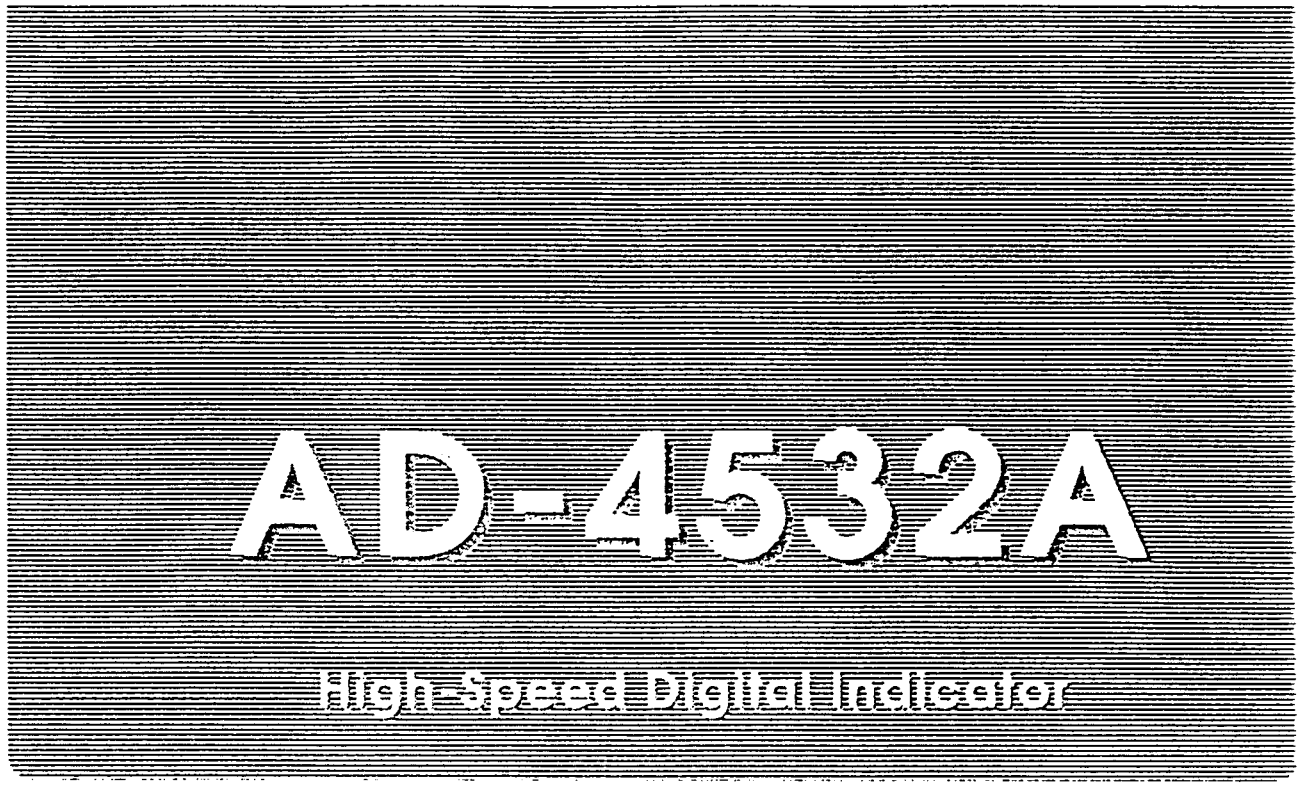


INSTRUCTION MANUAL

Instruction-AD-4532A v.3.a '94.3.24

High-Speed Digital Indicator

A&D Company, Limited

Compliance with FCC Rules

Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are desingned to provide reasonable protection against interference when equipment is operated in a commercial environment. If this unit is operated in a residential area it might cause some interference and under these circumstances the user would be required to take, at his own expense, whatever measures are necessary to eliminate the intrference.

(FCC = Federal Communications Commission in the U.S.A.)

Contents

1. Features

Thank you for purchasing the AD-4532A.

The AD-4532A is a digital indicator used to observe voltage signals from sensors. It has the following features:

1. High-speed conversion

   A 2000 times-per-second high-speed A/D converter is used for inputs from sensors.

   A 2000 times-per-second high-speed D/A converter is used for analog outputs.

   High-speed comparison and peak holding of 2000 times per second are ensured.

2. Calibration without actual load

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

3. Various input sources

   Upper and lower limit values can be input with front panel keys or by using the RS-232C interface with an external computer.

   The front panel keys, contact signals on the rear panel, and the RS-232C port can be used for zero calibration and peak holding.

4. 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.

5. Easy replacement of parts

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

6. Comparison function

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

7. The zero calibration value, upper and lower limit values are held in nonvolatile memory, so that they remain even after the AD-4532A has been switched off.

8. Electromagnetic compatibility (EMC)

9. Stable display and response speeds for various applications

   Two adjustable filters, one for display and the other for the sensors, are used to ensure stable display and to obtain response speeds suited to different applications for your AD-4532A.

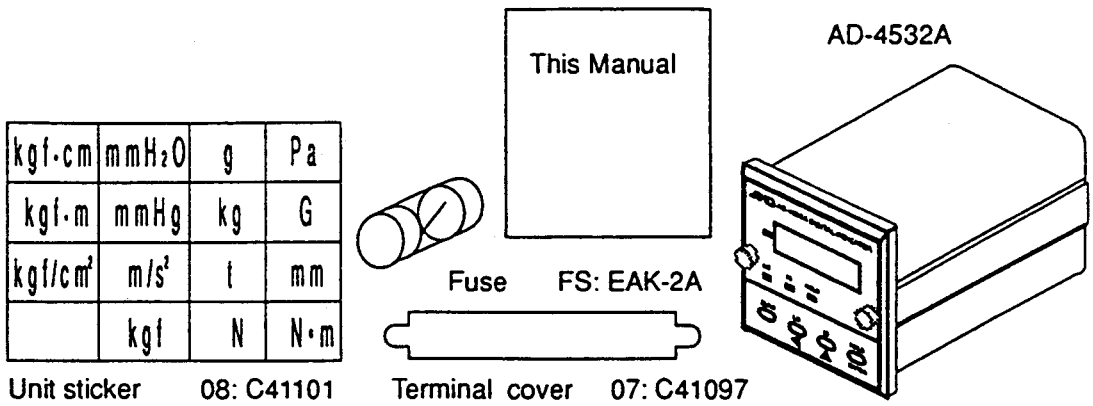
10. Various data output terminals

    Analog and comparator outputs come as standard with the AD-4532A.

    The AD-4532A offers averaging data, digital peak hold data, analog peak hold data, and comparison results (after hysteresis compensation). Optional interfaces available include, a parallel BCD interface, a serial interface (RS-232C) and a 4-20 mA analog output.

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

The carton in which the AD-4532A is delivered contains:



Notes before Use

To get the most from your AD-4532A, please read the notes below thoroughly. Points which are specific to the AD-4532A are given below.

- Avoid water or moisture.
- Avoid vibration, shock, extremely high temperature and humidity, direct sunlight, dust, and air containing salt or sulfurous gases.
- Do not use your AD-4532A in places exposed to inflammable gases, vapors, or dust.
- Connect a grounding wire to the ground terminal.
- Keep cables sensitive to electrical noise away from power cables and other sources of electrical noise.
- Connect a non-inductive load of 5 kΩ or more to the analog output terminals.
- Use 4-core shielded cables to connect sensors. Keep these cables away from power cables and other electrically noisy cables. Since 4-core sensors are used, connecting long cables to the sensors will increase the total cable resistance and cause measurement errors.

Notes during Operation

- Do not try to modify your AD-4532A.
- In any hold mode, the hold data 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-4532A 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 no key has been pressed for 20 seconds during upper/lower limit setting, the preceding data will not be read and the ordinary measurement mode will be selected automatically.
- During calibration, both no-load input and actual load input must be stable. If the inputs are unstable from the moment the ENTER key is pressed to the moment the next data is displayed, a calibration error will occur.

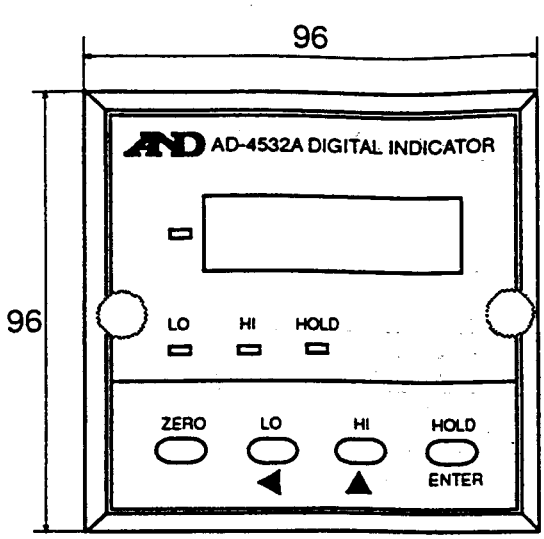
3. Basic Specifications

Number of measurement points	1
Sensor type	Strain gauge sensors (Bridge resistance: 350 or 120Ω)
Sensor power supply	(Bridge voltage: Adjustable with on-board switch)
(1) 350Ω sensor	Voltage applied: 5 VDC (Up to four sensors can be connected.)
(2) 120Ω sensor	Voltage applied: 2.5 VDC (Only one sensor can be connected.)
Calibration method	Digital calibration (automatic calibration by internal operation)

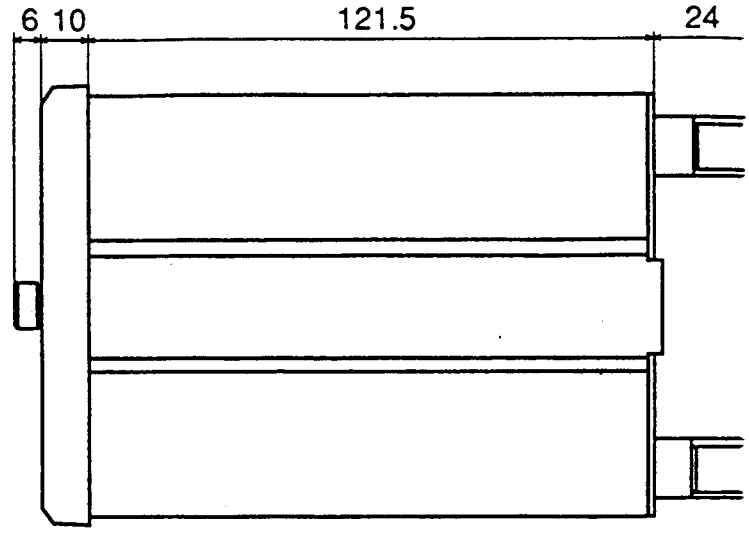
Classification	Name	Method
Method not using an actual load	Digital span	The sensor's rated data is keyed in for the span. Zero sampling establishes zero calibration.
Method using an actual load	CAL mode	An actual load or mean free load is used for zero and span calibration.
	FCAL mode	The minimum division and maximum weighing capacity are set and zero and span calibration is performed using an actual load.

Measurement ranges	
Zero calibration range	± 50% of the calibrated span range
Span calibration range	± 0.25 to 3 mV/V Max. (using 5V) ± 0.5 to 6 mV/V Max. (using 2.5V)
Minimum guaranteed input sensitivity	0.6 μV/d
Minimum guaranteed display sensitivity	0.12 μV/d
Maximum display	± 9999 digit
Linearity	0.05% F.S. ± 1 digit
A/D conversion	2000 times/sec.
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.

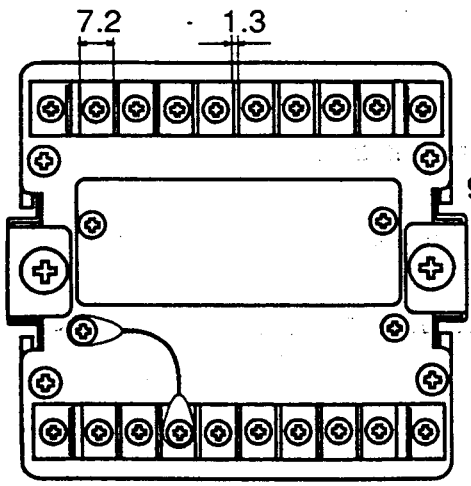
Status indicator LEDs	Three red LEDs representing measurement states (HI, LO, and HOLD)
Keys	Four
Functions	
Comparator function	Allows upper and lower limits to be set and HI and LO signals to be output from the rear panel contacts.
	Contact capacity: 0.1 A at 250 VAC or 0.5 A at 30 VDC
Hold modes	Select from among analog peak hold, digital peak hold, and sample hold modes.
	If a high response is needed, select analog peak hold mode. (Max. 1 kHz)
Analog output	Max. ±10 V (Scaling is enabled by setting values.)
Output resolution	Max. 1/9999
Temperature coefficient	100 ppm/°C
Others	Zero calibration and key disabling functions are also available.
Options	
OP-01	Parallel BCD interface
OP-04	RS-232C interface
OP-07	4-20 mA analog output
General Specifications	
Power requirement	85-265 VAC, 50/60 Hz, 20 VA
Operating temperature and humidity	-5°C to +40°C, Max. 85% RH (noncondensing)
External dimensions	96 x 96 x 155 (W/H/D) (Panel cut: 92 x 92)
Weight	Approx. 900 g



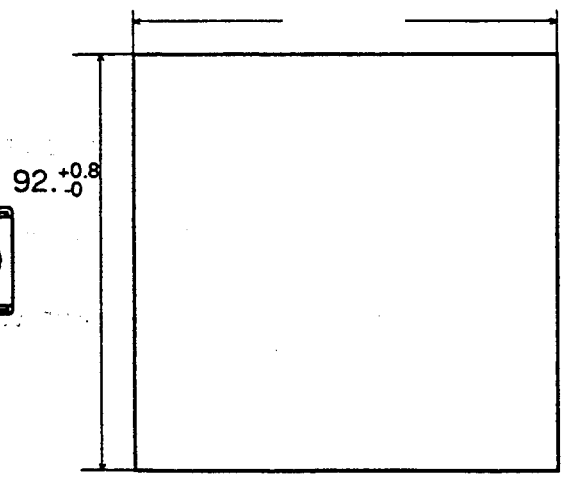
Front Panel



Side

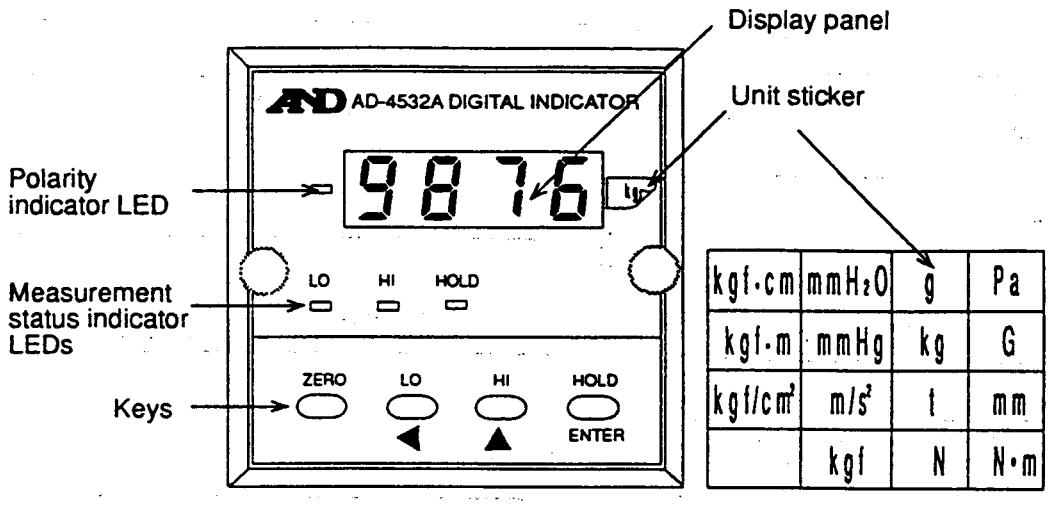


Rear Panel



Panel Cut

4. Front Panel



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

Measurement status indicator LEDs

LO — Lights when the measured value is below 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-4532A with the ZERO key pressed will cancel the zero calibration function.

LO ◀ — Pressing this key will display the set lower limit value and allows 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 a lower or upper limit is enabled.

Pressing this key will display the set upper limit value and allows you to change it.

This key is also used as a ▲ key to increment the digit at the blinking cursor when setting a HI or LO limit.

Pressing this key will start the holding function and turn on the HOLD LED. The type of hold mode to be used can be set in the function mode.

Pressing this key again will stop the holding function.

This key is also used as an ENTER key to store a value when setting the HI or LO limit.

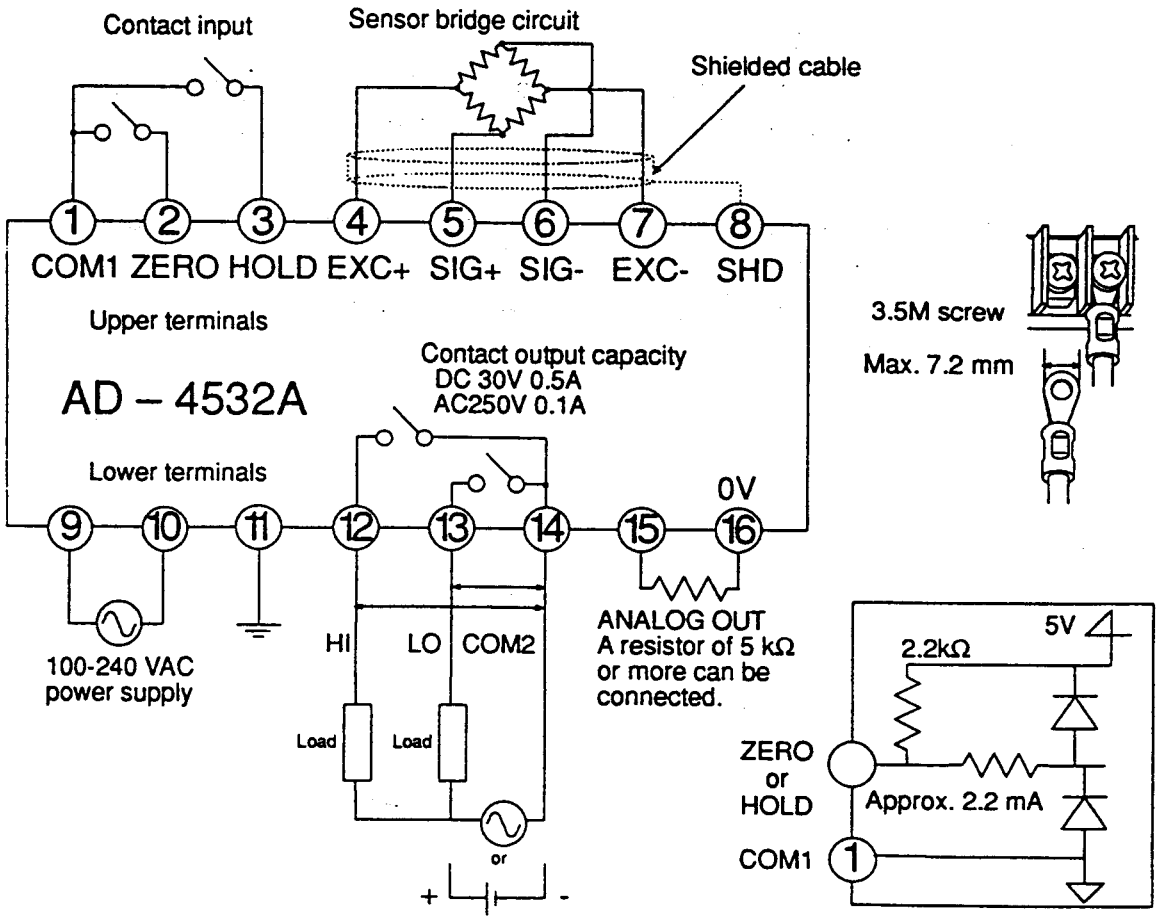
The zero calibration value and upper and lower limit values are stored in nonvolatile memory and remain even after the AD-4532A has been switched off.

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-4532A and all other units connected to it.

2. Connect the ground terminal ⑪ to earth 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 inputl 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 relay output terminals:

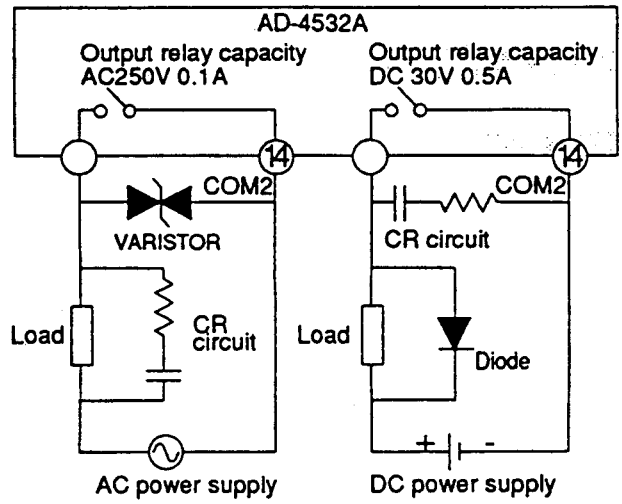
⑫ HI: HI limit relay output which is switched on when the measured value exceeds the set HI limit.

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

⑭ COM2: Relay output common.

Notes: To prevent damage, the rated capacities of the output relays should not be exceeded.

To protect the output relays, use a varistor, CR circuits, and diodes.



Example of adding loads to the output relays

5 Connect a load to the following analog output terminals.

⑮ Analog output terminal

⑯ Analog "0V" terminal for analog output

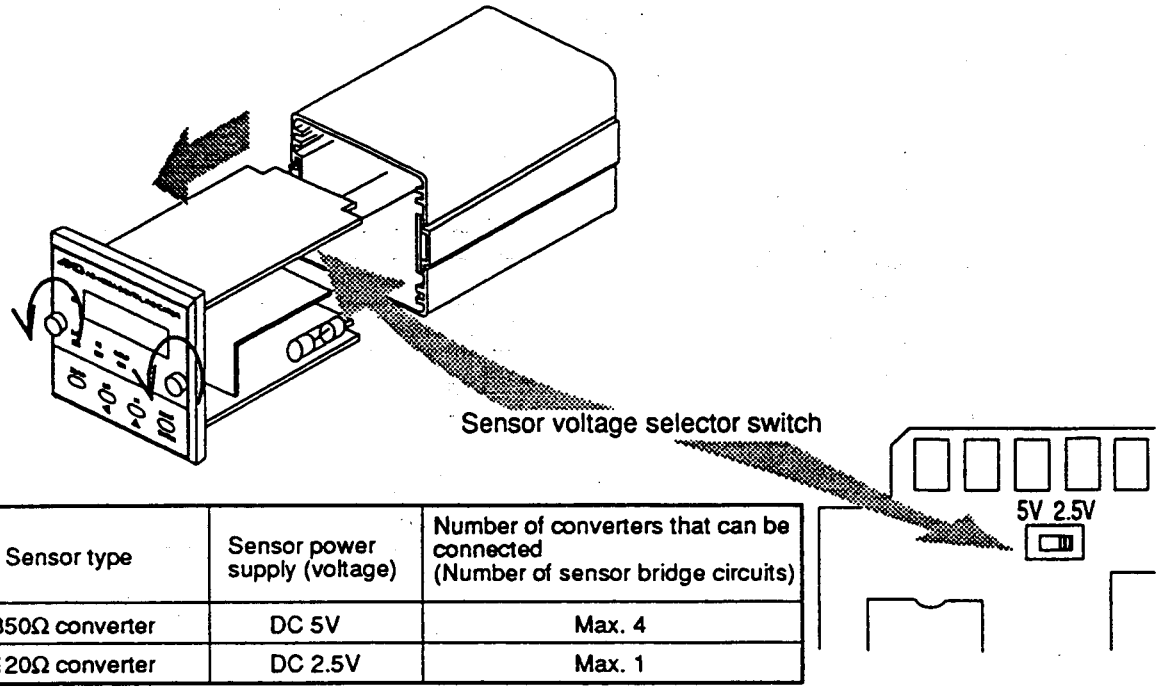
Note: Connect a non-inductive load of 5 kΩ or more to the analog output terminals.

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.

Connect the sensors using the following procedure:

1. Loosen two screws on the front panel of the AD-4532A and withdraw the front panel and boards from the cabinet.



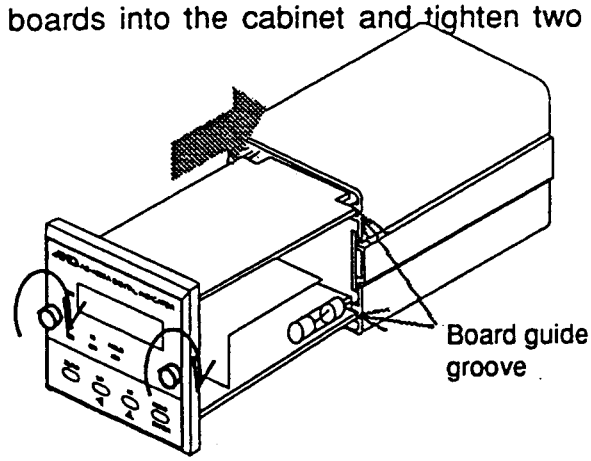
Sensor type	Sensor power supply (voltage)	Number of converters that can be connected (Number of sensor bridge circuits)
350Ω converter	DC 5V	Max. 4
120Ω converter	DC 2.5V	Max. 1

Factory setting: 5 V

2. Select a suitable sensor voltage according to the above table and set the sensor voltage selector switch on the board. If you use a 2.5 VDC type 120Ω sensor to prevent the internal temperature from increasing excessively, pay close attention to the minimum sensitivity because the output voltage is 1/2 that of the 350Ω sensor.
3. Connect the cables to the sensor terminals ④ to ⑧.
   - ④ EXC+: Positive excitation 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 terminal for the sensor
   - ⑧ SHD: Shielded cable connection terminal

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 will increase the total cable resistance and cause measurement errors.

4. Press the front panel and boards into the cabinet and tighten two screws on the front panel.

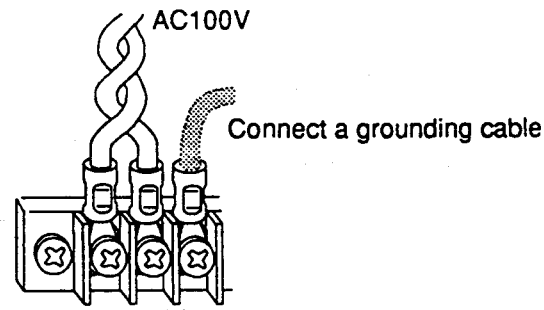


Note: Insert the boards along the guide grooves.

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

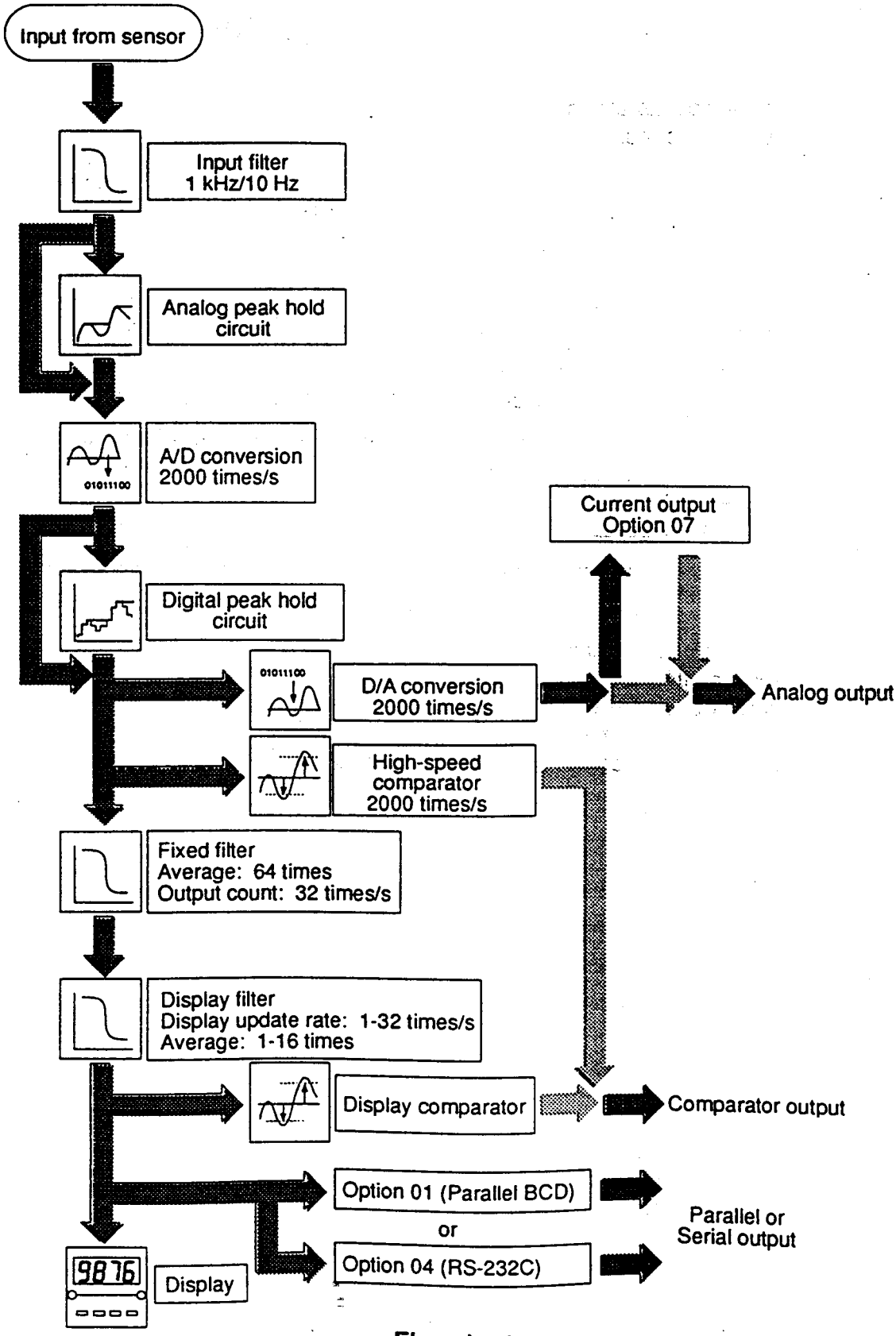
⑨, ⑩ : Connect the power supply cables with crimp type terminals.

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 shows how the functions of the AD-4532A are executed:



Flowchart

Input filter

An analog low-pass filter which removes noise in the inputs from the sensors. A pass band can be selected between 0 ~ 1 kHz and 0 ~ 10 Hz in function mode F-02.

Analog peak hold circuit

A high-speed analog peak hold circuit. It is used to hold the peak of the input signal at a high speed without causing drooping. Note that this circuit can only hold the peaks of positive signals. The hold mode can be selected in function mode F-06.

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. However, since this circuit uses A/D converted data for peak holding, it does not respond to rapidly varying signals.

- ❑ Holding peaks of signals (positive signals only)
- ❑ Holding bottoms of signals (negative signals only)
- ❑ Holding peaks of both positive and negative signals (absolute value data)

A hold mode can be selected in 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-4532A 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.

A high-speed comparator outputs the result of comparisons made 2000 times per second.

Either the display comparator or high-speed comparator can be selected in function mode. (F-07)

Analog output

The measured value from the sensors is processed according to the value 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.

Parallel BCD option (OP-01)

A parallel interface for outputing the display data to an external display or computer. The output can be positive or negative logic selected in the function mode (F-16). The output timming is set along with the display update rate (F-04)

Note: OP-01 and OP-04 can not be installed at the same time.

RS-232C option (OP-04) A serial interface connector allowing external commands to be received and display data to be output serially. Data transfer conditions can be set in the function mode. (F-14, F-15, F-16, F-20)

Note: When the command mode is selected, no serial output will appear until an external command is received.

Analog output option (OP-07)

An option for converting analog outputs to a current (4-20 mA).

6.1 Using Filters

Input filter

An analog low-pass filter which removes noise from the input. The filter can be set to pass up to 10 Hz or 1KHz using function F-02.

The effect of the 10Hz filter is to reduce noise above the 10Hz point. A fast change at the sensorl is responded to as a slowly changing signal going into the A/D converter. This filter is best used to eliminate power line noise. Do not use this setting if you must measure fast changes.

The effect of the 1KHz filter is to reduce noise above the 1KHz point. A change of the load cells actual load in 0.001 of a second will be passed to the A/D converter. Use this filter setting if you must be able to measure fast changes.

Refer to the following table:

	10Hz		1kHz
Noise resistivity	Normal	⟷	High
Response speed	Slow		Fast

Display filter

This filter is used 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	4	8	16	32
1/2	Slow display					Continuous display
1/4						
1/8	Intermittent display					Fast display

6.2 Using Hold (Peak Hold) Modes

Hold modes

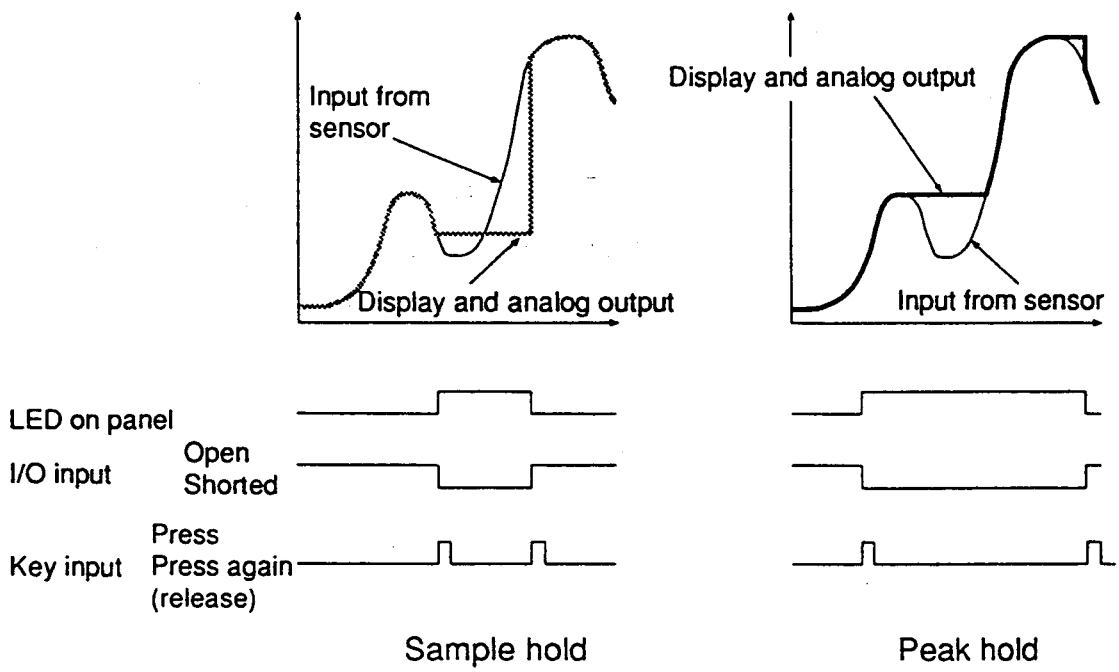
There are three hold modes.

- Sample hold mode in which the display data and analog output are held immediately after receiving a hold input
- Digital peak (bottom) hold mode in which the display data and analog output are held when the measured value (A/D converted digital value) reaches the peak (bottom) after receivng a hold input
- Analog peak hold mode in which the peak of an analog input from the sensors is held and stored in a digital manner

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 it is 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

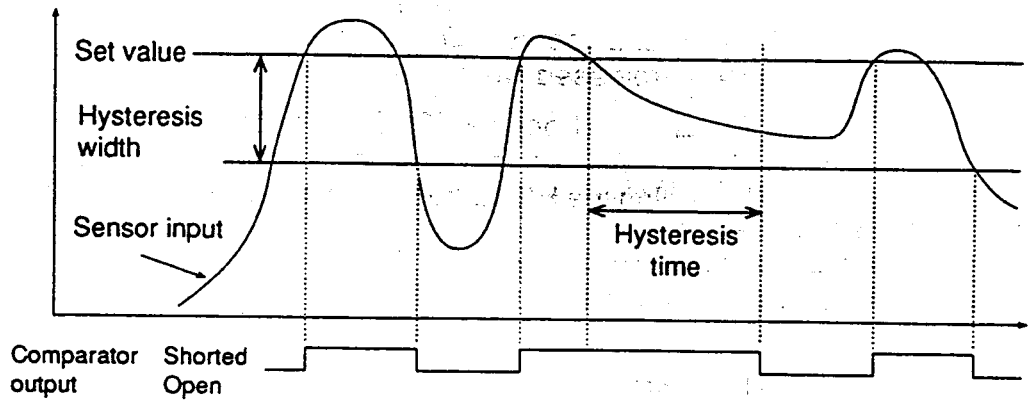
Comparator outputs

Comparison results are output by a high-speed comparator that compares 2000 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 output relay on/off timing to prevent chattering.

When the measured value exceeds the set value, the relay 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 relay is turned off.



The hysteresis direction can be selected. See the next page for diagrams.

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

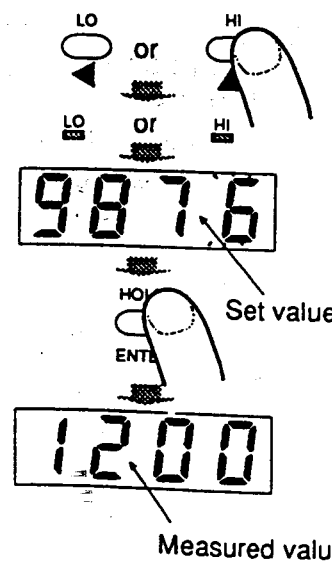
Note: The above function is disabled when the hysteresis time or width is set to 0

Displaying and changing a set upper or lower value

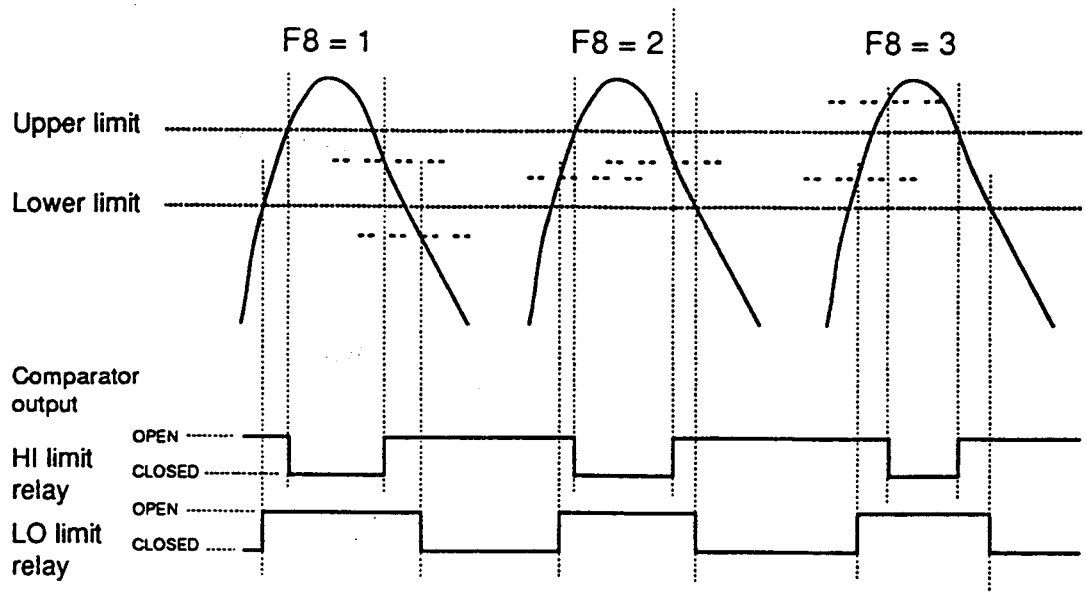
When you press the HI key, the HI LED blinks and the set upper value is displayed.

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 ordinary measurement mode will be selected automatically.



As the input signal from the load cell increases or decreases, the comparator hysteresis can be set to respond as shown in the diagram.

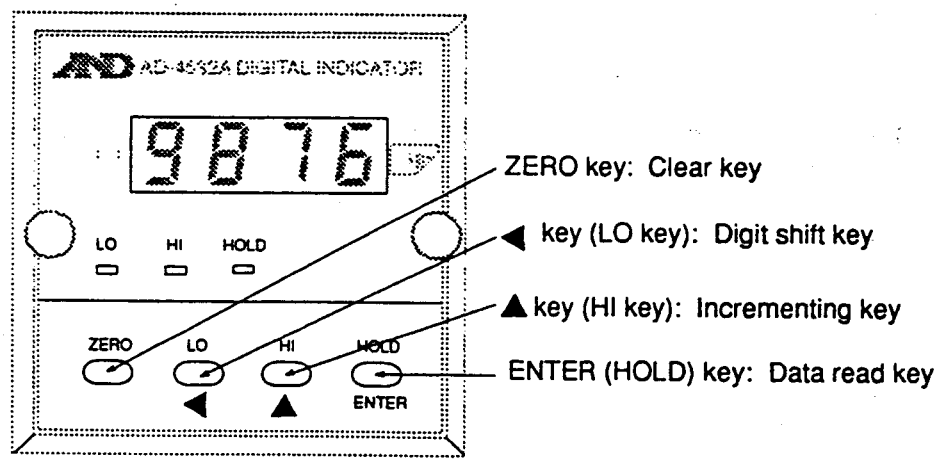


NOTE The HI limit relay closes above the set point and the LO limit relay opens above the set point.

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 ordinary measurement mode to be selected.
ZERO key:	Clears the new 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.

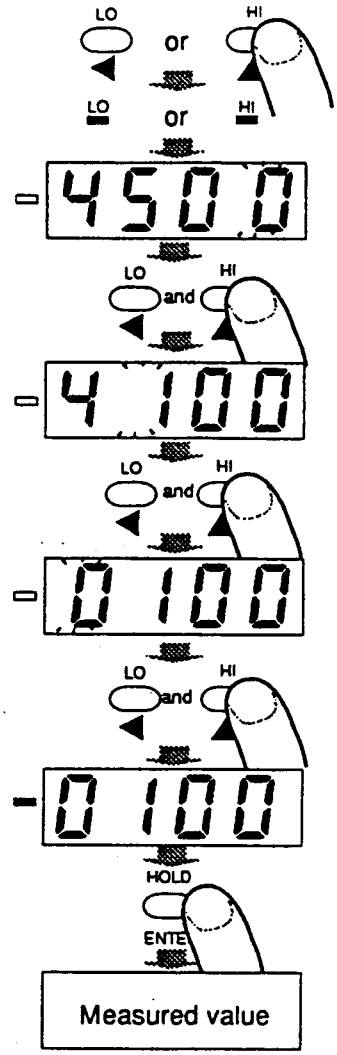
3. Press the ▲ key to change the digit at the blinking cursor to the desired value.

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 and the indicator will return to the measurement mode.

Note: If no key is pressed for 20 seconds during HI/LO limit setting, data will not be read and the indicator will return to the measurement mode.



6.5 Using Analog Outputs

Analog outputs

The measured values from the sensors are processed according to the values set in the function mode, and 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 result held is reflected in the voltage waveform as it is. The analog output response speed depends on the input filter setting.

Note: Connect a load of 5 kΩ or more to the analog output terminals. Do not connect an inductive load.

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 data. Pressing the ENTER key allows new data to be read and ordinary 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 0.000 V to 9.999 V.

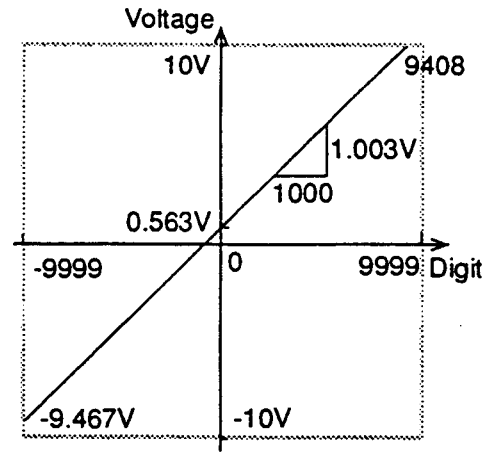
Example: To set 0.563 V, enter 0563.

F-13 (Analog output scaling)

Set the change in the analog output voltage per 1000 (display data). You can set from 0.000 to 9.999 (V).

Example: To set 1003 V, enter 1003.

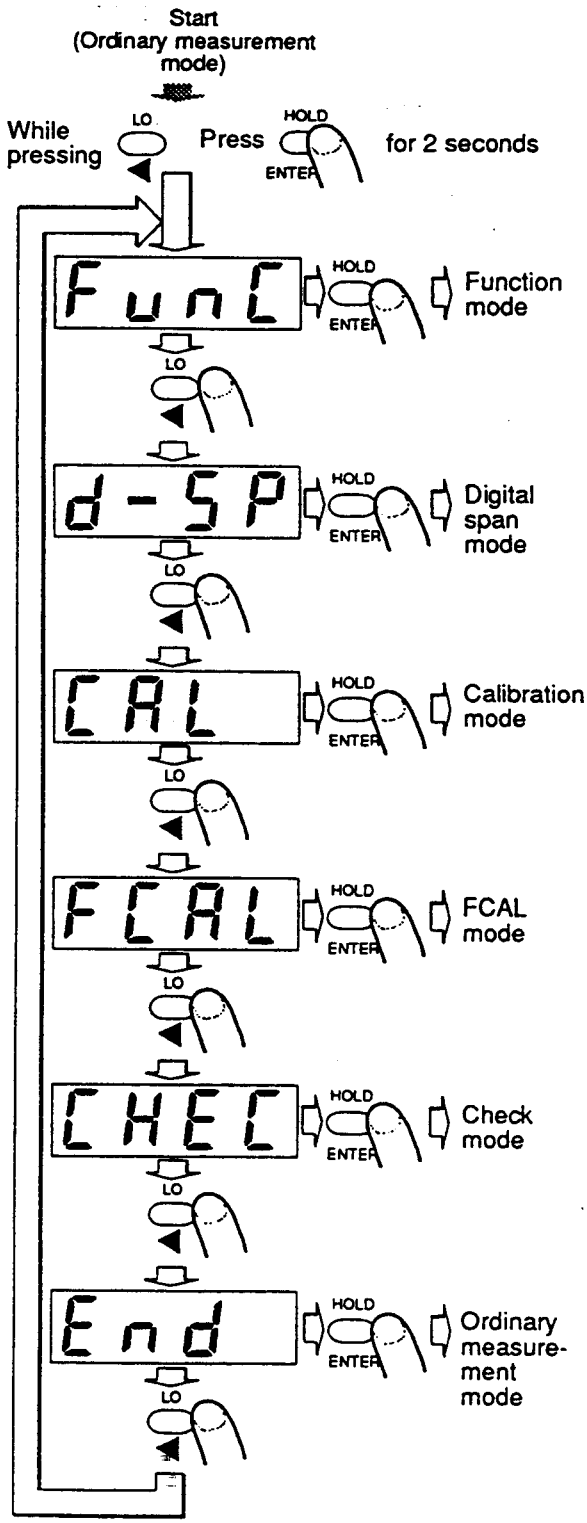
Note: The analog output voltage cannot exceed the measurement range; it is only permissible within the displayable range. The analog output voltage must not exceed ±10 V.



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 capacity
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-4532A 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 relay 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 ordinary measurement mode.

7.2 Function Mode

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

List of Function Modes

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	1kHz, 10Hz	10Hz
F-03	Display filter	None, or averaging time of 1/8 second, 1/4 second, or 1/2 second	1/4 second
F-04	Display update rate	1, 2, 4, 8, 16, or 32 times/second	8
F-05	Zero calibration range	2, 10, 20, 30%	30
F-06	Hold mode	Display SH, high-speed SA, DPH(+), DPH(-), DPH(±), APH(+)	Display SH
F-07	Comparison mode	Internal comparison (2000 times/second), 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, 0.50 or 1.00 second	0
F-10	Hysteresis width	1-99 digit	00
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	±9.999 [V]	0.000
F-13	Analog output	±9.999 [V/1000digit]	1.000
F-14	Baud rate	600/1200/2400/4800/9600	2400
F-15	Data bit	7E, 8N	7E
F-16	Data transfer mode	Stream mode and command mode	Stream
F-17	HI LED comparator and relay	Above upper limit, under lower limit, combined upper and lower limits	100
F-18	LO LED comparator and relay	Above upper limit, under lower limit, combined upper and lower limits	001
F-19	Zero tracking	9 (digits/0.5 sec) ~ 1 (digit/2 sec)	OFF
F-20	Unit for serial output	There are 15 kinds of units	None

DPH : Digital Peak Hold , APH : Analog Peak Hold , SH: Sample Hold

Keys Used

▲ Key: The ▲ key is an incrementing key used to select your desired item or data.

ENTER key: When an item is displayed, press the ENTER key to set the data for this item. When data is displayed, pressing the ENTER key allows the data be read as a set value and allows you to set next data. Data is stored in the nonvolatile memory only when 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.

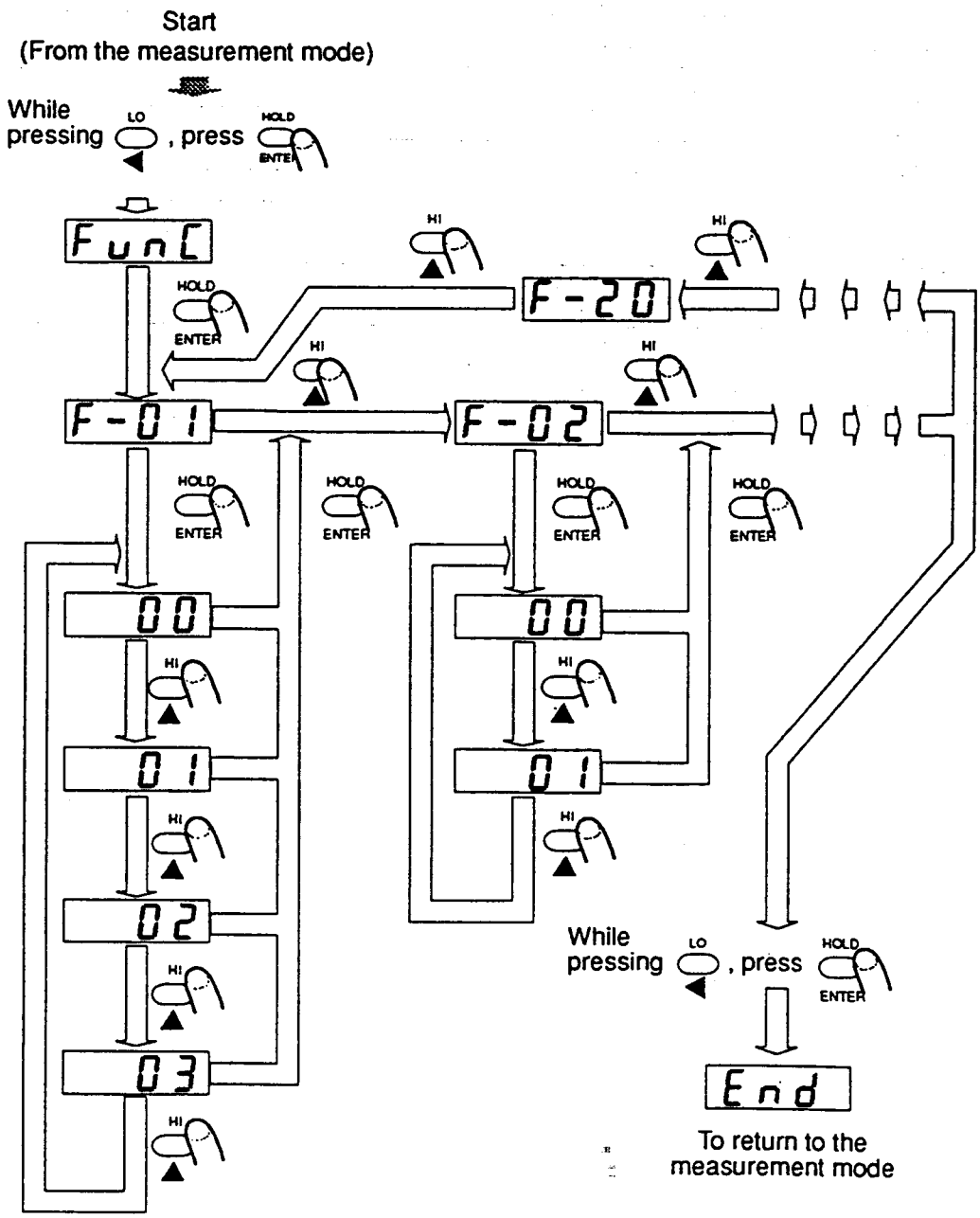
Settings Related to Basic Operations

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 Input filter pass bandpass (Factory setting: 1)

Display data	Setting
0	1 kHz
1	10 Hz



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

Display data	Setting
0	No filtering
4	Averaging time of 1/8 second
8	Averaging time of 1/4 second
16	Averaging time of 1/2 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
32	32 times/second

F-05 Zero calibration range (3% of maximum capacity) (Factory setting: 30)

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. Holds the display when a HOLD signal is input or if the HOLD key is pressed.
2	Digital peak holding. Holds the maximum value of the digital data when a HOLD signal is input.
3	Digital bottom holding. Holds the minimum value of the digital data when a HOLD signal is input.
4	Digital peak holding for positive and negative signals. Holds the absolute value of the digital data when a HOLD signal is input.
5	Analog peak holding of positive signals only .

F-07 Comparison mode (Factory setting: 1)

Display data	Setting
0	Internal comparison Makes comparison at a sampling rate of 2000 times/second.
1	Display comparison 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: 0)

Display data	Setting
0	0: Hysteresis is not used. 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. Disables the holding function of the HOLD key. Disables monitoring of upper and lower limit values. Disables modification of upper and lower limit values.
1 0 0 1	Example: 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 0000 (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.

F-14 Baud rate (Factory setting: 2400)

Display data	Setting
600	600bps
1200	1200bps
2400	2400bps
4800	4800bps
9600	9600bps

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 Data transfer mode (Factory setting: 0)

Display data	Setting	
0	Stream mode	Use only with OP-04 installed
1	Command mode	
2	Negative logic BCD	Use only with OP-01 installed
3	Positive logic BCD	

F-17 Hi relay output and HI LED indication (Factory setting: 100)

Display data	Settings for operation of HI LED and HI relay
000 ←	If you set 1, the comparator output is active (relay is closed) when the data is lower than the LO limit setting If you set 1, the comparator output is active (relay is closed) when the data is between the LO limit setting and the HI limit setting If you set 1, the comparator output is active (relay is closed) when the data is higher than the HI limit setting

F-18 LO relay output and LO LED indication (Factory setting: 001)

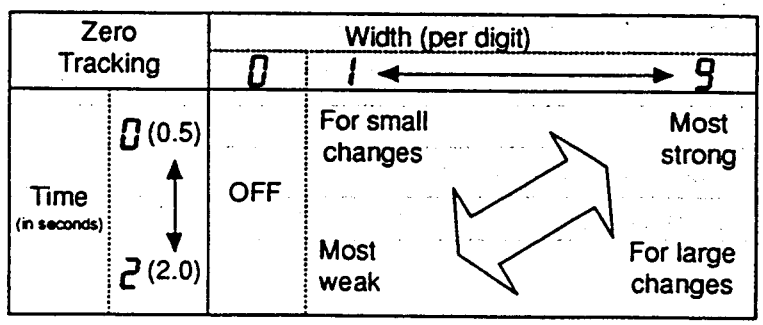
Display data	Settings for operation of LO LED and LO relay
000 ←	If you set 1, the comparator output is active (relay is open) when the data is lower than the LO limit setting If you set 1, the comparator output is active (relay is open) when the data is between the LO limit setting and the HI limit setting If you set 1, the comparator output is active (relay is open) when the data is higher than the HI limit setting

F-19 Zero tracking — Factory setting: 00

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

The AD-4532A tracks and can correct for zero drift caused by changes in temperature, humidity, air pressure, etc. The display is re-zeroed if the width is set to 1 or more, and will correct for changes of less than 1 division. 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.



Caution

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 actual zero load is measured and the span data is keyed in. Calibration is performed without using any span load.

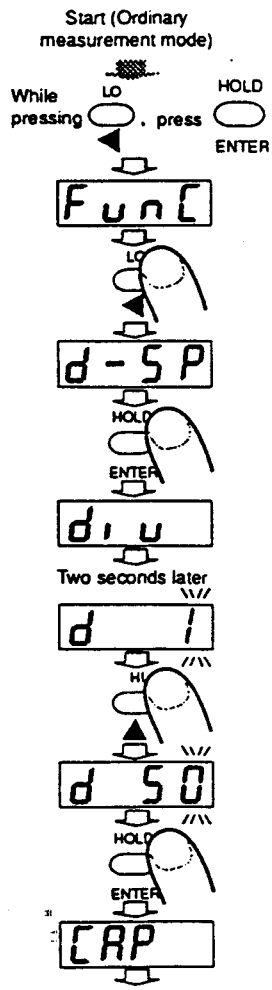
CAL Calibration mode in which zero and span calibration are carried out using an actual load. Used primarily for re-calibration where the minimum division and maximum capacity are already set.

FCAL Calibration mode in which zero and span calibration are carried out using an actual load after the minimum division value and maximum capacity have been set. Used for initial calibration and where the capacity or minimum division must be set.

7.3.1 Digital span mode

For the purpose of explanation lets assume that the indicator was checked in a laboratory using a 3600 3mV/V sensor loaded to 3600. The **FCAL** procedure was used and it was noted that the sensors actual output with the 3600 load was 3.005mV/V. These will appear in the procedure as the current values.

The digital span procedure allows the system to be calibrated to a sensor that has been certified prior to installation to a specific value. In this procedure the indicator will be set to 6800 at 0.780mV/V.



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**.

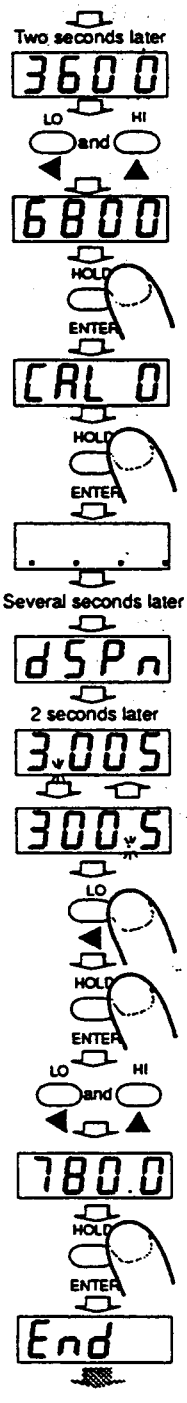
Press the ENTER key to select **d-SP** mode.

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

CAP is displayed for two seconds.



Next, the current maximum capacity is displayed automatically, waiting for you to enter a new maximum capacity.

(To change only the minimum division value, press the ZERO key. End will be displayed and the balance will return to the weighing mode.)

Using the ◀ and ▲ keys, enter the maximum capacity of the new sensor and press the ENTER key.

Example: Changing the maximum capacity from the current value of 3600 to the new value 6800

CAL 0 is displayed to allow you to start zero calibration.

With the load sensor connected and in a no-load state, press the ENTER key. Zero calibration will start automatically. Maintain the no-load state during zero calibration.

"...." is displayed to indicate that zero calibration is being performed.

dSPn is displayed for 2 seconds. Select the decimal point position for the new input voltage.

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.

Set the decimal position with the ◀ key, and then press the ENTER key.

The equation shown below gives the maximum input voltage (mV/V) from the sensors.

Using the ◀ and ▲ keys, enter the calculated maximum input voltage. Then, press the ENTER key.

Example: Changing 3.005 mV/V (from the previous calibration) to 780.0 μV/V (the value for the sensor at 6800)

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

$$\text{Maximum input voltage (mV/V)} = \text{Rated output (mV/V)} \times \frac{\text{Maximum measurement value}}{\text{Rated load}}$$

7.3.2 CAL Mode

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

Start (Ordinary measurement mode)

While pressing LO, press HOLD ENTER

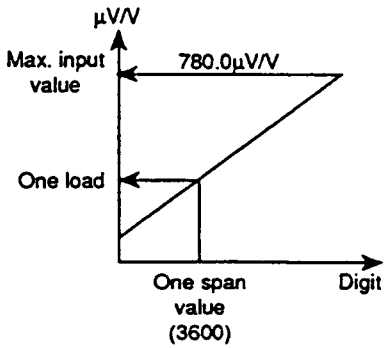
While pressing the ◀ key, press the ENTER key for at least 2 seconds to allow you to select a mode.

FunC

Press the ◀ key twice to display CAL.

CAL

Press the ENTER key to select CAL mode.



CAL 0

Put the input into the no-load state.

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. (See "Note" at the bottom of the page)
(If you do not need zero calibration, press the ZERO key. Span calibration will start without carrying out zero calibration. This span calibration is performed with reference to the zero point adjusted previously.)

Several seconds later

"...." is displayed to indicate that zero calibration is being carried out. (It takes a maximum of 10 seconds to complete zero calibration.)

SPAn

2 seconds later

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.)

3600

LO and HI ◀ ▲

Enter the measurement value to be displayed when an actual load value is entered using the ◀ and ▲ keys.
Example: Changing 3600 to 6800

6800

Enter a span's actual load value.

Enter a span's actual load value.

Press the ENTER key. Maintain the input ". . . . . " will be displayed.
The calibrated span value is stored in nonvolatile memory and the maximum input voltage will be displayed for about 4 seconds.

780.0

About 10 seconds later

Example: 780.0µV/V is displayed.

End

Span input stops.

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

Ordinary measurement mode

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.

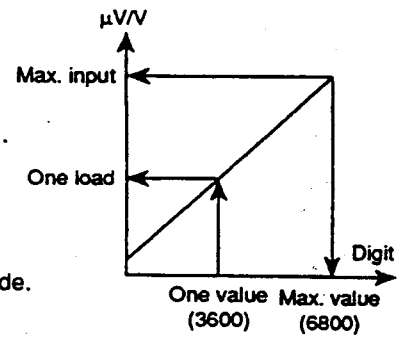
Start (Ordinary measurement mode)

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.

800

(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.)
"...." is displayed to indicate that zero calibration is being carried out. (It takes a maximum of 10 seconds to complete zero calibration.)

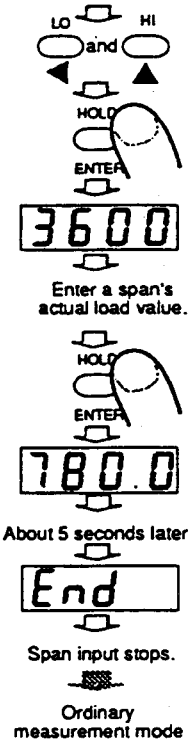
Several seconds later

SPAn

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.)

2 seconds later

6800



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

Example: Changing from 6800 to 3600.

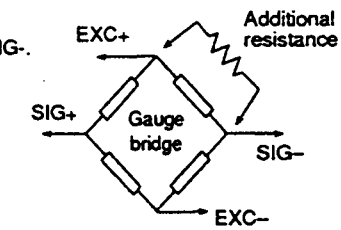
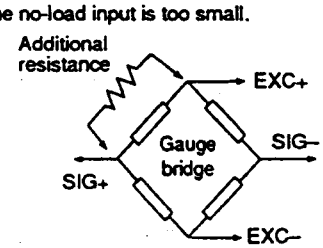
Enter a span's actual load value.

Press the ENTER key. Maintain the input ". . . . . " will be displayed.
The calibrated span value is stored in nonvolatile memory and the maximum input voltage will be displayed for about 4 seconds.

Example: 780.0 μV/V is the maximum input value

After End is displayed, the span input stops and the ordinary 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. Countermeasure: Connect a resistor of several hundreds kilohms between EXC+ and SIG-. Gauge resistance r = 350 [Ω]5 Additional resistance m = 300 [kΩ] Voltage applied to bridge E = 5 [V] Compensated voltage m [mV] $w = \left(\frac{1}{2}\ \frac{m+r}{2m+r}\right)\ E = \left(\frac{300k+350}{2 \cdot 300k+350} - \frac{1}{2}\right) \cdot 5 = 1.46\ [mV]$ 
Err 2	The zero calibration range has been exceeded in a negative direction. The no-load input is too small. Countermeasure: Connect a resistor of several hundreds kilohms between EXC+ and SIG-. Gauge resistance r = 350 [Ω]5 Additional resistance m = 300 [kΩ] Voltage applied to bridge E = 5 [V] Compensated voltage m [mV] $w = \left(\frac{1}{2} - \frac{m+r}{2m+r}\right)\ E = \left(\frac{1}{2} - \frac{300k+350}{2 \cdot 300k+350}\right) \cdot 5 = -1.46\ [mV]$ 
Err 3	The input sensitivity is lower than the minimum guaranteed input sensitivity of 0.12 μV (at 2.5 V) or 0.24 μV (at 5V). Increase the input sensitivity. Countermeasure: Change the minimum division setting value.
Err 4	The maximum input voltage exceeds the span calibration range. Countermeasure: Change the maximum capacity.

If any error occurs during calibration, the AD-4532A will ask you to enter the data again. Enter the data again or switch off the AD-4532A and check the wiring and sensor circuits. When the AD-4532A is switched on again, ordinary measurement mode will be selected automatically.

8. Options

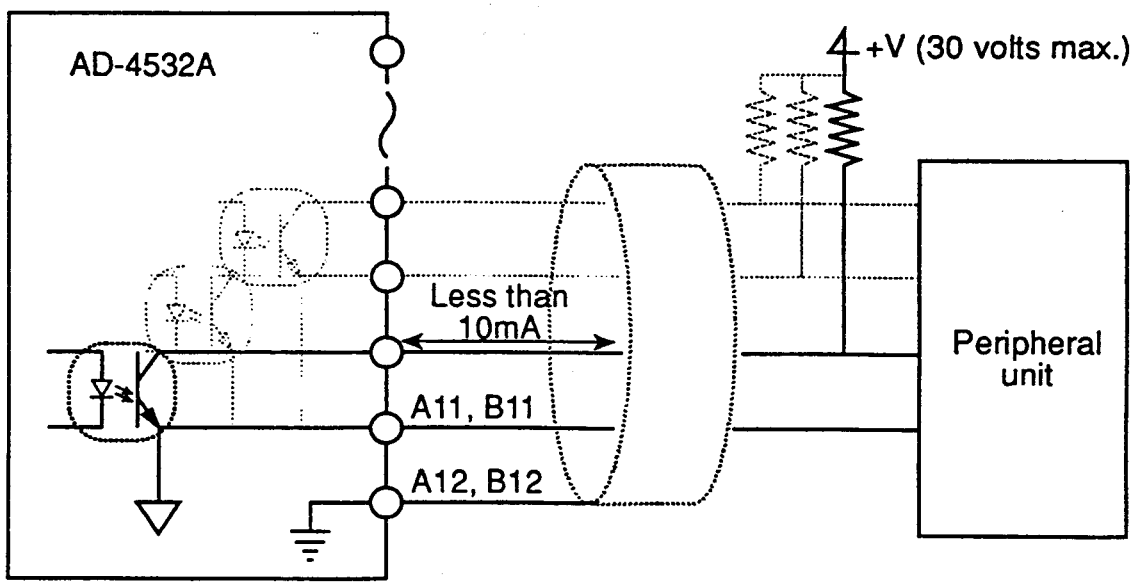
Note: Options 01 (parallel BCD) and 04 (serial) can not be installed at the same time.

8.1 OP-01 (Parallel BCD)

Output pin connections

Pin No.	Description	Pin No.	Description
A1	1 X 10^0	B1	1 X 10^2
A2	2 X 10^0	B2	2 X 10^2
A3	4 X 10^0	B3	4 X 10^2
A4	8 X 10^0	B4	8 X 10^2
A5	1 X 10^1	B5	1 X 10^3
A6	2 X 10^1	B6	2 X 10^3
A7	4 X 10^1	B7	4 X 10^3
A8	8 X 10^1	B8	8 X 10^3
A9	Polarity (+)	B9	Overload
A10	Print command	B10	N.C.
A11	Common ground	B11	Common ground
A12	Frame ground	B12	Frame ground

Circuit



The parallel BCD output is from isolated open-collector transistors

8.1.2 BCD Settings

The data logic for the BCD output is set using the function F-16. The output can be negative or positive logic.

Positive logic

Output	Voltage	Transistor
0	LO	ON
1	HI	OFF

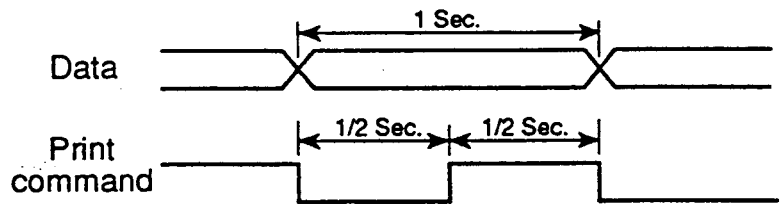
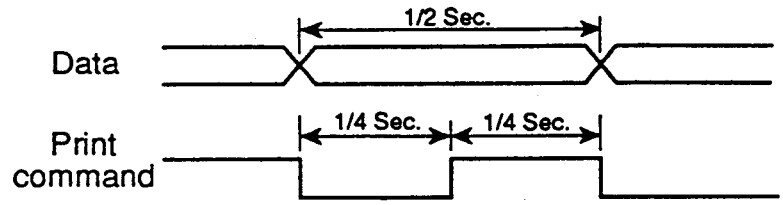
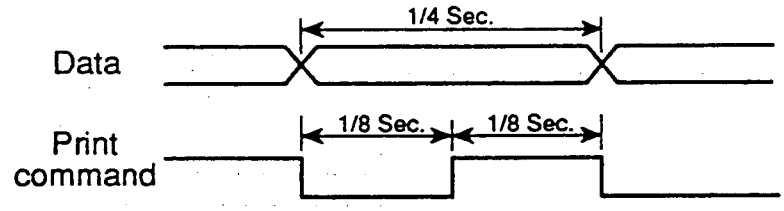
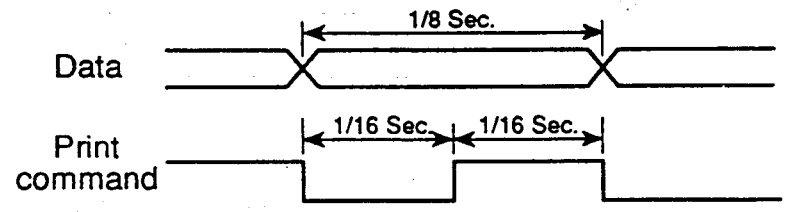
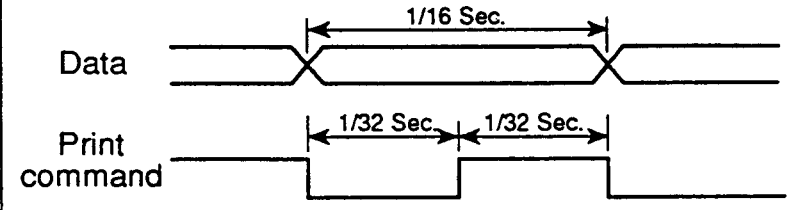
Negative logic

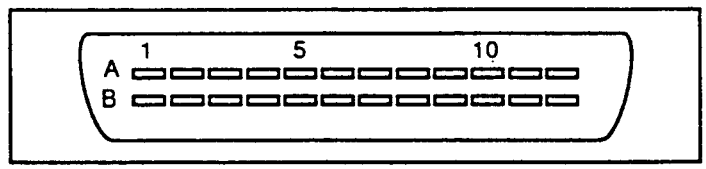
Output	Voltage	Transistor
0	HI	OFF
1	LO	ON

8.1.3 BCD Output

BCD and display timing.

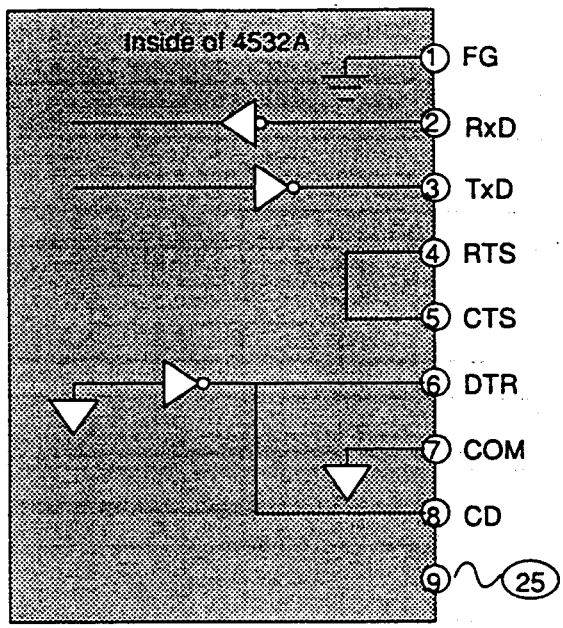
Note: The update rate for 16 and 32 times per second are the same.

Display update rate (F-04)	BCD data timing and print command
1 time per sec.	
2 times per sec.	
4 times per sec.	
8 times per sec.	
16 times per sec.	
32 times per sec.	



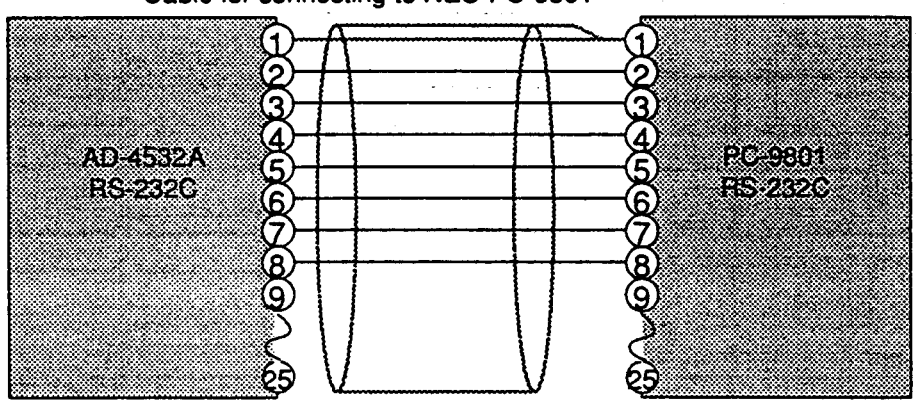
BCD output connector viewed from the rear panel

8.2 OP-04 (RS-232C)



1	FG	Frame ground
2	RxD	Receive data
3	TxD	Transmit data
4	RTS	Request to send (Connected to CTS internally)
5	CTS	Clear to send (Connected to RTS internally)
6	DTR	+10 V
7	COM	Common
8	CD	+10 V
9	25	N. C.

Cable for connecting to NEC PC-9801



Connector specifications: D-sub, 25-pin

Recommended connectors: 17JE-23250-02 (D8X) Daiichi Denshi Kogyo (DDK)
or equivalent

8.2.2 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) 600-9600 bps
F-15	Data bit (Factory setting: 7E) 7E: 7 bits, even parity 8n: 8 bits, no parity
F-16	Data transfer mode (Factory setting: Stream) 0: Stream 1: Command
F-20	Unit for serial output, selected from any of 15 available units

8.2.3 Stream Mode

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
When exceeded	O	L	.	±	9	9	.	9	9	CR	LF

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

8.2.4 Command mode

Setting F-16 to 1 allows the commands listed below to be executed. Since the AD-4532A uses a half-duplex transmission system, commands cannot be received during data transmission.

Commands

Measurement Data Request command

R	CR	LF

Transmits data in the same output format as stream mode.

Zero command

Z	CR	LF

Performs zero calibration and returns | Z | CR | LF |. If the zero calibration range is exceeded, | I | CR | LF | is returned. (See the F-5 setting.)

Hold On command

H	CR	LF

Turns on the hold function and returns | H | CR | LF | .

Hold Off command

C	CR	LF

Turns off the hold functions and returns | H | CR | LF |. If the hold functions is turned on by a HOLD signal from the I/O input terminal, | I | CR | LF | is returned with the hold function turned on.

Upper/Lower Limit Send command

S	CR	LF

Outputs the current upper and lower limits.

S	,	±	1	2	.	3	4	,	±	4	3	.	2	1	CR	LF

Lower limit Upper limit

Upper/Lower Limit Change command

S	,	±	1	2	.	3	4	,	±	4	3	.	2	1	CR	LF

The received values are stored as the new upper/lower limits. After reception, the new set values are returned.

S	,	±	1	2	.	3	4	,	±	4	3	.	2	1	CR	LF

Lower limit Upper limit

If the data is invalid, | I | CR | LF | is returned.

In cases other than above, | ? | CR | LF | is returned.

8.2.5 Sample Program (PC-9801)

Set the following data transmission conditions for the personal computer and the AD-4532A:

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	
Data transfer mode		(Set F-16 to 1 (command).

The program below is for receiving data once after performing zero calibration. If an error occurs, an error message is displayed on the display panel.

```
 10 OPEN "COM:E71NN" AS #1          {RS-232C setting}
 20 PRINT #1, "Z"                   {Zero calibration request}
 30 LINE INPUT #1, AK$
 40 IF AK$ <> "Z" THEN *ERROR       {Reception of data other than Z if an
                                     error occurs}
 50 FOR I=1 TO 1000: NEXT  I        {Stabilization wait time}
 60 PRINT #1, "R"                   {Measurement request}
 80 INPUT #1, HD$, DT$
 90 PRINT HD$, DT$                  {Measurement data display}
100 CLOSE
110 END
120 *ERROR
130 PRINT "ERROR HAS OCCURED"       {Error message}
140 CLOSE
150 END
```

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 0-10 V.

8.3.1 Setting analog output currents

The OP-07 option outputs 4 mA for 0 V and 20 mA for +10 V. To change 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 for 0000 (factory setting) to the corresponding analog output voltage and enter it as four digits.

Voltage [V] = (Current [mA] - 4.0 [mA]) x 0.625

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

To display "0000" for 12 mA, set F-12 to 5000.

F-13 (Analog output scaling)

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

$$\text{Voltage [V]} = (\text{Current [mA]} - 4.0\ \text{[mA]}) \times 0.625 \times \frac{1000\ \text{[digits]}}{\text{Maximum capacity [digits]}}$$

Examples: To display the maximum data "2000" for 20 mA, set F-13 to 5.000.

To display the maximum data "5000" for 20 mA, set F-13 to 2.000.

9. Maintenance and Inspection

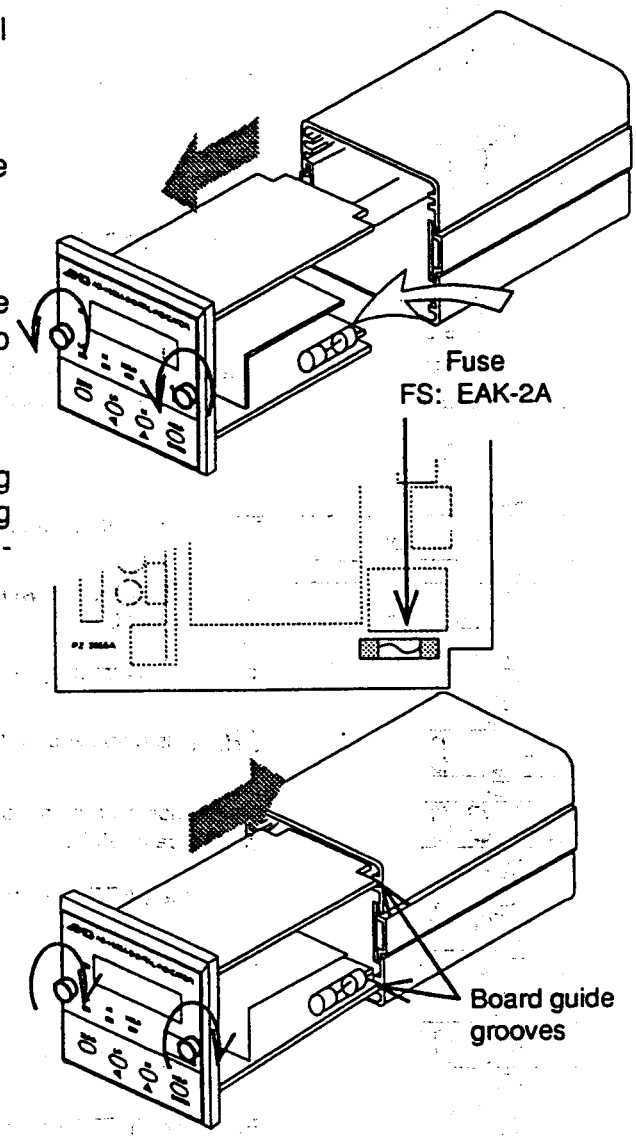
9.1 Replacing a Fuse

1. Turn off the AD-4532A and all other units connected to it.

2. Replace the 2A fuse on the power board.

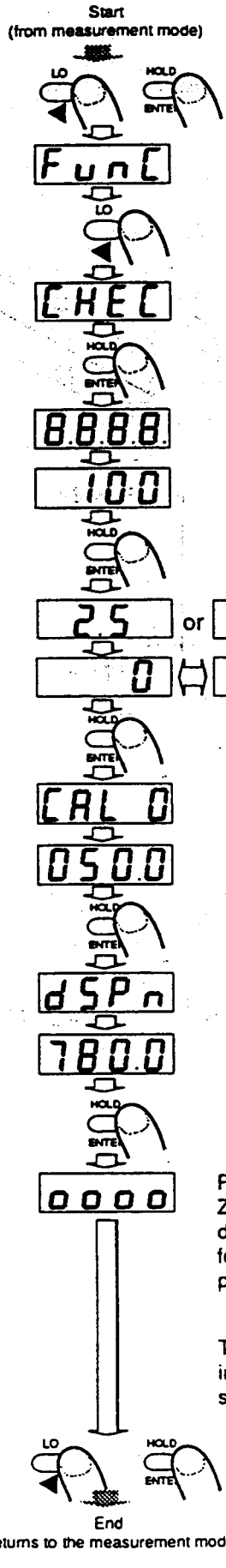
3. Insert the boards fully into the cabinet and tighten the two screws on the front panel.

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



9.2 Check Mode

Select the check mode to verify each function.



Press and hold the ◀ key and the ENTER key until FunC is displayed. Release both keys.

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.
Press the ◀ key to display the voltage applied.

The voltage applied to the sensor is displayed for 2 seconds.

Pressing the ▲ key will switch the analog output to between 0 V and 10 V.

Press the ENTER key to go to the CAL 0 check.

CAL 0 is displayed for two seconds

Calibration zero point voltage is then displayed
(In this case 50.0μV/V)

Press the ENTER key to go to the next step.

dSPn is displayed for two seconds

Calibration span point voltage is then displayed
(In this case 780.0μV/V)

Press the ENTER key to go to the next step.

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 make the LO relay output.

Pressing the HI key will display "1" at the second digit position and make the HI relay output.

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 indicator will return to the measurement mode.

A&D Company, Limited
3-23-14 Higashi-Ikebukuro, Toshima-ku, Tokyo 170 JAPAN
Telephone: [81] (03) 5391-6132 Fax: [81] (03) 5391-6148

A&D ENGINEERING, INC.
1555 McCandless Drive, Milpitas, CA. 95035 U.S.A.
Telephone: [1] (408) 263-5333 Fax: [1] (408) 263-0119

A&D INSTRUMENTS LTD.
Abingdon Science Park, Abingdon, Oxford OX14 3YS ENGLAND
Telephone: [44] (0235) 550420 Fax: [44] (0235) 550485

〈German Sales Office〉
Genfer Straße 6, Niedereschbach 6000 Frankfurt 50 GERMANY
Telephone: [49] (069) 507 1017 Fax: [49] (069) 507 2054

A&D MERCURY PTY. LTD.
32 Dew Street, Thebarton, South Australia 5031 AUSTRALIA
Telephone: [61] (08) 352-3033 Fax: [61] (08) 352-7409

A&D KOREA Limited
Seongmi Building 2/3F, 740-18 Panpo-1dong, Seocho-ku, Seoul, KOREA
Telephone: [82] (02) 517-4101 Fax: [82] (02) 546-4264