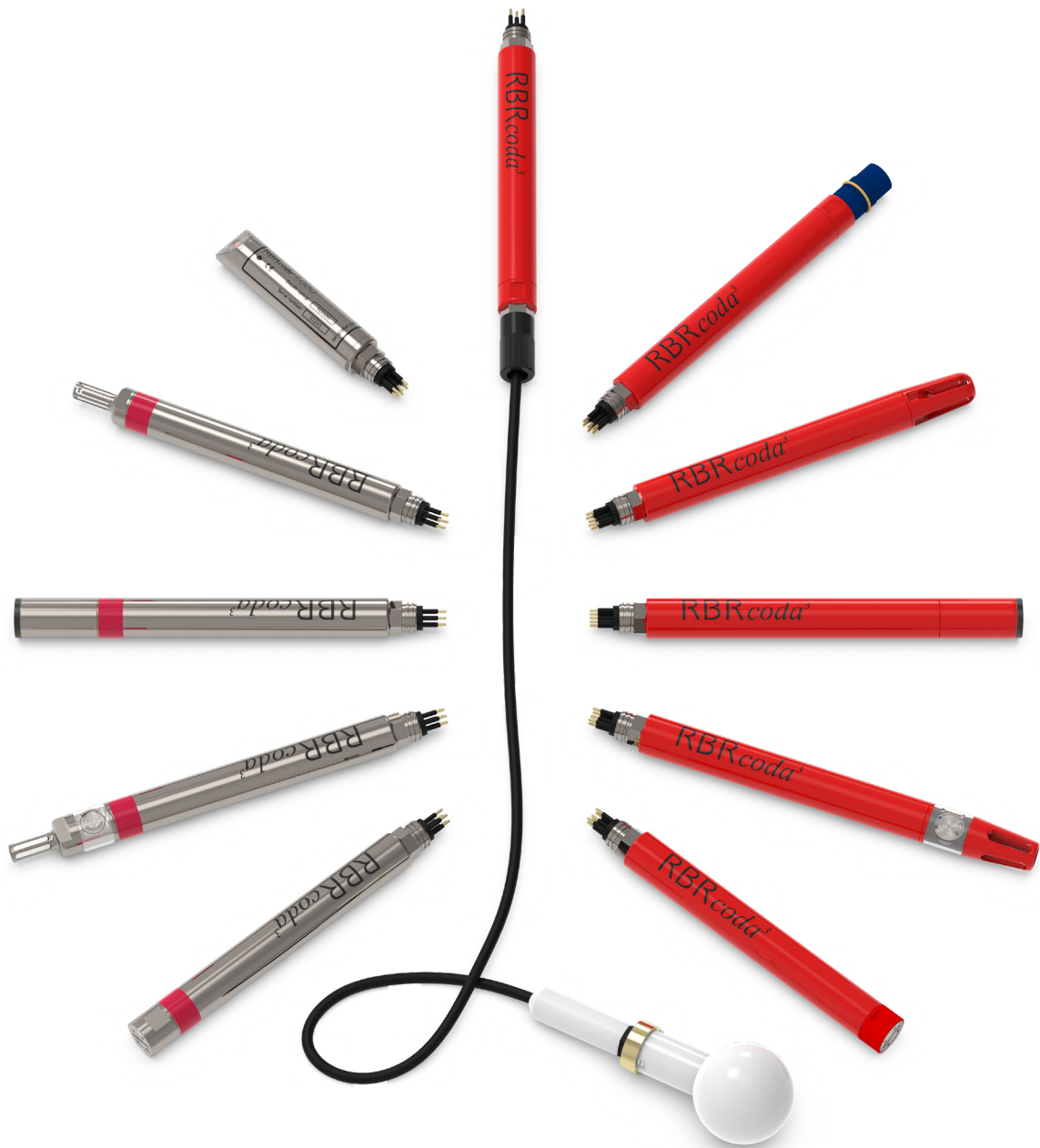


RBR*coda*³ INSTRUMENT GUIDE



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1 RBRcoda³

The RBRcoda³ small smart sensors are a family of cabled instruments with high accuracy, low power consumption, and ability to endure harsh conditions. These realtime streaming sensors are easy to integrate into any RBR multi-parameter instrument, or connect directly via RS-232.

The RBRcoda³ instruments are a perfect choice for many oceanographic and limnology applications where realtime streaming of data is desired, such as borehole monitoring, remotely operated underwater vehicles, stream gauging, or harbour water levels. These completely sealed units are available in plastic or titanium housings to accommodate shallow or deep deployments. Attach an MCIL connector with serial and power lines, and the data will stream.

Shallow variants

- RBRcoda³ D - depth
- RBRcoda³ T - temperature
- RBRcoda³ T.D - temperature and depth
- RBRcoda³ DO (OxyGuard®) - dissolved oxygen
- RBRcoda³ PAR - photosynthetically active radiation
- RBRcoda³ rad - narrow-band radiation
- RBRcoda³ PAR (LI-COR®) - photosynthetically active radiation

Deep variants

- RBRcoda³ D | deep - depth
- RBRcoda³ T | deep - temperature
- RBRcoda³ T.D | deep - temperature and depth
- RBRcoda³ T.ODO | deep - temperature and optical dissolved oxygen
- RBRcoda³ PAR | deep - photosynthetically active radiation
- RBRcoda³ rad | deep - narrow-band radiation

RBRtridente³

- chlorophyll *a*, fDOM, and backscatter or turbidity



2 Specifications

Some physical specifications are the same for all the RBRcoda³ instruments. Most configurations have only one sensor, but some include two or, potentially, three.

2.1 Physical specifications

Common specifications for all RBRcoda³ instruments

Parameter	Value
Storage	No onboard memory
Power	7-15V, 3mA (RBRcoda ³ T.ODO) 4.5-30V, 32mA (RBRtridente ³) 6-18V, 3mA (all other sensors)
Communications	RS-232
Sampling rate	24hr to 1Hz (RBRcoda ³ T.ODO) up to 16Hz (RBRcoda ³ D tide16, RBRcoda ³ T.D tide16) up to 32Hz (all other sensors)

Dimensions, weight, and depth rating for different configurations

Instrument	Diameter	Length*	Weight	Depth rating
RBRcoda ³ D RBRcoda ³ D deep	~25mm	~235mm	170g in air, 70g in water 370g in air, 270g in water	1000m 6000m
RBRcoda ³ T RBRcoda ³ T deep	~25mm	~244mm	160g in air, 60g in water 390g in air, 280g in water	1700m 6000m
RBRcoda ³ DO	~25mm	~290mm	190g in air, 70g in water	1700m
RBRcoda ³ T.ODO deep	~28mm	~160mm	180g in air, 100g in water	6000m
RBRcoda ³ PAR, RBRcoda ³ rad RBRcoda ³ PAR deep, RBRcoda ³ rad deep	~25mm	~271mm	140g in air, 15g in water 320g in air, 195g in water	1000m 2000m
RBRcoda ³ T.D RBRcoda ³ T.D deep	~25mm	~300mm	190g in air, 70g in water 390g in air, 280g in water	1000m 6000m
RBRcoda ³ PAR (LI-COR), cosine RBRcoda ³ PAR (LI-COR), spherical	~25mm	~300mm, cable 0.6m	460g in air, 240g in water 400g in air, 100g in water	560m 350m
RBRtridente ³	~63mm	~93mm	400g in air, 210g in water	6000m

*Total length of the instrument, including the connector.

2.2 Sensor specifications

Pressure

The RBRcoda³ D, RBRcoda³ D | deep, RBRcoda³ T.D, and RBRcoda³ T.D | deep use the same piezoresistive pressure sensor. It is protected by a clear plastic guard. During deployments, always orient the sensor downwards to reduce debris collecting in the housing.



Parameter	Value
Range*	20 / 50 / 100 / 200 / 500 / 1000dbar (plastic) 1000 / 2000 / 4000 / 6000dbar (Ti)
Initial accuracy	±0.05% full scale
Resolution	<0.001% full scale
Typical stability	±0.05% full scale / year
Time constant	<10ms

Temperature

The RBRcoda³ T, RBRcoda³ T | deep, RBRcoda³ T.D, RBRcoda³ T.D | deep, and RBRcoda³ T.ODO | deep use the same thermistor-type temperature sensor.



Parameter	Value
Range*	-5°C to 35°C
Initial accuracy	±0.002°C
Resolution	<0.00005°C
Typical stability	±0.002°C / year
Time constant	<0.1s fast, <1s standard, <15s slow

*A wider temperature range is available upon request. Contact [RBR](#) for more information.

PAR and narrow-band radiometers

The RBR*coda*³ PAR and RBR*coda*³ rad instruments look identical and share several specifications.

The RBR *coda*³ PAR and RBR *coda*³ PAR | deep use the cosine photosynthetically active radiation sensors.

The RBR *coda*³ rad and RBR *coda*³ rad | deep use radiometers measuring narrow-band light with a fixed channel width, available in various 10nm- and 25nm-wide channels. Both centre wavelength and channel width are factory-configured.



Optical radiometry

Parameter	Value
Initial offset error*	±0.0025% full scale
Resolution**	±0.0002% full scale
Dynamic range	>5.5 decades (nominal)
Absolute calibration***	±5%
Linearity	±1%
Time constant	<5ms
Operating temperature range	-5°C to 35°C
Gain temperature dependence	0.15% / °C
Cosine response error (water)	±5% at 0-60°, ±10% at 61-82°
Azimuth error (water)	±1.5% at 45°
Out-of-band rejection**	>25dB (typical), OD 2.5

* Dark offset is internally temperature-compensated.

** Out-of-band rejection and resolution are wavelength dependent for narrow-band radiometers.

*** RBR calibrates radiometers with NIST traceable references.

PAR

Parameter	Value
Wavelength range	400 to 700nm
Full scale range	0 to 5000μmol/m ² /s (minimum)
Initial offset error*	±0.125μmol/m ² /s
Resolution	±0.010μmol/m ² /s

Narrow-band channels

Parameter	Value
Centre wavelengths (CWL)	413/ 445/ 475/ 488/ 508/ 532/ 560nm
Accuracy (for CWL)	±3nm (for all CWLs except 475nm) ±5nm (for CWL 475nm only)
Full width at half-maximum (FWHM)	10nm (for all CWLs except 475nm) 25nm (for CWL 475nm only)
Accuracy (for FWHM)	±3nm
Full scale range	0 to 400μW/cm ² /nm (minimum)
Initial offset error*	±0.010μW/cm ² /nm
Resolution**	±0.001μW/cm ² /nm

Dissolved oxygen (OxyGuard)

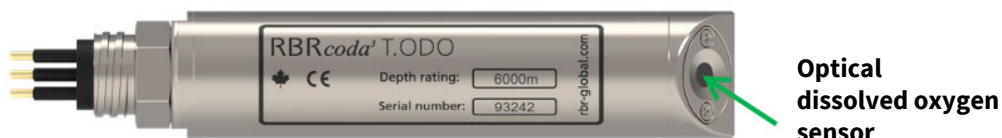
The RBRcoda³ DO uses the OxyGuard galvanic dissolved oxygen sensor. The sensor consumes oxygen from the environment and thus produces most accurate measurements when in a stirred environment. During deployments, always orient the sensor downwards to reduce debris collecting at the aperture and minimise direct sunlight. Store the sensor in the dedicated storage cap, included with the instrument.



Parameter	Value
Range	0 to 600%
Initial accuracy	±2% oxygen saturation
Resolution	1% of saturation
Response time	~10s, 90% step change at 20°C

Optical dissolved oxygen

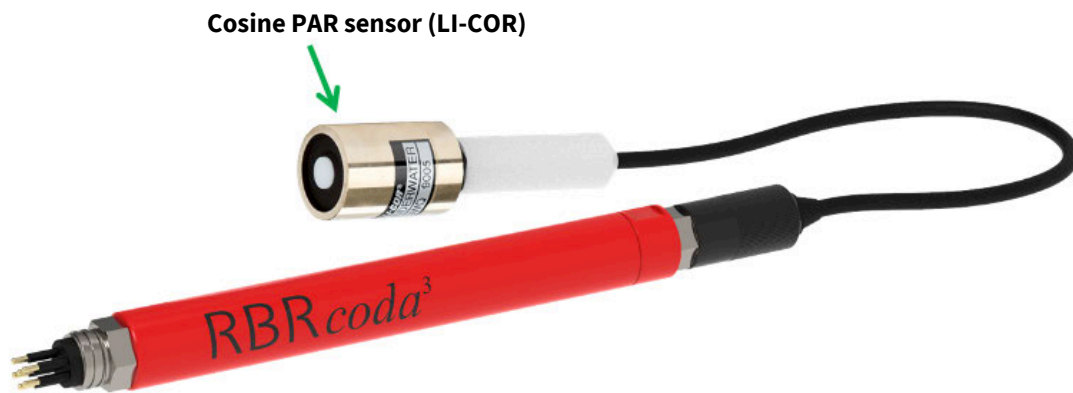
The RBRcoda³ T.ODO | deep uses the optical dissolved oxygen sensor. During deployments, always orient the sensor downwards to reduce debris collecting at the aperture and minimise direct sunlight. Store the sensor in the dedicated storage cap, included with the instrument.



Parameter	Value
Calibrated range	
Concentration	0-500µmol/L
Saturation	0-120%
Temperature	1.5°C to 30°C
Initial accuracy	Maximum of ±8µmol/L or ±5%
Resolution	<1µmol/L (saturation 0.4%)
Time constant	~1s (fast), ~8s (standard), ~30s (slow)

PAR sensor (LI-COR)

The RBR *coda*³ PAR (LI-COR) instruments use cabled cosine (one hemisphere, LI-192) or spherical (omnidirectional, LI-193) PAR sensors.



Parameter	Value
Wavelength range	400 to 700nm
Calibrated range	0 to 10000 μ mol/m ² /s
Initial accuracy	±2%

Fluorescence and backscatter

The RBR*tridente*³ is an optical sensor with three channels, capable of making multiple fluorescence and backscatter or turbidity measurements simultaneously.



Optical

Parameter	Value
Centroid angle	120°
Sensing volume	~1.3mL
Linearity, R ²	0.99
Calibration accuracy	5%

Chlorophyll *a*

Parameter	Value
Channel wavelength (excitation/emission)	470nm/695nm
Range	0-250µg/L
Detection limit	0.01µg/L

fDOM

Parameter	Value
Channel wavelength (excitation/emission)	365nm/450nm
Range	0-500ppb
Detection limit	0.004ppb

Backscatter

Parameter	Value
Channel wavelength	700nm
Range	0-5m ⁻¹
Detection limit	2x10 ⁻⁶ m ⁻¹

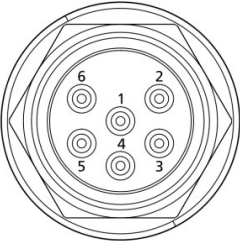
Turbidity

Parameter	Value
Channel wavelength	700nm
Range	0-500FTU
Detection limit	0.001FTU

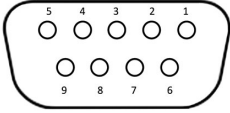
2.3 MCBH and DB9 connectors

RBRcoda³ has an external MCBH-6-MP connector on the instrument. The data will stream to your computer via a patch cable (ordered separately). Depending on the ordered configuration, your patch cable may have either an embedded converter and USB connector, or a DB9-F connector.

External MCBH-6-MP connector pinout

	Pin No.	RS-232
	1	Ground
	2	Power +4.5 to +30V
	3	Data output from the instrument (Tx)
	4	Data input into the instrument (Rx)
	5	N/C
	6	N/C

DB9-F connector pinout

	Pin No.	RS-232
	1	N/C
	2	Data output from the instrument (Tx)
	3	Data input into the instrument (Rx)
	4	N/C
	5	Ground
	6-9	N/C

2.4 RS-232 cables

The RBRcoda³ sensors use RS-232 patch cables to connect to power supplies and computers. Patch cables and underwater extension cables are sold separately and not included with the sensors. Refer to the [RBR Cable Guide](#) or contact our [support team](#) for the list of available cables.



RBRcoda³ D with an RS-232 cable

3 Maintenance

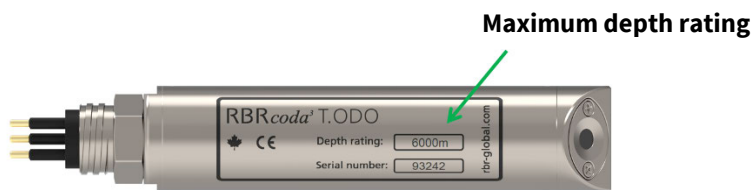
3.1 Deployment

The RBRcoda³ smart sensors are robust and reliable, but there are several things to keep in mind when deploying them. Proper deployment will ensure faultless operation and preserve your data.

Precautions

1. Do not exceed the maximum depth rating.

⚠ All RBRcoda³ instruments are individually rated to a maximum depth in meters, as indicated on the label.



2. Do not apply physical stress to the housing.

⚠ Stress due to improper mounting may cause the RBRcoda³ instruments to leak, resulting in the loss of valuable data or permanent damage to the electronics. Any type of clamp or bracket which concentrates the stress on the housing is not recommended for use in mooring, mounting, and/or other deployment. Contact [RBR](#) for proper mooring and mounting clamps suited to your specific application.

3. Do not attempt to open the sensor.

⚠ The RBRcoda³ instruments are sealed and cannot be opened by the user. Any attempt to do so will damage the sensor.

3.2 Cable maintenance

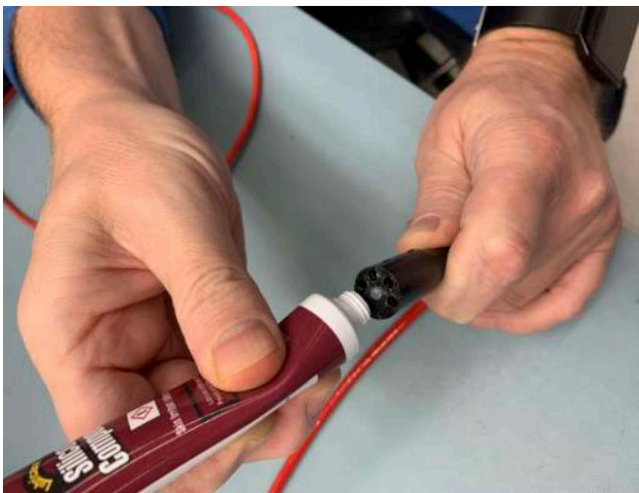
Cable bend radius

The smallest bend radius for RBR supplied cables is 15cm.

Lubricating the connectors

Lubrication improves watertight sealing, prevents corrosion, and reduces the force required to de-mate the connector. Use the silicone compound provided with your instrument.

- Apply the silicone compound to all female connectors before every mating
- Ensure each connector hole is filled with approximately 30% lubricant



Lubricating a connector

Reducing mechanical stress

- Do not pull on the cable
- Hold onto the connector to pull out the cable
- Disconnect by pulling straight out, not at an angle
- Avoid sharp bends at the point where the cable enters the connector
- Avoid angular loads on the connector

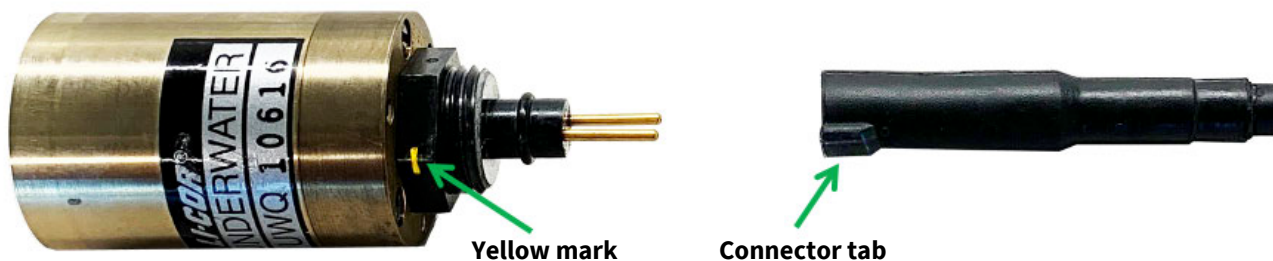
3.3 PAR sensor (LI-COR) connector alignment

Proper connection between the PAR sensors (LI-COR) and their cable is crucial for deployment success.

Both LI-192 and LI-193 have a two-pin connector with a small yellow mark on the side.



Always align this yellow mark with the tab on the side of the cable connector when connecting the sensor to its cable.



After connecting the cable to the PAR sensor, confirm that the yellow mark and the connector tab are aligned, and then put the white locking sleeve in place. The sensor is ready for deployment.

⚠ Ensure proper orientation of the yellow mark and the tab before each deployment. Inverted connection of your PAR sensor will result in incorrect or lost data.

3.4 DO sensor (OxyGuard) care and maintenance

Storage

Store the OxyGuard dissolved oxygen sensor in the dedicated storage cap to minimize fluid loss. Storage caps are provided with the instrument. Contact [RBR](#) if a replacement is needed.

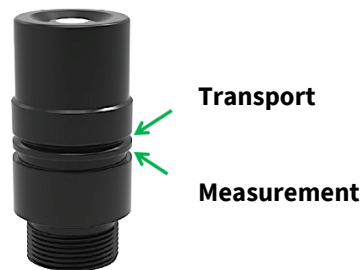


O-ring

The red O-ring of the OxyGuard sensor serves two purposes:

- To retain the electrolyte during storage
- To balance pressure during deployments

There are two positions for O-ring on the OxyGuard sensor, "Transport" and "Measurement".



During transportation or storage, move the red O-ring of the Oxyguard sensor to the "Transport" position, closing off the port on the side of the cell.

Before deployment, move the O-ring to the "Measurement" position to maintain the pressure balance.

After deployment, return the O-ring to the "Transport" position.



Support kit

RBR offers an OxyGuard sensor support kit that includes:

- Membrane tool
- Electrolyte solution (250ml)
- Fast response membranes
- Replacement O-rings
- Oxyguard Support Kit and Refurbishment Guide

Check the state of your DO sensor before deployment. Look for any damage to the membrane, cloudiness of the electrode, and buildup on the anode. If you find any damage, refurbish and re-calibrate the sensor.

Refer to Oxyguard Support Kit and Refurbishment Guide, included with the support kit, for instructions on refurbishing your sensor. See [Ruskin User Guide](#) for instructions on calibration.

4 Calibration

Factory calibration coefficients are calculated for each sensor, and the coefficients are stored on the instrument.

RBR calibration certificates contain calibration equations, coefficients, and residuals for each sensor. Hard copies are provided with each shipment. RBR can replace lost or misplaced calibration certificates upon request.

RBR recommends calibrating your instrument before any critical deployment, periodically once a year, or if you suspect the readings to be out of specifications.

Discuss your calibration requirements with RBR. In some cases, the instrument will need to be returned to RBR to have it checked and re-calibrated.

Please contact [RBR](#) for our current calibration fees.

5 Repairs

RBR supports all our products. Contact us immediately at support@rbr-global.com or via the [RBR website](#) if there are any issues with your instrument. Please have the model and the serial number of the unit ready. Our support team will work to resolve the issue remotely. In some cases, you may have to return your instrument to RBR for further servicing.



There are no user-repairable parts of the instrument. Any attempt to repair without prior authorisation from RBR will void the warranty. Refer to the [RBR warranty statement](#).

To return a product to RBR for an upgrade, repair, or calibration, please contact our [support team](#) to obtain a return merchandise authorisation code (RMA) and review the detailed shipping information on the [RBR website](#).

6 Revision history

Revision No.	Release date	Notes
A	30-November-2021	Original
B	28-February-2022	Corrected pressure rating (from 10000dbar to 6000dbar), added maintenance instructions for the OxyGuard DO sensor.
C	15-March-2022	Added MCBH pinout and description of the PAR sensor (LI-COR) connector to Specifications.
D	15-September-2022	Added RBRtridente ³ to the list of sensors and Specifications. Added sampling rates to Specifications. Moved description of the PAR sensor (LI-COR) connector to Maintenance. Added Deployment to Maintenance.

