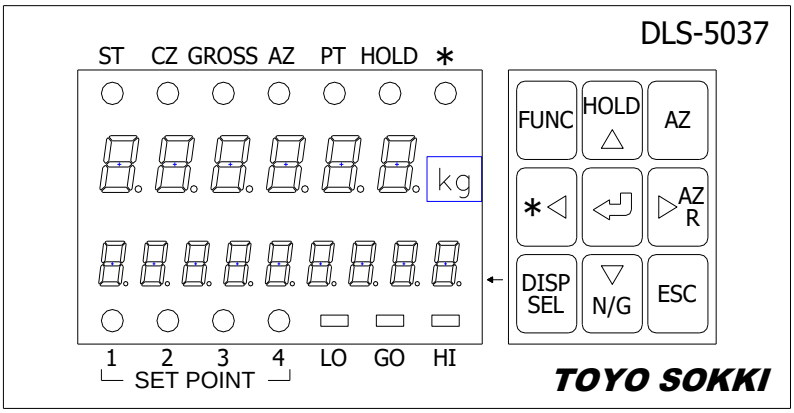
HIGH SPEED DIGITAL INDICATOR

MODEL　D L S – 5 0 3 7

OPERATION MANUAL



TOYO SOKKI CO.,LTD.

964-24 Nippa-cho Kohoku-ku, Yokohama 223-0057 Japan
TEL +81-45-540-8353
FAX +81-45-544-8354

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– – Table of contents – –

Page

※This operation manual conforms to program version 2.00 and later.

This document is translated from MA4-234-R1 (Japanese)

§ 1. Summary

This unit is a high speed sampling, 2,000 times per second, digital indicator for exclusive use of the strain gauge transducer that is most suitable for a system which needs high-speed control such as filling object, pressure or torque.
Frequency characteristic of analog filter of this unit is selectable by 2 switches on rear panel. Selectable 12 cut-off frequencies help to response various kind of input signal easily.
This unit has a main LED indicator to display the measured value and a sub LED indicator to display Tare Subtraction, Preset Tare, Integrated value, Hold level, it also can display the percentage of the measurement level against output of maximum load as the bar graph or numeric value. Also display a unit or the number which is converted.
This unit has 6 points of external comparator output as upper / lower limit judgement and window comparator judgement as LO/GO/HI. Also has 6 points of external command input which are able to be allocated as various function.
As an option, This unit can be installed as 4～20mA current output, ±10V voltage output, RS-232C/485 and BCD output. (specified at the time of order)
The power supplied voltage is AC100 to 240V or DC24V (specified at the time of order).

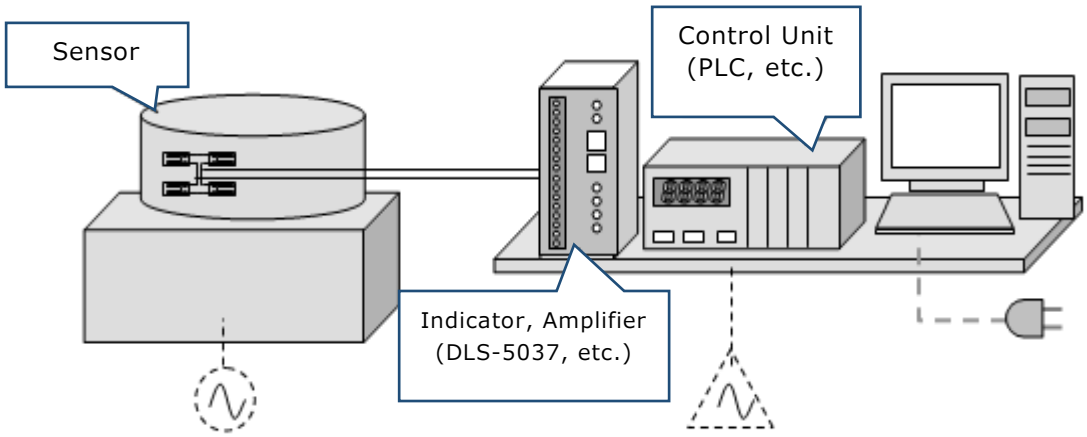
§2. Installation and connection method of the unit

2-1) Installation environment of the unit

1) Operation temperature range of this unit is −10℃～+40℃.
   Please install the unit where the place does not have direct sunlight and condensation.
2) The power supplied voltage is AC100～240V(as standard) or DC24V(as option).
   Recommend to use a constant voltage transformer if AC power supply is not stable.
3) This unit can be installed to the panel. Please install by using attached metal fittings.
4) Terminal array are 7.62mm pitch crimped terminals. Wire to them using Crimp terminal for M3 up to 6mm width. Please confirm the cable specification before wiring.
5) The shield of each cable should be grounded to one of this unit or each connected unit.

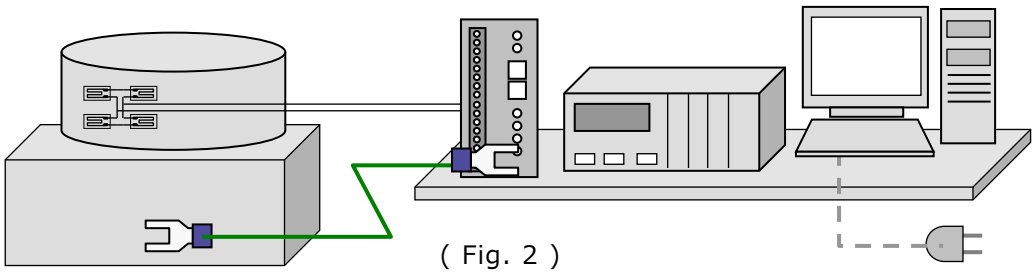
2-2) To obtain stable measurement

When a sensor of strain gauge (i.e., Load Cell, Pressure gauge) is amplified by an amplifier or is connected to an indicator, the value may fluctuate or may not be stable.



(Fig. 1)

This is because of difference of an electric potential between a sensor part and an amplifier / indicator part. It is induced from electricity rounding of general commercial power supply (AC100V/AC200V).



(Fig. 2)

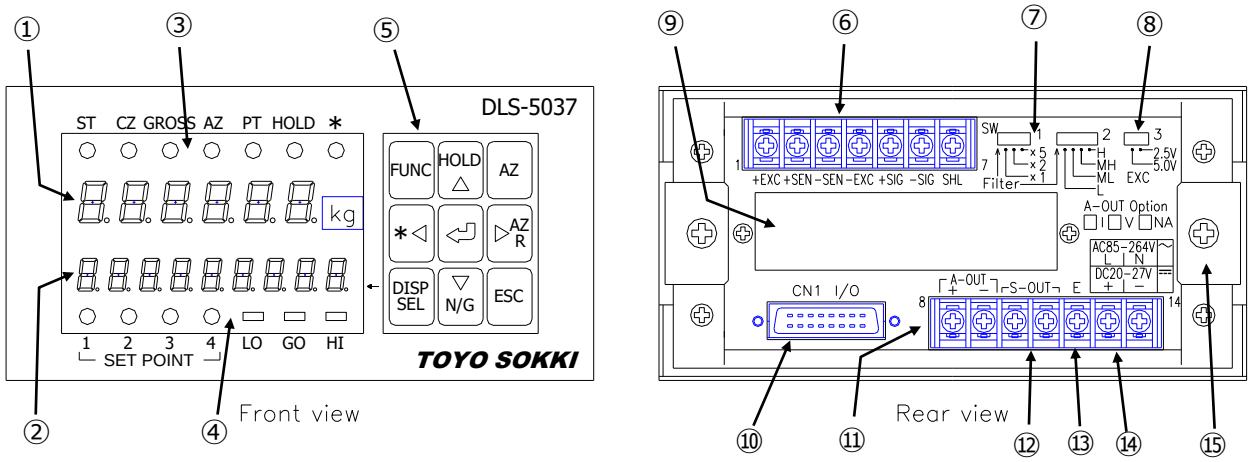
The most effective way to improve stability is to use a cable to connect an Earth terminal of an amplifier / indicator to a case or chassis of sensor, like Fig 2.

If it is difficult to find an Earth terminal of sensor side, loose bolt of metal case of sensor and connect the cable. Please make the electric potential be same as possible.

In case that a sensor and amplifier / indicator have installed apart separately, stability improves when an Earth terminal of indicator / amplifier and metal case of sensor connect to the nearest earth of each. But if they are apart far from each other, it may not bring a good result due to different electric potential of the earth. However, in such a case, stability improves if connecting a cable as Fig 2.

§3. Appearance and Each part name

3-1) Appearance of the unit



3-2) Name of each part

① Main Display
Indicates the measured value in Measuring Mode.
Also indicates a guidance to show items in Function Mode.

② Sub Display
Indicates a guidance in order whenever push DISP SEL key.
Also indicates the setting value listed below

No.	Guide display	Operation	
1	None	Guide display OFF	
2	tr.	Tare subtraction	
3	Pt.	Preset tare subtraction	
4	Γ.	Integration target gap	
5	t.	Integration target value	
6	n.	Integration number of times	
7	S - H.	Sampling Hold value	
8	P - H.	Peak Hold value	
9	b - H.	Bottom Hold value	
10	P - P.	Peak to peak Hold value	
11	L u L.	Bar Graph	Select one of them
	P c t.	Percentage	
	c u.	Unit conversion	

③ Status Display
Showing status of this unit by lighting ON/OFF each LED.
ST : The measured value is stable
CZ : Center zero. The measured value is within 1/4 scale division.
GROSS : Displaying Gross value
AZ : Tare subtraction is in operation
PT : Preset tare subtraction is in operation
HOLD : Hold function is in operation
∗ : User selected function
The function is selected at [Func/AStd SP] in Function Mode
a) Close to zero
b) In the range of zero trucking
c) Integration is in operation

④ Comparator judgment Display

SP1 : Upper / Lower limit judgment of set point 1
SP2 : Upper / Lower limit judgment of set point 2
SP3 : Upper / Lower limit judgment of set point 3
SP4 : Upper / Lower limit judgment of set point 4
LO : Measured value < (Reference value -Lower limit value)
GO : (Reference value -Lower limit value) ≦ Measured value ≦ (Reference value + Upper limit value)
HI : (Reference value + Upper limit value) < Measured value

Comparator function is selected at [Func/Comp] in Function Mode.

⑤ Key switches

FUNC : Function Mode

Enter Function Mode when pushing this key for one second.
This unit is still measuring even in Function Mode.
Return to Measuring Mode when pushing ESC key.
During Function Mode, the classification of function is displayed in turn when pushing this key.
Please refer to section §8 Function for the details.

∗◁ : User selected function

Perform an allocated function when pushing this key. The function is selected by [Func/ASt.KEY] in Function Mode.

a) Zero : Perform zero correction of Gross value (GROSS) when pushing this key for one second. To cancel zero correction, push this key and ESC key simultaneously.
Zero correction is not vanished even if turn power OFF.

b) total : Integrate the measured value. Reset an integrated value and the number of times of integration to 0 when pushing this key and ESC key simultaneously. If the integration condition is not met, and pushing this key for two seconds, can cancel the last integration amount. Integrated value is not vanished even if turn power OFF.

c) tt L.cLEAr : Cancel the last integration operation when this key is pushed for one second. Reset an integrated value and the number of times of integration to 0 when pushing this key and ESC key simultaneously.

d) Comp.cLEAr : Resume Hold operation of comparator output.

e) Print : Output data to RS-232C/485 for once.

In Function Mode, select a digit of the setting value toward left or select a classification of function in reverse order.

DISP SEL : Selection of Sub Display

Each time this key is pushed, the guidance in Sub Display is displayed in order,

(None) → Tare subtraction → Preset tare subtraction → Integration target gap → Integration target value → Integration number of times → Sampling Hold value → Peak Hold value → Bottom Hold value → Peak to peak Hold value → Conversion.

Conversion has three items and is selected at [Func/Unit] in Function Mode.
LEDs of Sub Display will be lighted OFF when pushing this key for 2 seconds.
Memorize the last item even if turn power OFF.

HOLD△ : Start/Stop to Hold

LED [HOLD] at Status Display will be lighted ON when Hold is in operation.
Clear the Hold value when pushing this key for 2 seconds. This unit can hold the 4 type of Hold value simultaneously and choose one of them at Sub Display by DISP SEL key, as sampling Hold / peak Hold / bottom Hold / peak to peak Hold.
In Function Mode, increase the selected value or select the item of function in order.

⏎ : Memorize

When a Sub Display indicates 'Preset tare subtraction', 'Integration target gap' or 'Conversion' and pushing this key for 1 second, appear the numerical setting value even in Measuring Mode.
In Function Mode, memorize the setting value, candidate or item.

▽N/G : Alternate Net / Gross value
Press this key to alternate to display the Net / Gross value.
LED [GROSS] at Status Display will be lighted ON when the Gross value is indicated.
In Function Mode, decrease the selected value or select the item of function in reverse order.

AZ : Auto Zero

Perform Tare subtraction and LED [AZ] at Status Display will be lighted ON when pushing for 1 second.

▷AZR : Auto Zero Reset
Cancel Tare subtraction when pushing for 1 second.
In Function Mode, select a digit of the setting value toward right or select a classification of function in order.

ESC : Escape

Keys except ESC key are locked when pushing this key for 2 seconds in Measuring Mode. And keys are unlocked pushing it again for 2 seconds.
In Function Mode, cancel the setting value, candidate or item. And return to Measuring Mode pushing ESC key again.

⑥ Load Cell input terminal

⑦ Analog filter switches

Cut off frequency : fc					
	SW2				
SW1		L	ML	MH	H
	X 1	2Hz	20Hz	200Hz	1.8kHz
	X 2	4Hz	40Hz	400Hz	2.9kHz
	X 5	10Hz	100Hz	980Hz	4kHz

⑧ EXC switch: Excitation voltage to Load Cell or a sensor

Select EXC=5V or EXC=2.5V

※ Please do not switch while this unit is in use because it will cause a measurement error after calibration has been done.

⑨ Option mounting port

Either one of RS-232C(OP-3), BCD output(OP-6) or RS-485(OP-7) can be installed into this port.

⑩ I / O connector: Connector for external I/O

Connector for comparator output and external command input.
They should be wired to an external equipment using attached FCN connector by user.

⑪ A-OUT terminal: Analog output terminal

This is a terminal for 4～20mA current output (OP-1) or ±10V voltage output (OP-2).
Either one of analog option can be installed.
Please do not connect anything if OP-1 or OP-2 is not installed.

⑫ S-OUT terminal: Current Loop serial output

Terminal for exclusive use of TOYO external peripheral equipment.

⑬ E : Earth terminal

Connect earth-line of ground resistance 100Ω or less to this terminal.

⑭ Power Terminal

Please do not connect other than specified power supplied voltage.
Please be careful of the polarity when connecting to DC24V.

⑮ Metal fittings for panel

Put metal panel between front of this unit and this fittings and tighten with screw.

§4. Operation

4-1) Measuring Mode

1) Over load

This is a function to inform over load of Load Cell. Set a rated capacity of Load Cell at [CAL/CAP] in Function Mode. If the measured value exceeds a setting value of [CAL/CAP], blink the measured value to warn of over load but keep measuring.
Tare subtraction and Integration operation cannot be done during over load.

2) Tare subtraction

Press AZ key for 1 second to memorize the measured value as Tare value. LED [AZ] at Status Display is lighted ON during Tare subtraction. Press ▷AZR key for 1 second to cancel Tare subtraction.
Tare value is memorized in a non-volatile memory and cannot be vanished even after powered OFF

3) Zero correction

Select [ZEro] at [Func/ASt.yEY] in Function Mode to allocate ∗◁ key to perform zero correction. Pressing ∗◁ key for 1 second, correct zero and memorize as Gross zero value. Pressing ∗◁ key and ESC key simultaneously, cancel zero correction.
Range of zero correction is determined at [F.CAL/2r.Lmit] in Function Mode, which enables what percentage of the rated capacity is effective to perform zero correction.
Zero correction value is memorized in a non-volatile memory and cannot be vanished even after powered OFF.

4) Net value / Gross value

Every time pressing ▽N/G key, alternates to display Net value and Gross value. LED [GROSS] at Status Display is lighted ON during Gross value is displayed.

5) Preset Tare subtraction

This is a function for an object that has a known container weight (Tare value) beforehand.
Select [P-tAr E] at [Func/nEt] in Function Mode and set container weight at [Func/P-tAr E] in Function Mode.
Range of setting value is -99999 to +99999.
Tare subtracted value appears on Main Display and keep it subtracted afterward. LED [PT] at Status Display is lighted ON.
When a preset Tare value is displayed on Sub Display as [Pt. xxxxx], pressing ↵ key for 1 second enables to set Tare value on Sub Display.
Choose one either Preset Tare subtraction or Net operation.

6) Net operation

This is a function for an object that has a known content amount (Net value) beforehand.
Select [P-nEt] at [Func/nEt] in Function Mode and set a content amount at [Func/P-tAr E] in Function Mode.
Range of setting value is -99999 to +99999.
LED [PT] at Status Display is lighted ON.
Content amount appears on Main Display when AZ key is pressed at Measuring Mode and increase / decrease amount is displayed from that moment. Memorize the value of subtracting content amount from the measured value.
Choose one either Preset Tare subtraction or Net operation.

7) Hold

a) Sampling Hold :Fix a display value to the number when start Hold operation
b) Peak Hold :Indicate maximum value during Hold operation
c) Bottom Hold :Indicate minimum value during Hold operation
d) Peak to peak Hold :Indicate maximum-minimum value during Hold operation

Every time pressing HOLD△ key, it alternates to start and stop Hold operation. LED [HOLD] at Status Display is lighted ON during Hold operation.
Select each Hold value to display on Sub Display pressing DISP SEL key. Each Hold operation is working during Hold operation. Each Hold value is cleared when pressing HOLD△ key for 2 seconds. Each Hold value is vanished after powered OFF.

8) Sub Display

Each time DISP SEL key is pushed, guidance is displayed in order,

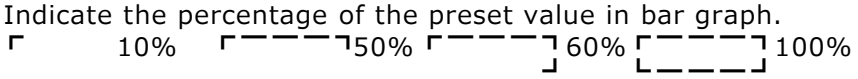
(None) → Tare subtraction → Preset tare subtraction → Integration target gap→ Integration target value → Integration number of times → Sampling Hold value → Peak Hold value → Bottom Hold value → Peak to peak Hold value → Conversion

Conversion has three items and is selected at [Func/Unit] in Function Mode.
LEDs of Sub Display is lighted OFF when pushing this key for 2 seconds.

9) Conversion

Bar graph, percentage or unit conversion of the measured value is displayed on Sub Display. Select one of three items as follows at [Func/Unit] in Function Mode.

a) LEVEL :Bar graph indication
Indicate the percentage of the preset value in bar graph.



Preset value is set at [Pct. xxxxx] in Sub Display, which appears when ↵ key is pressed for 1 second.
After the preset value is input and press ↵ key, [SEt] appears for one second and display a bar graph.
Preset value is common to b) Percentage indication.

b) PERCENT :Percentage indication
Indicate the percentage of the preset value with one decimal place.

Preset value is set at [Pct. xxxxx] in Sub Display, which appears when ↵ key is pressed for 1 second.
After the preset value is input and press ↵ key, [SEt] appears for one second and display percentage of the preset value with one decimal place.
Preset value is common to a) Bar graph indication.

c) CONVERT :Convert to the value divided with the preset value.

Preset value is set at [cu. xxxxxx.] in Sub Display, which appears when ↵ key is pressed for 1 second.
After the preset value with decimal point is input and press ↵ key, [SEt] appears for one second and proceeds to [dP. xxxxxx] where decimal point of converted value is set.
After decimal point is input and press ↵ key, [SEt] appears for one second and display the value divided with the preset value with preset decimal point.

10) Integration

a) Integration by key operation
Select [t o t A L] at [F u n c / A S t. U E Y] in Function Mode where allocate a function to [*◁] key. Each time to press [*◁] key, [t t L. A d d] is displayed in Sub Display for 1 second and add Net value to the integrated value.
When condition of integration has already been set at [F u n c / t t L. c n d] in Function Mode, If it is not fulfilled the condition, cancel the last addition operation by pressing [*◁] key for 1 second.
When [*◁] and [ESC] key is pressed simultaneously, [t t L. C L E A r] is displayed in Sub Display for 1 second and clear the integrated value.

b) Automatic integration
The sixth digit of setting value at [F u n c / t t L. c n d] in Function Mode is set '1'.
When the measured value is stable but not close to zero, add Net value to the integrated value automatically. After an addition operation is completed, next addition is not done until the measured value is back to close to zero.

c) Clear integrated value.
Clear integration when automatic integration or external integration command is selected.
Select [t t L. c L E A r] at [F u n c / A S t. U E Y] in Function Mode where allocate a function to [*◁] key.
When pressing [*◁] key for 1 second, [t t L. C A n C L] is displayed in Sub Display for 1 second and cancel the last addition operation.
When [*◁] and [ESC] key is pressed simultaneously, [t t L. C L E A r] is displayed in Sub Display for 1 second and clear the integrated value.

d) Integration by external command.
At [I n] in Function Mode, allocate external command as follows to operate integration.
A d d : Addition operation
C A n c E L : Cancel addition operation
t t L - C L E A r : Clear the integrated value

11) Target value of integration

Select [Γ.] in Sub Display during pressing [DISP SEL] key and the value of [Γ.] is called as 'target gap'.
Target gap = (integrated value + measured Net value) – Target value

Target value is set at [xxxxxxxx] in Sub Display, which appears when [↵] key is pressed for 1 second.

If a target value is set to '0', target gap equals the sum of integrated value and measured Net value, which easily anticipate the value before addition operation.
Remind that after addition operation has done, target gap is not updated until the measured value is back to close to zero.

12) Close to zero

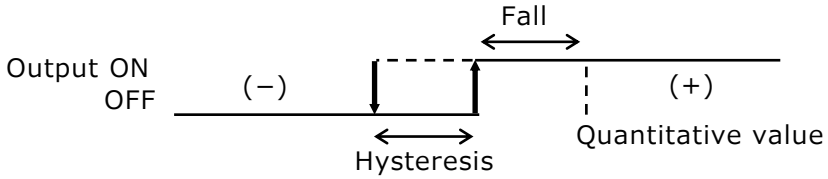
This function determines the range of close to zero when an object or load is put down from a scale and let it know the measuring has done.
Set numerical value of range from zero at [F u n c / n E A r - 0] in Function Mode.
This function is utilized as judgement condition of automatic integration, judgement range of comparator, reset of comparator output and automatic serial data output.

13) Comparator

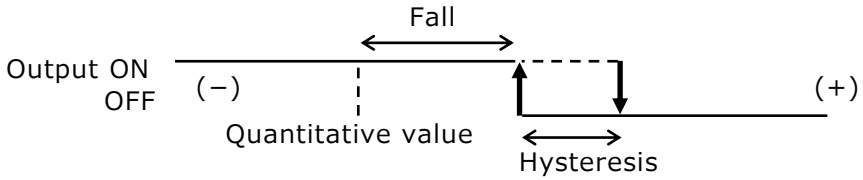
This unit has four comparators with upper / lower limit judgement and window a comparator with HI/GO/LO. It can output 6 comparator judgements in total. Output of judgement of SP4 / LO is selectable from one of them.

Numerical value and condition of comparator is set at [ｃｏｍＰ] in Function Mode.

a) Upper limit judgement
Output ON : Measured value ≧ Quantitative value – Fall value
Output OFF : Measured value < Quantitative value – Fall value – Hysteresis value



b) Lower limit judgement
Output ON : Measured value ≦ Quantitative value + Fall value
Output OFF : Measured value > Quantitative value + Fall value + Hysteresis value

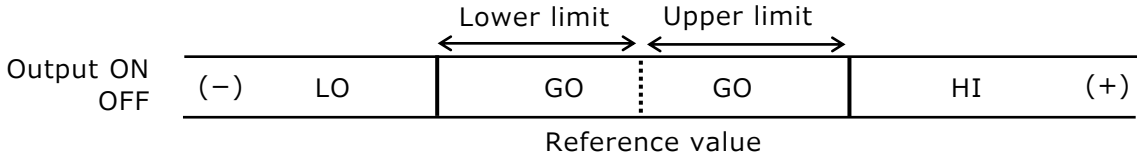


c) Delay time

External output can be delayed after comparator perform upper / lower limit judgement.
Set numerical value at [ｃｏｍＰ/ｄＬＹ] in Function Mode.
Delay time = set value x 0.5ms. i.e.) 2000(set value) x 0.5ms = 1 second

d) HI/GO/LO Window Comparator

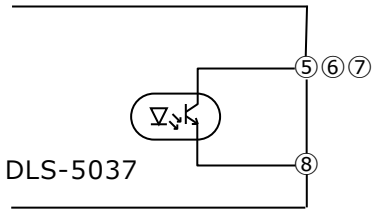
LO ＜ (Reference －Lower limit value) ≦ GO ≦ (Reference ＋Upper limit value) ＜ HI

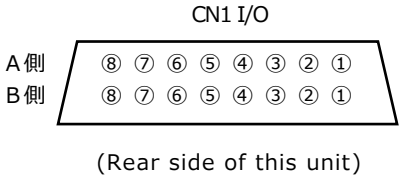


When hold of judgement(Fourth, third digit = 1) is set at [ｃｏｍＰ/ｃｏｎｄ０] in Function Mode, use together with stable (First digit =1).

14) External output

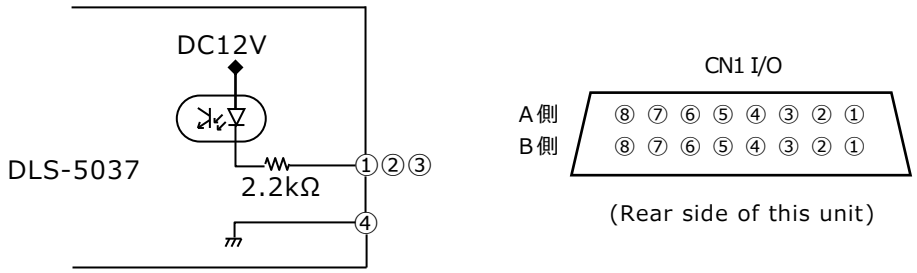
This unit has 6 Open Collector output as external output. Each output content is selected from comparator judgement or operation status at [ＯＵＴ] in Function Mode.





15) External command input

This unit has 6 Open Collector input as external input. Each command is selected at [In] in Function Mode.



16) Current Loop serial output

Interface for exclusive use of TOYO peripheral equipment such as ED-3020/3021(external large LED display), EP-3030(external printer).
It is isolated from internal circuit and connected to peripheral equipment using current loop signal 0～20mA.
Output data is selected at [SEr iAL/cL. SEL] in Function Mode.
Data output period is synchronized with renew period of displaying LED set at [F.cAL/dSP.cYc] in Function Mode. However maximum of data output period is 16 times/second (about 60ms)

17) Key lock

Key lock function can prevent wrong key operation.
Pressing any key other than ESC key in key lock status, [Loc Y] is displayed in Sub Display and doesn't accept key operation. But external command input is acceptable.
Pressing ESC key in Measuring Mode for 2 seconds can alternate Lock and Unlock key operation.

4-2) Function Mode
This is a mode for setting various function.
Pressing FUNC key for 1 second in Measuring Mode can enter Function Mode.
Refer to function table at section §8 Function for details.

4-3) Test Mode
This is a mode for checking operations of this unit.
The response of external I/O signal and indication of display is different during Test Mode. Please take measures to connected external equipment to keep it from abnormality.
To enter Test Mode, keep pushing ↵ key while powering ON, or pressing ↵ key 3 times immediately after powered ON. Or setting [on] at [Func/tESt] of Function Mode using ◁ or ▷ key and pressing ↵ key 3 times can enter Test Mode.

§5. Procedure of operation

5-1) Procedure of setting a function

Refer to function table at section §8 Function for details.

	Guide display	Operation	Detail
1	(Measuring Mode)	–	Press FUNC key for 1 second.
2	Func	Function Mode	
3	(Classification of Function Mode)	Select classification	Pressing FUNC key, display classification.
			Pressing ◁ ▷ key, display classification.
4	(Item of classification)	Select item	Pressing △ ▽ key, display item. Setting value or candidate is displayed in Sub Display.
5		Setting candidate	Pressing ◁ ▷ key, display candidate. Candidate is blinking while setting.
6		Setting numerical value	Pressing ◁ ▷ key, select the digit to change. The digit to change is blinking.
			Pressing △ ▽ key, change the numerical value.
7		Setting polarity	Highest digit may set polarity '-' pressing △ ▽ key in case of the setting range from minus.
8		Memorize setting	After setting value or candidate has been done, press ↵ key to memorize.
			[SEt] is displayed in Sub Display and proceed to the next item.
9		Leave without setting	Pressing ESC key while setting, return to the former value or candidate.
10	(Classification of Function Mode)	Leave item	Pressing ESC key again, return to display classification.
11	(Measuring Mode)	Leave Function Mode	Pressing ESC key again return to Measuring Mode.

5-2) Procedure of integration

Target gap = (integrated value + measured Net value) – Target value

	Guide display	Operation	Detail
1	ASt.UEY	Setting addition function beforehand (Either of ASt.UEY or In)	Select [totAL] at [Func/ASt.UEY] in Function Mode
	In		Set [Add] and [ttL-cLEAr] against two external input at [In] in Function Mode. (Set In5,6 at the time of shipment)
2	ttL.cnd	Setting condition of addition operation	Set condition at [Func/ttL.cnd] in Function Mode and return to Measuring Mode.
3	Γ.	Select target gap	Select target gap in Sub Display pressing DISP SEL key.
4	(setting value)	Setting target value	[xxxxxxxx] is appeared in Sub Display after pressing ↵ key for 1 second.
			Using ◁ ▷ △ ▽ key to set target value.
			Pressing ↵ key to memorize.
5	Γ.	No load on a scale Display target gap	Measured value is zero in Main Display. Minus of target value is in Sub Display.
6		Put a load on a scale (Start to measure)	Measured value of a load in Main Display. 'measured NET value – target value' is in Sub Display.
7		Addition operation	Pressing ∗◁ key or external command

			input [Add] operates addition function. Measured Net value is added to integrated value. 'integrated value - target value' in Sub Display.
8		Unload from a scale	Measured value is zero in Main Display. Still 'integrated value - target value' is in Sub Display.
9		Put a load on a scale (Next measurement)	Measured value of a load in Main Display. 'integrated value + measured NET value - target value' is in Sub Display.
10		Repeat until reach target	Repeat same procedure from 7 to 9 until target gap in Sub Display reach to zero.
11		Finish to measure	Pressing [∗◁] and [ESC] key simultaneously or external command input [ttL-CLEAr] let integrated value to clear.
12		Restart to measure	Repeat same procedure from 4 in case of changing target value. Repeat same procedure from 5 in case of same target value.

Example) Measure load amount on cargo bed of truck while loading with a crane

① Set maximum load of 10ton (10,000kg) as target value — target gap = -10,000kg
② 1st load = 2,000kg — target gap = -8,000kg
③ Press [∗◁] key or external command to add
④ 2nd load = 3,000kg — target gap = -5,000kg
⑤ Press [∗◁] key or external command to add
⑥ 3nd load = 4,000kg — target gap = -1,000kg
⑦ Press [∗◁] key or external command to add
⑧ 4th load = 1,200kg — target gap = +200kg
Target gap exceeds +200kg. Change to more lightweight load.
Before addition operation, integrated value is not settled thus can be recalculated.
Change 4th load = 900kg — target gap = -100kg
⑨ Press [∗◁] key or external command to add
⑩ Finish measuring with margin 100kg remained

If target value is set to '0', target gap equals the sum of integrated value and measured Net value, which easily anticipate the value before addition operation.

5-3) Procedure to indicate bar graph

Indicate 10 step of bar graph against preset value.
Bar graph = measured value / preset value X 10

	Guide display	Operation	Detail
1	Unit	Select unit	Select [LEuEL] at [Func/Unit] in Function Mode and return to Measuring Mode.
2	LuL.	Select Sub Display	Press [DISP SEL] key and select [LuL.]
3	Pct. xxxxx	Set preset value (Common to 5-4))	Press [↵] key for 1 second
4			Set preset value using [◁] [▷] [△] [▽] key
5			Press [↵] key to memorize
6	(Measuring Mode)		Return to Measuring Mode

5-4) Procedure to indicate percentage

Indicate percentage of preset value with one decimal place.

Percentage = measured value / preset value X 100.0

	Guide display	Operation	Detail
1	Unit	Select unit	Select [PErcEnt] at [Func/Unit] in Function Mode and return to Measuring Mode.
2	Pct.	Select Sub Display	Press DISP SEL key and select [Pct.]
3	Pct. xxxxx	Set preset value (Common to 5-3))	Press ⏎ key for 1 second
			Set preset value using ◁ ▷ △ ▽ key
			Press ⏎ key to memorize
4	(Measuring Mode)		Return to Measuring Mode

5-5) Procedure to convert unit

Converted value = measured value / preset value

	Guide display	Operation	Detail
1	Unit	Select unit	Select [Conuert] at [Func/Unit] in Function Mode and return to Measuring Mode.
2	cu.	Select Sub Display	Press DISP SEL key and select [cu.]
3	cu. xxxxxx.	Set preset value with decimal point	Press ⏎ key for 1 second
			Set preset value using ◁ ▷ △ ▽ key.
			Using ◁ ▷ key, select highest digit + one ◁ key or lowest digit + one ▷ key to start to blink decimal point. Using △ ▽ key, select decimal point
			Press ⏎ key to memorize
4	dP. xxxxxx	Set decimal point of converted value	Set decimal point using ◁ ▷ key
			Press ⏎ key to memorize
5	(Measuring Mode)		Return to Measuring Mode

Example 1) In case of converting to N (newton)

When converting weight to force,

①1N = 0.10197kgf

②Unit in Main Display is kilogram and if it is 123.4kg,

③Preset value should be 0.10197

④Decimal point of converted value should be 0.0 (one digit after decimal point)

Converted value (newton)= 123.4kg ÷ 0.10197(preset value) = 1210.2 N

Example 2) In case of converting to L (litre)

When monitoring the remains of liquid nitrogen in a tank

①Density of liquid nitrogen is about 0.809g/cm^3 = 809g／L

②Unit in Main Display is kilogram and if it is 12.34kg,

③Preset value should be 000.809 (suit to kg)

④Decimal point of converted value should be 0.00 (two digit after decimal point)

Converted value (litre)= 12.34kg ÷ 0.809(preset value) = 15.25 L

Example 3) In case of converting to the number of articles

When counting the number of articles in a container

①Weight of one article is = 567.89g, assumingly

②Unit in Main Display is kilogram and if it is 123.4kg,

③Preset value should be 0.56789 (suit to kg)

④Decimal point of converted value should be 0 (no decimal point)

Converted value (the number of articles)= 123.4kg ÷ 0.56789(preset value) = 217

§6. Calibration

As for calibration method, there are two kinds of calibration as [Equivalent Input Calibration] which input the equivalent output voltage of the Load Cell by key operation (available only EXC=5V), and as [Actual Load Calibration] which use a weight as an actual load. Calibration can be done by either method but it will be operated by the last performed calibration value. It is recommended to calibrate by actual load as much as possible.
To correct non-linearity of a sensor or Load Cell, This unit is able to calibrate five span points. If it is not necessary, Set 0 in [CAL / CAL 2~5] of Function Mode. After non-linearity correction is done, span correction value is re-sorted ascending order.

6-1) Calibration Lock
There is a function of calibration lock for not to break a calibrated value by wrong operation. If span calibration is going to be performed, it is displayed with [LocK] and does not accept a change during CAL LOCK. But zero point calibration can be performed.
Calibration lock procedure as follows.

	Guide display	Operation	Detail
1	(Measuring Mode)		Push ESC key while turning power ON, or press ESC key 3times immediately after powered ON.
2	CAL UnLocK	Select candidate	Use ◁ ▷ key to select [UnLocK] : Calibration permitted [LocK] : Calibration prohibited
			Press ↵ key to memorize
3	8.8.8.8.8.8. 8.8.8.8.8.8.8.8.8.	Reset	Reset automatically
4	(Measuring Mode)		Return to Measuring Mode

6-2) Actual Load Calibration

	Guide display	Item	Operation
1	CAL UnLocK	Cancel Cal. lock	Cancel calibration lock if locked
2	CAL	Start Calibration	Enter [CAL] in Function Mode
			Press △ key to the next item
3	d.Point 0	Decimal point position	Use ◁ ▷ key to select decimal point
			Press ↵ key to memorize
4	Scl.d iu 1	Minimum scale	Use ◁ ▷ key to select minimum scale
			Press ↵ key to memorize
5	CAP 99999	Rated capacity of Load Cell	Use ◁ ▷ △ ▽ key to set numeric value. Set '99999' if not needed.
			Press ↵ key to memorize
6	CAL 0 0	Zero Calibration	Put no load on Load Cell
7	CAL 0 00000		Press ◁ or ▷ key to start to blink one of the digit of '0' in Sub Display. Don't change '00000'.
			Press ↵ key to memorize
8	CAL 1 10000	Span Calibration	Put a reference weight on Load Cell. Prepare a weight as heavy as possible within the feasible range of Load Cell.
			Use ◁ ▷ △ ▽ key to set numeric value of a reference weight.
			Press ↵ key to memorize
9	CAL 2 ~ CAL 5 0	Non-linearity correction	Set '0' and memorize when non-linearity correction is not necessary
			When non-linearity correction is going to be made, operate same procedure as

			'CAL 1' until necessary span number ※Calibration value of span is sorted ascending order after calibration is competed
10	(Measuring Mode)		Press ESC key several times until return to Measuring Mode

6-3) Equivalent Input Calibration

Only effective when EXC=5V. When EXC=2.5V, please perform actual load calibration.

	Guide display	Item	Operation
1	CAL UnLocK	Cancel Cal. lock	Cancel calibration lock if locked
2	CAL	Start Calibration	Enter [CAL] in Function Mode
			Press △ key to the next item
3	d.Point 0	Decimal point position	Use ◁ ▷ key to select decimal point
			Press ↵ key to memorize
4	Sc L.div 1	Minimum scale	Use ◁ ▷ key to select minimum scale
			Press ↵ key to memorize
5	CAP 99999	Rated capacity of Load Cell	Use ◁ ▷ △ ▽ key to set numeric value. Set '99999' if not needed
			Press ↵ key to memorize
6	CAL 0 0	Zero Calibration	Press △ key 6 times to proceed to equivalent zero calibration.
7	E.0.Adj 0.00000	Equivalent zero input of Load Cell	Use ◁ ▷ △ ▽ key to set a zero voltage (mV/V) of Load Cell
			Press ↵ key to memorize
8	E.SPAn 1 10000	Display value of equivalent span of Load Cell	Use ◁ ▷ △ ▽ key to set display value of span amount
			Press ↵ key to memorize
9	E.S.Adj 1 1.00000	Equivalent span input of Load Cell	Use ◁ ▷ △ ▽ key to set span voltage (mV/V) of Load Cell
			Press ↵ key to memorize
10	E.SPAn2 ~ E.SPAn5 0	Non-linearity correction	Set '0' and memorize when non-linearity correction is not necessary
			When non-linearity correction is going to be made, operate same procedure as 'E.SPAn 1' and 'E.S.Adj 1'until necessary span number ※Calibration value of span is sorted ascending order after calibration is competed
11	(Measuring Mode)		Press ESC key several times until return to Measuring Mode

§7. Option (at the time of shipment)

7-1) 4～20mA current output (OP-1) / ±10V voltage output (OP-2)

After A/D converts the input signal from Load Cell to digital data, D/A converts it to analog output again. By a scaling function, it can link a display value to 4mA or 0V of analog output, and can link a display value to 20mA or 10V of analog output. In addition, it can fine-tune at 4mA, 20mA, 0V, +10V and −10V in order to regulate level error against input of instruments connected to this unit. Analog output is isolated from internal circuit. By using Test Mode, it can output 11 steps between 4～20mA or −10V～0～+10V.

1) Specifications

Output signal	(OP-1,2)	D/A converter output linked to A/D converter
Output range	(OP-1)	3.2～20.8mA (load resistance 510Ω or less)
	(OP-2)	0～±10V (load resistance 5kΩ or more)
Resolution	(OP-1,2)	linked to display resolution (maximum 1/40,000)
Non-linearity	(OP-1,2)	±0.1%FS (against display value)
Temp. characteristics	(OP-1,2)	Zero and Sensitivity are ±0.01%FS／℃.

2) Scaling of analog output

	Guide display	Content	Operation
1	dA oUt	Start setting of analog output	Enter 'dA oUt'in Function Mode. Press △ key to proceed the next item.
2	I_SEL or u_SEL nEt	Select output data type	When OP-1, proceed to 'I_SEL' When OP-2, press △ key 5times and proceed to 'u_SEL'
			Use ◁ ▷ key to select a data type.
			Press ↵ key to memorize
3	dSP. 4 0	Scaling to 4mA output	Use ◁ ▷ key to select a digit to change. Use △ ▽ key to change a numeric value. Press ↵ key to memorize
4	dSP. 20 10000	Scaling to 20mA output	
5	dSP. 0 0	Scaling to 0V output	
6	dSP. 10 10000	Scaling to +10V output	
7	(Measuring Mode)		Press ESC key several times until return to Measuring Mode

3) Fine adjustment of analog output

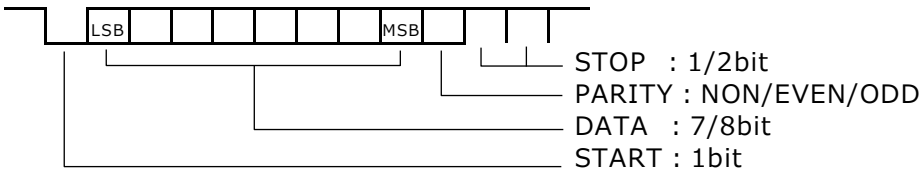
	Guide display	Content	Operation
1	dA oUt	Start setting of analog output	Enter 'dA oUt'in Function Mode. Press △ key 4 times to proceed the next item.
2	Adj. 4 0	Fine adjustment of 4mA output	Use ◁ ▷ key to adjust output level Fast forward when ▷ key pressed longer. Fast rewind when ◁ key pressed longer. Range of adjustment is ±999. Press ↵ key to memorize.
3	Adj. 20. 0	Fine adjustment of 20mA output	
4	Adj. 0 0	Fine adjustment of 0V output	
5	Adj. 10. 0	Fine adjustment of +10V output	
6	Adj. -10. 0	Fine adjustment of −10V output	
7	(Measuring Mode)		Press ESC key several times until return to Measuring Mode

7-2) RS-232C (OP-3) / RS-485 (OP-7)

In serial data interface of RS-232C or RS-485 conformity, it corresponds with two-way communication by the Half Duplex system.
It is isolated from internal circuit.
RS-485 can allocate identification number of connected unit from L01 to L99. (Maximum number of connectable unit is ten).
Writing 'non' as identification number doesn't identify the unit, which result in one to one communication. Interface of RS-485(OP-7) has internal termination resistance. If this unit is connected at the terminal end, it should make short between ⑤ and ⑥ of RS-485 terminal.

1) Specifications

Interface standard	EIA RS－232C conformity or RS-485 conformity(4 lines) RS-485 Maximum connected unit is ten units
Communication Protocol	Start-Stop Synchronous type / Half Duplex bi-directional
Command speed	2400, 4800, 9600, 19200, 38400bps
Communication Format	ASCII code, alphabet should be a capital letter

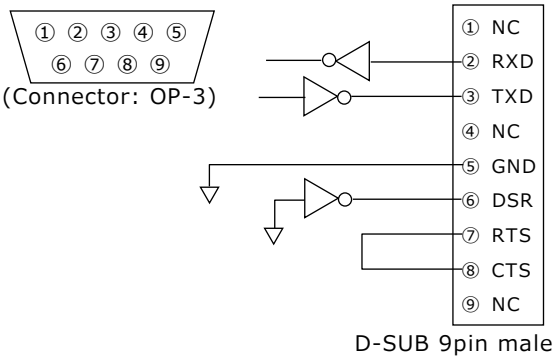


CR=0DH, LF=0AH

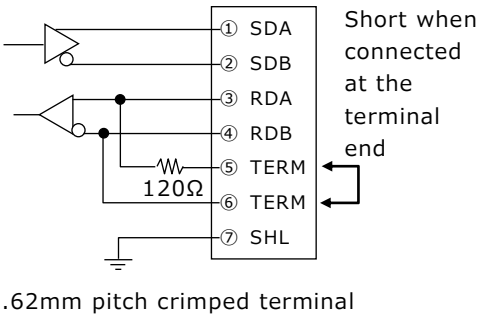
	1	2	3	4	5	6	7	8	9	10	11	12
Non decimal point	W	T	,	±	0	1	2	3	4	5	CR	LF
With decimal point	W	T	,	±	1	2	3	4	.	5	CR	LF
Over Load	O	L	,	±	9	9	9	9	.	9	CR	LF

Example 1) ID='non' when RS-232C or RS-485
Transmit from host:PTR,+012345<CR><LF> → Response :PTR,1234.5<CR><LF>

Example 2) ID=01 (other than 'non') when RS-485
Transmit from host:L01,PTR,+012345<CR><LF> → Response :L01,PTR,1234.5<CR><LF>



Interface circuit RS-232C (OP-3)



Interface circuit RS-485 (OP-7)

2) Communication Command

Command (Description)	Response ('←' : same as command)	The number of digit	Function	Remarks
REQ (Request)	WT,+######	6	Down-link demand	
ZRO (Zero)	←	–	Zero correction	
ZRC (Zero Clear)	←	–	Clear zero correction	
TRE (Tare)	←	–	Tare subtraction	
DAZ (Digital Auto Zero)				
TRC (Tare Clear)	←	–	Clear tare subtraction	
AZR (Auto Zero Reset)				
NET (Net)	←	–	Display Net value	
GRS (Gross)	←	–	Display Gross value	
NTQ (Net Data Request)	NET,+######	6	Down-link demand of Net value	
GSR (Gross Data Request)	GRS,+######	6	Down-link demand of Gross value	
PTR (Preset Tare)	PTR,+######	6	Down-link demand of preset tare value	
PTR,+###### (Preset Tare)	←	6	Set preset tare value	Forbid decimal point
RLY (Relay)	RLY,+######	6	Down-link demand of comparator output #----- :OUT1 -#---- :OUT2 --#--- :OUT3 ---#-- :OUT4 ----#- :OUT5 -----# :OUT6	Correspond 0 = OFF 1 = ON
STA (Status)	STA,+00####	6	Down-link demand of status #--- = Stable -#-- = Zero point --#- = Near zero ---# = Zero tracking	Correspond 0 = OFF 1 = ON
SPn (Set point)	SPn,+#########	9	Down-link demand of Quantitative value of comparator n	n=1∼4
SPn,+######### or SPn,+###### (Set point)	←	9 / 6	Set Quantitative value of comparator n	n=1∼4 Forbid decimal point
HYS (hysteresis)	HYS,+######	6	Down-link demand of Hysteresis value	
HYS,+###### (Hysteresis)	←	6	Set Hysteresis value	Forbid decimal point
GOQ (Go data Request)	SGO,+#########	9	Down-link demand of reference value of window comparator	

SGO,+######### or SGO,+###### (Set GO data)	←	9 / 6	Set reference value of window comparator	Forbid decimal point
HIQ (HI data Request)	SHI,+######	6	Down-link demand of upper limit of window comparator	
SHI,+###### (Set HI data)	←	6	Set upper limit of window comparator	Forbid decimal point
LOQ (LO data request)	SLO,+######	6	Down-link demand of lower limit of window comparator	
SLO,+###### (Set LO data)	←	6	Set lower limit of window comparator	Forbid decimal point
ADD (Add)	←	–	Addition operation	
TTL (Total)	TTL,+#########	9	Down-link demand of integrated value	
TTN (Total Number)	TTL,+######	6	Down-link demand of the number of times of integration	
TTC (Total Clear)	←	–	Clear integrated value	
Attach terminator <CR><LF> at the last of each command. ###### : number of figures is including decimal point. (with decimal point '1234.5', without decimal point '012345') Forbid decimal point when setting value. Attach decimal point as a response of down-link demand. Attach 'Lmn'(mn: identification number) at the start of each command when identifying connected unit using RS-485. Attaching 'non' makes no use of identification.				

3) Error response

Response	Content	Remarks
ERR-01	Memory error, writing error	Writing failure to nonvolatile memory, etc.
ERR-02	Non implementation	Tare subtraction during over load, etc.
ERR-05	Format abnormality	Undefined command, number of the digit of numerical value incorrect, etc.
There is terminator <CR><LF>		

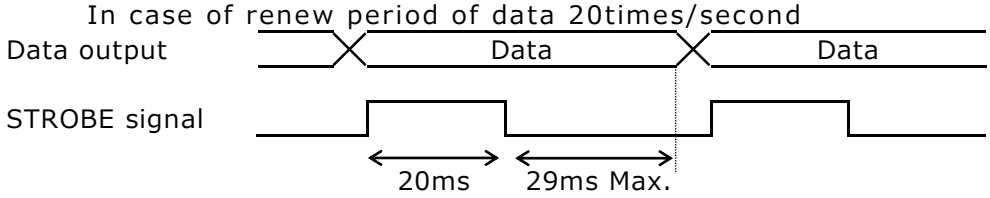
7-3) BCD data output (OP-6)

Output data	Select at [bcd/bcd.SEL] in Function Mode
Interface	Open Collector output (photo coupler isolation)
Rated output	DC30V 30mA (resistance load), saturation voltage 0.6V or less
Renew period of data	Synchronized with that of displaying. Maximum 20 times/sec. (50ms)
Output logic	Select positive / negative at [bcd/bcd.LGC] in Function Mode

Output format 28bit, No decimal point

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
STABLE	STROBE	POLARITY	OVERFLOW	Digit 10^5				Digit 10^4				Digit 10^3				Digit 10^2				Digit 10^1				Digit 10^0			
				8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1

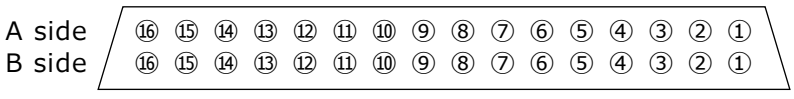
Output timing In case of renew period of data 20times/second



(About 40% of renew period occupy STROBE pulses)

Output pin array

	Pin No.	CN1 A side	CN1 B side	Signal	
Data	1	1×10^0	2×10^0	Digit 10^0 of data	Select logic positive / negative
	2	4×10^0	8×10^0		
	3	1×10^1	2×10^1	Digit 10^1 of data	
	4	4×10^1	8×10^1		
	5	1×10^2	2×10^2	Digit 10^2 of data	
	6	4×10^2	8×10^2		
	7	1×10^3	2×10^3	Digit 10^3 of data	
	8	4×10^3	8×10^3		
	9	1×10^4	2×10^4	Digit 10^4 of data	
	10	4×10^4	8×10^4		
	11	1×10^5	2×10^5	Digit 10^5 of data	
	12	4×10^5	8×10^5		
Status	13	OVER FLOW		Over Flow	
			POL (−)	Polarity (minus)	
	14	STROBE		Timing of update data being done	
			STABLE	Measured value is stable	
	15	E-COM		Common emitter to BCD output	
	16	SHL		Shield line of cable	
Conformed connector : FUJITSU COMPONET LIMITED FCN-361J032 (32pin female)					



(Pin array of BCD output on rear side)

§8. Function

8-1) Basic operation

① Press [FUNC] key for 1 second to enter Function Mode.
② Press [FUNC] key to display a classification in order.
③ Press [◁] [▷] key to display a classification.
④ Press [△] [▽] key to display an item.
⑤ Press [◁] [▷] key to select a candidate or a digit.
⑥ Press [△] [▽] key to change the numeric value of the selected digit.
⑦ Press [↵] key to memorize the setting.
⑧ Press [ESC] key to cancel the setting or leave Function Mode.

In regard to basic operation, refer to section §5 5-1)

8-2) Setting function

Func				
No.	Content	Guide display	Setting value or candidate	Operation
1	Preset Tare value	P-tArE 0	−99999 to +99999	Set numerical value (0 at the time of shipment)
2	Net Calculation	nEt P-tArE	P-tArE	Preset Tare subtraction (at the time of shipment)
			P-nEt	Net Calculation
3	Condition of adding operation	ttL.cnd 000000	xxxxx1	Add only when stable
			xxxx1x	Prohibit to add when close to zero
			xxx1xx	Prohibit to add again (unless back to close to zero)
			xx1xxx	Prohibit to add minus data
			x1xxxx	Prohibit to add plus data
			1xxxxx	Add automatically (Add only when stable and back to close to zero once)
				(000000 at the time of shipment)
4	Close to zero	nEAr-0 9	0 to 99999	Set numerical value (9 at the time of shipment)
5	Operation of [*] key	ASt.uEY 2Ero	2Ero	Zero correction (at the time of shipment)
			totAL	Addition / Integration
			ttL.cLEAr	Clear addition / Clear integration
			cnP.cLEAr	Clear hold of comparator output
			Print	Output data to RS-232C / RS-485 for once
6	Operation of LED '*'	AStdSP nEAr-0	nEAr-0	Turn ON when measured value is within the range of close to zero (at the time of shipment)
			0-trAcu	Turn ON when measured value is within the range of zero tracking
			totAL	Turn ON during integration
7	Conversion at Sub Display	Unit LEuEL	LEuEL	Bar graph indication (at the time of shipment)
			PErcEnt	Percentage indication
			conuErt	Unit conversion
8	Test Mode	tESt oFF	oFF on	Press [◁] or [▷] key to let 'on' blink and Press [↵] key to enter Test Mode.

8-3) Comparator function

⊏ o n̄ P				
No.	Content	Guide display	Setting value or candidate	Operation
1	Quantitative value of comparator 1	S P. 1 9 9 9 9 9	−99999 to +99999	Set numerical value
2	Quantitative value of comparator 2	S P. 2 9 9 9 9 9		
3	Quantitative value of comparator 3	S P. 3 9 9 9 9 9		
4	Quantitative value of comparator 4	S P. 4 9 9 9 9 9		(99999 at the time of shipment)
5	Fall value of comparator 1	S P 1. c 0	0 to 99999	Set numerical value
6	Fall value of comparator 2	S P 2. c 0		
7	Fall value of comparator 3	S P 3. c 0		
8	Fall value of comparator 4	S P 4. c 0		(0 at the time of shipment)
9	Hysteresis (common to comparator 1-4)	H Y S 0	0 to 99999	Set numerical value (0 at the time of shipment)
10	Delay time (common to comparator 1-4)	d L Y 0	0 to 9999	Set numerical value Delay time = setting value x0.5ms (0 at the time of shipment)
11	Judgement of comparator 1	S E L. 1 U P - n E t	O F F	No judgement. No output.
12	Judgement of comparator 2	S E L. 2 U P - n E t	U P - n E t	Upper limit of Net value (at the time of shipment)
13	Judgement of comparator 3	S E L. 3 U P - n E t	d n - n E t	Lower limit of Net value
14	Judgement of comparator 4	S E L. 4 U P - n E t	U P - G r o S S	Upper limit of Gross value
			d n - G r o S S	Lower limit of Gross value
			U P - P E A K	Upper limit of peak value while Hold operation
			d n - P E A K	Lower limit of peak value while Hold operation
			U P - b o t t o n̄	Upper limit of bottom value while Hold operation
			d n - b o t t o n̄	Lower limit of bottom value while Hold operation
			U P - P K _ P K	Upper limit of peak to peak value while Hold operation
			d n - P K _ P K	Lower limit of peak to peak value while Hold operation
			U P - t o t A r L	Upper limit of integrated value
			d n - t o t A r L	Lower limit of integrated value
			U P - ⊏ o u n t	Upper limit of the number of times of integration
			d n - ⊏ o u n t	Lower limit of the number of times of integration

15	Condition of comparator 1-4	Cond 0000	xxx1	Compare only when measured value is stable.
			xx1x	Don't compare when measured value is close to zero.
			x1xx	Keep a comparison result and release it when measured value is close to zero.
			1xxx	Keep a comparison result and release it when a key is pushed.
				(0000 at the time of shipment)
16	Reference value of window comparator	Go 0	−99999 to +99999	Set numerical value (0 at the time of shipment)
17	Upper limit of window comparator	Hi 0	0 to 99999	Set numerical value (0 at the time of shipment)
18	Lower limit of window comparator	Lo 0		
19	Judgement of window comparator	SEL.0 OFF	OFF	No judgement. No output. (at the time of shipment)
			net	Net value
			Gross	Gross value
			PEAK	Peak value while Hold operation
			bottom	Bottom value while Hold operation
			PEAK-PEAK	Peak to peak value while Hold operation
			totAL	Integrated value
			ttL-Count	The number of times of integration.
20	Condition of window comparator	Cond0 0000	xxx1	Compare only when measured value is stable.
			xx1x	Don't compare when measured value is close to zero.
			x1xx	Keep a comparison result and release it when measured value is close to zero.
			1xxx	Keep a comparison result and release it when a key is pushed.
				(0000 at the time of shipment)
21	Polarity of window comparator	mode Hi.Go.Lo	Hi.Go.Lo	Judge when plus / minus data (at the time of shipment)
			P-Hi.Go.Lo	Judge only when plus data

8-4) External output

OUt					
No.	Content	Guide display	Setting value or candidate		Operation
1	Output 1	o SEL.1 SP1	SP1		Comparator judgement result
2	Output 2	o SEL.2 SP2	SP2	StAbLE	Measured value is stable
3	Output 3	o SEL.3 SP3	SP3	nEAr-0	Measured value is close to zero.
4	Output 4	o SEL.4 SP4	SP4/Lo	Gross	During Gross value

5	Output 5	o SEL.5 StAbLE	Go	tArE	During Tare subtraction
6	Output 6	o SEL.6 nEAr-0	Hi	Hold	During Hold operation
				totAL	During integration
SEL.1=SP1, SEL.2=SP2, SEL.3=SP3, SEL.4=SP4, SEL.5=StAbLE, SEL.6=nEAr-0 at the time of shipment					

8-5) External input

In				
No.	Content	Guide display	Setting value or candidate	Operation
1	Input 1	i SEL.1 A2	non	No input allowed
2	Input 2	i SEL.2 A2-r	A2	Tare subtraction (equivalent AZ key)
3	Input 3	i SEL.3 2Ero	A2-r	Clear Tare subtraction (equivalent AZR key)
4	Input 4	i SEL.4 Hold	nEt-Gross	Display Gross value while ON. Display Net value when OFF.
5	Input 5	i SEL.5 Add	Hold	Hold operation while ON. Stop Hold operation when OFF.
6	Input 6	i SEL.6 ttL-CLEAr	diSP	Indicate an item in order at Sub Display (equivalent DISP SEL key)
			2Ero	Zero correction
			2Ero.CLEAr	Clear zero correction
			Add	Addition operation
			CAncEL	Cancel addition operation
			ttL-CLEAr	Clear integrated value
			CmP-rESEt	Release a comparator kept result.
			Print	Output data to RS-232C or RS-485 for once
SEL.1=AZ, SEL.2=AZ-r, SEL.3=ZEro, SEL.4=HoLd, SEL.5=Add, SEL.6=ttL-CLEAr at the time of shipment				

8-6) Analog output

dA oUt				
No.	Content	Guide display	Setting value or candidate	Operation
1	Select data of current output	i_SEL nEt	nEt	Net value (at the time of shipment)
			Gross	Gross value
			Hold	Sampling Hold value
			PEAY	Peak Hold value
			bottom	Bottom Hold value
			PEAY-PEAY	Peak to peak Hold value
2	Scale to 4mA output	dSP. 4 0	−99999 to +99999	Set numeric value (0 at the time of shipment)
3	Scale to 20mA output	dSP. 20 10000	−99999 to +99999	Set numeric value (10000 at the time of shipment)
4	Fine adjustment of 4mA output	Adj. 4 0	−999 to +999	Select numeric value (0 at the time of shipment)
5	Fine adjustment of 20mA output	Adj. 20 0	−999 to +999	Select numeric value (0 at the time of shipment)

6	Select data of voltage output	u_SEL nEt	nEt	Net value (at the time of shipment)
			GroSS	Gross value
			HoLd	Sampling Hold value
			PEAY	Peak Hold value
			bottoñ	Bottom Hold value
			PEAY-PEAY	Peak to peak Hold value
7	Scale to 0V output	dSP. 0 0	−99999 to +99999	Set numeric value (0 at the time of shipment)
8	Scale to 10V output	dSP. 10 10000	−99999 to +99999	Set numeric value (10000 at the time of shipment)
9	Fine adjustment of 0V output	Adj. 0 0	−999 to +999	Select numeric value (0 at the time of shipment)
10	Fine adjustment of +10V output	Adj. 10 0		
11	Fine adjustment of −10V output	Adj.- 10 0		

8-7) Serial output

SEr iAL				
No.	Content	Guide display	Setting value or candidate	Operation
1	Select transmitting data of Current Loop	cL. SEL nEt	nEt	Transmit Net value (at the time of shipment)
			GroSS	Transmit Gross value
			totAL	Transmit integrated value
			ttL-coun t	Transmit the number of times of integration
			diSP	Transmit displayed value
2	Data format of Current Loop	cL. Fñt FormñAt 1	−	No value nor candidate
3	RS-232C / RS-485 Mode	rS. ñod StrEAñ	StrEAñ	Transmit only (at the time of shipment)
			coññAnd	Receive command and Transmit data
			Auto	Transmit only one time automatically when measured value is stable outside of close to zero. Prohibit to transmit again until measured value is close to zero.
			P-Auto	Transmit only one time automatically when measured value is stable and positive outside of close to zero. Prohibit to transmit again until measured value is close to zero.
4	Select transmitting data of RS-232C / RS-485	rS. SEL nEt	nEt	Transmit Net value (at the time of shipment)
			GroSS	Transmit Gross value
			totAL	Transmit integrated value
			ttL-coun t	Transmit the number of times of integration
			diSP	Transmit displayed value

5	Data format of RS-232C/RS-485	rS. Fnt FormAt 1	–	No value nor candidate
6	Data speed of RS-232C/RS-485	rS. bPS 2400	2400	2400bps (at the time of shipment)
			4800	4800bps
			9600	9600bps
			19200	19200bps
			38400	38400bps
7	Data protocol of RS-232C/RS-485	rS. Pro 7EuEn2	7non 1	7/8: Data bit length Non/Even/Odd: Data parity 1/2: Data stop bit length (7Even2 at the time of shipment)
			7Even 1	
			7odd 1	
			8non 1	
			8Even 1	
			8odd 1	
			7non2	
			7Even2	
			7odd2	
			8non2	
			8Even2	
			8odd2	
8	Transmit timing of RS-232C/RS-485	rS. cYc d iSP	d iSP	Synchronized with renew period of displaying (at the time of shipment)
			SAnP	Synchronized with sampling incoming signal
9	Identification number of RS-485	rS. id	non	No identification number (at the time of shipment)
			L01 to L99	L : Identifier 01 to 99 : Identification number

8-8) BCD data output

bcd				
No.	Content	Guide display	Setting value or candidate	Operation
1	Select data of BCD output	bcd.SEL nEt	nEt	Net value (at the time of shipment)
			Gross	Gross value
			totAL	Integrated value (lower six digit)
2	Logic of BCD output	bcd.LGc 00000	xxxx1	Logic of data signal
			xxx1x	Logic of OVER FLOW signal
			xx1xx	Logic of POLARITY signal
			x1xxx	Logic of STROBE signal
			1xxxx	Logic of STABLE signal
			0 = Negative logic, 1 = Positive logic (00000 at the time of shipment)	

8-9) Weighing condition setting

F.cAL				
No.	Content	Guide display	Setting value or candidate	Operation
1	Digital Filter	d.F iLtr 5	0	Filter disabled (Quick response)
			1	Filter weak
			2	Filter middle
			3	Filter middle (eliminate 60Hz)
			4	Filter middle (eliminate 50Hz)
			5	Filter strong (eliminate 50/60Hz) (Slow response but stable) (at the time of shipment)

2	Condition of moving average	Avcond OFF	OFF	Normal moving average (at the time of shipment)
			0.5d, 1.0d, 1.5d, 2.0d, 3.0d, 4.0d, 5.0d, 6.0d, 8.0d, 10.0d	Clear moving average when measured value is out of the range specified here. d = minimum scale
3	Number of times of moving average	Avt inE 200t	1t, 10t, 20t, 50t, 100t, 200t, 400t, 600t, 800t, 1000t, 1200t, 1400t, 1600t, 1800t, 2000t	1t = No moving average (200t at the time of shipment)
4	Condition of stable	Stcond 1.0d	OFF	Always stable
			0.5d, 1.0d, 1.5d, 2.0d, 3.0d, 4.0d, 5.0d, 6.0d, 8.0d, 10.0d	Range of measured value to judge to be stable d = minimum scale (1.0d at the time of shipment)
5	Time length to judge stable	Stt inE 1.0S.	0.0S.	Judge immediately
			0.1S., 0.2S., 0.3S., 0.4S., 0.5S., 1.0S., 1.5S., 2.0S., 2.5S., 3.0S.	Time length to judge stable after fulfill condition of stable S. = second (1.0S at the time of shipment)
6	Condition of zero tracking	Ztcond OFF	OFF	Zero tracking in ineffective (at the time of shipment)
			0.5d, 1.0d, 1.5d, 2.0d, 3.0d, 4.0d, 5.0d, 6.0d, 8.0d, 10.0d	Range of zero tracking to be effective d = minimum scale
7	Working time of zero tracking	Ztt inE 1.0S.	0.0S.	Zero track immediately
			0.1S., 0.2S., 0.3S., 0.4S., 0.5S., 1.0S., 1.5S., 2.0S., 2.5S., 3.0S.	Time length to work zero tracking after fulfill condition of zero tracking S. = second (1.0S at the time of shipment)
8	Range of zero correction	Zr.Lin 10	0 to 100 (%)	Range of zero correction Specify percentage of rated capacity set at [CAL/CAP] (10% at the time of shipment)
9	Renew period of displaying	dSP.cyc 20tPS.	1tPS., 2tPS., 5tPS., 10tPS.,	Number of times to renew displaying per second.

			20tPS, 50tPS	(20tPS at the time of shipment)

8-10) Calibration

CAL				
No.	Content	Guide display	Setting value or candidate	Operation
1	Decimal point position	d.Point 0	0	No decimal point (at the time of shipment)
			0.0	One digit after decimal point
			0.00	Two digit after decimal point
			0.000	Three digit after decimal point
			0.0000	Four digit after decimal point
			0.00000	Five digit after decimal point
2	Minimal scale	Scl.d iv 1	1, 2, 5, 10, 20, 50, 100	Select numerical value (1 at the time of shipment)
3	Rated capacity of Load Cell	CAP 99999	1 to 99999	Set numerical value as rated capacity of Load Cell (99999 at the time of shipment)
4	Zero calibration by actual load	CAL 0 0	0 only	Use ◁ ▷ key to start to blink '0' Use ↵ key to memorize
5	Span calibration by actual load	CAL 1 10000	−99999 to +99999	Set numerical value (10000 at the time of shipment)
6	Non linearity calibration by actual load	CAL 2 0	−99999 to +99999	Set numerical value (0 at the time of shipment)
7		CAL 3 0		
8		CAL 4 0		
9		CAL 5 0		
10	Zero calibration by equivalent input	E.0.Adj 0.00000	−9.99999 to +9.99999	Set numerical value (0.00000 at the time of shipment)
11	Span display value by equivalent input	E.SPAn 1 10000	−99999 to +99999	Set numerical value (10000 at the time of shipment)
12	Span calibration by equivalent input	E.SAdj 1 1.00000	−9.99999 to +9.99999	Set numerical value (1.00000 at the time of shipment)
13	Non linearity calibration. Span display value by equivalent input	E.SPAn2 0	−99999 to +99999	Set numerical value (0 at the time of shipment)
14		E.SPAn3 0		
15		E.SPAn4 0		
16		E.SPAn5 0		

When non linearity (No.13～16) is modified other than 0, guide display 'E.SAdj x' will appear to set calibration value (x is corresponding span number).

Equivalent input calibration is effective when EXC=5V. When EXC=2.5V calibration should be done by actual load.

It can be a cause of measurement error to change excitation voltage (EXC) after calibration has been done.

§9. Test Mode

The response of Open Corrector output and indication of display is different during Test Mode. Please take measures to connected external equipment to keep it from abnormality. Test Mode confirms conditions of this unit by manual operation.

Test Mode helps to check input and output of this unit. When a system has malfunction, it is useful to confirm whether this unit or connected external equipment has failure in Test Mode.

9-1) Basic operation

1) To enter Test Mode, Push [↵] key while turning power ON, or press [↵] key 3 times immediately after powered ON.
   Pressing [◁] or [▷] key and [↵] key 3 times at [Func/tESt] in Function Mode can also enter Test Mode.
2) To leave Test Mode, turn power OFF or pressing [▷] key 3 times at displaying program version in Test Mode.
3) Proceed to the next item by [△] key and return to the previous item by [▽] key.

9-2) Test item

No.	Guide display	Item	Description
1	5037 P. XXX	Program version	press [▷] key 3 times to return to Measuring Mode
2	8.8.8.8.8.8. 8.8.8.8.8.8.8.8.8.	LED check	Check all LED on front panel ① Turn ON all LED ② Turn OFF all LED ③ Turn ON each segment of digit LED ④ Turn ON every digit LED in order
3	KEY 5.0 0	Key check	Left side : Excitation voltage Right side : Allocated key number 0 = No key pressed, 1=[DISP SEL], 2=[∗◁], 3=[FUNC], 4=[▽N/G], 5=[↵], 6=[HOLD△], 7=[ESC], 8=[▷AZR], 9=[AZ]
4	Out oooooo	External output check	Output 1 is ON/OFF by [DISP SEL] key Output 2 is ON/OFF by [∗◁] key Output 3 is ON/OFF by [FUNC] key Output 4 is ON/OFF by [ESC] key Output 5 is ON/OFF by [▷AZR] key Output 6 is ON/OFF by [AZ] key
5	In oooooo	External input check	oooooo : No external input is ON 1ooooo : Input 1 is ON o2oooo : Input 2 is ON oo3ooo : Input 3 is ON ooo4oo : Input 4 is ON oooo5o : Input 5 is ON ooooo6 : Input 6 is ON
6	dA. out 12.0mA 0u	Analog output check	Decrease analog output by [◁] key. Increase analog output by [▷] key. 11 steps as follows 4.0mA -10V 13.6mA 2V 5.6mA -8V 15.2mA 4V 7.2mA -6V 16.8mA 6V 8.8mA -4V 18.4mA 8V 10.4mA -2V 20.0mA 10V 12mA 0V Indicate even if OP-1 / 2 is not installed.
7	SEr iAL (no option)c.L (OP-3)rS-232c	Serial communication check	Transmit 'WT,+000000' by pushing [◁] [▷] key. Transmit 'WT,+000000' as answer back when received 'REQ' command of RS-232C / RS-485.

	(OP-7)rS-485		Protocol and speed follow settings at [SEriAL／rS.bPS] and [SEriAL／rS.Pro] in Function Mode. At RS-485, no identification is made. One to one communication
8	bcd (no option)nc (OP-6)FFFFFFF	BCD check	Only effective when OP-6 is installed ① All output is ON (Negative logic : Low level) ② All output is OFF(Negative logic : High level) ③ Output 1 bit for all digit. (4 bit) ④ Output 'F' for each digit. (1111B)
9	StrAin X.XXXX	Check input voltage from Load Cell	Display input voltage from Load Cell (mV/V) Using AZ or AZR key can let the display value be zero or restore a previous value.

§10. Troubleshooting

If this unit does not work properly, please take the following measures. If the trouble still cannot be solved, then please contact our company.
At query, please inform us the model name, product serial number, and conditions of this unit as detailed as possible.

10-1) Basic check point

1) Please check if using a correct power supply. this unit is supplied with voltage AC100～240V as standard or DC24V as option.
2) Please check that wires are connected to the terminal base properly.

10-2) Precautions at the time of calibration

1) Error occurs at the time of zero point calibration.
   ・In case of exceeding the setting range of zero point.
   To perform zero point calibration, Load Cell output with no load should be in the range of -2.8～+2.8mV/V
   If using Load Cell which has rated output more than 3.3mV/V and its no load output exceeds ±2.8mV/V, please contact our company.

2) Error occurs at the time of span calibration, or display value is not correct as set in span calibration.
   ・In case of output voltage of Load Cell being large.
   This unit cannot measure in a system that the sum of initial tare value and measured value exceed 3.3mV/V.
   If using Load Cell which has rated output more than 3.3mV/V, please contact our company.
   ・In case of span calibration voltage is slight.
   If span of Load Cell output with a load is lower than the setting value of span, calibration is incorrect.
   Make resolution rougher to set minimum scale higher, or use an appropriate Load Cell.

3) Fluctuation of measured value
   ・Inappropriate span setting value against resolution.
   Since the input sensitivity of this unit is 0.5μV/digit, the maximum display resolution is 1/10,000 when input 1.0mV/V. Exceeding this resolution makes fluctuation obviously. Set minimum scale higher to make fluctuation less to the degree not perceivable.

10-3) Countermeasures for unusual display

   ・Measured value is blinking (over load indication) when not overloaded.
   A part of sensor cable might be broken or a sensor itself might be defective.
   Please confirm the input voltage (mV/V) from a sensor in Test Mode.

10-4) Judgement whether this unit has malfunction

1) Please confirm whether a sensor excitation voltage is correct.
   Disconnect a sensor from this unit and check the voltage by a tester between #1(+EXC) and #4(-EXC) of terminal block. Please check whether it is stable at 5V±0.5V (EXC=5V). If it is unstable, power circuit for a sensor in this unit is failure.

2) Short-circuit (Jumper between No.5 (+SIG)～No.6 (-SIG)) at terminal block.
   Display input voltage (mV/V) in Test Mode. Then check if the input voltage is stable nearest to zero. If unstable, this unit is failure. If stable, please check a sensor side.

3) Check external input / output
   Check external input / output in Test Mode.

10-5) Checking a sensor (Load Cell)

Good or bad rough judgement can be done by measuring input/output resistance and insulation resistance because the Load Cell is structured by a bridge circuit. (Please make sure to power OFF this unit first and disconnect Load Cell before checking resistance)

1) Fault judging method by resistance of Load Cell

Check bridge resistance of Load Cell by a tester and confirm whether input/output resistance are correct

2) Fault judging method by insulation resistance of Load Cell

Measure the insulation resistance between shield line and other with voltage less than 50V. If the insulation resistance shows more than 1000MΩ, insulation of Load Cell is no problem.

§11. Specifications

11-1) A/D convert part

1) Input sensitivity:	0.5μV/digit Resolution: Max. 1/10,000 at 1.0mV/V input (EXC=5V)
2) Non-linearity:	±0.03%FS±1 count
3) Temperature characteristics:	Zero point ±0.005%FS/℃ (at 1.0mV/V input) Sensitivity ±0.005%Reading/℃
4) Frequency characteristics:	select 12 cut-off frequency(−3dB) from 2Hz to 4kHz -12dB/oct. low pass filter
5) Transducer power supply:	DC5V±5% 60mA or 2.5V±5% with remote sensing circuit Four 350Ω type sensors can be connected
6) ADC sampling cycle:	approx. 0.5ms (2000 times/sec)

11-2) Display part

1) Main Display (measured value)	
①Element:	LED 7-segment, 5-digit, Orange, character height 10mm
②Maximum reading:	±99999 (Zero suppress reading)
③Decimal point:	Select 1～5 digit after decimal point (Nil, 0.0, 0.00, 0.000, 0.0000, 0.00000)
④Over indication:	All digit Blink when measured value exceeds capacity and when voltage from sensor exceeds ±3.3mV/V
⑤Unit:	kg Other unit is pasted by unit seal as follows. kg, g, t, N, kN, N·m, kN·m, kPa, MPa, mm, %
⑥Renew cycle:	select from 1, 2, 5, 10, 20, 50 times/second
2) Sub Display	
①Element:	LED 7-segment, 9-digit, Orange, character height 8mm
②Content:	Select a content using DISP SEL key Tare subtraction, Preset tare subtraction, Integration target gap, Integration target value, Integration number of times, Sampling Hold value, Peak Hold value, Bottom Hold value, Peak to peak Hold value, Conversion(Bar graph, Percentage, Unit conversion)
3) Status Display	
①Element:	11 round shape LEDs, Φ3mm, red 3 square shape LEDs, red, green, yellow
②Status:	Upper side: ST:Stable, CZ:Center zero, Gross:Gross value, AZ:Tare subtraction, PT:Preset tare subtraction, HOLD:Hold, ＊:User selected function Down side: SET POINT 1 to 4 : Comparator 1 to 4 status LO/GO/HI: Window comparator status

11-3) Zero point and Sensitivity correction

1) Zero point correction:	adjustable by input signal of −3～+3mV/V
2) Sensitivity correction:	adjustable by span volume of −3.3～+3.3mV/V ※ The sum of zero point and span amount should not exceed ±3.5 mV/V.
3) Correction method:	Actual load calibration or Equivalent input calibration (only when EXC=5V)
4) Accuracy of Equivalent input:	±0.2%FS (span amount 1mV/V and cable length 1m) only when EXC=5V

11-4) I/O part

1) Operation switches

① Key switch:	9 keys
② Slide switch:	3 switches on rear side.
2) External input	6 inputs (6bit, 1bit common) Contact input without voltage or Open Collector input (Ic=10mA, voltage endurance more than 20V) 0.2s one shot MAKE signal or MAKE signal
3) External output	6 outputs (6bit, 1bit common)
① Output signal	Open Collector output (photo coupler insulation)
② Rated output	DC30V 50mA (resistance load), saturation voltage≦1.2V

11-5) Option

1) OP-1: 4 to 20mA current output

① Output signal:	DAC output linked with ADC sampling
② Output range:	3.2 to 20.8mA
③ Resolution:	linked with display resolution (maximum 1/10,000)
④ Load resistance:	510Ω or less
⑤ Non linearity:	0.1%FS (for display level)
⑥ Temperature characteristic:	0.01%FS/℃ for zero point and sensitivity

2) OP-2: 0 to ±10V voltage output

① Output signal:	DAC output linked with ADC sampling
② Output range:	0 to ±10V
③ Resolution:	linked with display resolution (maximum 1/10,000)
④ Load resistance:	5kΩ or more
⑤ Non linearity:	0.1%FS (for display level)
⑥ Temperature characteristic:	0.01%FS/℃ for zero point and sensitivity

3) OP-3: RS-232C serial communication

①Interface standard:	EIA RS-232C conformity
②Communication protocol:	Start-Stop Synchronous (Asynchronous) type / Half Duplex bi-directional
③Communication speed:	2400, 4800, 9600, 19200, 38400bps
④Data length:	7, 8 bit
⑤Data parity:	Non, Even, Odd
⑥Data stop bit:	1, 2bit
⑦Data format:	TOYO dedicated format, ASCII code

4) OP-6: BCD data output

①Interface:	Open Collector output (isolated by a photo coupler)
②Rated output:	DC30V 30mA (resistance load), saturation voltage≦0.6V
③Renew period of data:	Synchronized with renew period of displaying, maximum 20 times/second (50ms)
④Output logic:	Select positive or negative
⑤Output format:	28 bit length, no parity

5) OP-7: RS-485 serial communication

①Interface standard:	EIA RS-485 conformity (4-lines)
②Communication protocol:	Start-Stop Synchronous (Asynchronous) type / Half Duplex bi-directional,
③Communication speed:	2400, 4800, 9600, 19200, 38400bps
④Data length:	7, 8 bit
⑤Data parity:	Non, Even, Odd
⑥Data stop bit:	1, 2bit
⑦Data format:	TOYO dedicated format, ASCII code
⑧Maximum connectable unit:	10 units

11-6) General

① Countermeasure for power failure:	Each data is written in a non-volatile memory
② Power supplied voltage:	AC85～264V、50/60Hz、20VA as standard DC20～27V、0.5A as option
③ Operating Temperature and Humidity range:	−10～40℃、20～85% R.H. (without condensation)
④ Mounting:	Panel mounting type
⑤ Mass:	approx. 1 kg

§12. List of Models and Accessories

12-1) Model

DLS－5037－1－DC

Power supplied voltage	blank	: AC100 to 240V as standard
	DC	: DC24V as option
Option	blank	: No option
	1	: Current output (4 to 20mA)
	2	: Voltage output (0 to ±10V)
	3	: RS-232C communication
	6	: BCD data output
	7	: RS-485 communication
Model name	Digital indicator DLS-5037	

12-2) Accessories

1) Operation Manual	1 copy
2) Unit seal	1 pc.
3) Terminal cover	2 pcs.
4) Metal piece for SEN terminal	2 pcs. (Already assembled to the terminal)
5) FCN Connector for I/O (16pin)	1 pc.

§13. Terminal array

13-1) Terminal array

1) Terminal for Load Cell (7.62mm pitch crimped terminal)

No	Signal connection	
1	+EXC	Excitation voltage to Load Cell (+)
2	+SEN	Remote sensing input (+)
3	−SEN	Remote sensing input (−)
4	-EXC	Excitation voltage to Load Cell (−)
5	+SIG	Input signal from Load Cell (+)
6	−SIG	Input signal from Load Cell (−)
7	SHL	Shield line of Load Cell cable

Load Cell should be connected by a shielded cable of 6 cores. If shielded cable of 4 cores are used, use a metal short piece to connect #1 to #2 and #3 to #4 of terminal.
Also make it apart from a noisy line or AC line.
Please connect correctly after confirmed a signal name and cable color referring to Test Report attached to the Load Cell because cable wiring color is different from a manufacturer or a model.

2) Terminal for analog output and power line (7.62mm pitch crimped terminal)

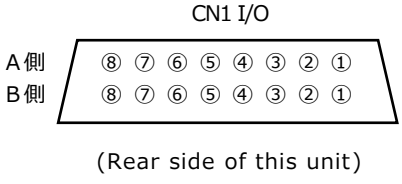
No.	Signal connection			
8	A-OUT+	Analog output (+) (option)		
9	A-OUT−	Analog output (−) (option)		
10	S-OUT	Current Loop output (No polarity)		
11				
12	E	Earth		
13	AC (L)	Power supplied voltage (AC100 to 240V)	DC (+)	Power supplied voltage (DC24V)
14	AC (N)		DC (−)	

Please connect #12(E) to the earth-line with ground resistance 100Ω or less.
Power supplied voltage is AC100 to 240V (standard) or DC24V (option). Please check the name plate of this unit and confirm whether the supplied voltage is correct.
In case of AC powered, please make twist of power wires.

3) Terminal for external I/O (FCN connector)

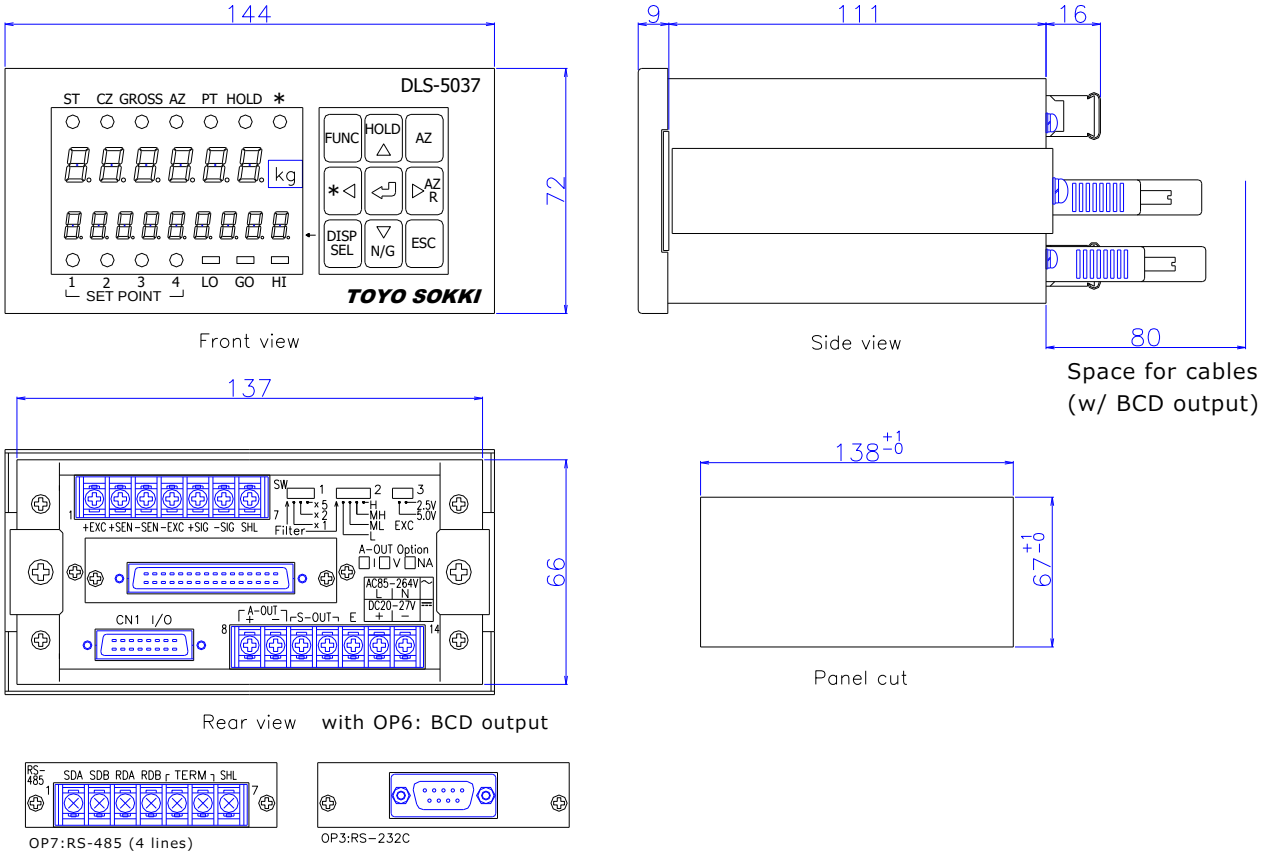
I/O	No.	Signal connection	
		A side	B side
Input	1	External input 1	External input 2
	2	External input 3	External input 4
	3	External input 5	External input 6
	4	Common ground for external input	
Output	5	External output 1 (Comparator 1)	External output 2 (Comparator 2)
	6	External output 3 (Comparator 3)	External output 4 (Comparator 4 / Window comparator LO)
	7	External output 5 (Window comparator GO)	External output 6 (Window comparator HI)
	8	Common Emitter for external output	
Conformed connector : Fujitsu Component Limited FCN-361J016 (16pin female)			

Do not bundle with AC power wire or drive motor wire to avoid malfunction



(Rear side of this unit)

§14. Dimensional Drawing



§15. Functional Block Diagram