The CF-4500 FFT comparator can be used as an OK/NG judgment machine on production lines for accurate quality inspection by sound or vibration from products. As featuring our accumulated FFT technology over the years, the CF-4500 enables OK/NG judgment by Block Comparator Function, Shape Comparator Function, Tracking Function and Band-pass Filter & Monitor Function. The combinations of these judgment functions greatly help to improve product quality and working efficiency on production sites.

Discontinued
(Reference only)
Features

Max. 20 judgment blocks for OK/NG judgment from the level of characteristic frequency signal. 5 kinds of judgment methods for each judgment block.

The Shape Comparator Function for OK/NG judgment by waveform shape (option).

The Tracking Function for OK/NG judgment by capturing level variation in specified order (option).

The Band-pass Filter & Monitor Function for allowing characteristic abnormal sound to be monitored auditorily through headphones (option).

A touch-panel color LCD enables easy setup of judgment block or judgment shape by drag & drop operations at a touch of a screen.

Measurement data and conditions can be stored on an USB memory. It enables management or backup copy of them on a PC.

An open collector output for total and individual judgment results to PLC* (controllable by 9 kinds of commands)

The Power Supply Backup Function prevents loss of measurement data in case of a main power down (option).

*PLC: Programmable Logic Controller
The Block Comparator Function makes OK/NG judgment depending on whether a peak value or level of a target signal coincides with a block area set in a certain frequency range and level range. 5 kinds of judgment methods (level, peak level, peak max, section overall, areal rate of content) are available for each block. The judgment block can be determined by drag operation at a touch of a screen or directly entering a numeric value on a list screen.

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The Shape Comparator Function is effective for judgment by waveform shape. Sometimes it is not easy to judge subtle variation in signal waveform of sound or vibration by frequency analysis. This function allows judgment of subtle variation in signal waveform by setting a judgment line along the shape of signal waveform. The judgment line connects any points to form judgment area.

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Judging frequency level
Block Comparator Function

Judging shape of waveform
Shape Comparator Function

Judging rotational speed variation
Tracking waveform Shape Comparator

Auditory checking of sound and vibration
Band-pass Filter & Monitor Function

No worry about accidental power failure
Power Supply Backup Function

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In sound and vibration countermeasures for rotational machines, it is important to measure or analyze which rotational speed increases sound or vibration. The CF-4500 is capable of tracking speed variation to extract sound and vibration components caused by rotational speed variation, and making OK/NG judgment of the rotating machine under measurement from level value variation. The LG series or the MP series rotational detectors by ONO SOKKI can be connected directly to input signal of rotational speed.

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At production site, it could be occurred an instantaneous power failure or a main power down of production line accidentally. This optional function deactivates the CF-4500 in normal manner in case of a main power down of production line. There is no need to prepare an uninterruptible power supply separately. Moreover, presetting of startup conditions helps smooth restart and also allows centralized power control of production line. The main power of production line and the CF-4500 can be powered on or off just by an ON/OFF operation.

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Motor inspection by rotational speed fluctuation

Rotational speed fluctuation is one of the items for motor quality inspection. An F/V converter is used to detect rotational fluctuation. The signal from a rotary encoder coupled with a rotating shaft is input to the High-speed F/V Converter (FV-1400) and then the F/V Converter outputs voltage signal proportional to rotational speed into the CF-4500. Voltage signal is maintained when rotational speed is kept constant. Otherwise, rotational fluctuation appears as subtle variation in voltage. The CF-4500 can perform frequency analysis of voltage fluctuation and quality inspection in amplitude level by the Block Comparator Function. (Block Comparator Function: standard)

Imbalance inspection of turbofan

An imbalanced turbofan increases larger power spectrum level in rotational frequency. The CF-4500 can make OK/NG judgment whether the max value of waveform is within a specified block area or not by using Peak Max as a judgment method. OK when the max value of the waveform exists in a specified block and does not exceed the upper limit, or NG otherwise. (Block Comparator Function: standard)

Inspection of transmission noise by tracking analysis

The CF-4500 can perform quality control of transmission by tracking analysis of vibration signal from a transmission. In this example, the CF-4500 performs tracking analysis with rotational pulses from a rotation controller in a transmission tester. Rotational tracking analysis of meshing order is performed by varying rotational speed from idling to the maximum. OK/NG judgment of the transmission is made by setting a judgment line along the tracking data. (CF-0451 Tracking Function + CF-0452 Shape Comparator Function: options)

Diagnosis of bearing

The CF-4500 performs frequency analysis of abnormal vibration to monitor any damage of bearings. A basic frequency analysis according to a damaged part can be performed by optional Envelope & Band-pass Filter 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 hearing vibration through headphones. (CF-0454 Envelope & Band-pass Filter Function: option)
Quality control of power supply board in home appliances

This example shows how to control quality of a power supply board in home appliances. Sound coming from a power board is measured by the MI-1234 Microphone and the MI-3111 Preamplifier in a sound insulating box to avoid influence of background noise, and then input to the CF-4500 for frequency analysis. It can make OK/NG judgment with areal rate of content in power spectrum by setting up of a judgment block around the power frequency caused the noise.

(Block Comparator Function: standard)

Inspection of metal part by hammering sound

In this example, a metal part (e.g. a casting part) is suspended in free vibration for hammer exciting, and then the hammering sound is measured by the LA-5560 Integrating Sound Level Meter. The CF-4500 performs frequency analysis of the AC output from the Sound Level Meter to find difference of power spectrum shape between OK and NG products by using the Shape Comparator Function.

(CF-0452 Shape Comparator Function: option)

Quality control of power steering pump

Pulsatile vibration is generated when a hydraulic pump for power steering is performed by applying oil pressure. You can input vibration detected by an accelerometer and rotational pulse detected by a rotational detector to the CF-4500. The CF-4500 can make OK/NG judgment of vibration amplitude from rotational the 1st-order to the Nth-order of pulsatile vibration by Peak Hold Function.

(CF-0451 Tracking Function: option)

Quality control of wire harness

Vehicle’s wire harness inside a sliding door makes sound while the door is in motion. The sound can be used for quality control of the wire harness system. Drive a motor of wire harness system in a sound insulating box and the LA-1410 Sound Level Meter measures the sound from wire harness system. Then the CF-4500 performs frequency analysis of the AC output signal from the Sound Level Meter to make OK/NG judgment of the partial overall level in a specific frequency band.

(Block Comparator Function: standard)
Rear panel

Remotely controllable via LAN and RS232C interfaces from a PC etc.

DC power supply connector (+24VDC) is provided as a standard for a usage on production line. AC adapter can be also used. (sold separately)

Specifications

**Input**
- The following functions are assigned to the connectors.
  - Control by command assignment (max. 9 connectors)
  - Panel condition selection (4 connectors)
  - Judgment block changeover (2 connectors)

**Status Output**
- Outputs 4 kinds of statuses. (Comp-BUSY, OK, NG, ERROR)

**Block Output**
- Any 5 judgment setups can be selected from 20 and the results can be output.

Recommended Connection Circuit

**CF-4500**
- Input type: Driven by contact or open collector
- Logic: Negative logic (Lo=1, Hi=0)
- Power voltage: 5V
- Applicable plug: FK-MC 0,5/10-ST-2,5
  - (by Phoenix Contact. GmbH & Co. KG)
  - (provided as a standard accessory)

**External device side (example)**
- Input type: Open collector (4-circuit isolation)
- Output withstand voltage: 50V
- Output current: 25mA or more (sink)
- Collector saturation voltage: 1.0V or less
- Logic: Negative logic (Lo=1, Hi=0)
- Applicable plug: FK-MC 0,5/8-ST-2,5
  - (by Phoenix Contact. GmbH & Co. KG)
  - (provided as a standard accessory)

System Configuration

Detector for external sample input
- Rotation
  - Rotational detector
  - LG-916
  - MP-981/8820
  - HT-5500

- AX-501

- MX-8105

- EXT-SAMP

- SIG IN

Detector
- Laser Doppler vibrometer
  - LV series
  - NP-0021
  - Charge converter
    - NP-0120/0130/0150 series

- Accelerometer
  - NP-3000 series

- Charge output type accelerometer
  - NP-2000 series

Sound
- Sound Level Meter
  - LA series
- Preamp
  - MI-3111
- Microphone
  - MI-1234/1432

Other amplifiers

Programmable Logic Controller

Personal Computer

LAN

RS-232C
Specifications

Input Section

General input
- Number of input channels, type: 1 channel, single-ended
- Connector, signal type: BNC, voltage/CCD (4mA, +24V/TEDS Ver1.0 or later)
- Input coupling: AC/DC
- Input impedance: 10kΩ
- Voltage range: 10mVrms-31.6Vrms, 8 ranges
- Dynamic range: 90dB (in 1Vrms range)
- External trigger input
- Connector, signal type: BNC, voltage
- Input voltage range: ±10V
- Trigger source, mode: Internal/external, Free/Repeat/Single/One-shot
- HPF, LPF: HPF; 1Hz, 10Hz / LPF: 1kHz, 10kHz (-18dB/oct)
- Frequency weighting filter: A/C JIS C1509-1 Class1, IEC61672-1 Class1

Analysis Section

- Frequency range: from 20Hz to 40kHz, 21 ranges
- Number of sampling points: 256/512/1024/2048/4096
- Real-time frequency range: 20kHz
- Window function: Hannig / Rectangular / Flat-top
- Averaging processing
- Type: Number of times (1 to 8192 times) or time duration (0.1 to 100 seconds)
- Time domain: Summation average
- Frequency domain: Summation average, exponential average, PeakHold, MaxOverAll (excluding phase spectrum)
- Phase spectrum: Summation average
- Amplitude domain: Summation average
- Time-axis waveform processing: DC cancel, trend elimination, absolute value, polarity inversion, first/second order derivative, single/double integration
- Frequency-axis waveform processing
  - Processing function: Time-axis waveform
  - Time domain: Time-axis waveform
  - Frequency domain: Power spectrum, Fourier spectrum, octave (1/1, 1/3)
  - Amplitude domain: Probability density function, probability distribution function

Comparator

- Block comparator
  - Target waveform: Power spectrum, octave (1/1, 1/3, 1/6), order spectrum
  - Maximum number of setup blocks: 20 blocks
  - Judgment method: PeakLevel, PeakMax, POA, areal rate of content, level ( Judgment method can be specified for each block.)
  - Judgment criterion: AND or OR of all specified blocks
  - Judgment mode: Continuous mode, single mode
  - Automatic data storage function: Only for NG or all measurement results
  - Timer function: Comparator start delay time and judgment execution time can be specified.
  - Specified time: 0 to 255 seconds in one-second steps
  - Judgment output
    - Judgment contents: Total judgment result and individual judgment result of up to 5 specified blocks or shapes
    - Connectors: Rear panel digital I/O, open-collector output
      - *Common isolation (Common for individual judgment output connector is shared.)

Display

- Display: 6.5-inch TFT color LCD (640 x 480) with touch panel
- Waveform display mode: Single, double, and overlay
- Y-axis scale: m/s, m/s, mm, μm, Pa, dB, V
- Y-axis unit: m/s², m/s, mm, μm, Pa, dB, V, Vrms (automatic unit conversion by derivative/integration)
- X-axis scale: Default / expanded display function
- X-axis unit: Hz, ORD, r/min, s (sec)
- Search function: Peak cursor, search cursor, search enhance
- List display
  - Number of points: 40 points (peak value or user-defined)
  - Harmonics: Up to 40th-order harmonics (with fit function)
- Comparator judgment display: Total judgment, and list display for individual judgment

Memory Function

- Screen data format: DAT, TXT, BMP, TRC (number of data: 300)
- Panel condition
  - Number of memory devices: 50
  - Contents of storage: Measurement conditions, comparator conditions (block and shape comparator setup, judgment conditions etc.)
  - Other functions: Deactivation-time auto store function, activation-time auto recall function

Interface

- Digital I/O
  - Number of input signals: 9 inputs, open collector (shared common)
  - Input function: The following functions are assigned to the connectors.
    * Control by command assignment (up to 9 kinds)
    * Panel condition selection (15 kinds)
    * Judgment block changeover (4 blocks)
  - Number of output signals: 9 outputs, open collector
    * Common isolation (Common for individual judgment output is shared.)
  - Output signal: Comp-BUSY, OK, NG, ERROR
    * Individual judgment output (any 5 outputs)
  - RS-232C: Control of the CF-4500
  - Baud rate: 1,200, 2,400, 4,800, 9,600, 19,200, 38,400bps
  - USB: USB 2.0 high speed
    - USB (A connector)
      - For USB memory
      - For USB mass storage class (connection to a PC)
  - BUS (A connector)
    - For USB memory
    - For USB mass storage class (connection to a PC)
  - LAN: Control of the CF-4500
    - Standards: 10BASE-T/100BASE-TX/1000BASE-T

General Specifications

- Power requirement: 24VDC or exclusive AC adapter (100 to 240 VAC, sold separately)
- Power consumption: 10W (AC adapter)
- Operating temperature /humidity range: 0 to 40°C (with no condensation)
- Outer dimensions: 149 (H) x 220 (W) x 250 (D) mm (not including protruded section)
- Weight: Approx. 3.3kg
- Accessories: Instruction manual (User Guide x 1, Reference guide CD-ROM x 1), terminal board socket (for DC power supply x 1, for I/O 10-pin x 1, 8-pin x 1, 6-pin x 1)
  *AC adapter is sold separately.

Optional Functions

- **CF-0451 Tracking Function**
  - Tracking analysis type: Constant speed or constant ratio
  - Schedule: Rotational speed or time
  - Maximum analysis order: 6.25, 12.5, 25, 50, 100, 200, 400, 800
  - Rotational speed order (1P/R input):
    - Maximum analysis order: 6.25
    - Measurable rotational speed (r/min)
      - 1,200 to 190,000
    - 12.5
      - 200 to 96,000
    - 25
      - 150 to 48,000
    - 50
      - 150 to 24,000
    - 100
      - 150 to 12,000
    - 200
      - 100 to 6,000
    - 400
      - 100 to 3,000
    - 800
      - 100 to 1,250

  - Processing function: Maximum amplitude order, POA, OrderPeak, OrderBand
  - Smoothing processing: Exponential averaging processing, smoothing processing (Type 1, Type 2)
  - Rotational slope: Rising (+), falling (-), rising(+)/falling (-)
  - Trace data
    - External sample / rotational sensor input
      - sensor input section
        - Level specification by one standard line
      - Judgment criterion: Range specification between two standard lines
        - Level specification by one standard line
  - CF-0453 Band-pass Filter & Monitor Function
    - Frequency setup range: HFP, LPF: 50kHz to 10kHz (-24dB/OCT)
    - Output connector: ø3.5 mini jack
  - CF-0454 Envelope & Band-pass Filter Function
    - Method: 1kHz low-pass filter method
    - *The specifications of judgment mode, automatic data storage function and judgment output are equivalent to the block comparator function.
  - CF-0453 Band-pass Filter & Monitor Function included.
  - *CF-0455 Power Supply Backup Function
    - Power failure countermeasure: If instantaneous power failure or power line function disconnection occurs, the CF-4500 is deactivated in normal manner.
    - Automatic activation function: When the power is supplied, the CF-4500 is automatically activated with setup conditions.
### Outer Dimensions

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Product name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CF-4500</td>
<td>FFT Comparator</td>
</tr>
<tr>
<td>CF-0451</td>
<td>Tracking Function</td>
</tr>
<tr>
<td>CF-0452</td>
<td>Shape Comparator Function</td>
</tr>
<tr>
<td>CF-0453</td>
<td>Band-pass Filter &amp; Monitor Function</td>
</tr>
<tr>
<td>CF-0454</td>
<td>Envelope &amp; Band-pass Filter Function</td>
</tr>
<tr>
<td>CF-0458</td>
<td>Power Supply Backup Function</td>
</tr>
<tr>
<td>CF-0459</td>
<td>Protection panel</td>
</tr>
<tr>
<td>CF-0702</td>
<td>Stylus pen</td>
</tr>
<tr>
<td>CF-0703</td>
<td>USB cable</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Model Name</th>
<th>Product Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>SQ60W15P</td>
<td>AC adapter</td>
</tr>
<tr>
<td>Power cable</td>
<td>VM1048-VM1099 (2m) 100V for Japan</td>
</tr>
<tr>
<td>VM0238-VM0225 (2m) 120V for USA</td>
<td></td>
</tr>
<tr>
<td>VM0718-VM0719 (1.5m) 240V for China (A plug)</td>
<td></td>
</tr>
<tr>
<td>VM0311-VM0322 (2m) 240V for Europe (C plug)</td>
<td></td>
</tr>
<tr>
<td>PE3532788 (20cm) R03=BNC conversion cable</td>
<td></td>
</tr>
</tbody>
</table>

- *The CF-0454 includes the CF-0453 Band-pass Filter & Monitor Function.*
- *The input connector for the CF-0451 Tracking Function can be selected from BNC (standard) or R03-R6F (specified at the time of order).*

*Outer appearance and specifications are subject to change without prior notice.*

URL: [http://www.onosokki.co.jp/English/english.htm](http://www.onosokki.co.jp/English/english.htm)