DIGIFORCE User's manual (STANDARD Version)



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! Safety cautions !

- 1) The apparatus should not be exposed to water(dripping or splashing) and no objects filled with liquids, such as vases, should be placed on the apparatus.
- 2) The mains plug is used as the disconnect device. The disconnect device shall remain readily operable.
- 3) This equipment shall be connected to mains socket outlet with a protective earthing connection.

1. Beginning

Thanks so much for purchasing one of our products.

1.1 Description

There are some merits when you use the type of touching displacement sensor(LVDT/HBT) for a high accuracy

- The sensor is hypersensitive itself and precise.

- It has high resistance to the influence of environment(temperature changes, humidity, etc...)

- Heavy duty, small size and light weight

For that reason this sensor can be used for several measuring field.

To operate the type of touching displacement sensor(LVDT/HBT) needs Amplifier or Indicator. we developed this product("Electrical micrometer") user centered who has Amplifier or Indicator. A feature of this product is we sell and develop it based on user's purpose. One thing we have model could measure manufacture's thickness, difference of height, flatness, perpendicularity rate, etc...

These are our advantages for the new product.

- It has many functions that can be provide you easy directions for your needs.

- It will print formatted data and results for the quality control directly using the built in serial port(RS232C/PLC Interface)

1.2 Structure and Fundamental

1) Structure of the type of touching displacement sensor(LVDT/HBT PROBE)

Displacement sensor include differential transformer that can convert with the change of Core & Coil's position into electrical signals. The Bobbin twisted with coil is insulated material, so that might be used by lower temperature modulus and



[Figure.1] Structure of sensor.(LVDT/HBT)

core might be used by high saturation magnetic flux density or resistivity.

2) Fundamental of measurement

[Figure.2]is differential transformer electric circuit. Magnetize primary coil into an A.C on the differential transformer. According to core's displacement it will show D.C signal after check the secondary sign of proportional change. When the Core is on the center of Coil[Figure.2] out voltage is O(Zero) and it will change directly according to the Core's displacement.

After Being taken out voltage passes through the Amplifier and Filter circuit, the user will get the final rectified voltage which is based on Core's position.



[Figure.2] Signal processor circuit

1.3 System specifications

1) General

DIVISION	G E N E R A L							
MAIN SUPPLY	AC100-220V~ 50/60Hz							
MAX.POWER CONSUMTION	30W							
INNER FUSE	Fuse T2AL 250V							
O P E R A T I N G TEMPERATURE	5 ~ 40°C							
R E L A T I V E H U M I D I T Y	Up To 70%							
O P E R A T I N G C O N D I T I O N	NO CORROSIVE GAS AND DUST							
SUPPORTING OUTAGE	DATA BACK UP BY INNER FLASH MEMORY							

2) Specifications

DIVI	SION	SPECIFICATIONS			
	INNER POWER	$\pm 12V, + 5V, + 24V$			
	SENSOR	DF1 PROBE 1CH. LOAD CELL 1CH.			
(AMP.)	INPUT	DF2 PROBE 2CH. LOAD CELL 2CH.			
	MEASUREMET R A N G E	ON MODELS			
	L C D	TFT COLOR GRAPHIC LCD			
DISPLAY	BACKLIGHT	CCFL			
	S I Z E	800×480(pixel)			
D I M E	N S I O N	W280×D290×H124(mm)			
W E I	G H T	5.8kg			
		RS232C, 9600N81			
	NIERFACE	PLC I/F(IN:6, OUT:6)			

3) Dimension drawing



1.5 Directions for use

- Master setting require Probe's value up to ± 100 um.
- Before use meter please set the master value for avoiding error.
- Before use meter please inspect the sensor for its useful life.
- If you keep the old meter model without use, inner battery might be discharge also the initial value can be change. It is not a faulty product. Please follow instructions and reset the meter.

1.6 Directions for installation

When you install the product must be careful of your micrometer and sensor. It is very sensitive and accuracy. Follow the instructions below to install easily not only our product but also inspection and measurement equipment.

- The cable of signal of the displacement sensor is treated by shield but it might be influenced by organic voltage, therefore please keep the distance(more than 30mm) all the PLC input/output, motor related, power cabels.
- 2)Please connect spark killer or varistor(ZNR/TNR) with the induction load power(or signal cable and RELAY, MAGNETIC CONTACTOR, MOTOR, PARTS FEEDER, etc) when the induction load power on have no problem but off make strong counter electromotive force(20times of power voltage) and it will have affect on results.

Please reduce counter electromotive force for the reliable results.

e.g. 1) USING 24V RELAY : USE ZNR 390(39x10°)

(or, CUTTING OVER 39V SURGE VOLTAGE)

e.g. 2) USING 220V MAGNETIC CONTACTOR : USE ZNR 391(39x10¹) (or, CUTTING OVER 390V SURGE VOLTAGE)



3) In case of using the motor for equipment's operation. This electric force might affect the results. In this case please make mounting bracket to be insulated materials(MC NYLON, BAKELITE)

0-1. Operation keys

There are function keys($\mathbf{F_1} \sim \mathbf{F_4}$) and numeral keys in front of meter. ($\mathbf{F_1} \sim \mathbf{F_4}$): Function keys carry out the function of each menu screen displayed or select menu. Numeral keys arrangement is organized by ($\mathbf{0} \sim \mathbf{9}$)and($\mathbf{-}$, $\mathbf{\bullet}$, \mathbf{esc} , $\mathbf{-}$). ($\mathbf{0} \sim \mathbf{9}$): These are for numeric input or choosing menu. ($\mathbf{-}$, $\mathbf{\bullet}$) : Negative number and decimal point.

Fucnt i		Function keys carry out the function of each menu screen					
on key		displayed or select menu.					
	0 1 2 3 4	These and for more in instance the star					
17	5 6 7 8 9	Inese are for numeric input or choosing menu.					
keys	- •	Negative number and decimal point.					
arrang		On meas. screen : Start measuring					
ement		On main menu : Move next item					
	On meas. screen : Move to Main Menu						
	On main menu : Move to previous menu						

Table 1. Basic of operation keys

0-2. Measuring Screen

There is a general measuring screen below. Measuring Screen is composed of graph, tolerance box and decision result.

* The screen is different below when you using this product first time. There is no setting tolerance value.



"Force By Position, Model[0]" on upper screen indicate measuring mode and selected model.

"OK" indicate measuring result. When measuring value is in all of setting tolerance boundary, the measuring result become "OK". If there is one escape the boundary, the measuring result bacome "NG".

The graph shows the relationship between displacement and force. In graph, blue line means increasing displacement, red line means decreasing displacement.

There is a simple explanation about function key on upper right screen.

- Num. key "3"(ZOOM OUT) : Graph is enlarged all over the screen. Enlarging once, there's no return former graph.
- Num. key "5"(TRACE) : You can see measuring value of wanted position in graph. Push the trace key and using number key[4,7=left] [6,9=right] you can move position on graph.
- Num. key "8"(INFO) : Use this when you want indicate measuring result of each tolerance box on screen.



"[3778]" on lower left screen is number of sampling data.

"POS" on lower left screen indicate position is setting maximum force tolerance. The values below "POS" indicate base value and upper/lower tolerance of position on maximum force.

* Refer to part of tolerance setting to know it in detail.

The points of graph are following.

- Display range of X-axis : 0~20.000mm Y-axis : 0~2000kg
- Three tolerance box section is satisfied.
- Maximum force position : 17.000mm, It is in tolerance range so satisfied.
- The measuring result is "OK" because the measuring value is satisfied by all of tolerance range.

0-3. Main Menu



Main menu is basic menu before entering each menu item. Press "ESC" key to move main menu on measuring screen.

* You can move to main menu press "ESC" key several times in whatever menu.

Upper screen "(F-ver 39.1 L1D1v2 . U25 . M25)" is program version information. "Probe = 25mm/25mm" indicates available sensor and indicatable displacement. In here, available sensor is DP-25 and indicatable displacement is 25mm. Lower screen "<MODEL 0>" is indicating selected model right now.

1. Loadcell Setting



Input specification of loadcell in this menu. There are many kind of loadcell, so you should input specification precisely.

- Press : Input rated capacity of loadcell. Using F1~F3 key, you can change units of force(g, kg, t).
- Excit. Vol. : Input excitation voltage of loadcell.
- Rated voltage : Input rated voltage of loadcell(mV/V).
- Resistance : Input output resistance of loadcell.

* Refer to manual of loadcell to know specification of it in detail or ask shop you purchased.

Upper screen "ax=1.0, dec=0" is indicate resolution according to loadcell spec. The resolution is changed by loadcell spec. because ADC(Analog to Digital convertor) of micrometer is limited.

The resolution calculated like this

Resolution = $ax \times 10^{-dec}$ [Setting unit of force] ex.) 1kg = $1 \times 10^{-0} = 1$ [kg]

2. Sensor direction



If the sensor's direction is set to "Positive", it shall be presented as (-) value when it's not pressed and since it's pressed it will increase to (+) value.

In case of It can be minus(-) value

* In case of loadcell, it may show (-) value when it wasn't pressed.

The sensor and the measurement surface will be in contact when the pressurization begins. It is a Common structure of Pressure but if you want to change the direction of the sensor you should change the hardware. In case of Loadcell, switching "SIG+"and "SIG-" shall change the directions. You may inquire to retailer for the case of PROBE.

Caution ; When it is in measuring process, in order to improve the speed of sampling, direction setting won't be considered. So please make sure to set it to "Positive" for proper operation

3. Zero(Master) Setting



you should move start position of pressure

Measurement value will be presented on the screen from the zero master point so Zero master point should be set on pressure starting point.

- Setting method
- 1) Place the Master on pressure starting point of the equipment.
- 2) Press F2 key.
- 3) press F3, The displacement sensor

The absolute value of displacement sensor will appear, Move the displacement sensor to see the value changes.

- 4) Press F4 to set present position on Zero point.
- 5) Press F1 and proceed 3), 4) again.
- 6) Press ESC to save and go back to previous menu.
- ** In case of Loadcell, Zero point configuration will be set after receiving measurement starting signal. If the measurement timing doesn't fit, pressure of Loadcell will not appear correctly, please make sure to send the measurement starting signal before pressurize.

4. Zero Base Value

The starting point of the sensor can be other than "0". You can input optional value on standard of starting point by pressing F4 key to set the starting point of Loadcell or displacement sensor

5. Tolerance



This product provide several tolerance for dividing OK/NG.

- Tollerance of Box : To setting tolerance box form, input max/min value of length[horizontal axis) and max/min value of force(vertical axis).
- 2) Set up of tollerance of Pressed Max Position : Setting maximum pressure position range and deciding OK/NG
- 4) Set up of tollerance of last measuring data : Setting the tolerance final sampling measurement value.
- 5) Set Display Range : Setting indication area of graph on screen.
- 6) Set event by real-time inspecting : Output signal outside when it reached setting position or pressure.
- 7) Use Meassuring End Output Signal : Output signal outside when it ended measurement.

5–1. Tollerance of Box



[그림 7]

In here, position and force tolerance input box form, decide OK/NG.

Tolerance setting is maximum 10 sections. In upper screen indicates a title and which one is present tolerance setting section. Using F1, F2 key move tolerance setting section.



- Setting method

- 1) Setting position tolerance in "Pos Begin" and "Pos End".
- 2) Input pressure tolerance in "Press Min", "Press Max".
- 3) Select which test do you want
- Average value test
- Minimum value test
- Maximum value test

Select is "1", not select "0". It's possible overlapping over 1.

4) Selecting result decision condition on setting position tolerance section within position tolerance

- Must : Deciding OK, force value existing over 1.
- X Over : Deciding OK, former and after position tolerance, force value existing over 1.
- Back/Fore : Measuring spring, you will measure force of push(forward) and pull(backward).

You can select over 1.

5) When the decision section is over 2, press F1 key, moving tolerance setting screen, doing 1~4 process.

* Input "0" on "Pos Begin" and "Pos End" value, removing tolerance setting.

5–2. Set up of tollerance of Pressed Max Position





- Items

- 1) Use : Selecting using the tolerance, if you want to change, press No.1 key.
- 2) Base : Input basic position of maximum force. Basis this position, you will designate upper/lower tolerance. On graph, using trace, you know maximum force basic position. In case [Fig.8-1], (2) indicate maximum force position.
- 3) + Tol, -Tol : After input base position, input upper/lower tolerance. lower tolerance must small than upper tolerance.
- 4) Display Large : Select "yes" measuring result indicated lower screen with big font.
- 5) Display Add : Using add the figure on base position.
 - Indicating postion value = Real max force position + Display Add value
- 6) Serial with Add: "yes" Max force position value + Display add value.

"no" Max force position value only.

5–4. Set up of tollerance of last measuring data



You can set separately about force and position. Setting method is same with maximum force position tolerance.



This is setting screen of max force by position. ①'s position and force is the base last spec data.

5–5. Set Display Range

Setup View Range	•			
Force	Start = End =	0. 2000.	Kg Kg	
Position	Start =	0.000	mm	
	End =	20.000	mm	
8				8

You can control view rance of graph. Force s x-axis, position is y-axis. On screen, press No.3 key and using zoomout function, you can see overall graph.

6. OK / NG Sound

You can change it using F3,F4 key.

7. Operation Time



- Delay Aftter Start : After input start signal, it is time till measurement. You're just waiting during delay time.
- Output Hold Time : After measurement output maintain time of result OK/NG. Exactly pulse width of output signal. If you input "0", result signal output is maintained
- Measuring Time : You're measuring during setting time.
- Delay after Press : It's stable time after measurement.

8. Password

If you set password, you should input password moving from measurement screen to main menu. If you don't know the password, you can't move to main menu. So you can't change every setting

Password is only setting the number you can input the number you can input 1~8Figures.

 $\$ If you don't remember the code, ask sales agency.

9. Running Mode



- Start Mode : You select the way of start.
- Stop Mode : You select the way of ending.

• Max Meas. Time : It's the same item, the measurement time of moving time setting.

• Auto Position Reset by : Yes/No setting of automatic zero position.

9-1. Start Mode



• Start On : Select start on, measurement start by outer input.

Generally, it's receiving signal input by outer(D-sub 15Pin) No.8 Pin.

* Start signal is on 100ms(0.1second) and off right away.

• ABS Position In : On start mode, select ABS position in, you're measuring by sensor's position value.

After select this item, return to former menu, new item "5. Position" is appeared.

• Position I/O ABS : On start mode, select ABS position in, measuring by setting position value.

If sensor's position value is bigger than setting position value, measurement is started.

9–2. Stop Mode



[그림 15]

• Start Off : You select "off" of measurment start signal on measurement final condition.

Start on -> Measuring start

Start off -> Measuring finished

• ABS Position Out : You select probe's position value with measuring finishing

condition.

Measuring is off that probe's absolute value is little than position I/O ABS setting value.

• Stop On : Selecting outer signal input.

Measurement final signal input by outer connecter No. 7 Pin.

- Meas Time : Generally selecting measurement time is final condition
- Force Over : Selecting force value of Loadcell.

Select this item, return to former menu, new item "7. Force over"is appeared.

Measurement is off that force value is bigger than setting value.

9–3. Auto Position Reset By



1) USE : Select Yes/No of using auto pos R, b.

2) Over : Input force value of Loadcell.

Reset by No.3 item(setting value) is bigger than input value.

3) Zero : Input reset position

F2. Change Lang

On Main menu, press F2 key, appear change Lang Screen. You'll select Korean and English. You can change it by F3, F4 key.

F3. Setup More



- 1) I/O Test : Confirm In/Out put condition.
- 3) Probe's reading numbers : Setting probe's reading numbers. According to this setting value sampling speed is changing.
- 5) Serial cable setting : Setting RS232C cable item.
- 6) Product model setting : Selecting model number of measuring goods. You can manage separately each models.
- 7) Graph line width : Setting graph line width on screen.

F3-1. I/O TEST

Input / Out put I	est		
Input :			
8) START	= OFF		
7) MODEL () = OFF		
6) MODEL	= OFF		
5) MODEL 2	2 = OFF		
4) STOP	= OFF		
3) EMC	= OFF		
Output			
14) OK	= OFF	(KEY=1)	
13) NG	= OFF	(KEY=2)	
12) EMC	= OFF	(KEY=3)	
11)	= OFF	(KEY=4)	
10) READY	′ = OFF	(KEY=5)	

On Setup more, press No. 1 key, appear I/O Test Screen. You can test connection condition of in/output port. You can confirm input condition y output signal on outer PLC.

Input signal is on, "off" change "on".

You can test press F1~F4 key or No.1~6 key.

 $\$ In/Output test is not operating automatically.

F3-5. RS232C



On Setup more, press No.5 key, appear serial cable setting screen.

You can set if you output of measurement value through serial cable port.

- 1) Each item's meaning(point)
 - Serial transmit : Yes/No of using serial cable
 - Explanation transmit : Output including item name with measurement value.
 - Decimal point output : Setting output form.

Output with base value including decimal point.

2)Transmit setting

Division	Setting
InterfacePort	 RS232C RS232C PORT ⇒ 1 Channel Asynchronous
 Character organization Control units Communication spped Connection 	 DATA BIT ⇒ 8 Bit PARITY BIT ⇒ None STOP BIT ⇒ 1 Bit ASCII Code 9600 Baud (Fixed) One

3) Cable setting

Elec' Mi	crometer	Direction of signal	Computer			
Signal	Pin No.	Direction of signal	Pin No.	Signal		
N.C	1		1	DC		
RD	2	\leftarrow	2	RD		
TD	3		3	TD		
N.C	4		4	DTR		
SG	5	••	5	SG		
N.C	6		6	DSR		
N.C	7		7	RTS		
N.C	8		8	CTS		
N.C	9		9	RI		

- Cable of computer serial working terminal - Connect 4P, 6P Connect 7P, 8P

4) Output types for communication

◆ ML-16PW5T2-DF1(L1D1)

Byte	1	2	1	2	1	7		8		8		8		8		8		 7	1	2	1	1
Char	E N Q	RESULT (OK/NG)	,	Num. Data	,	Toln Force Data	,	Toln Pos. Data	,	 Max Force Pos.	,	@@	C R	Γ								

• Num. Data : No. of output data, in case of L1D1 21.

 $21 = 10[Tol.] \times 2[Force, Pos.] + 1[Max force pos. 1CH]$

• Toln : Tolerance 1~10

• TolnForceData format : ±XXXX. • TolnPos.Data format : ±XX.XXX

• Max force Pos. Data format : ±XX.XXX

* Data position is blank when there's no tolerance,

◆ ML-16PW5T2-DF2(L2D2)

Byte	1	2	1	2	1	7		8		 7	1	7	1	2	1	1
Char	E N Q	RESULT (OK/NG)	,	Num. Data	,	CHx Toln Force Data	,	CHx Toln Pos. Data	,	 CH1Max Force Pos.	,	CH2Max Force Pos.	,	@@	C R	L

• Num. Data : No. of output data, in case of L2D2 42.

 $42 = 10[Tol.] \times 2[Force, Pos.] \times 2[1CH, 2CH] + 2[MaxForcePos.1CH, 2CH]$

• CH x : No. of channel $1 \sim 2$ • Toln : Tolerance $1 \sim 10$

✗ Data format is identical to DF1,

Data position is blank when there's no tolerance,

F3-6. Model setting

If there are various product which have to inspect, it is possible to manage tolerance, measuring time according to product.

Thare are two method to setting model.

- Input by number keypad : Input no. of model you want and then set sensor zero, tolerance of model(product). This setting values not change(saved) although the other model be selected.
- Setting by external input signal : Setting by external input signal after input "99".

* Refer to I/O configuration in appendix to get more information.



Appendix. I/O pin configuration

Pin	Name	In/Out		Description	Circuit
1	NCOMMON		0 V	GND	INPUT (START)
3	MODEL BIT3	in	H/L	Model control bit 3	+24V L
4	MODEL BIT2	in	H/L	Model control bit 2	
5	MODEL BIT1	in	H/L	Model control bit 1	₽ ₽
6	MODEL BITO	in	H/L	Model control bit O	INPUT CURRENT:MAX 10mA
7	STOP	in	H/L	Stop mode	OUTPUT (OK, NG, READY)
8	START	in	H/L	Meas. Start signal	
9	EMG	out	H/L	Emergency Stop signal	
10	READY	out	H/L	READY Signal	VOLTAGE:MAX 30V CURRENT:MAX 300mA
11	N.C				Model 3 4 5 6
12	N.C				MODELO OFF OFF OFF OFF
13	NG 1	out	Н/І	NG signal	MODEL1 OFF OFF OFF ON
14	0K 1	out	H/L	OK signal	MODEL9 ON OFF OFF ON

▶ ML-16PW5T2-DF2(L2D2)

Pin	Name	In/Out		Description	Circuit
1	NCOMMON		0 V	GND	INPUT (START)
3	MODEL BIT3	in	H/L	Model control bit 3	+24V L
4	MODEL BIT2	in	H/L	Model control bit 2	
5	MODEL BIT1	in	H/L	Model control bit 1	₽ ₽
6	MODEL BITO	in	H/L	Model control bit O	INPUT CURRENT:MAX 10mA
7	START 2	in	H/L	Meas. Start signal2	OUTPUT (OK, NG, READY)
8	START 1	in	H/L	Meas. Start signal1	
9	EMG	out	H/L	Emergency Stop signal	
10	READY	out	H/L	READY Signal	VOLTAGE:MAX 30V CURRENT:MAX 300mA
11	NG 2	out	H/L	NG signal	Model 3 4 5 6
12	0K 2	out	H/L	OK signal	MODELO OFF OFF OFF OFF
13	NG 1	out	H/L	NG signal	MODEL1 OFF OFF OFF ON
14	0K 1	out	H/L	OK signal	MODEL9 ON OFF OFF ON

▶ Timing Diagam

