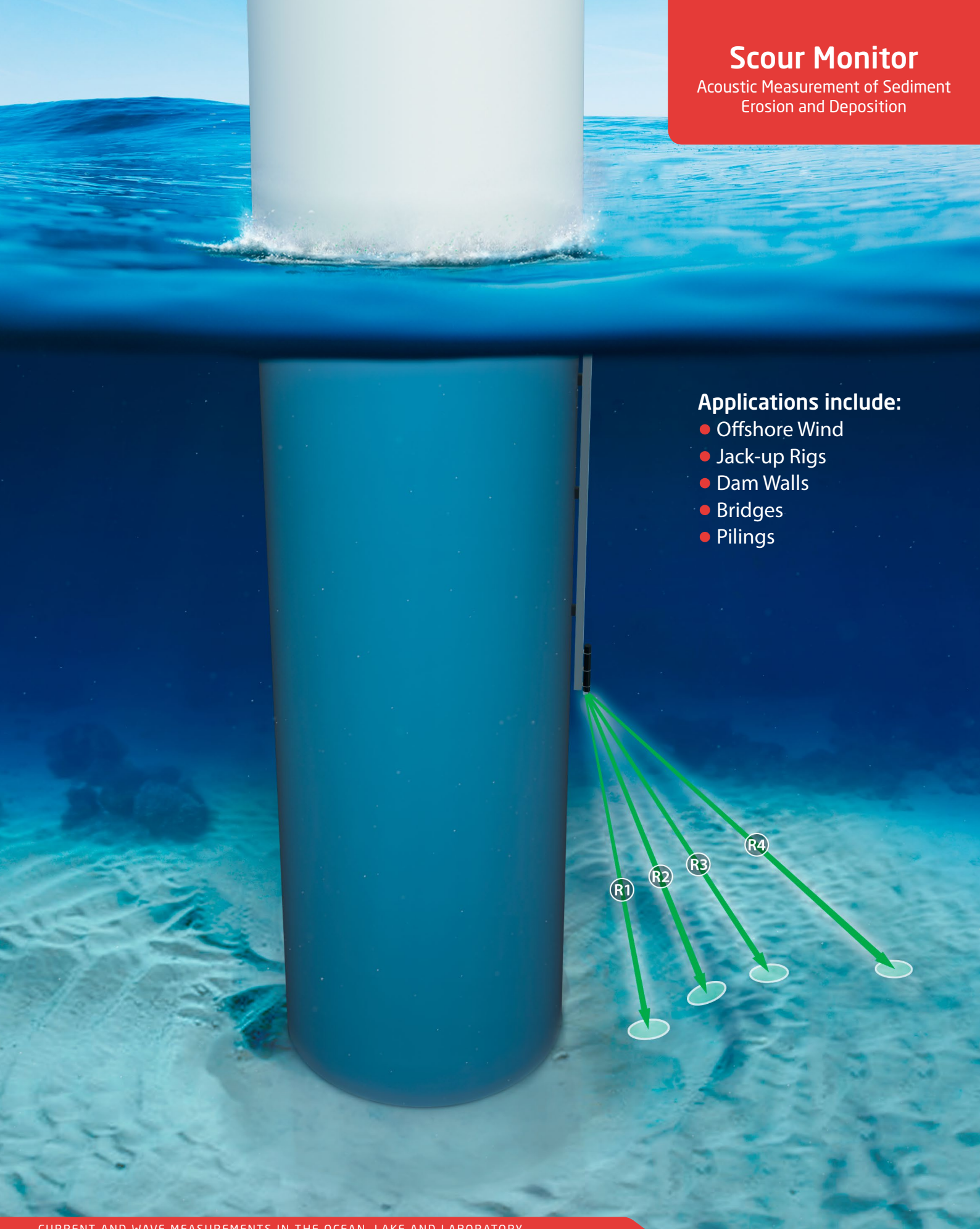
Scour Monitor

Acoustic Measurement of Sediment Erosion and Deposition

Applications include:

- Offshore Wind
- Jack-up Rigs
- Dam Walls
- Bridges
- Pilings



CURRENT AND WAVE MEASUREMENTS IN THE OCEAN, LAKE AND LABORATORY

NORTEK

Nortek AS
Vangkroken 2
1351 Rud, Norway
Tel: +47 6717 4500
Fax: +47 6713 6770
E-mail: inquiry@nortek.no

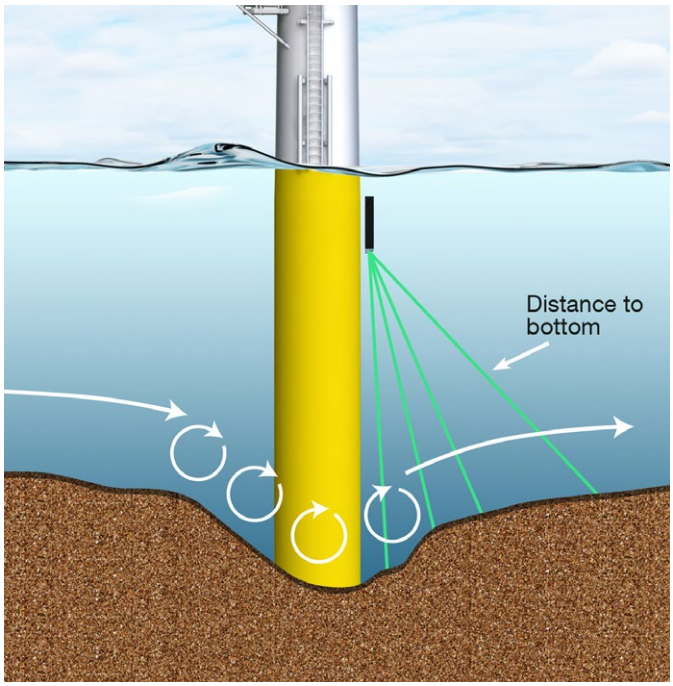
www.nortek-as.com

True innovation makes a difference

Scour Monitor

ACOUSTIC MEASUREMENT OF SEDIMENT EROSION AND DEPOSITION

Mono piles / offshore wind platforms



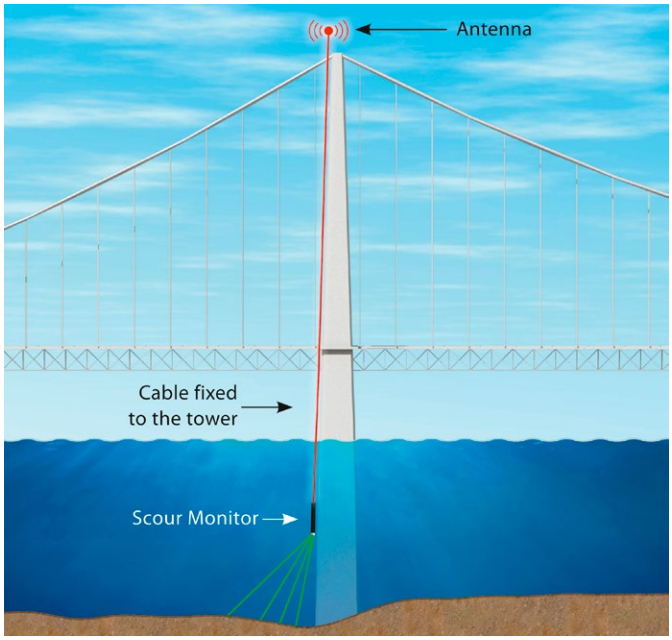
Offshore structures such as wind turbines, rigs, and pilings can be weakened by scour around their base. Scour holes are generated by storms or strong currents and will often appear and disappear on short notice. As a result, storm-driven scour may not leave a detectable signature in a post-storm survey. As such, it can only be properly characterized if monitored also when normal survey operations have to be suspended.

To capture these transient events, Nortek developed the acoustic scour monitor, which allows continuous data collection during scour events, either as real time monitoring system or in an autonomous mode for pre-installation research studies. The scour monitor uses four narrow acoustic beams to detect the along-beam distance from the sensor to the seabed at four points away from the structure (see illustration).

The instrument collects data at a user-specified sampling rate and outputs the acoustic scattering profile along the beam, which provides information both about the changing location of the bottom and the nature of the suspended sediments.

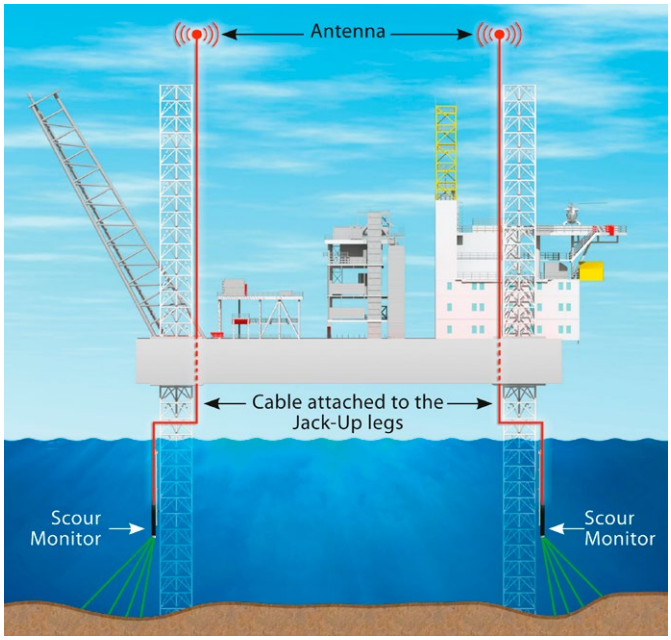
By monitoring scour events, operators can determine the requirement for protective measures such as rock dumping. If combined with vibration sensors it can also relate possible changes in the natural resonance frequency of the structure to changes in the position of the seabed.

Bridges



Bridge foundations can easily be undermined by scour, critically affecting the stability and integrity of the structure.
An online Nortek Scour monitor, can provide continuous and detailed information about the condition of a pier footings, allowing the appropriate actions to be taken in during storm or flood conditions. It also allows bridge owners to make long term structural studies, for planning and maintenance purposes.

Jack-Up Rigs



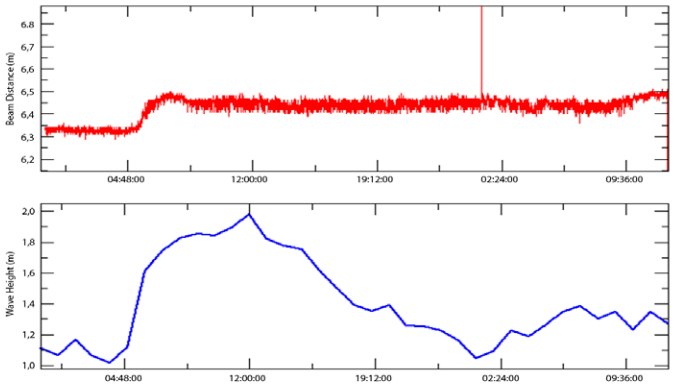
The mobility of the seabed can at times cause jack-up rig operators serious problems. In some circumstances, the legs may become buried or suspended. Both scenarios can be critical. The Nortek Scour Monitor is able to provide an early warning system of such events, allowing time for countermeasures to be taken.

A typical rig Scour Monitoring system might consist of a series of scour monitors, each mounted on a leg close to the seabed, with cables running from the sensor to the top of the leg. Here data are telemetered to the bridge and presented graphically.

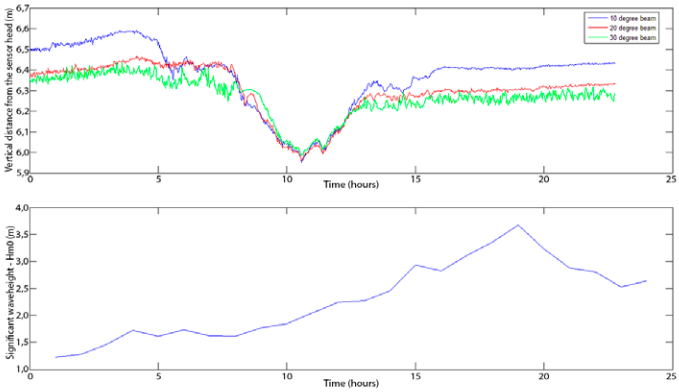
Any object placed on or fixed into the seabed, can be affected by scour. In the majority of cases, the effects of scour will be minimal or insignificant, however in some environments scour can be the cause of major structural problems. In potentially troublesome locations, surveying at weekly or monthly intervals can provide useful snap-shots of the situation, but continuous monitoring using a remote sensing device such as the Nortek Scour Monitor, is the only really effective solution. The Nortek Scour Monitor has been designed to continuously measure four vertical ranges at user time selected intervals, thus providing a full time-series picture of the river or seabed as changes occur.

Jennettes Pier data

The following two plots show results from an online scour monitor mounted at Jennette's Pier in Nags Head, North Carolina by the UNC Coastal Studies Institute in collaboration with Jennette's Pier owned by the North Carolina Aquarium System. The scour monitor was deployed six meters above the seabed, with a data collection interval of 10 seconds.



A sudden increase in wave height from 1 to 2m Hs is seen to erode 20cm off the seabed, in under two hours. Such rapid changes can only be recorded using an online scour monitoring system.



From the data it can be seen that there is a build-up of a 60cm layer of sand during a 5 hour period and following this the sand is again eroded. This demonstrates how rapid the erosional process can be, something which is only detectable using the scour monitor.

AOS - Worldwide Data Access

Where there is limited electrical power and communications, the Nortek Autonomous Online System (AOS) makes it possible to power, collect and process data, before transmitting vertical Scour levels via Iridium® to a Nortek server. These real-time Scour levels are ultimately displayed on a dedicated password-protected web site, allowing easy and convenient data access.

The AOS unit is housed in a weatherproof box and can accept inputs from up to three scour monitors.

Operational Deployment Options

Self Recording
Raw range data are date and time stamped and recorded internally at user selected time intervals.

Processing and Display
When the scour monitor is recovered, data are downloaded and converted to vertical scour values using programme supplied.

On-Line
Raw data are transmitted in real time via cable

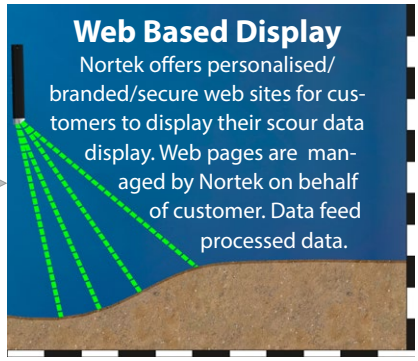
Processing
Range data are processed to vertical range data in real time. The processed data are output to external processing unit or PCL as RS232 (MODBUS, NMEA)

PLC / SCADA

On-Line
Raw data are transmitted in real time via cable

AOS
Range data are processed to vertical range data in real-time. Data output to Iridium

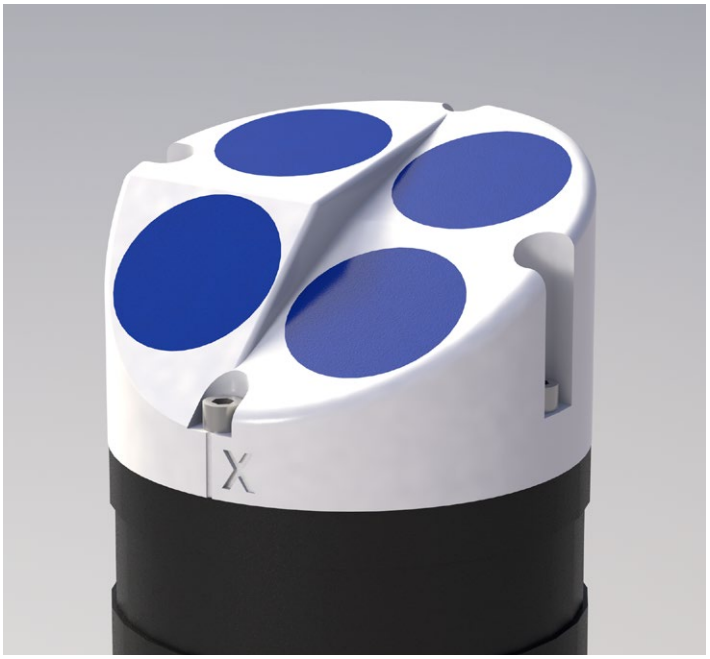
Web Based Display
Nortek offers personalised/ branded/secure web sites for customers to display their scour data display. Web pages are managed by Nortek on behalf of customer. Data feed processed data.



Technical Specifications

Transducer	
Frequency:	1.0 MHz
Beam width:	3.4°
Beam angles:	10°, 20°, 30° and 45°
Resolution:	1-1.5 or 2-3 cm
Distance to measurement area:	1-20 m
Measurement	
Vertical range:	30 m
Along beam range:	45.4 m
Measurement regions, vertical:	13 / 26 m
Accuracy:	10 or 20 cm
Temperature: Thermistor embedded in sensor head	
Range:	-4°C to 30°C
Accuracy/resolution:	0.1°C / 0.01°C
Time response:	10 min
Tilt: Liquid level	
Accuracy/resolution	0.2° / 0.1°
Maximum tilt:	30°
Data communication	
I/O:	RS422
Baud rate:	9600 standard, 300-115200 (User setting)
Internal recording	
Capacity:	9 Mb expandable
Power	
DC input:	9-16 VDC (21-48 VDC w. int. DC-DC converter)
Internal battery:	18AA Alkaline cells/50 Wh
New battery voltage:	13.5 VDC

Materials	
Standard model:	Delrin® and polyurethane
Dimensions	
Weight in air:	1.7 kg
Weight in water:	0.7 kg buoyant
Lenght:	590 mm
Diameter:	75 mm



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NortekMed S.A.S.
Z.I Toulon Est
67, Avenue Frédéric Joliot-Curie
BP 520, 83078 Toulon Cedex 09
Tel: + 33 (0) 4 94 31 70 30
Fax: +33 (0) 4 94 31 25 49
E-mail: info@NortekMed.com

NortekUK
Tresanton House
Bramshott Court
Bramshott
Hants
GU30 7RG, UK
Tel: +44- 1428 751 953
E-mail: inquiry@nortekuk.co.uk

NortekUSA
27 Drydock Avenue,
Mailbox 32, Boston,
MA 02210-2377
Tel: 617-206-5750
Fax: 617-275-8955
E-mail: inquiry@nortekusa.com

青岛诺泰克测量设备有限公司
地址：中国青岛香港西路65号
汇融广场 1302
邮编：266071
Tel: 0532-85017570, 85017270
Fax: 0532-85017570
E-mail: inquiry@nortek.com.cn

Nortek B.V.
Schipholweg 333a
1171PL Badhoevedorp
Nederland
Tel: +31 20 6543600
Fax: +31 20 6599830
email: info@nortek-bv.nl

Nortek Brasil
Av. Nilo Peçanha nº 50,
grupo 2910 – Centro - Rio de Janeiro - RJ – Cep 20020-906.
Tel: +55 (21) 4126-5954
Cel: +55 (21) 85046798
E-Mail nortek@nortekbrasil.com.br