LG4


C3 – a dedicated cryoneurolysis system

LG4 – a versatile radiofrequency generator for pain treatment

# Fire & Ice

inomed is the only company to offer both radiofrequency & cryoanalgesia systems

inomed

HEAT USED TO TREAT PAIN

# The use of heat to treat pain has a long history that can be traced back to the early Egyptian civilisation over 3,000 years ago

**Egyptians and other civilisations** used heat to treat muscular spasms and pain

In **1866**, Busch discovered that high temperatures cause tumours to shrink

In **1909**, Nagelschmidt demonstrated that high-frequency energy causes tissue necrosis. He later introduced the first diathermy system

In **1931**, Kirschner described the use of radiofrequency for the treatment of trigeminal neuralgia

In **1950**, Cosman and Arnoff developed the first commercial RF generator

In **1960**, Rees developed the technique of percutaneous rhizolysis

In **1974**, the first dorsal root radiofrequency was described

In **1975**, Shealy described the first use of radiofrequency for lumbar facet pain

In **1980**, Bogduk and Long developed percutaneous lumbar medial branch neurotomy

In **1998,** Sluijter, Cosman, Rittman and van Kleef invented pulsed radiofrequency

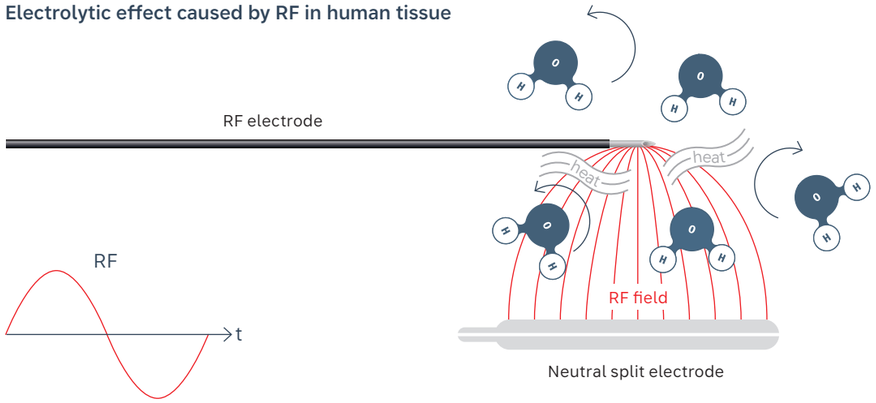
## What is **continuous radiofrequency (CRF)** denervation and and how does it work?

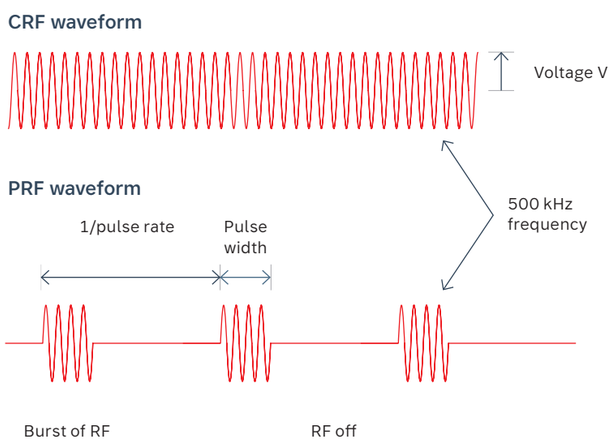
While heat has been used to treat pain for thousands of years, the use of radiofrequency to treat pain is a relatively new innovation. Radio waves are on the lower end of the electromagnetic spectrum and have the longest wavelengths and lowest energy of all types of radiation.

The term ‘continuous radiofrequency’ refers to the oscillation frequency of an alternating electric current; the frequency range used for radiofrequency denervation is between 250 and 500 kHz. The rapid oscillation of the radio waves causes ionic motion of the tissue directly adjacent to the active tip of the CRF electrode. The ionic motion leads to molecular friction and heating of the tissue within a predictable distance from the RF electrode. The heat causes coagulative necrosis of the nerve, which in turn results in a blockage of the nociceptive pathway.

In a monopolar CRF procedure, the patient is part of a closed loop circuit that includes the RF generator, electrode, and a large dispersing electrode.

**Electrolytic effect caused by RF in human tissue**

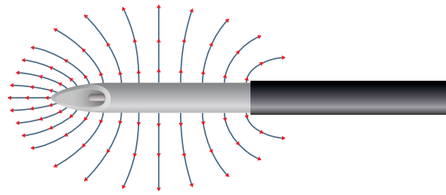


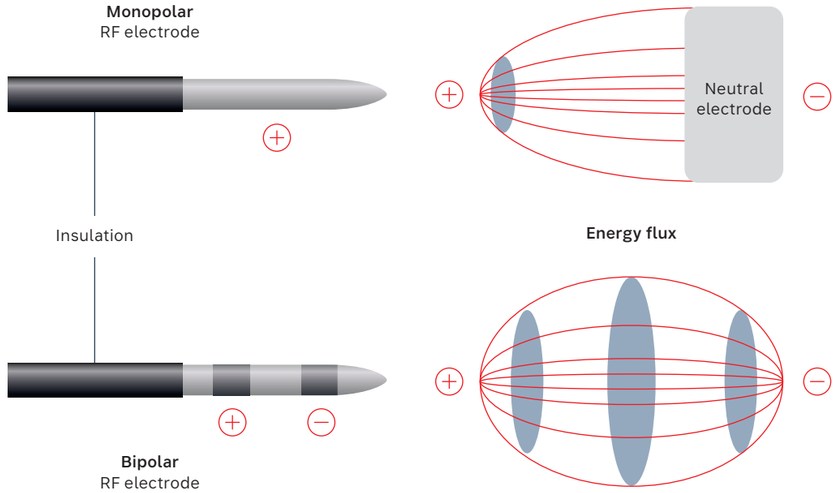






## What is **pulsed radiofrequency (PRF)?**

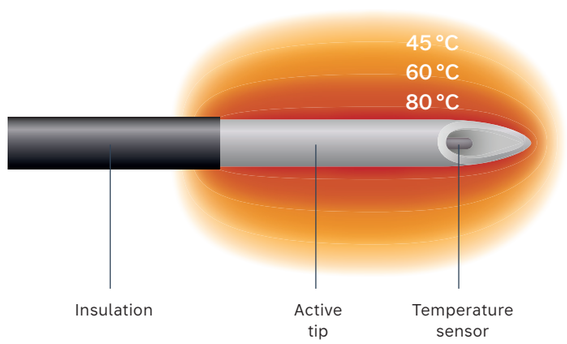
Pulsed radiofrequency differs from continuous radiofrequency as it is a non-destructive treatment method where the temperature is kept below 42°, which is not hot enough to cause coagulative necrosis. Instead, the pulsed radiofrequency generates an electromagnetic field around the nerve that modulates the pain signal by altering the nerve’s gene expression.



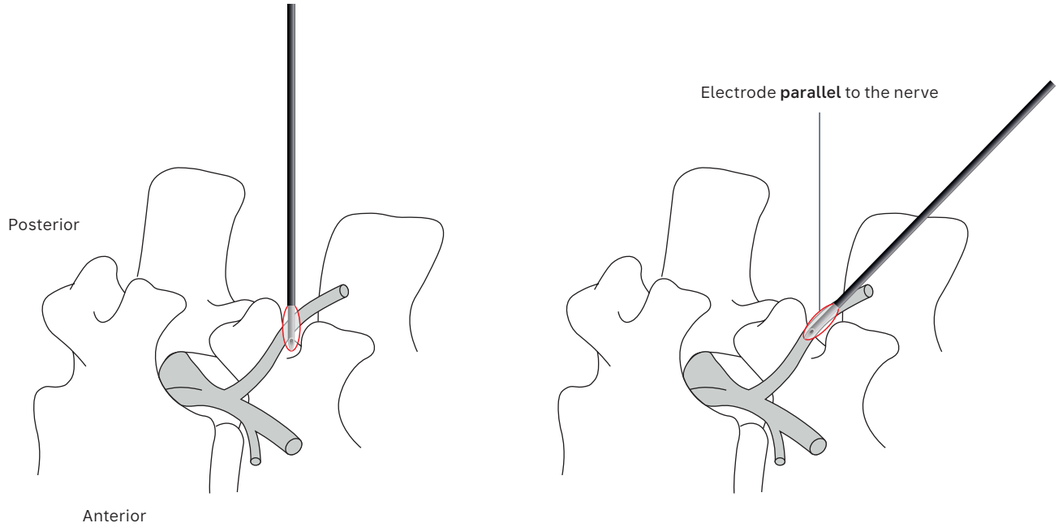



## How can understanding the shape and size of the lesion improve the outcome?

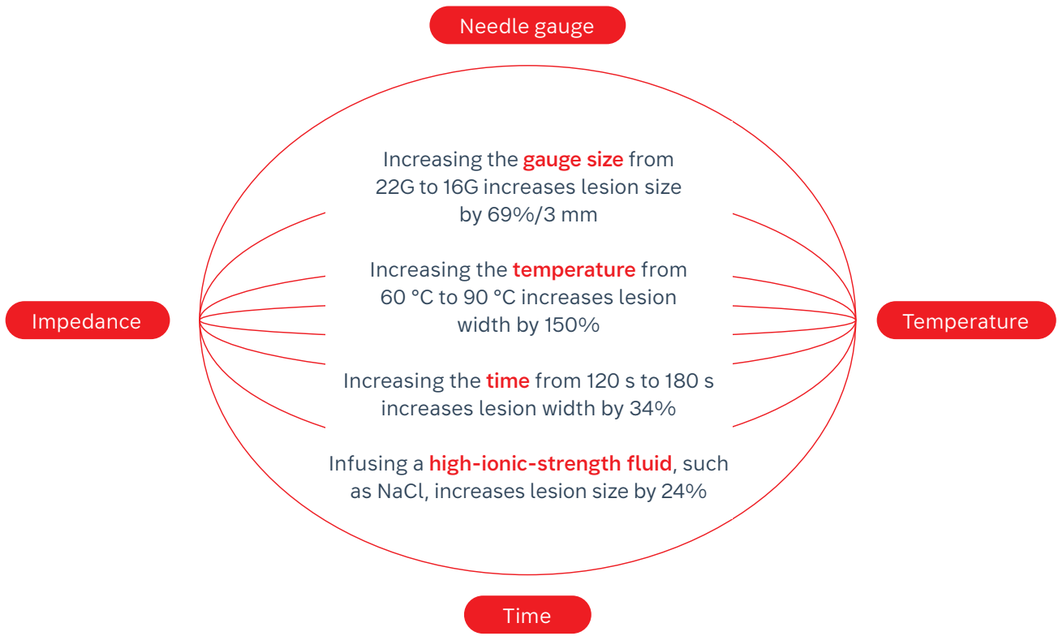
The heat generated during a continuous radiofrequency procedure originates from the tissue rather than the electrode, which affects the distribution of heat within the tissue. The heat radiates laterally from the active tip of the electrode, but does not reach the area distal to the electrode tip.



This means that the electrode must be positioned parallel to the nerve, rather than perpendicular to it, in order to maximise the contact area with the nerve.

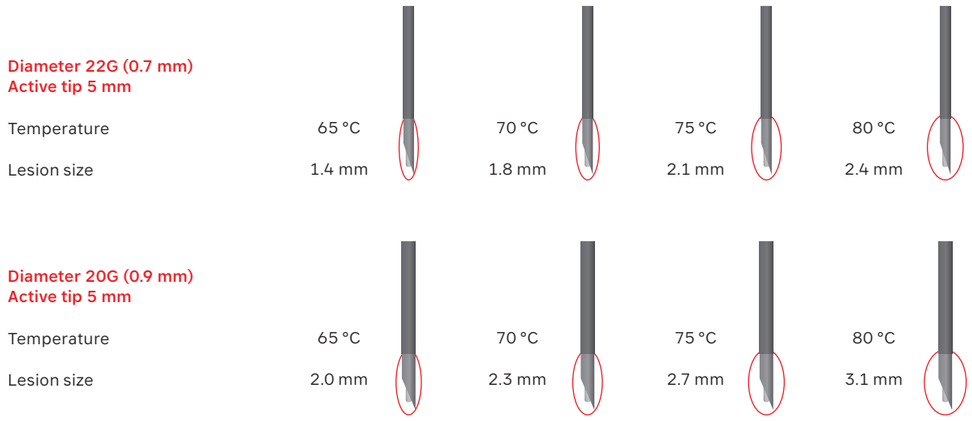



**The heat lesion can be adjusted by altering certain parameters of the procedure.**





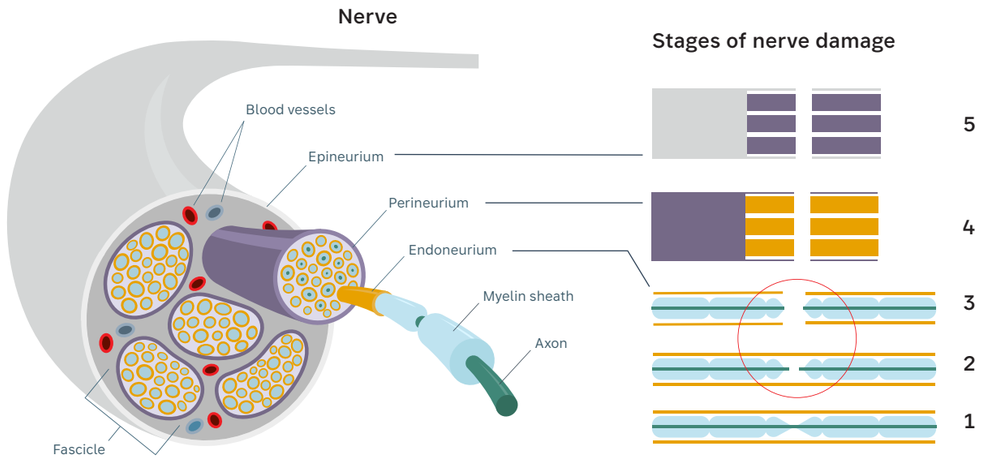

**In addition, a change in the size of the active tip also leads to an enlargement of the lesion.**

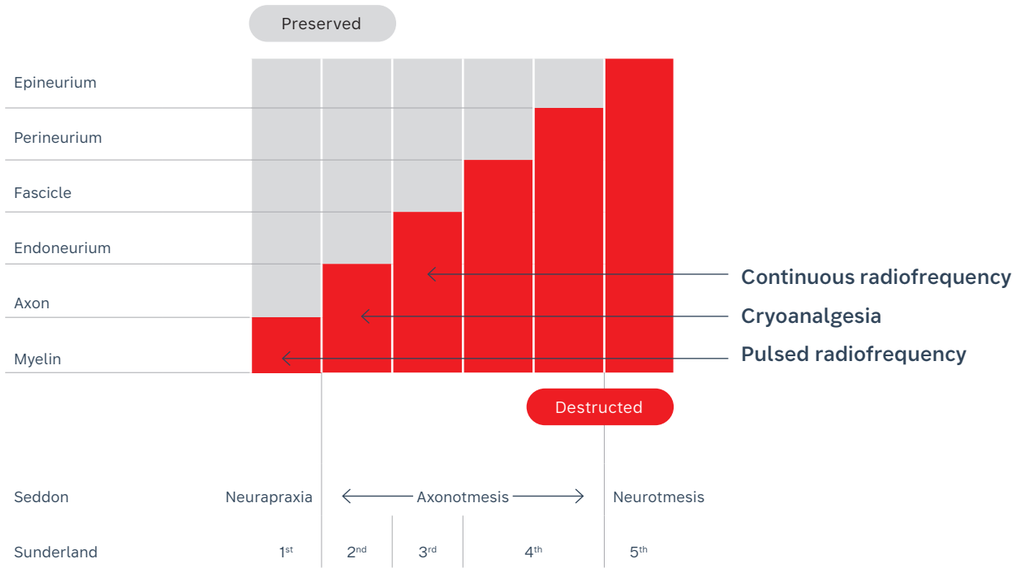



## What type of injury is caused by the treatment and how does it differ from PRF and cryoanalgesia?

According to the Sunderland classification of nerve injury, a heat-induced lesion corresponds to a grade 3 injury.

A key difference between a lesion created by cryoanalgesia and one created by continuous radiofrequency is that the endoneurium is damaged during continuous radiofrequency, whereas it remains intact during cryoanalgesia. Damage to the endoneurium can lead to procedural neuritis and neuromas, which is not possible with lesions caused by cryoanalgesia. Pulsed radiofrequency is not included in the Sunderland classification, as the treatment process is based on neuromodulation rather than coagulative necrosis or Wallerian degeneration.






## Indications of continous radiofrequency (CRF) and pulsed radiofrequency (PRF)

### CRF

- Intercostal
- Facet joint
- Genicular
- Gasserian ganglion
- Occipital neuralgia
- Chordotomy
- Sacroiliac joint

### PRF

- Atypical facial pain
- Neuropathic pain in one or more divisions of the trigeminal nerve
- Postherpetic neuralgia
- Intractable cluster headache
- Dorsal root ganglion
- Hip joint

Although there are numerous overlaps in the indications, since pulsed radiofrequency does not use heat as part of the therapeutic process, it is mainly used in areas where motor and sensory functions need to be preserved. This also avoids some of the complications associated with thermal injuries, such as neuritis, weakness, or deafferentation pain.




LG4 – a versatile radiofrequency generator for pain treatment

C3 – a dedicated cryoanalgesia system

## What is the difference between radiofrequency and cryoanalgesia?

**Continuous radiofrequency (CRF)** achieves effective lesioning through the prolonged application of continuous electrical current, elevating tissue temperatures to 60–80 °C. This creates targeted neuroablative effects through coagulative modification of both cellular and acellular structures. Histologically, this results in precise changes within the axonal and connective tissue components of the nerve, including the endoneurium, perineurium, and epineurium. CRF is associated with reliable and sustained pain relief and is especially valued for its precision, which allows for focused treatment of pain pathways.

**Pulsed radiofrequency (PRF)** applies short bursts of radiofrequency energy that generate an electromagnetic field, influencing cellular activity in a way that positively modulates pain signal transmission. While the exact mechanisms are still under investigation, PRF is believed to affect gene expression, neuronal membrane function and cytokine profiles. PRF is non-destructive, preserving the structural integrity of the nerve and is particularly well-suited for situations requiring a gentler neuromodulatory approach. It offers flexibility and is well-tolerated, making it a favourable option in a variety of clinical scenarios.

**Cryoanalgesia** uses extreme cold to create a temporary and reversible block of pain signal transmission by forming an ice ball around the target nerve. This results in a controlled axonotmesis injury, producing a lesion that can be easily visualised via ultrasound. The technique creates a larger treatment area, allowing effective targeting of both pure sensory and mixed sensorimotor nerves without long-term motor impairment. Its versatility makes it highly valuable where precise and reversible nerve modulation is essential.

inomed
# Lesion Generator (LG) family

## LG1

- → 50 W generator
- → Continuous radiofrequency: power- or temperature-controlled, or step mode
- → Pulsed radiofrequency: temperature-, voltage-, or pulse width-controlled
- → Sensory and motor stimulation
- → 1 channel monopolar or 1 channel bipolar
- → Continuous temperature monitoring
- → Continuous impedance monitoring
- → Contact quality monitoring
- → Audio impedance
- → Remote control

**Art. No. 261000**

## LG2

- → 50 W generator
- → Continuous radiofrequency: power- or temperature-controlled, or step mode
- → Pulsed radiofrequency: temperature-, voltage-, or pulse width-controlled
- → Sensory and motor stimulation
- → 2 channels monopolar, 2 channels monopolar as bipolar, 1 channel bipolar
- → Continuous temperature monitoring
- → Continuous impedance monitoring
- → Audio impedance
- → Contact quality monitoring
- → Remote control

**Art. No. 262000**

## LG2-sEEG

- → 50 W generator (10 W for sEEG)
- → 1 channel + sEEG
- → Continuous temperature monitoring
- → Continuous impedance monitoring
- → Contact quality monitoring
- → Audio impedance
- → sEEG simulator test plug
- → Remote control

**Art. No. 263000**

## LG4

- → 100 W generator
- → Various monopolar and bipolar configuration options
- → Sensory and motor stimulation
- → Continuous radiofrequency: power- or temperature-controlled, or step mode
- → Pulsed radiofrequency: temperature-, voltage-, or pulse width-controlled
- → Continuous temperature monitoring
- → Continuous impedance monitoring
- → Contact quality monitoring
- → Audio impedance
- → Separate modes for different channels
- → Remote control
- → Foot switch control

**Art. No. CR2020G**





→ LG1

→ LG2

→ LG2-sEEG

→ LG4

# Unique features of the **LG4**

- → Large touchscreen display for intuitive control of the device
- → Automatically controlled RF output with simultaneous or staggered starts
- → Multiple lesion setups
- → Neutral electrode contact quality monitoring to reduce the risk of skin burns
- → Continuous impedance and temperature monitoring during all modes up to 4 channels
- → Control via foot switch or remote control
- → Patient database for treatment, detailed export of the protocol via USB stick
- → Save up to 20 use scenarios per application



# Technology that works the way you do: **pain accessories**

Disposable cannulas / reusable (SuperLight) and disposable electrodes

## Percutaneous RF cannulas

Straight und sharp cannulas

| Art. No. | Description<br>Type – diameter x active tip |
|---|---|
| **Length=50 mm** | |
| 240100 | straight – 22G x 4 mm |
| 240109 | straight – 22G x 7 mm |
| **Length=100 mm** | |
| 240101 | straight – 22G x 2 mm |
| 240102 | straight – 22G x 5 mm |
| 240114 | straight – 22G x 7 mm |
| 240106 | straight – 22G x 10 mm |
| 240111 | straight – 20G x 2 mm |
| 240110 | straight – 20G x 5 mm |
| 240112 | straight – 20G x 10 mm |
| 240120 | straight – 17G x 2 mm |
| 240121 | straight – 17G x 5 mm |
| 240122 | straight – 17G x 7 mm |
| 240123 | straight – 17G x 10 mm |
| **Length=115 mm** | |
| 240140 | disposable cannula – 18G x 2 mm |
| 240141 | disposable cannula – 18G x 5 mm |
| 240142 | disposable cannula – 18G x 7 mm |
| 240143 | disposable cannula – 18G x 10 mm |
| **Length=150 mm** | |
| 240103 | straight – 20G x 2 mm |
| 240104 | straight – 20G x 5 mm |
| 240105 | straight – 20G x 7 mm |
| 240108 | straight – 20G x 10 mm |
| 240107 | straight – 20G x 15 mm |



## Fitting electrodes for cannulas

RF pain electrodes

| Art. No. | Description |
|---|---|
| **Length=50 mm** | |
| 260007 | disposable |
| 260006 | reusable (SuperLight) |
| **Length=100 mm** | |
| 260012 | disposable |
| 260011 | reusable (SuperLight) |
| **Length=115 mm** | |
| 260126 | disposable |
| 260121 | reusable (SuperLight) |
| **Length=150 mm** | |
| 260017 | disposable |
| 260016 | reusable (SuperLight) |


260007 | 260012 | 260017 | 260126


260006 | 260011 | 260016| 260121

## Bibliography


1. Wray J, Dixon B, Przkora R. Radiofrequency ablation. In: StatPearls. Treasure Island (FL): National Library of Medicine; 2023 Jun 12.
2. Patel P, Danish S. Radiofrequency ablation techniques. ScienceDirect.
3. Radiofrequency ablation: mechanism of action and devices. J Vasc Interv Radiol. 2010 Aug;21(8):179–189.
4. Mechanism of action of radiofrequency ablation. Springer Nature.
5. Essentials of radiofrequency ablation of the spine and joints. Springer Nature.
6. Kirschner M. Zur Kryochirurgie. Arch Klin Chir. 1931;167:761–768.
7. A history of the development of radiofrequency neurotomy. J Pain Res.
8. Choi EJ, Choi YM, Jang EJ, Kim JY, Kim TK, Kim KH. Neural ablation and regeneration in pain practice. Korean J Pain. 2016 Jan;29(1):3–11.
9. McCormick Z, Hurley R. The evolution of radiofrequency denervation for pain indications. Pain Med. 2021.
10. Cosman ER Sr, Cosman ER Jr. Electric and thermal field effects in tissue around radiofrequency electrodes. Pain Med. 2005.
11. Erdine S, Billir A, Cosman ER Sr, Cosman ER Jr. Ultrastructural changes in axons following exposure to pulsed radiofrequency fields. Pain Pract. 2009;9(6):407–417.
12. Cosman ER Jr, Dolensky JR, Hoffman RA. Factors that affect radiofrequency heat lesion size. Pain Med. 2014.
13. Sunderland S. Nerves and nerve injuries. Edinburgh: Livingstone; 1968.

**inomed Medizintechnik GmbH**
Im Hausgruen 29
79312 Emmendingen
(Germany)

Phone: +49 7641 9414-0
Fax: +49 7641 9414-94
info@inomed.com

inomed