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Advanced Neuromonitoring Solutions

Multimodal Neuromonitoring with Measuring Catheters

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Table of Contents

Measuring Catheters

Important parameters measured with high-precision microchip catheters

- **ICP (intracranial pressure)**
- **ICT (intracranial temperature)**
- **$p_{ti}O_2$ (oxygen partial pressure)**

The multi-modal neuromonitoring performed with the measuring catheter in the field of neurosurgery enables early recognition of potential cerebral damages.

ICP is measured using semiconductor pressure sensors. The quenching process of fluorescence is used to measure $p_{ti}O_2$. Consequently, the level and changes in the parameters are measured safely, quickly and accurately.

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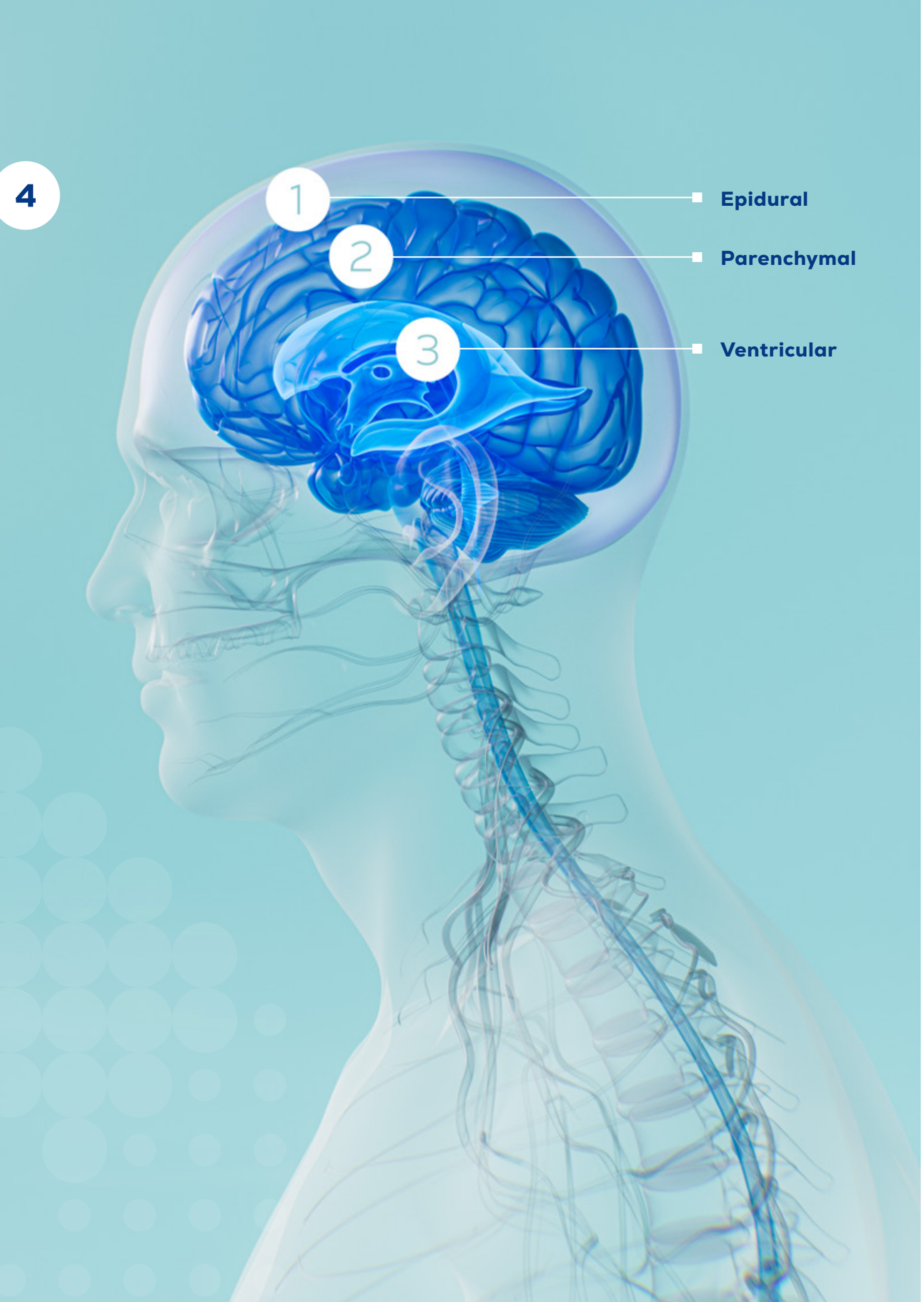

Measuring Locations

Parenchymal

- **NEUROVENT-P / NEUROVENT-PX**
  Parenchymal ICP measurement
- **NEUROVENT-P-TEMP**
  Parenchymal ICP and temperature measurement
- **NEUROVENT-PTO Series**
  Parenchymal ICP, temperature and $p_{ti}O_2$ measurement
- **NEUROVENT-TO**
  Parenchymal temperature and $p_{ti}O_2$ measurement

Ventricular

- **NEUROVENT Series**
  Ventricular ICP measurement and CSF-Drainage
- **NEUROVENT-TEMP Series**
  Ventricular ICP and temperature measurement with CSF-Drainage
- **NEUROVENT-Sleeve Housing**
  Ventricular CSF-Drainage and parenchymal ICP measurement
- **NEUROVENT VP 16**
  Ventricular CSF-Drainage and parenchymal ICP measurement, neuronavigable

Epidural

- **NEURODUR**
  Epidural ICP measurement
- **NEURODUR-TEMP**
  Epidural ICP and temperature measurement

Please find further technical data and product information on pages 24-25.

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Clinical Advantages

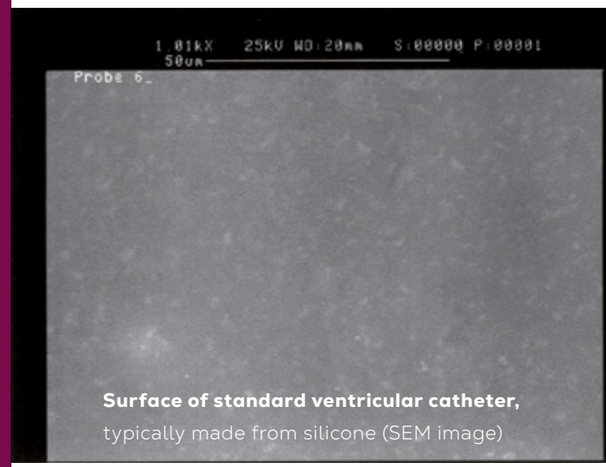
of RAUMEDIC NEUROVENT Catheters

- Plug & Play system – no catheter calibration required
- Compatible with all standard patient monitors
- Excellent measurement stability and linearity
- MR conditional at 1,5 T and 3,0 T[1] – no surgical intervention and disposition of the catheter required
- Monitor change without measurement loss of ICP is possible using zero point simulator (NPS2)*

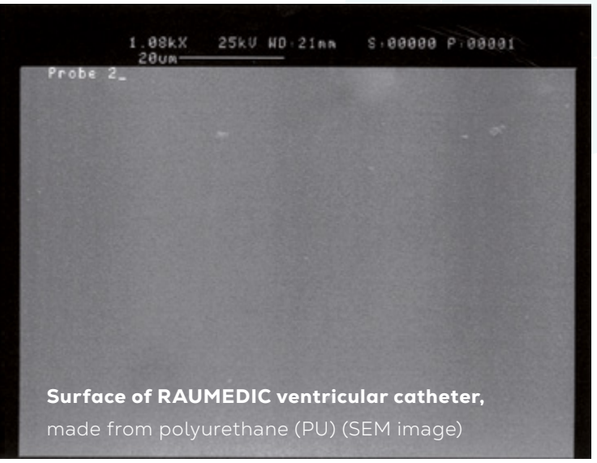
[1] Indicated within non-clinical laboratory tests.
*For more information about the NPS2 please have a look at page 25.

Comparison of Material Surfaces

RAUMEDIC ventricular catheters are made from polyurethane (PU) – compared to standard ventricular catheters that are typically made from silicone. The difference of the distinct catheters' surface structures becomes clear under a scanning electron microscope (SEM).



Surface of standard ventricular catheter,
typically made from silicone (SEM image)



Surface of RAUMEDIC ventricular catheter,
made from polyurethane (PU) (SEM image)

»Innovative Materials
»Smooth Surface Structure

Advantages of RAUMEDIC microchip catheter NEUROVENT in comparison with an EVD system

- Continuously ICP measurement and CSF drainage
- Precise measurement of the pressure variation
- No artefacts by moving the patient or opening of the CSF-Drainage valve
- No hydrostatic failure influences
- Fast adaption of changes in ICP

Please find further technical data and product information on page 24.

rau.md/icp

Accessories

The Zero-Point Simulator NPS2 is attached directly to the invasive blood pressure (IBP) port of the patient monitor.

All RAUMEDIC catheters are calibrated in the manufacturing process, and therefore are ready to use.

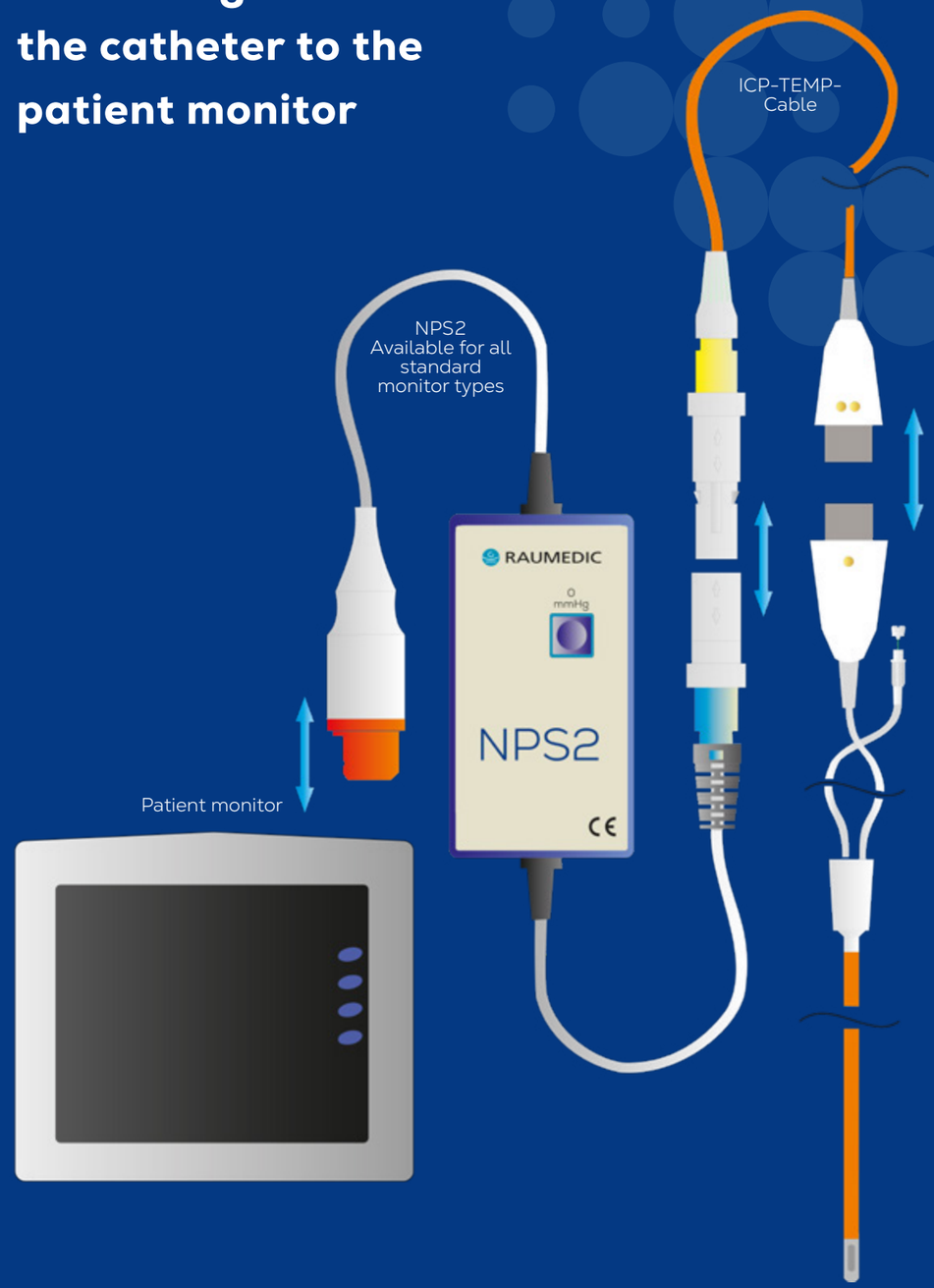
The Zero-Point Simulator NPS2 is used to transfer the ‚zero' to the patient monitor.

Your advantages

- Adapters available for all common patient monitors*
- Direct connection to the patient monitor
- No ICP monitor required
- Plug & Play system – no catheter calibration required

*Please find the full list of adapters as well as further technical data and product information on page 25.

Measuring chain from the catheter to the patient monitor



Please find further technical data and product information on page 25.

rau.md/nps2

Measuring ICP during Patient Transport

Measuring chain from the catheter to the NPS3 pressure display

The intrahospital transportation of critically ill patients with severe brain diseases is linked to a considerable rate of complications. Therefore, performing the transport of critically ill under monitoring ICP can often be crucial for positive patient outcomes.

The battery-powered pressure display device NPS3 can simply be connected to our ICP-TEMP-Cable, which – in turn – can be connected to a measuring catheter.

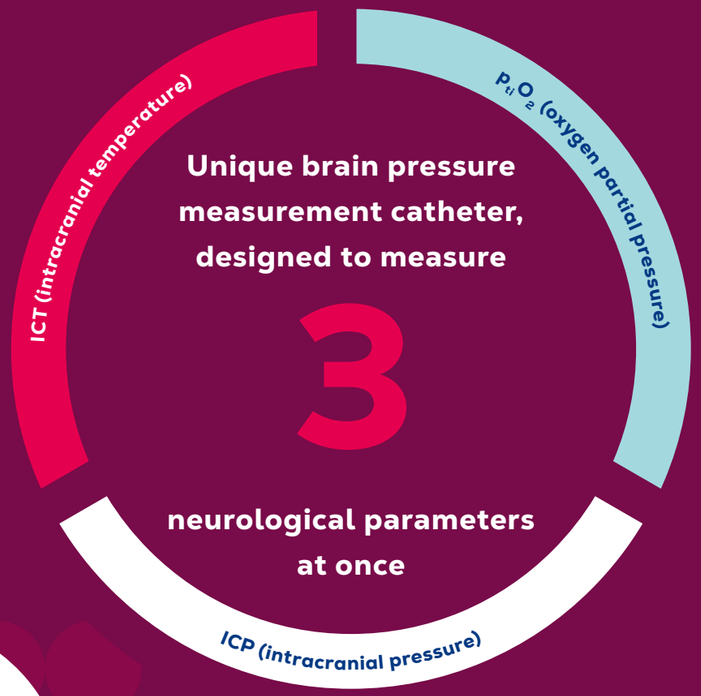
Great Advantages during Patient Transport

- Monitoring of ICP during patient transport
- Battery-powered display device
- No further monitor required
- Plug & Play system – no catheter calibration required

Please find further technical data and product information on page 25.

rau.md/nps3

One Catheter, three Measurement Functions



For measuring $p_{ti}O_2$, the quenching process of fluorescence is used. At the same time, parenchymal pressure is measured with the same measuring catheter via semiconductor pressure sensors.

Oxygen partial pressure measurement records the available oxygen in the brain tissue. This ensures possible cerebral damage is quickly detected and appropriate measures for the avoidance of cerebral ischaemia can be taken.

Unique advantages of a unique product

- Unique catheter that measures three parameters at once
- Parenchymal pressure, temperature and $p_{ti}O_2$ measurement in one catheter
- Easy handling via Plug & Play system – no calibration required
- No oxygen consumption by the O_2 sensor
- No refrigeration required
- Data recording and data display devices available*

NEUROVENT-PTO

NEUROVENT-TO

Catheter for measuring temperature and $p_{ti}O_2$

NEUROVENT-PTO 2L

Specially developed catheter for craniotomies which measures ICP, temperature and $p_{ti}O_2$

NEUROVENT-PTO 2L BOLT

Catheter for measuring ICP, temperature and $p_{ti}O_2$ for application with BOLT KIT PTO 2L and a microdialysis catheter

BOLT KIT PTO 2L

Two lumen BOLT for safe and functional implantation of the NEUROVENT-PTO 2L BOLT and a microdialysis catheter

*Please find further technical data and product information on page 26.

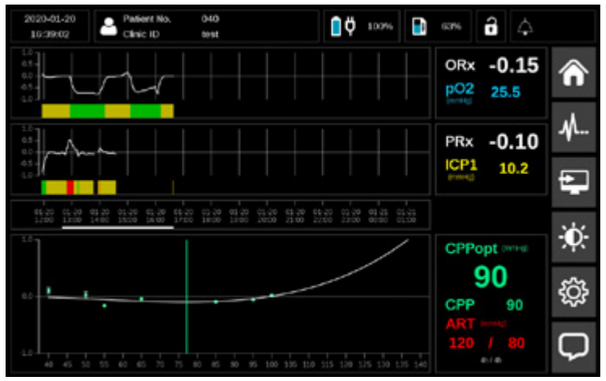
rau.md/pto

Smart Neuro-monitoring

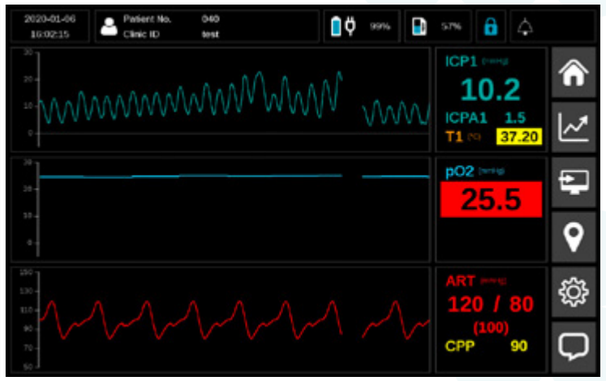
The Next Generation of Smart Neuromonitoring Devices

For the calculation and visualization of vital parameters
The RAUMED NeuroSmart is available for the visualization and storage of ICP and ICPT (telemetrically) measurement data. In another version, the RAUMED NeuroSmart logO, the oxygen partial pressure $p_{ti}O_2$ can also be recorded and visualized.

RAUMED NeuroSmart logO



Display of ORx, PRx and CPPopt
Regression curve CPPopt



Live data
Live Graph View

Advantages and Features

Clinical Advantages

- Display of ICP, brain temperature, $p_{ti}O_2$, ART, CVP, ICPA-amplitudes
- Integrated data storage for up to 10 days
- Audible and visual alarms
- Battery / mains operation possible
- Mobile use
- Connection to the patient monitor possible
- Attachment to the pole

Features

- Colored touch-screen display
- Colors can be set individually
- Calculation of PRx, ORx and CPPopt
- Various scaling options
- Display of the curves and trend graph
- 2 USB interfaces (USB stick and PC connection)

Please find further technical data and product information on page 26.

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Device features

- Invasive pressure (2 x)
- Telemetry pressure (1 x)
- Oxygen partial pressure (1 x) (only RAUMED NeuroSmart logO)
- Temperature (2 x ICT)
- Analogue outputs (2 x)
- USB interfaces (2 x)
- Analogue Rec output (1 x)

Connections RAUMED NeuroSmart logO

2 USB interfaces

General information

Display	LCD, color, 10-inch
Graphs / Trend display	Selectable via menu
Alarm limits	Selectable via menu
Dimensions	Approx. 310 x 225 x 150 mm (W x L x D)
Mass	Approx. 3 kg with battery and stand holder
Power supply	Internal battery with power adapter
Operating period in battery mode	≥ 4 h (charged, new battery, all channels occupied)

Please find further technical data and product information on page 26.

rau.md/neurosmart

Touch-screen Monitors

More Monitoring Solutions

Keeping an eye on key vital functions at all times

In neurocritical or neurointensive care, the monitoring of vital physiological functions of patients plays a central role.
The MPR2 logO DATALOGGER and EASY logO from RAUMEDIC are comprehensive monitoring solutions for this.

EASY logO: Simple display of data

For displaying of ICP data, temperature, and oxygen partial pressure.

MPR2 logO DATALOGGER: Easy visualizing and recording

For displaying and recording ICP, temperature and oxygen partial pressure – and visualization of parameters as curves and trend graphs.

	EASY logO	MPR2 logO
Mains operation	✓	✓
Rechargeable battery	✗	✓
2 x Analog outputs (Transfer of pressure value)	✓	✓
USB interface	✗	✓
Data storage	✗	✓
Curve display	✗	✓
Possible display of		
• ICP	✓	✓
• $p_{ti}O_2$	✓	✓
• Temperature	✓	✓
• ICPA	✓	✓
• ART	✗	✓
• CPP	✗	✓

Please find further technical data and product information on page 26.

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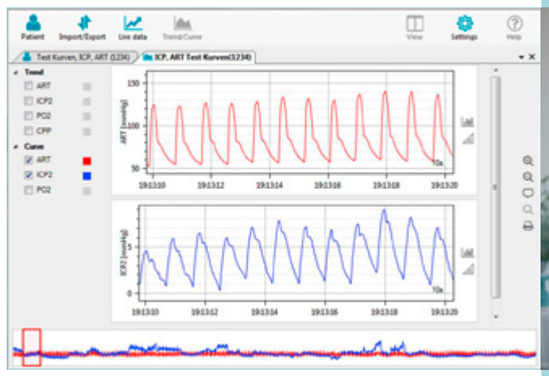
RAUMED DataView

Software for transferring measurement data to a PC or Laptop

RAUMED DataView is a software* solution for transferring recorded and saved data on the RAUMEDIC devices to a computer for visualization.



*No medical product according to Regulation (EU) 2017/745.
The application is not required for the operation and intended use of the devices.

»Benefits of RAUMED DataView

- No internet connection required
- Display of ICP, temperature, $p_{ti}O_2$ and ART on the PC
- Extended display of PRx, ORx and CPPopt
- Graphic (comparative) representation of data
- Filter functions for data search
- Data export to CSV, EDF, PDF and RAUMED DataView format (dv.data)

Please find further technical data and product information on pages 26-27.

rau.md/dataview

Application Accessories

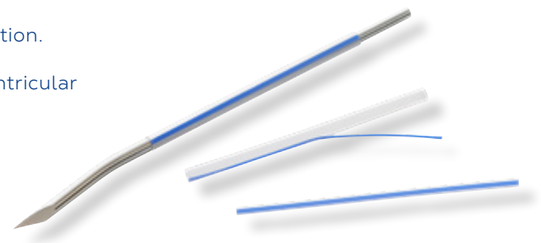
Single-use application accessories for the subcutaneous tunneling of RAUMEDIC catheters.

Spliceable Tunneling Sleeve

RAUMEDIC Tunneling Sleeves are made of biocompatible, polymer material – in-vitro tested according to EN ISO 10993-1.

The sleeve is chamfered for low resistance application.

Available in two versions: for parenchymal and ventricular catheters, NEUROVENT-PTO 2L.



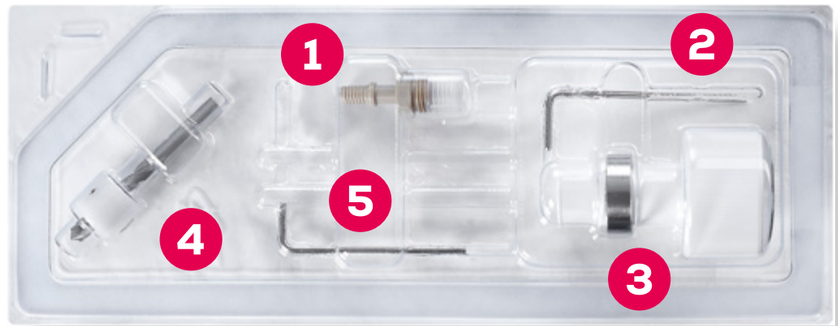
Tunneling KIT

With its fir-tree-like connection of the trocar, the Tunneling KIT provides a secure hold for the tunneling sleeve, which is cut off after being placed under the scalp.

Available in two versions: for parenchymal and ventricular catheters, NEUROVENT-PTO 2L.

BOLT-DRILL KIT

A recognized method for inserting a catheter is to use a drill and an appropriate drill bit to pass it through the calvaria. To safely position the measuring catheter, a BOLT is screwed into the drilled hole. Our BOLT-DRILL KIT offers the necessary components in a single set.



BOLT KIT components

1. Polymer screw with fixing cap and sealing ring

2. Dura opener

3. Screw-in tool

DRILL KIT components

4. Drill bit with stopper

5. Allen key

BOLT KIT advantages

- Material suitable for all imaging methods
- Low BOLT height
- Self-cutting thread with sealing function

Please find the full list of articles and technical product information on page 28.

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Product List

Parenchymal measurements

Product	Version	Dimension	Article number
NEUROVENT-P	ICP	5F	092 946-001
NEUROVENT-PX	ICP	5F	091 580-001
NEUROVENT-P-TEMP	ICP + temperature	5F	094 268-001
NEUROVENT-PTO	ICP + temperature + $p_{ti}O_2$	5F	095 008-001
	application with BOLT-DRILL KIT PTO		092 380-001
NEUROVENT-PTO 2L	ICP + temperature + $p_{ti}O_2$	5F	095 108-001
NEUROVENT-PTO 2L BOLT	ICP + temperature + $p_{ti}O_2$	5F	095 308-001
	application with BOLT KIT PTO 2L		096 076-001
	and DRILL KIT CH9		091 668-002
NEUROVENT-TO	Temperature + $p_{ti}O_2$	3F	095 908-001
	application with BOLT-DRILL KIT PTO		092 380-001

Ventricular measurements

Product	Version	Dimension	Article number
NEUROVENT	ICP + drainage, with stylet	9F	092 956-001
NEUROVENT 6F	ICP + drainage	6F	094 678-001
NEUROVENT-IFD-S	ICP + drainage, soft internal guide wire	9F	091 678-001
NEUROVENT-IFD-R	ICP + drainage, rigid internal guide wire	9F	095 317-001
NEUROVENT-Sleeve Housing	ICP (parenchyma), drainage (ventricular), with sleeve housing	9F	091 576-001
NEUROVENT VP 16	ICP (parenchyma), drainage (ventricular), neuronavigable	9F	096 704-001
NEUROVENT-TEMP	ICP + drainage + temperature, with stylet	9F	094 278-001
NEUROVENT-TEMP-IFD-S	ICP + drainage + temperature soft internal guide wire	9F	094 288-001
NEUROVENT-TEMP-IFD-R	ICP + drainage + temperature rigid internal guide wire	9F	095 327-001

Epidural measurements

Product	Version	Dimension	Article number
NEURODUR	ICP	5.8 x 2.1 mm (measurement head)	092 976-001
NEURODUR-TEMP	ICP + temperature	5.8 x 2.1 mm (measurement head)	094 298-001

Catheters

Technical data

Pressure measurement range	-40 to +400 mmHg (-5.3 to 53 kPa)
Upper cut-off frequency	20,000 Hz (-3 dB)
Catheter material	Polyurethane
Measurement range temperature sensor	+25°C to +45°C
Pressure sensitivity	5 µV/V/mmHg
Measurement range $p_{ti}O_2$*	0-200 mmHg
Electrical catheter length (tip to connector)	
- Parenchymal	approx. 55 cm
- Ventricular	approx. 55 cm
- Epidural	approx. 55 cm

* Measurement accuracy ± 2.5 mmHg (for < 120 mmHg)

Zero Drift Pressure

Ø Deviation 0.6 mmHg after 5 days*

* Bench test assessment of the new Raumedic Neurovent-P ICP sensor: a technical report by the BrainIT group Citerio G., Piper I., Cormio M., Galli D., Cazzaniga S., Enblad P., Nilsson P., Contant C., and Chambers I., BrainIT Group Acta Neurochirurgica (Wien). 2004, Aug; DOI: 10.1007/s00701-004-0351-z

Connecting Cables

Product	Description	Article number
ICP-TEMP-Cable	Connecting cable between ICP catheter and zero point simulator NPS2	094 328-001
ICP-TEMP-Adapter	Adapter between zero point simulator NPS2 and patient monitor	094 323-001
ICP-TEMP-Adapter Philips/HP	Adapter between zero point simulator NPS2 and patient monitor Philips/HP	094 047-001
NPS2 Siemens/Dräger Infinity	Adapter cable to Siemens/Dräger Infinity patient monitor	092 627-001
NPS2 Philips/HP	Adapter cable to Philips/HP patient monitor	092 637-001
NPS2 Nihon Kohden BSM 41xx	Adapter cable to Nihon Kohden BSM 41xx patient monitor	094 716-001
NPS2 GE/MARQUETTE	Adapter cable to GE/MARQUETTE patient monitor	093 807-001
NPS2 GE	Adapter cable to GE patient monitor	093 999-001
NPS2 SpaceLabs	Adapter cable to SpaceLabs patient monitor	091 715-001
NPS2 Fukuda Denshi	Adapter cable to Fukuda Denshi patient monitor	096 003-001
NPS3	Battery operated pressure device	091 656-001

Zero point simulator NPS2 for further monitor types upon request

Oxygen partial pressure measurement

Product	Version	Dimension	Article number
NEUROVENT-PTO	ICP + temperature + $p_{ti}O_2$	5F	095 008-001
	application with BOLT-DRILL KIT PTO		092 380-001
NEUROVENT-TO	Temperature + $p_{ti}O_2$	3F	095 908-001
	application with BOLT-DRILL KIT PTO		092 380-001
NEUROVENT-PTO 2L	ICP + temperature + $p_{ti}O_2$	5F	095 108-001
NEUROVENT-PTO 2L BOLT	ICP + temperature + $p_{ti}O_2$	5F	095 308-001
	application with BOLT KIT PTO 2L		096 076-001
	and DRILL KIT CH9		091 668-002
EASY logO	Data display		095 264-002
MPR2 logO DATALOGGER	Data recording and storage		095 254-002
RAUMED NeuroSmart logO	Data recording and storage		095 294-001

RAUMED NeuroSmart and Accessories

Product	Article number
RAUMED NeuroSmart	095 284-001
ICP-TEMP-Cable	094 328-001
RAUMED DataView*	296 900-001
USB-Cable*	283 949-001
Power adapter NeuroSmart	284 037-001
Rec-BNC-Cable NeuroSmart*	096 096-001

RAUMED NeuroSmart logO and Accessories

Product	Article number
RAUMED NeuroSmart logO	095 294-001
Cable PTO	095 624-001
Cable LWL	095 657-001
ICP-TEMP-Cable	094 328-001
RAUMED DataView*	296 900-001
USB-Cable*	283 949-001
Power adapter NeuroSmart	284 037-001
Rec-BNC-Cable NeuroSmart*	096 096-001

*No medical product according to Regulation (EU) 2017/745.

Accessories for all devices

Product	Article number	RAUMED NeuroSmart	RAUMED NeuroSmart logO	MPR2 logO DATALOGGER	EASY logO
Cable PTO	095 624-001		x	x	x
Cable LWL	095 657-001		x	x	x
ICP-TEMP-Cable	094 328-001	x	x	x	
ICP-TEMP-Adapter	094 323-001			x	
Main power adapter EASY logO	284 017-001				x
Wide range power adapter MPR 1/2	284 027-001			x	
Stand holder DATALOGGER	283 957-002			x	x
Table stand DATALOGGER	283 959-002			x	x
RAUMED DataView*	296 900-001	x	x	x	
USB-Cable*	283 949-001	x	x	x	
Power adapter NeuroSmart	284 037-001	x	x		
Rec-BNC-Cable NeuroSmart*	096 096-001	x	x		
Connecting cables from RAUMEDIC device to patient monitor					
Cable DATALOGGER GE/MARQUETTE	094 858-001	x	x	x	x
Cable DATALOGGER Philips/HP	094 868-002	x	x	x	x
Cable DATALOGGER Siemens/Dräger Infinity	094 878-002	x	x	x	x
Cable DATALOGGER SpaceLabs	094 967-001	x	x	x	x
Cable DATALOGGER Nihon Kohden 41xx	095 017-001	x	x	x	x
Transducercables between RAUMEDIC device and disposable transducer					
Transducercable Medex MX 960	095 974-001	x	x	x	
Transducercable Edwards TRUWAVE	096 036-001	x	x	x	
Transducercable Becton Dickinson	096 046-001	x	x	x	
Transducercable Combitrans	096 664-001	x	x	x	
Transducercable pvb xtrans	096 494-001	x	x	x	

Cable PTO

Cable LWL

Cable DATALOGGER Philips/HP

Transducercable Edwards TRUWAVE

Accessories for Catheters

Spliceable Tunneling Sleeve

Product	Article number
Spliceable Tunneling Sleeve CH8 (for parenchymal catheters)	090 506-002
Spliceable Tunneling Sleeve CH12 (for ventricular catheters and NEUROVENT-PTO 2L)	090 717-001

Tunneling KIT

Product	Article number
Tunneling KIT CH8 (for parenchymal catheters)	090 516-001
Tunneling KIT CH12 (for ventricular catheters and NEUROVENT-PTO 2L)	090 727-001

BOLT-DRILL KIT

Product	Version	Article number
BOLT KIT CH5	For parenchymal catheters	091 868-002
DRILL KIT CH5	For BOLT KIT CH5	091 878-002
BOLT-DRILL KIT CH5	Set for parenchymal catheters	091 888-001
BOLT KIT CH9	For ventricular catheters	091 688-002
DRILL KIT CH9	For BOLT KIT CH9	091 668-002
BOLT-DRILL KIT CH9	Set for ventricular catheters	091 898-001
BOLT KIT PTO	Only for NEUROVENT-PTO/-TO	096 026-001
BOLT-DRILL KIT PTO	Set for NEUROVENT-PTO/-TO	092 380-001
BOLT-DRILL KIT VP 16	Only for NEUROVENT VP 16 and NEUROVENT-Sleeve Housing	092 969-001
RALK-Hand Drill	Autoclavable drill	231 584-002

References

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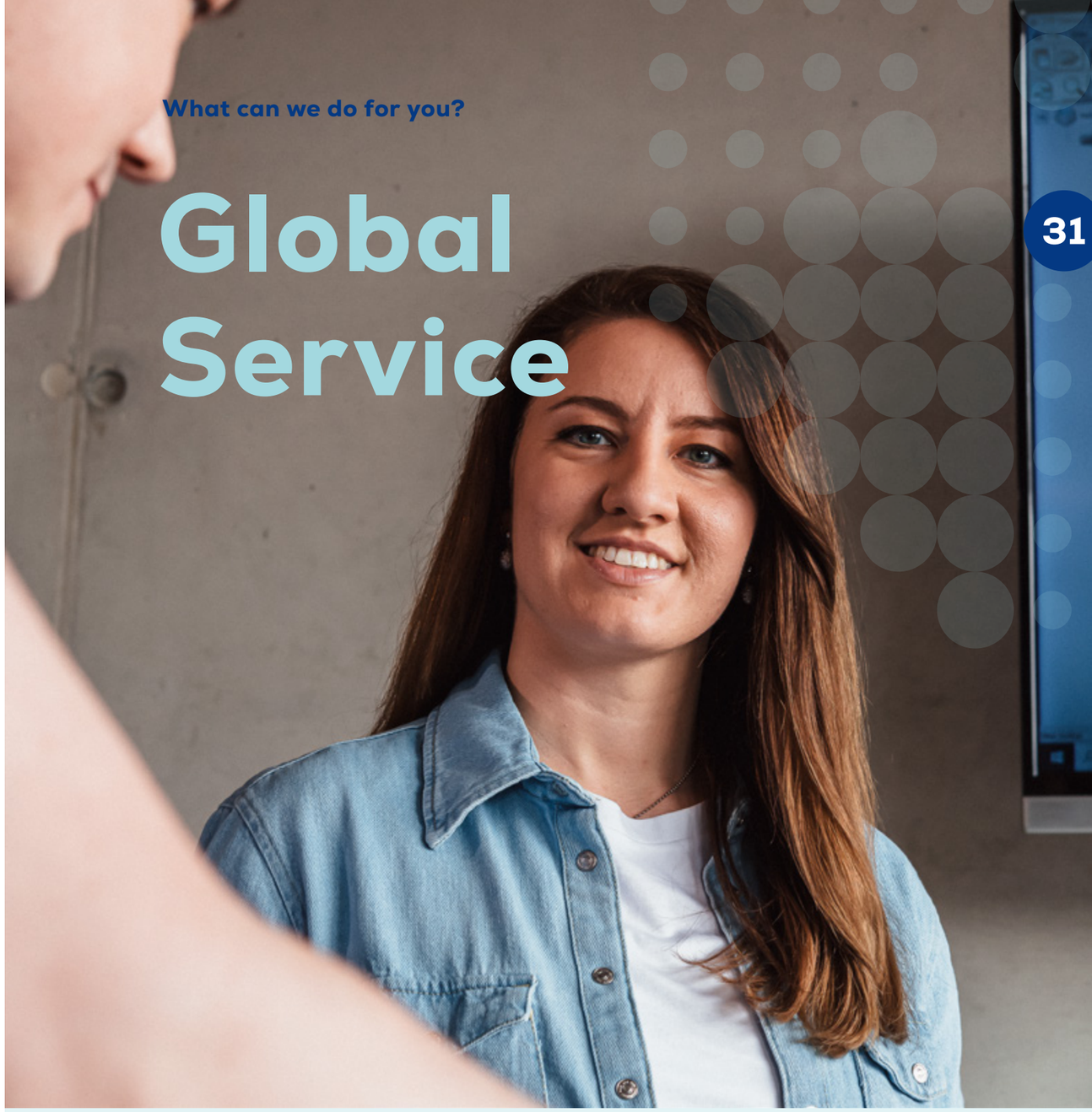

What can we do for you?

Global Service

Location | RAUMEDIC Group

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