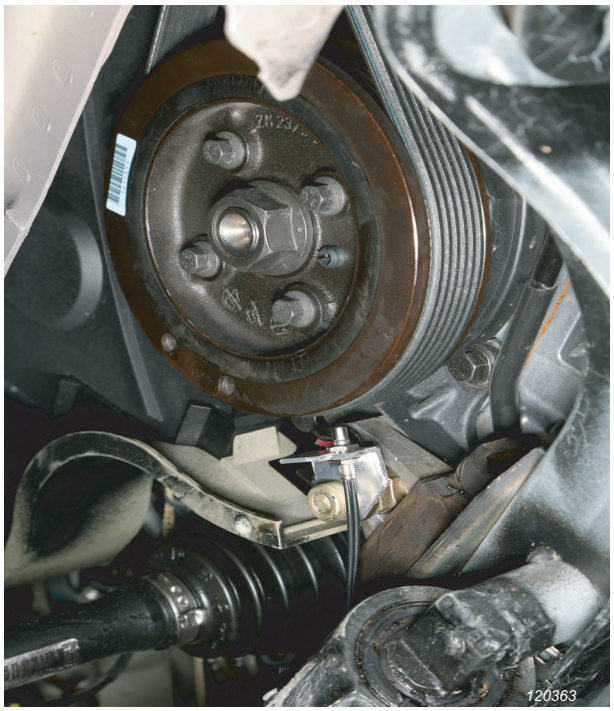
PRODUCT DATA

Brüel & Kjær® Tachometers

CCLD Laser Tacho Probe Type 2981
CCLD Laser Tacho Probe with Adaptor and High-temperature Fibre Type 2981-A

Uses
- Non-contact measurement of rotational speed
- Synchronization between rotating or reciprocating machine elements and measurement instruments

Features
- Compatibility with Constant Current Line Drive (CCLD), DeltaTron™ or ICP® input, from 3 to 20 mA constant current
- CCLD power, meaning:
  - No separate power supply required
  - Simple two-wire cabling
- Continuous wave laser for jitter-free order tracking and balancing applications
- Operating range:
  - Type 2981, to at least 70 cm (27 in)
  - With High-temperature Fibre AE-4003, to at least 5 cm (2 in)
- Low-speed measurements to 0 rpm for wind turbine and ship propulsion applications
- High-speed supercharger measurements up to 300,000 rpm
- Measurements in automotive engine compartments (130 °C) with optional fibre-optic cable
- Manual test button to verify tachometer trigger level when the machine is not rotating or available
- Robust and IP 64 rated
- Flexible mounting options, making it easy to attach:
  - ¼-20 UNC (camera tripod)
  - 10-32 UNF and M4 on the flat side of the probe
  - M22-1 threading with flange on the front
- Small size for measurements in tight locations



About the Tacho Probe

CCLD Laser Tacho Probe Type 2981 is designed especially for contact-free speed measurements on rotating or reciprocating machine parts, and produces a voltage pulse for each shaft rotation or machine part cycle.

When used with retroreflective tape, like the included QS-0056, Type 2981 has the advantage that it can be located between 1.5 and 70 cm (0.6 to 27 in) from the test object, thus safely separating the probe from possible contact with moving parts or otherwise hazardous environments.

Type 2981 is not a tachometer – rather, it is the sensor part of a tachometer system.

In order to make a complete tachometer system and interpret and present the data, for instance a trigger of an action or an rpm readout or similar, Type 2981 needs to be supplemented with a CCLD supply that provides a minimum of 3 mA along with data acquisition hardware to analyse the signal from Type 2981.

Type 2981 can be used with any CCLD supply that provides 3 mA to power the tacho probe and can ideally be used with Brüel & Kjær data acquisition hardware:
- LAN-XI multichannel data acquisition hardware (bp2215.pdf)
- Integrating Hand-held Vibration Analyzer Type 2250-V (bp2183.pdf)

This hardware includes a combined trigger input and a CCLD supply to power the tacho probe.

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Output Signal

For each pass of the target, a –0.8 Vp pulse is output, DC biased between +18.0 V and +19.5 V. Type 2981 can measure down to 0 rpm* when used with a system capable of DC coupling of the CCLD power supply such as in the LAN-XI family of data acquisition front ends or Integrating Hand-held Vibration Analyzer Type 2250-V.

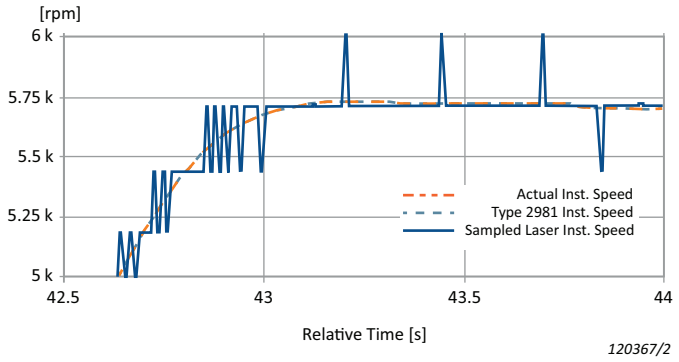
Fig. 1 *Type 2981 includes 4 m of retroreflective tape and a storage box*

It is possible to use Type 2981 with a standard CCLD supply. The low rpm limit of the system will be the high-pass frequency of the CCLD power supply rather than zero. Bias voltage and signal amplitude are almost completely unaffected by rpm and distance to the object and are also independent of CCLD current between 4 and 20 mA. A small LED on the probe body flashes when reflected light pulses are received, giving a positive indication of correct orientation relative to the moving object. Alternatively, the test button can be pressed momentarily to produce a pulse to confirm connection to a measurement channel and allow trigger setup when the test object is either unavailable or not rotating.

Jitter-free Measurement

Type 2981 uses a continuous-wave laser. A tacho probe based on a continuous-wave laser avoids the phase jitter from tacho probes based on pulsed or sampled lasers and provides the precise rotational speed and phase information needed for order tracking, phase or balancing applications. It also minimizes the size needed for the reflective target.

Fig. 2 *Comparison of Type 2981 to actual rpm and output of sampled laser (1.8 kHz) with jitter*



Mounting

Use of the probe is very straightforward. Mount it in a convenient static location on or off the machine up to 70 cm from the target by using a magnetic mounting base, such as the optional UA-0642, or a suitable bracket to connect to the M22-1 thread on the front of the probe. Alternatively, use a camera tripod with standard ¼″-20 UNC (DIN 4503) thread.

The probe should be angled so that its visible laser dot faces the test object to which a small strip of self-adhesive reflective tape has been attached. The retroreflective tape backscatters the laser energy to the receiver. Backscattering the light allows the probe to be more than 30° from perpendicular to the measurement surface.

Fig. 3 *Type 2981 with Integrating Hand-held Vibration AnalyzerType 2250-V for product vibration testing*

* Measurement down to 0 rpm requires DC coupling of the CCLD power supply and that the retroreflective target is small relative to the shaft circumference, ≤15°.

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Measurements in Hot Engine Compartments

Although the body of Type 2981 is limited to an ambient temperature of 50 °C (122 °F), it is possible to measure inside hot engine compartments by using heat-resistant fibre optics to transmit the outgoing and returning laser beams.

Optional Fibre Cable AE-4003-D-020 can function in temperatures of up to 130 °C (266 °F). Other fibre cables are also available in order to reach even higher temperatures.

AE-4003-D-020 is 2 metres long (6′ 6″) and allows Type 2981 to be placed in a relatively cool location (for example behind a car's bumper) while the tip of the fibre measures inside the engine compartment. AE-4003-D-020 includes a cutting tool for installations needing a shorter fibre cable.

The two 2.2 mm diameter fibres of AE-4003-D-020 couple with Type 2981 via Adaptor UA-2144.

Transmitting the laser light through AE-4003-D-020 does affect the operating range. The distance between the tip of the fibre cable and the target is not as large as Type 2981 without a fibre cable due to light losses in the cable. The fibre cable's 5 cm (2 in) operating range is sufficient for almost all measurements.

Fig. 4
AE-4003-D-020 is 2 m in length but comes with a precision cutting tool to reduce light losses from non-perpendicular cuts

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Fig. 5
Type 2981, UA-2144 and AE-4003-D-020 are also available as a bundle: Type 2981-A

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Speed Measurements in Tight Spaces

Some locations do not have direct line of sight to a mounting location for Type 2981.

In such instances, the very compact AE-4003-D-020 fibre cable has an M6 body less than 25 mm long and a minimum bend radius of 25 mm so that it can be routed to tight locations.

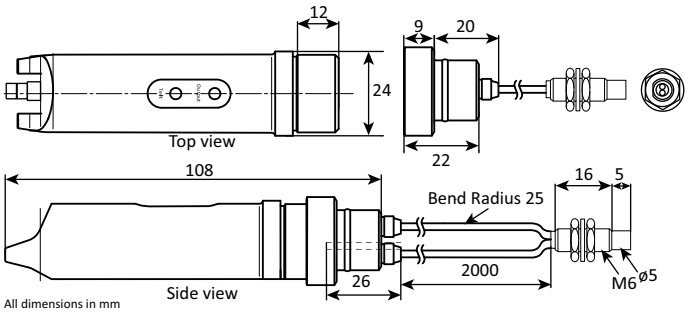
There is a wide range of other 2.2 mm diameter fibres that are compatible with the UA-2144 2.2 mm × 2 fibre adaptor, including fibres with smaller tips and tighter bend radii but that usually have lower operating temperatures.

NOTE: A 26 mm minimum length of 2.2 mm diameter fibre is required to fit in Adaptor UA-2144. Some fibres have a protective covering and only a short length of 2.2 mm diameter fibre.

For best performance with the optical fibre, ensure that:

- The retroreflective target is at least as large as the laser spot
- The bracket holding the fibre tip has minimal motion in the operating range of measurement

Fig. 6 *Physical dimensions of CCLD Tacho Probe Type 2981, Fibre Adaptor UA-2144 and Fibre Cable AE-4003-D-020*



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Compliance with Standards

	The CE marking is the manufacturer's declaration that the product meets the requirements of the applicable EU directives. RCM mark indicates compliance with applicable ACMA technical standards – that is, for telecommunications, radio communications, EMC and EME. China RoHS mark indicates compliance with administrative measures on the control of pollution caused by electronic information products according to the Ministry of Information Industries of the People's Republic of China. WEEE mark indicates compliance with the EU WEEE Directive
EMC Emission	EN/IEC 61000-6-3: Generic emission standard for residential, commercial and light industrial environments **NOTE:** The above is only guaranteed using accessories listed in this document
EMC Immunity	EN/IEC 61000-6-2: Generic standard – Immunity for industrial environments. **NOTE:** The above is only guaranteed using accessories listed in this document
Temperature	IEC 60068-2-1 & IEC 60068-2-2: Environmental Testing. Cold and Dry Heat Operating Temperature: –10 to +50 °C (14 to 122 °F) Storage Temperature: –20 to +80 °C (–4 to 176 °F)
Humidity	IEC 60068-2-78: Damp Heat: 93% RH (non-condensing at +40 °C (104 °F)). Recovery time 2 ~ 4 hours
Enclosure	IEC 60529 (1989): Protection provided by enclosures: IP 64

Specifications – CCLD Laser Tacho Probe Type 2981

ELECTRICAL

Current Requirements	CCLD, 3 to 20 mA
Voltage Requirements	CCLD, ≥20 V
DC Bias Output	+18.0 V to +19.5 V for CCLD current ≥4 mA (individually measured and stored in TEDS)
Signal Output	–0.8 ± 0.2 V_p re DC bias output. Rise and fall time < 500 ns current limited*
Output Connector	SMB
Protection	Max. Continuous Input Voltage –5 V to +30 V
Laser	Class 3R. Visible 660 – 690 nm, CW, P [optical] <2 mW Complies with EN/IEC 60825-1: 2007 
Activity LED	Flashes when pulses are received or lights up if the test button is activated
Test Button	When activated, the output level drops 0.8 V and the activity LED is lit. This corresponds to the active signal level
TEDS	TEDS template with probe identification and specifications for power requirements, trigger level, signal level and polarity
Isolation	Housing is separated from signal ground by a 1 kΩ resistor to avoid the effect of ground loops in multichannel systems

* Current limit at transducer: 20 mA up to +20 V; 13 mA up to +30 V to guarantee input power <400 mW

PERFORMANCE

RPM Range	0* – 300000
Operating Range	1.5 cm (0.6″) to >70 cm (27″) and >30° from centre line
Laser Spot	<∅ 5 mm at 70 cm distance

* Measurement down to 0 rpm requires DC coupling of the CCLD power supply and that the retroreflective target is small relative to the shaft circumference, ≤15°

MECHANICAL

Mounting	¼″-20 UNC (camera tripod), 10-32 UNF and M4 on the flat side of the probe; M22-1 thread with flange on the front
Front Protection Glass	Acrylic with hard-coated and antireflective surface
Weight	50 g (2 oz)
Dimensions	∅ 22.5 × 91 mm (∅ 0.87 × 3.6″)

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Specifications – Adaptor UA-2144 and Fiber Cable AE-4003-D-020

PERFORMANCE

Laser Spot	Approx. ∅ 6 mm at 25 mm (1″) distance. May be surrounded by weak halo	
Operating Range:		
	Retroreflecting Tape Size	Detection Range
Maximum	15 × 20 mm	>60 mm
	4 × 15 mm	28 mm
Minimum	4 × 15 mm	4 mm

ENVIRONMENTAL

Temperature Range (AE-4003)	–60 to +130 °C (–76 to +266 °F)

Compatible with existing MM-0360 serial number 100xxx (not compatible with MM-0360 serial number 110xxx)

MECHANICAL

Fiber Length	2 m (78.7″) Can be cut with included tool
Mounting	M6-0.75 thread with two included nuts
Bend Radius	25 mm (1″)
Minimum ∅ 2.2 mm Fiber Length with UA-2144	26 mm (1.02″)

Ordering Information

Type 2981 **CCLD Laser Tacho Probe**
includes the following accessories:
- QS-0056-001: Retroreflective Tape, 4 m
- KE-0345: Box for Type 2981 and tape

Type 2981-A **CCLD Laser Tacho Probe with Adaptor and High-temperature Fibre**
includes the following accessories:
- UA-2144 Adaptor for Fibre ∅ 2.2 mm for Laser Tacho Probe Type 2981
- AE-4003-D-020 High-temperature Dual Fibre for Type 2981

Optional Accessories

Type 1704-A	Battery-powered CCLD Signal Conditioner
UA-2144	Adaptor for ∅ 2.2 Fibres
AE-4003-D-020	High-temperature Fibre, 2 m (6.7 ft)
KE-1019:	Soft Case

DATA ACQUISITION

Type 2250-V-S01*	Integrating Hand-held Vibration Analyzer (1/n-octave band analysis only)
Type 2250-V-SC1	Integrating Hand-held Vibration Analyzer with calibrator (1/n-octave band analysis only)

For ordering information on LAN-XI data acquisition hardware, please see product data bp2215.pdf.

MOUNTING

UA-0801	Lightweight Tripod
UA-1251	Lightweight Tripod, compact type
UA-0642	Mounting Magnet with integrated 10-32 stud

CABLES

AO-0564-D-XXX†	SMB Right-angle Connector to BNC Cable
AO-0587-D-XXX	SMB Straight Connector to BNC Cable
AO-0726-D-XXX	SMB Straight Connector to Type 2250 Cable
WA-1705	SMB to 10-32 female adaptor

* Type 2250 requires units with serial number 2630266 or above
† XXX = represents length in decimetres (for example, -D-010 is 1 m long)

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