



# Foil Strain Gauges F series (GOBLET) CE



Strain gauges compliant to RoHS2 Directive 2011/65/EU are added to the lineup in F series. They are supplied with CE marking as standard specification. Our logo GOBLET, which is an abbreviation of "Gauges Of Brilliant Lifespan and Environmental Thoughtful", is marked on the package of these gauges.

|                                |             |                      |                |
|--------------------------------|-------------|----------------------|----------------|
| Operating temperature range    | -196~+150°C | Applicable adhesives | CN -196~+120°C |
| Temperature compensation range | +10~+100°C  | P-2                  | -30~+150°C     |
|                                |             | EB-2                 | -60~+150°C     |

Please specify the type number as shown in the example below.

**FLAB -5 (-350) -11 -3LJC-F**

Objective material for temperature compensation (coefficient of linear thermal expansion  $\times 10^{-6}/^{\circ}\text{C}$ )

-11: Mild steel ■ -17: Stainless steel ■ -23: Aluminium ■

| Gauge pattern                              | Type        | Gauge size(mm) |       | Backing size(mm) |       | Resistance $\Omega$ |
|--|-------------|----------------|-------|------------------|-------|---------------------|
|  |             | Length         | Width | Length           | Width |                     |
| <b>●Single axis</b>                        |             |                |       |                  |       |                     |
|  |             |                |       |                  |       |                     |
| <b>General use</b>                         | FLGB-02     | 0.2            | 1.4   | 3.5              | 2.5   | 120                 |
|  | FLGB-1      | 1              | 1.1   | 6                | 2.5   | 120                 |
|  | FLAB-03     | 0.3            | 1.4   | 3                | 2     | 120                 |
|  | FLAB-05     | 0.5            | 1.2   | 4.3              | 2.2   | 120                 |
|  | FLAB-1      | 1              | 1.3   | 5                | 2.5   | 120                 |
|  | FLAB-2      | 2              | 1.5   | 6.5              | 3     | 120                 |
|  | FLAB-3      | 3              | 1.7   | 7.7              | 3.5   | 120                 |
|  | FLAB-3-60   | 3              | 1.2   | 7.7              | 3     | 60                  |
|  | FLAB-5      | 5              | 1.5   | 10               | 3     | 120                 |
|  | FLAB-6      | 6              | 2.2   | 11               | 4.3   | 120                 |
|  | FLAB-10     | 10             | 2.5   | 15.4             | 5     | 120                 |
|  | FLAB-30     | 30             | 2     | 35               | 5     | 120                 |
|  | FLKB-1      | 1              | 0.7   | 4.5              | 1.4   | 120                 |
| <b>FLK pattern with narrow gauge width</b> | FLKB-2      | 2              | 0.9   | 5.5              | 1.5   | 120                 |
|  | FLKB-6      | 6              | 1     | 11               | 2.2   | 120                 |
|  | FLKB-10     | 10             | 1.6   | 15               | 3.8   | 120                 |
|  | FLAB-1-350  | 1              | 1.6   | 4.5              | 3     | 350                 |
| <b>●350Ω Single axis</b>                   | FLAB-1W-350 | 1              | 2     | 4.7              | 3.6   | 350                 |
|  | FLAB-2-350  | 2              | 1.9   | 6                | 3.5   | 350                 |
| <b>Gauge resistance 350Ω</b>               | FLAB-3-350  | 3              | 1.6   | 7.2              | 3     | 350                 |
|  | FLAB-3W-350 | 3              | 3.2   | 8.5              | 5     | 350                 |
|  | FLAB-5-350  | 5              | 1.8   | 9.4              | 3.8   | 350                 |
|  | FLAB-6-1000 | 6              | 4.6   | 11               | 7     | 1000                |
| <b>Gauge resistance 1000Ω</b>              |             |                |       |                  |       |                     |

Minimum order quantity is 10 strain gauges.




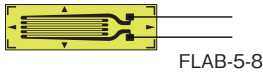
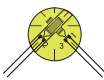
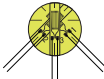
# F series (GOBLET)

| Gauge pattern                               | Type   | Gauge size(mm) |       | Backing size(mm) |       | Resistance Ω |
|---|--|----------------|-------|------------------|-------|--------------|
|   |  | Length         | Width | Length           | Width |              |
| <b>● 0° / 90° 2-axis Stacked type</b>       |  |                |       |                  |       |              |
|   | FCAB-1   | 1              | 0.7   | φ 4.5            |       | 120          |
|   | FCAB-2   | 2              | 0.9   | φ 7              |       | 120          |
|   | FCAB-3   | 3              | 1.7   | φ 11             |       | 120          |
|   | FCAB-5   | 5              | 1.9   | φ 12             |       | 120          |
|   | FCAB-6   | 6              | 2.4   | φ 14             |       | 120          |
|   | FCAB-10  | 10             | 2.5   | φ 17             |       | 120          |
|   | <b>● 350Ω 0° / 90° 2-axis Stacked type</b>       |                |       |                  |       |              |
|   | FCAB-1-350                                       | 1              | 1.6   | φ 8              |       | 350          |
|   | FCAB-2-350                                       | 2              | 1.9   | φ 9.5            |       | 350          |
|   | FCAB-3-350                                       | 3              | 2     | φ 10             |       | 350          |
|   | FCAB-5-350                                       | 5              | 1.8   | φ 10             |       | 350          |
| <b>● 0° / 45° / 90° 3-axis Stacked type</b> |  |                |       |                  |       |              |
|   | FRAB-1   | 1              | 0.7   | φ 4.5            |       | 120          |
|   | FRAB-2   | 2              | 0.9   | φ 7              |       | 120          |
|   | FRAB-3   | 3              | 1.7   | φ 11             |       | 120          |
|   | FRAB-5   | 5              | 1.9   | φ 12             |       | 120          |
|   | FRAB-6   | 6              | 2.4   | φ 14             |       | 120          |
|   | FRAB-10  | 10             | 2.5   | φ 17             |       | 120          |
|   | <b>● 350Ω 0° / 45° / 90° 3-axis Stacked type</b> |                |       |                  |       |              |
|   | FRAB-1-350                                       | 1              | 1.6   | φ 8              |       | 350          |
|   | FRAB-2-350                                       | 2              | 1.9   | φ 9.5            |       | 350          |
|   | FRAB-3-350                                       | 3              | 2     | φ 10             |       | 350          |
|   | FRAB-5-350                                       | 5              | 1.8   | φ 10             |       | 350          |

Minimum order quantity is 10 strain gauges.

## GLASS, CERAMIC USE

Please specify the type number as shown in the example below.  
-8: Glass, Ceramic 

| Gauge pattern  | Type     | Gauge size(mm) |       | Backing size(mm) |       | Resistance Ω |
|--|----------|----------------|-------|------------------|-------|--------------|
|  |          | Length         | Width | Length           | Width |              |
| <b>● Single axis</b><br><br>FLAB-5-8                        | FLAB-2-8 | 2              | 1.5   | 6.5              | 3     | 120          |
|  | FLAB-5-8 | 5              | 1.5   | 10               | 3     | 120          |
| <b>● 0° / 90° 2-axis Stacked type</b><br><br>FCAB-2-8       | FCAB-2-8 | 2              | 0.9   | φ 7              |       | 120          |
|  | FCAB-5-8 | 5              | 1.9   | φ 12             |       | 120          |
| <b>● 0° / 45° / 90° 3-axis Stacked type</b><br><br>FRAB-2-8 | FRAB-2-8 | 2              | 0.9   | φ 7              |       | 120          |
|  | FRAB-5-8 | 5              | 1.9   | φ 12             |       | 120          |

Minimum order quantity is 10 strain gauges.

## Dedicated leadwires recommendable for F series strain gauge(GOBLET)

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 32 to 40 for the details of combination of a strain gauge and a leadwire. For CE marked GOBLET series strain gauges, only the leadwires using lead-free solder are available.

Type and designation of leadwires (GOBLET)

| Usage  | Leadwire name                         | Operating temperature range of leadwire (°C) | Type number example                         |
|--|---------------------------------------|--|---|
| General purpose (without temperature change) | Paralleled vinyl LJB-F                | -20 ~ +80                                    | FLAB-5-11-3LJB-F                            |
|  | Paralleled vinyl LJC-F                |  | FLAB-5-11-3LJC-F                            |
| General use                                  | 3-wire paralleled vinyl LJBT-F        | -20 ~ +80                                    | FLAB-5-11-3LJBT-F                           |
|  | 3-wire paralleled vinyl LJCT-F        |  | FLAB-5-11-3LJCT-F                           |
| Mid-high temperature                         | 3-wire paralleled vinyl LXT-F         | -20 ~ +150                                   | FLAB-5-11-3LXT-F                            |
| 1-Gauge 4-Wire measurement                   | Polypropylene 4-wire paralleled LQM-F | -20 ~ +100                                   | FLAB-5-11-3LQM-F<br>(modular plug attached) |

NB: For use with CE compliant GOBLET strain gauges, specify leadwire with option -F having lead-free solder on order.

## Dedicated leadwires recommendable for F series strain gauge

We supply various leadwires dedicated to strain gauges so as to meet our customers' requirements. Please refer to page 32 to 40 for the details of combination of a strain gauge and a leadwire.

Type and designation of leadwires

| Usage  | Leadwire name                             | Operating temperature range of leadwire (°C) | Type number example                      |
|--|---|--|--|
| General purpose (without temperature change) | Paralleled vinyl LJB/LJB-F                | -20 ~ +80                                    | FLA-5-11-3LJB                            |
|  | Paralleled vinyl LJC/LJC-F                |  | FLA-5-11-3LJC                            |
| General use                                  | 3-wire paralleled vinyl LJBT/LJBT-F       | -20 ~ +80                                    | FLA-5-11-3LJBT                           |
|  | 3-wire paralleled vinyl LJCT/LJCT-F       |  | FLA-5-11-3LJCT                           |
| Mid-high temperature                         | 3-wire paralleled vinyl LXT/LXT-F         | -20 ~ +150                                   | FLA-5-11-3LXT                            |
| Temperature integration                      | 3-wire paralleled vinyl TLJBT/TLJBT-F     | -20 ~ +80                                    | FLA-5-T-11-3TLJBT                        |
| 1-Gauge 4-Wire measurement                   | Polypropylene 4-wire paralleled LQM/LQM-F | -20 ~ +100                                   | FLA-5-11-3LQM<br>(modular plug attached) |



# F series

In the F series, strain gauges dedicated to a special usage (shearing strain measurement, torque measurement, residual stress measurement or stress concentration measurement) and 2-axis plane type strain gauges are compliant to RoHS Directive when they are supplied with Option-F.

|                                |             |                      |                |
|--------------------------------|-------------|----------------------|----------------|
| Operating temperature range    | -196~+150°C | Applicable adhesives | CN -196~+120°C |
| Temperature compensation range | +10~+100°C  | P-2                  | -30~+150°C     |
|                                |             | EB-2                 | -60~+150°C     |

Please specify the type number as shown in the example below.

**FLT-05A (-350) -11 (-F) -3LJC (-F)**

↑ Gauge series name  
 ↑ Gauge resistance (blank for 120Ω)  
 ↑ Objective material for temperature compensation  
 ↑ Option F: LEAD-free soldering of strain gauge  
 ↑ Length in meter and type of integral leadwire  
 ↑ Option F: LEAD-free soldering of leadwire

Objective material for temperature compensation (coefficient of linear thermal expansion  $\times 10^{-6}/^{\circ}\text{C}$ )  
 -11: Mild steel ■ -17: Stainless steel ■ -23: Aluminium ■

## Shearing • Torque • Plane

| Gauge pattern                            | Type      | Gauge size(mm) |       | Backing size(mm)        |       | Resistance Ω |
|--|-----------|----------------|-------|-------------------------|-------|--------------|
|  |           | Length         | Width | Length                  | Width |              |
| <b>● Shearing strain measurement</b><br> | FLT-05A   | 0.55           | 0.66  | 4                       | 1.3   | 120          |
|  | FLT-05B   | 0.55           | 0.66  | 4                       | 1.3   | 120          |
| <b>● Torque measurement</b><br>          | FCT-2     | 2              | 1.5   | 8.7                     | 6.5   | 120          |
|  | FCT-2-350 | 2              | 1.5   | 7.6                     | 5.3   | 350          |
| <b>● 0° / 90° 2-axis Plane type</b><br>  | FCB-2     | 2              | 1.5   | X / Y axis<br>8.2   8   |       | 120          |
|  | FCB-6-350 | 6              | 2     | X / Y axis<br>10   11.9 |       | 350          |

Minimum order quantity is 10 strain gauges.

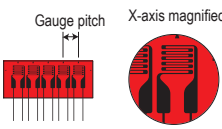
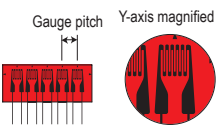
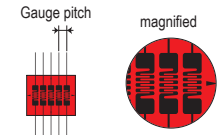
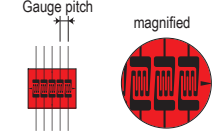

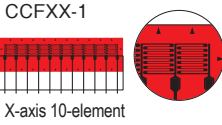
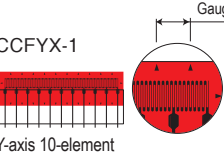



## Residual stress measurement

| Gauge pattern   | Type    | Gauge size(mm) |       | Backing size(mm) |       | Resistance Ω |
|---|---------|----------------|-------|------------------|-------|--------------|
|   |         | Length         | Width | Length           | Width |              |
| <b>● Residual stress measurement</b><br>                            | FR-5    | 5              | 1.5   | Φ12              |       | 120          |
|   | EUBC-06 | 0.6            | 0.7   | Φ2.4             |       | 120          |
| <b>● Residual stress measurement using hole drilling method</b><br> | FRAS-2  | 2              | 1.1   | 9                | 9     | 120          |
|   | FRS-2   | 1.5            | 1.3   | Φ9.5             |       | 120          |
|   | FRS-3   | 3              | 2.6   | Φ17.5            |       | 120          |

Gauge center diameter

Minimum order quantity is 10 strain gauges.

## Stress Concentration Measurement

| Gauge pattern   |   | Type  | Gauge size(mm) |       | Backing size(mm) |       | Resistance $\Omega$ |
|---|---|---|----------------|-------|------------------|-------|---------------------|
|   |   |   | Length         | Width | Length           | Width |                     |
| <b>●5-element Single-axis</b>   |   |   |                |       |                  |       |                     |
| FXV-1-11-002LE  | FYV-1-11-002LE  |   |                |       |                  |       |                     |
|    |    |   |                |       |                  |       |                     |
| Gauge pitch 2mm   |   | FXV-1-11-002LE  | 1              | 1.3   | 5                | 12    | 120                 |
|   |   | FYV-1-11-002LE  | 1              | 1.4   | 5                | 12    | 120                 |
| -002LE: Polyimide insulated gauge lead of 2-cm pre-attached   |   |   |                |       |                  |       |                     |
| FBXV-04   | FBYV-06   |   |                |       |                  |       |                     |
|    |    |   |                |       |                  |       |                     |
| Gauge pitch 1mm   |   | FBXV-04-11-005LE  | 0.4            | 1.3   | 5.4              | 7.4   | 120                 |
|   |   | FBYV-06-11-005LE  | 0.6            | 0.8   | 5.3              | 7     | 120                 |
| -005LE: Polyimide insulated gauge lead of 5-cm pre-attached   |   |   |                |       |                  |       |                     |
| <b>●10-element 2-axes</b>   |   |   |                |       |                  |       |                     |
| FCV-1   |  | X and Y axes<br>Y-axis leadwire is marked for identification. |                |       |                  |       |                     |
| Gauge pitch 2mm   |   | FCV-1-11-005LE  | 1              | 1.4   | 7.5              | 12    | 120                 |
| -005LE: Polyimide insulated gauge lead of 5-cm pre-attached   |   |   |                |       |                  |       |                     |
| <b>●Chain Strain Gauges</b>   |   |   |                |       |                  |       |                     |
| CCFXX-1   | CCFYX-1   |   |                |       |                  |       |                     |
|    |  |   |                |       |                  |       |                     |
| Gauge pitch 1.5mm   |   | CCFXX-1-11-002LE  | 1              | 1.5   | 4.5              | 16.4  | 120                 |
|   |   | CCFYX-1-11-002LE  | 1              | 1.5   | 4.5              | 16.4  | 120                 |
| -002LE: Polyimide insulated gauge lead of 2-cm pre-attached   |   |   |                |       |                  |       |                     |
| These gauges are specially designed to use Complete Compensation Method of Strain and need our Data Logger TDS-540 for the measurement. For details, contact TML. |   |   |                |       |                  |       |                     |
| <b>●Single axis</b>   |   |   |                |       |                  |       |                     |
| Single element cut away from the above Stress Concentration gauge   |   |   |                |       |                  |       |                     |
| FBX-04  |  | Q (x 3)   |                |       |                  |       |                     |
| FBY-06  |  | Q (x 3)   |                |       |                  |       |                     |
| FLX-1   |  | Q (x 3)   |                |       |                  |       |                     |
| -005LE: Polyimide insulated gauge lead of 5-cm pre-attached<br>-002LE: Polyimide insulated gauge lead of 2-cm pre-attached  |   |   |                |       |                  |       |                     |
| Minimum order quantity is 10 strain gauges.   |   |   |                |       |                  |       |                     |



### Important point

#### Option F

This code is appended to the basic strain gauge type for strain gauges with lead-free solder in place of leaded solder. Fatigue life of the strain gauge may become shorter by the use of the lead-free solder.



### Note

These gauges are specially designed to use Complete Compensation Method of Strain and need our Data Logger TDS-540 for the measurement. For details, contact TML.