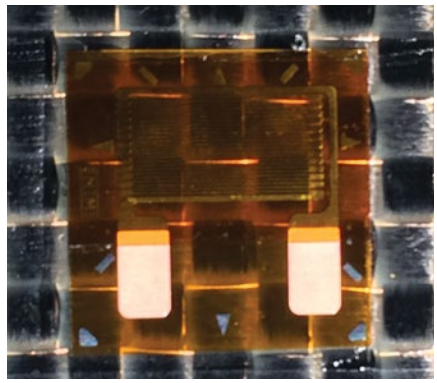
MICRO MEASUREMENTS
A VPG Brand

Strain Gage Installation Checklist

Composite and Plastic Materials

Strain Measurements for Plastics and Composites



Composites typically have one of two surface conditions. The tooling side is usually smooth requiring slight roughening to give the adhesive something to bite into. The non-tooling side is usually rough due to the layup of either woven or filament wound or random orientation carbon fiber filaments. This kind of surface typically needs to be as filled to make it smooth enough for bonding. The gage length is dictated by the desired averaging. With woven composites, that would typically be 3-5 cycles of the weave. Since composites are typically poor conductors of heat, pre-cabled gages or gages with preattached leadwires are highly recommended. For long-term dynamic loading conditions, strain gages with maximum fatigue life may be required.

Step 1
Define the Test Conditions

Conditions to Consider	Your Test Conditions
Static measurement One sample per second or less, steady loading	
Dynamic measurement Cyclical or impact loading, high frequency Event duration Anticipated frequency	
Installation longevity Short Term: Hours, days, weeks Long Term: Months, years	
Environment Maximum temperature Minimum temperature Exposure (outdoors, oil, chemicals)	

Step 2
Ensure Appropriate Surface Preparation Materials Are On Hand

Use the recommended **surface preparation materials** for composite materials:

GC-6 alcohol
GSP-1 gauze sponge
400-grit SCP-3 silicon carbide paper
CSP-1 cotton-tipped applicator
M-Prep Neutralizer 5A
M-Prep Conditioner A
PCT-3M gage installation tape
PDT-3 drafting tape

Reference **Related Documents**: SEARCH our website using the document number.
11129 – Instruction Bulletin B-129; **11183** – Application Note VMM-19

Strain Gage Installation Checklist

Composite and Plastic Materials

MICRO MEASUREMENTS
A VPG Brand

Step 3
Select the Strain Sensor

Consult the Micro-Measurements team and/or review our **Tech Note TN-505**, "Strain Gage Selection – Criteria, Procedures, Recommendations" for detailed information about the strain gage selection process.

Step 3A: Select the Gage Series for the Temperature Range

Consider the temperature range that will be encountered during the strain measurements and select a **Gage Series** that meets your requirements.

Gage Series	Temperature Range	Features
CEA	–100°F to +350°F (–75°C to +175°C)	Universal, general-purpose strain gages. Large, easily soldered tabs. Precabled (Option P2) available.
C2A	–60° to +180°F (–50° to +80°C)	Precabled, general-purpose strain gages.
WK	–452° to +550°F (–269° to 290°C)	Widest temperature range and most extreme environmental capability of any general-purpose gage when self-temperature compensation is required. High fatigue-endurance leadwires.
WD	–320° to +500°F (–195° to 260°C)	Highest fatigue life, for dynamic applications only. High endurance leadwires and wide temperature range.

Step 3B: Choose the STC for Your Material

Self-Temperature-Compensation (STC) numbers of **00, 03, and 06** are often selected for composite materials when the measurements involve changes in temperature. For constant-temperature measurements where thermal output is not a concern, 06 is often selected due to higher stock availability. Since composites and plastics offer poor heat sink conditions, strain gages with 350 Ω resistance or higher are often selected.

Step 3C: Consider the Geometry

The strain gages below are popular for strain measurements on composites. Check **Super Stock** for gages that are available to ship promptly.

Type	Gage Designation	Geometry/Construction	Super Stock
For Static and Low-Fatigue Dynamic Measurements	**C2A-06-125LW-350**	Linear pattern, precabled	Yes
	C2A-06-250LW-350	Linear pattern, precabled	Yes
	C2A-06-125LT-350	0-90 degree tee rosette, precabled	Yes
	CEA-06-125UN-350	Linear pattern	Yes
	CEA-06-250UW-350	Linear pattern	Yes
	CEA-03-250UW-350	Linear pattern	Yes
	CEA-06-125UT-350	0-90 degree tee rosette	Yes
	CEA-06-125UB-350	Linear pattern, solder tabs on side	No
	CEA-06-250UB-350	Linear pattern, solder tabs on side	No
	CEA-06-250UT-350	0-90 degree tee rosette	Yes
	CEA-06-500UW-350	Linear pattern, long gage length	Yes
For Dynamic Measurements (High Fatigue)	**WK-06-250BG-350**	Linear pattern, wide temperature	No
	WD-DY-250BG-350	Linear pattern, highest fatigue life	No
	WK-06-120WT-350	0-90 degree tee rosette, wide temperature	No
	WD-DY-120WT-350	0-90 degree tee rosette, highest fatigue life	No

MICRO MEASUREMENTS
A VPG Brand

Strain Gage Installation Checklist

Composite and Plastic Materials

Step 4
Select the Adhesive

Adhesive	Conditions to Consider	
M-Bond 200 Kit	Most frequently used adhesive for short-term room temperature testing, with fast installation	
M-Bond AE-10	Long term testing where room temperature cure is required	Used as a filler for rough surfaces prior to gage bonding, as well as for the strain gage adhesive
M-Bond GA-61 or **EPY-500**	Elevated temperature testing	

Follow the instructions included with the adhesive for application and cure requirements.

Application Kits contain specific adhesives, surface preparation materials, and in some cases wire and coatings necessary for a successful strain gage installation on plastics and composites.

- **BAK-200 Kit**
  Contains M-Bond 200 adhesive and basic materials for surface preparation (does not include GC-6 Alcohol). Excellent for use with pre-cabled gages.
- **GAK-2-AE-10 Kit**
  Contain all materials needed to install strain gages on plastics and composites, including solder and cable.

Step 5
Select Cable and Solder Terminals

Micro-Measurements offers a variety of **cable types** for gage installation on plastics and composites. For ease of installation, consider pre-cabled gages; no additional cable is required unless length needs to be extended.

Cable	Conditions to Consider
Vinyl Insulated	Room temperature testing
Teflon Insulated	Wide temperature range testing, high moisture or water immersion, and chemical resistance

Solder Terminals	Conditions to Consider
Bondable Terminals	Bonded to the test structure, these can be used as transition or anchor point for cable.

Step 6
Select a Solder

Micro-Measurements has a wide selection of **solder** for strain gage applications. Solder melt point should be at least 50°F (28°C) above the maximum operating temperature. Solder is not needed when using pre-cabled gages.

Step 7
Select a Protective Coating

Consider the environmental conditions that the coating will need to resist and any application issues, such as:

Environmental Conditions	Application Issues
• Temperature range • Humidity • Chemical exposure • Localized reinforcement concerns	• Vertical surface • Horizontal surface • Component sensitivity

For room temperature testing in a laboratory environment, the most popular coating is **M-Coat A**. For field testing, **M-Coat JA**, **M-Coat F**, and **Barrier E** are rugged and waterproof.

For testing in other environments and temperatures, refer to the **Protective Coating Selection Guide** to select the proper coating.

Strain Gage Installation Checklist

Composite and Plastic Materials

MICRO MEASUREMENTS
A VPG Brand

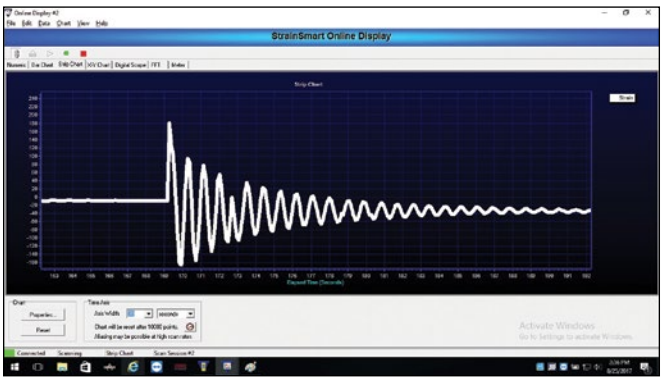
Step 8
Select the Measurement Instrumentation

Micro-Measurements offers a wide variety of **instrumentation** specifically designed and optimized for strain measurement. Simple Strain Indicators are available for high-accuracy static measurements. Signal Conditioning Amplifiers accept direct strain gage input and provide a conditioned signal output in the ±10 V range. Data Systems accept direct strain gage input and provide reduced data, already in engineering units of strain and/or stress.

P3
Strain Indicator

StudentDAQ

D4 Data Acquisition
Conditioner



StrainSmart® Data Acquisition Software

System 8000 Data Acquisition

System 9000 Data Acquisition

Pacific Instruments
Series 6000 Data Acquisition System