

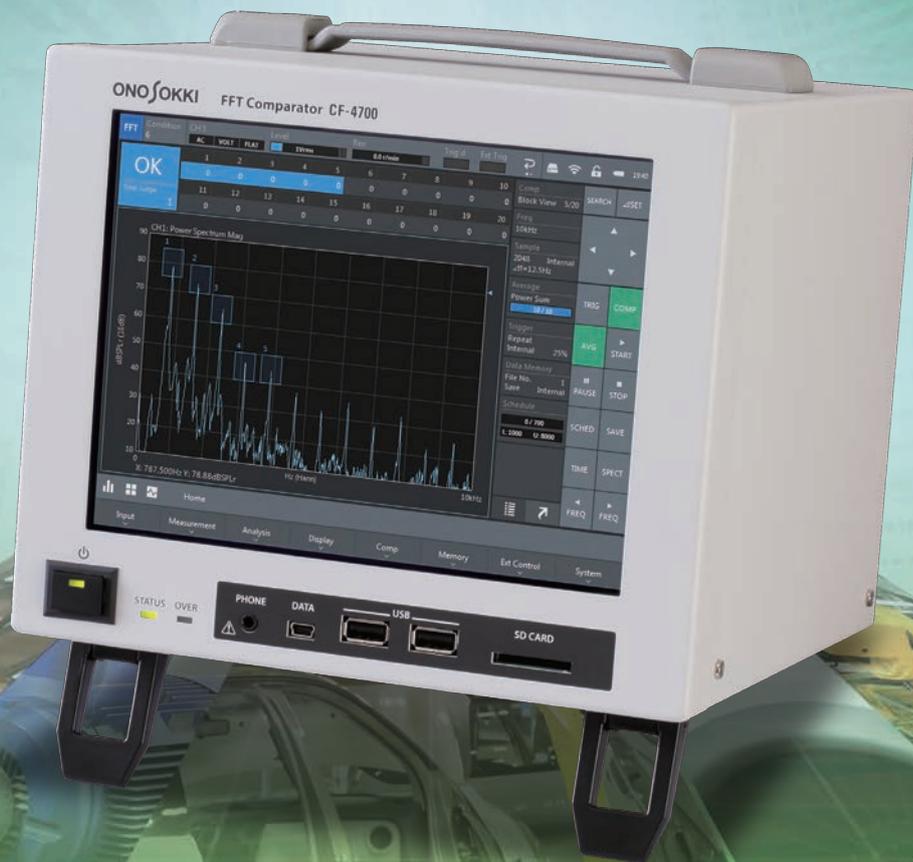
CF-4700



FFT
Comparator

FFT Comparator

CF-4700



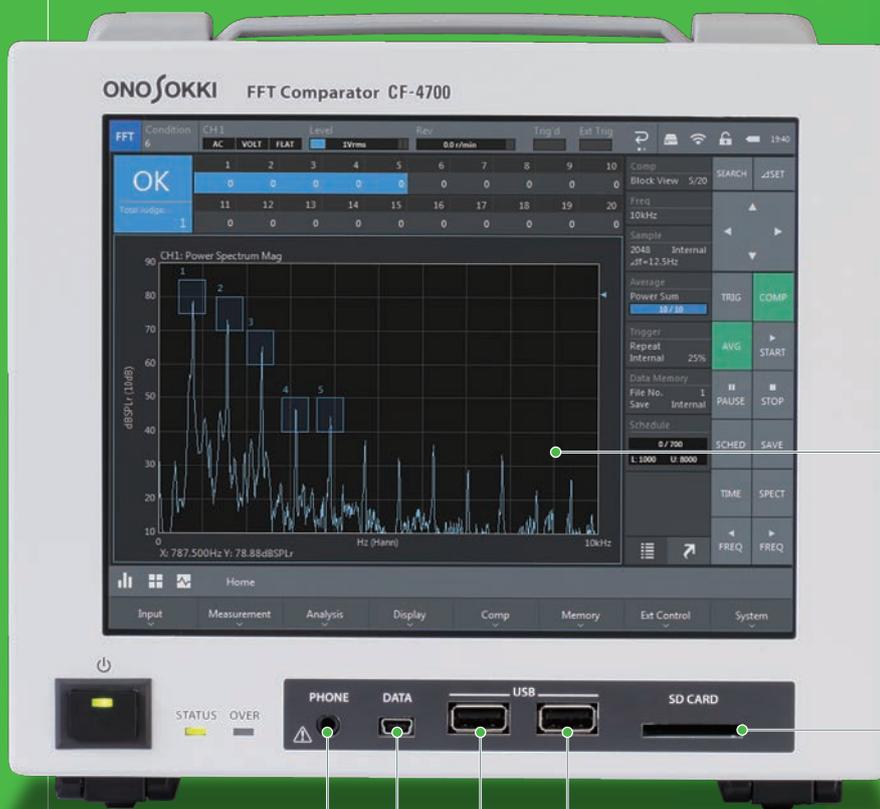
The CF-4700 FFT comparator is a pass/fail judgment machine used on production lines that is highly effective in accurate quality inspection by analyzing sound or vibration from products.

Enables pass/fail judgment by extracting the amount of fluctuation of signal size focusing on a specific frequency band.

ONO SOKKI

An FFT comparator capable of being used on production sites and dealing with sound or vibration that fluctuates periodically.

FFT Comparator CF-4700



8.4-inch touch-panel color LCD

SD/SDHC memory card slot

Headphone output

USB interface for exclusive use of the USB mass storage class

USB interface

Features

4 comparator functions

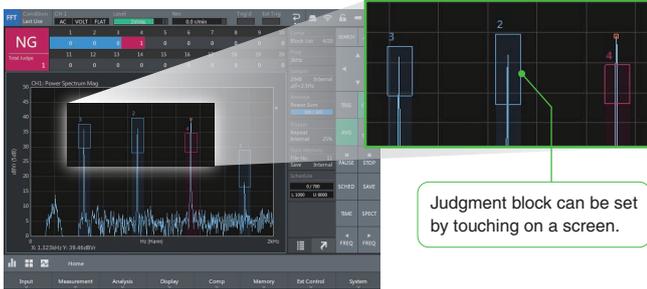
- The Block Comparator Function allows pass/fail judgment from the level of characteristic frequency signal using a preset judgment block area.
- The Shape Comparator Function for pass/fail judgment by waveform shape. **Option**
- The Tracking Function for pass/fail judgment by capturing level variation in specified order while rotational speed is varied. **Option**
- The Amplitude Modulation Component Extraction Function (Band pass filter, Envelope and Monitor Function) that enables pass/fail judgment by extracting the amount of periodical fluctuations in sound or vibration caused by buzzing or chattering. **Option**

A variety of user-friendly functions

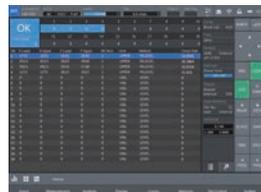
- The Assist Function for setting the judgment block area from the difference between frequency characteristics of OK and NG products.
- Accepts TEDS sensor for automatic unit calibration. (Accelerometer and microphone that conform to IEEE 1451.4 ver.0.9 and ver. 1.0)
- The Cable Disconnection Detecting Function for detecting cable disconnection or connector trouble automatically when using a constant current line drive (CCLD) type sensor.
- Measurement conditions and data can be stored on a USB memory and SD/SDHC memory card.
- Measurement conditions and data can be duplicated to a PC via USB cable. **Option**
- The Monitor Function for auditory confirmation of specified characteristic frequency sound through headphones. **Option**
- The Power Source Backup Function prevents loss of measurement data in case of a main power down. **Option**
- The CF-4700 can be turned ON/OFF from an external main power supply such as a production line control panel. **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, areal content rate) are available for each block. The judgment block can be determined by drag operation at a touch of a screen or by directly entering a numeric value on a list screen. In addition, the Assist Function reads differences in levels of sounds or vibrations from both passed and failed measurement data files respectively. This function makes it easier to set a judgment block, even for first-time users who are conducting a pass/fail judgment by frequency spectrum.



Related function | **Block Comparator Function** Standard
Assist Function Standard

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

The Amplitude Modulation Component Extraction Function (CF-0473) is a preprocessing function to extract the amount of fluctuation of signal size 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-0473) 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.

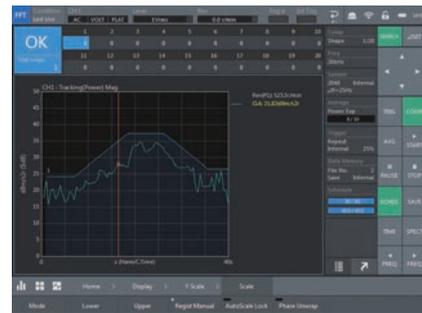


Related function | **CF-0473 Amplitude Modulation Component Extraction Function** Option

Judging by shape of waveform



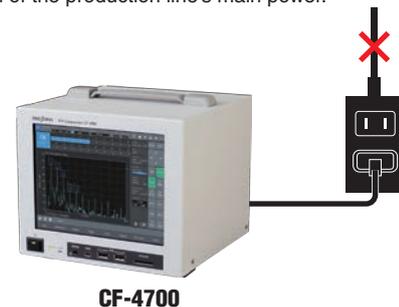
The Shape Comparator Function (CF-0472) makes pass/fail judgments by waveform shape. By setting a judgment line, this function enables pass/fail judgments on subtle variations in a time waveform or on differences in spectral shapes. In order to avoid misjudgment due to instantaneous noises in a time 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 this function together with the Tracking Function (CF-0471), you can measure and analyze vibrations or noises caused by rotation and make pass/fail judgments on devices on the basis of the level or fluctuation of vibration or noise components that fluctuate according to the rotation speed.



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-0478) deactivates the CF-4700 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-4700 can be turned on or off by mere operation of the control panel of the production line's main power.



Related function | **CF-0478 Power Source Backup Function** Option

Application Examples

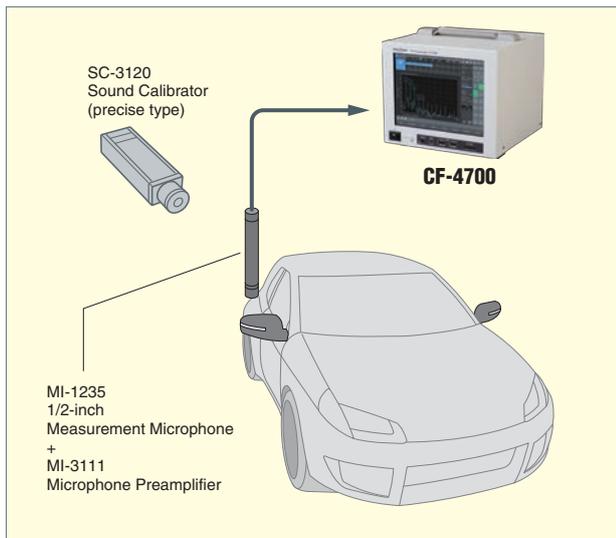
Unusual noise evaluation of door mirror operation

Irregularity in the rotation of a door mirror drive motor while it is opened or closed may generate unusual fuzzy noises having periodic fluctuation components.

These noises can be detected by the amount of periodic fluctuation extracted by the Amplitude Modulation Component Extraction Function from the door mirror motion sound measured with the MI-1235 1/2-inch Measurement Microphone and the MI-3111 Microphone Preamplifier.

Using the Amplitude Modulation Component Extraction Function it may be possible to make judgments on sounds that cannot be judged simply by the sound level.

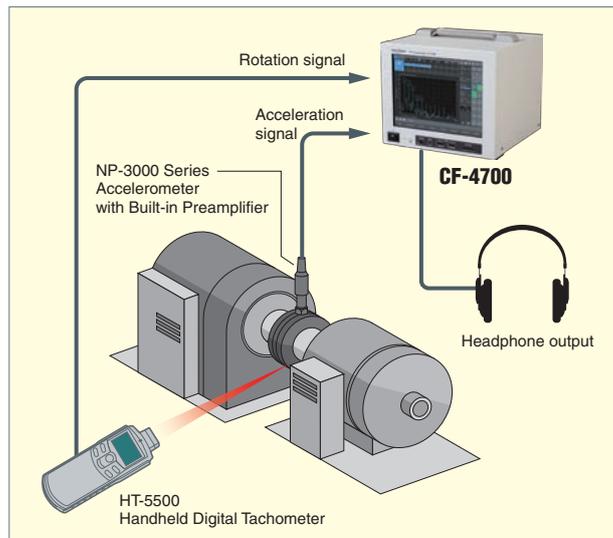
Function used | CF-0473 Amplitude Modulation Component Extraction Function



Abnormal vibration diagnosis of bearings

Damage of bearings causes abnormal vibrations. The CF-4700 performs diagnosis of bearings by inputted signal from an accelerometer attached on the rolling bearing. A basic frequency analysis according to a damaged part can be performed by optional band pass filter and envelope function (included in the CF-0473 Amplitude Modulation Component Extraction Function), which filters a frequency band in vibration caused from a damaged bearing. The amplitude in a frequency band tells the timing of bearing maintenance. Also the filter can be set while listening to the sounds from bearing through headphones.

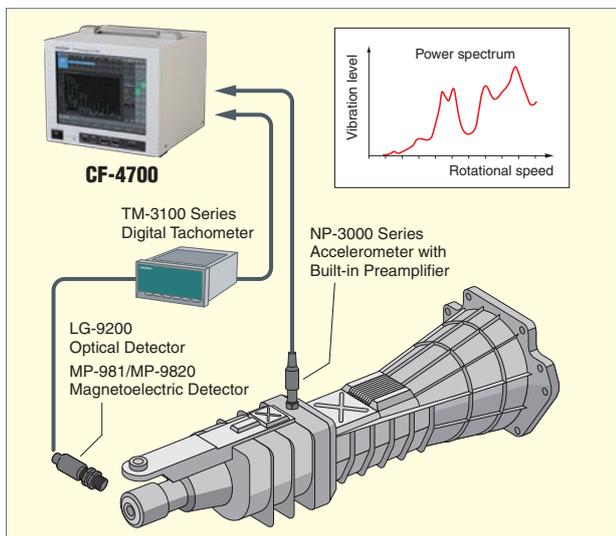
Function used | CF-0473 Amplitude Modulation Component Extraction Function



Inspection of transmission noise by tracking analysis

The CF-4700 can perform quality control of transmission by tracking analysis of vibration signal from a transmission. In this example, the CF-4700 performs tracking analysis with rotational pulses from a rotation controller in a transmission tester. Rotational tracking analysis of meshing order is performed using measured vibration by the NP-3000 Series Accelerometer with Built-in Preamplifier in terms of varying rotational speed from idling to the maximum. Pass/fail judgment of the transmission is made by setting a judgment line along the tracking data.

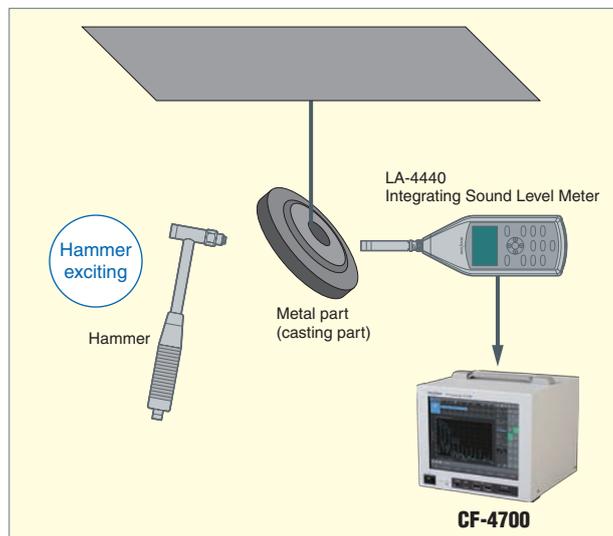
Function used | CF-0471 Tracking Function + CF-0472 Shape Comparator Function



Inspection of a metal part by hammering sound

The frequency spectrum of a hammering sound is affected by cracks or fractures of a metal part (e.g. a casting part). In this example, the metal part is suspended in free vibration for hammer exciting, and an inspection is made from the hammering sound. The hammering sound is measured by the LA-4440 Integrating Sound Level Meter. Then via AC output, inputted to the CF-4700 which performs a frequency analysis to find the difference in power spectrum shape between OK and NG products. The CF-4700 makes judgments using the Shape Comparator Function with the difference.

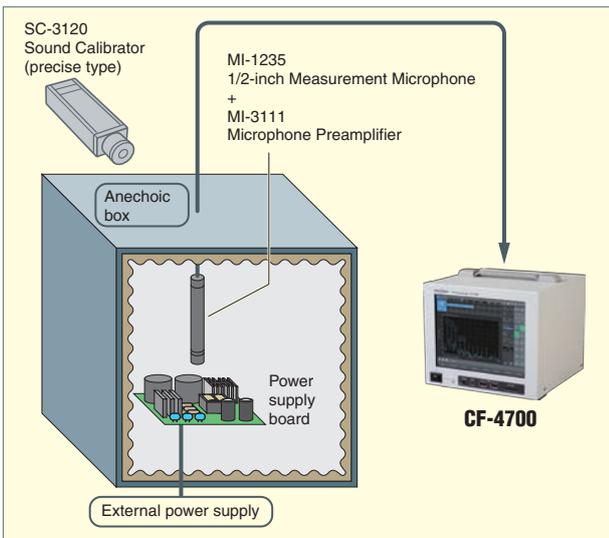
Function used | CF-0472 Shape Comparator Function



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. In this example, abnormal sound coming from a power board is measured by the MI-1235 1/2-inch Measurement Microphone and the MI-3111 Microphone Preamplifier in an anechoic box to avoid influence of background noise. Then the signal is inputted to the CF-4700 for frequency analysis. The CF-4700 makes pass/fail judgment with areal content rate in power spectrum by setting up of a judgment block around the power frequency caused the abnormal sound.

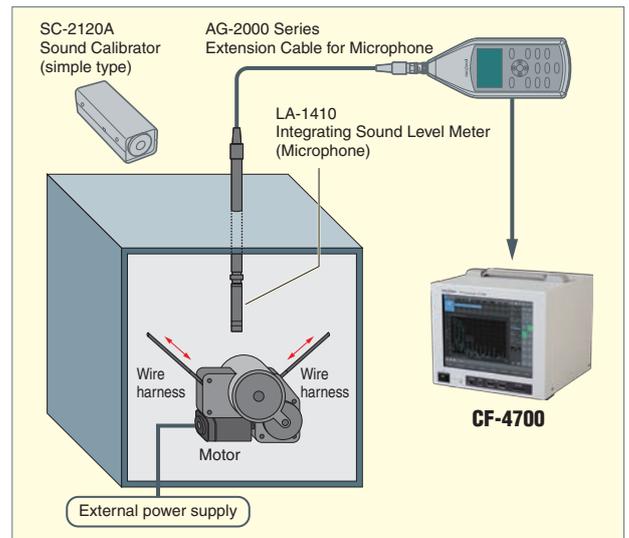
Function used | Block Comparator Function



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. The wire winding sound can be used for inspection. Drive a motor of wire harness device in a sound insulating box and the LA-1410 Integrating Sound Level Meter measures the sound from the device. Then the CF-4700 performs frequency analysis of the AC output signal from the Sound Level Meter to make pass/fail judgment of the partial overall level in a specific frequency band.

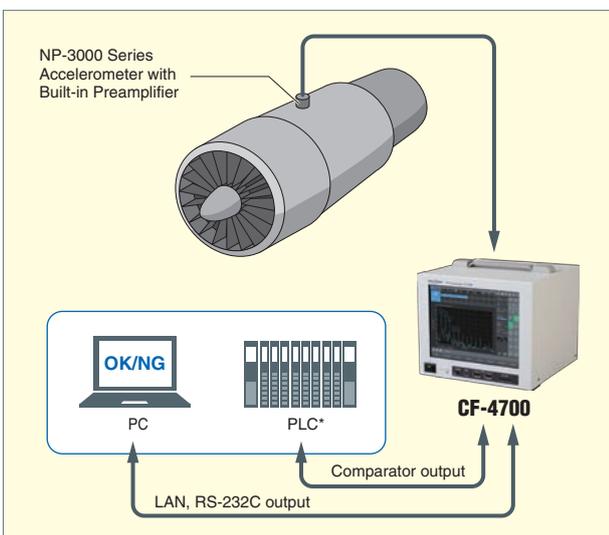
Function used | Block Comparator Function



Imbalance inspection of a turbo fan

When a turbo fan has imbalance, the signal from a vibration sensor attached on it increases. Therefore, it is effective for imbalance inspection to measure vibrations of the rotating turbo fan. By using signals from the NP-3000 Series Accelerometer with Built-in Preamplifier, you can define the target frequency band and the judgment level, then set judgment blocks to the CF-4700 FFT comparator. In this case, the "peak max" is selected as the judgment method. If the maximum value of the waveform exists in the specified block area, it means OK. If not exists, it means NG.

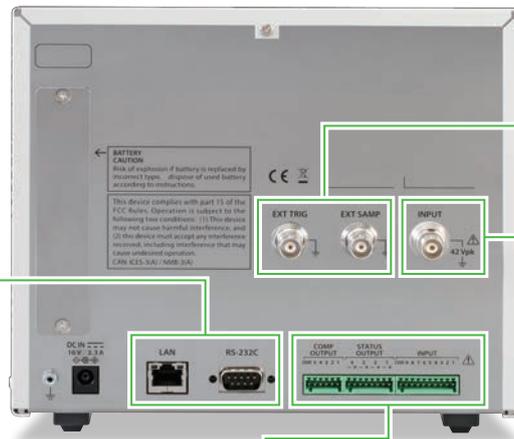
Function used | Block Comparator Function



* Programmable Logic Controller



Rear Panel



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

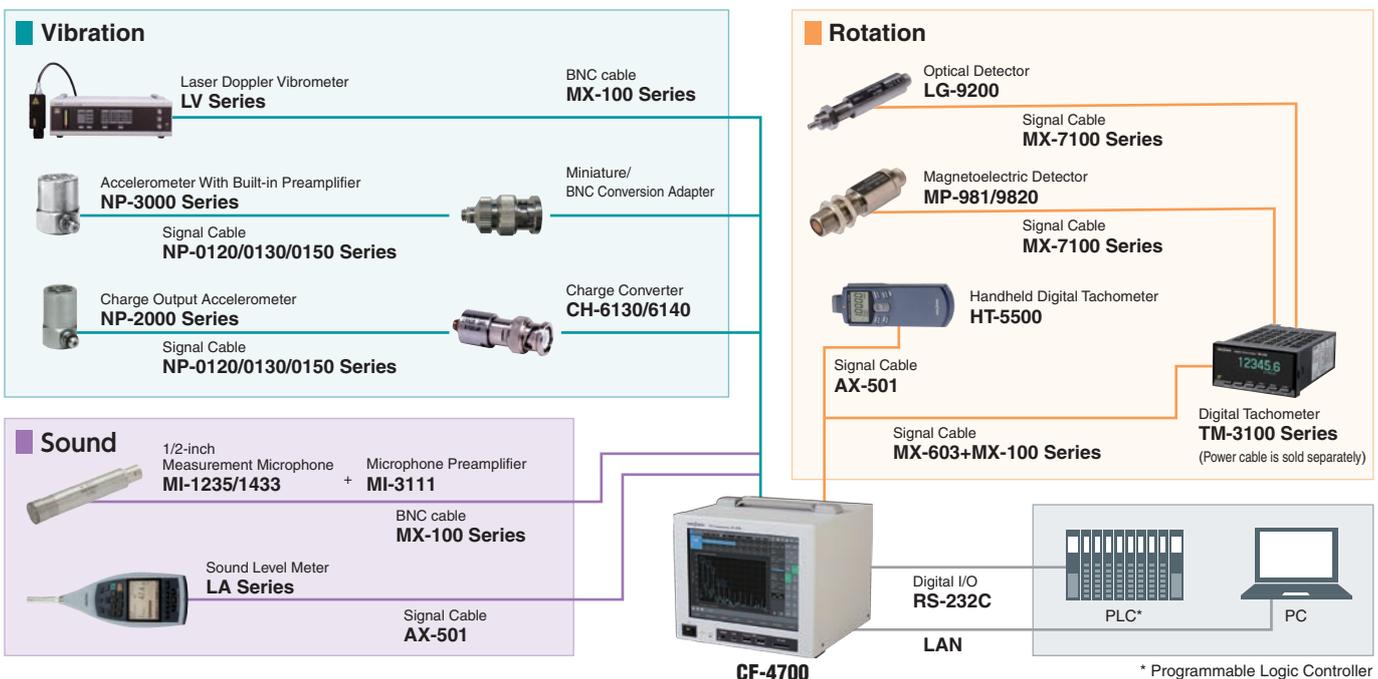
EXT TRIG : External trigger input
EXT SAMP : External sample input
 (Available when the CF-0471 Tracking Function is installed)

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

	Specifications	Recommended Connection Circuit	
<p>DIGITAL INPUT</p> <p>The following functions are assigned to the connector.</p> <ul style="list-style-type: none"> Control by command assignment (max. 9 terminals) Panel condition selection (4 terminals) Judgment block changeover (4 terminals) 	<p>Input type : Driven by contact or open collector (shared common, 9 inputs and common are isolated together)</p> <p>Input current : Max. 5 mA</p> <p>Logic : Negative logic (Low=1, High=0)</p> <p>Power voltage : Isolation 5 V</p> <p>Applicable connector : FK-MC 0,5/10-ST,2,5 (by Phoenix Contact, GmbH & Co. KG) (provided as a standard accessory)</p>	<p>CF-4700 side</p>	<p>External device side (example)</p>
<p>STATUS OUTPUT</p> <p>Outputs 4 kinds of statuses. (Comp-BUSY, OK, NG, ERROR)</p>	<p>Output type : Open collector (4 outputs are separated, each signal is isolated.)</p> <p>Output withstand voltage : 30 V</p> <p>Output current : Max. 25 mA (sink)</p> <p>Collector saturation voltage : 1.0 V or less</p> <p>Logic : Negative logic (Low=1, High=0)</p> <p>Applicable connector : FK-MC 0,5/8-ST-2,5 (by Phoenix Contact, GmbH & Co. KG) (provided as a standard accessory)</p>		
<p>COMP OUTPUT</p> <p>Any 5 judgment setups can be selected from 20 and the results can be outputted.</p>	<p>Output type : Open collector (shared common, 5 outputs and common are isolated together)</p> <p>Output withstand voltage : 30 V</p> <p>Output current : Max. 25 mA (sink)</p> <p>Collector saturation voltage : 1.0 V or less</p> <p>Logic : Negative logic (Low = 1, High = 0)</p> <p>Applicable connector : FK-MC 0,5/6-ST-2,5 (by Phoenix Contact, GmbH & Co. KG) (provided as a standard accessory)</p>		

System Configurations



Specifications

1. Input Section

General input	
Number of input channels	1 channel
Input connector type	BNC (Type C02)
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)	+ 24 V, 4 mA
TEDS function	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 (At 1 kHz)
Aliasing	-90 dB or less
Amplitude linearity	±0.0015 % (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 ΔΣ

External trigger input	
Input connector type	BNC (Type C02)
Input voltage range	±12 V
Input impedance	100 kΩ
Input coupling	DC or AC
Input frequency range	0 to 300 kHz

External sample input	
Input connector type	BNC (Type C02)
Input voltage range	±12 V
Input impedance	100 kΩ
Input coupling	DC or AC
Input frequency range	0 to 300 kHz (Not available direct sampling)

Analog filter	
High-pass filter (HPF)	Cut-off frequency (Selectable) 1, 3, 10 Hz (-18 dB/oct) 10 Hz conforms to vibration severity standards filter. (3 order Butterworth, ISO 2954)
Low-pass filter (LPF)	Cut-off frequency (Selectable) 1k, 10 kHz (-18 dB/oct) 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 Ed.1.0 class 1, ANSI S1.4-1983 type 1, JIS C1509-1: 2005 class 1)

2. Display

Size	8.4-inch
Resolution	800 × 600*
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	Summation average, exponential average
Frequency domain	Summation average, exponential average, peak hold, max overall
Amplitude domain	Summation 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	Only for NG, 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	AND or OR of all specified blocks

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/SDHC 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 (Type A)	
Number of ports	2
	USB 2.0 USB memory, keyboards, wireless LAN module
USB (Type mini B)	
Number of ports	1
	Data USB 2.0 for USB mass storage class function (CF-0477 option) Data in the main unit is read by connecting to a PC. (Not writable)
SD card	
Number of ports	1
	Supports SD/SDHC capacity: 4 GB, 32 GB
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-0478 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-0473 Amplitude Modulation Component Extraction Function and CF-0478 Power Source Backup Function are installed, including battery pack)
Main unit cooling	Naturally air cooling (Fanless)
Conforming standards	CE marking
Vibration resistance	9.8 m/s ² (Frequency 10 to 150 Hz, in each of X, Y and Z direction)
Shock resistance	400 m/s ² (11 ms duration)
Accessories	
AC adapter	×1 (PS-P20018A + power cable (2 m))
Instruction manual	×1
CD-ROM	×1 (Reference guide, utility, 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-0473 Amplitude Modulation Component Extraction Function (Band pass filter, Envelope and Monitor 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 (Same signal is outputted from L and R)

Accessory	
Ferrite core	×1 (E04SR200932, made by SEIWA ELECTRIC MFG. CO.,LTD.)

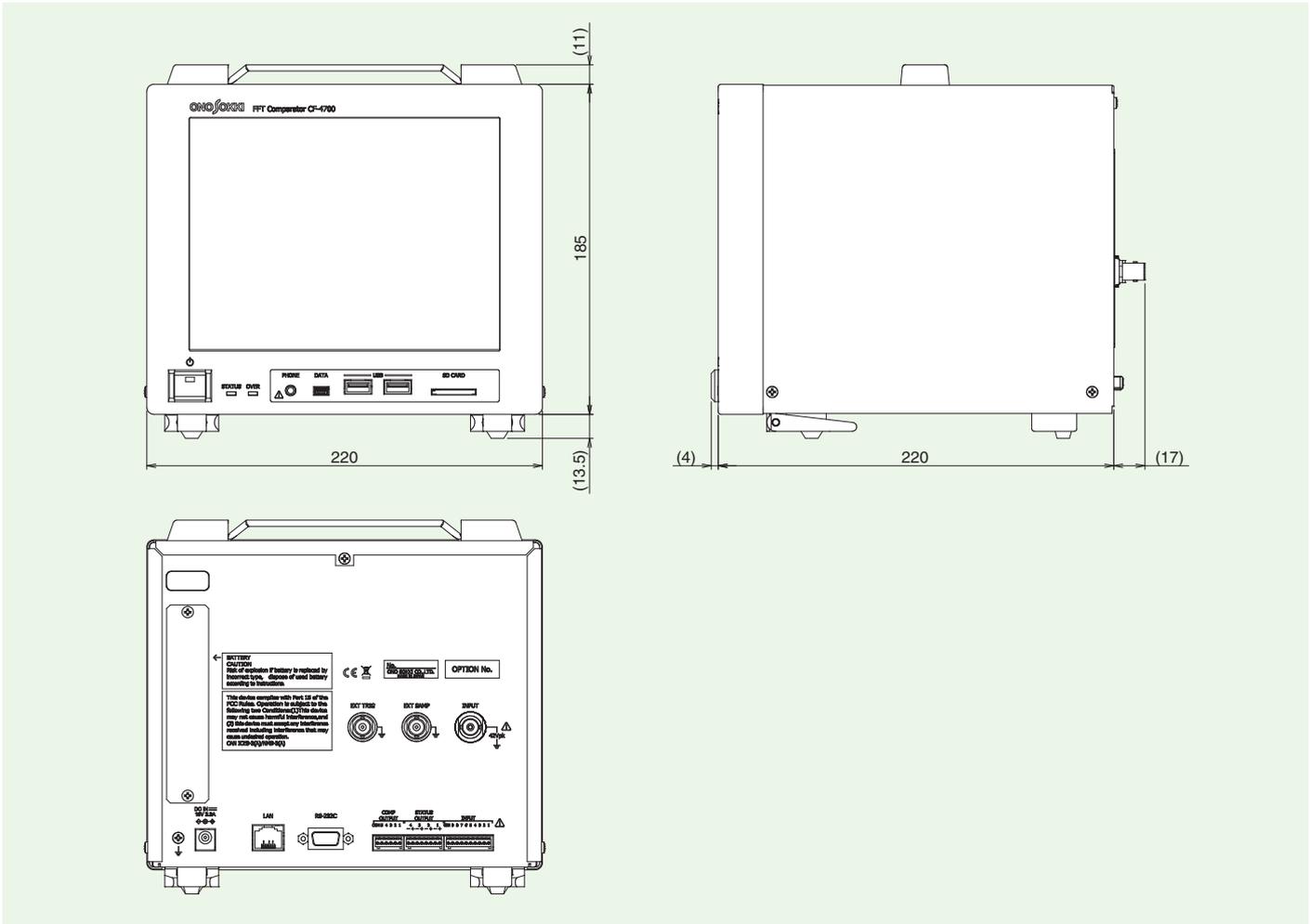
CF-0478 Power Source Backup Function

Battery	
Battery	Lithium ion secondary battery mounted in main unit (detachable)
Charging time that the Power Source Backup Function becomes available	15 minutes or more (At battery level 0%, surrounding temperature range +10°C to +35°C)
Battery replacing intervals	The battery can be charged only when the main unit is on. Approx. 2 years ^{*2}

Accessory	
Battery	×1

*1 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.

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



Product Lineup

Model name	Product name
CF-4700	FFT Comparator
CF-0471	Tracking Function
CF-0472	Shape Comparator Function
CF-0473	Amplitude Modulation Component Extraction Function (Band pass filter, Envelope and Monitor Function)
CF-0477	USB Mass Storage Function *CF-0703 USB connection cable is included.

Model name	Product name
CF-0478	Power Source Backup Function
CF-0702	Stylus pen
CF-0703	USB connection cable (1.5 m TYPE-A mini-B)
CF-0470J	Reference guide (Japanese)
CF-0470E	Reference guide (English)

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* Outer appearance and specifications are subject to change without prior notice.
URL: <https://www.onosokki.co.jp/English/english.htm>

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