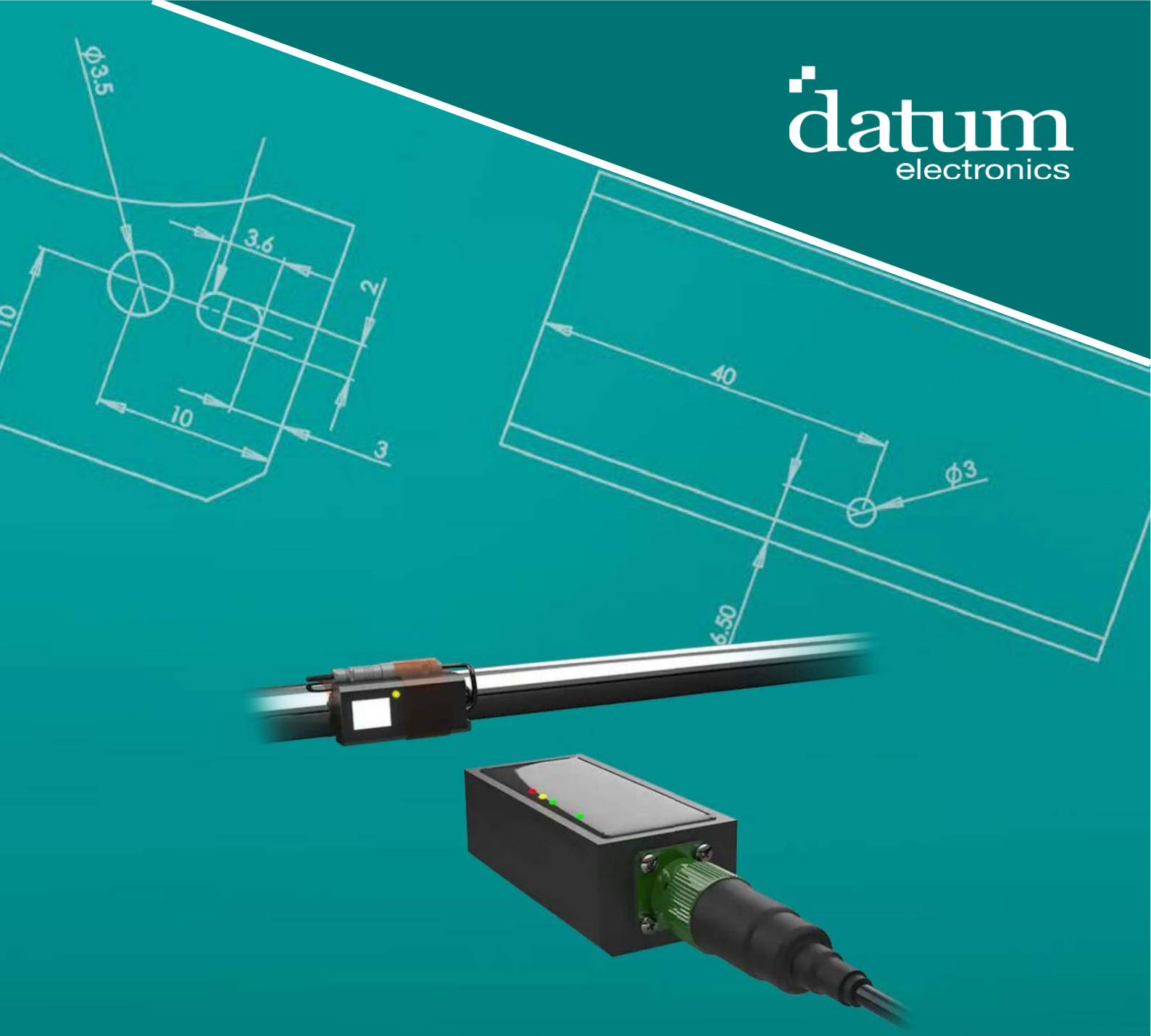
datum electronics



Shaft Power Measurement Kit

INSTALLATION GUIDE

MADE IN BRITAIN

PRECISION. DATA. INNOVATION.

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STRAIN GAUGE INSTALLATION FOR SHORT TERM USAGE

INTRODUCTION

Datum Electronics Shaft Power Measurement Kit is a user installable test system that measures shaft torque and shaft speed and hence shaft power.

Shaft Power (W) =

Shaft Torque (Nm) x Shaft Speed (RPM) x $\pi/30$

Shaft Torque is measured as shaft strain by a strain gauge bonded to the surface of the shaft. The Torque is proportional to the strain for any shaft as a function of the shaft material and its diameter.

Shaft Speed is measured by an optical sensor in the receiver that is directed at reflective tape on the shaft.

The on-shaft transmitter is powered by a PP3 9V battery giving a run time of approximately 10 hours. The transmitter has an input connector for the on-shaft strain gauge and transmits the strain value, the speed, and some diagnostic data.

The static receiver combines the data from the receiver with the RPM pulse in a built-in optical sensor and transmits this data to the test computer via USB from the interface unit.

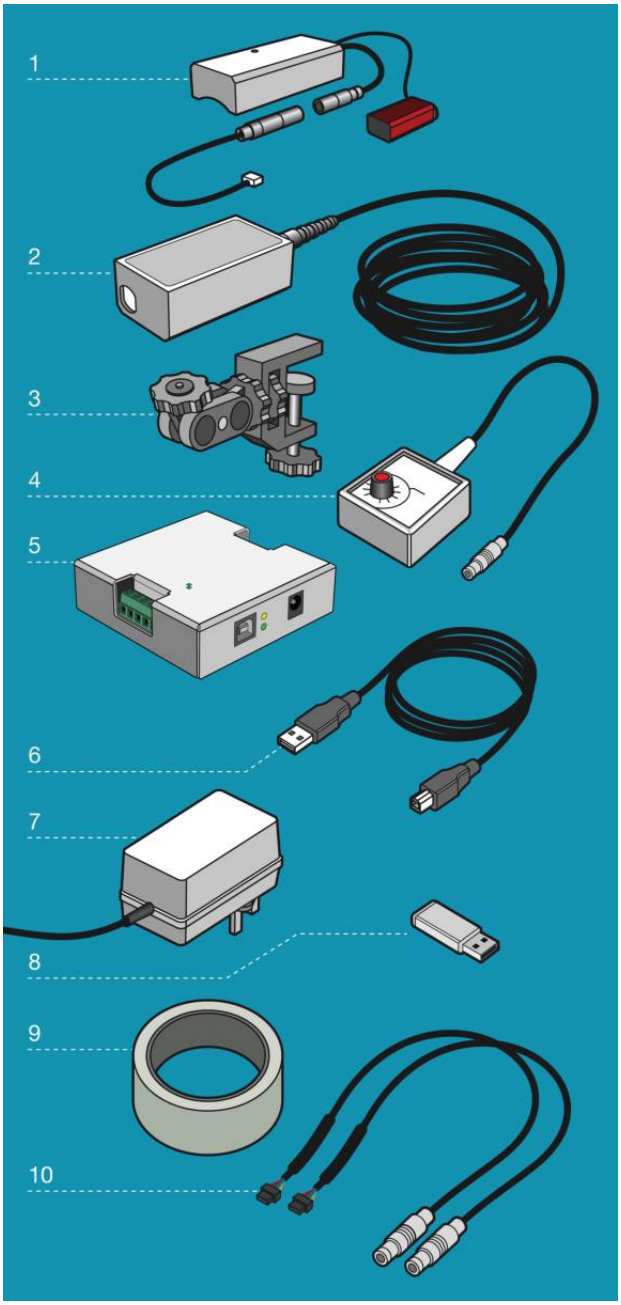
SYSTEM OUTLINE

The system consists of four basic elements:

- SHAFT MOUNTED TRANSMITTER WITH THE STRAIN GAUGE
- RECEIVER WITH THE OPTICAL RPM SENSOR
- INTERFACE UNIT
- PC SOFTWARE TO DISPLAY AND LOG THE DATA

SYSTEM HARDWARE

DESCRIPTION			QUANTITY
• 1:	Transmitter (400102)	[shown with PP3 battery]	1
• 2:	Receiver (400107)	[shown with RS-485 cable]	1
• 3:	Receiver Mounting Clamp		1
• 4:	Strain Gauge Simulator		1
• 5:	Interface Unit (401444)		1
• 6:	USB Connection Lead		1
• 7:	Interface Power Supply		1
• 8:	PowerKit Software (USB)		1
• 9:	Gauge Adapter Cables		2



It is recommended that all hardware, consumables, tools, and software are checked and present before preparation and installation commences.

INSTALLATION EQUIPMENT

Gauges *

Gauges with connectors

Datum Electronics supply fully encapsulated pre-wired gauges for simple installation.

DESCRIPTION	QUANTITY
• Datum SPMK gauges with connectors as supplied Gauges are not reusable.	10

Cleaning & preparation *

DESCRIPTION	QUANTITY
• M-Prep neutraliser 5A: 60 ml bottle (6 shafts)	1
• M-Prep conditioner: 60 ml bottle (6 shafts)	1
• 400 & 120 grit silicon carbide paper	2 pack
• Permanent marking pen: Sharpie	1
• Cotton tip applicator	Box of 100
• GSP-1 gauze sponges	Box of 100
• Kimi wipe lint free tissues	1 Box
• 1” reel of Mylar tape	1

Adhesives *

NOTE: Adhesives classified as Dangerous Goods

TEMPORARY ADHESIVES KIT - UP TO 5 SHAFTS
FOR UP TO 6 MONTHS INSTALLATION LIFESPAN

DESCRIPTION	QUANTITY
• M-Bond 200 multi-pack	(5 x 2 g containers)
• Catalyst C 200 ml	1

Environmental protection *

DESCRIPTION	QUANTITY
• Self-adhering Teflon tape	1
• Butyl pliable rubber sealant	1

Installation *

DESCRIPTION	QUANTITY
• Silver reflective tape	1
• Strong cross weave tape	1 roll

Recommended consumables

DESCRIPTION	QUANTITY
• Ballpoint pen	1
• Industrial degreaser	1
• Cable ties	6
• Cleaning rags	1
• TCW24 tinned copper wire	1
• Masking tape or marker pen	1 roll
• Banding	kit

Recommended tools

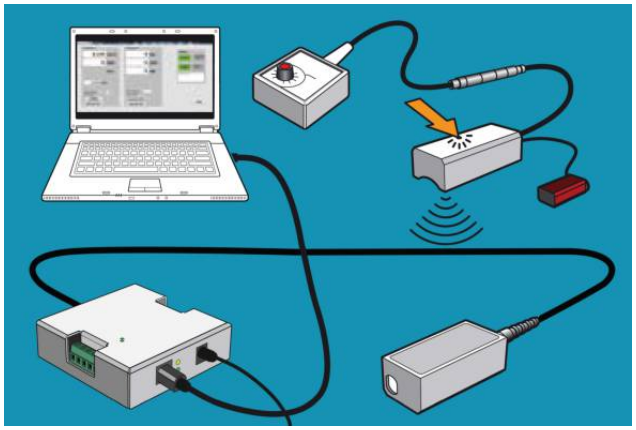
DESCRIPTION	QUANTITY
• Dremel (or equivalent)	1
• Angle marking bar	1
• Metric hex driver set	1
• Large flat head screwdriver	1
• Side cutters	1
• Tin snips	1
• Tweezers	1
• PC / Laptop with test software	1
• Small toughened glass plate for gauge preparation	1

* Items supplied by Datum Electronics.
For additional requirements, please contact Datum Electronics

EQUIPMENT PREPARATION

01

FAMILIARISE YOURSELF WITH THE SYSTEM



Testing of Transmitter and Receiver communications is vital before on-site installation commences.

Connect the interface module to the test computer with only the USB cable connected. Then install the PowerKit software and connect the off-shaft receiver and power the interface module. The red LED will show on the receiver to indicate it is working. Connect the battery to the on-shaft transmitter; the LED on top of the transmitter will blink several times to show it has power. Connect the strain gauge simulator to the on-shaft transmitter and move the selector to the zero position.

The green LED on the off-shaft receiver should now show one green light indicating that the transmitter and receiver are connected and good data is being transmitted.

Wave the speed reflector in front of the off-shaft receiver's optical sensor and check that the green speed pulse LED lights to indicate the RPM counter is working correctly.

Load the PowerKit software and correctly connect to the receiver/transmitter system. Once correctly connected move the strain gauge simulator through all the points and the onscreen torque value will change, wave the speed sensor in front of the off-shaft receiver's optical sensor and the RPM figure will change. With no strain gauge connected the software will display approximately 1.90 mV/V.

Having completed this test, you have tested the transmitter and your test receiver and gained a level of familiarity with the kit. The hardware and software checks are now complete.

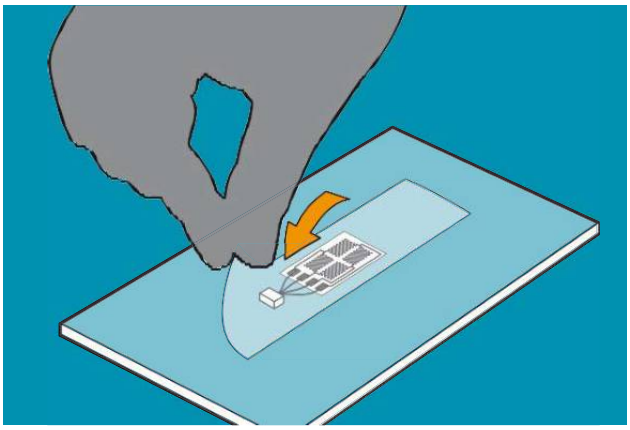
02

STRAIN GAUGE PREPARATION (GUIDANCE ONLY)

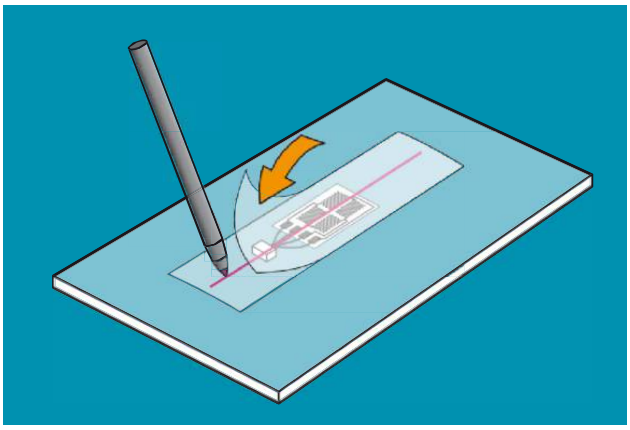
1. When mounting the strain gauge, you will need to have prepared it on a glass plate with Mylar tape. It is better to complete this stage in a clean room with good light before going on site.

   Thoroughly clean the surface of the glass plate using the M-Prep Conditioner first and then the M-Prep Neutraliser. This will ensure that the plate is chemically clean.

2. Using clean tweezers place the gauge on the plate with the solder/cable side uppermost. Familiarise yourself with the gauge element orientation using a magnifying glass.



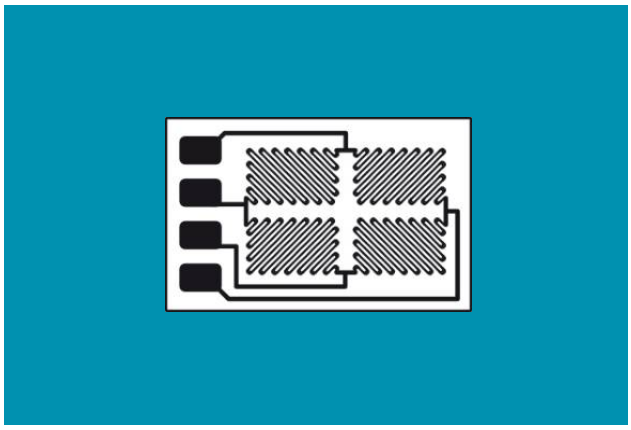
3. Cut a length of Mylar tape approximately 150 mm in length. Carefully offer the tape to the top side of the gauge and stick the gauge roughly in the centre of the Mylar tape (see above). Stick the tape onto the glass plate with the gauge in a central position.



4. After applying the first layer of tape mark a line across the gauge (see above) using an indelible marker, parallel to the long side of the gauge. Then add a second layer of Mylar tape. The second layer will stop the tape curling when applying the gauge to the shaft.

   Gently lift the two layers of tape away, with the gauge now stuck to it, ensuring that you always handle the tape and not the gauge itself.

   IF NO PREPARED CLEAN SURFACE IS AVAILABLE:
   Cut a strip of Mylar tape approximately 150 mm in length. Lay the tape on a flat clean surface so that the adhesive backing is facing upwards. Remove the gauge from its packaging using a pair of clean tweezers using the minimum pressure possible. Carefully place the strain gauge in the centre of the Mylar tape. During all processes take great care to avoid contaminating the gauge or Mylar tape.



The strain gauge supplied by Datum Electronics is a full bridge encapsulated gauge complete with a connector. These simplify the installation process and remove the need for soldering on site. The gauge has fine elements within its grid that measure strain. These elements can be seen under a magnifier and should be aligned at 45 degrees to the axis of the shaft to measure the torsional strain.

You should familiarise yourself with the gauge in a well-lit environment before going to site where light may be limited.

STRAIN GAUGE PREPARATION IS NOW COMPLETE; YOU NOW NEED TO PREPARE THE SHAFT.

03

BATTERY TESTING

The PP3 9V battery should be new. Connect the battery to the Transmitter Enclosure using the supplied connectors. If the light on the top of the Transmitter Enclosure flashes, then the battery is fully charged. If the light does not flash, replace the battery with a new one.

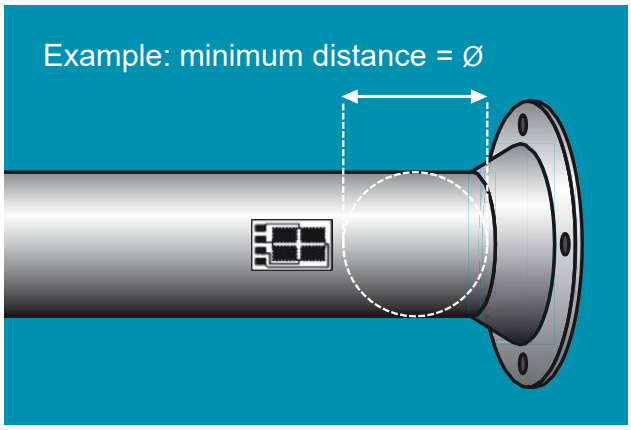
SHAFT PREPARATION

04

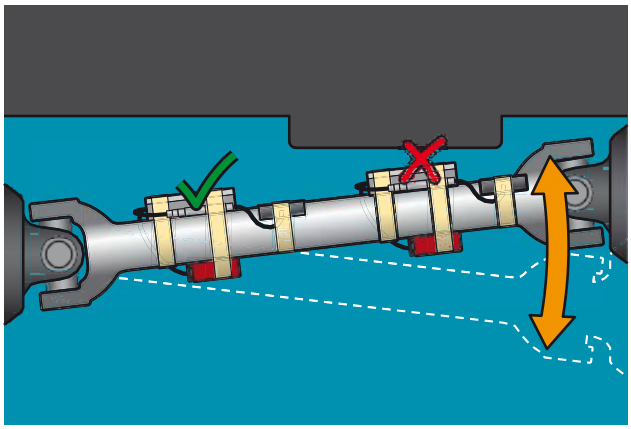
SELECTION OF INSTALLATION POSITION

The selection of a suitable area to be gauged on the drive shaft is vital to the success of the installation and data recovery. The area to be gauged should, where practicably possible, transmit the maximum level of torque/strain that is to be measured through the shaft.

1. The area should be large enough to mount the instrumentation. Look at the Transmitter unit to approximate the size of the clean gauging area that will be required.



2. Measure the diameter of the shaft. The gauging area should be no less than one shaft diameter away from any obstruction or shaft joint (see above).



3. There must not be any areas of interference once the instrumentation is mounted and the shaft is rotating. Changes in pitch/travel of the shaft during normal operation should be considered, with the instrumentation mounted clear of any obstructions caused by shaft pitch/travel (see above). If the instrumentation is mounted on a vehicle suspension, travel should also be accounted for.
4. If measuring shaft speed (and power) you will need to mount the receiver so that it can be directed at the shaft.
5. There should be sufficient hand and working access to enable installation of the equipment and fitting of the battery.
6. Avoid any section of the shaft that contains major pitting or excessively deep scratches.
7. Offer the complete Transmitter Assembly up to the chosen area to check clearance and check for any rotational interferences.

Full guidance is supplied with the adhesives and cleaner preparation chemicals.

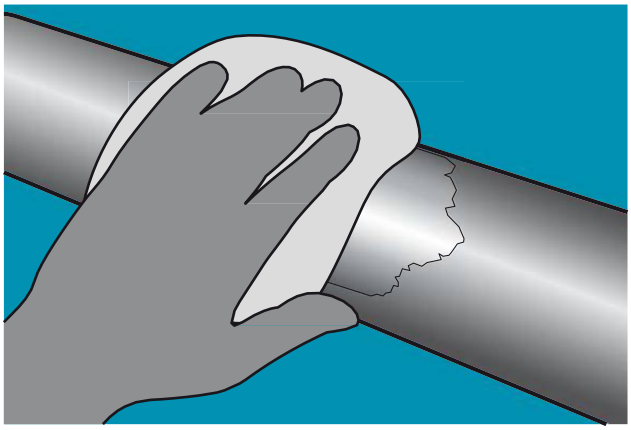
05

SURFACE PREPARATION (GUIDANCE ONLY)

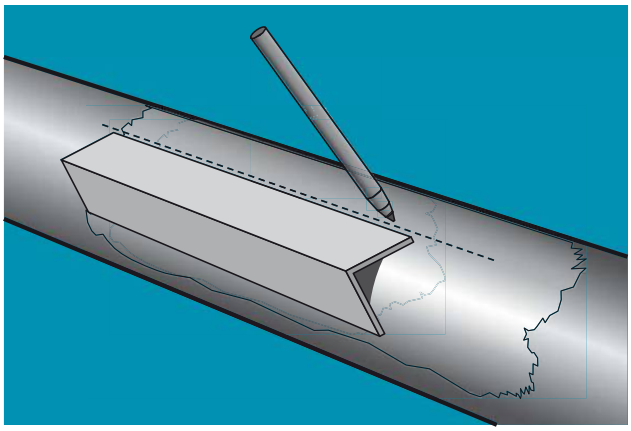
Once the installation position has been determined it is time to prepare the strain gauge area. Correct preparation of surfaces to be gauged is essential for successful equipment installation and data collection.

It is recommended that the chosen area of drive shaft is thoroughly cleaned and degreased prior to commencing strain gauging in order to prevent contaminating the gauge area.

BASIC CLEANING PREPARATION



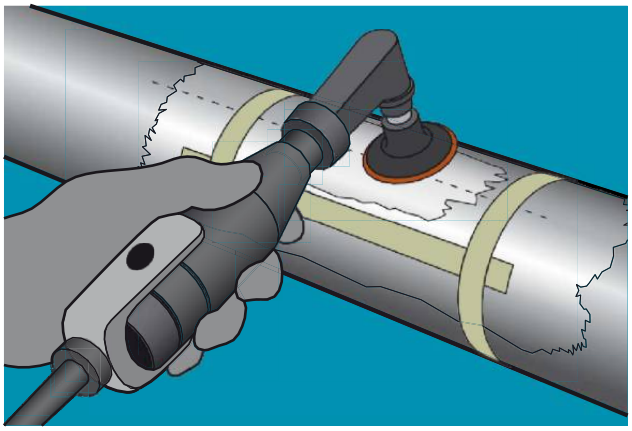
1. Clean the chosen area using rags and industrial cleaner/degreaser (see above). Remove as much dirt and grease as possible.
2. Clean area again. Once area is clean commence marking out following the steps below.



3. Place the angled bar flush to the shaft and mark a line parallel to the shaft using a ball point pen (see above). This will act as a burnished line positioning guide to the centre line you marked on the Mylar tape over the gauge in Stage 1.4.

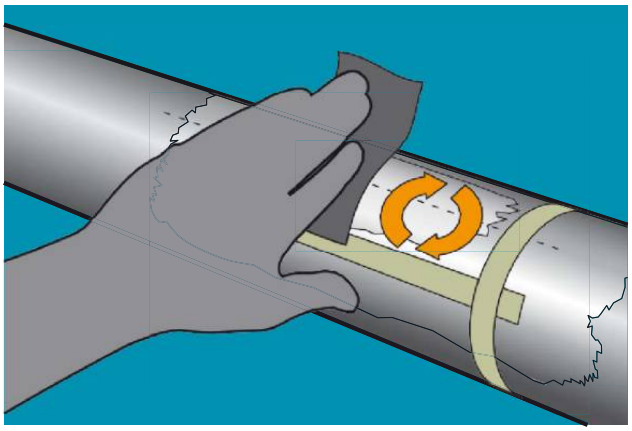
SURFACE ABRADING

The surface of the drive shaft should be abraded to remove any loosely bonded adherents such as scale, rust, paint, galvanised coatings or oxides.



4. Using the Transmitter unit as a guide, roughly indicate the area to be cleaned using masking tape (see above).

   Begin with a grinder, Dremel, disc sander or file to coarsely abrade the surface and remove any large particles such as paint, rust or any other adherents (see above). Abrade with 80-120 grit abrasive to develop a surface texture suitable for bonding.



5. Second stage abrading uses silicon carbide paper of the appropriate grit. It is recommended that abrading should start at 120 grit progressing through to 400 grit in a random pattern to attain a flat, clean, and well-keyed surface (see above).

   The optimum surface finish for gauge bonding depends somewhat upon the nature and purpose of the installation. For general stress analysis applications, a relatively smooth surface is suitable.

WET ABRADING

Wet abrading is carried out using a conditioner solution. Conditioner is a mildly acidic solution which generally accelerates the cleaning process and, on some materials, acts as a gentle etchant.

6. Carry out final abrading with 400 grit paper while keeping the surface wet with conditioner solution. Use a random pattern to attain a flat, clean, and well keyed surface.

   Following cleaning the burnished line should still be visible. If working in poor light, mark reference lines either side of the gauge markings to draw the eye to the burnished lines.

GAUGE LOCATION LAYOUT LINES

Gauge location layout lines should be made with a tool which burnishes, rather than scores or scribes, the surface. A scribed or scored line may raise a burr or create a stress concentration detrimental to strain gauge performance.

It is recommended that ballpoint pen is used for making alignment markings. Layout lines are ordinarily applied following the abrading operation and before final cleaning. All residues from the location marking operation should be removed by scrubbing with conditioner, as described in Stage 9 of the Surface Preparation process.

7. Mark out strain gauge location lines on the centreline you marked in step 05.3.
8. All masking tape can now be removed from the drive shaft.

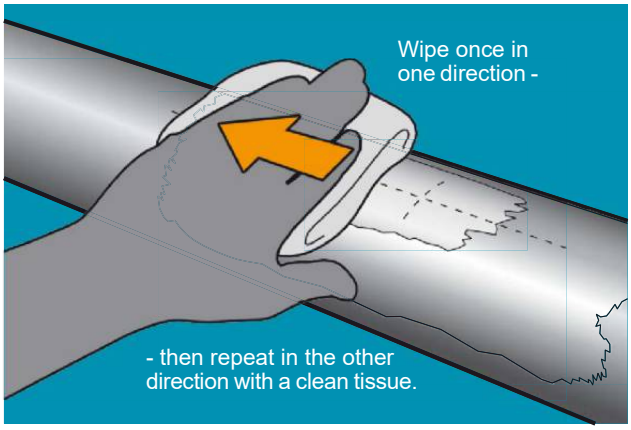
SURFACE CONDITIONING

9. Repeatedly apply conditioner and scrub the surface with cotton-tipped applicators until a clean tip is no longer discoloured by the scrubbing. During this process, the surface should be kept constantly wet with the conditioner until cleaning is completed. Cleaning solutions should never be allowed to dry on the surface.
10. When clean, the surface should be dried by wiping across the cleaned area with a single slow stroke of a lint-free tissue. The stroke should begin from well within the cleaned area and move outwards to avoid dragging contaminants in from the boundary of the area using each tissue once only.

NEUTRALISING

The final step in surface preparation is to bring the surface condition back to an optimum alkalinity of 7.0 to 7.5 pH, which is suitable for all strain gauge adhesive systems.

11. Liberally apply neutraliser to the cleaned surface and scrub the surface with a cotton-tipped applicator. The cleaned surface should be kept completely wet with neutraliser throughout this operation.



12. When neutralised, the surface should be dried by wiping across the cleaned area with a single slow stroke of a clean lint-free tissue. With a fresh lint-free tissue, a single stroke should then be made in the opposite direction, beginning within the cleaned area and moving outwards to avoid recontamination from the uncleaned boundary (see above).

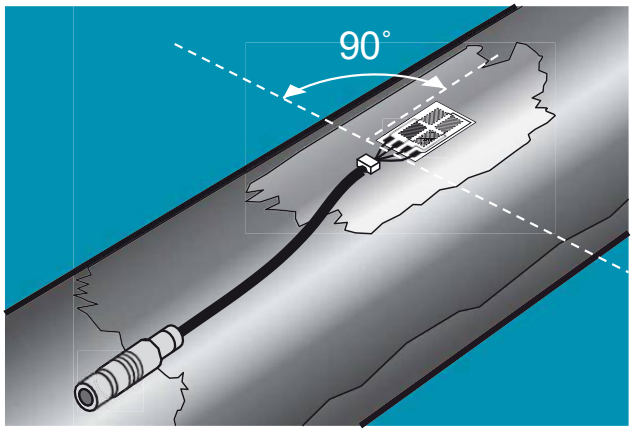
The surface is now properly prepared for gauge bonding. Gauges should be installed **as soon as possible** after this operation to prevent contamination.

PREPARATION IS NOW COMPLETE

INSTALLATION

06

GAUGE APPLICATION



You are now ready for strain gauge application.

The strain gauge supplied for this application is manufactured by Vishay Micro-Measurements Group to Datum specifications. The standard procedures for Vishay strain gauge application are described in Appendices 1 and 2 of this document.

Additional information regarding alternative adhesives can be found at: **https://micro-measurements.com/adhesives**

1. The strain gauge is bonded to the shaft using one of two procedures.

   PROCEDURE A - Trials application

   This is recommended for short trials of 3 months in duration and where time on-site is limited. This procedure utilises a cyanoacrylate adhesive (M-Bond 200) that will cure in approximately 60 seconds by thumb pressure.

   PROCEDURE A IS LISTED IN DETAIL IN **APPENDIX 1** OF THIS DOCUMENT. THE INSTRUCTIONS IN THIS APPENDIX MUST BE FOLLOWED BEFORE MOVING TO THE NEXT STAGE.

Protection from the environment

Both strain gauge installation methods require that coatings are applied to ensure that no moisture or other contamination reaches the strain gauge or the exposed wiring. The level of coatings applied will vary according to the operating conditions and the duration of the testing.

2. **After applying the strain gauge as described in the Appendix,** the gauge should be visually inspected to check that the bonds are secure, and that there are no significant air bubbles or inclusions present under the strain gauge.

The gauge, once bonded, will usually display a signal offset due to the distortion of the gauge around the radius and by the action of applying hand pressure during the bonding process. The level of offset will vary from installation to installation. The offset of the gauge can be measured using a PC connected to the Receiver running the software utility. The output of the gauge, and hence the offset, will be shown in mV/V. Typically this reading will be +/-0.000 mV/V to +/-0.500 mV/V, the instrumentation being designed to cater for an offset of up to 1.000 mV/V. If the offset is greater than this value the installation is likely to be faulty. This may be caused by an uneven or twisting pressure at installation. If the gauge offset is greater than 1.0 mV/V you will need to replace the gauge. Clean the area and repeat the gauge installation.

Alternatively, this offset can be measured using a gauge indicator of some description.

3. Once the gauge is installed, and with either a handheld indicator or PC connected, you should, if possible, apply a twist to the shaft. Applying a small torque to the shaft by hand or by a manual lever is usually sufficient to allow you to see the readings on the display change. By applying a small force in this way you can gain additional confidence in your strain gauge installation.

   The value should increase/decrease slightly and then return to the start value as the twist is released (see above).

   Note the value for the gauge with no load at this stage as this will be required for future testing and diagnostics.

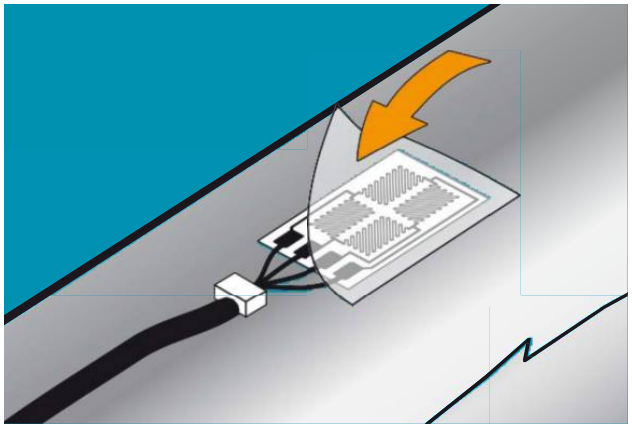
STRAIN GAUGE INSTALLATION IS NOW COMPLETE

07

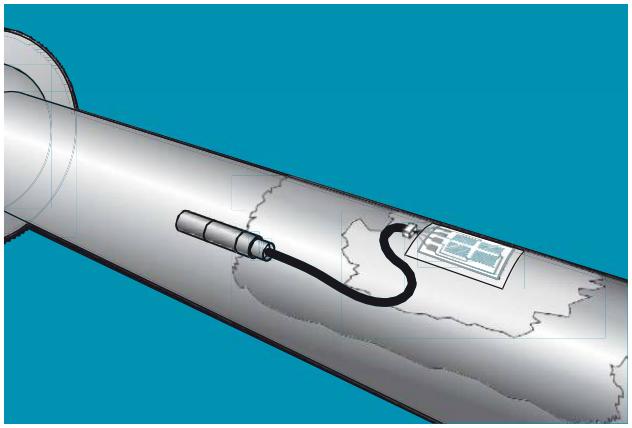
PROTECTION OF THE STRAIN GAUGE

The protection of strain gauges is vital in order to maintain good strain readings.

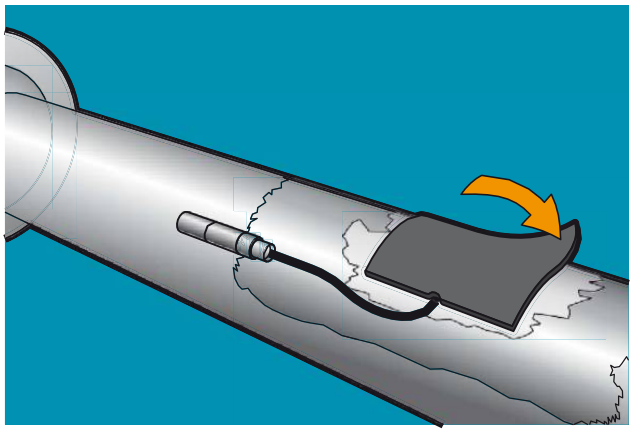
Excessive moisture or ingress of other fluids may cause a strain gauge to drift, resulting in poor or unrealistic readings. When encapsulated strain gauges are being used the following process offers a suitable level of protection.



1. Cut a piece of Teflon tape (approx. 30 mm long) to cover the gauge and the connector and stick it over the strain gauge onto the cleaned area where the strain gauge is bonded to the shaft.



2. Apply pressure to the edges of the Teflon tape to provide a good seal around the gauge.

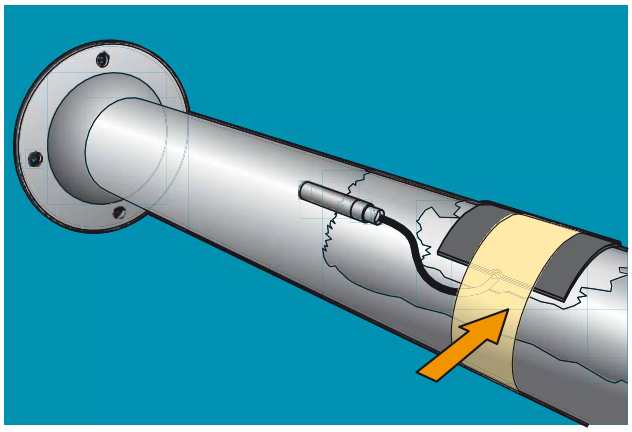


3. Cut a strip of butyl mastic large enough to cover the strain gauge and the area of Teflon and stick over gauge onto the cleaned area where the strain gauge is bonded to the shaft (see above). Apply pressure to the edges of the mastic to provide a good seal around the gauging area but leave the cable exposed.

The shaft area needs to be chemically clean for the mastic to adhere - warming the mastic to 25-30˚C will also assist with fitting and adhesion.

Additional information regarding strain gauge coating options can be found at:

https://micro-measurements.com/protective-coatings



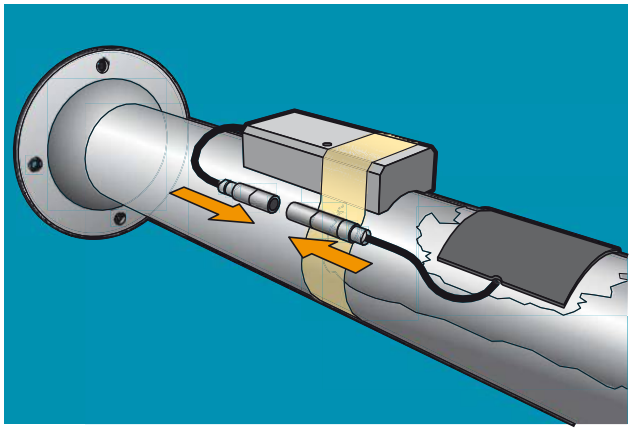
4. At higher revolutions additional layers of cross weave tape should be used to secure the mastic coatings. Suitable tapes to use are either Strong Cross Weave Tape or Adhesive Glass Cloth Tape with a strength more than 25 kg per cm.

PROTECTION OF STRAIN GAUGE IS NOW COMPLETE

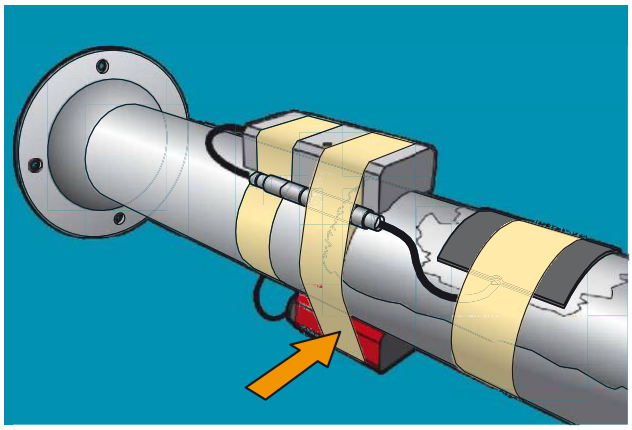
08

TRANSMITTER INSTALLATION

1. Place the Transmitter Enclosure close to the protected gauge area ensuring that the gauge cable does not become trapped in any way and allowing enough cable to plug the gauge connector to the Transmitter Enclosure. Secure the Transmitter Enclosure in place by taping to the shaft with four wraps of the crossweave tape. Take care not to cover the LED.



2. Plug the strain gauge connector into Transmitter connector. Wrap excess cable around Transmitter Enclosure.



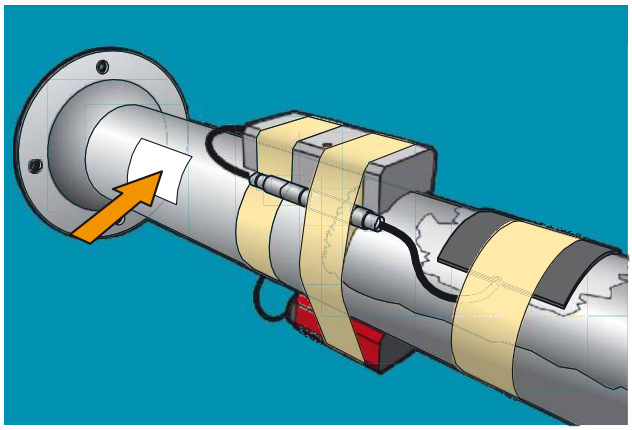
3. Position the battery on the shaft at 180 degrees to the transmitter on shaft up to 100 mm to improve shaft balance.
4. Secure the battery in place by taping it to the shaft. Tape around the shaft and over the Transmitter Enclosure, battery, and Transmitter connectors, securely fixing them all to the shaft (see above).

TRANSMITTER INSTALLATION IS NOW COMPLETE

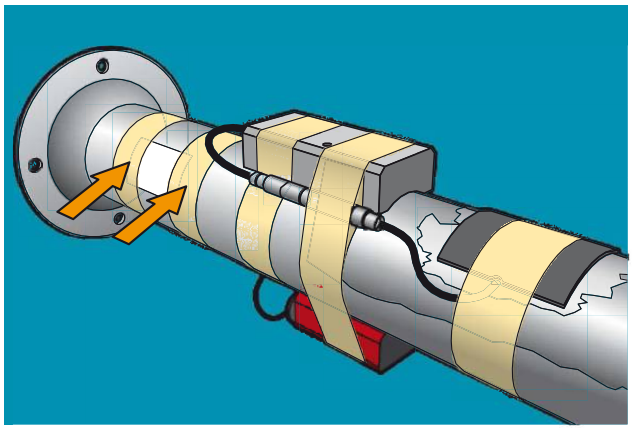
09

MEASURING RPM AND POWER – SPEED REFLECTOR INSTALLATION

1. The reflective tape that forms the target for the Optical Proximity Sensor should be positioned on the shaft so that the optical Receiver Module can be aimed at it. The Receiver Module's optical beam should be perpendicular to the sensor to ensure a good reflected signal. Avoid positioning the tape next to other highly reflective structures or surfaces that might reflect a false signal once the shaft is rotating.



2. Cut a piece of reflective tape approximately 25 mm x 100 mm and position it on the shaft.



3. Hold it in place by wrapping tape around the shaft at each end of the reflective tape.

SPEED REFLECTOR INSTALLATION IS NOW COMPLETE

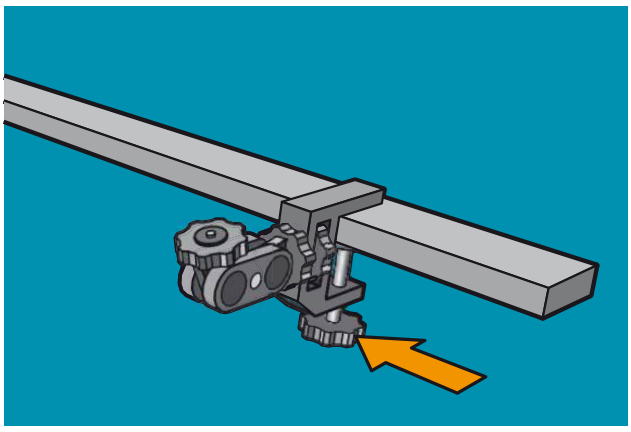
10

RECEIVER INSTALLATION

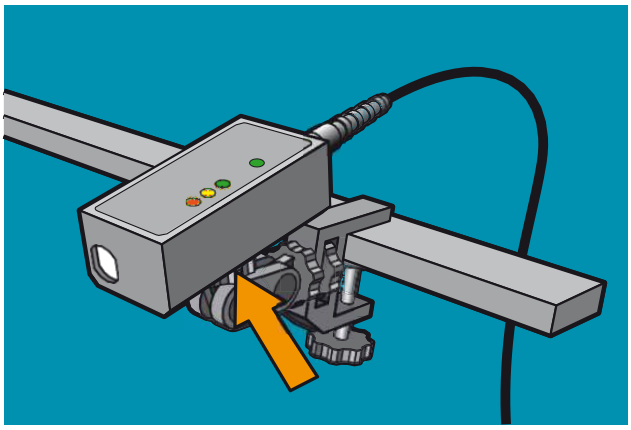
If measuring RPM/Power locate a suitable structure to mount the Receiver Module to, that also allows the receiver's speed sensor to be aligned to the Transmitter.

If only measuring torque the receiver needs to be located within 3 metre line of sight to the transmitter location, but its directional alignment is not critical.

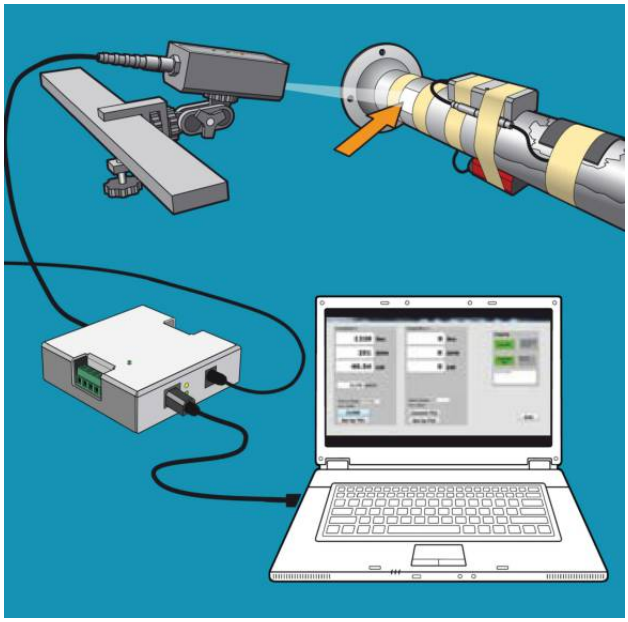
The Optical Speed Sensor on the Receiver Module should be aligned perpendicular to the reflector on the shaft to ensure the beam is reflected back to the Receiver and measured correctly.



1. Attach the Receiver Mounting Clamp to the suitable structure and tighten the locking wheels (see above).



2. Attach the Receiver Module to the Receiver Mounting Clamp by screwing it to the mounting thread and firmly tighten the locking wheel.
3. Position the optical sensor to aim at the reflector on the shaft by adjusting the locking wheels as required. Tighten all the locking wheels on the Receiver Mounting Clamp firmly.
4. Connect the Receiver Module to the Interface Unit using the 10-metre cable supplied. The cable has a RS-485 connector for the Interface Unit and a connector for the Receiver. Optional extension cables are available on request.



The cable run from the Receiver to the Interface should be secured approximately every 0.5 metres so as not to become a hazard. IMPORTANT NOTE: When running cable ensure that it is not mounted in any area that may become damaged by the moving or rotational machinery. Coil up and securely tie any excess cable.

For multi-shaft installation we can provide transmitters with unique transmission channels and a multi-channel PC interface/power supply.

RECEIVER INSTALLATION IS NOW COMPLETE

APPENDIX 01

UNDERSTANDING THE RECEIVER LEDs

Understanding the LEDs on Datum's 2.4 GHz radio-based Torque Meters and help diagnosing communication problems.

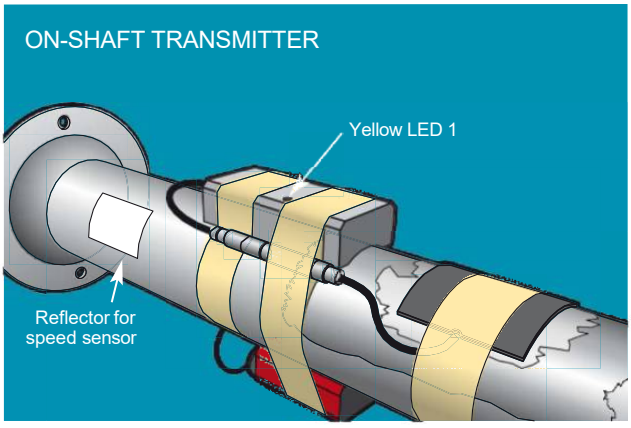
ON-SHAFT TRANSMITTER

The on-shaft transmitter has only one LED.

YELLOW LED: This LED will flash once after approx. 1 second whilst trying to connect to the receiver when the battery is connected.

Once the transmitter has connected to the receiver, the Yellow LED will flash at a constant rate until powered off.

If the transmitter cannot connect to the receiver the Yellow LED will go off and stay off until a connection is established. If this happens, check the status of the off-shaft receiver LEDs (opposite), check that power is supplied to the off-shaft receiver, the equipment that supplies power to the off-shaft receiver is powered on etc.



OFF-SHAFT RECEIVER

The Receiver has four LEDs.

RED LED 1: Is illuminated if no data has been received from the transmitter for more than 1.5 seconds. It is extinguished as soon as data is received.

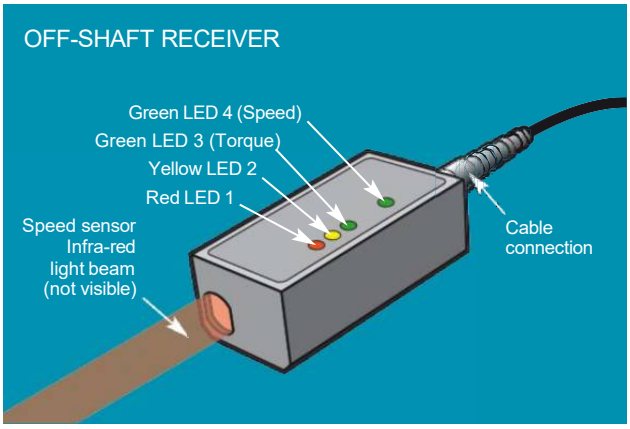
YELLOW LED 2: Flashes if data is not received for a period of approximately 1 to 1.5 seconds, after which it will be extinguished, and the Red LED will illuminate. If data is received the Yellow LED will be extinguished.

GREEN LED 3 (Torque): Flashes briefly every time data is sent from the off-shaft receiver. In normal operation this will flash approximately 4 times per second, indicating reception of continuous data. Reception of data is only an indication of the integrity of the data transmission between the on-shaft transmitter and the off-shaft receiver; it does not convey any indication of the accuracy of the data received.

If no LEDs are visible, check that power is supplied to the off-shaft receiver and that the equipment that supplies power to the off-shaft receiver is powered on. Ensure that the circular connector to the off-shaft receiver is screwed in tight, no cables are damaged and in-line fuses are correct. Try power cycling the off-shaft receiver (undo the circular connector remove for a moment and reconnect, look at the LEDs, and confirm the correct operation as above.

Note: Ensure that the on-shaft transmitter's Yellow LED is flashing before power cycling the off-shaft receiver to ascertain that a connection can be made.

GREEN LED 4 (Speed) flashes based on the speed of the shaft at a rate of approx. 1/60th of the current RPM. The speed sensor detects the reflective tape attached to the shaft.



APPENDIX 02

STRAIN GAUGE INSTALLATION FOR SHORT TERM USAGE

THE STRAIN GAUGES SUPPLIED ARE MANUFACTURED BY **VISHAY MICRO-MEASUREMENTS GROUP** TO DATUM SPECIFICATIONS.

SHOULD MATERIALS SPECIFIED NOT BE AVAILABLE, OR THERE ARE PROCESSES WHICH REQUIRE CLARIFICATION, CONTACT YOUR **LOCAL VISHAY OFFICE** FOR ADVICE AND RECOMMENDATIONS.

INTRODUCTION

Micro-Measurements Certified M-Bond 200 is an excellent general-purpose laboratory adhesive because of its fast room-temperature cure and ease of application.

When properly handled and used with the appropriate strain gauge, M-Bond 200 can be used for high-elongation tests in excess of 60 000 microstrain, for fatigue studies, and for one-cycle proof tests to over +200 °F [+95 °C] or below -300 °F [-185°C]. The normal operating temperature range is -25° to +150°F [-30° to +65°C]. MBond 200 is compatible with all Micro-Measurements strain gauges and most common structural materials.

When bonding to plastics, it should be noted that for best performance the adhesive flowout should be kept to a minimum. For best reliability, it should be applied to surfaces between the temperatures of +70° and +85°F [+20° to +30°C], and in a relative humidity environment of 30% to 65%.

M-Bond 200 catalyst has been specially formulated to control the reactivity rate of this adhesive. The catalyst should be used sparingly for best results. Excessive catalyst can contribute many problems, e.g., poor bond strength, age-embrittlement of the adhesive, poor glueline thickness control, extended solvent evaporation time requirements, etc.

Since M-Bond 200 bonds are weakened by exposure to high humidity, adequate protective coatings are essential.

This adhesive will gradually become harder and more brittle with time, particularly if exposed to elevated temperatures. For these reasons, M-Bond 200 is not recommended for installations exceeding one or two years.

For proper results, the procedures and techniques presented here should be used with qualified Micro- Measurements installation accessory products (refer to Catalog A-110). Those used in this procedure are:

- CSM Degreaser or GC-6 Isopropyl Alcohol
- Silicon Carbide Paper
- M-Prep Conditioner A
- M-Prep Neutraliser 5A
- GSP-1 Gauze Sponges
- CSP-1 Cotton Applicators
- PCT- 2M Gauge Installation Tape

SHELF AND STORAGE LIFE

M-Bond 200 adhesive has a minimum shelf life of three months at +75°F [+24°C] after opening and with the cap placed back onto the bottle immediately after each use.

NOTE: To ensure the cap provides a proper seal, the bottle spout should be wiped clean and dry before replacing the cap.

Unopened M-Bond 200 adhesive may be stored up to three months at +75°F [+24°C] or six months at +40°F [+5°C].

HANDLING PRECAUTIONS

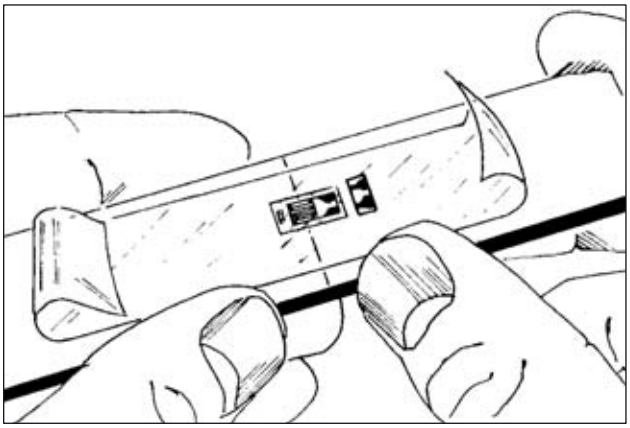
M-Bond 200 is a modified alkyl cyanoacrylate compound. Immediate bonding of eye, skin or mouth may result upon contact. Causes irritation. The user is cautioned to: (1) avoid contact with skin; (2) avoid prolonged or repeated breathing of vapors; and (3) use with adequate ventilation. For additional health and safety information, consult the Material Safety Data Sheet, which is available upon request.

NOTE: Condensation will rapidly degrade adhesive performance and shelf life; after refrigeration the adhesive must be allowed to reach room temperature before opening, and refrigeration after opening is not recommended.

GAUGE APPLICATION TECHNIQUE

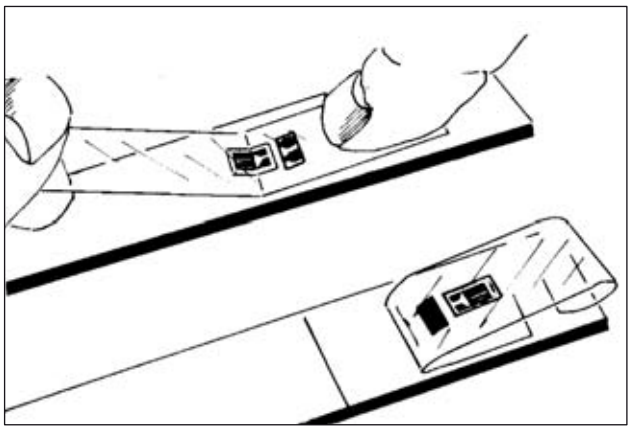
The installation procedure presented on the following pages is abbreviated and is intended only as a guide in achieving proper gauge installation with M-Bond 200. Micro-Measurements Application Note B-129 presents recommended procedures for surface preparation and lists specific considerations which are helpful when working with most common structural materials.

STEP 01



Position the gauge/tape assembly so that the triangle alignment marks on the gauge are over the layout lines on the specimen. If the assembly appears to be misaligned, lift one end of the tape at a shallow angle until the assembly is free of the specimen. Realign properly and firmly anchor at least one end of the tape to the specimen. Realignment can be done without fear of contamination by the tape mastic if Micro-Measurements PCT-2M gauge installation tape is used, because this tape will retain its mastic when removed.

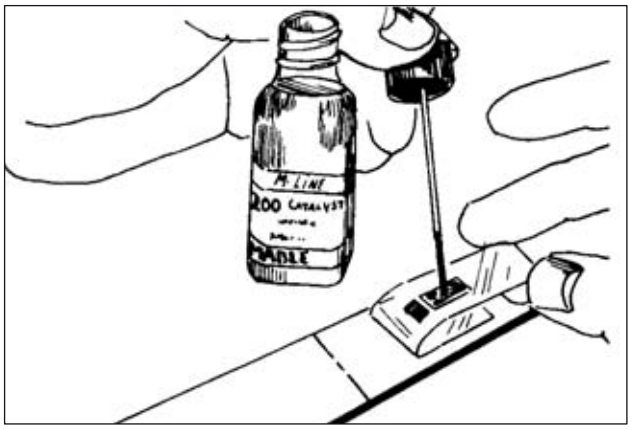
STEP 02



Lift the gauge end of the tape assembly at a shallow angle to the specimen surface (about 45 degrees) until the gauge and terminal are free of the specimen surface. Continue lifting the tape until it is free from the specimen approximately 1/2 in [10 mm] beyond the terminal. Tuck the loose end of the tape under and press to the specimen surface so that the gauge and terminal lie flat, with the bonding surface exposed.

NOTE: Micro-Measurements gauges have been treated for optimum bonding conditions and require no pre-cleaning before use unless contaminated during handling. If contaminated, the back of any gauge can be cleaned with a cotton-tipped applicator slightly moistened with M-Prep Neutraliser 5A.

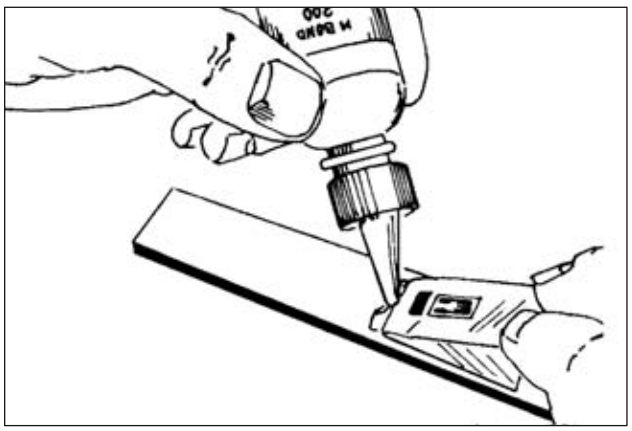
STEP 03



M-Bond 200 catalyst can now be applied to the bonding surface of the gauge and terminal. M-Bond 200 adhesive will harden without the catalyst, but less quickly and reliably. Very little catalyst is needed, and it should be applied in a thin, uniform coat. Lift the brush-cap out of the catalyst bottle and wipe the brush approximately 10 strokes against the inside of the neck of the bottle to wring out most of the catalyst. Set the brush down on the gauge and swab the gauge backing. Do not stroke the brush in a painting style but slide the brush over the entire gauge surface and then the terminal. Move the brush to the adjacent tape area prior to lifting from the surface. Allow the catalyst to dry at least one minute under normal ambient conditions of +75°F [+24°C] and 30% to 65% relative humidity before proceeding.

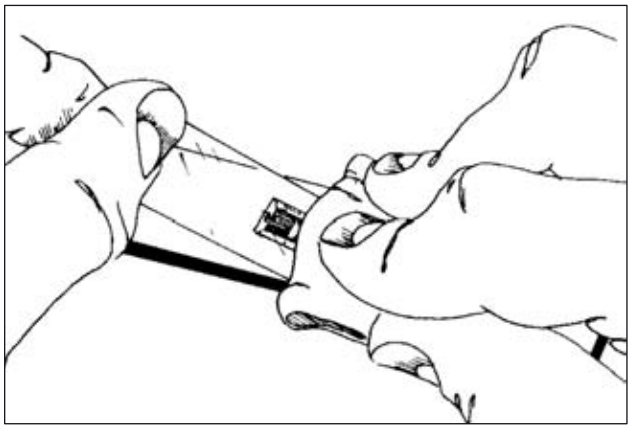
NOTE: **THE NEXT THREE STEPS MUST BE COMPLETED IN THE SEQUENCE SHOWN, WITHIN 3 TO 5 SECONDS. READ STEPS 8, 9, AND 10 BEFORE PROCEEDING.**

STEP 04



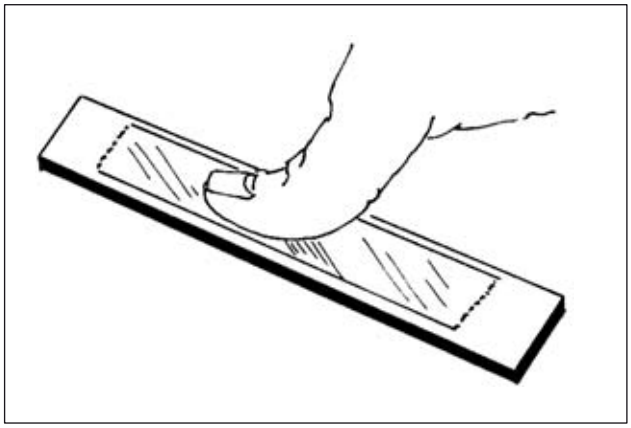
Lift the tucked-under tape end of the assembly, and, holding in the same position, apply one or two drops of MBond 200 adhesive at the fold formed by the junction of the tape and specimen surface. This adhesive application should be approximately 1/2 in [13 mm] outside the actual gauge installation area. This will ensure that local polymerization that takes place when the adhesive comes in contact with the specimen surface will not cause unevenness in the gauge glueline.

STEP 05



Immediately rotate the tape to approximately a 30-degree angle so that the gauge is bridged over the installation area. While holding the tape slightly taut, slowly and firmly make a single wiping stroke over the gauge/tape assembly with a piece of gauze bringing the gauge back down over the alignment marks on the specimen. Use a firm pressure with your fingers when wiping over the gauge. A very thin, uniform layer of adhesive is desired for optimum bond performance.

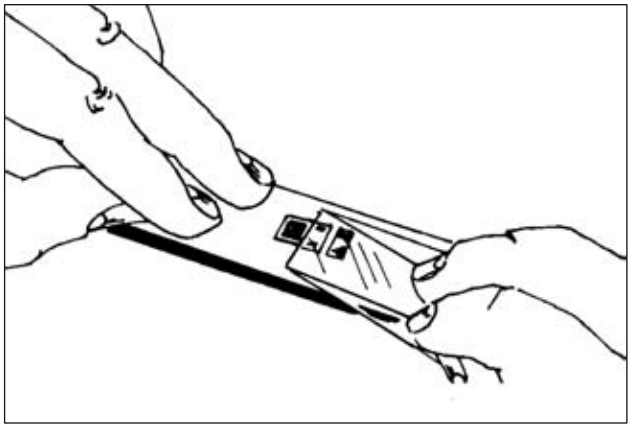
STEP 06



Immediately upon completion of wipe-out of the adhesive, firm thumb pressure must be applied to the gauge and terminal area. This pressure should be held for at least one minute. In low-humidity conditions (below 30%), or if the ambient temperature is below +70°F [+20°C], this pressure application time may have to be extended to several minutes.

Where large gauges are involved, or where curved surfaces such as fillets are encountered, it may be advantageous to use preformed pressure padding during the operation. Pressure-application time should again be extended due to the lack of “thumb heat” which helps to speed adhesive polymerization. Wait two minutes before removing tape.

STEP 07



The gauge and terminal strip are now solidly bonded in place. It is not necessary to remove the tape immediately after gauge installation. The tape will offer mechanical protection for the grid surface and may be left in place until it is removed for gauge wiring. To remove the tape, pull it back directly over itself, peeling it slowly and steadily off the surface. This technique will prevent possible lifting of the foil on open-faced gauges or other damage to the installation.

ONCE INSTALLATION IS COMPLETE, PROCEED TO **SECTION 07.2** OF THIS MANUAL TO CONTINUE THE STRAIN GAUGING PROCESS.

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