

8730-10 & 8731-10 WAVE COMPARATOR

USER'S GUIDE



Contents:

① New Inspection with the WAVE COMPARATOR (Combined with various sensors)	Page 1
② Application Examples	Page 2 to 8
③ Application Details	Page 9
• General	Page 10
• Missing pulse	Page 11
• Movement rate	Page 12
• Timing Pulse	Page 13
• Revolution/Frequency	Page 14
• Insertion process	Page 15
• Welding current	
• Phase difference	
• Analog output	
• Pulse of encoder	
④ Benefits of Model 8730/31-10	



ISO14001
JQA-E-90091



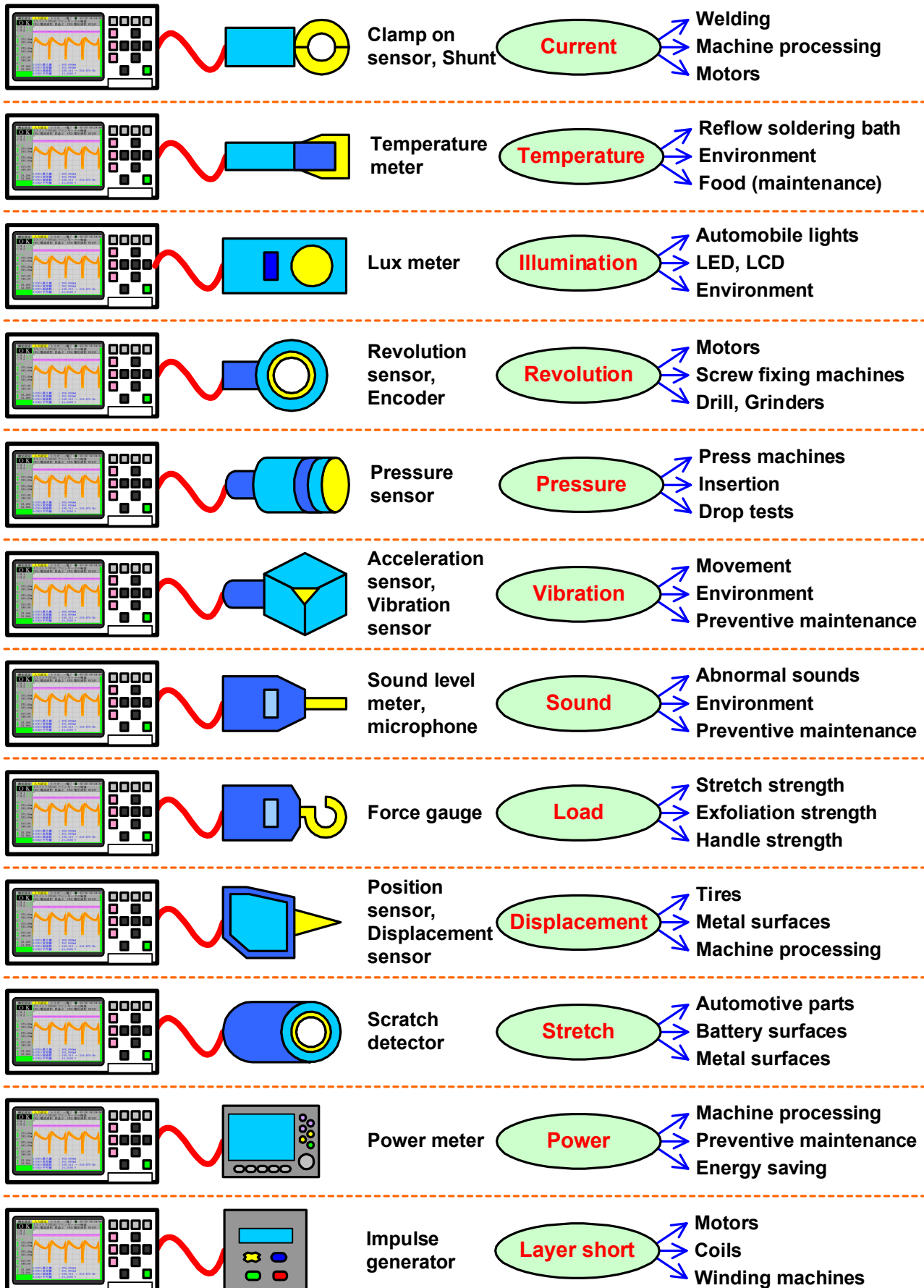
<http://www.hioki.co.jp/>

HIOKI company overview, new products, environmental considerations and other information are available on our website.

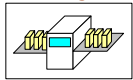
HIOKI E. E. CORPORATION
November 2004
Rev.1

New inspection with WAVE COMPARATOR

- <Combined with>
1. Sensors
 2. Instruments with analog output
 3. Generators



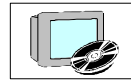
Industry 1



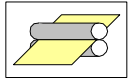
Machinery



Automotive



Electronics



Steel/Metal

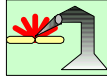


Miscellaneous

Application



Maintenance



Process monitoring

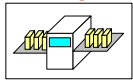


Product testing



R&D

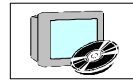
No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
1		Machine tools	NC servo systems		Sensor output (acceleration)	Motion and maintenance
2		Machine tools	Caulking machines		Sensor output (Pressure, displacement)	Detection of metal type and alien objects
3		Machine tools	Construction machines (Backhoes)		Sensor output (vibration)	Distortion detection for breakers
4		Machine tools	Grinder		Output of power meter	Grinding quality evaluation
5		Machine tools	Cutting machines		Load current	Blade exchange timing detection
6		Machine tools	Cutting machines		Load current	Cutting quality evaluation
7		Machine tools	Magnetizers		Sensor output (magnetic flux density)	Magnetic flux density on magnetized material
8		Machine tools	Ultrasonic wire bonders		Bonding current	Bonding quality evaluation
9		Machine tools	Electrical injection molders		Current and motor control signal	Difference from theoretic value
10		Machine tools	Electrical injection molders		Temperature control signal	Difference from theoretic value
11		Machine tools	Screw fixing machines		Sensor output (torque)	Screw fixing strength evaluation
12		Machine tools	Welding robots		Welding current and voltage	Welding quality evaluation
13		Machine tools	Belt conveyors		Sensor output (speed)	Speed maintenance

Industry 1

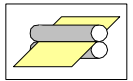
Machinery



Automotive



Electronics



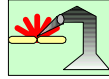
Steel/Metal



Miscellaneous

Application

Maintenance



Process monitoring



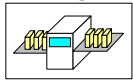
Product testing



R&D

No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
14		Bearings	Processing machines		Sensor output (load)	Process quality evaluation
15		Bearings	Grinders		Power meter / sensor output (position)	Grinding quality evaluation
16		Bearings	Grinders		Power meter / sensor output (displacement)	Blade exchange timing detection
17		Bearings	Bearings		Sensor output (torque)	Rotation smoothness evaluation
18		Bearings	Bearings		Meter output (scratch detection meter)	Internal scratch detection
19		Bearings	Bearings		Current flow of spindle motor	Grind stone lifespan evaluation
20		Mechanical Parts	Gas pedals		Sensor output (stepping force, rotation angle)	Relationship evaluation of 2 parameters in X-Y
21		Mechanical Parts	Differential gears		Sensor output (torque)	Rotation smoothness evaluation
22		Mechanical Parts	Shock absorbers		Sensor output (load, stroke)	Relationship evaluation of 2 parameters in X-Y
23		Mechanical Parts	Cylinders		Sensor output (load, stroke)	Relationship evaluation of 2 parameters in X-Y
24		Mechanical Parts	Cylinders		Meter output of surface test equipment	Surface scratch detection
25		Mechanical Parts	Dampers, Springs		Sensor output (load, stroke)	Relationship evaluation of 2 parameters in X-Y
26		Mechanical Parts	Spark plugs		Applied voltage (withstanding voltage tester)	Withstanding voltage evaluation

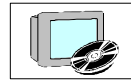
Industry 1



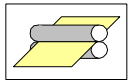
Machinery



Automotive



Electronics



Steel/Metal

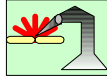


Miscellaneous

Application



Maintenance



Process monitoring

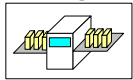


Product testing



R&D

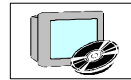
No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
27		Mechanical Parts	Spark plugs		Sensor output (rpm, cylinder position)	Relationship evaluation of 2 parameters in X-Y
28		Mechanical Parts	Pistons		Meter output of surface test equipment	Surface scratch detection
29		Mechanical Parts	Bearings		Sensor output (torque)	Rotation smoothness evaluation
30		Mechanical Parts	Bearings		Meter output (scratch detection meter)	Internal scratch detection
31		Mechanical Parts	Bearings		Current flow of spindle motor	Grind stone lifespan evaluation
32		Machine Tools	Cutters		Load current	Blade exchange timing detection
33		Machine Tools	Automotive bodies		Welding current	Welding quality evaluation
34		Tires	Belt conveyors		Sensor output (speed)	Speed maintenance
35		Tires	Tires		Sensor output (displacement)	Displacement evaluation in rotation
36		Electrical Parts	Glow plugs		Voltage and current	Arcing short detection
37		Electrical Parts	Light bulbs		Activating pulse	Instantaneous light off detection
38		Electrical Part	Starter		Voltage and current at activation	Function check
39		Electrical Part	Starter		ON signal and current	In-rush current evaluation

Industry 1

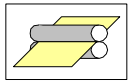
Machinery



Automotive



Electronics



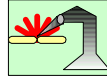
Steel/Metal



Miscellaneous

Application

Maintenance



Process monitoring

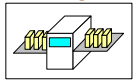


Product testing



R&D

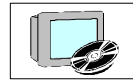
No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
40		Electrical Parts	Light controllers		Control pulse	Function evaluation of room light
41		Electrical Parts	Door mirrors		Motor current in open/close action	Open/close smoothness evaluation
42		Electrical Parts	Door locks		Activation voltage and contact signal	Detection of poor connection or alien object
43		Cables	Cables		Voltage in bending	Durability evaluation
44		Electrical Equipment	UPS		Output voltage	Output waveform quality evaluation
45		Electrical Equipment	Infrared thermometers		Meter output (thermometer)	Response speed evaluation
46		Electrical Equipment	Magnetic cards for railway		Magnetic reading signal	Dust or poor printing detection (when starting a new lot)
47		Electrical Equipment	Electrical tooth brushes		Sensor output (vibration)	Vibration width adjustment
48		Electrical Equipment	Push buttons for telephones		Sensor output (strain, displacement)	Relationship evaluation of 2 parameters in X-Y
49		Electrical Equipment	Telephone switchboards		Control signal	Function inspection
50		Electrical Equipment	Flow meters		Input and pulse output	Missing pulse detection
51		Electrical Equipment	Welding baths		Sensor output (temperature)	Temperature maintenance in process
52		Electrical Equipment	Assembled PCBs		Output of PCB	Function inspection

Industry 1

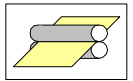
Machinery



Automotive



Electronics



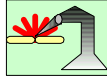
Steel/Metal



Miscellaneous

Application

Maintenance



Process monitoring

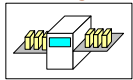


Product testing



R&D

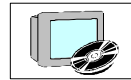
No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
53		Electrical Equipment	PCBs		Sensor output (strain)	Stress evaluation to PCB
54		Electrical Components	LCDs		Voltage and sensor output (temperature)	Operation condition of production tools
55		Electrical Components	Dry cell batteries		Meter output of surface test equipment	Surface scratch detection
56		Electrical Components	Connectors		Sensor output (load, flexure)	Insertion quality evaluation in X-Y
57		Electrical Components	Electro-magnetic valves		ON/OFF signal and pressure signal	Air output inspection signal
58		Electrical Components	Switches		Sensor output (load, displacement)	Relationship evaluation of 2 parameters in X-Y
59		Electrical Components	Switches		Sensor output (load, displacement)	Push response evaluation
60		Electrical Components	Touch panels		Sensor output (response to load)	Chattering (ON/OFF response) evaluation
61		Electrical Components	Resistors		Welding current voltage	Welding quality evaluation
62		Electrical Components	Conveyor motors		Motor current	Preventive maintenance
63		Electrical Components	Motors		Motor current	Current change in a specific period
64		Electrical Components	Motors		Sensor output (displacement)	Vibration evaluation
65		Electrical Components	Motors		Sensor output	Magnetizing evaluation of motor scanner

Industry 1

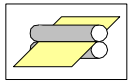
Machinery



Automotive



Electronics



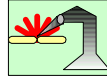
Steel/Metal



Miscellaneous

Application

Maintenance



Process monitoring



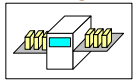
Product testing



R&D

No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
66		Electrical Components	Motors		Induction voltage and output of hall IC	Phase difference evaluation
67		Electrical Components	ICs		Output of hybrid IC	Phase difference evaluation
68		Electrical Components	Relay timers		Contact signal	Contact function evaluation
69		Metal Processing	Metal plates		Meter output of surface test equipment	Surface scratch detection
70		Metal Processing	Metal plates		Sensor output (displacement)	Surface scratch detection, Plate thickness evaluation
71		Metal Processing	Metal bars		Sensor output (torque, angle)	Strength evaluation
72		Metal Processing	Micro-terminal for wrist watches		Sensor output (strain)	Process inspection of press machine
73		Machine Tools	Cutting machines		Load current	Blade exchange timing detection
74		Food Processing	Noodle cutters		Pulse output for cutting	Noodle length control by pulse cycle
75		Rubber	Electric conductive rubber rollers		Applied current and voltage	Resistance evaluation
76		Film	Protection film for LCD		Sensor output (displacement)	Film surface evaluation
77		Glass	Glass		Load current of left and right conveyor wheels	Surface balance evaluation of bevelling process
78		Bottle Caps	Bottle caps		Sensor output (pulse)	Capping torque evaluation

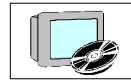
Industry 1



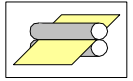
Machinery



Automotive



Electronics



Steel/Metal

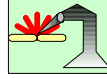


Miscellaneous

Application



Maintenance



Process monitoring



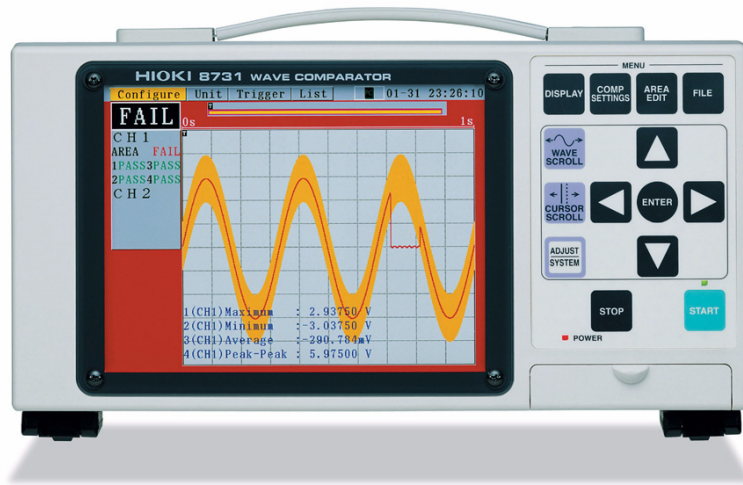
Product testing



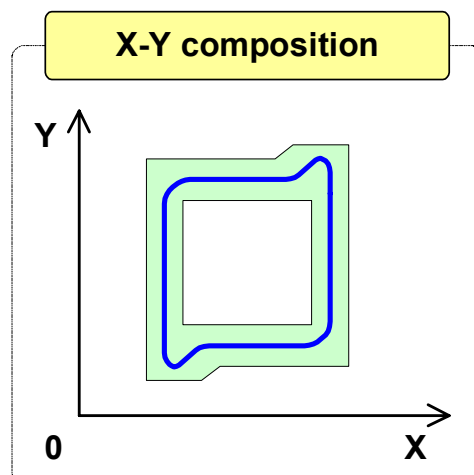
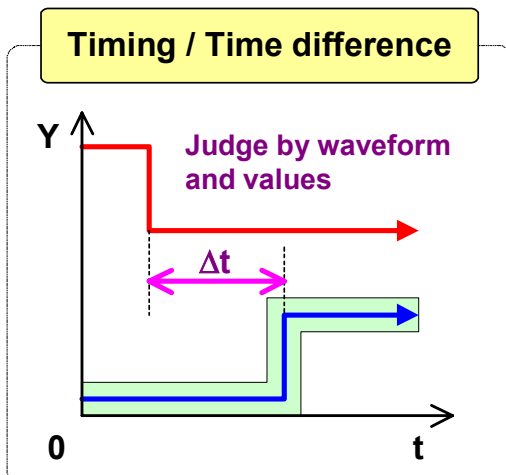
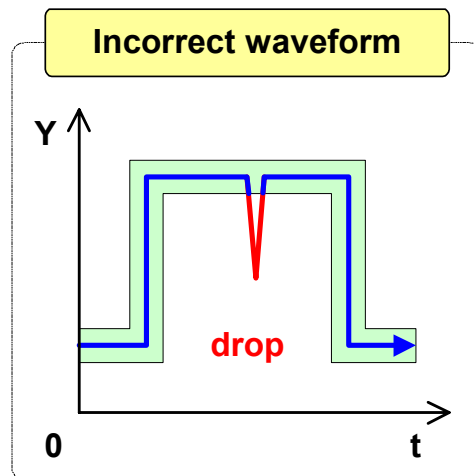
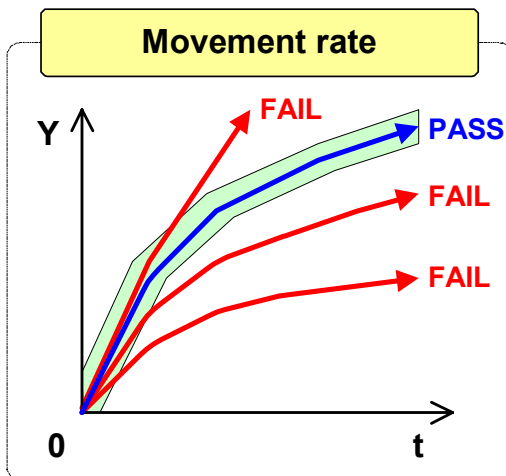
R&D

No.	Industry 1	Industry 2	Product	Application	Measurement	Target of evaluation
79	MISC	Concrete	Concrete		Current and voltage of concrete mixer	Viscosity evaluation
80	MISC	Sensors	Gas pressure sensors		Sensor output (pressure, displacement)	Function testing
81	MISC	Sensors	Light sensor for cameras		Output signal	Evaluation by calculated waveform
82	MISC	Universities	Piping for boilers		Temperature signal	Pipe damage evaluation in sudden temperature change
83	MISC	Boilers	Gas boilers		Beeper sound of PCB	Beeper volume inspection
84	MISC	Tapes	Tapes		Sensor output (load)	Peeling strength test
85	MISC	Plastics/ Metals	Handles		Sensor output (load)	Tension and durability test
86	MISC	Beds	Welders		Welding current	Periodical maintenance
87	MISC	Lenses	Camera lenses		Drive signal	Function testing

Model 8730-10 and 8731-10 Application Examples



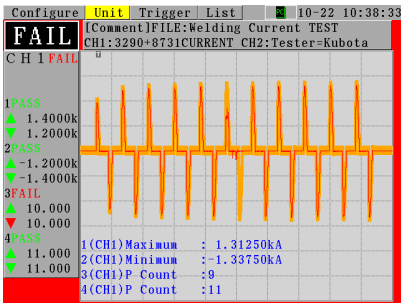
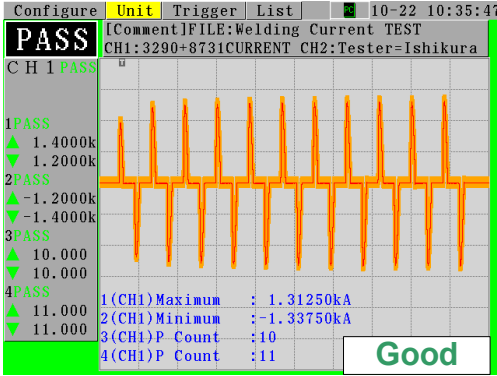
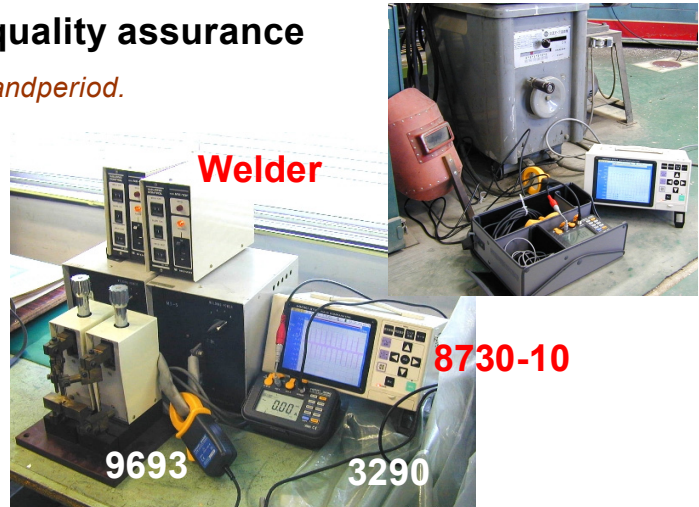
For various inspections using area judgment



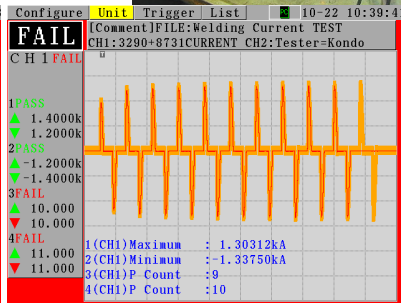
Welding Current (with Model 3290)

Judge the welding current for quality assurance

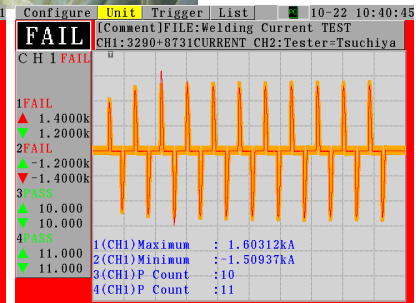
Welding quality depends on the current and period.



Missing Pulse



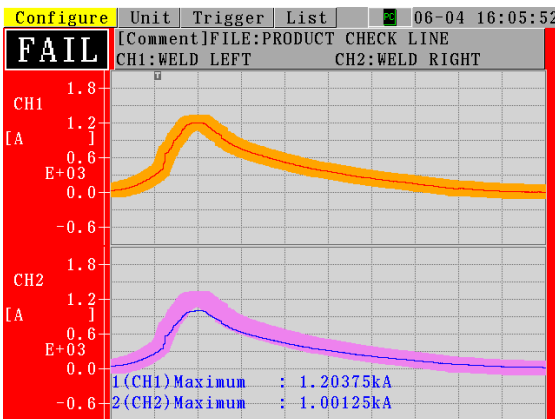
Insufficient pulses



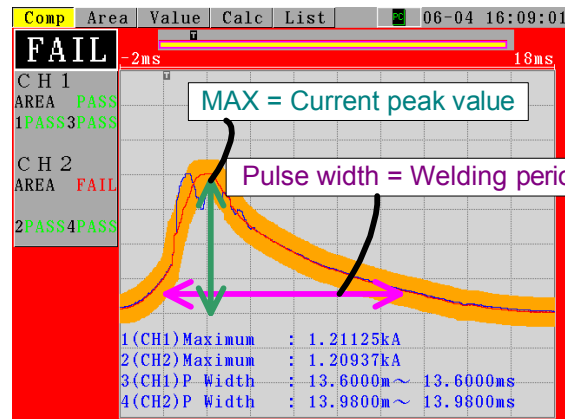
Incorrect pulses

<Example>

- ❖ Simultaneous welding for 2 points such as DIP component welding
- ❖ Scaling function allows the operator to read out the value as current (Ex. 1V=1kA)



Easy to specify the FAIL input in **DUAL** display

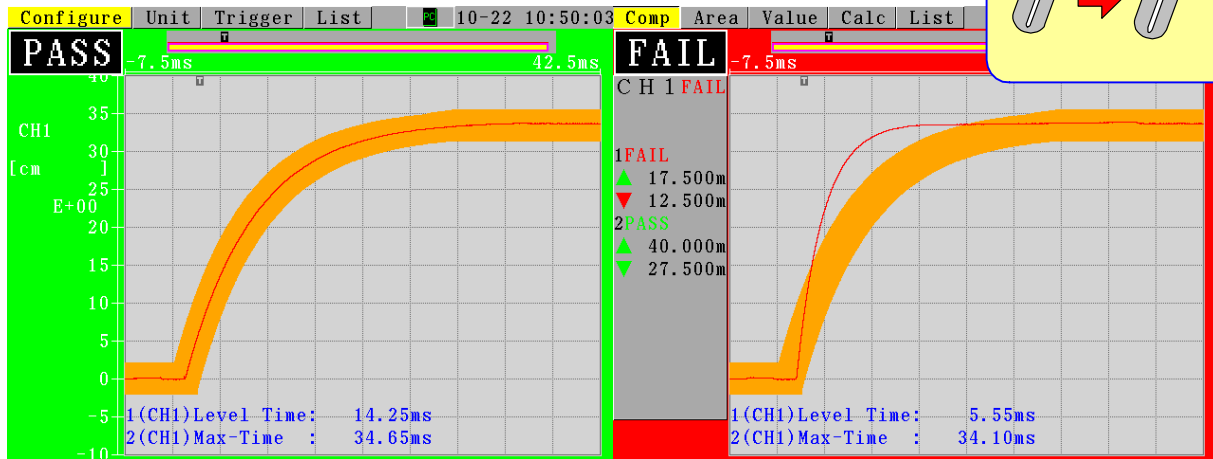
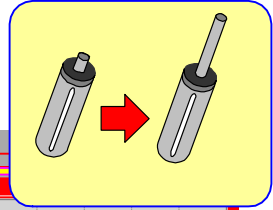


Simultaneous value judgment by calculation

Movement Rate

Judge if products like suspensions move properly

Excessively fast movement is dangerous while insufficient movement is not useful.

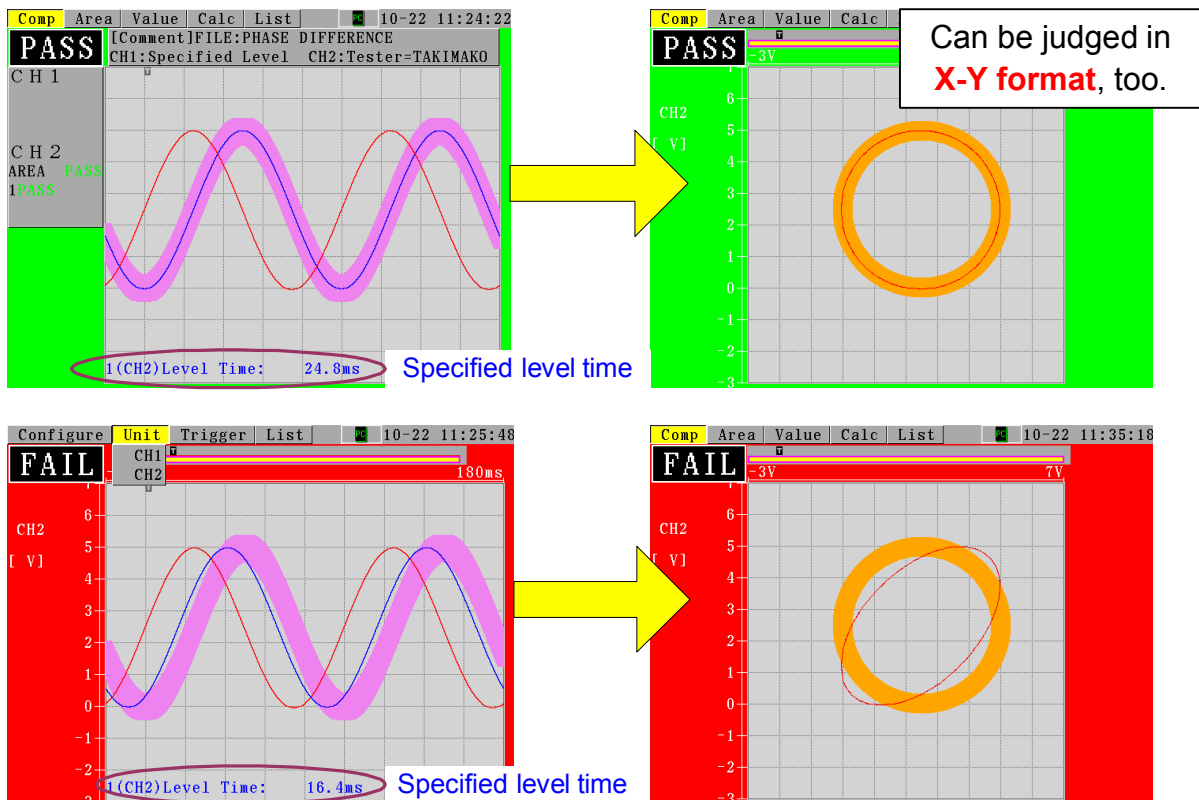


By using the value calculations together, more details can be obtained.

- ❖ "Level time (specified level time)" calculates the time to reach the specified level from a trigger point.
- ❖ You can confirm "type of failure" or "actual quality" in addition to judgment.

Phase Difference

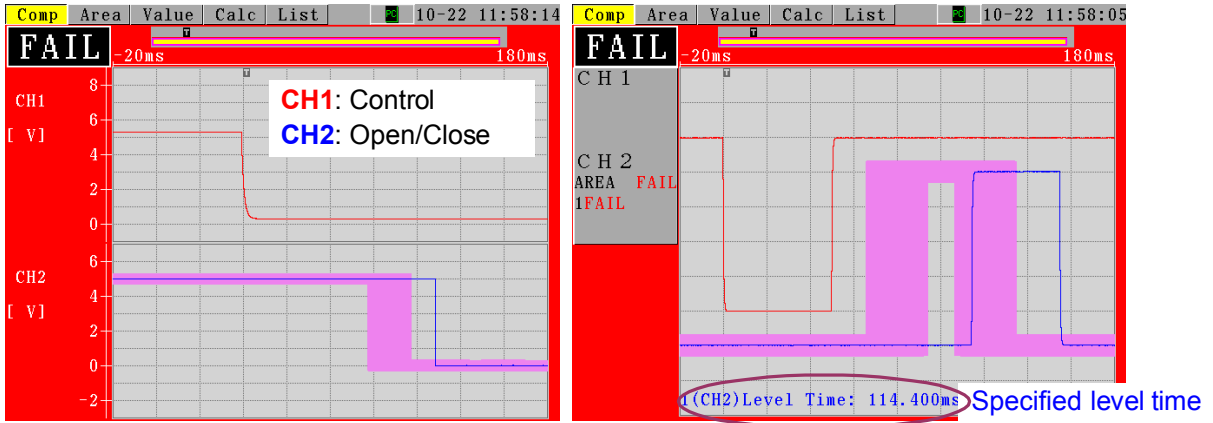
The phase difference can be judged by either "area" or "value."



Timing

Watch the timing of control and action signals

- ❖ The open/close timing of a valve or the contact signal of open/close of a door lock, etc.
- ❖ In addition to the area judgment, it can be judged by the "Level time (specified time level)" calculation.

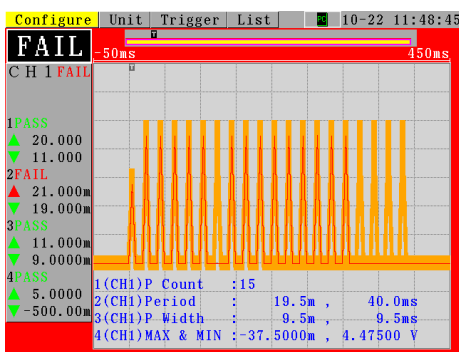


Time between trigger and crossing the specified level
(UP or DOWN selectable)

Pulse (Number and Shape)

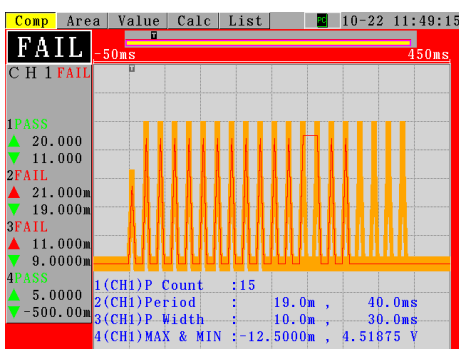
Judge the number of pulses or the pulse shape

The failure details can be identified by using the **value judgment** simultaneously.



* Area: FAIL
 * Calc. No.1: PASS
 * Calc. No.2: FAIL
 * Calc. No.3: PASS
 * Calc. No.4: PASS
 * Period: FAIL
 * Pulse width: PASS
 => Missing pulse

- * No.1: Pulse count
=> Number of pulses
- * No.2: Period
- * No.3: Pulse width
- * No.4: Max&Min
=> MAX and MIN values



* Area: FAIL
 * Calc. No.1: PASS
 * Calc. No.2: FAIL
 * Calc. No.3: FAIL
 * Calc. No.4: PASS
 * Period: FAIL
 * Pulse width: FAIL
 => Connected pulses

Independent output of calculation judgment results from EXT_OUT1 to 5 terminals.

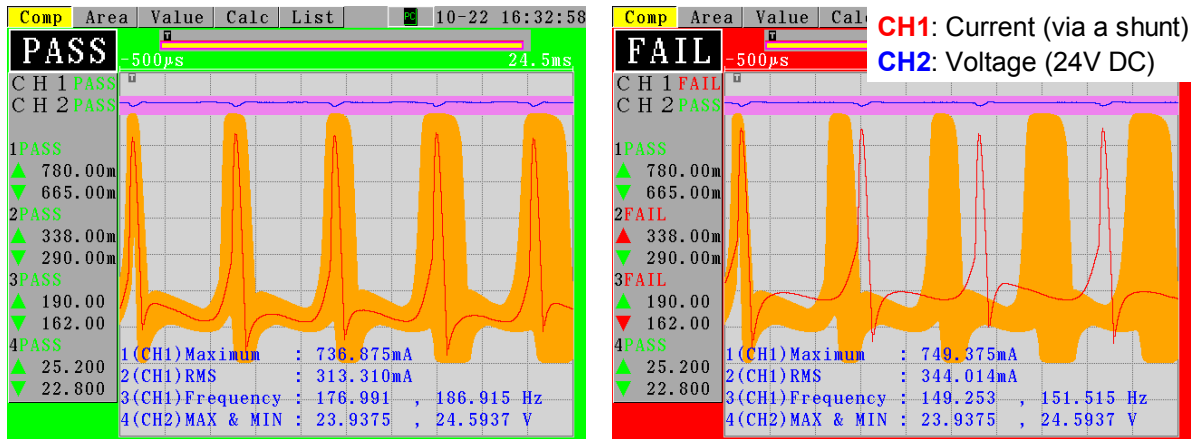
↓
Can be sorted by the causes.

Revolution / Frequency

Judge the revolution speed by area and values

Automated judgment in favor of visual inspection by an oscilloscope + data storage

Current consumption and revolution of a fan motor <Area + Values> (24V+/-5% for voltage)



Store the inspection data => Quality improvement

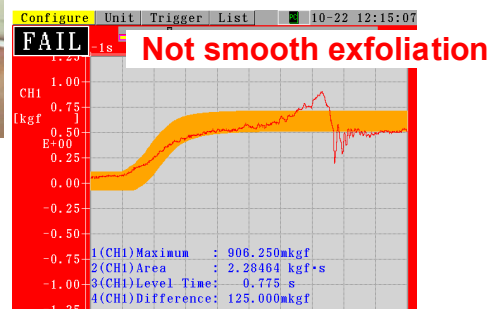
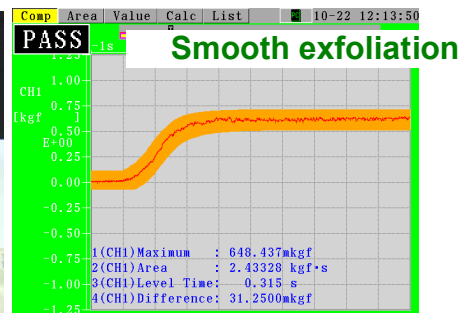
Knowing a parameter failed => Improve the production line by analysis

Analog Output of a Meter/Sensor

Judge the analog output of a meter or a sensor

Convert the measured voltage to another parameter using the scaling function.

<Example> Judge the exfoliation by using a force gauge.

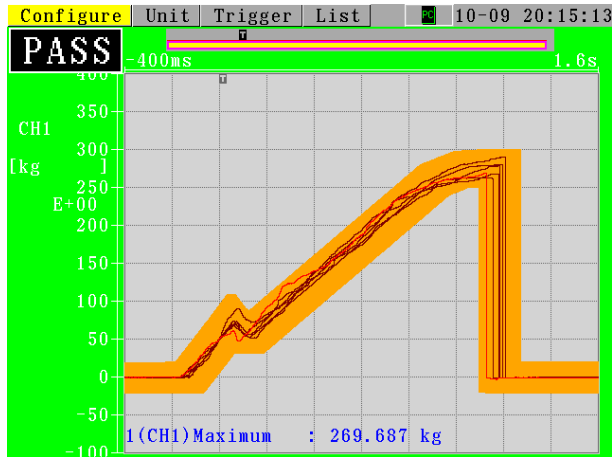
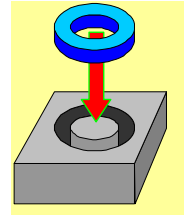


By using the scaling function, the input can be read out by the unit of force (kgf*s)

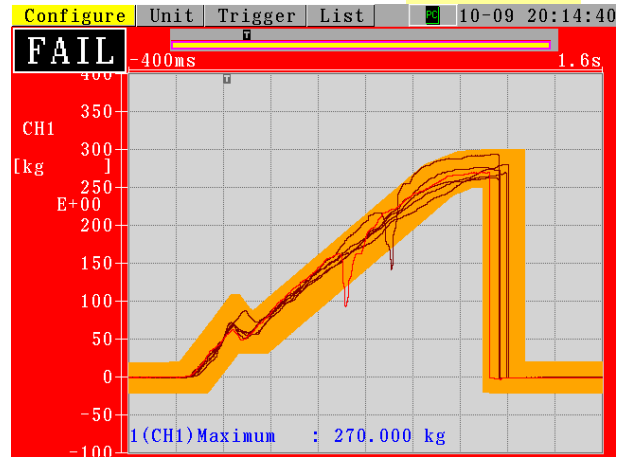
Insertion Process

Watch the insertion process by area

The difficulties associated with detecting low insertion pressure using a meter can be resolved by **monitoring the entire process using area comparison.**



Convert the unit by the **scaling** (kg)

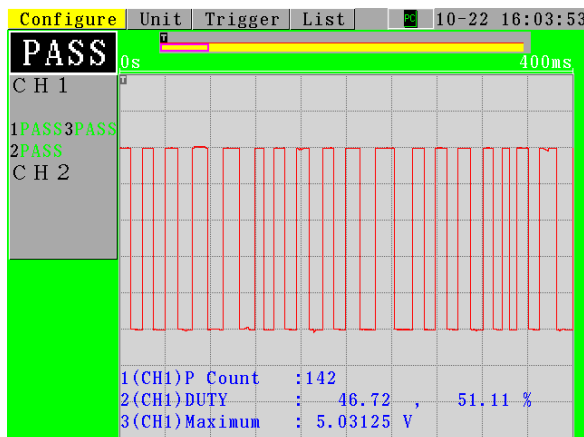


Confirm the past waveform by **overwriting**

Pulse of Encoder

Watch the missing pulse of an encoder using values comparison

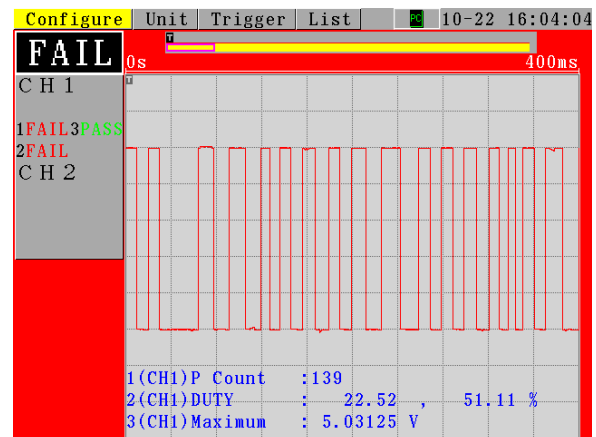
- ❖ It is difficult to judge by area due to the frequency fluctuation.
 - ❖ This can be resolved by monitoring the calculated values such "**duty ratio**" or "**pulse count.**"
- => **The duty ratio becomes smaller if there is a missing pulse or level error.**



* No.1 Pulse count: **PASS**

* No.2 Duty ratio: **PASS**

* No.3 Max: **PASS**



* No.1 Pulse count: **FAIL**

* No.2 Duty ratio: **FAIL** => **Missing pulse**

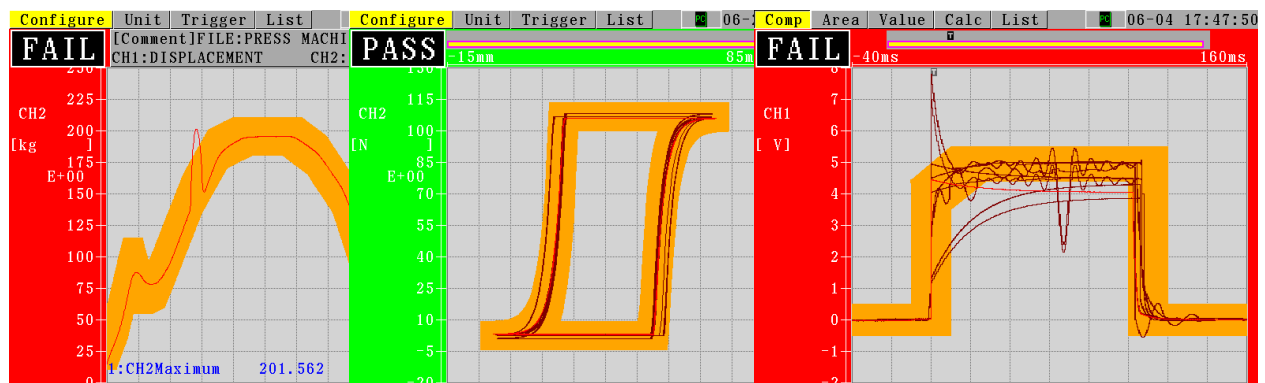
* No.3 Max: **PASS**

Oberserving Machine Process

Observe for correct operation of production equipment

- ❖ Watch signals showing the process status
- ❖ Watch the current consumption of drilling machines, etc. (Current increases when the blade breaks or when a foreign objects is introduced).

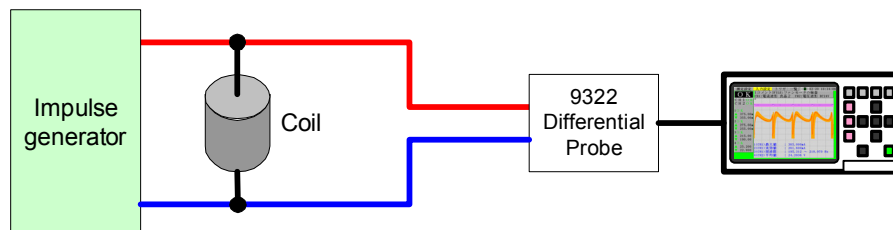
Output FAIL signal from the external I/O terminal to stop further operations.



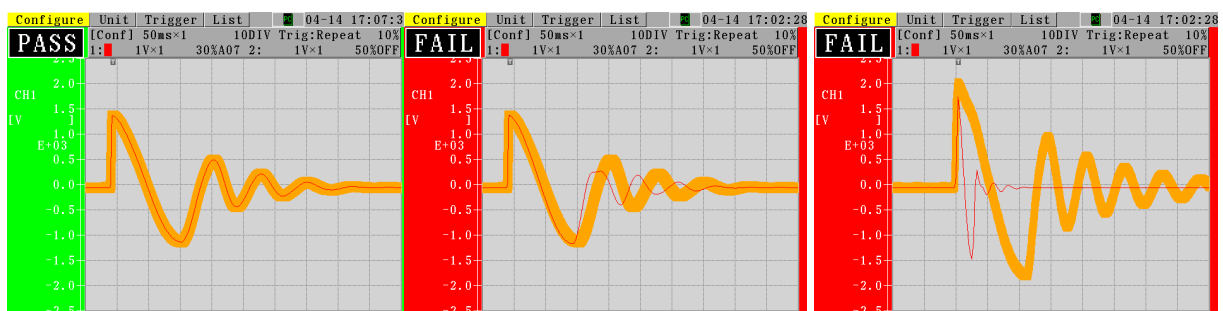
Layer Short Test

Judgment part for layer short test of coils

- ❖ Edit the area from the PASS product.
- ❖ Calculations such as MAX or AREA is effectively used.



Hint: Pay careful attention to sampling speed (1MS/s) as some coils require faster sampling.



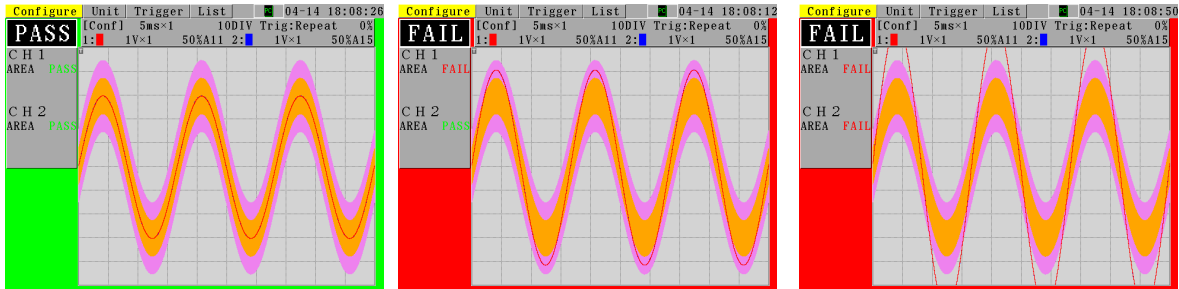
Poor winding

Layer short

Advanced Usage - Sorting

Selecting very good items

- ❖ Input the same signal to 2 channels.
- ❖ Create a sever area for CH1 and normal area for CH2.



CH1: **PASS** CH2: **PASS**

Very good

CH1: **FAIL** CH2: **PASS**

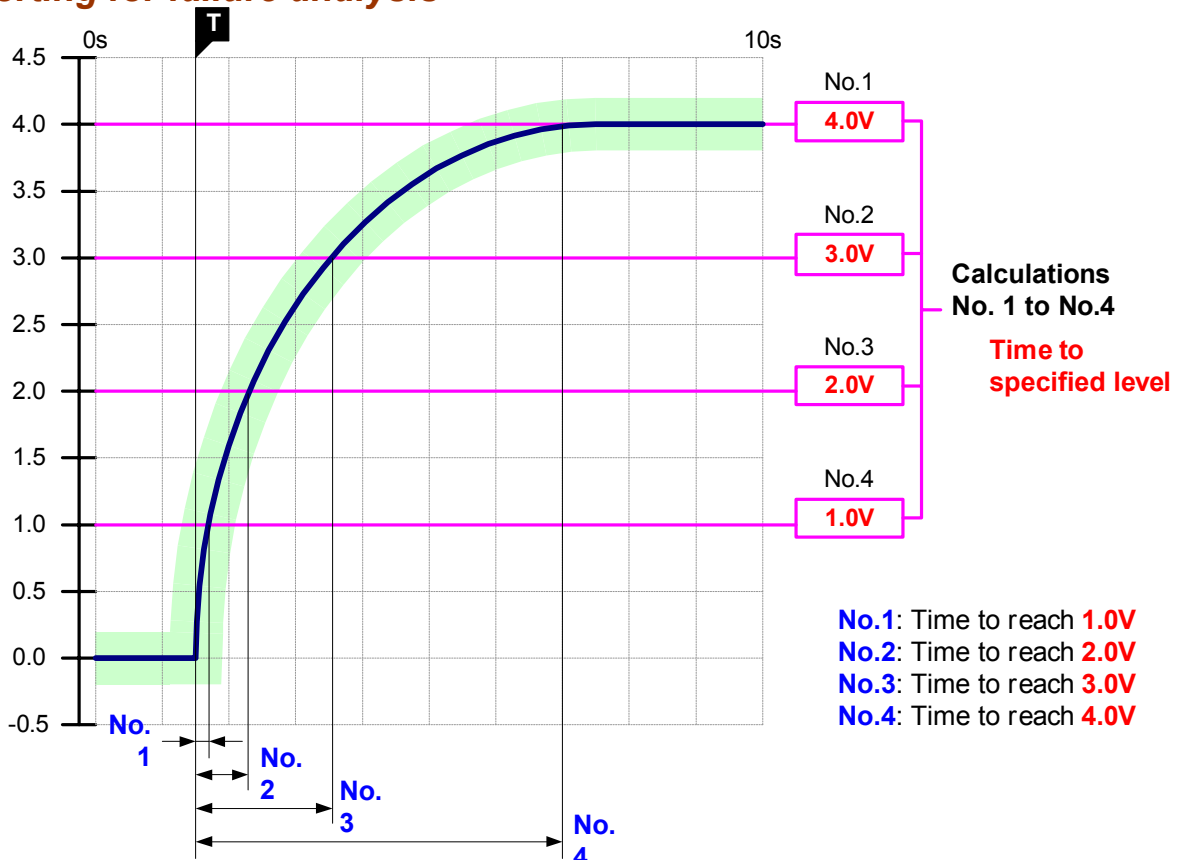
Good (acceptable)

CH1: **FAIL** CH2: **FAIL**

Bad

Analyzing very good items may help to improve quality.

Sorting for failure analysis



More information to improve quality is obtained by referring to 4 calculations.

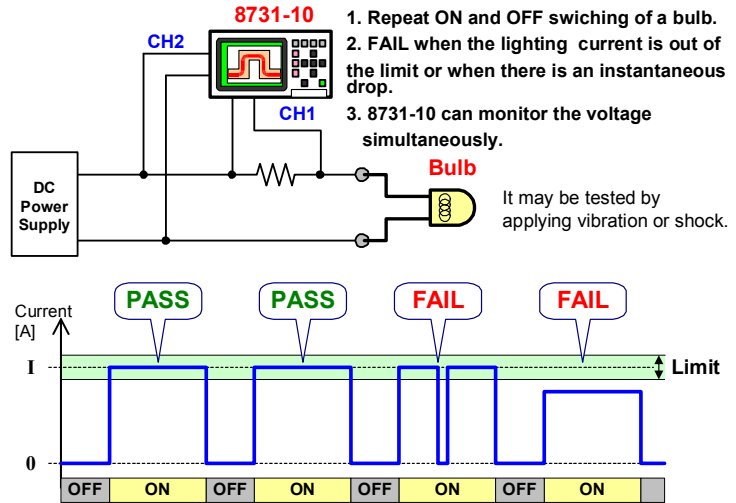
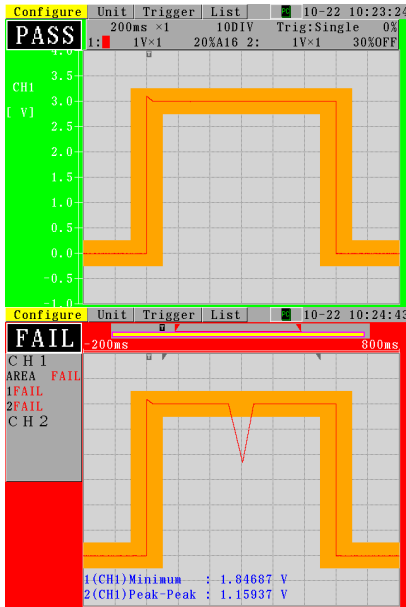
- No.1 **FAIL**, No.2 **PASS**, No.3 **PASS**, No.4 **PASS** → Too fast/slow at start
- No.1 **PASS**, No.2 **PASS**, No.3 **PASS**, No.4 **FAIL** → Too fast/slow at stop
- No.1 **PASS**, No.2 **FAIL**, No.3 **FAIL**, No.4 **PASS** → Not smooth in middle

Makes it easy to identify the details of the problem.

Missing Pulse

Light bulbs are tested for ON/OFF switching

- ❖ Detecting instantaneous drop of contact failure using a meter was previously impossible.
- ❖ Area judgment enabled the detection of missing pulses such as an instantaneous drop.



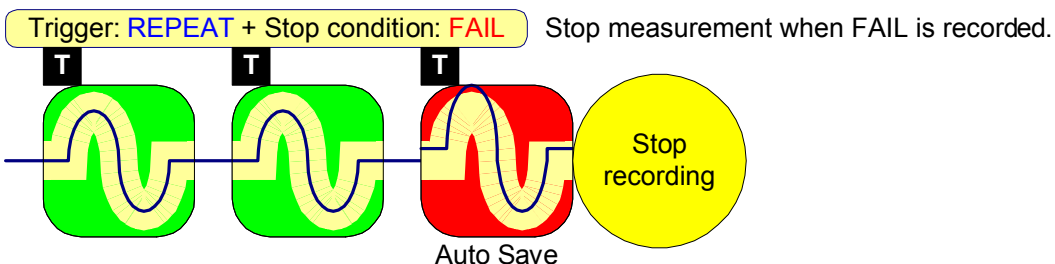
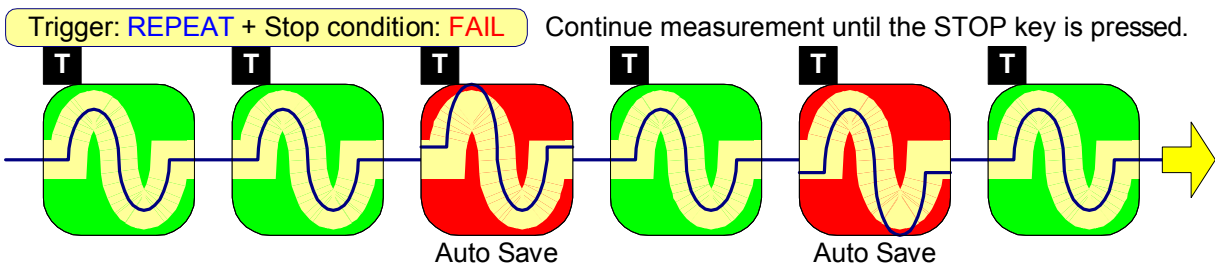
Durability Test

Durability test without an attending operator

- ❖ Trigger + Automatic judgment => Full auto durability test for long period
- ❖ All FAIL results can be automatically saved to a PCcard

<Examples>

Connectors, Switches, Shock absorbers, Output voltage under high temperature, etc.

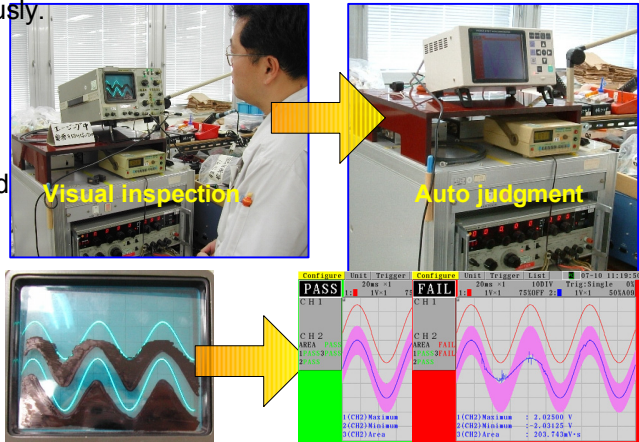


Benefits of using 8730-10 and 8731-10 Wave Comparators

- ❖ The Wave Comparator has a dual function: as a measuring instrument to "judge the waveform" and as a waveform monitor.
- ❖ It can judge waveforms by "shape" using "Area Judgment" as well as "value" using "Calculated value judgment" simultaneously.

- ❖ Waveform judgment is very effective for evaluating the movement rate, timing and process, etc., which are difficult to judge according to values alone.

- ❖ Currently, oscilloscopes are generally used for this purpose, but there are problems such as varying judgment standards among operators, missing a failure, no data storage and automation difficulties. To resolve this situation, the waveform comparator can judge and store the data automatically of both area and value calculations.



- ❖ Reduce costs and improve productivity by automatic judgment. In addition, the Wave Comparators offer the possibility to analyze the results for quality improvement by using the stored data.

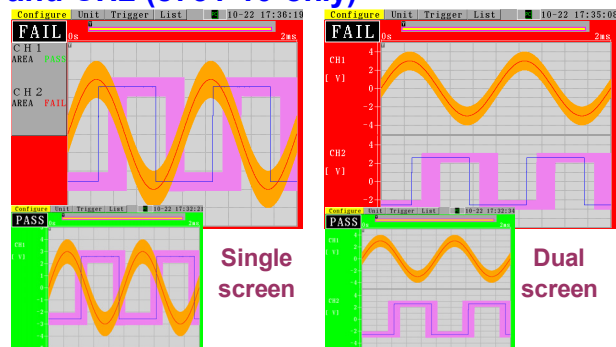
Easy to install

- ❖ The Wave Comparators offer operation switches in front and the input/output terminals in rear, making them easy to install to a rack or panel. They are also small enough to carry single-handedly or used on a workbench due to their compact design.
- ❖ The external control terminals are isolated, allowing them to be connected to a device such as a PLC having different GND electric potentials.



Independent area judgment for CH1 and CH2 (8731-10 only)

- ❖ 8731-10 can be used to judge the different areas between CH1 and CH2 independently, enabling inspection of 2 different signals or 2 of the same products simultaneously.
- ❖ Judgment result outputs are also independent, making it easy to specify which CH has failed.
- ❖ In addition, it is able to judge by the X-Y area between CH1 and CH2.



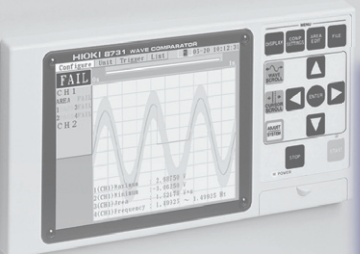
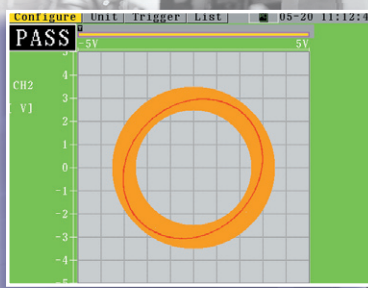
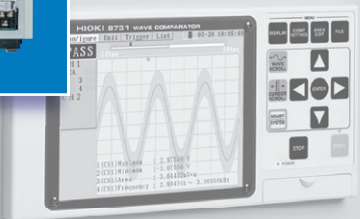
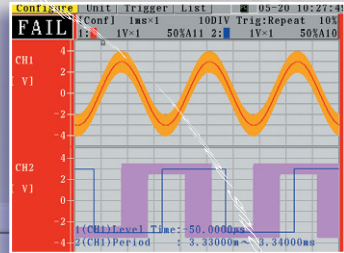
Data storage

- ❖ Measured data can be stored automatically or manually to a PC card. The waveform and judgment area data are common to 8835-01 Memory HiCORDER.
- ❖ Stored data can be used for failure analysis to improve the quality or for record keeping in quality management.

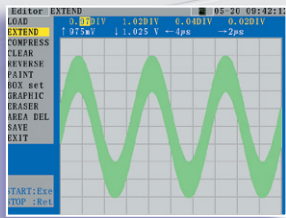


Judge	Trigger time	MAX
PASS	2003/7/9 16:06	2.03E+00
PASS	2003/7/9 16:06	2.03E+00
FAIL	2003/7/9 16:06	2.14E+00
PASS		E+00
PASS		E+00
PASS		E+00
FAIL		E+00
PASS	2003/7/9 16:07	2.14E+00
PASS	2003/7/9 16:08	2.04E+00
PASS	2003/7/9 16:08	2.04E+00
PASS	2003/7/9 16:08	2.03E+00
FAIL	2003/7/9 16:08	2.03E+00
PASS	2003/7/9 16:09	2.04E+00
PASS	2003/7/9 16:09	2.04E+00

Wave comparison area evaluation pass fail



ture voltage change comparator production line efficiency



HIOKI

HIOKI E. E. CORPORATION

HEAD OFFICE :
 81 Koizumi, Ueda, Nagano, 386-1192, Japan
 TEL +81-268-28-0562 / FAX +81-268-28-0568
 E-mail: os-com@hioki.co.jp

HIOKI USA CORPORATION :
 6 Corporate Drive, Cranbury, NJ 08512 USA
 TEL +1-609-409-9109 / FAX +1-609-409-9108
 E-mail: hioki@hiokiusa.com

Shanghai Representative Office :
 1704 Shanghai Times Square Office
 93 Huaihai Zhong Road
 Shanghai, 200021, P.R.China
 TEL +86-21-6391-0090, 0092
 FAX +86-21-6391-0360
 E-mail: hioki-sh@81890.net

DISTRIBUTED BY