



VIAMED



THE MICROSTIM DB NERVE STIMULATOR

**A Peripheral Nerve Stimulator
For Use During Anaesthesia**

CE0086



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How to use the Microstim

1 Position the stimulating Electrodes

- i Chose the monitoring site, for example:
 - Ulnar nerve
 - Facial nerve
 - Posterior tibial nerve
- ii Clean the skin with acetone or an alcohol wipe.
- iii Apply two ECG-type electrodes, either along the line of the nerve or straddling the nerve.
- iv Connect the leads. (the positive [red] electrode should usually be proximal)
- v Set the output control at approximately half-maximum.

2 Decide on the mode of stimulation

PROFOUND BLOCKADE: Post-Tetanic count

SURGICAL BLOCKADE: Train-of-four count

REVERSAL: Double Burst ratio or Train-of-Four ratio.

3 Adjust the output current

Increase the output current until the twitch response is maximal. If the current is increased excessively, direct muscle stimulation will become more pronounced- see "Problems and Solutions".

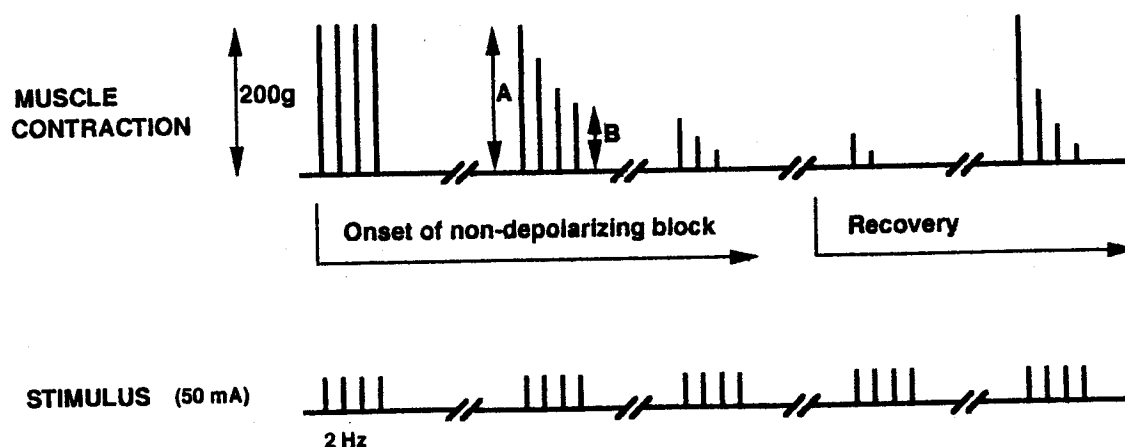
NB: When using ulnar nerve stimulation, only the force of adduction of the thumb should be monitored; contraction of the other muscles of the hand should be ignored. The force of contraction should be assessed by the anaesthetist's index finger applying a slight pre-load to the patient's thumb. Visual assessment is of little value.

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Train-of-Four Stimulation

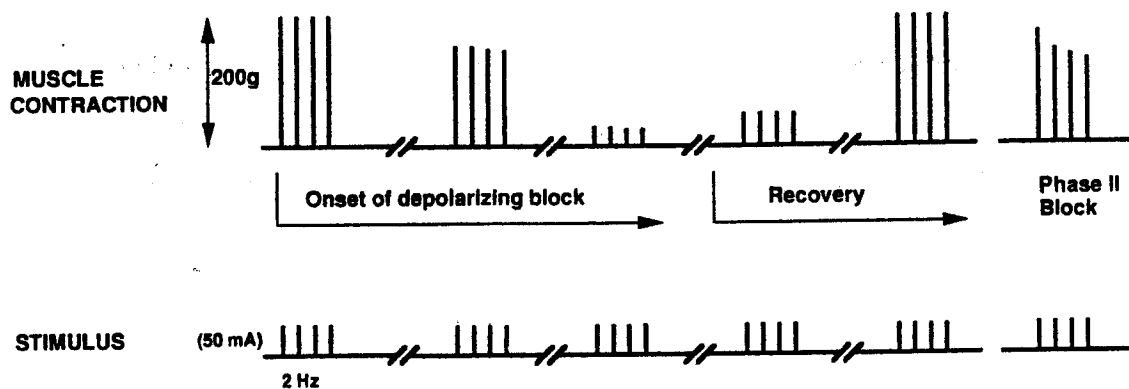
To initiate train-of-Four stimulation, depress the TOF switch once. The Microstim will automatically deliver the correct sequence of stimuli (four stimuli at 2Hz). An interval of at least 10 seconds should be permitted between successive TOF estimations.

This mode of stimulation, first described in 1970, permits the user to assess the depth of neuromuscular blockade without recourse to a "control twitch" obtained before the muscle relaxant was given. Each train comprises four stimuli of equal intensity at a frequency of 2Hz. During partial non-depolarizing blockade there is a characteristic fade in the magnitude of the resulting four twitches. Depolarizing blockade does not produce significant fade unless Phase 11 block has intervened.



The Train-of-Four ratio is the magnitude of the fourth twitch divided by the magnitude of the first twitch. In the absence of fade, the ratio would be 1.0. *Even in experienced hands, it is unusual for fade to be detectable using the palpation method unless the Train-of-Four ratio has fallen to below 0.5.* At this level of blockade, the patient's ability to breathe adequately may still be impaired- see "Double Burst Stimulation".

When blockade is more profound (at a level more appropriate to surgery) the twitches successively disappear, so that only one or two small responses remain. The number of twitches remaining is the Train-of-Four count. A count of one or two is usually compatible with adequate surgical relaxation and also indicates that reversal with neostigmine will be satisfactory. Occasionally, four small responses persist even at profound blockade- see "Problems and Solutions".



Depolarizing blockade does not produce significant fade unless Phase II block has intervened.

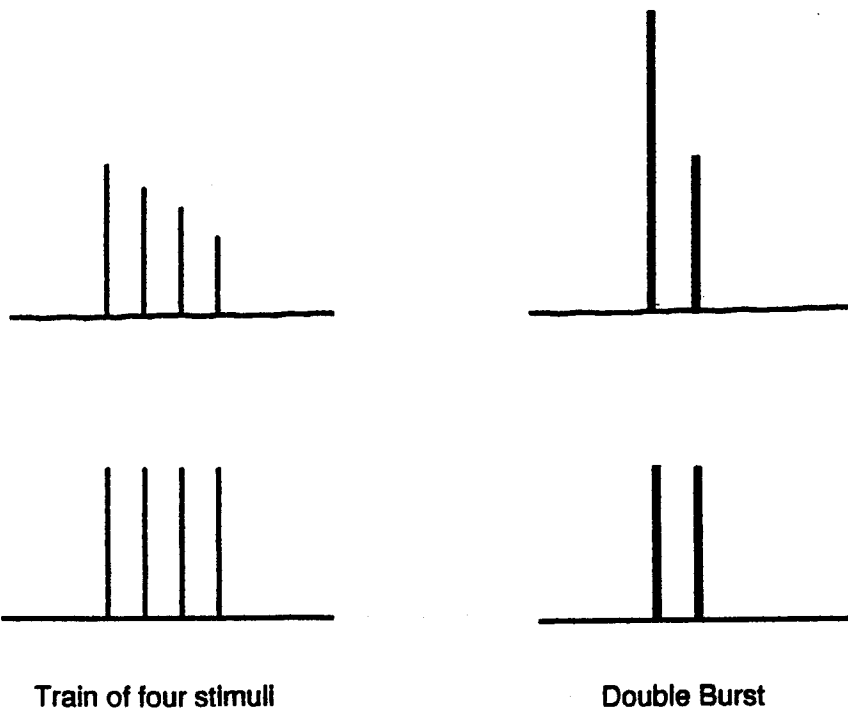
Double Burst Stimulation

To initiate Double Burst stimulations, depress the DBS switch once. The Microstim will automatically deliver the correct sequence of stimuli (Two burst of stimuli at 50Hz separated by 750ms. DBS 3,2 is standard, DBS 3,3 can be supplied on request). An interval of at least 15 seconds should be permitted between DBS estimations.

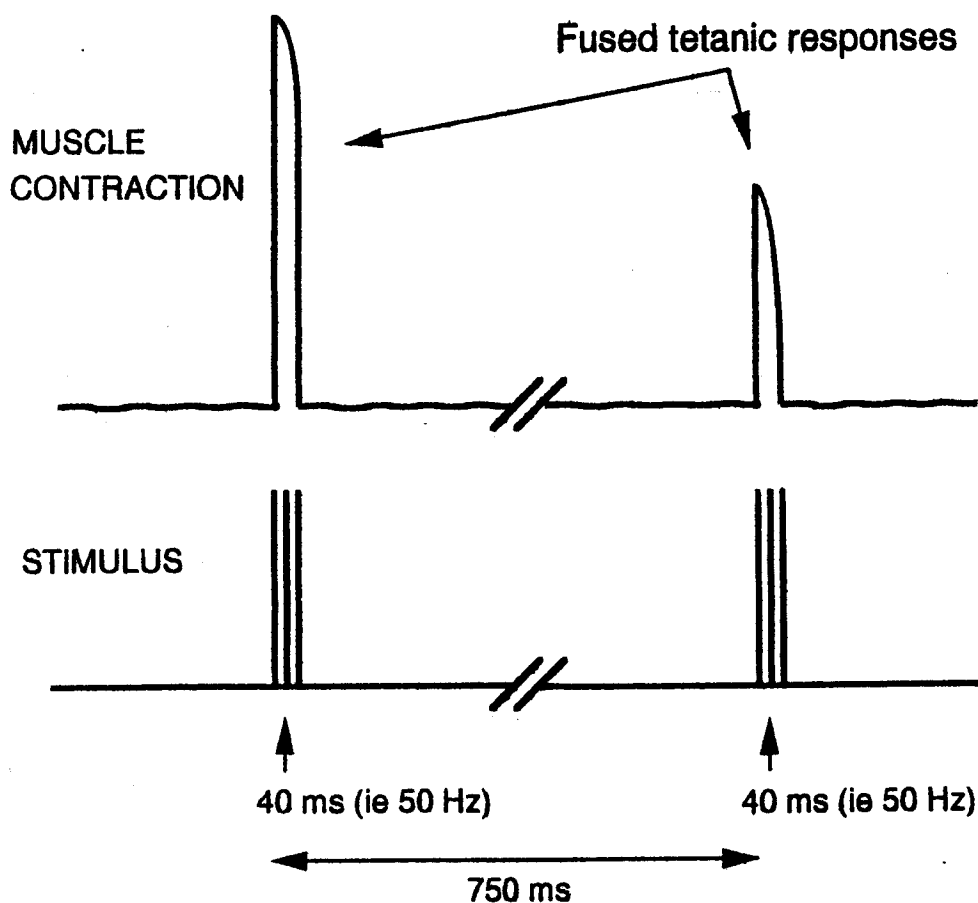
Although the Train-of-Four ratio provides a method of monitoring light to moderate neuromuscular blockade, its accuracy is much reduced unless a force transducer is used to measure the response of the muscle. This is because the ability of the anaesthetist to reliably estimate the Train-of-Four ratio is limited. Thus, considerable fade in the four responses may exist without the anaesthetist being aware of the risk of residual blockade.

Double Burst Stimulation (DBS) was designed to produce the same degree of fade as the Train-of-Four with the advantage that DBS fade is more easily detected and quantified by the anaesthetist who is monitoring the twitch response of the thumb by the palpation method.

Two, short tetanic bursts of stimuli are delivered and the response of the muscle is felt by the anaesthetist as two discrete twitches. It is relatively easy to quantify the extent to which the second twitch is less powerful than the first twitch because a) Both twitches are, in any case, larger than the Train-of-Four twitches, and b) the two middle twitches of the Train-of-Four normally confound the comparison of the first and the fourth responses.



During spontaneous recovery, the first DBS response reappears slightly earlier than the first TOF response and the second DBS response reappears slightly earlier than the fourth TOF response. These differences are unlikely to be of clinical significance, and DBS and TOF can be used interchangeably, with the advantage that DBS provides more accurate information to the anaesthetist who does not have access to a force transducer.



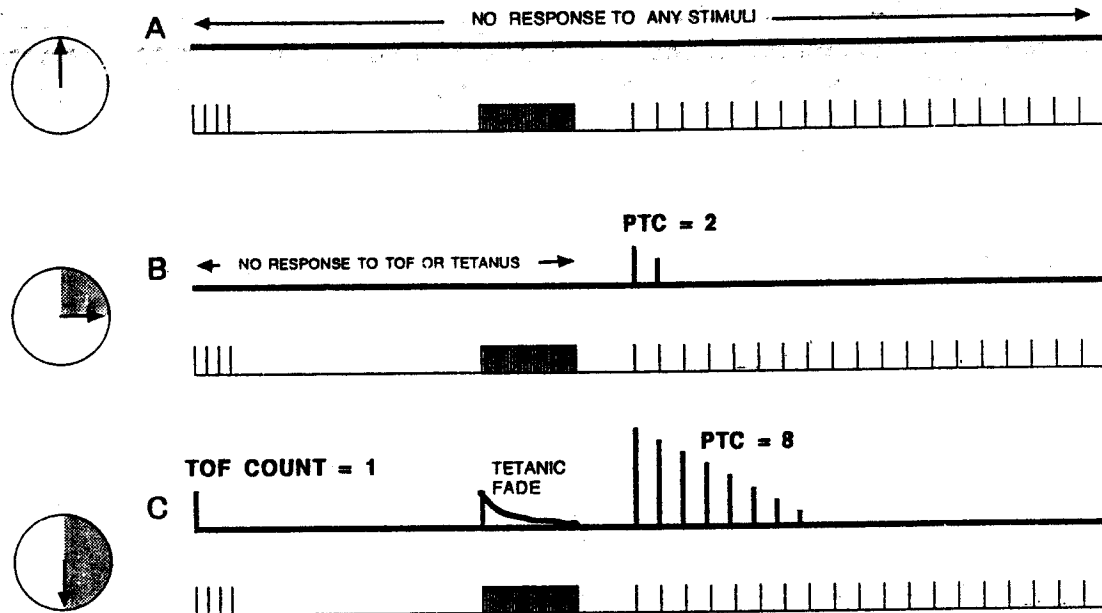
Post-Tetanic Count

To initiate PTC stimulation, depress the PTC switch once. The microstim will automatically deliver the correct sequence of stimuli (50Hz for 5seconds, 3 second pause, followed by 1Hz stimuli). An interval of at least 5-6 minutes should be permitted between successive estimations of PTC.

This method of measuring the depth of profound non-depolarizing neuromuscular blockade was introduced in 1981. Suppose that blockade is very profound and there is no response whatever to other modes of nerve stimulation. A difficulty exists in quantifying such extreme blockade. However, for a short while following a burst of tetanic stimulation (for example, 50Hz for 5 seconds), the process of mobilization of acetyl choline at the motor nerve terminal persists in a state of enhanced activity.

If, at this stage, the nerve is stimulated at a much slower rate (for example at 1Hz), the twitch response is initially boosted by the greater quantity of acetyl choline that is released by each stimulus. This is the phenomenon of post-tetanic facilitation. The enhancement of transmitter release soon wanes, and the twitch response also declines to the level that existed before the tetanic burst was given. The number of palpable facilitated twitches can easily be counted: this number is the Post-Tetanic Count.

The more profound the blockade, the lower is the Post-Tetanic Count (PTC). As neuromuscular transmission recovers, the number of palpable post-tetanic twitches increases until, at a PTC of approximately 6-10 (depending on the muscle relaxant) spontaneous recovery has progressed sufficiently for the first response of the train-of-Four to become just detectable. From this point onwards, PTC loses its usefulness and Train-of-Four and DBS takes over.



PTC is useful in monitoring the progress of profound blockade soon after a dose of relaxant has been given or when any sudden spontaneous diaphragmatic movement is undesirable, for example during neurosurgery.

Problems and Solutions

P. *During TOF stimulation or DBS, all the twitch responses persist even at profound blockade.*

S. This is due to direct stimulation of the flexors of the forearm. Try the following:

- i Reduce the stimulus current.
- ii Reposition the electrodes; try moving the positive electrode to the ulnar groove at the elbow.

Avoid the temptation to assess the muscle response visually; always use tactile assessment and apply a pre-load to the patient's thumb.

P. *At the end of the surgical procedure movement of the reservoir bag appears to indicate adequate tidal breathing and there is no fade in the TOF responses; should neostigmine still be given?*

S. Tactile assessment of the Train-of-Four ratio is inaccurate. The TOF ratio can be less than 0.5 with no apparent clinical fade. Try changing to DBS which often reveals covert fade. If there is any fade whatever, neostigmine should be given (in a reduced dose if this is appropriate),

P. *The response of the facial muscles to stimulation of the facial nerve indicates that the patient is fully reversed but the patient is clearly partially paralysed.*

S. The facial muscles are relatively resistant to muscle relaxants compared with the muscles of the hand. This must be borne in mind if this monitoring site is used, otherwise it is easy to over-paralyse the patient.

P. *There is very little response to stimulation but the patient is clearly insufficiently relaxed for surgery.*

S. This is commonly due to dry ECG electrodes. It is preferable to use ordinary ECG electrodes rather than to keep a supply of special electrodes for neuromuscular monitoring which might become dry if they are left in a drawer for a period of time.

P. *It would be desirable to measure neuromuscular transmission in the awake patient in the recovery room but supramaximal is too painful.*

S. The stimulus current may be reduced to approximately 1/3 maximum (30mA). At this level the TOF ratio (but not the single twitch) is not reduced compared with supramaximal stimulation and the stimuli are much less unpleasant for the patient.

NOTE

- 1 Caution in the presence of Pacemakers.
- 2 Do not use as a nerve locator stimulator.
- 3 Do not use needle electrodes.
- 4 Interference may be seen on e.c.g. equipment during stimulation.

Which is the appropriate mode?

CLINICAL FADE

DBS

T-O-F

1..... n	1 2 3 4	0 0.5 1.0
Post-Tetanic Count	Train-of-Four Count	Double Burst Ratio or Train-of-Four Ratio

SURGICAL

BLOCK

REVERSIBILITY

Normal
Vital
Capacity