# OMRON

**Smart Sensors** 

Laser Displacement Sensors CMOS Type

ZX2 Series



# **User's Manual**





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# Introduction

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Thank you for purchasing the ZX2 Series Smart Sensor. This manual provides information regarding functions, performance and operating methods that are required for using the sensor.

When using the ZX2 Smart Sensor, make sure to observe the following:

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- To ensure correct use, please read this manual thoroughly to deepen your understanding of the product.
- Please keep this manual in a safe place so that it can be referred to whenever necessary.

## READ AND UNDERSTAND THIS DOCUMENT

Please read and understand this document before using the products. Please consult your OMRON representative if you have any questions or comments.

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SETTING TRANSITION CHARTS The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this document.

Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.

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	Meanings of Signal Words				
CONTENTS	The following signal words are used in this manual.				
INTRODUCTION			Indicates a potentially hazardous situation which, if not		
PREPARATION		NING	avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant		
FOR MEASUREMENT			property damage.		
OPERATION					
		Ν	leanings of Alert Symbols		
SETUP					
ΜΔΙΝ	The following a	alert symbols	s are used in this manual.		
APPLICATIONS & SETTING METHODS					
Height	*	Indicates f	the possibility of laser radiation.		
Steps and					
Warpage		Indicates	prohibition when there is a risk of minor injury from electrical		
Double Sheet Detection		shock or c	other source if the product is disassembled.		
Thickness	L				
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Laser Safety		CONTENTS
■ Sensor Head ZX2-LD50L, LD50, LD100L, LD100: Class 2		INTRODUCTION
		PREPARATION FOR MEASUREMENT
Never look into the laser beam. Doing so continuously will result in visual impairment.	$\wedge$	FLOW OF OPERATION
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Do not disassemble the product. Doing so may cause the laser beam to leak, resulting in the danger of visual impairment.		MAIN APPLICATIONS & SETTING METHODS
		Height

#### Sensor Head ZX2-LD50V: Class 1

🕂 WARNING	
-----------	--

Do not disassemble the product.

Doing so may cause the laser beam to leak, resulting in the danger of visual impairment.



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In Europe, diffuse-reflective models in the ZX2 Series are categorized as Class 2 laser products and the regular-reflective model is classified as a Class 1 laser product according to EN60825-1 (see note).

In the U.S.A., diffuse-reflective models in the ZX2 Series are categorized as Class II laser

products, and the regular-reflective model is classified as a Class I laser product according to EN60825-1 criteria, in accordance with the stipulations of the FDA standard

The diffuse-reflective models have already been registered with the CDRH (Center for

The CE markings on the products also reflect these categorizations.

Devices and Radiological Health). (Accession Number: 1020665-000)

The regular-reflective model is scheduled for registration with CDRH.

Place the laser warning label and the FDA label on the sensor.

Laser Notice No. 50 (see note).

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SETTING TRANSITION CHARTS Place the laser warning label on the sensor. The ZX2 Series is meant to be built into final system equipment. Pay special attention to the following precautions for the safe use of the product:

Note: Europe: Class 1 and Class 2 of EN 60825-1: 1994 +A11:1996 +A2:2001 = IEC 60825-1:1993 +A1:1997 +A2:2001

U.S.A.: Class I and Class II of FDA (21 CFR1040.10)

(1) ZX2-LDDDD emits visual laser beam. Do not stare directly into the laser.

Make sure that the laser beam path is terminated. If specular objects are present in the laser beam path, make sure that they are prevented from reflecting the laser beam.

When used without an enclosure, make sure the laser path from eye level is avoided.

- (2) To avoid exposure to hazardous laser radiation, do not displace nor remove the protective housing during operation, maintenance, and any other servicing.
- (3) As for countries other than those of Europe and the U.S.A., observe the regulations and standards specified by each country.
- (4) Label Indications

The EN and FDA labels are supplied with the product.

Replace the current labels with them according to the instructions given in the manuals.

## **Precautions for Safe Use**

Please observe the following precautions for safe use of the products.

#### Installation Environment

- Do not use the product in environments where it can be exposed to inflammable/ explosive gas.
- Do not install the product close to high-voltage devices and power devices in order to secure the safety of operation and maintenance.

#### Power Supply and Wiring

- The supply voltage must be within the rated range (DC12 to 24 V±10%).
- Reverse connection of power supply is not allowed. Connection to AC power supply is also not allowed.
- · Open-collector outputs should not be short-circuited.
- High-voltage lines and power lines must be wired separately from this product. Wiring them together or placing in the same duct may cause induction, resulting in malfunction or damage.
- Always turn off the power supply before connecting or disconnecting cables and connectors.

#### Others

- Do not attempt to dismantle, repair, or modify the product.
- · Dispose of this product as industrial waste.

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## **Precautions for Correct Use**

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SETTING TRANSITION CHARTS Please observe the following precautions to prevent failure to operate, malfunctions, or undesirable effects on product performance.

## Installation of the Product

#### Installation Site

Do not install the product in locations subjected to the following conditions:

- Ambient temperature outside the rating
- Rapid temperature fluctuations (causing condensation)
- Relative humidity outside the range of 35 to 85%
- Presence of corrosive or flammable gases
- Presence of dust, salt, or iron particles
- Direct vibration or shock
- Reflective sensor of intense light (such as other laser beams or electric arc-welding machines)
- · Direct sunlight or near heaters
- · Water, oil, or chemical fumes or spray
- Strong magnetic or electric field

## **Component Installation and Handling**

#### Power Supply and Wiring

- When using a commercially available switching regulator, make sure that the FG terminal is grounded.
- If surge currents are present in the power lines, connect surge absorbers that suit the operating environment.
- When connecting two or more amplifier units by using calculating units, make sure that the linear GND lines of the amplifier units are connected to each other. Supply power to all connected amplifier units at the same time.
- Before turning ON the power after the product is connected, make sure that the power supply voltage is correct, there are no incorrect connections (e.g. load shortcircuit) and the load current is appropriate. Incorrect wiring may result in breakdown of the product.
- The ferrite core accessory must be attached to the sensor head cable before use. (For how to attach the ferrite core, see pages 24 and 28.)
- The cables must be 10 m or shorter in total length, for both sensor head and amplifier units. To extend the cable from the sensor head, an optional extension cable (ZX2-XC□R) must be used. For extension of the cable of amplifier units, shielded cables of the same type must be used.
  - When using calculating units, make sure that the linear GND lines of the amplifier units are connected to each other.

#### Warming Up

After turning ON the power supply, allow the product to stand for at least 10 minutes before use. The circuits are still unstable just after the power supply is turned ON, so measured values may fluctuate gradually.

A warmup of at least 10 minutes is also required after canceling LD-OFF input if LD-OFF input is being used.

#### Sensing Object

The product cannot accurately measure the following types of objects: Transparent objects, objects with an extremely low reflective sensor ratio, objects smaller than the beam size, objects with a large curvature, excessively inclined objects, etc.

#### Mutual Interference

Inserting a calculating unit between amplifier units can prevent mutual interference between two sensor heads.

#### Maintenance

- Always turn OFF the power supply before adjusting or connecting/disconnecting the sensor head.
- Do not use thinner, benzene, acetone or kerosene to clean the sensor head and amplifier units. If large dust particles adhere to the front filter of the sensor head, use a blower brush (used to clean camera lenses) to blow them off. Do not blow the dust away with your mouth. To remove smaller dust particles, use a soft cloth (for lenses) with a small amount of alcohol. Take care not to wipe them off with excessive force.

Scratches on the filter may cause errors.

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# How to Use This Manual

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PREPARATION

## **Page Format**

This section explains the page format by using the Setting for MAIN APPLICATIONS AND SETTING METHODS chapter as an example. INTRODUCTION

#### Index label

Shows the chapter and header titles with white characters.



## **Meanings of Symbols**

Symbol	Meaning	CONTENTS
Important	Indicates points that are important to achieve the full product performance, such as operational precautions and applica- tion procedures.	INTRODUCTION
(For details about xxx, see page xx.)	Indicates pages where related information can be found.	PREPARATION FOR
Required (white characters on a black background)	Indicates a required setting in a setup procedure.	FLOW OF OPERATION
Optional (black characters on a white background)	Indicates an optional setting in a setup procedure.	BASIC SETUP
Pros to digity	Indicates which button to press to display the menu shown in the Display column.	MAIN APPLICATIONS & SETTING METHODS Height
Press to select Press to select the desired value.	Indicates that the user can select the menu that accords with their usage conditions by pressing the relevant button.	Steps and Warpage Double Sheet Detection
[Change numeric value]	Indicates that the user can specify a value that accords with their usage conditions by pressing the relevant button	Thickness
Press to set. Set any value.	and addy contained by proceing the relevant button.	Positioning
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# PREPARATION FOR MEASUREMENT

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# **Part Names and Functions**



# **Basic Configuration**

See the following pages for details:

Sensor Heads

Amplifier Units

Calculating Unit

Extension Cables

The basic configuration of the ZX2 series Smart Sensors is shown below.



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# **Amplifier Unit**



## **Digital Displays**

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The information displayed on the main and sub-displays depends on the currently selected mode. The default mode is the RUN mode.

When the power is turned ON, the model of Amplifier Unit (ZX2-LDA) will be displayed on the main display and the channel number will be displayed on the sub-display. Subsequently, the Sensor Head software version will be displayed on the main display and the Amplifier Unit software version will be displayed on the sub-display.

These details are displayed for approximately five seconds, and then data for the RUN mode will be displayed.

Mode	Main display (upper section, red)	Sub-display (lower section, orange)
RUN	The measured value (the value after the measurement conditions have been reflected) is displayed. For example, when the hold function is set, the held value will be displayed. Default measured values are as follows: <u>Measurement range</u> <u>+ indication</u> <u>Measurement center distance</u>	By pressing the <b>**</b> button, the HIGH threshold, LOW threshold, analog output value, resolution (max. value of measured value during one second - min. value), current value (value before execution of zero reset, hold, scaling and 2-sensor operation), and BANK are displayed in this order.
MENU	The function names are displayed in order by pressing the <b>(* * *</b> ) buttons.	The setting for the function displayed on the main display is displayed.

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(For details on setting transition charts, see page 158.)

## Alphabet Display Format

The alphabet appears on the main and sub-displays as shown in the following table. SPECIFI-

CATIONS	А	В	С	D	Е	F	G	Н	I	J	К	L	Μ
INDEX	Я	Ь	Ε	Ъ	Ε	F	Г	Н		ப	К	L	М
	Ν	0	Р	Q	R	S	Т	U	V	W	Х	Y	Ζ
SETTING TRANSITION CHARTS	N		Ρ	D	R	5	F	Ш	1/	N	X	Ч	2

## **Button Operation**

The functions of buttons change according to the currently selected mode.

Button type		Button function				
		RUN mode	MENU mode	INTRODUCTION		
ttons	& button button	<ul> <li>Normal press: Changes the sub-display content.*</li> <li>Both (*) buttons held down for three seconds: Locks button operation.</li> <li>Function changes depending on setting.</li> <li>Switches the function display.</li> <li>Selects the digit of numerical v.</li> <li>Stops setting.</li> </ul>		PREPARATION FOR MEASUREMENT		
or bu	Sutton	Normal press: Executes timing input.	The function changes depending on	OPERATION		
Curso	station	<ul> <li>Held down for one second: Executes zero reset.</li> <li>Both buttons held down for one second:</li> </ul>	<ul> <li>Changes the selection menu.</li> <li>Changes numerical values.</li> </ul>	BASIC SETUP		
MENU/SET button		Cancels a zero reset.  • Held down for 3 seconds: Changes the mode to the MENU Finalizes the set condit		MAIN APPLICATIONS & SETTING METHODS		
		mode.	value. <ul> <li>Held down for 3 seconds:</li> <li>Changes to the RUN mode.</li> </ul>	Height		
Smart tuning button		Held down for one second, held     down for three seconds, held down	Held down for one second, held     down for three seconds, held down	and Warpage		
		for five seconds: Executes smart tuning according to the time the button is held down.	for five seconds: Executes smart tuning according to the time the button is held down.	Double Sheet Detection		
L				Thickness		

\* For how to select the initial sub-display to be displayed when the power is turned on, see page 84.

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## **Sensor Head**



# Installation

#### Important

Before connecting/disconnecting Smart Sensor components, make sure that the power to the Amplifier Unit is turned OFF. The Smart Sensor may malfunction if components are connected or removed while the power is ON.

# **Installing Sensor Heads**

## **Installation Method**

- · Check the Sensor Head setting position by its emission center mark.
- Fix the sensor head in place with M3 screws. The screws must be tightened with a torque of 0.5 N•m.



Tilt the regular-reflective model as shown below with respect to the workpiece.
 A mounting bracket can also be attached to the regular-reflective model to tilt it correctly. (E39-L178; see page 141.)

ZX2-LD50V



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& SETTING METHODS · Be sure to attach the ferrite core accessory to the Sensor Head. Attach it within 100 mm of the Sensor Head side



#### Important

FOR MEASUREMENT FLOW OF

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· When mounting a Sensor Head, take care not to touch the emitter and receiver. Finger marks on the emitter and receiver may hinder correct measurements. If you have touched OPERATION them by mistake, wipe them with a clean, soft cloth.

· Fix the connectors in places that are not subject to vibration or impact.

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# Installing the Amplifier Unit

Amplifier Units can be easily mounted to 35-mm DIN Track.

Hook on the connector end

decrease if the output cable end is hooked on the DIN Track first.

## Installation Method

Hook the connector end of the Sensor Head on the DIN Track, and press in at the bottom until the Amplifier Unit locks into place. If necessary, fix it in place by the End Plate.

DIN Track (Option)

PFP-100N (shallow type/1 m)

PFP-50N (shallow type/0.5 m)

PFP-100N2 (shallow type/1 m)

End Plate (Option)

PFP-M

## **Removal Method**

Important

Push the Amplifier Unit and pull out from the connector end of the Sensor Head.

Hook the connector end of the Sensor Head on the DIN Track first. The mounting strength may



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# **Connecting Calculating Units**

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Use a Calculating Unit to connect Amplifier Units when performing calculations between Amplifier Units and to prevent mutual interference between Sensor Heads.

INTRODUCTION The number of Amplifier Units that can be connected differs depending on the functions to be used.

PREPARATION FOR	Function	Number of Connectable Amplifier Units	See:
MEASUREMENT	Calculation	Up to two units (Up to five units can be connected.	(A-B)
FLOW OF OPERATION		However, calculations are done between pairs of two.) For (A-B) calculations A: CH1	calculation: Page 47 Thickness
BASIC SETUP		B: CH2 or later ; CH1 CH1 CH2 CH2 CH2 CH2-CH1)	calculation: Page 57
MAIN APPLICATIONS & SETTING METHODS		CH4 (CH3-CH1) CH5 (CH4-CH1) (CH5-CH1)	
Height	Mutual interference prevention	Up to five units	Page 88
Steps and Warpage			L]
Double Sheet Detection	For details on the cor	nnection method, see the next page.	
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## **Connection Method**



- **1** Open the connector cover on the Amplifier Unit. Open the connector cover by lifting and sliding it.
- **2** Mount the Calculating Unit to the DIN Track.
- **3** Slide and connect the Calculating Unit to the Amplifier Unit connector.
- **4** Slide and connect the second Amplifier Unit to the Calculating Unit connector.
- 5 Fix in place with the End Plate (sold separately: PFP-M).

#### Important

- To disconnect Amplifier Units and Calculating Units, perform the above operations in reverse order.
- The following diagram shows the channel numbers when multiple Amplifier Units are sconnected.



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# Connecting the Sensor Head to the Amplifier Unit

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## Installation Method

· Extending the Sensor Head cable

Only one extension cable can be used.

Within 100 mm

An optional extension cable (ZX2-XC□R) must be used.

30

16.5 dia.

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Within 100 mm

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Be sure to attach the two supplied ferrite cores within 100 mm of each end of the extension

Within 100 mm

Made by TDK Corporation ZCAT1730-0730A

## **Removal Method**

To disconnect the Sensor Head, hold the Sensor Head's connector ring and the Amplifier Unit connector, and then pull them straight out.

# Connector Ring

#### Important

- Do not touch the terminals inside the connector.
- · Prevent the connector from being subjected to static electricity.
- When the Sensor Head is replaced with a different type, set all the setting data inside the Amplifier Unit again since it will be cleared. (default values: → See page 123.)



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# Wiring Diagram

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## Wiring Input/Output Cables

The input/output cable has the following wires.

#### Important

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Wire the cable correctly. Incorrect wiring may damage the Smart Sensor. (For details on the cable's conductor cross-section and insulation resistance, see page 136.)

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Cable color	Name	Function			
Brown	Power supply	Connects the 10 to 30 VDC (including (p-p) 10% ripple) power supply. When using an Amplifier Unit with a PNP output, the power supply terminal is also the common I/O terminal for all I/O except for the analog output.			
Blue	GND (0 V)	The GND terminal is the 0 V power supply terminal. When using an Amplifier Unit with an NPN output, the power supply terminal is also the common I/O terminal for all I/O except for the analog output.			
White	HIGH judgement output	The HIGH judgement output outputs judgement results (HIGH).			
Green	PASS judgment output	The PASS judgement output outputs judgement results (PASS).			
Gray	LOW judgment output	The LOW judgement output outputs judgement results (LOW).			
Yellow	Error output	This is output when the system detects an error. (For details on error messages, see page 130.)			

ZX2 User's Manual

Cable color	Name	Function	
Black	Analog output	The analog output outputs a current or voltage in accordance with the measured value. (For details on setting method, see page 109.)	CONTENTS
Shield	Analog GND (0 V)	Analog GND (0 V) The analog GND terminal is the 0 V terminal for the analog output.	
		Important • Use the shield for analog output separately from the blue	PREPARATION FOR MEASUREMENT
		<ul><li>(0V) wire for power supply.</li><li>When analog output is not used, be sure to connect this wire to the blue (0 V) wire.</li></ul>	FLOW OF OPERATION
		• When using Calculating Units, make sure that the analog GND lines of the Amplifier Units are connected to each other	BASIC SETUP
Pink	LD-OFF input	If this LD-OFF input signal is ON, the laser will stop emission, causing a light intensity error. In this case, the analog output, digital display, judgement output, and judgement output display signals will be output according to the non-measurement settings. The sub-display will show LdDFF. Warm up the sensor for at least 10 minutes after canceling LD-OFF input.	MAIN APPLICATIONS & SETTING METHODS
			Height
			Steps and Warpage
			Double Sheet Detection
		see page 111.)	Thickness
Orange	Zero reset input	The zero reset input is used to execute and cancel zero reset. (For details, see page 101.)	Positioning
Purple	Timing input/ BANK input 0 (switched by external input setting)	input/       Timing input:         nput 0       Signal input wire for obtaining hold function timing. While         ed by       this input is being input, the sub-display will show         I input       LI MI N□.         BANK input 0:       Signal input wire for bank switching. Banks are switched         by ON/OFF combinations with BANK input 1.       When connecting two or more Amplifier Units, use the         CH1 Amplifier Unit for bank switching. The banks of the	Eccentricity and Surface Deflection
			DETAILED SETTINGS
			TROUBLE- SHOOTING
		Amplifier Units of CH2 and later are switched together with CH1. (For details on switching and inputs, see page 118.)	SPECIFI- CATIONS

	Cable color	Name	Function
CONTENTS	Red	Reset input/BANK input 1 (switched by external input	Reset input: While a reset signal is being input, RESEL is displayed on the sub-display.
INTRODUCTION		setung)	<ul> <li>When the hold function is not used The output while a reset signal is being input is held in accordance with the output during non-measurement setting</li> </ul>
PREPARATION For Measurement			This feature can be used in cases such as to input a mask signal if you want to stop output for a certain period
FLOW OF OPERATION			<ul> <li>When the hold function is used</li> <li>If a reset signal is input, the state in effect before the hold function was set will be restored</li> </ul>
BASIC SETUP			(For details on the hold function, see page 93, and for details on the output during non-measurement, see page 111.)
MAIN APPLICATIONS & SETTING METHODS			BANK input 1: Signal input wire for bank switching. Banks are switched
Height Steps and			When connecting two or more Amplifier Units, use the CH1 Amplifier Unit for bank switching. The banks of the Amplifier Units of CH2 and later are switched together
Warpage Double Sheet Detection			with CH1. (For details on switching and inputs, see page 118.)
Thickness	For the tir to 146.	ning at which thes	e signals are input, see the timing charts on pages 144
Positioning			
Eccentricity and Surface Deflection			
DETAILED SETTINGS			
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# I/O Circuit Diagrams



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# **FLOW OF OPERATION**


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Connecting Two or More Amplifier U	Inits	р. 86	MEASUREMENT
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(Improving Unstable Measuremen	t Near the Judgement Threshold	)	OPERATION
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# **BASIC SETUP**

**BASIC SETUP** 

# **BASIC SETUP**

#### **Display of RUN Mode** CONTENTS



## Simplest Setting

### Smart Tuning (Single Smart Tuning)

Smart tuning sets optimum sensing conditions according to the operating conditions (response time and color/state of workpiece)

Thickness	(response and	sponse line and coloristate of workpiece)				
	Button Operation	Display	Description of Operation	Explanation of Selection Menu		
Positioning Eccentricity and Surface Deflection	_	_	Set the reference workpiece in place, adjust the position of the Sensor Head while looking at the digital display values on the Amplifier Unit or the indicators on the Sensor Head on that the			
DETAILED SETTINGS			distance between the Sensor Head and the workpiece is the measurement center distance, and install the Sensor Head at this position.			
SHOUTING	SMART MENU/SET	Pressing down	Press the 🖲 button for one	If "FALLEd" flashes on the		
SPECIFI- CATIONS	Hold down for 1 second	<u>SMARE</u> SI NGLE	second. When SMARE/ SI NGLE is displayed, release	seconds, it indicates that tuning was not possible.		
INDEX			start execution of smart tuning.	Change the response time setting to a larger value, and itry again.		
SETTING TRANSITION		Flashing		L		

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FOR

Height

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To tune multiple workpieces or to tune workpieces having a different surface condition: page 80

# MAIN APPLICATIONS & SETTING METHODS

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Thickness	57
Positioning	66
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# Height



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#### Procedure for setting up height



**1** Sensor installation/wiring Required

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#### Set the reference workpiece in place, adjust the position of the Sensor Head while looking at the digital display values on the Amplifier Unit or the indicators on the Sensor Head so that the height to be measured is near the measurement center

Set to the MENU mode Required

distance, and install the Sensor Head at this position.

Has the Sensor been installed and wired? (See page 23.)

Select the desired mode to set the measurement conditions in.

Buttop			
Operation	Display	Description of Operation	Explanation of Selection Menu
SMART MENU/SET		Hold down the button for three seconds to switch to the MENU mode.	
TING Press to display,	delai l Baabaa	Press the 🏶 button to display dELRI L.	* This operation is not required when hold and trigger conditions are not to be set.
IS Press to display.	I <u>dELAI L</u> ON	Press the   button to set the display to □N to set display of the detail menu.	

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
SMART MENU/SET		Press the button to apply the setting.		CONTENTS

### **3** Response time setting Required

Select the response time to match the size and moving speed of the sensing object.

Button Operation	Display	Description of Operation	Explanation of Selection Menu	PREPARATION For
Press to display,	5855d 888888	Press the 🌒 button to display SPEEd .	Default value: 500 ms	MEASUREMENT
Press to select	SPEEd IM5 Select the desired value.	Press the 💲 button to select the response time.	Select the response time to match the size and moving speed of the sensing object. $\begin{array}{c} 60 \ \mu\text{s}, 120 \ \mu\text{s}, 240 \ \mu\text{s}, 500 \ \mu\text{s}, 1 \ \text{ms}, 2 \ \text{ms}, 4 \ \text{ms}, 8 \ \text{ms}, 12 \ \text{ms}, 20 \ \text{ms}, 36 \ \text{ms}, 66 \ \text{ms}, 128 \ \text{ms}, 250 \ \text{ms}, 500 \ \text{ms}} \end{array}$	BASIC SETUP MAIN APPLICATIONS & SETTING METHODS Height Steps
SMART MENU/SET		Press the button to apply the setting.	* After the response time is changed, the smart tuning results are cleared, so be sure to re-execute tuning.	and Warpage Double Sheet Detection

### 4 Smart tuning Required

Smart tuning sets optimum sensing conditions according to the operating conditions (response time and color/state of workpiece)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Eccentricity and Surface Deflection
—	—	Check that the reference workpiece is set in place.		DETAILED SETTINGS
SMART MENU/SET Hold down for 1 second	Pressing down SMARL SI NULE Pressed down LUNI NU SI NULE Flashing	Press the button for one second. When SMARE/ SI NELE is displayed, release your finger from the button to start execution of smart tuning.	If " FRILED" flashes on the Isub-display for three seconds, it indicates that tuning was not possible. Change the response time Isetting to a larger value, and try again.	TROUBLE- SHOOTING SPECIFI- CATIONS

\* To tune multiple workpieces or to tune workpieces having a different surface condition: **page 80** 

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### 5 Hold Optional

Set this item to hold measured values during the measurement period according to preset hold conditions.

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display.	<u>HDLd</u> 888888	Press the ♦ button to display H□Ld.	Default value: OFF
PREPARATION For Measurement		HOLd	Press the 💲 button to select the hold conditions.	CIFF Hold OFF
FLOW OF OPERATION	Press to select	Select the desired value.		The average measured value during the sampling period is held
BASIC SETUP				The difference between the
MAIN APPLICATIONS & SETTING METHODS				values during the sampling period is held.
Height				The measured value at the start of the sampling period is
Steps and Warpage				held.
Double Sheet Detection				The minimum value during the sampling period is held.
Thickness				The maximum value during the sampling period is held. (For details, see page 95.)
Positioning Eccentricity	SMART MENU/SET		Press the button to apply the setting.	* The clamp value is output until the first sampling period
and Surface Deflection			When other than DFF is selected, proceed to "6	is finished. (For details on the clamp value, see page 111.)
DETAILED SETTINGS			Trigger conditions," and when □FF is selected, proceed to "7 Threshold	, , ,
TROUBLE- SHOOTING			setting."	
SPECIFI- CATIONS	6 Trigge	er conditions	Optional Set how timing period is to be	of the hold measurement input.
INDEX	Button Operation	Display	Description of Operation	Explanation of Selection Menu
SETTING TRANSITION CHARTS	Press to display.	<u>ERI G</u> 888888	Press the ♦ button to display ERI [].	Default value: TIMING
44			1	

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	<u>ERIG</u> EIMING	Press the subtton to select the trigger conditions.	El MI NG Enter the trigger by using the timing input or by pressing the enter button in the BLIN	CONTENTS
Press to select	Select the desired value.		mode. The period that the timing signal is ON is the	INTRODUCTION
			SELF-d The sampling period is the	PREPARATION FOR MEASUREMENT
			period that the measured value is lower than the specified self-trigger level.	FLOW OF OPERATION
			The sampling period is the period that the measured	BASIC SETUP
			specified self-trigger level. (For details, see page 97.)	MAIN APPLICATIONS & SETTING METHODS
SMART MENU/SET		Press the button to apply the trigger conditions.		Height
		When SELF-U and		Steps and Warpage
		5ELF - d are selected, proceed to the next item, and when ELMLNC is selected.		Double Sheet Detection
		proceed to "7 Threshold setting."		Thickness
Press b c	<u>SELF.LV</u>	Press the s button to display	Default value: 0.000	Positioning
display.				Eccentricity and Surface Deflection
		Press the sutton to enable setting of the self-trigger level.		DETAILED SETTINGS
[Change numeric value]	SELFLV	Press the 🕸 button to move the digit, press the 💲 button to	* If the \$ button is pressed when the cursor is at the	TROUBLE- SHOOTING
Press to set.	Set any value.	set the self-trigger level.	button is pressed when the cursor is at the left-most digit, the setting will be canceled.	SPECIFI- CATIONS
SMART MENU/SET		Press the button to apply the setting.		INDEX
				SETTING TRANSITION CHARTS

#### 7 Threshold setting Required

Set the range of measured values to be judged as PASS by setting the HIGH and LOW thresholds.

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display.	Lit H L MENU	Press the the button to display the HIGH threshold.	Setting example: Non-defective product height 0 to 10 mm
PREPARATION FOR MEASUREMENT			Press the 🏶 button to enable setting of the HIGH threshold.	NG OK NG P10 L0
FLOW OF OPERATION				Set the MAX and MIN
BASIC SETUP	[Change numeric value]	Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the HIGH threshold.	to the HIGH and LOW thresholds, respectively.
MAIN APPLICATIONS & SETTING METHODS	SMART MENU/SET		Press the button to apply the setting.	when the cursor is at the right-most digit or the &
Height Steps and Warpage	Press to display.	Lit H L MENU	Press the \$ button to display the LOW threshold.	the setting will be canceled.
Double Sheet Detection			Press the 🏶 button to enable setting of the LOW threshold.	threshold is greater than the LOW threshold.
Positioning Eccentricity and Surface	[Change numeric value] More dgi Press to set.	CODD Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the LOW threshold.	
Deflection	SMART MENU/SET		Press the button to apply the setting.	
TROUBLE-	8 Retur	n to RUN mod	e Required Switch to the is performe	ne mode in which measurement d.
SPECIFI-	Button Operation	Display	Description of Operation	Explanation of Selection Menu
	SMART MENU/SET Hold down for 3 seconds		Hold down the button for three seconds to switch to the RUN mode.	
SETTING TRANSITION CHARTS	* For details Example	s on optimizing (Setting the ref	settings, such as output and inp erence height to 0 (or the offset	but, see "Detailed Settings." value): <b>Zero Reset</b> $\rightarrow$ <b>page</b>

Example (Setting the reference height to 0 (or the offset value): **Zero Reset**  $\rightarrow$  **page** 101.)

# **Steps and Warpage**



Note that different channels are used to specify each menu item, as shown below.



ON: Mutual interference prevention is ON OFF: Mutual interference prevention is OFF

### Sensor installation/wiring Required

Has the Sensor been installed and wired? (See page 23.)

Connect two Amplifier Units with a Calculating Unit in between. (The calculation result is displayed and output on the CH2 Amplifier Unit.)

Set the reference workpiece in place, adjust the position of the Sensor Head while looking at the digital display values on the Amplifier Unit or the indicators on the Sensor Head so that each of the heights to be measured is near the measurement center distance, and install the Sensor Head at this position.

### 2 Set to the MENU mode Required

Select the desired mode to set the measurement conditions in.

(Use CH1 and CH2 for these settings.)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	INDEX
SMART MENU/SET	Lit H L MENU	Hold down the button for three seconds to switch to the		SETTING TRANSITION
3 seconds		MENU mode.		CHARTS

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	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press to display.	<u>dELRI L</u>	Press the 🏶 button to display dEEAI L.	
INTRODUCTION		JELAI L	Press the 拳 button to set the display to □N to set display of	
PREPARATION For Measurement	Press to display.		the detail menu.	
FLOW OF OPERATION	SMART MENU/SET		Press the button to apply the setting.	
BASIC SETUP	<b>3</b> Mutua (Use (	<b>al interference</b> CH1 for these s	prevention Optional interference	m to prevent the influence of mutual ce between two Sensor Heads.
MAIN APPLICATIONS & SETTING METHODS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Height Steps and	Press to display.	<u>59NC</u> 888888	Press the ♦ button on the CH1 Amplifier Unit to display S∃N[.	Default value: OFF
Warpage Double Sheet Detection	Press to display.	<u>SSNC</u> ON	Press the 拳 button to display □N.	
Positioning	SMART MENU/SET		Press the button to apply the setting.	* For details on the response time when connecting two or more Amplifier Units, see page 86.
and Surface Deflection	1		Select the re	esponse time to match the size
DETAILED SETTINGS	H Respo	ual interference	ng Required and moving prevention is ON: Use CH	speed of the sensing object.
TROUBLE- SHOOTING	Button	Display	Description of Operation	Explanation of Selection Menu
SPECIFI- CATIONS	Press	SPEEd	Press the 🌢 button to display	Default value: 500 ms
INDEX	to display.	888888		
SETTING TRANSITION CHARTS				

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	IMS	Press the 💲 button to select the response time.	Select the response time to match the size and moving speed of the sensing object.	CONTENTS
Press to select	Select the desired value.		60 µs, 120 µs, 240 µs, 500 µs, 1 ms, 2 ms, 4 ms, 8 ms, 12 ms, 20 ms, 36 ms, 66 ms, 128 ms,	INTRODUCTION
SMART MENU/SET		Press the button to apply	* After the response time is changed, the smart tuning	PREPARATION FOR MEASUREMENT
			results are cleared, so be sure to re-execute tuning.	FLOW OF OPERATION
5 Smart	t tuning Requ	Smart tuning set according to the (response time a	s optimum sensing conditions operating conditions nd color/state of workpiece)	BASIC SETUP
If muti	ual interference ual interference	prevention is ON: Use CF prevention is set to OFF: Use CF	11 for these settings. 11 and CH2 for these settings.	MAIN APPLICATIONS & SETTING
Button Operation	Display	Description of Operation	Explanation of Selection Menu	Height
_	_	Check that the reference workpiece is set in place.		Steps and Warpage
SMART MENU/SET	Pressing down	Press the ● button for one second. When SMRRE/	If " FAILEA" flashes on the sub-display for three	Double Sheet Detection
1 second	SI NGLE	SI NELE is displayed, release your finger from the button to	tuning was not possible. Change the response time	Thickness
	<u>EUNI NG</u> SI NGLE	start execution of smart tuning.	Isetting to a larger value, and try again.	Positioning
	Flashing		prevention is set to ON, after smart tuning execution for	Eccentricity and Surface Deflection
			CH1 ends, it is also executed for the Amplifier Units of CH2 and later. If the tuning result	DETAILED SETTINGS
			is NG for either Amplifier Unit, the smart tuning setup results are not applied to any	TROUBLE- SHOOTING

\* To tune multiple workpieces or to tune workpieces having a different surface CATIONS condition: page 80

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amplifier units.

### 6 2-sensor operation (A-B) Required

(Use CH2 for these settings.)

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press	CALE	Press the <b>\$</b> button on the CH2 Amplifier Unit to display [RL].	Calculating Unit
PREPARATION FOR MEASUREMENT	to display.	888888		
FLOW OF OPERATION				CH2 (Calculation result is output.)
BASIC SETUP			Press the \$ button to display	
MAIN APPLICATIONS & SETTING	Press to select	<u>8-9</u>		
METHODS Height Steps and	SMART MENU/SET		Press the button to apply the setting.	* For details on the response time when connecting two or more Amplifier Units, see page 86.

Warpage Double Sheet Detection

Thickness

### 7 Threshold setting Required

Set the range of measured values to be judged as PASS by setting the HIGH and LOW thresholds.

(Use CH2 for these settings.)

Positioning	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Eccentricity and Surface Deflection	Press to display	Lit H L MENU	Press the to button on the CH2 Amplifier Unit to display the HIGH threshold.	Setting example: Non-defective product step 3 to 8 mm
DETAILED SETTINGS				
TROUBLE- SHOOTING				H/ P//
SPECIFI- CATIONS				Set the MAX and MIN steps to be regarded as OK to the
INDEX				HIGH and LOW thresholds, respectively.

SETTING TRANSITION CHARTS

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
		Press the Soutton to enable setting of the HIGH threshold.	* If the s button is pressed when the cursor is at the right-most digit or the s button is pressed when the	CONTENTS
[Change numeric value]	12345 8000	Press the 🐝 button to move the digit, press the 🕱 button to	cursor is at the left-most digit, the setting will be canceled.	INTRODUCTION
Press to set.	Set any value.	set the HIGH threshold.	* Set so that the HIGH threshold is greater than the	PREPARATION FOR MEASUREMENT
SMART MENU/SET		Press the  button to apply the setting.	LOW threshold.	FLOW OF
Pre		Press the 🔹 button to display		OPERATION
ess to display.	Lit H L MENU	the LOW threshold.		BASIC SETUP
		Press the 🍣 button to enable setting of the LOW threshold.		MAIN APPLICATIONS & SETTING METHODS
[Change numeric value]		Press the 🏘 button to move	-	Height
Move	<u>- 12,345</u> 2000	the digit, press the solution to		Steps and Warpage
Press to set.	Set any value.	set the LOW threshold.		Double Sheet
SMART MENU/SET		Press the button to apply the setting.		Thickness

### 8 Return to RUN mode Required

Switch to the mode in which measurement is performed.

(Use CH1 and CH2 for these settings.)

Button	Diaplay	Description of Operation	Explanation of	Dellection
Operation		Description of Operation	Selection Menu	DETAILED
SMART MENU/SET	Out	Hold down the 🖱 button for		SETTINGS
Hold down for 3 seconds	H L MENU	three seconds to switch to the RUN mode.		TROUBLE- SHOOTING

\* For details on optimizing settings, such as output and input, see "DETAILED SETTINGS."

Positioning

Eccentricity and Surface

# **Double Sheet Detection**



Set the reference workpiece in place, adjust the position of the Sensor Head while looking at the digital display values on the Amplifier Unit or the indicators on the Sensor Head so that the measured value at measurement of one product and at measurement of two products is within the measurement range, and install the Sensor Head at this position.

Other than OFF

Select the desired mode to set

the measurement conditions in.

Required setting

Optional setting

. . . .

Set to the MENU mode Required Eccentricity and Surface Deflection

	Operation	Display	Description of Operation	Selection Menu
SETTINGS	SMART MENU/SET	Lit	Hold down the 👅 button for three seconds to switch to the	
TROUBLE- SHOOTING	Hold down for 3 seconds	H L MENU	MENU mode.	
	-		Press the 🕸 button to display	* This operation is not
SPECIFI- CATIONS	Press to display.	<u>888888</u>	delai L.	required when hold and trigger conditions are not to be set.
INDEX		delai L	Press the 拳 button to set the display to ⊡N to set display of	
SETTING TRANSITION CHARTS	Press to display.		the detail menu.	

Thickness

Positioning

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
SMART MENU/SET		Press the button to apply the setting.		CONTENTS

### **3** Response time setting Required

Select the response time to match the size and moving speed of the sensing object.

INTRODUCTION

Button Operation	Display	Description of Operation	Explanation of Selection Menu	PREPARATION FOR MEASUREMENT
Press to displ	<u> </u>	Press the 🌒 button to display SPEEd .	Default value: 500 ms	FLOW OF OPERATION
*	SPEEJ	Press the 💈 button to select the	Select the response time to	BASIC SETUP
Press to select	IM5 Select the	response time.	speed of the sensing object.	MAIN APPLICATIONS & SETTING METHODS
	desired value.		60 µs, 120 µs, 240 µs, 500 µs, 1 ms, 2 ms, 4 ms, 8 ms, 12 ms, 20 ms, 36 ms, 66 ms, 128 ms,	Height
		N6N/37	250 ms, 500 ms	Steps and Warnage
SMART MENU/SET		Press the <b>b</b> button to apply the setting.	After the response time is changed, the smart tuning results are cleared, so be sure to re-execute tuning	Double Sheet Detection
			sure to re excedite turning.	Thickness

### 4 Smart tuning Required

Smart tuning sets optimum sensing conditions according to the operating conditions (response time and color/state of workpiece)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Eccentricity and Surface Deflection
_	—	Check that the reference workpiece is set in place.		DETAILED SETTINGS
SMAPT MENU/SET	Pressing down	ressing down       Press the ● button for one         SMARE       second. When SMARE/         SI NGLE       is displayed, release         Pressed down       your finger from the button to         SI NN NE       start execution of smart tuning.	If <b>TABLES</b> fashes on the sub-display for three seconds, it indicates that tuning was not possible. Change the response time setting to a larger value, and	TROUBLE- SHOOTING
				SPECIFI- CATIONS
		SI NGLE Flashing	Itry again.	INDEX

\* To tune multiple workpieces or to tune workpieces having a different surface SETTING TRANSITION CHARTS

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#### 5 Hold Optional

Set this item to hold measured values during the measurement period according to preset hold conditions.

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display.	<u> </u>	Press the ♦ button to display H□Ld.	Default value: OFF
PREPARATION FOR MEASUREMENT		HQLA PERK	Press the 💲 button to select the hold conditions.	UFF Hold OFF BVF
FLOW OF OPERATION	Press to select	Select the desired value.		The average measured value during the sampling period is
BASIC SETUP				PEOP The difference between the minimum and maximum
MAIN APPLICATIONS & SETTING METHODS				values during the sampling period is held.
Height Steps				The measured value at the start of the sampling period is held.
and Warpage Double Sheet Detection				BULLEUM         The minimum value during         the sampling period is held.         PERK
Thickness				The maximum value during the sampling period is held. (For details, see page 95.)
Positioning	SMART MENU/SET		Press the button to apply the setting.	* The clamp value is output until the first sampling period
Eccentricity and Surface Deflection			When other than DFF is selected, proceed to "6	(For details on the clamp value, see page 111.)
DETAILED SETTINGS			Trigger conditions," and when []FF is selected, proceed to "7 Threshold setting."	
TROUBLE- SHOOTING			Set how timin	ng of the hold measurement
SPECIFI- CATIONS	<b>b</b> Trigge	er conditions	Optional period is to b	e input.
INDEX	Button Operation	Display	Description of Operation	Explanation of Selection Menu
SETTING TRANSITION CHARTS	Press to display.	<u></u> 888888	Press the ♦ button to display ERI [].	Default value: TIMING

**Double Sheet Detection** 

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	<u>ERIG</u> EIMING	Press the subtton to select the trigger conditions.	EI MI NG Enter the trigger by using the timing input or by pressing the constitute in the DLIN	CONTENTS
Press to select	Select the desired value.		mode. The period that the timing signal is ON is the	INTRODUCTION
			Samping period. SELF-d The sampling period is the	PREPARATION FOR MEASUREMENT
			period that the measured value is lower than the specified self-trigger level.	FLOW OF OPERATION
			The sampling period is the period that the measured	BASIC SETUP
			value is greater than the specified self-trigger level. (For details, see page 97.)	MAIN APPLICATIONS & SETTING METHODS
SMART MENU/SET		Press the button to apply the trigger conditions.		Height
		When $5ELF-U$ and $5ELF-d$ are selected,		and Warpage Double
		proceed to the next item, and when <u>LI MI N</u> is selected, proceed to "7 Threshold setting."		Sheet Detection Thickness
Press to d	SELFLV	Press the ♦ button to display SELFLV .	Default value: 0.000	Positioning
isplay,				Eccentricity and Surface Deflection
		Press the sutton to enable setting of the self-trigger level.		DETAILED SETTINGS
[Change numeric value]	<u>SELFL/</u> 99999	Press the (**) button to move the digit, press the (*) button to	* If the the button is pressed when the cursor is at the right-most digit or the	TROUBLE- SHOOTING
Press to set.	Set any value.	set the self-trigger level.	button is pressed when the cursor is at the left-most digit, the setting will be canceled.	SPECIFI- CATIONS
SMART MENU/SET		Press the button to apply the setting.		INDEX
	<u> </u>		<u> </u>	SETTING TRANSITION CHARTS

#### 7 Threshold Setting Required

Set the range of measured values to be judged as PASS by setting the HIGH and LOW thresholds.

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display.	Lit H L MENU	Press the to button to display the HIGH threshold.	Examples:
FOR MEASUREMENT			Press the ✤ button to enable setting of the HIGH threshold.	Set the HIGH and LOW thresholds right in the middle
FLOW OF OPERATION				of the measured values of sheets 1 and 2 and sheets 1
BASIC SETUP	[Change numeric value]	0,500 Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the HIGH threshold.	<ul> <li>* If the s button is pressed when the cursor is at the right-most digit or the s</li> </ul>
APPLICATIONS & SETTING METHODS	SMART MENU/SET		Press the button to apply the setting.	button is pressed when the cursor is at the left-most digit,
Height Steps and Warpage	Press to display,	Lit H L MENU	Press the to button to display the LOW threshold.	* Set so that the HIGH threshold is greater than the
Double Sheet Detection Thickness			Press the 🏶 button to enable setting of the LOW threshold.	
Positioning Eccentricity and Surface	[Change numeric value]	-0,500 Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the LOW threshold.	
Deflection	SMART MENU/SET		Press the <b>b</b> button to apply the setting.	
SETTINGS	8 Retur	n to RUN mod	e Required Switch to the is performed.	mode in which measurement
SHOOTING	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CATIONS	CAMADE MENUJCET		Hold down the 🖱 button for	

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\* For details on optimizing settings, such as output and input, see "Detailed Settings." Example (Setting the reference height to 0 (or the offset value): Zero Reset  $\rightarrow$  page 101)

three seconds to switch to the

RUN mode.

Out

MENU

Π [

SMART MENU/SET

Hold down fo

# Thickness



#### Procedure for setting up thickness

The Amplifier Units to set up differ for each menu. Note also that different channels are used to specify each menu item, as shown below.



### Sensor installation/wiring Required

Has the Sensor been installed and wired? (See page 23.)

Connect two Amplifier Units with a Calculating Unit in between. (The calculation result is displayed and output on the CH2 Amplifier Unit.)

Set up the two Sensor Heads so that they are facing each other, adjust the positions of the Sensor Heads while looking at the digital display values on the Amplifier Units or the indicators on the Sensor Heads so that the clearance between the sensing object and each Sensor Head is near the measurement center distance, and install the Sensor Heads at these positions.

Prepare a reference sensing object of known thickness.

#### 2 Set to the MENU mode Required

Select the desired mode to set the measurement conditions in.

(Use CH1 and CH2 for these settings.)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	INDEX
SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button for three seconds to switch to the MENU mode.		SETTING TRANSITION CHARTS

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	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press to display.	delai L	Press the I button to display dELRI L.	
INTRODUCTION		JELAI L	Press the 拳 button to set the display to □N to set display of	
PREPARATION For Measurement	Press to display.		the detail menu.	
FLOW OF OPERATION	SMART MENU/SET		Press the button to apply the setting.	
BASIC SETUP	<b>3</b> Mutua (Use (	al interference CH1 for these s	prevention Required Set this it interferer ettings.)	em to prevent the influence of mutual ice between two Sensor Heads.
MAIN APPLICATIONS & SETTING METHODS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Height Steps and Warnage	Press to display.	<u>54NC</u> 888888	Press the ♦ button on the CH1 Amplifier Unit to display 55NE.	Default value: OFF
Double Sheet Detection	Press to display.	<u>Sunc</u> In	Press the 巻 button to display □N.	
Positioning	SMART MENU/SET		Press the button to apply the mutual interference prevention setting.	* For details on the response time when connecting two or more Amplifier Units, see page 86.
Eccentricity and Surface Deflection	4 Resp	onse time setti	ng Required Select the read and moving set of the set o	sponse time to match the size speed of the sensing object.
DETAILED SETTINGS	(Use (	CH1 for these s	ettings.)	E desette et
TROUBLE-	Operation	Display	Description of Operation	Explanation of Selection Menu
SPECIFI- CATIONS	Press to display.		Press the to button on the CH1 Amplifier Unit to display	Default value: 500 ms
INDEX			·	
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Button Operation	Display	Description of Operation	Explanation of Selection Menu	
Prose to called	SPEE3 IMS	Press the 💲 button to select the response time.	Select the response time to match the size and moving speed of the sensing object.	CONTENTS
FIESS IN SEIEU	Press to select the desired value.		60 μs, 120 μs, 240 μs, 500 μs, 1 ms, 2 ms, 4 ms, 8 ms, 12 ms, 20 ms, 36 ms, 66 ms, 128 ms,	INTRODUCTION
			250 ms, 500 ms	PREPARATION
SMART MENU/SET		Press the 🖱 button to apply	* After the response time is	MEASUREMENT
		the setting.	results are cleared, so be sure to re-execute tuning.	FLOW OF

### 5 Smart tuning Required

Smart tuning sets optimum sensing conditions according to the operating conditions (response time and color/state of workpiece)

(Use CH1 for these settings.)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	APPLICATIONS & SETTING METHODS
_	_	Check that the reference workpiece is set in place.		Height Steps
Held down for become	Pressing down	Press the button on the CH1 Amplifier Unit for one second. When SMARE/SI NGLE is displayed, release your finger from the button to start execution of smart tuning.	If "FILLED" flashes on the sub-display for three seconds, it indicates that tuning was not possible. Change the response time setting to a larger value, and try again. * After smart tuning execution for CH1 ends, it is also executed for the Amplifier Units of CH2 and later. If the tuning result is NG for either Amplifier Unit, the smart tuning setup results are not applied to any amplifier units.	and Warpage Double Sheet Detection Thickness Positioning Eccentricity and Surface Deflection DETAILED SETTINGS TROUBLE- SHOOTING

\* To tune multiple workpieces or to tune workpieces having a different surface condition: page 80

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### 6 2-sensor operation (thickness) Required

Make this initial setting to measure thickness when using two Sensor Head to measure thickness.

(Use CH2 for these settings.)

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION			Set the reference sensing object of which thickness is known in	Calculating Unit
PREPARATION For Measurement	_	_	piace.	CH1
FLOW OF OPERATION				(Calculation result is output.)
BASIC SETUP	Press to display.	CRLC 888888	Press the the button on the CH2 Amplifier Unit to display [RL[.	
MAIN APPLICATIONS & SETTING METHODS Height	Press to select	EHI EK	Press the 💲 button to display 上HI [K.	
Steps and Warpage	SMART MENU/SET		Press the button to apply the thickness setting.	
Double Sheet Detection Thickness Positioning	[Change numeric value] [Note God Press to set.	Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the thickness numeric value.	* If the \$ button is pressed when the cursor is at the right-most digit or the \$ button is pressed when the cursor is at the left-most digit, the setting will be canceled.
Eccentricity and Surface Deflection	SMART MENU/SET		Press the button to apply the setting.	* The 2-sensor operation reference value is determined based on the measured values of CH1 and CH2 by the timing that setting of the thickness numeric values is executed.
TROUBLE- SHOOTING				* For details on the response time when connecting two or more Amplifier Units, see page 86.
SPECIFI- CATIONS			1	1
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Important

- . If analog output is to be used, the entered thickness value is used as the center value of the analog output range. (For example, 0 V is used if the analog output is ±5 V.)
- · After thickness calculation, the maximum and minimum measurement range values (CH2 measurement values) are assigned as the maximum and minimum analog output range.
- · Concerning the minimum and maximum analog output values, the analog output minimum value is output for the smaller of the post-thickkness calculation values, and the analog output maximum value is output for the larger of these values.

Example: If the ZX2-LD50 is used, a thickness value of 20 mm is entered, and analog output from -5 to 5 V is specified.

Measured Value After Thickness Calculation	How the Measurement Value Is Calculated	Analog Output	FLOW OF
10.000	Thickness value– (CH2 measurement range/2)= 20.000–10.000	–5 V	BASIC
20.000	Thickness value = 20.000	0 V	MAIN
30.000	Thickness value+ (CH2 measurement range/2)= 20.000+10.000	5 V	& SETTING METHODS

\* The measurement range for the ZX2-LD50 is ±10 mm.

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### 7 Hold Optional

(Use CH2 for these settings.)

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display	<u> </u>	Press the to button on the CH2 Amplifier Unit to display HOLd.	Default value: OFF
PREPARATION For Measurement		년 11년 11년	Press the S button to select the	
FLOW OF OPERATION	Press to select	PERK Select the	noia conaitions.	Hold OFF RVE The average measured value
BASIC SETUP		desired value.		during the sampling period is held.
MAIN APPLICATIONS & SETTING METHODS				The difference between the minimum and maximum values during the sampling
Height				period is held.
Steps and Warpage				The measured value at the start of the sampling period is held.
Double Sheet Detection				The minimum value during
Thickness				The maximum value during
Positioning				the sampling period is held. (For details, see page 95.)
Eccentricity and Surface Deflection	SMART MENU/SET		Press the button to apply the setting.	* The clamp value is output until the first sampling period is finished.
DETAILED SETTINGS			When other than DFF is selected, proceed to "8	(For details on the clamp value, see page 111.)
TROUBLE- SHOOTING			when DFF is selected, proceed to "9 Threshold	
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### 8 Trigger conditions Optional

(Use CH2 for these settings.)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	CONTENTS
Press to dis	<u> </u>	Press the ♦ button on the CH2 Amplifier Unit to display 上尺/ [].	Default value: TIMING	INTRODUCTION
		Press the 🛣 button to select the		PREPARATION FOR MEASUREMENT
		trigger conditions.	Enter the trigger by using the timing input or by pressing	FLOW OF OPERATION
Press to select	Select the desired value.		mode. The period that the timing signal is ON is the sampling period.	BASIC SETUP
			SELF-d The sampling period is the period that the measured	MAIN APPLICATIONS & SETTING METHODS
			value is lower than the specified self-trigger level.	Height
			The sampling period is the	Steps and Warpage
			value is greater than the specified self-trigger level.	Double Sheet Detection
SMART MENU/SET			(For details, see page 97.)	Thickness
		the trigger conditions.		Positioning
		When SELF-U and SELF-d are selected, proceed to the next item, and		Eccentricity and Surface Deflection
		when EI MI NG is selected, proceed to "9 Threshold setting."		DETAILED SETTINGS
Press to displa	SELF <u>L</u> V 888888	Press the \$ button to display SELFLV .	Default value: 0.000	TROUBLE- SHOOTING
×		Press the 🍩 button to enable		SPECIFI- CATIONS
		setting of the self-trigger level.		INDEX

SETTING TRANSITION CHARTS

	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	[Change numeric value]	55151/ 99,999	Press the <b>()</b> button to move the digit, press the <b>()</b> button to change the numeric value, and set the self-triager level	* If the the button is pressed when the cursor is at the right-most digit or the the button is pressed when the
INTRODUCTION	Press to set.	Set any value.	set the sen-trigger revel.	cursor is at the left-most digit, the setting will be canceled.
PREPARATION For Measurement	SMART MENU/SET		Press the button to apply the setting.	

#### 9 Threshold Setting Required

Set the range of measured values to be judged as PASS by setting the HIGH and LOW thresholds.

(Use CH2 for these settings.)

DAGIC				
SETUP	Button Operation	Display	Description of Operation	Explanation of Selection Menu
APPLICATIONS & SETTING METHODS Height	Press to display.	Lit H L MENU	Press the to button on the CH2 Amplifier Unit to display the HIGH threshold.	Setting example: Non-defective product thickness 3 to 8 mm
Steps and Warpage Double Sheet			Press the 🏶 button to enable setting of the HIGH threshold.	
Detection Thickness	[Change numeric value]	8000 Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the HIGH threshold.	Set the MAX and MIN thicknesses to be regarded as OK to the HIGH and LOW
Positioning	SMART MENU/SET		Press the button to apply the setting.	* If the \$ button is pressed
Deflection DETAILED SETTINGS	Press to display.	H L MENU	Press the \$ button to display the LOW threshold.	when the cursor is at the right-most digit or the \$ button is pressed when the cursor is at the left-most digit, the setting will be canceled.
TROUBLE- Shooting			Press the 🏶 button to enable setting of the LOW threshold.	* Set so that the HIGH threshold is greater than the LOW threshold.
SPECIFI- CATIONS	[Change numeric value]	12.345 7000	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and	
INDEX	Press to set.	Set any value.	set the LOW threshold.	
SETTING	SMART MENU/SET		Press the  button to apply the setting.	

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FLOW OF

-

OPERATION

# **10** Return to RUN mode Required

Switch to the mode in which measurement is performed.

(Use CH1 and CH2 for these settings.)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	CONTENTS
SMART MENU/SET	Out	Hold down the button for three seconds to switch to the RUN mode.		INTRODUCTION

\* For details on optimizing settings, such as output and input, see "DETAILED FOR MEASUREMENT"

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SE TR CH



### Procedure for setting up positioning



### Sensor installation/wiring Required

Has the Sensor been installed and wired? (See page 23.)

Set the sensing object in place, adjust the position of the Sensor Head while looking at the digital display values on the Amplifier Unit or the indicators on the Sensor Head so that the upper and lower limits of the distance between the Sensor Head and the sensing object is within the measurement range, and install the Sensor Head at this position.

Set to the MENU mode Required

Select the desired mode to set the measurement conditions in.

IOOTING	Button Operation	Display	Description of Operation	Explanation of Selection Menu
PECIFI- ATIONS	SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the three button for three seconds to switch to the MENU mode.	
IDEX	Pres	dEERI L	Press the 🕸 button to display	* This operation is not
TTING ANSITION IARTS	s to display.	888888		to be set.

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	delai l On	Press the   button to set the display to □N to set display of the detail menu.		CONTENTS
SMART MENU/SET		Press the button to apply the setting.		INTRODUCTION
3 Resp	onse time setti	Select the r	esponse time to match the size	PREPARATION FOR MEASUREMENT
Button	Display	Description of Operation	Explanation of Selection Menu	FLOW OF OPERATION
Press	SPEEd	Press the 🏘 button to display	Default value: 500 ms	BASIC SETUP
to display	888888			MAIN APPLICATIONS & SETTING METHODS
	SPEEd	Press the 💲 button to select the response time.	Select the response time to match the size and moving	Height
Press to select	Select the		60 µs, 120 µs, 240 µs, 500 µs,	Steps and Warpage
	desired value.		1 ms, 2 ms, 4 ms, 8 ms, 12 ms, 20 ms, 36 ms, 66 ms, 128 ms, 250 ms, 500 ms	Double Sheet Detection
SMART MENU/SET		Press the button to apply the setting.	* After the response time is changed, the smart tuning	Thickness
			results are cleared, so be sure to re-execute tuning.	Positioning

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# 4 Smart tuning Required

Smart tuning sets optimum sensing conditions according to the operating conditions (response time and color/state of workpiece)

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	_	_	Check that the reference workpiece is set in place.	
PREPARATION FOR MEASUREMENT	SMART Hold down for 1 second	Pressing down SMARL SI NGLE	Press the <b>b</b> utton for one second. When SMARE/ SI NGLE is displayed, release	If " <b>FRILES</b> " flashes on the sub-display for three seconds, it indicates that tuning was not possible.
FLOW OF OPERATION		Pressed down	your finger from the button to start execution of smart tuning.	Change the response time setting to a larger value, and try again.
BASIC SETUP	* To tune	Flashing multiple workp	ieces or to tune workpieces	having a different surface
MAIN APPLICATIONS & SETTING METHODS	condition:	page 80		
Height	<b>5</b> Scalir	gOptional	Set this item to change the display a digital value on the Amplifier Ur measured value. (e.g. to display t	y scale when you want to display hit different from the actual he actual sensing distance)
and Warpage	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Sheet Detection Thickness	Pres b display.	<u>SCALE</u>	Press the \$ button to display SCRLE.	Default value: OFF
Positioning Eccentricity and Surface Deflection	Press to display.	<u>SCRLE</u> ON	Press the 巻 button to display □N.	
DETAILED SETTINGS	SMART MENU/SET		Press the button to enable setting of scaling.	
TROUBLE- SHOOTING				
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Button Operation	Display	Description of Operation	Explanation of Selection Menu	
Press to display.	<u>5 1-66F</u> -99999	Press the 🏶 button to display 5 I-BEF .	<to actual="" display="" distance="" sensing="" the=""></to>	CONTENTS
		Press the 🏶 button to enable setting of S1-Before.	-8 0 8 + 58 50 42	INTRODUCTION
[Change numeric value]		Press the 🕸 button to move	58	FOR MEASUREMENT
Press to set.	- 8000 [Numeric	the digit, press the 💲 button to change the numeric value, and set the measured value before	42 After	FLOW OF OPERATION
	value before change] Set any value.	S1 is changed.	-8 S1 S2	BASIC SETUP
SMART MENU/SET		Press the button to apply the numeric value of S1-Before.	* If the \$ button is pressed when the cursor is at the	MAIN APPLICATIONS & SETTING METHODS
Press to	<u>S I-RFE</u>	Press the 🏘 button to display	right-most digit or the <b>\$</b> button is pressed when the	Height
display.			the setting will be canceled.	Steps and Warpage
		Press the 🏶 button to enable setting of S1-After.		Double Sheet Detection
[Change numeric value]	5 !-85F	Press the 👀 button to move	-	Thickness
[Move digit	58,000 Numeric	the digit, press the s button to change the numeric value, and set the measured value after S1		Positioning
Press to set.	value after change] Set any value.	is changed.		Eccentricity and Surface Deflection
SMART MENU/SET		Press the button to apply the numeric value of S1-After.		DETAILED SETTINGS
				TROUBLE- SHOOTING

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	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press to display.	<u>52-68F</u> -99999	Press the \$ button to display 52-667.	58 42
INTRODUCTION			Press the Sutton to enable setting of S2-Before.	8
PREPARATION FOR				* If the \$ button is pressed
FLOW OF OPERATION	[Change numeric value]	52-66F 8,000	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the measured value before	when the cursor is at the right-most digit or the & button is pressed when the
BASIC SETUP	Press to set.	value before change] Set any value.	S2 is changed.	the setting will be canceled.
MAIN APPLICATIONS & SETTING METHODS	SMART MENU/SET		Press the button to apply the numeric value of S2-Before.	
Height Steps and Warpage	Press to display.	<u>52-AFE</u> -99999	Press the ♦ button to display 52-RFE .	
Double Sheet Detection Thickness			Press the Soutton to enable setting of S2-After.	
Positioning Eccentricity and Surface Deflection	[Change numeric value] Internet of the second secon	Numeric value after chance]	Press the (*) button to move the digit, press the s button to change the numeric value, and set the measured value after S2 is changed.	
DETAILED SETTINGS	SMART MENU/SET	Set any value.	Press the method to apply	
TROUBLE- SHOOTING			the numeric value of S2-After.	
SPECIFI- CATIONS				
INDEX				
SETTING TRANSITION CHARTS				

### 6 Threshold Setting Required

Set the range of measured values to be judged as PASS by setting the HIGH and LOW thresholds.

Button Operation	Display	Description of Operation	Explanation of Selection Menu	CONTENTS	
Press to display.	Lit H L MENU	Press the 🏶 button to display the HIGH threshold.	Setting example: Non-defective product position 49 to 51 mm	INTRODUCTION	
		Press the 🍣 button to enable setting of the HIGH threshold.		PREPARATION FOR MEASUREMENT	
[Change numeric value]	5 IOOO Set any value.	Press the <b>**</b> button to move the digit, press the <b>*</b> button to change the numeric value, and set the HIGH threshold.	Set the positioning MAX and MIN distances to the HIGH and LOW thresholds, respectively.	OPERATION BASIC SETUP	
SMART MENU/SET		Press the button to apply the setting.	* If the s button is pressed when the cursor is at the	MAIN APPLICATIONS & SETTING METHODS	
Press to display.	H L MENU	Press the \$ button to display the LOW threshold.	<ul> <li>right-most digit or the fiber</li> <li>button is pressed when the cursor is at the left-most digit, the setting will be canceled.</li> </ul>	button is pressed when the cursor is at the left-most digit, the setting will be canceled.	Height Steps and Warpage
		Press the 🏶 button to enable setting of the LOW threshold.	* Set so that the HIGH threshold is greater than the LOW threshold.	Double Sheet Detection Thickness	
[Change numeric value]	H9000 Set any value.	Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and set the LOW threshold.		Positioning Eccentricity	
SMART MENU/SET		Press the button to apply the setting.			
7	1	Switch to the	e mode in which measurement	SETTINGS	

### 7 Return to RUN mode Required

Switch to the mode in which measurement is performed.

Button Operation	Display	Description of Operation	Explanation of Selection Menu	SPECIFI- CATIONS
SMART MENU/SET Held down for 3 seconds	Out	Hold down the button for three seconds to switch to the RUN mode.		INDEX

\* For details on optimizing settings, such as output and input, see "DETAILED SETTINGS."

SHOOTING

# **Eccentricity and Surface Deflection**

INTRODUCTION

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PREPARATION FOR MEASUREMENT

FLOW OF OPERATION

BASIC SETUP

PLICATIONS & SETTING METHODS

Height Steps and

1

Warpage Double Sheet Detection

Thickness

Positioning

Eccentricity and Surface Deflection

DE. SE

TRO SH

SP CA

IN

SET TRANSIT

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### Sensor installation/wiring Required

Has the Sensor been installed and wired? (See page 23.)

Set the sensing object in place, adjust the position of the Sensor Head while looking at the digital display values on the Amplifier Unit or the indicators on the Sensor Head so that the clearance between the Sensor Head and the sensing object is near the measurement center distance, and install the Sensor Head at this position.

#### 2 Set to the MENU mode Required

Select the desired mode to set the measurement conditions in.

TAILED	Button Operation	Display	Description of Operation	Explanation of Selection Menu
DUBLE-	SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button for three seconds to switch to the MENU mode.	
ECIFI- TIONS	Press to display.	dELRI L 888888	Press the I button to display dELRI L.	* This operation is not required when scaling, hold and trigger conditions are not to be set.
DEX TING INSITION	Press to display.	<u>delai l</u> On	Press the ♣ button to set the display to ☐N to set display of the detail menu.	
Button Operation	Display	Description of Operation	Explanation of Selection Menu	
---------------------	---------	--	----------------------------------	----------
SMART MENU/SET		Press the button to apply the setting.		CONTENTS

# **3** Response time setting Required

Select the response time to match the size and moving speed of the sensing object.

• Respo	Response time setting management and moving speed of the sensing object.			
Button Operation	Display	Description of Operation	Explanation of Selection Menu	PREPARATION FOR MEASUREMENT
Press to display.	<u></u>	Press the \$ button to display SPEEd.	Default value: 500 ms	FLOW OF OPERATION
Press to select	Select the desired value.	Press the 💲 button to select the response time.	Select the response time to match the size and moving speed of the sensing object. 60 µs, 120 µs, 240 µs, 500 µs, 1 ms, 2 ms, 4 ms, 8 ms, 12 ms, 20 ms, 36 ms, 66 ms, 128 ms, 250 ms, 500 ms	BASIC SETUP MAIN APPLICATIONS & SETTING METHODS Height
SMART MENU/SET		Press the button to apply the setting.	* After the response time is changed, the smart tuning results are cleared, so be sure to re-execute tuning.	and Warpage Double Sheet Detection
				Thickness

## 4 Smart tuning Required

Smart tuning sets optimum sensing conditions according to the operating conditions (response time and color/state of workpiece)

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Eccentricity and Surface Deflection
_	—	Check that the reference workpiece is set in place.		DETAILED SETTINGS
SMART MENU/SET	Pressing down SMARE SINGLE Pressed down EUNING SINGLE Flashing	Press the button for one second. When SMARE/ SI NGLE is displayed, release your finger from the button to start execution of smart tuning.	If " FRI LED" flashes on the sub-display for three seconds, it indicates that tuning was not possible. IChange the response time setting to a larger value, and try again.	TROUBLE- SHOOTING SPECIFI- CATIONS INDEX

\* To tune multiple workpieces or to tune workpieces having a different surface condition: **page 80** 

SETTING TRANSITION CHARTS

Positioning

# 5 Scaling Optional

Set this item to change the display scale when you want to display a digital value on the Amplifier Unit different from the actual measured value. (e.g. to reverse the - and + indications)

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display.	<u>SCALE</u> 1888888	Press the \$ button to display SERLE .	Default value: OFF
PREPARATION FOR MEASUREMENT		<u>SCALE</u> DN	Press the ✤ button to display □N.	
OPERATION	Press to display.		Press the 🖱 button to enable	
BASIC SETUP			setting of scaling. Press the \$ button to display	To set the NEAR and FAR sides
MAIN APPLICATIONS & SETTING METHODS	Press to display.	<u>-99999</u>	S I-66F.	as - and + indications to the sensor:
Height			Press the 🍣 button to enable setting of S1-Before.	
Steps and Warpage			Dress the AA butter to resur	
Double Sheet Detection	[Change numeric value]	<u>-2000</u> [Numeric	the digit, press the button to move change the numeric value, and set the measured value before	-2 1 2 -1
Thickness	P1635 10 561.	value before change] Set any value.	S1 is changed.	2 Before
Positioning	SMART MENU/SET		Press the button to apply the numeric value of S1-Before.	.1 After
and Surface Deflection	Press to dsp	<u>5 I-AFE</u> -99999	Press the 🏶 button to display 5 I-RFL .	s1 s2
DETAILED SETTINGS	lay		Press the 🌧 button to enable	* If the the button is pressed when the cursor is at the
TROUBLE- SHOOTING			setting of S1-After.	right-most digit or the <b>\$</b> button is pressed when the cursor is at the left-most digit,
SPECIFI- CATIONS	[Change numeric value]	<u>1-855</u> 2,000	Press the \$\$ button to move the digit, press the \$\$ button to change the numeric value, and	the setting will be canceled.
INDEX	Press to set.	[Numeric value after change] Set any value	set the measured value after S1 is changed.	
SETTING TRANSITION CHARTS	SMART MENU/SET		Press the button to apply the numeric value of S1-After.	

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
Press to display.	52-6EF -99999	Press the \$ button to display 52-66F.	2	CONTENTS
		Press the 🏶 button to enable setting of S2-Before.	After	INTRODUCTION
[Change numeric value]	52-666	Press the () button to move	S1 S2	FOR MEASUREMENT
Press to set.	[DDD] [Numeric	change the numeric value, and set the measured value before	* If the \$ button is pressed when the cursor is at the right-most digit or the \$	FLOW OF OPERATION
	value before change] Set any value.	S2 is changed.	button is pressed when the cursor is at the left-most digit, the setting will be canceled	BASIC SETUP
SMART MENU/SET		Press the button to apply the numeric value of S2-Before.	the setting will be canceled.	MAIN APPLICATIONS & SETTING
Press to display.	52-AFE -99999	Press the \$ button to display 52-RFE .	-	Height Steps
		Press the 🏶 button to enable setting of S2-After.		Warpage Double Sheet Detection
[Change numeric value]	52- <u>85</u> 2	Press the 🔹 button to move the digit, press the 🕱 button to		Thickness
Press to set.	- UUU	change the numeric value, and set the measured value after S2		Positioning
	value after change] Set any value.	is changed.		Eccentricity and Surface Deflection
SMART MENU/SET		Press the button to apply the numeric value of S2-After.		DETAILED SETTINGS
6	Ontional	Set this item to hold measured valu	ies during the measurement	TROUBLE- SHOOTING

O Hold Optional	period according to preset hold co	period according to preset hold conditions.		
Button Display	Description of Operation	Explanation of Selection Menu	SPECIFI- CATIONS	
Press loc	Press the \$ button to display	Default value: OFF	INDEX	
Lisphay.			SETTING TRANSITION CHARTS	

	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press to select	PERK Select the	Press the 💲 button to select the hold conditions.	Hold OFF
INTRODUCTION		desired value.		during the sampling period is held.
PREPARATION FOR Measurement				The difference between the minimum and maximum
FLOW OF OPERATION				period is held.
BASIC SETUP				start of the sampling period is held.
MAIN Applications & Setting Methods				The minimum value during the sampling period is held.
Height Steps				The maximum value during the sampling period is held.
and Warpage				(For details, see page 95.)
Double Sheet Detection	SMART MENU/SET		Press the button to apply the setting.	* The clamp value is output until the first sampling period is finished.
Thickness			When other than DFF is selected, proceed to "7	(For details on the clamp value, see page 111.)
Positioning			when OFF is selected, proceed to "8 Threshold	
Eccentricity and Surface Deflection			setting."	

## DETAILED SETTINGS

7 Trigger conditions Optional

# Set how timing of the hold measurement period is to be input.

TROUBLE- Shooting	Button Operation	Display	Description of Operation	Explanation of Selection Menu
SPECIFI- CATIONS	Press to deplay	ERI G 888888	Press the ♦ button to display ERI [].	Default value: TIMING

SETTING TRANSITION CHARTS

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	ERIG El MING	Press the subtton to select the trigger conditions.	Enter the trigger by using the timing input or by pressing	CONTENTS
Press to select	Select the desired value.		mode. The period that the timing signal is ON is the	INTRODUCTION
			Sampling period.	PREPARATION FOR MEASUREMENT
			value is lower than the specified self-trigger level.	FLOW OF OPERATION
			The sampling period is the period that the measured	BASIC SETUP
			specified self-trigger level. (For details, see page 97.)	MAIN APPLICATIONS & SETTING METHODS
SMART MENU/SET		Press the button to apply the trigger conditions.		Height
		When SELF-U and		Steps and Warpage
		SELF - ∂ are selected, proceed to the next item, and		Double Sheet Detection
		proceed to "8 Threshold setting."		Thickness
Press to di	<u>SELF.LV</u>	Press the ♦ button to display SELFLV	Default value: 0.000	Positioning
splay.				Eccentricity and Surface Deflection
		Press the sutton to enable setting of the self-trigger level.		DETAILED SETTINGS
[Change numeric value]	<u>SELFL/</u> 99999	Press the (**) button to move the digit, press the (*) button to	* If the \$ button is pressed when the cursor is at the right-most digit or the	TROUBLE- SHOOTING
Press to set.	Set any value.	set the self-trigger level.	button is pressed when the cursor is at the left-most digit, the setting will be canceled.	SPECIFI- CATIONS
SMART MENU/SET		Press the button to apply the setting.		INDEX
				SETTING TRANSITION CHARTS

## 8 Threshold Setting Required

Set the range of measured values to be judged as PASS by setting the HIGH and LOW thresholds.

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INTRODUCTION	Press to display.	Lit H L MENU	Press the the button to display the HIGH threshold.	Setting example: Non-defective product eccentricity -1 to 1 mm
PREPARATION FOR MEASUREMENT			Press the Soutton to enable setting of the HIGH threshold.	1 mm -1 mm
OPERATION	[Change numeric value]	וכורכן	Press the 👀 button to move	HPL
BASIC SETUP	Press to set.	LOO Set any value.	the digit, press the S button to change the numeric value, and set the HIGH threshold.	Set the eccentricity MAX and MIN distances to be regarded as OK to theHIGH
APPLICATIONS & SETTING METHODS	SMART MENU/SET		Press the button to apply the setting.	and LOW thresholds, respectively.
Height Steps and Warpage	Press to display,	H L MENU	Press the 🏶 button to display the LOW threshold.	* If the \$ button is pressed when the cursor is at the right-most digit or the \$ button is pressed when the
Sheet Detection			Press the The button to enable setting of the LOW threshold.	cursor is at the left-most digit, the setting will be canceled.
Thickness	IChange numeric valuel		Press the As button to mayo	* Set so that the HIGH
Positioning	Ince diff	− (□□□) Set any value.	the digit, press the subtron to move the digit, press the subtron to change the numeric value, and set the I OW threshold	LOW threshold.
and Surface Deflection	SMART MENU/SET		Press the <b>button to apply</b> the setting.	
DETAILED				

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SETTING TRANSITION CHARTS Return to RUN mode Required

Switch to the mode in which measurement is performed.

CIFI-	Button Operation	Display	Description of Operation	Explanation of Selection Menu
EX	SMART MENU/SET Hold down for 3 seconds	Uut H L MENU	Hold down the button for three seconds to switch to the RUN mode.	

\* For details on optimizing settings, such as output and input, see "DETAILED SETTINGS."

# **DETAILED SETTINGS**

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# **Smart Tuning**

Setting channels used when connecting multiple units If mutual interference prevention is ON: CH1 If mutual interference prevention is set to OFF: Each CH

### Smart tuning:

Important

1

Button

Operation

SMART MENU/SET

Hold down fo 3 seconds

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#### PREPARATION FOR MEASUREMENT

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### DETAILED SETTINGS

S

S C

II

## 2 Response time setting Optional

Display

HOOTING	Button Operation	Display	Description of Operation	Explanation of Selection Menu
PECIFI- ATIONS	Press to display.	SPEEd 888888	Press the ♦ button to display SPEEd.	Default value: 500 ms

SETTING TRANSITION CHARTS



it is also executed for the Amplifier Units of CH2 and later.

Set to the MENU mode Optional

Lit

MENU

conditions (response time and color/state of workpiece).

\* Steps 1, 2 and 4 are not required when the response time setting is completed since smart tuning can be performed even in the RUN mode.

This setting option sets optimum sensing conditions according to the operating

 When connecting two or more Amplifier Units and mutual interference prevention is set to ON, use the CH1 Amplifier Unit to execute tuning. After smart tuning execution for CH1 ends,

If the tuning result is NG for either Amplifier Unit, the smart tuning setup results are not

**Description of Operation** 

Hold down the 💭 button for

three seconds to switch to the

MENU mode.

Button

applied to any amplifier units.

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Explanation of

Selection Menu

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	<u>IMS IIMS</u>	Press the 💲 button to select the response time.	Select the response time to match the size and moving speed of the sensing object.	CONTENTS
Press to select	Select the desired value.		60 μs, 120 μs, 240 μs, 500 μs, 1 ms, 2 ms, 4 ms, 8 ms, 12 ms, 20 ms, 36 ms, 66 ms, 128 ms, 250 ms, 500 ms	INTRODUCTION
SMART MENU/SET		Press the button to apply	* After the response time is	FOR MEASUREMENT
		the setting.	results are cleared, so be sure to re-execute tuning.	FLOW OF OPERATION

## **3** Smart tuning Required

Select from one of the following three methods to execute smart tuning:

- (1) Tuning of a single stationary workpiece: Single smart tuning
- (2) Tuning of multiple stationary workpieces: Multi-smart tuning (a mix of workpieces having different color and state)
- (3) Tuning of workpieces having different surface states: Active smart tuning (execution of tuning while workpieces are moving)

### (1) Tuning of a single stationary workpiece: Single smart tuning

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Thickness
_	_	Set the reference workpiece in place.		Positioning
Hold down for 1 second	Pressing down	Press the to button for one second. When SMARE/ SI NGLE is displayed, release	If "FILES" flashes on the sub-display for three seconds, it indicates that tuning was not possible.	Eccentricity and Surface Deflection
	Pressed down	your finger from the button to start execution of smart tuning.	Change the response time setting to a larger value, and try again.	SETTINGS TROUBLE- SHOOTING

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and Warpage Double Sheet

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	Button Operation	Display	Description of Operation	Explanation of Selection Menu	
CONTENTS	_		Set reference workpiece 1 in place.		
INTRODUCTION	SMART Hold down for 3 seconds	Pressing down	Press the button for three seconds. When SMARE /	* SMARE /SI NGLE is displayed for one to three	
PREPARATION FOR MEASUREMENT		Pressed down	your finger from the button to start execution of smart tuning.	pressed, and then SMARE/ MULLEI is displayed.	
FLOW OF OPERATION				It " [-Fill _ Ed" flashes on the Isub-display for three seconds, it indicates that	
BASIC SETUP				Change the response time	
APPLICATIONS & SETTING METHODS			Swap the workpiece with reference workpiece 2 and set it	<u>Luy ayanı.</u>	
Height			in place.		
Steps and Warpage	SMART Hold down for 3 seconds	Pressing down	Press the button for three seconds. When SMARE / MULEI is displayed. release	The optimum conditions are set for either reference workpiece 1 or 2 is set.	
Double Sheet Detection		Pressed down	Pressed down	your finger from the button to start execution of smart tuning.	* SMRRE /SI_NGLE_is displayed for one to three
Thickness		EUNI NU MULEI Flashing	When there are three or more reference workpieces, swap	pressed, and then SMARE/	
Positioning			the procedure.	If you release your finger from the button $SMBRE /$	
Eccentricity and Surface Deflection				workpiece 1 will not be reflected.	
DETAILED SETTINGS				seconds, it indicates that tuning was not possible.	
TROUBLE- SHOOTING				Isetting to a larger value, and I try again.	
SPECIFI- CATIONS					
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### (2) Tuning of multiple stationary workpieces: Multi-smart tuning (a mix of workpieces having different color and state)

#### (3) Tuning of workpieces having different surface states: Active smart tuning (execution of tuning while workpieces are moving) Dutton Evalenction of

Operation	Display	Description of Operation	Selection Menu	
SMART MENU/SET	Pressing down	Press the button for five	* SMRRE/SI NGLE and SMRRE/MULEL are	CONTENTS
Hold down for 5 seconds		in place. When $SMRRE/REE/E$ is displayed, release your finger from the button to	displayed for one to five seconds after the button is	INTRODUCTION
	EUNI NG ACEI VE	start execution of smart tuning.	pressed, and then SMARE/ REEI VE is displayed.	PREPARATION FOR MEASUREMENT
	Flashing	smart tuning continues, move the workpiece.		FLOW OF OPERATION
SMART MENU/SET		At the end of the desired tuning period, press the button again for 5 to end tuning.	The optimum setting conditions will be set.	BASIC SETUP
			sub-display for three seconds, it indicates that tuning was not possible.	MAIN APPLICATIONS & SETTING METHODS
			Change the response time setting to a larger value, and	Height
<b>A</b> Potur	n to PUN mod	o Optional		Steps and Warpage

#### 4 Return to RUN mode Optional

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Sheet Detection
SMART MENU/SET	Out	Hold down the button for three seconds to switch to the		Thickness
Hold down for 3 seconds	H L MENU	RUN mode.		Positioning

Double

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# Selecting the Initial Sub-Display

Setting channels used when connecting multiple units: Each CH

CONTENTS

Initial sub-display:

The initial sub-display is the display that appears when the power is turned on.

INTRODUCTION Procedure for setting up initial sub-display



1

BASIC SETUP

Heigh Steps and Warpag Double Sheet

Set to the MENU mode

Setting completed

MAIN APPLICATIONS	Set to the MENU mode			
METHODS	Button	Display	Description of Operation	Explanation of
Height	Operation	Display	Description of Operation	Selection Menu
Steps and Warpage	SMART MENU/SET	H L MENU	Hold down the button for three seconds to switch to the MENU mode.	
Daulala				

Detection

### 2 Sub-display memory setting

Thickness	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Social Surface Deflection	Pres b dsplay.	<u>SUB</u> MEM	Press the I button to display	Default value: HIGH
DETAILED Settings		R-OUL	Press the 💲 button to select the sub-display memory.	HI CH HIGH threshold
TROUBLE- SHOOTING	Press to select	Select the desired value.		LOW threshold
SPECIFI- CATIONS				
INDEX				Current value
SETTING				BANK

CHARTS

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
SMART MENU/SET		Press the button to apply the setting.		CONTENTS

## **3** Return to RUN mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	PREPARATION
SMART MENU/SET	Out	Hold down the button for		MEASUREMENT
Hold down for 3 seconds	H L MENU	RUN mode.		FLOW OF



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SETTING TRANSITION CHARTS

# **Connecting Two or More Amplifier Units**

CONTENTS

Use a Calculating Unit to connect Amplifier Units when performing calculations between Amplifier Units and to prevent mutual interference between Sensor Heads.

The number of Amplifier Units that can be connected differs depending on the functions to be used.

	Function	Number of (	Number of Connectable Amplifier Units See:		
PREPARATION FOR MEASUREMENT	Calculation	Up to two units (Up However, calculation	to five units can be connected. ns are done between pairs of two.)	(A-B) calculation:	
FLOW OF OPERATION		For (A-B) A: CH1 B: CH2 o	calculations r later	Page 47 Thickness calculation:	
BASIC SETUP			CH1 CH2 CH3 CH2-CH1) CH3-CH1) CH4-CH2-CH1) CH4-CH2-CH1)	Page 57	
MAIN APPLICATIONS & SETTING			CH5-CH1) (CH5-CH1)		
METHODS	Mutual interference	Up to five units		Page 88	
Height	prevention				
Steps and Warpage Double	Important • Supply power to all • When connecting tw	connected Amplifier vo or more Amplifier	Units at the same time. Units, the response times (maximur	n values) are as	
Detection	Mutual Interference Prevention	Two-Sensor Operation	Total Response Time		
Thickness		OFF	Response time setting for ea	ch CH	
Positioning	OFF	(A – B), THICK	(Total response time setting for e (4 ms × number of connected	ach CH) + I units)	
Eccentricity	ON -	OFF (A – B), THICK	(Response time per unit (T) in the ta number of connected un	able below) × its	
and Surface	<respo< td=""><td>nse time if mutual ir</td><td>nterference prevention is set to ON</td><td>1&gt;</td></respo<>	nse time if mutual ir	nterference prevention is set to ON	1>	

CH1 Response Time Setting	Response Time per Unit (T)
60 µs	3 ms
120 µs	3 ms
240 µs	3 ms
500 µs	4 ms
1 ms	8 ms
2 ms	16 ms
4 ms	32 ms
8 ms	64 ms
12 ms	72 ms
20 ms	80 ms
36 ms	100 ms
66 ms	160 ms
128 ms	280 ms
250 ms	520 ms
500 ms	1 s

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SETTING TRANSITION CHARTS The displayed and set up menus differ depending on the channel when two or more Amplifier Units are connected and when mutual interference prevention is set to ON.

Use the Amplifier Units of the corresponding channel numbers to specify settings by referring to the tables below.

INTRODUCTION

<Menus and setting channels when two or more Amplifier Units are connected>

Menu	CHs Used to Specify Settings	CHs Not Used to Specify Settings	Notes	PREPARATION FOR MEASUREMENT
Mutual interference prevention 도님NC	CH1	CH2 to CH5: These cannot be used. (The setting menu is not displayed on the digital display.)	The setting of CH1 is also applied to Amplifier Units of CH2 and later.	FLOW OF OPERATION
Two-sensor operation setting	CH2 to CH5	CH1: This cannot be used. (The setting menu is not displayed on the digital display.)		BASIC SETUP
Thickness setting				MAIN APPLICATIONS & SETTING METHODS
Bank switching setting 占日NK	CH1	CH2 to CH5: These cannot be used. (The setting menu is not displayed on the digital display.)	<ul> <li>The Amplifier Units of CH2 and later are switched together with CH1. (Bank</li> </ul>	Height
			registration is possible for individual amplifier units.) • Also use CH1 to switch the	Steps and Warpage
			banks by means of an external input.	Double Sheet Detection
Initialization	CH1	CH2 to CH5: These cannot be used. (The setting menu is not displayed on the digital display.)	The Amplifier Units of CH2 and later are initialized together with CH1.	Thickness

### <Menus and setting channels when mutual interference prevention is set to ON>

Menu	CHs Used to Specify Settings	CHs Not Used to Specify Settings	Notes	and Surface Deflection
Response time setting SPEEd	CH1	CH2 to CH5: These cannot be used. (The setting menu is not displayed on the digital display.)	The setting of CH1 is also applied to Amplifier Units of CH2 and later.	DETAILED SETTINGS
Smart tuning	CH1	CH2 to CH5: Smart tuning cannot be executed for these separately.	Smart tuning for the Amplifier Units of CH2 and later are executed together with CH1.	TROUBLE- SHOOTING

(For details on the setup procedure when mutual interference prevention is set to ON, see the next page.)

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SPECIFI-

Positioning

# Mutual Interference Prevention Setting channel: CH1

Calculating Unit

Amplifier Unit

CH2

снз CH4

Set on CH1 Amplifier Unit

CH1

## CONTENTS

Mutual interference prevention:

Set to the MENU mode

Mutual interference

prevention setting

Return to RUN mode

Setting completed

Procedure for setting up mutual interference prevention

This refers to the function for preventing the influence of Sensor Heads when mounted close to each other. (This function can be used for up to five Amplifier Units connected by using Calculating Units (ZX2-CAL).)

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Height

Th

Po

### Set to the MENU mode

Steps and Warpage	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Double Sheet Detection	SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button of the CH1 Amplifier Unit for three seconds to switch to the MENU	
Thickness			mode.	
Positioning Eccentricity	Press to display.	<u>dELRI L</u>	Press the I button to display dELRI L.	* This step is not required if detail menu display is already set to ON in the MENU mode.
and Surface Deflection			Press the 🍣 button to set the	
DETAILED SETTINGS	Press to display.		display to LIN to set display of the detail menu.	
TROUBLE- SHOOTING	SMART MENU/SET		Press the <b>b</b> button to apply the setting.	

SPECIFI-CATIONS

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CHARTS

# **2** Mutual interference prevention setting

Button	Display	Description of Operation	Explanation of	
Operation			Selection Menu	CONTENTS
Pre	SHNE	Press the 🏶 button to display	Default value: OFF	CONTENTS
is to display.	888888			INTRODUCTION
		Press the 🚓 button to display		
	<u> </u>			FOR MEASUREMENT
	0, 1			
Press to display.				FLOW OF
SMART MENU/SET		Press the 👅 button to apply		OPERATION
		the setting.		BASIC
				SETUP

## **3** Return to RUN mode

				APPLICATIONS
Button	Display	Description of Operation	Explanation of	& SETTING METHODS
Operation	1 5	· ·	Selection Menu	Height
SMADT MENIL/SET		Hold down the 👅 button for		
Hold down for 3 seconds	UUL H L MENU	three seconds to switch to the RUN mode.		Steps and Warpage
				Double

### Important

• When CH1 is used to specify a setting while mutual interference prevention is set to ON, the menus for which the same setting is applied to the Amplifier Units of CH2 and later are shown in the following table.

Specify settings for the menus in the following table after setting mutual interference prevention to ON.

Menu	Displayable and Specifiable CH Number	Notes		Eccentricity and Surface
Response time setting	CH1	The setting of CH1 is also applied to Amplifier Units of CH2 and later.	D	ETAILED
Smart tuning	CH1	Smart tuning for the Amplifier Units of CH2 and later are executed together with CH1.	S	ETTINGS

When connecting two or more Amplifier Units, the response times (maximum values) are as follows:
 TROUBLE-SHOOTING

Mutual Interference Prevention	Two-Sensor Operation	Total Response Time	SPECIFI-
	OFF	Response time setting for each CH	CATIONS
OFF	(A – B), THICK	(Total response time setting for each CH) + (4 ms × number of connected units)	INDEX
ON	OFF (Response time per unit in the table below) >		
	(A – B), THICK	number of connected units	SETTING

SETTING TRANSITION CHARTS

MAIN

Sheet Detection

Thickness

Positioning

### <Response time if mutual interference prevention is set to ON>

CH1 Response Time Setting	Response Time per Unit
60 µs	3 ms
120 µs	3 ms
240 µs	3 ms
500 µs	4 ms
1 ms	8 ms
2 ms	16 ms
4 ms	32 ms
8 ms	64 ms
12 ms	72 ms
20 ms	80 ms
36 ms	100 ms
66 ms	160 ms
128 ms	280 ms
250 ms	520 ms
500 ms	1 s

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SETTING TRANSITION CHARTS

Hysteresis width:

CONTENTS This refers to the difference between the operation point and return point. Set the hysteresis width for the upper and lower limits of the judgements if the HIGH, PASS or LOW judgement is unstable near the threshold values. INTRODUCTION



### Procedure for setting up the hysteresis width



## Set to the MENU mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Positioning Eccentricity
SMART MENU/SET	Lit H L MENU	Hold down the <b>button for</b> three seconds to switch to the MENU mode.		and Surface Deflection
T A	י וסבנע	Press the 🕸 button to display	* This step is not required if	SETTINGS
ress to display.		deehi L.	detail menu display is already set to ON in the MENU mode.	TROUBLE- SHOOTING
	delai L	Press the ♣ button to set the display to □N to set display of the datail		SPECIFI- CATIONS
Press to display.		the detail menu.		INDEX
SMART MENU/SET		Press the 👅 button to apply		
		the setting.		SETTING TRANSITION

CHARTS

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MAIN APPLICATIONS & SETTING METHODS

Height Steps

and Warpage

Double Sheet Detection

Thickness

## **2** Hysteresis width setting

Return to RUN mode

Display

• The hysteresis width is enabled when the self-trigger is set.

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press	HYS	Press the 🕸 button to display 님식도 .	Default value: 0.000
INTRODUCTION	b display,	888888		
PREPARATION For Measurement			Press the Solution to enable setting of the hysteresis width.	
FLOW OF OPERATION	Press to display.			
	[Change numeric value]	HYS	Press the 🗱 button to move the digit. press the 🅱 button to	* If the solution is pressed when the cursor is at the
BASIC SETUP	light	0.000	change the numeric value, and	right-most digit or the <b>(</b>
ΜΔΙΝ	Press to set.	Set any value.		cursor is at the left-most digit,
APPLICATIONS & SETTING				the setting will be canceled.
Height	SMART MENU/SET		Press the button to apply the setting.	

Description of Operation

Hold down the 🖱 button for

three seconds to switch to the

• The hysteresis width for HIGH, PASS or LOW judgment is disabled when the hold function is

RUN mode.

#### Steps and Warpage

3

**Button** 

Operation

SMART MENU/SET

Important

enabled.

Hold down for 3 seconds

#### Double Sheet Detection

Thickness

Positioning

#### Eccentricity and Surface Deflection

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SETTING TRANSITION CHARTS

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Explanation of

Selection Menu

# Setting the Hold Function Setting channels used when Connecting multiple units: Each CH

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OPERATION

Hold:

CONTENTS The hold function holds any values during the measurement period (sampling period), and outputs these values at the end of measurement.

### Procedure for setting up hold



#### 1 Set to the MENU mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Steps and Warpage
SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button for three seconds to switch to the MENU mode.		Double Sheet Detection
Press	dEERI L	Press the 🔅 button to display	* This step is not required if detail menu display is	Thickness
a to display.	888888		already set to ON in the MENU mode.	Positioning
	delai L	Press the		Eccentricity and Surface Deflection
Press to display.		the detail menu.		DETAILED
SMART MENU/SET		Press the button to apply		SETTINGS
		the setting.		TROUBLE- SHOOTING

SPECIFI-CATIONS

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SETTING TRANSITION CHARTS

# **2** Hold conditions setting

00075070	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press	HUI 4	Press the s button to display	Default value: OFF
INTRODUCTION	ass to display.	888888	HULd.	
PREPARATION FOR MEASUREMENT		PERK	Press the 💲 button to select the hold conditions.	OFF Hold OFF 81/F
FLOW OF OPERATION	Press to select	Select the desired value.		The average measured value during the sampling period is held.
BASIC SETUP				PLO P The difference between the
MAIN APPLICATIONS & SETTING METHODS				values during the sampling period is held.
Height				The measured value at the start of the sampling period is
Steps and Warpage				held.
Double Sheet Detection				The minimum value during the sampling period is held.
Thickness				The maximum value during the sampling period is held.
Positioning				following page.)
Eccentricity and Surface Deflection	SMART MENU/SET		Press the <b>b</b> utton to apply the setting.	* The clamp value is output until the first sampling period is finished.
DETAILED SETTINGS			When other than <i>DFF</i> is selected, proceed to "3 Self-trigger setting."	(For details on the clamp value, see page 111.)
TROUBLE- SHOOTING		1	1	<u> </u>
SPECIFI- CATIONS				
INDEX				
SETTING TRANSITION CHARTS				

Selection menu	Details	
OFF (default)	Hold measurement is not performed. The measured value is output at all times.	
	The average measured value during the sampling period is held. The output	CONTENTS
RVE	changes at the end of the sampling period and is held until the end of the next sampling period.	INTRODUCTION
	Current measured value Sampling period	PREPARATION FOR MEASUREMENT
HOLd	The difference between the minimum and maximum values during the sampling period is held. This option is selected mainly to detect vibration	FLOW OF OPERATION
P	The output changes at the end of the sampling period and is held until the end of the next sampling period.	BASIC SETUP
	Current measured value	MAIN APPLICATIONS & SETTING METHODS
	Sampling period	Height
SAMPLE	The measured value at the start of the sampling period is held. The output changes at the end of the sampling period and is held until the end of the port sampling period.	Steps and Warpage
		Double Sheet Detection
	Sampling period	Thickness
	The minimum value during the sampling period is held. The output changes	Positioning
BOEEOM	at the end of the sampling period and is held until the end of the next sampling period.	Eccentricity and Surface Deflection
	Current measured value	DETAILED SETTINGS
	Sampling period	TROUBLE- SHOOTING
PERK	at the end of the sampling period and is held until the end of the next sampling period.	SPECIFI-
	Current measured value	INDEX
	Sampling period	SETTING TRANSITION CHARTS

# **3** Self-trigger setting

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Pres	ERI G	Press the 🔹 button to display	Default value: TIMING
INTRODUCTION	s to display.	888888		
PREPARATION FOR MEASUREMENT		ERIG El MING	Press the 💲 button to select the self-trigger.	EI MI NC Enter the trigger by using the timing input or by pressing
FLOW OF OPERATION	Press to select	Select the desired value.		the solution in the RUN mode. The period that the timing signal is ON is the
BASIC SETUP				sampling period. <b>SELF-d</b> The sampling period is the
MAIN APPLICATIONS & SETTING METHODS				period that the measured value is lower than the specified self-trigger level.
Height				SELF-U
Steps and Warpage				period that the measured value is greater than the
Double Sheet Detection				specified self-trigger level. (For details, see the following page.)
Thickness	SMART MENU/SET		Press the button to apply the self-trigger.	
Positioning			(When SELF-U and	
Eccentricity and Surface Deflection			SELF - d are selected, proceed to the next item, and when ∠I MI N□ is selected,	
DETAILED Settings			proceed to "5 Return to RUN mode."	
TROUBLE- SHOOTING				
SPECIFI- CATIONS				
INDEX				
SETTING				

Selection menu	Details	
	Either input the timing signal from an external device, or enter the trigger for starting sampling by pressing the $\bigcirc$ button. The period that the timing signal is ON is the sampling period.	CONTENTS
(Default)	Timing input	INTRODUCTION
	(For details on external inputs, see page 118.)	
	The sampling period is the period that the measured value is lower than the specified self-trigger level. Hold measurement is possible without a	PREPARATION FOR MEASUREMENT
	sync input. Measured value	FLOW OF OPERATION
	Self-trigger level • Operation point • Operation point • Return point	BASIC SETUP
<u></u>	Sampling period The sampling period is the period that the measured value is greater than the specified self-trigger level. Hold measurement is possible without a	MAIN APPLICATIONS & SETTING METHODS
5222-0	sync input.	Height
	Self-trigger level	Steps and Warpage
	• Operation point Sampling period Sampling period <sup>O</sup> Return point	Double Sheet Detection

## 4 Trigger level setting

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Positioning
Press to	SELF.LV	Press the ♦ button to display SELFLV.	Default value: 0.000	Eccentricity and Surface Deflection
display.	000000			DETAILED SETTINGS
		Press the 🧇 button to enable		
		setting of the self-trigger level.		TROUBLE- SHOOTING
[Change numeric value]	<u>SELFLI/</u>	the digit, press the 🕱 button to	* If the the button is pressed when the cursor is at the	SPECIFI- CATIONS
		change the numeric value, and	right-most digit or the 🔇	
Press to set.	Set any value.	set the self-trigger level.	button is pressed when the cursor is at the left-most digit,	INDEX
			the setting will be canceled.	
			<b>–</b>	SETTING

Thickness

Button Operation	Display	Description of Operation	Explanation of Selection Menu
SMART MENU/SET		Press the button to apply the setting.	

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CONTENTS

## 5 Return to RUN mode

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FOR MEASUREMENT

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MAIN APPLICATIONS

C	Button Operation	Display	y	Description of Operation	Explanation of Selection Menu
SM	Hold down for 3 seconds	— — — H L M		Hold down the button for three seconds to switch to the RUN mode.	

### Important

 Generally, the held value continues to be output until the next measurement ends (the sampling time elapses).

If you want to reset the held value before the next measurement ends, set the external input to  $\not\vdash \mid MR f respect to f respect to f respect to f respect to the external of the external input wire.$ 



# **Bank Setting**

Procedure for setting up banks

Set to the MENU mode

Bank switching

Various settings

Return to RUN mode

Setting completed

Setting channels used when connecting multiple units Bank switching: CH1 Bank registration: Each CH

The following menu settings can be registered to banks:

### Bank setting:

1

2

3

4

CONTENTS Up to four sets of settings can be stored in memory. (Default: bank 0) This is recommended, for example, when measuring on multi-lot lines.

HIGH threshold

LOW threshold Response time

Hysteresis width

Self-trigger level Display during zero reset

Sensing conditions when executing smart tuning

Measured value display scaling

Pre-scaling display value 1 Post-scaling display value 1

Pre-scaling display value 2

Post-scaling display value 2

### INTRODUCTION

## PREPARATION



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BASIC SETUP

MAIN APPLICATIONS & SETTING METHODS

Height

Steps and

Warpage Double

Sheet Detection

Doe	itio	nin	n

SETTING TRANSITION CHARTS

Important
important

· When connecting two or more Amplifier Units, use the CH1 Amplifier Unit for switching. The Amplifier Units of CH2 and later are switched together with CH1.

## Set to the MENU mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Thickness
SMART MENU/SET	H L MENU	Hold down the button for three seconds to switch to the		Positioning
		Press the & button to display	* This step is not required if	and Surface Deflection
Press to display.	<u>delai l</u> Beesee		detail menu display is already set to ON in the MENU mode.	DETAILED SETTINGS
	delai L	Press the    button to set the display to □N to set display of the detail mean.	-	TROUBLE- SHOOTING
Press to display.		the detail menu.		SPECIFI- CATIONS
SMART MENU/SET		Press the 🖱 button to apply		
		the setting.		INDEX

ZX2 User's Manual

## **2** Bank switching

	Button Operation	Display	Description of Operation	Explanation of Selection Menu	
CONTENTS	A B	L.Q.N.K	Press the 🌒 button to display	Default value: 0	
INTRODUCTION	ess to display.				
PREPARATION FOR MEASUREMENT		- Pank S	Press the 💲 button to select the bank.	to 3	
FLOW OF OPERATION	Press to select	Select the desired value.			
BASIC SETUP	SMART MENU/SET		Press the button to apply the setting.		



Height

Steps and

Warpage

Double Sheet Detection

Thickness

Positioning

## **3** Various settings

Set the various menu items that require setting.

Execute smart tuning for each bank to be used because the smart tuning results are not applied to other banks.

## **4** Return to RUN mode

Button Operation	Displ	ay	Description of Operation	Explanation of Selection Menu
 SMART MENU/SET Hold down for 3 seconds	H L	Out MENU	Hold down the button for three seconds to switch to the RUN mode.	

Either switch banks by following the steps  $1 \rightarrow 2 \rightarrow 4$  described above, or input the

The following explains how to switch banks and perform measurement.

required signal from an external device to switch the bank.

Eccentricity and Surface Deflection

#### DETAILED SETTINGS

TROUBLE-SHOOTING

SPECIFI-CATIONS

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SETTING TRANSITION CHARTS

# Zero Reset

Setting channels used when connecting multiple units: Each CH I

Zero reset:

This refers to setting the reference value to "0" or any desired numeric value so that the measured value can be displayed and output as a positive or negative deviation (tolerance) from the reference value. The measured value can be set to "0" or any desired numeric value at any timing in the RUN mode.



### Procedure for setting up zero reset

	7 Set to the MENU mode
	2 Zero reset memory setting
TENTS	<i>3</i> Display setting at zero reset
DUCTION	4 Return to RUN mode
	5 Zero reset execution
RATION	Setting completed

PREPA FOR MEASUREMENT

----

1

CON

INTRO

### Set to the MENU mode

OPERATION	Button Operation	Display	Description of Operation	Explanation of Selection Menu
BASIC SETUP	SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button for three seconds to switch to the MENU mode	
APPLICATIONS & SETTING METHODS Height	Press to da	delai l	Press the & button to display dELRI L.	* This step is not required if detail menu display is already set to ON in the
Steps and Warpage	veros		Press the 🗢 button to set the	MENU mode.
Double Sheet Detection	Press to display.	<u>oceni L</u> []N	display to UN to set display of the detail menu.	
Thickness	SMART MENU/SET		Press the button to apply the setting.	

Positioning

Eccentricity and Surface

2 Zero reset memory setting

Select whether or not to hold the measured value after the zero reset was performed when the power is turned OFF.

Deflection	Button Operation	Display	Description of Operation	Explanation of Selection Menu
SETTINGS	Pres	ZRMEM	Press the & button to display	Default value: OFF
TROUBLE- SHOOTING	ss to display.	888888		
SPECIFI- CATIONS		ZRMEM OFF	Press the 💲 button to select the zero reset memory setting.	Saves the current measured result.
INDEX	Press to select	Select the desired value.		Does not save the current measured result.
Setting Transition Charts				When executing a zero reset at each measurement, set to

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
SMART MENU/SET		Press the button to apply the setting.		CONTENTS

### Important

3

Display setting at zero reset

• If zero reset memory is set to ON, the zero reset level will be written in the Amplifier Unit's non-volatile memory (EEPROM) each time a zero reset is executed.

non-volatile memory (EEPROM) each time a zero reset is executed. The EEPROM can be written a maximum of 100,000 times. Writing the zero reset level for each measurement can, therefore, use up the life of the memory and lead to malfunctions.

Set the zero reset memory function to set the

reference value to any numeric value.

FLOW OF OPERATION

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BASIC SETUP

Button Operation	Display	Description of Operation	Explanation of Selection Menu	MAIN
Press to display.	<u>ZR</u> di SP	Press the 🌒 button to display ZRdl SP .	Default value: 0.000	& SETTING METHODS Height
		Press the 🏶 button to enable setting of values at a reset.		Steps and Warpage Double Sheet Detection
[Change numeric value]	ZRdi SP	Press the 😻 button to move the digit, press the 💲 button to	* If the \$ button is pressed when the cursor is at the	Thickness
Press to set.	Set any value.	change the numeric value, and set the offset level.	right-most digit or the <b>(</b> button is pressed when the cursor is at the left-most digit,	Positioning
SMART MENU/SET		Press the button to apply the setting.	the setting will be canceled.	Eccentricity and Surface Deflection
	1	U U		DETAILED

## 4 Return to RUN mode

Button	Display	Description of Operation	Explanation of	SHOOTING
	Out	Hold down the button for three seconds to switch to the		SPECIFI- CATIONS
Hold down for 3 seconds	H L MENU	RUN mode.		INDEX

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SETTINGS

TROUBLE-

#### 5 Zero reset execution

Button Operation	Display	Description of Operation	Explanation of Selection Menu
		Set the sensing object to be	
—	_	reset.	
	Lit	Either press the 🧇 button for	(For details on external
	LD ON ZERO ENABLE	one second in the RUN mode,	inputs, see page 118.)
		or input the zero reset signal (4	
Hold bour down for 1 second		device.	
	Button Operation	Button Operation     Display       —     —       —     —       Hold both down for 1 second     —	Button Operation         Display         Description of Operation           —         —         Set the sensing object to be used for executing the zero reset.           Image: Construction of the sensing object to be used for executing the zero reset.         Either press the set button for one second in the RUN mode, or input the zero reset signal (4 ms to 1 s) from an external device.

### BASIC SETUP



Height

Steps and Warpage

Double Sheet Detection

Thickness

Positioning

Eccentricity and Surface

D S

TI S

S C

Ш

SI TI C

### Important

- The minimum display value is -99.999, and the maximum display value is 999.999. If the measured value is below the minimum value after execution of zero reset, -99.999 will be displayed. 999.999 will be displayed if the measured value is above the maximum value. Zero reset can be executed only if the measured value is within ±10% of the rated
  - measurement range.
  - · Even if a zero reset is executed, the threshold does not change from the setting before execution of the zero reset.

(For example, even if a zero reset is executed so that the measured value 2 becomes 0, the HIGH threshold stays at 5 if it is 5 before zero reset is executed.)

 After a zero reset, analog values are output in a range that corresponds to the zero-reset display value (initial value: 0 mm), which accords with the zero-reset distance point. (When the zero-reset display is 0 mm and scaling is set to OFF, the analog output value will be 3 V if the range is 1 to 5 V, 0 V if the range is -5 to 5 V, and 12 mA if the range is 4 to 20 mA.)

### Procedure for canceling a zero reset

ETAILED	Button Operation	Display	Description of Operation	Explanation of Selection Menu
ETTINGS ROUBLE- HOOTING	Hold both down for 1 second Hold both down for 1 second	50000	Either press the 💲 button for one second in the RUN mode, or input the zero reset signal (3 s or more) from an external	
PECIFI-			device.	
NDEX				
etting Ransition Harts				
104				

# Scaling

Scaling:

CONTENTS The display scale can be changed when you want to display a digital value on the Amplifier Unit different from the actual measured value. (For example, when you want to set the measured value as the actual measuring distance.) INTRODUCTION

Procedure for setting up scaling



#### 1 Set to the MENU mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Height
SMART MENU/SET	Lit	Hold down the button for		and Warpage
Hold down for 3 seconds	H L MENU	MENU mode.		Double Sheet Detection
Press to disp	<u>dELRI L</u> 888888	Press the 🔅 button to display dELRI L.	* This step is not required if detail menu display is already set to ON in the	Thickness
lay.			MENU mode.	Positioning
Press to display.	<u>delai l</u> On	Press the Solution to set the display to □N to set display of the detail menu.		Eccentricity and Surface Deflection
SMART MENU/SET		Press the button to apply the setting.		DETAILED SETTINGS

#### 2 Scaling

Button Operation	Display	Description of Operation	Explanation of Selection Menu	SPECIFI- CATIONS
Press to dis	<u>SCALE</u>	Press the \$ button to display	Default value: OFF	INDEX
play.				SETTING TRANSITION

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TROUBLE-

SHOOTING

PREPARATION FOR MEASUREMENT

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MAIN APPLICATIONS & SETTING METHODS

	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	Press to display.	<u>SCRLE</u> ON	Press the ♥ button to display □N.	
INTRODUCTION	SMART MENU/SET		Press the button to enable setting of scaling.	
PREPARATION For Measurement	Press to display	<u>5 I-66F</u> -99999	Press the \$ button to display 5 I-BEF -	<to actual="" display="" distance="" sensing="" the=""></to>
FLOW OF OPERATION			Press the 🏶 button to enable setting of S1-Before.	
BASIC SETUP			Desce the AA butter to serve	50 50 42
MAIN APPLICATIONS & SETTING METHODS	Change numeric valuej	5 1-66F	the digit, press the subtron to move change the numeric value, and	58 After
Height	Press to set.	value before	S1 is changed.	8 Before
Steps and Warpage	SMART MENU/SET	Set any value.	Press the me button to apply	S1 S2
Double Sheet Detection			the numeric value of S1-Before.	* If the solution is pressed when the cursor is at the
Thickness	Press to display.	<u>5 I-AFE</u> -99999	S I-RFE.	button is pressed when the cursor is at the left-most digit, the setting will be canceled.
Positioning Eccentricity and Surface			Press the 🏶 button to enable setting of S1-After.	
DETAILED	[Change numeric value]	5 - 85 E 58000 [Numeric	Press the (**) button to move the digit, press the (**) button to change the numeric value, and set the measured value after S1	
TROUBLE- SHOOTING		value after change] Set any value.	is changed.	
SPECIFI- CATIONS	SMART MENU/SET		Press the button to apply the numeric value of S1-After.	
INDEX				
SETTING TRANSITION CHARTS				

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
Press to display,	<u>52-66F</u> -99999	Press the \$ button to display 52-bEF.	58 After	CONTENTS
		Press the 🏶 button to enable setting of S2-Before.	8 Before	INTRODUCTION
[Change numeric value]	52 <u>-6</u> 2F	Press the 👀 button to move the digit, press the 🕱 button to	* If the \$ button is pressed when the cursor is at the	PREPARATION FOR MEASUREMENT
Press to set.	[Numeric value before change]	change the numeric value, and set the measured value before S2 is changed.	right-most digit or the button is pressed when the cursor is at the left-most digit, the setting will be canceled.	FLOW OF OPERATION
SMART MENU/SET		Press the button to apply the numeric value of S2-Before.		BASIC SETUP
Press to dsplay	<u>52-AFE</u> -99999	Press the 🏘 button to display 52-RFE .		MAIN APPLICATIONS & SETTING METHODS
		Press the 🏶 button to enable setting of S2-After.		Height Steps and Warpage
[Change numeric value]	<u>S2-AFL</u>	Press the 😻 button to move the digit, press the 🅱 button to		Double Sheet Detection
Press to set.	[Numeric value after change] Set any value.	change the numeric value, and set the measured value after S2 is changed.		Thickness
SMART MENU/SET		Press the button to apply the numeric value of S2-After.	-	Positioning
3 Retur	n to RUN mod	le	1	Eccentricity and Surface Deflection

## **3** Return to RUN mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	DETAILED SETTINGS
SMART MENU/SET Hold down for 3 seconds	Out H L MENU	Hold down the <b>button for</b> three seconds to switch to the RUN mode.		TROUBLE- SHOOTING

SPECIFI-CATIONS

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Important



DETAILED Even if scaling is executed, the threshold does not change from the setting before execution of scaling. (For example, the HIGH threshold stays at 5 if it was 5 before scaling is executed.)

TROUBLE-SHOOTING

SPECIFI-CATIONS

INDEX

SETTING TRANSITION CHARTS
Setting channels used when connecting multiple units: Each CH

# **Analog Output**

Analog output:

CONTENTS This refers to the conversion of measurement results to 4 to 20 mA current output or to -5 to +5 V/1 to 5 V voltage output.

The relationship between display values and analog output values can be freely INTRODUCTION specified. (Monitor focus)

## Procedure for setting up analog output





#### **Button** Explanation of **Description of Operation** Display Operation Selection Menu Hold down the mount button for MENU/SET Lit three seconds to switch to the 8 2 MENU Hold down for 3 seconds MENU mode.

### 2 Analog output setting

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Eccentricity and Surface Deflection
Press to display.	<u>R-OUL</u> 888888	Press the ♦ button to display R-DUE .	Default value: -5 to +5 V	DETAILED SETTINGS
	R-CUL	Press the 💲 button to select analog output.	U. 20MR Current output 4 to 20 mA	TROUBLE- SHOOTING
Press to select	Select the desired value.		$\begin{cases}, 5' \\ Voltage output 1 to 5 V \\ -5,, 5' \end{cases}$	SPECIFI- CATIONS
SMART MENU/SET		Press the tww button to apply	Voltage output 5 to +5 V	INDEX
		the setting.		SETTING

### RANSIII CHARTS

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and

OPERATION

# **3** Return to RUN mode

CONTENTS	Button Operation	Display	Description of	Operation	Explar Selecti	nation of on Menu
INTRODUCTION	SMART MENU/SET Hold down for 3 seconds	H L MENU	Hold down the three seconds to second to secon	button for witch to the		
	Freely specify	ving the relati	onship between c	lisplay value	s and analog	output values
PREPARATION FOR	(equivalent to	the former Z	X-L-N monitor fo	cus)	J	
MEASUREMENT	<ul> <li>To specify an</li> </ul>	iy analog outpu	ut value for a displa	y value, assig	n the analog o	utput range and
FLOW OF OPERATION	the minimum setting up sca	and maximum aling.	n analog output val	ues by selectir	ng the analog	output and then
BASIC	(If scaling is r	not set up, the	measurement range	e is the same a	s the analog o	utput range.)
SETUP	The analog o	utput rango is	assigned based on	the next scali	na display val	uo cottina rango
MAIN	(between S1-	AFT and S2-A	FT).		ng uispiay vai	ue setting range
& SETTING METHODS	Concerning t	he minimum a	nd maximum analo	g output value	s, the analog	
Height	value is output	ut for the smal t maximum val	ler of the post-scali ue is output for the l	ng display valu arger of these	ies (S1-AFT/S values.	2-AFT), and the
Steps			·	-		
Warpage	To only speci	fy the analog o	utput range, without	t changing disp	blay values	
Double Sheet Detection	Example: To set the analog output in the range of –5 V to 5 V when using the ZX2-LD50(L) at a distance of 45 mm to 55 mm from the sensor:					
Thickness	(1) Select -	55⊮ as the	analog output settir	ng.	_5 mm	5 mm
Positioning	<ul> <li>(2) Specify the measurement range to use for the BEF and AFT values, and then assign the analog output range based on the measured value range.</li> </ul>					
and Surface Deflection	• S1-BEF			04 555		
	• S1-AFT • S2-BEF	: –5 (mm) → S <sup>:</sup> : 5 (mm)	et the same value a	S S1-BEF		
DETAILED SETTINGS	• S2-AFT	$\therefore$ 5 (mm) $\rightarrow$ Se	t the same value as	S2-BEF		
TROUBLE-	<initial setting<="" th=""><th>g&gt;</th><th><scaling settir<="" th=""><th>ıg&gt;</th><th></th><th></th></scaling></th></initial>	g>	<scaling settir<="" th=""><th>ıg&gt;</th><th></th><th></th></scaling>	ıg>		
SHOOTING SPECIFI-	Display value	Analog output	Scaling point	Pre-scaling display value (BEF)	Post-scaling display value (AFT)	Analog output
CATIONS	–10 mm	–5 V	S1	–5 mm	–5 mm	–5 V
INDEX	10 mm	5 V	S2	5 mm	5 mm	5 V
	<ul> <li>To specify the</li> </ul>	e analog output	t range after changi	ng display valu	ies	
SETTING	(For details	on scaling, se	e page 108.)			

TRANSITION CHARTS

Output for Non-measurement Setting channels used when connecting multiple units: Each CH

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MAIN APPLICATIONS & SETTING METHODS

Height

Steps

Sheet Detection

Thickness

and Warpage Double

### Output for non-measurement:

CONTENTS This refers to specifying the output contents when an error occurs (Error-dark or Error-bright), when a reset is being input, or before measured values are finalized.

### (For details on these errors, see page 130.)

O ala ati an Manu	Output Contents				
Selection Menu	Judgment Output Analog Output		PREPARATION		
KEEP (Default)	The measurement va held and output.	e measurement value immediately before the non-measurement state is entered is d and output.			
CLAMP	All OFF	The specified CLAMP value is output. The following options are available. • For voltage output: -5.00 to 5.00 V (in 1-V steps), or	FLOW OF OPERATION		
		For current output: 4.00 to 20.00 mA (in 1-mA steps), or the maximum (approximately 22 mA)	BASIC SETUP		

### Procedure for setting up output for non-measurement



### 1 Set to the MENU mode

				Positioning
Button Operation	Display	Description of Operation	Explanation of Selection Menu	Eccentricity and Surface
SMART MENU/SET		Hold down the 🖱 button for		Deflection
Hold down for 3 seconds		three seconds to switch to the MENU mode.		DETAILED SETTINGS
-		Press the 🕸 button to display	* This step is not required if	
Press to display.	<u>8658888</u>	delai L.	detail menu display is already set to ON in the	TROUBLE- SHOOTING
			MENO Mode.	
	delai L	Press the $\Leftrightarrow$ button to set the display to $\Box N$ to set display of		SPECIFI- CATIONS
		the detail menu.		
Press to display.				INDEX
SMART MENU/SET		Press the 🖱 button to apply		OFTTINO
		the setting.		TRANSITION

# 2 Output settings for non-measurement

CONTENTS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
CONTENTS	y A	85FU!!F	Press the 🏶 button to display	Default value: KEEP
INTRODUCTION	ess to display,	888888	RSEUUE .	
PREPARATION FOR MEASUREMENT		RSEOUE KEEP	Press the 💲 button to select output for non-measurement.	KEEP The measured value status before measurement is
FLOW OF OPERATION	Press to select	Select the desired value.		stopped is held and output.
BASIC SETUP				Analog output: The preset clamp value is output.
MAIN APPLICATIONS & SETTING METHODS	SMART MENU/SET		Press the button to apply the setting.	
Height				

# **3** Clamp value setting

Steps and	J Clam	p value setting	l	
Warpage Double	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Detection	¥		Press the \$ button to display	Default value: MAX
Thickness	ass to displa	888888		The clamp value is output
Positioning	*			from when the power is turned on until the measured value is finalized, even when
Eccentricity and Surface Deflection				KEEP is selected, so be sure to set this value.
DETAILED SETTINGS		<u> </u>	Press the 💲 button to display the clamp value.	For voltage output:
TROUBLE- SHOOTING	Press to select	Select the desired value.		For current output:
SPECIFI- CATIONS				In 1 mA units
INDEX	SMART MENU/SET		Press the button to apply the setting.	
SETTING TRANSITION CHARTS				



Button Operation	Display	Description of Operation	Explanation of Selection Menu	
SMART MENU/SET	Out	Hold down the button for		CONTENTS
Hold down for 3 seconds	H L MENU	RUN mode.		INTRODUCTION

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TROUBLE-SHOOTING

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# Timer

#### Timer: CONTENTS

The timing for judgement outputs can be adjusted to match the operation of external devices. (Timer accuracy: Up to 1 ms)

#### INTRODUCTION Procedure for setting up the timer



1

# SETUP

DETAILED

SETTINGS

## Set to the MENU mode

MAIN APPLICATIONS	Set to	the MENU mo	ode	
& SETTING METHODS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Steps and Warpage	SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button for three seconds to switch to the MENU mode.	
Double Sheet Detection	Press to displa	<u>delai l</u> 888888	Press the I button to display dELRI L.	* This step is not required if detail menu display is already set to ON in the
Thickness			Press the 🗢 button to set the	MENU mode.
Positioning		<u>deeki l</u> On	display to	
Eccentricity and Surface Deflection	SMART MENU/SET		Press the button to apply the setting.	

# Timer setting

TROUBLE- SHOOTING	Button Operation	Display	Description of Operation	Explanation of Selection Menu
SPECIFI- CATIONS	Press to display	<u> </u>	Press the the button to display INEL M when setting the ON- delay and IFFEL M when	ON-LIM ON-delay timer
INDEX		Select the desired value.	setting the OFF-delay.	OFF-delay timer (For details, see the following page.)
SETTING TRANSITION CHARTS			Press the sutton to enable setting of the timer.	

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
[Change numeric value]		Press the <b>\$</b> button to move the digit, press the <b>\$</b> button to change the numeric value, and out the time set to the time.	* If the \$ button is pressed when the cursor is at the right most diviter the	CONTENTS
Press to set.		set the time set to the timer.	button is pressed when the cursor is at the left-most digit,	INTRODUCTION
SMART MENU/SET		Press the button to apply the setting.	the setting will be canceled.	PREPARATION FOR MEASUREMENT



# **3** Return to RUN mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	INDEX
SMART MENU/SET Hold down for 3 seconds	Uut H L MENU	Hold down the button for three seconds to switch to the RUN mode.		SETTING TRANSITION CHARTS

SPECIFI-CATIONS

# Setting the Differential Function

Setting channels used when connecting multiple units: Each CH

### Differential function:

CONTENTS

This function is used to display measurement change amounts when it is difficult to specify a threshold for the measured value, making it easier to detect only sudden changes in the measured values.



### Important

The detection effectiveness varies depending on the response time setting.

**Description of Operation** 

Hold down the 👅 button for

three seconds to switch to the

MENU mode

### Procedure for setting up differential function



#### TROUBLE-SHOOTING

1

Button

Operation

MENU/SET

Hold down for 3 seconds

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Display

Lit

MENU

Explanation of

Selection Menu

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
Press to display.	<u>dELRI L</u> 888888	Press the 🏶 button to display dEERLL.	* This step is not required if detail menu display is already set to ON in the MENU mode.	CONTENTS
	delai L	Press the 拳 button to set the display to □N to set display of		INTRODUCTION
Press to display.		the detail menu.		PREPARATION FOR MEASUREMENT
SMART MENU/SET		Press the button to apply the setting.		FLOW OF
				OPERATION

# 2 Differential function setting

Button Operation	Display	Description of Operation	Explanation of Selection Menu	SETUP
Press to		Press the 🌢 button to display dl FF .		MAIN APPLICATIONS & SETTING METHODS
display.				Height
	di FF	Press the 拳 button to set the display to □N .		Steps and Warpage
Press to display.				Double Sheet Detection
SMART MENU/SET		Press the 👅 button to apply the setting.		Thickness

# **3** Return to RUN mode

MANUSET MINUSET MIS decords MIS decords	Eccentricity and Surface Deflection
	DETAILED SETTINGS

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# **External Input for Bank, Timing Input, Reset Input**

Setting channels used when connecting multiple units: Each CH, Bank switching: CH1

External input:

1

2

3

1

SMART MENU/SET

SMART MENU/SET

**Button** 

Operation

Hold down fo

Procedure for setting up external input

Set to the MENU mode

External input terminal setting

Return to RUN mode

Setting completed

dЬ

Set to the MENU mode

Display

Lit

MENU

This refers to inputting the bank switching signal, the timing signal during a hold and the reset signal from an external device to execute these operations.

**Description of Operation** 

Hold down the 
button for

three seconds to switch to the

Press the 🔹 button to display

Press the 🧇 button to set the

Press the button to apply

display to DN to set display of

MENU mode

defall.

the detail menu

the setting.

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### TROUBLE-SHOOTING

# 2 External input terminal setting

SPECIFI- CATIONS	Button Operation	Display	Description of Operation	Explanation of Selection Menu
INDEX	Prest to display.	<u>E×E-I N</u> 888888	Press the to button to display EXE-I N.	Default value: TIM.RST
SETTING				

TRANSITION

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External	Input for	Bank, T	'imina Ir	nput. R	eset lı	nput

Explanation of

Selection Menu

\* This step is not required if

detail menu display is

MENU mode.

already set to ON in the

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
	EXE-IN El MRSE	Press the 💲 button to select the external input terminal.	LI MRSE timing input/reset input	CONTENTS
Press to select	s to select the desired value.	Select the esired value.	Bank switching	INTRODUCTION
SMART MENU/SET		Press the 🖱 button to apply		
		the setting.		PREPARATION FOR MEASUREMENT

#### 3 Return to RUN mode

Button		Description of Operation	Explanation of	OPERATIO
Operation	,		Selection Menu	BASIC
SMART MENU/SET	0.1	Hold down the 👅 button for		SETUP
		three seconds to switch to the		
Hold down for 3 seconds	H L MENU	RUN mode.		MAIN APPLICATIO

## Procedure for executing external input

Each of the functions is executed when signals are input using the external input wire in table 1 below.

Timing input, reset input and bank switching are executed by a signal input of 4 ms or more. While the signal in table 2 below is being input, measurement is performed based on the settings of the specified bank.

When connecting two or more Amplifier Units, use the CH1 Amplifier Unit for bank switching. The banks of the Amplifier Units of CH2 and later are switched together with CH1

Table 1 External Input Wiring

Amplifier Unit Connector Cable Color Setting	Purple	Red
EI MRSE	Timing input	Reset input
6ANK	BANK input 0	BANK input 1

Table 2 Bank Signal Switching Wiring

	BANK Input 0 (purple)	BANK Input 1 (red)
BANK 0	OFF	OFF
BANK 1	ON	OFF
BANK 2	OFF	ON
BANK 3	ON	ON

Bank signal switching is enabled only in the RUN mode. Note:

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# **Setting the Detection Surface Selection**

Setting channels used when connecting multiple units: Each CH

### Detection surface selection:

The default value is FIRST. Setting the value to MAX can decrease incorrect measurements caused by diffused reflection or multireflection due to the shape of the workpiece.

#### Sensor Head PREPARATION Correct reflection MEASUREMENT Multireflection Measurement NEAR FLOW OF while moving FAR OPERATION Measurement performed with Measurement performed on the NEAR side correct reflection components BASIC (with the FIRST setting) (with the MAX setting) Correct reflection SETUP --- Multireflection

Procedure for setting up detection surface selection

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1

2

3

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## Set to the MENU mode

Set to the MENU mode

Detection surface

selection setting

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Setting completed

Eccentricity and Surface	Button Operation	Display	Description of Operation	Explanation of Selection Menu
DETAILED	SMART MENU/SET Hold down for 3 seconds	Lit H L MENU	Hold down the button for three seconds to switch to the MENU mode.	
TROUBLE- SHOOTING	Press to display,	<u>defai r</u>	Press the I button to display	* This step is not required if detail menu display is already set to ON in the MENU mode.
SPECIFI- CATIONS			Press the 拳 button to set the display to □N to set display of	
INDEX	Press to display.		the detail menu.	
SETTING	SMART MENU/SET		Press the button to apply the setting.	

CHARTS

# **2** Detection surface selection setting

Button Operation	Display	Description of Operation	Explanation of Selection Menu	
Press to deplay.	<u>dELECL</u> 888888	Press the ♦ button to display dELEEL .		CONTENTS
Press to select	Select the desired value.	Press the ♥ button to display MRX.	FLRSE During normal measurement MRX When an incorrect measurement occurs due to diffused reflection or multireflection	PREPARATION FOR MEASUREMENT FLOW OF OPERATION BASIC
SMART MENU/SET		Press the button to apply the setting.		
				ADDI ICATIONIS

# **3** Return to RUN mode

Button Operation	Display	Description of Operation	Explanation of Selection Menu	Steps
SMART MENU/SET	Out H L MENU	Hold down the button for three seconds to switch to the RUN mode.		Warpage Double Sheet Detection

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# **Key Lock Function**

Explanation of

Selection Menu

Explanation of

Selection Menu

CONTENTS

Key Lock Function:

The key lock function disables all keys. Once keys have been disabled, no key input will be accepted until the lock is released. This function is useful for preventing inadvertent changes to settings. INTRODUCTION

**Description of Operation** 

Hold both the (1) buttons down

for three seconds in the RUN

mode.

(Although button operations are disabled, external input is still possible.)

PREPARATION FOR MEASUREMENT

# **Key Lock Function**

Button

Button

Operation

FLOW OF OPERATION

BASIC SETUP

Operation	Display	Description of Operation
Hold both down for 3 seconds	888888 K-LOCK	Hold both the (a) buttons down for three seconds in the RUN mode.

Canceling the Key Lock

Display

aved until com

MAIN APPLICATIONS & SETTING METHODS

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ETAILED	

Initializing Settings Data Setting channels used when connecting multiple units: Each CH

Initialization: This function resets all settings to their default values.

### **Default Values**

Function	Default Value	INTRODUCTION
Display	0 reference: Measurement center distance + indication: NEAR side - indication: FAR side	PREPARATION FOR MEASUREMENT
HIGH threshold	Measurement range maximum value	EL OWLOE
LOW threshold	Measurement range minimum value	OPERATION
Response time	500 ms	
Analog output setting	-5 to +5 V	BASIC SETUP
Detail menu display selection	OFF	MAIN
Bank switching settings	0	& SETTING METHODS
Mutual interference prevention	OFF	Height
Hysteresis width	0.000	Steps and
Two-Sensor operation setting	OFF	Warpage Double Sheet
Thickness setting	0.000	Detection
Measured value display scaling	OFF	Thickness
Differential function	OFF	Positioning
Hold setting	OFF	
Trigger mode	TIMING (self-trigger timing input)	Eccentricity and Surface
Self-trigger level	0.000	Deflection
Output for non- measurement	KEEP	DETAILED SETTINGS
Clamp value	MAX	
ON-delay time	0 ms	SHOOTING
OFF-delay time	0 ms	
Zero reset memory	OFF	SPECIFI- CATIONS
Display during zero reset	0.000	
External input terminal setting	TIM.RST (timing input/reset input)	SETTING
Detection surface selection	FIRST	TRANSITION CHARTS

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### Procedure for initializing settings data



#### Important PREPARATION

1

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OPERATION

 When connecting two or more Amplifier Units, use CH1 to perform initialization because CH2 and later channels cannot be used to do this.

Note that CH2 and later channels are initialized together with CH1.

# Set to the MENU mode

DAGIC				
SETUP	Button	Display	Description of Operation	Explanation of
	operation			
MAIN APPLICATIONS & SETTING METHODS	SMART MENU/SET		Hold down the  button for  three seconds to switch to the	
Height	Hold down for 3 seconds		MENU mode.	

#### 2 Setting data initialization

Warpage Double Sheet	Button Operation	Display	Description of Operation	Explanation of Selection Menu
Detection Thickness	Press to dag	NI E 888888	Press the 🏶 button to display I NI E.	
Positioning	day.			
Eccentricity and Surface Deflection	Press to display.	E×E	Press the ♥ button to display E XE.	
DETAILED SETTINGS	SMART MENU/SET		Press the 👅 button.	
TROUBLE- SHOOTING	Hold down	Displayed 1 digit at a time		
SPECIFI- CATIONS			When $\Box H$ is displayed, this means that initialization is completed.	
INDEX			p	

SETTING TRANSITION CHARTS

# **3** Return to RUN mode

Button	Display	Description of Operation	Explanation of	
Operation			Selection Menu	
SMART MENU/SET	Out	Hold down the button for		CONTENTS
	H L MENU	three seconds to switch to the		
Hold down for 3 seconds		RUN mode.		

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### DETAILED SETTINGS

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# TROUBLESHOOTING

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Error Messages	130
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# Troubleshooting

CONTENTS

This section describes countermeasures for temporary hardware problems. Check the malfunction in this section before sending the hardware for repair.

INTRODUCTION	Category	Problem		Probable cause and possible countermeasure	Pages						
PREPARATION For		The device restarts during operation.	•	Is the power supply device connected correctly? Are the Calculating Units connected correctly?	p.30 p.26						
		No input signal is received.	•	Are all cables connected correctly? Is the input signal line disconnected?	p.30						
OPERATION		The measured values fluctuate and are not stable	•	This problem may be due to temperature characteristics. Execute zero reset periodically using	p.101						
BASIC SETUP	tion	depending on day and time.		the standard object to correct this problem.							
MAINI	bera	Laser light is not emitted.	•	Is the LD-OFF input short-circuited?	p.30						
APPLICATIONS & SETTING METHODS	Q	ğ	Bank switching by signals from the external input terminal is not functioning.	•	Is the external input terminal set to 占用NH? Is the cable connected correctly?	p.118 p.30					
Steps and Warpage Double Sheet		The state returns to BANK in the RUN mode even if after a bank is switched by button operation.	•	Is the external input terminal set to 上 MRSE ?	p.118						
Detection Thickness		The main display stays at [].	•	Has a timing input been made while hold is enabled and the the trigger mode is $\lfloor I & \text{MI} & \text{NG} \end{vmatrix}$ ? If the hold function is enabled and the trigger type is $\exists \exists \bot \Box = - \sqcup$ or $\exists \exists \bot \Box = - \sqcup$ , has the self-trigger level been set to an appropriate value?	p.93						
Eccentricity and Surface Deflection	splay	splay	splay	splay	splay	isplay	isplay	An abnormal distance is displayed when the object is clearly outside the measurement range.	•	This problem may occur due to the characteristics of the sensor. Make sure that the distance to the sensing object is appropriate.	_
DETAILED SETTINGS								isplay	Ldd[]WN is displayed on the sub-display when the power is turned ON.	•	The laser of the Sensor Head has deteriorated. Replace the Sensor Head.
TROUBLE- SHOOTING	Ō	Ld, IFF is displayed on the sub-display.	•	Is the LD-OFF input short-circuited?	p.30						
SPECIFI-		EI MI N⊑ is displayed on the sub-display.	•	Is the timing input short-circuited?	p.30						
CATIONS		RESEE is displayed on the sub-display.	•	Is the reset input short-circuited?	p.30						
INDEX SETTING TRANSITION		Even though the installation conditions are the same, measured values differ considerably.	•	Is the zero-reset input short-circuited?	p.30						

Category	Problem	Probable cause and possible countermeasure	Pages	
olay	<u>E−BRGE</u> is displayed on the main display	<ul> <li>Is the distance between the Sensor Head and the workpiece within the measurement range?</li> </ul>	p.139	CONTENTS
Disp	E - 님유운K is displayed on the main display.	<ul> <li>Is the distance between the Sensor Head and the workpiece within the measurement range?</li> </ul>	p.139	
	Judgements are not output to external devices.	<ul><li>Are all cables connected correctly?</li><li>Is the output signal line disconnected?</li></ul>	p.30	INTRODUCTION
Output		<ul> <li>Is the reset input short-circuited?</li> <li>Is the HIGH threshold set to a value larger than the LOW threshold?</li> </ul>		PREPARATION FOR MEASUREMENT
	Analog output levels are strange.	Are the analog output settings correct?	p.109	FLOW OF OPERATION

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# **Error Messages**

**CONTENTS** This section outlines the error messages displayed on the Amplifier Unit and the countermeasures for those messages.

	While	displaying	an	error,	the	error	output	signal	is	also	output.	(There	are	some
INTRODUCTION	excep	tions.)												

	Display	Error	Countermeasure
PREPARATION FOR MEASUREMENT	Error-bright	Saturated light amount intensity, measurement error. (The error output signal is not output.)	<ul> <li>Install so that the distance between the Sensor Head and the workpiece is within the measurement range.</li> </ul>
OPERATION	Error-channel	There is only one Amplifier Unit even though mutual interference	<ul> <li>If two or more Amplifier Units have been installed, turn OFF the power</li> </ul>
BASIC SETUP		<ul><li>prevention is set to ON.</li><li>There is only one Amplifier Unit even though two-Sensor operation</li></ul>	supply and check that the Amplifier Units and Calculating Units are connected correctly.
MAIN APPLICATIONS & SETTING METHODS	Error-channel	is set to ON. Two Amplifier Unit communication error.	<ul> <li>If only one Amplifier Unit is being used, connect another Amplifier Unit temporarily and turn OFF</li> </ul>
Height			mutual interference prevention and two-Sensor operation, or initialize
and Warpage	Error-dark	Insufficient received light intensity,	<ul><li>Install so that the distance between</li></ul>
Double Sheet Detection	<u>E-dARk</u> 888888	measurement error. (The error output signal is not output.)	the Sensor Head and the workpiece is within the measurement range.
Thickness	Error-head	The Sensor Head is disconnected. Or, a sensor communications error has occurred.	<ul> <li>Turn OFF the power supply, check the Sensor Head connection, and then turn ON the power supply</li> </ul>
Positioning	Error-head		again.
Eccentricity and Surface Deflection	E-HEHd E0M02 Error-head		not solve the problem, the Sensor Head is malfunctioning. Replace the Sensor Head.
DETAILED SETTINGS	<u>E-HERA</u> COMO3		
TROUBLE- SHOOTING	Error-head E-HERd LdD I	Sensor Head laser error.	
SPECIFI- CATIONS	Error-head	The Sensor Head internal memory is in error.	
	Error-head		
	<u>- 7688</u> MEMO2		

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Display	Error		Countermeasure	
Error-head	Sensor Head system error.	•	Turn OFF the power supply, check the Sensor Head connection, and then turn ON the power supply	
Error-head	-	•	again. If the above countermeasure does	CONTENTS
SSC2 Error-head	-		not solve the problem, the Sensor Head is malfunctioning. Replace the Sensor Head.	INTRODUCTION
<u>e-rera</u> 55503				PREPARATION
Error-head	Because the Sensor Head version is	•	Contact the company with which	MEASUREMENT
<u>E-HERd</u> VER	cannot be used.		the OMRON sales representative handling your company.	FLOW OF OPERATION
Error-memory	Amplifier Unit setting memory error.	•	Turn OFF the power supply, check if wiring is connected correctly, and then turn ON the power supply	BASIC SETUP
		•	again. If the above countermeasure does	MAIN APPLICATIONS & SETTING METHODS
			Amplifier Unit is malfunctioning. Replace the Amplifier Unit.	Height
Error-memory	Amplifier Unit setting memory error.	•	Initialize the settings by holding down the SET key for at least three seconds	Steps and Warpage
		•	If the above countermeasure does not solve the problem, the	Double Sheet Detection
Emer also at			Amplifier Unit is malfunctioning. Replace the Amplifier Unit.	Thickness
Error-short E-SHRE	Short-circuited.	•	that the HIGH, PASS, LOW or error output lines are not short-	Positioning
			circuited, then turn ON the power supply again.	Eccentricity and Surface Deflection
Error-system	Amplifier Unit system error.	•	Turn OFF the power supply, check if wiring is connected correctly, and then turn ON the power supply again	DETAILED SETTINGS
		•	If the above countermeasure does not solve the problem, the Amplifier Unit is malfunctioning.	TROUBLE- SHOOTING
Tuning-failed	Smart Tuning failed.	•	Replace the Amplifier Unit. Change the response time setting	SPECIFI- CATIONS
<u>EUN ING</u> FR ILEJ	(The error output signal is not output.)	•	to a larger value, and try again. Make sure that the distance between the Sensor and	INDEX
			Workpiece is within the measurement range, and try again.	SETTING TRANSITION
				CHARTS

Error Messages

	Display	Error		Countermeasure
	LD.down	The laser of the Sensor Head has	•	Replace the Sensor Head.
	<u>BBBBBB</u> Lddûwn	deteriorated.		
CONTENTS		Measured values are not output	•	Normally, measured values are
	888888	because the reset signal is being		displayed once they can be output.
INTRODUCTION		timing is before the hold sampling		
		time, etc.		
PREPARATION		(The error output signal is not output.)		
FOR MEASUREMENT				
FLOW OF OPERATION				
BASIC				
SETUP				
& SETTING				
neight				
Steps				
Warpage				
Double Sheet				
Detection				
Thickness				
THURIESS				
Positioning				
rositioning				
Eccentricity				
Deflection				
SETTINGS				
TROUBLE-				
SHOOTING				
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CATIONS				
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SETTING TRANSITION				
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Question	Answer	CONTENTS
What is the positional variation range with	The range is ±0.5° of the ideal emitter axis in	
respect to the machine axis of the emitter	the dimensional drawing on page 138.	INTRODUCTION
beam spot?		
After the response time is changed, is it	Yes. After the response time is changed, the	
necessary to re-execute smart tuning?	smart tuning results are cleared. Therefore,	FOR
	re-execute tuning.	MEASUREMENT
If using a different bank for the first time, is it	Yes. The smart tuning results are not applied	
necessary to execute smart tuning?	to other banks. If using a different bank for the	OPERATION
	first time, execute smart tuning.	
For the line beam type, is it possible to detect	Spot-internal steps cannot be measured. Use	BASIC
beam-spot-internal steps?	the line beam spot so that it is at only one	SETUP
	height.	
Is it possible to add additional extension	Regardless of the length, only one extension	MAIN APPLICATIONS
cables between the Sensor Head and	cable can be added. It is not possible to add	& SETTING
Amplifier Unit?	multiple extension cables.	METHODS
About how much signal input and open time is	These times can be checked using the timing	Height
required for each input operation?	charts in this manual (on page 144).	Stone
Can calculations be performed when Sensor	Yes. This is possible without specifying any	and
Heads that have different measurement	special settings.	Warpage
ranges are connected to two Amplifier Units?		Double
How can I prevent an incorrect value being	If the incorrect measurement is caused by	Detection
measured and output due to the shape of the	multireflection due to the shape of the	
workpiece?	workpiece, setting the detection surface	Thickness
	selection to MAX might improve the	
	measurement accuracy. (See page 120.)	Positioning
Does the sensor need to be warmed up after	Yes. The sensor must be warmed up for at	rostaorning
canceling LD-OFF input?	least 10 minutes in the same way as when	Eccentricity
	turning on the power.	and Surface
Can the sensor head of a diffuse-reflective	Yes it can, but because the sensor is tilted,	Denection
model2	the senser and the worknisse will differ from	
moder	the distance diaplayed	SETTINGS
	In this case, use a regular reflective model	
	whose linearity has been ontimized by using	TROUBLE-
	regular-reflective optics	SHOOTING
	regular reneouve optioo.	

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col	PTM
CO	:N13

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# **Specifications and Dimensions**

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# Amplifier Units

# ZX2-LDA11/LDA41

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\* Min. length when connected: 50



Model Item	ZX2-LDA11	ZX2-LDA41		
Measurement	Min. 30 μs			
Response time	60 us 120 us 240 us 500 us 1 ms 2 ms 4 ms 8 ms 12 ms 20 ms 36 ms 66 ms			
Tresponse time	128 ms, 250 ms, 500 ms			
Analog output (*2)	4 to 20 mA, Max. load resistance: 300 $\Omega$ , ±6 Output impedance: 100 $\Omega$	5 VDC or 1 to 5 VDC,	INTRODUCTION	
Judgment outputs (HIGH/PASS/ LOW: 3 outputs),	NPN open-collector outputs, 30 VDC, 50 mA max.	PNP open-collector outputs, 30 VDC, 50 mA max.	PREPARATION FOR	
error output	10 mA max.,	10 mA max.,	MEAGUREMENT	
	2 V max. for load current above 10 mA	2 V max. for load current above 10 mA	FLOW OF OPERATION	
zero reset input,	1.2 V or less.	Supply voltage short-circuited or supply voltage within –1.2 V		
timing input, reset input, bank input	OFF: Open (leakage current: 0.1 mA max.)	OFF: Open (leakage current: 0.1 mA max.)	BASIC SETUP	
Functions	Smart tuning, scaling, sample hold, peak hold, bottom hold, peak-to-peak hold, self-peak hold, self-bottom hold, average hold, zero reset, On-delay timer, OFF-delay timer, keep/clamp switch, (A-B) calculations (*3), thickness calculation (*3), mutual			
	interference prevention (*3), laser deterioration detection, bank function (4 banks), differential function			
Indications	Judgement indicators: HIGH (orange), PASS (green), LOW (orange),11-segment main display (red), 11-segment sub-display (orange), laser ON (green), zero reset (green), ENABLE (green), MENU (green), HIGH threshold (orange), LOW threshold (orange)			
Power supply voltage	10 to 30 VDC, including 10% ripple(p-p)			
Power consumption	3,000 mW max. with power supply voltage of 30 VDC and power supply current of 100 mA max. (with Sensor connected)			
Ambient temperature	Operating: 0 to +50°C, Storage: -15 to +70°C (with no icing or condensation)			
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)			
Dielectric strength	1,000 VAC, 50/60 Hz for 1 minute			
Vibration resistance (destruction)	10 to 150 Hz, 0.7-mm double amplitude, 80 minutes each in X, Y, and Z directions			
Shock resistance (destruction)	300 m/s <sup>2</sup> 3 times each in six directions (up/down, left/right, forward/backward)			
Degree of protection	IEC60529, IP40		SETTINGS	
Connection method	Prewired (standard cable length: 2 m)			
Weight (packed state)	Approx. 200 g (main unit only: approx. 135 g)			
Materials	Case: PBT (polybutylene terephthalate), Cover: Polycarbonate, Display: Acrylic resin, Buttons: Polyacetal, Cable: PVC			
Accessories	Instruction sheet			
(*1) In the case of a white ceramic OMRON standard object INDEX				

(\*2) In the MENU mode, select and set current output (4 to 20 mA) and voltage output (±5 V or 1 to 5 V).

(\*3) A Calculating Unit (ZX2-CAL) is required. Mutual interference prevention is possible for up to five Amplifier Units, and calculations are possible for SETTING TRANSITION up to two. CHARTS

# **Sensor Heads**

## ZX2-LD50/LD50L, ZX2-LD100/LD100L, ZX2-LD50V



# Setting Up the Regular-reflective Model

Tilt the regular-reflective model as shown below with respect to the workpiece. See page 141 if attaching a bracket to tilt the regular-reflective model.

ZX2-LD50V

48 (Measurement center distance) Workpiece 12.3 ±0.05

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and Warpage Double

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Model Item	ZX2-LD50L	ZX2-LD50	ZX2-LD100L	ZX2-LD100	
Optical system	Diffuse-reflective				
Light source	<ul> <li>Visible-light semiconductor laser with a wavelength of 660 nm and an output of 1 mW max.</li> <li>EN class 2, FDA class II (*5)</li> </ul>				
(wave length)					CONTENTS
Measurement center distance	50 mm 100 mm				
Measurement range	±10 mm		±35 mm		INTRODUCTION
Beam shape	Line	Spot	Line	Spot	
Beam size (*1)	Approx. 60 µm x 2.6 mm	Approx. 60 µm dia.	Approx. 110 µm x 2.7 mm	Approx. 110 µm dia.	PREPARATION
Resolution (*2)	1.5 µm		5 µm		MEASUREMENT
Linearity (*3)	±0.05% F.S. (40 to 50 mm)	±0.1% F.S. (40 to 50 mm)	±0.05% F.S. (65 to 100 mm)	±0.1% F.S. (65 to 100 mm)	FLOW OF
	±0.1% F.S. (entire range)	±0.15% F.S. (entire range)	±0.1% F.S. (entire range)	±0.15% F.S. (entire range)	OPERATION
Temperature characteristic (*4)	0.02% F.S./°C			BASIC SETUP	
Ambient illumination	Incandescent lamp: 10,000 lx max. (on light receiving side)				MAIN
Ambient temperature	Operating: 0 to +50°C, Storage: -15 to +70°C (with no icing or condensation)				& SETTING METHODS
Ambient humidity	Operating and storage: 35% to 85% (with no condensation)			Height	
Dielectric strength	1,000 VAC, 50/60 Hz for 1 minute				
Vibration resistance (destruction)	10 to 150 Hz, 0.7-mm double amplitude, 80 minutes each in X, Y, and Z directions				Steps and Warpage
Shock resistance (destruction)	300 m/s <sup>2</sup> 3 times each in six directions (up/down, left/right, forward/backward)				Double Sheet
Degree of protection	IEC60529, IP67				Detection
Connection method	Connector connection (standard cable length: 500 mm)			Inickness	
Weight (packed state)	Approx. 160 g (main unit only: approx. 75 g)			Positioning	
Materials	Case and cover: PBT (polybutylene terephthalate), Optical window: Glass, Cable: PVC			Eccentricity	
Accessories	Instruction sheet, ferrite core x 1 (made by TDK Corp. ZCAT1730-0730A), laser warning label (English), FDA certification label				and Surface Deflection

(Note) Highly reflective objects can result in incorrect detection by causing out-of-range measurements.

(\*1) Beam size: The beam size is defined by 1/e<sup>2</sup> (13.5%) of the strength of the beam at the beam center (measured value). Incorrect detection may occur if there is light leakage outside the defined spot and the material around

the sensing object is more reflective than the sensing object. (\*2) Resolution: The resolution is the deviation (±3c) in the analog output when connected to the ZX2-LDA Amplifier Unit. (The resolution is measured with the standard reference object (white ceramic), at the measurement point when the response time of the ZX2-LDA is set to 128 ms.) The resolution is given at the repeat accuracy for a stationary workpiece, and is not an indication of the distance accuracy. The resolution may be adversely affected under strong electromagnetic fields.

(\*3) Linearity: The linearity is given as the error in an ideal straight line displacement output when measuring the standard reference object. The linearity and measurement values vary with the object being measured. F.S. is the entire INDEX

- measurement range. (ZX2-LD50□:20mm)
   (\*4) Temperature characteristic: The temperature characteristic is measured at the measurement center distance with the Sensor and reference object (OMRON's standard reference object) secured with an aluminum jig.
- (\*5) Categorized as Class 2 by EN60825-1 criteria in accordance with the stipulations of the FDA standard Laser Notice No. 50, and registered with CDRH (Center for Devices and Radiological Health) (accession number: 1020665-000)

	Model Item	ZX2-LD50V		
	Optical system	Regular-reflective		
CONTENTS	Light source (wave length)	Visible-light semiconductor laser with a wavelength of 660 nm and an output of 0.24 mW max.		
		EN class 1, FDA class I (*5)		
INTRODUCTION	Measurement center distance	48 mm		
PREPARATION	Measurement range	±5 mm		
MEASUREMENT	Beam shape	Spot		
	Beam size (*1)	Approx. 60 µm		
FLOW OF	Resolution (*2)	1.5 μm		
OPERATION	Linearity (*3)	±0.3% F.S. (entire range)		
BASIC	Temperature characteristic (*4)	0.06% F.S./°C		
SETUP	Ambient illumination	Incandescent lamp: 10,000 lx max. (on light receiving side)		
MAIN APPLICATIONS & SETTING	Ambient temperature	Operating: 0 to +50°C, Storage: -15 to +70°C (with no icing or condensation)		
METHODS	Ambient humidity	Operating and storage: 35% to 85% (with no condensation)		
Height	Dielectric strength	1,000 VAC, 50/60 Hz for 1 minute		
Steps and	Vibration resistance (destruction)	10 to 150 Hz, 0.7-mm double amplitude, 80 minutes each in X, Y, and Z directions		
Double	Shock resistance (destruction)	300 m/s <sup>2</sup> 3 times each in six directions (up/down, left/right, forward/backward)		
Sheet Detection	Degree of protection	IEC60529, IP67		
Thickness	Connection method	Connector connection (standard cable length: 500 mm)		
Positioning	Weight (packed state)	Approx. 160 g (main unit only: approx. 75 g)		
rositioning	Materials	Case and cover: PBT (polybutylene terephthalate), Optical window: Glass, Cable: PVC		
Eccentricity	Accessories	Instruction sheet, ferrite core, laser warning label (English)		
Deflection	(Note) Highly re	flective objects can result in incorrect detection by causing out-of-range measurements.		
DETAILED SETTINGS	(*1) Beam size: (measured) Incorrect de the sensing	The beam size is defined by 1/e <sup>2</sup> (13.5%) of the strength of the beam at the beam center value). tection may occur if there is light leakage outside the defined spot and the material around object is more reflective than the sensing object.		
TROUBLE- SHOOTING	(*2) Resolution: The resolution is the deviation (±3σ) in the analog output when connected to the ZX2-LDA Amplifier Unit. (The resolution is measured with the standard reference object (1/4 λ flat mirror), at the measurement point when the response time of the ZX2-LDA is set to 128 ms.) The resolution is given at the repeat accuracy for a stationary workpiece, and is not an indication of the distance accuracy. The resolution may be adversely affected under strong electromagnetic fields.			
SPECIFI- CATIONS	(*3) Linearity: Th the standard The linearit measureme	ne linearity is given as the error in an ideal straight line displacement output when measuring d reference object. y and measurement values vary with the object being measured. F.S. is the entire nt range.		
INDEX	(*4) Temperature with the Sen	e characteristic: The temperature characteristic is measured at the measurement center distance sor and reference object (OMRON's standard reference object) secured with an aluminum jig.		
SETTING TRANSITION CHARTS	(*5) Categorized Notice No. 5	as Class 1 by EN60825-1 criteria in accordance with the stipulations of the FDA standard Laser 0, and scheduled for registration with CDRH (Center for Devices and Radiological Health)		

# **Mounting Bracket**



# Sensor Head Extension Cables

ZX2-XC1R, ZX2-XC4R, ZX2-XC9R, ZX2-XC20R

(Unit: mm)



PREPARATION FOR MEASUREMENT

\*L Cable lengths: ZX2-XC1R: 1 m, ZX2-XC4R: 4 m, ZX2-XC9R: 9 m, ZX2-XC20R: 20 m

Note. Two or more extension cables cannot be connected in series.

FLOW OF OPERATION	Item	ZX2-XC1R	ZX2-XC4R	ZX2-XC9R	ZX2-XC20R	
	Cable type	Flex-resistance type				
	Degree of protection IP67					
BASIC SETUP	Dielectric strength (connector)	No flashover and no breakdown at AC 300 V for 1 minute				
	Insulation resistance (connector)	1000 MΩ min. (at 100 VDC)				
MAIN	Weight (packed state)	Approx. 70 g	Approx. 450 g	Approx. 600 g	Approx. 1050 g	
APPLICATIONS & SETTING METHODS	Materials	Connector: PPS and PBT, Cable: PVC				
	Minimum bend radius	30 mm				
	Accessories	Ferrite core x 2 (made by TDK Corp. ZCAT1730-0730A)				

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# **Calculating Unit**

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# **Timing Charts**

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This section explains the timing charts for the I/O signals that are exchanged between the Controller and external devices.

#### Laser OFF input INTRODUCTION ① Laser emission ON→OFF 2 Laser emission **OFF**→ON PREPARATION 4 ms Within Within 4 ms FOR 8 ms ( 20 ms (\*) or more MEASUREMENT or more ON Laser OFF input FLOW OF OFF OPERATION ON BASIC Laser emission SETUP OFF MAIN APPLICATIONS Laser emission If laser OFF input is ON for 4 ms or more, the signal is received, and 1 & SETTING $ON \rightarrow OFF$ laser emission is turned OFF within 8 ms. METHODS 2 Laser emission If laser OFF input is OFF for 4 ms or more, the signal is received, and Height laser emission is turned ON within 20 ms. $OFF \rightarrow ON$ Steps (\*) The value is within 150 ms when mutual interference prevention is set to ON. and Warpage **Reset input** Double Sheet Detection ② Output value D Output value reset execution reset cancellation Thickness 4 ms Within or more 4 ms (\*1) 4 ms ON Reset input Positioning OFF Eccentricity and Surface Deflection Effective reset period DETAILED SETTINGS 1 Output value If reset input is ON for 4 ms or more, the signal is received, and output reset execution is reset within 4 ms TROUBLE-2 Output value If reset input is OFF for 4 ms or more, measurement is resumed. SHOOTING reset Acquire the measurement results after the preset response time cancellation elapses. (\*2) SPECIFI-(\*1) The value is within 150 ms when mutual interference prevention is set to ON. CATIONS (\*2) When connecting two or more Amplifier Units, acquire the measurement results after the response time specified for connecting two or more units elapses. (See page 86.) Note. • When the hold function is not used INDEX The output while a reset signal is being input is held in accordance with the output during nonmeasurement setting. When the hold function is used SETTING If a reset signal is input, the state in effect before the hold function was set will be restored. TRANSITION (For details on the hold function, see page 93, and for details on the output during CHARTS non-measurement, see page 111.) 144
## Bank input



### Zero reset input

### · When the zero reset memory setting is OFF



# **Engineering Data (Typical)**

# Angle Characteristic

The angle characteristic is a plot of the inclination of the sensing object in the measurement range and the maximum value of the error to analog output. Note: SUS304 = Stainless steel SUS304



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#### ZX2-LD50V

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Front-to-back inclination with respect to flat mirror



Front-to-back inclination with respect to silicon wafer



Front-to-back inclination with respect to glass



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## **Linearity Characteristic for Different Materials**









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Note. X axis displacement: Measurement distance displayed on the Amplifier Unit For the measurement distance displayed on the Amplifier Unit, the measurement center distance is displayed as 0,

and the NEAR and FAR sides from the sensor are displayed by + and -, respectively.

-25 -15 — FAR side

-35

-5 0 5

15 25 35

ance Displacement [mm]

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-25 -15 FAR side Mea

-35

H

-505

irement center di

15 25 35

ance Displacement [mm]

# Linearity Characteristic for Different Materials

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- L Beam cross-section

### 7X2-I D50

L	+10 mm	0 mm	-4 mm	–10 mm
х	Approx. 600 µm	Approx. 160 µm	Approx. 40 µm	Approx. 220 µm
Y	Approx. 350 µm	Approx. 90 µm	Approx. 60 µm	Approx. 130 µm

### 7X2-I D100

+35 mm L 0 mm -20 mm -35 mm Positionina Х Approx. Approx. Approx. Approx. 1.1 mm 400 µm 70 µm 250 µm Eccentricity Υ Approx. Approx. Approx. Approx. and Surface 550 µm 190 µm 110 µm 150 µm Deflection

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ZX2-LD50V

L	+5 mm	0 mm	-4.2 mm	–5 mm
X Approx. Approx. 350 μm 160 μm		Approx. 40 µm	Approx. 50 µm	
Υ Approx. 180 μm Appro 90 μm		Approx. 90 µm	Approx. 60 µm	Approx. 70 µm

SETTING TRANSITION CHARTS

#### Error [%E'S] 0.8 0.6 Elat mirro Silicon wafe 04 0.2 0 -02 -0.4 -0.6 Note. X axis displacement: Measurement distance displayed on -0.8 -10 NEAR side -- FAR side H

Beam Size Spot Beams

ZX2-LD50V 0° Inclination

> the measurement center distance is displayed as 0, and the NEAR and FAR sides from the sensor are displayed by + and -, respectively. ment (mm)

the Amplifier Unit

### Line Beams

For the measurement distance displayed on the Amplifier Unit,



### ZX2-LD50L

L	+10 mm	0 mm	-4 mm	–10 mm
х	Approx.	Approx.	Approx.	Approx.
	2.6 mm	2.6 mm	2.6 mm	2.6 mm
Y	Approx.	Approx.	Approx.	Approx.
	350 µm	90 µm	60 µm	130 µm

### 7X2-I D100

L	+35 mm	0 mm	–20 mm	–35 mm
х	Approx.	Approx.	Approx.	Approx.
	2.1 mm	2.5 mm	2.7 mm	2.9 mm
Y	Approx.	Approx.	Approx.	Approx.
	550 µm	190 µm	110 µm	150 µm

Measurement distance displayed on the Note. L: Amplifier Unit (For the measurement distance displayed on the Amplifier Unit, the measurement center distance is displayed as 0, and the NEAR and FAR sides from the sensor are displayed by + and -, respectively.)

## Reference: Distance between two diffusereflective models that causes malfunction when mutual interference prevention is turned off

The distance at which the resolution exceeded the rated value when sensors were moved towards each other (in all the X, Y, and Z directions) while mutual interference prevention was turned off was measured. (Workpiece: white ceramic; positioned facing the sensor, not on an angle.)

### Horizontal direction

### Vertical direction





# Results: For all models, the distance that causes malfunction is 0 mm in all the X, Y, and Z directions.

Note. The above result was obtained when the white ceramic workpiece was positioned facing the sensor, not on an angle.

Note that mutual interference can occur when using different types of workpieces or when the sensors are attached at an angle, so it is recommended to use the sensors with mutual interference prevention turned on.

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A manual revision code appears as a suffix to the catalog number at the bottom of the front and back covers of this manual.



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03	Apr. 2011	General revision (differential function and detection surface selection function added)
04	Jul. 2011	Revision (regular-reflective model launched)
05	Dec. 2011	Minor corrections

# **SETTING TRANSITION CHARTS**





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