WELCOME TO
the Next-Generation TetraGraph Era:

Navigating the
New Frontier of Precision
Beyond Twitch
Monitoring

SENZIME

NEXT-GENERATION TETRAGRAPH®:
the Future of TOF Monitoring

Smart — Accurate — Essential:
Redefining EMG Monitoring

> " Achieving optimal signal strength ensures precise sensor placement, **enhancing the accuracy** even at profound and complete levels of neuromuscular block."

Large, high-resolution, non-glare display— 2.5x bigger for enhanced visibility

Experience Seamless Monitoring with TetraGraph's Intelligent Design and Unmatched Precision

Next-generation TetraGraph® invigorates the field of perioperative monitoring with quantitative train-of-four (TOF) advancements. Its TetraGraph® Level-of-Block Gauge™ simplifies data interpretation across all phases of anesthesia and neuromuscular block.

Senzime's TetraGraph® Adaptive Intelligence™ aids in signal strength optimization and automates workflows in accordance with guidelines from the American Society of Anesthesiologists (ASA) and the European Society of Anaesthesia and Intensive Care (ESAIC).

Its advanced 6th generation EMG algorithm analyzes muscle function at 4 times higher resolution, delivering unmatched accuracy and sensitivity in muscle function analysis.

TetraGraph features a slim, portable design to augment a dynamic OR with multiple mounting options and seamless connectivity.

Accommodating complex patients and procedures like robotic and tucked-arm cases, its sustainable footprint and future-proof platform assures lasting reliability, top-tier performance, and facilitates software upgrades.

TetraGraph brings the future of quantitative TOF monitoring to reality.

Incidence indicators

- **Incidence of rNMB is >33%**[1]
- **PACU LOS increases on average 80 minutes**[2]
- **Reduces ICU admissions 3-fold**[3]
- **Reduces reversal drug costs by 70%**[4]

TACKLE THE
Challenge of Residual Neuromuscular Block

Elevating Patient Safety and Outcomes by Advancing Beyond Conventional Techniques

The Clinical Problem:
Residual Neuromuscular Block

Residual neuromuscular block (rNMB) remains a challenge in perioperative care that contributes to increased postoperative complications, prolonged recovery times, and higher healthcare costs. Despite advancements in anesthesia, rNMB afflicts countless surgical patients with respiratory distress, muscle weakness, increased risk of critical respiratory events, and other severe conditions.

The Solution:
TetraGraph EMG-based Monitoring

EMG-based monitoring ensures precise detection of residual block through accurate, real-time neuromuscular assessments with higher sensitivity and specificity than traditional methods.

Priority 1:
Patient Safety

EMG-based monitoring complies with ASA and ESAIC guidelines. Trustworthy TetraGraph aligns with best practices and enhances patient safety protocols.

Reference:
1. Carvalho H, et al.: Forty years of neuromuscular monitoring and postoperative residual curarisation: a meta-analysis and evaluation of confidence in network meta-analysis. *Br J Anaesth.* 2020 Oct;125(4):466-482.
2. Butterly A, et al.: Postoperative residual curarization from intermediate-acting neuromuscular blocking agents delays recovery room discharge. *Br J Anaesth* 2010; 105:304–309.
3. Grabitz SD, et al.: The effects of postoperative residual neuromuscular blockade on hospital costs and intensive care unit admission: A population-based cohort study. *Anesth Analg* 2019; 128:1129–1136.
4. Thilen SR, et al.: Management of muscle relaxation with rocuronium and reversal with neostigmine or sugammadex guided by quantitative neuromuscular monitoring. *Anesth Analg.* 2024 Sep 1;139(3):536-544.
5. Ebert TJ, et al.: Train-of-four ratio, counts and post-tetanic counts with the TetraGraph electromyograph in comparison with mechanomyography. *Journal of Clinical Monitoring and Computing,* August 2024.
6. Wedemeyer Z, et al.: "Accuracy and Precision of Three Acceleromyographs, Three Electromyographs, and a Mechanomyograph Measuring the Train-of-Four Ratio in the Absence of Neuromuscular Blocking Drugs" *Anesthesiology.* 2024; https://doi.org/10.1097/ ALN.0000000000005051.
7. Wedemeyer, Z., et al.: "Comparative Performance of Stimpod Electromyography with Mechanomyography for Quantitative Neuromuscular Blockade Monitoring." *Journal of Clinical Monitoring and Computing,* vol. 38, 2023, pp. 205-212. https://doi.org/10.1007/s10877-023-01087-1.
8. Bowdle A, et al.: "A Comparison of a Prototype Electromyograph vs. a Mechanomyograph and an Acceleromyograph for Assessment of Neuromuscular Blockade." *Anaesthesia,* vol. 75, 2020, pp. 187-195. https://doi.org/10.1111/anae.14872.

Why Forgo Conventional Techniques for EMG Train-of-Four Monitoring?

✓ Unmatched Precision:

The 6th generation TetraGraph EMG algorithm offers 4x higher resolution, measuring compound muscle action potential (CMAP) with greater precision than other methods to ensure absolutely accurate neuromuscular assessments.[5]

✓ Independent of Limb Movement:

Unlike traditional monitoring techniques, TetraGraph EMG can function without requiring unimpeded thumb movement during surgery, enabling flexibility in arm positioning, such as tucking arms under surgical drapes.

✓ Seamless Integration:

Senzime TetraGraph complements external multiparameter monitors and electronic health records to automate charting and maximize direct patient care.

Clinical Validation and Study Results:

TetraGraph® EMG has been clinically validated as more accurate and consistent—at all levels of block including deep—than MMG, with strong correlations (r >0.9) across TOF ratios, TOF counts, and PTC measurements. Its portable design, accuracy at all levels of block, and simplicity of use make it an ideal tool for neuromuscular monitoring in clinical settings.[5]

A recent clinical study published in Anesthesiology (2024) demonstrated that TetraGraph achieves accuracy and precision when measuring baseline TOF ratios. TetraGraph produced results similar to the clinical reference standard, mechanmyography (MMG), reinforcing its reliability for quantitative TOF monitoring.[6]

EMG Devices Comparison:

Accuracy to reference for commercially available EMG neuromuscular monitoring devices*[6, 7-8]

Device	Accuracy
TetraGraph Ebert T.J. et. al. (2024)[5]	97.9%
Stimpod Wedemeyer. Z, et.al (2023)[7]	97.2%
TwitchView Bowdle A. et. al. (2020)[8]	95.3%

*Calculated as 1-Bias vs. MMG. The TetraGraph was shown to achieve the highest accuracy in a validation study, with the least likelihood of over-reading baseline train-of-four ratio measurements.

	TetraGraph EMG	Other EMG Devices
Clinically validated at all levels of block, including deep and profound blocks	Yes	No
Proprietary Level-of-Block Gauge™ for easy-to-interpret, high-resolution, real-time display of individual EMG readings, waveforms (CMAPs) and trends	Yes	No
TetraGraph® Adaptive Intelligence™ to to aid in signal strength optimization, providing confidence in the accuracy of every reading	Yes	No
Backed by over 40 years of research, and developed with insights from global leaders in anesthesiology	Yes	No
6th generation advanced EMG algorithm with 4x resolution, superior artifact handling, and noise cancellation without the need for extra (ground) electrodes.	Yes	No
Complete sensor portfolio, from infants to adults with sensitive skin	Yes	No

Three Unique Trend Views to Elevate Clinical Confidence

Explore advanced trend graph capabililties for enhanced anesthesia management and post-procedure analysis

1

Rapid trends displayed on the TetraGraph® Level-of-Block Gauge™

The TetraGraph introduces the first-ever Level-of-Block Gauge™ displaying short-term, rapid trends of muscle block using with faded needles.

This advanced display offers an intuitive and easy-to-interpret window indicating the direction and last measurement results of a patient's neuromuscular block or reversal, minimizing any second-guessing.

2

Post-Procedure Data Review

Review post-procedure data on a full-screen, high-resolution trend display with intuitive zoom-in controls. A dynamic line tool allows for the selection of specific values or time points within the trend graph for detailed insights.

3

Real-Time Trend Graph

A real-time graph featuring a secondary y-axis that displays the Level of Block, allowing for straightforward interpretation of the gauge. Updates are made instantly as new data are added.

Proprietary TetraGraph® Level-of-Block Gauge™

TetraGraph uses our proprietary Level-of-Block Gauge™, an innovation that evolved from our enduring dedication to precision-based patient monitoring. This essential component continues to raise quantitative TOF monitoring market standards in personalized anesthesia.

SIMPLY INTELLIGENT
Next Generation TOF Monitoring

Introducing the First-Ever Level-of-Block Monitor with TetraGraph® Adaptive Intelligence™

Intuitive Interface for Data Trends

TetraGraph features an intuitive interface, so clinicians can easily view and analyze patient data trends, enhancing decision-making and patient management throughout the perioperative period, including both real-time and post-procedure reviews.

EMG Analysis Made Smart

Reimagined in TetraGraph technology, intelligent EMG analysis with Peak-to-Trough (PtT) analytics gives clinicians the added assurance of industry-leading accuracy and optimum patient-centered care.

Every possible surgical case is familiar to our 6th generation EMG algorithm. Powerful computations are automatically formulated from a knowledge base comprising millions of waveforms.
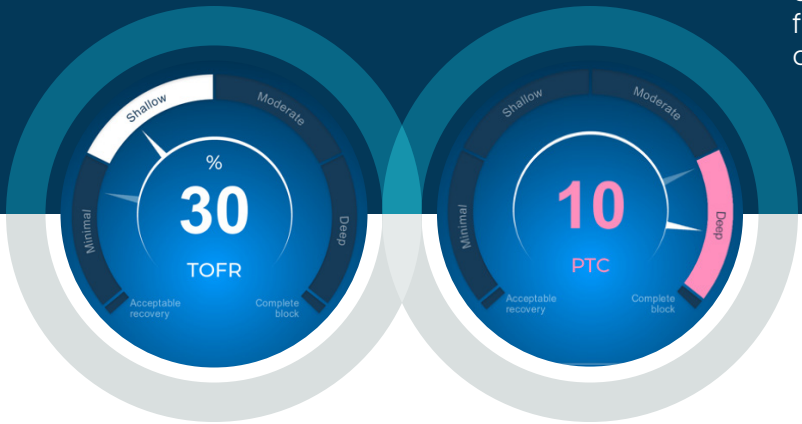
THE NEW STANDARD
of TOF Accuracy Surpasses Traditional Twitch Monitoring

If monitoring cannot begin before muscle relaxants are administered, TetraGraph® Adaptive Intelligence™ provides an estimated, objective signal strength reading to guide precise sensor placement, thereby ensuring accurate and reliable monitoring.

Proprietary TetraGraph® Adaptive Intelligence™

Series of Specialized Algorithms Automates Your Workflow from Induction to Recovery

Sensor Placement Optimization
Aids in optimal sensor placement and signal strength for accurate monitoring of neuromuscular block.

TetraGraph® Adaptive PTC™
Enters Deep Block Mode automatically when TOFC is 0, using a single stimulation to check response amplitude and signal quality. If conditions are met, it proceeds with tetanic stimulation and PTC measurements. Otherwise, it returns to TOF mode, ensuring safe and efficient deep block management.

Adaptive Time Interval
Adjusts measurement intervals automatically based on neuromuscular response changes, ensuring more precise assessments and capturing spontaneous recovery without omission.

Patented, Advanced, Noise-Cancelling Technology

Senzime's TetraGraph system features patented noise-canceling technology, providing clinicians with precise and reliable patient monitoring during anesthesia. Its innovative design filters out operating room noise by generating a single stimulus signal and measuring noise when no response is expected to ensure clean and accurate data.

Unlike other monitors that require extra (ground) electrodes for noise cancellation, TetraGraph integrates this function into its software, enhancing ease of use, improving patient safety, and bolstering the anesthesia provider's confidence.

Connects with Senzime's family of flexible EMG sensors, offering 12' or 18' cables to adapt to various surgical procedures, such as those with space and movement limitations, like tucked-arm and robotic cases.

TetraSens:
Adaptable for adult patients, ensuring precise neuromuscular monitoring for a wide range of surgical procedures.

TetraSensitive:
Customized for geriatrics and patients with sensitive skin. Hypoallergenic and latex-free with soft edges, including low-profile design.

TetraSens Pediatric:
Ultrasoft, flexible material and the only FDA-cleared sensor with a separate and specific pediatric indication, enabling one sensor for infants to adolescents.

VERSATILE
for a Wide Range of Patients and Procedures

Revitalizing the Modern OR with **Clinician-Centric Connectivity**

Next Generation TetraGraph:
Engineering Precision in Every Measure

Next-generation TetraGraph was developed with modifiable portability to meld into a dynamic OR environment where every device is as vital as every member.

Industry-leading options combine seamless integration with external multiparameter monitors and electronic patient health records for an uninterrupted, linear workflow.

MEETING
Tomorrow's Demands Today

Designed in Partnership
with Clinicians Across the Globe

Compelling reasons to bring a value-based, sustainable, and future-proof solution into the OR:

Evolving from 40 years of research and feedback from patients and clinicians, the TetraGraph system was invented and tested in the USA, developed and manufactured in Sweden, and is now helping patients in over 30 (and counting) countries worldwide.

Developed and manufactured in Sweden with sustainability built-in as the first TOF monitor incorporating biocompatible materials and a fossil-free energy final manufacturing and assembly process in Uppsala, Sweden.

Future-proof, upgradable platform ready for upcoming software features to keep TetraGraph the State-of-the-Art in technological innovation.

Sorin J. Brull
MD, FCARCSI (Hon),

The visionary behind TetraGraph, pioneered the technology with over four decades of research and clinical practice
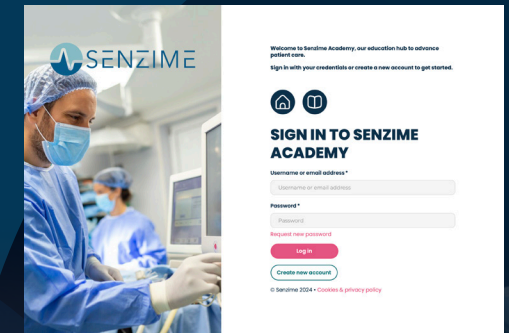

Our community of healthcare providers trusts our unwavering commitment to excellence and utilizes a comprehensive array of features with personalized support from our dedicated team. Our technology prevails in the most demanding conditions to achieve superior patient care. With over 100 years of combined critical care and anesthesia experience, our clinicians will help integrate our technologies into any medical environment for meaningful outcomes that justify your investment every day.

CLINICAL EDUCATION

IMPLEMENTATION SUPPORT

POST GO-LIVE ONGOING SUPPORT

Explore Senzime Academy. Our eLearning platform is designed to help anesthesia providers master all the capabilities of the TetraGraph system quickly and effectively. Our free online courses ensure compliance with clinical guidelines and enhance patient safety. Access training anytime, anywhere, or use our exportable SCORM files for integration into your hospital's learning management system (LMS).

TECHNICAL SPECIFICATIONS

Modes of Operation

TOF Interval	15 seconds - 60 minutes
Automatic stimulus setup	Automatic detection of maximal current
	Supramaximal current 20% above maximal current
Train-of-Four (TOF Ratio & TOF Count)	4 pulses of 200 or 300 µs duration at 2 Hz repeated at user selected frequency of 15 seconds, 1 minute, 5 minutes, 15 minutes or 60 minutes
Post-tetanic Count (PTC)	PTC consists of Tetanic Stimulation, a set of 250 pulses (1 pulse at 50Hz over 5 seconds stimulated according to the current setting in the monitor; allowed by up to 20 ST pulses at 1 Hz)
Single Twitch (ST)	Pulse of 200 or 300 µs duration at 10 or 5 seconds

Stimulation

Current	10-60 mA @ 5k-ohm
Pulse Width	200 µs or 300 µs
Pulse Type	Monophasic square wave
Voltage	300V

Sensor Type

Integrated strip sensor	TetraSens disposable stimulator recorder
Sensor stimulus placement	Ulnar nerve or Posterior Tibial nerve
Sensor recording placement	Adductor Pollicis muscle (AP), Abductor Digiti Minimi muscle (ADM), Flexor Hallucis Brevis muscle (FHB)
Duration of use	Single use, cumulative use less than 24 hours on the same patient

Recording

Range	0.1–50 mV
50/60 Hz filter	Yes
Measurement	Peak-to-Peak MAP

Graphics

Display	Color LCD, Brightness control, Touch Screen interface
MAP (Muscle Action Potentials)	Display of waveforms
TOF	Bar of four pulse amplitudes and %, trend of successive TOFR values
TOFC	TOF Count, integer and trend
ST	Amplitude of response, mV, series of response amplitudes as bars
PTC	Number of post-tetanic count

Power Supply

Charger	EN 60601-1 certified power supply 5V DC
Connection to mains electricity during use	TetraGraph must only be used with the provided power supply adapter
Battery	8 hours continuous operation with new battery in good condition
Battery Specifications	Rechargeable Lithium battery, Fey Elektronik
Cord length	3 meters

Dimensions

Length	215 millimeters
Width	116 millimeters
Thickness	38 millimeters, 85 millimeters including pole clamp
Weight	573 grams, 748 grams including pole clamp

Additional Features

Case Reference Number	8-digit number
Audible stimulus	On/Off
Data review	On-screen review of trend data
Data Interface	TetraGraph Philips Interface and TetraHub
Connectivity	Philips Capsule, Masimo DCX™, Philips IVOI
Data Management	TetraConnect cloud-based connectivity portal to upload, view, share and export data
Communication Interface	USB C connector Connected equipment USB C 2.0 or higher
Patient Cable Cord length	3.65 meters

Environment during storage

Temperature	5-50°C (41-122°F)
Relative humidity	10% to 85% non-condensing
Atmospheric pressure	50 kPa to 106 kPa

Environment during use

Temperature	5°C to 40°C (41°F to 86°F)
Relative humidity	10% to 85% non-condensing
Atmospheric pressure	70k Pa to 106 kPa

Standards Applied

IEC 60601-1:2005/AMD1:2012/AMD2:2020

EN 60601-1-2:2015/AMD1:2020

IEC 60601-2-40:2016

Redefining Quantitative Train-of-Four (TOF) Monitoring with the Industry's First-Ever Level-of-Block Gauge™ + TetraGraph® Adaptive Intelligence™

COMMITMENT TO
Patient Safety :

Our commitment propels healthcare providers to reach a new level of patient care, where every clinician is empowered, every patient assured, and the highest standards of care are not just met — they're invented.

Learn more?
Senzime.com/NextGen