CF-4700A

FFT Comparator

ONO SOKKI

An FFT comparator that can measure
periodically changing sounds and vibrations
Advantages in the manufacturing field

FFT Comparator CF-4700A

The CF-4700A FFT comparator is the best pass/fail judgment machine
for precise quality inspection of production line by analyzing sound and vibration.
Enables pass/fail judgment by extracting the problematic frequency components.

Features

4 comparator functions

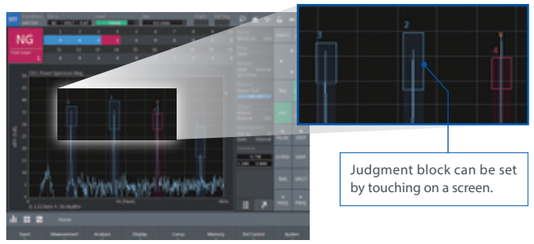
Block Comparator	Pass/fail judgment is performed from the signal level with characteristic frequency by setting a judgment block area.
Shape Comparator by waveform shape	Pass/fail judgment is performed by waveform shape. Option
Shape Comparator by tracking waveform	Pass/fail judgment by capturing level variation in specified orders while rotation speed is varied. Option
Amplitude Modulation Component Extraction Function (Bandpass Envelop Monitoring Function)	Pass/fail judgment is made by extracting fluctuation amount of vibration (chatter vibration etc.) and sounds caused by periodic fluctuations (roaring sound etc). Option

A variety of user-friendly functions

- **Judgment Criterion Assist Function** that sets the judgment block area based on the difference between frequency characteristics of good and defective products
- Accepts **TEDS sensor** that automatically perform unit calibration. (Accelerometer and microphone that conform to IEEE 1451.4 ver.0.9 and ver.1.0)
- **Cable Disconnection Detecting Function** that automatically detects cable disconnection and connector failure when using a constant current drive (CCLD) type sensor
- Stores measurement conditions and measurement data on an **USB memory and SD / SDHC / SDXC memory card**.
- **Monitor Function** that allows you to listen to and confirm characteristic frequency focused on. Option
- **Power Source Backup Function** prevents loss of measurement data in case of a main power down, and enables the CF-4700A is turned ON/OFF from the control panel of equipment that supplies power to the CF-4700A. Option

Functions

Judging by frequency level



The Block Comparator Function makes pass/fail judgments using a block area which is set in a certain frequency and level range. The judgment is made in terms of whether a peak value or level of a target signal coincides with the conditions which are set in advance or not.

- 6 kinds of judgment methods (level, peak level, peak max., inside max, partial overall, and areal content rate)
- Two methods for setting judgment block (drag operation at a touch of a screen or direct value entering on a list screen)
- Easy block setting by judgment assist function that reads differences in levels of sounds or vibrations from both passed and failed measurement data files respectively.

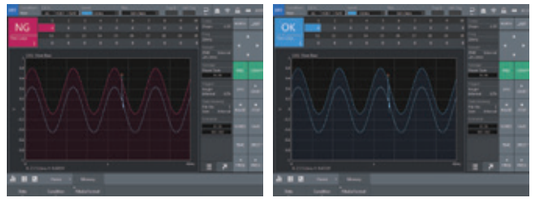
Related function: Block Comparator Function Standard; Judgment Criterion Assist Function Standard

Judging by the signal amount of fluctuation in a specific frequency band

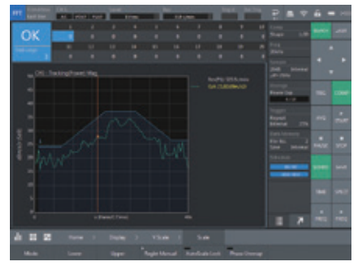
The Amplitude Modulation Component Extraction Function (CF-0473A) is a preprocessing function to extract the signal amount of fluctuation in a specific frequency band.
This function is effective for making judgments on abnormal sound or vibration stemming from fluctuations in signal size, and can be used as a preprocessing function for making pass/fail judgments on fuzzy creaks or chattering by a motor-driven device in operation.
This function (CF-0473A) also enables measurements such as 'monitoring of bearing vibrations' using the band pass filter and envelope functions, as well as 'auditory inspections of vibrations through headphones' using the monitor function which amplifies inaudible vibrations to audible sounds.

Related function: CF-0473A Amplitude Modulation Component Extraction Function Option

Judging by shape of waveform



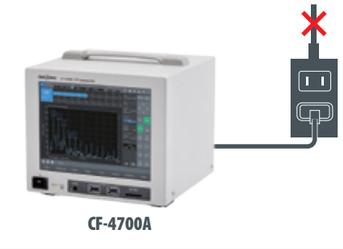
The Shape Comparator Function (CF-0472) makes pass/fail judgments by waveform shape. By setting a judgment line, this function enables pass/fail judgments on subtle variations in a time waveform or on differences in spectral shapes. In order to avoid misjudgment due to instantaneous noises in a time waveform, if the number of data exceeding the judgment level is equal to or smaller than a set value, they are assumed to be noises and can be excluded from the target data for the judgment.
By using with the CF-0471, it extracts the vibration and noise components which follow rotational speed and are caused by rotation and makes pass/fail judgment of the equipment based on the level or its fluctuation.



Related function: CF-0472 Shape Comparator Function Option; CF-0471 Tracking Function Option

Effective countermeasure against accidental power failure

At the production site, an instantaneous power failure or sudden large drop in the voltage of the production line's main power could occur accidentally. The Power Source Backup Function (CF-0478A) deactivates the CF-4700A in a normal manner in the event of a main power down of the production line. There is no need to prepare an uninterruptible power supply separately.
Moreover, presetting of startup conditions helps a smooth restart at the time of power restoration.
This function also allows for centralized power control of the production line. In other words, the CF-4700A can be turned on or off by mere operation of the control panel of the production line's main power.



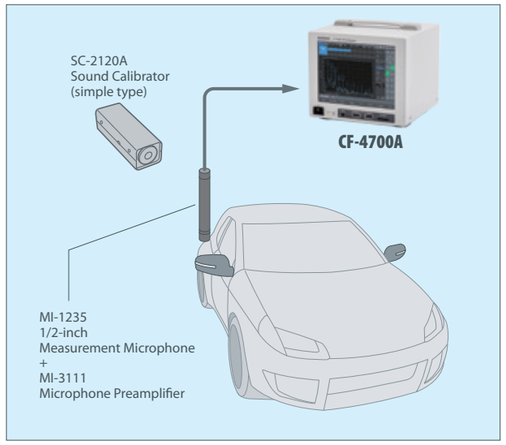
Related function: CF-0478A Power Source Backup Function Option

Application Examples

Unusual noise evaluation of door mirror operation

Unusual fuzzy noises having periodic fluctuation components may be generated while door opening and closing if a drive motor of door mirror has irregularity in the rotation.
The Amplitude Modulation Component Extraction Function (CF-0473A) is helpful for the evaluation of those sounds. The fluctuation amount of periodic fluctuation detected by microphones is the judgment index whether it contains abnormal sound or not.
Using the CF-0473A may be possible to evaluate on sounds that cannot be judged simply by the sound level.

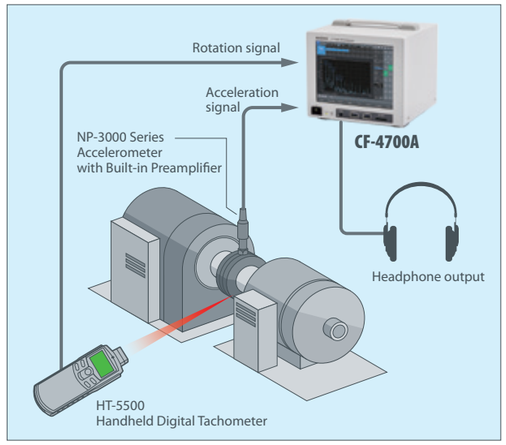
Function used | CF-0473A Amplitude Modulation Component Extraction Function



Abnormal vibration diagnosis of bearings

If the bearings are damaged, abnormal vibrations will occur.
The Amplitude Modulation Component Extraction Function (CF-0473A) is suitable for judging the maintenance timing of bearings.
Apply a filter (bandpass filter) to the frequency band of vibration caused by bearing damage, and the basic frequency corresponding to the damaged part is analyzed by the envelope function.
Monitor the condition of the bearing focusing on the amplitude of the frequency, and then the maintenance timing is judged. You can also set the filter while listening to the sound using the headphone output.

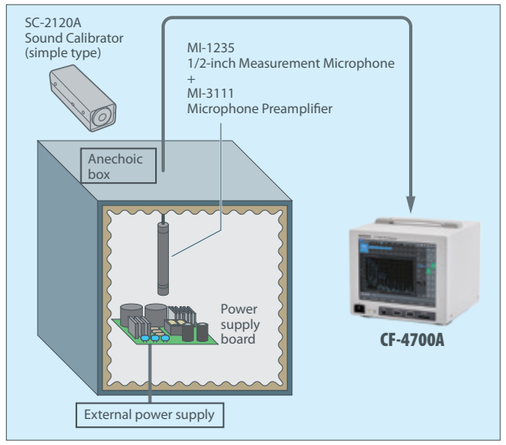
Function used | CF-0473A Amplitude Modulation Component Extraction Function



Inspection of abnormal sound generated from a power supply board

Sometimes power frequency sound and high frequency sound are generated from electronic parts on a power supply board. The Block comparator of CF-4700A can be used for the pass/fail judgment of those electronic parts using the block comparator function.
In this example, abnormal sound coming from a power board is measured by microphone in an anechoic box to avoid influence of background noise. Perform the frequency analysis with the CF-4700A, and then pass/fail judgment is made to that sound by block comparator with areal content rate by setting the judgment block including the frequency caused the abnormal noise.

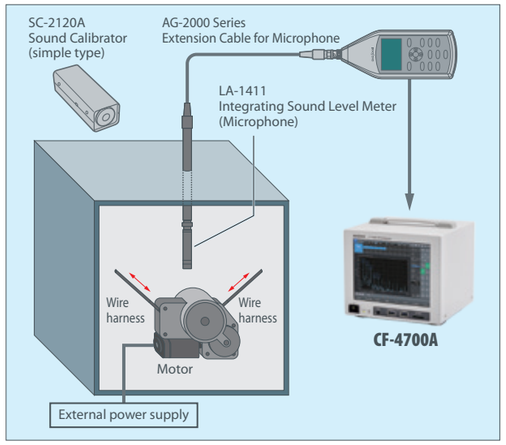
Function used | Block Comparator Function



Inspection of a wire harness device for automobile

A wire harness device inside a sliding door of automobile sometimes makes abnormal sound while the door is in motion.
To check the harness sound, block comparator function is effective. Measure and output the winding sound of wire harness while driving a motor at a sound insulating box with a sound level meter. The CF-4700A performs frequency analysis of that sound and makes pass/fail judgment using the partial overall level in a specific frequency band.

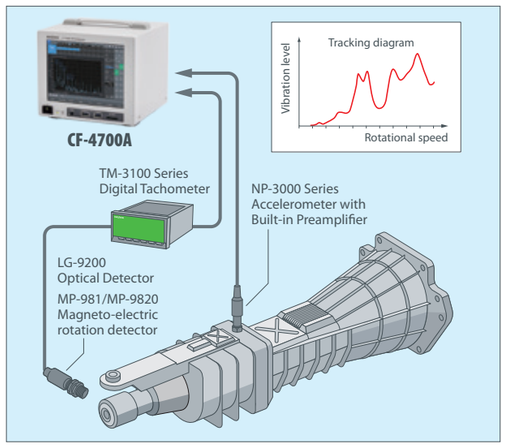
Function used | Block Comparator Function



Inspection of transmission noise by tracking analysis

The CF-4700A can perform quality control of transmission by tracking analysis of vibration signal from a transmission.
In this example, the CF-4700A performs tracking analysis with rotation pulses from a rotation controller in a transmission tester. Rotation tracking analysis of meshing order is performed using vibration generated when its rotation speed is varied from idling to maximum. Pass/ fail judgment of the transmission is made by setting a judgment line along the tracking data.

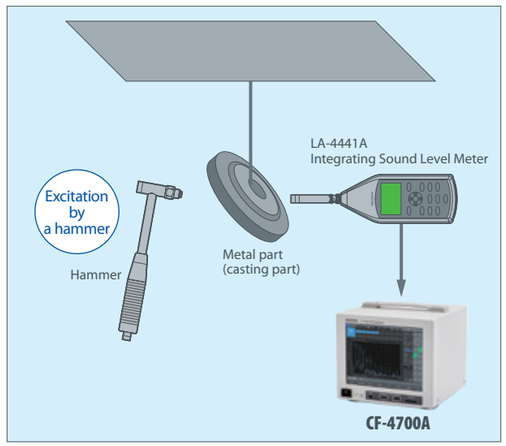
Function used | CF-0471 Tracking Function +
CF-0472 Shape Comparator Function



Inspection of a metal part by hammering sound

The CF-0472 is helpful to make pass/fail judgment of metal parts. Frequency spectrum of a hammering sound of a metal part (a casting part) which will change with cracks or fractures is used for the inspection.
In this example, the metal part suspended in free vibration is hit with a hammer, and its distribution sound is recorded with a sound level meter. FFT analysis is performed on CF-4700A to be able to see the difference in power spectrum shape between good and defective products. By reference to the shape, set the Shape Comparator to make pass/fail judgment.

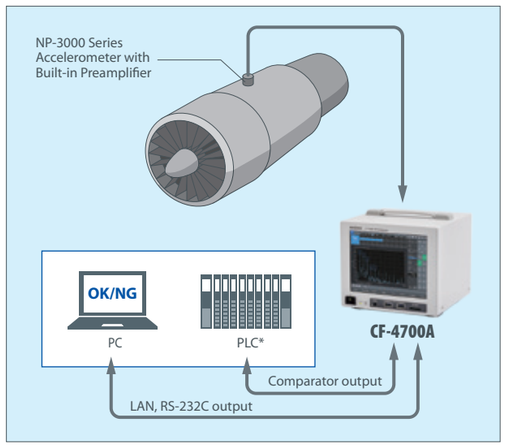
Function used | CF-0472 Shape Comparator Function



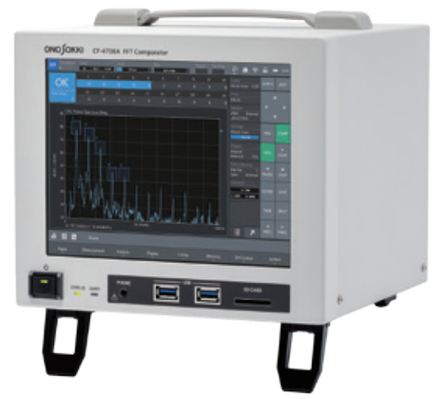
Imbalance inspection of a turbo fan

To inspect the imbalance of turbo fan, block comparator function is helpful. Using the vibration of turbo fan which increases when it has imbalance, find the frequency band and judgment block to be set.
The CF-4700A can make pass/fail judgment by setting the "peak max" judgment block. When there is MAX value of waveform inside the block area, it means "Pass". If not, it means "Fail".

Function used | Block Comparator Function



* Programmable Logic Controller



Rear Panel

Remotely controllable from a PC etc via LAN and RS-232C interfaces.

EXT TRIG : External trigger input
EXT SAMP : External sample input
(Available when the CF-0471 Tracking Function is installed)

INPUT : Signal input connector (isolated)
TEDS available. Cable disconnection detecting function is also available when a constant current line drive (CCLD) type sensor is connected.

Digital I/O

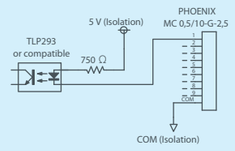
● DIGITAL INPUT

The following functions are assigned to the connector.
- Control by command assignment (max. 9 terminals)
- Panel condition selection (4 terminals)
- Judgment block changeover (4 terminals)

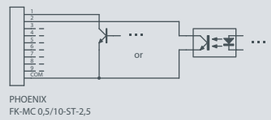
Input type	: Driven by contact or open collector (common are isolated together)
Input current	: Max. 5 mA
Logic	: Negative logic (Low=1, High=0)
Power voltage	: Isolation 5 V
Applicable connector	: FK-MC 0,5/10-ST-2,5 (by Phoenix Contact. GmbH & Co. KG) (provided as a standard accessory)

Recommended Connection Circuit

CF-4700A side



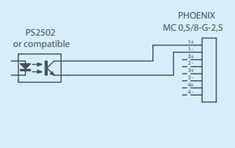
External device side (example)

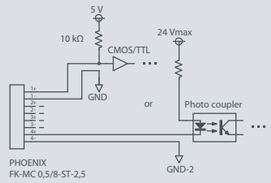


● STATUS OUTPUT

Contact terminal to output 4 kinds of statuses.
(Comp-BUSY, OK, NG, ERROR)

Output type	: Open collector (4 outputs are separated, each signal is isolated.)
Output withstand voltage	: 30 V
Output current	: Max. 25 mA (sink)
Collector saturation voltage	: 1.0 V or less
Logic	: Negative logic (Low=1, High=0)
Applicable connector	: FK-MC 0,5/8-ST-2,5 (by Phoenix Contact. GmbH & Co. KG) (provided as a standard accessory)

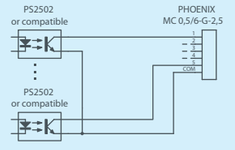


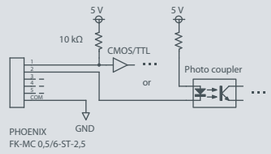


● COMP OUTPUT

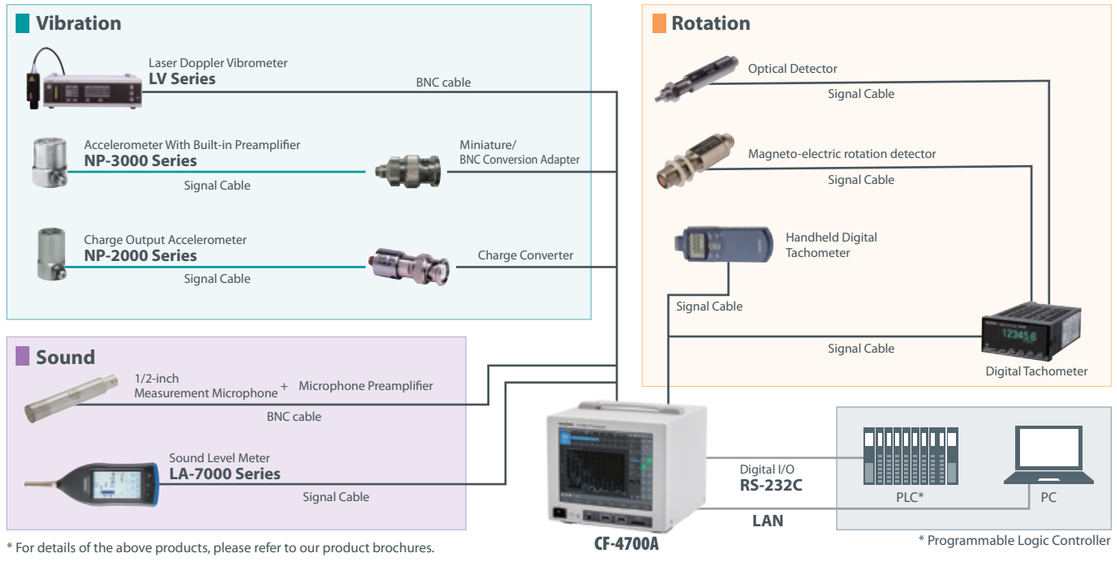
Contact terminal that selects 5 judgment setups from 20 setups, and outputs the results.

Output type	: Open collector (5 outputs and common are isolated together)
Output withstand voltage	: 30 V
Output current	: Max. 25 mA (sink)
Collector saturation voltage	: 1.0 V or less
Logic	: Negative logic (Low = 1, High = 0)
Applicable connector	: FK-MC 0,5/6-ST-2,5 (by Phoenix Contact. GmbH & Co. KG) (provided as a standard accessory)





System Configurations



* For details of the above products, please refer to our product brochures.

Specifications

1. Input Section

General input	
Number of input channels	1 channel
Input connector type	BNC (C02 type)
Input type	Single-ended, isolated
Input impedance	1 MΩ±0.5 %, 100 pF or less
Input coupling	DC or AC (-3 dB±0.3 dB at 0.5 Hz)
Power supply current for sensor (CCLD)	+23 V to 26 V / 4 mA±25 % (25 °C)
TEDS function*1	Accepts accelerometer and microphone conforming to IEEE 1451.4 ver.0.9, ver.1.0. TEDS ver.0.9 (0: accelerometer, 12: microphone) TEDS ver.1.0 (25: accelerometer, 27: microphone)
Maximum input voltage	30 Vrms (42.4 Vpeak)
Absolute maximum input voltage	70 Vrms AC 1 minute (50 Hz)
Input voltage range	1 Vrms, 31.62 Vrms (2 ranges)
DC offset	-60 dB full scale or less (When auto zero is on and DC coupling)
Amplitude flatness	±0.1 dB
Harmonic distortion	-90 dB or less (Standard, when optional filter is off)
Full-scale accuracy	±0.1 dB or less (At 1 kHz)
Aliasing	-90 dB or less
Amplitude linearity	±0.0015 % or less (At full scale)
Input level monitor	Lights up in red LED at excessive input. (Lights up in red for 95% of input voltage range)
Dynamic range	110 dB or more
A/D converter	24 bits type ⊿Σ
External trigger input	
Input connector type	BNC (C02 type)
Input voltage range	±12 V
Input impedance	100 kΩ
Input coupling	DC or AC
Input frequency range	0 to 300 kHz (out-of-band filter: 330 kHz –3 dB)
External sample input	
Input connector type	BNC (C02 type)
Input voltage range	±12 V
Input impedance	100 kΩ
Input coupling	DC or AC
Input frequency range	0 to 300 kHz (out-of-band filter: 330 kHz –3 dB)
Analog filter	
High-pass filter (HPF)	Cut-off frequency (Selectable) 1, 3, 10 Hz 10 Hz conforms to vibration severity standards filter. (3 order Butterworth, ISO 2954)
Low-pass filter (LPF)	Cut-off frequency (Selectable) 1k, 10 kHz 1 kHz conforms to vibration severity standards filter. (3 order Butterworth, ISO 2954)
Digital filter	
Frequency weighting filter	A, C (Conforms to IEC 61672-1:2013 Class1, ANSI S1.4-2014/ Part1 Class1, JIS C 1509-1:2017 Class1 (Compatible in terms of the filter shape))

2. Display

Size	8.4-inch
Resolution	800 × 600*2
Method	TFT color LCD with resistive film type touch panel
Brightness adjustment	ON/OFF 2 levels
Lighting (backlight)	LED

3. Analysis Section

Frequency range	1 Hz to 40 kHz
Number of sampling points/ analysis points	256/100, 512/200, 1024/400, 2048/800, 4096/1600, 8192/3200, 16384/6400
Real-time analysis	40 kHz (16384 points or less, at internal sampling)
Overlap processing	MAX, 75 %, 66.7 %, 50 %, 25 %, 0 %, optional setup
Window function	Rectangular, Hanning, flat-top
Time waveform processing function	First and second order differentials, single and double integrals Absolute value conversion, DC cancel, trend elimination, smoothing
FFT calculation	32-bit floating point (IEEE single-precision format)
Trigger function	
Trigger level	-99 to 99 (Unit: %) Default value: 25 %
Hysteresis level	0 to 99 (Unit: %) Default value: 2 %
Position	±8191
Trigger mode	Free, repeat, single, one-shot
Slope	+, -, ±
Trigger source	CH1, external trigger input
Averaging function	
Number of averaging setup	1 to 65535 times
Averaging setup time	0.1 to 999.9 seconds (Interval: 0.1 second)
Time domain	Arithmetic mean, exponential average
Frequency domain	Arithmetic mean, exponential average, peak hold, max overall
Amplitude domain	Histogram addition average
Averaging control function	A/D over cancel
Processing Functions	
Time domain	Time waveform
Frequency domain	Power spectrum, Fourier spectrum, 1/1 octave (bundled),1/3 octave (bundled)
Amplitude domain	Amplitude probability density function, amplitude probability distribution function

4. Comparator Function

Judgment mode	Continuous mode, single mode
Judgment result output	Total judgment result, individual judgment result of up to 5 specified blocks or shapes
Automatic data storage	Either NG or all measurement results
Timer function	Start delay time setting, judgment execution time setting 0 to 255 seconds (Interval: 1 second)
Block mode	
Target waveform	Power spectrum, 1/1 octave (bundled), 1/3 octave (bundled), order spectrum
Maximum number of setup blocks	20 blocks
Judgment method	Level, peak level, peak max (maximum value), inside max, partial overall, areal content rate (Judgment method can be specified for each block.)
Judgment criterion	NG for whole block, 1 block
Shape mode (CF-0472 option)	
Target waveform	Time waveform, power spectrum, 1/1 octave (bundled), 1/3 octave (bundled), order spectrum, tracking diagram
Maximum number of setting shape lines	20 lines
Judgment criterion	Specified area, specified level

5. Memory Function

Recording device	Selectable from internal storage of main unit, USB memory or SD card
Data file	Number of storable data: 9990 (max.) DAT, TXT, BMP, TRC (Data can be saved simultaneously in four formats. (Data storage in TXT, BMP, and TRC formats can be selected optionally.))
Panel condition memory	Memorizes and recalls measurement conditions. (50 types max.)

6. Interface

USB	
Number of ports	2 USB 3.0 USB memory, keyboards, wireless LAN module*3
SD card	
Number of ports	1 Supports SD/SDHC/SDXC capacity: 128 GB*4
LAN	
Number of ports	1 10BASE-T/100BASE-TX/1000BASE-T Remote desktop, external control, file sharing (internal storage)
RS-232C	
Number of ports	1
Baud rate	1,200 to 115,200 bps
Digital I/O	
Digital input	
Number of input signals	9 inputs and common (Insulation withstand voltage 42.4 Vpeak)
Applicable connector	FK-MC 0,5/10-ST-2,5
Input function	Control by command assignment (max. 9 kinds) Judgment block changeover (selectable 4 blocks) Panel condition selection (15 kinds)
Status output	
Number of output signals	4 outputs are separated (Each signal is isolated, insulation withstand voltage 42.4 Vpeak)
Applicable connector	FK-MC 0,5/8-ST-2,5
Output function	BUSY, OK, NG, ERR
Comp output	
Number of output signals	5 outputs and common (Insulation withstand voltage 42.4 Vpeak)
Applicable connector	FK-MC 0,5/6-ST-2,5
Output function	Individual judgment output (any 5 outputs)

7. General Specifications

Power requirement	16 VDC, 3.3 A
AC adapter	Power requirement 100 to 240 VAC, 50/60 Hz Power consumption 65 VA or less 150 VA or less (When CF-0478A Power Source Backup Function is installed and charging battery)
Operating temperature range	0 to 40 °C (Humidity 20 to 80 %RH, with no condensation)
Storage temperature range	-10 to +50 °C (Humidity 20 to 80 %RH, with no condensation)
Outer dimensions	220 (W) × 185 (H) × 220 (D) mm (Excluding handle, stand, and protruded section)
Weight	Without option Approx. 2.8 kg With options Approx. 3.3 kg (When CF-0473A Amplitude Modulation Component Extraction Function and CF-0478A Power Source Backup Function are installed, including battery pack)
Main unit cooling	Naturally air cooling (Fanless)
Conforming standards	CE marking
Accessories	
AC adapter	×1 (PS-P20023 , power cable)
Instruction manual	×1
CD-ROM	×1 (Reference guide, utility, DLL for external control, etc.)
SD card	×1 (Exclusive for updates, 512 MB)
Connectors for terminal blocks (3 kinds)	FK-MC 0,5/10-ST-2,5 ×1, FK-MC 0,5/8-ST-2,5 ×1, FK-MC 0,5/6-ST-2,5 ×1
Ferrite core	×1 (E04SR301334, made by SEIWA ELECTRIC MFG. CO.,LTD.)

Optional Functions

CF-0473A Amplitude Modulation Component Extraction Function (Bandpass Envelop Monitoring Function)

Analog filter	
High-pass filter (HPF)	Cut-off frequency (variable) 50 Hz to 10 kHz (-24 dB/oct)
Low-pass filter (LPF)	Cut-off frequency (variable) 50 Hz to 10 kHz (-24 dB/oct)
Envelope filter	1 kHz low-pass filter method
Headphone output	
Number of output connectors	1
Maximum output (at load resistance 24 Ω)	15 mW
Output impedance	10 Ω unbalance
Output connector type	Stereo mini-jack φ3.5 mm (L and R same signal output)
Accessory	
Ferrite core	×1 (E04SR200932, made by SEIWA ELECTRIC MFG. CO.,LTD.)

CF-0478A Power Source Backup Function

Battery	Lithium ion secondary battery mounted in main unit (detachable)
Charging time that the Power Source Backup Function becomes available	Approx. 10 to 30 minutes (At battery level 0 %, surrounding temperature range +10°C to +35°C) The battery can be charged only when the main unit is on.
Battery replacing intervals	Approx. 2 years *5
Accessory	
Battery	×1

*1 If a TEDS supported sensor made by other companies is used, TEDS information may not be read according to the type of a TEDS chip included in a sensor.
- If you are considering the purchase of a TEDS sensor made by other companies, please consult to the manufacturer or dealer of the TEDS sensor, and perform the operation check.
- When you want to use a TEDS sensor you already have with the TEDS supported measurement instruments made by Ono Sokki, please perform the operation check with a demonstration product of Ono Sokki.

*2 The TFT color LCD is created by the full use of advanced technology. However, the pixels (dots) of non-lighting or always lighting occasionally exist in the display. (The ratio of the number of effective dots: 99.999 % or more.) Also, unevenness of the color or brightness may be visible depending on the viewing angle or the temperature change. This is not a product failure, so please note that return or exchange of the product cannot be accepted.

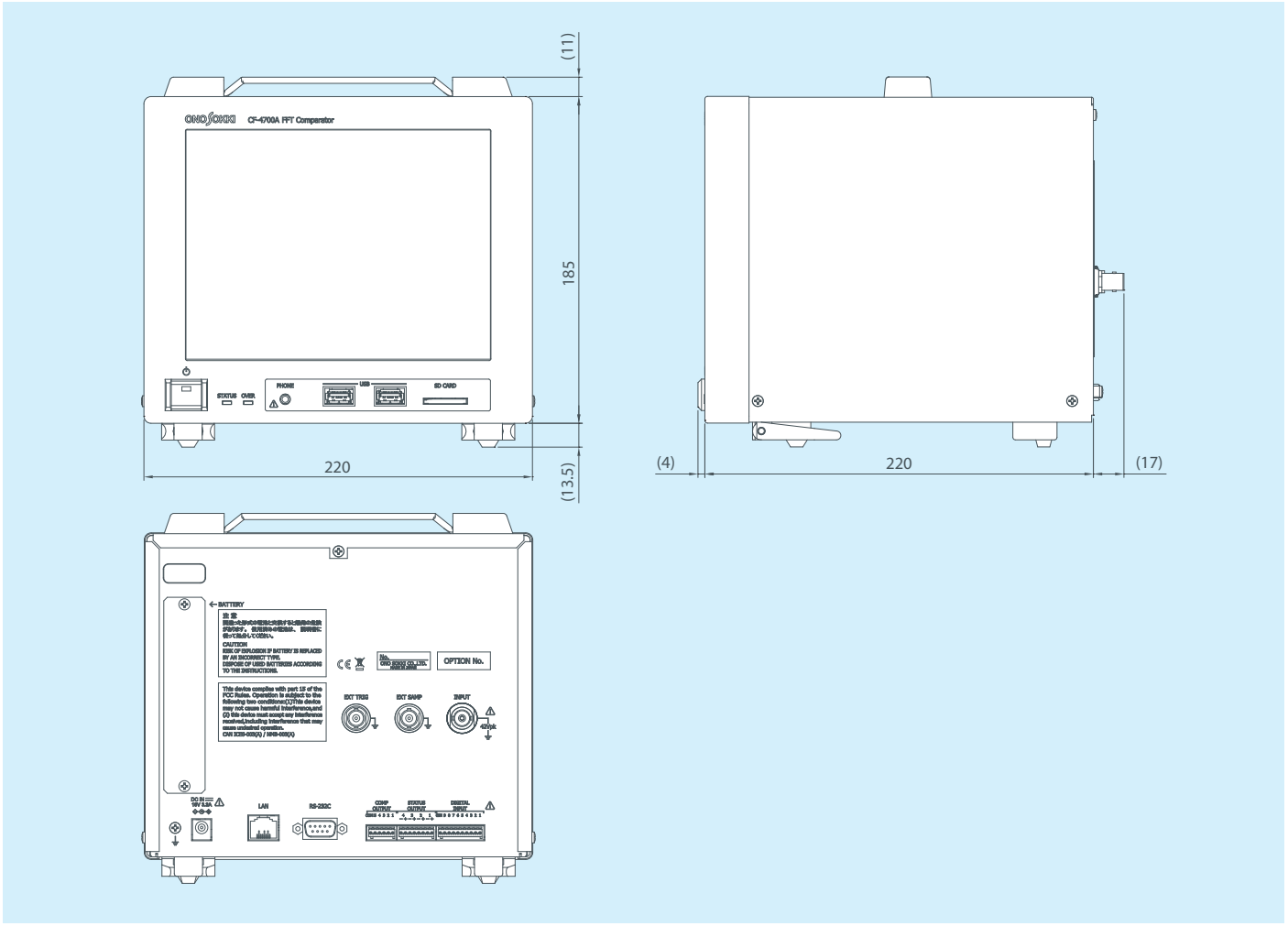
*3 Please refer to P.8 "Recommended product".

*4 For the latest information on recommended SD cards, please visit our website.

*5 The battery replacing intervals may be shorter than the above depending on the operating and storage conditions.

Outer Dimensions

(Unit: mm)



Main unit

Model name	Product name
CF-4700A	FFT Comparator

Recommended Product

Model name	Product name
TL-WN725N	Wireless LAN adapter

*Please refer to our website for the latest information on recommended SD cards.

Option

Model name	Product name
CF-0471	Tracking Function
CF-0472	Shape Comparator Function
CF-0473A*	Amplitude Modulation Component Extraction Function (Band pass filter, Envelope and Monitor Function)
CF-0478A*	Power Source Backup Function
CF-0470AJ	Reference guide (Japanese)
CF-0470AE	Reference guide (English)
—	Security software

* If adding the CF-0473A and CF-0478A after delivery, additional fee will be required.

 URL: https://www.onosokki.co.jp/English/english.htm

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