SENSONICS LTD
Northbridge Road
Berkhamsted
Herts
HP4 1EF
England

Telephone: +44 (0) 1442 876 833
Fax: +44 (0) 1442 876 477
E-mail: sales@sensonics.co.uk
Web site: www.sensonics.net

Senturion Range

Disc Eddy Current Probes, Extensions & Drivers

Type PRD04 to PRD18

Handbook Ref. HB.1217

Contents

Drawings & Data

General Information on Disc Probes and Drivers

This product handbook is a general document that covers all standard disc eddy current probes within the Senturion range. Every effort has been made to detail data for each individual probe size and measuring range. Therefore when reading certain sections, ensure you are reading the data applicable to that probe size and range being used, especially when performing a calibration check.

Table of Senturion Disc Eddy Current Probe range

Probe Type	Tip Size mm	Linear Range mm (inches)	Sensitivity mV/µm (mV/0.001")
PRD04	ø8.0	0.125-2.5 (0.005"-0.100")	8.0 (200)
PRD04	ø8.0	0.125-4.0 (0.005"-0.160")	4.0 (100)
PRD08	ø20.0	1.0-8.5 (0.040"-0.335")	2.0 (50)
PRD12	ø25.0	1.0-12.0 (0.040"-0.475")	1.4 (35)
PRD18	Ø40.0	2.0-18.0 (0.080"-0.710")	1.0 (25)

Electrical Vs Physical cable length, probe to driver.

The eddy probe and driver operate by using a tuned circuit, i.e. at the natural frequency of the system. This natural frequency is dependent on Resistance Inductance and Capacitance.

The probe cable and extension cable to the driver is essentially a capacitive load. In order to maintain interchangeability between probes extension cables and drivers each element is tuned to a certain capacitive value.

In manufacture of the probe and extension cable the electrical characteristics vary from item to item and particularly between probe and probe. The tuning of each probe and extension cable is achieved by altering the physical length of the cable.

It is for this reason that the physical length is a nominal value with a tolerance of +/- 16% to allow for individual tuning.

Probe cables must not, therefore, be shortened, as this will affect the calibration. As a guide, a decrease of 10 mm in length will vary the sensitivity by approximately +/- 2%.

Matching of probe and driver

For a given nominal probe cable length and a driver unit intended for this cable length, the 'interchangeability' of any two components is such that a measuring accuracy within +/- 5% will result. For applications that do not require an actual measurement, e.g. speed and phase, then no further adjustment is necessary.

For 'measuring' applications, e.g. eccentricity, thrust position, then to achieve the specified accuracy of +/- 1% it is necessary to adjust a trimmer potentiometer (marked 'Cal') on the driver unit when the two components are assembled, powered and the probe is sensing the required target material.

Components of the System

General description – Disc Eddy Current Probe

The probe consists of a coil of copper wire sealed into a flat, cylindrical ('pancake'), non-metallic housing fixed to a flat stainless steel mounting base. The base providing two or three mounting holes for cap head screw fixing. An integral, coaxial cable exits radially one end of the mounting base, this being plain cable or armoured with stainless steel braided. The cable lengths available are restricted to the matching drive for the system, and are terminated at the end by a miniature coaxial electrical connector that carries the connections from the coil to the associated driver unit.

Probes that have outer armoured braiding on the cable offer mechanical protection only and is not intended as a conductor. It is; however, in contact with the probe base plate but is isolated from the coaxial connector.

General specification – Disc Eddy Current Probe

Probe Type	Tip Size mm	Linear Range mm (inches)	Sensitivity mV/µm (mV/0.001")	Frequency range
PRD04	ø8.0	0.125-2.5 (0.005"-0.100")	8.0 (200)	DC to 10kHz
PRD04	ø8.0	0.125-4.0 (0.005"-0.160")	4.0 (100)	DC to 10kHz
PRD08	ø20.0	1.0-8.5 (0.040"-0.335")	2.0 (50)	DC to 10kHz
PRD12	ø25.0	1.0-12.0 (0.040"-0.475")	1.4 (35)	DC to 4kHz
PRD18	Ø40.0	2.0-18.0 (0.080"-0.710")	1.0 (25)	DC to 4kHz

Operating Temperature limits: -30°C to + 180°C operational

General description - Eddy Current Driver Unit

This unit consists of an electronic circuit board assembly potted within a cast housing that is fitted with a rectangular base mounting plate. Two through holes, one in each top corner of the mounting plate accepts mounting screws up to ø5mm. A terminal block and a coaxial connector are fitted to the top of the housing for the electrical connections and access is provided to a trimmer potentiometer for individual calibration of the unit with a specific probe. All input and output connections are isolated from the outer case of the unit.

General specification - Eddy Current Driver Unit

Operating voltage	:	-24V dc (stabilised)
Operating current	:	30mA nominal
Temperature limits	:	-30 to +90°C
Output signal sensitivity	:	(As listed in table for the probe above)
Frequency range	:	(As listed in table for the probe above)

Calibration Procedure

Important: Take note of which probe type/range is being calibrated.

1. Set up probe, driver, calibrator and DVM as shown in the diagram on the next page and apply power.
2. Leave system powered for up to 1/2 hour to allow electronics to warm up.
3. With the DVM across the driver O/P terminals (measuring the sensitivity), move calibrator until DVM reads the **Datum voltage** as below, ensuring that movement of calibrator is always such that any backlash is removed.

Probe Type & Range	Tip Size mm	Datum Voltage
PRD04 / 0-2.5mm	ø8.0	2.000
PRD04 / 0-4.0mm	ø8.0	2.000
PRD08 / 0-8.0mm	ø20.0	2.500
PRD12 / 0-12.0mm	ø25.0	1.400
PRD18 / 0-18.0mm	Ø40.0	2.500

4. Note micrometer reading. *(this is Start point or Datum gap)*
5. Move calibrator out, so the gap increases by **exactly** the distance shown below:

Probe Type & Range	Tip Size mm	Increase distance by inch (mm)
PRD04 / 0-2.5mm	ø8.0	0.080" (2.032mm)
PRD04 / 0-4.0mm	ø8.0	0.140" (3.81mm)
PRD08 / 0-8.0mm	ø20.0	0.300" (7.50mm)
PRD12 / 0-12.0mm	ø25.0	0.500" (12.70mm)
PRD18 / 0-18.0mm	Ø40.0	0.600" (15.24mm)

6. Note reading on DVM.
7. Adjust Cal pot on driver to read **volts** as shown below, +0/-0.2v

Probe Type & Range	Tip Size mm	Volts
PRD04 / 0-2.5mm	ø8.0	18.000
PRD04 / 0-4.0mm	ø8.0	16.000
PRD08 / 0-8.0mm	ø20.0	17.500
PRD12 / 0-12.0mm	ø25.0	18.900
PRD18 / 0-18.0mm	Ø40.0	17.500

8. Repeat step (3) to (7) until the reading taken (volts) in step (6) is the same as in table (7) without adjustment.
   The probe and driver is now calibrated for the material used as the target in the calibrator. This calibration is not necessarily the best straight-line plot for all points on the calibration curve but is a very good approximation. To get the best straight line the following trim calibration may now be carried out.
9. Move calibrator, such that DVM reads the **Datum voltage** (see tables in step **10.** Below). This now becomes the *Start point or Datum gap*. Note: this is an arbitrary datum. The readings from an eddy probe system do not always assume that zero displacement starts at the probe face. The zero datum can vary by ±2% of range. This fact is, however, not relevant or important to static or dynamic machinery monitoring.
10. Take readings to complete the following table:

PRD04, 0-2.5mm range – 8.0mV/µm sensitivity

GAP (thou)	GAP (mm)	CORRECT VALUE (C)	INDICATED VALUE (I) volts	ERROR mV (+ OR -)
10	0.254	(2.0 volt **datum**)	2.0	0
30	0.762	6.00		
50	1.270	10.00		
70	1.778	14.00		
90	2.286	18.00		

PRD04, 0-4.0mm range – 4.0mV/µm sensitivity

GAP (thou)	GAP (mm)	CORRECT VALUE (C)	INDICATED VALUE (I) volts	ERROR mV (+ OR -)
10	0.254	(2.0 volt **datum**)	2.0	0
30	0.762	4.00		
50	1.270	6.00		
70	1.778	8.00		
90	2.286	10.00		
110	2.794	12.00		
130	3.302	14.00		
150	3.810	16.00		
160	4.064	17.00		

PRD08, 0-8.0mm range – 2.0mV/µm sensitivity

GAP (thou)	GAP (mm)	CORRECT VALUE (C)	INDICATED VALUE (I) volts	ERROR mV (+ OR -)
50	1.25	(2.5 volt **datum**)	2.500	0
100	2.50	5.00		
150	3.75	7.50		
200	5.00	10.00		
250	6.25	12.50		
300	7.50	15.00		
350	8.75	17.50		

PRD12, 0-12.0mm range – 1.4mV/µm sensitivity

GAP (thou)	GAP (mm)	CORRECT VALUE (C)	INDICATED VALUE (I) volts	ERROR mV (+ OR -)
40	1.00	(1.4 volt **datum**)	1.400	0
100	2.54	4.90		
200	5.08	8.40		
300	7.62	11.90		
400	10.16	15.40		
500	12.70	18.90		

PRD18, 0-18.0mm range – 1.0mV/µm sensitivity

GAP (thou)	GAP (mm)	CORRECT VALUE (C)	INDICATED VALUE (I) volts	ERROR mV (+ OR -)
100	2.54	(2.5 volt **datum**)	2.500	0
200	5.08	5.00		
300	7.62	7.50		
400	10.16	10.00		
500	12.70	12.50		
600	15.24	15.00		
700	17.78	17.50		

11. Reading the error **mV** column, take the negative and positive extremes.

12. Add these two extremes together ignoring the negative or positive signs and divide by 2. This value is now designated **X**.

13. Adjust the micrometer to a position such that DVM reads the indicated value associated with positive error extreme.

14. Move Cal pot on driver until DVM reads **correct value** + **X**. Driver is now set up for best straight line.

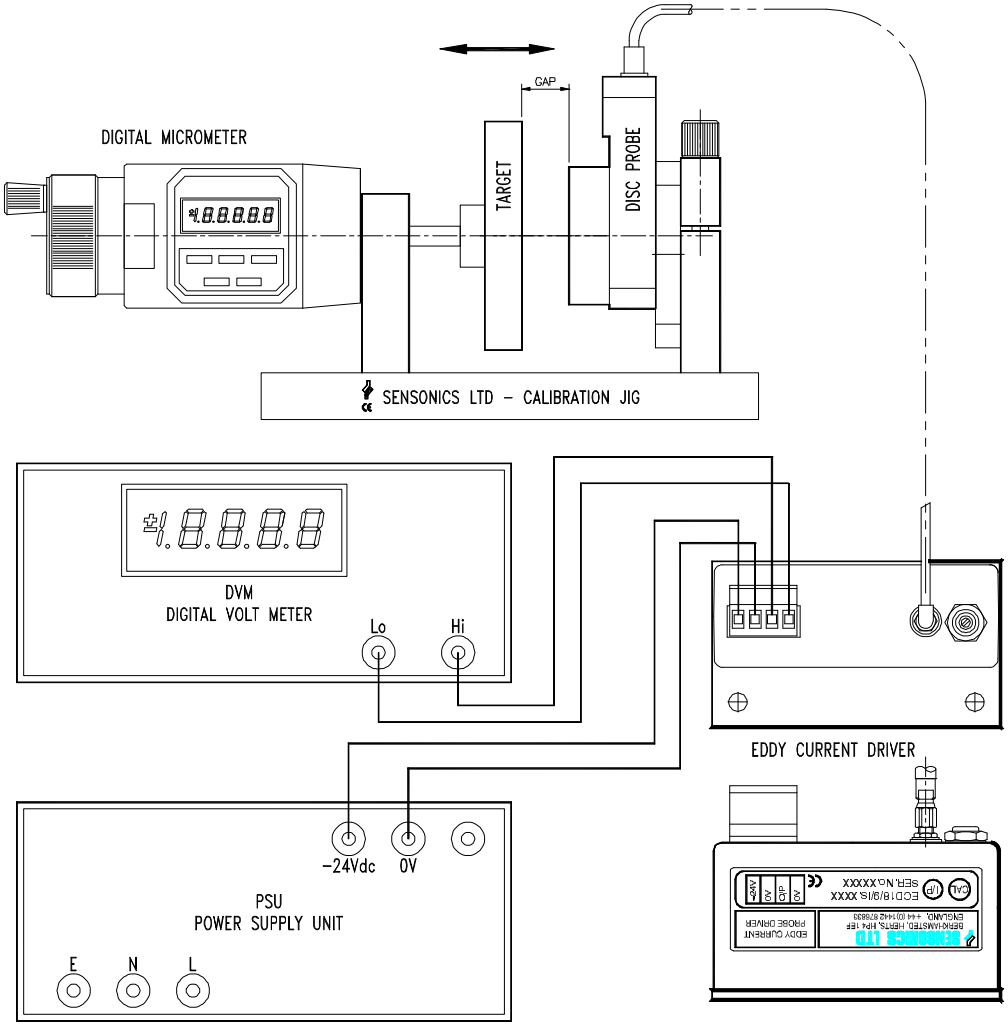
Continued next page

Linearity Calculation

15. Repeat table in step (10) and step (11).

16. Take the **highest** of the two extremes, this value is now **Y** in mV. Linearity of system in percent is calculated by dividing **Y** mV's with the **factor** below: (O/P voltage span x 10, e.g.2.0v-18.0v = 16.0x10=160)

Probe Type & Range	Tip Size mm	Factor
PRD04 / 0-2.5mm	ø8.0	160
PRD04 / 0-4.0mm	ø8.0	150
PRD08 / 0-8.0mm	ø20.0	150
PRD12 / 0-12.0mm	ø25.0	175
PRD18 / 0-18.0mm	Ø40.0	150



Equipment Set-up for Probe and Driver Calibration

Installation Setting of Probe

Depending upon the application, the probe may be set via its bracket such that the nominal gap between probe tip and target is anywhere within the linear range of the probe. Consideration of the direction and magnitude of the expected displacement of the target will normally determine the nominal gap setting. This will be such that the displacement extremes remain within the linear range of the probe and that a gap always exists between probe tip and target. Provided that these requirements are met, it is usual to set the probe for a gap of approx. half its linear range (i.e. mid range) and this may be achieved by measuring the output from the driver unit and adjusting the probe position to give a reading of -10V.

CAUTION

Care must be taken in setting the mechanical probe position to ensure that there is always a gap between the target and the probe tip during normal running conditions or damage to the probe tip could result.

Due to the large measuring range of these probes, the calibration may be affected by proximity to parts of the machine (e.g. the shaft) which are close to the intended target (i.e. a flange or collar on the shaft). Similarly, the linearity may be affected due to the field from the probe tip extending beyond the edge of the target flange. For these reasons, the probe and driver combination is calibrated in situ rather than on a calibration test fixture. This is achieved by means of a DTI (dial test indicator) monitoring the actual displacement between probe face and target collar over the probe range (positive & negative about the mid point). The initial setting of the probe is such that an output of -10V appears at the driver, approx. mid range. The probe is then displaced (half its range) towards the target until the datum voltage (-2.0V nominal, see tables in calibration section, step 10.) appears at the output of the driver. This then becomes the datum for the calibration plot as per the procedure outlined previously. For example a **PRD18,** and assuming that the calibrated displacement range is from -300 thou (17.5V) through 'zero' (-10V) to +300thou (-2.5V).

The 'cal' potentiometer on the driver unit is adjusted for the best straight line over this range.

Maintenance

The probe cannot be dismantled and, if damaged (e.g. tip knocked off or body distorted), is not repairable. A connector may be replaced or re-fixed provided that this does not involve any significant shortening of the cable (i.e. more than a few millimetres).

None of the coaxial cables supplied for interconnecting the EC probe to the driver module should be shortened or the tuning of the probe will be

affected. If shorter (or longer) extension cables are required for a particular installation, then these should be ordered by their required nominal length - bearing in mind the tolerance on 'nominal' cable length to allow for tuning during factory assembly.

Breakdown Maintenance

The equipment is factory set and designed for reliable operation without maintenance. Should a failure occur, then it is recommended that the equipment be returned to Sensonics for examination and repair.

On-site repair or re-adjustment of internal settings should only be carried out, if considered essential, by a qualified electronic engineer after careful study of the circuit diagrams and other relevant data provided in the handbook.

Sensonics offers an out of warranty repair and or re-calibration services please contact the sales department for more details (see the front page for telephone/web site numbers).

WARRANTY POLICY

All Sensonics products are warranted against defects in materials and workmanship. The warranty applies to transducers and analogue signal conditioning for a period of one year. Certain components, listed in the applicable instruction manuals with other warranty periods specified, are excepted. All warranty periods apply from the date of delivery. Sensonics will repair or replace products that prove to be defective during the warranty period, providing the failure or damage has not been caused by misuse or by abnormal operating conditions. Fuses and lamps are specifically excluded from warranty. If the malfunction or a portion thereof is determined by Sensonics to have been caused by misuse or abnormal conditions of operation, an estimate of cost to repair will be submitted to the purchaser for approval before beginning any repair work. This warranty is also invalidated if an unauthorised person carries out re-adjustment or attempted repair.

Liability under the warranty is limited to servicing and adjusting the equipment returned to the factory, with transportation charges prepaid by the purchaser. No other warranty is expressed or implied and no liability for consequential damage is accepted.