-232C)

### 8.1.1 Circuit diagram




### 8.1.2 Setting Functions for RS-232C Interface

To use the RS-232C interface, the functions below must be set. See Section 7.2.

| | |
|---|---|
| F-14 | Baud rate (Factory setting: 2400 bps)<br>600 / 2400 bps |
| F-15 | Data bit (Factory setting: 7E)<br>7E: 7 bits, even parity<br>8n: 8 bits, no parity |
| F-16 | Option<br>Select 04 for RS-232C |
| F-20 | Unit for serial output, selected from any of 15 available units |

### 8.1.3 Data format

In the stream mode, measurement data is output continuously whenever the display is updated. However, this may be disabled, depending on the baud rate and display update rate settings.

Output data format

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | W | T | , | ± | 1 | 2 | . | 3 | 4 | CR | LF |
| No decimal point | W | T | , | ± | 0 | 1 | 2 | 3 | 4 | CR | LF |
| When exceeded | O | L | , | ± | 9 | 9 | . | 9 | 9 | CR | LF |

All capital letters. CR = 0DH LF = 0AH

### 8.1.4 Sample Program

Set the following data transmission conditions for the personal computer and the AD-4531A:

| | | |
|---|---|---|
| Baud rate: | 2400 bps | Set F-14 to 2400 bps. |
| Parity: | Even | Set F-15 to 7E (even parity). |
| Data length: | 7 bits | |
| Stop bit: | 1 bit | |
| Option | | (Set F-16 to 04) |

**NEC PC-9801**

The program below is for receiving data and indicate them on the display.

```
10  OPEN "COM:E71NN" AS #1          {RS-232C setting}
20  LINE INPUT #1, DK$              {Buffer memory clear}
30  INPUT #1, HD$, DT$              {Measurement data read}
40  PRINT HD$, DT$                  {Measurement data display}
50  CLOSE
60  END
```

**IBM PS/V (using IBM DOS J5V)**

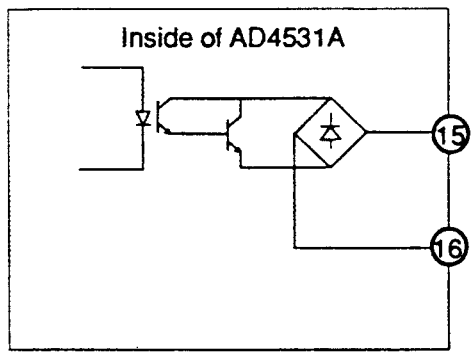
```
10  OPEN "COM1: 2400,E,7,1,DS" AS #1    {RS-232C setting}
20  LINE INPUT #1, DT$                  {Buffer memory clear}
30  INPUT #1, HD$, DT$                  {Measurement data read}

40  PRINT HD$, DT$                      {Measurement data display}
60  GOTO 30
100 END
```

# 8.2 OP-05 (Current loop Output)

The OP-05 option is used to output currents of 0-20mA.
(Transmission format:Start-stop serial data)

### 8.2.1 Circuit diagram




### 8.2.2 Setting

| | |
|---|---|
| F-14 | Baud rate (Factory setting: 2400 bps)<br>600 / 2400 bps |
| F-15 | Data bit (Factory setting: 7E)<br>7E: 7 bits, even parity<br>8n: 8 bits, no parity |
| F-16 | Option<br>Select 05 for RS-232C |
| F-20 | Unit for serial output, selected from any of 15 available units |

### 8.2.3 Data format

The data will be outputed everytime the display is refreshed.

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal | W | T | , | ± | 1 | 2 | . | 3 | 4 | CR | LF |
| No decimal point | W | T | , | ± | 0 | 1 | 2 | 3 | 4 | CR | LF |
| When exceeded | O | L | , | ± | 9 | 9 | . | 9 | 9 | CR | LF |

All capital letters. CR = 0DH LF = 0AH

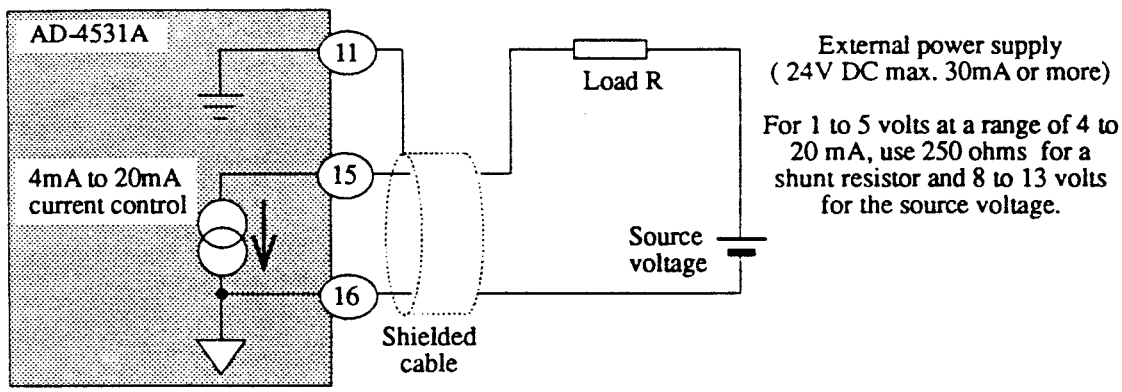
# 8.3 OP-07 (4-20 mA Analog Output)

The OP-07 option is used to output currents of 4-20 mA to pins 15 and 16 instead of outputting voltages of ±9.999 V.

### 8.3.1 Wiring

The OP-07 requires an external power supply, which voltage must be within the range below.

R×20mA+3V<E<R×20mA+8V




### 8.3.2 Setting analog output currents

The OP-07 option outputs 4 mA to 20 mA . To set these currents, enter an offset and scaling value as mentioned below. Convert analog output currents to analog output voltages and enter an offset and scaling value with functions F-12 and F-13.

F-12 Analog output offset

Convert the analog output current (Io) for 0000 (factory setting) to the corresponding analog output voltage and enter it as four digits.

F12 [V] = (Io [mA] - 4.0 [mA]) x 0.125

Examples: To output 4 mA for "0000"display, set F-12 to 0000.

To output 12 mA for "0000" display, set F-12 to 1000.

F-13 (Analog output scaling)

Convert the analog output current per 1000 (display data) to the corresponding voltage and enter it as four digits.

$$F13\,[V] = (I_F\,[mA] - I_o\,[mA]) \times 0.125 \times \frac{1000\,[digits]}{\text{Maximum capacity [digits]}}$$

* $I_F$: the current value at the maximum measurement

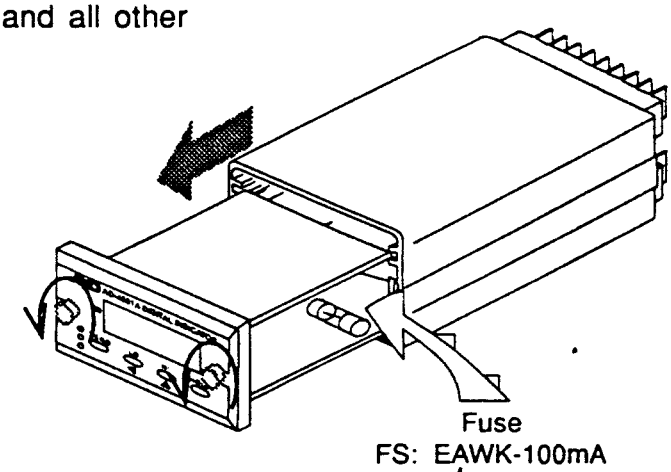
Examples: To output 20 mA when the maximum measured value is "2000", set F-13 to 1000.

To output 20 mA when the maximum measured value is "5000", set F-13 to 0400.

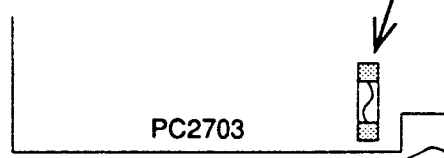
# 9. Maintenance and Inspection

## 9.1 Replacing a Fuse

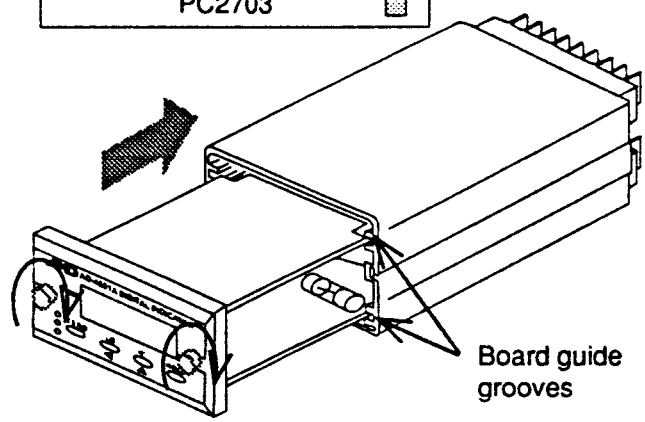
1. Turn off the AD-4531A and all other units connected to it.




2. Replace the 100mA fuse on the power board.



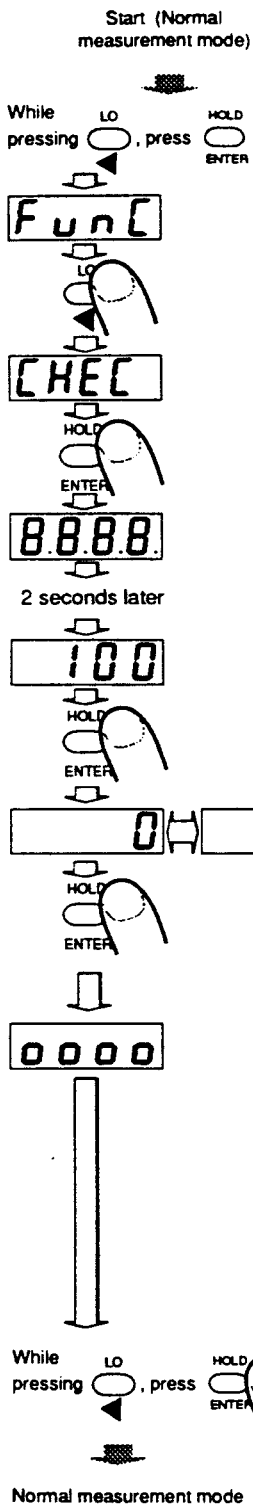

3. Insert the boards fully into the cabinet and tighten the two screws on the front panel.




Note: Insert the boards properly along the guide grooves. Inserting boards at an angle may damage them.

# 9.2 Check Mode

Select check mode to verify the display, analog output, keys, and inputs and outputs.




While pressing the ◀ key, press the ENTER key for at least 2 seconds to allow you to select a mode.

Press the ◀ key to display "CHEC".

Press the ENTER key to enter check mode.

All segments come on for 2 seconds.

The ROM version is displayed.

Pressing the ▲ key will switch the analog output to between 0 V and 2 V.
Press the ENTER key to go to the I/O check.

Pressing the ZERO key will display "1" at the fourth digit position.
Pressing the LO key will display "1" at the third digit position and turn on the LO open collector.
Pressing the HI key will display "1" at the second digit position and turn on the HI open collector.
Pressing the HOLD key will display "1" at the first digit position.

The LO LED lights when the ZERO input terminal on the rear panel is shorted.
The HOLD LED lights when the HOLD input terminal on the rear panel is shorted.

While pressing the ◀ key, press the ENTER key for at least 2 seconds.
The normal measurement mode will be selected again.