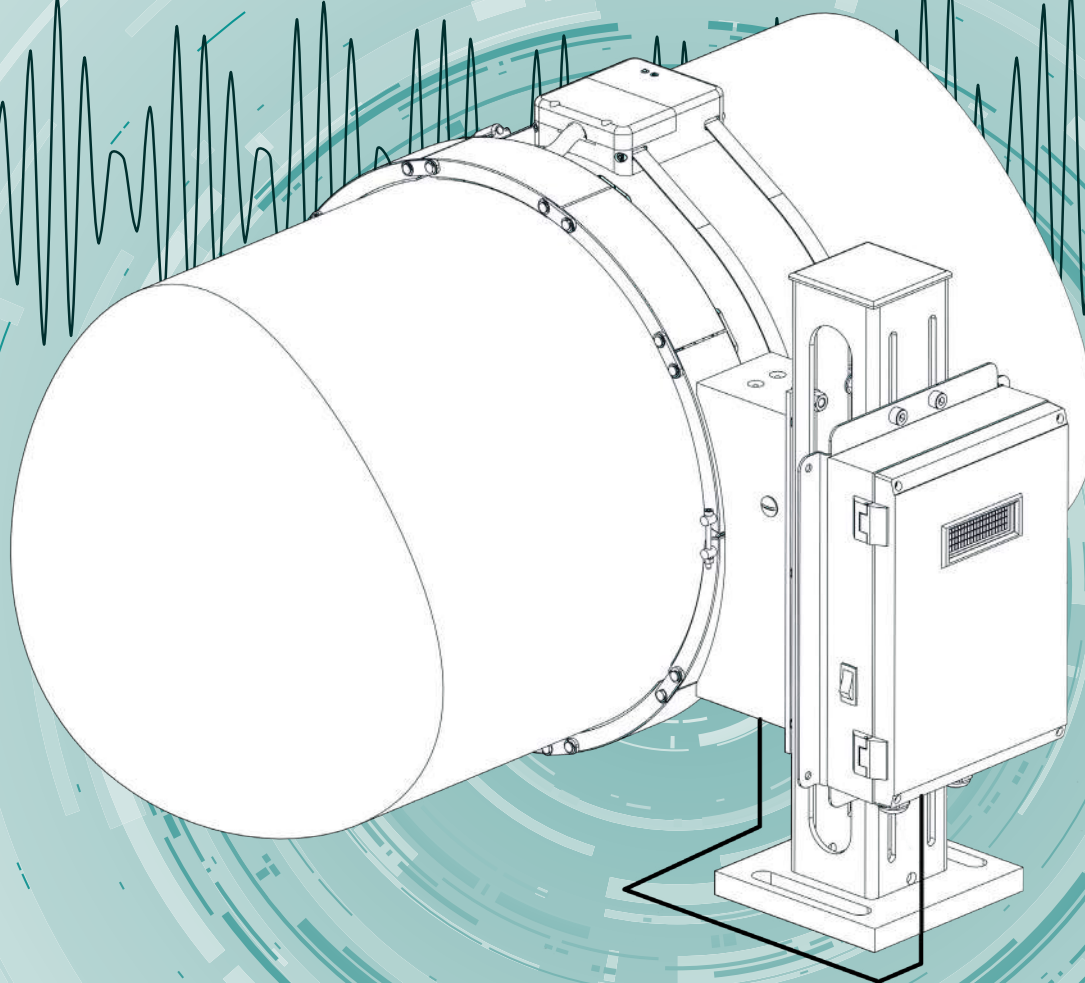

DATUM ELECTRONICS

COMMERCIAL MARINE SHAFT POWER METER

HANDBOOK



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CMSPM OVERVIEW

System design

The Commercial Marine Shaft Power Meter, CMSPM, system continually measures on shaft torque (kNm), speed (RPM) and power (kW).

The Commercial Marine Shaft Power Meter Systems have been developed to meet the requirements of the Commercial Marine customers to provide ongoing power monitoring data on ships including; Propulsion, Thruster and even Generator Shafts.

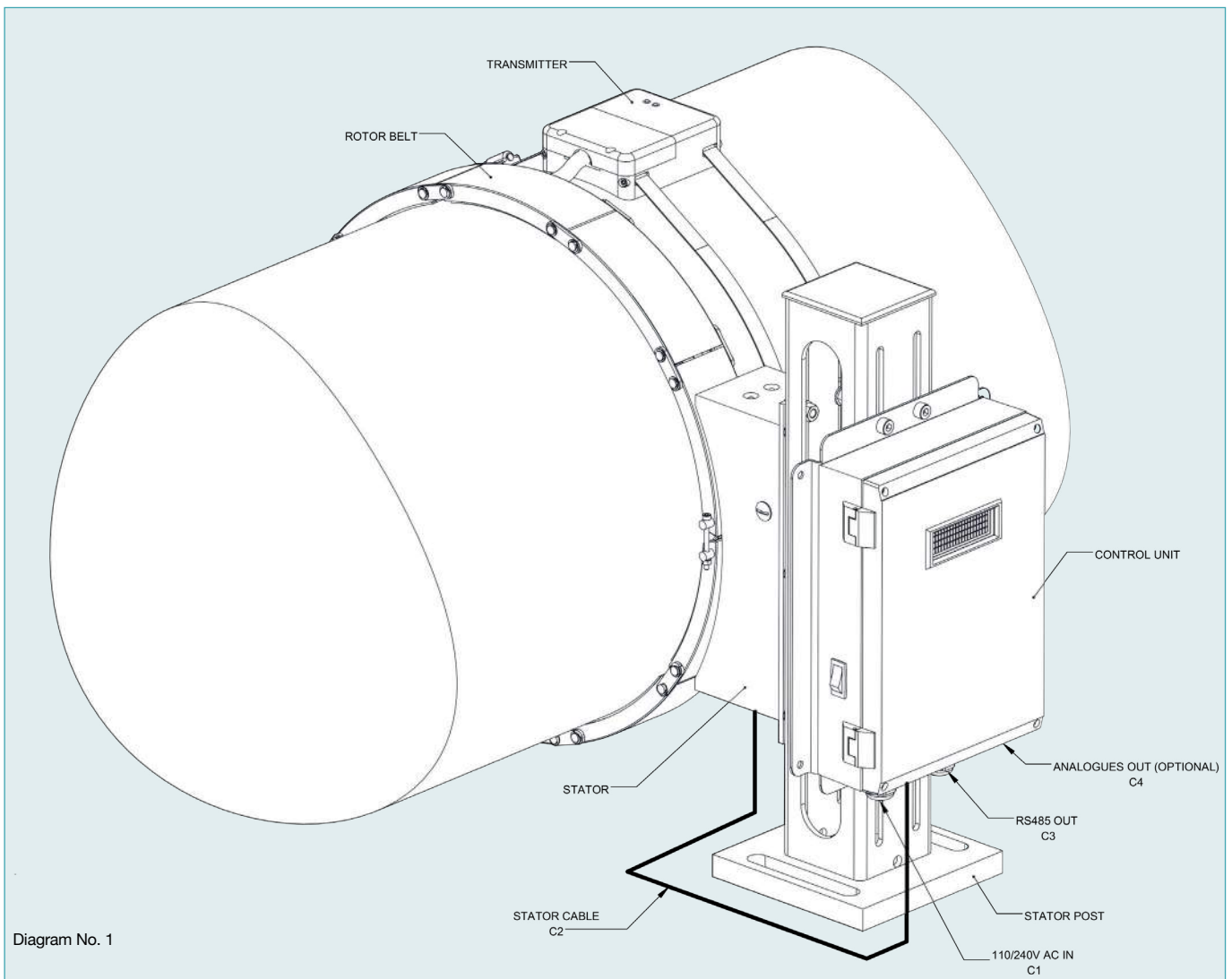
SYSTEM SPECIFICATIONS

CMSPM system performance and benefits:

- Simple and Easy to install
- Accurate - electronics rated at 0.1% accuracy
- Robust Design : IP68
- Modular system design
- Flexible shaft fit - 70mm - 1200mm
- Cost effective
- Efficient Power Usage compared to other systems

SYSTEM OVERVIEW

STANDARD SYSTEM OVERVIEW



Typical installation shown above.

The CMSPM system can also be supplied with the extra 7 inch ECR display (Diagram 2):

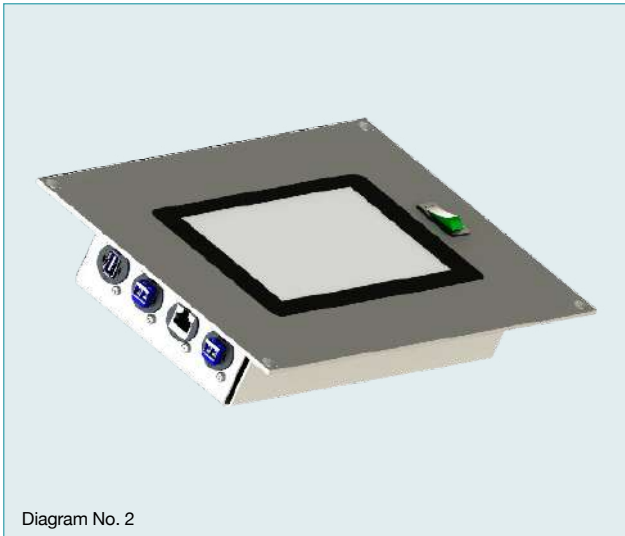


Diagram No. 2

SYSTEM COMPONENT INFORMATION

TRANSMITTER (Diagrams 3-4)



Diagram No. 3

Features:

- Powered from Rotor belt (5V)
- IP 68 rated
- 2 status LED's for easy system diagnosis
- Transmits 2 channels of strain (optimal thrust)
- 2.4Ghz transmission
- Removable cover to access 2 x strain channels and rotor band power connection
- Acts as strain gauge protection cover
- Secured to shaft via 2 x supplied bands

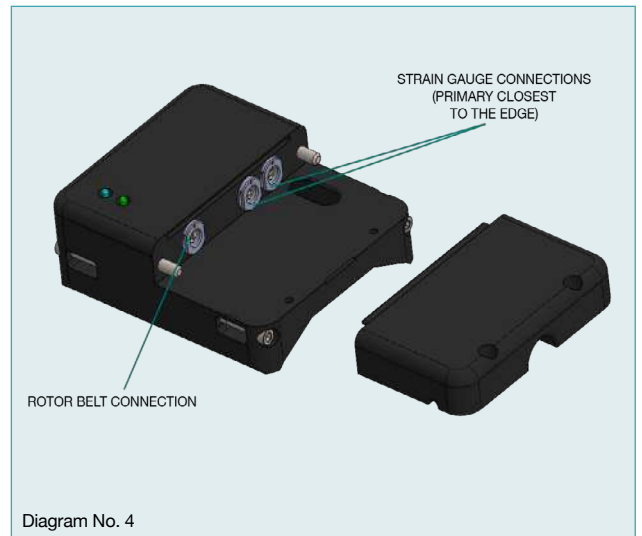


Diagram No. 4

ROTOR BELT (Diagrams 5)

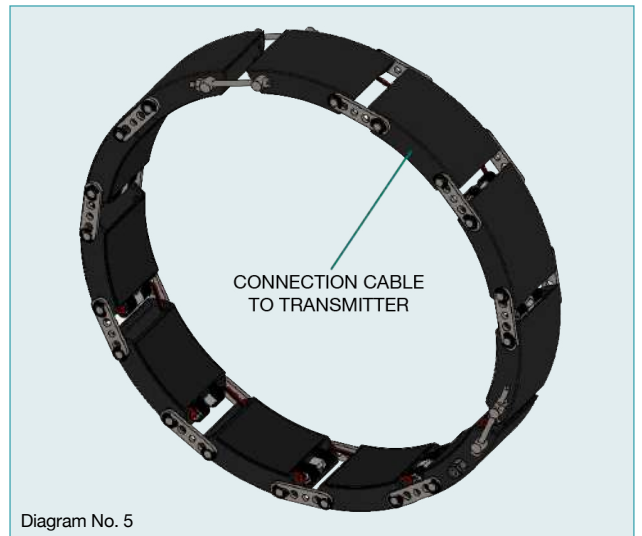


Diagram No. 5

Features:

- Modular belt design made up of individual links
- IP68 rated design
- Powers the on shaft Transmitter
- Inductively receives power from Stator
- Every belt has a 'master' link which comprises a magnet in to generate a 1 pulse per revolution rpm signal output

SINGLE POINT STATOR

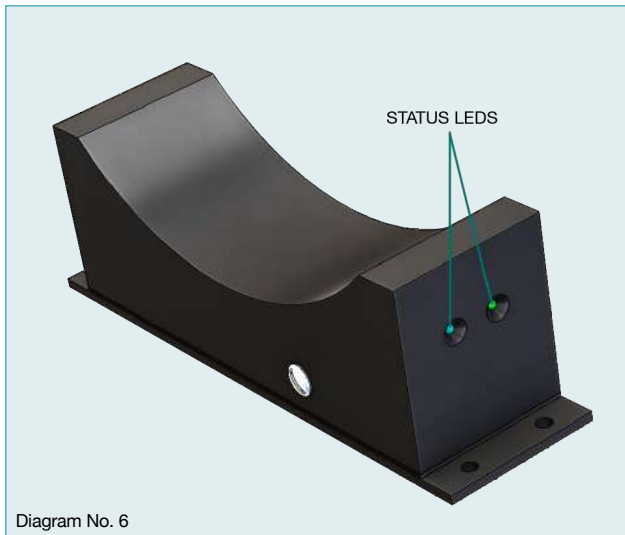


Diagram No. 6

Features:

- IP 68 Rated
- Inductively powers the on shaft Rotor Belt
- Receives data from the on shaft Transmitter
- Contains the rpm speed sensor to measure 1 pulse per revolution
- Features 2 LED's for simple system diagnosis
- Has a single cable output (not shown) for power and RS485 serial data to the marine controller
- Powered from marine controller (24VDC)

MARINE CONTROLLER



Diagram No. 7

Features:

- IP 68 Rated enclosure
- Simple 4 Line display showing; Torque, Speed, Power and System Status
- Can be supplied on post or be bulk-head mounted
- Requires 110/240VAC power (see system drawings for more information)
- Connects to Stator Head with single cable for power and RS485 serial data
- Supplies the stator head with 24vdc power
- Set-up and configured via USB mini b cable to PC with free supplied test and configuration software from Datum, DUI Config (for more information please see software guide)
- Contains Marine Datum Universal Interface (DUI), which can be configured for a range of outputs including:
 - 3 x analogue channels of calibrated; Torque, Speed and Power data
 - Analogue outputs selection include; 0-10V, +/-5V, 4-20mA, 12-8mA, +/-10V, 0-5V
 - Digital data output: RS485 and/or Ethernet as a variety of selectable output types for system integration
 - Local USB memory stick logging of data (Plug & Play)
- Sends RS485 Serial data to the Datum 7inch ECR display panel

7-INCH ECR DISPLAY PANEL (OPTIONAL EXTRA)

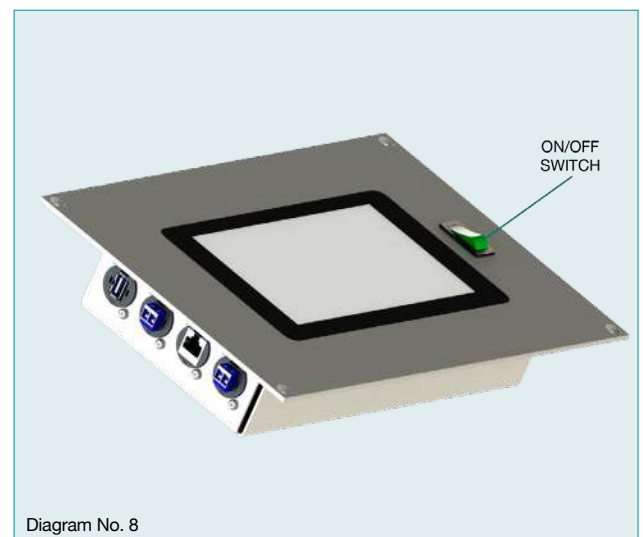


Diagram No. 8

Features:

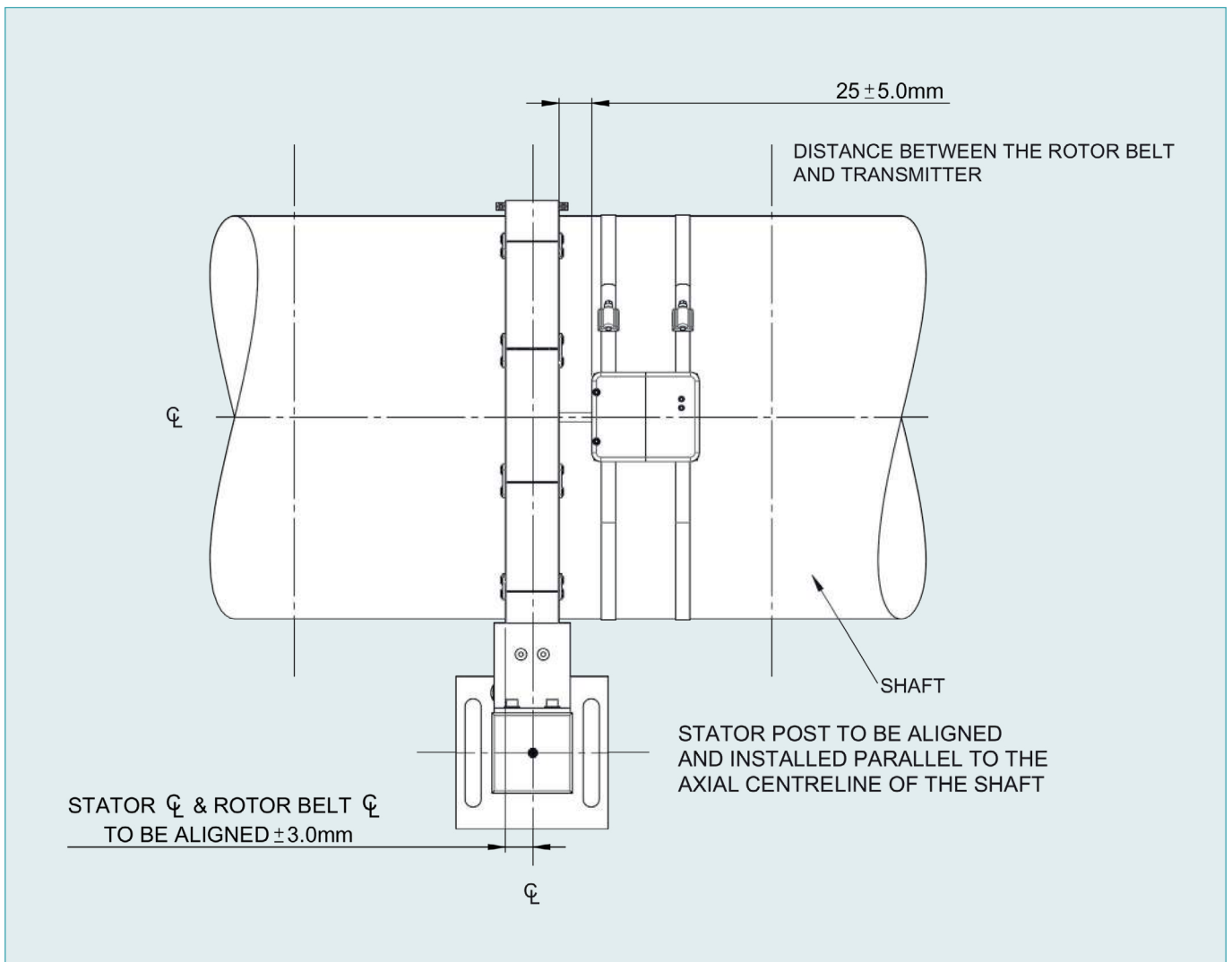
- Running display of calibrated information from the CMSPM system
- As standard displays; Torque, Speed & Power
- Can have multiple display panels per systems
- Receives RS485 data from the Marine Controller
- Simple Installation and usage
- Requires local power 24VDC

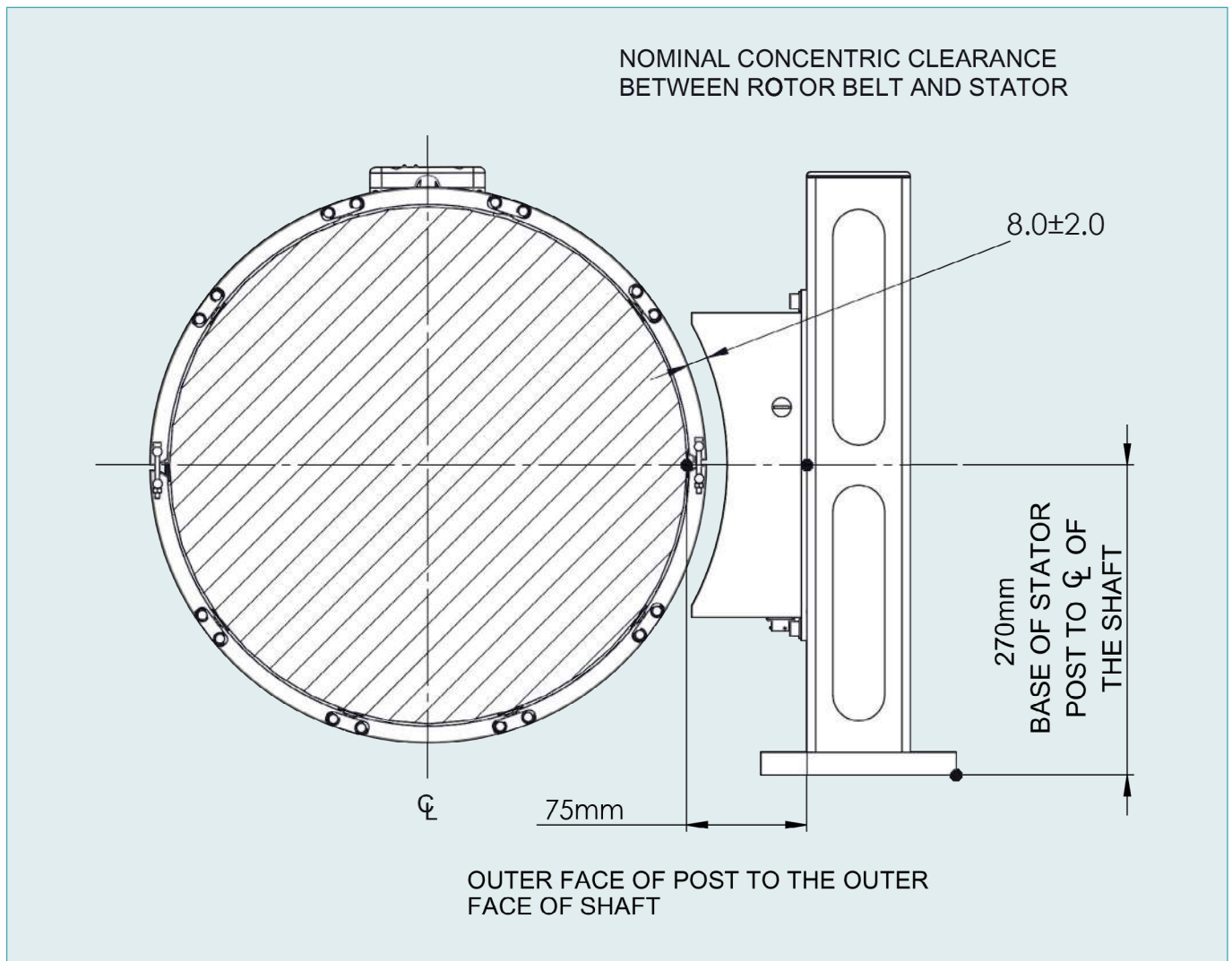
SYSTEM ALIGNMENT

The Datum CMSPM system is simple and easy to install. The engineer who installs it will have to ensure:

1. Continuous power transmission between Stator and Rotor Belt
2. Accurate measurement of speed as 1 pulse per revolution between the 'master' link belt piece and the Stator

Please see below drawings which illustrate best practice – please note that the Transmitter can be positioned either side of the Rotor Belt:





For more information on the installation of the system and how to align the CMSPM please refer to the installation guide.

SYSTEM FAQ'S

How is the shaft power meter calibrated?

The CMSPM system receives the raw strain value (mV/V) from the strain gauges on shaft and mathematically calibrates this into torque (kNm). This is calculated using the following equation:

$$mV / V = \frac{Torque (Nm) * 16000 * Gauge Factor * (1 + \sigma)}{Diameter (mtrs)^3 * \pi * Young's Modulus (Pa)}$$

It is important for the calibration of the system that the correct dimensional information (outer and where needed inner diameters) be provided to the installation engineer and, where possible, shaft material, Young's Modulus and Poissons Ratio.

Datum use the properties for nominal tool steel for the Young's Modulus and Poisson's Ratio if the exact steel properties are not known during installation.

How is the power calculated from the Torque and speed data?

Power (KW) = Torque (kNm) x Angular Velocity (radians/sec)

or

Power (KW) = Torque (kNm) x Shaft Speed (RPM) x P/30

Can the outputs of the system be changed after installation?

Yes this can be done by accessing the marine DJI inside the controller and using the Datum configuration software. Please note that all the functions of the controller will be set up as requested during installation – see section 8 for more information.

Negative displays of torque and power?

If the display or indicator is showing a negative value this is simply showing the direction of the torque;

+ indicated clockwise strain/torque

- indicates counter-clockwise strain/torque

As the power is calculated from the Torque and Speed if there is counter clockwise torque then this will give a negative value of power.

Datum Electronics can change this setting to only display one direction torque and power, if requested.

The values appear to be changing very quickly on Marine Controller display?

The Marine Controller has a 4 Line display which gives a simple indication of the Torque, Speed and Power and the system status. It will show live data from the shaft power meter which samples the data at a minimum of 10 samples per second, this can appear to change quickly. Please discuss this with the Datum Support Team as this can be changed in the settings to suit your needs.

Torque still showing when there is no RPM?

The torque data is continuously being transmitted even when there is no shaft rotation so an indication of torque is either

1. Locked in torque seen from a brake being applied to the shaft
2. Zero not being set correctly
3. Combination of the above

Please refer to section 8 for more information on zero setting information.

How to fault find system?

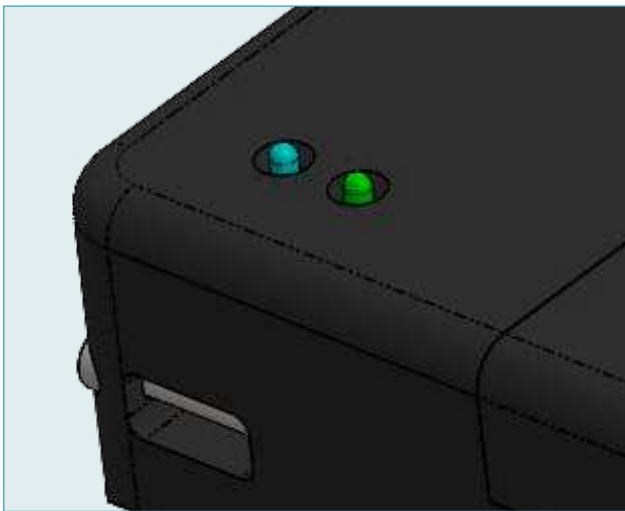
Refer to section 7 for more information on system diagnosis.

SYSTEM DIAGNOSIS

The Datum CMSPM features several simple indicators to help with system diagnosis:

- 2 x LED's on the Transmitter (Rotor)
- 2 x LED's on the Stator
- 4 line display on the Marine Controller display

TRANSMITTER LEDS (ROTOR)



BLUE LED = Data status

GREEN LED = Power status

BLUE FAST FLASH = Good data connection with Stator

BLUE SLOW FLASH (1 per second) = Powered but no connection stator received

GREEN = Good power from Rotor Belt

STATOR LEDS



BLUE FAST FLASH = Good data connection with on shaft transmitter

BLUE SLOW FLASH = No connection with the on shaft transmitter

GREEN = This will illuminate every time an RPM pulse is triggered from the Rotor master link

MARINE CONTROLLER DISPLAY & 7 INCH DISPLAY

The fourth line of the display alternatively shows the status of the controller as well as the current sample rate. The status will either show as;

- STATUS OK = receiving data from stator and transmitter, followed by samples per second being received
- STATUS no input = not receiving data from stator and transmitter, followed by 0 samples per second

Both the display and controller have a manual power on/off switch which can be used to reset the system. Please note that this will not delete any settings stored into the marine DUI.

CMSPM ADDITIONAL SETTINGS

CONFIRMING THE TORQUE OUTPUT

If you are concerned about the amount of torque being displayed and have checked your calibration values then it is possible to prove the CMSPM system and its output of torque by replacing the strain gauges with a set of known mV/V values. With every shaft power meter Datum Electronics supply a strain gauge simulator which can inject known mV/V steps in both directions of; 0, 0.2, 0.5, 1.0, 1.5 & 2.0 mV/V



Please note that it is only possible to use the strain gauge simulator whilst the shaft is static as you will need to connect to the on shaft transmitter.

To use the strain gauge simulator you will need to remove the access cover on the on shaft transmitter and unplug the connector from the primary gauge. The primary gauge connector is the furthest from the rotor belt connection (Diagram 4). Now connect the strain gauge simulator. You can then use the dial to select the different mV/V values in both clockwise (positive) and counter-clockwise (negative) direction.

You can then compare the calibration setting of your system to the closest value on the strain gauge simulator to confirm the system is functioning correctly, i.e:

Calibration setting for system = 0.9mV/V is equal to 500kNm, therefore using the simulator you should see torque of; 0.2mV/V = 112kNm, 0.5mV/V = 278kNm & 1.0mV/V = 556kNm.

FAULT FINDING

For any fault finding and diagnosis you will need to check the status of all three sets of indicators, this will highlight where the potential issue could be. Please then contact your distributor or the Datum Support team:

Email: support@datum-electronics.co.uk

Tel: +44 (0) 1983 282834

ZERO SETTING

If you wish to re-zero an offset (torque) at any time, this can be achieved by pressing the zero reset button within the control unit. You will need to undo the four cover hex screws to be able to open the marine controller.

Once opened, you can see the Marine DUI on the lid and on the top of this is the ZERO button. To zero the system you need to press and hold the button as indicated on the screen. Please ensure that when setting the zero point there is no locked in torque on the shaft.

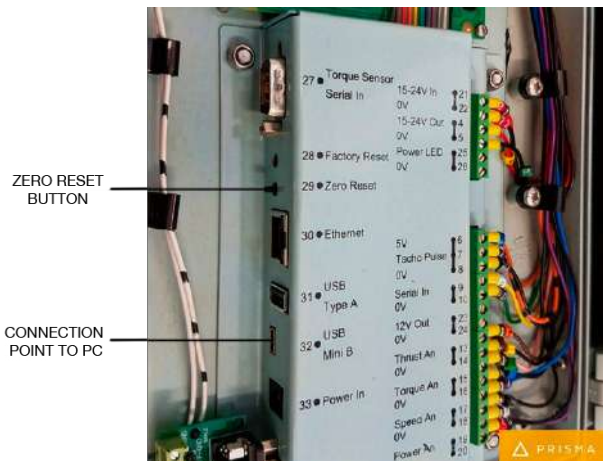
To zero the system you need to press and hold the button for 5 seconds and this will remove any offset on the shaft. The torque display will now read 0 kNm.

ALTERING SYSTEM CALIBRATION AND SETTINGS

If you need to change any settings on the shaft power meter this can be done using a few simple tools;

- Datum free DUI configuration software – a copy will be supplied with the shaft power meter
- User guide for the software
- USB mini B to USB A cable
- Windows laptop/netbook

The user guide contains information on how to change settings using the software if you have any questions or concerns about this please contact the Datum support team who will be able to assist.





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