

AD-4328

OP-01/02/03/04

WEIGHING INDICATOR

INSTRUCTION MANUAL

AND
A&D Company, Limited

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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 designed 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 interference.
(FCC = Federal Communications Commission in the USA.)

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1. INTRODUCTION

The AD-4328 is a weighing indicator that amplifies, performs A/D conversion of the load cell output, and gives a digital display of the weight value.

2. INSTALLATION & POWER SUPPLY

2-1 INSTALLATION

The AD-4328 is a precision electronic instrument, and requires careful handling. The operating temperature range is -10°C to $+40^{\circ}\text{C}$. It should be installed where it will not be exposed to direct sunlight.

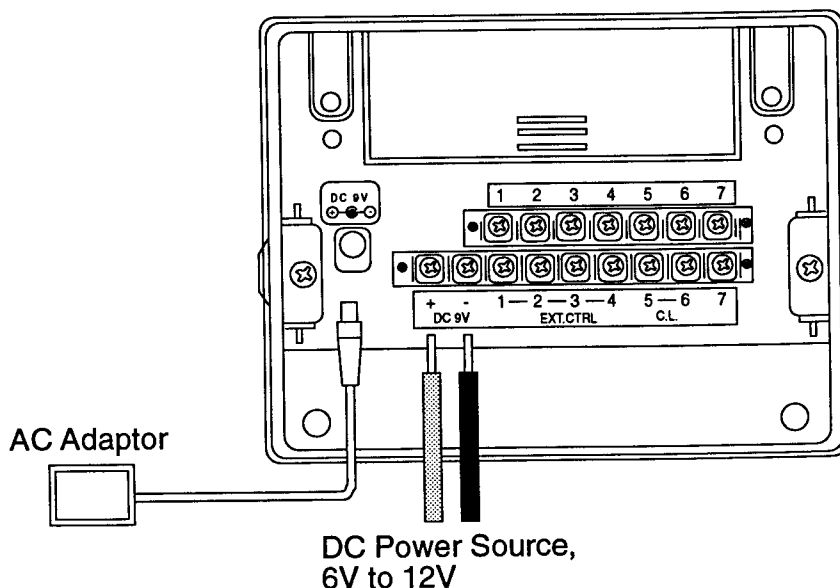
The AD-4328 must be kept away from electrical noise sources, since only an extremely weak voltage is produced as the load cell output, and the cable connected to the AD-4328 is affected by noise sources which include pulse components.

2-2 POWER SUPPLY

The AD-4328 can use two kinds of power supply, the accessory AC Adaptor and an external DC power supply (6V to 12V, 300mA or more). The power source must be stable, non-instantaneous noise, that does not cause misoperation.

CONNECTION

When the AC adaptor plugged in, the AD-4328 is powered-off once and if there is a DC power input from the rear panel terminals it will automatically be terminated.

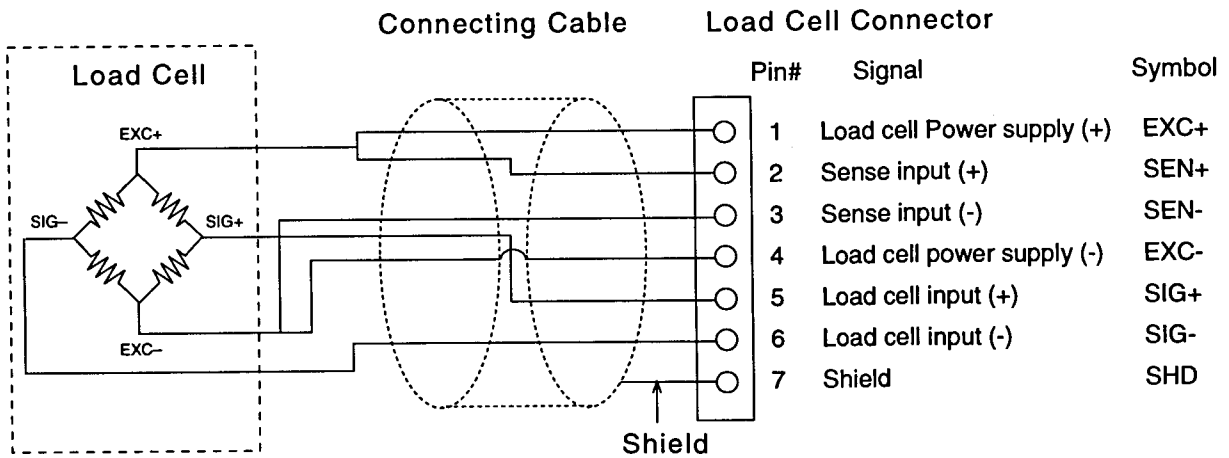


2-3 CONNECTION TO LOAD CELL

Connect the load cell cable to the load cell connector of the AD-4328 shown below.

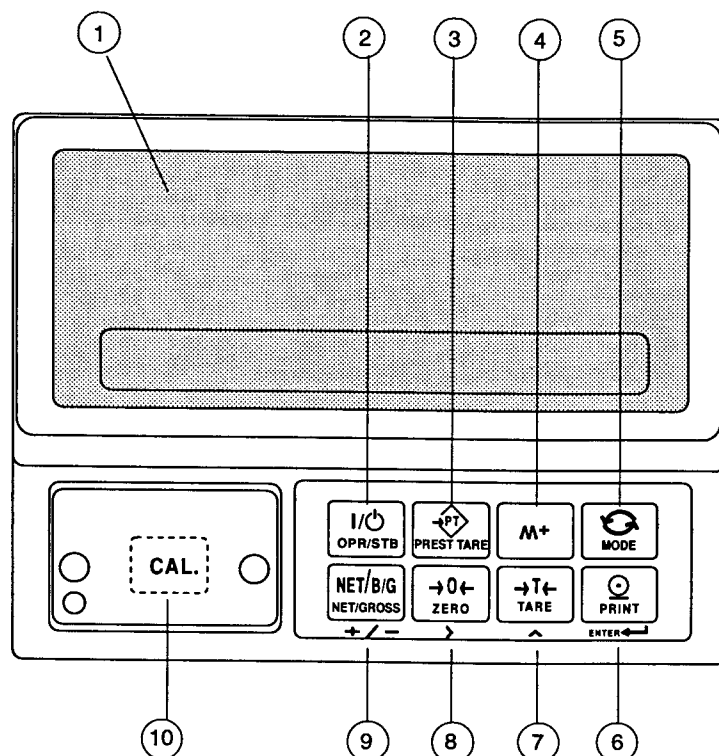
INFORMATION ON CONNECTION TO A LOAD CELL

If the AD-4328 is close to the load cell (cable length 5m or less), it can be connected with a 4-wire shielded cable, with connectors 1 & 2 shorted and connectors 3 & 4 shorted. If the load cell is more than 5m away, it should be connected with a 6 wire shielded cable to prevent loss of weighing precision.



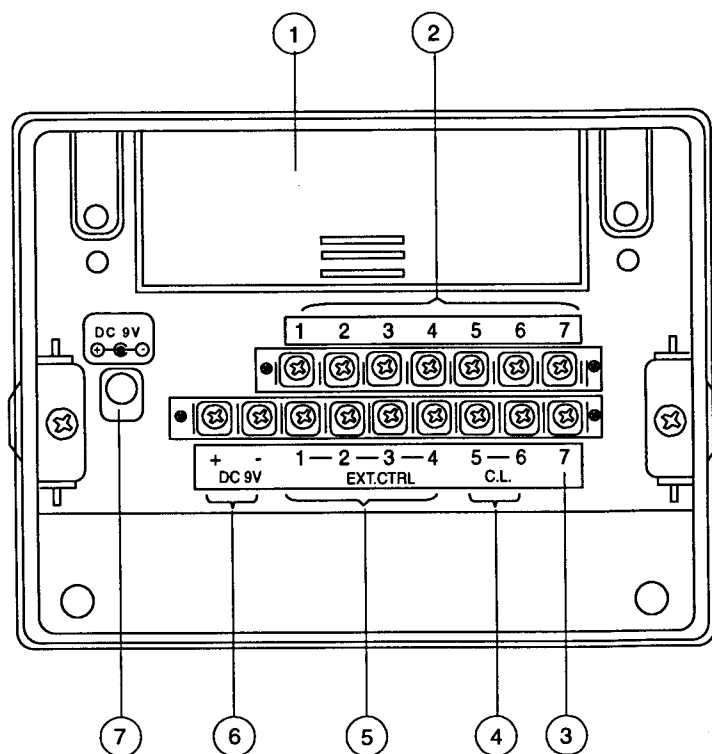
3. OPERATING CONTROLS

3-1 FRONT PANEL



No.	Name	Description
1	Display	Displays gross, net, and Tare.
2	[OPR/ STB]	Turns display on/off. * The load cell is still powered when the display is off. * The AD-4328 will be zeroed automatically when the display is turned on. See { 5-2. CF Functions } for setting.
3	[PRESET TARE]	Sets the preset tare. See { 6. Tare }.
4	[M+]	Accumulates the displayed weighing value. See {7 Accumulation}.
5	[MODE]	Changes the weight unit lb/kg(USA version only)/ Displays the accumulated weighing value./ Used in the Calibration mode.
6	[PRINT/ENTER]	Outputs data to a peripheral device such as a printer. / Saves the input data in the function setting.
7	[TARE ^]	Subtracts the tare weight. See { 6 Tare }.
8	[ZERO >]	Sets the zero point.
9	[NET/GROSS]	Switches between net weight and gross weight.
10	[CAL]	Hidden behind the cover. Enters the Calibration Mode. / Enters CF function settings.

3-2 REAR PANEL



No.	Name	Description
1	Option Slot	Where Options, OP-01/02/03/04, are installed.
2	Load Cell Connector	Connects to the load cell cable.
3	<Not in use>	Do not use.
4	Standard Serial Interface	Connects the peripherals, Indicators and printers , manufactured by A&D Company.
5	External Input	Inputs the control signals. See {9. External Input }.
6	DC Power input	Plugs in an external DC supply, 6VDC to 12VDC.
7	AC Adaptor input	Connects the AC adaptor.

4. CALIBRATION

In the calibration mode, the decimal point (see function setting) is not displayed. When a numeric value is set, it should be set assuming a decimal point in the proper position.

4-1 ENTERING CALIBRATION MODE

- Step1 Connect the load cell and press [ON/OFF] to turn the display on. All the segments, "888888", are displayed an "00" (depends on the setting) will be showed about 5 seconds later.
Warm up for more than 10 minutes to stabilize the load cell and the indicator.

If the "888888" display does not change after 10 seconds, press [MODE].

- Step 2 Press [CAL], located behind the key cover, to enter the Calibration Mode. "[RL]" is displayed for about two seconds, then the Calibration Mode is entered.

4-2 SETTING MINIMUM DIVISION

Setting the Minimum division, "d-0 l"

- When the setting is NOT to be changed;
Press [MODE] to skip.
- When the setting is to be changed;
Press [TARE ^] to select either 1, 2, 5, 10, 20, or 50.
(Each time the key pressed, the value increases: 1, 2, ...50.)
Press [PRINT/ ENTER] to store the value set.

(USA Model only)

When minimum division has been set in kg, certain value in lb, unchangeable, will be set automatically as shown below and vice versa.

* If 1 lb is set for minimum division with CF=1 (no decimal point), 0.5kg is set automatically with a decimal point.

(lb)	→	(kg)	(kg)	→	(lb)
2	→	1	1	→	2
5	→	2	2	→	5
10	→	5	10	→	20
20	→	10	20	→	50
50	→	20	50	→	50

4-3 SETTING MAXIMUM CAPACITY

Setting the Maximum Capacity, "[RP]"

Any number can be input as the maximum capacity, except a value which exceeds 10,000 times the resolution (resolution = maximum capacity / minimum division).

- When the setting is NOT to be changed; press [MODE] to skip.
- When the setting is to be changed;
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to store the value set.

4-4 ZERO CALIBRATION

- When Zero is NOT to be adjusted, press [MODE].
- When Zero is to be adjusted (STANDARD ADJUSTMENT);
Check that there is nothing on the weighing platform and that the stability symbol is displayed, then press [PRINT/ ENTER].

An error will result if the key is pressed when the stability symbol is not displayed.

- When Zero is adjusted to THE LOAD CELL OUTPUT VOLTAGE;
While "[RL 0]" is displayed, press [M+] to show "00000". Set the zero output voltage (mV/V) of the load cell with the following keys;
[TARE ^] to increment the flashing digit.
[ZERO >] to shift the flashing digit to the right.
[PRINT/ ENTER] to store the value set.

4-5 SPAN CALIBRATION

Calibrate Span, "SPRn"

- When span calibration is NOT necessary; press [MODE] to skip the Span calibration, the previous span value is retained and it goes back to {4-2 Setting minimum Division}. To escape the Calibration mode now, go to {4-6 Escaping the Calibration Mode}.
- When Span is to be calibrated with THE CAPACITY WEIGHT;
Place weights equivalent to the maximum capacity on the weighing platform, check that the stability symbol is displayed, then press [PRINT/ ENTER].
"[OFF]" will be displayed when completed.

An error will result if [PRINT/ ENTER] is pressed when the stability symbol is not displayed.

- If weights are NOT OF THE MAXIMUM CAPACITY;
Use weights as near as possible to the maximum capacity. Place these weights on the weighing platform, then input that weight value.
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to store the value set.
"C OFF" is displayed when the span calibration has been completed.
- When Span is adjusted to the LOAD CELL OUTPUT VOLTAGE;
While Span weight, example " 10000", is displayed, press [M+] to show the current span value, example "32000" mV/V. Set the span output voltage (mV/V) of the load cell with the following keys;
[TARE ^] to increment the flashing digit.
[ZERO >] to shift the flashing digit to the right.
[PRINT/ ENTER] to store the value set.
- When SPAN is adjusted without using calibration weights;
Follow calibration instructions above to set max. capacity & min. division.
During calibration, when Span is displayed, press [M+] to show current span value.
Enter rated load cell mV/V output.
[PRINT/ENTER] to store the value.
Note: Accuracy will depend on the accuracy of the load cell vs. rated output. This method is used for approximate weighing and will have an accuracy of $\pm 5\% \sim \pm 10\%$.

4-6 ESCAPING THE CALIBRATION MODE

- If the CALIBRATION is to be CANCELED;
While pressing [NET/ GROSS], press [CAL]. "[CANCEL]" is displayed. Press [OPR/ STB] to escape from the calibration mode.
- If the CALIBRATION should be COMPLETED;
Press [CAL] to write the calibration data to memory, "End" is displayed when completed. Press [OPR/ STB] to escape from the calibration mode.
- If the settings need to be CORRECTED;
Press [MODE] to return to {4-2 Setting Minimum division".

4-7 CALIBRATION ERRORS

If a calibration error of some kind is caused during calibration, a message will be displayed. The causes of errors, and the actions to be taken, are shown below.

[Err 1

Displayed if the resolution exceeds 1/10000. The resolution is displayed as maximum capacity/minimum division. As the maximum resolution is 10000, you should either decrease the maximum capacity or increase the minimum division to give a value of 10000 or less.

[Err 2 [Err 3

Displayed if the zero adjustment range is exceeded. (Refer to {Load Cell Output Adjustment} below.) Load cell connection may have trouble.

[Err 4

Displayed if the calibration weight (keyed-in value) is greater than the maximum capacity when span calibration is performed.

Use a weight value which does not exceed the maximum capacity when performing span calibration.

[Err 6

Displayed if the input sensitivity of the AD-4328 is not met because the load cell output voltage is too small for the span. Either change to a load cell with a higher output voltage or reduce the resolution by increasing the minimum division. See {4-8 Load Cell Output & Input Sensitivity} for the relation between the load cell output voltage and the input sensitivity of the AD-4328.

[Err 7

Displayed if the load cell output, when the weights are mounted, is smaller than the zero point. Check for an error in the connection of the load cell, or reversal of the load cell load direction.

[Err 8

Displayed if the load cell output voltage exceeds the maximum input voltage. If the load cell zero setting has shifted greatly in the + direction, insert a resistor as described in { Load Cell Output Adjustment}. If an error is displayed even though the zero setting is correct, either change to a load cell with a smaller output voltage or decrease the maximum capacity.

[Err 9

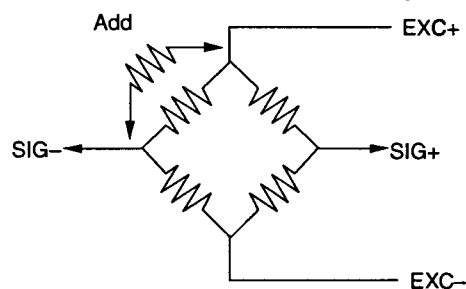
Occurs in the case of calibration zero or span input. The load cell output voltage at this time greatly exceeds the input range for the AD-4328.

See {2-3 Connection To Load Cell} for the connection, and {4-8 Load Cell Output & Input Sensitivity} for the load cell output.

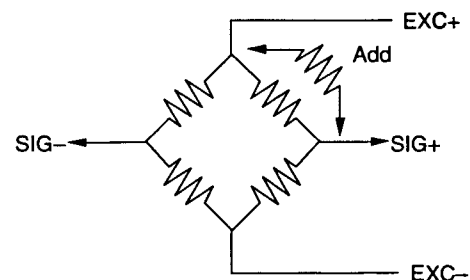
LOAD CELL OUTPUT ADJUSTMENT

When adding a resistor, use a metal film resistor in the range 50 to 500 k Ω with a good temperature coefficient. The added resistor should be connected at the terminals of the AD-4328. Use as large a resistance value as possible in the range in which zero adjustment is possible.

If an error still occurs when the above method is used, check whether the load cell is defective or incorrectly connected.



When zero output is too large



When zero output is too small

4-8 LOAD CELL OUTPUT & INPUT SENSITIVITY

The input sensitivity is 0.2 $\mu\text{V}/\text{D}$ or more. The input sensitivity indicates the variation in the load cell output voltage required to change the display one point on the display. When designing a weighing system, the load cell output voltage must satisfy the input sensitivity of the AD-4328. For this purpose, the system should be designed so that the following equation is satisfied. In order to achieve a system with stable performance, it should be designed so that the sensitivity is as great as possible. The load cell excitation (5 volts) is expressed as 5000 millivolts

$$0.2 \leq (5000 \times B \times D) / A$$

A: Load cell rated capacity

B: Load cell rated output [mV/V]

D: Minimum division

(0.2 is the input sensitivity in μV)

Example:

To make a weighing system with a maximum capacity of 300kg and minimum division of 0.05kg, using a single load cell with ratings of 750kg and 3mV/V.

In this example, A=750, B=3 and D=0.05, so that the right-hand side of equation (a) is as follows:

$$(5000 \times 3 \times 0.05) / 750 = 1$$

and equation (a) is satisfied. There is thus no problem with the design

If multiple load cells are used, the design should ensure that the following equation is satisfied.

N: Number of load cells

$$0.2 \leq (5000 \times B \times D) / (A \times N)$$

When a lever is used, the lever ratio should be taken into consideration.

n: Lever ratio

$$0.2 \leq (5000 \times B \times D) / (A \times N \times n)$$

5. FUNCTIONS

Various features can be set by means of the F-functions. Set values are stored in nonvolatile memory, and thus are not lost when the AC adapter/ DC power supply is disconnected.

Functions are divided into two kinds:

F-Functions: Internal settings.

CF-Functions: Calibration-related settings. These settings cannot be changed after the seal is affixed to the [CAL] key access plate.

5-1 F-FUNCTIONS

F-FUNCTION LIST

F1	Filtering *	0	2d/1.6 sec.	7	2d/3.2 sec.
		1	4d/1.6 sec.	[8]	4d/3.2 sec.
		2	8d/1.6 sec.	9	8d/3.2ib
		3	16d/1.6 sec.	10	16d/3.2 sec.
		4	32d/1.6 sec.	11	32d/3.2 sec.
		5	64d/1.6 sec.	12	64d/3.2 sec.
		6	128d/1.6 sec.	13	128d/3.2 sec.
F2	Comparator Function	[0]	Disable	2	Setpoint comparison
		1	Upper/Lower limit comparison	-	-
F3	Comparator Mode (Data compared / Condition)	[0]	All data /Always	3	Data exceeding +5d / Stabilized only
		1	All data / Stabilized only	4	Data exceeding 5d to +5d / Always
		2	Data exceeding +5d / Always	5	Data exceeding -5d to +5d / Stabilized only
F4	External Control 1 **	[0]	Disable	5	[M+]
		1	[ZERO]	6	[NET/B/G]
		2	[TARE]	7	[MODE]
		3	[PRINT]	8	"BCD HOLD" signal
		4	[OPR/STB]	9	"OVER" signal
F5	External Control 2 **	[0]	Disable	5	[M+]
		1	[ZERO]	6	[NET/B/G]
		2	[TARE]	7	[MODE]
		3	[PRINT]	8	"BCD HOLD" signal
		4	[OPR/STB]	9	"OVER" signal ***
F6	External Control 3 **	[0]	Disable	5	[M+]
		1	[ZERO]	6	[NET/B/G]
		2	[TARE]	7	[MODE]
		3	[PRINT]	8	"BCD HOLD" signal
		4	[OPR/STB]	9	"OVER" signal***
F12	Accumulation Mode	[0]	Manual, + only	2	Auto, + only
		1	Manual, +/-	3	Auto, +/-
Standard Serial Output					
F7	Baud Rate	0	600bps	[1]	2400bps
F8	Output Data	[0]	Weight displayed	3	"TARE"
		1	"GROSS"	4	"GROSS","NET","TARE"
		2	"NET"	-	-
F9	Output Mode	[0]	Stream	2	Manual
		1	Auto-print	-	-
F10	Auto-print determination	[0]	+ only	1	+/-
F11	Data-to-data interval, approx. 2sec. ****	[0]	None	1	2 sec.

("[" : initial factory setting)

* If the filter is set as weak, the response will be faster, but will be more susceptible to external influences such as vibration. If the filter is set as strong, the response will be slower, but will be less susceptible to external influences such as vibration. You should select the appropriate filter for the weighing environment.

** External Control 1/2/3 function works by shorting [EXT.CTRL] terminals on the rear. See {9 External Input} for more information.

*** Inputting the 'OVER' signal displays blank and outputs 'OL' for the header 1 .

**** Set to 1 when connecting the instrument to a printer which does not have a receive buffer, such as the AD-8117, AD-8117A, AD-8121. Valid in Auto-print or Manual mode.

OP-01 (BCD Output)

F13	Output Data	[0]	Weight displayed	2	"NET"
		1	"GROSS"	3	"TARE"
F14	Output Mode	[0]	Stream*	2	Manual***
		1	Auto-print**	-	-
F15	Output Logic	[0]	Negative Logic	1	Positive Logic
F16	Autoprint judgment	[0]	+ only	1	+/-

("["]": initial factory setting)

* Output each time the display is overwritten.

** When stable, print command is output and the data will be kept until the next data overwritten.

• When F16 (Auto-print-judgment)=0 (positive only), Printable range is '+6d or more'.

• When F16 (Auto-print-judgment)=1 (positive/negative), Printable range is '+6d or more' or '-6d or less'.

To output a new weighing data, remove the weight from the platform to get a reading of +5d or less. This is a function to avoid counting the same data double.

*** When [PRINT/ENTER] pressed, output one data. Print command is output and the data will be kept until the next data overwritten.

**** When F15 (Output logic) = 0 (Negative), Output data:0, Output transistor: OFF / Output data:1, Output transistor: ON

When F15 (Output logic) = 1 (Positive), Output data:0, Output transistor: ON / Output data:1, Output transistor: OFF

Output transistors are off regardless of the output logic when the display is off.

OP-03 (RS-422/485) / OP-04 (RS-232C/20mA Current Loop)

F17	Baud Rate *	0	600	3	4800
		1	1200	4	9600
		[2]	2400	-	-
F18	Output Data	[0]	Weight displayed	3	"TARE"
		1	"GROSS"	4	"GROSS","NET","TARE"
		2	"NET"	-	-
F19	Output Mode	[0]	Stream	3	Command (w/o Address)
		1	Auto-print	4	Command (with Address)
		2	Manual	-	-
F20	Auto-print determination	[0]	+ only	1	+/-
F21	Data-to-data interval, approx.. 2sec. ***	[0]	None	1	2 sec.
F22	Command Address	[0]	00' to '99'		

("["]": initial factory setting)

* Do not use 4800bps, 9600bps for 20mA Current Loop output.

** F21 is available in Auto-print mode or Manual print mode.

SETTING PROCEDURES

- Step 1 Press [OPR/ STB] to turn off the display.
- Step 2 While pressing [MODE] press [OPR/ STB] to enter the setting mode.
"F-0", a function number, is displayed.
- Step 3 Access the function numbers using these keys;
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to select the function.
- Step 4 Make the setting using these keys;
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to store the setting.
- Step 5 Press [OPR/ STB] to return to the weighing mode.

5-2 CF-FUNCTIONS

CF-FUNCTION LIST

CF1	Decimal point position	0	None, 12345	2	10 ² , 123.45
		[1]	10 ¹ , 1234.5	3	10 ³ , 12.345
CF2	Display unit	[0]	kg	2	lb (USA version only)
		1	t	3	lb/kg (USA version only)
CF3	Zero range	[0]	±2% of maximum capacity	1	±10% of maximum capacity
CF4	Zero track width *	0	None	6	0.5d/2 sec.
		1	0.5d/1 sec.	7	1.0d/2 sec.
		2	1.0d/1 sec.	[8]	1.5d/2 sec.
		3	1.5d/1 sec.	9	2.d/2 sec.
		4	2.0d/1 sec.	10	2.5d/2 sec.
		5	2.5d/1 sec.	-	-
CF5	Zero Tracking Object	0	Gross when 'GROSS' displayed	[2]	Gross when 'GROSS' or 'NET' displayed, Net when 'NET' displayed
		1	Gross when 'GROSS' or 'NET' displayed	-	-
CF6	Stabilization Detection Condition **	0	None	6	0.5d/1 sec.
		1	0 d/0.5 sec.	7	1.0d/1 sec.
		2	1.0d/0.5 sec.	[8]	2.0d/1 sec.
		3	2.0d/0.5 sec.	9	3.0d/1 sec.
		4	3.0d/0.5 sec.	10	4.0d/1 sec.
		5	4.0d/0.5 sec.	-	-
CF7	Power-on Zero ***	0	None	[1]	Zero on the power-on
CF8	Preset Tare Deduction	[0]	([PRESET TARE] operates)	1	([PRESET TARE] is disabled)
CF9	Tare Data Output Mode	[0]	In accordance with F8 and F18	1	Tare is output when [PRESET TARE] used in Manual & Auto mode.
CF10	Output on unstable or 'over' conditions	[0]	No Output	1	Output (in Manual & Auto mode.)
CF11	Differentiation between [TARE] & [PRESET TARE]	[0]	None ('TR' is returned as header 2 for both)	1	Differed ('TR' returned for [TARE], 'PT for [PRESET TARE])
CF12	Output Format	See {14-8 DATA FORMAT}			
CF13	Accumulation	[0]	Disabled	1	Enabled

("["]: initial factory setting)

* Zero tracking stabilizes the zero point by having the zero point of the AD-4328 tracks the slow drift of the zero point of the weighing system. The zero tracking condition is set by the zero tracking valid width and time. For example, if 1.5 divisions per 2 seconds is set and the weight value is within ±1.5 divisions of the zero point, and that state continues for 2 seconds, the zero point is tracked 1/4 division at a time. Therefore, if ±1.5 divisions are exceeded, zero tracking cannot be performed. The tracking speed is 1 division per 4 seconds if the set value is between 1 and 5, and 1 division per 8 seconds if the set value is between 6 and 10. Zero tracking cannot be performed if the rate of change is faster than this. Zero tracking is not performed outside the range specified by the zero range (CF-4).

** If the stabilization detection condition is 2 divisions per second, stabilization is judged to have been detected if the weight value varies within 2 divisions for 1 second. In comparatively rough weighing in which weighing speed is demanded, the stabilization detection width is made large, and the time short. When checking whether the unit is fully stabilized, the stabilization detection width is made small, and the time long. However, caution is required since stabilization is hard to achieve if there are influences such as vibration.

*** If "zero performed at power-on" is set, zero is performed in the power-on state, and the weight display starts at zero. However, if this state drifts 9% or more of the maximum capacity from the calibration zero, a zero-start is not performed.

SETTING PROCEDURES

- Step 1 Press [OPR/ STB] to turn off the display.
- Step 2 While holding down [MODE] press [OPR/ STB] to enter the setting mode.
"F-□ I", a function number, is displayed.
- Step 3 Press [CAL] and "[F-□ I" is displayed.
- Step 4 Select function numbers using these keys;
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to select the functions, the current setting will be shown.
- Step 5 Make the setting using these keys;
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to store the setting.
- Step 6 Press [OPR/ STB] to complete the CF-setting.

6. TARE

There are two keys to be used to perform Tare, [TARE ^] and [PREST TARE].

6-1 [TARE ^] KEY TARING

Tare is performed with [TARE ^] pressed.

Press [TARE ^] with the tare weight on the weighing platform. The display changes to net weight.

When gross weight is within the range of 1 division of the capacity weight, it is tared to NET ZERO display with [TARE] pressed. If gross weight is zero, tare weight will be cleared and return to GROSS ZERO display.

Normally, [TARE ^] is only valid when the AD-4328 is stabilized, but if CF-6 is set to "0", it will be valid at all times. (See 5-2 CF Functions).

6-2 [PREST TARE] KEY TARING

A weight set with [PREST TARE] is used as the tare weight. Set the weight in the manner described below.

Preset Tare weight to be set has to be dividable by the minimum division. If not, automatically it will be adjusted to proper weight .

<i>Minimum division</i>	<i>Input</i>	<i>Weight to be set</i>
10	4	0
10	5	10
10	13	10
10	15	20

- Step 1 Press [PRESET TARE] and the current Preset Tare weight is displayed. (if the tare weight has been cleared or has been set with [TARE ^], only a decimal point will appear.)
- Step 2 Set preset tare weight using these keys;
Press [TARE ^] to increment the flashing digit.
Press [ZERO >] to shift the flashing digit to the right.
Press [PRINT/ ENTER] to store the setting and return to Net weight display.

When CF7(Power-on Zero) is set to 1(ON), the AD-4328 automatically clear the tare weight when powered on.

7. ACCUMULATION

The weighing data is accumulated pressing [M+] or automatically. See F12 (5-1 F-Functions). The type of weighing data (positive, negative, or both) is selectable in F12. The accumulated data is stored in nonvolatile memory, and thus is not lost when the AC adapter/ DC power supply is disconnected.

Accumulation functions only with CF13=1. See (5-2 CF Functions) for more information.

7-1 ACCUMULATION

MANUAL ACCUMULATION

Press [M+] to accumulate the weighing data on conditions as follows. The display blinks when accumulation has been completed.

- Stable reading.
- F12 is set to 0 (manual, positive only)
Accumulation range: +6d or more.
To accumulate new weighing data, remove the weight from the platform to get a reading of +5d or less. This is a function to avoid counting the same data twice.
- F12 is set to 1 (manual, positive and negative)
Accumulation range: +6d or more / -6d or less
To accumulate new weighing data, remove the weight from the platform to get a reading of +5d or less / -5d or more. This is a function to avoid counting the same data twice.

AUTOMATIC ACCUMULATION

The data is accumulated automatically on conditions as follows. The display blinks when accumulation has been completed.

- Stable reading.
- F12 is set to 2 (Auto, positive only)
Accumulation range: +6d or more.
To accumulate new weighing data, remove the weight from the platform to get a reading of +5d or less. This is a function to avoid counting the same data twice.
- F12 is set to 3 (Auto, positive and negative)
Accumulation range: +6d or more / -6d or less
To accumulate new weighing data, remove the weight from the platform to get a reading of +5d or less / -5d or more. This is a function to avoid counting the same data twice.

7-2 DISPLAYING ACCUMULATION DATA

Press [MODE] to display accumulation data. If any, after "t 0 t RL " is displayed, the accumulation data will be shown with a flashing unit LED, which indicates accumulation data is displayed. To return to the weighing display, press [MODE] again. If nothing accumulated, "t 0 t RL " and the data are not displayed.

The AD-4328 will not show how many times accumulation has been performed but can output it. See {7-5 Outputting the accumulation data}

7-3 UNDOING ACCUMULATION

The last weighing data has been entered into accumulation may be undone following the steps below:

- Step 1 Press [MODE] to display accumulation data. "TOTAL" is displayed and the accumulation data is shown with a flashing unit LED. To return to the weighing display, press [MODE] again
- Step 2 Press and hold [M+] for more than 3 seconds. The display will get blank once and the last weighing data is deducted from the accumulation data.

7-4 CLEARING THE ACCUMULATION DATA

The accumulated data is cleared from memory using the following steps.

- Step 1 Press [MODE] to display accumulation data. "TOTAL" is displayed and the accumulation data is shown with a flashing unit LED. To return to the weighing display, press [MODE] again.
- Step 2 Press and hold [ZERO >] for 3 seconds or more. The display blanks and the accumulated data is cleared.

7-5 OUTPUTTING THE ACCUMULATION DATA

The accumulation data is output through the Standard Serial Output, RS422/485 (OP-03), or RS-232C (OP-04) in Manual Print Mode (See 5-1 F-Functions).

- Step 1 Press [MODE] to display accumulation data.
- Step 2 Press [PRINT] to output accumulation data. The data is sent in the data format shown below.

DATA FORMAT

Then number of times of accumulation: 23 times, _: space
_ _ _ _ N,+0000023 _ <CR><LF>

The accumulation data: 52 kg
TOTAL,+0000052kg<CR><LF>

8. COMPARATOR

*Options, OP-02/03/04 are required to use the comparator function.
Comparator signals won't be shown on the display, but output
through the optional interfaces.*

The AD-4328 has a comparator function which compares weighing data with preset weight settings, and outputs the result by open-collector / relay-output signals through OP-02 (Comparator Output), OP-03 (RS-422/485), and OP-04 (RS-232C).

There are two types of comparison, Upper/Lower limit comparison and Setpoint comparison.

- * The results of comparison are only for output, not be displayed.
- * When OP-01(BCD output) is used, the comparator function is not available since the OP-01 has no comparator output function.

UPPER/LOWER LIMIT COMPARISON

This function checks whether a weight is within the prescribed range. The Lower limit and Upper limit are set, and a weight is judged to be in one of 3 categories: under (LO), accept (OK), over (HI).

SETPOINT CONTROL

- * Only available for batch weighing, not for Loss-in weighing.

This is useful for batching applications.

The weighing data is compared with four preset weights, Target weight, Free fall, Preliminary weight, and Zero band, and the result of comparison is sent in three output signals, Full flow control output, Preliminary control output, and Zero band output.

8-1 UPPER/LOWER LIMIT COMPARISON

Comparison is performed based on the following formula.

under (LO) < lower limit ≤ accept (OK) ≤ Upper limit < over (HI)

*Comparison is made with a value, with the decimal point omitted.
Example: If the Upper limit setting is 10.0kg, the Upper limit is treated
as 100.*

- The set values are stored internally, and are retained when the power is removed.
- In the "Plus over" case, HI is set, and in the "minus over" case, LO is set.
- Negative values are also available.
Example:
lower limit: -500, upper limit: -100
LO < -500 ≤ OK ≤ -100 < HI
- A Upper/ Lower limit size check is not performed. If Lower limit > Upper limit, the judgment is indeterminate.

SETTING UPPER/LOWER LIMITS

See {5-1 F-Functions} for F2 (Comparator Function) for more information.

- Step 1 To make Upper/Lower limit comparison available, F2 should be set to 1. If not, follow the setting procedures in 5-1 F-Functions for the F2 setting .
- Step 2 Press [OPR/ STB] to turn the display off.
- Step 3 While pressing [PRINT/ ENTER], press [OPR/ STB] to enter the setting mode. "H, " is displayed and the current setting for Upper limit is shown.
- Step 4 When the setting is NOT to be changed; press [MODE] and go to Step 6.

When the setting is to be changed;

Setting the Upper limit;

Press [TARE] to increment the flashing digit.

Press [ZERO] to shift the flashing digit to the right.

Press [NET/ GROSS +/-] to set a polarity of the digit.

Press [PRINT/ ENTER] to store the value set.

When the setting is completed, it moves to the Lower limit setting.

- Step 5 Set the Lower limit in the same manner above.
- Step 6 Press [OPR/ STB] to return to the weighing mode.

COMPARATOR MODE

See {5-1 F-Functions} for the F3 settings.

F3=1, 3, 5: 'when stabilized only'

The judgment of the state is turn off while the weight data is in motion.

F3=2, 3: 'items exceeding +5d'

The judgment of the state is turned off when there is nothing on the platform.

F3=4, 5: 'items exceeding range -5d to +5d'

Judgment near zero is turned off and comparison of both positive and negative values are performed.

8-2 SETPOINT CONTROL

Set values are stored in nonvolatile memory, and thus are not lost when the AC adapter/ DC power supply is disconnected.

This function checks whether a weight is within the prescribed range. Final Weight, Free Fall, Preliminary Weight, and Zero Band are set, and a weight is judged to be in one of 3 categories: HI, OK, LO.

SET0 : Final Weight

SET1 : Free Fall

SET2 : Preliminary Weight

SET3: Zero Band

LO (Zero Band) : Gross weight < SET3 (Zero Band)

OK (Preliminary): Net weight \geq SET0 (Final Weight) - SET2 (Preliminary Weight)

HI (Final Weight): Net weight \geq SET0 (Final Weight) - SET1 (Free Fall)

- Comparison is made using a value with the decimal point omitted.
Example: If the SET0 setting is 10.0kg, the SET0 is treated as 100.
- The set value is stored internally, and is retained when power is removed.
- In the "Plus over" case, HI (Final Weight) and OK (Preliminary) are turned ON.

SETTINGS

See {5-1 F-Functions} for the F2 settings.

- Step 1 Set 2 to F2 (Comparator Function) for Setpoint comparison.
- Step 2 Press [OPR/ STB] to turn the display off.
- Step 3 While pressing [PRINT/ ENTER], press [OPR/ STB] to enter the setting mode. "SET 0" is displayed and the current SET0 setting is shown.
- Step 4 When the setting is NOT to be changed; press [MODE] and go to Step 5.

Set SET0 (Final Weight);
Press [TARE \wedge] to increment the flashing digit.
Press [ZERO $\>$] to shift the flashing digit to the right.
Press [NET/GROSS] to set a polarity.
Press [PRINT/ENTER] to store the value set.
- Step 5 Set SET1 (Free Fall), SET2 (Preliminary Weight), and SET3 (Zero Band) in the same manner as above.
- Step 6 Press [OPR/ STB] to return to the weighing mode or press [MODE] for further function setting.

COMPARATOR MODE

Comparator mode, F3, applies only to the Upper/Lower limit comparison, not to the Setpoint control.

9. EXTERNAL INPUT

See {5-1 F-Functions} for F4/5/6 settings.

The AD-4328 can be controlled by shorting Pin # 4 ([EXT. CTRL] at the rear panel) and Pin #1, 2, or 3 as done from the front operation keys. The pin function should be set in F4,F5 , and F6.

10. STANDARD SERIAL OUTPUT

This is a passive current loop interface for connection to remote displays and printers.

When AD-8117, AD-8117A, and AD-8121 are connected to the AD-4328 and they are used in Auto print mode or Manual mode, F11 must be set to '1'.

10-1 STREAM MODE (F9=0)

*Output each time the display is overwritten.

This mode is used for connecting an external indicator, printing by means of the printer print switch and so on.

** Due to Baud rate and output data, it may not send out every display update..*

10-2 AUTO PRINT MODE (F9=1)

Output is performed once when the weight stabilizes after entering the printable range from the print-disabled range. When this mode is used, set CF6 to the setting except '0' for 'stabilization detection ON'. See {5-2 CF-Functions}.

- F10 (Auto-print-determination)=0 (positive only)
 - Printable range: +6d or more.
 - To output a new weighing data, remove the weight from the platform to get a reading of +5d or less. This is a function to avoid sending the same data twice.

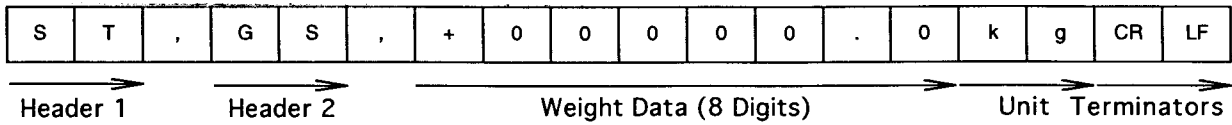
F10(Auto-print-determination)=1: (positive and negative)

- Printable range: +6d or more / -6d or less)
- To output a new weighing data, remove the weight from the platform to get a reading of +5d or less / -5d or more. This is a function to avoid sending the same data twice.

10-3 MANUAL PRINT MODE (F9=2)

Output is performed once when is [PRINT/ ENTER] pressed.

10-4 DATA FORMAT



Header 1

ST: STable reading / **UN:** Unstable reading / **OL:** OverLoad

Header 2

GS: GrosS weight / **NT:** NeT weight / **TR:** TaRe value / **PT:** Preset Tare

Weight Data (8 digits)

The weight data starts with the polarity (+ or -). If the weight value is 0, the polarity is +. The next 7 digits are the weight value, including the decimal point. If the header is "OL", the number comprises spaces. (The sign and decimal point are output.)

Unit (2 or 3 characters), _ indicates space

kg, _t, lb (when CF12 is '0' or '2'.)

_kg, __t, _lb (when CF12 is '1' or '3'.)

Terminators

<CR><LF> (Carriage Return, Line Feed)

Example Data :367.0kg gross weight display when display is stable.

ST,GS,+00367.0kg<CR><LF>

53 54 2C 47 53 2C 2B 30 30 33 36 37 2E 30 6B 67 0D 0A (ASCII hexadecimal)

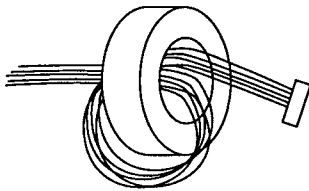
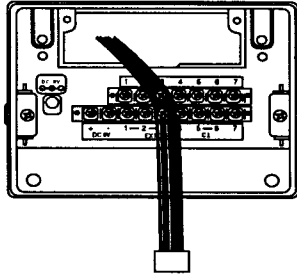
11. OPTION INSTALLATION

Install the option card of the AD-4328 following the steps below.

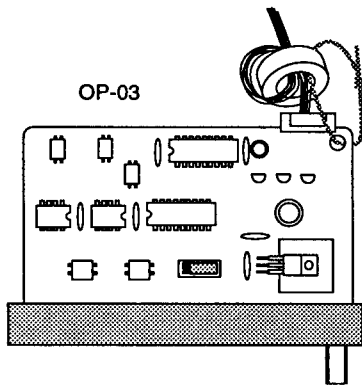
Be sure to disconnect the AC adaptor / DC power supply.



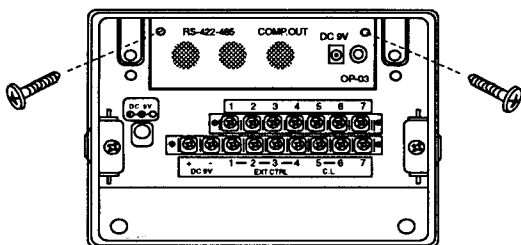
Step 1 Remove the cover at the rear panel.



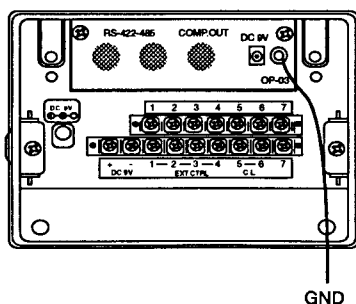
Step 2 There is a cable inside the case. Pull out the end of the cable gently and coil the cable around the ferrite core supplied.



Step 3 Connect the cable connector to the option board and secure the core to the board with the tie-wrap supplied.



Step 4 Attach the option board with two screws.



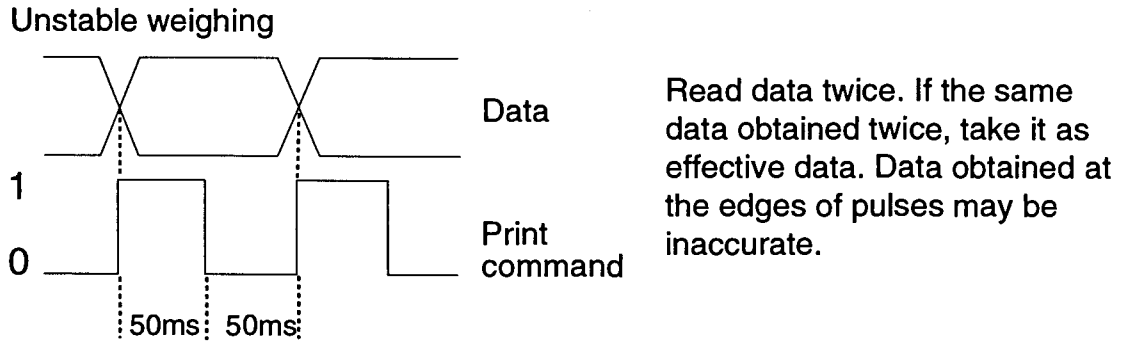
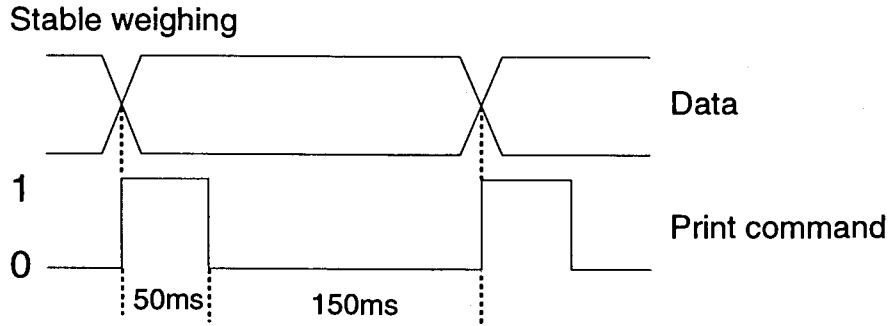
Step 5 Ground the ground terminal.

12. OP-01 (BCD OUTPUT)

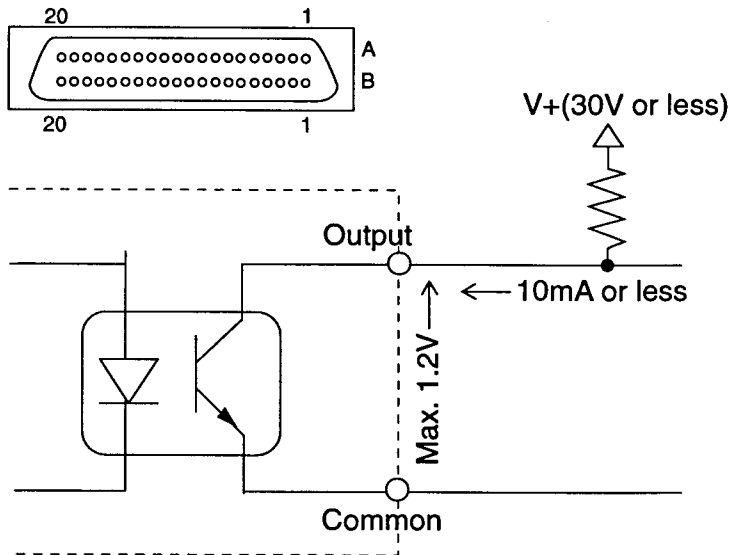
12-1 PIN CONNECTION

Pin Connection			Output
A1	1] 10 ⁰	0: 0000 1: 0001 2: 0010 3: 0011 4: 0100 5: 0101 6: 0110 7: 0111 8: 1000 9: 1001 OVER: 1111
B1	2		
A2	4		
B2	8		
A3	1] 10 ¹	
B3	2		
A4	4		
B4	8		
A5	1] 10 ²	
B5	2		
A6	4		
B6	8		
A7	1] 10 ³	
B7	2		
A8	4		
B8	8		
A9	1] 10 ⁴	
B9	2		
A10	4		
B10	8		
A11	1] 10 ⁵	
B11	2		
A12	4		
B12	8		
A13	OVER		OVER: 0
B13	+		+:1, -:0
A14	STABLE		Stable:1
B14	NET		NET:1
A15	Decimal Point, 10 ¹		Decimal Point assigned:0
B15	Decimal Point, 10 ²		
A16	Decimal Point, 10 ³		
B16	Decimal Point, 10 ⁴		
A17	Unit1		unit1 unit2 0 0 :kg 0 1 :t 1 0 :lb
B17	Unit2		
A18	Print Command		Print:1
A20	Ground		-

12-2 PRINT COMMAND-TIMING



12-3 OUTPUT CIRCUIT



12-4 RELATED FUNCTIONS

See {5-1 F-Functions} for more information.

F13: Output Data

F14: Output Mode

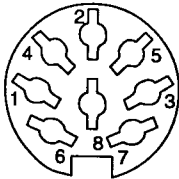
F15: Output Logic

F16: Auto print judgment

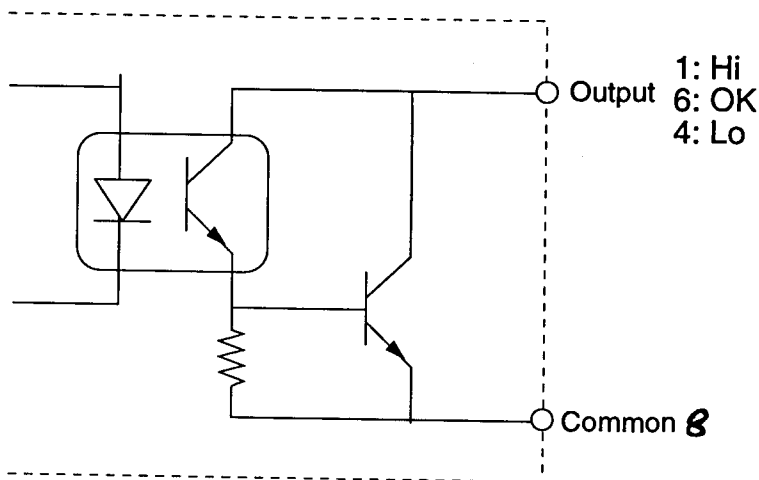
13. OP-02 (COMPARATOR OUTPUT)

A Comparator weight is judged to be in one of 3 categories: HI, OK, LO.
The optional OP-02 (Comparator Output) allows the display of the judged weight on a status light or alarm.

OUTPUT CIRCUIT



Max. Output Voltage: 30V
Max. Current: 50mA
Max. On-Voltage: 1.3V



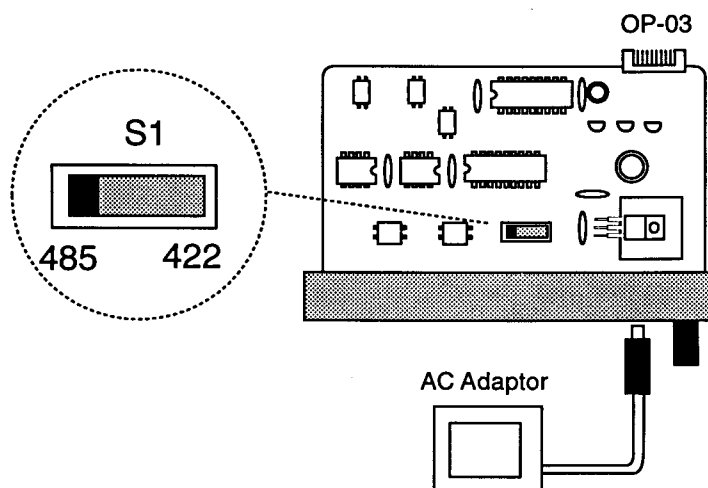
14. OP-03 (RS-422/ RS-485) OP-04 (RS-232C/ CURRENT LOOP)

The OP-03 is an RS-422/ RS-485 interface card, the OP-04 a RS-232C / 20mA current loop interface. They connect the AD-4328 to a peripheral device, personal computer and a programmable controller. Both options also supply a relay type output (3 points).

See {8. Comparator} for the output setting.

14-1 RS-422/ RS-485 SELECTION

Select either RS-422 or RS-485 with S1 switch on the board.



14-2 RELATED FUNCTIONS

See {5-1 F-Functions} and {5-2 CF-Functions} for the settings in detail.

F17: Baud Rate

F18: Output Data

F19: Output Mode

F20: Auto print determination

F21: Interval between data items in the case of multiple data output (approx. 2 seconds)

CF9: Tare data output

CF10: Over, non-stabilization output

CF11: Tare differentiation (Preset tare, Tare)

CF12: Serial output data format. See 14-8 'Data Format '.

14-3 INTERFACE SPECIFICATIONS

Method	OP-03 conforms to EIA-RS-422 and EIA-RS-485. Relay output for comparator. OP-04 conforms to EIA-RS-232C, 20mA current loop Relay output for comparator.
Transmission method	Half-duplex, asynchronous
Baud rate	600, 1200, 2400, 4800, 9600
Data bits	7
Parity bits	1 (even)
Stop bits	1
Code used	ASCII
Terminators	<CR><LF>
Output level	OP-03 (RS-422/ RS-485) Mark (1): SDA < SDB, RDA < RDB Space (0): SDA > SDB, RDA > RDB OP-04(RS-232C) Mark (1): -5 to -15V / Space (0): +5 to +15V (20mA current loop) Mark (1): 20mA / Space (0): 0m
Accessories	Ferrite core (1), Screws(2), AC adaptor (OP-03 only) Note) Up to 10 units of AD4328 with OP-03 can be connected.

14-4 STREAM MODE (F19=0)

*Output each time the display is overwritten.

** Due to Baud rate and output data, it may not send out every display update.*

14-5 AUTO PRINT MODE (F19=1)

Output is performed once when the weight stabilizes after entering the printable range from the print-disabled range. When this mode is used, set CF6 to the setting except '0' for 'stabilization detection ON'. See {5-2 CF-Functions}.

- F10 (Auto-print-determination)=0 (positive only)
 - Printable range: +6d or more.
 - To output a new weighing data, remove the weight from the platform to get a reading of +5d or less. This is a function to avoid sending the same data twice.
- F10(Auto-print-determination)=1: (positive and negative)
 - Printable range: +6d or more / -6d or less)
 - To output a new weighing data, remove the weight from the platform to get a reading of +5d or less / -5d or more. This is a function to avoid sending the same data twice.

14-6 MANUAL PRINT MODE (F19=2)

Output is performed when is [PRINT/ ENTER] pressed.

14-7 COMMAND MODE (F19=3 OR 4)

The command mode is used when the AD-4328 is connected to a personal computer. In the command mode, when the AD-4328 receives a command, it performs the operation corresponding to that command and also sends back a response. Nothing is output unless a command is received. The command mode can not be used with 20mA Current Loop output.

Terminators, <CR><LF> must be added to the end of command.

Wait for a response from the AD-4328 before sending next command.

To avoid a communication failure due to electric noise, set a time-out period of two seconds or more.

F19 = 3 : 'WITHOUT ADDRESS'

COMMANDS

(Command without a parameter)

- RW: Data request command. Display data is output immediately after the command is received.
- MZ: Performs a zero operation.
- MT: Performs tare deduction.
- CT: Clears the tare.
- MG: Switches the display to the gross weight display.
- MN: Switches the display to the net weight display.

(Command with a parameter)

- PT: Sets the preset tare.
- LO: Sets the comparator LO Limit.
- HI: Sets the comparator HI Limit.
- S0: Sets 'SET0': Final Weight
- S1: Sets 'SET1': Free Fall
- S2: Sets 'SET2': Preliminary Weight
- S3: Sets 'SET3': Zero Band

Writing a command;

- A comma, ',', must be added between a command and a parameter.
- The decimal point should be ignored.

Example;

To set '100' for the preset tare. : PT,100 or PT,+100

(When the decimal point position is 0.0, the value is treated as 10.0))

RESPONSE TO COMMANDS

First a command received is checked if it is acceptable, then a certain response to the command will be returned.

'Acceptable ':

Weighing data will be returned to RW command, and the same command to other commands.

'NOT Acceptable'

I<CR><LF> will be returned.

'Unknown'

?<CR><LF> will be sent.

F19 = 4 : 'WITH ADDRESS'

Installing OP-04 and assigning an address to each AD-4328 connected in series make it possible for the peripherals (computer or programmable controller) to control the AD-4328s.

ASSIGNING ADDRESSES

Set the number from 0 to 99 for each F22 of the AD-4328s.
See {5-1 F-Functions} for the setting.

COMMANDS

Writing a command;

- Place '@' and 'address code' in that order before a command.

Example;

To request reading value from the address '01' unit.

@01RW<CR><LF>

To set 100 as preset tare value to the address'12' unit.

@12PT,100<CR><LF>

RESPONSE TO COMMANDS

First a command received is checked if it is acceptable, then a certain response to the command will be returned. If the address is not correct, no response will be returned.

'Acceptable ':

Weighing data will be returned to RW command, and the same command to other commands.

Example:

@01RW<CR><LF> =====> @01ST,GS,+00000.0kg<CR><LF>

@01MT<CR><LF> =====> @01MT<CR><LF>

'NOT Acceptable'

I<CR><LF> will be returned.

Example:

@01MT<CR><LF> =====> @01I<CR><LF>

'Unknown'

?<CR><LF> will be sent.

@01AB<CR><LF> =====> @01?<CR><LF>

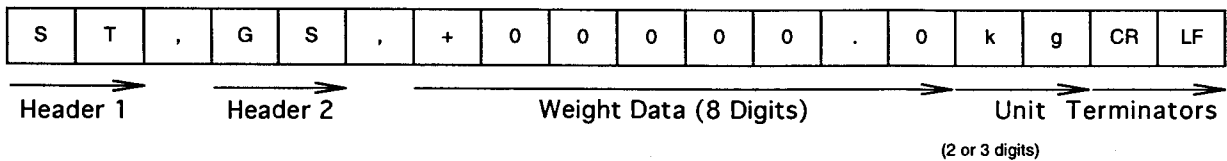
14-8 DATA FORMAT

OP-03/04 and the standard serial output have two types of data , format 1 and 2, selectable in the CF12 setting.

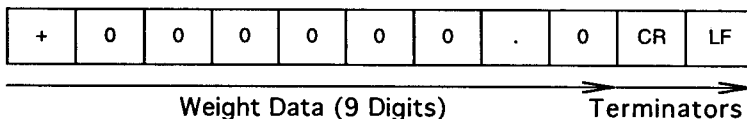
CF12 SETTINGS

		CF12 settings			
		0	1	2	3
Standard Serial Output		Format 1 2-digit unit	Format 1 3-digit unit	Format 1 2-digit unit	Format 1 3-digit unit
OP-03/04				Format 2	Format 2

Format 1:



Format 2:



Header 1

ST: Stable reading / **UN:** UNstable reading / **OL:** OverLoad

Header 2

GS: GrosS weight / **NT:** NeT weight / **TR:** TaRe value / **PT:** Preset Tare

Weight Data (Format 1: 8 digits/ Format 2: 9 digits)

The weight data starts with the polarity (+ or -). If the weight value is 0, the polarity is +. The next 7 (8 for Format 2) digits are the weight value, including the decimal point. If the header is "OL", the number comprises spaces for Format 1. (The sign and decimal point are output.) Format 2 will be +99999999 or -99999999.

Unit (2 or 3 characters), _ indicates space

kg, _t, lb (when CF12 is '0' or '2'.)

_kg, __t, _lb (when CF12 is '1' or '3'.)

Terminators

<CR><LF> (Carriage Return, Line Feed)

Example Data :367.0kg gross weight display when display is stable.

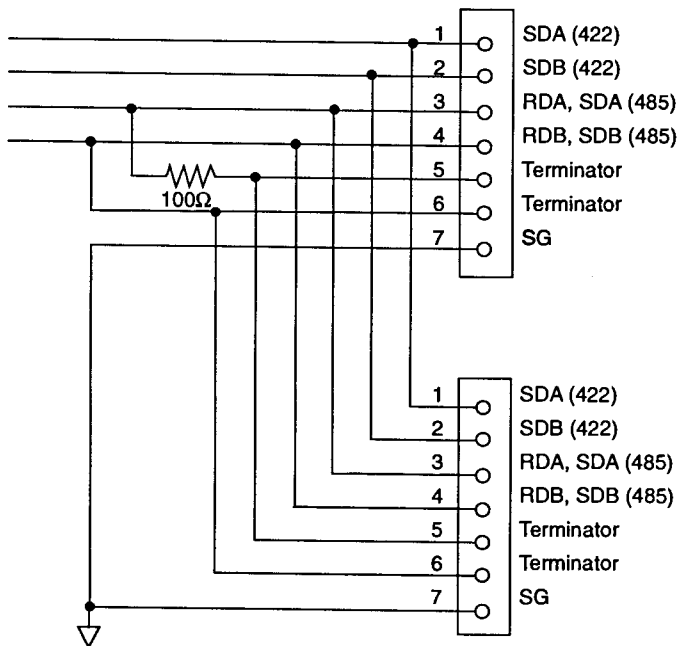
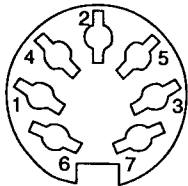
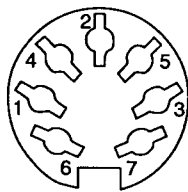
ST,GS,+00367.0kg<CR><LF>

53 54 2C 47 53 2C 2B 30 30 33 36 37 2E 30 6B 67 0D 0A (ASCII hexadecimal)

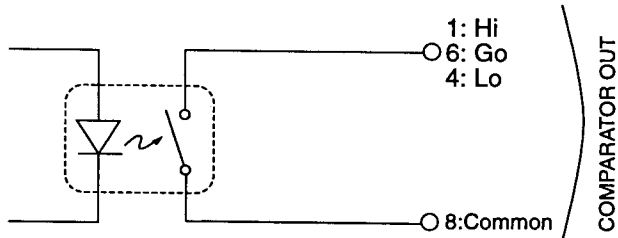
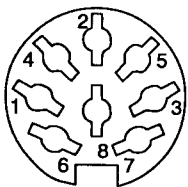
OP-03 OUTPUT CIRCUIT

RS422 and RS485 is selectable with a switch on the OP-03.

RS422/ 485



COMP OUT



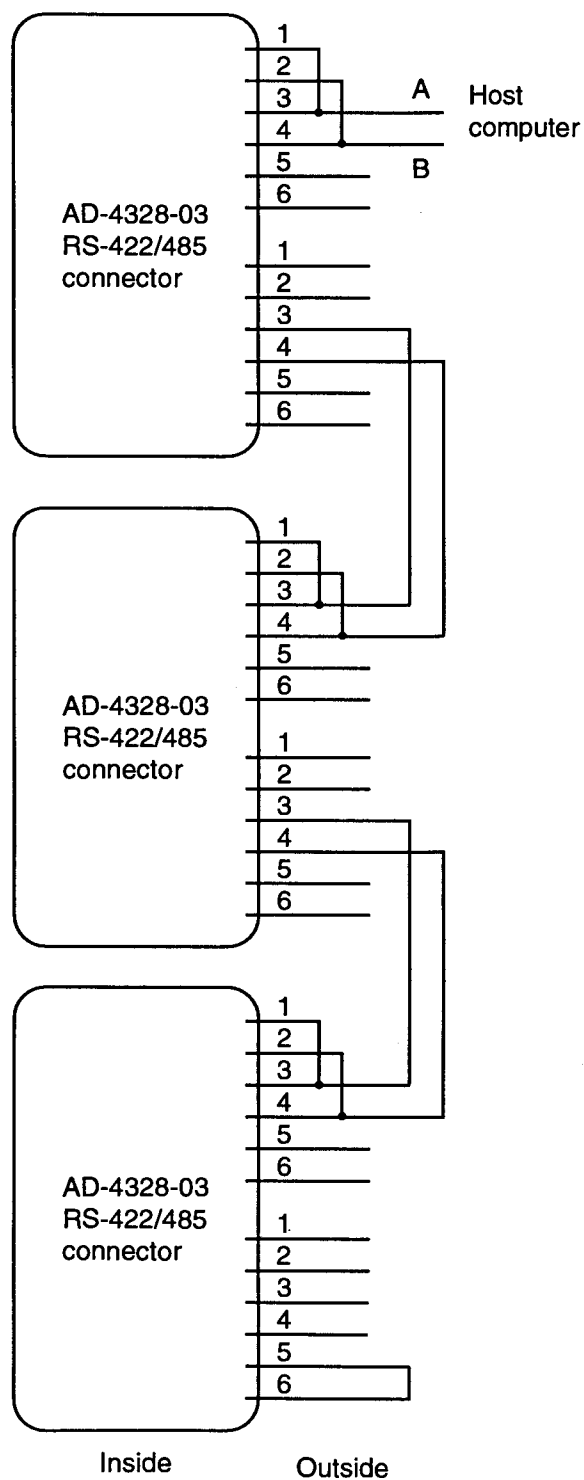
COMPARATOR OUT
50V, 100mA
ON-Resistor: 8Ω or less

CONNECTION IN CASE OF RS-485

- Set the switch on the OP-03 board to the 485 position.
- Set 1.5 seconds or more between each command.
- OP-03 has two RS422/485 connectors and each pin is connected to the counterpart inside. (Pin #1-Pin #1, Pin #2-Pin #2...)

How to connect

Connect the AD-4328s and a host computer as shown in the picture below.

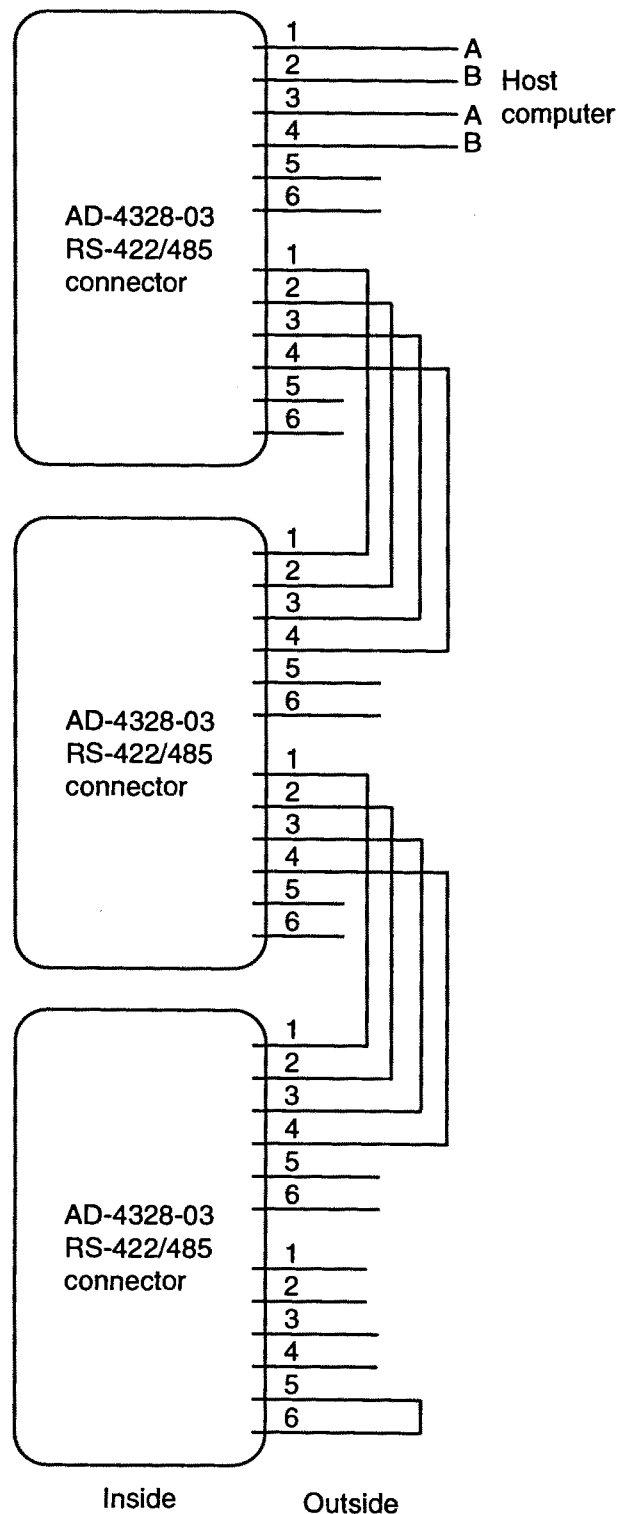


CONNECTION IN CASE OF RS-422

- Set the switch on the OP-03 board to the 422 position.
- Set 1.5 seconds or more between each command.
- OP-03 has two RS422/485 connectors and each pin is connected to the counterpart inside. (Pin #1-Pin #1, Pin #2-Pin #2...)

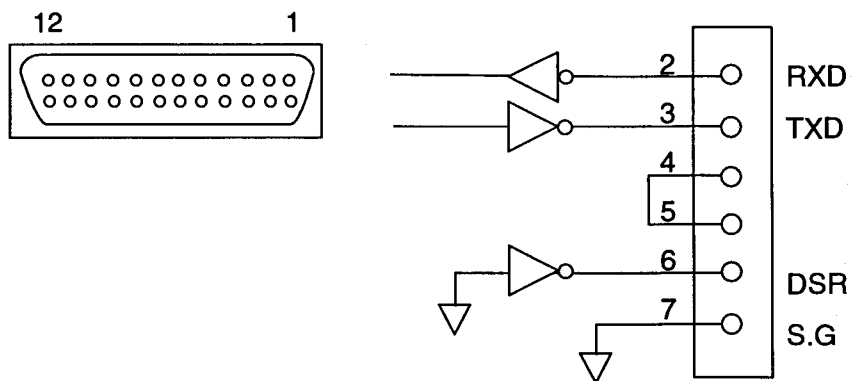
How to connect

Connect the AD-4328s and a host computer as shown in the picture below.

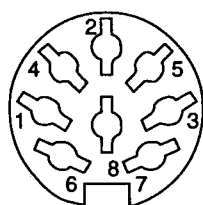


OP-04 OUTPUT CIRCUIT

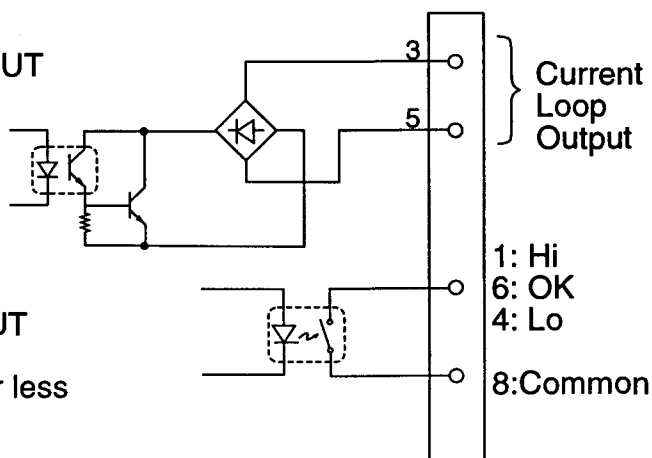
RS-232C



COMPARATOR OUT



COMPARATOR OUT
50V, 100mA
ON-Resistor: 8Ω or less



15. SPECIFICATIONS

Analog Part	
Input sensitivity	0.2 μ V/dmin (d = minimum division)
Input signal range	-1mV to 15mV
Load cell excitation voltage	5VDC \pm 5% (with remote sensing)
Load cell drive capacity	Max 6 units with 350 Ω load cell (max 90mA)
Temperature coefficient	Zero: \pm (0.2 μ V \pm 0.0008% of zero adjustment voltage) / $^{\circ}$ C(TYP.) Span: \pm 8ppm/ $^{\circ}$ C of rdg (TYP.)
Non-linearity	0.01% of F.S.
Maximum input noise	\pm 0.2 μ V p-p
Input impedance	10M Ω or more
A/D conversion method	Integral type
Maximum display resolution	10000d (divisions)
A/D conversion speed	Approx. 10 times/sec (same for display update) (5 times/sec when stable)
Digital Part	
Weight Display	7-segment LCD, character height: 14.2mm
Annunciators	Minus, Zero Point, Stable, Gross, Net, Tare, Unit (kg or t/ lb or kg)
Interface	
Relay output (Option)	3 points
	Capacity: 50VDC, 100mA, ON-resistor: 8 Ω or smaller
	Comparison Mode:(Selectable)
	Setpoint comparison: Zero Band/Preliminary/Free Fall) HI/OK/LO comparison: Hi limit/Lo limit
Current Loop output (Standard)	Exclusive output for A&D peripherals
General	
Power supply	9VDC supplied from the accessory AC Adaptor, or from a external DC supply / approx. 3VA
Operating Temperature / Humidity	-10 $^{\circ}$ C to 40 $^{\circ}$ C / 85% RH or less (no condensation)
Weight	Approximately 0.8 kg
Dimensions	170 (W) x 145 (D) x 130(H) mm
Accessories	Instruction Manual (1), Water proof packing (1), Sealing Screw Bolt (1), Rubber foot (4), Capacity label (1)
Option	
OP-01	BCD Output (open collector type)
OP-02	Comparator Output (open collector type)
OP-03	RS-422/485+Relay Output
OP-04	RS-232C+20mA Current Loop Output + Relay Output
OP-10	Stand

Only one option, OP-01, 02, 03, or 04, can be installed. RS-422 and RS-485 are selectable.

APPENDIX A. GRAVITY COMPENSATION

ABOUT GRAVITY COMPENSATION

This weighing indicator is equipped with a gravity compensation function which allows it to be calibrated in one location and then adjusted to match the acceleration of gravity at another location where it will be used.

It is solely for this use (when the indicator is to be transported to a different geographical area), and it is not intended, nor needed for local or on-site calibration.

SPAN Calibration should be done before the Gravity Compensation Function is used.

The first gravity setting, G-1, will be lost the next time you perform SPAN calibration.

Calibration of this indicator is required when it is initially installed, if the indicator is moved a substantial distance, or in accordance with local regulations. It is necessary because the weight of a mass in one location is not necessarily the same in another location. Also, with time and use, mechanical deviations can occur. "Weight" equals mass times acceleration due to Earth's field of gravity. The internationally adopted value for gravitational acceleration is 9.80665 m/s² (32.174 ft/s²) in a vacuum. However, this varies by about ±0.3 percent depending on how far you are from the Earth's center of mass. Mass distorts space in such a way that the gravitational power of attraction is inversely proportional to the square of the distance between material objects (if non-gravitational forces are ignored). So, gravitational acceleration is greatest at the poles, least at the equator and decreases with altitude.

When we weigh a mass, we are trying to find its weight expressed in pounds or kilograms. Because "g" and other factors vary from location to location, we must calibrate this indicator whenever we move it. Otherwise, a mass of 30kg might display 30.00kg in one location and 30.08kg in another (ie: "g" may have changed by +0.267%. $w=m \times g$). This would be an error; but it can be prevented by placing an accurate mass on the weighing device (say 30kg) and then telling this indicator, in effect, "this is what 30kg weighs at this location so please display 30.00kg"..... this is calibration.

It is best to set the "g" with the actual value of gravity, measured at the location. This can be found in reference tables for the country (or area), or sometimes from a physics laboratory at a local academic institution. Also, if you know the latitude and altitude, you can use the following formula:

Helmert's formula can be used to find the value of "g", the acceleration *due to terrestrial gravity, for a given latitude and altitude:*

$$g = 9.806\ 16 - 0.025\ 928 \cos 2l + 0.000\ 069 \cos^2 2l - 0.000\ 003\ 086H$$

"g" is in m/s², "l" means latitude and "H" is meters above sea level.

Alternatively, please refer to the attached table for the value of "g" at various world wide locations or plot the end-user's position in terms of latitude and altitude on the enclosed graph, {A-2 Graph}.

SETTINGS

To perform gravity correction, the gravity of the location at which calibration was performed is first set. Then, span coordination is achieved by inputting the gravity of the location at which the AD-4328 is to be used.

It is not necessary to set the gravity if the AD-4328 is to be used where it was calibrated.

If the gravity compensation has been done, the stored gravity compensation data, G1 and G2, are cleared.

PROCEDURES

Example:

When the AD-4328 was *CALIBRATED IN TOKYO* (minimum division: 1, maximum capacity: 10000, gravity = 9.798m/s²) and is to be *USED IN WASHINGTON, D.C.* (gravity = 9.803m/s²).

When the AD-4328 is to be used where it was calibrated.

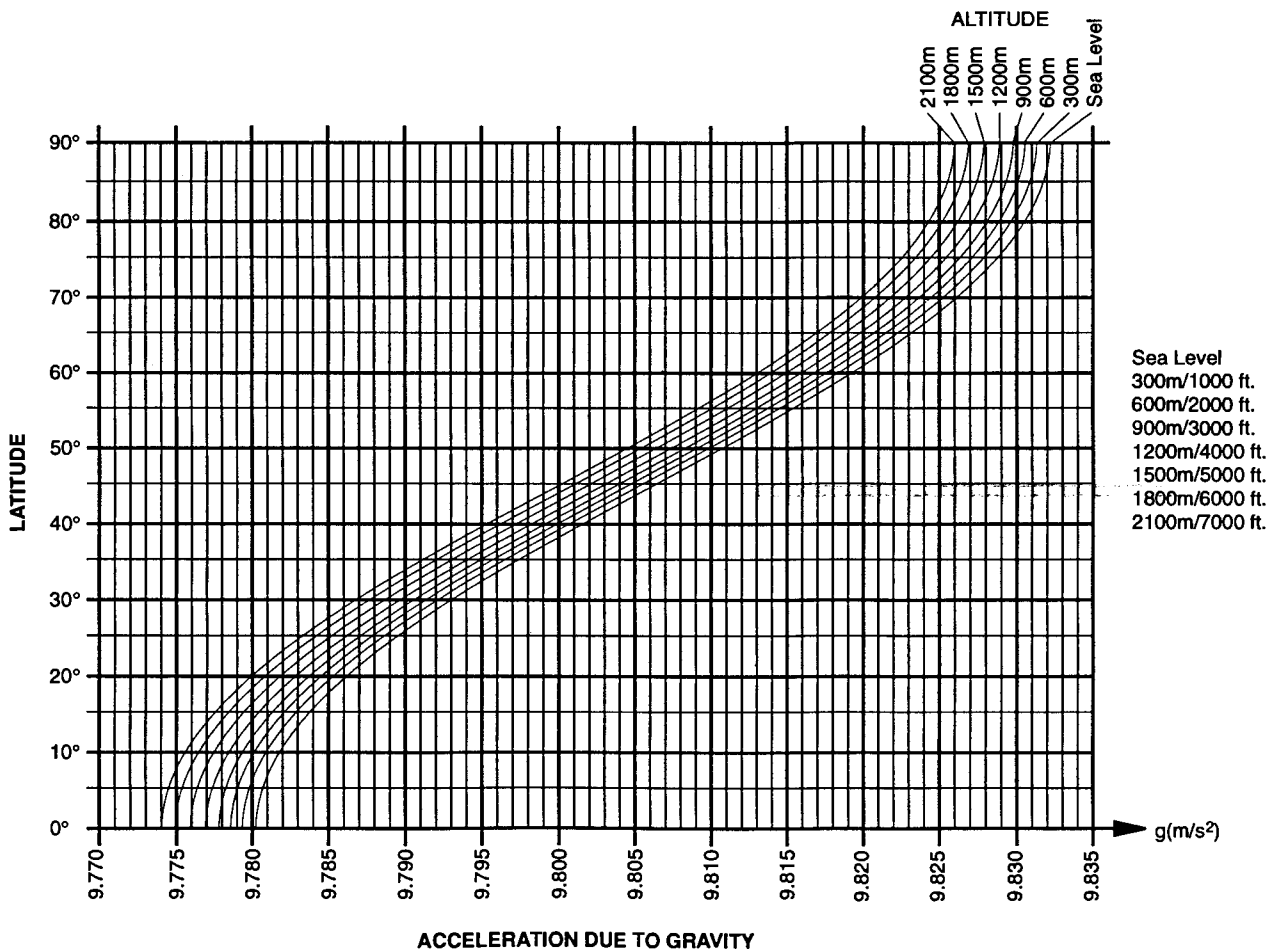
*Setting procedures will be explained based on the example above, so please change data to suit your case.

- Step 1 Calibrate the AD-4328 in *TOKYO* with minimum division: 1 and maximum capacity 10000, in this case of the example. See {4 Calibration} for calibration.
- Step 2 Enter the calibration mode again.
- Step 3 Press [PREST TARE] to enter the Gravity Compensation Mode. "G1" is shown for approximately two seconds, and the current G1 data will be appeared.
(G1 indicates the gravity of the location at which calibration was performed.)
- Step 4 Enter 9.798, gravity acceleration value of *TOKYO*, in this case of the example, pressing the keys;
[TARE ^] to increment the flashing digit.
[ZERO >] to shift the flashing digit to the right.
[PRINT/ ENTER] to complete G1 setting.
"G2" is shown for approximately two seconds, and the current data will be appeared.
(G2 indicates the gravity of the location at which the AD-4328 is to be used.)
- Step 5 Enter 9.803 gravity acceleration value of *WASHINGTON*, , in this case of the example, pressing the keys;
[TARE ^] to increment the flashing digit.
[ZERO >] to shift the flashing digit to the right.
[PRINT/ ENTER] to complete G2 setting.
It will return to G1 setting.
- Step 6 Press [CAL] to escape from the compensation mode.
"End" is shown and returns to weighing mode.

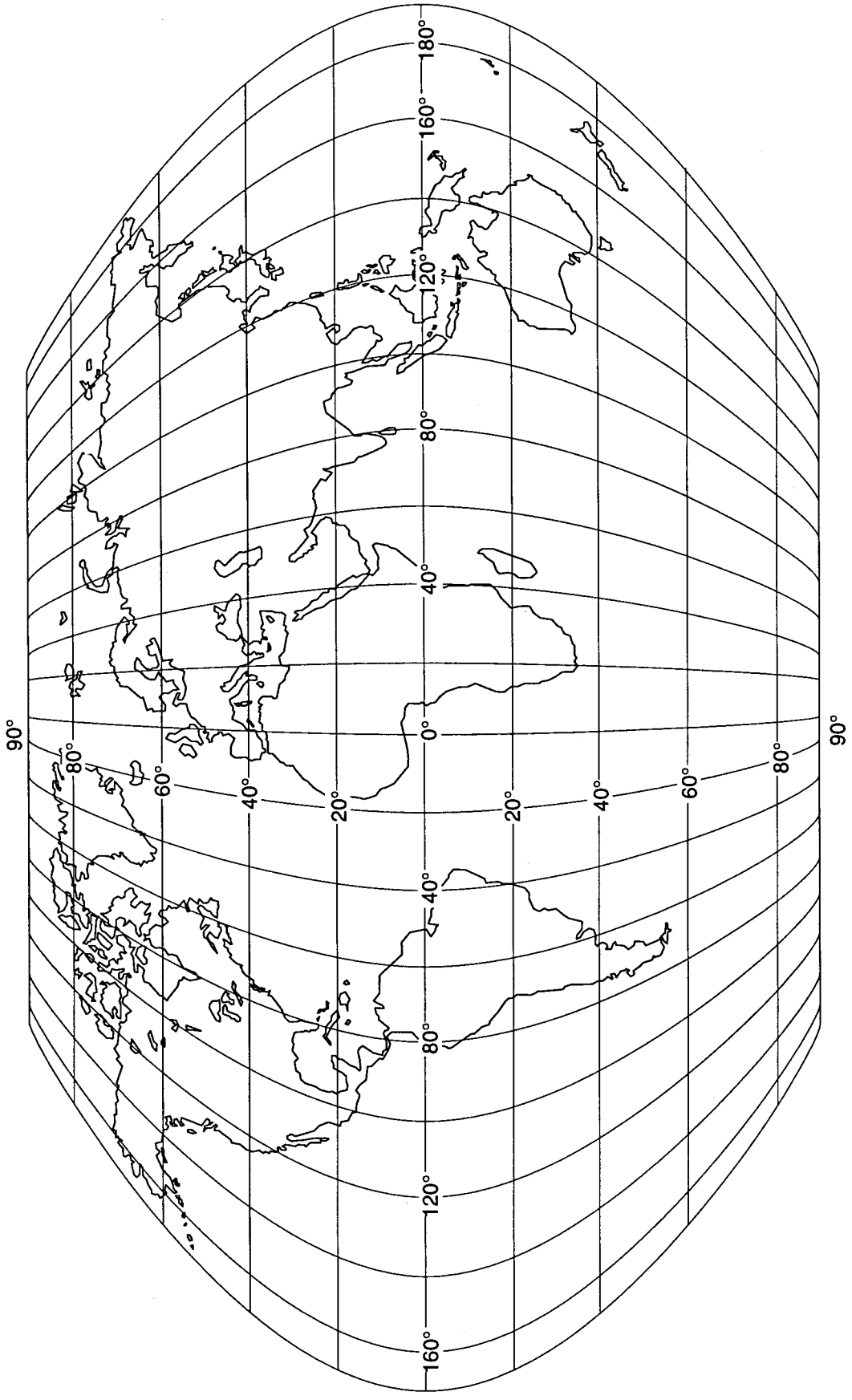
Once the AD-4328 has been calibrated in Tokyo at 10000, and shipped to Washington, D.C., the instrument will indicate 10000 there just like in Tokyo.

VALUE OF GRAVITY AT VARIOUS LOCATIONS

Amsterdam	9.813 m/s ²	Manila	9.784 m/s ²
Athens	9.800 m/s ²	Melbourne	9.800 m/s ²
Auckland NZ	9.799 m/s ²	Mexico City	9.779 m/s ²
Bangkok	9.783 m/s ²	Milan	9.806 m/s ²
Birmingham	9.813 m/s ²	New York	9.802 m/s ²
Brussels	9.811 m/s ²	Oslo	9.819 m/s ²
Buenos Aires	9.797 m/s ²	Ottawa	9.806 m/s ²
Calcutta	9.788 m/s ²	Paris	9.809 m/s ²
Capetown	9.796 m/s ²	Rio de Janeiro	9.788 m/s ²
Chicago	9.803 m/s ²	Rome	9.803 m/s ²
Copenhagen	9.815 m/s ²	San Francisco	9.800 m/s ²
Cyprus	9.797 m/s ²	Singapore	9.781 m/s ²
Djakarta	9.781 m/s ²	Stockholm	9.818 m/s ²
Frankfurt	9.810 m/s ²	Sydney	9.797 m/s ²
Glasgow	9.816 m/s ²	Taichung	9.789 m/s ²
Havana	9.788 m/s ²	Taiwan	9.788 m/s ²
Helsinki	9.819 m/s ²	Taipei	9.790 m/s ²
Kuwait	9.793 m/s ²	Tokyo	9.798 m/s ²
Lisbon	9.801 m/s ²	Vancouver, BC	9.809 m/s ²
London (Greenwich)	9.812 m/s ²	Washington DC	9.801 m/s ²
Los Angeles	9.796 m/s ²	Wellington NZ	9.803 m/s ²
Madrid	9.800 m/s ²	Zurich	9.807 m/s ²



WORLD MAP

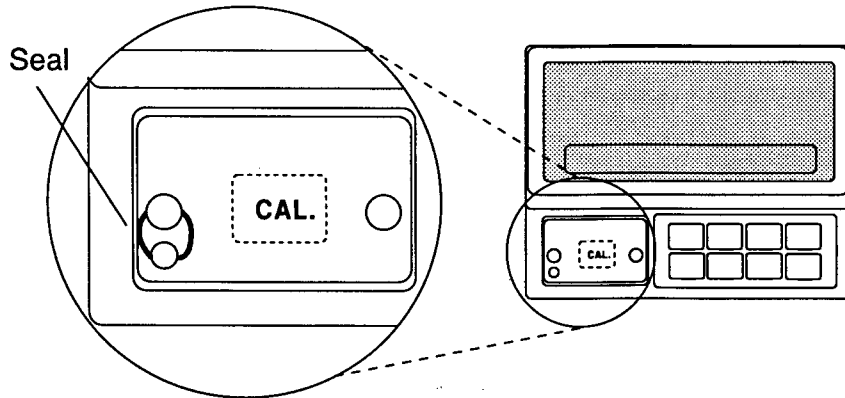


APPENDIX B. APPROVAL

When the AD-4328 is used for a trade purpose, it must be approved as your country requires.

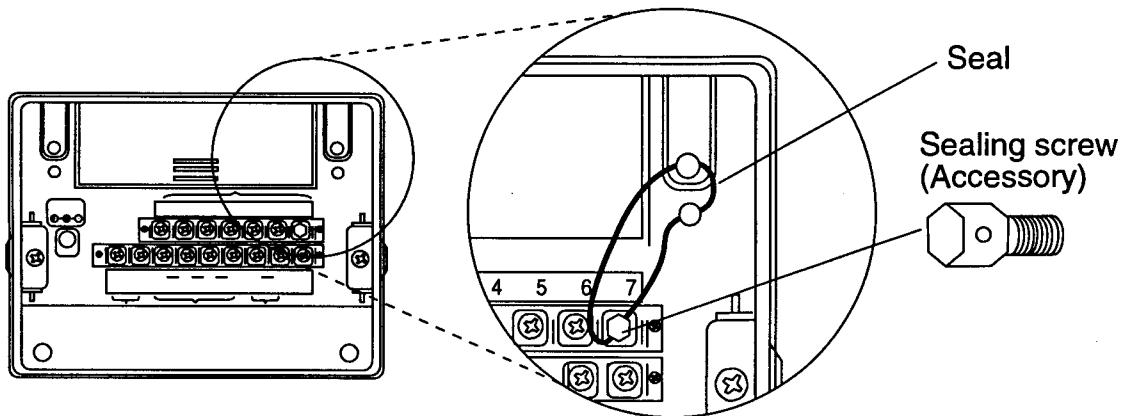
Seal the [CAL] key and rear panel as shown below.

SEALING THE [CAL] KEY



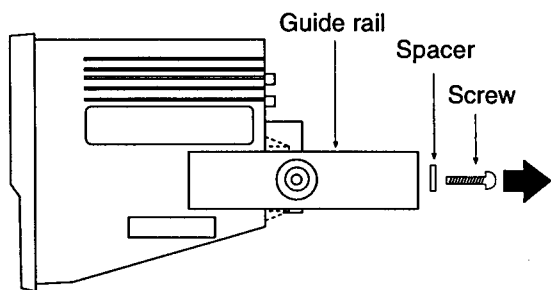
SEALING THE REAR PANEL

Remove the screw at pin# 7 of the [LOAD CELL] connector and install the accessory sealing screw instead.

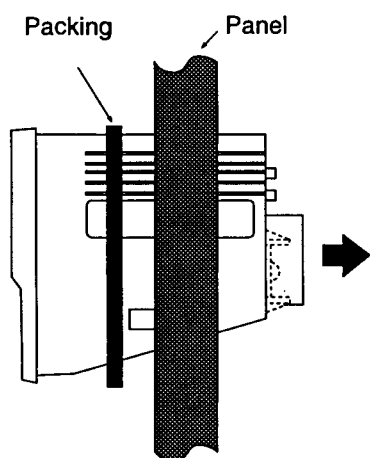


APPENDIX C. PANEL MOUNTING

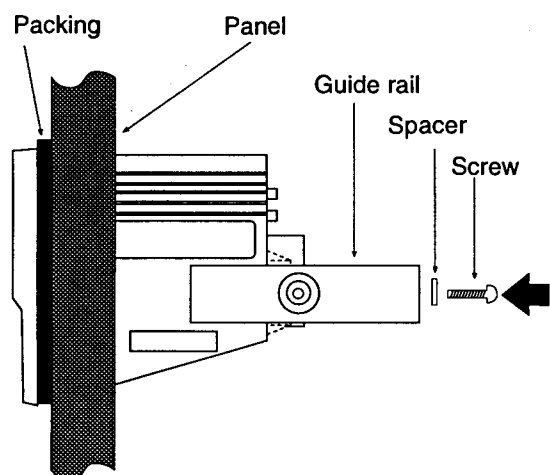
Mount the AD-4328 to a panel for a water-proof use using the accessory packing as shown below. (equivalent to IP65 for the panel)



Step 1 Remove both the right and left guide-rails.



Step 2 Insert the packing between the AD-4328 and the panel.



Step 3 Attach the guide rails and affix with screws so that water will not get into the unit.

If the packing is not attached properly, the AD-4328 may not be well water-proofed.

APPENDIX D. DIMENSIONS

