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Is the Absorption of Anaesthetic Agents Non Linear?

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Summary

Knowledge of the absorption of inhalation anaesthetic agents is essential if one is to safely administer them. Despite many years of research in linear science, no model has been described that can reliably predict inhalation agent uptake. To date no published investigation has looked for non-linearity in the absorption process. The aim if this research project was to determine if the absorption of anaesthetic agents is non-linear, using isoflurane and enflurane as examples.

To detect non-linearity, four conditions must be met:
Sensitivity to initial conditions,
Fractal Dimension of the attractor,
Invariant probability distribution of the attractor, and
Detection of an underlying dynamical process.

Ten measured time series for both isoflurane and enflurane absorption were measured. These were then compared with ten noise signals, with similar standard deviations, means and number of points in the series.

Calculated Lyapunov exponents tested sensitivity to initial conditions. The dimension of the attractor was calculated using the following statistics, each giving an approximation of the fractal dimension. Approximate entropy, information entropy, correlation dimension and fractal dimension (box counting method). The Invariant probability distribution of the attractor was tested for using non-linear forecasting. Detection of an underlying dynamical process was determined by the method of surrogate data.

Each of the four conditions required have been met with statistical significance ($p< 0.05$) and acceptable statistical power (>0.8). It is therefore concluded that the absorption of both isoflurane and enflurane are non-linear processes. The implications and implementations in anaesthesia practice are discussed.

Opsomming

'n Deeglike kennis van die opname van narkose dampe is nodig om die toediening daarvan veilig te maak. Ten spyte van etlike jare van navorsing, is geen liniêre model beskryf wat die opname van dampe akkuraat voorspel nie. Geen publikasie het tot op hede die hipotese van nie-liniêre absorpsie van narkosedampe ondersoek nie. Die doel van die navorsingsprojek is om die moontlikheid dat die opname van narkose dampe nie-liniêr is te ondersoek, met gebruik van isofluraan en enfluraan as voorbeelde.

Om vir nie lineariteit te toets, moet daar aan die volgende vereistes voldoen word:
Sensitiwiteit vir aanvanklike omstandighede,
Fraktale dimensie van die attraktor,
Invariante waarskynlikheids verspreiding van die attraktor, en die Identifisering van 'n onderliggende dinamiese proses.

Tien gemete tydreekse is vir beide isofluraan- en enfluraan-absorpsie afsonderlik bepaal. Dié is vergelyk met tien ruis-tydreekse met vergelykbare standaardafwykings, gemiddelde waardes en aantal datapunte in elke betrokke reeks.

Berekende Lyapunov eksponente is gebruik om te toets vir sensitiwiteit vir aanvanklike omstandighede. Die attraktor-dimensie is gemeet met die volgende statistiese metodes, waar elkeen 'n beraming gee van die fraktale dimensie. Benaderde entropie, inligtings-entropie, korrelasie-dimensie en fraktale-dimensie (blok-tel-metode). Die invariant waarskynikheids-verspreiding van die attraktor is bepaal deur nie-liniêrevoorspelling. Identifisering van 'n onderliggende dinamiese proses is gedoen volgens die metode van surrogaat-data.

Daar is aan al die vereistes van statistiese betekenis voldoen ($p<0.05$) en aanvaarbare statistiese krag (>0.8). Met analise van beskikbare data is die

gevolgtrekking dat die opname van narkose-dampe nie-liniêr geskied. Die implikasies en toepaslikheid in narkose praktykvoering word bespreek.

Declaration

I, Johan Daniel Steyn do hereby solemnly declare that this is my own original work, and that it has not been submitted to any other university for degree purposes.

Signed: Johan Steyn

Date: 21/02/2003

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1 Introduction

Knowledge of the absorption of inhalation anaesthetic agents is essential if one is to safely administer them. Severinghaus was the first to systematically study inhalation agent absorption, and his investigations resulted in the "square root of time model"[1, 2] . As the possibility of computer-assisted anaesthesia administration becomes a reality, interest in this fundamental aspect of anaesthesia has continued to remain intense. Despite many years of research in linear science, no model has been described that can reliably predict inhalation agent uptake.

In a recent essay in The Lancet, Ary L Goldberger[3] states that, "Clinicians are increasingly aware of the remarkable upsurge of interest in non-linear dynamics, the branch of sciences widely referred to as chaos theory. The extent to which chaos relates to physiological dynamics is being investigated and is controversial. Chaos theory also holds promise for the elucidation of major problems in contemporary physiology and molecular biology."

A literature study was conducted to see if the possibility that the absorption of inhalation agents was a non-linear process had been investigated. Not a single reference could be found.

The aim if this research project is to determine if the absorption of anaesthetic agents is non-linear, using isoflurane and enflurane as examples.

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[1] Severinghaus J.W. The Rate Of Uptake Of Nitrous Oxide In Man. Journal Of Clinical Investigation 1954:33;1183-1189.

[2] Lowe H.J.,Ernst E.A. The Quantitative Practice Of Anaesthesia - Use Of The Closed Circuit. Baltimore: Williams And Wilkins, 1981.

[3] Goldberger A.L. Non-Linear Dynamics For Clinicians: Chaos Theory, Fractals And Complexity At The Bedside. The Lancet 1996:347;1312-1314.

2 Literature Study

2.1 Linear Models Described in the Literature

2.1.1 The square root of time model

This model was described by Severinghaus and refined by Lowe[1, 2]. The uptake of a potent inhaled anaesthetic is said to be predicted by the square root of time. This concept has been widely accepted during the past forty years, despite its shortcomings.

A "unit dose" is taken up by the body during the first minute and during each subsequent time interval (3 min, 5 min, 7 min, 9 min, 11 min, etc). In addition, a prime dose is required to saturate the circuit, the functional residual capacity, and the arterial delivery system. The addition of the prime and unit doses yields the cumulative dose. The doses are calculated using equations incorporating the patient's estimated cardiac output, anaesthetic agent minimum alveolar concentration (MAC), molecular weight, and blood/gas partition coefficient of the inhalation agent in use.

Unit dose (Liters of vapor) = 2 x fraction of minimum alveolar concentration being delivered x minimum alveolar concentration x blood gas partition coefficient x cardiac output.

Prime dose (Liters of vapor)= Unit dose (liters of vapor) = 2 x fraction of minimum alveolar concentration being delivered x minimum alveolar concentration x blood gas partition coefficient x cardiac output + circuit and functional residual capacity volume x fraction of minimum alveolar concentration x minimum alveolar concentration.

Cumulative dose (Liters of vapor)=prime dose + unit dosex $\sqrt{}$time in minutes.

The cardiac output is estimated using the formula of DeBrodie:

Cardiac output = 0.2 x mass$^{3/4}$ (liters per minute)^{2}.

This model was derived with data obtained form five (5) patients, using a narcotest gas analyzer. This type of apparatus calculates the concentration of inhalation agent based on its absorbtion by silicone. It was popular in the 1950's.[5]

2.1.2 The relationship between anaesthetic uptake and cardiac output

Watt et al.[3] investigated the relationship between cardiac output and anaesthetic uptake. They predicted that the continuous measurement of uptake of a volatile anaesthetic agent during inhalation anesthesia would prove to be a sensitive guide to trends in cardiac output. This hypothesis was tested by comparing the rate of uptake of enflurane at a constant end expired concentration of 1% (in reality the uptake was not measured, only the anaesthetic agent requirement to maintain a 1% end tidal concentration), with repeated thermodilution cardiac output measurements in patients undergoing cardiac surgery. A closed breathing system using a computer controlled liquid enflurane injection system was used to maintain the constant end tidal concentrations. In all 266 cardiac output measurements were made before cardiopulmonary bypass. No combined statistics are presented, but coefficients of determination (r^2) ranging from 0.16 to 0.42 were reported. The conclusion reached by the authors was that a qualitative but not quantitative relationship was demonstrated, and that they were unable to derive a clinically useful quantitative measure of cardiac output from the rate of the enflurane uptake using a computer controlled system[3].

These findings refute the square root of time model, where the only patient dependent variable is an estimation of the cardiac output.

2.1.3 Re-evaluations of the Square Root Of Time Model

Recently, the square root of time model has been subject to numerous re-evaluations[4,5,6,7,8]. None of these investigators were able to validate the model.

2.1.3.1 Couto Da Silva et al

These authors[8] studied the square root of time model in a quantitative way to test its clinical use, particularly for developing countries. The technique of intermittent injection into a closed circuit was used. The concentrations of inhalation agent were measured, but blinded from the investigator, and the systolic blood pressure was used as an end point. The objective was to maintain a value within 20% of pre-induction values. The prescribed doses were adhered to, but after the first two, they were adjusted according to the systolic blood pressures. The mean doses found necessary for each anaesthetic were within 33% of those calculated to produce 1.3 minimum alveolar concentration, however, the end-tidal concentrations stabilized at levels of 0.97 minimum alveolar concentration for halothane, 0.43 minimum alveolar concentration for enflurane and 0.77 minimum alveolar concentration for isoflurane. This represents a range of 33% to 74% of predicted values. They concluded that the Lowe intermittent-injection square root of time method of closed circuit anaesthesia provides a basis for simple, economic anaesthesia, but that the uptake of anaesthetic agents declined more slowly than predicted.

2.1.3.2 Hendrickx et al

Hendrickx et al[5]investigated the uptake of desflurane and isoflurane during closed-circuit anaesthesia using liquid injection techniques, to see if patient characteristics predict desflurane and isoflurane uptake, and, if the mode of ventilation had any effect on uptake. The investigation was initiated by the recent clinical observations on the uptake of inhaled anesthetics which conflict the square root of time model[9,10,7,6,11], where some authors have suggested that the uptake of anaesthetic gases is fairly constant during the first 60 to 100 minutes[11] and the inability to correlate isoflurane and enflurane uptake with patient characteristics[7,6].

For this study the cumulative dose and end expired concentrations of anaesthetic gases were recorded over time at one minute intervals. Individual uptake curves were fitted when a 1.3 * minimum alveolar

concentration values were obtained. The cumulative doses after 4, 15, 30, 45 and 60 minutes as well as the variables of the fitted curves of each individual were correlated with patient characteristics. The desflurane and isoflurane uptake was compared with the square root of time model. The uptake during controlled and spontaneous ventilation were compared to determine the effects of the mode of ventilation of the uptake of anaesthetic agents.

Within each group, there was interindividual variability in the uptake at all times, with a coefficient of variation of 8% to 20%. The cumulative dose versus time data, did not correlate with any of the patient characteristics, neither did the cumulative doses as 4, 15, 30, 45 and 60 minutes. No significant difference was found between spontaneous and controlled ventilation. The square root of time model was found to overestimate the uptake, especially during the first part of the procedure.

			R^2 BETWEEN SLOPE AND PATIENT CHARACTERISTICS				
Agent	Slope of linearly fittted curve	Range of slope	Age	Height	Weight	$Weight^{3/4}$	Body surface area
Desflurane (Spontaneous)	0.22	0.174-0.313	0.281	0.306	0.689	0.674	0.635
Desflurane (Controlled)	0.22	0.191-0.246	0.145	0.122	0.212	0.206	0.126
Isoflurane (Spontaneous)	0.1	0.077-0.125	0.166	0.470	0.274	0.273	0.453
Isoflurane (Controlled)	0.11	0.088-0.131	0.004	0.027	0.002	0.002	0.006

Table 2-1 Anaesthetic Uptake As Represented By The Slope Of The Linearly Fitted Curve And Coefficient Of Determination (R^2) Between The Slope And Patient Characteristics. (After Hendrickx Et Al[5])

Inter-individual variation in uptake in this study was observed, with poor correlation between uptake and patient characteristics. These results are similar to others recently published[9,7,12].

2.1.3.3 Bengston et al

Bengston et al[4] undertook a study to investigate uptake rates of enflurane and isoflurane during spontaneous and controlled ventilation. No significant difference in uptake was found between spontaneous and controlled ventilation, regardless of the agent used. They conclude, "In the present study, the anaesthetic uptake rates of the square root of time concept

could not be confirmed." If unit doses according to Lowe's formula were to be injected in a closed circuit system, the amount of liquid anaesthetic would not correspond to the patient's uptake rate.

2.1.4 The System model for closed circuit inhalation anaesthesia

The System model for closed circuit inhalation anaesthesia[13] and other models have recently been described [6,7,13], but only the Systematic Model has been subject to systematic performance evaluation. The purposes of constructing this model were to construct a model that simulates the uptake and distribution of a single inhaled anaesthetic agent during closed circuit anaesthesia and to extend the basic model to more elaborate models with additional features. The model does not assume a constant alveolar concentration, and therefore lends itself for validation by non-invasive measuring techniques such as respiratory mass spectometry[13].

The basic model for the uptake and distribution of a single inhaled anaesthetic agent depicts the body and the closed circuit as a system of 14 compartments. The anaesthetic is taken up from the lung-close circuit compartment and is then distributed to other tissue compartments: kidney, brain, heart, liver, muscle, connective tissue, and adipose tissue. The model derives from the subject's age, weight, height and gender the other physiologic variables including tissue volumes, blood volume, cardiac output, dead space, alveolar space and tidal volume. The data for the total blood volume, cardiac output, tissue volumes, tissue blood flow and partitian coefficients are derived from Lowe's data. The volume into which the anaesthetic agent is distributed in the lung not only includes the mid-inspiratory alveolar gas volume, i.e. the mid-inspiratory alveolar gas volume plus half the tidal volume, but also the lung tissue volume multiplied by its tissue-gas partitian coefficient. The functional residual capacity is calculated as a function of height, age, and gender with the aid of a regression equation for un-anaesthetized subjects in the sitting position. It was subsequently adapted for a supine, anaesthetized subject by a correction factor of 0.65.[13]

All blood is stored in pools, thus simulating the differences in circulation times that exist in the body. One fifth of the total blood volume is at arterial tension and is stored in the arterial pool. The rest of the blood is shared among the central venous pool and three venous pools associated with tissues and organs grouped into compartments, mainly based on perfusion.[13]

The basic model is intended to operate with controlled ventilation and does not take into account the concentration and second gas effects. Alveolar ventilation is the difference between total ventilation and dead space ventilation. The basic model has two versions: these differ in the size of their peripheral shunt: the shunt is 0 and 16% of the cardiac output for Version A and B respectively[13].

A liquid anaesthetic agent injected directly into the closed system is assumed to mix uniformly after vaporization with the contents of the anaesthetic system as to behave as an ideal gas. A bolus injection of liquid anaesthetic was simulated by adding anaesthetic vapor to the closed system over a period of 60 seconds[13].

The model has some important unique features: it includes the breathing system and does not avoid the complexity of the closed system[13]. One must note that it does not consider the alveolar membrane as a barrier[11] as the lung tissue volume is included in the lung compartment volume[13]. Unlike earlier closed circuit anaesthesia models it does not assume constant arterial concentration or zero calculation time. It is written with the aid of a special purpose simulation language developed at the University of Technology (The Netherlands)[13].

Different versions of the model were subject to quantified predictive performance evaluations by comparison of the predicted and measured alveolar concentrations profiles in 53 patients. Each concentration was measured by mass spectrometry and was compared to four predicted concentrations calculated by the four computer simulations (one per version of the model). For each patient, the authors calculated the root mean

squared error, bias, and the scatter of the prediction errors. Liquid halothane[14] was used in this performance evaluation. The version showing the best overall performance showed a root mean square error of 19.6±7.2% (mean±standard deviation), a bias of 0.5±15.9% and a scatter of 13.2±3.5%. The range of the results for all the models was: root mean square error 19.6 to 25.3%, the bias .48 to 13.57% and the scatter 13.18 to 15.92%[14].

The model incorporating non-pulmonary elimination and age adjusted partitian coefficients proved to be the most accurate and was said to be sufficiently reliable and accurate to represent halothane closed circuit anaesthesia[14].

The same model was evaluated in a performance evaluation quantifying the total variability and within patient variability, but between repeat anaesthetics variability[15]. Fourteen patients were studied who received closed circuit enflurane anaesthesia on two occasions. The end tidal concentrations measured and those predicted served to calculate the predictive performance measures of the model. The overall results were: the root mean squared error 15±7%, bias 0±14% and scatter 9±3%. The within the patient standard deviations were smaller for the root mean squared error (4%) and bias (10%), but not for scatter (3%)[15].

The estimated variance resulting from within patient variance was 90%. The authors conclude that the performance measures were partly dependent on the patient. There was no association between the personal performance measures and age, sex, body weight, body surface area or body mass index. These findings lead the authors to conclude, "Additional, yet unknown factors may contribute in a significant extend to an individuals pharmacokinetic response"[15].

2.1.5 Simple linear regression models

2.1.5.1 Lockwood et al

Two almost identical studies[6,7] investigating the uptake of desflurane and isoflurane respectively were published by these authors. Both studies

report linear regression fit equations using the best least squares fit method. A bi-exponential equation was reported for isoflurane and a tri-exponential one for desflurane. However, no coefficient of determination is reported for either equation, and only one study[7] reported a cumulative mean and standard deviation for the dose of isoflurane given. Perturbations from the equation were assumed to reflect changes in cardiac output. Due to lack of vital information, these results must be interpreted with caution.

2.2 Non linear dynamics and medicine

2.2.1 Non linear dynamics in general

The entire section 2.2.1 is taken from an article by JD Meiss of Boulder, Colorado[16].

2.2.1.1 What is non-linear?

In geometry, linearity refers to Euclidean objects: lines, planes, three dimensional space etc. these objects appear the same no matter how they are examined. A non-linear object, a sphere for example, looks different on different scales, when looked at closely enough it looks like a plane, and from far enough distance it looks like a point.

In algebra linearity is defined in terms of functions that have the property $f(x+y)=f(x)+f(y)$ and $f(ax)=af(x)$. Non-linear is defined as the negation of linear. This means that the result f may be out of proportion to the input x or y. The result may be more than linear or less than linear.

2.2.1.2 What is non-linear science?

Linearity is rather special and no model of a real system is truly linear. Some things are profitably studied as linear approximations to the real model.

Nonlinear systems have been shown to exhibit surprising and complex effects that would never be anticipated by a scientist trained only in linear techniques. While linear objects can be enumerated, nonlinear ones

are nonenumerable, and as of yet mostly unclassified. There is currently no general technique for telling whether a particular nonlinear system will exibit the complexity of chaos, or the simplicity of order. Thus as nonlinear science cannot be subdivided into proper subfields, it exists as a whole. Nonlinear science has applications to a variety of fields from mathematics, physics, biology and chemistry, engineering, economics and medicine. One of its most exciting aspects, is that it brings researchers from many disciplines together with a common language.

2.2.1.3 What is a dynamical system?

A dynamical system consists of an abstract phase space or state pace, whose coordinates describe the dynamical state at any instant, and a dynamical rule which specified the immediate future trend of all state variables, given only the present values of those same state variables. Mathematically, a dynamical system is described by an initial value problem.

Dynamical systems are determinestic if there is a unique consequent to every state, and stochastic or random if there is more than one consequent chosen from some probability distribution e.g. tossing a coin has two consequents with equal probability for each initial state.

2.2.1.4 What is phase space?

Phase space is the collection of possible states of a dynamical system. A phase space can be finite (limited number of states), countably finite (integer) or uncountalbly infinite (state variables are real numbers). Implicit in the notion is that a particular state in phase space specifies the system completely, all that we need to know about a system to have complete knowledge of its immediate future.

The path in phase space traced out by a solution of an initial value problem is called an orbit or trajectory of the dynamical system. If the state variables take real values in a continuum, the orbits or continuous time

system is a curve, while the orbit of a discrete system is a sequence of points.

2.2.1.5 What is chaos?

In mathematical terms, chaos is effectively unpredictable long time behavior arising in a deterministic dynamical system because of sensitivity to initial conditions. A deterministic dynamical system is perfectly predictable given perfect knowledge of the initial conditions.

For a dynamical system to be chaotic, it must have a large set of initial conditions, which are highly unstable. No matter how precisely you measure the initial conditions in these systems, your prediction of its subsequent motion goes radically wrong after a time. The key to long term unpredictability is a property known as sensitivity to (or sensitive dependence on) initial conditions. Typically, the predictability horizon grows only logarithmically with the precision of measurements. A chaotic system can be represented in phase space.

2.2.1.6 What are fractals?

A fractal as defined by Mandelbrot is a set with a fractional (non integer) dimension, and a self similar structure. The dimensions of properties measured are dependent on the scale of measurement. Self-similarity implies that measurement at a smaller scale will yield similar characteristics to those at a larger scale.

2.2.2 Non-linear Dynamics and Medicine

Clinicians are increasingly aware of the remarkable upsurge of interest in non-linear dynamics; the branch of science widely referred to as chaos theory[17]. Linear systems are well behaved. The magnitude of their responses is proportionate to the strength of the stimuli. These systems can be fully understood and predicted by dissecting out their components, and these subunits add up without surprises or anomalous behaviors. By contrast for non-linearity proportionality does not hold, neither can the

system be understood by analyzing their components individually. The reductionism strategy fails because the components of the non-linear system are coupled. Their non-linear coupling generates behaviors that defy explanation by traditional (linear) models such as self-sustained, periodic waves (e.g. ventricular tachycardia), abrupt changes (e.g. sudden onset of a seizure) and, possibly chaos[17].

One important class of abrupt, non-linear transition is called a bifurcation, which describes situations in which a very small increase or decrease in the value of some factor controlling the system causes it to change abruptly from one type of behavior to another. A common type of bifurcation is the sudden appearance of regular oscillations that alternate between two values. This dynamic may underlie various alternans patterns in cardiovascular dysfunction. A familiar example is the beat to beat alternation in QRS axis and amplitude seen in some cases of cardiac tamponade[18]. Many other examples of alternans in pertubated cardiac physiology have been described such as ST-T alternans preceding ventricular fibrillation, and pulsus alternans during heart failure[19].

The extent to which chaos relates to physiological dynamics is being investigated and is controversial[17]. At first, it was widely assumed that chaotic fluctuations were produced by pathological systems such as cardiac electrical activity during atrial or ventricular fibrillation. However, the current weight of evidence does not support the view that the irregular ventricular response in fibrillation itself represents deterministic cardiac chaos. An alternative hypothesis is that the subtle but complex heart rate fluctuations seen during normal sinus rhythm in individuals are attributable in part to deterministic chaos, and that various diseases may involve a paradoxical decrease in this type of non-linear variability[20]. The intriguing question of the role, if any, of chaos in physiology or pathology remains unresolved.

Examples of fractal like anatomies include the arterial and venous trees, the branching of certain cardiac muscle bundles, the tracheobronchial tree and His-Purkinje network. Mechanistically these self-similar structures

all serve a common physiological function: rapid and efficient transport over a complex spatially distributed system. Various other organ systems contain fractal structures that serve functions related to information distribution (the nervous system), nutrient absorption (bowel), and collection and transport (biliary duct system, renal calyces)[17].

Complex structures with the statistical properties of fractals have been described for heart rate variability, fluctuations in respiration[21], systemic blood pressure[22], human gait[23], white blood cell counts, and certain ion-channel kinetics[17].

If scale variance is a central organizing principle of physiological structure and function, we can make a general, but potentially useful prediction about what might happen when these systems are severely perturbed. If a functional system is self-organised in such a way that it does not have a characteristic scale of length or time, a reasonable anticipation would be a breakdown of scale free structure or dynamics with disease. The antithesis of a scale free system, i.e. one with many scales, is one that is dominated by one frequency or scale. A system that has only one dominant scale becomes easily to recognize and characterize, because such a system is by definition periodic, i.e. it repeats behavior in a highly predictable pattern[17].

The paradoxical appearance of periodic dynamics in many disease states in one of the most compelling examples of complexity loss in disease. Complexity refers specifically to multi-scale, fractal type of variability in structure of function. Many of the disease states are marked by less complex dynamics than those seen under healthy conditions[17]. This decomplexification of systems with disease seem a common feature of many diseases as well as aging[24]. Remarkably, the output of many severely pathological systems is nearly sinusoidal in appearance. For example, severe congestive heart failure and fetal distress syndrome[17].

Generally, the practice of bedside diagnosis would be impossible without the loss of complexity and the emergence of such pathological

periodicities[20]. It is these periodicities and highly structured patterns that allow clinicians to identify and classify many pathological features of their patients. Familiar examples include periodic tremors in neurological disease, AV Wenckebach patterns, the sine wave electrocardiogram pattern in hyperkalemia, manic depressive alternations and Cheyne-Stokes breathing patterns in heart failure[17].

Although fractals are irregular, not all irregular structures or erratic time series are fractal. An essential feature of the class of fractals seen in biology is a distinctive type of long range order[17] This property generates correlations that extend over many scales of space or time. Certain diseases are marked by a breakdown of this long-range organization property producing an uncorrelated randomness similar to white noise. An example is the erratic ventricular response in atrial fibrillation[17]

Practical applications of non-linear dynamics are likely to arise within the next few years. Probably the first bedside implementations will be in physiological monitoring[17] Several indices derived from chaos theory have shown promise in forecasting those at high risk of electrophysiological or hemodynamic instability, including heart rate alternans, ST-T alternans, breakdown in fractal scaling, differences or changes in the non-linear dimension or complexity of a time series[17]

Findings of non-linear dynamics have also challenged conventional mechanisms of physiological control based on classic homeostasis, which indicates that healthy systems seek to attain a constant steady state. By contrast non-linear systems with fractal dynamics behave as if they are driven far from equilibrium under bases conditions. This kind of complex variability, rather than a single homeostatic steady state, seems to define the free running function of many biological systems[17,20].

2.2.3 Recent advances in pharmacokinetics

Fractal washout curves for ^{15}O-labeled water in isolated, perfused rabbit hearts have recently been described[25]. These concepts are being incorporated into noncompartmental pharmacokinetic models, although the

question arises as to whether one can ascribe physical or physiological significance to time as a fractal, and whether the fractal so used can cast some light on the enigma of the power function[26].

2.2.4 Anaesthesiology

In 1990 Goodman[27] predicted that many anaesthesia applications would be forthcoming from the emerging science of non-linear dynamics. However, to date the literature does not bear this prediction out. The only publications to date have concerned heart rate variability[28].

2.3 Non linear models

A literature study was conducted to see if anyone had investigated the possibility that the absorption of inhalation agents was a non-linear process. Not a single reference could be found.

One article[29] investigating the uptake of oxygen during exercise identified a non-linear component above that which was expected for extrapolation of the linear relationship which lead the authors to conclude, " suggests that it [oxygen uptake] is not related to the pattern of motor unit recruitment in any simple way". However, this non-linear component was not further quantified.

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3 Research Method

3.1 Aim

To investigate if the absorption of anaesthetic gases, using isoflurane and enflurane as examples, is a non-linear process.

3.2 Data required

A time series of gas absorption was used, consisting of the amount of gas absorbed and the time at which this took place.

This was not a comparative study but an experimental study to statistically prove that the absorption of isoflurane and enflurane is non-linear. With this deterministic analysis any individual's data can be decisively predictive. NB This is not possible with stochastic measurements.

3.3 Patient selection and anaesthetic technique

Patient data from twenty (20) patients undergoing general anaesthesia with controlled ventilation at the Pretoria Academic Hospital were used. Informed consent for the use of the data was obtained from the patients. (See attached consent form, Appendix A). The technique used was the decision of the anaesthesiologist administering anaesthesia, but only patients where the main anaesthetic used was isoflurane or enflurane were selected for the purposes of this study. Gas analysis data as displayed on the Datex monitor screen was recorded from 5 minutes after the induction of anaesthesia until about 50 minutes after the induction of anaesthesia. This yielded a time series with approximately 550 to 1000 readings per series. The number of points is sufficient for the analysis required[8].

3.4 Accuracy of Measurements

The anaesthetic agent concentration was measured by the Datex AS/3 or Datex Capnomac Ultima Anaesthesia monitors currently in use at the Pretoria Academic Hospital. Before each recording, the apparatus and recording device was calibrated. The accuracy of these measuring instruments is given by the manufacturer[1,2] as being accurate ≤ 0.2% for both the Datex AS/3 and the Datex Capnomac Ultima. This compares well to mass spectrometery which approaches accuracies of ≤ 0.01% if properly calibrated.[9]

3.5 Ethical considerations

No deviation from standard anaesthesia practice was required. No additional risk was incurred by the patient. Informed consent was required for the use of the patient data by the researcher. No personal information about the patient will be disclosed at any stage. The necessary approval of the Ethics Committee, Faculty of Medicine, University of Pretoria and Pretoria Academic Hospitals was obtained on 22/07/1998. An addendum to the original protocol was approved on 30/09/1998 allowing both enflurane and isoflurane to be used. The protocol was assigned protocol number 120/98.

3.6 Data processing

Data indicating gas absorption in a breath by breath fashion was recorded from the Datex monitors currently in use at the Pretoria Academic Hospital.

The inspiratory and expiratory isoflurane or enflurane concentrations was processed using Lin's[3] method to yield a time series of milliliters per breath of isoflurane or enflurane absorbed.

$$\text{Uptake of agent in ml} = CI\% \times \left[1 - \frac{Fa}{Fi}\right] \times \overset{*}{V}$$

CI: Inhalation agent concentration in inspired breath

i17299494
b16309595

$\dot{V}$: Tidal volume in milliliters

3.7 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect nonlinearity four conditions must be met[4,5,12]:

3.7.1 Sensitivity to initial conditions

3.7.2 Fractal Dimension of the attractor

3.7.3 Invariant probability distribution of the attractor

3.7.4 Detection of an underlying dynamical process

3.8 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables[12], i.e. the variability seen in the absorption is random[6] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

3.9 Data analysis

Numerous methods of analysis derived from classical signal processing or non-linear dynamics are available. No single measure is more appropriate than others for physiological research or clinical practice[7,8], on the contrary it is necessary to use a large panel of analysis techniques, rather than a single one, to investigate a time series[7]. This is in contrast with linear statistical practice where the greatest difficulty lies in selecting the appropriate test[9].

Therefore, a panel of tests recommended by Mansier et al[7] will be used in the analysis of the time series obtained. They are:

3.9.1 Time domain indexes

3.9.1.1 Mean

$$u = \frac{\sum Xi}{N}$$

u: Mean

Xi: Data points

N: Number of points in series

Reference [9]

3.9.1.2 Standard deviation

$$\sigma = \sqrt{\frac{\sum (Xi - u)^2}{N}}$$

σ: Standard deviation

u: Mean

Xi: Data points

N: Number of points in series

Reference [9]

3.9.2 Non-linear indexes

3.9.2.1 Sensitivity to initial conditions

Lyapunov exponents[7] allow the quantification of sensitive dependence on initial conditions. The first exponent λ_1, has to be positive for the system to be chaotic, but the following ones may be positive or negative. The sum $\Lambda=\lambda_1 + \lambda_2 + \ldots + \lambda_n$ gives the exponential rate Λ of the contraction (if positive) or expansion (if negative) of the system.

3.9.2.2 Fractal Dimension of the chaotic attractor

3.9.2.2.1 Embedding dimension or reconstructing the attractor

Using a method of delays, the one dimensional time series will be constructed into an *m* dimensional attractor[7]. The *m* dimension of the space in which one embeds the trajectory is called the embedding dimension. If this is large enough then the geometrical properties of the trajectory and of the reconstructed attractor are conserved by this processing. Statistical and geometrical variants of the attractor such as fractal dimension, Lyapunov exponents, and entropy can then be computed[7].

3.9.2.2.2 Measuring the attractor

3.9.2.2.2.1 Fractal dimension

Chaotic systems are drawn together towards attractors that have in most cases a non-integer dimension: i.e. fractal dimension[8]. This can be obtained by the box counting method[7].

3.9.2.2.2.2 Correlation dimension

Also a measure of the non-integer dimension of the attractor, which is computationally more efficient than the box counting method[8]. This can be obtained by the Grassberger-Proacaccia algoritm[7].

3.9.2.2.2.3 Information entropy

This is a quantification of the information uniformity carried by the probability distribution. In the case of a strange attractor where the measure considered is the counting measure on the trajectory, the information entropy is lower than the sum of positive Lyapunov exponents[7].

3.9.2.2.2.4 Approximate entropy

A variant of Information entropy has been proposed by Pincus et al[10], as less sensitive to noise and more suitable for short stationary time series, in the range from 500 to 1000 numbers[10].

3.9.2.3 Invariant probability distribution of attractor or unpredictability

Non linear forecasting described by Sugihara and May[11] is a method whereby apparent noise associated with deterministic chaos can be distinguished from sampling error and other sources of induced environmental noise.

3.9.2.4 Detection of an underlying dynamical process[12]

Comparison with surrogate data is a means of identifying non-linearity in a time series. Surrogate data is generated by one of three methods, namely Unwindowed Fourier transform, Windowed Fourier transform or Amplitude adjusted Fourier transform[12]. The surrogate data generated is then compared to the original. This developed "check" has been described as significant development in chaos research[8].

3.10 Computation

The above-mentioned analyses will be done using Microsoft Excel 8® (in licensed possession of the researcher), Santis, and DSN. (Two non-linear analyses programs, in public domain). Should it become necessary other software may also be used.

3.11 Power Analysis

A power analysis[13] using expected results[14] revealed that considering a p value (using a Student's T-test) of < 0.05 as significant, ten measured signals and ten noise signals in each group would be sufficient for a power >0.8.

3.12 Testing of the null hypotheses

3.12.1 Description

Each individual condition will be subject to testing. The isoflurane and enflurane groups will be individually compared to noise control signals.

A p value < 0.05 will be considered significant in each case. A power analysis will be done on each set of results and only accepted if the power > 0.8. If all four conditions are met for a gas, then the variability in the absorption will be considered non-linear, and the null hypothesis that the variability is random will be rejected.

3.12.2 Symbolic representation

3.12.2.1 Nul hypothesis

H_0: $\delta_G = \delta_N$

δ_G : Test statistic for measured time series

δ_N : Test statistic for noise signals

3.12.2.2 Hypothesis

H_{1A}: $\mu_G \neq \mu_N$ (Lyapunov exponents, H_{0A} : $\mu_G = \mu_N$)

H_{1B}: $\mu_G \neq \mu_N$ (Dimension, H_{0B} : $\mu_G = \mu_N$)

H_{1C}: $\pi > 0.5$ (Non-linear forecasting, H_{1C}: $\pi = 0.5$)

H_{1D} : $\mu_G \neq \mu_N$ (Surrogate data),

$H_{1D(I)}$: $\mu_G \neq \mu_{SD}$, $H_{0D(I)}$: $\mu_G = \mu_{SD}$, (Lyapunov exponent)

$H_{1D(II)}$: $\mu_G \neq \mu_{SD}$, $H_{0D(II)}$: $\mu_G = \mu_{SD}$, (Correlation Dimension)

The null hypothesis will be rejected for a gas, if H_{1A}, H_{1B}, H_{1C}, and H_{1D} are all found to be true.

The null hypothesis were rejected for a gas, if H_{1A}, H_{1B}, H_{1C}, and H_{1D} were all found to be true.

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4 Measured Time Series

4.1 Method

After measuring instrument calibration, the anaesthesia gas analysis displayed on the Datex Monitor screen was captured in a spreadsheet format using a personal computer (Siemens Nixdorf PCND). The anaesthetic agent to be used was up to the discretion of the anaesthesiologist administering the anaesthetic.

4.2 Characteristics

4.2.1 Description

A total of twenty times series were measured, each on a different patient. For ten, isoflurane was used as an anaesthetic and for ten, enflurane was used as an anaesthetic. The mean age of the patients was 50±20 (mean ± standard deviation) , with a range of 21 to 82 years. The mean mass of the patients was 61±14, with a range of 41 to 89 kilograms. Six of the ten patients in the isoflurane group were male, in comparison with five of the ten patients in the enflurane group. The mean number of points in the time series is 599±244 with a range of 254 to 1259 points.

4.2.2 Tabular Summary

FILE NAME	AGE	MASS (KG)	SEX	NUMBER OF POINTS	MEAN	STANDARD DEVIATION	TIDAL VOLUME
Iso-01	63	63	M	495	133.37	118.54	600
Iso-02	65	61	F	254	99.47	66.56	650
Iso-03	56	89	M	912	236.28	76.24	700
Iso-04	77	67	M	1259	175.75	98.59	650
Iso-05	34	78	M	854	147.68	49.79	550
Iso-06	23	50	F	641	140.72	69.53	500
Iso-07	24	45	F	276	127.36	104.09	300
Iso-08	65	43	F	341	183.35	72.06	250
Iso-09	68	41	M	753	54.42	20.38	375
Iso-10	45	70	M	664	113.55`	58.11	450

Table 4-1 Tabular Summary Of The Measured Time Series For Isoflurane

FILE NAME	AGE	MASS (KG)	SEX	NUMBER OF POINTS	MEAN	STANDARD DEVIATION	TIDAL VOLUME
Enf-01	77	65	F	387	366.49	63.73	500
Enf-02	34	63	F	472	170.2	82.63	385
Enf-03	21	60	M	383	253.02	104.21	385
Enf-04	82	62	M	636	162.45	71.71	400
Enf-05	34	44	M	692	49.55	2.688	300
Enf-06	34	55	M	377	196.54	248.81	350
Enf-07	30	58	F	637	224.7	133.47	450
Enf-08	72	85	M	504	160.71	61.11	600
Enf-09	65	83	F	708	99.27	5.46	550
Enf-10	43	55	F	740	160.69	63.17	450

Table 4-2 Tabular Summary Of The Measured Time Series For Enflurane

A full listing of the measured time series is to be found in Appendix B.

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5 Dimension

5.1 Definition

The description "strange attractor" has been used to describe nonperiodic, randomlike time series, describing the unfamiliar geometric structure on which the series moves in phase space[1]. The quantitative measure of the "strangeness" of the attractor is described by its dimension[1], dimension being the first level of knowledge necessary to characterize its properties. Dimension may be thought of as giving the amount of information necessary to specify the position of a point on the attractor within a given accuracy[2].

5.2 Discussion

The revolution in nonlinear dynamics has been sparked by the introduction of new geometric, analytic, and topological ideas, which have given experimentalists and numerical analysts new tools to analyze dynamical processes. This in some ways parallels the earlier Newtonian revolution, which introduced the calculus into dynamics. Thus in some ways we are entering the second phase of the Newtonian revolution in dynamics[1].

5.2.1 Classical Fractals and Self-Similarity

Mandelbrot is often called the father of fractal geometry, although fractals and their description go back to classical mathematics and mathematicians of the past like Cantor (1872), Peano (1890), Hilbert (1891), von Kock (1904), Sierpinski (1916), Julia (1918) and Huasdorff (1919) to name a few examples[3]. The creations of these mathematicians played an essential role in Mandelbrot's concept of new geometry, although they did not think of their creations as conceptual steps towards a new perception or a new geometry of nature. On the contrary, their creations, for example the Cantor Set and the Koch curves, were regarded as exceptional objects, as counter examples, as "Mathematical Monsters"[3]. These were seen as

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shapes, intended to demonstrate the deviation from the familiar rather than typify the normal.

Mandelbrot was the first to demonstrate that these early mathematical fractals in fact had many features in common with shapes found in nature. He turned the manifested mathematical interpretation and value of these inventions upside down, and furthermore went on to develop a language into which these characters could be embedded. Noticing that the seemingly exceptional is more like the rule and then developing a systematic language with words, sentences, and grammar[3], Mandelbrot called this a summary of scientific experiments in mathematics, linguistics, economics, physics, medical sciences and communication networks to mention just a few areas in which he was involved[3].

5.2.2 Fractals and the problem of dimension

The original concepts of dimension originated in topology, a branch of mathematics that deals with form and shape from a qualitative point of view. Two of its basic notions are "dimension" and "homeomorphism." Straight lines can be bent into curves and circles can be pinched into triangles or pulled into squares, but not everything is topologically interchangeable[3]. The intersection of two lines, for example, remain an intersection, the number of holes in an object is also a topological invariant. The transformations, which are applied, are called homeomorphisms, and when applied they must not change the invariant properties of the objects[3]. Thus, a sphere and a cube are homeomorphic, but the sphere and a doughnut are not. In the development of topology, mathematicians looked for qualitative features, which would not change when the objects were transformed properly, technically by a homeomorphism, but preserving the dimension[3]. But it turned out there were severe difficulties in arriving at a proper and detailed notion of dimension that would behave in that way[3].

During this century, mathematicians came up with many different notions of dimension such as small inductive dimension, large inductive dimension, covering dimension, and homological dimension[4]. Some of

these are topological in nature; their value is always a number or zero for points and does not change for topologically equivalent objects[3].

In attempting to measure complex objects, the questions of length, area and volume can be ill posed. Curves, surfaces, and volumes can become so complex that these ordinary measurements become meaningless. However, it is possible to measure the degree of complexity by evaluating how fast length, or surface, or volume increases if one measures with respect to smaller and smaller scales. The fundamental idea is to assume the two qualities, length, or surface or volume on the one hand, and scale on the other hand are not arbitrarily but rather are related by a law[3]. This law will allow one to compute one quantity from the other. The law that seems to be relevant is the power law in the form of $y \propto x^d$.

The power law can be summarizes as follows:[3] if the x and y data of an experiment range over very large numerical scales, then it is possible that there is a power law which expresses y in terms of x, $y \alpha x^d$. To test the power law conjecture a plot of the data is made in a log/log plot. If then, the measurements fit a straight line, the exponent can be read off as the slope of the line.

Such a law turns out to be very useful for the discussion of dimension. The problem of dimension has not been made easier to understand with the description of at least ten different kinds of dimension since the turn of the century[3]. They are all related. Some of them make sense in certain situations, but not in others, sometimes they make sense and are the same, sometimes several make sense, but do not agree. The details can be confusing even to the research mathematician[3].

For the purposes of this thesis, dealing with a biological time series, the discussion of dimension will be limited to those dimensions, which have been found useful for analyzing biological time series. They are fractal dimension, information dimension and correlation dimension[5,6] .

The issue is further confused by the lack of uniformity of definitions. For example Farmer et al[2] consider the capacity and the Hausdorff

dimensions as metric dimensions and groups them under the heading "Fractal Dimension", and information dimension and pointwise dimension as dimensions of the "Natural Measure". This is in contrast with Moon[1], who classifies the pointwise dimension and the information dimension as measures of the fractal dimension! For the purpose of this thesis, the definitions used will be taken from Mansier et al[5], being the most recent reference to discuss all three dimensions that are to be calculated.

5.2.3 Fractal dimension

This dimension is calculated using the box counting method[5] and is sometimes called the "Box Counting Dimension"[3]. The box counting method proposes a systematic measurement of any structure in the plane under consideration and can be readily adapted for structures in space.

The structure under consideration is placed on a regular mesh with mesh size s, and the number of grid boxes which contain some of the structure are counted[3]. This gives a number, N; the value of which depends on the choice of s and so is denoted as $N(s)$. S is changed to progressively smaller sizes and the corresponding number $N(s)$ is counted. A log/log diagram is then plotted of $\log(N(s)) / \log(1/s)$. A straight line is then plotted to the points of the diagram and its slope D_b is measured. This number is the fractal dimension[3].

This dimension is one of the most commonly used dimensions. The reason for its dominance lies in easy and automatic calculation by computer. It is straight forward to count boxes and to maintain statistics allowing dimension counting. The program can be used for shapes with and without self-similarity. Moreover, the objects can be embedded in higher dimensional spaces[3].

A formal definition of the box counting dimension is given by Peitgen et al[3]:

The box counting dimension is D_B of any bounded subset A of R^n.

Let $N_\delta(A)$ be the smallest number of sets of diameter at most, δ which cover A. Then:

$$D_b(A) = \lim_{\delta \to 0} \frac{\log N_\delta(A)}{\log 1/\delta}$$

provided that the limit exists.

Roughly speaking the definition says that $N_\delta(A) \ \alpha \ \delta^s$ for small δ, where $s=D_{(b)}(A)$.

More precisely, it says that:

$$N_\delta(A)\delta^s \rightarrow \left\{ \begin{matrix} \infty \ for \ s < D_b(A) \\ 0 \ for \ s > D_b(A) \end{matrix} \right\}$$

5.2.4 Information dimension

The information dimension gives an idea of the natural measure of an attractor[2,3]. In computing the box counting dimension the cubes used in covering the attractor are equally important although the frequencies with which an orbit on the attractor visits these cubes may be very different. In order to take the frequency, with which each cube is visited into account, the relative frequency with which a typical orbit visits different regions of the attractor must also be taken into account[2]. The natural measure gives the relative probability of different regions of the attractor as obtained from the averages, and is therefore "natural" to consider[2].

The information dimension is a generalization of the capacity that takes into account the relative probability of the cubes used to cover the set. This dimension was originally introduced by Balatoni and Renyi[2].

The information dimension is given by

$$d_i = \lim_{\varepsilon \to 0} \frac{I(\varepsilon)}{\log(1/\varepsilon)}$$

Where

$$I(\varepsilon)=\sum_{i=1}^{N(\varepsilon)} P_i \log\frac{1}{p_i}$$

and P_I is the probability contained in the I^{th} cube. Letting the i^{th} cube of side ε be C_I, $P_I=\mu(C_I)$. Note that if all cubes have equal probability then $I_{(\varepsilon)}=logN_{(\varepsilon)}$, and hence $d_c=d_I$. However for unequal probabilities $I_{(\varepsilon)}<logN_{9\varepsilon)}$. Thus in general $d_c>d_I$, where d_c is the box counting dimension.

$I_{(\varepsilon)}$ is the amount of information necessary to specify the state of the system to within an accuracy of ε. The information dimension may therefore be viewed as telling how fast the information necessary to specify a point on the attractor increases as ε decreases[2]. Stated otherwise it may be viewed as a measure of the unpredictability in a system[1].

5.2.5 Correlation dimension

This dimension is the exponent of the power law dependence of the correlation integral as a measure of the strangeness of an attractor[7]. It has been successfully used by many experimentalists and is in some ways related to the pointwise dimension[1].

To calculate the correlation dimension the orbits of an attractor are discretized in phase space. One then calculates the distances between the pairs of points using either conventional Euclidean measure of distance (square root of the sum of the squares of the components) or some equivalent measure such as the sum of absolute values of vector components. A correlation function is then defined as[1]:

$$C(r)=\lim_{N\to\infty}\frac{1}{N^2}\left(\frac{number\ of\ pairs\ (i,j)}{with\ dist-ance\ s_{ij}<r}\right)$$

For many attractors this function has been found to exhibit a power law dependence on r as $r\to 0$; that is,

$$\lim_{r\to 0} C(r)=ar^d$$

So that one may define a correlation dimension using the slope of the ln C versus ln r curve:

$$d_G = \lim_{r \to 0} \frac{\log C(r)}{\log r}$$

It has been shown that $C(r)$ may be calculated more effectively by constructing a sphere or cube at each point x_i in phase space and counting the number of points in each sphere. That is:

$$C(r) = \lim_{r \to 0} \frac{1}{N^2} \sum_{i}^{N} \sum_{j}^{N} H(r - |x_i - x_j|)$$

Where $H(s)=1$ if $s>0$ and $H(s)=0$if $s<0$. This differs form the pointwise dimension in that the sum here is performed about every point[1].

5.3 Computational algorithms

The program SANTIS has the facility to calculate the Correlation Dimension using the Grassberger Procaccia algorithm[8]. Neither of the two programs used had the facility to calculate either the Fractal dimension or the Information dimension. A programmatic solution was developed using Microsoft Excel version 8® and Microsoft Visual Basic for Applications®.

The code for the programmatic solution for the fractal dimension can be found in Appendix F and the code for the programmatic solution for the information dimension can be found in Appendix G.

5.3.1 Computational description

The fractal dimension is calculated by putting the structure onto a regular mesh with a mesh size s and counting the number of grid boxes, which contain some of the structure. The mesh sizes are made progressively smaller and the process repeated. A log/log-diagram is then constructed and a straight line fitted to the plotted points of the diagram. The slope of this line is now measured and this is the fractal dimension[3]. For the information

dimension the number of grid boxes containing structure are weighted according to the number of orbits contained in a specific box, using the probability of finding a point in that cell[1].

5.3.2 Computational solution

The time series to be analyzed is put into an array structure, the maximum and minimum values are determined. The user is asked then to enter the maximum number of boxes required in the mesh structure. Box sizes are then calculated from 1 box to the maximum number specified, with the grid size being calculated from the values in the time series and the number of boxes required by the user. To calculate the information dimension, the number of points in a box are added up and weighted according to the formula in 5.2.4. to calculate the fractal dimension the number of boxes containing structure are summed.

These stored values are then entered into a log/log-plot, and the slope of the regression line is determined, which is the dimension that is desired, either fractal or infomation.

5.4 Programmatic solution

The program for both the fractal dimension and for the information dimension was developed using Microsoft Excel version 8®, using Visual Basic for Applications. The time series under consideration is pasted into a range and then a runtime resizable array. The time series maximum and minimum values are used to calculate the box sizes up to the maximum number of boxes specified. The counting procedure is done in a loop. The values calculated are stored in an array. These values are later pasted into a new range from which a graph is constructed. Microsoft graph® does not have the facility to construct log/log graphs. To overcome this problem, the required log conversions of the numbers are done first in the spreadsheet and then a graph is constructed from the converted values. Using linear regression, the slope of the graph is then calculated.

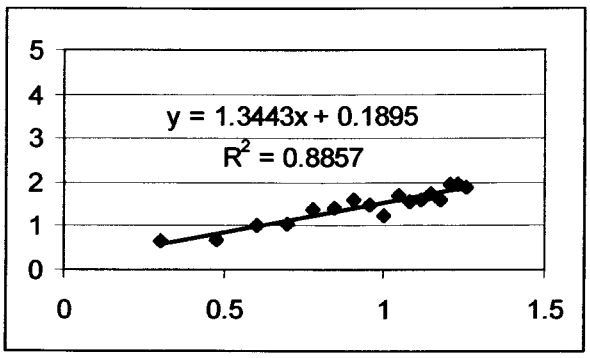

Figure 5-1 Example of log/log plot and regression line with slope created by the information dimension program.

5.4.1 Testing the programs

5.4.1.1 Method

The programs written and the SANTIS correlation dimension feature were tested, to see if they could measure the information, fractal, and correlation dimensions accurately. The null hypothesis is that they are unable to distinguish known chaos from noise. A Henon time series and Logistic map with a starting value 0.2 and a delta value of 3.8 were used as known chaotic series[1] (These two time series may be found in Appendix E). Four noise series generated by SANTIS were used as control series (These four time series may be found in Appendix D). A Student's T-test was used as the test statistic and a p value of <0.05 was considered significant, in order to reject the null hypothesis.

5.4.1.2 Results

	HENON	LOGISTIC MAP	NOISE1	NOISE2	NOISE3	NOISE4	P
Information Dimension	1.370	2.140	0.854	0.850	1.120	0.944	0.0164
Correlation Dimension	1.245	0.933	3.039	3.039	3.039	2.986	0.000038
Fractal Dimension	0.990	1.025	0.948	0.940	0.940	0.850	0.0366

Table 5-1 Calculated dimensions for known chaos and known noise signals

The p values calculated were 0.0164, 0.000038, and 0.0366 for the information dimension, correlation dimension, and the fractal dimension respectively. They are all less than 0.05 and therefore the null hypothesis is rejected and it is concluded that the programs are successfully able to differentiate known chaos from known noise.

5.5 The dimensions of the recorded times series

The dimensions were calculated in the same manner for the twenty measured time series. The time series are to be found in Appendix B.

FILE NAME	INFORMATION DIMENSION	CORRELATION DIMENSION	FRACTAL DIMENSION
Iso-01	1.504	0.785141	0.864
Iso-02	1.52	1.48417	1.068
Iso-03	1.41	0.952904	0.847
Iso-04	1.586	1.03614	1.13
Iso-05	1.64	1.50338	0.989
Iso-06	1.338	1.3673	1.17
Iso-07	0.917	1.04189	0.987
Iso-08	1.38	1.36093	1.15
Iso-09	0	1.52047	0
Iso-10	0	1.57578	0.8521
Enf-01	0.0634	1.88901	0.476
Enf-02	1.9	0.814319	0.9622
Enf-03	1.949	0.975127	1.04
Enf-04	1.84	1.81347	0.894
Enf-05	0	0.0982057	0
Enf-06	1.24	1.46198	0.94
Enf-07	1.47	1.46198	1.035
Enf-08	1.67	1.23643	0.862
Enf-09	0	0.101749	0
Enf-10	1.57	0.80455	0.672

Table 5-2 Dimensions of the measured time series

5.6 The dimensions of the control noise times series

NOISE SIGNAL	INFORMATION DIMENSION	CORRELATION DIMENSION	FRACTAL DIMENSION
1	1.352	2.98029	1
2	1.972	2.92491	0.965
3	1.9707	2.94902	1.018
4	2.0346	2.93406	0.984
5	1.6275	2.95673	0.910
6	1.9972	3.33461	1.0354
7	1.8233	2.9325	1.0554
8	1.884	3.12329	0.9182
9	1.8115	2.93593	1.0885
10	2.0456	2.80135	0.9991

Table 5-3 Dimensions of the control noise time series

5.7 Statistical Analysis

The hypothesis and null hypothesis were formulated and stated in chapter 3, and are repeated here for clarity sake.

5.7.1 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect nonlinearity four conditions must be met:

- Fractal Dimension of the attractor
- Sensitivity to initial conditions

- Invariant probability distribution of the attractor
- Detection of an underlying dynamical process

5.7.1.1 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables, i.e. the variability seen in the absorption is random[9] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

5.7.1.2 Fractal Dimension of the attractor

This part of the hypothesis is being tested by this chapter.

5.7.2 Statistical Methods and Tests

The information dimension, the fractal dimension and the correlation dimension for each of the measured time series was compared to the information dimension, fractal dimension and correlation dimensions of a control noise series. The isoflurane and enflurane measured time series were treated as separate groups and each was individually compared to the noise series control group.

A Student's T-test was used to compare the measured and the control groups, with, as stipulated in chapter 3 a p value of < 0.05 being considered significant.

5.7.3 Results

	INFORMATION DIMENSION	CORRELATION DIMENSION	FRACTAL DIMENSION
Isoflurane group	0.005435	<0.00000	0.2133
Enflurnane group.	0.028838	0.000003	0.038049

Table 5-4 Results of the Student's T-test comparisons for the two groups of measured time series

All the Student's T-test comparisons yield p values of <0.05 except for the fractal dimension of the isoflurane measured series and the noise group. These results strongly recommend the acceptance of the hypothesis stated above (5.7.1) and more specifically, that there is evidence for a fractal attractor underlying the measured time series for both isoflurane and enflurane.

5.7.3.1 Isoflurane Fractal Dimension

The fractal dimension or box counting dimension[3] as termed in some literature is the eldest of the measures of dimension, being based on work done by Hausdorff in 1919. As the number of computations are increased the log/log plot is no longer a straight line and therefore it becomes impossible to accurately measure the fractal dimension and the results reported often underestimate the dimension[3]. These shortcomings have lead investigators to sometimes give up using the fractal dimension or look for alternatives such as the information dimension[1] etc.

Bearing these facts in mind, it is concluded that not too much significance should be drawn from the fact that the t test was unable to distinguish the isoflurane measured time series from the noise series.

5.7.4 Power Analysis

To prevent a type II statistical error from being made, where the null hypothesis is accepted when the hypothesis is actually true, a power analysis[10] was performed. For the analysis, an alpha level of 2.35 was used which corresponds to a p value of <0.01 for the rejection of the null hypothesis. A power level of >0.8 was considered acceptable[10].

5.7.4.1 Power analysis for Isoflurane group

5.7.4.1.1 Information Dimension

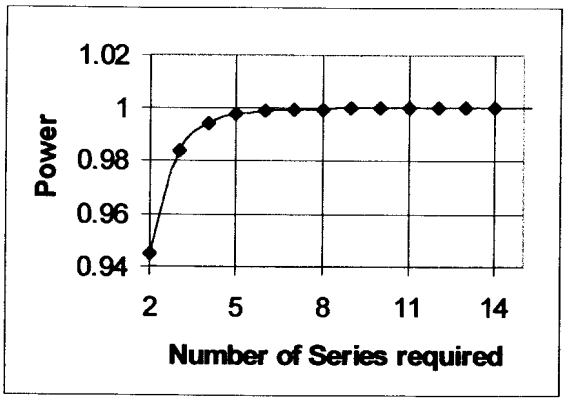

Figure 5-2 Power of the Student's T-test for the isoflurane measured time series

5.7.4.1.2 Fractal Dimension

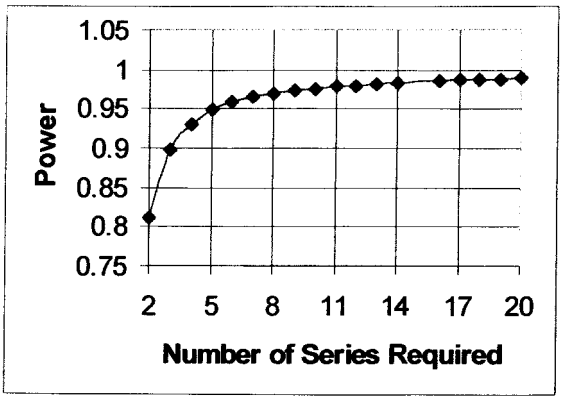

Figure 5-3 Power of Student's T-test for isoflurane measured time series

5.7.4.1.3 Correlation Dimension

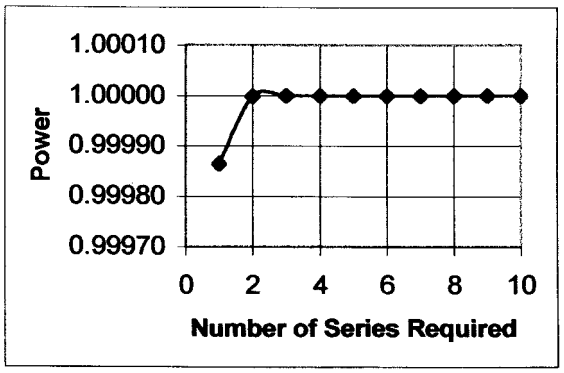

Figure 5-4 Power of Student's T-test for isoflurane measured time series

5.7.4.2 Power analysis for Enflurane group

5.7.4.2.1 Information Dimension

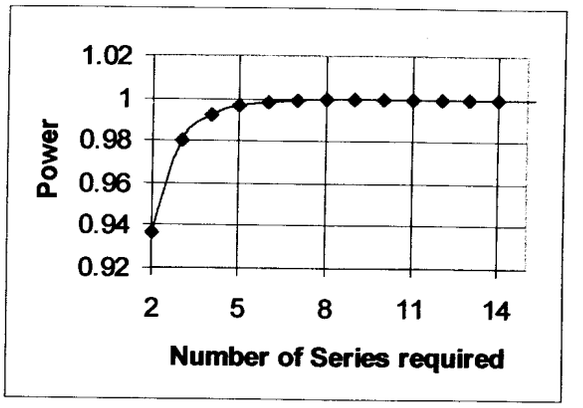

Figure 5-5 Power of Student's T-test for enflurane measured time series

5.7.4.2.2 Fractal Dimension

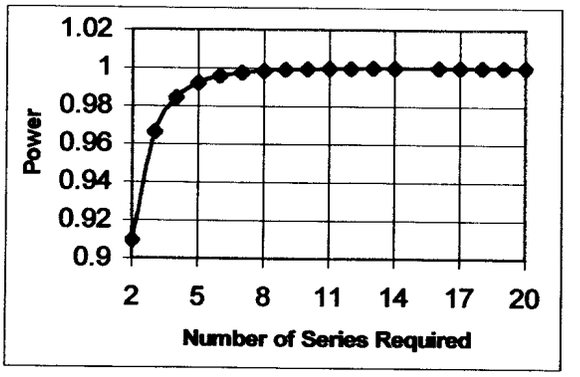

Figure 5-6 Power of the Student's T-test for the enflurane measured time series

5.7.4.2.3 Correlation Dimension

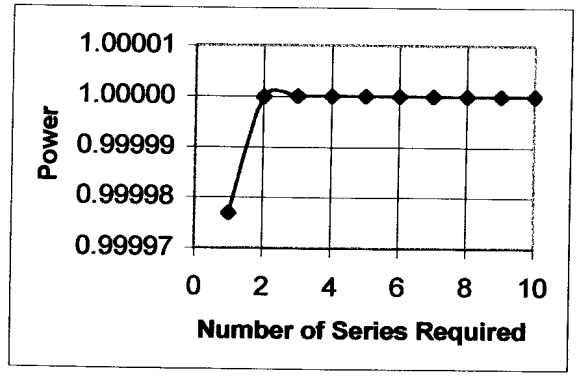

Figure 5-7 Power of Student's T-test for enflurane measured time series

5.7.4.3 Power Analysis Conclusion

Twenty series were used in each of the Student's T-test analyses. All the power analysis showed that this was more than adequate for a power of > 0.8 and a p value of < 0.01.

5.7.5 Conclusion

The results presented above show that there is evidence for a fractal attractor underlying the absorption of both isoflurane and enflurane. These results reach statistical significance ($p<0.05$) with acceptable statistical power (>0.8).

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6 Approximate Entropy

6.1 Definition

Approximate Entropy is the natural information theoretical parameter for an approximating Markov Chain to a process[1]. It is a recently developed statistic quantifying regulatory and complexity that appears to have potential application to a wide variety of physiological and clinical time-series data, including quantifying chaotic systems.

6.2 Discussion

In applications to a range of medical settings, findings have associated sickness and aging with significantly decreased Approximate Entropy values, consistent with the general hypothesis associating compromised physiology in many systems with more regular, patterned sinus rhythm heart rate tracings, and normative physiology in many systems with greater irregularity[1]. Findings implicitly associating greater regularity with compromised physiological status have been found elsewhere, including spectral analysis of heart rate in preterm babies[2], sudden infant death syndrome babies[3], in adult sudden death syndrome victims and in analysis of electrocardiographic waveforms during fatal ventricular tachyarrythmias[4]. These findings have produced qualitatively interesting results but lack a clear-cut statistic that summarizes the frequency spectra or underlying system structure[1].

In order to calculate Approximate Entropy two input parameters m and r must be fixed. M is the "length" of the compared runs and r is effectively a filter. Clinically, relatively low Approximate Entropy values (e.g., for heart rate) appear to correlate with pathology[1]. Greater non-linearity causes larger Approximate Entropy values. Greater stochastic influence produces larger Approximate Entropy values. Both greater ensemble non-linear and stochastic effects are manifested visually in greater randomness and complexity.

Approximate Entropy is a regularity parameter, and discerning changes in apparently random to very regular is the primary focus of this parameter[1].

The historical development of mathematics to quantify regularity has centered on various types of entropy measures. Entropy addresses system randomness and predictability. Greater entropy is associated with more randomness and less system order[1].

There are numerous entropy formulations and many entropy definitions, which often cannot relate to one another. K-S entropy, developed by Kolmogorov allows one to classify deterministic systems by rates of information generation[1]. This form of entropy can be estimated by algorithms such as the Grassberger and Procaccia[5] algorithm or the Eckmann and Ruelle[6] algorithm. There has been keen interest shown in these algorithms in the last 10 years[1], since entropy has been shown a parameter that characterizes chaotic behavior[7].

K-S entropy was not developed for statistical application. It is primarily applied by ergodic theorists to well defined theoretical transformations, with no noise, and an almost infinite amount of data[1]. It is compromised by steady, small amounts of noise, and generally requires a vast amount of input data to achieve a convergence[8], 10 000 points or more.

Approximate Entropy was constructed along thematically similar lines to K-S entropy, though with a different focus[1]. This was to promote a widely applicable statistically valid formula for the data analyst that will distinguish data sets by a measure of regularity. The intuition motivating Approximate Entropy is that, if joint probability measures for reconstructed dynamics that describe each of the two systems are different, then their marginal probability distributions on a fixed partition are probably different.

Orders of magnitude of fewer points are needed to accurately estimate these marginal probabilities than to accurately reconstruct the "attractor" measure defining the process[1].

Approximate Entropy has three technical advantages over K-S entropy. Approximate Entropy is nearly unaffected by noise of magnitude below r, the filter level. It is robust to occasional, very large or small artifacts, it gives meaningful information with a reasonable number of data points, and is finite for both stochastically and deterministic processes[1].

6.3 Computation Algorithms

6.3.1 Computational description

Two input parameters m and r are fixed. M is the "length" of compared runs, and r is effectively a filter. For a fixed m and r, the parameter Approximate Entropy (m,r) and the statistical estimate Approximate Entropy(N,m,r), given N data points $\mu(1)$, $\mu(2)$... $\mu(N)$ are defined.

Given N data points $\{\mu(i)\}$, form vector sequences $x(i)$ through $x(N-m+1)$, defined by $x(I)=[\ \mu(i),...\ \mu(N+m-1)]$. These vectors represent m consecutive μ values, commencing with the i^{th} point.

Define the distance $d[x(i),x(j)]$ between vectors, with $x(i)$ and $x(j)$ as the maximum difference in their respective scalar components. Use the sequence $x(1),x(2)....\ x(N-m+1)$ to construct for each $i \leq N-m+1$, $C_I^m(r)=$*(number of* $j \leq N+m-1$*)* such that $d[x(i),\ x(j)] \leq r\ /\ (N-m+1)$. The $C_I^m(r\ )$ values measure within a tolerance r the regularity or frequency of patterns similar to a given pattern of window length m. Define $\phi m(r) = (N-m+1)-1\ \sum N-1+mI=1\ ln(CIm(r))$, where ln is the natural logarithm, and then define the parameter Approximate Entropy$(m,r) = lim_{N\to\infty}[\phi m(r)-\phi m+1(r)]^1$.

Approximate Entropy is a measure of the logarithmic likelihood that runs of patterns that are close for m observations remain close on next incremental comparisons. The greater the likelihood of remaining close, produces smaller Approximate Entropy values and vice versa[1].

6.3.2 Computational solution

This is described as a number of steps[1]:

6.3.2.1 Step one

Focus on a specific length 2 vector, called for example *x(44)*. The conditional probabilities will be calculated for all length 2 vectors, then log averaged.

6.3.2.2 Step two

Identify all the length 2 vectors that are component wise close to vector *x(44)*, using the *r*-value to define "close."

6.3.2.3 Step three

Compute the conditional probability that the identified vectors are close to the original vector plus two, *x(46)*. The probability ratio A/B is calculated where A is the number of instances where the length 2 vector is close to *x(46)* and B the number of instances that the length 2 vector is close to *x(44)*.

6.3.2.4 Step four

Repeat steps one to three for each length 2-vector *x(i)*, calculating the conditional probability in each case. Calculate the average of the logarithm of these probabilities. The negative of this value is the Approximate Entropy. The negative of the log is used to ensure a positive result.

The opposing extremes are a perfectly regular sequence, e.g. sinusoidal behavior, which produces very low Approximate Entropy and independent sequential processes, e.g. random walk, which produces very large Approximate Entropy.

6.3.3 Implementation and interpretation

The value of N for Approximate Entropy is typically between 100 (one hundred) and 5000 (five thousand). Based on theoretical analysis and clinical application it has been concluded that for $m=2$ and $N=1000$, values of r from 0.1 to 0.25 of the standard deviation of the $\mu(i)$ data produce good statistical validity for Approximate Entropy(N,m,r) for many models[1].

Theoretical calculations indicate reasonable estimates of these probabilities are achieved with a N value of at least 10^m and preferably at least 30^m points[1], analogous to results for correlation dimension[8]. For r values smaller than 0.1 of the standard deviation one usually achieves poor conditional probability estimates as well, whereas r values larger than 0.25 the standard deviation, too much detailed system information is lost[1].

6.4 Programmatic solution

Neither of the two non-linear programs, SANTIS and DSN offered calculation facilities for Approximate Entropy. A programmatic solution was developed using Microsoft Excel version 8® and Microsoft Visual Basic for Applications®.

The code for the programmatic solution is found in Appendix H.

6.4.1 Programmatic considerations

The program was developed using the algorithm as described in section 6.3. A Macro was written for Microsoft Excel Version 8 using Microsoft Visual Basic for Applications. The user first places the time series to be analyzed in column A of Sheet 1 of the Approximate Entropy Workbook. The user is then asked to enter the number of points in the time series to be analyzed. The mean and standard deviation of the time series are then calculated. The user is then asked for the r (filter) value that is to be used. A value of 0.24 times the Standard deviation of the time series was used throughout the analyses for this thesis. This is within the recommendations made by Pincus et al [1]. An embedding dimension of is

then selected for the analysis. A value of two (2) was used throughout the analyses for this thesis, being appropriate for the size of the time series under consideration[1].

Using a series of nested loops[9] the time series is analyzed as described in section 1.3 for each two-length vector in the time series. For a time series consisting of one thousand points, this involves over one million runs through the loop, with 5 decisions and at least one calculation per loop! Each calculated probability is stored in a variable and the negative log of the average is then the approximate entropy of the time series.

6.4.2 Testing the Program

6.4.2.1 Method

The program written was tested to see if it could measure the approximate entropy accurately. The null hypothesis is that it is unable to distinguish known chaos from noise. A Henon time series and Logistic map with a starting value 0.2 and a delta value of 3.8 were used as known chaotic series[7] (These two time series may be found in Appendix E). Four noise series generated by SANTIS were used as control series (These four time series may be found in Appendix D). A Student's T-test was used as the test statistic and a p value of <0.05 was considered significant, in order to reject the null hypothesis.

6.4.2.2 Results

SIGNAL	HENON	LOGISTIC MAP	NOISE1	NOISE2	NOISE3	NOISE 4	P
Approximate Entropy	0.278	0.195	0.119	0.090	0.119	0.108	0.0096

Table 6-1 Calculated approximate entropy for known chaos And Known Noise

The calculated p value was 0.0096. This is less than 0.05 and therefore the null hypothesis is rejected and it is concluded that the program is successfully able to differentiate known chaos from known noise.

6.5 *Approximate Entropy of the measured time series*

The Approximate Entropy was calculated in the same manner for the twenty measured time series. The time series are to be found in Appendix B.

TIME SERIES	APPROXIMATE ENTROPY
Iso-01	0.066
Iso-02	0.113
Iso-03	0.144
Iso-04	0.095
Iso-05	0.121
Iso-06	0.133
Iso-07	0.062
Iso-08	0.03
Iso-09	0.243
Iso-10	0.127
Enf-01	0.204
Enf-02	0.132
Enf-03	0.087
Enf-04	0.183
Enf-05	0
Enf-06	0.056
Enf-07	0.143
Enf-08	0.125
Enf-09	0
Enf-10	0.13

Table 6-2 Approximate entropy values for the measured time series

6.6 Approximate Entropy of the control Noise time Series

NOISE SIGNAL	APPROXIMATE ENTROPY
1	0.01101
2	0.01105
3	0.00708
4	0.09901
5	0.0689
6	0.02084
7	0.013347
8	0.023086
9	0.000701
10	0.008503

Table 6-3 Approximate entropy of the control noise signals

6.7 Statistical Analysis

The hypothesis and null hypothesis were formulated and stated in chapter 3, and are repeated here for clarity sake.

6.7.1 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect nonlinearity four conditions must be met:

- Fractal Dimension of the attractor
- Sensitivity to initial conditions
- Invariant probability distribution of the attractor
- Detection of an underlying dynamical process

6.7.1.1 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables, i.e. the variability seen in the absorption is random[10] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

6.7.1.2 Fractal Dimension of the attractor

This chapter is testing this part of the hypothesis.

6.7.2 Statistical Methods and Tests

The approximate entropy for each of the measured time series was compared to the approximate entropy of a control noise signal. The isoflurane and enflurane measured time series were treated as separate groups, and each was individually compared to the noise signal control group.

A Student's T-test was used to compare the measured and the control groups, with, as stipulated in chapter 3, a p value of <0.05 being considered significant.

6.7.3 Results

	APPROXIMATE ENTROPY
T-test isoflurane group	0.000499
T-test enflurane group	0.003085

Table 6-4 Results of Student's T-test for the measured time series and the noise control signals

All the Student's T-test comparisons yielded p values of < 0.05. These results strongly recommend the acceptance of the null hypothesis stated above(6.7.1) and more specifically, add to the evidence presented in chapter 5 that there is a fractal attractor underlying the measured time series for both isoflurane and enflurane.

6.7.4 Power Analysis

To prevent a type II statistical error from being made, where the null hypothesis is accepted when the hypothesis is actually true, a power analysis[11] was performed. For the analysis, an alpha level of 2.35 was used which corresponds to a p value of <0.01 for the rejection of the null hypothesis. A power level of >0.8 was considered acceptable[11].

6.7.4.1 Power Analysis of the isoflurane group

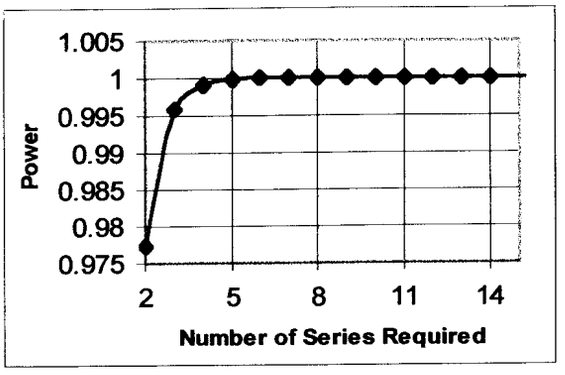

Figure 6-1 Power of the Student's T-test for the isoflurane measured time series

6.7.4.2 Power analysis of the enflurane group

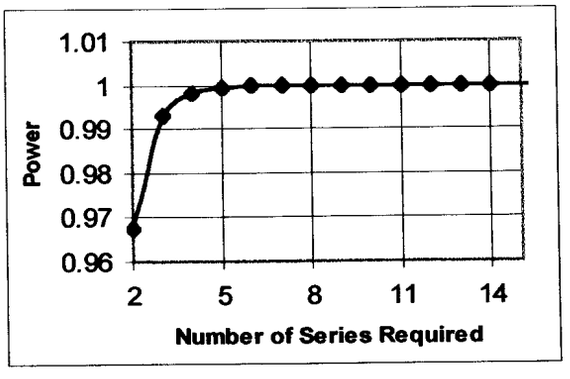

Figure 6-2 Power of the Student's T-test for the enflurane measured time series

6.7.4.3 Power Analysis conclusion

Twenty series were used in each of the Student's T-test analyses. All the power analysis showed that this was more than adequate for a power of > 0.8 and a p value of < 0.01.

6.8 Conclusion

The results presented above are further evidence for a fractal attractor underlying the absorption of both isoflurane and enflurane. These results reach statistical significance ($p<0.05$) with acceptable statistical power (>0.8).

6.9 References

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7 Lyapunov exponents

7.1 Definition

Lyapunov exponents are the average exponential rates of divergence or convergence of nearby orbits in phase space[1]. The calculation of Lyapunov exponents is a tool for determining whether or not a system is chaotic[2], and quantifying the sensitive dependence on initial conditions.

7.2 Discussion

7.2.1 General description

Since nearby orbits correspond to nearly identical states, exponential orbital divergence means that systems whose initial differences may not be resolvable, will soon behave differently, and predictability will soon be lost. Any system containing at least one positive Lyapunov exponent is defined to be chaotic[1,3]. The magnitude of the exponent reflects the time scale on which the dynamics of the system become unpredictable.

Assuming two trajectories $a_1(t)$ and $a_2(t)$ are starting with a small difference (i.e., a small distance in phase space), for the distance Δ the following relation holds[3]:

$$\Delta(t) = |a_2(t) - a_1(t)| = |a_2(0) - a_1(0)| \cdot \exp(\lambda t) = \varepsilon \cdot \exp(\lambda t)$$

The first exponent has to be positive for the system to be chaotic, but the following one may be positive or negative[4]. The sum of the Lyapunov exponents is the timer-averaged divergence of the phase space velocity, and is therefore a quantitative measure for chaotic behavoir[3]. A dissipative dynamical system will have at least one negative exponent[1]. A Lyapunov exponent of zero holds for a periodic system[3].

The magnitudes of the Lyapunov exponents quantify an attractor's dynamics in information theoretic terms. The exponents measure the rate at which the system process creates or destroys information[1]. Thus the

exponents are expressed in bits of information per second or bits per orbit for a continuous system and bits per iteration for a discrete system.

7.2.2 Implementation details

7.2.2.1 Selection of embedding dimension and delay time

In principle, when using delay coordinates to reconstruct an attractor, an embedding dimension, m, of the original attractor is obtained for a sufficiently large m and almost any choice of the time delay, τ. Accurate exponent estimation requires some care in choosing these two parametes[1,5]. An embedding is usually obtained if m is chosen to be greater than twice the dimension of the underlying attractor, although using smaller values of m may often yield reliable Lyapunov exponents[1]. When an attractor is reconstructed in phase space, whose dimension is too low, "catastrophes" or so called spurious exponents the interleave a distinct part of the attractor are likely to result[5]. If m is chosen too large, noise will tend to decrease the density of the points defining the attractor, making it hard to find replacement points. Increasing m past what is minimally required has the effect of unnecessarily increasing the level of contamination of the data[1].

7.2.2.2 Noise

Noise in an infinite dimension process that, unlike the deterministic component of the data, fills each available phase space dimension in reconstructing the attractor. Noise can originate either in measurement because of simple lack of resolution, or form fluctuations in the state of the system or its parameters, which enter into the dynamics. It is ironic that noise is not a problem unless large amounts of data are available to define the attractor. This is because noise is only detectable when the point density is high enough to provide replacements near the noise length scale[1].

Low pass filtering has been proposed as an approach for reducing the effects of noise[1]. As could be expected filtering can distort shapes in the attractor, but the divergent nature of the attractor is not usually lost.

Published figures estimate about 20 percent difference in Lyapunov exponent estimation for filtered and unfiltered experimental data[1].

7.3 Computation algorithms

The main idea in calculating the Lyapunov exponent is comparing an orbit belonging to some initial condition with an orbit for an initial condition, which carries and error E_0. Then it is possible to record how the error amplifies during the course of the iteration to $E_1, E_2, \ldots$. The error amplification factor $|E_n/E_0|$ is written as a "telescope product"[6].

$$\left|\frac{E_n}{E}\right| = \left|\frac{E_n}{E_{n-1}}\right|\left|\frac{E_{n-1}}{E_{n-2}}\right|\cdots\left|\frac{E_1}{E_0}\right|$$

The Lyapunov exponent characterizes the average logarithmic growth of the relative error per iteration. To arrive at a well-defined exponent, the size of the initial error must approach zero. In practice the size of the error in each iteration is renormalized to some convenient number $\in$[6].

$$\lambda = \lim_{n\to\infty}\lim_{E0\to 0}\frac{1}{n}\sum_{k=1}^{n}\log\left|\frac{E_k}{E_{k-1}}\right|$$

The choice of the size of the error $\in$ to which is renormalized after each iteration may effect the result. The amplification factor for infinitesimally small errors, is obtained when $\in\to 0$. Using a derivative transformation, it is possible to compute how much an infinitesimally small error in a point (x,y) of the attractor is transformed by one iteration[6].

$$DH(x,y) = \begin{pmatrix} -2ax & 1 \\ b & 0 \end{pmatrix}$$

If the error is in the direction of the given vector (dx,dy), then this vector can be multiplied by the derivative matrix[6].

$$\begin{pmatrix} -2ax & 1 \\ b & 0 \end{pmatrix}\begin{pmatrix} dx \\ dy \end{pmatrix} = \begin{pmatrix} -2ax\cdot dx + dy \\ b\cdot dx \end{pmatrix}$$

The amplification factor is determined by the quotient of the lengths of the two vectors (dx, dy) and $(-2ax \cdot dx + dy, b \cdot dx)$.

Using this approach the algorithm may be summarized as follows[6]:

7.3.1 Initialization

Iterate the initial point $(0,0)$ one hundred times to arrive at (x,y). initialize an accumulator to zero.

7.3.2 Initial error

For an arbitrary angle ϕ, consider $(\cos\phi, \sin\phi)$, the direction of the error.

7.3.3 Transformation

Compute the transformed error according to

$$\begin{pmatrix} -2ax & 1 \\ b & 0 \end{pmatrix} \begin{pmatrix} dx \\ dy \end{pmatrix} = \begin{pmatrix} -2ax \cdot dx + dy \\ b \cdot dx \end{pmatrix}$$

Then iterate (x,y), i.e. obtain the point $H(x,y)$ and the transformed error

$(-2ax \cdot \cos\phi + \sin\phi, b \cdot \cos\phi)$.

7.3.4 Error amplification

The error has increased (or decreased) by the factor

$$d = \sqrt{(-2ax \cdot \cos\phi + \sin\phi)^2 + (b \cdot \cos\phi)^2}$$

Accumulate the logarithm of this factor.

7.3.5 Renormalization

Replace the old point (x,y) by its successor $H(x,y)$ and replace the old error direction by the new directional vector $(\cos\phi, \sin\phi)$ by $(-x \cdot \cos\phi + \sin\phi, b \cdot \cos\phi)/d$.

7.3.6 Loop

Go back to step 3, transformation until N iterations have been performed.

7.3.7 Result

Divide the contents of the accumulator by N.

7.4 Summary of the main aspects of Lyapunov exponents relevant to strange attractors

- It is recognized that an attractor is chaotic if it has one positive Lyapunov exponent .
- In discrete systems, as well as in continuous systems, there are as many Lyapunov exponents as there are dimensions of underlying space.
- The sum of all Lyapunov exponents characterizes how fast area (in two dimensions) or volume (in three dimensions) expands or shrinks.
- The Lyapunov exponents are independent of the choice of coordinates.

7.5 Program used to estimate the Lyapunov exponents

The program SANTIS has the capability to estimate Lyapunov exponents for a time series[7].

7.5.1 Testing the program

7.5.1.1 Method

The program used was tested to see if it could measure the Lyapunov exponents accurately. The null hypothesis was that is unable to distinguish known chaos from noise. A Henon time series and Logistic map

with a starting value 0.2 and a delta value of 3.8 were used as known chaotic series[2]. (These two time series may be found in Appendix E). Four noise series generated by SANTIS were used as control series (These four time series may be found in Appendix D). The Student's T-test was used as the test statistic and a p value of <0.05 was considered significant, in order to reject the null hypothesis.

7.5.1.2 Results

	HENON	LOGISTIC MAP	NOISE1	NOISE2	NOISE3	NOISE 4	P
Lyapunov exponent	3.90	4.69	0.22	0.22	0.22	0.26	0.000074
Settings for the Lyapunov exponent Calculation with SANTIS							
Delay / tau	1	1	1	1	1	1	
Embedding dimension	2	2	2	2	2	2	
Minimum Distance of Trajectories (% of sample range)	1.0	1.0	1.0	1.0	1.0	1.0	
Maximum Distance of Trjectories (% of sample range)	10.0	10.0	10.0	10.0	10.0	10.0	

Table 7-1 Lyapunov exponents for known chaos and known noise signals

The calculated p value was 0.000074. This is less than 0.05 and therefore the null hypothesis is rejected and it is concluded that the program is successfully able to differentiate known chaos from known noise.

7.6 Lyapunov exponents for the time series measured

The Lyapunov exponents were calculated in the same manner for the twenty measured time series. The time series are to be found in Appendix B.

FILE NAME	LYAPUNOV EXPONENT	DELAY / TAU	EMBEDDING DIMENSION	MINIMUM DISTANCE OF TRAJECTORIES (% OF SAMPLE RANGE)	MAXIMUM DISTANCE OF TRJECTORIES (% OF SAMPLE RANGE)
Iso-01	0.79	1	2	1	10
Iso-02	1.27	1	2	1	10
Iso-03	0.207	1	2	1	10
Iso-04	1.63	1	2	1	10
Iso-05	1.107	1	2	1	10
Iso-06	0.638	1	2	1	10
Iso-07	0.41	1	2	1	10
Iso-08	1.06	1	2	1	10
Iso-09	1.66	1	2	1	10
Iso-10	0.65	1	2	1	10
Enf-01	0.645	1	2	1	10
Enf-02	0.131	1	2	1	10
Enf-03	0.687	1	2	1	10
Enf-04	1.245	1	2	1	10
Enf-05	0.393	1	2	1	10
Enf-06	0.579	1	2	1	10
Enf-07	0.52	1	2	1	10
Enf-08	0.452	1	2	1	10
Enf-09	0.37	1	2	1	10
Enf-10	0.519	1	2	1	10

Table 7-2 Lyapunov exponents for the measured time series

7.7 Lyapunov exponents for the Control Noise Signals

NOISE NEW	LYAPUNOV EXPONENT
1	0.123468
2	0.074407
3	0.126614
4	0.102054
5	0.100305
6	0.120309
7	0.098572
8	0.100782
9	0.098225
10	0.092514

Table 7-3 Lyapunov exponents of the control noise time series

7.8 Statistical Analysis

The hypothesis and null hypothesis were formulated and stated in chapter 3, and are repeated here for clarity sake.

7.8.1 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect nonlinearity four conditions must be met:

- Fractal Dimension of the attractor
- Sensitivity to initial conditions
- Invariant probability distribution of the attractor
- Detection of an underlying dynamical process

7.8.1.1 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables, i.e. the variability seen in the absorption is random[8] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

7.8.1.2 Sensitivity to initial conditions

This chapter is testing this part of the hypothesis.

7.8.2 Statistical Methods and Tests

The Lyapunov exponents for each of the measured time series was compared to the Lyapunov exponent a control noise signal. The isoflurane and enflurane measured time series were treated as separate groups and each was individually compared to the noise signal control group.

A Student's T-test was used to compare the measured and the control groups, with, as stipulated in chapter 3, a p value of <0.05 being considered significant.

7.8.3 Results

	LYAPUNOV EXPONENTS
T-test isoflurane group	0.000426
T-test enflurane group	0.000824

Table 7-4 Results of the Student's t-test comparisons for the two groups of measured time series

All the T-test comparisons yielded p values of < 0.05. These results strongly recommend the acceptance of the null hypothesis stated above (7.8.1) and more specifically, that there is evidence for sensitivity to initial conditions underlying the measured time series for both isoflurane and enflurane.

7.8.4 Power Analysis

To prevent a type II statistical error from being made, where the null hypothesis is accepted when the hypothesis is actually true, a power analysis[9] was performed. For the analysis, an alpha level of 2.35 was used which corresponds to a p value of <0.01 for the rejection of the null hypothesis. A power level of >0.8 was considered acceptable[9].

7.8.4.1 Power analysis for Isoflurane group

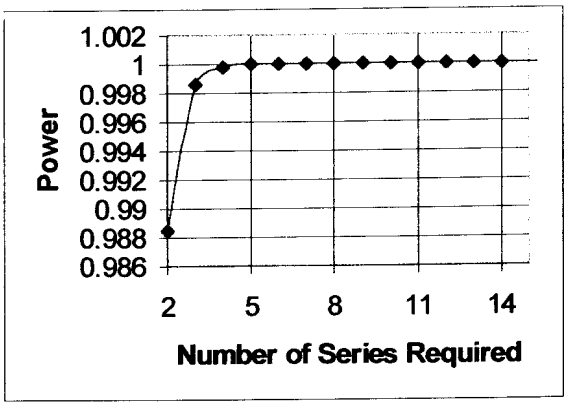

Figure 7-1 Power of the Student's T-test for the isoflurane measured time series

7.8.4.2 Power analysis of the enflurane group

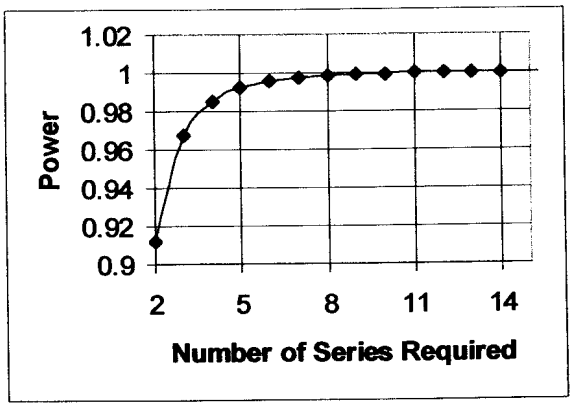

Figure 7-2 Power of the Student's T-test for the enflurane measured time series

7.8.4.3 Power analysis conclusion

Twenty series were used in each of the Student's T-test analyses. All the power analysis showed that this was more than adequate for a power of > 0.80 and a p value of < 0.01.

7.9 Conclusion

The results presented above show that there is evidence for sensitivity to initial conditions underlying the absorption of both isoflurane and enflurane. These results reach statistical significance ($p<0.05$) with acceptable statistical power (>0.8).

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8 The Method of Surrogate Data

8.1 Definition

The method of surrogate data is a statistical approach to identifying nonlinearity in a time series. The method first specifies some linear process as a null hypothesis, then generates surrogate data sets which are consistent with this null hypothesis, and finally computes a discriminating statistic for the original and for each of the surrogate data sets. If the value computed for the original data is significantly different than the ensemble of values computed for the surrogate data, then the null hypothesis is rejected, and nonlinearity is detected[1].

8.2 Discussion

8.2.1 Introduction

The inverse problem for a nonlinear system is to determine the underlying dynamical process in the practical situation where all that is available is a time series of data. For experimental sets simple autocorrelation and Lyapunov exponent estimates can signal chaos where there is none. This is particularly so of data sets that are short and noisy[1]. Most authors recognize these pitfalls, but they are not easily avoided.

Some data sets very cleanly exhibit low dimensional chaos, but there are many examples where the evidence is sketchy and difficult to evaluate. The real complication arises because low dimensional chaos and uncorrelated noise are not the only available alternatives. The erratic fluctuations that are observed in an experimental time series owe their dynamical variation to a number of various influences. Chaos, nonchaotic but still nonlinear determinism, linear correlations and noise, both in the dynamics and in the measuring apparatus[1,2,3].

The goal of identifying linearity is considerably easier than that of positively identifying chaotic dynamics. The approach of surrogate data is to specify a well defined underlying linear process or null hypothesis, and to

determine the distribution of the quantity, for example, dimension, for an ensemble of surrogate data sets which are just different realizations of the hypothesized linear stochastic process[1,4].

Error bars can be put on the value given by the surrogates reliably because of the many realizations of the null hypothesis, the errors can be estimated numerically form the standard deviation of all the estimated dimensions of the surrogate data sets[1].

8.2.2 Statistical Hypothesis testing

The formal application of the surrogate data method is expressed statistically using a null hypothesis against which observations are tested, and a discriminating statistic[1].

The null hypothesis is a potential explanation that is sought to be shown inadequate for explaining the data. The discriminating statistic is a number, which quantifies some aspect of the time series. If this number is different for the observed data, than would be expected under the null hypothesis, then the null hypothesis can be rejected[1].

An ensemble of surrogate data sets are generated which share given properties of the observed times series. These are, for example, mean variance, and Fourier spectrum. Nevertheless, these surrogate data sets are otherwise random as specified by the null hypothesis[4]. For each surrogate data set, the discriminating statistic is computed, and form this ensemble of statistics the distribution is approximated[1].

This approach is computationally intensive, but avoids analytical deviation, which can be difficult, if not impossible. This allows increased flexibility in the choice of the null hypothesis and the discriminating statistic(s). The hypothesis and statistic can even be chosen independently of each other[1].

8.2.3 Computing significance

Let Q_D denote the statistic computed for the original time series and Q_{Hi} for the *i*-th surrogate generated under the null hypothesis. Let μ_H and σ_H denotes the sample mean and the standard deviation of the distribution of Q_H [1].

If multiple realizations of the experimental data are available, then it may be possible to compare the two data sets directly using a Mann-Whitney or a student-t test. Alternatively if only one realization of the experimental data is available, the following method can be used[1].

The measure of "significance" is defined by the difference between the original and the mean surrogate value of the statistic, divided by the standard deviation of the surrogate data values.

$$\vartheta = \frac{|Q_D - \mu_H|}{\sigma_H}$$

The significance is a dimensionless quantity, but is call by convention, "sigmas"[1].

8.2.4 Estimating error bars on significance

The errors are computed by the standard propagation of errors methodology. They are written on the graph as $\Delta\vartheta$.

$$\left(\frac{\Lambda\vartheta}{\vartheta}\right)^2 = \left(\frac{\Delta|\mu_H - \mu_D|}{\mu_H - \mu_D}\right)^2 + \left(\frac{\Delta\sigma_H}{\sigma_H}\right)^2$$

$$= \frac{(\Delta\mu_H)^2 + (\Delta\mu_D)^2}{(\mu_H - \mu_D)^2} + \left(\frac{\Delta\sigma_H}{\sigma_H}\right)^2$$

Now the error of the sample mean based on *N* observations is given by $(\Delta\mu)^2=\sigma^2/N$, and the error of the sample standard deviation is $(\Delta\sigma)^2=\sigma^2/N$.

Therefore[1]:

$$\left(\frac{\Delta\vartheta}{\vartheta}\right)=\frac{\sigma_H^2/N_H+\sigma_D^2/N_D}{(\mu_H-\mu_D)^2}+\frac{1}{2N_H}$$

The absolute error is given by [1]:

$$\Delta\vartheta=\sqrt{\left(1+\frac{1}{2}\vartheta^2\right)/N_H+(\sigma_D/\sigma_H)^2/N_D}$$

When only a single realization of the time series is available, then σ_D is taken to be zero and the second term of the equation is ignored.

8.2.5 Battery of discriminating statistics

The method of surrogate data can in principle be used with virtually any discriminatory statistic. Formally the null hypothesis can be rejected if the statistic has different distributions for the data and the surrogates. However the method is more useful if the statistic actually provides a good estimate of a physically interesting quantity[1]. Choices of statistics used have included correlation dimension, Lyapunov exponents, forecasting error and correlation integral[1,5].

8.3 Algorithms for generating surrogate data

8.3.1 Unwindowed Fourier Transform Algorithm

This algorithm is based on the null hypothesis that the data came from a linear Gaussian process. The surrogate data are constructed to have the same Fourier spectra as the raw data[1].

First the Fourier transform is computed for both positive and negative frequencies, $f=0,1/N,2/N,....1/2$, without the benefit of windowing. The Fourier transform has complex amplitude at each frequency. To randomize the phases, each complex amplitude is multiplied by $e^{i\phi}$, where ϕ is independently chosen for each frequency in the interval $[0,2\pi r]$. in order for the inverse Fourier transform to be real, i.e. with no imaginary

components, the phases must be symmetrized, so that $\phi(f)=-\phi(-f)$. Finally, the inverse Fourier transform is the surrogate data[1].

This algorithm has at least two limitations. Firstly that it does not reproduce " pure" frequencies very well. Secondly spurious high frequencies can be introduced, most probably as an artifact of the Fourier transform, which assumes the time series is periodic with a period of N[1].

8.3.2 Windowed Fourier Transform Algorithm

The problem of spurious high frequencies can be addressed by windowing the data before taking the Fourier transform. The time series is multiplied by a function $w(f)=sin(\pi t/N)$ which vanishes at the end points $t=0$ and $t=N$. This suppresses the jump discontinuity from the last to the first point, and seems to effectively get rid of the high frequency effect. It may however introduce spurious low frequencies form the power spectrum $w(t)$ itself[1].

8.3.3 Amplitude Adjusted Fourier Transform

This algorithm generates a surrogate data set associated with the null hypothesis that the observed time series is a monotonic nonlinear transformation of a linear gaussian process[1]. The idea is to first rescale the values in the original time series so that they are gaussian. Then the windowed or unwindowed Fourier transformation algorithms are used to make a surrogate time series, which has the same Fourier spectrum as the rescaled data. Finally, the gaussian surrogate is then rescaled back to have the same amplitude distribution as the original time series.

8.4 Experimental observations using this technique

The method of surrogate data has been applied to both experimental and other data. Some of the observations made were[1]:

a) Increasing the number of points in a time series increases the significance with which nonlinearity can be detected in a time series, which is known to be chaotic.

b) Increasing the complexity of the chaotic time series decreases the ability to distinguish from linearity.

c) Nonlinearity could be detected even with a signal to noise ratio of one to one, using a time series of length 512.

d) The decrease in significance is not always monotonic, low levels of dynamical noise can make the nonlinearity more evident.

e) Oversampling can produce artifacts of autocorrelation and mask nonlinearity, which is evident if a correct sampling interval is used.

8.5 Program used

The public domain program SANTIS has the capacity for generating Surrogate Data[6] using a random phase method, which is described in 8.3.1. This algorithm is based on the null hypothesis that the data came from a linear Gaussian process[1].

8.5.1 Testing the program

8.5.1.1 Method

8.5.1.1.1 Statistical Tests

The program used was tested to see if it generated surrogate data accurately. The null hypothesis tested against was that is unable to distinguish known chaos from noise. A Henon time series was used as a known chaotic series[7]. This time series may be found in Appendix E. A noise signal generated by SANTIS was used as a control series. (This time series may be found in Appendix D).

For the present situation where only one realization of the 'experimental' data is available, a modified T-test is used to calculate a measure of significance[1]. The measure of significance (S) is defined by the difference between the original and the mean surrogate value of the statistic, divided by the standard deviation of the surrogate values:

$$S = \frac{|Q_D - \mu_H|}{\sigma_H}$$

Where Q_D denotes the statistic computed for the original time series, μ_H is the sample mean and σ_H is the sample standard deviation. The significance is properly a dimensionless quantity. If the distribution of the statistic is gaussian (and numerical experiments indicate that this is often a reasonable approximation[1]), then the p value is given by $p=P(Z \geq S/\sqrt{2})$[1], where Z has a n(0,1) distribution[8]. This gives the probability of observing significance S or larger if the null hypothesis is true. For the current test, a p value of <0.05 was considered significant, in order to reject the null hypothesis.

8.5.1.2 Results

HENON TIME SERIES	LYAPUNOV EXPONENT	CORRELATION DIMENSION
Henon Original	2.07854	1.24500
SD1	1.34043	3.02000
SD2	1.15344	3.05000
SD3	1.33218	3.15000
SD4	1.36878	2.96000
SD5	1.33900	3.06000
Mean of Surrogates	1.30676	3.04800
Standard deviation of Surrogates	0.08685	0.06907
NOISE TIME SERIES	LYAPUNOV EXPONENT	CORRELATION DIMENSION
Noise Original	0.12347	3.03000
SD1	0.13290	2.93500
SD2	0.12597	3.03200
SD3	0.14202	2.99490
SD4	0.12780	2.95600
SD5	0.13647	3.14750
Mean of Surrogates	0.13303	3.01308
Standard deviation of Surrogates	0.00652	0.08383

Table 8-1 Calculated values for the henon and noise time series

	LYAPUNOV EXPONENT		CORRELATION DIMENSION	
	Sigma	p	Sigma	p
Henon Time Series	8.886	1.66E-10	26.1057	→0
Noise Times Series	1.4668	0.149	0.20183	0.4432

Table 8-2 Calculated statistics for the henon and noise time series and their surrogates

The *p* values for the known chaotic signal, the Henon Time series, and its surrogates for both the Lyapunov exponent and the correlation dimension are well below 0.05. The *p* values for the known noise series and its surrogates are well above 0.05. It is therefore concluded that the SANTIS program is able to distinguish noise from known chaos using the method of surrogate data The surrogate data sets for the Henon Time series and the Noise time series are to be found in Appendix C.

8.6 The Method of Surrogate Data applied to the time series measured

8.6.1 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect nonlinearity four conditions must be met:

- Fractal Dimension of the attractor
- Sensitivity to initial conditions
- Invariant probability distribution of the attractor
- Detection of an underlying dynamical process

8.6.1.1 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables, i.e. the variability seen in the absorption is random[9] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

8.6.1.2 Invariant probability distribution of the attractor

This part of the hypothesis is being tested by this chapter.

8.6.2 Statistical Methods and Tests and Data processing

The twenty measured time series were processed using SANTIS and a surrogate data set for each time series was constructed. A single surrogate was made for each series because they are multiple realizations of observational data[1]. The surrogate data sets are to be found in Appendix J. The statistics chosen for the analysis were the correlation dimension and the Lyapunov exponent[1]. These two statistics were calculated for the surrogates and the originals as set out in Chapters 5 and 7 respectively.

The isoflurane group and the enflurane group are each compared to their own surrogate data set. The two groups of statistics will be compared using a Student's T-test[1] and a p value of < 0.05 will be considered significant.

8.6.3 Power Analysis

To prevent a type II statistical error from being made, where the null hypothesis is accepted when the hypothesis is actually true, a power analysis[8] was performed. For the analysis, an alpha level of 2.35 was used which corresponds to a p value of < 0.01, for the rejection of the null hypothesis. A power level of >0.8 was considered acceptable[8].

8.6.3.1 Power Analysis for the Isoflurane Group

8.6.3.1.1 Lyapunov Exponent

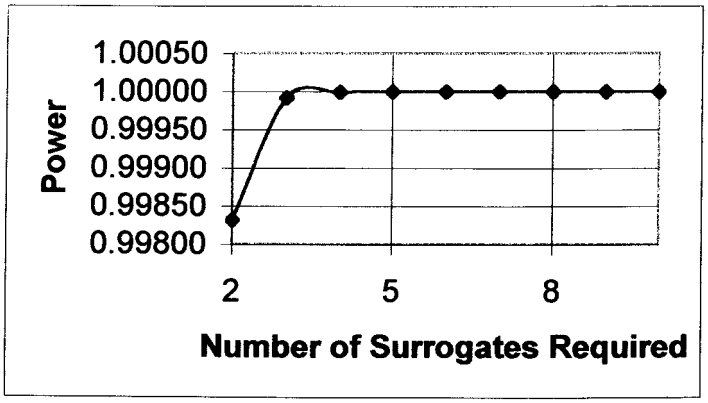

Figure 8-1 Power of the Student's T-test for the isoflurane surrogates

8.6.3.1.2 Correlation Dimension

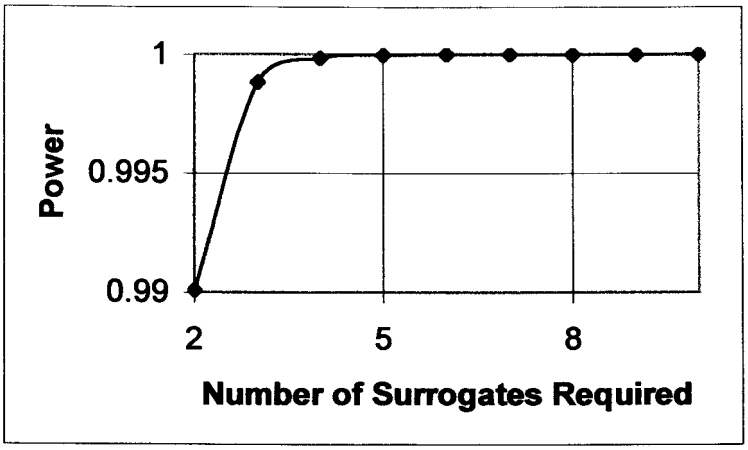

Figure 8-2 Power of the Student's T-test for the isoflurane surrogates

8.6.3.2 Power Analysis for the Enflurane Group

8.6.3.2.1 Lyapunov Exponent

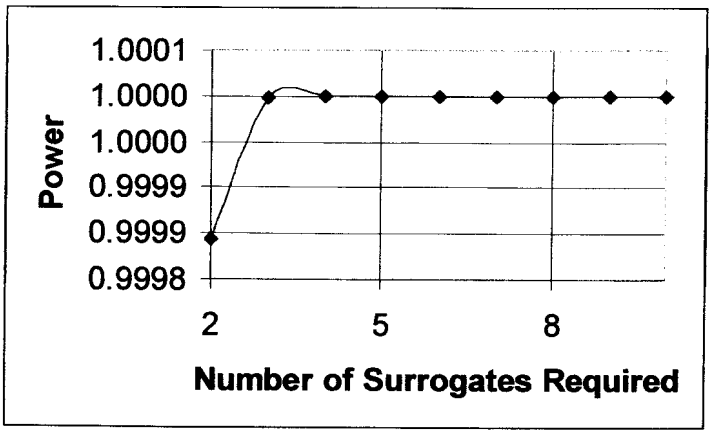

Figure 8-3 Power of the Student's T-test for the enflurane surrogates

8.6.3.2.2 Correlation dimension

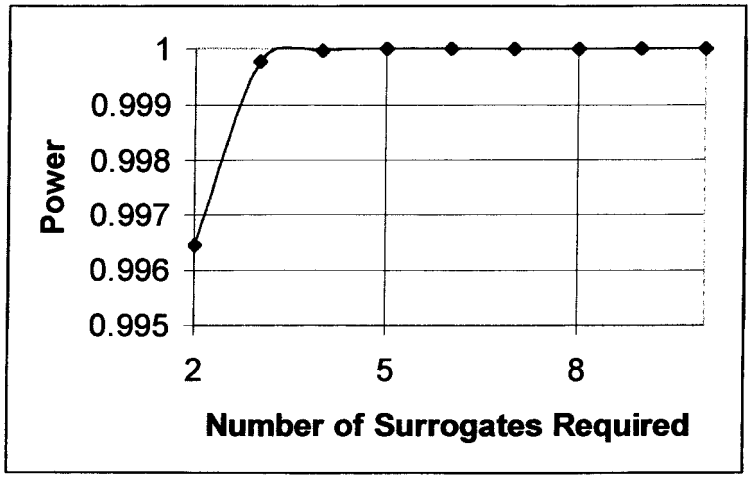

Figure 8-4 Power of the Student's T-test for the enflurane surrogates

8.6.3.3 Power Analysis conclusion

Ten surrogates were used in each of the Student's T-test analyses. All the power analysis showed that this was more than adequate for a power of > 0.8 and a p value of < 0.01.

8.6.4 Results

8.6.4.1 Tabular summary of results obtained

ORIGINALS			SURROGATES	
	Lyapunov Exponent	Correlation Dimension	Lyapunov Exponent	Correlation Dimension
Iso-01	0.79	0.785141	0.95	2.54573
Iso-02	1.27	1.48417	1.77	2.63195
Iso-03	0.207	0.952904	2.71	2.70931
Iso-04	1.63	1.03614	1.57	2.28634
Iso-05	1.107	1.50338	1.76	2.84977
Iso-06	0.638	1.3673	1.79	2.50964
Iso-07	0.41	1.04189	1.59	2.45525
Iso-08	1.06	1.36093	2.38	2.54241
Iso-09	1.66	1.52047	0	2.70942
Iso-10	0.65	1.57578	1.86	2.42537
Student's T-test	0.378105	0.0000001	(p Values)	

Table 8-3 The results for the measured isoflurane times series and their surrogates

ORIGINALS			SURROGATES	
	Lyapunov Exponent	Correlation Dimension	Lyapunov Exponent	Correlation Dimension
Enf-01	0.645	1.88901	2.11	2.61761
Enf-02	0.131	0.814319	2.07	2.48397
Enf-03	0.687	0.975127	1.87	2.55907
Enf-04	1.245	1.81347	1.358	2.51946
Enf-05	0.393	0.0982057	2.38	2.87178
Enf-06	0.579	1.46198	2.995	2.92315
Enf-07	0.52	1.46198	1.922	2.92315
Enf-08	0.452	1.23643	2.32	3.22789
Enf-09	0.37	0.101749	2.17	2.96908
Enf-10	0.519	0.80455	1.967	2.63558
Student's T-test	0.0000119	0.0000187	(p values)	

Table 8-4 The results for the measured enflurane times series and their surrogates

8.6.4.2 Conclusion

The results presented above show that there is evidence for an invariant probability distribution of the attractor underlying the absorption of both isoflurane and enflurane. These results all reach statistical significance ($p < 0.05$) with acceptable statistical power (>0.8).

8.7 References

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9 Nonlinear forecasting

9.1 Definition

Nonlinear forecasting is an approach for making short term predictions about the trajectories of chaotic dynamical system. It distinguishes apparent noise associated with deterministic chaos from sampling error and other sources of externally induced environmental noise[1,2].

9.2 Discussion

Nonlinear forecasting combines some new ideas with previously described techniques to make short term predictions that are based on a library of past patterns in the time series[1,2]. By comparing the predicted and actual trajectories, tentative distinctions between dynamical chaos and measurement error can be made.

For a chaotic time series, the accuracy of nonlinear forecasting falls off with an increase in prediction interval, whereas for uncorrelated noise, the forecasting accuracy is roughly independent of the prediction interval[1]. The rate at which the prediction accuracy falls off for a chaotic time series gives an estimate of its Lyapunov exponent[3]. This method provides an estimate of the number of dimensions or "active variables" of the attractor underlying a time series that is identified as chaotic. It does not require a large number of data points, and seem to be useful when the observed time series has relatively few points.

9.2.1 Forecasting for a chaotic time series

Nonadjacent values in chaotic time series are completely uncorrelated, and standard statistical methods cannot be used to generate predictions two or more steps into the future that are significantly better than the mean value for the series. But if deterministic laws govern the system, then, even if the dynamical behavior is chaotic, the future may be

able to some extent be predictable from the behavior of past values that are similar to those of the present[1].

The predictions are sensitive to the choice of the embedding dimension, E[1]. They are less accurate with higher embedding dimensions. This effect is thought to be caused by the contamination of nearby points in the higher dimensional embeddings with points whose earlier coordinates are close but, whose recent and therefore more relevant coordinates are distant.

The forecasting technique is phenomenological in that it attempt to asses the qualitative character of a system's dynamics without attempting to provide an understanding of the physical or biological mechanisms which ultimately govern the system[1]. This contrasts strongly with many laboratory and field experiments, which often attempt to elucidate detailed mechanisms.

The time series is split into two parts and inferences are made about the dynamical nature of the system. This is done by examining the way in which the correlation coefficient between the predicted and the observed results for the second part of the times series varies with the prediction interval[1]. It has been shown to work with artificially generated time series, for which the underlying mechanisms are known, as well as for epidemiological data[1], heart rate analysis[2,4], action potential trains[3], the human EEG[5] and disease incidence[6].

9.3 Computational algorithm

First an embedding dimension, E, is chosen, and then lagged coordinates are used to represent each lagged sequence (with a lag time of τ) of data points, $\{x_t, x_{t-\tau}, x_{t-2\tau} \ldots x_{t-(E-1)\tau}\}$ as a point in E dimensional space. The results do not seem to be very sensitive to the choice of τ value, provided it is not too large[1]. Each sequence for which a prediction is to be made is now regarded as an E-dimensional point, comprising of its present value and the E-1 previous values each separated by one lag time τ. All nearby E

dimensional points are located in the state space, and a minimal neighborhood is defined to be such that the predictee is contained within the smallest simplex termed by its $E+1$ closest neighbors. The prediction is now obtained by projecting the domain of the simplex into its range, that is by keeping track of where the point in the simplex end up after p time steps. To obtain the predicted value, the original predictee position is computed within the range of its simplex, giving exponential weight to its original distances from the relevant neighbors[1].

Nonlinear forecasting is a non-parametric method which uses no prior information about the model used to generate the time series, only the information in the output itself[1,2].

9.4 *Program used*

Neither of the two programs used for analysis in this thesis have the facility to do the nonlinear forecasting method as described above.

Microsoft Excel 8® and Visual Basic for Applications® were used to develope a computer program using the algorithm outlined above. The code for the program is to be found in Appendix I.

9.4.1 Description

9.4.2 Testing the program

The program written was tested to see if it could perform nonlinear forecasting accurately. The null hypothesis is that it is unable to distinguish known chaos from noise. A Henon attractor time series as well as a noise series were used in the testing. The data for the Henon time series is to be found in Appendix E, the data for the noise series is to be found in Appendix D.

A Henon attractor time series of 1500 data points was used and the following results were obtained:

PREDICTION TIME	HENON	NOISE
	Correlation coefficient	Correlation coefficient
1	0.931009	0.508566
2	0.834199	0.446426
3	0.7625	0.522498
4	0.51392	0.429119
5	0.493131	0.482085
6	0.454723	0.484795
7	0.39385	0.472593
8	0.27307	0.508908
9	0.266334	0.403556
10	0.267688	0.436132

Table 9-1 Tabular results of non-linear forecasting with a henon attractor and a noise signal.

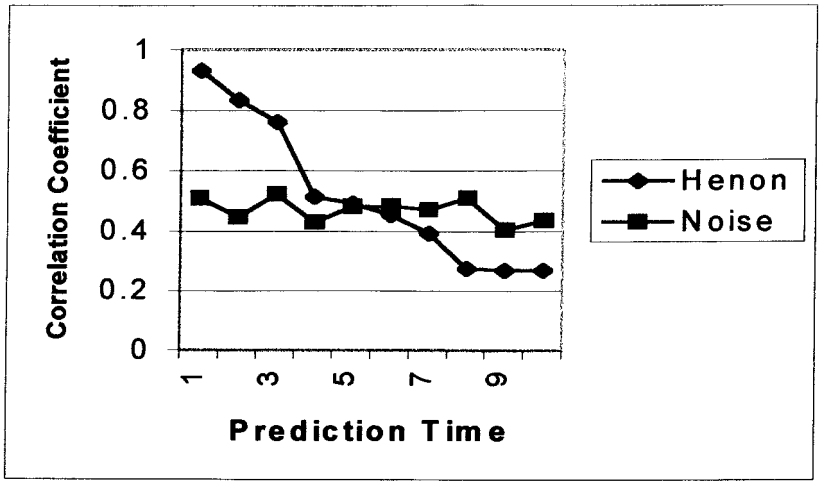

Figure 9-1 The correlation coefficient of the predicted and actual values for a henon attractor and a noise signal.

The decrease in the correlation coefficient with increasing prediction time is a characteristic of chaos when subjected to nonlinear prediction[1]. This property is noteworthy because it indicates a simple way to differentiate additive noise from deterministic chaos. Prediction with additive noise that is uncorrelated will seem to have a fixed amount of error, regardless of how far or close into the future one tries to project. However, prediction with deterministic chaos will tend to deteriorate as one tries to forecast into the future[1,4].

In this testing process, the noise signal serves as a control. It is therefore concluded that the program successfully distinguished two known chaotic signals from noise, and can therefore be used in the measured time series analysis.

9.5 Nonlinear forecasting applied to the measured time series

9.5.1 Tabular results of the nonlinear forecasting

	PREDICTION TIME									
Time Series	1	2	3	4	5	6	7	8	9	10
Iso-01	0.998405	0.998335	0.992936	0.992584	0.988504	0.985449	0.101956	0.941643	0.635765	0.504829
Iso-02	0.533014	0.600201	0.52655	0.518132	0.242406	0.247409	0.201772	0.253008	0.273863	0.242467
Iso-03	0.839198	0.564994	0.319887	0.279051	0.276087	0.384769	0.380413	0.32074	0.291326	0.219981
Iso-04	0.394032	0.606389	0.492526	0.218237	0.225495	0.291932	0.271515	0.237173	0.281784	0.257786
Iso-05	0.705453	0.677779	0.457691	0.359112	0.544889	0.430544	0.439531	0.516171	0.453563	0.396119
Iso-06	0.606736	0.422822	0.400923	0.351216	0.375366	0.361049	0.32929	0.321007	0.292137	0.318042
Iso-07	0.649942	0.651781	0.623762	0.623034	0.639909	0.464699	0.225289	0.219731	0.250955	0.3424
Iso-08	0.770772	0.614863	0.5281	0.327084	0.188408	0.215324	0.248173	0.242243	0.264178	0.258138
Iso-09	0.745023	0.679602	0.516286	0.551967	0.60212	0.547318	0.534397	0.523138	0.442113	0.438931
Iso-10	0.682728	0.62896	0.609579	0.374676	0.328768	0.297518	0.267572	0.235619	0.289276	0.329628
Enf-01	0.717534	0.723738	0.660926	0.546588	0.426491	0.288177	0.311193	0.385414	0.422615	0.485991
Enf-02	0.600321	0.404382	0.375737	0.424702	0.443001	0.415924	0.447971	0.465681	0.460097	0.406184
Enf-03	0.531233	0.576416	0.335309	0.19716	0.202522	0.227774	0.257508	0.321101	0.344167	0.362232
Enf-04	0.765703	0.620539	0.492355	0.28632	0.168492	0.214412	0.24075	0.211609	0.187674	0.221962
Enf-05	0.572695	0.535491	0.401022	0.334509	0.336435	0.307602	0.319179	0.335237	0.325309	0.327527
Enf-06	0.503582	0.406577	0.450085	0.420845	0.411436	0.412036	0.406986	0.370103	0.411651	0.445861
Enf-07	0.532502	0.518669	0.507854	0.451757	0.493164	0.416277	0.280079	0.274419	0.303553	0.294224
Enf-08	0.682265	0.595385	0.457385	0.403076	0.352322	0.312621	0.31423	0.222915	0.224516	0.23655
Enf-09	0.70515	0.731499	0.576043	0.497984	0.455496	0.329483	0.319908	0.306684	0.325026	0.324227
Enf-10	0.589421	0.529481	0.426854	0.36702	0.416705	0.486401	0.341717	0.424236	0.283022	0.321246

Table 9-2 Tabular results of the non-linear forecasting for the measured time series

9.5.2 Graphical results of the nonlinear forecasting

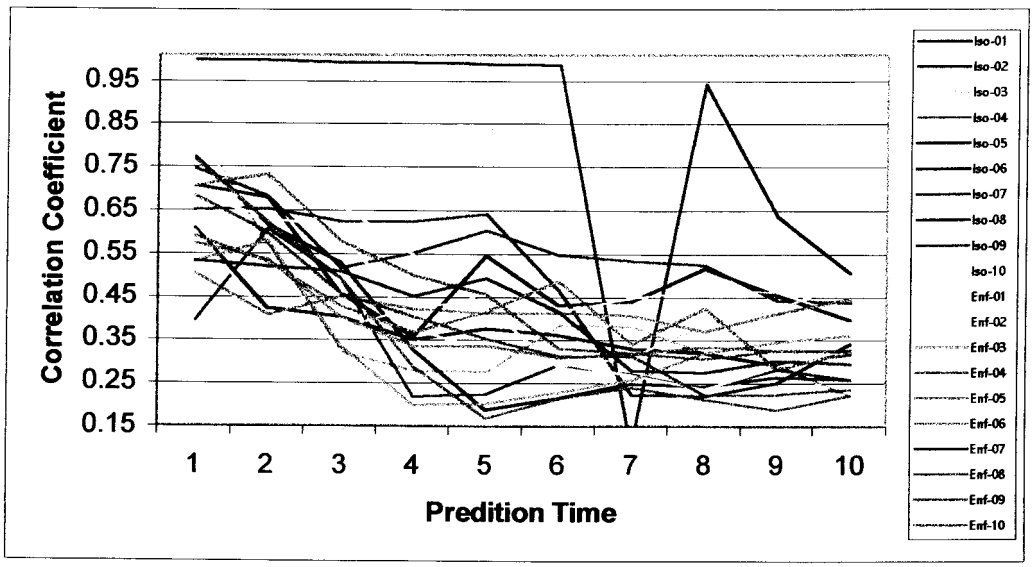

Figure 9-2 Graphical results of non-linear forecasting with all the measured time series

9.5.3 Individual Graphical Results with Noise as a control

Individual graphs of Non-Linear forecasting with a noise signal as control are to be found in Appendix I.

9.6 Statistical Analysis

The hypothesis and null hypothesis were formulated and stated in chapter 3, and are repeated here for clarity sake.

9.6.1 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect nonlinearity four conditions must be met:

- Fractal Dimension of the attractor
- Sensitivity to initial conditions

- Invariant probability distribution of the attractor
- Detection of an underlying dynamical process

9.6.1.1 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables, i.e. the variability seen in the absorption is random[7] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

9.6.1.2 Detection of an underlying dynamical process

This part of the hypothesis is being tested by this chapter.

9.6.2 Statistical Analysis of the Results

No recommendation is made by Sugihara et al1 on how to decide whether the time series under consideration is non-linear as determined by the method of Non-Linear forecasting other than graphical representation and imperial decision. Using this method, only one of the time series was considered not to demonstrate characteristics of a non-linear time series, namely Enf-016.

To make the decision more objective and less imperial, it was decided to calculate the coefficient of determination between the measured signal and the noise signal, using the values obtained with the Henon time series as a guideline for a coefficient of determination value which should be used in deciding if the time series should be considered non-linear or not.

SERIES	COEFFICIENT OF DETERMINATION	<<0.5	<<0.37	VISUAL
Henon	0.363	Yes	Yes	Yes
Io-01	0.263	Yes	Yes	Yes
Iso-02	0.082	Yes	Yes	Yes
Iso-03	0.281	Yes	Yes	Yes
Iso-04	0.151	Yes	Yes	Yes
Iso-05	0.281	Yes	Yes	Yes
Iso-06	0.446	Yes	No	Yes
Iso-07	0.169	Yes	Yes	Yes
Iso-08	0.234	Yes	Yes	Yes
Iso-09	0.331	Yes	Yes	Yes
Iso-10	0.246	Yes	Yes	Yes
Enf-01	0.091	Yes	Yes	Yes
Enf-02	0.169	Yes	Yes	Yes
Enf-03	0.055	Yes	Yes	Yes
Enf-04	0.277	Yes	Yes	Yes
Enf-05	0.198	Yes	Yes	Yes
Enf-06	0.156	Yes	Yes	No
Enf-07	0.256	Yes	Yes	Yes
Enf-08	0.250	Yes	Yes	Yes
Enf-09	0.168	Yes	Yes	Yes
Enf-10	0.342	Yes	Yes	Yes

Table 9-3 Statistical and visual analysis of non-linear forecasting on the henon and measured time series

The coefficient of determination for the Henon Time Series was calculated to be 0.363. The coefficient's of determination for the measured time series were all less than 0.5, and only one, Iso-06 is not less than 0.37. Adopting the most strict approach, that the nonlinear forecasting of a time series must not only visually be judged to be in favor of a nonlinear process, but also that the coefficient of determination be less than the control value, namely 0.37, the following is then deducted: nine out of the ten measured isoflurane time series and nine out of the ten measured enflurane time series are in favor of their being an underlying dynamical process in the absorption of the two gases. Is this statistically significant?

9.6.3 Testing for statistical significance

The problem identified in the section above will be statistically addressed using a binomial distribution[8].

9.6.3.1 Hypothesis and Null hypothesis

The hypothesis to be tested is as follows:H_1: $\pi > \pi_0$, with the null hypothesis being: H_0 : $\pi = \pi_0$. The value used for π_0 will be 0.5[8].

9.6.3.2 Power Analysis

To prevent a type II statistical error from being made, where the null hypothesis is accepted when the hypothesis is actually true, a power analysis[8] was performed. For the analysis, an alpha level of 1.645 was used which corresponds to a p value of < 0.05 for the rejection of the null hypothesis. A power level of >0.8 was considered acceptable[8].

9.6.3.2.1 Power Analysis for the Isoflurane Group

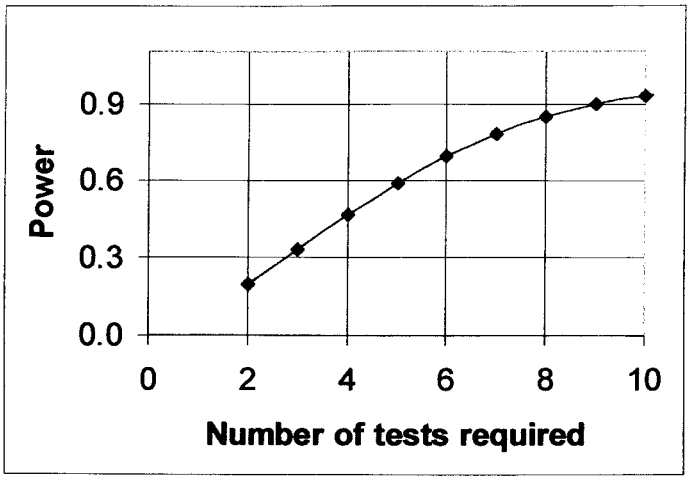

Figure 9-3 Power of the binomial for the isoflurane measured time series

9.6.3.2.2 Power Analysis for the Enflurane Group

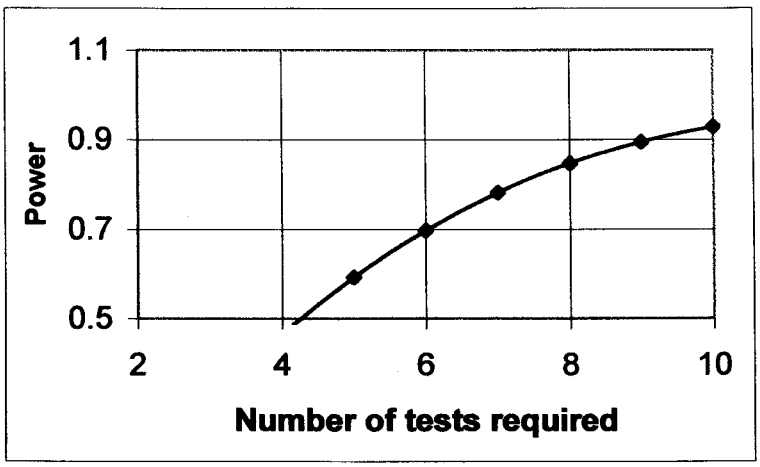

Figure 9-4 Power of the binomial for the enflurane measured time series

9.6.3.2.3 Power Analysis Conclusion

Ten binomial comparisons were used in each group. Both the power analysis showed that this was adequate for a power of > 0.8 and a p value of <0.05.

9.6.3.3 Results

	BINOMIAL RESULTS (P VALUES)
Isoflurane Group	0.01074
Enflurane group	0.01074

Table 9-4 Results of the binomial comparison

Both of the binomial comparisons yielded p values < 0.05. These results strongly recommend the acceptance of the hypothesis stated above (9.6.1) and more specifically, that there is evidence for an underlying dynamical process underlying the measured time series for both isoflurane and enflurane.

9.7 Conclusion

The results presented above show that there is evidence for a fractal attractor underlying the absorption of both isoflurane and enflurane using the method of nonlinear forecasting. These results reach statistical significance ($p < 0.05$) with acceptable statistical power (>0.8).

9.8 References

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10 Statistical Analysis Summary

10.1 Hypothesis

The absorption of isoflurane and enflurane is a non-linear process. To detect non-linearity, four conditions must be met[1,2]:

1. Sensitivity to initial conditions
2. Fractal Dimension of the attractor
3. Invariant probability distribution of the attractor
4. Detection of an underlying dynamical process

10.2 Null hypothesis

The absorption of the anaesthetic agents Isoflurane and Enflurane is fully described by independent and identically distributed random variables, i.e. the variability seen in the absorption is random[3] and there is no underlying deterministic process.

The time series measured will be analytically indistinguishable from noise signals.

10.3 Testing the hypothesis

10.3.1 Method

Ten measured time series for both isoflurane and enflurane absorption were measured. These were then compared to ten noise signals, with similar standard deviations, means and number of points in the series.

10.3.2 Sensitivity to initial conditions

Calculating Lyapunov exponents tests for sensitivity to initial conditions.

STUDENT'S T-TEST RESULTS (P VALUE) FOR THE MEASURED TIME SERIES COMPARED TO NOISE CONTROLS	
Isoflurane group	0.000426 (power: 0.998495)
Enflurane group	0.000824 (power: 0.999492)

Table 10-1 Student's T-test (p value) for the measured time series compared to noise controls (Lyapunov exponent)

10.3.3 Fractal Dimension of the attractor

The dimension of the attractor was calculated using the following statistics. Each statistic gives an approximation of the fractal dimension. The approximate entropy is the only method described specifically for short, noisy, biological signals[4]. Therefore only the statistics calculated for the approximate entropy will be used for testing against the null hypothesis.

- Approximate entropy
- Information entropy
- Correlation dimension
- Fractal dimension (Box counting method)

STUDENT'S T-TEST RESULTS (P VALUES) FOR THE MEASURED TIME SERIES COMPARED TO NOISE CONTROLS				
	Approximate Entropy	Information Dimension	Correlation dimension	Fractal Dimension
Isoflurane group	0.000499 (Power: →1)	0.005435 (Power: 0.999905)	<0.000000 (Power: →1)	0.2133 (Power: 0.975885)
Enflurane group	0.003085 (Power: 0.999997)	0.028838% (Power: 0.999954)	0.000003 (Power: →1)	0.038049 (Power: 0.999427)

Table 10-2 Student's T-test (p values) for the measured time series compared to noise controls (fractal dimension)

10.3.4 Invariant probability distribution of attractor

Non linear forecasting was used to determine this characteristic. Each series was judged by a combination of visual and statistical criteria and then designated a "yes" or "no" answer. The proportions were analyzed using a binomial distribution, with $H_0 \pi$=0.5.

THE P VALUES OF THE BINOMIAL FOR THE 10 TESTS IN EACH GROUP		
Isoflurane group	0.01074 (Power: 0.928)	9/10 tests "yes"
Enflurane group	0.01074 (Power: 0.928)	9/10 tests "yes"

Table 10-3 The p values of the binomial for the ten tests in each group

10.3.5 Detection of an underlying dynamical process

This was determined by the method of surrogate data.

THE P VALUES FOR THE MEASURED TIME SERIES AND THEIR SURROGATES USING LYAPUNOV EXPONENTS AND CORRELATION DIMENSION AS COMPARISONS		
	Lyapunov Exponent group	Correlation Dimension Group
Isoflurane group	0.0378105 (Power: →1)	0.0000001 (Power: →1)
Enflurane group	0.0000119 (Power: →1)	0.0000187 (Power: →1)

Table 10-4 The p values for the measured time series and their surrogates using Lyapunov exponents and correlation dimension as comparisons

10.4 Conclusion

Each of the four conditions required by the hypothesis have been met with statistical significance ($p < 0.05$) and acceptable statistical power (>0.8). It is therefore concluded that the null hypothesis should be rejected and accepted that the absorption of both isoflurane and enflurane are non-linear processes.

10.5 References

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11 Discussion

11.1 Implications for anaesthesia

11.1.1 Administration

11.1.1.1 User adjusted inhalation agent concentration

The practice whereby the anaesthesiologist adjusts the concentration of the inhalation agent against the patient's response to stimuli does not require any change, because this process is inherently non-linear.

11.1.1.2 Calculated inhalation agent concentration

The method of pre-calculated injections described by Lowe[1] assumes that the absorption of the inhalation agent is predictable and therefore needs to be adjusted or phased out.

Computer assisted anaesthesia provision where preset concentrations are entered by the user are coming into practice, for example, Dräger's "Physioflex." These types of anaesthesia machines can compensate for a nonlinear absorption, provided that a feedback loop is built into the system, allowing adjustment of the inspired concentration based on the expired concentration of inhalation agent.

11.1.2 Modelling

Prediction is the sine qui non of modelling[2] and studying biological signals is the first step toward this end. Presently prediction of how non-linear systems behave in the real world is only possible for a limited period of time[3]. As further mathematical techniques are developed and the dynamics underlying non-linear processes are further discovered, this goal should be realized. For the moment, it eludes us.

11.1.3 Pharmacokinetics

Standard textbooks do not mention pharmacokinetic models other than those based on compartments described by single or multiple exponential equations. Non compartmental models, which have kinetics, that are fractal in nature, have been described for tracers[4], ^{15}O-labeled Water,[5] and opiates[4].

If the non-linear nature of inhalation agent absorption is taken into account when simplified models are described, then the search for an ideal model that accurately describes the process will prove to be futile. Maybe the 40 odd years since Severinghaus and the square root of time model have proved this!

11.2 Literature evidence against the compartmental models

11.2.1 Assumptions made in linear modeling

11.2.1.1 Assumptions made in the compartment model

A compartment is a region or subspace within a biological system throughout which the concentration of some substance is regarded as uniform[4]. A compartmental model is one consisting of one or several of such subspaces. The rate of exchange of material between compartments is governed by a set of non-negative rate coefficients, which are usually taken to be constant in time. Not every compartment in a given system exchanges material with every other compartment, which allows compartmental models to assume various configurations such as the catenary or linear model, and the radially symmetric or mammillary model[4].

Compartments are largely intuitive structures and they can be useful for both heuristic and computational purposes. They are governed by sets of ordinary differential equations, where time is the sole independent variable, and the concentrations or masses of material in the various compartments are the dependent variables. One differential equation can be written for each compartment to govern the flow of material to and from this

compartment. Compartments are easily visualized and sometimes identifiable with anatomical spaces[4].

In a steady state, the amount of substance within a compartment remains constant. When the steady state is displaced by means of a disturbance that increases or decreases the amount of material in one or more compartments, the masses of material in many of the compartments will change with time. When the disturbance is removed, the system will return to steady state. This relaxation process, under the influence of constant rate coefficients, will be described by sums of real, negative exponential functions. The real negative exponential is the characterizing function of the linear compartmental model, although complex exponents giving rise to sine and cosine terms, can, in principle appear[4].

When the clearance of a substance is measured by some or other means, a clearance curve can be constructed. When such a process is modeled by means of a linear compartmental model, one compartment of which contains the plasma; the mathematical function governing the clearance curve will consist of sums of real, negative exponentials. If the logarithm of the plasma concentration of the substance under consideration is plotted against time, and if a compartmental model is a valid representation of the biokinetic process of plasma clearance, data will tend to fall on a straight line for large values of time. Stated otherwise, a semi-log plot of clearance data will tend to approach linearity with increasing time[4].

11.2.1.2 The System Model for Closed-circuit Inhalation Anaesthesia

This model is the most recently described compartmental model of inhalation anesthetic agents in the literature[6].

It does not assume a constant alveolar concentration of inhalation agent, and therefore lends itself to validation by non-invasive measuring techniques as well as attempting to predict the breath by breath alveolar concentration after bolus injections of liquid inhalation agent.

The basic model for the uptake and distribution of a single inhalation anesthetic depicts the body and the closed circuit as a system of 14 compartments. The anesthetic agent is taken up from the lung-closed circuit compartment and is then distributed to the other tissue compartments: kidney, brain, liver, muscle, connective tissue, and adipose tissue. The model derives from the subject's age, body weight, height and gender the other physiological variables, including tissue volumes, blood volume, cardiac output, dead space, alveolar space and tidal volume[6]. This type of model has been illustrated by both hydraulic[7] and electrical[8] analogies.

The data source for the total blood volume, cardiac output, tissue volumes, tissue blood flows, and partitian coefficients were based on that of Lowe[1].

Two extensions were made to the basic model to include the effect of the anesthetic agent on cardiac output and to allow monitoring feedback from expiratory gas[6].

11.2.2 Shortfalls in the compartmental model noted in the literature to date

11.2.2.1 Failure to recognize the functional residual capacity as an extension of the anaesthetic circuit

This criticism has been leveled by Lin[9] against both the square root of time model and the compartmental models such as those described by Lerou et al[6]. The basis of this argument is that the functional residual capacity must be considered part of the breathing circuit and not as part of the "lung compartment" as done by both the examples mentioned. This criticism by Lin is backed up by experimental evidence[10] where the absorption of nitrous oxide was determined by a subtraction method. Their results differ significantly from those previously described, showing that the initial absorption of nitrous oxide was minimal and that after a period of functional residual capacity washin, the absorption was relatively constant[9].

11.2.2.2 Failure to recognize the alveolar membrane as a barrier

The mathematical model of uptake described by Eger[11] used the Fick principle in part to explain the uptake of anesthetic agents, but only took the solubility coefficient and the partial pressure across the membrane to explain uptake, but did not include the diffusion coefficient, the area of the membrane or the thickness of the membrane into account. This is again pointed out by Lin[9], who then proposes that the absorption of anaesthetic agents should be represented by 1-(Alveolar fraction/Inspired fraction) and not by the (Alveolar fraction/Inspired fraction) as proposed by Eger[11]. The method of Lin's was used in this thesis to calculate the absorption of anesthetic agents.

Anaesthetic uptake has been traditionally described using high flow techniques during which the inspired concentration is held constant[9]. The relationship between the alveolar (Fa) and inspired (Fi) concentrations over time (Fa/Fi curve) is used to describe the pharmacokinetics. However, several misconceptions exist regarding the meaning of the Fa/Fi curves. The initial portion of the Fa/Fi curves represents mostly washin of the anaesthetic circuit and the functional residual capacity, and patient uptake is probably minimal during the first few minutes of an anaesthetic[12]. In addition, the Fa/Fi curves by themselves do not describe the patient uptake, but uptake is rather represented by the area above the Fa/Fi curves and is the product of Fi, the fraction of uptake (1-Fa/Fi) and the alveolar ventilation[9].

11.2.2.3 No correlation with patient demographics

In a study designed to see whether patient characteristics (age, height, weight, body surface area, and cardiac output estimated by the Brody formula) could predict the uptake of desflurane and isoflurane[12], the authors conclude, "There was a poor correlation between uptake and patient characteristics. Interindividual variability in the uptake is likely not as a

result of patient characteristics." Other studies have reached similar conclusions[14,13]

11.2.2.4 Failure to describe adequately statistical methods

Two articles recently describe the absorption of isoflurane and desflurane during anesthesia[14,15]. A tri-exponential and bi-exponential model were fitted respectively. However, almost no statistical information is given. This forces one to regard these results with caution.

11.2.2.5 Fractal nature of structure and blood flow of organs

Organs are not normally homogeneously perfused[5]. Regional blood flows in the heart are broadly heterogeneous. In both the heart and lung, the spatial variation appears to be fractal. This means that the spatial heterogeneity shows statistical self-similarity. Fractal like anatomy has been described for the arterial and venous trees, the branching of cardiac muscle bundles, the tracheobronchial tree, and the His-Purkinje network[16]. Other organ systems containing fractal like structures including the nervous system, the bowels, the billiary duct system, and the renal calyces[16].

11.2.2.6 Fractal nature of flow limited blood-tissue exchange and the invalidity of the "well stirred" tank model

Bassinghtwaighte et al[5] measured flow-limited washout of a tracer from the heart. The data exhibited a particular combination of power law forms. The interpretation is that both the residue and the outflow curves demonstrate self-similarity, in the sense that for each proportional increase in time, there is a constant proportional diminution in signal. In the field of nonlinear dynamics, this is termed power law behavior. Such behavior is the hallmark of fractals, the self-similarity means that apparent behavior is independent of the time unit considered. The evidence points strongly to the conclusion that the myocardial water washout is a fractal process.

The observed fractal washout may be explicable on the basis that regional flows per gram of tissue have spatial distributions[5].

This study contrasts notably with and clearly refutes, the long held perception that washout is an exponential prosess.[5]

11.2.3 Alternatives to the compartmental model

Compartmental models remain the most popular means of modeling kinetic data in the medical literature at present, but they are not used universally[4]. Non-compartmental models are defined as those models that do not necessarily require the presence of regions that are well mixed. Concentrations of drugs may vary continuously both in space and time within the organism. Continuous concentration gradients will be permitted. Partial differential equations or integral equations may replace the ordinary differential equations of compartmental systems[4].

The power function given by $C = At^{-\alpha}$ is proposed as an alternative. The clearances of both drugs and tracers have been modeled using this function[4]. One area of great theoretical interest involves the area of its application, in that the concept of biological halftime is completely fallacious and may result in gross errors, both actually and conceptually.

The power function may arise from the diffusion process, which constitute a rate-limiting step for removal of certain substances from the circulation (see 11.2.2.2). It has been realized for some time that a power function can be related to the sum or integral of an infinitely large number of exponential functions[4].

11.2.4 The role of statistical tests

When measured data can be curve fitted by a power function requiring only two or three adjustable parameters and gives rise to a smaller sum of squares residuals than required by a curve, for example a triple exponential with six adjustable parameters, the case for the power function would seem overwhelming[4]. It is probably true that statistical tests in

themselves convince us that one model is to be preferred over another, but there are circumstances where no intuitive or geometric criteria really present themselves. One may then seek refuge in purely statistical criteria[4]. One wonders whether functions are decided upon merely because it was assumed that it should be so, when another function would fit the data equally well[17].

11.3 Possible sources of non linearity in the absorption process

11.3.1 Non-heterogeneous blood flow

The standard textbook lists the flows of blood to organs in ml/min or in ml/g/min.[18] No indication of intra-organ variation will be found, and the ranges of values given implicitly reflect with inter-animal or temporal fluctuation. For years, there was a generally held opinion that the variation in apparent regional blood flow was due to unavoidable experimental errors in the methods used. Recently it has been shown that the spatial dispersion of the heterogeneity of blood flow in the heart has a fractal dimension approaching 1.2, and for the lung of approximately 1.1[18]. These values are very similar to the information dimension values calculated for the measured time series of isoflurane and enflurane. The values were 1.12 and 1.29 respectively.

11.3.2 Fractal vascular anatomy

The dichotomously branching and randomly asymmetric variation models of simple bifurcating networks of blood vessels that have been described[18], prove adequate to describe the dependence of the relative dispersion of the flow distribution on the size of the supplied region, even though they give overly simple descriptions of the vascular network. In each case, the form of the microvascular network is linked to an experimentally measurable variable, local blood flow, and its heterogeneity in the normally functioning organ. While this approach has been tried only in the heart and lung, it seems safe to predict that such fractal approaches

will be useful in describing other systems with heterogeneous flow distributions[18].

11.3.3 Dynamic state of the cell membranes in the body

The compartment model of inhalation agent absorption ignored membranes and used solubility coefficients derived from cadaver specimens of organs[6]. This meant that any dynamic from either heterogeneity of blood flow or of the membranes themselves were ignored or never considered. It is now proven that the membranes in the absorption process constitute a barrier to the absorption process[9]. Chaotic models of cell membrane channel kinetics have been proposed in the recent literature[18] and could partly explain variability in cell membrane permeability over time. Other mechanisms cannot be excluded.

11.3.4 Physiological advantages of chaos

Chaotic systems can be controlled more finely and more quickly than linear systems. In linear systems, the response of the output depends linearly on the input. Small changes in a parameter of a linear system produce only small changes in output. Chaotic systems can have bifurcations, and qualitative changes in behavior as a parameter is varied. Thus, small changes in a parameter of a chaotic system can produce very large changes in the output. Hence, a chaotic system is under much finer control. The variable controlling a chaotic physiological response may need to change only a small amount to induce the desired large change in the physiological state. A chaotic physiological system can switch very quickly from one state to another[18].

"Homeostasis," the stability of the "milieu interieure" has been regarded as the modus operandi of physiological systems since the time of Claude Bernard. The principle was that the body is designed so that the concentrations and rates of processes tended toward a stable state, through multiple feedback mechanisms. This was not a passing idea, for it had many affirmations and was firmly positioned in the medical literature. Now

the questions is posed if the term homeostasis should not be replaced by the term homeodynamics, allowing a more flexible view of how the systems work and making room for the concept of systems with complex responses, even to the point of instability[18].

11.4 Why were only two gases used?

11.4.1 Are these results necessarily applicable to other gases used in anaesthesia?

In the anaesthesia literature, inhalation agents are treated as a homogenous group as far as pharmacokinetics are concerned, with two notable exceptions, halothane, and methoxyflurane.[8] The unity of the group originates in the different solubilities of the agents predicting minimum alveolar concentrations at which responses to noxious stimuli are blunted. The two exceptions are made because they are the only two agents that are metabolized to a significant degree in the body, affecting their kinetics. Due to cost and time constraints, two of the most commonly used inhalation agents in South Africa were chosen as examples for this thesis.

11.5 References

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12 Conclusion and Implementation

12.1 Conclusion

The results presented in this thesis meet the four conditions required to accept the hypothesis that the absorption of both isoflurane and enflurane are non linear, with statistical significance ($p<0.05$) acceptable statistical power ($p>0.8$). The four conditions met are: sensitivity to initial conditions, fractal dimension of the attractor, invariant probability distribution of the attractor and detection of an underlying dynamical process.

It is therefore concluded that the absorption of the anaesthetic agents isoflurane and enflurane is non linear.

12.2 Implementation in Anaesthesia practice

12.2.1 Anaesthesia Administration

12.2.1.1 User adjusted inhalation agent concentration

The practice whereby the anaesthesiologist adjusts the concentration of the inhalation agent against the patient's response to stimuli does not require any change, because this process is inherently non-linear.

12.2.1.2 Calculated inhalation agent concentration

The method of pre-calculated injections described by Lowe[1] assumes that the absorption of the inhalation agent is predictable and therefore needs to be adjusted or phased out.

Computer assisted anaesthesia provision where preset concentrations are entered by the user are coming into practice, for example, Dräger's

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"Physioflex." These types of anaesthesia machines can compensate for a nonlinear absorption, provided that a feedback loop is built into the system, allowing adjustment of the inspired concentration based on the expired concentration of inhalation agent.

12.2.2 Anaesthesia Modelling

Prediction is the sine qui non of modelling[2] and studying biological signals is the first step toward this end. Presently prediction of how non-linear systems behave in the real world is only possible for a limited period of time[3]. As further mathematical techniques are developed and the dynamics underlying non-linear processes are further discovered, this goal should be realized. For the moment, it eludes us.

12.2.3 Anaesthesia Pharmacokinetics

Standard textbooks do not mention pharmacokinetic models other than those based on compartments described by single or multiple exponential equations. Non compartmental models, which have kinetics, that are fractal in nature, have been described for tracers[4], ^{15}O-labeled Water,[5] and opiates[4].

If the non-linear nature of inhalation agent absorption is taken into account when simplified models are described, then the search for an ideal model that accurately describes the process will prove to be futile. Maybe the 40 odd years since Severinghaus and the square root of time model have proved this!

12.3 References

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APPENDIX A

Patient Consent Form Example

Protocol Number:

Patient Consent Form
Research Study

I, _____ willingly agree to participate in this study which has been explained to me by Dr JD Steyn. The Department of Anaesthesiology, University of Pretoria, is conducting this research study.

Purpose of the study

It has been explained to me that as part of my treatment during the surgical procedure that I will undergo, certain monitoring procedures will be employed to facilitate my care. The purpose of this study is to investigate the anaesthetic agent absorption by patients.

Description of the procedures

I understand that this is a research study. In order to qualify to enter this study I must meet certain criteria, which are standards used to assure that patients who enter this are medically appropriate candidates for this procedure and that they meet these criteria without exception. This is important for my own wellbeing, as well as to ensure that the results of this study can be used in the future as a basis for striving towards more accurate and safe anaesthesia administration.

Risks and discomforts

Data that is routinely measured by respiratory gas analysis is required for this study. No permanent side effects or any additional risk will be imposed on me by participation in this study.

Benefits

The participants in this study will incur no direct benefits.

Voluntary participation

Participation in this study is voluntary. No compensation for participation will be given. I am free to withdraw my consent in this trial at any time without prejudice to my subsequent care. Refusing to participate will involve no penalty or loss of benefits. I am free to seek care from a physician of my own choice at any time. If I do not take part in or withdraw from the study, I will continue to receive care. In the event that I withdraw from the study no further clinical data will be collected for the purpose of the study.

Confidentiality

A record of the data collected during my surgical procedure will be kept in a confidential from at the Department of Anaesthesiology, University of Pretoria and in a computer file at the residence of Dr JD Steyn. During the trial, the statistician may have insight into the information. However no information by which I can be identified will be published or released.

I have read all the above, had time to ask questions, received answers concerning areas I did not understand and I willingly give my consent to participate in this program. Upon signing this form, I will receive a copy.

Patients signature	Date
Witness 1	Date
Witness 2	Date
Physicians signature	Date

APPENDIX B

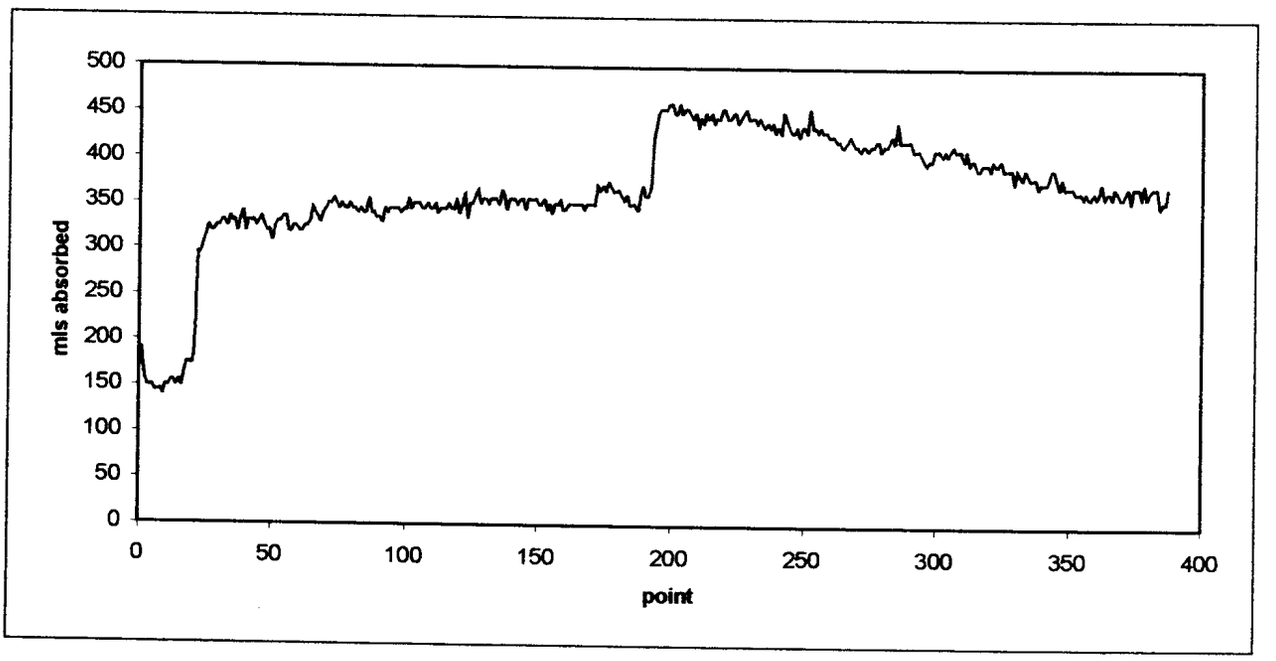
Measured Time Series

Summary Data Sheet of Measured Time Series

File Name	Age	Mass	Sex	n	mean	sd	Tidal volume
Iso-01	63	63	M	495	133.37	118.54	600
Iso-02	65	61	F	254	99.47	66.56	650
Iso-03	56	89	M	912	236.28	76.24	700
Iso-04	77	67	M	1259	175.75	98.59	650
Iso-05	34	78	M	854	147.68	49.79	550
Iso-06	23	50	F	641	140.72	69.53	500
Iso-07	24	45	F	276	127.36	104.09	300
Iso-08	65	43	F	341	183.35	72.06	250
Iso-09	68	41	M	753	54.42	20.38	375
Iso-10	45	70	M	664	113.55`	58.11	450
Enf-01	77	65	F	387	366.49	63.73	500
Enf-02	34	63	F	472	170.2	82.63	385
Enf-03	18	60	m	383	253.02	104.21	385
Enf-04	82	62	M	636	162.45	71.71	400
Enf-05	34	44	M	692	49.55	2.688	300
Enf-06	34	55	M	377	196.54	248.81	350
Enf-07	30	58	F	637	224.7	133.47	450
Enf-08	72	85	M	504	160.71	61.11	600
Enf-09	65	83	F	708	99.27	5.46	550
Enf-10	43	55	F	740	160.69	63.17	450
		Males	11				
		Females	9				
Max	82.00	89.00		1259.00	366.49	248.81	700.00
Min	18.00	41.00		254.00	49.55	2.69	250.00
Mean	50.45	61.85		599.25	165.37	78.54	469.75
Sd	20.64	14.02		244.77	73.02	52.38	129.02
Variation coefficient	40.91%	22.66%		40.85%	44.16%	66.69%	27.47%
Range	64.00	48.00		1005.00	316.94	246.12	450.00
Kurtosis	-1.51	-0.50		1.31	2.18	5.36	-0.94
Skewness	-0.03	0.39		0.86	0.93	1.68	0.13
Mode	34.00	63.00		N/A	N/A	N/A	450.00
Median	50.50	61.50		636.50	160.71	70.62	450.00

Time Series Name: Enf-01

Graphical Representation:



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165.00	330.00	345.00	355.00	355.00	455.00	440.00	415.00	400.00	365.00
150.00	330.00	345.00	340.00	345.00	455.00	435.00	415.00	390.00	365.00
150.00	330.00	340.00	350.00	345.00	460.00	440.00	420.00	390.00	360.00
150.00	325.00	345.00	360.00	350.00	460.00	430.00	420.00	395.00	365.00
145.00	330.00	340.00	335.00	350.00	450.00	435.00	410.00	395.00	360.00
145.00	335.00	340.00	350.00	350.00	450.00	430.00	415.00	395.00	360.00
145.00	325.00	355.00	350.00	350.00	460.00	450.00	415.00	390.00	365.00
140.00	320.00	340.00	360.00	350.00	450.00	445.00	420.00	400.00	360.00
150.00	320.00	340.00	365.00	350.00	455.00	435.00	425.00	395.00	365.00
150.00	310.00	335.00	350.00	345.00	455.00	430.00	420.00	395.00	375.00
155.00	325.00	335.00	355.00	350.00	450.00	430.00	440.00	400.00	360.00
155.00	330.00	330.00	355.00	350.00	445.00	435.00	420.00	390.00	365.00
150.00	330.00	345.00	350.00	350.00	450.00	425.00	420.00	390.00	365.00
155.00	335.00	340.00	355.00	350.00	435.00	435.00	420.00	390.00	360.00
150.00	335.00	345.00	355.00	370.00	445.00	435.00	420.00	390.00	370.00
165.00	320.00	345.00	355.00	365.00	440.00	430.00	420.00	375.00	365.00
175.00	320.00	345.00	350.00	370.00	450.00	455.00	410.00	390.00	360.00
175.00	325.00	345.00	365.00	365.00	445.00	435.00	410.00	385.00	360.00
175.00	325.00	340.00	360.00	375.00	450.00	435.00	410.00	380.00	365.00
205.00	320.00	345.00	345.00	370.00	440.00	430.00	405.00	390.00	370.00
295.00	320.00	345.00	355.00	365.00	445.00	435.00	400.00	385.00	355.00
295.00	325.00	355.00	355.00	365.00	445.00	430.00	395.00	380.00	370.00
305.00	325.00	345.00	355.00	365.00	455.00	430.00	400.00	380.00	370.00
315.00	330.00	350.00	350.00	360.00	455.00	425.00	400.00	380.00	370.00
325.00	345.00	350.00	355.00	355.00	445.00	425.00	410.00	370.00	360.00
320.00	340.00	350.00	355.00	360.00	445.00	425.00	410.00	375.00	375.00
320.00	335.00	345.00	345.00	350.00	450.00	420.00	410.00	375.00	360.00
325.00	330.00	345.00	355.00	350.00	450.00	420.00	405.00	375.00	365.00
325.00	340.00	350.00	355.00	350.00	440.00	415.00	410.00	380.00	370.00
330.00	345.00	345.00	355.00	345.00	445.00	415.00	405.00	390.00	370.00
330.00	350.00	345.00	355.00	360.00	450.00	420.00	410.00	390.00	370.00
325.00	350.00	350.00	350.00	370.00	455.00	425.00	415.00	380.00	350.00
335.00	355.00	340.00	350.00	360.00	445.00	420.00	410.00	370.00	355.00
330.00	350.00	345.00	355.00	360.00	445.00	415.00	410.00	380.00	355.00
330.00	345.00	345.00	345.00	370.00	445.00	415.00	410.00	370.00	370.00
320.00	350.00	345.00	350.00	420.00	440.00	410.00	400.00	370.00	
335.00	345.00	350.00	340.00	435.00	445.00	415.00	410.00	370.00	
340.00	345.00	345.00	350.00	450.00	440.00	415.00	395.00	370.00	

Time Series Name: Enf-02

Inhalation Agent used: Enflurane

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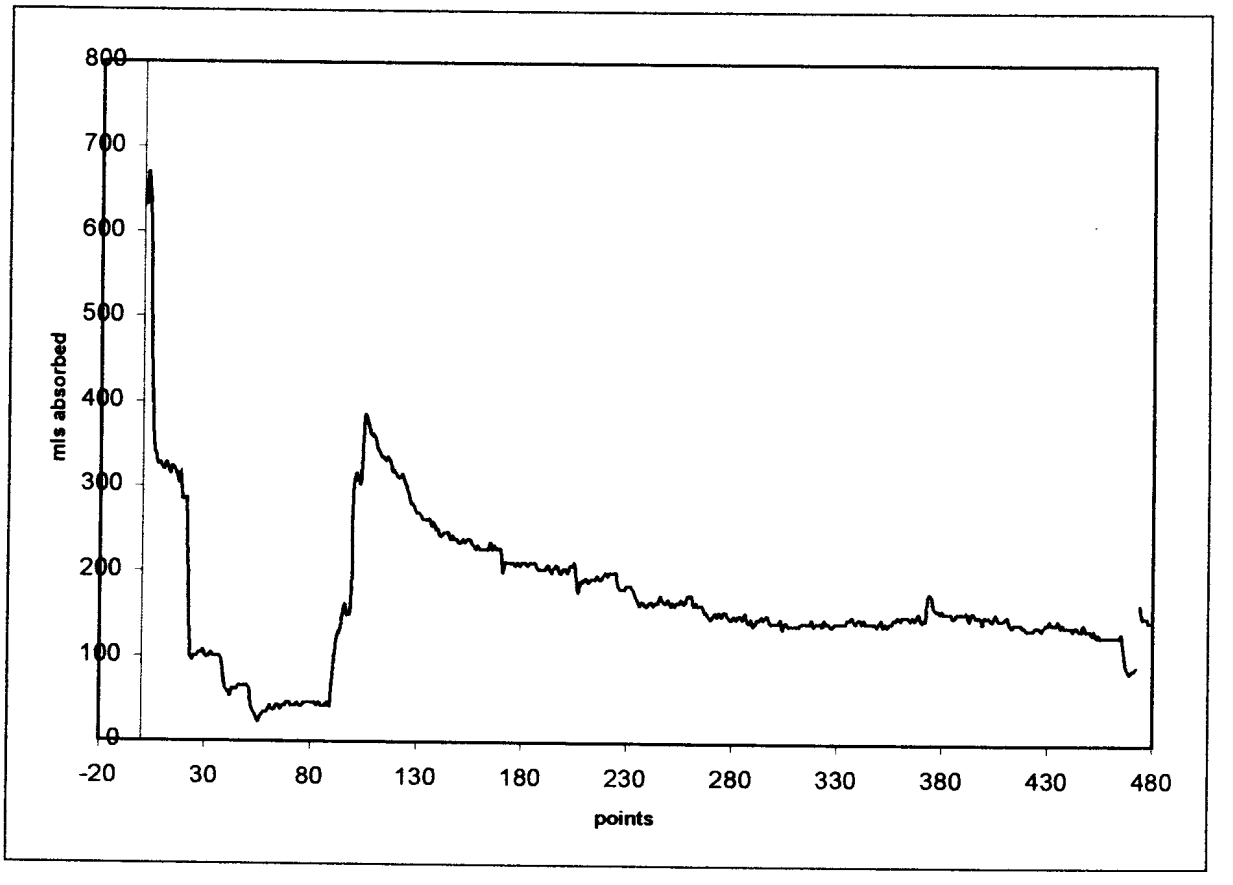

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608.3	42.35	319.55	207.9	169.4	146.3	146.3	146.3	92.4	330.00
465.85	38.5	315.7	211.75	161.7	150.15	138.6	150.15	88.55	335.00
350.35	38.5	311.85	207.9	165.55	146.3	142.45	150.15	84.7	335.00
338.8	42.35	311.85	211.75	165.55	150.15	138.6	142.45	88.55	320.00
327.25	42.35	315.7	211.75	161.7	150.15	142.45	138.6	88.55	320.00
327.25	38.5	308	211.75	161.7	142.45	142.45	142.45	92.4	325.00
323.4	42.35	300.3	207.9	165.55	142.45	146.3	142.45		325.00
319.55	42.35	292.6	211.75	165.55	142.45	146.3	142.45	165.00	320.00
327.25	46.2	281.05	211.75	161.7	142.45	150.15	142.45	150.00	320.00
323.4	46.2	281.05	211.75	165.55	142.45	146.3	138.6	150.00	325.00
315.7	42.35	273.35	207.9	165.55	146.3	150.15	138.6	150.00	325.00
323.4	42.35	269.5	204.05	173.25	134.75	150.15	134.75	145.00	330.00
319.55	42.35	269.5	204.05	169.4	142.45	150.15	134.75	145.00	345.00
315.7	46.2	265.65	204.05	165.55	142.45	150.15	134.75	145.00	340.00
304.15	42.35	261.8	204.05	165.55	138.6	146.3	134.75	140.00	335.00
315.7	42.35	261.8	207.9	169.4	138.6	150.15	138.6	150.00	330.00
284.9	46.2	261.8	207.9	161.7	138.6	146.3	138.6	150.00	340.00
284.9	46.2	261.8	200.2	165.55	138.6	150.15	138.6	155.00	345.00
284.9	46.2	254.1	204.05	161.7	138.6	154	134.75	155.00	350.00
150.15	46.2	257.95	207.9	165.55	138.6	146.3	138.6	150.00	350.00
100.1	46.2	250.25	207.9	165.55	142.45	146.3	142.45	155.00	355.00
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107.8	42.35	246.4	207.9	173.25	138.6	157.85	146.3	205.00	350.00
100.1	46.2	238.7	207.9	161.7	142.45	157.85	138.6	295.00	345.00
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100.1	127.05	234.85	188.65	154	142.45	154	138.6	320.00	340.00
100.1	134.75	238.7	192.5	154	142.45	154	134.75	320.00	355.00
100.1	150.15	234.85	192.5	150.15	138.6	150.15	138.6	325.00	340.00
96.25	161.7	238.7	188.65	146.3	138.6	150.15	138.6	325.00	340.00
69.3	150.15	238.7	192.5	150.15	142.45	154	134.75	330.00	335.00
61.6	150.15	234.85	192.5	154	142.45	154	134.75	330.00	335.00
57.75	173.25	231	192.5	150.15	142.45	154	142.45	325.00	330.00
53.9	296.45	227.15	196.35	154	142.45	154	134.75	335.00	345.00
61.6	315.7	231	192.5	150.15	142.45	154	134.75	330.00	340.00
61.6	311.85	227.15	192.5	154	142.45	154	134.75	330.00	345.00
61.6	304.15	227.15	196.35	154	146.3	146.3	130.9	320.00	345.00
65.45	331.1	227.15	200.2	150.15	146.3	154	134.75	335.00	345.00
65.45	385	227.15	196.35	146.3	150.15	154	127.05	340.00	345.00
65.45	381.15	227.15	200.2	146.3	146.3	150.15	130.9	320.00	340.00
65.45	373.45	234.85	200.2	150.15	142.45	150.15	127.05	330.00	345.00
65.45	361.9	227.15	200.2	146.3	146.3	150.15	127.05	330.00	345.00
61.6	361.9	231	200.2	150.15	146.3	142.45	127.05	330.00	355.00
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34.65	346.5	227.15	180.95	146.3	146.3	150.15	127.05	330.00	350.00
30.8	342.65	227.15	180.95	154	142.45	150.15	127.05	335.00	350.00
23.1	334.95	200.2	180.95	146.3	142.45	146.3	127.05	325.00	350.00
26.95	334.95	211.75	184.8	142.45	142.45	146.3	127.05	320.00	345.00
30.8	331.1	211.75	184.8	146.3	142.45	154	127.05	320.00	345.00
34.65	334.95	211.75	184.8	138.6	142.45	150.15	127.05	310.00	350.00

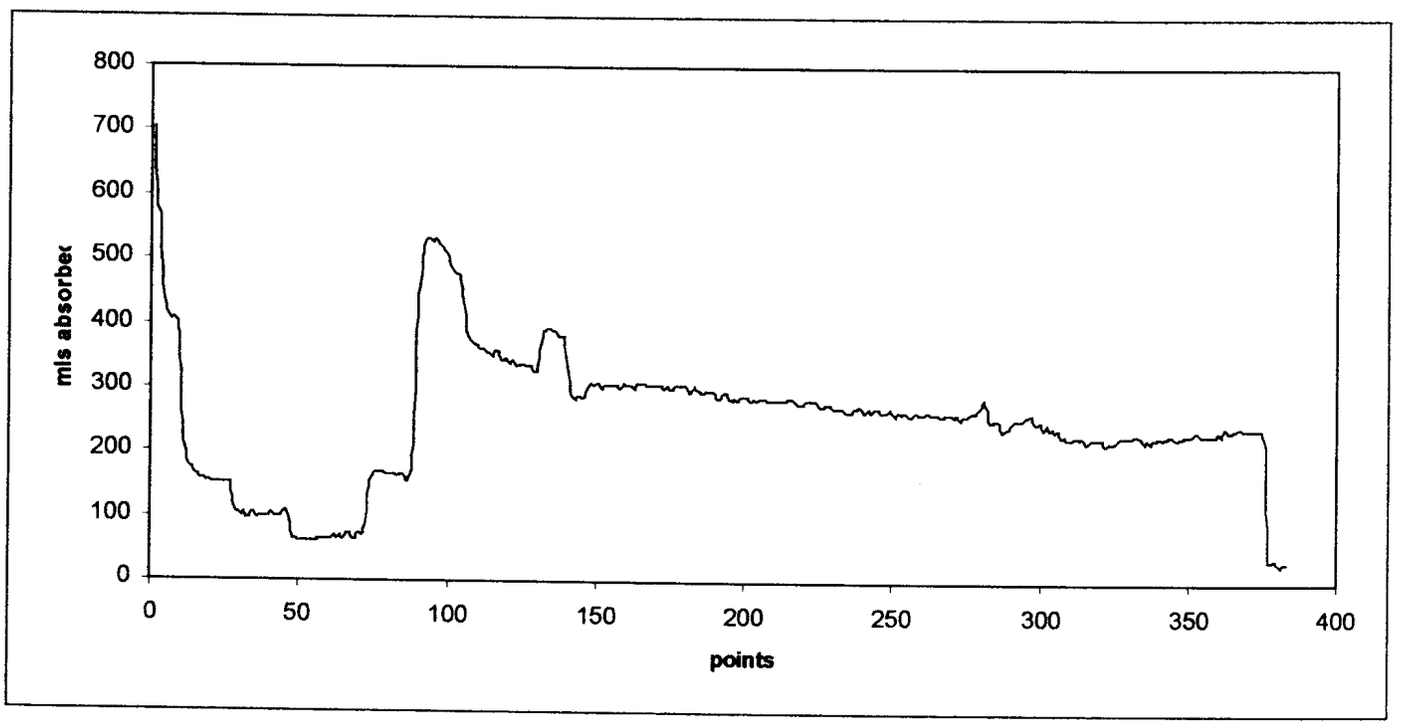
Measured Time Series

345.00	360.00	350.00	420.00	445.00	435.00	420.00	410.00	390.00	365.00
345.00	345.00	350.00	435.00	445.00	435.00	420.00	415.00	385.00	375.00
350.00	355.00	345.00	450.00	450.00	430.00	410.00	410.00	380.00	360.00
340.00	355.00	350.00	455.00	450.00	455.00	415.00	410.00	380.00	365.00
345.00	355.00	350.00	455.00	440.00	435.00	415.00	410.00	380.00	365.00
345.00	350.00	350.00	455.00	445.00	435.00	420.00	400.00	370.00	360.00
345.00	355.00	350.00	460.00	450.00	430.00	425.00	410.00	375.00	370.00
350.00	355.00	370.00	460.00	455.00	435.00	420.00	395.00	375.00	365.00
345.00	345.00	365.00	450.00	445.00	430.00	440.00	400.00	375.00	360.00
345.00	355.00	370.00	450.00	445.00	430.00	420.00	400.00	380.00	360.00
355.00	355.00	365.00	460.00	445.00	425.00	420.00	390.00	390.00	365.00
340.00	355.00	375.00	450.00	440.00	425.00	420.00	390.00	390.00	370.00
350.00	355.00	370.00	455.00	445.00	425.00	420.00	395.00	380.00	355.00
360.00	350.00	365.00	455.00	440.00	420.00	420.00	395.00	370.00	370.00
335.00	350.00	365.00	450.00	435.00	420.00	410.00	395.00	380.00	370.00
350.00	355.00	365.00	445.00	440.00	415.00	410.00	390.00	370.00	370.00
350.00	345.00	360.00	450.00	435.00	415.00	410.00	400.00	370.00	360.00
360.00	350.00	355.00	435.00	440.00	420.00	405.00	395.00	370.00	375.00
365.00	340.00	360.00	445.00	430.00	425.00	400.00	395.00	370.00	360.00
350.00	350.00	350.00	440.00	435.00	420.00	395.00	400.00	365.00	365.00
355.00	350.00	350.00	450.00	430.00	415.00	400.00	390.00	365.00	370.00
355.00	355.00	350.00	445.00	450.00	415.00	400.00	390.00	365.00	370.00
350.00	345.00	345.00	450.00	445.00	410.00	410.00	390.00	360.00	370.00
355.00	345.00	360.00	440.00	435.00	415.00	410.00	390.00	365.00	350.00
355.00	350.00	370.00	445.00	430.00	415.00	410.00	375.00	360.00	355.00
355.00	350.00	360.00	445.00	430.00	410.00	405.00	390.00	360.00	355.00
350.00	350.00	360.00	455.00	435.00	415.00	410.00	385.00	365.00	370.00
365.00	350.00	370.00	455.00	425.00	415.00	405.00	380.00	360.00	

Time Series Name: Enf-03

Inhalation Agent used: Enflurane

Graphical Representation:



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585.2	61.6	373.45	304.15	281.05	257.95	223.3	238.7
562.1	61.6	369.6	304.15	284.9	261.8	223.3	238.7
458.15	65.45	365.75	300.3	284.9	261.8	215.6	238.7
423.5	65.45	361.9	308	281.05	261.8	219.45	200.2
411.95	65.45	361.9	308	277.2	257.95	219.45	34.65
404.25	65.45	354.2	308	277.2	261.8	219.45	34.65
408.1	65.45	354.2	304.15	277.2	254.1	223.3	38.5
400.4	69.3	350.35	304.15	281.05	257.95	227.15	30.8
369.6	65.45	358.05	304.15	281.05	257.95	227.15	26.95
227.15	69.3	358.05	304.15	281.05	261.8	227.15	30.8
192.5	65.45	342.65	304.15	281.05	265.65	227.15	30.8
177.1	73.15	342.65	304.15	273.35	265.65	227.15	
173.25	73.15	346.5	300.3	273.35	269.5	231	
165.55	65.45	338.8	304.15	273.35	277.2	231	
161.7	65.45	342.65	300.3	277.2	284.9	227.15	
157.85	73.15	334.95	300.3	277.2	265.65	219.45	
157.85	69.3	334.95	304.15	269.5	250.25	223.3	
154	73.15	338.8	304.15	269.5	250.25	219.45	
154	107.8	334.95	304.15	269.5	254.1	223.3	
150.15	154	334.95	304.15	269.5	250.25	223.3	
150.15	161.7	334.95	296.45	265.65	234.85	227.15	
150.15	169.4	327.25	292.6	265.65	238.7	223.3	
150.15	169.4	327.25	304.15	265.65	242.55	227.15	
150.15	169.4	346.5	300.3	269.5	246.4	227.15	
150.15	165.55	388.85	296.45	269.5	254.1	231	
150.15	165.55	388.85	292.6	273.35	254.1	227.15	
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103.95	165.55	388.85	296.45	265.65	254.1	227.15	
103.95	161.7	388.85	296.45	269.5	257.95	227.15	
100.1	161.7	381.15	292.6	265.65	257.95	231	
103.95	165.55	381.15	284.9	269.5	261.8	231	
96.25	157.85	381.15	288.75	269.5	250.25	231	
103.95	154	350.35	292.6	265.65	246.4	234.85	
103.95	180.95	311.85	292.6	265.65	250.25	234.85	
96.25	331.1	288.75	284.9	265.65	238.7	231	
100.1	427.35	281.05	281.05	269.5	246.4	231	
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100.1	531.3	288.75	288.75	265.65	234.85	231	
103.95	531.3	300.3	288.75	261.8	238.7	231	
100.1	527.45	308	288.75	265.65	227.15	234.85	
100.1	531.3	304.15	281.05	261.8	231	231	
100.1	523.6	308	284.9	257.95	223.3	242.55	
107.8	519.75	308	281.05	261.8	223.3	238.7	
107.8	512.05	300.3	284.9	265.65	223.3	234.85	
88.55	504.35	304.15	284.9	261.8	227.15	238.7	
65.45	488.95	304.15	284.9	261.8	223.3	238.7	
65.45	481.25	304.15	281.05	261.8	227.15	242.55	
61.6	477.4	304.15	281.05	265.65	219.45	238.7	
61.6	473.55	304.15	281.05	261.8	219.45	238.7	
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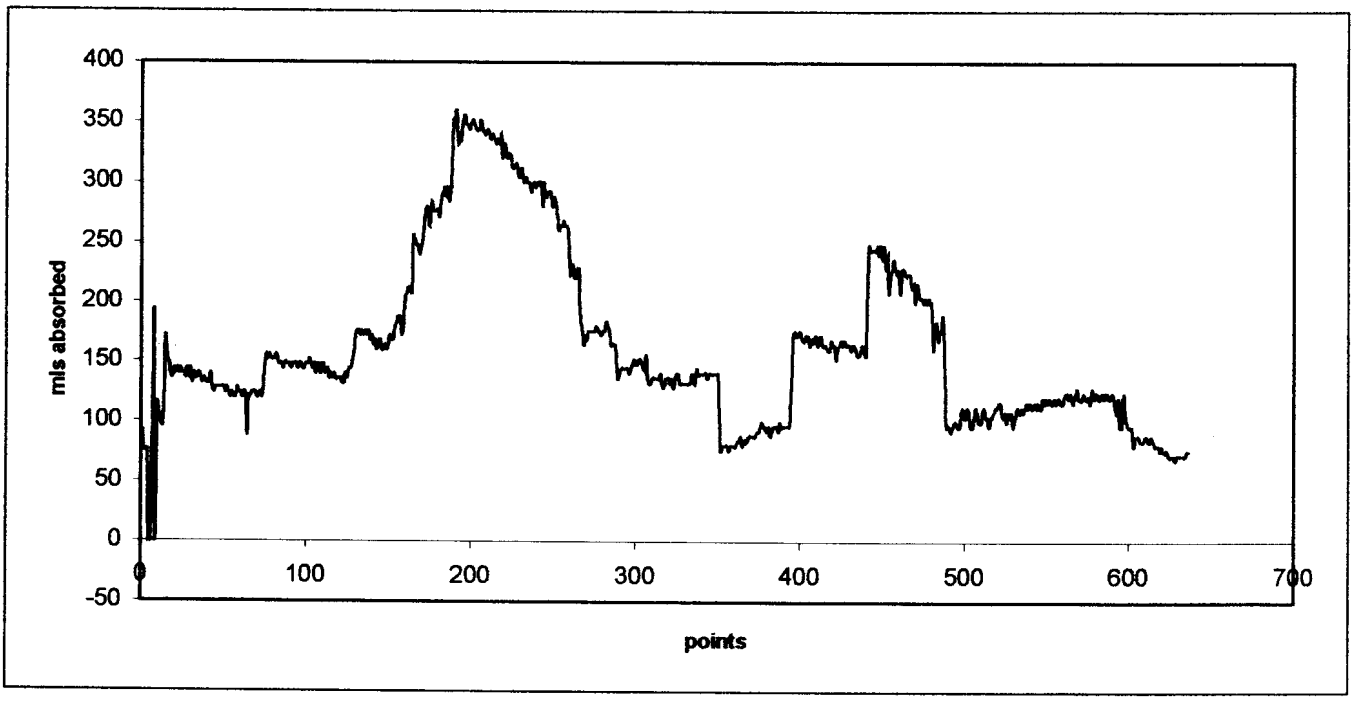
Time Series Name: Enf-04

Inhalation Agent used: Enflurane

Graphical Representation:



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148	120	132	284	304	184	136	100	220
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144	148	148	272	300	164	140	96	244
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144	152	172	292	292	136	140	128	240
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136	144	168	332	288	148	108	172	236
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132	148	160	356	280	152	80	168	208
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132	148	160	348	260	156	80	168	224
140	144	164	352	264	140	80	172	224
128	148	160	348	264	132	80	164	224
124	148	164	344	268	132	84	164	212
128	144	172	344	264	136	84	164	216
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128	148	180	344	224	136	84	168	208
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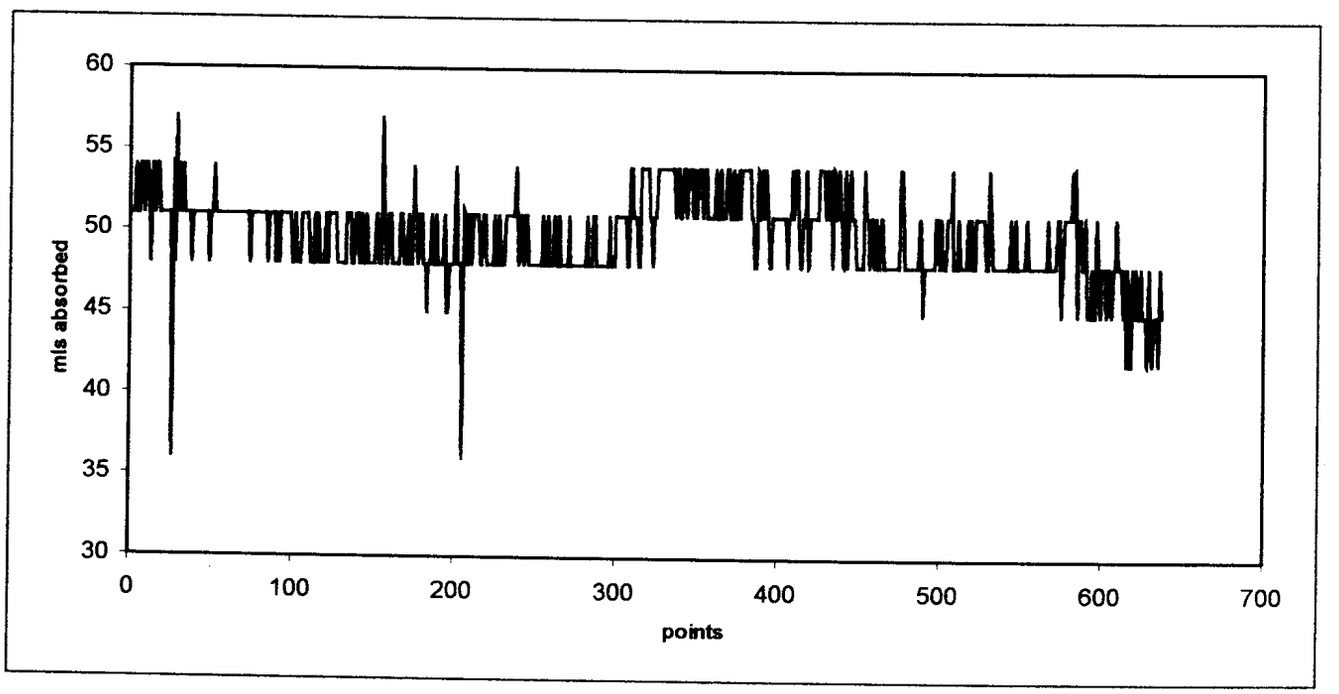
Time Series Name: Enf-05

Inhalation Agent used: Enflurane

Graphical Representation:



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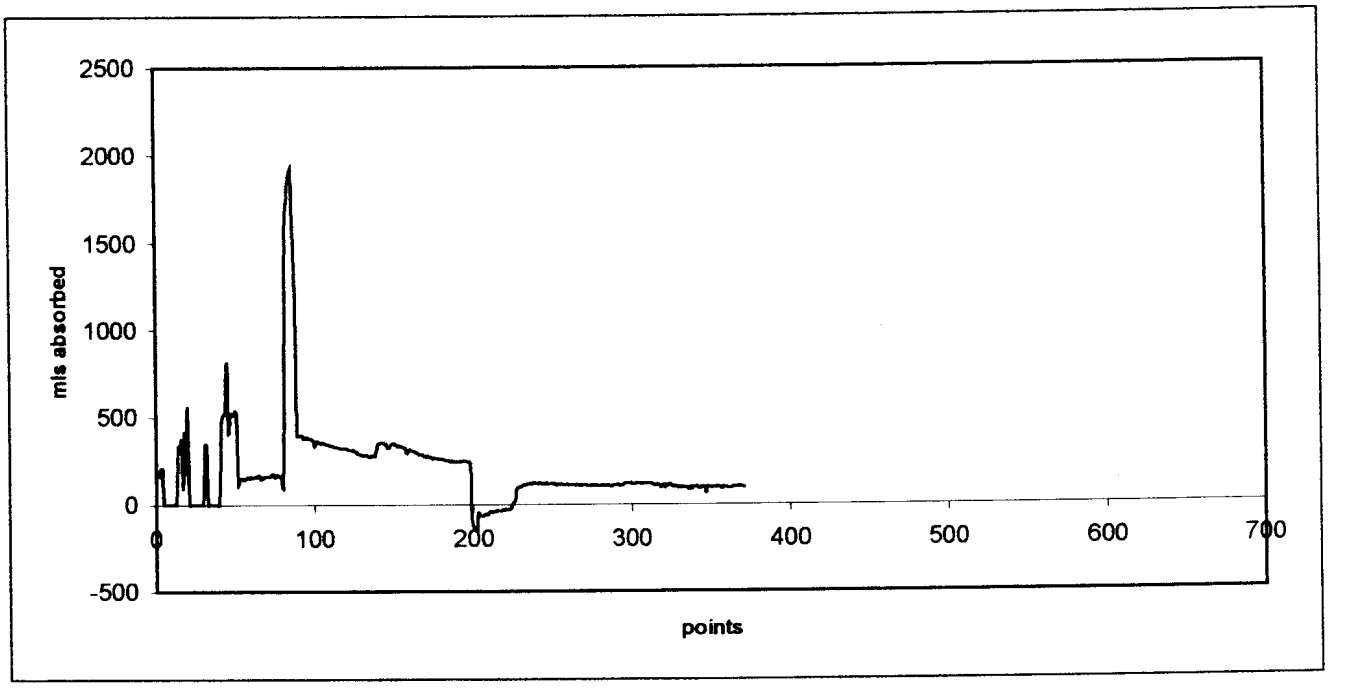
Time Series Name: Enf-06

Inhalation Agent used: Enflurane

Graphical Representation:



164.5	150.5	346.5	311.5	-42	108.5	98
164.5	147	343	308	-42	108.5	108.5
206.5	143.5	339.5	304.5	-35	105	91
206.5	154	336	301	-35	108.5	108.5
0	157.5	336	294	-35	108.5	105
0	150.5	332.5	290.5	-35	108.5	112
0	157.5	329	283.5	-31.5	105	101.5
0	154	329	283.5	-31.5	105	101.5
0	157.5	325.5	283.5	-28	105	98
0	157.5	322	273	-28	108.5	101.5
0	161	322	273	-28	105	94.5
0	168	322	276.5	-10.5	108.5	98
0	147	322	269.5	7	105	94.5
322	157.5	318.5	269.5	21	105	98
322	154	315	262.5	77	105	94.5
374.5	161	311.5	266	94.5	105	94.5
91	161	311.5	262.5	98	108.5	94.5
416.5	161	311.5	262.5	101.5	105	84
175	161	304.5	259	108.5	105	98
556.5	171.5	301	259	108.5	108.5	87.5
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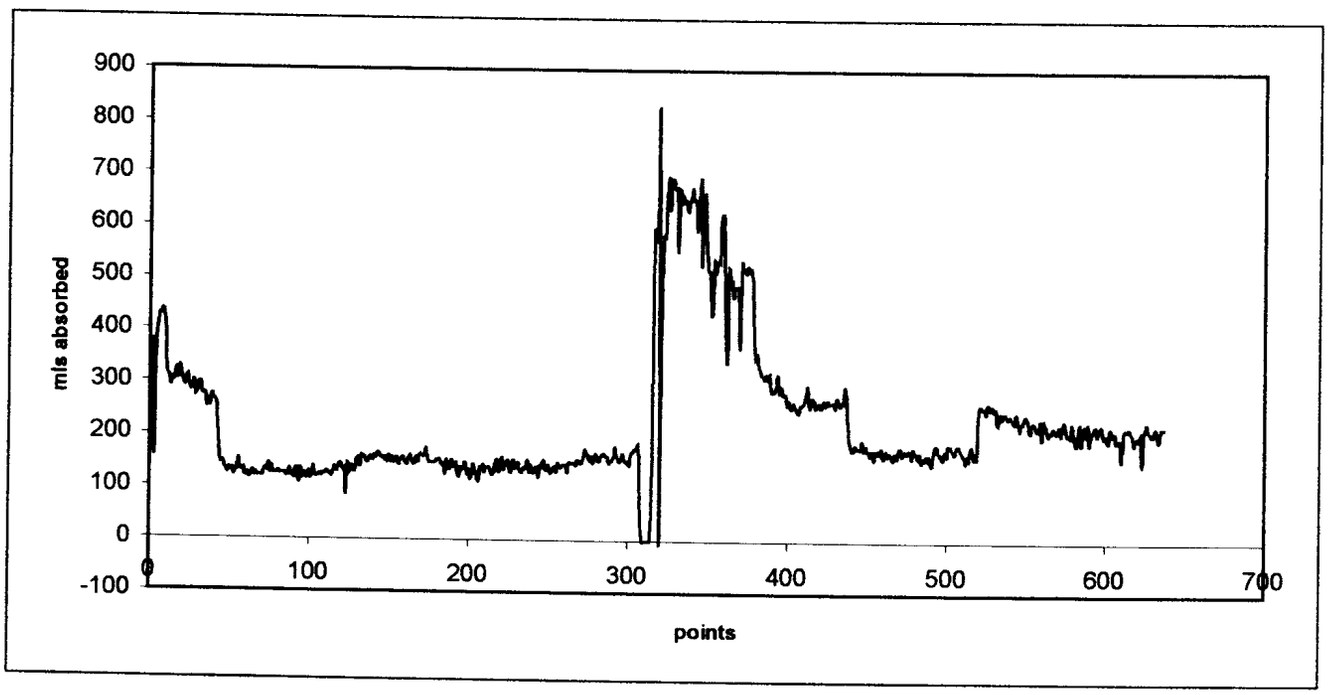
0	168	283.5	252	119	105	98
0	168	280	252	115.5	108.5	94.5
0	161	280	248.5	119	108.5	87.5
0	164.5	280	245	122.5	112	94.5
0	101.5	280	248.5	119	108.5	98
0	829.5	273	241.5	119	105	94.5
0	1571.5	273	241.5	115.5	108.5	63
0	1743	280	241.5	119	115.5	98
343	1844.5	276.5	245	115.5	119	98
343	1893.5	276.5	245	119	119	94.5
0	1925	315	245	115.5	119	94.5
0	1463	346.5	248.5	122.5	119	98
0	1151.5	350	248.5	115.5	115.5	94.5
0	395.5	353.5	245	115.5	112	98
0	395.5	353.5	241.5	115.5	115.5	98
0	395.5	346.5	241.5	115.5	119	94.5
0	395.5	346.5	231	115.5	115.5	87.5
0	378	322	-87.5	108.5	115.5	98
441	385	325.5	-129.5	112	115.5	98
504	385	343	-147	112	115.5	94.5
514.5	378	350	-147	115.5	115.5	91
560	378	346.5	-49	112	115.5	91
815.5	374.5	343	-63	108.5	115.5	91
420	364	332.5	-66.5	108.5	115.5	98
514.5	332.5	336	-66.5	112	115.5	98
518	360.5	332.5	-59.5	108.5	112	98
511	360.5	329	-59.5	108.5	108.5	98
535.5	353.5	325.5	-56	108.5	105	101.5
500.5	350	322	-45.5	108.5	108.5	98
115.5	353.5	290.5	-42	108.5	108.5	98
147	350	311.5	-45.5	112	94.5	94.5

Time Series Name: Enf-07

Inhalation Agent used: Enflurane

Graphical Representation:



378	130.5	126	148.5	139.5	148.5	814.5	517.5	270
378	130.5	121.5	144	126	144	0	522	265.5
157.5	153	126	153	126	153	387	513	265.5
355.5	135	126	162	130.5	153	580.5	526.5	265.5
405	130.5	130.5	153	148.5	148.5	580.5	517.5	265.5
427.5	135	126	148.5	153	148.5	661.5	522	256.5
427.5	121.5	126	144	130.5	162	697.5	499.5	274.5
436.5	121.5	121.5	157.5	144	175.5	634.5	391.5	270
432	126	130.5	148.5	157.5	166.5	693	351	261
409.5	117	139.5	162	135	166.5	693	360	265.5
319.5	126	130.5	162	148.5	153	675	337.5	265.5
310.5	130.5	135	162	144	162	675	328.5	297
292.5	121.5	144	162	153	148.5	553.5	319.5	279
306	126	144	175.5	130.5	162	670.5	315	220.5
301.5	121.5	135	162	130.5	166.5	648	310.5	189
310.5	121.5	135	148.5	153	153	661.5	319.5	180
324	121.5	85.5	148.5	139.5	153	648	310.5	175.5
306	121.5	144	148.5	139.5	162	652.5	319.5	184.5
328.5	130.5	126	148.5	148.5	166.5	630	288	180
315	135	139.5	148.5	135	166.5	643.5	288	180
301.5	130.5	139.5	153	130.5	162	657	288	180
292.5	144	130.5	153	135	162	675	297	180
306	126	135	153	139.5	148.5	652.5	319.5	193.5
310.5	139.5	153	144	139.5	153	652.5	288	175.5
288	126	148.5	144	153	153	594	297	184.5
283.5	126	139.5	126	130.5	162	648	283.5	175.5
292.5	126	162	153	144	180	688.5	283.5	175.5
301.5	130.5	157.5	139.5	130.5	162	526.5	283.5	166.5
274.5	126	157.5	135	130.5	153	634.5	261	175.5
283.5	126	148.5	153	139.5	153	666	270	157.5
297	126	148.5	144	139.5	162	558	256.5	175.5
297	126	157.5	139.5	121.5	166.5	517.5	256.5	171
279	121.5	157.5	148.5	144	153	517.5	265.5	175.5
274.5	121.5	153	126	139.5	148.5	432	256.5	171
274.5	135	162	121.5	153	153	436.5	252	180
252	121.5	157.5	139.5	135	144	535.5	247.5	162
265.5	126	166.5	135	139.5	166.5	513	261	166.5
252	117	162	139.5	144	171	535.5	261	175.5
274.5	135	157.5	148.5	130.5	175.5	535.5	265.5	166.5
265.5	135	157.5	126	130.5	175.5	612	270	171
265.5	108	153	135	139.5	184.5	625.5	288	166.5
256.5	135	157.5	117	139.5	153	625.5	297	157.5
216	117	148.5	135	130.5	36	409.5	256.5	171
157.5	126	162	144	148.5	0	342	274.5	166.5
144	121.5	148.5	130.5	144	0	522	270	162
148.5	117	157.5	126	139.5	0	499.5	270	180
135	130.5	148.5	112.5	144	0	499.5	256.5	180
135	117	153	139.5	144	0	468	261	166.5
126	121.5	157.5	135	144	0	486	265.5	171
135	139.5	144	144	130.5	58.5	486	256.5	175.5
130.5	121.5	153	130.5	148.5	598.5	486	261	171
135	121.5	153	139.5	148.5	589.5	369	270	175.5
121.5	121.5	157.5	139.5	148.5	576	535.5	261	175.5

162	229.5	211.5
180	234	225
171	247.5	207
171	238.5	229.5
162	243	189
171	247.5	207
153	243	216
162	238.5	220.5
157.5	243	225
166.5	238.5	207
157.5	234	216
166.5	229.5	225
148.5	247.5	216
148.5	234	202.5
175.5	216	207
184.5	229.5	198
184.5	229.5	193.5
171	238.5	220.5
171	243	207
162	234	207
162	216	211.5
175.5	211.5	193.5
166.5	229.5	198
184.5	229.5	198
184.5	225	157.5
184.5	216	189
175.5	216	216
171	234	216
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184.5	234	220.5
184.5	229.5	211.5
175.5	216	207
171	207	189
166.5	211.5	198
153	211.5	202.5
166.5	220.5	198
157.5	220.5	207
175.5	211.5	148.5
184.5	216	198
162	225	220.5
162	207	229.5
162	216	216
238.5	234	211.5
261	216	207
261	207	207
256.5	207	216
256.5	202.5	220.5
247.5	229.5	198
265.5	207	198
256.5	193.5	220.5
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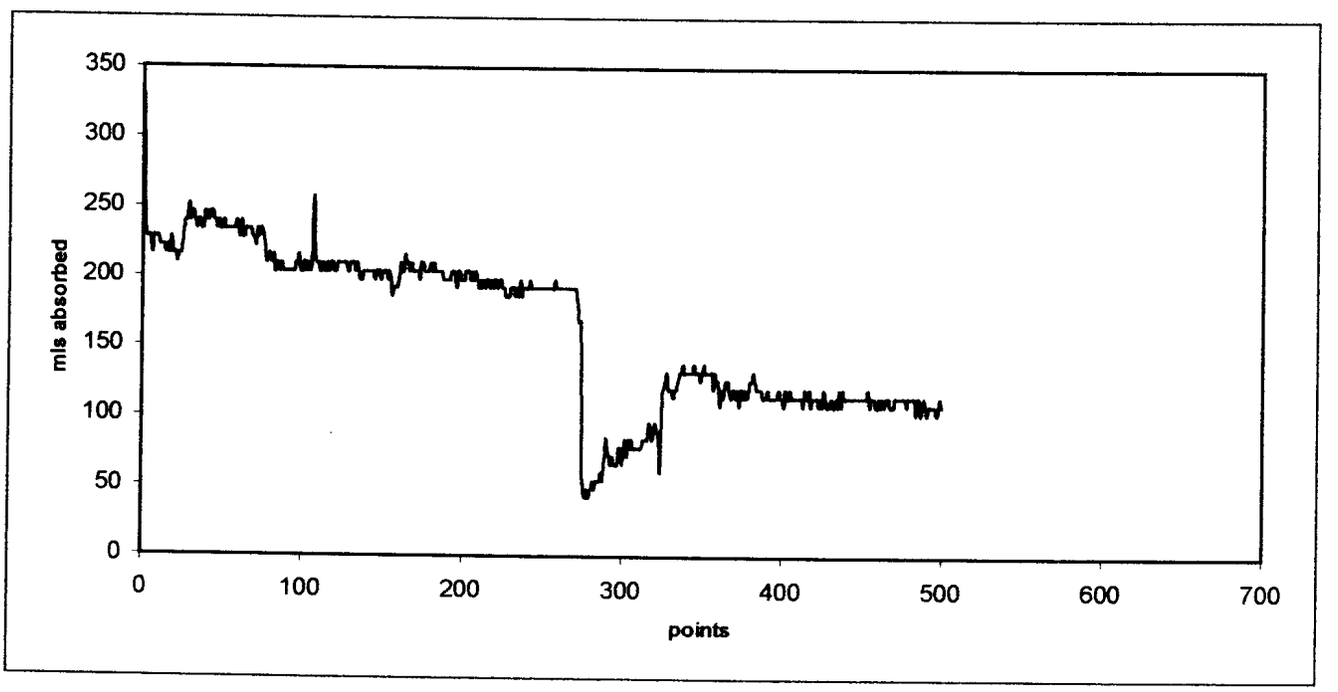
Time Series Name: Enf-08

Inhalation Agent used: Enflurane

Graphical Representation:



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228	234	210	204	198	192	96	120	114
228	234	210	204	198	192	90	120	108
228	234	204	216	192	192	84	114	108
216	240	204	210	198	192		120	108
228	234	210	210	192	180	60	114	114
228	228	204	204	198	168	114	120	108
228	240	204	210	198	168	120	126	108
228	228	210	204	192	60	126	126	114
222	228	204	204	198	48	132	132	108
222	234	210	204	198	42	120	126	120
222	234	210	204	192	48	120	120	108
222	234	204	198	192	42	120	120	120
216	234	204	210	186	48	114	120	114
222	228	210	210	186	48	120	120	114
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216	234	210	204	192	54	132	114	114
216	228	210	204	192	54	132	120	114
216	234	210	210	186	54	138	114	114
210	234	204	204	192	60	132	114	114
216	228	204	210	186	54	132	114	114
216	216	210	204	198	66	132	114	114
222	210	210	204	186	84	132	114	114
234	216	210	204	192	78	132	114	114
240	216	204	204	192	72	132	120	114
240	210	210	204	192	66	138	114	114
252	216	204	198	192	72	132	114	114
240	204	198	198	198	66	132	108	120
246	204	198	198	192	66	132	120	108
246	210	204	198	192	66	126	114	114
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246	204	198	204	192	84	132	114	114
240	204	204	198	192	78	120	114	108
246	204	204	198	192	84	132	114	114
240	204	204	198	192	78	126	108	114
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246	210	204	204	192	78	108	114	108
240	216	204	204	192	78	120	114	108
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240	210	204	198	192	84	126	114	114
234	210	198	204	192	84	126	114	114
234	204	186	198	192	84	120	114	114
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234	204	192	198	192	96	120	108	114
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108
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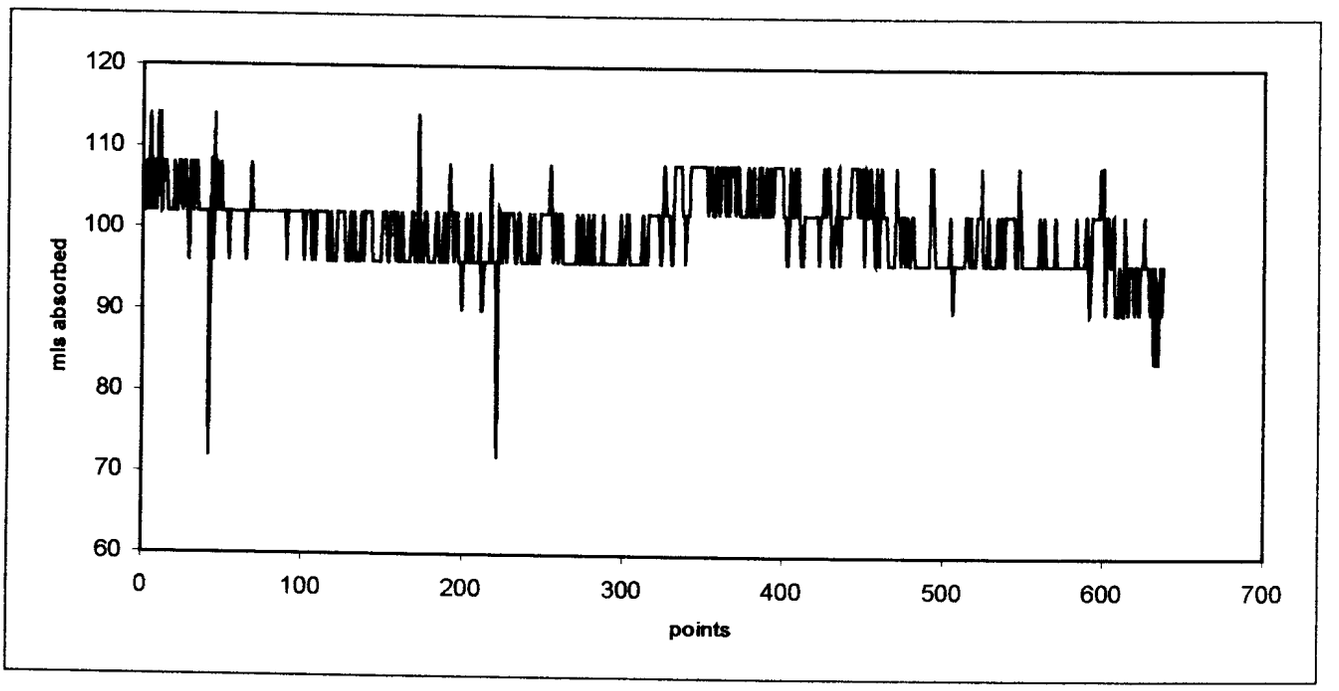
108

Time Series Name: Enf-09

Inhalation Agent used: Enflurane

Graphical Representation:



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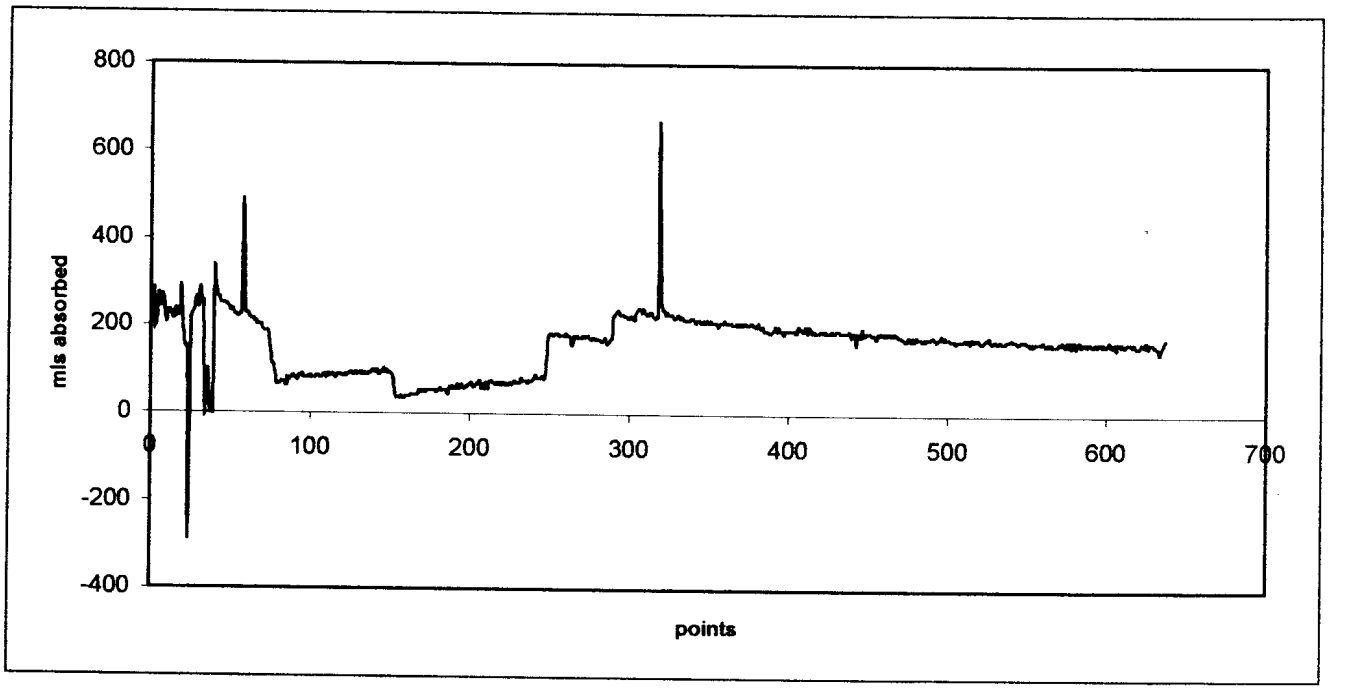
Time Series Name: Enf-10

Inhalation Agent used: Enflurane

Graphical Representation:



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283.5	220.5	85.5	40.5	72	180	270	211.5	189
198	225	90	40.5	72	175.5	243	207	193.5
207	225	81	45	67.5	175.5	238.5	207	189
274.5	490.5	90	45	72	175.5	229.5	207	189
243	234	90	45	72	180	234	211.5	193.5
270	229.5	85.5	45	67.5	175.5	229.5	207	193.5
261	229.5	90	45	72	180	229.5	202.5	189
238.5	220.5	85.5	54	67.5	180	229.5	202.5	189
207	216	81	49.5	72	175.5	220.5	211.5	189
229.5	216	90	49.5	67.5	171	220.5	202.5	189
234	211.5	90	54	67.5	175.5	225	198	189
225	211.5	90	49.5	72	175.5	229.5	202.5	189
216	202.5	85.5	54	67.5	171	220.5	193.5	193.5
216	202.5	90	54	72	171	225	193.5	180
238.5	202.5	85.5	54	76.5	171	220.5	193.5	189
220.5	193.5	90	54	72	166.5	216	189	189
229.5	189	90	54	72	166.5	216	189	162
292.5	189	94.5	54	72	171	216	193.5	189
202.5	189	94.5	49.5	81	175.5	216	198	184.5
175.5	184.5	90	54	76.5	162	220.5	202.5	180
148.5	148.5	94.5	58.5	76.5	166.5	220.5	193.5	198
148.5	112.5	94.5	54	76.5	171	216	202.5	184.5
-288	112.5	90	54	72	175.5	211.5	193.5	184.5
211.5	90	94.5	54	76.5	225	216	193.5	189
225	67.5	94.5	54	76.5	229.5	216	184.5	189
234	67.5	90	45	76.5	234	211.5	193.5	189
252	67.5	94.5	63	81	238.5	211.5	193.5	184.5
265.5	72	90	58.5	90	229.5	216	193.5	184.5
243	72	90	63	81	229.5	211.5	193.5	180
288	72	94.5	58.5	81	229.5	216	193.5	175.5
256.5	63	94.5	58.5	81	225	211.5	193.5	189
256.5	81	99	67.5	85.5	225	216	193.5	184.5
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99	81	94.5	63	81	220.5	211.5	202.5	189
99	85.5	99	67.5	130.5	225	211.5	198	184.5
0	81	90	58.5	175.5	225	211.5	198	189
0	81	94.5	63	184.5	216	202.5	193.5	184.5
0	76.5	94.5	63	184.5	229.5	211.5	198	189
333	85.5	103.5	67.5	180	238.5	211.5	202.5	184.5
288	85.5	94.5	67.5	184.5	243	211.5	189	184.5
265.5	90	99	72	184.5	243	216	202.5	189
265.5	81	94.5	63	184.5	234	211.5	198	184.5
252	81	94.5	63	180	243	211.5	189	184.5
252	81	90	67.5	180	234	211.5	193.5	180
252	81	81	72	180	229.5	211.5	189	180
247.5	85.5	45	76.5	180	229.5	207	189	175.5
247.5	81	36	58.5	184.5	234	207	189	175.5
243	81	36	67.5	180	234	207	193.5	171
234	81	36	58.5	180	225	211.5	193.5	171
238.5	85.5	40.5	72	175.5	220.5	207	189	180
229.5	85.5	36	58.5	157.5	225	211.5	193.5	175.5
225	81	36	72	180	225	207	189	171

180	166.5	166.5	180	175.5
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175.5	171	166.5	184.5	175.5
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175.5	171	171	175.5	175.5
175.5	171	162	180	171
184.5	166.5	162	175.5	166.5
175.5	166.5	166.5	175.5	166.5
180	162	153	180	175.5
175.5	166.5	166.5	180	171
175.5	162	166.5	180	180
175.5	166.5	162	175.5	162
171	166.5	166.5	175.5	175.5
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166.5	162	166.5	175.5	166.5
175.5	162	166.5	175.5	162
175.5	166.5	162	180	162
171	166.5	171	175.5	171
175.5	171	157.5	175.5	126
175.5	166.5	166.5	175.5	85.5
171	162	166.5	175.5	72
166.5	171	166.5	175.5	72
166.5	162	162	175.5	72
171	171	162	175.5	72
175.5	157.5	157.5	175.5	72
175.5	171	144	175.5	
180	166.5	148.5	175.5	
171	157.5	162	175.5	
166.5	166.5	166.5	180	
171	171	175.5	180	
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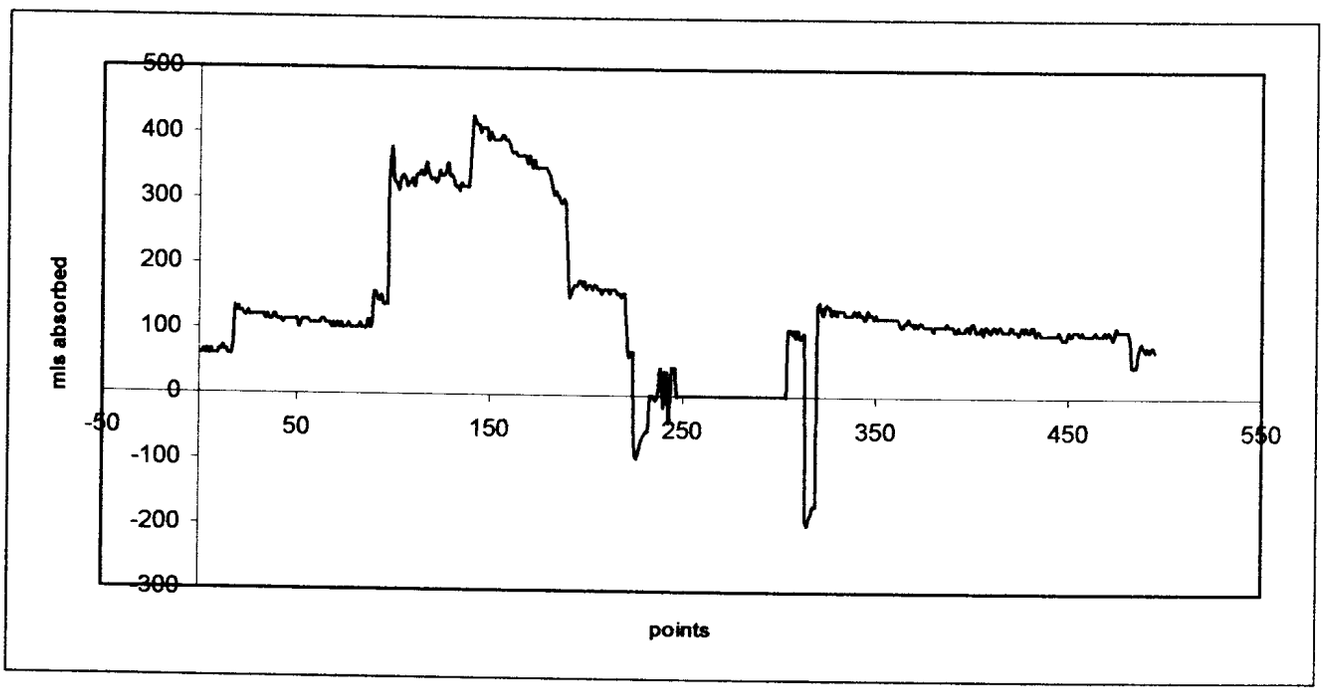
166.5	166.5	175.5	171	

Time Series Name: Iso-01

Inhalation Agent used: Isoflurane

Graphical Representation:



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66	108	336	366	60	0	132	114	96
60	108	336	366	66	0	132	108	96
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60	108	336	366	-78	0	126	108	102
66	108	336	360	-96	0	126	102	96
60	108	354	348	-90	0	126	102	90
60	114	342	360	-78	0	126	108	90
60	114	330	348	-66	0	132	102	90
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66	108	330	348	-54	0	132	102	96
72	108	324	348	-54	0	126	108	96
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66	108	342	348	0	0	120	102	102
60	102	336	342	0	0	120	114	102
60	108	336	336	-6	0	132	114	96
72	102	342	318	0	0	126	102	102
132	108	354	306	42	0	126	102	96
126	102	336	312	36	0	120	102	96
132	102	336	306	-18	0	126	108	96
126	102	330	300	36	0	120	96	96
126	108	318	294	36	0	120	108	96
120	102	318	300	-42	0	120	108	96
120	102	312	294	42	0	120	102	102
126	102	324	222	42	0	120	102	96
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120	108	318	162	0	0	120	102	96
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114	138	396	162	0	-186	114	108	102
114	138	390	162	0	-180	108	102	90
108	330	390	156	0	-168	114	108	48
114	378	390	162	0	-168	114	102	48
114	330	390	162	0	138	108	102	48
114	324	396	162	0	144	108	108	66
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108	318	372	156	0	126	108	96	72
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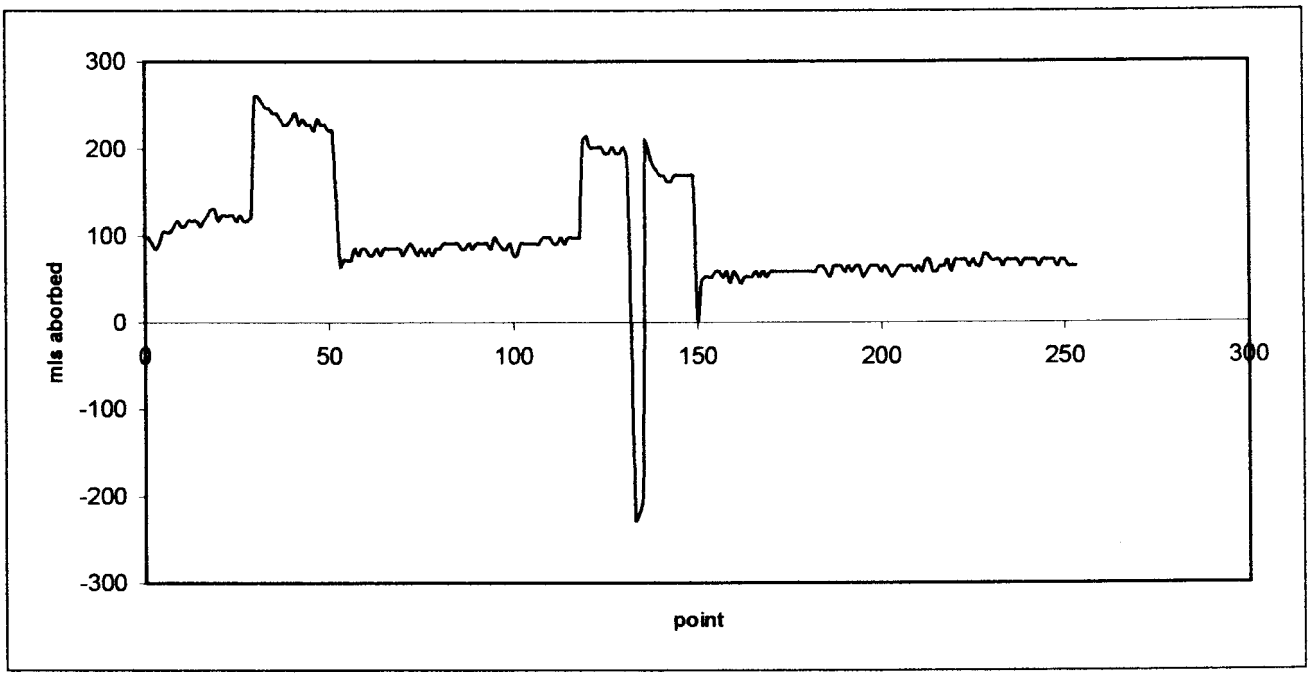
Time Series Name: Iso-02

Inhalation Agent used: Isoflurane

Graphical Representation:



97.5	260	84.5	91	97.5	169	58.5	58.5	65
91	260	84.5	84.5	97.5	169	58.5	65	71.5
84.5	253.5	78	91	208	169	58.5	65	71.5
91	247	78	91	214.5	169	58.5	65	71.5
104	247	84.5	91	201.5	6.5	58.5	65	71.5
104	240.5	78	91	201.5	45.5	58.5	58.5	65
104	240.5	84.5	84.5	201.5	52	58.5	65	71.5
110.5	234	84.5	97.5	201.5	52	58.5	58.5	71.5
117	227.5	84.5	91	195	52	65	71.5	71.5
110.5	227.5	84.5	84.5	195	58.5	65	71.5	71.5
110.5	234	84.5	84.5	201.5	58.5	58.5	58.5	65
117	240.5	78	91	195	52	52	58.5	71.5
117	227.5	84.5	78	195	58.5	65	65	71.5
117	234	91	78	201.5	45.5	65	65	71.5
110.5	227.5	84.5	91	188.5	58.5	65	71.5	71.5
117	227.5	78	91	-19.5	52	58.5	58.5	65
123.5	221	84.5	91	-227.5	45.5	65	71.5	71.5
130	234	78	91	-221	52	58.5	71.5	71.5
130	227.5	84.5	91	-201.5	52	65	71.5	65
117	227.5	78	91	208	52	65	71.5	65
123.5	221	84.5	97.5	195	58.5	52	65	65
123.5	221	84.5	97.5	182	52	58.5	71.5	
123.5	149.5	91	97.5	175.5	58.5	65	65	
123.5	65	91	91	169	52	65	65	
117	71.5	91	91	169	58.5	65	78	
123.5	71.5	91	97.5	162.5	58.5	58.5	78	
117	71.5	91	91	162.5	58.5	65	71.5	
117	84.5	84.5	97.5	169	58.5	58.5	71.5	
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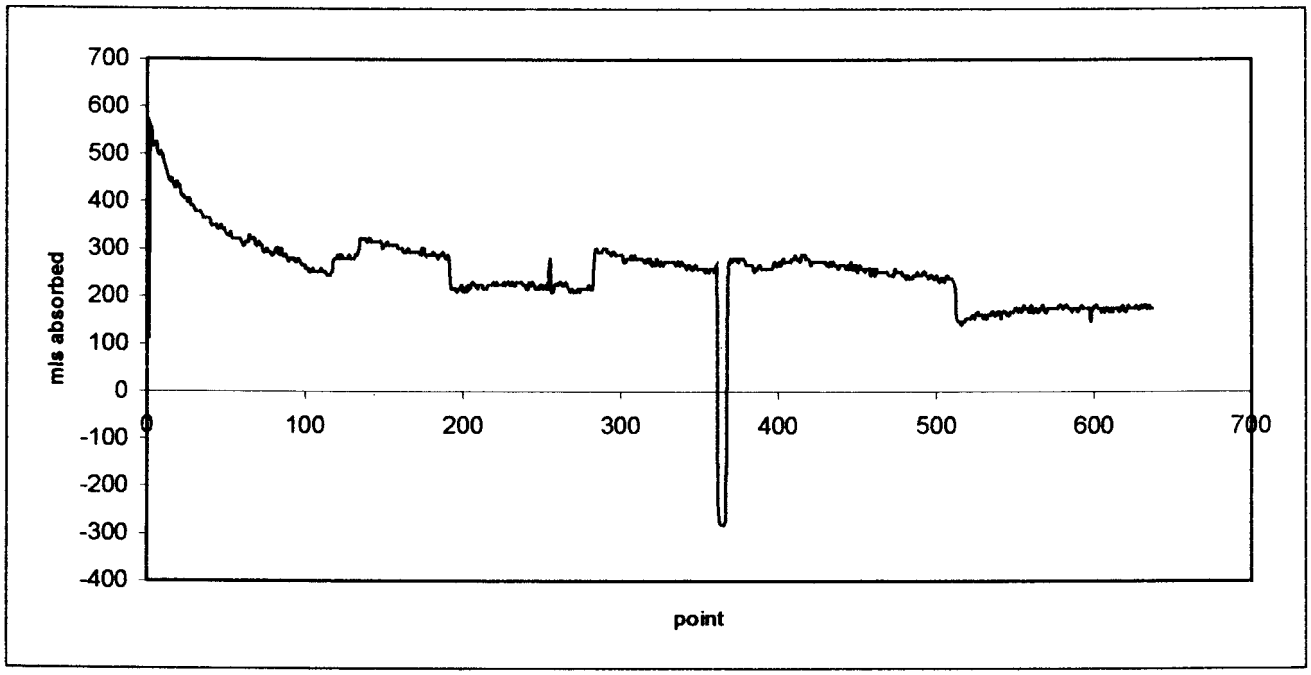
Time Series Name: Iso-03

Inhalation Agent used: Isoflrane

Graphical Representation:



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518	315	287	287	231	294	259	287	252
525	315	280	287	224	294	252	280	245
504	329	287	294	224	287	259	280	245
497	322	280	287	217	287	252	273	245
504	322	280	287	217	287	259	287	245
497	322	280	280	231	287	259	287	259
483	308	280	287	224	287	259	287	252
469	308	287	287	231	273	252	280	252
455	315	280	294	224	273	266	280	252
448	308	280	287	217	280	-224	273	252
441	308	280	280	217	280	-273	266	245
448	294	287	287	217	280	-280	273	245
434	294	287	280	224	287	-280	273	238
427	301	301	217	224	280	-280	273	245
441	294	322	217	217	287	-266	273	238
434	294	322	217	224	280	217	273	238
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413	287	322	210	224	280	280	273	245
413	294	315	217	280	280	273	273	245
406	301	322	217	210	280	280	273	252
406	301	322	224	210	273	280	266	245
399	287	315	210	224	273	280	266	245
406	301	315	217	224	280	273	273	245
392	287	315	210	224	273	280	266	252
392	287	315	224	231	280	280	273	252
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378	280	315	224	224	273	273	266	238
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378	280	301	224	231	280	266	266	245
378	280	308	224	224	273	266	266	238
371	280	308	217	217	266	266	266	238
364	273	315	224	210	273	266	266	245
364	273	308	224	217	266	252	259	238
364	280	308	224	210	273	259	266	231
364	273	308	217	210	273	259	259	238
364	266	308	217	210	273	266	273	238
350	266	308	217	217	273	266	259	231
350	266	308	224	210	273	259	259	238
350	259	301	224	217	273	259	266	245
350	259	301	224	217	273	259	252	238
343	252	301	231	217	266	259	259	238
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343	252	294	224	224	266	259	259	217
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336	252	294	224	217	266	273	259	147
329	252	294	224	266	266	266	259	147
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336	252	294	224	301	266	273	245	147
322	252	294	231	294	266	266	259	147
322	252	294	231	294	259	280	245	154
322	245	294	224	294	259	273	259	154
322	245	287	231	301	266	273	252	154
322	245	301	224	301	266	273	252	154

161	182	175	168	161	175	196	238	238
154	168	175	175	168	175	196	245	245
161	168	175	175	168	175	196	238	231
168	175	168	175	161	175	203	238	238
161	175	175	182	175	175	196	238	238
161	175	182	175	175	182	196	238	238
161	175	175	175	175	168	203	238	238
154	175	168	175	182	182	196	245	238
161	175	175	175	161	168	203	245	231
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161	182	175	126	175	175	203	238	231
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168	175	182	119	175	175	182	238	238
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168	175	182	175	182	175	238	238	224
168	175	182	182	182	182	245	245	224
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161	168	182	182	182	175	252	238	224
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168	182	175	182	175	182	245	245	224
168	175	175	168	175	175	252	231	217
168	175	175	175	175	175	245	238	231
175	175	182	168	175	175	245	238	217
175	175	182	168	175	175	252	238	217
168	175	182	168	182	161	252	245	231
175	147	182	161	175	203	245	238	210
168	175	182	161	182	182	245	231	224
175	175	182	168	168	210	245	231	217
182	182	182	168	182	203	238	231	224
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168	175	175	168	182	203	238	231	224
182	168	182	168	182	210	238	231	217
168	175	182	168	168	210	245	238	217
168	168	175	168	182	203	245	238	
175	175	175	168	175	210	231	238	
168	175	175	168	175	203	238	231	
168	168	182	168	168	210	238	231	
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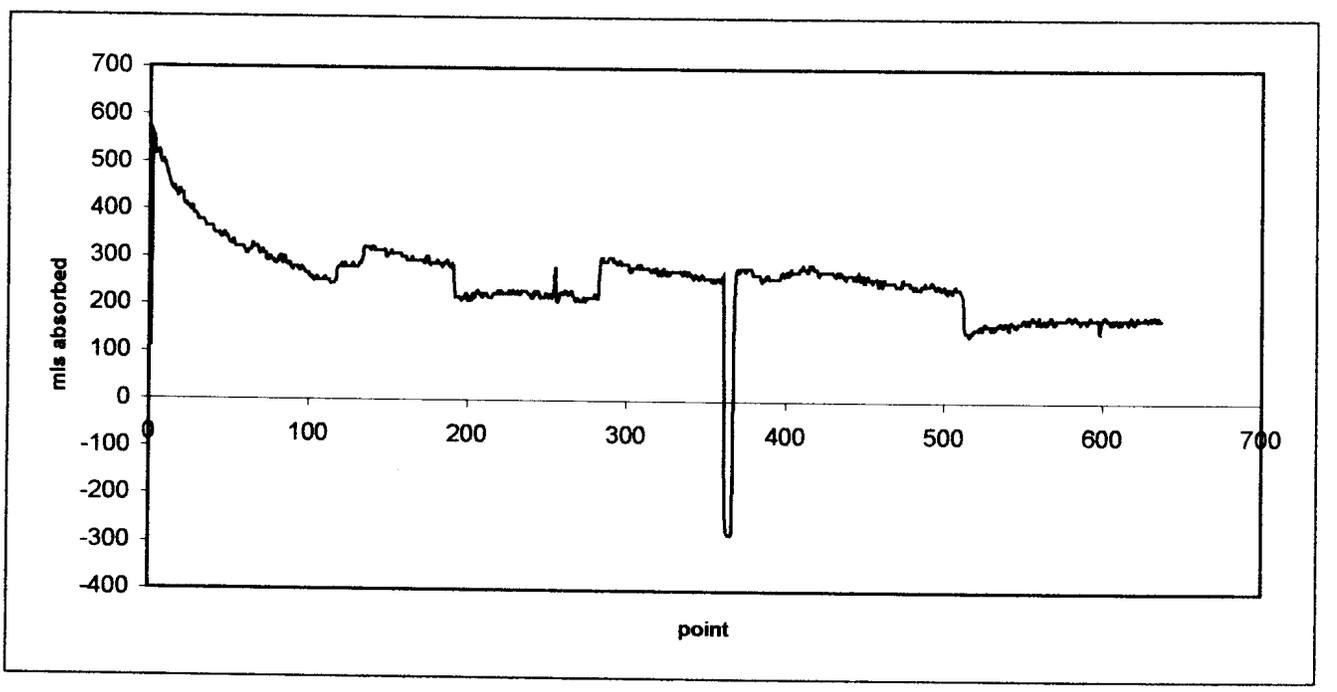
Time Series Name: Iso-03

Inhalation Agent used: Isoflrane

Graphical Representation:



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560	315	273	287	231	294	259	273	252
553	308	280	287	231	294	259	280	252
518	308	280	287	231	287	259	280	252
518	315	287	287	231	294	259	287	252
525	315	280	287	224	294	252	280	245
504	329	287	294	224	287	259	280	245
497	322	280	287	217	287	252	273	245
504	322	280	287	217	287	259	287	245
497	322	280	280	231	287	259	287	259
483	308	280	287	224	287	259	287	252
469	308	287	287	231	273	252	280	252
455	315	280	294	224	273	266	280	252
448	308	280	287	217	280	-224	273	252
441	308	280	280	217	280	-273	266	245
448	294	287	287	217	280	-280	273	245
434	294	287	280	224	287	-280	273	238
427	301	301	217	224	280	-280	273	245
441	294	322	217	217	287	-266	273	238
434	294	322	217	224	280	217	273	238
434	287	322	217	217	280	273	273	238
413	287	322	210	224	280	280	273	245
413	294	315	217	280	280	273	273	245
406	301	322	217	210	280	280	273	252
406	301	322	224	210	273	280	266	245
399	287	315	210	224	273	280	266	245
406	301	315	217	224	280	273	273	245
392	287	315	210	224	273	280	266	252
392	287	315	224	231	280	280	273	252
385	287	315	217	231	266	280	266	245
378	280	315	224	224	273	273	266	238
378	273	315	231	224	266	266	259	245
378	280	301	224	231	280	266	266	245
378	280	308	224	224	273	266	266	238
371	280	308	217	217	266	266	266	238
364	273	315	224	210	273	266	266	245
364	273	308	224	217	266	252	259	238
364	280	308	224	210	273	259	266	231
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343	252	301	231	217	266	259	259	238
343	252	294	224	217	273	259	266	238
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343	252	294	224	224	266	259	259	217
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336	252	294	224	217	266	273	259	147
329	252	294	224	266	266	266	259	147
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336	252	294	224	301	266	273	245	147
322	252	294	231	294	266	266	259	147
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322	245	287	231	301	266	273	252	154
322	245	301	224	301	266	273	252	154

161	182	175	168	161	175	196	238	238
154	168	175	175	168	175	196	245	245
161	168	175	175	168	175	196	238	231
168	175	168	175	161	175	203	238	238
161	175	175	182	175	175	196	238	238
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154	175	168	175	182	182	196	245	238
161	175	175	175	161	168	203	245	231
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161	182	175	168	175	175	196	245	238
161	182	175	126	175	175	203	238	231
168	175	175	91	175	175	196	238	224
168	175	175	84	175	182	196	245	231
161	182	182	77	175	175	182	245	224
161	182	175	84	175	175	196	245	238
168	175	175	84	175	175	189	252	224
168	175	182	119	175	175	182	238	238
154	168	175	168	175	175	210	238	224
168	175	182	175	182	175	238	238	224
168	175	182	182	182	182	245	245	224
168	175	175	175	175	182	252	245	231
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168	182	175	182	175	182	245	245	224
168	175	175	168	175	175	252	231	217
168	175	175	175	175	175	245	238	231
175	175	182	168	175	175	245	238	217
175	175	182	168	175	175	252	238	217
168	175	182	168	182	161	252	245	231
175	147	182	161	175	203	245	238	210
168	175	182	161	182	182	245	231	224
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182	182	182	168	182	203	238	231	224
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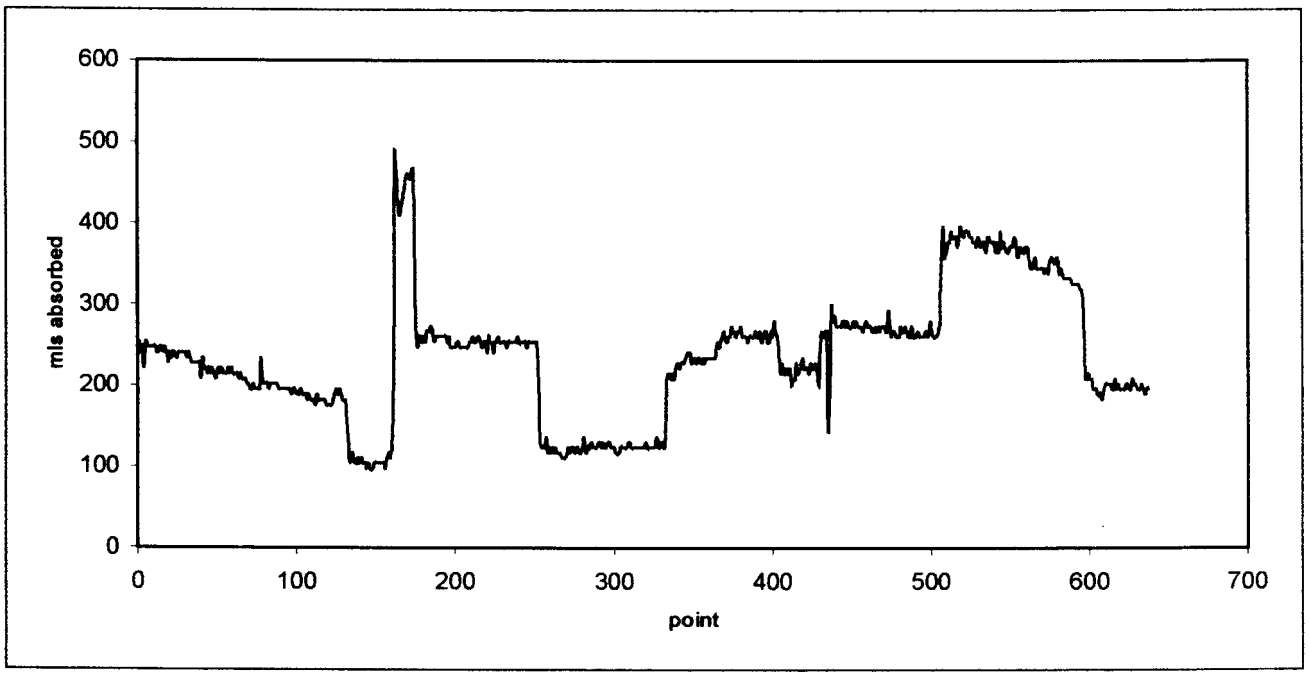
Time Series Name: Iso-04

Inhalation Agent used: Isoflrane

Graphical Representation:



253.5	221	182	273	253.5	130	227.5	214.5	273
240.5	214.5	182	247	253.5	123.5	234	214.5	266.5
247	214.5	175.5	260	253.5	130	234	221	273
221	214.5	175.5	260	253.5	123.5	227.5	214.5	266.5
253.5	214.5	175.5	253.5	253.5	123.5	234	221	273
247	208	175.5	260	253.5	130	234	201.5	273
247	214.5	182	253.5	260	130	227.5	208	273
247	208	188.5	266.5	253.5	123.5	234	208	266.5
247	208	195	266.5	253.5	123.5	227.5	227.5	292.5
247	208	188.5	266.5	253.5	123.5	234	214.5	279.5
247	201.5	195	273	253.5	117	234	221	260
240.5	201.5	188.5	260	253.5	117	234	221	266.5
240.5	195	182	253.5	247	117	234	234	266.5
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247	201.5	182	260	253.5	123.5	234	221	260
240.5	195	149.5	260	253.5	123.5	234	221	260
247	195	110.5	260	253.5	123.5	253.5	214.5	273
240.5	195	104	260	253.5	123.5	247	227.5	266.5
227.5	195	117	260	253.5	130	253.5	221	266.5
240.5	234	110.5	260	208	130	260	221	273
234	201.5	104	253.5	136.5	123.5	266.5	227.5	266.5
240.5	201.5	104	260	123.5	123.5	260	221	260
240.5	201.5	110.5	247	123.5	123.5	253.5	201.5	260
234	201.5	104	247	123.5	123.5	260	247	273
234	195	110.5	247	136.5	123.5	260	266.5	260
240.5	201.5	104	247	117	123.5	273	260	260
240.5	201.5	104	253.5	123.5	123.5	266.5	266.5	260
240.5	201.5	97.5	253.5	117	123.5	266.5	266.5	266.5
240.5	201.5	104	247	123.5	123.5	260	143	260
240.5	201.5	97.5	247	117	130	266.5	195	260
234	195	97.5	247	123.5	123.5	266.5	299	260
240.5	195	97.5	247	117	123.5	273	279.5	260
234	195	104	247	117	123.5	260	286	266.5
227.5	195	104	247	117	123.5	260	273	260
227.5	195	104	253.5	110.5	123.5	260	273	266.5
227.5	195	104	253.5	110.5	123.5	253.5	273	279.5
227.5	195	104	260	110.5	136.5	260	273	266.5
227.5	195	104	253.5	117	123.5	260	279.5	260
227.5	188.5	104	253.5	123.5	123.5	260	279.5	260
208	195	97.5	260	117	130	260	273	260
234	195	110.5	260	123.5	130	266.5	279.5	266.5
221	188.5	117	253.5	123.5	123.5	260	273	279.5
221	188.5	110.5	247	117	201.5	260	273	357.5
214.5	188.5	123.5	253.5	123.5	214.5	266.5	273	396.5
221	195	221	253.5	123.5	214.5	253.5	279.5	357.5
214.5	188.5	487.5	240.5	117	208	260	273	364
221	188.5	461.5	260	117	214.5	266.5	279.5	377
214.5	188.5	429	253.5	123.5	208	266.5	273	377
208	182	409.5	253.5	136.5	221	253.5	273	390
214.5	188.5	422.5	240.5	117	227.5	253.5	273	383.5
221	182	429	253.5	123.5	221	266.5	266.5	383.5
214.5	182	442	253.5	123.5	227.5	260	273	383.5
221	182	455	260	123.5	227.5	279.5	279.5	370.5
214.5	175.5	461.5	253.5	130	227.5	266.5	273	383.5
214.5	188.5	455	253.5	123.5	234	260	273	396.5
214.5	182	455	253.5	123.5	240.5	234	273	390
221	182	468	253.5	123.5	240.5	214.5	266.5	383.5
214.5	182	468	247	130	240.5	227.5	266.5	390

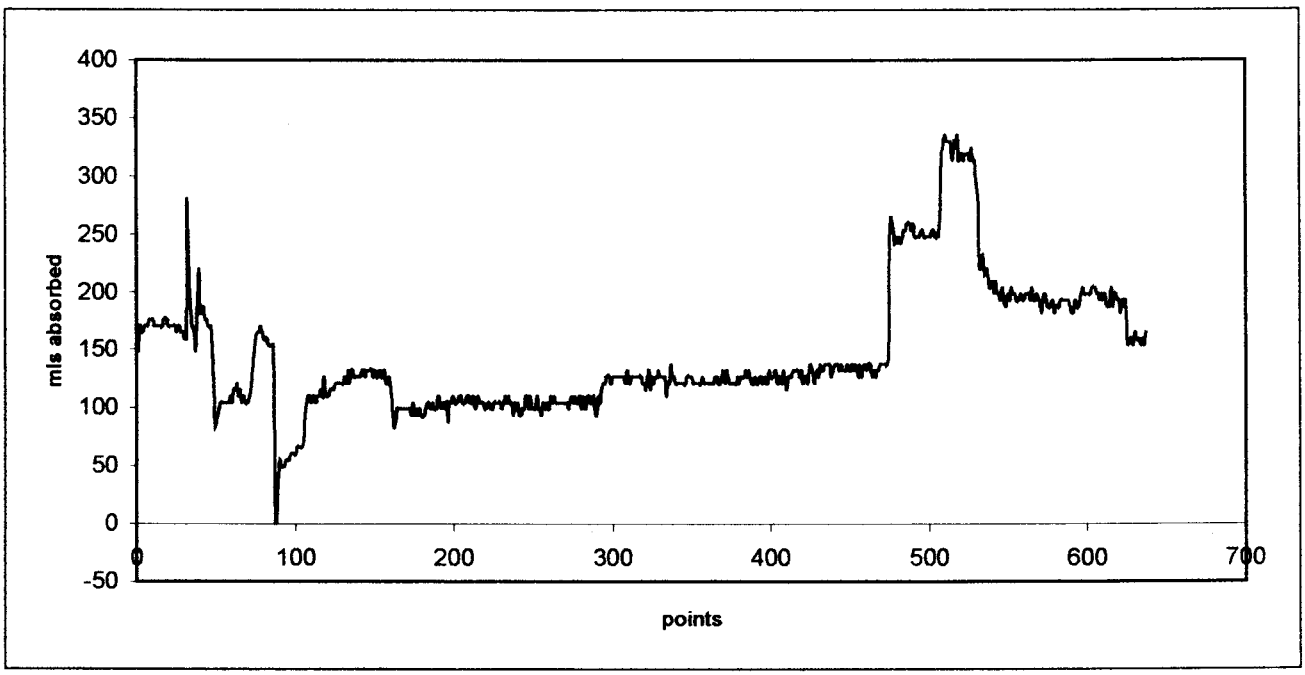
390	344.5	188.5	188.5	130	130	130	110.5	221
390	338	201.5	188.5	136.5	130	130	117	208
383.5	331.5	195	182	130	136.5	130	117	195
383.5	331.5	195	188.5	130	136.5	130	117	201.5
377	331.5	201.5	182	130	130	130	104	208
377	331.5	195	182	130	136.5	130	110.5	221
370.5	331.5	195	182	130	136.5	130	117	227.5
383.5	325	195	188.5	130	136.5	130	117	227.5
377	325	201.5	182	130	130	130	104	227.5
370.5	325	195	175.5	130	136.5	130	110.5	234
377	325	188.5	182	130	130	130	110.5	234
377	325	182	175.5	130	123.5	123.5	117	227.5
364	318.5	195	182	130	123.5	123.5	110.5	227.5
383.5	318.5	188.5	195	130	130	130	110.5	227.5
383.5	305.5	201.5	188.5	123.5	130	130	110.5	227.5
377	208	195	182	130	110.5	130	110.5	234
377	208	201.5	182	123.5	130	130	117	240.5
377	214.5	201.5	175.5	136.5	130	123.5	110.5	234
364	208	195	182	130	130	130	110.5	221
377	208	195	182	130	130	130	110.5	240.5
364	195	195	175.5	136.5	130	123.5	110.5	221
390	195	195	182	130	130	130	110.5	227.5
370.5	195	195	182	136.5	130	130	117	227.5
377	188.5	195	182	136.5	130	123.5	117	156
370.5	188.5	195	182	136.5	130	110.5	117	130
364	188.5	188.5	182	123.5	130	110.5	0	143
364	182	195	175.5	123.5	130	117	39	143
370.5	195	188.5	175.5	130	130	104	45.5	136.5
370.5	201.5	188.5	175.5	130	136.5	104	39	143
370.5	201.5	188.5	175.5	130	136.5	104	39	143
383.5	201.5	188.5	182	123.5	136.5	104	0	130
370.5	201.5	188.5	175.5	130	136.5	104	0	136.5
357.5	195	188.5	175.5	123.5	136.5	104	0	130
364	195	188.5	175.5	123.5	130	104	0	136.5
370.5	208	188.5	175.5	123.5	130	104	0	136.5
364	195	188.5	175.5	130	130	104	0	136.5
364	201.5	188.5	182	136.5	130	110.5	0	136.5
370.5	195	188.5	175.5	123.5	136.5	110.5	0	130
370.5	195	182	175.5	130	130	110.5	0	130
357.5	195	188.5	169	136.5	130	110.5	0	130
344.5	195	188.5	169	136.5	130	110.5	0	123.5
344.5	201.5	188.5	175.5	130	130	110.5	0	123.5
351	201.5	188.5	175.5	136.5	130	110.5	0	97.5
357.5	195	188.5	169	136.5	130	110.5	0	58.5
344.5	195	175.5	149.5	136.5	130	117	0	58.5
344.5	208	188.5	136.5	136.5	130	117	0	65
344.5	201.5	182	136.5	130	130	110.5	0	71.5
344.5	201.5	188.5	136.5	130	130	110.5	0	65
344.5	195	182	130	123.5	130	104	0	52
338	195	188.5	130	130	130	117	0	65
344.5	195	182	130	130	130	104	0	58.5
338	201.5	182	123.5	136.5	110.5	104	0	52
351	195	175.5	123.5	130	130	110.5	0	58.5
357.5	188.5	182	130	136.5	130	110.5	0	58.5
357.5	195	182	136.5	136.5	130	117	0	58.5
351	195	182	130	136.5	130	104	0	58.5
351	201.5	188.5	136.5	130	130	104	0	58.5
357.5	201.5	182	136.5	136.5	136.5	110.5	104	58.5
338	195	182	136.5	136.5	130	110.5	182	58.5

58.5	0	0	0	0	0	13	208	201.5
58.5	0	0	0	0	0	45.5	214.5	195
58.5	0	0	0	0	0	71.5	214.5	195
52	0	0	0	0	0	188.5	214.5	195
58.5	0	0	0	0	0	201.5	208	188.5
52	0	0	0	0	0	188.5	201.5	188.5
52	0	0	0	0	0	195	208	195
52	0	0	0	0	0	188.5	201.5	195
58.5	0	0	0	39	0	188.5	208	195
58.5	0	0	0	39	0	201.5	201.5	188.5
58.5	0	0	0	39	0	208	208	195
58.5	0	0	0	39	0	208	201.5	201.5
58.5	0	0	0	39	0	208	201.5	195
58.5	0	0	0	39	0	201.5	208	201.5
0	0	0	0	0	0	208	208	188.5
0	0	0	0	0	0	208	201.5	201.5
0	0	0	0	0	0	221	208	201.5
0	0	0	0	0	0	214.5	201.5	201.5
0	0	0	0	0	0	214.5	195	195
0	0	0	0	0	0	208	195	208
0	0	0	0	0	0	201.5	195	208
0	0	0	0	0	0	208	201.5	240.5
0	0	0	0	0	0	208	201.5	

Time Series Name: Iso-05

Inhalation Agent used: Isoflurane

Graphical Representation:



148.5	110	110	93.5	104.5	110	126.5	121	132
170.5	104.5	126.5	99	110	104.5	126.5	132	126.5
165	115.5	110	93.5	104.5	115.5	121	121	132
165	115.5	110	99	104.5	121	121	115.5	132
170.5	121	110	93.5	93.5	121	121	126.5	137.5
170.5	110	115.5	93.5	104.5	126.5	121	126.5	137.5
170.5	115.5	115.5	93.5	99	126.5	121	126.5	137.5
176	104.5	115.5	99	104.5	126.5	121	132	137.5
176	110	121	104.5	93.5	121	126.5	132	137.5
176	104.5	121	104.5	93.5	126.5	121	132	143
170.5	104.5	121	99	99	126.5	121	132	242
170.5	104.5	121	104.5	99	126.5	121	126.5	264
170.5	110	121	99	110	126.5	121	132	258.5
170.5	121	121	99	110	126.5	121	121	242
170.5	132	126.5	99	99	126.5	121	126.5	247.5
170.5	148.5	121	110	110	126.5	121	126.5	242
176	159.5	132	104.5	99	126.5	126.5	121	247.5
176	165	121	99	99	121	126.5	132	242
176	165	132	104.5	99	132	121	137.5	247.5
170.5	170.5	132	99	110	126.5	121	132	253
170.5	165	126.5	104.5	99	121	126.5	121	253
170.5	159.5	126.5	88	99	126.5	132	126.5	258.5
170.5	159.5	126.5	104.5	93.5	126.5	121	132	258.5
170.5	159.5	126.5	104.5	104.5	126.5	132	126.5	258.5
165	154	126.5	110	99	126.5	126.5	137.5	253
170.5	154	132	104.5	104.5	126.5	121	132	258.5
170.5	154	132	104.5	99	126.5	121	132	247.5
165	154	126.5	104.5	99	126.5	121	137.5	247.5
165	0	132	110	110	121	121	137.5	247.5
159.5	0	132	110	104.5	121	121	137.5	247.5
159.5	38.5	132	104.5	110	115.5	126.5	137.5	253
280.5	55	132	104.5	104.5	126.5	121	126.5	253
209	49.5	126.5	104.5	104.5	132	126.5	132	247.5
181.5	49.5	132	110	104.5	115.5	126.5	137.5	247.5
170.5	49.5	126.5	110	104.5	126.5	126.5	137.5	247.5
165	55	126.5	104.5	104.5	121	132	137.5	247.5
148.5	55	132	104.5	104.5	126.5	126.5	132	247.5
181.5	55	126.5	110	104.5	126.5	132	137.5	253
220	60.5	126.5	99	104.5	132	126.5	132	253
181.5	60.5	132	104.5	99	126.5	121	132	247.5
181.5	60.5	121	110	104.5	126.5	121	132	247.5
187	60.5	121	104.5	110	126.5	126.5	137.5	247.5
176	66	126.5	104.5	104.5	126.5	121	132	264
176	66	115.5	104.5	110	110	121	132	319
170.5	66	93.5	99	104.5	121	126.5	137.5	324.5
170.5	66	82.5	99	104.5	121	126.5	132	335.5
170.5	71.5	88	104.5	110	137.5	121	137.5	330
137.5	93.5	99	104.5	99	126.5	126.5	132	330
82.5	104.5	99	99	110	126.5	121	126.5	330
88	110	99	99	104.5	121	121	137.5	330
93.5	110	99	104.5	99	121	132	126.5	313.5
99	104.5	99	104.5	110	121	126.5	132	330
104.5	110	99	104.5	110	121	126.5	137.5	324.5
104.5	110	99	104.5	104.5	121	126.5	132	335.5
104.5	104.5	99	104.5	104.5	121	132	137.5	313.5
104.5	110	99	99	110	121	121	137.5	319
104.5	110	93.5	104.5	93.5	126.5	126.5	137.5	319
104.5	115.5	104.5	110	99	126.5	126.5	126.5	313.5

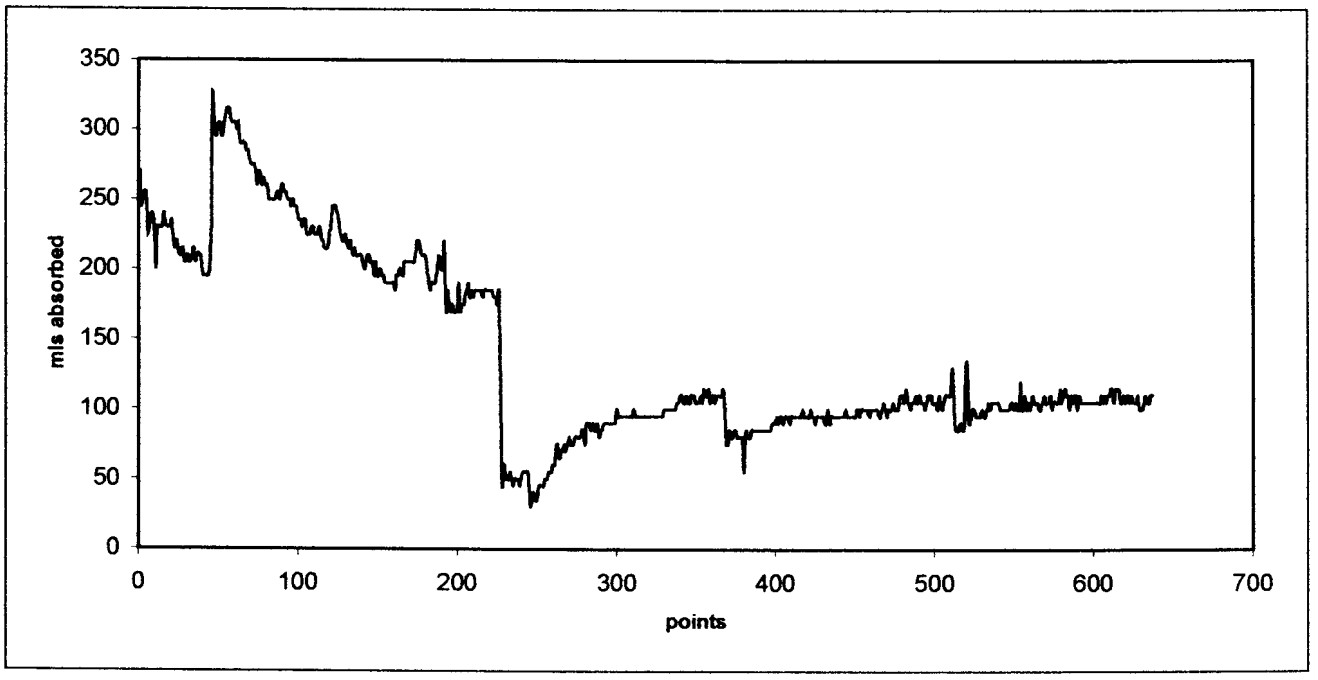
Measured Time Series

319	198	192.5	187	148.5	148.5	154	143	148.5
319	192.5	192.5	198	154	148.5	154	148.5	148.5
319	192.5	192.5	198	148.5	154	159.5	143	154
313.5	192.5	192.5	192.5	154	148.5	159.5	148.5	154
324.5	198	187	192.5	154	154	154	154	148.5
313.5	192.5	181.5	181.5	159.5	154	154	148.5	148.5
313.5	192.5	181.5	192.5	154	154	159.5	148.5	148.5
291.5	198	192.5	187	159.5	154	154	148.5	148.5
275	198	187	192.5	148.5	154	154	148.5	148.5
220	198	187	154	154	154	159.5	148.5	148.5
225.5	192.5	187	154	154	148.5	154	154	148.5
231	203.5	198	159.5	143	148.5	159.5	148.5	148.5
214.5	192.5	203.5	159.5	148.5	148.5	154	143	154
220	192.5	198	154	143	148.5	154	154	148.5
214.5	198	198	165	148.5	148.5	148.5	143	148.5
203.5	192.5	198	159.5	148.5	148.5	154	148.5	148.5
203.5	192.5	198	159.5	148.5	148.5	148.5	148.5	143
209	181.5	198	159.5	154	154	143	154	137.5
198	192.5	203.5	154	148.5	154	137.5	154	148.5
209	198	203.5	159.5	154	159.5	143	154	148.5
198	192.5	203.5	154	154	154	143	148.5	148.5
198	187	198	165	154	154	143	148.5	154
192.5	187	198	154	159.5	159.5	143	148.5	154
203.5	187	192.5	148.5	159.5	154	143	148.5	154
198	192.5	198	154	154	154	143	148.5	148.5
187	181.5	192.5	154	159.5	154	143	148.5	148.5
192.5	187	198	148.5	148.5	154	143	148.5	
198	187	187	159.5	159.5	154	143	148.5	
192.5	187	187	159.5	154	148.5	143	148.5	
203.5	192.5	187	154	154	154	143	148.5	
198	192.5	203.5	159.5	148.5	154	148.5	143	

Time Series Name: Iso-06

Inhalation Agent used: Isoflurane

Graphical Representation:



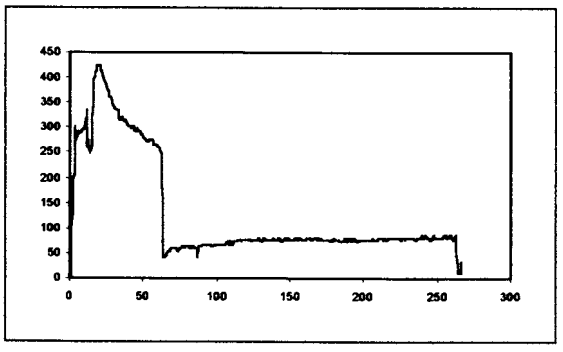
270	305	215	220	55	85	110	95	95
245	305	215	220	50	90	105	95	95
250	305	215	215	45	90	105	90	100
255	300	225	210	50	90	105	95	105
255	305	230	210	50	90	110	95	100
225	290	245	210	50	90	105	95	95
230	290	245	200	45	90	115	95	100
235	290	245	195	50	90	110	95	100
240	290	240	185	55	90	110	95	100
235	285	235	190	55	100	115	95	105
200	285	225	190	55	95	105	100	100
230	280	220	190	55	95	110	95	100
230	275	220	195	45	95	110	95	100
230	275	225	205	30	95	105	95	110
230	275	220	210	40	95	110	95	110
240	270	215	200	40	95	110	100	110
235	260	220	200	35	95	110	95	105
230	270	215	220	35	95	110	95	115
230	265	210	170	45	95	115	90	105
230	260	215	185	45	95	105	95	105
235	265	210	175	45	100	75	95	100
225	260	210	170	45	95	75	95	105
215	260	210	175	50	95	85	95	105
220	250	210	170	50	95	80	95	110
215	250	205	170	55	95	80	90	105
210	250	200	170	55	95	85	90	110
210	250	205	190	55	95	85	100	110
215	250	210	170	60	95	80	90	105
205	255	210	175	60	95	80	95	105
205	255	205	175	75	95	80	95	100
210	250	205	180	75	95	80	95	105
205	260	195	185	65	95	55	95	110
205	260	205	190	70	95	80	95	110
210	255	195	180	70	95	85	95	110
215	255	195	185	75	95	80	95	105
205	250	200	180	70	95	80	95	105
210	250	195	185	75	95	85	95	105
210	245	195	185	80	95	85	100	100
210	250	190	185	75	95	85	95	110
205	245	190	185	75	100	85	95	105
195	245	190	185	75	100	85	95	100
195	240	190	180	80	100	85	95	105
195	235	190	185	80	100	85	95	110
195	235	190	185	80	100	85	95	110
200	230	185	185	80	100	85	100	110
235	235	195	185	85	100	85	100	110
325	235	195	185	85	100	85	95	130
305	225	200	185	75	105	85	100	115
295	225	200	180	90	105	85	100	85
300	225	195	180	90	110	90	100	85
305	230	205	175	90	110	90	100	85
300	230	205	185	85	105	90	100	90
295	225	205	145	90	105	95	95	90
305	225	205	45	85	110	90	100	85
310	225	205	60	85	105	95	100	90
315	230	205	55	90	105	95	100	135
315	220	205	50	80	110	90	100	100
310	220	210	50	85	110	95	100	90

95	105	105	110	105	110	105	115	105
100	105	100	105	105	110	105	115	110
100	105	105	105	105	100	105	115	100
95	105	100	105	105	110	105	105	100
95	105	100	100	115	105	110	105	100
95	100	120	100	105	105	105	110	105
95	100	100	105	110	105	110	105	110
100	100	100	110	115	105	105	110	105
95	100	110	105	110	105	110	110	105
95	100	100	105	110	105	110	105	110
100	100	105	105	100	105	115	110	110
105	100	100	110	110	105	115	105	
100	105	105	100	105	105	105	105	

Time Series Name: Iso-07

Inhalation Agent used: Isoflurane

Graphical Representation:

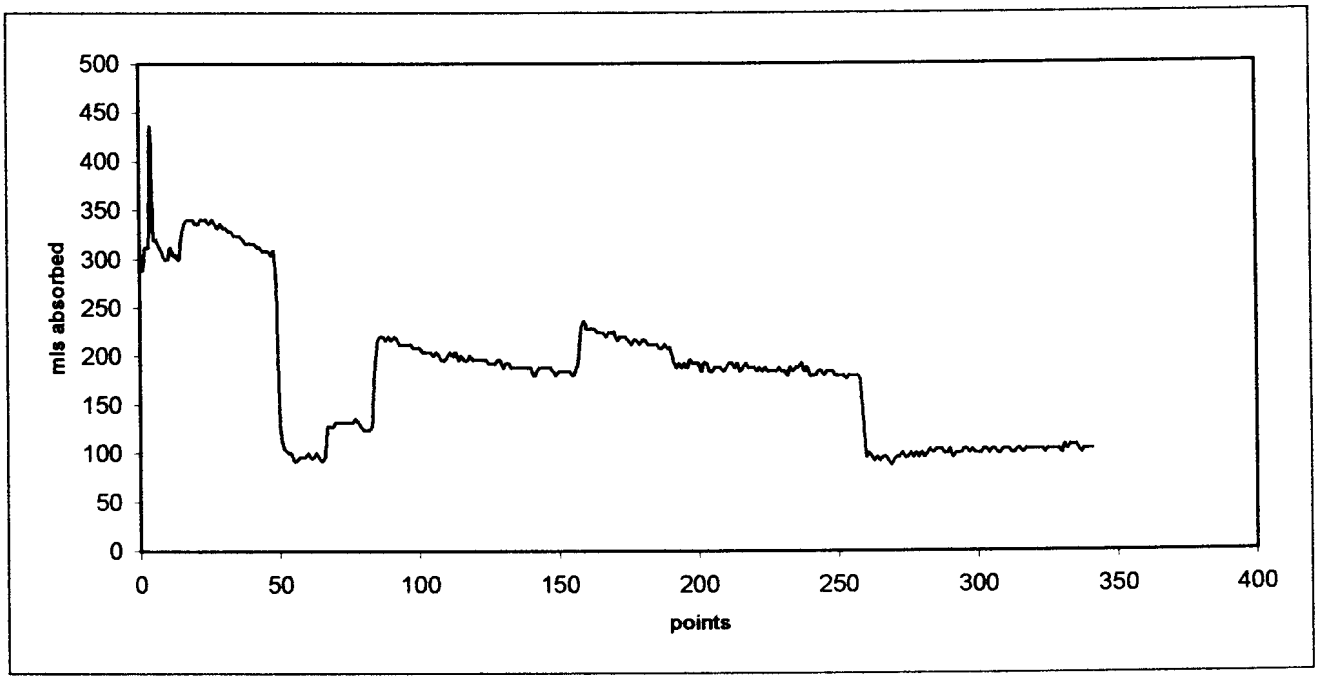


0	337.5	256.5	67.5	76.5	76.5	76.5	81	81
189	333	247.5	67.5	76.5	76.5	76.5	81	85.5
220.5	333	67.5	67.5	76.5	81	76.5	81	81
301.5	324	40.5	67.5	72	81	72	76.5	81
274.5	315	40.5	67.5	76.5	81	72	81	81
292.5	319.5	45	67.5	76.5	76.5	72	76.5	76.5
288	310.5	54	63	76.5	81	76.5	81	81
292.5	315	54	67.5	76.5	76.5	81	81	85.5
297	306	58.5	67.5	81	76.5	72	81	81
297	301.5	58.5	67.5	72	76.5	81	81	81
333	301.5	58.5	67.5	81	81	76.5	81	81
261	301.5	58.5	67.5	81	81	72	81	81
274.5	297	58.5	67.5	81	81	76.5	81	81
247.5	301.5	54	67.5	76.5	81	81	81	81
265.5	292.5	58.5	67.5	76.5	76.5	76.5	81	85.5
369	297	58.5	67.5	76.5	81	72	76.5	85.5
409.5	292.5	63	72	76.5	81	76.5	81	81
418.5	292.5	58.5	67.5	76.5	81	76.5	76.5	85.5
423	283.5	63	72	81	76.5	76.5	81	85.5
423	283.5	63	72	76.5	76.5	76.5	81	85.5
423	279	63	67.5	76.5	81	76.5	81	81
409.5	274.5	58.5	72	76.5	76.5	76.5	81	76.5
396	270	58.5	72	81	76.5	76.5	81	85.5
387	274.5	63	72	72	76.5	76.5	81	9
378	274.5	58.5	76.5	76.5	76.5	76.5	76.5	9
369	274.5	58.5	72	81	76.5	81	76.5	9
360	265.5	40.5	76.5	76.5	76.5	76.5	76.5	31.5
360	265.5	63	76.5	76.5	76.5	76.5	81	
355.5	265.5	63	76.5	81	72	76.5	81	
342	261	63	76.5	76.5	81	76.5	85.5	

Time Series Name: Iso-08

Inhalation Agent used: Isoflurane

Graphical Representation:

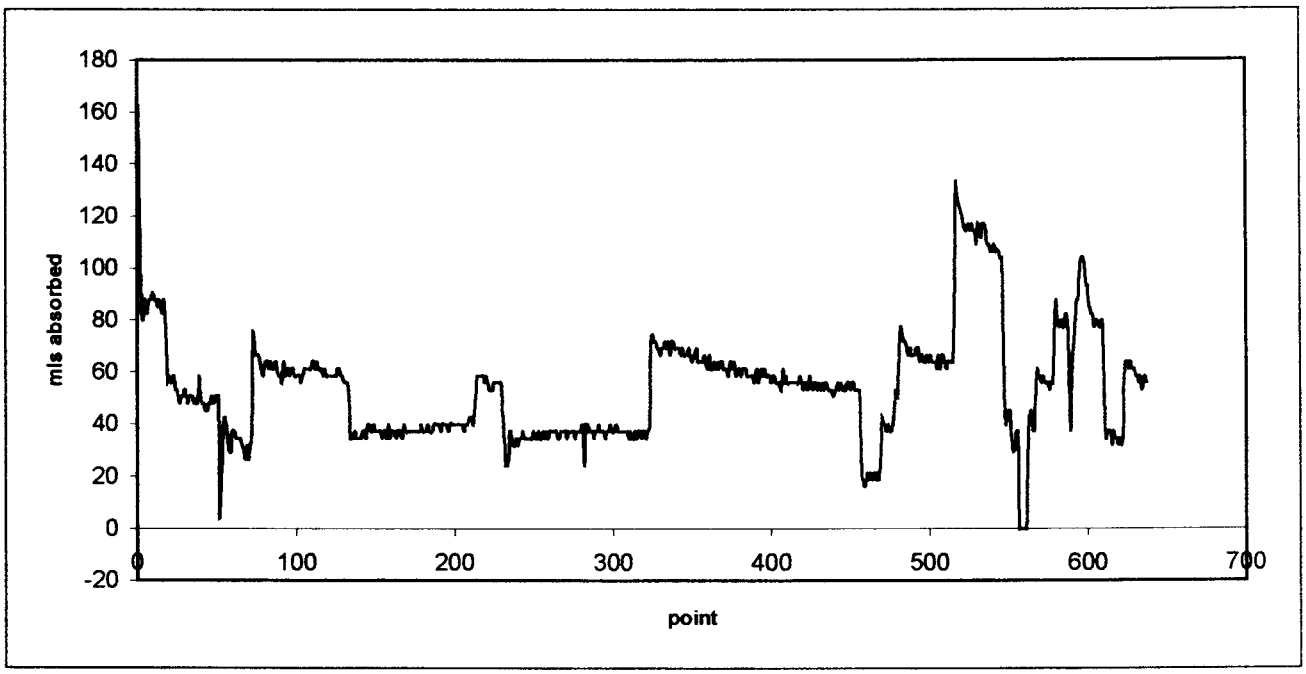


288	316	136	200	184	196	188	96	104
312	316	132	196	184	188	184	92	104
312	316	128	196	180	192	184	88	100
436	312	124	200	184	188	180	92	100
320	312	124	196	196	192	188	96	104
320	308	124	196	224	188	184	96	104
312	308	128	196	236	196	188	100	104
308	308	184	196	228	192	188	96	100
300	304	216	196	228	192	192	96	100
300	308	220	196	228	192	184	100	104
312	268	220	192	228	184	188	96	104
304	132	216	192	224	192	180	100	100
304	108	220	192	224	192	180	96	104
300	104	216	196	224	184	180	100	104
320	100	220	196	220	184	184	96	104
336	100	216	188	224	188	184	100	104
340	92	212	192	224	188	180	104	104
340	92	212	192	224	188	184	100	104
340	96	212	188	216	184	184	104	104
336	96	212	188	220	188	184	104	100
336	96	212	188	220	192	180	104	104
340	100	208	188	220	192	180	100	104
340	96	208	188	216	188	180	100	104
340	96	208	188	212	192	180	104	104
336	100	204	188	216	184	176	96	104
340	96	204	188	216	188	180	100	100
336	92	204	180	212	192	180	100	108
332	96	204	184	216	188	180	100	104
336	128	200	188	216	188	180	104	108
332	128	204	188	212	188	176	104	108
332	128	200	188	212	184	136	100	108
328	132	196	188	212	188	96	104	104
328	132	196	188	212	184	100	100	100
324	132	200	184	208	188	96	100	104
324	132	204	180	208	184	92	100	104
324	132	200	184	212	184	96	104	104
320	132	204	184	208	184	92	104	104
316	132	196	184	208	184	96	100	

Time Series Name: Iso-09

Inhalation Agent used: Isoflurane

Graphical Representation:



162.26	29.26	58.52	37.24	23.94	39.9	66.5	61.18	21.28
117.04	37.24	61.18	37.24	26.6	37.24	63.84	55.86	18.62
85.12	37.24	58.52	37.24	37.24	37.24	66.5	58.52	21.28
79.8	34.58	58.52	37.24	34.58	37.24	66.5	55.86	18.62
87.78	34.58	58.52	39.9	31.92	34.58	69.16	55.86	23.94
82.46	34.58	58.52	37.24	31.92	37.24	63.84	55.86	42.56
85.12	34.58	58.52	37.24	34.58	37.24	63.84	55.86	39.9
87.78	31.92	58.52	37.24	31.92	39.9	63.84	55.86	39.9
87.78	29.26	58.52	39.9	34.58	37.24	63.84	55.86	37.24
90.44	26.6	61.18	37.24	34.58	37.24	66.5	55.86	39.9
87.78	31.92	61.18	37.24	37.24	37.24	63.84	55.86	37.24
87.78	26.6	58.52	37.24	34.58	39.9	61.18	58.52	37.24
85.12	31.92	58.52	39.9	34.58	37.24	66.5	55.86	39.9
87.78	37.24	55.86	39.9	34.58	37.24	61.18	53.2	47.88
85.12	74.48	55.86	39.9	34.58	37.24	61.18	55.86	53.2
82.46	66.5	55.86	39.9	34.58	37.24	63.84	55.86	50.54
87.78	66.5	50.54	37.24	34.58	37.24	61.18	53.2	61.18
77.14	66.5	34.58	39.9	37.24	37.24	63.84	58.52	77.14
55.86	63.84	34.58	39.9	34.58	37.24	61.18	55.86	74.48
58.52	61.18	34.58	39.9	34.58	34.58	63.84	53.2	71.82
55.86	58.52	37.24	39.9	37.24	37.24	63.84	55.86	71.82
55.86	61.18	34.58	37.24	34.58	34.58	61.18	55.86	69.16
58.52	63.84	34.58	39.9	34.58	34.58	61.18	53.2	66.5
53.2	63.84	34.58	39.9	37.24	37.24	61.18	55.86	69.16
53.2	61.18	34.58	39.9	34.58	34.58	58.52	53.2	66.5
50.54	63.84	37.24	39.9	37.24	37.24	63.84	55.86	66.5
47.88	61.18	37.24	39.9	34.58	37.24	63.84	53.2	66.5
50.54	61.18	34.58	39.9	37.24	34.58	61.18	55.86	69.16
50.54	63.84	39.9	39.9	37.24	37.24	63.84	55.86	69.16
53.2	61.18	39.9	39.9	37.24	37.24	58.52	53.2	63.84
50.54	58.52	37.24	39.9	37.24	34.58	61.18	53.2	66.5
47.88	58.52	37.24	37.24	37.24	37.24	61.18	53.2	66.5
50.54	55.86	39.9	39.9	34.58	39.9	58.52	50.54	63.84
50.54	63.84	37.24	39.9	34.58	71.82	61.18	53.2	63.84
50.54	58.52	37.24	42.56	37.24	74.48	61.18	53.2	66.5
47.88	61.18	37.24	42.56	37.24	71.82	61.18	55.86	63.84
47.88	61.18	37.24	42.56	37.24	71.82	58.52	53.2	66.5
47.88	58.52	34.58	39.9	37.24	69.16	58.52	55.86	63.84
58.52	61.18	37.24	47.88	34.58	69.16	58.52	53.2	63.84
50.54	61.18	37.24	58.52	37.24	66.5	58.52	53.2	63.84
47.88	58.52	34.58	58.52	37.24	69.16	55.86	53.2	61.18
47.88	58.52	39.9	58.52	37.24	69.16	58.52	55.86	66.5
45.22	58.52	34.58	58.52	37.24	71.82	61.18	55.86	61.18
45.22	58.52	37.24	58.52	34.58	69.16	55.86	53.2	66.5
47.88	55.86	37.24	55.86	37.24	71.82	58.52	55.86	66.5
47.88	58.52	37.24	58.52	37.24	66.5	61.18	55.86	63.84
50.54	61.18	34.58	55.86	37.24	71.82	58.52	53.2	61.18
47.88	61.18	37.24	53.2	39.9	71.82	61.18	53.2	63.84
50.54	61.18	37.24	53.2	39.9	69.16	58.52	53.2	63.84
50.54	61.18	37.24	53.2	23.94	69.16	58.52	53.2	63.84
50.54	61.18	34.58	55.86	39.9	69.16	58.52	21.28	63.84
5.32	63.84	39.9	55.86	39.9	69.16	55.86	18.62	95.76
18.62	63.84	37.24	55.86	37.24	66.5	58.52	15.96	133
37.24	61.18	37.24	55.86	37.24	69.16	58.52	18.62	127.68
42.56	63.84	37.24	55.86	37.24	66.5	55.86	21.28	125.02
39.9	61.18	37.24	50.54	34.58	66.5	55.86	18.62	122.36
31.92	61.18	37.24	37.24	37.24	66.5	55.86	21.28	119.7
29.26	61.18	37.24	23.94	37.24	69.16	53.2	18.62	117.04

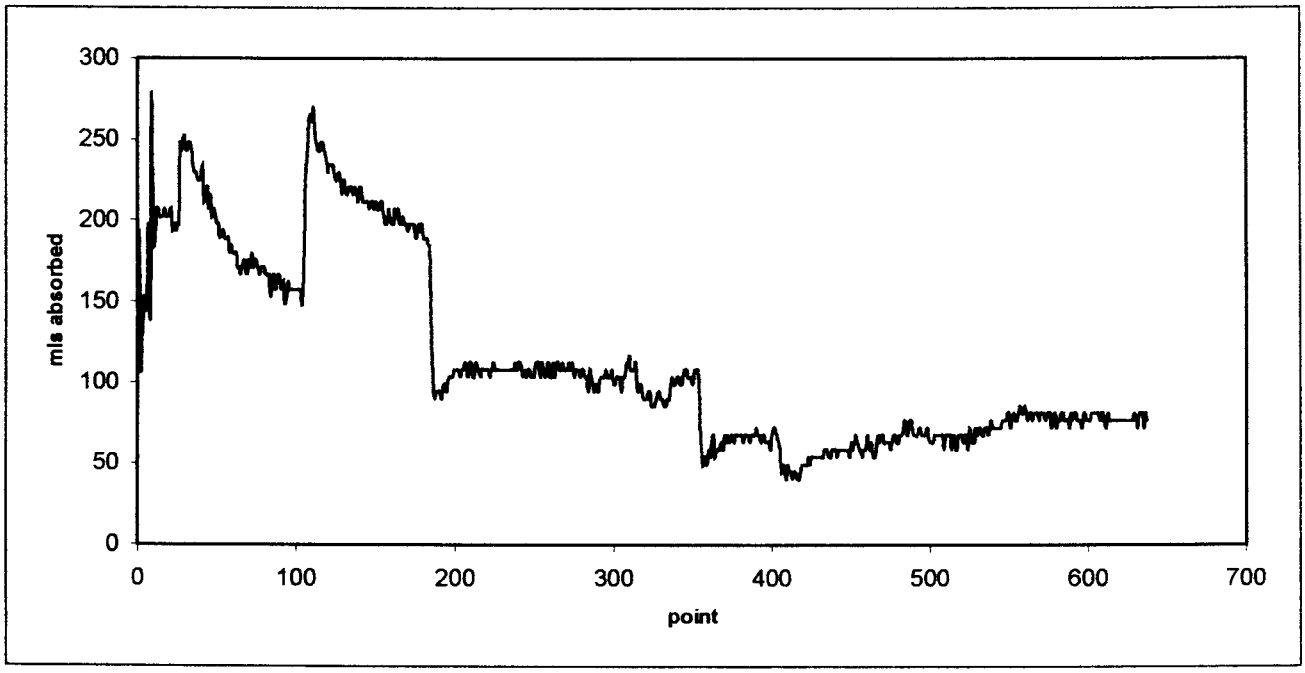
Measured Time Series

114.38	42.56	55.86	85.12	63.84	45.22	45.22	47.88	53.2
114.38	45.22	53.2	82.46	61.18	42.56	45.22	50.54	53.2
117.04	45.22	55.86	82.46	61.18	47.88	45.22	47.88	50.54
114.38	34.58	55.86	77.14	58.52	47.88	45.22	50.54	58.52
117.04	29.26	79.8	79.8	58.52	47.88	45.22	50.54	63.84
114.38	31.92	87.78	79.8	55.86	47.88	45.22	47.88	63.84
114.38	37.24	79.8	77.14	58.52	47.88	47.88	47.88	66.5
109.06	37.24	77.14	77.14	53.2	47.88	45.22	50.54	66.5
117.04	0	79.8	79.8	55.86	45.22	45.22	50.54	69.16
114.38	0	77.14	66.5	58.52	45.22	47.88	47.88	69.16
111.72	0	77.14	34.58	55.86	45.22	47.88	50.54	71.82
117.04	0	82.46	37.24	55.86	47.88	47.88	50.54	69.16
117.04	0	79.8	37.24	55.86	47.88	45.22	47.88	69.16
114.38	15.96	71.82	37.24	55.86	47.88	45.22	50.54	71.82
109.06	42.56	37.24	31.92	55.86	50.54	47.88	50.54	69.16
109.06	45.22	58.52	37.24	58.52	45.22	45.22	50.54	69.16
106.4	39.9	69.16	34.58	55.86	47.88	50.54	50.54	66.5
106.4	37.24	79.8	34.58	55.86	47.88	47.88	50.54	66.5
109.06	47.88	87.78	31.92	55.86	47.88	47.88	50.54	66.5
106.4	61.18	87.78	34.58	55.86	47.88	50.54	50.54	66.5
106.4	58.52	98.42	31.92	58.52	50.54	47.88	53.2	101.08
106.4	58.52	103.74	34.58	55.86	47.88	47.88	50.54	140.98
103.74	55.86	103.74	58.52	58.52	50.54	53.2	50.54	
103.74	58.52	101.08	63.84	55.86	45.22	47.88	53.2	
69.16	55.86	93.1	63.84	58.52	47.88	50.54	55.86	
39.9	55.86	93.1	61.18	55.86	47.88	50.54	55.86	

Time Series Name: Iso-10

Inhalation Agent used: Isoflurane

Graphical Representation:



193.5	184.5	247.5	189	108	99	103.5	49.5	54
108	180	243	193.5	108	103.5	99	45	58.5
135	180	238.5	198	108	103.5	108	40.5	67.5
153	180	229.5	193.5	108	103.5	108	49.5	63
144	171	234	198	108	108	108	45	67.5
162	171	234	189	112.5	103.5	99	45	67.5
198	166.5	234	189	108	103.5	63	40.5	63
139.5	171	229.5	189	112.5	103.5	49.5	45	63
279	175.5	225	184.5	112.5	108	54	45	63
184.5	171	225	184.5	108	99	54	40.5	63
193.5	166.5	229.5	126	103.5	99	49.5	40.5	58.5
207	175.5	225	94.5	108	103.5	58.5	45	63
207	171	216	90	103.5	103.5	54	49.5	67.5
202.5	180	225	94.5	108	103.5	63	49.5	67.5
202.5	171	220.5	94.5	108	94.5	67.5	49.5	63
202.5	175.5	216	94.5	103.5	103.5	54	49.5	63
207	175.5	220.5	90	103.5	103.5	58.5	54	67.5
202.5	171	220.5	94.5	103.5	112.5	58.5	49.5	67.5
202.5	166.5	220.5	99	112.5	112.5	58.5	54	72
202.5	171	216	94.5	112.5	117	63	54	76.5
207	171	220.5	99	112.5	108	58.5	54	72
193.5	171	216	103.5	103.5	108	67.5	54	67.5
198	166.5	211.5	103.5	112.5	108	63	54	76.5
193.5	166.5	220.5	103.5	108	112.5	67.5	54	76.5
198	166.5	220.5	108	103.5	94.5	63	54	72
198	153	211.5	108	108	94.5	67.5	54	67.5
247.5	162	211.5	108	112.5	99	67.5	58.5	67.5
243	166.5	211.5	108	103.5	94.5	63	58.5	67.5
252	157.5	211.5	103.5	103.5	90	67.5	58.5	72
247.5	162	207	108	112.5	90	67.5	54	72
243	166.5	211.5	108	103.5	90	67.5	54	67.5
247.5	162	211.5	112.5	112.5	94.5	67.5	58.5	67.5
247.5	157.5	207	108	112.5	94.5	67.5	58.5	67.5
243	162	211.5	103.5	108	85.5	63	58.5	72
234	148.5	207	112.5	108	85.5	67.5	54	67.5
229.5	153	207	112.5	112.5	85.5	67.5	58.5	63
229.5	162	211.5	103.5	108	90	67.5	58.5	63
225	157.5	211.5	103.5	108	94.5	63	58.5	63
225	157.5	202.5	112.5	108	94.5	67.5	58.5	67.5
225	157.5	198	108	112.5	90	67.5	58.5	67.5
234	157.5	198	108	108	90	67.5	58.5	67.5
211.5	157.5	207	103.5	112.5	85.5	72	58.5	67.5
220.5	157.5	202.5	108	103.5	85.5	67.5	54	67.5
220.5	157.5	198	108	108	90	67.5	63	67.5
207	157.5	198	108	108	90	63	58.5	58.5
216	148.5	207	108	108	99	67.5	63	67.5
202.5	184.5	202.5	108	103.5	103.5	67.5	67.5	67.5
207	225	207	103.5	108	99	63	63	67.5
202.5	238.5	198	108	108	99	63	58.5	67.5
198	256.5	198	112.5	103.5	103.5	63	58.5	58.5
198	265.5	202.5	108	103.5	103.5	58.5	54	67.5
189	261	198	108	94.5	99	67.5	58.5	63
193.5	270	198	108	108	99	72	58.5	58.5
193.5	252	193.5	108	103.5	103.5	72	67.5	67.5
189	247.5	198	108	99	108	67.5	63	67.5
189	243	198	108	94.5	108	63	58.5	67.5
189	243	198	108	99	103.5	58.5	63	63
180	247.5	198	108	94.5	103.5	45	54	67.5

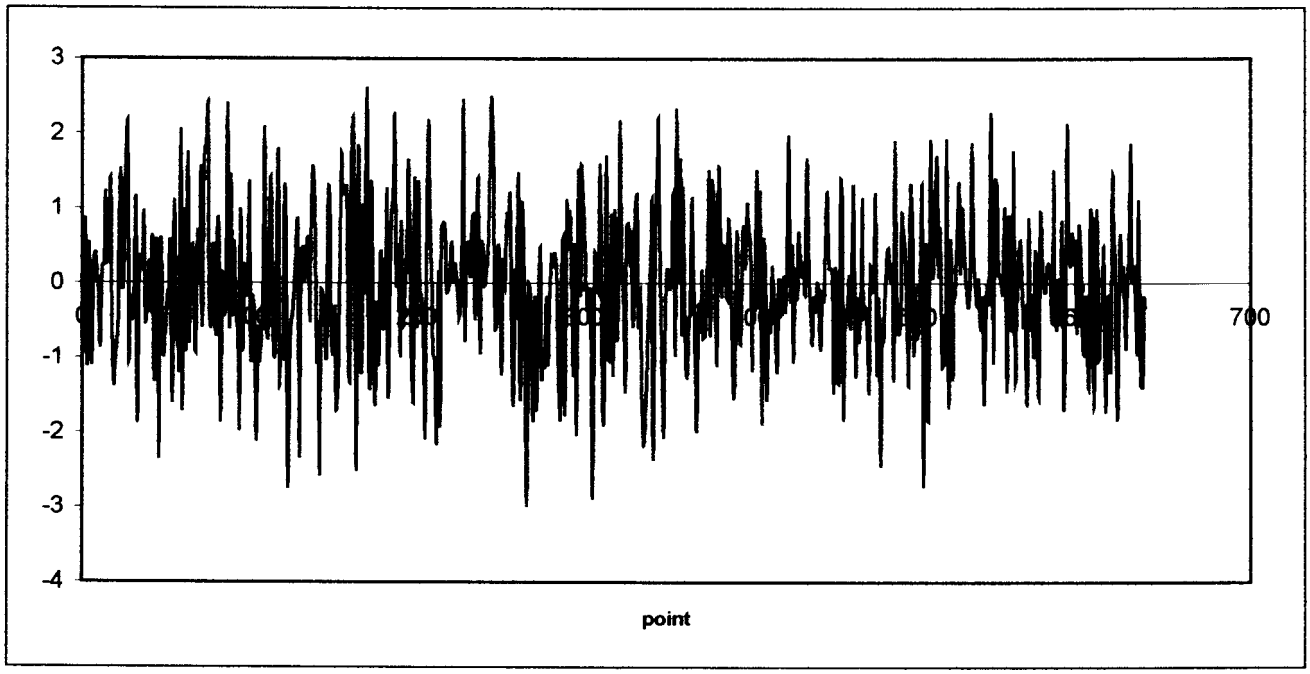
67.5	76.5	76.5	81	76.5	81	76.5	72	81
58.5	72	81	81	72	81	76.5	81	76.5
72	72	85.5	76.5	81	81	76.5	76.5	72
67.5	72	81	81	76.5	81	76.5	76.5	54
63	72	81	81	81	76.5	76.5	76.5	58.5
63	72	85.5	81	81	81	76.5	76.5	49.5
72	72	81	72	76.5	81	76.5	81	54
67.5	76.5	76.5	76.5	76.5	76.5	76.5	72	54
72	76.5	81	81	76.5	72	76.5	81	54
72	76.5	81	72	72	81	76.5	81	54
67.5	81	76.5	76.5	81	76.5	81	81	58.5
67.5	81	81	76.5	81	76.5	76.5	76.5	58.5
72	72	81	81	76.5	76.5	72	76.5	67.5
72	76.5	81	81	76.5	76.5	81	81	
67.5	81	76.5	76.5	76.5	76.5	81	76.5	
72	76.5	81	76.5	81	76.5	81	85.5	

APPENDIX C

Surrogate Data Sets for Henon Time Series, Noise time series and Logistic Map

Time Series Name: Henon Time Series Surrogate Data

Graphical Representation:



-0.859083	1.36709	0.458432	-0.447293	-0.370369	0.0968184	-0.277012
0.825869	-1.27077	-1.02405	-0.449689	-0.13695	0.0600193	0.385445
-1.26598	0.601214	-1.04282	-0.635991	-0.776991	-0.582602	-0.28289
0.730431	-1.30288	-0.427935	0.0629155	1.25892	-0.912699	-1.07988
-0.648728	0.331592	0.179829	0.318258	0.77218	-0.390421	-0.392733
-0.752163	-0.875288	-0.0847793	-0.833224	-0.752693	-1.12381	0.482782
-0.483925	0.32949	-0.885841	-0.220186	-0.0197263	0.891728	-0.862469
-0.182349	0.441952	-0.636836	-0.130611	-1.43409	-1.35871	1.14025
-0.570689	-0.257231	-0.759449	-1.01001	-0.543743	0.828919	-0.40996
0.382462	-0.741097	-0.234836	-1.10623	0.118739	0.0494721	1.41898
-0.54835	0.196865	-1.05996	0.614329	-0.104383	0.764359	-1.71299
-0.329984	-1.06274	0.38317	0.464788	1.29634	-0.270383	-0.178413
-0.937995	0.94945	-0.0225099	1.30241	0.646248	-0.622481	-2.08083
0.857447	-1.21366	-1.55495	-0.257738	0.895111	-0.207741	-0.709906
-0.251851	1.01187	0.220037	0.0233406	-0.636303	-1.27762	0.313574
0.355569	-0.0544336	0.205205	-1.61748	-0.0834723	-1.16408	0.735487
0.524693	1.41254	-0.837798	0.00296536	-0.510006	-0.493284	0.897145
-0.800303	-0.60627	0.0450382	-0.980838	0.515113	0.361245	-0.50368
-1.34833	-0.127893	-0.81455	0.716897	-1.18651	-1.14762	-1.28649
-0.67862	-1.01284	0.198931	-0.122669	0.0220404	1.25713	-1.65325
-0.301893	-0.265231	0.0257296	0.655923	-1.19216	-1.41345	-0.194148
-0.223001	-1.03799	1.22778	0.0612378	0.459921	-0.991254	-0.89851
0.877908	0.516405	0.488061	-1.08501	0.0668863	-0.288566	0.797887
-0.551336	0.672913	-0.746551	-1.7217	0.250564	0.854968	-0.612363
-0.39884	-1.4262	-0.543187	0.854955	-0.324427	-1.17788	-0.00143453
0.233917	-0.00760914	-1.93171	-1.18051	-0.877372	-0.136307	-0.250683
0.689513	-0.416591	-0.141488	0.913271	0.681604	-0.569251	0.775939
-0.850018	-1.11982	-0.617489	-0.555154	-1.75179	-1.01711	-0.768704
-0.583773	1.17498	0.23915	-0.446526	0.933028	-0.0772797	0.466061
-0.486349	-0.775416	-0.940988	-0.783794	-1.28493	-0.0567101	-0.0235284
-0.098177	1.00579	0.935289	-1.03386	0.556771	0.0632146	0.0875647
0.893085	-1.14395	-0.580492	-0.230383	-0.0670311	0.374529	-1.59126
-0.808611	0.0115549	1.20689	1.9939	-0.425319	-0.535128	0.561323
-0.355755	-1.17621	-0.942292	0.189112	-1.66062	0.199023	0.0757709
-0.690186	-0.693669	-0.580474	-0.125494	-0.346272	-1.50668	-0.240433
-0.520514	-0.122663	-1.82084	-0.219618	-0.0106588	0.400372	-0.318106
0.742816	0.343125	-1.20838	-1.4479	-0.722899	-0.281799	0.103446
-0.175243	0.111712	-0.268565	-0.861584	-0.646474	0.38314	-0.817545
-0.0444479	-1.14865	0.64544	-0.225793	0.00155695	-0.125666	0.111487
0.049307	0.339665	0.250448	-0.934196	-0.880465	-0.508526	0.327783
-0.904061	-0.7691	0.722006	0.119842	-0.505299	0.0369286	-0.974153
-0.412	0.821762	0.286683	-0.167348	0.926084	0.253315	-1.08868
-1.14748	-1.48596	-1.33446	1.17343	-1.51651	-0.417333	-1.21013
-0.348439	0.159974	-1.40428	-1.11432	0.140766	-0.0533545	-0.343831
0.394024	-0.0288755	0.252335	0.223485	-1.06619	-0.57021	-0.559405
-0.843431	-1.2317	0.72543	0.129418	0.0252176	-1.2	0.243021
0.229683	0.025513	-0.00136031	0.212097	-1.37406	-0.714586	-0.480877
-0.623774	-1.38008	-1.39691	-0.446116	0.0683427	-0.852452	0.833748
-1.01011	-0.394012	1.70645	0.150587	-0.516597	-0.21957	-0.630515
-0.618712	-0.986813	-0.39549	0.0159079	0.42313	-0.403305	0.827584
-0.0621762	1.04771	-2.06429	-0.996534	0.0629108	0.950931	-0.348812
0.1209	-0.282354	0.820363	0.139532	0.556205	-1.40675	0.252742
0.519273	0.610585	-1.02555	-0.700593	-0.886891	0.490921	-1.94343
-1.32891	-0.101392	1.45614	1.66442	-1.34272	0.418614	0.34518
-0.117374	0.366082	-0.77117	-0.912898	-0.651856	1.07521	-1.57047
-1.34369	-0.844706	-0.647365	0.336608	0.203742	-0.189961	1.06864
0.307191	-0.200412	0.230595	-0.370752	-1.36667	-1.20801	-0.67966
-1.2713	-0.642915	-1.04813	-0.602575	0.753696	-1.3035	0.849861

-1.35674	-1.03585	0.489848	-0.729812	-0.323571	-1.4176	-0.45002
-0.0448984	0.395251	0.416679	0.156982	-0.536497	-0.641462	-0.381223
-0.475784	0.180179	0.0727564	-0.50434	-0.841916	-0.191631	-0.696563
-1.14064	0.382206	-0.747195	0.276424	0.617634	0.287348	-0.116007
-0.183389	-0.529709	-0.632071	-0.695276	-0.533482	0.211389	-1.01897
-0.876088	-0.965171	-0.343765	-0.757579	0.806426	0.375482	-0.544173
0.55188	-0.462211	-0.3823	0.617708	-0.848267	-0.522922	0.210591
-0.958	-0.185462	0.415525	0.354894	0.542974	-0.280875	-0.781447
0.212924	-0.497232	0.797223	-1.15138	-0.912239	-1.89841	0.538277
-1.37199	0.542993	0.0270712	-0.175169	1.21259	-0.0699909	-0.734117
0.637054	-0.644441	-0.252397	0.00634988	-0.637861	-0.398531	-0.104923
-0.964028	-0.419302	-0.217979	-0.233997	-0.889201	-0.216441	0.222608
-0.731329	-1.5141	0.0678592	-0.852988	-0.443449	-0.0237853	-1.66132
-0.476774	-1.05632	0.125712	0.603336	0.0977452	-0.0623871	0.157843
-0.00256582	0.46033	0.40681	-0.777593	0.365706	-0.966723	-0.509543
-0.408771	-0.152294	-1.42918	0.518282	-1.17467	-0.62328	0.0182343
1.66026	-0.468141	-0.916702	-1.32833	-0.125849	-0.601499	-1.29603
-0.620415	0.404712	0.0641647	0.472906	-0.445866	0.345836	1.6023
0.635641	-0.589448	-0.532751	-0.578887	1.43516	0.255411	-0.88151
-1.33714	0.116383	1.34097	-0.65865	-1.14475	-1.04998	-0.109058
-0.331089	-1.66229	-0.483528	-0.0497932	-0.574458	-0.416199	-1.98887
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0.118978	-0.492286	0.130053	0.17205	-0.0543525	0.194612	0.00253969
0.142087	-1.27619	-1.64026	-0.953249	0.0014592	-0.631634	-0.731188
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0.732301	-2.05759	0.745784	-0.850924	0.772705	-0.312694	-0.364948
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0.301677	0.713422	0.344061	-0.52575	-0.665485	0.0688974	-0.56602
-0.0123494	-1.11824	-0.0647755	0.371359	-0.168717	-0.378024	-1.37996
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-0.0252475	-0.20375	0.304359	-0.0980643	-0.717133	0.278933	-0.611622
0.756813	-0.138384	0.68157	0.775938	-1.24239	0.439305	0.423604
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0.2802	-0.250416	-0.933989	-1.04045	0.109808	-1.3554	0.000831759
-0.810865	0.460856	-0.561603	-0.864809	-0.0867378	-1.29511	-0.276797
1.10086	-0.878773	-0.902003	-0.997389	-0.616847	-1.20695	-0.770958
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0.0818955	-0.953356	-0.0568076	0.502663	0.821502	-0.673542	-0.202456
-0.133128	0.324855	0.327736	-0.920381	-0.548976	1.04021	-0.23934
0.556261	-0.872797	0.299312	0.291025	-1.19328	-0.865795	0.220339
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-1.40897	1.09062	0.0347075	-0.226653	-1.0983	-0.445103	
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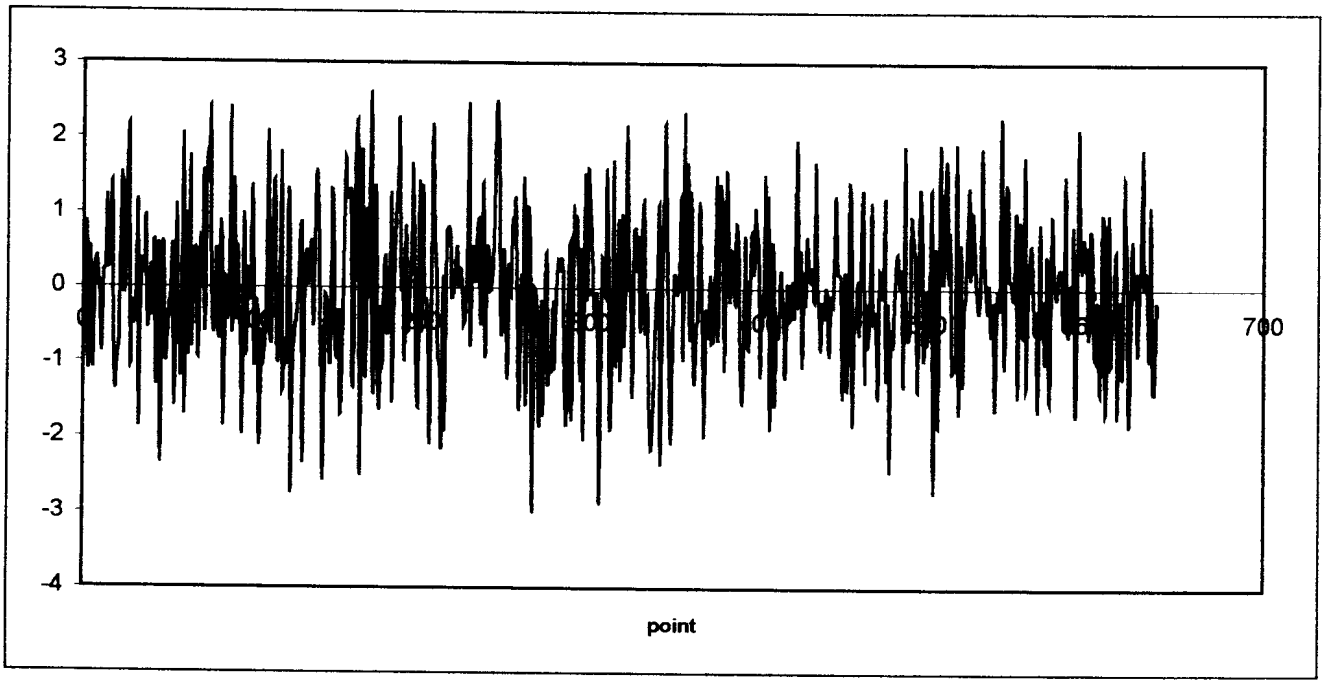
Time Series Name: O-1 Noise Surrogate Data

Graphical Representation:



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0.067235	-0.901636	-0.389304	0.0284146	0.169854	1.07416	1.66607
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0.246785	1.55887	0.866666	2.24501	2.49824	-0.368184	-0.74874
1.22547	-0.587161	-2.33181	-0.0301058	1.83274	-0.0837685	-1.26911
0.270756	1.68602	0.262697	0.346011	-0.610305	-1.5976	-0.471258
0.760786	1.84777	0.488793	-0.979951	-0.468342	-2.83119	-0.418651
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0.158171	-0.33716	1.65294	-0.0854695	-1.10156	-1.42594	-0.654337
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0.830859	1.03575	-1.09773	0.0357035	0.930398	-2.26728	1.5447
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0.559406	-1.4544	-2.78868	-0.262766	-0.204751	0.652248	-1.6451
0.339718	-0.790016	-1.91468	-0.0920744	-0.387473	-0.850503	1.12966
-0.185863	-1.44557	-0.415257	-0.102447	1.07072	-0.840734	-0.809124
0.580565	-0.289609	1.2007	0.101667	-0.332821	0.00871521	-1.26728
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0.270438	-1.17041	0.731008	-0.366396	-0.930747	0.691784	-1.51523
0.42061	0.401803	0.765892	1.0641	-0.422751	-0.993606	-0.265751
-0.379484	0.53308	-0.730208	1.53373	2.18436	-1.06681	0.393799
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1.19378	-1.42906	-0.375191	-0.860629	-0.0334691	0.221328	-0.52163
-0.820715	0.717837	0.0754213	-0.0252169	0.12652	2.7608	-0.242847
0.450809	-0.315629	-0.62295	-0.786578	0.546992	0.816376	0.414923
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0.862989	1.33579	0.0061211	1.11601	-1.76959	0.583889	0.000248925
0.143988	-0.276056	-1.26335	-0.11741	1.40484	2.40096	-1.62198
0.666219	1.0406	-0.170324	-1.82982	0.668696	-0.274256	0.660439
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0.277047	0.0694307	1.09741	0.798043	1.09587	0.073012	
0.478332	0.764008	-0.26474	1.48015	-0.0693139	-0.171225	
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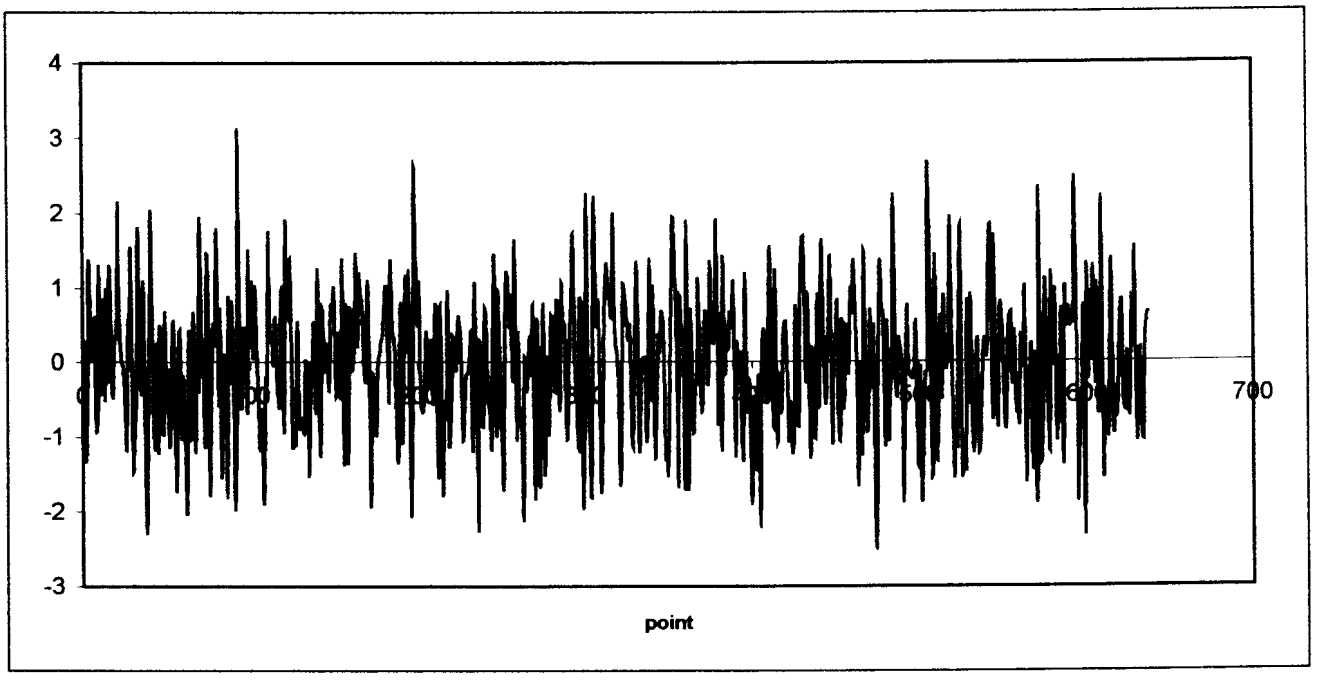
Time Series Name: O-2 Noise Surrogate Data

Graphical Representation:



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1.37213	-2.02496	-0.939114	0.295485	-2.25376	-0.218561	0.804941
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0.309369	-1.04009	0.932772	0.6888	-0.048143	-1.1331	1.33918
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1.30487	0.211297	-0.818381	1.38236	-0.521976	-0.705245	0.395913
-0.421271	-0.321971	-1.10269	0.406169	-0.631357	2.25478	0.211157
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0.991647	0.0235346	-0.89632	-1.34121	1.43578	-1.74893	-1.7019
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0.707999	-1.81756	-0.126205	-0.518266	0.405214	0.455915	0.280473
1.47518	0.869918	0.25145	-0.671208	-0.759701	0.151857	0.252507
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2.0352	1.49729	0.7794	-1.7714	-1.66667	1.34251	1.0246
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0.555023	0.296051	1.09438	-0.560708	1.03832	0.373412	-1.40472
-1.06132	0.303987	-0.110866	-0.177574	0.581241	0.129735	-1.44157
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0.443533	-1.23834	1.75204	-0.818021	0.0281416	0.629161	1.38106
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1.10169	0.709157	-0.0603448	-1.57791	-1.33892	0.956979	-0.61147
1.35649	1.06917	-0.227407	0.933249	-0.335677	0.108221	-2.75994
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1.6821	-0.92833	0.182428	1.18708	1.58554	0.316374	-1.42066
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-1.34873	-0.33519	-0.411515	-0.696555	1.54612	0.406037	0.432766
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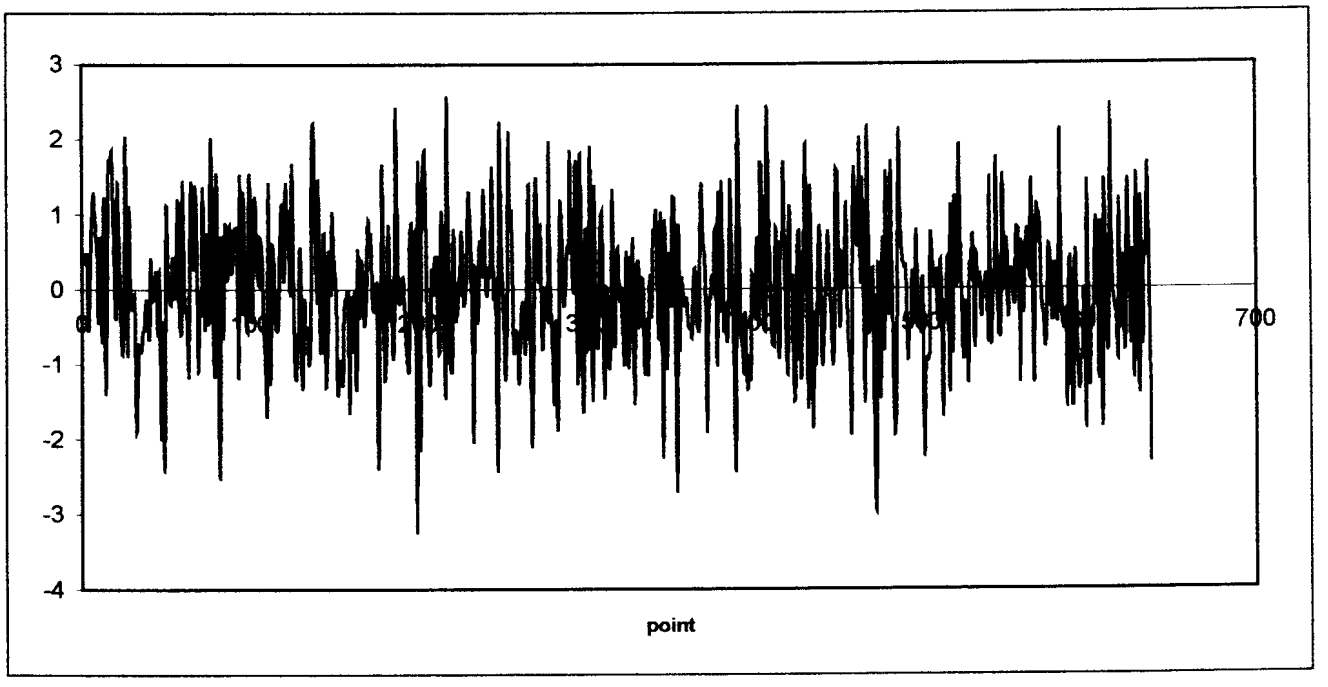
Time Series Name: O-Noise-03 Surrogate Data

Graphical Representation:



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0.800743	0.271672	-0.0758391	0.856069	0.061671	-1.61172	-0.820824
0.369508	1.38378	1.66676	-0.40303	-0.0945056	-1.23147	0.116272
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1.72066	0.740943	-0.139831	-0.0572316	1.01477	-0.720896	-0.0948123
1.73523	-0.461917	-0.635694	0.150348	2.22537	-0.789747	0.271547
1.85029	0.308415	-0.528276	-0.394149	0.255997	0.18925	-0.447244
0.582544	2.0072	-1.01483	-0.950978	-0.385738	0.970976	-0.565415
-0.395324	-0.822102	-0.549669	-1.09749	-1.21037	1.027	0.153011
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0.827194	1.53904	2.19292	0.867036	2.08948	-0.00575514	0.593927
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-0.867332	-2.49414	-0.174663	0.686105	1.03719	-1.07241	-1.90804
0.172122	0.677523	1.45128	-3.24424	-0.833969	-0.672331	-0.272549
2.03172	-0.654708	-0.82904	1.69819	-0.545294	1.3184	-0.127482
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1.09849	0.1184	0.677067	0.514834	-1.27025	0.20262	-0.0462218
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-0.147752	1.29536	-0.960198	-0.862126	1.43557	0.669218	1.45478
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0.408786	0.31507	-0.125742	0.51199	0.804715	0.376475	-2.39842
-0.132003	1.53736	-0.0339682	-1.43266	-0.806451	-0.479048	1.37707
0.0470018	-0.41624	-1.65513	2.52541	0.0238441	-0.205088	2.40543
0.220811	0.439216	-0.0967233	0.678893	0.00733196	0.10366	-0.472913
-0.609553	1.22763	-0.830196	-0.967741	-0.364545	-1.14049	-0.710472
0.194885	0.346994	-0.0421294	-1.09194	1.95618	-0.410107	-1.13819
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0.0550328	-0.301381	-0.703592	1.4393	-0.205993	-0.234358	-2.27108
0.14826	1.69147	1.49558	-1.26017	0.0294914	0.823741	0.509964
-1.46948	-0.175607	-0.687654	-0.311622	-0.528192	-0.542616	-1.72542
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-0.36746	0.410538	1.44711	-0.739616	-0.381573	-0.620963	-0.29686
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1.15099	-0.179353	-0.385062	-0.75036	0.34224	-0.478587	0.0497757
-0.603241	-0.273568	-0.775202	0.556349	1.57181	0.674033	0.0178865
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1.17089	2.48929	1.63206	0.340157	0.629744	-0.811329	0.143722
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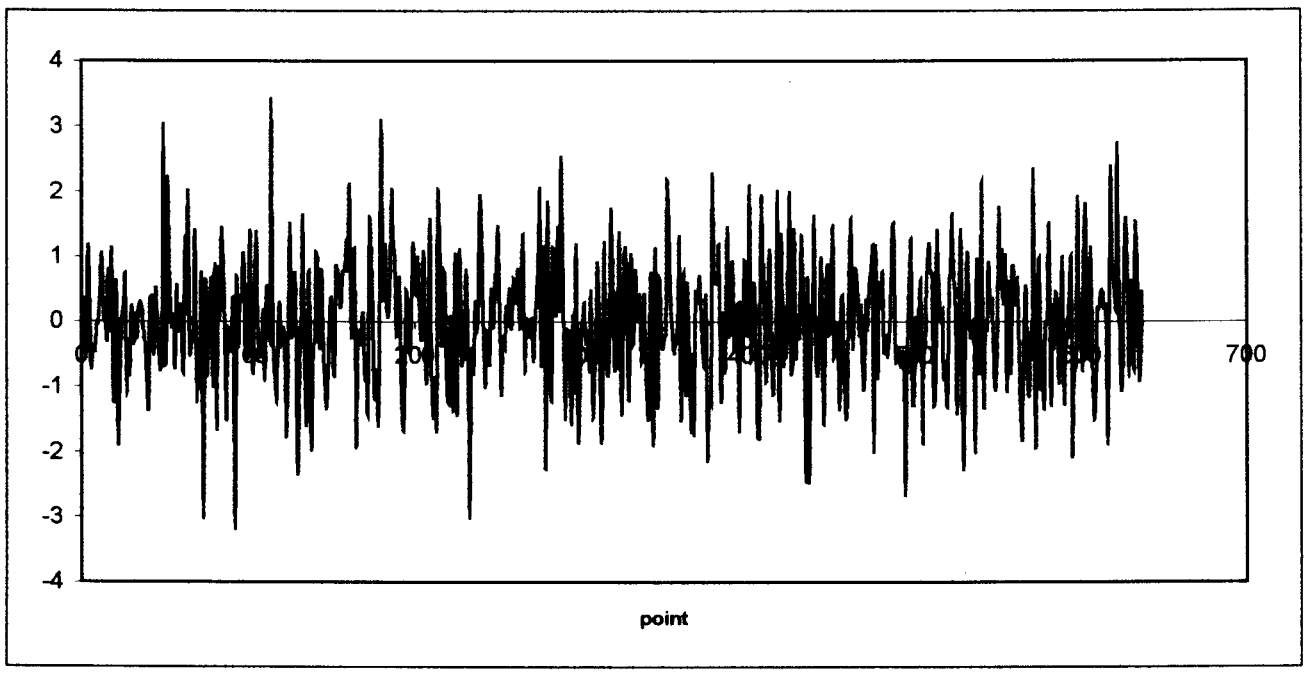
Time Series Name: O-Noise-4 Surrogate Data

Graphical Representation:



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1.06276	-0.358067	0.729743	2.04202	-0.166605	0.274915	-1.50133
0.0926135	-1.0363	-0.252129	1.31595	-0.669115	-0.311209	-0.252115
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0.7985	0.615489	0.160462	0.295169	0.73557	0.484925	0.594489
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0.599101	0.618815	-0.0122716	-0.162288	-1.13752	0.915652	-1.75262
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0.39269	-0.565867	0.79698	-0.367172	0.877283	0.309286	0.0928766
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0.116227	-0.804031	2.12323	-0.786242	1.14968	0.40285	-0.100073
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2.23742	-0.912432	-0.173456	-0.118827	0.539608	0.751956	-0.208063
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1.11163	-0.139843	-0.228993	-1.26667	1.072	-0.396774	1.05764
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-0.559861	1.51169	0.329116	1.14723	0.421454	0.254451	0.890713
0.097075	-0.611897	-0.713889	-0.55458	1.48797	-0.480622	-2.55984
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0.796594	-0.705243	1.75954	0.189473	-1.07278	0.917388	-0.287305
0.0649435	-0.455489	0.495504	0.192188	0.566312	-0.697836	-0.651103
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1.63382	-1.28234	-0.792851	0.480164	1.24521	0.065538	-0.352977
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0.396607	-0.0126037	0.939864	0.83797	0.785762	-1.75651	-0.928802
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0.786153	0.716194	0.241123	-0.314241	-0.484353	-0.951718	1.02221

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0.381924	0.338628	-1.76111	-0.216658	0.307684	-0.353021	-0.864333
-0.475464	1.62068	-0.183032	1.15717	-1.66058	0.70171	-1.38126
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0.62235	0.50436	-0.639271	-2.66196	0.42269	0.51756	-1.20076
-0.179525	-0.530069	0.347909	-1.27408	0.751436	1.51688	0.456154
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0.844788	0.0507133	-0.985091	-3.06302	1.59926	0.71499	1.20688
-1.06979	-0.0455525	0.436304	-0.401994	0.989415	-0.475243	0.61564
0.0751251	-0.40669	-0.265151	0.518557	-0.527167	0.302923	-0.553054
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0.568349	0.629142	-0.678408	0.123695	0.542501	0.946631	
1.19312	1.69079	-0.435365	-0.474714	1.05944	-0.258242	
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1.60843	0.21979	0.707553	-0.693404	-1.27939	1.45125	

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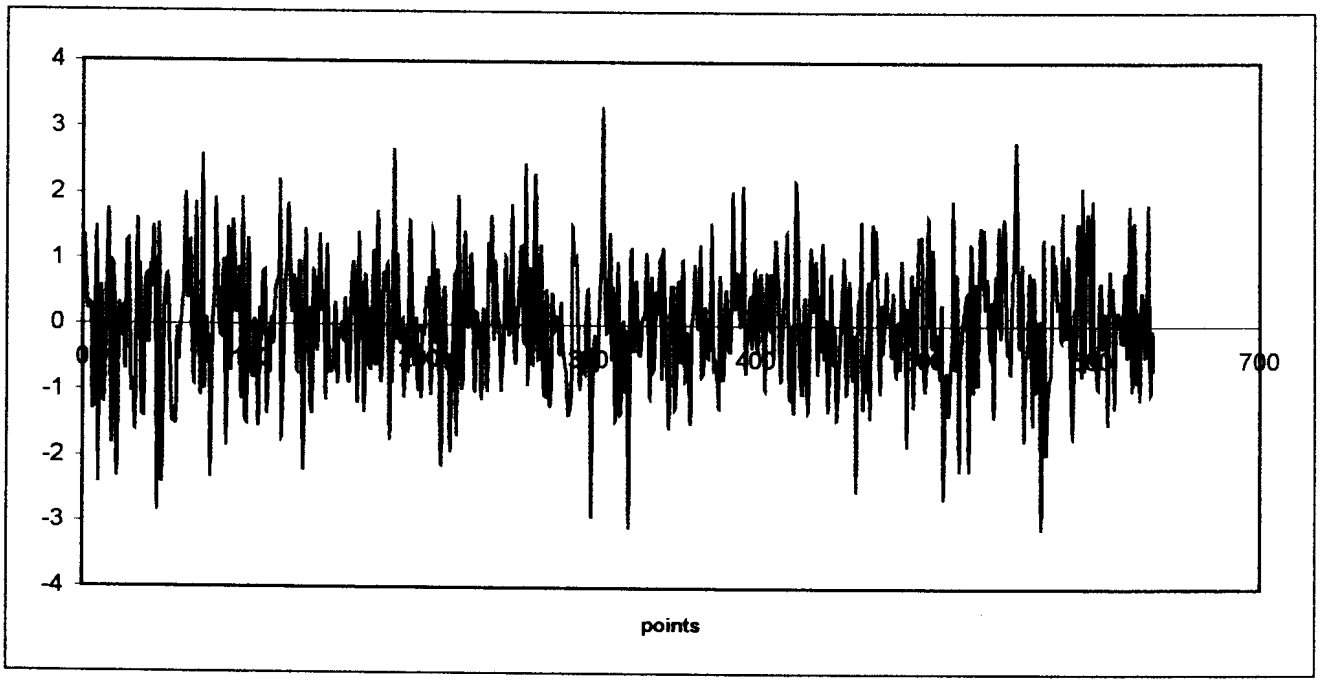
Time Series Name: O-Noise 5 Surrogate Data

Graphical Representation:



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0.241155	0.820625	1.0121	0.780807	-1.12144	-0.966466	-0.605192
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0.222386	-0.906188	-0.655095	-0.171078	0.229869	-0.161967	0.031632
1.74947	0.0554119	-2.16964	-0.277776	0.0101677	-0.679552	0.225
0.347619	-0.196484	1.42357	0.0431509	-0.96655	-0.438025	0.917922
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0.875746	-2.32743	0.197359	-0.0645224	-0.149261	1.03797	-0.0139559
0.269608	-0.00770666	-1.16757	-0.660218	1.0246	3.3144	1.21561
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0.63813	0.201941	-0.543609	-1.06631	0.857965	-0.193279	-0.809698
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0.535931	0.769027	-0.121634	1.94867	0.12883	-0.663548	0.444142
0.739436	0.813131	0.532798	-0.0218751	0.0339725	-0.00878254	-0.327901
0.255848	-1.35804	-1.32675	-0.973364	-0.446931	0.508347	0.245738
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0.762131	-0.954441	0.353075	0.0170412	-0.0840589	-0.874397	0.0235692
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0.872732	1.45511	0.641362	0.245197	-0.355136	1.26107	-0.772849
0.457193	0.177485	-0.906594	-0.449704	-1.64999	2.28475	-1.54807
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0.50796	0.0444219	1.46136	2.0923	-0.972323	0.926724	1.60234
1.36928	0.821595	0.267622	-0.663518	-0.647171	0.0629005	0.500626
-1.04725	0.0809233	0.713187	1.09793	0.533059	-0.237733	1.44683
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1.62728	-0.758221	0.690166	-0.564519	0.55644	0.0148902	-0.00582569
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Time Series Name:Logistic Map Surrogate Data

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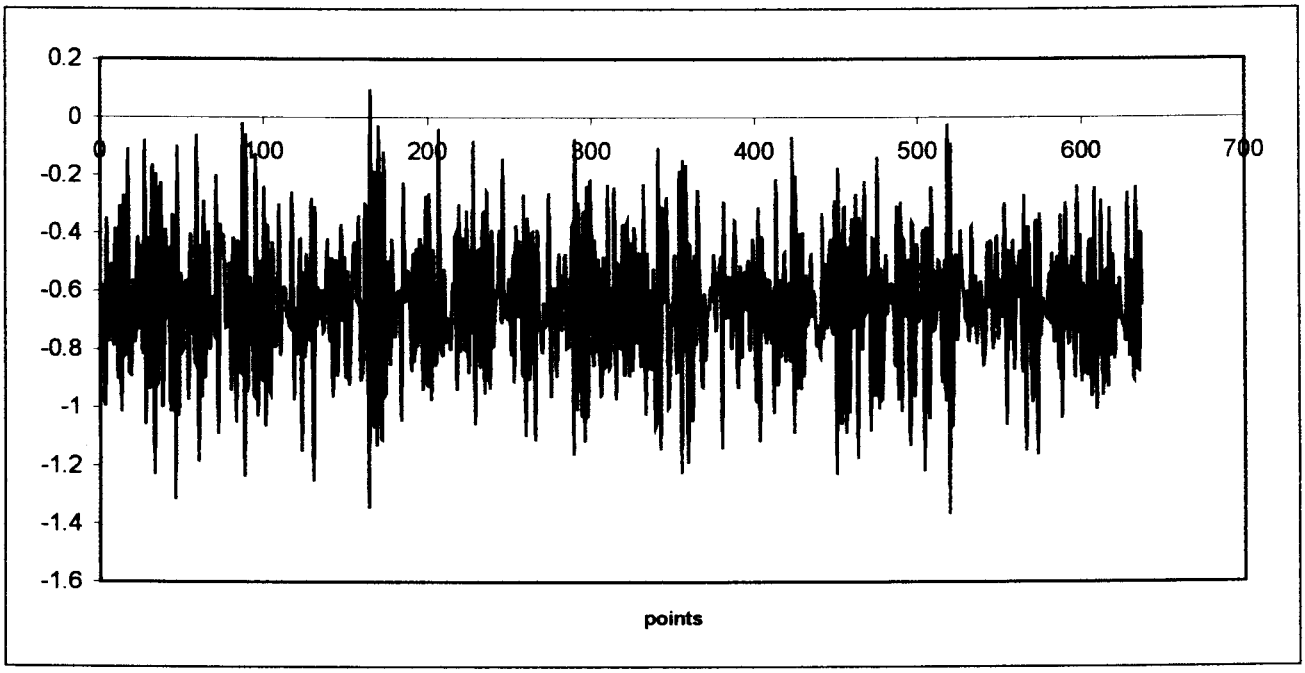

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-0.277013	-1.0452	-0.539712	-0.909043	-0.520345	-0.864848	-0.828064
-1.17279	-0.691464	-0.711124	-0.441691	-0.607044	-0.606327	-0.475211
-0.352199	-0.47592	-0.470612	-0.924505	-0.434465	-0.290257	-0.296715
-0.742669	-0.768068	-0.77054	-0.486807	-0.748982	-1.06295	-1.02316

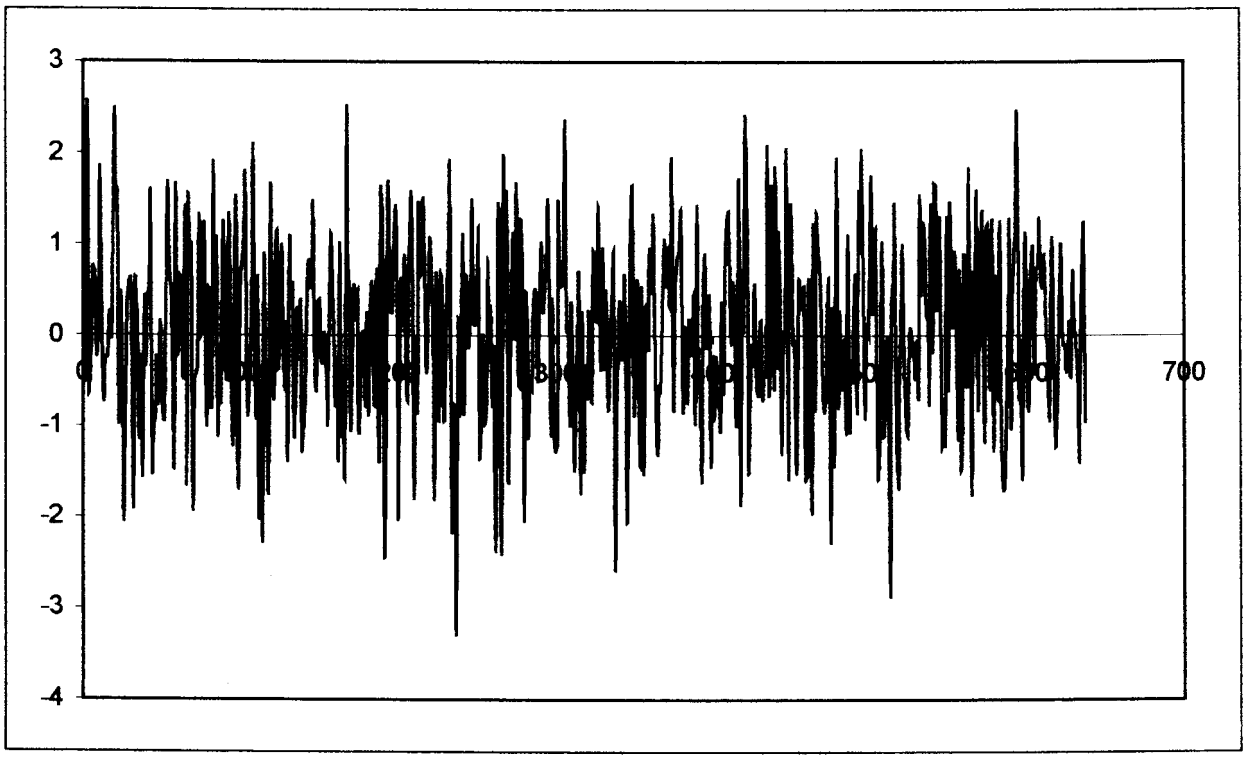
-0.384153	-0.390886	-0.556078	-0.337846	-0.571305	-0.916391	-0.364154
-0.858947	-0.57367	-0.667306	-0.91467	-0.735487	-0.564675	-0.950317
-0.451608	-0.911744	-1.08829	-0.665536	-0.559499	-0.478758	-0.736341
-0.700783	-0.458882	-0.472853	-0.681928	-0.683169	-0.864653	-0.456933
-0.647633	-0.908841	-0.711095	-0.726187	-0.561158	-0.671826	-0.735123
-0.528604	-0.75591	-0.500024	-0.292454	-0.852446	-0.576462	-0.905633
-0.523016	-0.355497	-0.708178	-0.952685	-0.601219	-0.638172	-0.551344
-0.764762	-0.997789	-0.640219	-0.32273	-0.719825	-0.382123	-0.875422
-0.563427	-0.355068	-0.523753	-0.68681	-0.793408	-0.915596	-0.581317
-0.801438	-0.681526	-0.749172	-0.443173	-0.207272	-0.708581	-0.420315
-0.491694	-0.466715	-0.811782	-0.616134	-0.586189	-0.403508	-0.991527
-0.728219	-0.67055	-0.597155	-0.929533	-0.851233	-0.755043	-0.288305
-0.844236	-0.653212	-0.560143	-0.429091	-0.50109	-0.381156	-0.812065
-0.138379	-0.502926	-0.575599	-0.550453	-1.21625	-0.762544	-0.406082
-0.764944	-0.693071	-0.900488	-0.801884	0.0160929	-0.396086	-1.04741
-0.87326	-0.812415	-0.479271	-0.507953	-0.916056	-0.523229	-0.61758
-0.443425	-0.491865	-0.677111	-0.776153	-0.527874	-0.659653	-0.196405
-1.03125	-0.38158	-0.644034	-0.592494	-0.69253	-1.13133	-0.844537
-0.254133	-1.11015	-0.959862	-1.13276	-0.625598	-0.757405	-0.46253
-1.03299	-0.439714	-0.224534	-0.550317	-0.571741	0.0997412	-0.860027
-0.308751	-0.944406	-0.705924	-0.528267	-0.690658	-0.868069	-0.642283
-0.760675	-0.285329	-0.639256	-0.827393	-0.541818	-0.440612	-0.50043
-0.425604	-0.801002	-0.470452	-0.422417	-0.953132	-0.841329	-0.561775
-0.654717	-0.523788	-0.728614	-0.745635	-0.454105	-0.186004	-1.02951
-0.290643	-0.392647	-0.823327	-0.636758	-0.535585	-0.705822	-0.237021
-1.17718	-0.670106	-0.465087	-0.67807	-0.981508	-0.771677	
-0.462279	-0.244531	-0.98645	-0.588367	-0.319181	-0.417427	
-0.765314	-0.936404	-0.26561	-0.631743	-0.714038	-0.764128	
-0.212681	-0.511593	-0.81856	-0.724446	-0.582896	-0.649637	
-1.14314	-0.714852	-0.614833	-0.406509	-0.531553	-0.507188	

Appendix D

Noise Signals

Time Series Name: Noise O-1

Graphical Representation:



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0.52871	-0.0597794	0.452851	-0.789203	0.11442	-1.1024	-1.52957
2.57058	0.638696	-0.71291	0.245435	-0.889075	0.413229	0.14707
-0.608616	0.298773	0.612788	-0.878695	-0.452955	-1.13032	0.355888
-0.288598	-0.478795	1.12277	-0.134907	1.11819	-1.28369	-0.157911
0.763309	1.4275	-0.338521	0.590958	-0.874437	-1.18835	0.95535
0.72423	-1.65402	0.00229841	-0.314457	0.634355	1.44467	0.472385
0.553211	1.4714	0.996067	-0.734708	0.382345	0.54166	1.33112
-0.236094	0.682247	0.0975582	0.724924	-0.133597	0.549696	0.234535
0.260038	0.997919	-0.604115	-0.395337	0.296669	0.564542	-1.0937
1.85418	-1.91108	0.142034	-1.31966	1.48917	2.36367	-1.31165
0.119222	-0.542057	-1.38706	1.63353	0.128463	0.041623	-0.552641
-0.734402	-0.42764	1.04916	1.32835	0.118047	0.0559198	-0.623221
-0.24363	-0.329504	0.387677	-2.40105	0.4911	-0.991782	0.238594
-0.246358	1.3334	0.572714	-1.66961	1.1363	0.363487	1.05611
-0.233376	0.00977245	-1.09791	1.23229	-1.31368	-0.58711	0.550256
0.259752	0.279931	-0.492424	1.69706	-0.969737	-1.48187	0.617536
-0.0288758	1.23736	0.30692	0.266924	0.0123936	-0.706622	0.976179
1.10826	-0.759678	-0.162263	0.247362	-0.969139	-0.117584	0.316936
2.49159	-1.00677	0.384917	0.810149	-0.744695	0.646369	1.95217
1.52044	0.478438	-1.24922	1.43433	0.811396	-1.74225	-0.813949
1.60115	-0.0136769	-0.955872	1.04808	0.0988486	0.263775	0.431781
-0.979618	-0.736726	-0.658619	-1.99035	0.328383	-1.50651	0.729396
0.478545	1.91486	0.42674	-0.77414	-0.777512	-0.331658	0.888902
-0.681835	0.0460761	0.829119	0.583327	-0.146748	-0.684536	0.948765
-2.04889	1.0798	0.515378	0.121018	-2.37707	0.274549	1.35608
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0.143624	-0.124871	1.46907	-0.589802	1.46026	-0.687285	0.105474
0.591812	-0.730471	-0.432938	-0.713496	0.188649	0.91779	-0.446764
0.632102	1.24019	-0.622464	0.835217	-2.39587	0.229345	-0.704456
0.191736	0.316328	0.342453	1.58318	1.93453	0.168071	0.162747
-1.90985	-0.467269	0.394327	1.0243	0.330553	1.42089	0.0405308
0.617709	-0.487644	-0.235693	-1.80014	1.56564	0.671534	-0.216491
0.372421	1.34064	-0.313035	-0.0110492	-1.54406	-0.375159	0.440249
0.125467	-0.104545	0.0329951	-0.83703	-0.809412	0.963474	-0.977121
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-0.22441	0.0138985	-0.995705	0.671344	1.12974	0.499129	-0.434377
-1.56636	1.54014	-0.117269	0.950171	-0.0264342	-0.810123	-0.531199
0.424883	-0.626691	1.09955	1.50854	1.6777	-0.749904	-1.61022
-0.340618	-1.6783	0.81151	0.355199	-0.0210113	0.0286315	0.133057
0.438926	0.523416	0.0797931	-0.40927	-0.536472	0.327351	0.898788
0.539371	0.791091	-0.782656	0.216698	1.2769	0.873061	-0.130082
1.55805	1.11063	-0.29231	1.04801	0.755807	-2.59003	0.336631
-1.50304	1.7847	-1.37682	0.763992	-2.04511	-0.41509	0.451964
-1.04672	-0.198681	1.0178	0.21293	0.443077	-0.24701	-1.44781
-0.907624	-0.894108	-1.08745	-1.80533	0.127219	0.381414	-0.217061
-0.233533	-0.313526	-0.35611	0.675344	-1.12658	-0.260326	-0.929796
-0.766397	0.219322	-1.50503	-0.537322	-0.438034	-0.248598	-0.229572
0.157851	2.10096	2.46084	-0.902322	-0.588935	0.63018	-0.732335
-0.395314	-0.171235	1.02957	0.648179	0.388939	-1.98185	-0.594665
-0.94155	-0.917517	0.400182	0.450884	0.519884	-1.31377	-1.05164
-0.954115	0.650618	-1.05676	-0.909016	0.128887	0.12185	0.365181
0.777303	-2.02239	0.00494806	-0.455895	-0.51107	1.2179	-0.642577
1.69047	-0.514743	0.554055	0.482178	0.160207	1.60689	0.59045
0.755485	-2.27592	0.216178	1.09447	1.02718	-0.849497	1.25395
0.506832	0.870984	0.469107	1.85161	0.273153	0.0342937	1.35044
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-1.45075	-0.330935	-0.556874	-0.744944	0.719178	-0.55832	-0.0954951
1.67155	-1.71955	-0.00312737	-1.64712	1.49856	-1.42687	0.591031

0.23032	0.600794	1.22136	2.42762	0.540564	0.209308	0.386878
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-1.86762	0.0870155	-0.748405	-0.484436	-1.72522	-0.0439557	-0.422417
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-0.669341	-0.487707	1.29277	0.638081	0.783197	-0.950903	-1.87156
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-0.390729	1.53108	0.0815897	-0.144885	0.167827	0.729675	0.695537
-0.444725	0.913107	0.922128	-0.950123	0.769121	1.73362	-0.575555
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-0.659491	0.581631	-1.15015	1.06877	-3.42499	0.389185	-0.275018
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1.58796	0.103479	-1.43738	-1.22262	0.975536	-1.22441	-0.853094
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0.39996	1.09141	1.83144	-0.104304	0.118202	-0.414309	-1.09768
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-1.58627	1.02674	1.59255	-0.47127	1.72631	-1.51352	0.260024
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-0.586499	0.376397	0.922745	-0.590954	0.494891	1.34154	-0.359319
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-1.53216	0.0895919	0.653948	0.333895	-1.43905	-0.873129	0.775391
0.605437	0.996591	-0.638498	-0.189223	0.498372	-0.158706	-0.647264
-0.286923	-0.310418	-0.70291	-1.4755	-0.931183	2.3003	0.377455
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1.30724	0.0765653	-1.67247	-0.261952	-0.290363	0.37147	-0.197838
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0.859453	-0.222653	0.0966576	-0.849676	-0.937661	-0.603279	-0.43363
0.419824	-0.486276	1.26667	-1.17655	0.760878	0.0744182	0.010743
-0.632425	-0.045933	-1.02981	-0.146921	0.542309	-0.631985	-1.6309
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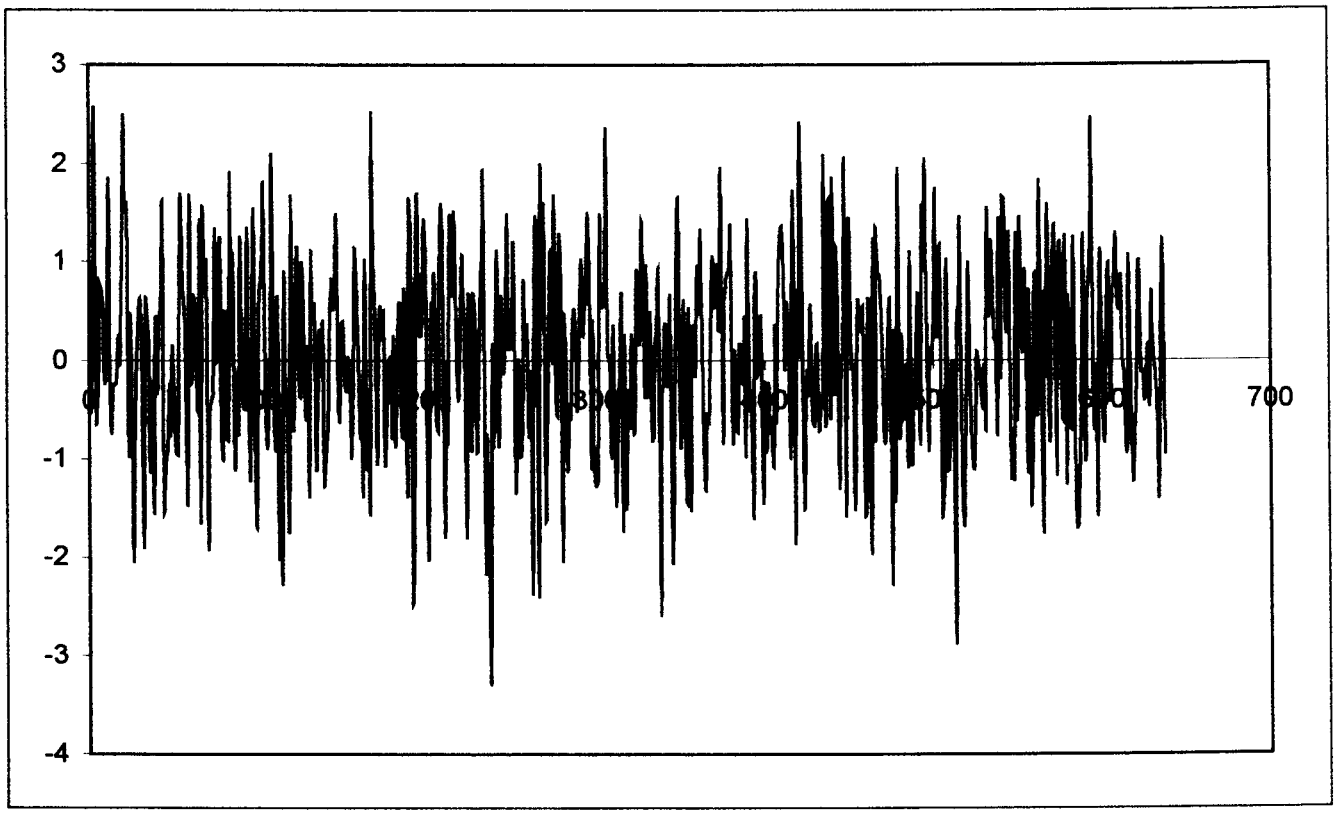
Time Series Name: Noise O-2

Graphical Representation:



-0.525209	-0.216309	1.60999	0.0365966	-3.26894	0.844362	0.534449
0.52871	-0.0597794	0.452851	-0.789203	0.11442	-1.1024	-1.52957
2.57058	0.638696	-0.71291	0.245435	-0.889075	0.413229	0.14707
-0.608616	0.298773	0.612788	-0.878695	-0.452955	-1.13032	0.355888
-0.288598	-0.478795	1.12277	-0.134907	1.11819	-1.28369	-0.157911
0.763309	1.4275	-0.338521	0.590958	-0.874437	-1.18835	0.95535
0.72423	-1.65402	0.00229841	-0.314457	0.634355	1.44467	0.472385
0.553211	1.4714	0.996067	-0.734708	0.382345	0.54166	1.33112
-0.236094	0.682247	0.0975582	0.724924	-0.133597	0.549696	0.234535
0.260038	0.997919	-0.604115	-0.395337	0.296669	0.564542	-1.0937
1.85418	-1.91108	0.142034	-1.31966	1.48917	2.36367	-1.31165
0.119222	-0.542057	-1.38706	1.63353	0.128463	0.041623	-0.552641
-0.734402	-0.42764	1.04916	1.32835	0.118047	0.0559198	-0.623221
-0.24363	-0.329504	0.387677	-2.40105	0.4911	-0.991782	0.238594
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0.143624	-0.124871	1.46907	-0.589802	1.46026	-0.687285	0.105474
0.591812	-0.730471	-0.432938	-0.713496	0.188649	0.91779	-0.446764
0.632102	1.24019	-0.622464	0.835217	-2.39587	0.229345	-0.704456
0.191736	0.316328	0.342453	1.58318	1.93453	0.168071	0.162747
-1.90985	-0.467269	0.394327	1.0243	0.330553	1.42089	0.0405308
0.617709	-0.487644	-0.235693	-1.80014	1.56564	0.671534	-0.216491
0.372421	1.34064	-0.313035	-0.0110492	-1.54406	-0.375159	0.440249
0.125467	-0.104545	0.0329951	-0.83703	-0.809412	0.963474	-0.977121
-1.14029	-1.22074	-0.301214	1.44244	0.249414	-0.372729	1.43501
-0.22441	0.0138985	-0.995705	0.671344	1.12974	0.499129	-0.434377
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0.424883	-0.626691	1.09955	1.50854	1.6777	-0.749904	-1.61022
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0.438926	0.523416	0.0797931	-0.40927	-0.536472	0.327351	0.898788
0.539371	0.791091	-0.782656	0.216698	1.2769	0.873061	-0.130082
1.55805	1.11063	-0.29231	1.04801	0.755807	-2.59003	0.336631
-1.50304	1.7847	-1.37682	0.763992	-2.04511	-0.41509	0.451964
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-0.233533	-0.313526	-0.35611	0.675344	-1.12658	-0.260326	-0.929796
-0.766397	0.219322	-1.50503	-0.537322	-0.438034	-0.248598	-0.229572
0.157851	2.10096	2.46084	-0.902322	-0.588935	0.63018	-0.732335
-0.395314	-0.171235	1.02957	0.648179	0.388939	-1.98185	-0.594665
-0.94155	-0.917517	0.400182	0.450884	0.519884	-1.31377	-1.05164
-0.954115	0.650618	-1.05676	-0.909016	0.128887	0.12185	0.365181
0.777303	-2.02239	0.00494806	-0.455895	-0.51107	1.2179	-0.642577
1.69047	-0.514743	0.554055	0.482178	0.160207	1.60689	0.59045
0.755485	-2.27592	0.216178	1.09447	1.02718	-0.849497	1.25395
0.506832	0.870984	0.469107	1.85161	0.273153	0.0342937	1.35044
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1.67155	-1.71955	-0.00312737	-1.64712	1.49856	-1.42687	0.591031

0.23032	0.600794	1.22136	2.42762	0.540564	0.209308	0.386878
-0.999693	-2.2791	1.00156	-0.665351	1.00914	0.894953	0.978992
0.390276	0.304459	0.220356	-0.0510583	-1.12732	0.907211	-0.641509
1.66583	-1.4386	0.168919	-1.58843	0.55272	0.588071	-2.45016
-1.86762	0.0870155	-0.748405	-0.484436	-1.72522	-0.0439557	-0.422417
0.680708	1.94871	1.43805	1.12811	0.403857	-0.294048	-0.450246
0.0623429	-0.773761	-0.185398	-0.0416451	1.77807	-0.833974	0.152928
2.40216	0.268932	1.66491	-0.837121	-1.60078	-0.112091	0.707869
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-0.444725	0.913107	0.922128	-0.950123	0.769121	1.73362	-0.575555
2.08424	2.04791	0.47065	-0.482967	1.78888	0.216817	0.449402
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1.58796	0.103479	-1.43738	-1.22262	0.975536	-1.22441	-0.853094
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0.39996	1.09141	1.83144	-0.104304	0.118202	-0.414309	-1.09768
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0.0708725	-1.36581	0.670249	-0.13989	-0.316958	-1.31392	-1.32372
2.03829	-0.683743	-0.164235	0.155876	2.18705	-0.913296	0.833669
-1.58627	1.02674	1.59255	-0.47127	1.72631	-1.51352	0.260024
0.882086	-1.06308	-0.829645	0.700305	-0.0853684	-0.276314	0.0970222
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-0.0417615	-0.268145	1.35001	-0.359497	-0.557388	0.464643	1.74545
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-0.586499	0.376397	0.922745	-0.590954	0.494891	1.34154	-0.359319
0.586796	0.578527	1.20807	0.637891	-1.12457	-3.16662	-0.536816
0.312005	1.41178	0.201952	1.16752	-1.23518	-0.421299	-0.819146
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0.518154	-1.68894	1.26549	0.354715	-1.02379	-0.824817	1.10647
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0.892076	-0.0503292	-0.875664	0.230905	-0.313298	0.586424	-1.4434
0.859453	-0.222653	0.0966576	-0.849676	-0.937661	-0.603279	-0.43363
0.419824	-0.486276	1.26667	-1.17655	0.760878	0.0744182	0.010743
-0.632425	-0.045933	-1.02981	-0.146921	0.542309	-0.631985	-1.6309
-0.849481	-0.664518	0.348516	1.23066	0.802328	0.111953	0.216571
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0.263682	0.441972	1.22994	0.146868	2.17667	1.68016	0.72615

-0.727703	-0.915451	2.29126	-0.379115	0.738882	-1.28491	0.16086
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1.35258	0.627347	-1.68765	-1.37703	-1.58005	-0.473639	0.950884
0.898319	0.474413	0.236384	-1.70455	-0.604946	-0.00112487	1.95023
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0.0182901	1.38781	-0.11411	0.538972	0.61845	-0.901014	-0.01706
0.231074	-0.372135	0.726016	-0.359776	0.0662632	1.34927	0.0350738
0.890244	0.76185	-2.28806	-0.935647	0.508112	-0.347557	0.646551
0.354001	0.573003	0.647722	1.07008	0.446673	-1.23141	-1.55233
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-1.38639	1.19288	1.23927	-1.34515	0.787787	0.399061	2.50725
-1.43102	-0.798061	-1.03694	-0.231415	-0.387283	-0.595198	-0.315547
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0.0660704	-0.0863325	-0.0356744	0.179324	-0.0757431	0.0404682	-1.23381
-0.253665	0.0605966	0.0692688	-0.581803	0.190881	-0.523842	-0.217993
-0.944354	-0.220154	-0.535623	0.157329	0.0941957	1.13847	1.9391
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0.679331	1.88136	-1.32841	-0.717551	0.330062	0.457833	0.145209
0.947936	-0.560167	0.425407	-0.418274	-0.109358	-1.55408	0.0818346
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-1.24911	1.70361	0.148949	-0.00643384	-0.138873	-2.07589	0.952764
0.605729	1.12954	-0.751295	0.578719	1.11281	0.541474	-0.0374385
0.989613	-0.480507	-0.790129	-0.921298	-0.524496	0.371416	
2.04332	0.699746	-1.65456	-1.25002	0.581675	0.835041	
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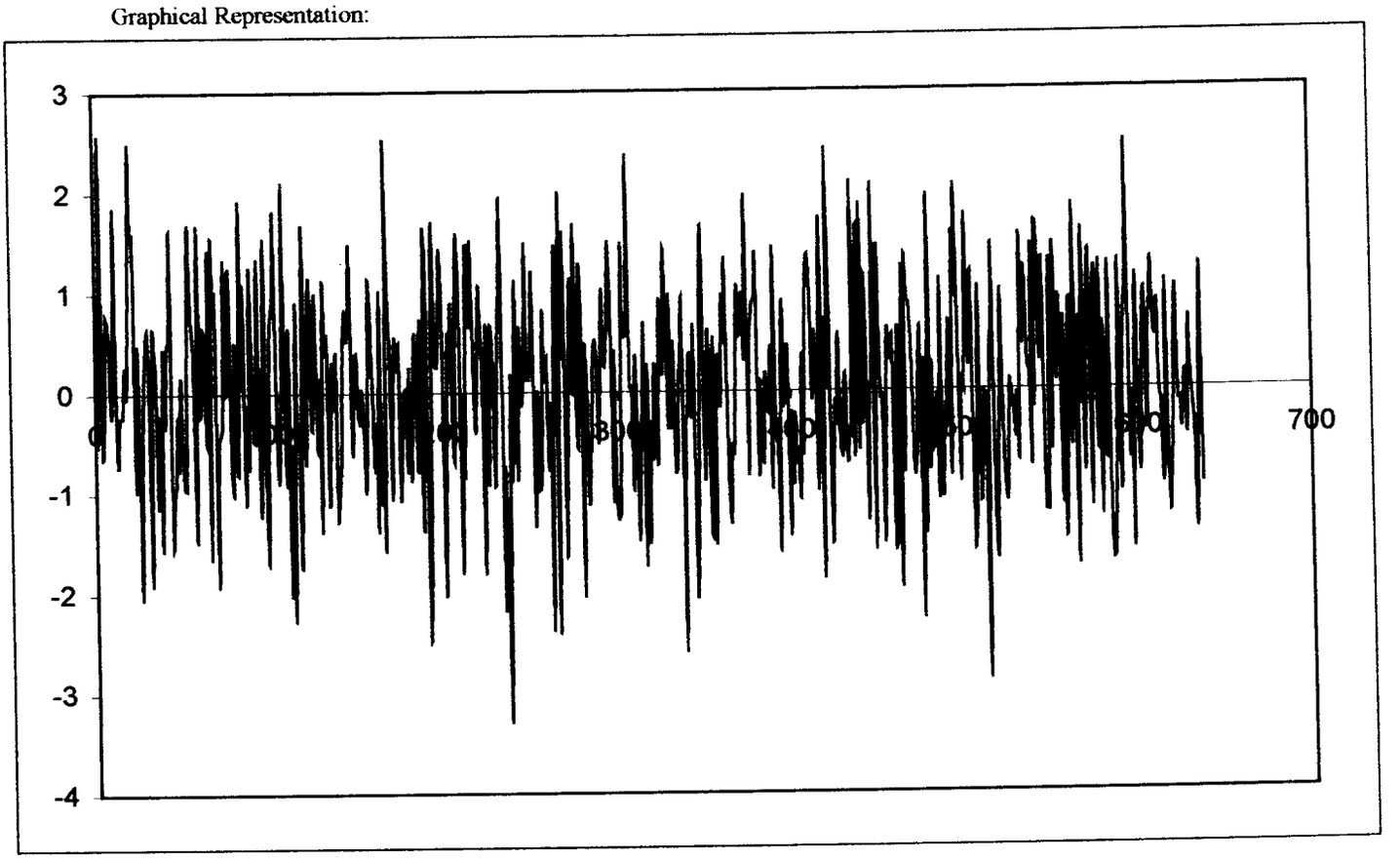
Time Series Name: Noise O-3

Graphical Representation:



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0.72423	-1.65402	0.00229841	-0.314457	0.634355	1.44467	0.472385
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0.260038	0.997919	-0.604115	-0.395337	0.296669	0.564542	-1.0937
1.85418	-1.91108	0.142034	-1.31966	1.48917	2.36367	-1.31165
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-0.246358	1.3334	0.572714	-1.66961	1.1363	0.363487	1.05611
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1.10826	-0.759678	-0.162263	0.247362	-0.969139	-0.117584	0.316936
2.49159	-1.00677	0.384917	0.810149	-0.744695	0.646369	1.95217
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0.143624	-0.124871	1.46907	-0.589802	1.46026	-0.687285	0.105474
0.591812	-0.730471	-0.432938	-0.713496	0.188649	0.91779	-0.446764
0.632102	1.24019	-0.622464	0.835217	-2.39587	0.229345	-0.704456
0.191736	0.316328	0.342453	1.58318	1.93453	0.168071	0.162747
-1.90985	-0.467269	0.394327	1.0243	0.330553	1.42089	0.0405308
0.617709	-0.487644	-0.235693	-1.80014	1.56564	0.671534	-0.216491
0.372421	1.34064	-0.313035	-0.0110492	-1.54406	-0.375159	0.440249
0.125467	-0.104545	0.0329951	-0.83703	-0.809412	0.963474	-0.977121
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0.424883	-0.626691	1.09955	1.50854	1.6777	-0.749904	-1.61022
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1.55805	1.11063	-0.29231	1.04801	0.755807	-2.59003	0.336631
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-0.233533	-0.313526	-0.35611	0.675344	-1.12658	-0.260326	-0.929796
-0.766397	0.219322	-1.50503	-0.537322	-0.438034	-0.248598	-0.229572
0.157851	2.10096	2.46084	-0.902322	-0.588935	0.63018	-0.732335
-0.395314	-0.171235	1.02957	0.648179	0.388939	-1.98185	-0.594665
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0.777303	-2.02239	0.00494806	-0.455895	-0.51107	1.2179	-0.642577
1.69047	-0.514743	0.554055	0.482178	0.160207	1.60689	0.59045
0.755485	-2.27592	0.216178	1.09447	1.02718	-0.849497	1.25395
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1.67155	-1.71955	-0.00312737	-1.64712	1.49856	-1.42687	0.591031

0.23032	0.600794	1.22136	2.42762	0.540564	0.209308	0.386878
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0.680708	1.94871	1.43805	1.12811	0.403857	-0.294048	-0.450246
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0.39996	1.09141	1.83144	-0.104304	0.118202	-0.414309	-1.09768
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0.231074	-0.372135	0.726016	-0.359776	0.0662632	1.34927	0.0350738
0.890244	0.76185	-2.28806	-0.935647	0.508112	-0.347557	0.646551
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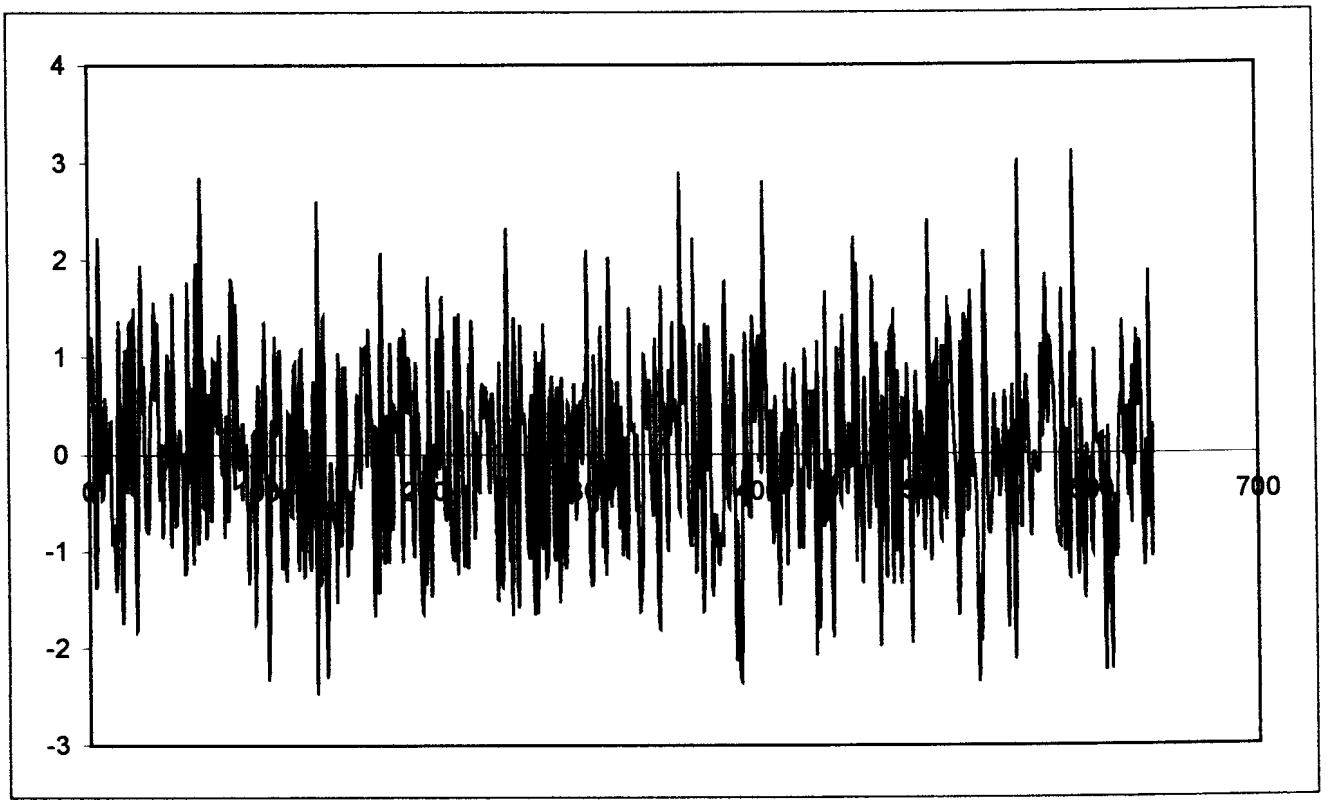
Time Series Name: Noise O 4

Graphical Representation:



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0.769622	0.530031	-0.539903	-1.22751	-1.05823	-0.048139	0.399401
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1.21146	1.6332	-1.70011	0.0757247	-0.617646	0.585378	1.56492
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0.230118	-1.3035	0.229321	0.443366	-0.879121	0.377529	1.35011
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0.995921	1.29438	0.839854	1.20944	-0.705748	-0.476391	
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0.1237	-0.0882854	0.0025922	-0.761982	0.65674	-0.17733	
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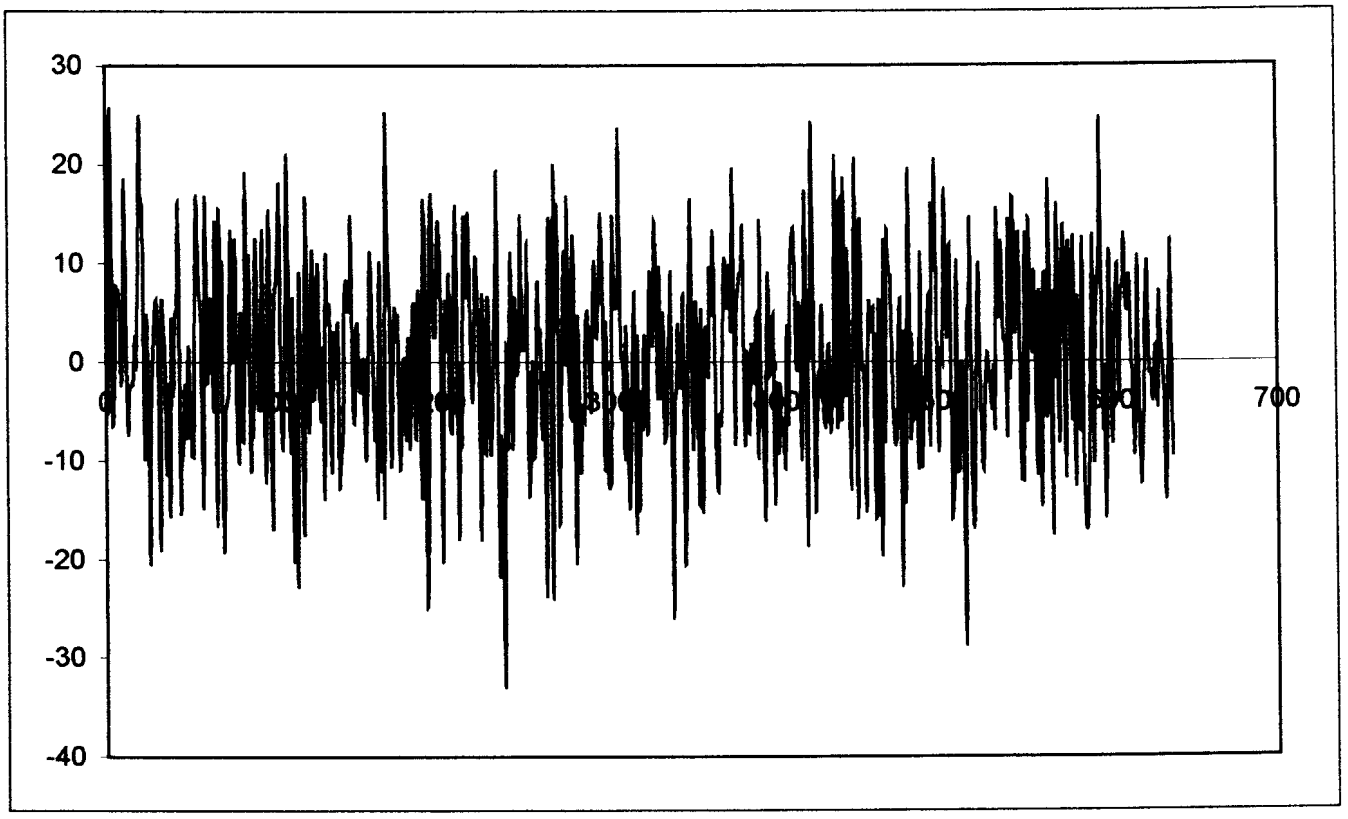
Time Series Name: Noise O 5

Graphical Representation:



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25.7058	6.38696	-7.1291	2.45435	-8.89075	4.13229	1.4707
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7.63309	14.275	-3.38521	5.90958	-8.74437	-11.8835	9.5535
7.2423	-16.5402	0.0229841	-3.14457	6.34355	14.4467	4.72385
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18.5418	-19.1108	1.42034	-13.1966	14.8917	23.6367	-13.1165
1.19222	-5.42057	-13.8706	16.3353	1.28463	0.41623	-5.52641
-7.34402	-4.2764	10.4916	13.2835	1.18047	0.559198	-6.23221
-2.4363	-3.29504	3.87677	-24.0105	4.911	-9.91782	2.38594
-2.46358	13.334	5.72714	-16.6961	11.363	3.63487	10.5611
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11.0826	-7.59678	-1.62263	2.47362	-9.69139	-1.17584	3.16936
24.9159	-10.0677	3.84917	8.10149	-7.44695	6.46369	19.5217
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16.0115	-0.136769	-9.55873	10.4808	0.988487	2.63775	4.31781
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1.43624	-1.24871	14.6907	-5.89802	14.6026	-6.87285	1.05474
5.91812	-7.30471	-4.32938	-7.13496	1.88649	9.1779	-4.46764
6.32102	12.4019	-6.22464	8.35217	-23.9587	2.29345	-7.04456
1.91736	3.16328	3.42453	15.8318	19.3453	1.68071	1.62747
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3.72421	13.4064	-3.13035	-0.110492	-15.4406	-3.75159	4.40249
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5.39371	7.91091	-7.82656	2.16698	12.769	8.73061	-1.30082
15.5805	11.1063	-2.9231	10.4801	7.55807	-25.9003	3.36631
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-7.66397	2.19322	-15.0503	-5.37322	-4.38034	-2.48598	-2.29572
1.57851	21.0096	24.6084	-9.02322	-5.88935	6.3018	-7.32335
-3.95314	-1.71235	10.2957	6.48179	3.88939	-19.8185	-5.94665
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16.9047	-5.14743	5.54055	4.82178	1.60207	16.0689	5.9045
7.55485	-22.7592	2.16178	10.9447	10.2718	-8.49497	12.5395
5.06832	8.70984	4.69107	18.5161	2.73153	0.342937	13.5044
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16.7155	-17.1955	-0.0312737	-16.4712	14.9856	-14.2687	5.91031

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6.79331	18.8136	-13.2841	-7.17551	3.30062	4.57833	1.45209
9.47936	-5.60167	4.25407	-4.18274	-1.09358	-15.5408	0.818346
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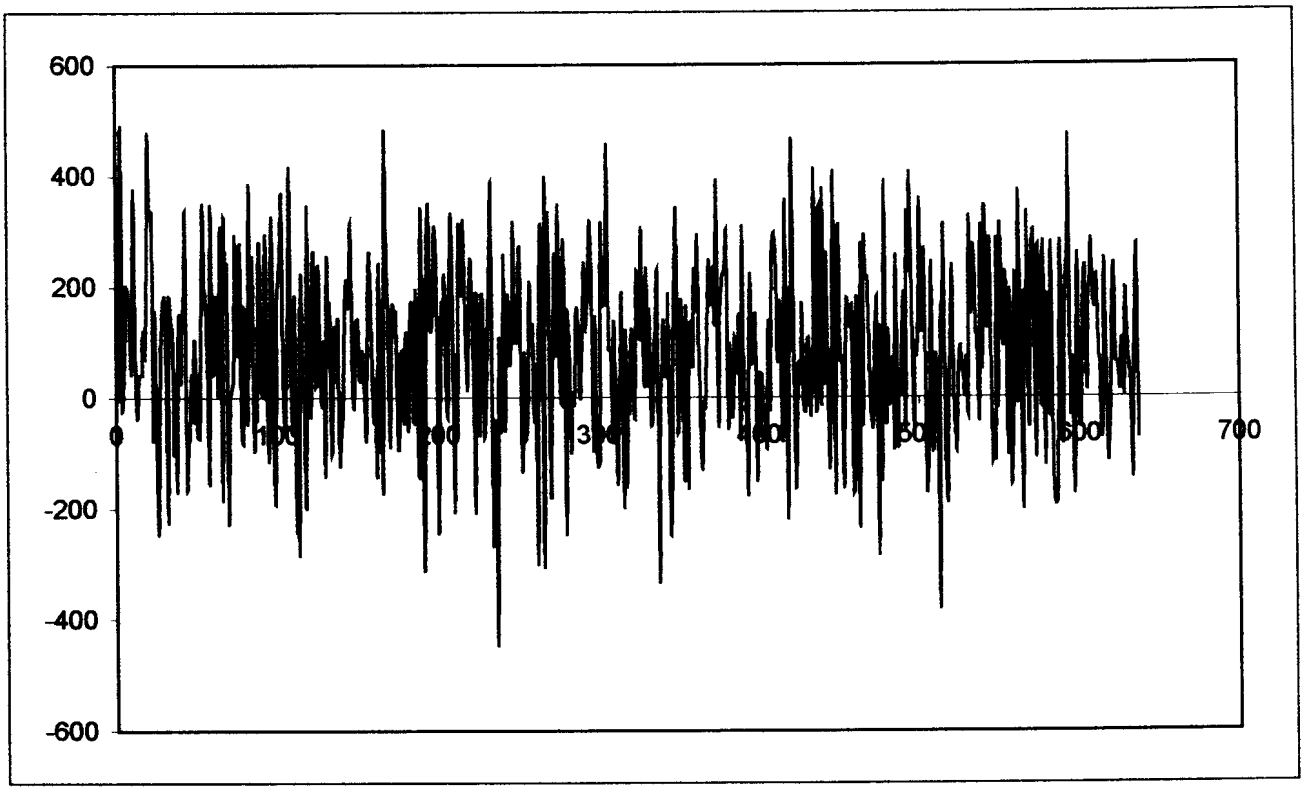
Time Series Name: Noise N 1

Graphical Representation:



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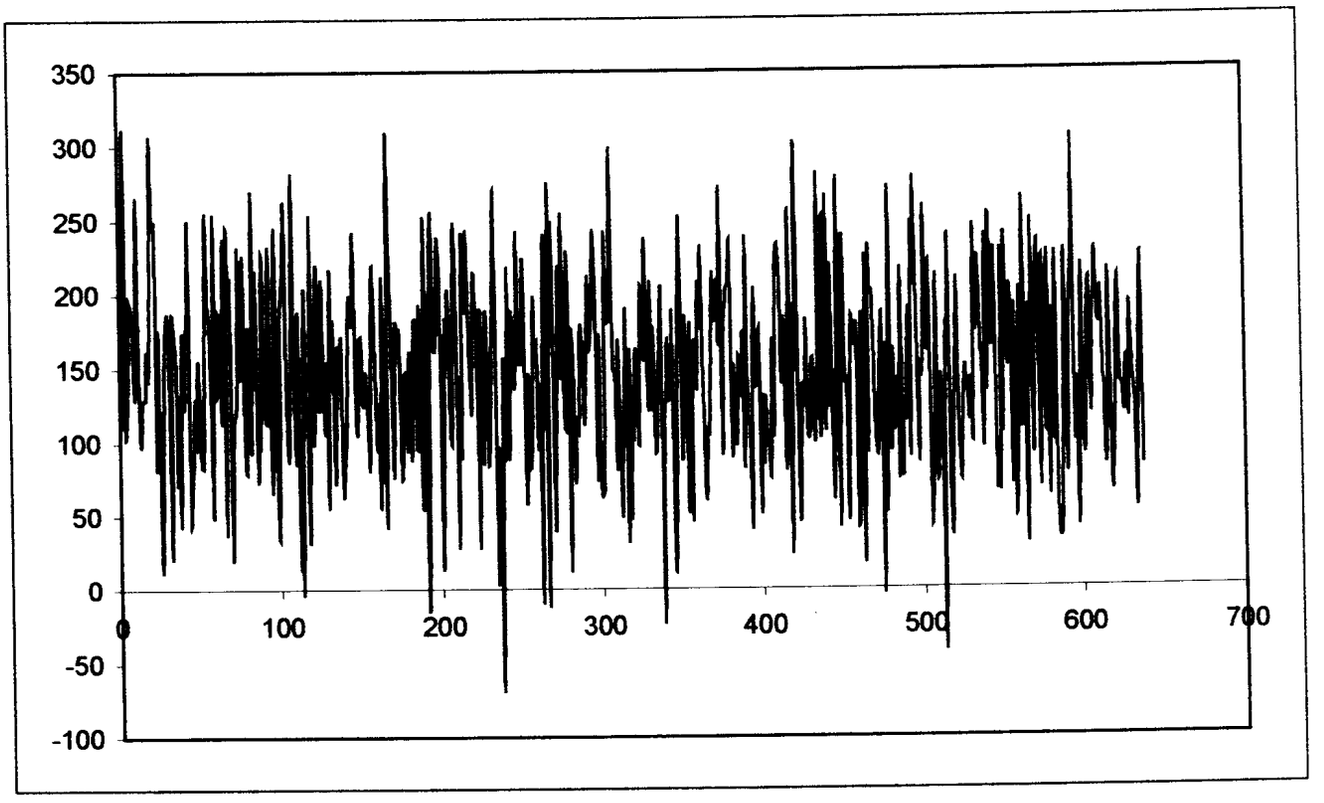
33.8243	3.39288	259.643	58.4149	258.911	-125.39	54.7342	-218.819	-150.176	115.257
202.129	308.4	25.8367	174.553	-59.9099	-110.136	232.856	188.913	93.9225	107.027
195.877	-184.643	80.3677	29.6869	181.497	311.147	155.582	89.9749	391.794	-39.7447
168.514	315.424	239.371	-37.5533	141.175	166.666	292.98	464.345	-43.8017	310.089
42.225	189.159	95.6093	195.988	58.6245	167.951	117.526	258.326	123.029	50.3363
121.606	239.667	-16.6583	16.7461	127.467	170.327	-94.9922	-154.624	-13.9208	346.385
376.669	-225.773	102.725	-131.145	318.266	458.188	-129.864	-18.7976	46.204	342.887
99.0754	-6.72917	-141.93	341.365	100.554	86.6597	-8.42263	64.0113	69.628	125.153
-37.5043	11.5776	247.866	292.536	98.8876	88.9472	-19.7154	30.5219	-92.4809	286.23
41.0191	27.2794	142.028	-304.169	158.576	-78.6852	118.175	170.984	256.522	287.25
40.5826	293.344	171.634	-187.137	261.807	138.158	248.978	-13.5228	-86.5751	-107.661
42.6598	81.5636	-95.6655	277.166	-130.188	-13.9375	168.041	-27.0946	30.9814	-32.1483
121.56	124.789	1.2122	351.53	-75.1579	-157.099	178.806	52.4401	1.96692	-109.636
75.3799	277.977	129.107	122.708	81.983	-33.0595	236.189	103.974	111.733	286.843
257.322	-41.5484	54.0379	119.578	-75.0622	61.1866	130.71	-33.3561	182.203	-17.8837
478.655	-81.0827	141.587	209.624	-39.1512	183.419	392.347	17.4833	-56.8975	304.783
323.27	156.55	-119.875	309.493	209.823	-198.76	-50.2318	8.84403	324.972	208.472
336.183	77.8117	-72.9396	247.693	95.8158	122.204	149.085	413.478	226.097	93.0544
-76.7389	-37.8761	-25.379	-238.457	132.541	-161.041	196.703	-25.5186	407.666	227.541
156.567	386.378	148.278	-43.8624	-44.4019	26.9347	222.224	214.276	173.061	155.304
-29.0936	87.3722	212.659	173.332	56.5204	-29.5257	231.802	334.074	-66.6037	-104.024
-247.822	252.768	162.46	99.3629	-300.332	123.928	296.973	-14.5246	96.5566	194.43
-14.5277	-96.4037	175.306	222.271	77.46	27.9077	-54.5657	377.039	74.068	-149.981
102.98	60.0206	315.051	-14.3684	313.641	-29.9657	96.8758	24.004	157.514	-65.0311
174.69	-36.8753	10.7299	-34.1594	110.184	226.846	8.5177	261.68	359.45	215.055
181.136	278.431	-19.5942	213.635	-303.339	116.695	-32.7129	143.994	117.97	157.115
110.678	130.613	134.793	333.308	389.525	106.891	106.04	-128.48	254.626	-8.07703
-225.576	5.23703	143.092	243.888	132.889	307.342	86.4849	77.4808	267.126	373.03
178.833	1.97698	42.2891	-208.023	330.503	187.446	45.3614	91.3396	-170.925	53.8893
139.587	294.503	29.9144	78.2321	-167.05	19.9746	150.44	406.127	-138.53	-201.591
100.075	63.2728	85.2792	-53.9247	-49.5058	234.156	-76.3393	-173.803	-29.3989	187.24
-102.447	-115.319	31.8058	310.79	119.906	20.3634	309.601	221.134	244.279	53.7225
44.0943	82.2238	-79.3128	187.415	260.758	159.861	10.4996	311.108	-90.0927	334.807
-170.617	326.422	61.237	232.027	75.7705	-49.6197	-4.99179	65.9664	-25.3522	-52.7431
147.981	-20.2705	255.929	321.367	348.431	-39.9847	-177.635	73.3182	78.6596	178.126
25.5011	-188.528	209.842	136.832	76.6382	84.581	101.289	-163.63	37.0968	246.4
150.228	163.747	92.7669	14.5168	-5.83557	132.376	223.806	-13.8398	-380.856	296.001
166.299	206.575	-45.225	114.672	284.303	219.69	59.1869	173.887	140.223	-108.098
329.289	257.7	33.2304	247.681	200.929	-334.404	133.861	129.921	172.564	227.639
-160.487	365.551	-140.292	202.239	-247.218	13.5856	152.314	127.82	305.885	273.291
-87.4756	48.211	242.847	114.069	150.892	40.4784	-151.65	162.905	-97.9851	112.312
-65.2199	-63.0573	-93.9916	-208.854	100.355	141.026	45.2702	-174.334	-190.231	-13.2857
42.6347	29.8359	23.0224	188.055	-100.253	38.3479	-68.7673	-165.145	-21.8394	282.478
-42.6235	115.091	-160.806	-5.9716	9.91456	40.2242	43.2684	176.87	94.3347	-122.46
105.256	416.154	473.735	-64.3715	-14.2296	180.829	-37.1736	34.0923	239.454	184.632
16.7498	52.6023	244.731	183.709	142.23	-237.095	-15.1464	-232.095	30.3332	-22.1597
-70.648	-66.8028	144.029	152.141	163.182	-130.204	-88.2619	276.842	-77.772	-32.4657
-72.6584	184.099	-89.0814	-65.4426	100.622	99.496	138.429	-51.0667	-95.8536	280.006
204.368	-243.582	80.7917	7.05685	-1.77123	274.864	-22.8124	289.158	28.4923	-137.908
350.476	-2.35886	168.649	157.149	105.633	337.102	174.472	222.732	92.2505	-193.857
200.878	-284.148	114.588	255.114	244.348	-55.9195	280.632	217.513	71.9473	-187.596
161.093	219.357	155.057	376.257	123.705	85.487	296.071	147.172	44.3756	-60.1062
68.1349	6.45109	-88.3956	-259.969	152.051	177.519	220.35	-21.188	2.19589	95.4652
-152.12	27.0504	-9.0999	-39.1911	195.069	-9.33113	64.7208	-55.9169	72.6507	282.668
347.448	-195.128	79.4996	-183.539	319.769	-148.3	174.565	-23.0877	-26.323	-84.7695

135.763	182.063	-23.8519	162.486	173.828	95.5235	32.3104	61.7424	78.9706	-11.3543
213.192	266.803	-44.3476	138.358	-16.5247	217.902	188.693	196.163	172.595	-63.7124
276.791	-72.8352	90.0264	-0.52678	91.9069	107.364	231.67	-286.09	-67.4077	143.85
468.418	136.754	99.1892	65.44	-21.1177	359.271	59.0446	183.635	-120.003	-15.2317
-26.4562	85.5691	98.9123	-4.85273	97.9125	-81.7306	-119.858	252.665	577.846	-31.6469
71.8307	133.423	10.6518	6.89986	314.588	22.509	176.917	50.4132	-222.42	86.4749
-174.149	49.7243	95.3993	-72.1445	348.825	-5.89052	238.338	278.283	55.581	-3.81472
2.49018	-156.079	29.2868	116.186	141.9	-51.0634	406.932	-85.9103	198.221	262.156
260.498	-32.2637	429.928	-64.7462	236.639	162.112	72.7329	482.978	202.924	6.63423
73.3368	238.936	356.209	124.857	-22.6415	257.036	33.9732	74.2921	-172.807	153.253
-53.9394	-260.278	66.3411	196.748	-312.026	171.992	-83.77	91.083	-16.7914	-168.653
101.366	38.0877	-31.6367	357.379	12.4133	204.063	-66.4722	-5.69975	-312.587	150.095
195.589	116.945	100.014	114.691	7.96065	-23.5623	376.739	-16.9607	178.952	-252.143
233.712	-55.9481	-9.18212	142.27	104.468	140.393	180.375	-132.546	90.6021	166.636
13.5805	-108.249	-81.6904	245.017	193.259	-118.809	155.906	148.065	161.298	139.427
196.921	56.4926	159.183	-115.905	-43.9042	318.44	97.7389	95.9583	151.468	213.607
200.993	276.905	-99.9314	270.477	87.792	76.7131	302.049	103.832	287.441	122.535
286.097	181.239	-117.628	4.8764	58.6574	48.3459	20.4584	-40.2072	143.851	300.313
182.093	103.499	361.207	5.37465	-83.3364	-150.944	201.896	-46.4207	206.046	109.721
162.515	166.49	-83.8067	-3.17004	289.681	10.6193	171.68	-184.73	18.0347	105.738
219.608	241.463	20.0368	13.7105	300.091	81.7189	-99.6464	79.5483	102.933	-268.398
87.431	-100.371	-150.248	-109.11	32.9495	-180.945	88.151	-53.6608	67.8811	232.141
56.8184	168.435	159.739	135.932	-219.449	114.651	270.86	196.148	110.541	392.037
-72.0198	-196.036	-68.9893	-130.227	46.3162	135.354	-47.6898	19.3416	95.0713	-9.02277
2.72536	144.617	-118.997	-66.1273	-155.948	196.184	227.197	148.655	8.46406	77.2704
251.003	364.491	699.24	-162.163	-75.6488	-36.4324	66.1868	-140.325	132.81	85.6118
37.1732	-176.124	296.611	35.7897	191.286	119.976	89.6954	-192.727	62.5027	183.448
-115.618	127.15	33.5419	44.8065	-12.0888	296.412	44.7753	155.032	-129.13	-168.372
-43.5256	78.3449	29.8723	130.93	151.904	223.731	80.6454	166.235	57.7804	25.2796
45.5676	181.518	-70.0257	154.343	35.9971	11.2466	381.017	22.4359	258.049	35.0898
174.75	197.358	201.741	27.5902	-27.8193	82.9264	-9.62666	-69.7036	-3.91944	481.16
238.498	263.245	166.769	294.647	-56.4951	116.972	203.435	251.213	173.068	29.5125
63.3114	415.409	208.372	-426.659	9.14912	222.439	352.578	159.556	185.032	-25.7481
62.7695	-67.4805	127.041	12.5921	170.626	136.64	260.726	21.6434	178.831	-117.409
14.3136	205.312	428.267	205.856	253.592	-10.8666	3.11885	-135.224	241.909	45.1212
57.6177	182.987	113.489	-51.9707	135.016	184.393	191.959	42.9737	-125.586	390.256
104.94	117.501	223.193	100.377	-95.6295	-141.823	37.8385	230.681	180.736	140.842
4.59685	198.699	225.154	-59.7006	-	-148.963	342.007	108.692	4.2177	103.233
192.049	106.852	174.091	54.6071	0.02263	-	12.0225	-13.0885	79.82	93.0935
117.193	203.059	72.9671	448.048	75	0.19891	446.601	105.173	10.5439	-174.993
71.7992	366.221	32.9523	209.576	45.8792	5	-143.008	-4.52096	-64.1623	232.442
22.4805	-467.998	-53.4358	214.215	-131.795	90.5713	-190.024	-34.8082	295.884	74.0098
-145.252	59.8431	62.0654	44.584	213.387	39.4137	117.822	13.0762	24.3909	
-14.5527	236.086	-75.2253	139.435	121.604	-71.0966	229.91	33.1877	-117.026	

Time Series Name: Noise N 2

Graphical Representation:

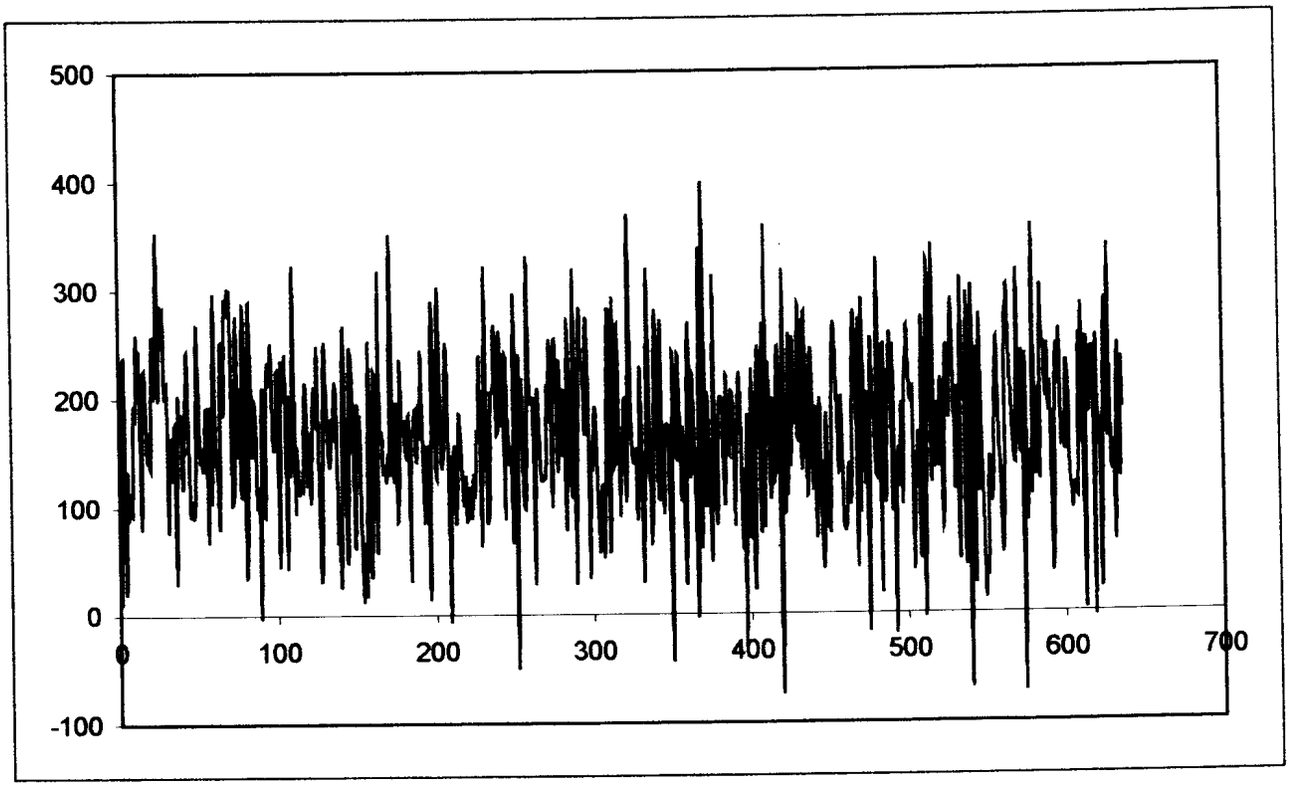


110.861	130.94	249.649	147.379	-67.4814	199.884	179.739	159.971	162.139	245.073
179.366	141.114	174.435	93.7018	152.437	73.344	45.578	80.02	184.052	173.728
312.088	186.515	98.6609	160.953	87.2101	171.86	154.56	170.368	-3.14148	224.388
105.44	164.42	184.831	87.8848	115.558	71.5293	168.133	253.279	164.79	210.101
126.241	113.878	217.98	136.231	217.683	61.5602	134.736	23.6046	51.4909	159.323
194.615	237.788	122.996	183.412	88.1616	67.7574	207.098	189.246	150.656	155.98
192.075	37.4887	145.149	124.56	186.233	238.903	175.705	149.052	271.666	96.3537
180.959	240.641	209.744	97.244	169.852	180.208	231.523	301.14	94.7055	238.473
129.654	189.346	151.341	192.12	136.316	180.73	160.245	217.445	162.481	132.949
161.902	209.865	105.733	119.303	164.284	181.695	73.9094	49.6839	106.845	253.219
265.522	20.7796	154.232	59.2222	241.796	298.639	59.7428	104.863	131.27	251.798
152.749	109.766	54.8411	251.18	153.35	147.705	109.078	138.505	140.786	163.343
97.2639	117.203	213.195	231.343	152.673	148.635	104.491	124.9	74.9297	228.781
129.164	123.582	170.199	-11.0685	176.921	80.5341	160.509	181.962	216.712	229.195
128.987	231.671	182.226	36.4755	218.859	168.627	213.647	107.006	77.3289	68.7626
129.831	145.635	73.6359	225.099	59.6111	106.838	180.767	101.493	125.086	99.4398
161.884	163.196	112.992	255.309	81.9671	48.6787	185.14	133.804	113.299	67.9605
143.123	225.428	164.95	162.35	145.806	99.0696	208.452	154.739	157.891	229.03
217.037	95.621	134.453	161.079	82.006	137.357	165.601	98.9491	186.52	105.235
306.953	79.5602	170.02	197.66	96.5948	187.014	271.891	119.603	89.3854	236.318
243.828	176.098	63.8007	238.232	197.741	31.7536	92.0933	116.093	244.52	197.192
249.074	144.111	82.8683	213.125	151.425	162.145	173.066	280.476	204.352	150.303
81.3248	97.1128	102.19	15.627	166.345	47.077	192.411	102.133	278.114	204.938
176.105	269.466	172.738	94.6809	94.4617	123.442	202.779	199.55	182.806	175.592
100.681	147.995	198.893	182.916	135.461	100.505	206.67	248.218	85.4422	70.2403
11.8224	215.187	178.5	152.866	-9.50973	162.846	233.145	106.599	151.726	191.487
106.598	73.336	183.718	202.798	143.968	123.837	90.3327	265.672	142.59	51.5703
154.336	136.883	240.489	106.663	239.917	100.326	151.856	122.252	176.49	86.0811
183.468	97.5194	116.859	98.6228	157.262	204.656	115.96	218.807	258.527	199.866
186.087	225.613	104.54	199.289	-10.7314	159.907	99.2104	170.997	160.425	176.328
157.463	165.561	167.259	247.906	270.744	155.925	155.579	60.3052	215.942	109.219
20.8596	114.628	170.631	211.579	166.486	237.358	147.635	143.977	221.02	264.043
185.151	113.303	129.68	27.9908	246.767	188.65	130.928	149.607	43.0619	134.393
169.207	232.142	124.653	144.282	44.6359	120.615	173.616	277.489	56.2223	30.6037
153.155	138.205	147.145	90.5931	92.3883	207.626	81.4872	41.8927	100.557	188.566
70.8808	65.6516	125.421	238.758	161.212	120.773	238.276	202.336	211.738	134.325
130.413	145.903	80.2792	188.637	218.433	177.443	116.765	238.887	75.8998	248.516
43.1868	245.109	137.378	206.761	143.282	92.342	110.472	139.299	102.201	91.0731
172.617	104.265	216.471	243.055	254.05	96.2562	40.3356	142.286	144.455	184.864
122.86	35.9105	197.748	168.088	143.634	146.861	153.649	46.0253	127.571	212.6
173.53	179.022	150.187	118.397	110.129	166.278	203.421	106.878	-42.2227	232.751
180.059	196.421	94.1274	159.085	227.998	201.749	136.545	183.142	169.466	68.5851
246.273	217.191	126	213.12	194.127	-23.3518	166.881	165.28	182.604	204.978
47.3023	261.005	55.5064	194.659	12.0678	118.019	174.378	164.427	236.766	223.524
76.963	132.086	211.157	158.84	173.8	128.944	50.8923	178.68	72.6936	158.127
86.0044	86.883	74.3159	27.6532	153.269	169.792	130.891	41.6767	35.2187	107.103
129.82	124.621	121.853	188.897	71.7724	128.079	84.5633	45.4097	103.628	227.257
95.1842	159.256	47.1728	110.074	116.528	128.841	130.078	184.353	150.823	62.7505
155.26	281.563	304.955	86.3491	106.719	185.962	97.3982	126.35	209.778	187.507
119.305	133.87	211.922	187.132	170.281	16.18	106.347	18.2114	124.823	103.498
83.7992	85.3614	171.012	174.307	178.792	59.6047	76.6436	224.967	80.9051	99.3108
82.9825	187.29	76.3107	85.9139	153.378	152.92	168.737	91.7542	73.5595	226.252
195.525	13.5449	145.322	115.367	111.78	224.164	103.232	229.97	124.075	56.4747
254.881	111.542	181.014	176.342	155.413	249.448	183.379	202.985	149.977	33.7457
194.107	-2.9351	159.052	216.14	211.766	89.7827	226.507	200.864	141.729	36.2892
177.944	201.614	175.492	265.355	162.755	147.229	232.779	172.289	130.528	88.0819
140.18	115.121	76.5893	6.8875	174.271	184.617	202.017	103.892	113.392	151.283
50.7011	123.489	108.803	96.5786	191.747	108.709	138.793	89.7838	142.014	227.334
253.651	33.2292	144.797	37.9372	242.406	52.2533	183.417	103.121	101.806	78.0624

167.654	186.463	102.81	178.51	183.118	156.116	63.8076	215.145	347.25	99.6434
199.109	220.889	94.4838	168.708	105.787	258.454	184.372	132.98	22.1417	147.63
224.946	82.9107	149.073	112.286	149.837	79.297	209.325	225.552	135.08	110.95
302.795	168.057	152.796	139.085	103.921	121.644	277.816	77.599	193.027	219.001
101.752	147.262	152.683	110.529	152.277	110.107	142.048	308.71	194.938	115.195
141.681	166.703	116.827	115.303	240.301	91.7555	126.302	142.681	42.297	174.759
41.752	132.701	151.256	83.1913	254.21	178.358	78.4684	149.502	105.678	43.9846
113.512	49.0928	124.398	159.701	170.147	216.921	85.4957	110.184	-14.4885	173.476
218.327	99.3929	287.158	86.1969	208.634	182.372	265.55	105.61	185.199	10.067
142.293	209.568	257.21	163.223	103.302	195.4	185.778	58.6533	149.307	180.196
90.5871	6.76214	139.451	192.429	-14.2605	102.928	175.837	172.651	178.027	169.142
153.68	127.973	99.6476	257.685	117.543	169.535	152.206	151.483	174.034	199.278
191.958	160.009	153.131	159.093	115.734	64.2337	235.208	154.682	229.273	162.28
207.446	89.7711	108.77	170.297	154.94	241.866	120.811	96.1658	170.94	234.502
118.017	68.524	79.3133	212.038	191.011	143.665	194.52	93.6416	196.206	157.074
192.499	135.45	177.168	65.4135	94.6639	132.141	182.245	37.4533	119.827	155.456
194.153	224.993	71.9028	222.381	148.166	51.1788	72.0187	144.817	154.317	3.46346
228.727	186.128	64.7136	114.481	136.33	116.814	148.311	90.7003	140.077	206.807
186.475	154.546	259.24	114.683	78.6446	145.698	222.537	192.185	157.407	271.765
178.522	180.137	78.4535	111.212	230.183	38.9913	93.126	120.358	151.123	108.835
201.716	210.594	120.64	118.07	234.412	159.077	204.799	172.891	115.939	143.891
148.019	71.7244	51.4617	68.174	125.886	167.488	139.388	55.4928	166.454	147.28
135.582	180.927	177.394	167.722	23.3488	192.2	148.939	34.2045	137.892	187.026
83.242	32.8604	84.4731	59.5952	131.316	97.6993	130.69	175.482	60.0407	44.0989
113.607	171.251	64.1573	85.6358	49.1459	161.24	145.262	180.033	135.973	122.77
214.47	260.575	396.566	46.6213	81.7677	232.917	267.288	121.615	217.333	126.755
127.602	40.9494	232.998	127.04	190.21	203.391	108.589	84.1829	110.908	307.971
65.53	164.155	126.126	130.703	107.589	117.069	195.145	214.555	182.809	124.489
94.8177	144.328	124.636	165.69	174.211	146.189	255.735	177.32	187.669	102.04
131.012	186.242	84.052	175.202	127.124	160.02	218.42	121.293	185.15	64.8026
183.492	192.677	194.457	123.709	101.198	202.866	113.767	57.5652	210.776	130.83
209.39	219.443	180.25	232.2	89.5489	168.01	190.483	129.958	61.4806	271.042
138.22	281.26	197.151	-60.8303	116.217	108.085	127.872	206.214	185.924	169.717
138	85.086	164.11	117.616	181.817	187.409	251.44	156.656	114.213	154.439
118.315	195.908	286.483	196.129	215.522	54.8844	117.384	107.183	144.927	150.319
135.907	186.839	158.605	91.3869	167.35	51.984	293.932	155.226	116.783	41.4092
155.132	160.235	203.172	153.278	73.6505	112.419	54.403	110.663	86.4341	206.93
114.367	193.221	203.969	88.2466	112.491	149.295	35.3027	98.3592	232.703	142.566
190.52	155.909	183.225	134.684	131.138	128.512	160.365	117.812	122.409	
160.11	194.993	142.143	294.519	58.9582	83.617	205.901	125.982	64.9581	
141.668	261.277	125.887	197.64	199.188	125.626	137.583	144.582	107.887	
121.633	-77.6242	90.7917	199.525	161.902	189.157	192.191	182.617	86.6168	
53.4914	136.811	137.714	130.612	151.306	206.616	-3.72392	85.1156	170.939	
106.588	208.41	81.9397	169.146	201.023	136.487	187.102	63.7488	106.312	

Time Series Name: Noise N 3

Graphical Representation:

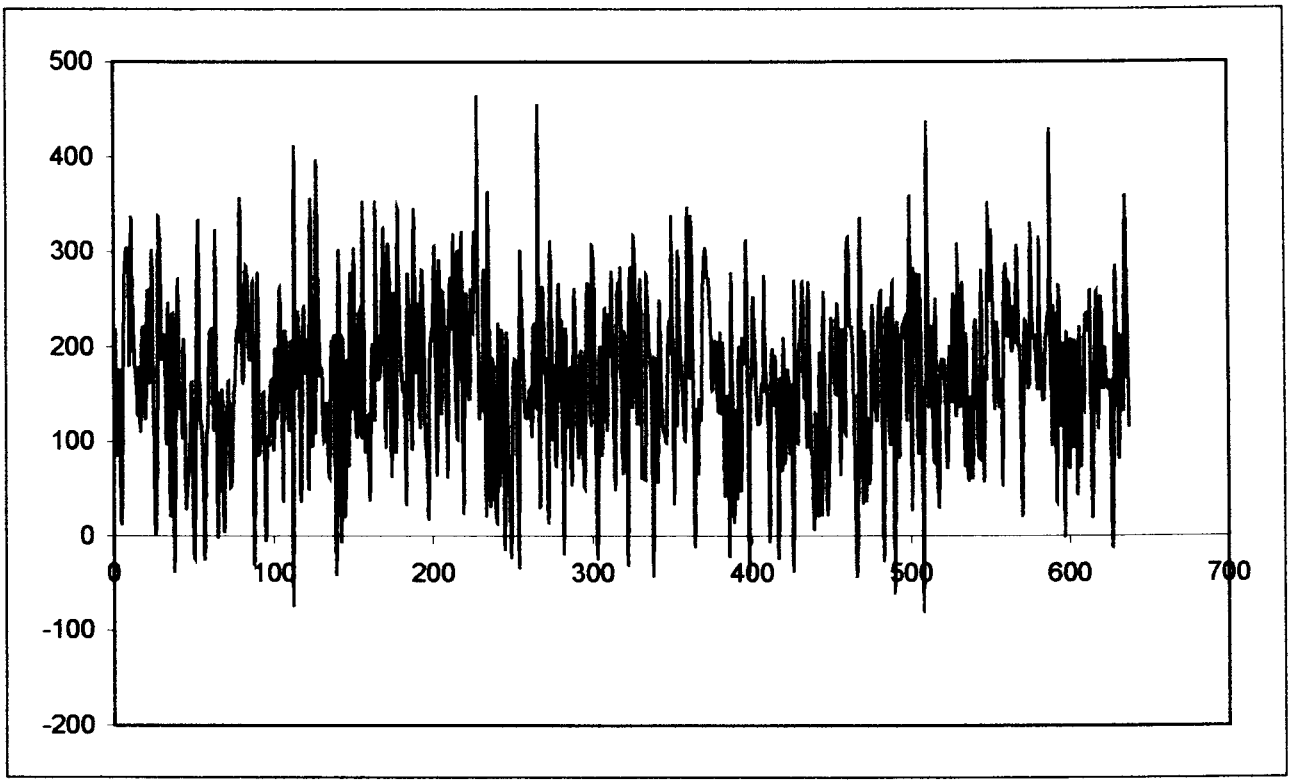


10.8661	296.263	119.597	235.411	212.706	273.782	197.798	197.835	117.914	120.591
204.379	156.69	168.132	168.81	267.006	206.463	104.305	120.612	200.652	57.3792
234.589	134.552	104.07	179.654	167.826	33.3761	171.541	134.487	-16.5832	305.351
20.8414	82.3913	180.402	152.113	174.679	157.392	89.2932	212.593	207.508	212.694
132.384	248.266	210.356	144.83	261.641	133.216	30.1269	243.37	252.991	234.986
88.0581	252.744	176.448	181.147	174.446	190.919	199.514	121.725	190.954	44.1007
112.901	184.982	247.728	31.8797	239.233	183.373	267.741	-71.0555	169.584	293.964
93.6088	291.428	151.259	161.365	88.6507	101.945	126.104	315.28	129.68	112.23
193.435	276.906	31.4441	171.336	236.274	57.396	219.914	92.8306	324.45	-65.7391
183.284	301.379	46.2449	189.836	168.624	84.3922	204.057	191.335	218.09	289.041
258.585	299.094	210.346	141.226	138.335	117.987	125.586	108.884	19.1066	205.823
213.41	102.519	252.297	194.983	153.74	52.344	-2.42684	256.754	242.821	27.2645
242.989	106.678	184.117	163.048	69.3793	124.949	57.8182	135.527	247.484	242.17
80.1169	136.595	163.123	243.525	294.127	210.255	336.455	254.307	101.982	111.658
204.618	275.727	137.061	173.952	218.271	275.616	60.4796	174.469	205.7	274.324
226.052	147.227	181.409	89.1703	-49.0013	59.6399	289.551	205.964	210.702	151.295
160.048	210.04	162.298	112.474	233.5	152.419	392.858	161.808	253.905	99.0664
141.382	108.986	214.848	152.251	156.477	291.664	102.641	281.736	93.6925	13.4636
168.927	285.163	205.498	13.8781	216.913	139.015	203.52	234.657	246.428	48.3493
137.259	264.266	67.8628	132.316	112.613	211.597	138.707	132.65	-16.6807	33.7874
257.144	38.3744	93.6931	286.559	98.1502	262.837	48.5626	262.997	102.724	142.209
200.54	77.1998	27.8987	257.535	156.134	93.1475	125.36	276.148	151.313	101.956
241.166	282.436	207.952	141.585	329.819	128.139	311.557	110.027	115.788	110.949
352.505	230.45	265.06	127.278	194.629	145.589	130.951	125.725	192.611	192.99
198.767	146.626	112.509	302.048	198.627	199.288	82.6626	223.413	99.9599	233.759
286.172	198.259	48.4946	189.384	199.772	104.143	180.485	240.88	209.547	252.146
249.153	180.289	127.28	136.284	28.4173	178.309	199.954	113.523	238.016	159.015
281.204	98.8442	245.603	149.465	169.688	367.776	195.744	189.578	265.001	132.113
199.788	118.09	236.466	182.425	208.032	264.664	135.487	69.2628	205.763	55.0419
212.171	-2.34034	134.565	250.369	173.1	155.904	104.025	129.589	193.635	98.0772
76.9187	208.15	61.5224	201.919	124.149	138.58	217.771	197.65	208.303	271.349
149.181	112.712	193.209	-6.45206	123.079	149.973	173.906	119.654	40.4581	280.86
163.998	93.246	169.115	138.6	125.462	87.3276	146.378	41.1721	126.875	300.234
125.409	208.749	184.163	102.112	126.422	125.175	204.652	68.5244	144.153	224.448
173.841	233.639	89.9821	155.823	211.435	227.882	193.634	183.633	164.918	195.204
29.383	213.023	12.3602	84.2729	178.481	175.323	81.1928	81.2496	50.2777	148.554
200.548	249.893	66.1962	126.845	252.38	29.6796	141.905	107.785	269.503	138.265
170.409	152.882	22.8649	184.552	99.0643	118.285	172.046	76.3963	207.298	191.201
184.303	169.7	186.932	160.471	223.288	140.528	221.863	223.808	-3.22855	314.3
116.888	182.425	249.523	132.503	254.785	317.983	189.008	267.777	150.124	173.214
159.758	221.695	39.9638	101.657	224.621	149.215	58.7399	253.895	321.512	147.062
205.212	45.7795	84.729	128.214	131.766	66.0497	131.866	182.939	258.046	233.66
240.783	232.785	221.296	86.222	234.113	91.3205	-32.2245	129.922	120.014	-72.4433
138.051	199.216	171.04	116.71	147.051	178.832	182.322	159.6	339.103	235.436
90.9572	214.235	60.1388	101.183	207.317	279.473	74.4979	197.587	137.524	87.8192
105.546	238.777	316.145	90.3802	160.323	172.414	70.4983	82.5534	181.207	130.192
90.1023	43.2968	170.964	129.958	80.1571	109.369	224.933	76.1834	191.417	146.571
113.164	202.476	168.55	110.082	268.384	270.389	60.8361	85.2016	134.655	111.075
263.599	130.024	132.305	170.263	239.894	186.588	23.9276	136.925	215.224	356.646
218.818	204.257	138.436	161.203	148.377	92.9569	193.314	100.943	79.8762	128.251
141.322	321.956	123.169	237.849	113.359	171.86	245.77	107.383	98.8504	159.462
153.658	99.4667	149.263	63.7467	318.241	175.349	165.833	222.598	232.175	203.381
133.69	154.337	130.649	164.01	30.7754	172.671	75.1943	277.877	246.627	122.244
141.786	127.903	350.308	148.822	159.738	57.8806	266.321	216.153	179.284	295.624
189.851	112.211	151.368	321.186	180.384	-39.3464	79.9622	42.3759	232.384	249.452
67.9379	123.932	123.129	84.8994	282.632	235.577	357.87	270.702	288.307	247.646
192.063	117.202	196.192	93.3482	233.13	177.647	157.548	93.0555	207.504	197.613
104.438	212.976	88.3119	205.292	222.872	146.033	230.28	285.044	113.505	245.781
147.424	201.24	125.861	204.984	165.782	238.378	105.952	244.972	206.459	184.64

209.84	123.792	162.119	65.7515	241.621	218.85	149.616	106.479	143.443	302.89
42.205	232.739	302.078	122.57	137.519	38.3535	195.773	152.754	159.606	105.63
80.0968	187.122	233.677	121.586	186.561	273.064	148.917	154.325	171.198	168.07
204.711	227.141	13.6391	215.043	94.2241	129.706	147.586	207.064	48.335	350.042
246.406	134.75	116.764	221.463	128.955	94.0904	258.506	266.884	197.632	134.118
208.916	148.215	46.9125	145.255	153.92	25.3746	246.32	191.428	20.4234	151.401
259.885	167.834	243.659	307.394	13.2858	117.1	247.269	158.997	264.09	117.535
157.1	322.661	187.495	206.646	63.5265	86.593	336.14	-29.2951	182.398	125.68
180.376	196.376	261.063	231.884	220.058	291.017	371.485	236.576	119.731	177.521
148.043	119.553	39.6287	0.34517	235.034	166.036	198.587	173.483	141.918	141.01
229.219	-14.221	206.219	82.204	189.732	12.6877	172.72	130.731	68.5374	200.761
216.275	143.802	209.625	76.4388	247.156	275.367	120.946	290.962	129.456	171.754
141.827	162.049	272.343	76.9899	180.853	132.196	197.547	131.061	147.312	118.709
112.047	98.8875	145.117	176.792	239.425	312.589	39.0097	167.128	289.736	178.225
95.3301	189.383	115.052	102.513	114.323	293.782	121.083	102.561	215.569	149.113
117.206	7.33073	187.375	264.021	118.737	323.646	278.383	144.455	339.89	83.2599
114.219	209.755	169.754	315.883	67.3836	204.905	131.828	156.956	57.051	144.377
106.675	214.357	61.516	287.814	150.622	69.949	154.77	206.251	220.98	82.8247
255.249	300.028	201.268	215.931	115.849	123.344	52.5745	225.526	242.623	113.739
153.911	204.966	48.4099	187.305	84.6131	273.212	202.458	224.628	278.227	89.9184
283.07	183.743	228.091	303.319	214.113	240.017	272.979	234.114	216.183	193.057
120.899	167.962	136.127	221.654	207.384	181.092	109.281	228.186	177.153	255.225
5.26092	239.551	97.1519	137.236	254.24	214.137	157.607	179.659	95.3571	27.5214
246.239	277.378	36.7892	154.296	145.886	212.268	91.2097	131.409	137.889	241.259
183.123	238.699	84.2578	16.5541	163.64	75.0849	263.317	118.672	209.363	195.183
214.277	167.186	303.332	150.391	220.239	210.737	139.966	176.202	200.562	184.06
241.904	157.481	107.144	80.4721	17.7117	173.973	154.796	202.953	177.752	187.505
241.839	311.074	244.548	173.828	184.883	267.916	206.655	109.209	160.104	115.903
-3.18811	280.189	172.853	63.2018	80.4752	232.541	330.954	96.224	223.305	93.3898
248.104	120.383	220.19	186.929	224.12	214.084	276.654	249.943	162.812	174.81
182.024	244.913	223.808	-18.5951	126.742	291.501	250.858	64.4751	75.5252	331.12
173.204	100.788	188.38	186.808	102.631	245.674	188.39	75.4114	213.713	65.6907
22.5742	163.124	116.48	244.583	256.276	149.211	80.9505	171.677	85.0522	197.196
110.145	146.49	244.061	263.901	163.588	246.022	109.735	240.562	122.829	165.475
246.163	224.705	90.4217	290.478	193.092	198.874	64.9587	256.926	269.207	122.56
287.032	213.779	99.948	237.184	77.7524	171.967	220.083	186.89	226.697	152.443
160.238	142.202	150.759	45.1821	125.243	52.365	271.297	199.842	206.832	238.563
336.501	52.6717	223.84	169.461	320.949	217.651	272.868	183.014	81.4708	184.618
146.078	140.937	225.843	152.114	212.647	281.505	299.221	160.988	158.857	
129.183	153.693	125.004	287.518	171.324	256.845	169.811	222.996	108.905	
154.928	219.405	111.938	213.707	188.163	218.697	173.721	369.108	123.148	
65.3245	275.055	81.799	276.983	255.667	176.725	64.9242	152.965	283.719	
200.965	104.016	97.5109	199.173	290.916	28.7185	-30.121	108.25	210.215	
245.409	76.8997	184.121	257.931	304.853	176.288	97.5509	211.478	219.944	

Time Series Name: Noise N 4

Graphical Representation:

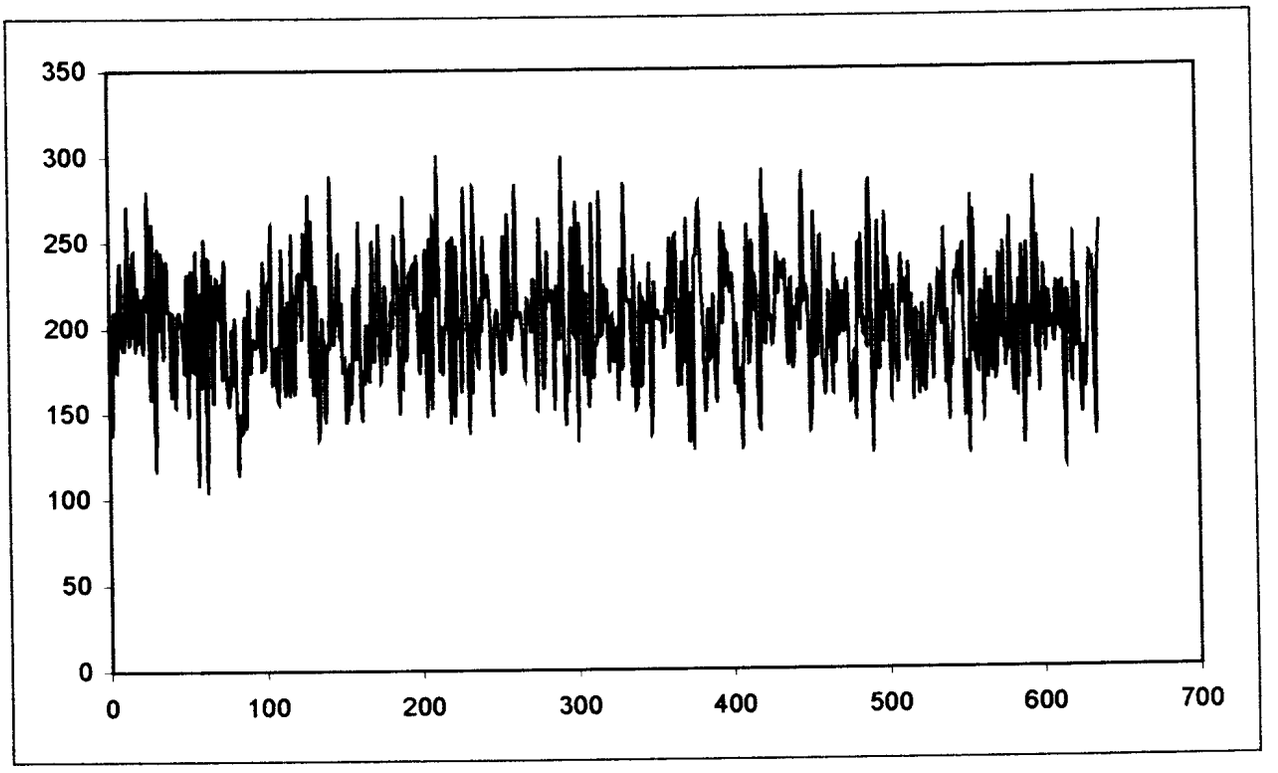


218.299	214.945	36.2731	193.589	358.787	128.489	117.335	129.767	215.329	308.184
85.6833	219.231	194.334	91.587	33.0378	51.3424	300.533	197.384	36.3402	137.876
175.617	192.667	243.596	338.904	186.858	216.774	200.032	138.521	124.039	161.198
122.586	113.867	172.74	260.031	176.314	266.62	168.916	189.601	55.3372	267.03
12.4939	321.9	204.301	177.863	45.2566	263.263	146.44	101.091	93.958	73.7682
206.72	-	50.3774	152.377	17.369	117.423	102.957	-23.8558	243.585	212.885
285.689	0.35350	355.713	153.543	224.496	304.411	214.818	166.612	169.429	74.4779
303.766	1	94.987	33.7591	53.5823	286.991	346.234	69.5835	133.145	57.6717
274.898	150.33	252.601	272.523	218.072	126.009	167.162	209.41	123.002	146.392
180.408	47.5097	110.332	225.676	106.605	-24.6664	337.078	76.7062	219.008	60.73
336.632	154.193	394.791	143.216	-14.2215	172.132	223.905	159.773	256.43	190.316
249.381	4.4721	246.925	95.8252	214.199	199.853	-12.3851	173.92	258.834	228.047
187.484	91.8742	169.694	345.159	95.4764	85.5906	134.412	86.9822	-26.383	150.824
156.45	129.734	177.379	173.922	52.178	182.799	65.5149	157.467	149.065	84.1454
127.326	161.416	100.508	244.351	-23.5908	238.226	143.962	-37.1602	233.367	81.5637
178.299	53.7524	128.548	223.81	117.771	111.509	122.852	267.331	240.211	279.602
110.084	71.7062	138.698	113.85	185.872	233.416	250.018	124.731	96.2521	58.2264
219.564	132.565	71.589	276.629	179.539	190.163	276.227	98.0804	202.771	177.569
220.853	168.501	61.4315	216.099	61.7101	278.559	304.098	190.241	261.419	165.158
123.43	216.551	204.958	99.5683	-23.9115	185.916	274.202	209.92	-59.3203	351.059
258.798	204.997	198.425	89.256	294.573	48.3861	269.35	268.531	114.789	247.969
162.132	356.386	211.592	18.126	232.76	149.721	227.364	151.843	224.88	322.264
197.267	239.304	-40.8225	185.888	153.74	266.048	156.579	197.372	82.2547	222.772
301.156	161.184	158.836	213.03	125.16	259.476	174.877	93.2157	172.699	133.368
135.366	235.271	298.673	226.802	124.98	282.411	205.472	267.07	211.06	223.437
1.5173	284.104	-6.08682	300.848	129.746	66.3008	171.472	97.6157	224.303	198.621
82.2238	260.699	205.761	68.3601	154.443	214.063	131.786	80.3943	230.791	135.921
334.69	187.322	119.485	123.525	105.29	183.69	214.349	6.98496	121.89	159.294
310.908	202.679	20.172	290.562	216.298	-31.0716	129.258	125.488	235.544	53.7848
187.691	261.594	185.756	128.969	223.722	229.287	203.339	112.051	353.697	276.393
212.413	-28.6073	74.4536	255.081	143.049	283.692	42.1877	21.225	26.8343	286.971
188.428	119.942	276.964	218.416	454.682	136.081	147.701	193.069	279.519	210.62
96.9577	277.162	134.332	211.886	38.0096	314.151	64.026	22.7048	195.528	265.757
245.647	87.977	303.801	61.4619	172.775	274.607	-14.4912	255.464	275.65	242.686
21.0533	109.014	161.09	217.421	263.032	119.152	274.87	149.484	86.7715	193.912
191.766	103.432	104.453	272.196	172.975	118.897	131.381	80.9305	274.936	241.341
229.927	148.296	168.168	218.806	182.16	270.948	14.2373	22.7204	189.495	203.884
-37.8477	-5.0378	235.607	318.315	14.037	61.2734	132.201	97.9735	-80.2961	306.505
151.618	101.883	103.665	163.772	123.373	60.519	39.2819	228.698	143.463	200.632
271.715	96.6397	352.655	105.678	311.03	59.9714	198.929	180.036	167.549	201.048
136.2	158.212	90.6146	300.788	104.037	270.624	48.0048	172.968	436.781	20.907
159.617	164.761	101.656	166.688	180.301	221.92	204.606	151.952	143.98	116.992
103.225	90.8696	124.846	319.616	73.6858	192.525	182.386	245.482	221.485	224.94
207.992	197.635	37.6256	23.8558	212.927	164.166	187.329	199.739	141.984	205.54
28.7134	124.308	131.259	238.279	266.259	-42.2702	305.98	64.69	81.2141	155.701
47.236	211.371	202.576	256.198	143.822	181.721	-39.7965	218.24	250.099	162.586
72.8735	259.94	124.595	158.35	225.312	128.401	149.831	120.221	69.3528	329.964
127.135	128.725	352.517	145.674	-19.2578	59.1467	170.326	109.863	30.1556	208.94
160.277	37.2456	171.591	256.361	217.323	247.642	251.952	302.651	166.949	211.094
-14.4242	215.097	165.292	219.63	115.851	150.297	217.029	314.348	186.238	191.931
-23.8095	202.01	177.824	320.907	155.879	116.641	132.139	222.184	185.459	158.209
245.38	144.355	263.115	263.746	174.967	108.483	117.64	220.29	150.607	315.069
332.523	113.617	317.946	463.68	53.9977	99.5103	119.503	175.084	71.4159	180.953
130.331	200.866	94.1821	127.517	172.698	156.771	159.78	42.6596	88.0016	142.292
115.958	-72.2156	228.109	175.552	260.829	226.892	152.709	-43.8574	199.695	144.235
54.1764	408.655	308.515	140.414	158.637	195.684	274.492	16.8456	141.176	203.39
-25.3004	159.184	255.807	280.663	82.4257	335.108	179.734	273.991	255.591	228.592
100.971	236.298	62.78	21.2312	144.107	34.6273	137.164	331.46	176.74	240.181
120.847	152.334	251.183	218.684	195.132	197.166	-6.33421	34.4575	132.359	428.774

98.5542	81.0595	125.98	11.2414	187.104	353.367	53.7806	219.541	163.249	64.4858
242.949	207.957	171.907	85.964	247.821	168.904	-43.6936	199.927	149.647	89.8464
108.753	155.063	119.637	125.769	135.581	183.702	48.4535	80.1168	126.277	151.15
40.4599	132.734	261.762	196.156	165.571	57.7262	147.915	148.657	-36.1986	151.963
259.22	356.217	-18.4807	141.504	-4.38394	142.518	133.376	185.176	157.349	184.318
221.468	259.482	111.105	293.79	362.927	189.496	152.607	241.049	259.643	295.942
116.07	114.816	136.172	220.197	103.27	227.428	290.615	119.132	196.549	158.754
201.23	209.519	211.364	205.262	222.113	50.2146	195.283	273.709	257.401	47.9718
-	169.48	113.595	56.8922	125.46	317.91	115.971	318.059	73.3287	142.343
0.82246	81.6811	155.957	100.723	259.926	215.024	142.486	147.563	113.817	149.529
1	155.112	30.9285	148.455	253.012	-51.0187	266.734	182.221	110.887	263.49
210.531	169.314	236.867	60.2163	-1.67357	231.229	193.686	432.104	225.954	87.4916
133.815	134.914	192.884	236.246	129.761	129.513	388.15	186.551	111.075	166.552
71.6473	202.671	211.564	273.854	156.821	233.685	28.5241	174.821	163.763	268.133
206.442	227.31	285.065	230.857	128.62	252.756	145.313	-64.4404	276.953	173.227
93.117	97.441	170.149	26.4412	273.407	217.616	189.786	100.817	249.877	229.578
205.5	288.165	97.2397	10.8297	284.684	302.949	74.4456	216.02	163.658	341.483
113.786	163.949	373.664	181.302	101.362	143.482	183.579	226.154	89.1258	219.098
45.0728	59.5123	128.484	223.388	326.042	153.463	227.025	158.789	61.1744	231.969
220.622	48.3488	49.3193	201.74	105.919	204.358	295.344	271.482	54.8195	26.2804
72.4931	201.266	102.476	2.50638	235.115	116.421	268.945	204.335	73.1529	168.031
176.225	251.064	220.497	110.741	145.34	140.771	7.66032	246.563	251.522	121.303
134.6	44.391	296.055	267.465	212.304	63.1586	266.496	233.427	239.354	268.661
231.825	251.292	84.1037	9.35039	254.304	91.2614	314.343	31.7891	95.811	245.232
234.833	307.756	13.0544	49.2056	155.084	150.682	147.031	92.3483	81.8732	181.758
215.642	377.915	234.891	243.622	125.943	218.107	74.8277	81.2866	214.707	192.905
256.651	62.4862	121.278	69.26	119.203	283.594	85.8085	160.039	59.4046	88.9447
21.3083	52.5186	56.5245	26.7061	292.601	-10.4528	205.199	158.682	-14.3116	404.33
117.132	-58.7398	156.138	153.242	101.604	-124.02	108.783	175.643	131.096	297.893
188.021	208.614	68.7335	223.481	2.31187	93.7598	73.7269	127.624	298.996	-7.15232
257.165	62.753	122.76	264.578	87.0474	172.201	147.339	129.022	142.83	261.94
112.512	127.879	93.5093	171.198	126.864	56.519	170.807	130.587	205.327	164.648
243.419	62.1646	200.648	198.178	107.697	165.599	212.056	69.1714	205.98	218.69
251.327	142.058	313.751	198.82	316.004	207.818	16.5376	275.602	149.747	266.248
155.344	126.695	168.578	81.571	87.001	287.932	191.413	199.991	127.549	228.462
198.678	108.967	123.654	291.616	98.1046	88.7686	181.557	283.382	224.722	345.861
168.134	265.348	225.177	297.36	351.304	169.123	-42.5395	115.585	128.308	200.596
155.174	220.782	4.49876	28.5331	177.893	176.315	355.269	-3.02704	218.409	231.238
162.575	147.336	145.61	104.92	150.03	50.2921	153.69	265.733	8.29607	90.8281
71.1801	106.822	216.785	230.191	268.459	28.4056	242.566	171.196	261.111	367.045
-8.36076	193.448	116.836	184.578	344.137	244.737	118.124	255.818	139.999	-21.6403
198.499	256.856	52.0036	53.0196	151.989	185.494	123.558	102.617	125.224	73.1879
285.029	143.373	113.915	96.1002	-69.037	48.5257	91.5135	82.8478	175.625	
165.246	171.274	148.739	1.48649	135.53	107.765	122.256	259.127	221.909	

Time Series Name: Noise N 5

Graphical Representation:



193.222	165.694	161.229	180.455	176.948	229.019	204.959	209.205	197.46	206.368
137.986	251.312	201.609	194.102	217.037	257.688	187.088	229.477	226.399	229.912
208.723	226.885	228.937	184.134	198.207	209.304	193.444	214.547	209.05	225.597
196.493	104.013	232.151	214.823	252.881	196.212	221.789	148.507	156.171	199.767
175.179	237.124	213.903	200.569	218.547	272.192	207.556	139.609	161.624	220.029
220.433	202.876	194.233	253.982	226.176	133.14	251.076	196.826	167.246	254.212
238.12	230.88	253.68	222.118	230.363	259.223	197.226	290.933	184.804	165.196
196.648	157.199	232.693	235.441	211.282	208.764	220.547	222.878	145.488	207.633
187.219	186.676	229.554	149.7	176.263	230.953	247.678	189.352	247.429	143.732
187.129	228.039	277.149	187.809	148.444	171.688	252.962	264.355	204.208	186.721
229.907	210.541	172.072	169.182	185.441	219.449	164.739	206.391	252.279	175.596
271.24	205.812	262.52	276.435	204.832	193.867	214.306	205.539	203.356	208.602
192.625	224.858	162.826	213.323	209.928	153.426	165.674	188.879	193.794	229.361
206.537	170.34	177.981	181.326	196.416	214.244	235.775	196.092	203.472	226.194
232.897	239.502	224.823	215.649	180.507	272.012	211.329	208.918	188.423	241.668
243.557	192.994	135.606	231.757	173.183	171.375	179.581	242.335	274.358	216.74
186.913	160.348	142.556	232.718	253.098	190.438	262.451	218.301	283.961	241.069
223.735	154.253	191.251	236.043	173.874	189.062	133.782	235.404	128.004	246.865
192.583	164.873	205.554	211.58	229.377	201.353	146.214	232.78	158.641	149.464
207.421	198.793	177.268	242.293	265.966	278.692	219.05	227.575	163.296	173.114
216.14	167.385	145.102	205.24	198.584	194.889	128.051	238.118	193.614	177.387
185.976	205.848	190.542	173.31	192.839	198.895	237.923	215.802	260.069	126.594
219.578	155.1	188.209	207.403	200.094	223.971	242.099	176.755	173.988	274.917
213.157	114.176	288.891	208.381	217.96	204.888	265.98	202.775	216.659	183.905
279.543	148.815	221.241	186.407	283.203	221.146	271.923	226.233	205.898	266.468
180.146	138.511	191.093	245.466	205.672	173.534	224.552	175.848	191.748	188.408
159.332	139.865	204.153	148.187	207.785	199.464	207.739	179.773	265.422	175.258
260.647	206.972	219.547	224.366	208.48	206.118	170.028	209.829	207.787	172.676
158.113	141.8	242.652	250.373	198.408	179.487	149.754	203.285	238.202	218.184
118.133	189.091	195.711	153.109	178.957	198.822	174.748	220.618	180.817	209.716
243.583	222.304	214.599	260.41	170.539	188.546	209.672	198.708	157.116	144.44
207.392	176.115	174.314	229.553	215.665	157.64	181.064	272.148	222.287	181.324
200.22	187.891	181.762	220.215	203.752	233.291	188.029	288.503	178.212	230.721
243.891	193.688	145.224	300.259	211.597	175.138	218.474	215.175	187.188	168.652
182.198	188.58	147.985	176.569	197.265	177.821	190.306	223.079	166.344	219.777
219.054	189.801	179.083	200.504	227.917	283.487	154.996	201.05	214.703	225.265
238.638	211.546	156.488	172.52	226.755	220.131	183.817	139.646	240.412	172.086
210.071	200.724	188.146	195.077	178.082	214.975	206.125	154.743	212.37	210.032
209.927	175.23	223.347	201.364	154.182	215.368	259.63	204.957	226.218	168.328
160.021	238.752	182.155	216.311	261.871	208.384	201.366	265.995	220.257	177.223
208.898	176.44	182.6	247.571	243.459	164.705	254.671	182.384	178.56	239.643
172.481	210.912	261.735	144.35	211.674	241.558	222.892	183.131	235.52	216.714
155.154	226.686	166.49	231.952	164.006	151.437	242.262	223.262	196.408	191.731
206.89	223.4	146.082	251.674	183.933	154.852	232.353	250.646	216.822	247.193
209.19	258.729	173.082	148.326	243.792	178.222	219.11	182.126	155.756	175.335
204.14	168.715	168.726	247.168	217.123	225.203	230.146	173.952	191.008	182.784
202.42	178.22	201.257	195.572	215.407	166.221	221.83	159.373	209.125	186.04
186.892	187.51	192.523	205.221	221.072	190.105	165.914	179.408	180.239	261.788
174.639	159.006	169.219	162.731	212.341	212.449	201.089	218.212	159.229	214.472
231.21	156.408	221.681	224.809	151.93	202.213	160.741	207.641	199.107	161.269
148.27	215.792	249.809	281.259	223.527	206.103	173.174	182.026	211.115	169.312
195.592	245.858	180.716	223.59	192.877	234.098	128.083	162.736	163.63	209.17
233.571	201.595	214.053	207.022	193.898	139.225	155.032	240.854	160.897	157.945
197.181	160.648	212.034	137.904	237.981	166.919	199.484	177.712	184.258	224.952
176.678	195.032	260.406	202.281	299.182	225.515	218.415	224.528	197.704	196.8
244.723	214.318	170.132	163.42	225.159	204.886	258.898	194.016	221.767	244.203
108.314	160.515	187.849	280.181	142.865	209.111	179.842	217.344	202.788	132.482
193.953	254.583	198.253	235.596	181.994	204.954	192.126	218.747	167.653	164.347
220.627	206.441	224.414	197.354	163.047	203.557	249.485	196.138	197.292	246.379

168.291	207.477	174.925	145.674	208.934	182.447	206.055	163.359	142.146	243.147
207.562	242.395	163.597	135.672	195.676	173.186	120.985	214.298	238.758	153.302
199.116	259.326	216.382	238.587	240.01	149.474	229.876	273.961	241.041	243.501
220.428	155.906	225.04	231.779	137.638	185.412	174.349	158.423	206.763	183.628
285.127	216.648	217.71	187.577	171.099	215.077	188.286	180.629	170.65	191.351
185.774	129.226	200.606	181.187	136.908	200.339	214.626	210.329	214.007	166.729
250.764	221.046	250.066	222.973	182.531	190.055	234.408	177.419	204.908	222.887
160.019	162.631	139.795	217.547	186.519	207.816	222.753	230.335	132.142	177.235
215.505	157.559	223.76	180.49	204.257	214.936	201.571	201.221	191.986	181.485
196.769	262.12	188.23	237.065	229.69	250.43	119.064	165.346	128.24	171.12
233.961	177.576	204.793	201.02	215.04	170.251	174.226	221.662	183.71	155.308
183.476	211.55	250.152	128.83	196.681	194.138	189.627	185.196	195.607	216.875
218.552	149.072	163.227	232.048	184.244	171.243	103.917	219.848	179.955	230.843
217.782	195.486	180.803	174.995	204.283	214.66	268.525	216.513	174.819	242.539
198.087	199.296	268.345	202.427	237.913	280.642	241.133	217.885	222.033	206.685
203.818	180.548	187.589	193.661	222.329	175.664	260.595	129.131	176.02	219.813
197.233	178.97	202.614	165.239	185.166	267.63	295.917	283.402	273.767	149.402
189.639	211.868	229.93	201.688	206.996	215.851	169.737	201.759	193.7	165.146
224.054	256.302	215.094	202.547	226.299	195.393	224.114	205.45	201.845	164.972
197.931	198.519	234.886	207.971	204.61	225.772	146.24	196.456	222.501	267.05
222.964	212.306	242.188	194.122	163.017	238.92	261.681	220.068	162.145	180.394
195.894	207.583	207.908	193.678	217.984	204.256	246.748	194.822	191.939	203.91
224.634	254.873	210.488	240.933	207.885	193.124	231.118	158.488	193.082	185.4
155.66	226.518	223.763	224.438	235.514	196.001	235.796	205.008	204.664	126.333
120.013	179.417	257.362	215.362	211.066	193.402	190.539	108.092	124.84	289.164
216.986	251.355	198.227	193.904	221.569	265.948	195.884	185.267	252.992	184.765
202.581	200.19	186.478	249.067	89.1601	187.923	194.459	147.32	235.002	207.487
198.276	137.597	182.775	206.704	173.871	215.987	191.505	196.387	210.892	175.326
167.779	219.211	220.129	241.811	160.733	201.576	190.002	210.745	277.942	262.317
251.712	236.936	175.364	182.112	209.558	251.248	248.036	185.64	236.094	265.344
215.286	221.45	199.601	235.715	222.303	242.72	149.96	153.916	230.685	209.427
186.354	206.487	233.162	234.914	173.311	202.939	187.386	128.417	146.292	219.538
222.111	227.706	239.757	202.178	238.966	234.615	172.061	199.398	167.202	237.376
194.338	272.361	211.5	188.359	144.543	135.085	219.544	194.122	231.54	155.7
147.833	207.834	287.232	189.85	227.117	201.131	181.626	171.573	206.264	198.431
169.047	173.474	157.428	215.961	235.433	223.261	251.052	221.976	317.226	150.335
186.302	201.137	184.218	214.46	157.503	205.434	233.15	155.688	175.704	215.625
162.81	226.102	233.497	189.838	232.87	227.342	191.653	221.438	243.63	198.423
200.273	105.692	225.329	179.111	181.422	240.991	143.426	263.171	293.82	
240.354	153.292	198.684	269.4	205.579	253.091	251.143	228.128	180.181	
230.281	204.423	186.75	206.669	157.664	216.955	210.889	207.912	226.635	
236.606	241.285	143.288	211.052	216.343	180.429	133.647	193.463	218.604	
200.659	262.86	158.086	185.262	195.918	210.659	194.7	188.136	151.568	
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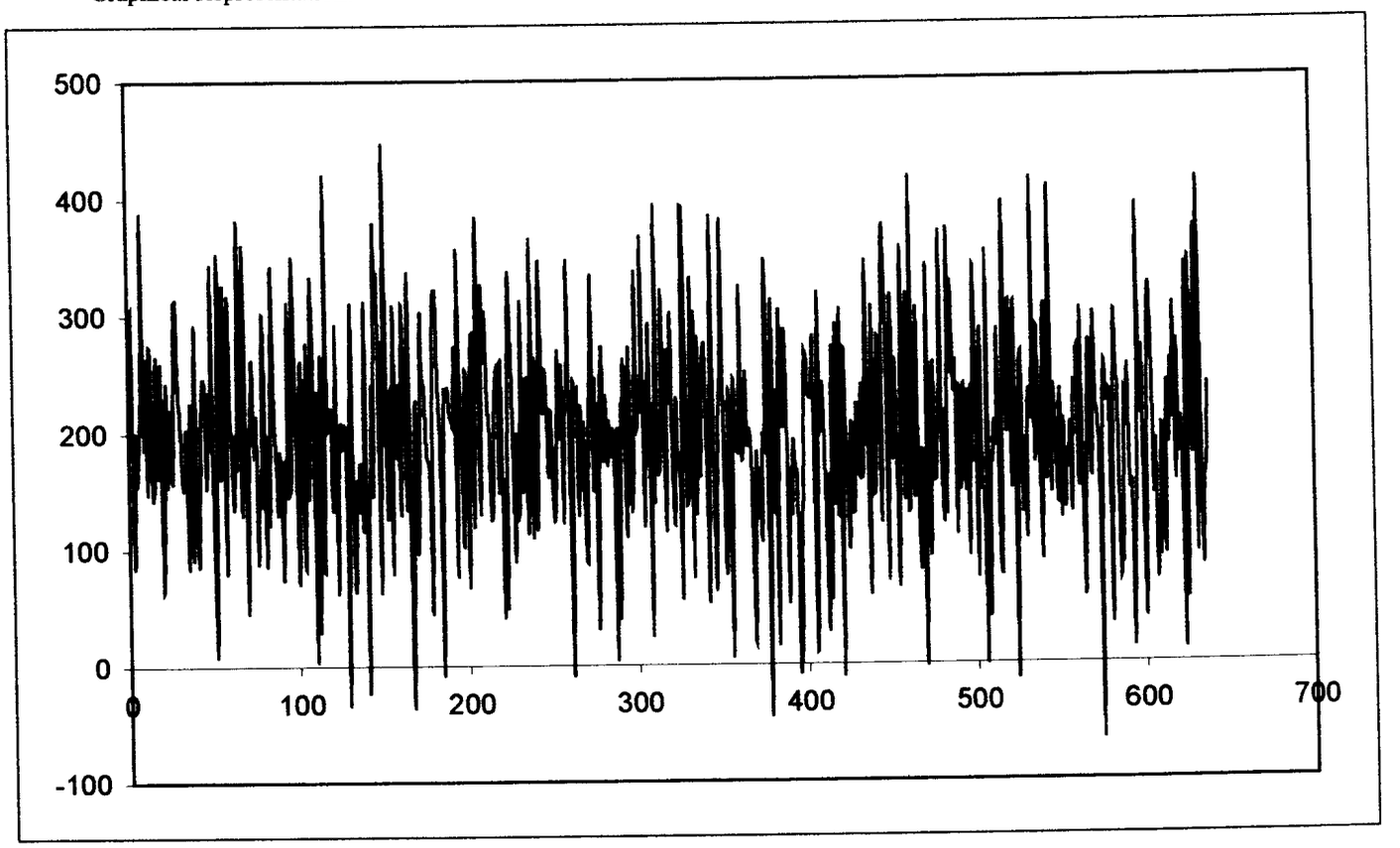
Time Series Name: Noise N 6

Graphical Representation:

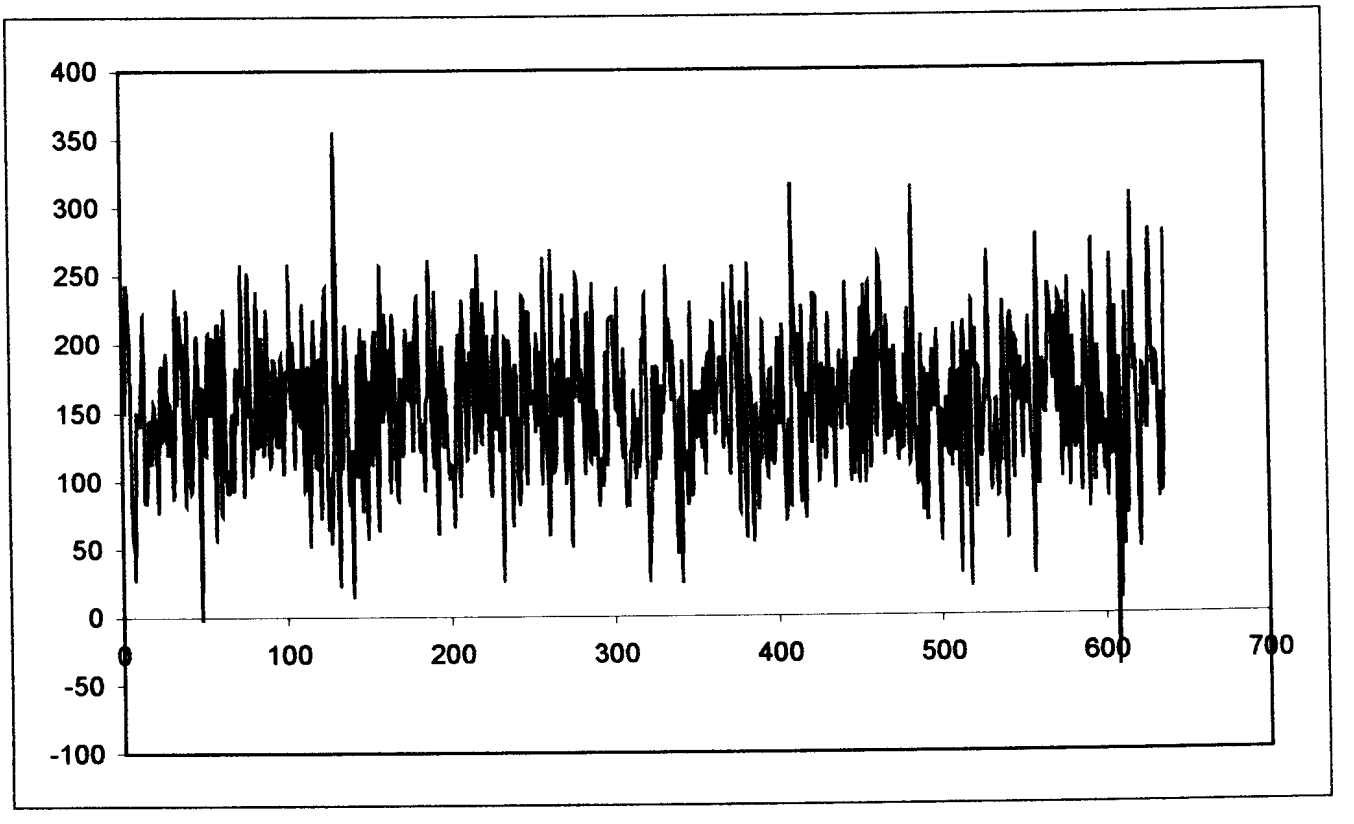


229.233	201.696	220.498	44.7526	364.77	190.999	199.059	55.3727	333.961	105.858
297.938	198.949	132.791	276.833	109.041	130.692	5.88233	270.624	222.612	222.751
84.503	133.76	159.371	321.516	263.264	175.67	240.758	135.44	91.7938	232.936
199.169	197.918	291.339	320.965	116.956	336.559	207.203	290.543	235.463	208.616
154.496	169.788	63.6431	239.918	146.719	204.388	182.421	168.753	256.963	413.412
192.369	381.433	182.083	193.233	343.506	243.319	180.098	129.706	156.785	172.598
237.711	243.656	208.145	-8.66621	269.274	217.994	323.327	302.387	199.301	284.714
388.303	130.912	186.102	155.857	215.841	366.221	175.665	-10.4014	206.278	249.775
187.351	360.715	206.95	237.571	253.54	119.748	189.648	261.964	368.664	164.139
263.73	174.025	191.945	235.325	213.794	242.126	250.278	189.896	166.668	90.7387
147.657	45.1024	-34.0601	238.37	161.195	170.465	187.249	162.453	119.942	283.489
272.541	177.616	199.558	212.827	217.281	290.555	201.036	97.9135	215.656	304.69
250.518	226.214	309.866	210.004	193.581	24.1173	181.454	206.834	129.61	155.657
142.06	262.283	144.963	203.425	136.246	221.569	99.8209	151.781	370.208	279.569
151.109	183.919	63.1661	270.423	125.42	141.494	18.7281	131.037	246.757	404.896
265.542	212.651	157.761	75.9785	204.194	393.282	179.891	220.27	325.852	148.578
174.728	87.1217	132.176	353.364	269.889	161.971	124.448	201.254	232.141	233.453
162.836	160.6	173.881	229.41	193.671	163.749	166.306	159.946	258.352	210.048
258.962	140.758	140.858	165.306	257.736	192.829	104.875	238.542	109.526	172.563
69.1096	299.785	117.622	102.696	121.978	320.536	196.877	157.619	237.292	137.671
129.233	278.4	310.498	250.584	228.004	205.077	183.989	223.468	147.615	233.068
242.259	85.6629	-19.6553	209.913	237.551	114.024	346.406	343.834	216.413	123.237
154.238	196.849	119.355	67.3315	345.074	267.014	316.174	228.704	235.897	207.93
218.63	120.984	153.32	242.636	111.251	222.815	-44.9818	59.2086	146.455	131.834
212.208	268.667	240.389	282.295	-6.99882	301.065	250.113	248.891	232.066	181.081
158.27	341.957	147.931	119.27	241.655	169.947	310.476	304.323	92.2092	165.982
309.22	209.515	376.293	245.033	218.333	120.317	128.656	148.02	235.79	204.581
313.68	171.216	296.048	383.951	235.969	228.627	232.831	174.412	171.669	128.862
250.171	129.641	333.44	303.05	128.377	166.234	15.4309	278.483	338.714	238.956
213.31	183.17	62.9895	129.899	222.179	178.237	296.187	262.461	249.458	232.81
167.44	125.486	276.468	323.119	150.089	60.2862	239.283	120.5	73.1076	265.264
150.669	73.7169	192.89	259.591	208.479	391.808	202.451	337.382	226.317	150.012
152.657	176.363	446.25	303.44	91.2734	390.533	286.068	375.571	284.655	302.101
202.338	146.838	128.438	215.169	87.2303	136.285	234.884	288.341	148.98	212.668
83.4393	311.146	160.317	214.686	193.829	140.169	51.4915	70.762	146.114	56.4773
223.537	150.12	234.281	125.335	258.336	202.705	162.45	229.826	2.54666	147.929
215.19	165.215	78.7545	133.099	331.829	329.099	127.326	314.807	351.341	168.261
91.6976	349.956	307.397	208.378	148.775	74.3894	191.958	173.694	42.4942	274.679
290.72	250.413	192.98	251.273	244.313	301.618	167.798	260.132	173.136	217.48
191.302	177.783	179.147	257.763	34.1766	127.944	159.965	176.389	170.43	159.471
85.2365	70.3239	241.102	147.948	78.4886	279.791	-5.88839	65.3775	206.507	298.613
162.077	229.483	129.16	261.729	241.178	160.434	11.6863	160.365	186.102	222.758
216.477	260.833	304.504	41.6308	272.2	227.421	122.867	355.89	283.84	211.246
246.022	142.607	259.098	159.118	174.433	262.03	149.507	249.054	89.2567	181.753
240.832	87.9754	180.308	48.6064	231.279	273.732	266.598	139.122	76.5057	-65.7002
152.318	276.377	137.643	237.111	169.795	153.515	262.764	315.264	281.07	176.334
234.92	143.198	336.795	336.731	209.172	52.5309	230.536	128.485	393.065	256.478
190.441	219.282	24.0697	260.051	178.644	209.907	226.634	132.469	198.146	223.725
344.233	332.975	-36.3317	210.438	202.554	383.626	242.216	415.686	280.634	233.45
111.788	258.697	150.186	88.9934	188.767	209.124	277.204	171.966	305.905	230.298
8.18791	3.51858	226.685	197.908	3.79721	63.6101	14.8765	142.095	148.858	33.4786
129.805	235.167	96.7575	124.458	202.612	167.702	99.3312	303.487	269.672	156.032
352.962	28.8156	146.125	136.703	39.3247	215.103	316.721	164.192	303.791	298.487
163.259	261.52	301.273	311.601	221.412	252.475	199.283	79.5779	-5.75699	244.729
234.933	186.898	246.47	149.732	186.185	380.478	240.556	182.095	71.1611	234.081
322.241	89.0676	239.214	215.084	261.791	189.058	216.356	163.195	256.429	74.6364
84.2828	419.896	180.266	242.174	154.667	77.7038	121.142	-	265.475	105.563
164.254	202.619	175.701	112.553	112.654	108.785	27.1318	0.29980	128.02	84.7848
316.763	218.264	168.662	169.129	271.143	234.306	160.937	4	190.657	228.376

199.815	233.397	123.731	147.63	358.966	-12.3492	312.213	144.839	301.122	170.228
253.257	82.8126	330.673	184.904	317.946	70.8589	301.746	208.743	386.858	166.273
148.093	155.201	161.228	364.611	443.18	202.204	67.4328	221.146	219.773	224.114
154.297	168.712	278.754	66.1908	159.607	59.0773	261.83	145.194	111.874	211.66
12.9659	237.528	263.034	137.688	310.677	147.996	309.525	190.843	173.208	279.787
117.234	167.417	289.755	208.326	130.898	174.714	169.592	228.867	391.82	155.385
169.26	225.71	194.943	350.5	70.4429	188.707	272.379	133.828	131.819	18.5715
390.645	25.2164	198.312	150.608	410.594	328.787	-59.2262	297.859	241.367	280.27
213.367	46.3559	24.6088	293.25	8.24135	202.145	300.075	174.643	238.862	132.35
269.352	330.432	258.234	147.873	176.923	331.317	297.075	185.488	316.367	114.069
141.305	300.701	168.108	167.461	292.838	135.609	304.155	159.928	274.359	406.609
39.0218	161.645	251.011	116.782	46.271	228.49	242.041	141.191	4.43114	60.5142
228.572	137.942	243.128	272.911	296.088	191.255	176.142	164.789	171.307	185.601
303.864	289.124	98.4373	208.685	188.999	297.04	137.253	152.029	247.88	180.097
321.611	369.6	280.291	174.638	166.556	245.904	141.941	80.2931	178.129	341.016
242.771	168.784	158.93	-75.6574	304.391	184.917	195.404	271.499	277.563	229.73
143.035	256.371	78.4918	137.91	311.856	140.32	130.828	285.309	26.8915	165.503
188.528	234.705	280.737	25.374	267.322	105.402	178.788	251.194	135.458	185.648
70.9819	273.088	123.707	146.95	187.108	246.862	181.104	215.627	202.828	178.636
133.779	132.915	169.678	306.607	180.552	186.647	184.709	212.283	374.515	288.392
90.6352	334.889	450.68	47.2371	81.9361	152.986	140.515	250.371	215.676	286.794
201.723	322.897	47.6301	108.724	181.29	329.556	219.548	241.597	120.762	282.085
199.839	289.932	113.524	204.777	169.297	331.235	131.489	258.43	174.98	222.548
91.9643	94.2686	181.708	140.853	232.639	67.0779	230.081	332.527	283.771	45.1297
237.687	185.936	242.195	183.175	114.503	198.923	149.704	323.653	203.698	147.654
185.987	333.273	264.777	139.128	120.609	273.946	228.989	128.705	84.8971	221.574
257.918	79.18	186.976	54.1293	93.4001	205.236	316.817	223.938	382.842	-64.9488
207.168	258.674	15.3636	345.491	101.895	219.831	328.448	334.213	79.0201	127.718
305.481	258.18	281.07	13.8185	133.461	271.214	267.071	80.4351	268.145	158.406
154.731	272.123	292.295	250.855	83.6614	35.001	195.829	151.169	196.736	262.44
273.921	238.272	125.676	259.329	167.495	108.434	334.291	226.437	304.81	154.981
179.629	168.481	-	267.05	233.383	50.2607	326.192	271.619	191.559	142.299
208.162	171.319	0.94104	237.868	303.341	235.138	193.858	98.4625	149.213	151.432
159.788	304.237	5	256.519	177.357	377.316	80.7603	298.722	283.048	234.913
14.7592	78.7985	112.409	217.339	140.742	188.739	229.651	285.273	223.939	183.241
339.098	118.893	185.577	136.177	239.268	189.432	215.8	217.844	241.395	247.72
54.3656	77.0257	147.992	323.671	142.38	72.7265	306.887	313.555	136.1	161.129
339.657	34.073	66.2048	185.861	128.268	313.218	334.922	328.87	181.862	254.361
243.674	152.235	210.764	192.998	207.5	186.124	147.731	328.729	387.006	351.228
176.979	260.875	196.264	257.982	330.524	263.936	262.124	291.823	266.622	219.442
235.717	341.509	102.533	279.619	242.248	306.677	247.932	135.022	213.073	212.776
368.986	96.7224	245.925	127.921	347.128	42.7071	326.81	227.571	57.1874	396.035
93.2052	63.4095	325.712	102.451	256.822	306.464	254.358	229.23	96.6157	
410.677	155.918	24.8822	17.158	169.914	163.057	167.107	77.9647	84.0556	

Time Series Name: Noise N 7

Graphical Representation:

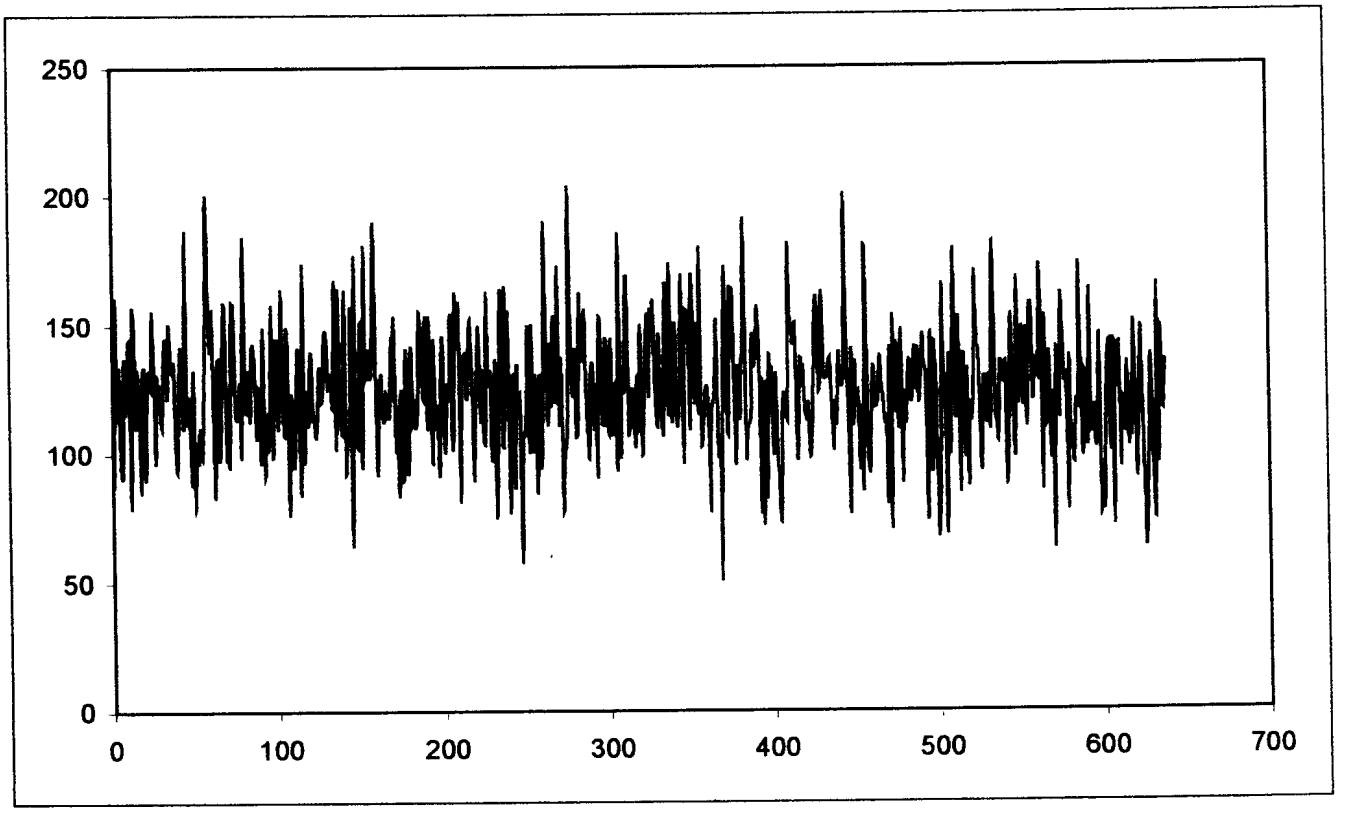


155.729	118.747	136.599	171.153	143.171	110.964	180.99	82.9151	140.335	122.417
152.165	78.133	188.793	215.785	66.0603	215.003	103.958	226.874	112.888	140.245
240.541	225.332	72.2991	232.233	178.015	218.737	184.678	138.774	153.704	155.557
220.703	116.102	192.114	128.142	184.385	219.45	191.685	71.4856	121.701	87.9914
197.017	94.305	219.047	121.142	133.529	193.923	148.459	161.321	123.042	115.199
62.6312	90.6886	239.009	139.947	82.2633	152.43	214.756	147.483	186.543	112.171
47.548	99.6795	67.1622	92.8188	116.65	240.561	213.673	198.591	168.65	228.769
28.6813	148.665	102.016	156.737	235.243	140.326	133.492	126.505	223.981	163.141
148.494	93.3285	53.9627	163.141	230.955	173.053	165.684	235.402	111.384	98.9493
140.39	182.661	101.73	260.802	186.235	116.371	169.538	234.148	141.452	61.4803
140.433	142.08	137.857	178.966	97.2106	196.375	188.925	232.274	313.825	206.628
179.495	180.357	354.779	126.372	223.742	81.741	179.128	101.617	151.448	220.732
217.526	166.454	112.008	111.387	156.065	91.0629	123.313	127.632	124.181	182.22
84.9575	257.123	22.376	238.179	165.238	82.1087	242.882	183.499	95.5104	100.025
84.0113	89.7998	168.592	62.1811	162.35	119.675	133.609	179.548	118.713	199.644
125.995	165.92	109.697	136.655	135.837	128.257	131.793	114.805	204.762	157.842
144.014	148.578	172.912	182.372	207.146	165.908	103.588	124.219	76.4488	165.128
112.48	251.647	213.286	196.086	140.687	101.117	150.348	220.797	180.042	185.369
155.576	166.442	147.815	124.586	192.972	144.542	255.01	150.789	87.2221	113.913
146.992	105.482	82.4466	166.973	97.2069	109.558	216.63	137.662	70.0067	158.737
140.633	123.375	117.735	126.836	262.731	117.95	193.874	179.876	172.302	180.652
76.5236	139.554	14.6292	103.478	133.133	202.718	128.512	93.6894	148.687	154.231
135.344	238.038	121.329	111.676	161.809	185.997	80.924	151.65	193.34	217.347
183.865	125.936	104.415	100.261	59.7264	233.845	228.311	162.608	153.735	138.121
131.334	127.957	191.938	65.644	114.621	97.0923	162.378	193.106	152.785	101.926
134.21	204.589	103.343	121.537	268.059	25.3519	142.604	136.274	208.381	30.4381
193.28	121.125	211.068	182.443	107.058	65.1162	59.1985	168.454	122.555	187.177
119.293	151.382	77.711	203.551	113.699	101.301	256.612	175.992	53.9527	276.827
156.432	224.865	182.763	88.3238	146.94	182.46	160.414	243.417	146.27	97.6447
146.706	161.194	200.014	227.54	188.118	100.75	173.549	142.173	122.598	161.93
87.2027	111.304	57.4138	190.298	147.174	180.917	54.4727	151.593	145.888	185.906
107.602	119.481	171.06	195.203	151.052	154.545	126.284	97.8442	157.798	152.197
240.057	188	131.498	116.767	235.495	115.418	152.824	177.67	116.953	147.556
156.421	181.231	114.432	146.236	98.8376	168.371	78.1448	103.147	178.05	191.862
218.18	126.66	197.496	193.262	145.142	148.746	118.926	186.162	108.561	240.263
204.711	125.525	208.123	177.895	173.296	165.587	115.483	168.843	212.481	230.597
193.691	148.74	96.2538	240.149	123.822	256.458	212.789	96.8163	119.596	202.775
125.403	190.638	66.506	121.64	52.543	186.881	179.691	224.472	170.165	171.931
85.3278	105.919	253.334	141.058	215.677	217.454	124.239	118.272	176.891	217.082
224.525	137.983	191.114	264.825	161.328	158.577	102.251	241.092	30.2219	147.036
137.008	179.636	143.312	166.36	250.275	201.608	170.162	97.2851	184.655	234.262
91.4806	179.437	221.587	128.802	243.501	152.337	179.561	204.6	214.302	229.787
101.818	257.506	153.47	229.494	158.737	45.6798	114.553	241.425	120.177	100.588
152.954	153.595	194.877	152.143	180.576	102.435	111.031	108.624	94.6128	227.336
180.402	201.266	91.5658	175.175	151.006	155.97	135.07	172.042	191.506	123.008
205.757	109.317	184.796	202.682	104.244	24.3559	203.405	201.886	20.4823	131.837
150.784	175.724	221.509	101.478	185.341	186.371	141.025	204.605	226.401	245.589
-2.41903	181.446	164.341	89.31	220.712	107.781	141.484	130.586	182.174	93.6909
165.437	155.559	105.455	186.404	139.6	120.378	212.986	262.743	207.041	187.285
138.934	141.294	87.0154	205.566	115.723	81.5477	146.738	259.917	78.6375	202.43
120.176	228.851	173.455	137.971	243.67	101.458	71.7114	224.617	179.528	122.356
179.893	93.2813	160.777	237.716	120.716	229.497	102.588	135.009	142.526	131.324
207.417	96.3646	117.788	122.884	150.298	88.5913	143.302	118.392	115.951	163.812
148.265	183.181	167.793	144.539	112.916	159.414	86.4177	218.57	140.447	148.486
204.465	53.1825	210.957	25.9772	81.1692	164.554	310.475	128.143	170.717	89.6421
171.494	109.145	179.618	204.546	114.879	132.167	254.712	192.857	166.119	150.423
55.9661	190.586	158.904	202.333	95.9258	142.415	201.604	130.349	265.426	231.933
213.428	216.235	201.127	147.814	126.266	164.154	167.745	195.056	137.109	191.738
214.515	113.179	121.417	202.528	193.151	123.463	203.784	178.343	90.6493	157.119

78.0474	88.5569	196.766	85.4843	246.346	111.79	236.701	192.607	298.306	131.997
197.75	131.68	171.378	243.224	196.249	61.3931	193.664	176.184	148.936	199.616
272.369	279.309	188.525	253.363	129.976	174.235	208.283	168.344	151.666	127.493
99.2523	174.357	173.294	167.885	173.483	218.373	123.797	186.007	150.312	176.605
163.338	110.091	102.629	191.321	168.511	89.832	62.5146	155.277	151.023	97.0957
195.474	183.429	77.9552	132.918	169.582	171.483	202.652	90.9517	157.718	170.272
124.916	134.448	210.882	117.417	200.623	166.995	177.658	204.635	144.966	161.377
159.696	63.7182	251.851	183.34	180.303	159.306	50.1346	91.0573	123.38	153.754
148.866	66.459	150.914	249.032	173.618	154.375	224.243	181.574	201.321	171.624
105.262	133.273	109.786	101.869	125.08	151.276	198.148	102.415	181.669	216.855
139.476	230.973	143.392	249.08	156.027	170.696	91.49	139.634	209.771	214.007
85.7144	126.866	86.5342	139.008	86.2506	160.214	238.918	71.9596	24.1565	165.897
170.494	227.216	267.67	228.621	133.945	82.752	156.702	253.176	84.7214	251.035
262.422	81.607	203.417	222.767	146.984	141.058	79.1552	206.581	204.947	89.2839
120.355	196.66	170.979	111.946	231.945	202.467	140.584	109.044	187.655	185.535
143.815	164.731	198.747	188.463	46.1464	118.298	240.982	151.758	105.039	97.0031
218.862	186.792	211.4	120.315	82.1881	187.208	228.452	225.926	73.3955	184.708
-38.101	84.905	172.651	213.995	28.1352	186.777	156.98	260.025	168.306	212.762
186.696	79.8308	170.346	169.552	93.6524	104.746	130.924	229.422	220.269	104.96
11.5277	193.951	63.964	127.631	170.142	131.331	183.518	166.69	151.459	213.416
138.594	218.031	217.031	254.412	147.278	189.118	141.076	132.838	63.3129	97.2227
50.7093	179.681	154.727	171.141	209.89	154.453	67.8373	163.327	133.096	195.607
233.92	171.25	167.613	250.354	121.76	120.856	122.173	198.632	101.049	94.1009
72.8487	108.285	215.773	149.829	292.136	12.8663	146.706	241.908	164.291	201.174
182.336	141.458	247.931	167.582	158.401	153.704	221.318	190.741	106.167	178.25
189.44	129.869	90.8273	116.33	263.755	114.419	100.347	182.29	161.157	217.697
307.445	177.846	110.988	109.202	160.132	154.209	256.969	106.433	160.462	216.406
178.053	168.469	191.552	112.755	223.045	157.204	138.37	173.794	246.74	65.6728
194.915	215.101	100.225	148.582	108.502	205.353	143.33	199.831	221.006	160.621
124.295	117.832	119.788	187.074	192.257	160.891	53.3902	78.7273	188.498	115.162
48.567	117.727	195.715	209.752	26.6027	172.903	134.047	138.972	43.4013	60.5305
83.614	101.52	159.566	182.664	224.589	137.172	109.549	111.276	78.2606	152.992
181.342	166.149	214.682	126.74	135.3	33.4734	145.958	47.2792	155.873	166.608
173.883	64.8002	130.385	90.0454	134.667	278.026	124.982	144.896	145.686	153.996
144.464	144.455	163.692	164.706	156.018	29.8286	85.2243	254.198	190.26	133.122
135.424	157.156	163.02	189.368	119.591	137.605	89.2519	106.037	212.87	153.195
261.059	194.966	215.549	186.07	235.867	219.363	166.4	173.742	207.511	95.2387
280.47	116.056	72.1567	189.97	54.5189	104.806	172.972	92.4329	211.234	196.446
199.962	189.985	190.281	228.188	167.256	219.692	158.183	80.2158	134.571	
166.289	224.989	163.47	162.405	179.399	197.849	50.0167	202.926	185.051	
191.339	197.268	227.051	155.077	172.611	94.5092	150.121	156.47	84.5921	
186.372	154.897	82.9787	223.362	218.185	113.943	206.268	139.458	185.881	
84.2044	178.1	85.1048	270.28	176.557	152.766	181.267	99.4929	87.658	
159.869	138.813	106.919	168.626	225.403	179.366	98.0492	133.805	202.238	

Time Series Name: Noise N 8

Graphical Representation:

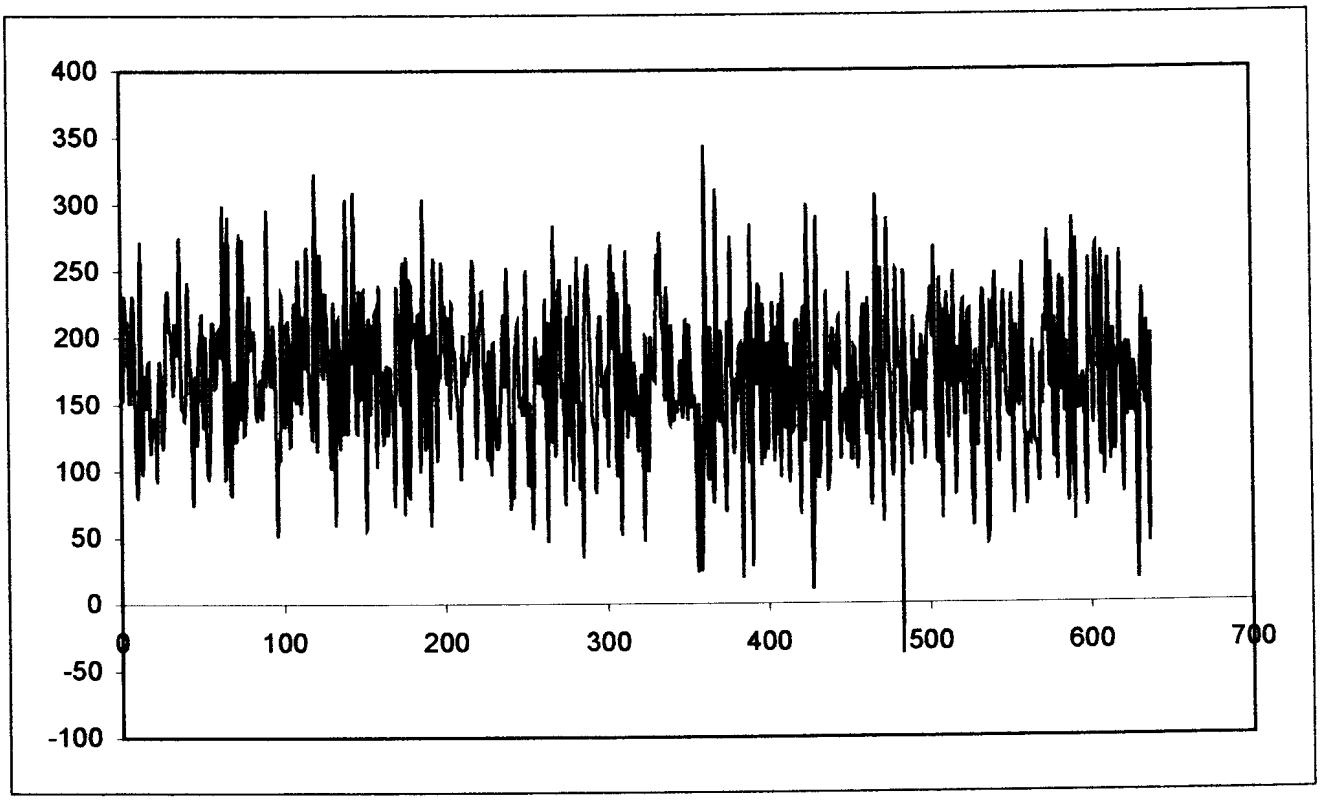


87.5688	154.82	122.817	92.7626	164.806	111.203	179.834	97.6443	115.697	157.698
160.572	104.241	139.727	102.306	120.457	111.069	103.491	104.624	142.937	180.306
113.16	83.4376	113.219	141.712	155.029	144.533	112.877	136.101	122.628	117.85
133.827	131.385	114.647	111.558	77.1248	128.218	118.859	126.143	110.139	110.659
95.8357	136.556	106.344	120.946	126.887	107.782	126.062	134.026	147.731	104.567
91.1663	97.415	123.228	110.146	130.169	144.303	115.909	115.832	88.2393	135.534
136.931	125.67	133.79	116.113	86.6178	108.049	77.1027	112.586	122.783	131.339
115.781	158.81	120.302	154.322	133.707	116.168	116.098	119.54	111.335	126.934
130.711	157.131	125.325	147.78	120.564	126.944	119.924	98.3701	121.426	134.259
143.132	99.574	146.376	126.807	123.09	94.5072	132.234	106.493	136.095	88.2071
78.9242	114.16	147.727	121.42	57.8751	185.684	151.351	132.127	119.982	96.2827
156.884	95.8881	125.841	153.36	104.998	99.1382	98.4166	154.207	125.05	141.674
153.597	158.847	131.234	109.507	107.361	133.519	106.426	160.054	141.16	153.775
110.303	157.818	126.418	153.46	118.872	124.162	50.777	124.214	124.339	120.124
132.78	116.224	118.447	125.494	149.675	168.791	129.292	128.604	140.515	100.216
115.416	113.353	167.193	96.1293	100.422	169.005	172.445	162.577	119.337	167.672
85.11	113.706	101.709	144.396	150.221	108.126	137.535	130.392	132.225	118.72
128.116	127.666	163.969	110.823	100.771	116.985	107.906	128.683	146.14	140.798
133.415	99.8183	114.705	118.14	130.582	124.797	164.565	129.439	133.72	147.662
90.1006	184.13	114.676	91.3689	104.15	114.676	137.653	135.151	131.3	117.956
124.418	120.289	108.006	123.316	84.8187	102.285	164.101	136.563	73.9567	147.918
132.431	115.866	163.613	145.566	130.479	130.012	117.368	116.378	100.833	110.219
125.932	132.446	93.7256	112.041	94.6059	108.493	95.5109	100.916	146.796	140.357
155.566	112.59	109.185	100.604	142.721	149.982	133.848	119.841	92.3356	158.03
130.282	138.288	105.792	125.625	189.818	100.909	112.861	111.568	142.174	157.701
96.5169	142.716	156.659	121.649	140.114	113.861	134.126	138.549	131.726	120.468
129.637	128.403	64.1098	154.478	111.114	137.045	140.461	131.96	94.5495	135.577
122.148	105.942	176.566	102.34	142.621	154.139	190.879	125.718	67.4463	132.197
115.474	126.03	112.024	118.2	118.317	121.745	97.9968	129.242	90.3919	129.198
110.599	123.143	102.817	162.549	153.51	154.927	109.225	200.575	164.646	172.727
139.071	96.3845	133.914	140.74	120.703	145.643	111.187	149.927	135.042	155.897
~~144.566~~	~~148.986~~	149.634	157.735	120.269	159.435	116.734	113.843	113.619	85.2192
121.692	91.539	94.6463	81.2851	172.69	121.18	146.308	76.4456	68.5181	152.857
150.65	115.674	180.945	133.712	111.196	110.928	133.394	140.126	138.08	111.025
138.063	101.199	130.233	138.179	137.083	146.41	145.494	110.925	99.3709	118.582
131.76	111.783	140.418	139.274	78.6683	125.975	156.897	135.366	139.845	138.949
135.78	157.984	129.417	121.243	96.0059	110.95	140.145	117.903	179.297	97.4913
101.854	98.5643	133.638	146.371	103.742	106.891	76.3061	123.266	113.9	122.622
92.9641	130.887	151.427	151.969	119.088	165.624	128.679	93.254	119.623	62.8692
113.239	144.325	189.692	128.798	203.584	161.484	72.2078	117.875	152.259	139.942
141.777	109.728	119.546	89.6814	144.394	114.722	127.526	86.5735	84.5253	133.341
119.853	121.612	91.8071	117.459	122.266	173.835	82.5668	180.411	137.957	113.303
110.504	163.671	125.237	127.684	140.501	113.043	137.035	178.046	138.012	160.409
186.698	127.268	131.08	149.776	106.172	123.616	120.281	102.893	97.9246	144.545
112.353	107.887	119.927	112.468	107.824	150.658	133.111	92.1624	132.418	127.268
122.358	149.099	112.529	132.718	161.837	111.368	99.2689	110.35	87.043	129.782
106.84	138.073	123.543	105.466	142.438	119.438	131.041	133.902	118.203	77.4503
88.4252	76.3446	121.742	103.544	136.081	118.695	98.7161	117.448	112.15	137.076
132.289	123.309	114.817	162.911	155.781	169.281	90.0393	117.668	133.707	106.187
78.9482	99.0011	145.312	126.561	126.486	96.1564	73.5283	120.521	170.494	101.794
103.468	95.2879	121.032	132.186	109.373	155.497	111.774	137.841	142.761	96.3371
96.6343	127.255	153.242	97.3704	98.5973	155.396	123.145	124.563	139.282	120.304
110.111	140.994	101.033	111.391	130.598	142.479	114.438	121.659	99.4668	116.729
98.3365	130.575	118.566	135.961	135.049	109.158	112.884	111.286	92.7406	173.575
126.112	84.4474	83.6482	75.1157	109.28	167.916	181.368	112.022	129.114	141.218
156.05	173.768	124.667	110.68	126.542	148.91	148.551	80.0999	126.149	98.3904
200.257	97.44	89.2258	163.067	90.6441	119.215	145.574	140.699	111.377	130.911
156.569	124.343	90.466	142.998	153.198	150.298	142.189	70.4393	130.087	117.992
139.765	110.986	140.524	102.464	150.841	115.21	149.681	152.677	108.635	104.32

163.263	126.122	116.733	109.986	99.8007	100.418	136.015	112.092	129.628	115.131
108.142	116.52	114.812	123.841	131.71	118.256	130.096	131.088	65.8447	104.401
115.368	135.16	121.698	170.344	91.8319	130.428	114.523	116.406	128.284	150.694
117.5	102.284	120.265	160.003	146.002	87.7381	180.651	131.534	145.063	108.44
101.583	140.157	124.716	97.3171	93.6498	142.012	145.496	124.203	160.827	127.1
115.097	148.21	150.622	125.957	119.942	97.4099	125.557	142.382	175.21	107.101
145.607	128.148	118.787	117.02	111.332	86.3492	172.387	138.723	120.829	112.98
77.6696	131.672	104.243	151.203	128.937	133.068	156.985	82.2076	177.397	154.798
94.0601	137.852	163.39	91.4292	110.477	74.569	151.064	141.262	89.1502	94.9128
77.4517	125.171	116.943	126.203	146.463	110.644	142.183	119.938	89.8801	122.349
108.256	93.7781	127.544	165.567	148.726	111.698	121.804	98.1302	136.902	120.543
135.418	127.458	139.588	139.888	105.637	130.536	101.05	145.115	144.65	128.838
142.101	123.326	99.8232	139.702	113.143	139.611	162.414	137.786	99.9999	131.791
100.386	158.327	123.182	143.13	96.8703	118.27	104.838	175.683	157.268	132.755
143.614	135.762	104.496	136.182	113.16	138.366	139.08	108.418	140.093	76.3018
71.6555	150.892	98.5097	111.88	133.902	150.251	98.1413	129.982	134.7	105.677
139.796	110.396	144.453	166.675	147.434	96.0019	106.934	145.078	95.4238	156.312
124.759	153.203	127.71	160.108	106.544	63.0588	153.47	102.499	137.706	114.341
141.531	97.9772	116.56	117	124.294	145.596	114.653	87.1673	116.575	161.328
93.9158	113.322	126.229	138.159	124.882	99.2161	140.26	176.338	154.318	144.756
120.944	125.952	126.866	161.784	113.558	128.486	135.585	146.231	149.612	101.935
113.046	140.575	141.813	102.256	109.616	185.672	120.052	94.4167	132.21	129.934
107.905	121.94	132.878	112.653	115.419	113.553	109.429	70.3683	143.412	116.592
134.751	108.486	96.5155	155.867	119.114	162.449	104.238	110.764	128.404	147.28
102.454	154.976	106.838	104.038	74.1607	127.998	158.845	121.267	170.581	117.601
125.642	102.131	93.2497	135.66	130.929	92.6366	134.47	121.529	96.822	126.146
105.613	113.12	124.926	145.626	115.024	143.447	94.3763	168.235	160.237	99.4139
150.981	116.601	122.199	145.351	127.641	122.013	180.36	171.571	114.129	132.014
115.318	140.768	157.3	144.126	132.591	145.919	119.831	110.621	87.0587	168.331
90.2396	125.69	139.573	106.315	105.708	92.1633	128.829	85.5564	152.779	139.118
120.242	129.864	139.349	98.1049	154.091	61.3945	50.2737	88.5325	132.69	129.933
148.433	149.638	149.104	121.059	127.997	100.882	108.757	124.259	59.0113	121.63
138.9	143.149	129.17	85.9609	129.236	191.895	115.437	109.553	151.523	124.465
98.9079	109.601	103.232	101.734	177.763	137.171	152.922	123.56	123.772	148.694
63.4131	128.964	141.467	112.846	118.968	95.3861	131.722	131.068	130.774	134.574
72.6864	139.129	134.323	150.224	126.277	169.292	134.361	88.759	123.243	128.052
101.954	73.2018	186.173	114.69	118.119	128.695	140.116	106.412	156.011	97.4599
137.717	169.81	144.295	103.057	93.2609	137.853	114.198	107.017	120.095	90.8916
109.324	151.032	117.597	185.634	120.435	92.1904	95.6712	134.109	115.844	
93.5259	154.052	139.288	135.169	163.992	169.39	122.254	106.205	133.553	
75.877	119.388	116.907	115.506	121.029	156.554	127.241	98.0233	145.827	
165.508	135.597	124.398	101.053	132.118	121.897	119.396	80.6563	119.587	
95.5183	140.747	124.211	103.71	142.21	145.98	150.369	139.754	115.647	
148.185	178.597	119.429	95.1066	172.422	130.838	118.424	147.999	144.568	

Time Series Name: Noise N 9

Graphical Representation:

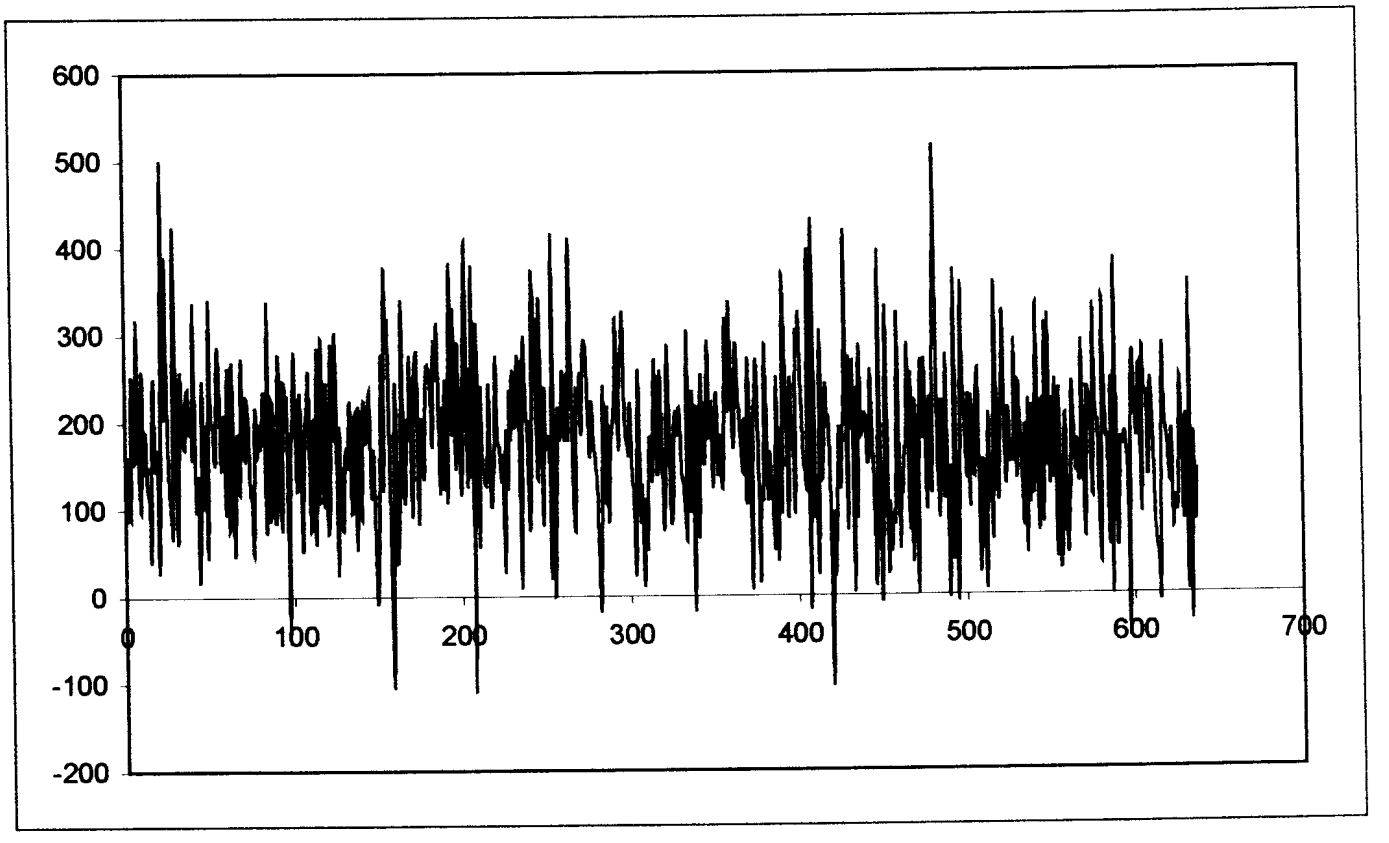


153.602	204.583	193.534	79.4496	163.977	215.295	110.816	176.547	194.719	185.305
228.797	207.143	323.088	236.084	251.764	164.01	24.239	128.746	288.59	234.498
208.24	187.738	115.403	202.074	217.502	165.884	149.369	132.826	187.306	233.24
211.983	298.445	251.673	205.049	72.2525	140.823	26.5214	209.217	166.79	114.476
151.398	98.5989	262.239	210.116	135.194	174.758	48.9302	212.354	95.7065	45.616
165.32	142.385	212.169	177.443	79.9354	104.334	155.691	164.151	130.562	57.6766
230.98	290.597	170.141	216.202	181.134	249.791	343.057	67.6028	249.998	219.828
208.943	83.6517	231.595	99.7145	196.265	269.401	144.493	196.189	199.092	190.957
100.427	82.0935	212.433	207.509	208.829	192.336	93.1767	221.392	176.364	221.207
79.7817	153.476	175.672	302.602	148.618	246.788	207.28	122.452	175.873	244.515
131.269	167.407	102.341	118.969	147.876	96.4069	114.043	296.425	-37.4527	148.989
271.727	122.648	123.647	185.163	142.597	233.029	75.7764	234.808	245.632	104.931
99.3137	144.456	226.245	199.67	164.853	135.066	150.479	184.809	206.448	179.378
170.203	277.623	59.3673	59.1308	249.533	51.7534	310.091	14.5792	143.069	199.225
147.803	139.83	199.075	179.99	90.736	185.358	211.447	71.2837	127.529	233.192
164.253	273.44	211.824	258.761	150.671	147.861	136.528	157.207	124.14	177.771
179.992	129.442	117.313	229.242	132.524	264.082	204.482	290.037	104.707	143.052
115.948	145.274	190.641	108.076	56.5522	125.463	134.396	95.3665	214.871	141.695
132.693	173.968	128.472	180.412	148.023	223.469	130.739	105.348	143.451	139.057
139.183	230.994	213.341	172.307	200.285	178.698	70.3237	155.762	180.964	230.833
139.226	192.511	302.683	256.111	169.435	141.351	209.191	145.074	150.451	66.9174
92.2894	203.837	130.205	204.247	166.635	180.716	178.5	137.514	144.947	175.192
158.564	204.634	197.028	223.545	166.63	155.637	275.034	234.002	199.57	207.095
181.84	149.088	181.446	166.457	185.509	115.128	151.899	86.5358	191.28	160.744
156.85	138.355	240.56	215.105	156.171	152.1	112.642	99.521	107.995	148.895
117.301	150.449	307.083	140.393	226.924	157.308	164.676	156.399	176.594	216.441
155.976	168.548	134.953	225.75	47.0405	171.174	152.078	205.791	206.732	251.529
225.377	139.19	127.575	189.399	210.574	47.7748	189.763	183.029	218.31	143.211
234.994	182.851	234.825	189.513	128.233	198.013	194.692	177.755	236.226	73.4514
206.6	168.105	155.929	161.493	123.278	138.977	19.7065	175.702	199.767	118.174
201.8	295.806	190.013	149.341	283.378	100.695	193.393	213.106	266.966	125.673
157.177	185.547	230.616	110.424	111.439	198.854	188.876	108.931	128.82	120.671
209.105	173.954	60.4128	94.9226	201.886	170.548	216.039	153.241	104.397	195.652
187.572	165.094	105.985	200.743	216.857	189.504	106.066	138.773	173.553	125.917
200.792	209.12	214.83	165.585	241.321	168.727	283.608	160.151	241.174	120.792
274.793	174.984	142.922	181.475	156.693	260.468	29.1234	124.952	63.399	115.924
148.187	51.5473	209.005	171.834	163.097	233.252	171.288	247.518	217.417	93.3279
146.403	118.976	174.796	184.422	75.1156	278.074	197.936	108.235	166.672	183.006
138.614	111.262	216.87	197.49	187.42	218.971	164.291	108.578	232.182	148.916
164.261	231.697	103.183	257.851	215.476	201.95	239.506	192.706	123.732	213.853
241.57	175.809	239.305	249.441	127.372	152.912	234.862	189.384	212.894	202.699
181.921	133.353	166.379	111.899	238.552	237.278	104.037	101.169	162.226	278.143
173.03	174.645	174.822	133.328	93.5339	165.529	223.942	158.598	247.686	208.276
74.6863	211.811	121.903	208.656	207.857	135.11	109.26	155.258	86.3753	163.118
132.521	120.912	141.832	206.864	152.201	208.681	194.861	209.081	120.654	254.03
170.874	148.378	179.109	234.154	259.915	137.554	116.268	223.431	189.264	108.61
120.012	187.009	126.966	164.125	87.4485	151.6	195.605	193.232	165.879	212.816
190.458	225.93	177.354	155.867	150.492	144.299	165.097	126.856	208.47	92.667
200.228	151.83	153.856	108.578	35.0597	150.319	225.494	228.539	224.893	149.875
215.817	256.073	149.503	190.064	157.978	154.758	107.121	123.923	142.387	244.225
133.027	214.817	75.0763	97.5065	242.756	182.167	206.851	74.1796	174.04	159.36
200.712	144.055	236.487	184.213	254.299	139.933	127.149	134.755	214.66	241.709
108.704	216.213	214.21	196.418	229.161	177.354	224.221	177.19	219.76	143.08
94.1092	177.807	207.738	136.728	172.127	211.647	95.1405	305.126	97.7392	194.939
118.298	221.981	150.44	116.717	136.407	138.54	246.899	272.486	58.5446	79.3548
210.791	266.953	255.444	117.926	131.467	209.136	163.819	122.805	165.309	111.44
210.76	158.716	67.9862	147.897	83.5069	167.629	131.427	250.844	187.847	195.084
163.535	153.801	257.549	170.568	167.046	147.901	194.676	61.9554	117.775	284.823
168.286	124.771	179.268	216.866	205.977	154.593	91.5606	161.781	160.79	62.196

272.032	208.173	173.308	102.827	136.224	221.68	245.29	129.017	249.638	158.724
145.165	45.3264	277.412	143.674	174.831	92.081	203.815	130.644	71.3866	172.123
145.823	200.755	191.705	134.917	199.297	227.72	177.555	93.4892	26.0071	178.886
145.407	128.027	94.6141	146.493	194.042	102.137	223.84	123.067	194.129	251.842
171.456	189.64	186.36	126.676	278.88	97.1512	169.729	235.499	208.256	218.238
150.545	173.169	153.868	174.511	123.237	140.516	145.178	277.327	207.579	123.302
72.4511	175.316	128.159	114.993	189.158	204.094	215.47	252.364	182.876	103.572
76.9387	122.55	94.6089	203.33	158.633	138.358	166.09	135.821	79.6288	164.726
255.519	221.019	141.792	89.0905	227.84	169.35	204.26	78.4249	270.525	74.7183
186.801	221.99	171.184	143.026	126.986	268.484	101.124	185.056	215.059	175.414
186.327	182.169	174.806	180.313	149.064	211.477	215.771	168.188	188.411	177.357
134.605	143.458	147.604	271.457	59.7121	173.462	222.441	273.971	131.971	138.284
259.9	144.04	105.233	179.91	81.8959	148.801	121.161	208.557	161.648	169.062
268.863	180.06	214.993	203.822	163.305	173.359	201.778	214.025	112.656	8.90543
187.529	110.858	66.2266	192.833	116.05	183.503	185.165	153.936	272.402	91.7319
110.045	200.692	179.245	202.237	153.363	189.442	68.6005	248.676	220.793	139.815
263.185	181.047	110.839	111.922	54.6191	62.2826	117.283	187.464	203.28	271.589
96.7777	193.901	191.774	277.249	217.39	233.682	213.616	250.788	97.8816	180.082
177.85	260.924	152.201	167.885	205.543	203.855	123.106	187.625	172.663	175.431
193.652	206.308	159.032	106.509	230.388	213.007	94.8548	116.123	189.168	160.157
255.559	85.3182	143.957	253.563	140.15	94.6091	222.053	128.994	185.191	88.9155
106.595	254.138	163.124	121.444	121.597	139.845	267.271	190.001	116.563	165.346
191.922	133.485	256.757	148.492	150.471	70.2403	18.4584	179.21	41.8953	248.481
203.506	274.806	135.715	139.346	153.295	199.004	118.477	137.623	235.491	94.2128
114.608	166.208	182.176	163.605	233.978	177.308	184.064	164.782	213.047	167.061
181.361	228.797	121.866	229.611	187.545	258.466	9.60617	209.064	172.988	124.065
177.589	144.776	169.397	248.156	167.599	88.3149	222.576	156.575	196.39	149.921
263.249	188.084	165.002	228.838	143.266	182.947	219.059	108.083	150.086	192.933
172.893	185.541	190.718	183.051	255.881	205.428	161.952	86.356	165.274	164.436
82.2662	235.663	171.537	192.348	215.454	126.921	154.237	169.025	175.63	203.073
169.498	141.836	212.623	149.291	146.711	223.334	103.846	131.688	235.701	269.843
194.602	278.67	258.808	217.67	27.7092	167.162	224.33	220.952	235.073	174.637
140.107	248.902	183.525	138.422	133.086	115.89	191.065	166.901	110.035	272.065
193.873	241.95	57.3162	168.572	203.353	173.704	143.506	227.39	180.442	199.4
143.632	9.12616	173.694	199.194	125.041	125.46	167.26	267.951	161.735	141.25
142.66	78.323	87.5398	176.06	285.323	224.147	150.897	188.949	82.038	168.134
179.387	148.91	289.778	170.414	-11.0364	128.415	194.777	232.935	190.641	212.354
164.025	127.854	132.846	205.175	119.824	203.445	123.964	123.367	223.176	153.944
18.3673	218.955	203.863	181.807	150.814	155.557	115.468	166.972	143.472	
89.3237	258.716	62.962	176.474	134.715	143.983	268.291	77.8745	145.4	
171.678	221.527	239.326	90.6182	147.536	73.6788	183.014	193.739	127.368	
234.471	190.467	254.884	193.947	156.793	146.038	153.813	35.2696	105.089	
180.013	137.612	177.893	139.521	228.851	197.247	137.324	85.1997	116.089	
149.367	128.884	153.835	269.436	169.042	241.569	193.997	254.506	150.8	

Time Series Name: Noise N 10

Graphical Representation:



87.8019	94.6729	245.545	229.215	297.765	323.732	122.563	136.851	268.238	200.488
160.193	262.063	73.9463	264.505	200.9	196.484	224.318	177.171	178.356	144.672
92.0072	78.0212	104.635	261.883	200.669	175.425	317.673	242.843	269.633	77.6524
252.875	175.572	289.285	235.586	75.2404	161.051	211.078	193.675	102.911	192.468
152.815	266.232	182.399	172.124	159.182	221.056	336.034	204.556	141.486	46.2185
158.134	46.2746	213.991	291.12	369	135.27	270.648	79.2658	225.411	222.496
316.757	166.956	297.255	249.005	335.246	116.12	169.923	-103.346	116.447	104.019
147.26	186.344	24.6729	313.492	210.017	23.3486	198.188	92.4965	320.904	215.026
98.59	119.107	194.63	205.9	138.487	190.254	289.482	22.255	424.357	114.755
258.566	272.552	89.8457	117.621	339.18	257.425	225.52	109.707	506.62	244.75
142.696	192.269	76.4327	216.923	266.493	85.5419	207.779	192.018	151.594	324.933
189.152	158.918	144.656	124.316	81.3644	127	161.54	121.309	88.4354	72.3812
122.977	227.829	171.48	248.06	238.585	10.684	141.77	190.26	219.314	206.507
107.524	210.347	147.763	107.878	170.659	109.741	202.358	241.916	203.649	219.423
40.4707	115.867	223.931	223.851	183.175	53.1748	104.551	416.269	110.056	81.6853
220.917	127.55	99.1687	381.852	181.998	180.131	270.924	75.4613	274.035	309.9
250.24	49.0347	132.055	186.245	24.8198	182.549	187.752	271.152	87.1181	146.698
145.023	215.01	206.163	329.808	414.981	130.545	6.66021	189.833	-3.20443	320.163
168.277	158.416	54.2027	146.953	10.5623	230.603	186.253	261.934	145.297	126.272
27.9705	197.93	217.996	291.012	99.0577	269.311	228.862	2.91039	44.4583	222.327
189.311	169.487	113.711	218.405	214.83	141.642	269.866	236.245	372.065	132.894
499.988	183.377	94.117	116.491	178.768	183.202	206.655	88.4359	110.457	245.115
204.958	234.834	223.125	161.238	213.597	257.793	15.5237	286.669	-7.4179	41.4503
389.423	196.359	177.955	317.594	258.723	150.028	109.793	181.924	126.072	234.923
230.066	74.6204	183.973	399.344	178.982	74.2489	108.823	188.291	356.404	32.4339
116.965	337.904	211.633	127.396	253.874	144.317	283.912	207.991	253.17	56.3013
93.3955	88.6223	233.353	260.499	182.081	286.144	233.233	199.399	196.34	137.408
68.0435	222.314	113.116	137.98	409.472	244.927	109.319	150.264	132.828	203.394
421.866	200.533	167.99	375.929	240.968	83.4744	164.241	162.155	229.155	49.2792
230.845	84.3453	97.8342	-109.97	112.206	96.4164	123.656	257.777	100.069	83.5655
61.0578	121.299	-8.63929	306.202	76.6655	191.859	78.553	166.232	226.436	130.264
177.28	276.528	66.6483	312.785	234.662	210.607	53.6443	79.3506	141.898	242.92
257.734	221.281	141.172	56.7957	211.219	184.443	250.387	11.3278	134.989	184.043
181.386	75.0987	277.285	241.012	255.19	215.368	39.6321	124.392	234.018	139.877
170.816	244.686	122.233	143.906	185.425	143.122	189.961	394.52	255.903	175.928
220.126	229.416	370.39	142.433	271.041	132.971	96.7539	1.55642	27.8426	129.715
237.646	230.254	296.849	127.8	293.948	105.648	359.649	86.3902	60.5186	141.579
187.663	-41.0862	317.789	172.052	283.435	67.3815	292.006	104.697	153.395	290.232
215.663	153.201	70.8791	244.09	196.568	302.731	173.443	330.713	131.422	98.2828
159.437	188.544	-104.995	104.813	158.839	164.643	88.8678	30.8034	6.41873	65.3163
336.02	281.008	67.08	132.613	223.123	95.8947	248.818	105.925	207.455	235.523
99.9265	211.138	245.378	159.629	170.806	233.937	167.036	49.9939	107.185	226.055
138.542	123.892	42.9975	274.974	161.681	-18.0012	200.668	91.4197	156.431	199.052
16.9335	146.576	80.2034	176.841	129.351	208.583	93.5923	81.051	67.0374	114.997
105.229	233.247	168.342	171.323	67.4743	153.512	297.766	213.959	356.187	331.154
247.699	52.9036	338.972	132.549	-17.3305	66.912	275.936	320.559	212.583	199.342
102.214	134.38	185.491	161.438	113.956	253.256	324.583	58.9208	108.049	197.399
196.825	195.319	106.902	27.2988	241.009	158.191	221.263	111.182	187.835	94.4689
45.0003	222.871	203.512	190.149	106.086	150.526	148.855	117.662	253.737	42.4069
338.735	256.389	185.911	123.042	216.892	207.009	144.042	168.085	322.182	331.391
196.321	77.3938	275.672	235.519	84.1096	291.493	121.725	170.378	141.08	255.846
199.342	157.056	91.8496	179.808	165.696	182.728	395.681	288.167	125.783	178.104
150.874	200.006	217.909	258.762	189.557	217.521	-15.0284	73.9164	213.243	177.511
200.273	60.3777	266.229	193.76	203.669	124.033	233.185	253.717	150.928	54.9765
286.728	285.196	279.699	196.616	272.191	183.308	429.057	37.1479	170.639	245.947
224.051	107.709	83.0601	275.946	314.523	231.829	89.6135	218.383	153.864	-
146.868	292.232	202.938	258.345	167.776	138.955	89.2896	168.001	291.879	0.71182
148.11	232.964	188.981	9.78878	262.621	183.759	29.4552	1.97995	132.753	5
208.775	103.216	134.972	253.491	282.293	133.118	302.723	194.969	239.312	211.647

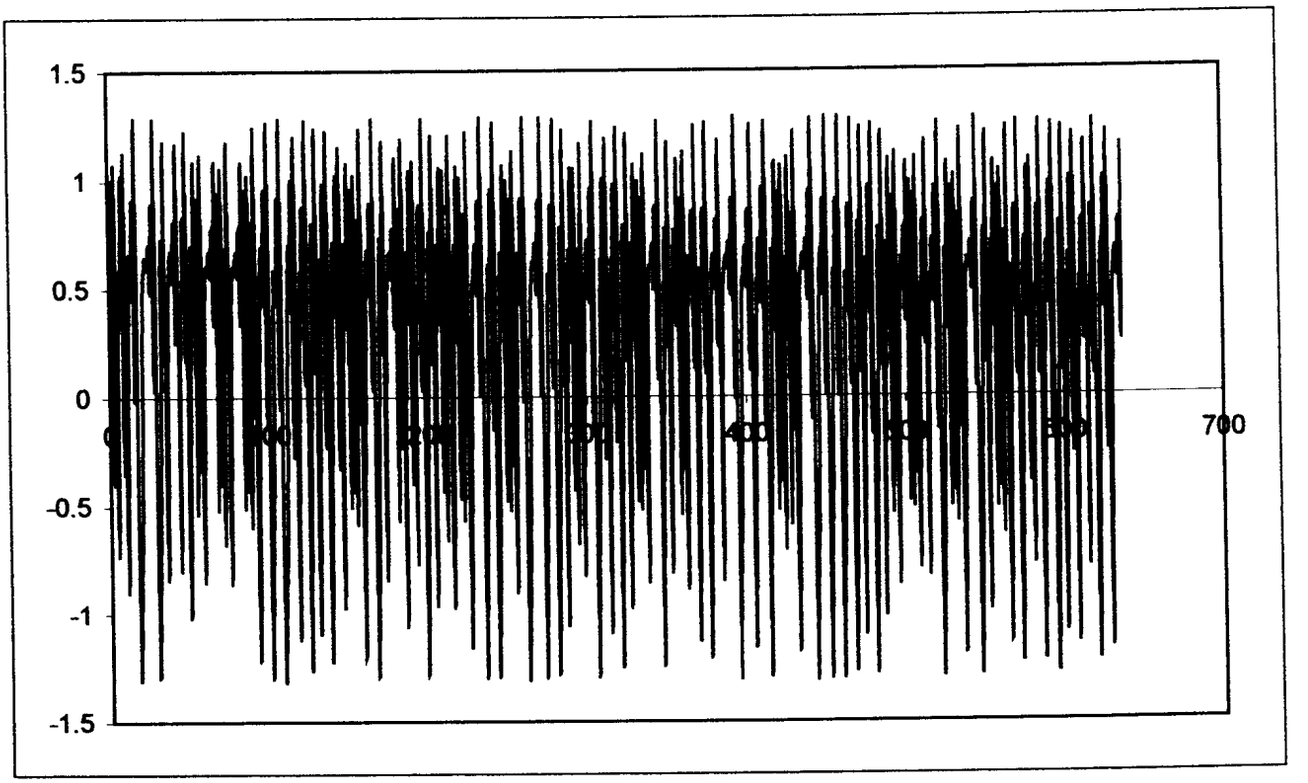
381.266	-28.85	212.815	418.337	-32.9612	278.025	251.476	202.77	80.3266	304.616
61.512	182.589	86.8255	-108.227	184.979	331.732	26.7924	144.72	171.556	360.132
127.449	82.7672	336.104	158.278	196.239	125.319	238.917	285.736	249.657	64.5902
177.777	140.4	47.6598	288.832	278.186	47.6452	-36.9414	312.626	233.242	160.247
170.499	274.017	105.34	120.014	319.329	196.365	-126.811	87.8214	136.013	86.4483
185.114	29.6528	155.674	189.477	145.606	152.052	194.644	89.4982	194.198	163.494
170.113	122.133	70.3941	20.2918	299.855	125.111	267.381	157.536	119.013	139.737
136.753	206.36	141.51	233.079	148.998	139.942	170.683	165.635	96.5401	283.053
-48.6893	-18.5059	326.519	153.135	187.464	205.569	37.906	242.511	106.837	221.494
241.751	205.605	93.6644	-30.0509	129.491	337.6	184.396	46.2093	296.558	115.631
278.288	233.502	212.867	141.845	127.001	265.092	287.68	252.023	73.5186	147.281
244.424	237.526	111.654	268.617	147.315	98.9443	198.278	179.57	245.425	145.319
180.835	195.625	237.074	92.7015	191.1	82.6155	283.682	303.9	269.566	385.684
210.092	417.016	238.724	223.781	157.997	90.0979	269.657	330.8	119.437	251.551
257.621	137.873	310.714	193.068	20.3695	78.2861	230.374	150.107	225.967	97.8685
92.7576	146.076	260.036	91.2284	121.653	-32.5665	57.9259	263.299	301.513	219.067
279.287	56.0213	99.4876	245.421	170.615	141.85	159.175	85.8994	376.446	43.6996
228.37	74.2595	176.938	257.049	214.075	90.9517	251.031	138.181	35.2833	115.044
229.608	171.907	327.259	43.8695	216.295	-	158.622	202.301	181.221	170.859
135.284	157.378	-	71.81	67.562	0.92017	215.079	208.797	180.667	164.3
190.235	286.665	0.20018	24.3997	-31.7811	8	147.944	30.1151	225.674	153.63
246.241	236.948	2	253.186	261.524	124.708	100.032	290.663	251.583	195.673
188.986	79.1278	215.345	206.146	217.022	208.056	191.09	274.347	100.937	330.127
91.0374	-71.1955	193.231	0.24708	121.494	80.1738	-	2.88215	309.201	163.388
60.875	145.255	101.551	7	12.2292	135.557	0.78333	111.759	172.764	161.806
44.8018	356.99	23.951	86.0253	304.479	262.941	7	125.613	244.566	268.463
-5.62224	281.138	248.296	111.575	176.784	200.801	165.055	169.348	261.742	137.559
166.69	186.506	255.637	193.245	258.45	214.224	47.3296	94.5617	141.234	97.6647
286.014	421.555	167.063	244.45	183.141	106.383	167.74	306.266	88.1561	192.692
208.261	190.697	158.949	186.654	186.534	146.529	161.824	290.829	453.371	66.456
182.213	274.135	301.137	164.818	34.726	40.6833	225.465	-38.056	338.014	272.443
148.825	166.651	200.29	51.6119	234.735	211.114	58.321	291.725	236.901	269.63
129.001	210.637	-	-14.3683	20.9498	237.921	27.914	254.005	137.567	27.4909
187.049	200.212	0.81729	248.3	197.131	265.553	85.1039	193.809	225.683	115.914
76.8912	140.772	9	69.4718	202.021	125.566	175.539	147.772	264.412	112.217
109.864	193.957	162.126	248.817	211.969	179.586	98.0032	205.951	83.5514	131.033
94.3697	95.3324	173.608	179.7	270.946	118.227	109.784	176.016	173.717	105.988
120.949	149.479	262.865	83.67	79.6607	245.203	120.575	89.9141	218.483	335.247
248.053	347.798	193.327	167.931	116.889	416.333	52.0832	322.727	128.097	328.555
173.146	180.813	151.808	180.199	195.83	354.909	196.744	277.653	314.32	146.583
85.5712	318.208	163.146	166.961	153.133	265.812	117.35	205.813	199.524	
124.384	211.838	272.023	135.987	105.906	124.637	2.68222	304.868	236.536	
201.857	176.261	212.135	392.108	68.739	78.5148	73.5713	275.888	104.808	
4.01616	177.251	280.462	141.23	102.477	17.5802	104.049	301.601	179.028	
358.134	281.349	175.693	260.332	162.676	37.4666	158.707	108.624	229.535	

Appendix E

Henon and Logistic Map Time Series

Time Series Name: Henon Time Series

Graphical Representation:



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1.07349	0.669229	0.878731	-0.570117	0.953028	0.396258	1.08309
-0.734094	0.553914	0.056307	0.872194	-0.151047	0.532909	-0.544946
0.567597	0.771219	1.25918	-0.236045	1.25397	0.721289	0.909174
0.328738	0.333483	-1.20286	1.18365	-1.24672	0.431512	-0.320721
1.01898	1.07567	-0.64786	-1.03226	-0.799852	0.955702	1.12874
-0.355035	-0.519848	0.051532	-0.1367	-0.269685	-0.14926	-0.879909
1.12923	0.944362	0.801924	0.664159	0.658223	1.25552	0.254688
-0.89172	-0.404503	0.115144	0.341439	0.312534	-1.25164	0.645215
0.225537	1.05424	1.22202	1.03603	1.06072	-0.816597	0.493584
0.66127	-0.677334	-1.05611	-0.400283	-0.481411	-0.309057	0.85249
0.455472	0.673978	-0.194908	1.08649	0.993756	0.621298	0.130641
0.907945	0.160856	0.629982	-0.772739	-0.526994	0.366867	1.23185
-0.017468	1.16597	0.385899	0.489972	0.909314	0.997962	-1.08525
1.27196	-0.85502	0.98051	0.432076	-0.315692	-0.284238	-0.279331
-1.27026	0.326307	-0.230189	0.885626	1.13327	1.18628	0.565187
-0.877406	0.594427	1.21997	0.031557	-0.892723	-1.05544	0.468989
-0.458856	0.603212	-1.15272	1.26429	0.224244	-0.203645	0.861625
0.44201	0.668918	-0.494271	-1.22835	0.661784	0.625309	0.10134
0.588821	0.554532	0.312159	-0.733079	0.454132	0.391491	1.24411
0.647209	0.770168	0.715298	-0.12087	0.909804	0.973022	-1.13653
0.590215	0.335938	0.377336	0.759623	-0.022601	-0.208032	-0.43515
0.706467	1.07305	1.01525	0.155901	1.27223	1.23132	0.393943
0.478331	-0.511242	-0.329834	1.19386	-1.27276	-1.18501	0.652188
0.891619	0.956001	1.15227	-0.948651	-0.886229	-0.596557	0.522695
0.03052	-0.432886	-0.957764	0.098245	-0.481393	0.146264	0.813162
1.26618	1.02445	0.061445	0.701892	0.409697	0.791083	0.231082
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0.731512	1.23098	-0.509734	1.04549	0.471067	0.072539	0.572849
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0.531385	-0.141854	1.22651	0.704086	0.560275	0.917223	1.27194
0.806907	1.25757	-1.14142	0.330938	0.450689	-0.334154	-1.26847
0.247876	-1.25664	-0.45602	1.0579	0.883713	1.11884	-0.871026
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0.467018	0.426116	0.891104	0.844966	-0.703139	0.586169	0.691803
0.832123	0.91943	0.029807	-0.171226	-0.058005	0.699873	0.499581
0.170704	-0.055658	1.26609	1.21244	0.784348	0.490099	0.858128
1.20884	1.27149	-1.23523	-1.1094	0.121316	0.873686	0.118938
-0.994604	-1.28007	-0.756269	-0.359331	1.2147	0.078371	1.23763
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0.700924	-0.549868	0.732044	0.560962	-0.118828	-1.17628	-0.349766
0.305504	0.302938	0.19837	0.705375	0.671442	-0.561038	0.496104
1.07961	0.70656	1.16452	0.471713	0.333183	0.206447	0.550503
-0.540133	0.391964	-0.839047	0.900095	1.04602	0.77202	0.724556
0.915442	0.996877	0.363757	0.007275	-0.431858	0.227513	0.430177
-0.335288	-0.273681	0.563039	1.26995	1.0527	1.15914	0.958293
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0.66614	0.399501	-1.12623	-0.022273	-0.35723	1.14112	-0.006915
0.300581	0.962419	-0.409942	0.793553	1.09876	-0.925872	0.704755
1.07335	-0.176899	0.426858	0.111701	-0.797349	0.142202	0.302575
-0.522749	1.24492	0.621927	1.2206	0.439556	0.693928	1.08325
0.939433	-1.22281	0.586547	-1.05229	0.490302	0.36851	-0.552044
-0.392373	-0.71989	0.704925	-0.184068	0.795312	1.01806	0.898323
1.06629	-0.092382	0.480277	0.636879	0.261561	-0.340469	-0.295392
-0.709479	0.772085	0.888546	0.376919	1.14281	1.14313	1.14734
0.615183	0.137725	0.038764	0.992169	-0.749966	-0.931588	-0.931556
0.257326	1.20507	1.26446	-0.265083	0.555416	0.127942	0.129285
1.09185	-0.991754	-1.22677	1.19927	0.343128	0.697607	0.697132
-0.591797	-0.015486	-0.727626	-1.09309	1.00179	0.357065	0.358394
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-0.158905	0.305157	0.765003	0.534925	1.17278	-0.380416	-0.375765
1.21582	1.08027	0.147904	0.5055	-1.0162	1.10663	1.11111
-1.11718	-0.542235	1.19887	0.802736	-0.093893	-0.828617	-0.841136
-0.38259	0.912455	-0.96785	0.249511	0.682798	0.370741	0.34282
0.45992	-0.328274	0.048234	1.15366	0.319134	0.558987	0.583123
0.589086	1.12287	0.706388	-0.788459	1.06225	0.673769	0.6268
0.652144	-0.863646	0.315893	0.475765	-0.483998	0.532145	0.624907
0.581318	0.292623	1.07221	0.44657	0.990721	0.805682	0.641327
0.722541	0.621027	-0.514727	0.863535	-0.519338	0.250871	0.611651
0.443504	0.547843	0.950742	0.090001	0.919619	1.15359	0.668634
0.941388	0.766124	-0.419893	1.24772	-0.33978	-0.787827	0.557596
-0.107644	0.342629	1.03839	-1.15253	1.11425	0.477137	0.765311
1.26619	1.06549	-0.635518	-0.485332	-0.840125	0.444928	0.347297
-1.27684	-0.486573	0.746081	0.324475	0.346143	0.865996	1.06073
-0.902589	0.98819	0.030054	0.707003	0.580221	0.083551	-0.471026
-0.523587	-0.5131	1.22256	0.397549	0.632523	1.25003	1.00761
0.345423	0.927876	-1.0835	0.990838	0.613946	-1.16253	-0.562691
0.67588	-0.359267	-0.276784	-0.255199	0.662055	-0.517041	0.859013
0.464088	1.09766	0.567698	1.20607	0.570541	0.276978	-0.201872
0.901236	-0.794584	0.465772	-1.11302	0.742893	0.737484	1.20065
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1.27036	0.483906	0.088365	0.471815	1.00052	1.0764	-0.268984
-1.25872	0.805786	1.24905	0.576591	-0.281916	-0.52558	0.575082
-0.837029	0.236164	-1.15765	0.676104	1.18889	0.93619	0.456298
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0.900608	0.532428	0.358268	1.15228	0.412587	0.577569	-1.21036
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-1.25977	0.958045	1.08866	0.432866	1.26148	-0.405615	0.79817
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0.452885	-0.797324	0.863022	-1.22342	0.49129	0.386687	-0.207898
0.880431	-0.263799	0.091478	-0.716468	0.535367	0.948341	0.621319
0.050642	0.663377	1.24719	-0.085682	0.746122	-0.143086	0.397179
1.26054	0.304764	-1.15024	0.774782	0.381232	1.25584	0.965544
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0.79905	-0.439718	0.415379	-0.039355	-0.926182	0.627479	-0.686397
0.109099	1.01697	0.968305	0.697665	0.141416	0.357947	-0.023395
1.22305	-0.579831	-0.188047	0.306762	0.694147	1.00887	0.793315

0.111894	1.05573	0.052992	1.01197	0.437895	0.618432	0.65432
1.22047	-0.681299	1.26105	-0.566967	0.948748	0.646423	0.586344
-1.05178	0.666883	-1.21043	0.853558	-0.128803	0.600522	0.714976
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0.375749	-0.826012	0.79812	-1.0915	-0.866204	0.834751	-0.041611
0.993672	0.392237	0.109098	-0.30628	-0.430297	0.179101	1.27296
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0.133418	-0.92114	1.24096	0.62593	-1.23741	0.918797	-0.356174
1.22985	-0.572581	-1.21197	0.536241	-0.768625	-0.343203	1.12949
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0.584675	0.333021	0.794259	1.11147	0.226092	0.368326	0.662719
0.444482	1.06378	0.111154	-0.640214	1.14274	0.561014	0.451925
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0.002334	0.990661	-1.05376	0.000105	0.533395	0.540096	-0.031126
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0.406426	0.346806	1.20759	0.7052	-0.660034	0.162786	0.663955
0.946707	0.579667	-1.1171	0.472094	0.028709	1.16417	0.490946
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1.25931	0.611832	0.457557	0.00879	0.110739	0.341127	0.107631
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0.468276	1.03846	0.478949	0.606727	0.398467	0.60778	0.622542
0.857005	-0.399649	0.890708	0.387583	0.963813	0.675837	0.585331
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0.581161	0.072709	0.742484	0.130763	0.783073	0.706832	-1.24518
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0.550632	-1.17848	1.17631	0.155561	1.21375	1.19821	-0.247824
0.775765	-0.568236	-0.88257	1.20446	-1.02559	-0.980174	0.676944
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0.05194	0.629434	0.054342	-0.331468	0.768425	1.11551	-0.249512
0.707632	0.619758	0.706097	1.12032	-0.013098	-0.843327	0.591226
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0.646508	1.06925	0.565596	0.370249	0.403237	-0.790507	0.877008
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1.14709	0.992315	0.122565	-1.08042	-1.10799	0.110152	-0.602424
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0.525645	0.923545	-1.10196	0.569429	0.488763	-1.11874	0.793679
0.383793	-0.349198	-0.329255	0.463329	0.558331	-0.380282	0.158666
0.951478	1.10635	0.517639	0.870285	0.710202	0.461918	1.20286
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0.842273	-0.917682	0.673537	0.568278	0.432604	-0.553423	-0.808413
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1.21227	0.28035	1.16549	1.02273	-0.120055	0.766357	0.515319
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0.557347	-0.402758	0.609823	0.297506	-0.464972	0.518352	-0.416661
0.712026	1.08443	0.656717	0.617768	0.433352	0.393447	1.07005
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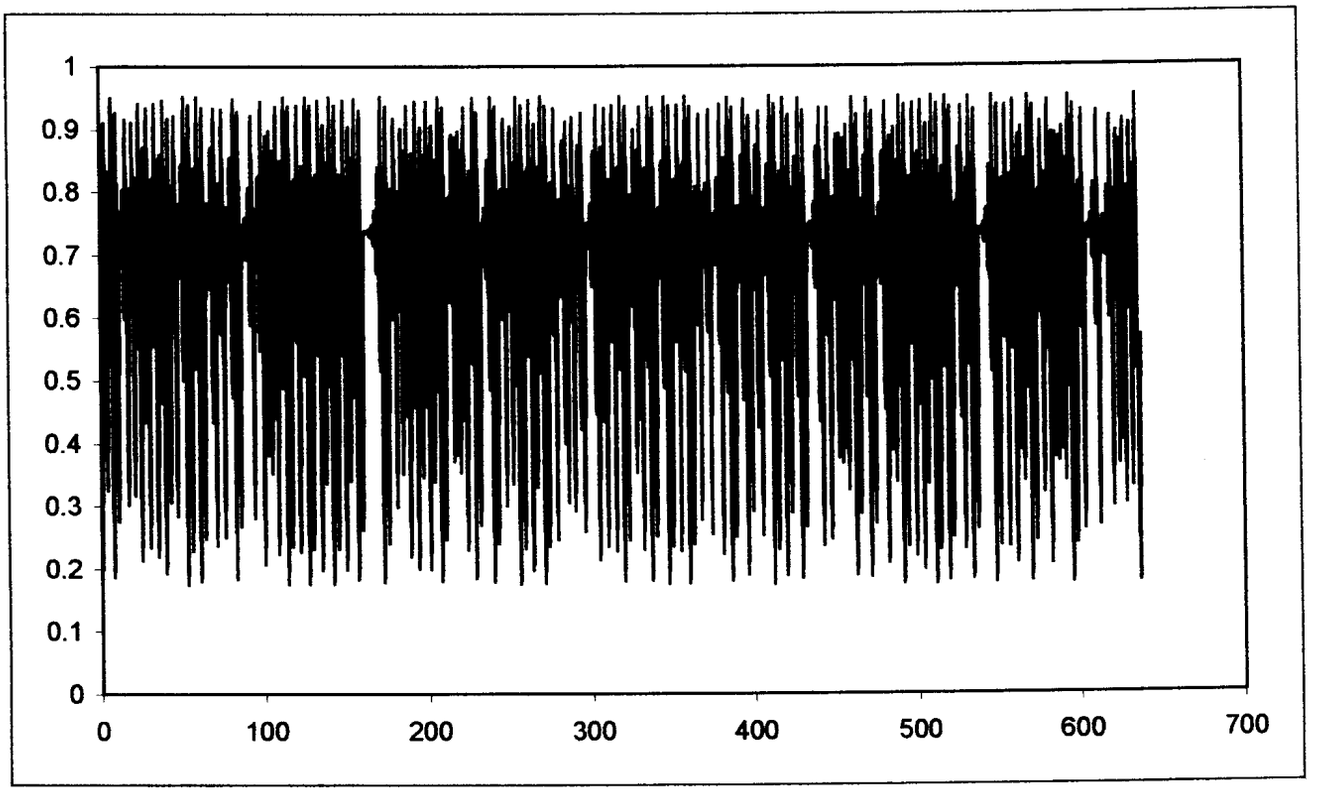
Time Series Name: Logistic Map

Graphical Representation:



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0.2	0.9486507	0.819918024	0.804686218	0.849797513	0.258823948	0.229095062
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0.93906702	0.18918414	0.181355378	0.202339721	0.678734973	0.948935042	0.821012324
0.217436578	0.582895305	0.5641693	0.613313761	0.828604475	0.184137846	0.558414134
0.646600069	0.9238878	0.934352744	0.901207968	0.539672575	0.570878178	0.937033598
0.868331996	0.267212706	0.233083237	0.338322233	0.94401913	0.930909878	0.22420621
0.434459856	0.744078288	0.679270679	0.850669139	0.200818647	0.244403371	0.660963584
0.93367706	0.723617999	0.82787569	0.482718389	0.609863969	0.701747381	0.851544754
0.235311988	0.759980964	0.541490621	0.948865115	0.904133652	0.795332379	0.480381887
0.683772974	0.693157613	0.943458408	0.184376414	0.329368768	0.618559387	0.948537493
0.821664477	0.808222518	0.202709634	0.571450658	0.839362934	0.896585953	0.185493647
0.556821464	0.588995741	0.614150066	0.930600253	0.512364637	0.352334412	0.574125865
0.937731021	0.919903081	0.900485097	0.245417003	0.94941904	0.867140522	0.929120353
0.221887904	0.279989331	0.340524411	0.70371249	0.182485601	0.437789781	0.250251745
0.656083915	0.766062161	0.853356639	0.792304641	0.566901505	0.935293577	0.712978074
0.857423684	0.681001521	0.475528527	0.625320388	0.932991917	0.229974108	0.777633291
0.46454358	0.825506108	0.947724359	0.890320241	0.2375684	0.672926866	0.657095071
0.945222801	0.547373941	0.188263015	0.371070416	0.688292689	0.836365936	0.856220327
0.1967513	0.941471697	0.580716199	0.886833217	0.81527428	0.520060237	0.467806899
0.600552858	0.209390415	0.925242602	0.381368237	0.572288088	0.94847083	0.946061696
0.911578666	0.629075063	0.262841172	0.896520719	0.930142843	0.185720875	0.193910061
0.306291406	0.886690587	0.736271624	0.352531015	0.246913113	0.5746688	0.593974006
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0.918607783	0.351393388	0.740159334	0.93500117	0.635240551	0.714873912	0.783995944
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0.772898544	0.440741632	0.747527808	0.674907839	0.399840907	0.663562712	0.87173205
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0.180500927	0.48897852	0.514896969	0.584244948	0.916334902	0.565966944	0.77206682
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0.946320604	0.862050764	0.740209208	0.690450875	0.182351638	0.576650471	0.5467716
0.193032091	0.451893128	0.730738238	0.812168164	0.566578168	0.92767388	0.941687186
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0.776639484	0.884746312	0.670366915	0.732623764	0.81681211	0.68715204	0.377196342
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0.946286505	0.887152728	0.900468723	0.891313835	0.278428005	0.947092854	0.947550224
0.193147752	0.380428506	0.340574246	0.368119234	0.763442234	0.190410322	0.188855428
0.592198452	0.8956701	0.85341703	0.883908362	0.686273119	0.585786079	0.58211841
0.917697893	0.355091653	0.475366331	0.389934605	0.818148835	0.922034845	0.924374953
0.287008188	0.87020597	0.947694093	0.903965314	0.565369011	0.273169042	0.265642416
0.777611054	0.429200651	0.188365997	0.329885697	0.933762191	0.754481322	0.741290787
0.657141991	0.930952318	0.580960142	0.840032271	0.235031374	0.703909175	0.728759274
0.8561643	0.244264378	0.92509273	0.510636609	0.683208184	0.791999983	0.751142939
0.467958567	0.701477307	0.263325448	0.949570078	0.822452092	0.625996837	0.710323451
0.946098717	0.7957462	0.737143595	0.181969632	0.554893663	0.889674228	0.781903374
0.193784552	0.617629905	0.736299079	0.565655403	0.938549406	0.372985184	0.648015853
0.593681978	0.897420181	0.737818432	0.933619599	0.21916279	0.888695499	0.866746968
0.916650011	0.349817359	0.735081095	0.235501366	0.650295754	0.375880076	0.438887314
0.290330521	0.864291662	0.740000139	0.684153795	0.864162508	0.891458129	0.935807911
0.782947096	0.445708022	0.731119747	0.821132043	0.446065539	0.367690027	0.228271567
0.645775575	0.938799048	0.747017919	0.558122002	0.938946081	0.88347747	0.669421904
0.869248031	0.218330501	0.718132162	0.937162965	0.217840085	0.391191113	0.84092563
0.431892389	0.648516715	0.769189767	0.22377646	0.647465973	0.905010379	0.508324915
0.932373142	0.866182584	0.674640103	0.660062113	0.86736439	0.326673052	0.949736644
0.23960317	0.440459198	0.834103171	0.852644456	0.43716494	0.835839523	0.181400414
0.692335265	0.936528593	0.52582527	0.477439174	0.93499667	0.521404897	0.564278355
0.809427155	0.225882593	0.947465611	0.948065835	0.23095601	0.948258956	0.934299514
0.586168377	0.664466658	0.189143204	0.18710063	0.67493826	0.186442853	0.233258942
0.921785041	0.84721273	0.582798598	0.577957139	0.8337071	0.57639128	0.679626991
0.27397004	0.491884617	0.92394869	0.926906201	0.526830371	0.927824615	0.827389747
0.755859738	0.949749734	0.267016531	0.257454163	0.947264499	0.254471176	0.542700622
0.70123602	0.181355671	0.743731073	0.726451765	0.189826979	0.720919267	
0.796115445	0.564170009	0.724261624	0.755134473	0.58441225	0.764539774	
0.616799445	0.934352398	0.758885552	0.702644324	0.922923374	0.684071091	
0.898159981	0.233084378	0.69531743	0.793954057	0.270316115	0.821247767	
0.347580794	0.679272994	0.805034186	0.621645847	0.749532189	0.557839514	

APPENDIX F

Box Counting or Fractal Dimension Macro Code

```
Sub mBox()
Box counting Dimension Macro
'
' Macro recorded 8/25/98 by Johan Steyn
'
Dim mTotal As Integer
Dim mMax As Integer
Dim mMin As Integer
Dim mTimeSeries() As Double
Dim n As Integer
Dim x As Integer
Dim y As Integer
Dim mBoxSize As Double
Dim mBoxNumber As Integer
Dim mBox() As Integer
Dim mData As Integer
Dim mIs
Dim mNum As String
Dim mInEnt() As Double

mTotal = InputBox("Enter number of points in time series")


    Sheets("Sheet2").Select
    Range("B1").Select
    ActiveCell.FormulaR1C1 = "=R[1]C[-1]"
    Range("B1").Select
    Selection.Copy
        mNum = "B2:B" & mTotal
    Range(mNum).Select
    ActiveSheet.Paste
    Range("C4").Select
    Application.CutCopyMode = False
        mNum = "A1:A" & mTotal
    Range(mNum).Select
    Selection.Sort Key1:=Range("A1"), Order1:=xlAscending,
Header:=xlGuess, _
        OrderCustom:=1, MatchCase:=False,
Orientation:=xlTopToBottom
    Range("A1").Select

'get data from user
Dim mRange As String
    mRange = "A" & mTotal
    'Range(mRange).Select
    mMax = Range(mRange).Value
    'mMax = InputBox("Enter maximum value")
    MsgBox (mMax)

    mRange = "A1"
    mMin = Range(mRange).Value
```

```
    'mMin = InputBox("Enter minimum value")
    MsgBox (mMin)

n = InputBox("Enter maximum boxes / square root")

ReDim mInEnt(n)
ReDim mTimeSeries(mTotal, 2)
ReDim mBox(n * n)


'get data into array
    Range("A1:B400").Select

' add string making routine for number in series
Dim mStr As String

For x = 1 To mTotal
    mStr = "A" & x
    mTimeSeries(x, 1) = Range(mStr).Value
    mStr = "B" & x
    mTimeSeries(x, 2) = Range(mStr).Value
Next x

Dim mCalcs As Integer
'start of outside loop
For mCalcs = 2 To n
mBoxSize = (mMax - mMin) / mCalcs
mBoxNumber = 0
mIs = 0
ReDim mBox(n * n)
'calculate data
For x = 1 To mCalcs
    For y = 1 To mCalcs
        mBoxNumber = mBoxNumber + 1
            For mData = 1 To mTotal
                If mTimeSeries(mData, 1) <= y * mBoxSize And _
                mTimeSeries(mData, 1) > (y - 1) * mBoxSize And
_
                mTimeSeries(mData, 2) <= x * mBoxSize And _
                mTimeSeries(mData, 2) > (x - 1) * mBoxSize
Then
                    mBox(mBoxNumber) = mBox(mBoxNumber) + 1
                Else: End If
            Next mData
        Next y
    Next x

Dim mLog As Double
Dim nStr As String

For mBoxNumber = 1 To (mCalcs * mCalcs)
```

```
    If mBox(mBoxNumber) = 0 Then GoTo mNext
    'new section for box counting dimension
    'mLog = mBox(mBoxNumber) / mTotal
    mIs = mIs + 1

mNext:
Next mBoxNumber


    mInEnt(mCalcs) = mIs
Next mCalcs

Range("E1").Select
    ActiveCell.FormulaR1C1 = "Number"
    Range("F1").Select
    ActiveCell.FormulaR1C1 = "Inf Ent"
Range("E1").Select

For mCalcs = 1 To n
    mStr = "E" & mCalcs + 1
    Range(mStr).Select
        mStr = Str(mCalcs)
        ActiveCell.FormulaR1C1 = mStr
    mStr = "F" & mCalcs + 1
    Range(mStr).Select
        mStr = Val(mInEnt(mCalcs))
        ActiveCell.FormulaR1C1 = mStr
Next mCalcs
mGraph

End Sub



Public Sub mGraph()
'graph drawing routine with 15 sets
Sheets("Sheet2").Select
    Range("G2").Select
    ActiveCell.FormulaR1C1 = "1"
    Range("G3").Select
    ActiveCell.FormulaR1C1 = "2"
    Range("G4").Select
    ActiveCell.FormulaR1C1 = "3"
    Range("G2:G4").Select
    Selection.AutoFill Destination:=Range("G2:G32"),
Type:=xlFillDefault
    Range("G2:G32").Select
    Range("A1").Select

Sheets("Sheet2").Select
```

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```
    Range("H2").Select
    ActiveCell.FormulaR1C1 = "=LOG(RC[-2])"
    Range("H2").Select
    Selection.Copy
    Range("H3:H32").Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
    Range("I2").Select
    ActiveCell.FormulaR1C1 = "=-(LOG(1/RC[-2]))"
    Range("I2").Select
    Selection.Copy
    Range("I3:I32").Select
    ActiveSheet.Paste
    Range("C6").Select
    Application.CutCopyMode = False
    Range("H3:I32").Select
    Charts.Add
    ActiveChart.ChartType = xlXYScatter
    ActiveChart.SetSourceData
Source:=Sheets("Sheet2").Range("H32:I3"), PlotBy _
        :=xlColumns
    ActiveChart.SeriesCollection(1).XValues =
"=Sheet2!R3C9:R11C9"
    ActiveChart.SeriesCollection(1).Values =
"=Sheet2!R3C8:R11C8"
    ActiveChart.Location Where:=xlLocationAsObject,
Name:="Sheet2"
    With ActiveChart
        .HasTitle = False
        .Axes(xlCategory, xlPrimary).HasTitle = False
        .Axes(xlValue, xlPrimary).HasTitle = False
    End With
    ActiveChart.Axes(xlValue).MajorGridlines.Select
    ActiveChart.ChartArea.Select
    ActiveChart.SeriesCollection(1).Select

ActiveChart.SeriesCollection(1).Trendlines.Add(Type:=xlLinear,
Forward:=0, _
        Backward:=0, DisplayEquation:=True,
DisplayRSquared:=True).Select


End Sub




Public Function jdLog(mNumber As Double, mBase As Integer)
'claculates the log of mnumber to the base mbase
    jdLog = (Log(mNumber)) / (Log(mBase))
```

```
End Function



Public Sub CutSection()
'mLog = (((mBox(mBoxNumber) / (mCalcs * mCalcs))))
     mLog = 1 / (mBox(mBoxNumber) / (mCalcs * mCalcs))
    'nStr = "=LOG(" & mLog & ",2)"
     '    Range("F7").Select
      '   ActiveCell.FormulaR1C1 = nStr
       ' mLog = ActiveCell.Value
      mLog = jdLog(1 / mLog, 2)
    'mIs = mIs + ((mBox(mBoxNumber) / (mCalcs * mCalcs))) *
mLog
    'original for trial
    mIs = mIs + (1 / (mBox(mBoxNumber) / (mCalcs * mCalcs))) *
mLog

End Sub
```

APPENDIX G

Information Dimension Macro Code

Sub msort()

```
'information dimension macro
' msort Macro
' Macro recorded 8/25/98 by Johan Steyn
'
Dim mTotal As Integer
Dim mMax As Integer
Dim mMin As Integer
Dim mTimeSeries() As Double
Dim n As Integer
Dim x As Integer
Dim y As Integer
Dim mBoxSize As Double
Dim mBoxNumber As Integer
Dim mBox() As Integer
Dim mData As Integer
Dim mIs
Dim mNum As String
Dim mInEnt() As Double

mTotal = InputBox("Enter number of points in time series")


    Sheets("Sheet2").Select
    Range("B1").Select
    ActiveCell.FormulaR1C1 = "=R[1]C[-1]"
    Range("B1").Select
    Selection.Copy
        mNum = "B2:B" & mTotal
    Range(mNum).Select
    ActiveSheet.Paste
    Range("C4").Select
    Application.CutCopyMode = False
        mNum = "A1:A" & mTotal
    Range(mNum).Select
    Selection.Sort Key1:=Range("A1"), Order1:=xlAscending,
Header:=xlGuess, _
        OrderCustom:=1, MatchCase:=False,
Orientation:=xlTopToBottom
    Range("A1").Select

'get data from user
Dim mRange As String
    mRange = "A" & mTotal
    'Range(mRange).Select
    mMax = Range(mRange).Value
    'mMax = InputBox("Enter maximum value")
    MsgBox (mMax)

    mRange = "A1"
    mMin = Range(mRange).Value
```

```
    'mMin = InputBox("Enter minimum value")
    MsgBox (mMin)

n = InputBox("Enter maximum boxes / square root")

ReDim mInEnt(n)
ReDim mTimeSeries(mTotal, 2)
ReDim mBox(n * n)



'get data into array
    Range("A1:B400").Select

' add string making routine for number in series
Dim mStr As String

For x = 1 To mTotal
    mStr = "A" & x
    mTimeSeries(x, 1) = Range(mStr).Value
    mStr = "B" & x
    mTimeSeries(x, 2) = Range(mStr).Value
Next x

Dim mCalcs As Integer
'start of outside loop
For mCalcs = 2 To n
mBoxSize = (mMax - mMin) / mCalcs
mBoxNumber = 0
mIs = 0
ReDim mBox(n * n)
'calculate data
For x = 1 To mCalcs
    For y = 1 To mCalcs
        mBoxNumber = mBoxNumber + 1
            For mData = 1 To mTotal
                If mTimeSeries(mData, 1) <= y * mBoxSize And _
                mTimeSeries(mData, 1) > (y - 1) * mBoxSize And
_
                mTimeSeries(mData, 2) <= x * mBoxSize And _
                mTimeSeries(mData, 2) > (x - 1) * mBoxSize
Then
                    mBox(mBoxNumber) = mBox(mBoxNumber) + 1
                Else: End If
            Next mData
        Next y
    Next x

Dim mLog As Double
Dim nStr As String
```

```
For mBoxNumber = 1 To (mCalcs * mCalcs)
    If mBox(mBoxNumber) = 0 Then GoTo mNext
    mLog = (1 / ((mBox(mBoxNumber) / mTotal)) * 100)
    nStr = "=LOG(" & mLog & ",2)"
        Range("F7").Select
        ActiveCell.FormulaR1C1 = nStr
        mLog = ActiveCell.Value
    mIs = mIs + ((mBox(mBoxNumber) / mTotal) * 100) * mLog
mNext:
Next mBoxNumber

'    MsgBox ("The Information Entorpy is: " & mIs)
    mInEnt(mCalcs) = mIs
Next mCalcs

Range("E1").Select
    ActiveCell.FormulaR1C1 = "Number"
    Range("F1").Select
    ActiveCell.FormulaR1C1 = "Inf Ent"
Range("E1").Select

For mCalcs = 1 To n
    mStr = "E" & mCalcs + 1
    Range(mStr).Select
        mStr = Str(mCalcs)
        ActiveCell.FormulaR1C1 = mStr
    mStr = "F" & mCalcs + 1
    Range(mStr).Select
        mStr = Val(mInEnt(mCalcs))
        ActiveCell.FormulaR1C1 = mStr
Next mCalcs
mGraph

End Sub



Public Sub mGraph()
'graph drawing routine with 15 sets
Sheets("Sheet2").Select
    Range("G2").Select
    ActiveCell.FormulaR1C1 = "1"
    Range("G3").Select
    ActiveCell.FormulaR1C1 = "2"
    Range("G4").Select
    ActiveCell.FormulaR1C1 = "3"
    Range("G2:G4").Select
    Selection.AutoFill Destination:=Range("G2:G16"),
Type:=xlFillDefault
    Range("G2:G16").Select
```

```
    Range("A1").Select

Sheets("Sheet2").Select
    Range("H2").Select
    ActiveCell.FormulaR1C1 = "=LOG(RC[-2])"
    Range("H2").Select
    Selection.Copy
    Range("H3:H16").Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
    Range("I2").Select
    ActiveCell.FormulaR1C1 = "=-(LOG(1/RC[-2]))"
    Range("I2").Select
    Selection.Copy
    Range("I3:I16").Select
    ActiveSheet.Paste
    Range("C6").Select
    Application.CutCopyMode = False
    Range("H3:I16").Select
    Charts.Add
    ActiveChart.ChartType = xlXYScatter
    ActiveChart.SetSourceData
Source:=Sheets("Sheet2").Range("H3:I16"), PlotBy _
        :=xlColumns
    ActiveChart.Location Where:=xlLocationAsObject,
Name:="Sheet2"
    With ActiveChart
        .HasTitle = False
        .Axes(xlCategory, xlPrimary).HasTitle = False
        .Axes(xlValue, xlPrimary).HasTitle = False
    End With
    ActiveChart.Axes(xlValue).MajorGridlines.Select
    ActiveChart.ChartArea.Select
    ActiveChart.SeriesCollection(1).Select

ActiveChart.SeriesCollection(1).Trendlines.Add(Type:=xlLinear,
Forward:=0, _
        Backward:=0, DisplayEquation:=True,
DisplayRSquared:=True).Select


End Sub
```

APPENDIX H

Approximate Entropy Code

```
Sub mApnEntrop()
'
' mApnEntrop Macro
' Macro recorded 8/26/98 by Johan Steyn
'

'
    Sheets("Sheet1").Select
    Range("C1").Select
    ActiveCell.FormulaR1C1 = ""
    Range("B1").Select
    ActiveCell.FormulaR1C1 = "=R[2]C[-1]"
    Range("B1").Select
    Selection.Copy
    Range("B2:B502").Select
    ActiveSheet.Paste
    Range("C2").Select
    Application.CutCopyMode = False
    Columns("A:B").Select
    Selection.Copy
    Columns("D:D").Select
    ActiveSheet.Paste
    Range("D4").Select
    Application.CutCopyMode = False
    Range("D1:E502").Select
   ' Selection.Sort Key1:=Range("D1"), Order1:=xlAscending,
Header:=xlGuess, _
        OrderCustom:=1, MatchCase:=False,
Orientation:=xlTopToBottom
    Range("D1").Select

Dim m As Integer
Dim r As Double
Dim mVector() As Double
Dim X As Integer
Dim Y As Integer
Dim A As Double
Dim B As Double
Dim ABr As Double
Dim APn As Double
Dim N As Integer

'get data from user
N = InputBox("Enter number in time series")
'calculate the sd
mSD (N)

r = InputBox("Enter r value [0.1 to 0.25 of the SD of the time
series]")
m = InputBox("Enter m value  [Embedding dimension, usually 2
or more]")
```

```
'store data in array
ReDim mVector(N, 2)
Dim mStr As String

For X = 1 To N
    mStr = "D" & X
    mVector(X, 1) = Range(mStr).Value
    mStr = "E" & X
    mVector(X, 2) = Range(mStr).Value
Next X


' start calculations

For X = 1 To (N - m)
    A = 0
    B = 0
        For Y = 1 To (N - m)
            If Y = X Then GoTo mNexty

            If Abs(mVector(X, 1) - mVector(Y, 1)) <= r And _
            Abs(mVector(X, 2) - mVector(Y, 2)) <= r Then
                B = B + 1
                If mVector(Y, 1) < mVector(X + m, 1) + r And _
                mVector(Y, 1) > mVector(X + m, 1) - r And _
                mVector(Y, 2) < mVector(X + m, 2) + r And _
                mVector(Y, 2) > mVector(X + m, 2) - r Then
                    A = A + 1
                Else: End If

            Else: End If

mNexty:
        Next Y

If B = 0 Then GoTo mNextx
If A = 0 Then GoTo mNextx

ABr = ABr + Log(A / B)

mNextx:
Next X

APn = -(ABr / N)


MsgBox ("APn = " & APn)
```

```
End Sub



Public Sub mSD(mNumber As Integer)
 'Calculates the sd of the time series
 Dim mSt As String
 Range("A1").Select
    Sheets("Sheet1").Select
    Sheets("Sheet1").Name = "Sheet1"
    mSt = "A1:A" & mNumber
    Range(mSt).Select
    Selection.Copy
    ActiveWindow.ScrollRow = 1
    Range("I1").Select
    ActiveSheet.Paste
    Range("G1").Select
    Application.CutCopyMode = False
    ActiveCell.FormulaR1C1 = "sd ="
    Range("H1").Select
    mSt = "=STDEV(RC[1]:R[" & mNumber & "]C[1])"

    ActiveCell.FormulaR1C1 = mSt

    Range("G2").Select
    ActiveCell.FormulaR1C1 = "'0.1 * sd ="
    Range("H2").Select
    ActiveCell.FormulaR1C1 = "=0.1*R[-1]C"
    Range("G3").Select
    ActiveCell.FormulaR1C1 = "'0.25* sd ="
    Range("H3").Select
    ActiveCell.FormulaR1C1 = "=0.25*R[-2]C"
    Range("G4").Select


    Range("A1").Select
End Sub
```

APPENDIX I

Non Linear Forecasting Macro Code And Non Linear Forecasting Graphs

```
Sub mPivot1( )
'
' mPivot1 Macro
' Macro recorded 8/19/98 by Johan Steyn
' Non linear forecasting macro collection

'
    ActiveCell.FormulaR1C1 = "=RC[-2]"
    Range("D2").Select
    ActiveCell.FormulaR1C1 = "=R[1]C"
    Range("E2").Select
    ActiveCell.FormulaR1C1 = ""
    Range("D2").Select
    ActiveCell.FormulaR1C1 = "=R[1]C[-3]"
    Range("E2").Select
    ActiveCell.FormulaR1C1 = "=R[2]C[-4]"
    Range("F2").Select
    ActiveCell.FormulaR1C1 = "=R[3]C[-5]"
    Range("G2").Select
    ActiveCell.FormulaR1C1 = "=R[4]C[-6]"
    Range("H2").Select
    ActiveCell.FormulaR1C1 = "=R[5]C[-7]"
    Range("I2").Select
    ActiveCell.FormulaR1C1 = "=R[6]C[-8]"
    Range("J2").Select
    ActiveCell.FormulaR1C1 = "=R[7]C[-9]"
    Range("K2").Select
    ActiveCell.FormulaR1C1 = "=R[8]C[-10]"
    Range("L2").Select
    ActiveCell.FormulaR1C1 = "=R[9]C[-11]"
    Range("M2").Select
    ActiveCell.FormulaR1C1 = "=R[10]C[-12]"
    Range("N2").Select
    ActiveCell.FormulaR1C1 = "=R[11]C[-13]"
    Range("O2").Select
    ActiveCell.FormulaR1C1 = "=R[12]C[-14]"
    Range("P2").Select
    ActiveCell.FormulaR1C1 = "=R[13]C[-15]"
    Range("Q2").Select
    ActiveCell.FormulaR1C1 = "=R[14]C[-16]"
    Range("R2").Select
    ActiveCell.FormulaR1C1 = "=R[15]C[-17]"
    Range("S2").Select
    ActiveCell.FormulaR1C1 = "=R[16]C[-18]"
    Range("T2").Select
    ActiveCell.FormulaR1C1 = "=R[17]C[-19]"
    Range("U2").Select
    ActiveCell.FormulaR1C1 = "=R[18]C[-20]"
    Range("V2").Select
    ActiveCell.FormulaR1C1 = "=R[19]C[-21]"
    Range("A2").Select
```

```
End Sub
```

```
Sub mPivot2()
'
' mPivot2 Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Range("C2:V2").Select
    Selection.Copy
    ActiveWindow.SmallScroll ToRight:=-19
    Range("C3:C202").Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
    Range("A1").Select
End Sub
```

```
Sub mPivot4()
'
' mPivot4 Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Columns("C:V").Select
    Selection.Copy
    Sheets("Sheet2").Select
    Columns("C:C").Select
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone,
SkipBlanks:= _
        False, Transpose:=False
    Sheets("Sheet1").Select
    Range("A1").Select
End Sub
```

```
Sub mpivot5()
'
' mpivot5 Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Range("A1").Select
    Sheets("Sheet2").Select
    Range("H8").Select
    ActiveWindow.ScrollRow = 574
    ActiveWindow.ScrollRow = 498
    ActiveWindow.ScrollRow = 442
    ActiveWindow.ScrollRow = 209
    ActiveWindow.ScrollRow = 189
    Range("C2:V202").Select
    Range("G202").Activate
    Selection.Sort Key1:=Range("G2"), Order1:=xlAscending,
Key2:=Range("F2")
        , Order2:=xlAscending, Key3:=Range("E2"),
Order3:=xlAscending, Header:=
        xlGuess, OrderCustom:=1, MatchCase:=False,
Orientation:=xlTopToBottom
    ActiveWindow.ScrollRow = 1
    Range("A1").Select
End Sub
```

```
Sub mOriginalSeries()
'
' mOriginalSeries Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'get input as to what numbers to be used in the original
series
Dim mStart As Integer
Dim mFin As Integer
Dim mString As String

mStart = InputBox("Enter number for start of original series")
mFin = mStart + 20
```

```
Sheets("Sheet1").Select
'ActiveWindow.ScrollRow = 1
Range("A1").Select
ActiveWindow.ScrollRow = 400
mString = "A" & mStart & ":A" & mFin

'Range("A400:A419").Select
Range(mString).Select
Selection.Copy
Sheets("Sheet2").Select
ActiveSheet.Paste
Range("a1").Select
Application.CutCopyMode = False
ActiveCell.FormulaR1C1 = "=RC[-4]"
Range("F1").Select
ActiveCell.FormulaR1C1 = "=R[1]C[-5]"
Range("G1").Select
ActiveCell.FormulaR1C1 = "=R[2]C[-6]"
Range("C1:G1").Select
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
Selection.Borders(xlEdgeLeft).LineStyle = xlNone
Selection.Borders(xlEdgeTop).LineStyle = xlNone
With Selection.Borders(xlEdgeBottom)
    .LineStyle = xlContinuous
    .Weight = xlMedium
    .ColorIndex = xlAutomatic
End With
Selection.Borders(xlEdgeRight).LineStyle = xlNone
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Range("B1").Select
ActiveCell.FormulaR1C1 = "Original"
Range("A3:A20").Select
Selection.Copy
Sheets("Sheet3").Select
Range("A3").Select
ActiveSheet.Paste
Range("A2").Select
Application.CutCopyMode = False
ActiveCell.FormulaR1C1 = "original"
Range("B2").Select
ActiveCell.FormulaR1C1 = "Surrogate"
Range("C2").Select
Sheets("Sheet1").Select
ActiveWindow.LargeScroll Down:=-5
ActiveWindow.ScrollRow = 1
Range("A1").Select
Sheets("Sheet2").Select
ActiveWindow.ScrollRow = 1
Range("A1").Select
```

```
    Sheets("Sheet2").Select
    Range("A1").Select

End Sub



Sub mBestFit()
'
' mBestFit Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Range("G1").Select
    ActiveCell.FormulaR1C1 = "=R[3]C[-6]"
    Range("F1").Select
    ActiveCell.FormulaR1C1 = "=R[2]C[-5]"
    Range("E1").Select
    ActiveCell.FormulaR1C1 = "=R[2]C[-4]"
    Range("E1").Select
    ActiveCell.FormulaR1C1 = "=R[1]C[-4]"
    Range("D1").Select
    ActiveCell.FormulaR1C1 = "=RC[-3]"
    Range("H1").Select
    ActiveCell.FormulaR1C1 = "=R[5]C[-7]"
    Range("I1").Select
    ActiveCell.FormulaR1C1 = "=R[6]C[-8]"
    Range("J1").Select
    ActiveCell.FormulaR1C1 = "=R[7]C[-9]"
    Range("K1").Select
    ActiveCell.FormulaR1C1 = "=R[8]C[-10]"
    Range("L1").Select
    ActiveCell.FormulaR1C1 = "=R[9]C[-11]"
    Range("M1").Select
    ActiveCell.FormulaR1C1 = "=R[10]C[-12]"
    Range("N1").Select
    ActiveCell.FormulaR1C1 = "=R[11]C[-13]"
    Range("O1").Select
    ActiveCell.FormulaR1C1 = "=R[12]C[-14]"
    Range("P1").Select
    ActiveCell.FormulaR1C1 = "=R[13]C[-15]"
    Range("Q1").Select
    ActiveCell.FormulaR1C1 = "=R[14]C[-16]"
    Range("R1").Select
    ActiveCell.FormulaR1C1 = "=R[15]C[-17]"
    Range("S1").Select
    ActiveCell.FormulaR1C1 = "=R[16]C[-18]"
    Range("T1").Select
```

```
    ActiveCell.FormulaR1C1 = "=R[17]C[-19]"
    Range("U1").Select
    ActiveCell.FormulaR1C1 = "=R[18]C[-20]"
    Range("V1").Select
    ActiveCell.FormulaR1C1 = "=R[19]C[-21]"
    Range("W1").Select
    ActiveWindow.SmallScroll ToRight:=-14
    Range("B1:V11").Select
    Selection.Copy
    Sheets("Sheet3").Select
    Range("E2").Select
    Selection.PasteSpecial Paste:=xlValues, Operation:=xlNone,
SkipBlanks:=
        False, Transpose:=False
    Range("E14").Select
    ActiveWindow.SmallScroll ToRight:=6
    ActiveWindow.ScrollColumn = 1
    Sheets("Sheet2").Select
    Application.CutCopyMode = False
    Range("F5").Select
    Sheets("Sheet3").Select
    ActiveWindow.SmallScroll ToRight:=4
    Columns("J:J").Select
    Selection.Borders(xlDiagonalDown).LineStyle = xlNone
    Selection.Borders(xlDiagonalUp).LineStyle = xlNone
    Selection.Borders(xlEdgeLeft).LineStyle = xlNone
    Selection.Borders(xlEdgeTop).LineStyle = xlNone
    Selection.Borders(xlEdgeBottom).LineStyle = xlNone
    With Selection.Borders(xlEdgeRight)
        .LineStyle = xlContinuous
        .Weight = xlThin
        .ColorIndex = xlAutomatic
    End With
    Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
    Rows("2:2").Select
    Range("E2").Activate
    Selection.Borders(xlDiagonalDown).LineStyle = xlNone
    Selection.Borders(xlDiagonalUp).LineStyle = xlNone
    Selection.Borders(xlEdgeLeft).LineStyle = xlNone
    Selection.Borders(xlEdgeTop).LineStyle = xlNone
    With Selection.Borders(xlEdgeBottom)
        .LineStyle = xlContinuous
        .Weight = xlThin
        .ColorIndex = xlAutomatic
    End With
    Selection.Borders(xlEdgeRight).LineStyle = xlNone
    Range("E7").Select
    ActiveWindow.SmallScroll ToRight:=-4
    Range("E13").Select
    ActiveCell.FormulaR1C1 = "Predicted"
    Range("G13").Select
```

```
ActiveCell.FormulaR1C1 = "=R[-11]C"
Range("H13").Select
ActiveCell.FormulaR1C1 = "=R[-11]C"
Range("I13").Select
ActiveCell.FormulaR1C1 = "=R[-11]C"
Range("J13").Select
ActiveCell.FormulaR1C1 = "=R[-11]C"
Range("K13").Select
ActiveCell.FormulaR1C1 = "=EXP(-(ABS(R2C-R[-10]C)))"
Range("G14").Select
ActiveWindow.SmallScroll ToRight:=3
Range("K13").Select
Selection.Copy
Range("L13:Y13").Select
ActiveSheet.Paste
ActiveWindow.SmallScroll ToRight:=-2
Application.CutCopyMode = False
Range("K13:Y13").Select
Selection.Copy
ActiveWindow.SmallScroll ToRight:=-12
Range("K14:K23").Select
ActiveSheet.Paste
Range("J16").Select
ActiveWindow.SmallScroll ToRight:=-2
Range("J24").Select
Application.CutCopyMode = False
ActiveCell.FormulaR1C1 = "sum"
Range("K24").Select
ActiveCell.FormulaR1C1 = "=SUM(R[-11]C:R[-1]C)"
Range("K24").Select
Selection.Copy
Range("L24:Y24").Select
ActiveSheet.Paste
ActiveWindow.SmallScroll ToRight:=-2
Range("J25").Select
Application.CutCopyMode = False
Rows("24:24").Select
Range("F24").Activate
Selection.ClearContents
ActiveWindow.SmallScroll Down:=2
Range("J25").Select
ActiveCell.FormulaR1C1 = "'n x exp "
Range("K25").Select
ActiveCell.FormulaR1C1 = "=R[-22]C"
Range("K25").Select
ActiveCell.FormulaR1C1 = "=R[-22]C*R[-12]C"
Range("K25").Select
Selection.Copy
Range("L25:Y25").Select
ActiveSheet.Paste
Range("K25:L25").Select
```

```
Application.CutCopyMode = False
Range("K25:Y25").Select
Selection.Copy
ActiveWindow.SmallScroll ToRight:=-12
Range("K26:K34").Select
ActiveSheet.Paste
Range("J29").Select
Application.CutCopyMode = False
Range("J35").Select
ActiveCell.FormulaR1C1 = "sum"
Range("K35").Select
ActiveCell.FormulaR1C1 = "=SUM(R[-10]C:R[-1]C)"
Range("K35").Select
ActiveCell.FormulaR1C1 = "=SUM(R[-10]C:R[-1]C)/3"
Range("J35").Select
ActiveCell.FormulaR1C1 = "sum/10"
Range("K35").Select
Selection.Copy
Range("L35:Y35").Select
ActiveSheet.Paste
Application.CutCopyMode = False
Range("K37").Select
ActiveWindow.ScrollRow = 1
Range("K2").Select
ActiveWindow.SmallScroll Down:=24
Range("J38").Select
ActiveCell.FormulaR1C1 = "original"
Range("K38").Select
ActiveCell.FormulaR1C1 = "=R[-36]C"
Range("K39").Select
ActiveWindow.SmallScroll Down:=-24
Range("J13").Select
ActiveWindow.SmallScroll Down:=24
Range("J39").Select
ActiveCell.FormulaR1C1 = "predicted"
Range("K39").Select
ActiveCell.FormulaR1C1 = "=R[-29]C[-1]"
Range("K39").Select
ActiveWindow.LargeScroll Down:=-1
Range("K23").Select
ActiveWindow.LargeScroll Down:=1
Range("K39").Select
ActiveCell.FormulaR1C1 = "=R[-26]C[-1]"
Range("K39").Select
ActiveCell.FormulaR1C1 = "=R[-26]C[-1]+R[-4]C"
Range("K38").Select
Selection.Copy
Range("L38").Select
ActiveSheet.Paste
Range("L39").Select
Application.CutCopyMode = False
```

```
ActiveCell.FormulaR1C1 = "=RC[-1]+R[-4]C"
Range("L38:L39").Select
Selection.Copy
Range("M38:Y38").Select
ActiveSheet.Paste
ActiveWindow.ScrollRow = 1
ActiveWindow.SmallScroll ToRight:=-8
Range("B4").Select
ActiveWindow.ScrollRow = 10
ActiveWindow.ScrollRow = 13
ActiveWindow.SmallScroll ToRight:=5
ActiveWindow.SmallScroll Down:=14
Application.CutCopyMode = False
ActiveWindow.SmallScroll Down:=1
ActiveWindow.ScrollRow = 10
ActiveWindow.ScrollRow = 12
ActiveWindow.SmallScroll ToRight:=5
ActiveWindow.SmallScroll Down:=15
Range("M39").Select
ActiveWindow.ScrollColumn = 1
ActiveWindow.ScrollRow = 1
Range("B5").Select
ActiveCell.FormulaR1C1 = "=R[34]C[9]"
Range("B6").Select
ActiveCell.FormulaR1C1 = "=R[33]C[10]"
Range("B7").Select
ActiveCell.FormulaR1C1 = "=R[32]C[11]"
Range("B8").Select
ActiveCell.FormulaR1C1 = "=R[31]C[12]"
Range("B9").Select
ActiveCell.FormulaR1C1 = "=R[30]C[13]"
Range("B10").Select
ActiveCell.FormulaR1C1 = "=R[29]C[14]"
Range("B11").Select
ActiveCell.FormulaR1C1 = "=R[28]C[15]"
Range("B12").Select
ActiveCell.FormulaR1C1 = "=R[27]C[16]"
Range("B13").Select
ActiveCell.FormulaR1C1 = "=R[26]C[17]"
Range("B14").Select
ActiveCell.FormulaR1C1 = "=R[25]C[18]"
Range("B15").Select
ActiveCell.FormulaR1C1 = "=R[24]C[19]"
Range("B16").Select
ActiveCell.FormulaR1C1 = "=R[23]C[20]"
Range("B17").Select
ActiveCell.FormulaR1C1 = "=R[22]C[21]"
Range("B18").Select
ActiveCell.FormulaR1C1 = "=R[21]C[22]"
Range("B19").Select
ActiveCell.FormulaR1C1 = "=R[20]C[23]"
```

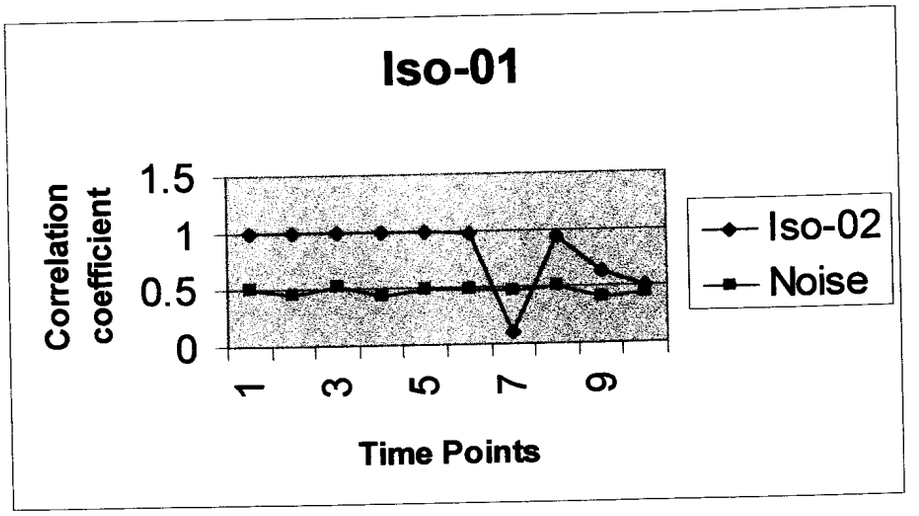
```
    Range("B20").Select
    ActiveCell.FormulaR1C1 = "=R[19]C[24]"
    Range("B21").Select
    ActiveWindow.LargeScroll Down:=-1
    Range("A1").Select
End Sub



Sub mBestfitfix1()
'
' mBestfitfix1 Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Range("K13").Select
    ActiveCell.FormulaR1C1 = "=EXP(-(ABS((R2C-R[-10]C)/R[-
10]C)))"
    Range("K13").Select
    Selection.Copy
    Range("L13:Y13").Select
    ActiveSheet.Paste
    ActiveWindow.SmallScroll ToRight:=-3
    Range("K13").Select
    Application.CutCopyMode = False
    Range("K13:Y13").Select
    Selection.Copy
    ActiveWindow.SmallScroll ToRight:=-1
    ActiveWindow.LargeScroll ToRight:=-2
    Range("K14:K23").Select
    ActiveSheet.Paste
    ActiveWindow.SmallScroll Down:=21
    ActiveWindow.SmallScroll ToRight:=2
    ActiveWindow.SmallScroll Down:=-6
    Range("K35").Select
    ActiveWindow.SmallScroll Down:=6
    ActiveWindow.SmallScroll ToRight:=7
    ActiveWindow.ScrollColumn = 1
    ActiveWindow.SmallScroll ToRight:=5
    Range("K39").Select
    Application.CutCopyMode = False
    ActiveCell.FormulaR1C1 = "=R13C10+R[-4]C"
    Range("K39").Select
    Selection.Copy
    Range("L39:Y39").Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
    ActiveWindow.ScrollRow = 1
```

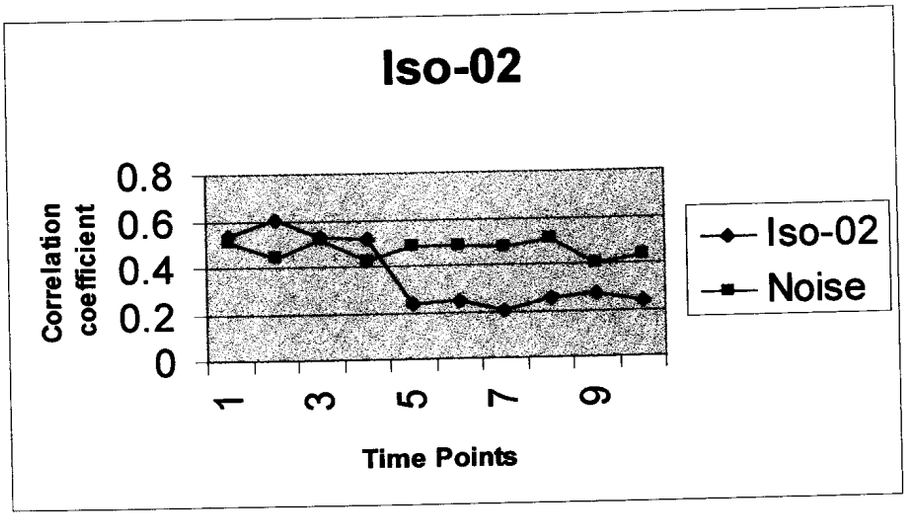
```
    ActiveWindow.SmallScroll ToRight:=-7
    ActiveWindow.SmallScroll Down:=0
    Range("A1").Select
End Sub



Sub BestFitFix3()
'
' BestFitFix3 Macro
' Macro recorded 98/08/20 by Johan Steyn
'

'
    ActiveWindow.ScrollRow = 1
    Sheets("Sheet3").Select
    ActiveWindow.ScrollColumn = 1
    Sheets("Sheet3").Name = "Sheet3"
    Range("A1").Select
    ActiveCell.FormulaR1C1 = ""
    Range("A1").Select
    ActiveWindow.SmallScroll ToRight:=3
    ActiveWindow.SmallScroll Down:=24
    Range("K39").Select
    ActiveCell.FormulaR1C1 = "=R[-4]C"
    Range("K39").Select
    Selection.Copy
    Range("L39:Y39").Select
    ActiveSheet.Paste
    Range("H39").Select
    Application.CutCopyMode = False
End Sub



Sub mCorreltaion()
'
' mCorreltaion Macro
' Macro recorded 8/19/98 by Johan Steyn
'
```

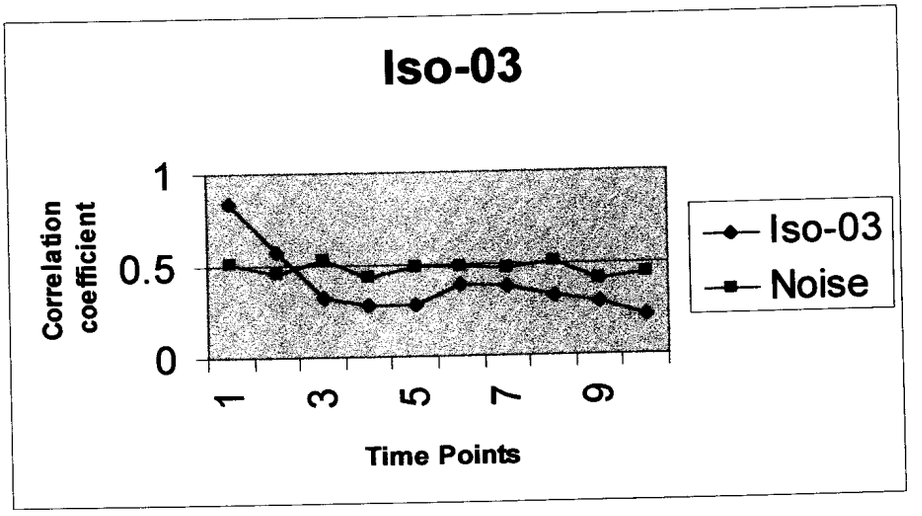
```
'
    Range("C3").Select
    ActiveCell.FormulaR1C1 = "=RC[-1]/RC[-2]"
    Range("C3").Select
    Selection.Copy
    Range("C4:C20").Select
    ActiveSheet.Paste
    Range("D6").Select
    Application.CutCopyMode = False
    ActiveWindow.SmallScroll Down:=5
    ActiveWindow.ScrollRow = 1
    Range("C3").Select
    ActiveCell.FormulaR1C1 = "=(ABS(RC[-2]-RC[-1]))/(RC[-
2]+RC[-1])"
    Range("C3").Select
    Selection.Copy
    Range("C4:C20").Select
    ActiveSheet.Paste
    Range("C4").Select
    ActiveWindow.SmallScroll Down:=5
    ActiveWindow.ScrollRow = 1
End Sub



Sub mbestfitfix2()
'
' mbestfitfix2 Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Range("F6:J12").Select
    Selection.ClearContents
    ActiveWindow.SmallScroll ToRight:=4
    Range("K6:Y11").Select
    Selection.ClearContents
    Range("K12:Y12").Select
    Selection.ClearContents
    ActiveWindow.SmallScroll Down:=14
    Range("K16:Y22").Select
    Selection.ClearContents
    ActiveWindow.SmallScroll Down:=11
    ActiveWindow.SmallScroll ToRight:=12
    ActiveWindow.LargeScroll ToRight:=-3
    ActiveWindow.ScrollRow = 1
    ActiveWindow.SmallScroll Down:=5
    Range("G22").Select
    ActiveWindow.SmallScroll Down:=-1
```

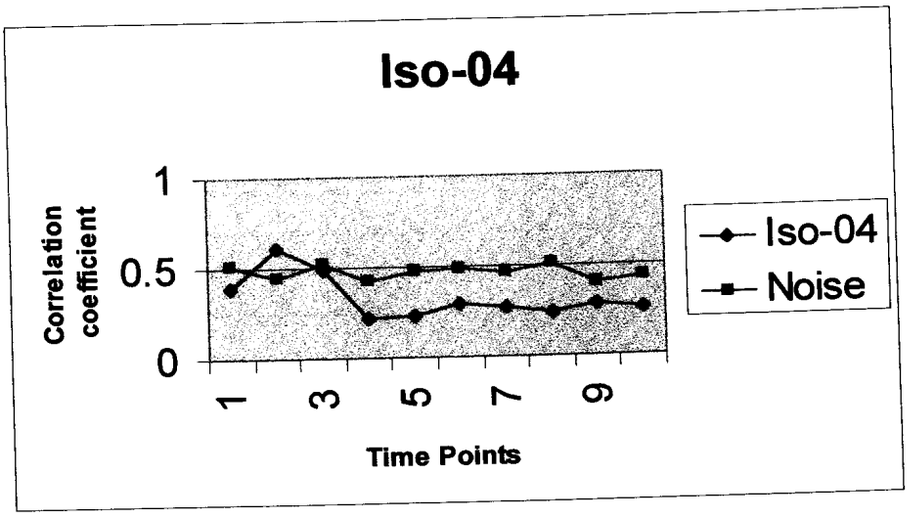
```
End Sub



Sub mExcelcorr()
'
' mExcelcorr Macro
' Macro recorded 8/19/98 by Johan Steyn
'

'
    Range("D4").Select
    ActiveCell.FormulaR1C1 = "=CORREL(RC[-3],RC[-2])"
    Range("D5").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-1]C[-3]:RC[-3],R[-
1]C[-2]:RC[-2])"
    Selection.Copy
    Range("D6:D19").Select
    ActiveSheet.Paste
    Range("D6").Select
    Application.CutCopyMode = False
    ActiveCell.FormulaR1C1 = "=CORREL(R[-2]C[-3]:RC[-3],R[-
2]C[-2]:RC[-2])"
    Range("D7").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-3]C[-3]:RC[-3],R[-
3]C[-2]:RC[-2])"
    Range("D8").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-4]C[-3]:RC[-3],R[-
4]C[-2]:RC[-2])"
    Range("D9").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-5]C[-3]:RC[-3],R[-
5]C[-2]:RC[-2])"
    Range("D10").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-6]C[-3]:RC[-3],R[-
6]C[-2]:RC[-2])"
    Range("D11").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-7]C[-3]:RC[-3],R[-
1]C[-2]:RC[-2])"
    Range("D11").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-7]C[-3]:RC[-3],R[-
7]C[-2]:RC[-2])"
    Range("D12").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-8]C[-3]:RC[-3],R[-
8]C[-2]:RC[-2])"
    Range("D13").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-9]C[-3]:RC[-3],R[-
9]C[-2]:RC[-2])"
    Range("D14").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-10]C[-3]:RC[-3],R[-
10]C[-2]:RC[-2])"
```

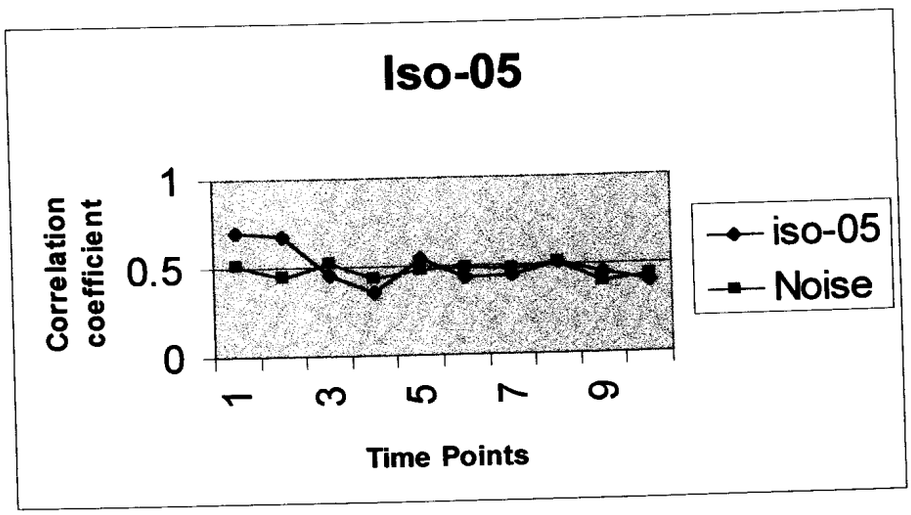
```
    Range("D15").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-11]C[-3]:RC[-3],R[-
11]C[-2]:RC[-2])"
    Range("D16").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-12]C[-3]:RC[-3],R[-
1]C[-2]:RC[-2])"
    Range("D16").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-12]C[-3]:RC[-3],R[-
12]C[-2]:RC[-2])"
    Range("D17").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-13]C[-3]:RC[-3],R[-
13]C[-2]:RC[-2])"
    Range("D18").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-14]C[-3]:RC[-3],R[-
1]C[-2]:RC[-2])"
    Range("D18").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-14]C[-3]:RC[-3],R[-
14]C[-2]:RC[-2])"
    Range("D19").Select
    ActiveCell.FormulaR1C1 = "=CORREL(R[-15]C[-3]:RC[-3],R[-
15]C[-2]:RC[-2])"
    Range("D20").Select
    ActiveWindow.SmallScroll Down:=-3
    Range("D5:D19").Select
    ActiveWindow.ScrollRow = 1
    Range("E5").Select
    ActiveCell.FormulaR1C1 = "=abs"
    Range("E5").Select
    ActiveCell.FormulaR1C1 = "=ABS(RC[-1])"
    Range("E5").Select
    Selection.Copy
    Range("E6:E19").Select
    ActiveSheet.Paste
    Application.CutCopyMode = False
    Range("E6:E19").Select
    Charts.Add
    ActiveChart.ChartType = xlXYScatterSmoothNoMarkers
    ActiveChart.SetSourceData
Source:=Sheets("Sheet3").Range("E6:E19"), PlotBy _
        :=xlColumns
    ActiveChart.Location Where:=xlLocationAsObject,
Name:="Sheet3"
    With ActiveChart
        .HasTitle = False
        .Axes(xlCategory, xlPrimary).HasTitle = False
        .Axes(xlValue, xlPrimary).HasTitle = False
    End With
    ActiveWindow.Visible = False
'    Windows("Non-linearForecasting.xls").Activate
    Range("F7").Select
End Sub
```

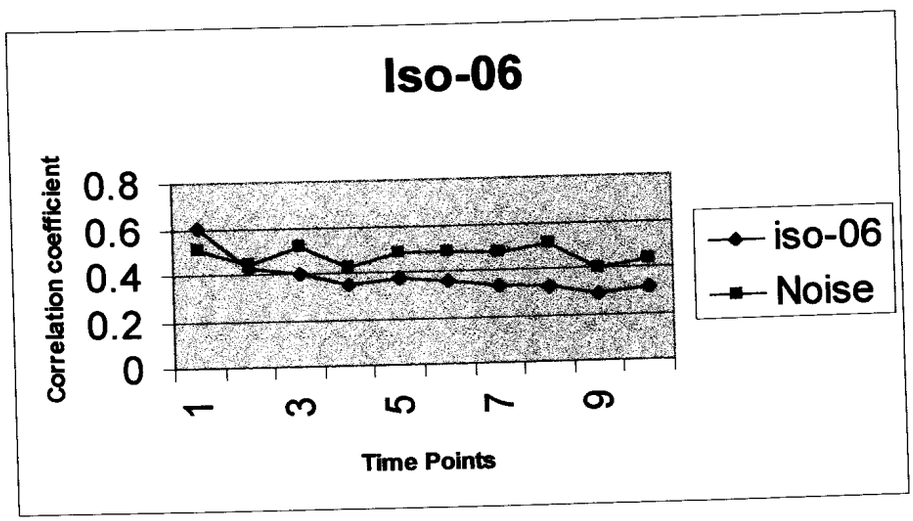

Iso-01
Correlation coefficient
1.5
1
0.5
0
1
3
5
7
9
Time Points
Iso-02
Noise

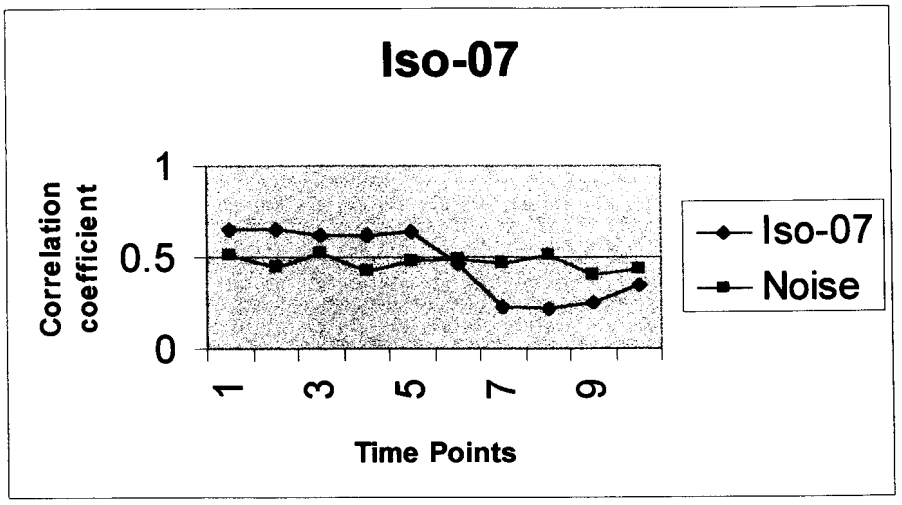

Iso-02
Correlation coefficient
0.8
0.6
0.4
0.2
0
1
3
5
7
9
Time Points
Iso-02
Noise

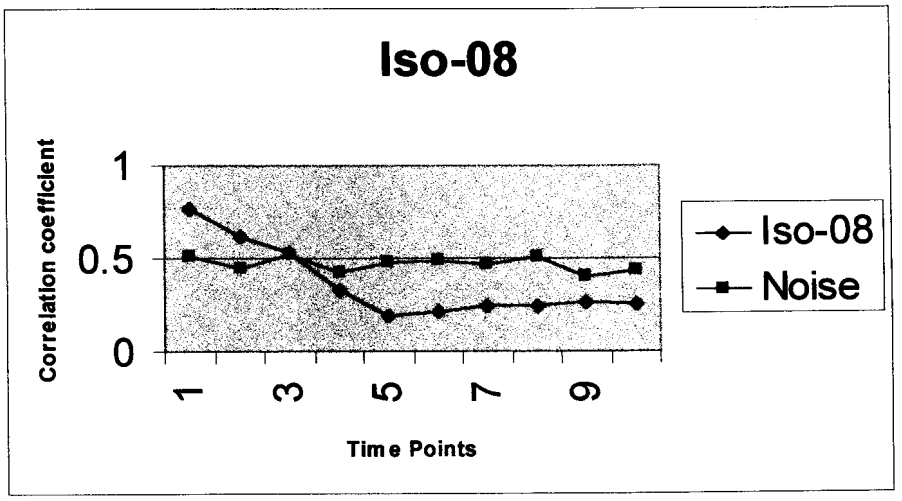

Iso-03
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Iso-03
Noise

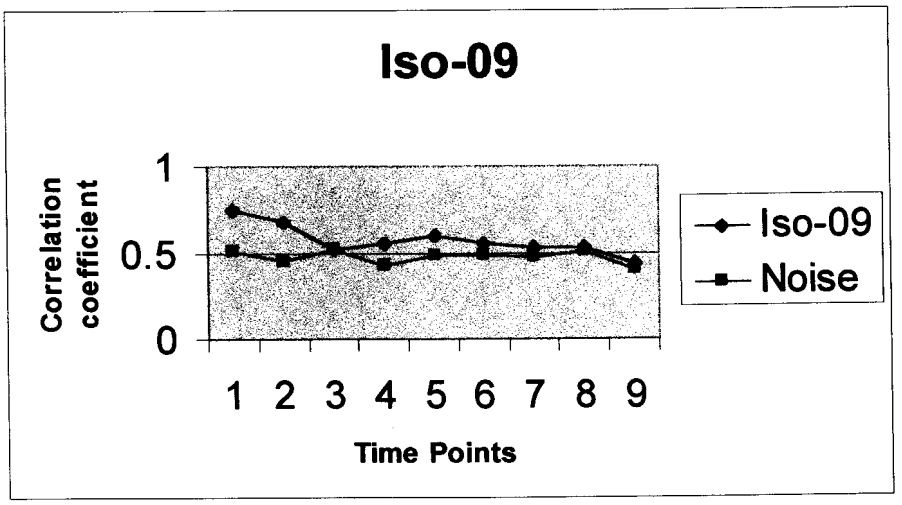

Iso-04
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Iso-04
Noise

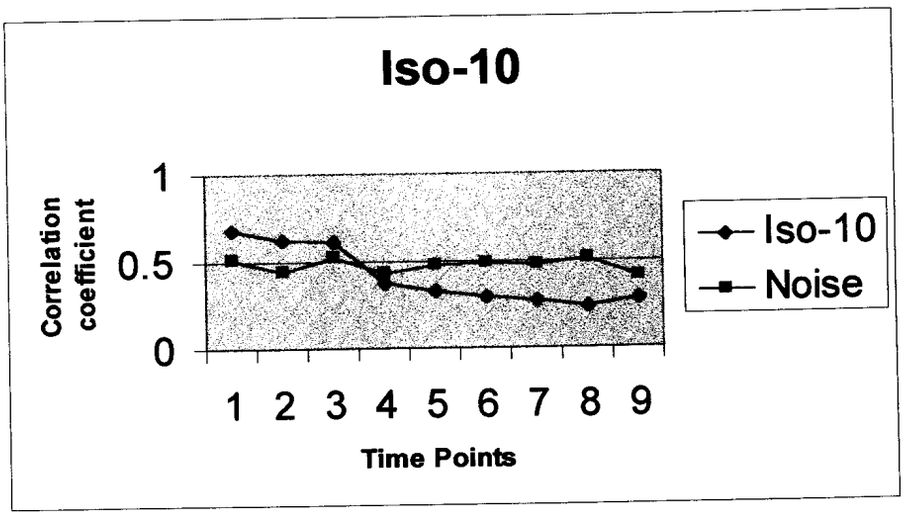

Iso-05
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
iso-05
Noise

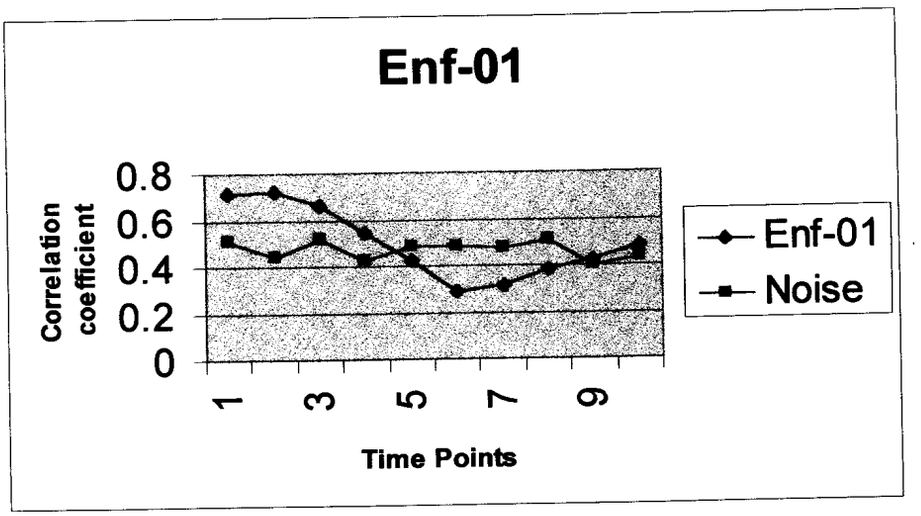

Iso-06
Correlation coefficient
0.8
0.6
0.4
0.2
0
1
3
5
7
9
Time Points
iso-06
Noise

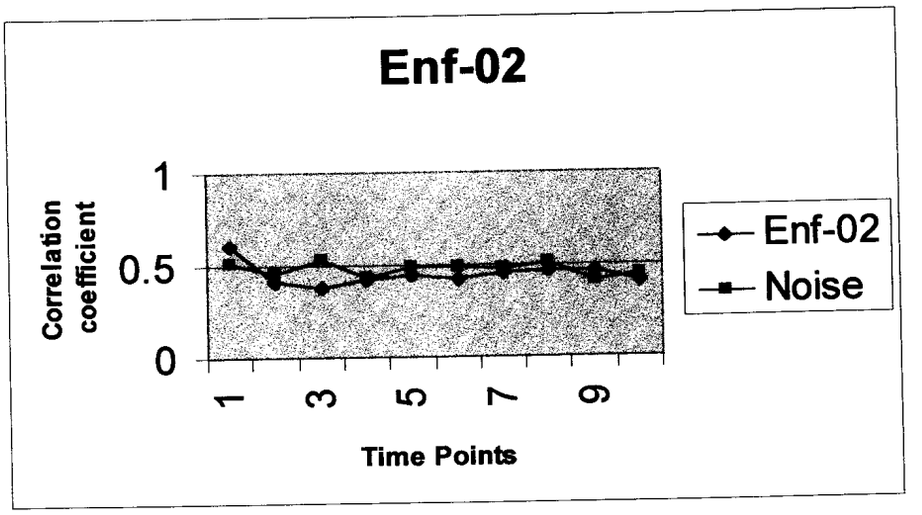

Iso-07
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Iso-07
Noise

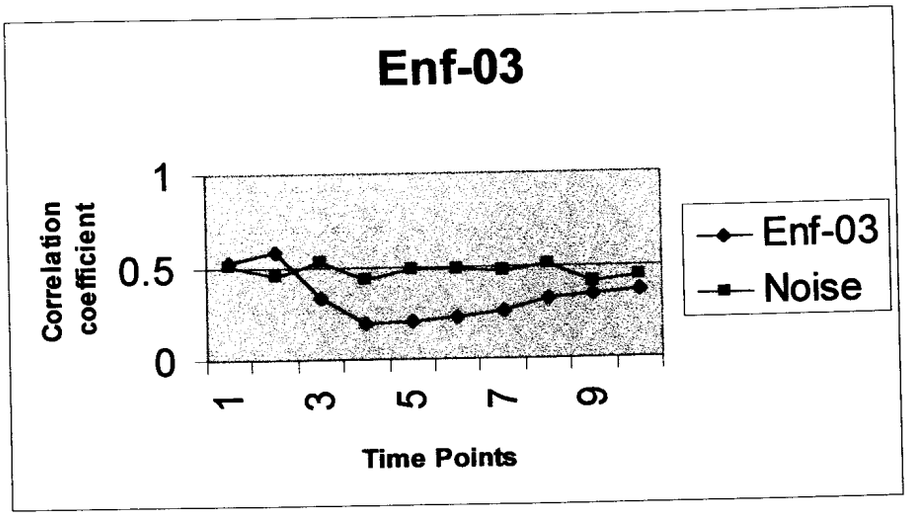

Iso-08
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Iso-08
Noise

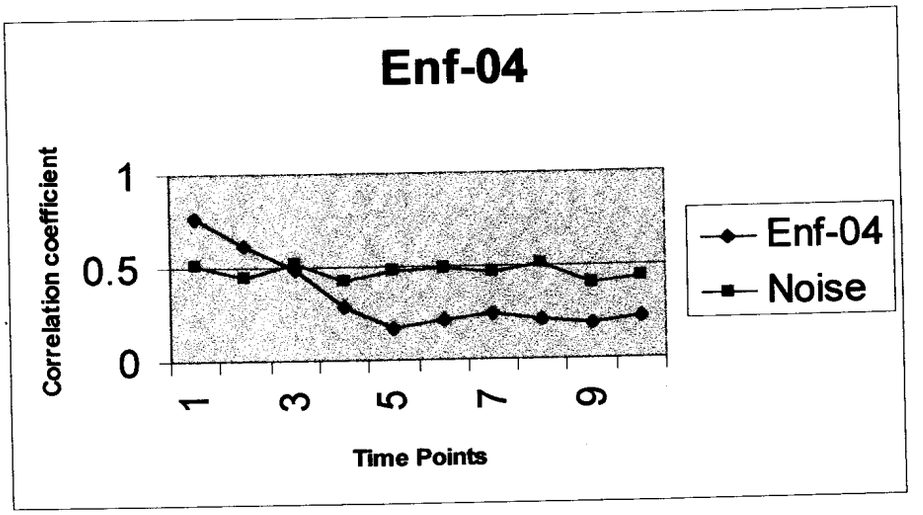

Iso-09
Correlation coefficient
1
0.5
0
1 2 3 4 5 6 7 8 9
Time Points
Iso-09
Noise

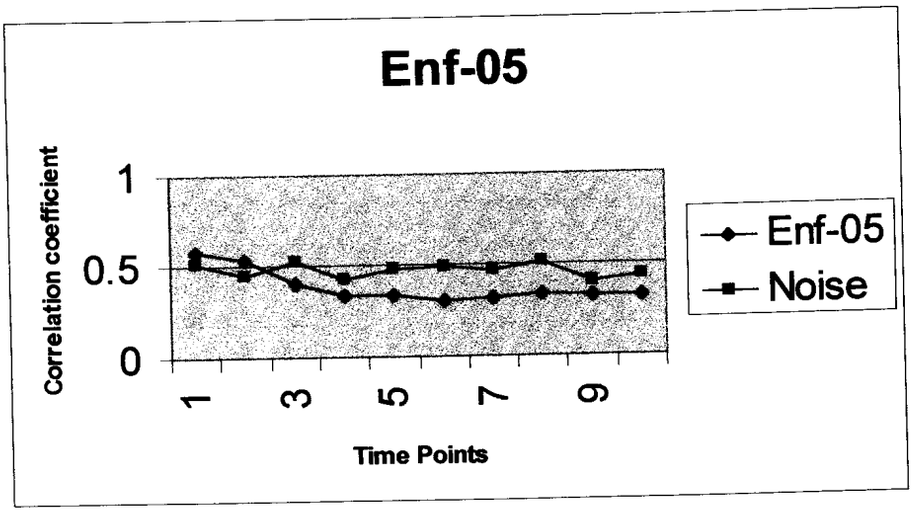

Iso-10
Correlation coefficient
1
0.5
0
1 2 3 4 5 6 7 8 9
Time Points
Iso-10
Noise

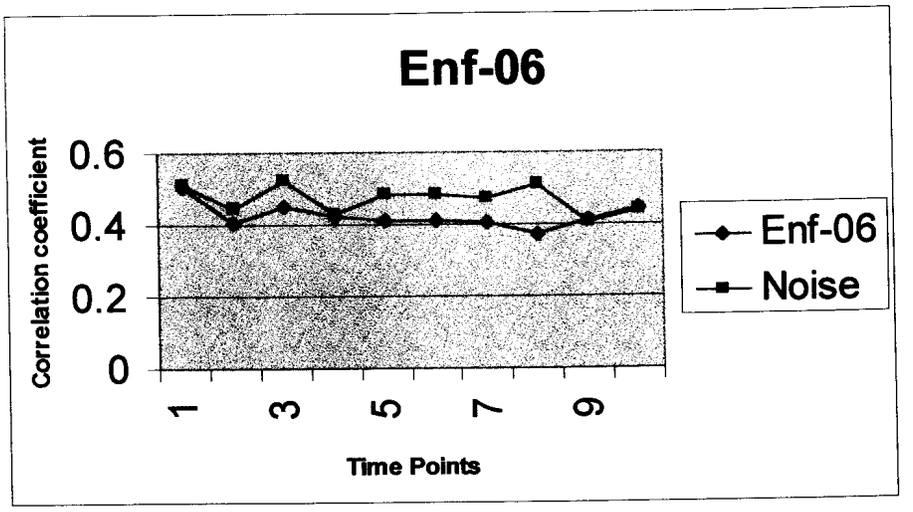

Enf-01
Correlation coefficient
0.8
0.6
0.4
0.2
0
1 3 5 7 9
Time Points
Enf-01
Noise

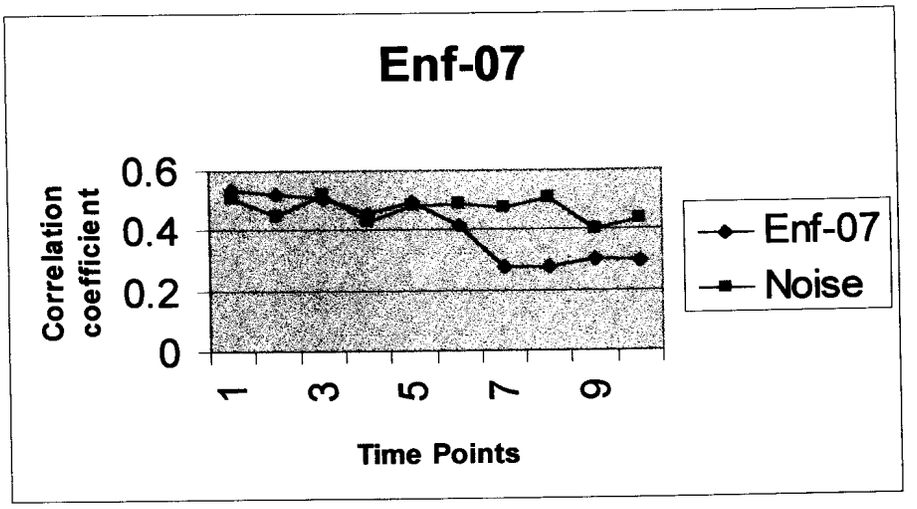

Enf-02
Correlation coefficient
1
0.5
0
1 3 5 7 9
Time Points
Enf-02
Noise

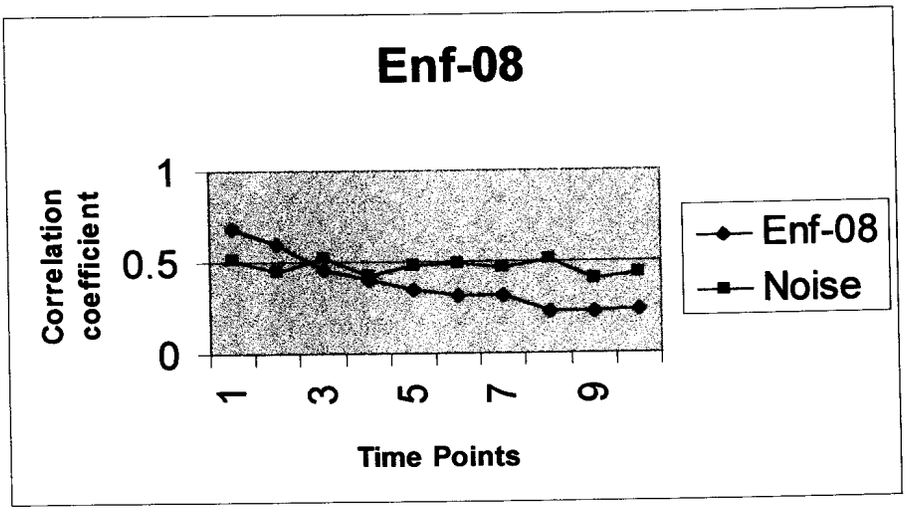

Enf-03
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Enf-03
Noise

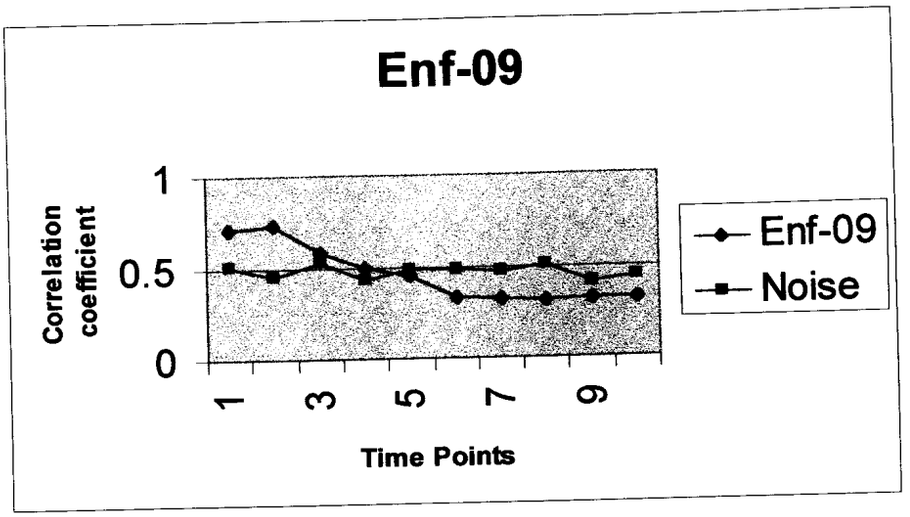

Enf-04
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Enf-04
Noise

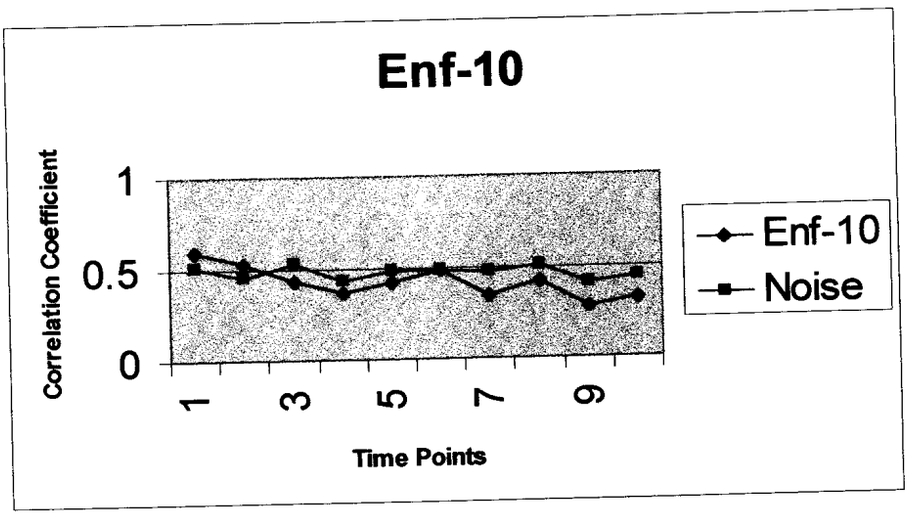

Enf-05
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Enf-05
Noise


Enf-06
Correlation coefficient
0.6
0.4
0.2
0
1
3
5
7
9
Time Points
Enf-06
Noise


Enf-07
Correlation coefficient
0.6
0.4
0.2
0
1
3
5
7
9
Time Points
Enf-07
Noise


Enf-08
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Enf-08
Noise


Enf-09
Correlation coefficient
1
0.5
0
1
3
5
7
9
Time Points
Enf-09
Noise


Enf-10
Correlation Coefficient
1
0.5
0
1
3
5
7
9
Time Points
Enf-10
Noise

Appendix J

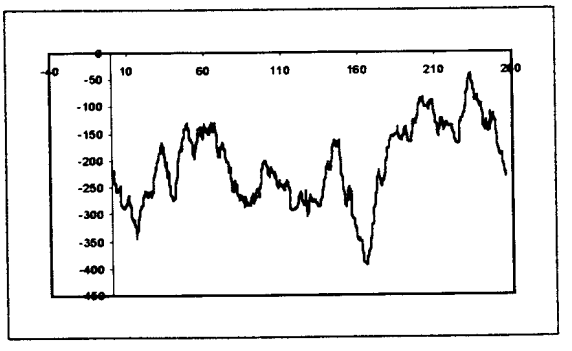
Surrogate Data sets for the measured time series

Time Series Name: Enf-01 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:

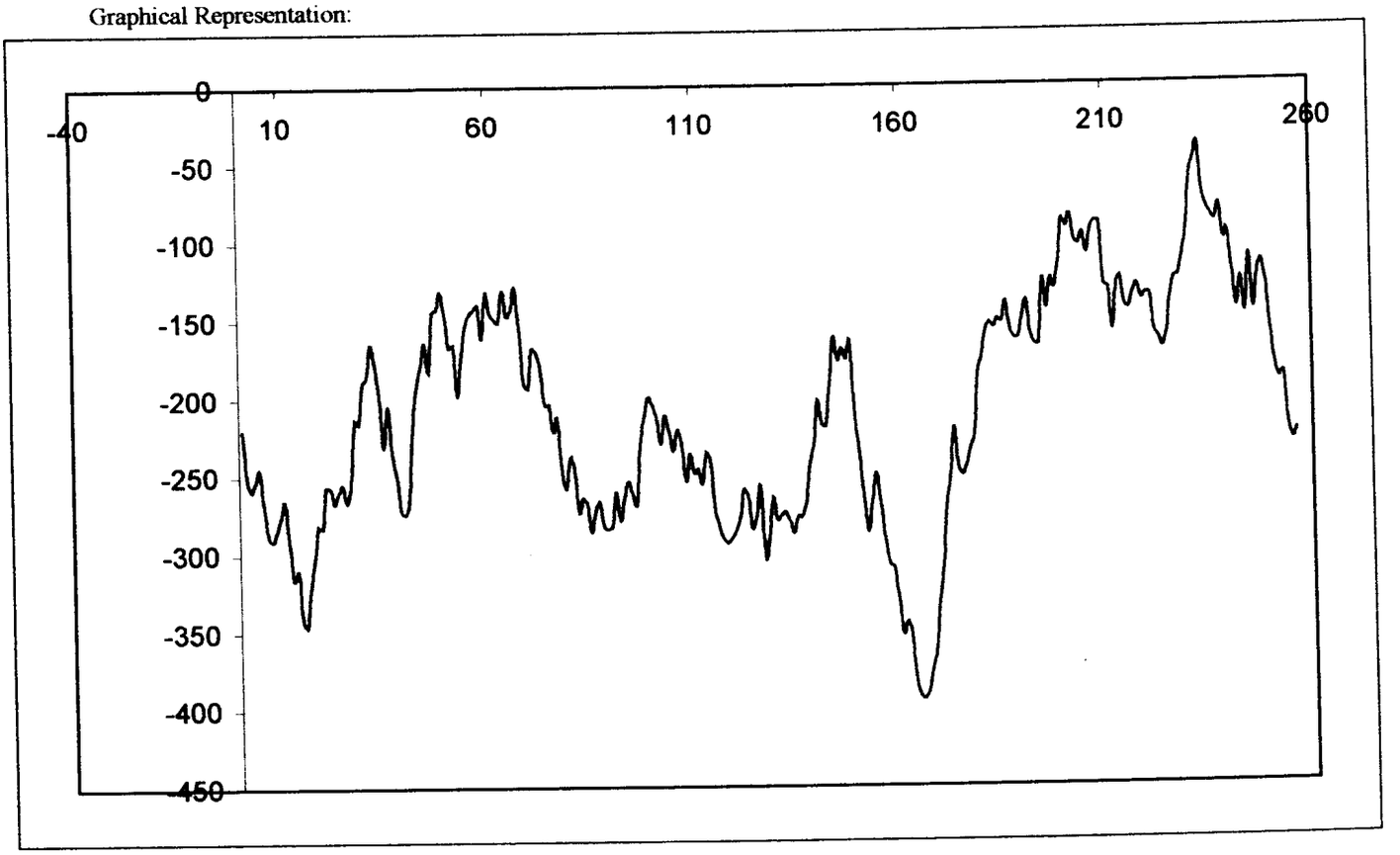


Time Series Name: Enf-01 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:



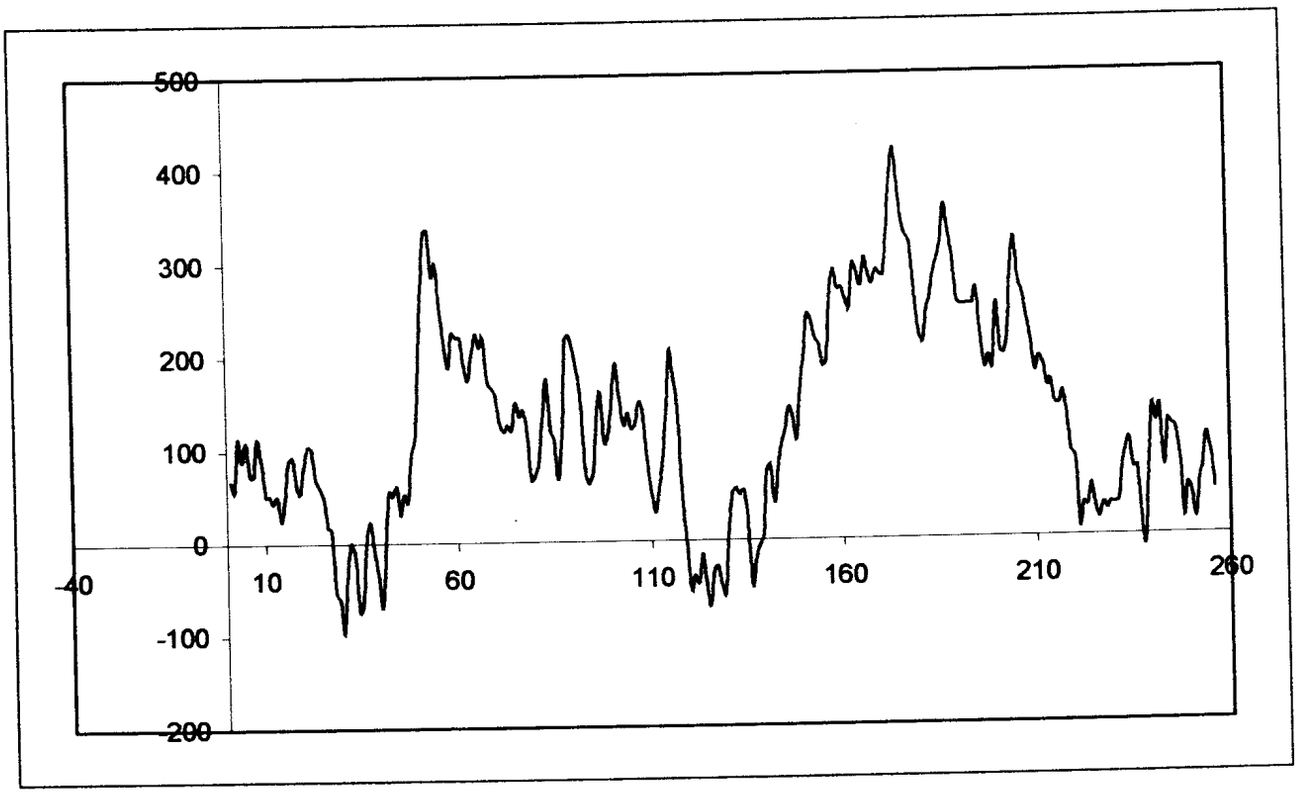
-220.033	-254.334	-197.957	-258.109	-234.437	-276.323	-308.32	-156.051	-89.7087	-80.3833
-252.115	-213.519	-170.496	-238.157	-220.826	-274.069	-310.138	-150.627	-128.977	-85.1702
-258.999	-216.001	-153.16	-245.245	-229.964	-280.052	-330.614	-152.193	-131.882	-88.6236
-252.505	-190.134	-145.767	-273.889	-253.732	-287.318	-352.628	-139.64	-158.414	-78.816
-245.661	-186.216	-142.939	-264.058	-236.482	-276.993	-344.938	-157.659	-128.973	-100.327
-270.484	-164.944	-139.859	-268.574	-248.679	-276.887	-352.169	-162.941	-124.757	-96.3549
-288.081	-176.489	-161.207	-285.936	-245.918	-268.307	-383.65	-162.522	-143.423	-122.007
-291.214	-198.338	-131.543	-272.618	-255.998	-243.742	-392.64	-149.874	-144.62	-144.784
-284.704	-231.237	-144.636	-267.017	-236.123	-230.671	-394.143	-139.215	-134.635	-126.255
-275.312	-204.924	-149.386	-282.962	-240.142	-202.874	-389.664	-160.807	-129.888	-148.588
-265.747	-234.127	-150.877	-284.661	-272.728	-217.944	-374.955	-167.135	-138.811	-111.426
-293.689	-249.761	-130.323	-282.65	-283.116	-218.757	-362.931	-167.443	-135.548	-145.944
-315.736	-271.343	-146.924	-260.558	-291.364	-189.797	-330.326	-125.637	-136.012	-123.187
-310.383	-274.515	-142.902	-279.059	-293.515	-162.042	-310.809	-144.042	-158.551	-115.504
-340.714	-266.668	-128.42	-264.838	-291.021	-177.002	-270.037	-125.446	-163.954	-129.335
-346.115	-216.672	-155.499	-253.937	-286.319	-169.207	-253.401	-131.234	-170.011	-158.193
-321.919	-193.354	-189.605	-261.491	-277.603	-175.877	-220.336	-114.729	-161.263	-182.689
-302.445	-179.184	-193.284	-269.121	-259.24	-164.751	-244.789	-87.3381	-138.162	-191.065
-282.099	-163.735	-167.718	-230.295	-264.031	-213.883	-250.654	-91.9443	-125.367	-187.623
-282.621	-182.624	-170.598	-211.975	-284.508	-235.781	-245.072	-84.2206	-123.968	-219.881
-256.479	-144.473	-180.794	-200.21	-276.678	-266.485	-233.617	-100.635	-111.144	-230.484
-257.608	-142.599	-204.684	-204.818	-257.296	-286.953	-225.743	-102.906	-95.3964	-224.598
-267.156	-130.865	-204.309	-212.507	-304.016	-266.515	-185.099	-96.1155	-59.3586	
-259.762	-146.388	-221.781	-229.696	-292.083	-249.368	-174.951	-109.042	-49.652	
-255.349	-167.154	-212.779	-211.694	-265.042	-269.751	-158.457	-93.115	-39.7501	
-266.696	-165.401	-248.417	-222.213	-278.829	-292.204	-153.257	-89.1501	-69.0954	

Time Series Name: Enf-02 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:



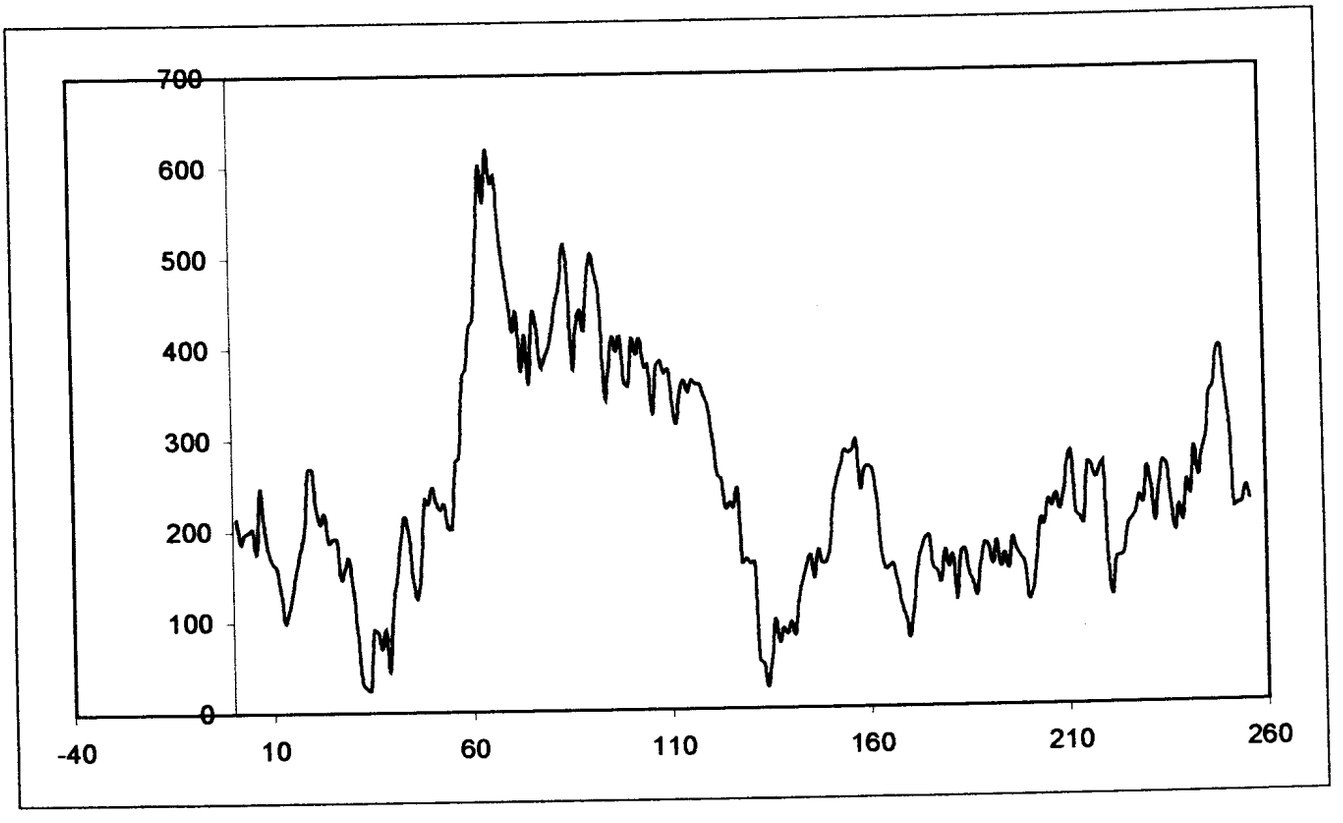
67.0713	14.1718	186.109	135.193	155.045	-47.9936	208.196	222.395	274.837	71.2051
56.248	-50.8766	267.281	141.579	123.926	-58.949	185.574	210.692	261.092	91.005
112.417	-61.5733	334.777	119.634	137.735	14.6554	193.708	243.7	232.402	102.713
88.8083	-96.7183	336.103	66.6387	121.242	50.0379	268.704	258.435	207.221	71.3676
109.008	-32.4618	286.244	70.9761	125.398	56.0379	289.196	283.359	177.235	72.7057
73.5458	0.20547	298.9	85.8771	149.545	49.242	269.025	301.059	192.711	18.5797
73.5037	5	245.113	130.549	138.306	53.4224	269.803	321.318	185.158	-9.07365
112.932	-14.7475	209.457	175.325	89.0034	15.4115	256.033	357.754	162.561	81.1599
88.0311	-74.6698	188.258	121.244	50.2484	-50.4975	247.541	325.69	166.304	138.686
51.5179	-66.1987	225.347	110.184	29.9534	-22.3309	295.081	295.888	143.773	120.684
51.8285	6.45797	220.33	67.0241	53.3076	-5.49932	286.724	253.365	142.23	137.716
43.1316	22.9978	220.192	114.532	83.9852	4.05338	271.369	250.206	155.06	72.8011
50.6746	-6.07793	189.888	217.052	138.884	73.3106	301.476	250.267	131.267	122.161
24.1369	-32.7753	173.863	222.114	204.982	80.3178	286.556	251.053	91.6977	117.873
48.2093	-69.1671	204.532	208.413	176.997	39.7455	273.572	250.836	83.148	114.469
87.3405	-	224.166	181.764	143.923	76.2537	288.321	267.186	10.0254	84.2607
92.8851	0.61526	210.023	145.921	42.9175	101.555	284.498	210.156	34.4097	18.6809
62.8053	9	219.493	74.2729	-4.61861	117.205	282.101	181.651	32.7686	53.3738
55.2089	55.9156	171.376	62.3341	-53.3848	142.294	326.068	194.394	54.7988	45.4748
82.4491	50.5814	166.303	77.0623	-38.1307	129.223	389.277	181.511	32.2363	16.1512
103.92	60.6348	157.417	138.595	-45.9451	108.83	418.934	252.241	18.3856	57.1245
101.279	30.3825	129.565	159.492	-15.6257	167.579	382.782	199.822	33.8601	73.5345
70.9318	52.5214	118.902	105.505	-44.8444	199.283	340.122	196.407	27.816	107.172
60.8901	43.8031	126.106	117.301	-71.1893	241.445	324.538	218.194	34.6462	87.8807
49.0141	96.8322	120.511	155.841	-30.7723	235.308	315.341	297.798	33.8625	47.7687
17.4698	111.808	149.786	191.009	-28.1138	215.39	264.681	321.517	37.1897	

Time Series Name: Enf-03 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:

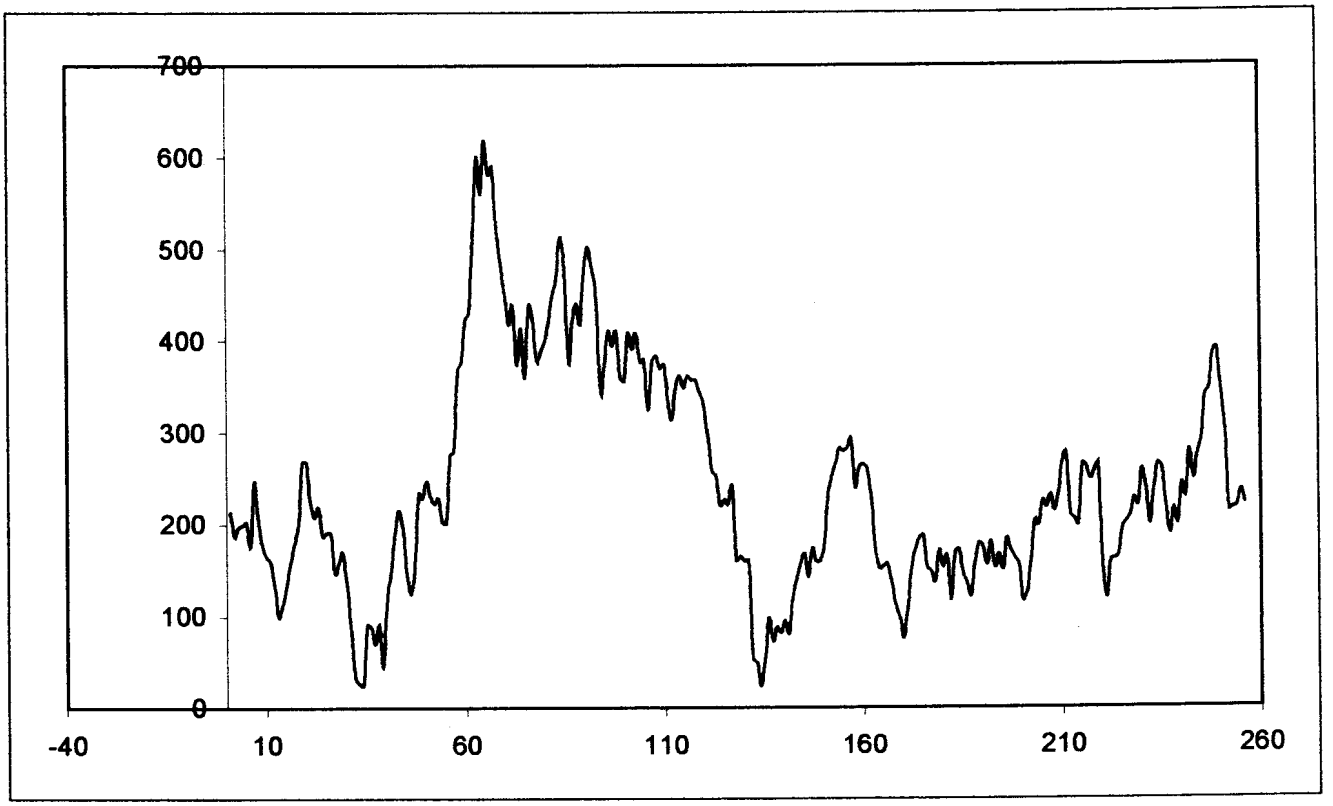


Time Series Name: Enf-03 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:



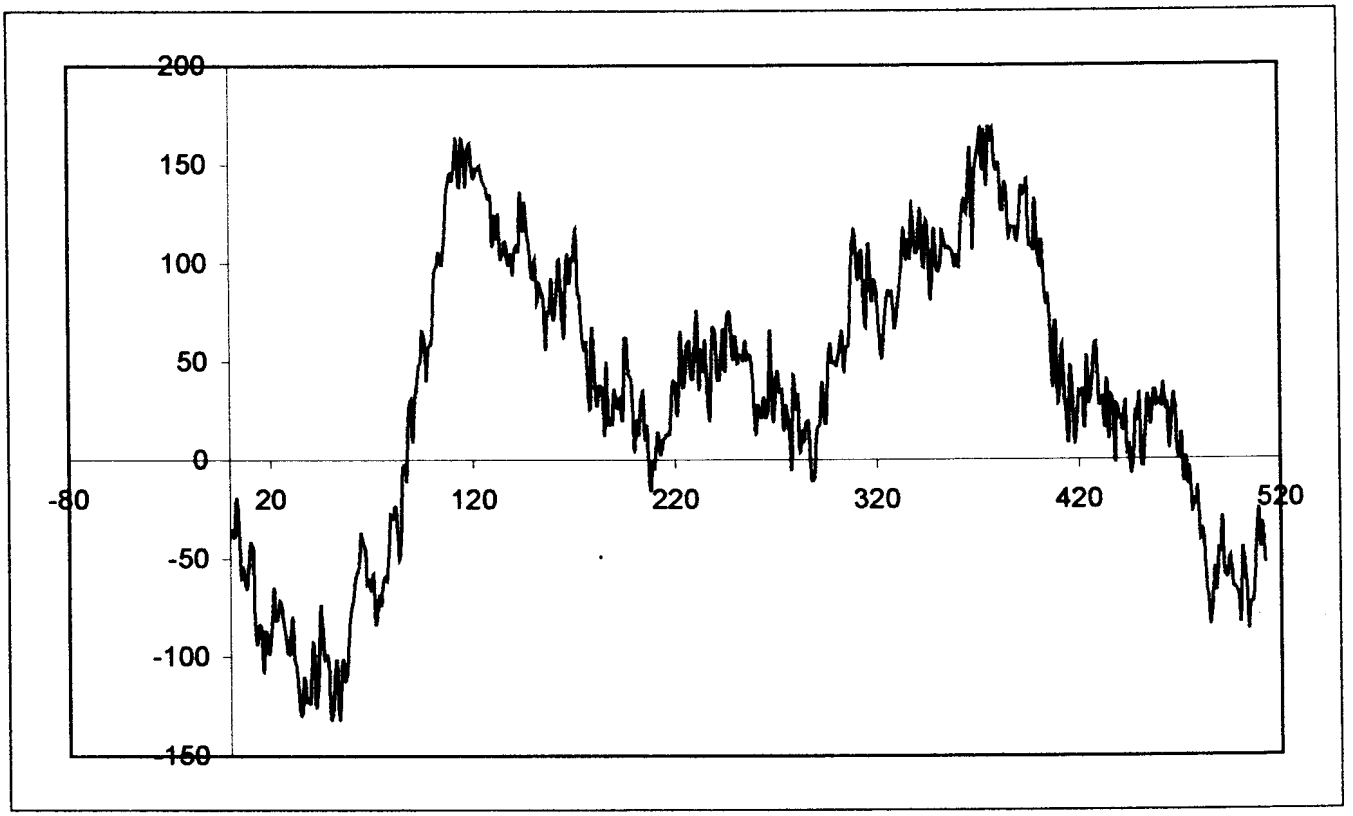
212.912	146.886	228.313	386.813	379.992	160.419	293.028	168.383	233.842	260.157
186.797	158.371	202.508	399.39	324.966	54.2082	240.194	172.557	266.291	221.756
196.091	169.417	201.394	420.148	375.724	48.3904	262.041	146.349	277.407	188.872
199.752	132.277	275.802	450.149	383.601	23.6212	265.193	135.453	210.611	216.294
201.737	87.4706	279.354	466.198	369.865	55.2158	260.182	121.097	205.28	199.989
176.662	32.6215	366.686	513.966	373.837	97.5905	231.281	156.885	198.649	243.48
246.367	27.1959	378.088	488.619	336.843	72.4157	170.476	178.275	264.721	228.679
201.446	24.2267	423.719	376.845	313.915	88.2262	151.409	175.09	262.759	280.241
176.844	90.7258	431.055	420.138	350.08	81.3375	153.663	155.754	248.702	248.943
164.248	88.2246	513.999	440.62	361.464	94.6412	156.799	180.142	256.399	273.907
158.723	69.8315	601.096	417.577	348.112	79.9152	136.632	152.185	265.202	291.097
131.164	90.494	560.217	477.29	361.465	118.79	112.585	166.817	156.634	338.711
98.7557	45.5834	618.389	502.817	357.39	140.448	97.9829	150.075	119.221	347.087
113.136	121.083	581.454	479.108	356.593	156.015	75.1437	183.639	159.348	382.447
133.267	147.543	589.837	453.658	343.874	167.181	106.777	170.498	161.915	390.055
158.682	191.191	521.758	344.586	330.606	142.307	148.851	163.539	164.908	348.626
178.449	214.979	486.824	370.658	295.192	173.715	172.533	154.308	194.628	301.564
200.952	194.829	450.223	410.448	259.198	159.394	183.575	116.719	202.272	214.009
267.101	145.838	418.128	394.046	251.84	160.383	187.744	125.982	209.433	216.881
267.402	123.929	438.387	410.925	220.54	174.321	154.391	158.216	227.851	218.545
223.41	154.362	374.105	360.329	226.152	229.12	147.496	203.46	220.681	236.152
207.773	234.496	414.073	356.208	221.48	250.829	136.288	197.862	259.004	221.78
218.296	228.275	359.275	408.944	240.443	265.956	171.547	224.447	239.083	
187.271	247.632	438.798	391.048	160.368	282.096	152.628	218.019	199.254	
190.959	230.761	426.403	408.903	164.985	279.29	164.644	231.879	238.747	
190.007	222.473	378.566	376.69	159.259	283.033	116.56	213.616	264.793	

Time Series Name: Enf-04 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:



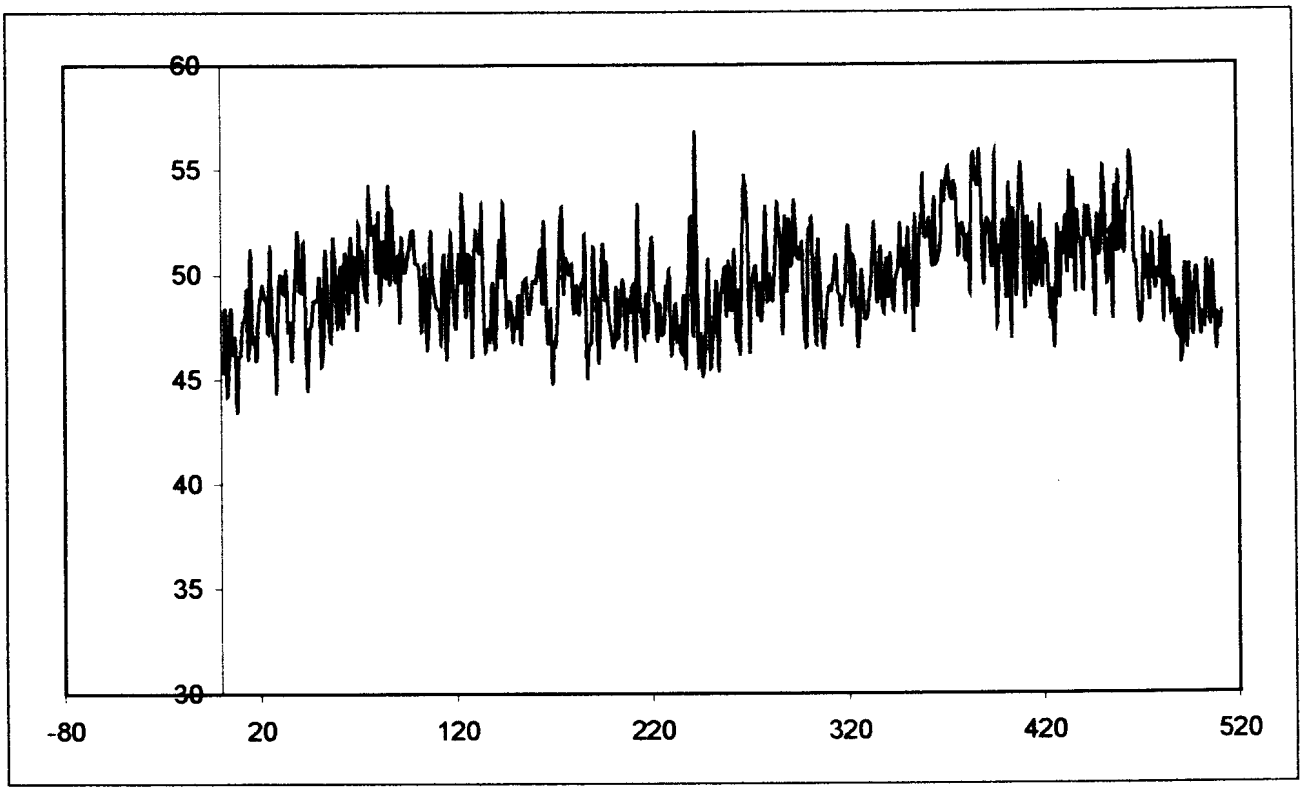
-35.4106	-131.824	99.4955	74.8771	-1.24288	27.3586	106.17	125.239	28.6149	27.208
-38.7221	-113.215	113.91	74.7909	-3.35741	25.8923	76.0956	143.105	8.54488	3.70024
-19.3334	-100.938	129.976	92.2387	13.6003	21.6088	67.8882	156.639	15.9165	0.40129
-33.6194	-111.897	139.805	71.7309	9.67095	31.78	108.232	107.138	34.5377	4
-59.5888	-106.439	145.718	79.3798	2.50495	21.6215	97.6575	140.154	33.3315	13.1827
-54.4054	-90.6904	141.671	93.7361	10.2063	24.7644	80.3041	151.586	35.3653	-11.2701
-63.1666	-78.0561	147.705	101.869	11.3135	65.0039	91.0984	159.962	16.2252	1.43671
-64.8081	-71.4608	163.656	82.0694	12.9313	48.0755	86.9025	167.815	52.2483	-12.3142
-52.2558	-61.916	144.057	61.9986	13.136	19.1526	72.1026	146.688	29.0542	-5.29446
-41.8395	-57.4969	139.082	89.8	24.3547	38.2355	53.9968	167.339	31.4533	-25.8784
-45.0761	-53.6342	162.725	104.733	39.9998	44.9533	51.9178	139.076	46.1157	-20.3637
-83.2606	-37.6544	153.003	89.7093	38.6462	34.0533	67.9762	167.95	58.6448	-22.1634
-93.5633	-41.4528	138.842	102.388	22.5179	35.4233	82.0844	161.462	59.2769	-14.3477
-83.6099	-45.0409	156.903	101.63	41.0041	15.0294	85.7984	167.726	27.9609	-40.0325
-86.2597	-62.9209	160.459	116.949	65.5047	27.4169	83.0012	151.352	29.7797	-35.0802
-107.677	-60.7113	147.034	84.519	37.1508	20.0231	84.7802	146.905	31.6032	-40.6684
-87.4064	-66.2704	143.285	83.2697	40.6826	9.18329	67.242	150.012	16.5937	-65.9031
-90.3631	-57.839	147.984	65.8348	58.1165	-3.70361	71.0371	127.018	40.7428	-70.4327
-98.4367	-83.1123	147.555	55.828	60.2673	42.0962	80.6529	126.071	10.7895	-83.7243
-84.2043	-81.189	149.19	59.3513	42.7657	25.8087	92.3762	140.382	32.5652	-70.741
-65.0819	-68.4356	142.185	38.7475	41.2292	31.846	104.378	134.21	27.2955	-54.7643
-81.0761	-73.484	140.264	27.2286	61.3357	3.85355	117.544	112.748	-1.38018	-66.4225
-81.0562	-62.5292	138.387	66.6972	74.4232	14.6704	101.678	117.987	27.0017	-45.6501
-71.5972	-58.7305	133.305	51.1321	35.9187	9.33091	111.451	117.713	21.1072	-47.2612
-74.3214	-60.987	134.369	27.9821	55.9698	18.3942	103.097	118.03	22.0608	-29.5222
-82.2123	-45.9086	108.978	33.4152	44.7945	19.4338	131.42	110.643	14.7049	-58.2965
-90.8927	-28.2559	124.162	37.8771	60.8775	-1.84354	111.546	120.723	29.4387	-60.1429
-97.9722	-29.674	112.662	35.3269	37.6805	-10.8187	104.637	138.418	3.74012	-55.8841
-98.2894	-23.7469	124.963	12.6233	19.8014	-8.9948	106.913	134.514	7.61017	-49.5209
-79.6175	-28.0327	102.56	49.4474	41.0458	12.3086	127.265	137.337	-7.05235	-64.2143
-101.179	-50.32	105.018	18.2763	67.1336	16.8097	107.715	141.615	0.91086	-64.9481
-103.73	-40.8222	111.349	21.2547	63.8107	18.2205	98.0499	108.502	6	-66.5825
-112.655	-3.65203	107.587	18.4212	40.7833	39.2554	121.028	109.155	23.7308	-70.8212
-129.321	-2.23036	99.2609	35.7925	40.5302	21.9168	110.293	106.853	19.8638	-81.6762
-128.302	-9.80489	104.601	26.9383	51.9376	18.5442	80.7521	132.152	32.8208	-45.3423
-110.277	21.9201	93.967	28.0772	66.4278	53.3368	98.4961	110.726	-2.70551	-57.881
-122.124	30.3424	106.385	31.2523	44.8443	58.7792	117.411	97.9452	-3.18707	-67.6175
-122.599	9.12387	109.07	20.8014	72.0536	49.1549	100.367	111.683	16.9957	-86.2847
-123.624	31.167	106.524	61.8888	75.1814	49.6791	95.6055	91.757	32.2157	-73.1476
-93.2135	34.9583	136.234	61.8189	66.1867	47.7827	99.6955	79.1208	28.3697	-72.3739
-105.58	48.028	116.688	43.7586	51.0869	51.0187	116.072	83.8335	17.8314	-59.433
-125.485	50.0083	131.026	41.5495	62.6331	62.0512	110.791	70.9778	34.9109	-40.9657
-103.703	64.9962	116.777	28.7186	48.9447	64.699	107.194	36.7021	35.3433	-25.1268
-73.9176	58.937	108.61	3.89816	53.0038	44.3307	108.062	61.9293	28.0948	-44.4258
-86.8017	40.15	95.6109	19.9947	52.7472	57.0512	107.389	69.0901	30.2532	-32.6637
-100.652	56.8935	92.1887	12.8804	50.3906	57.8676	104.459	28.8675	27.6075	-52.3261
-98.8467	58.7574	101.337	26.2842	60.6908	84.2459	97.9424	45.143	38.6142	
-103.255	68.2385	80.4592	34.2942	51.3705	103.442	103.682	57.5639	25.718	
-131.095	95.4348	89.7469	11.8072	53.1379	117.372	98.3665	33.7033	27.5875	
-124.855	98.2433	85.9614	17.2685	49.3071	106.977	117.721	21.4379	5.89597	
-107.99	104.876	81.4998	-11.2126	37.4555	91.1584	125.397	9.44367	24.1955	
-102.24	103.143	56.2135	-15.5746	12.9252	104.778	132.442	46.8468	33.4052	

Time Series Name: Enf-05 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 512

Graphical Representation:



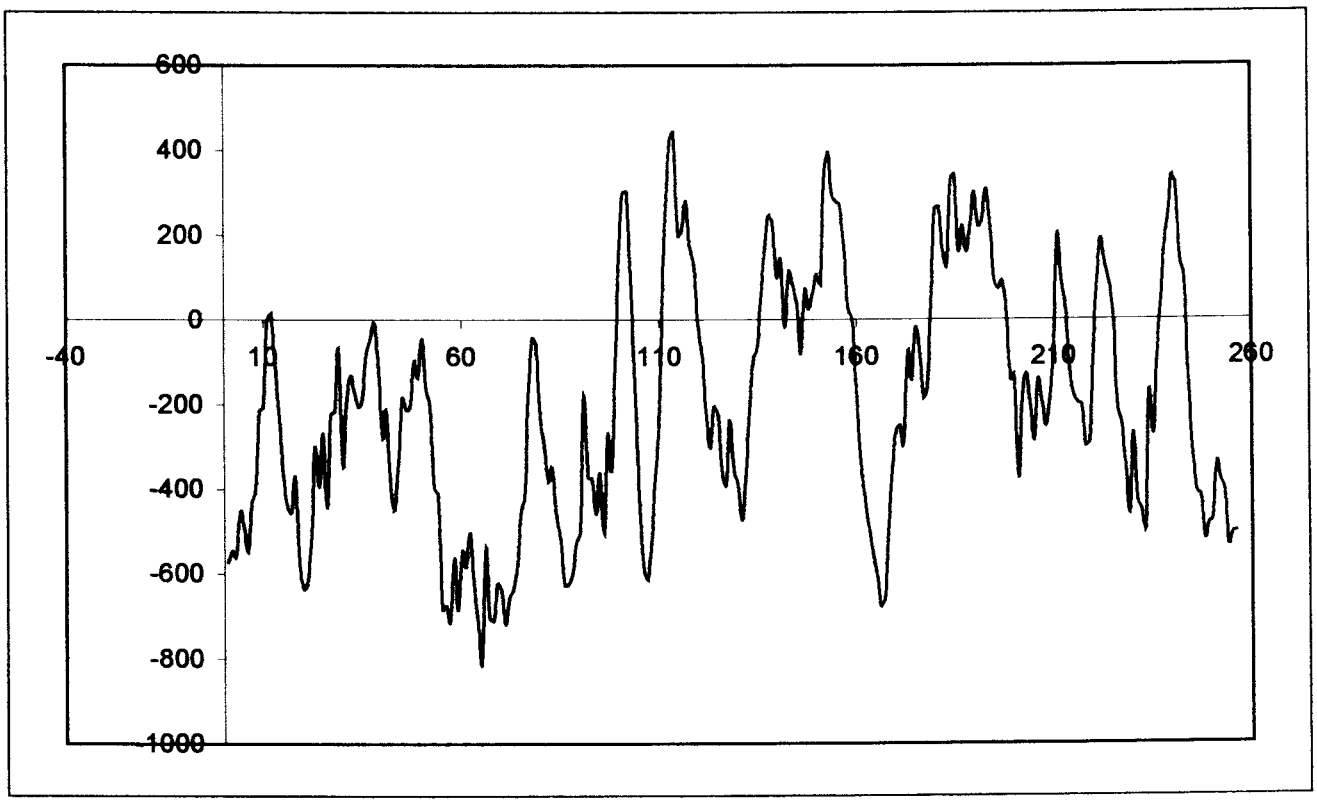
45.3831	51.183	46.4095	48.123	48.1746	48.2728	49.8765	53.6625	49.4308	48.3271
48.3962	48.3274	48.8472	48.5814	49.4252	51.2054	50.92	50.5251	49.7342	47.6499
44.2899	47.8371	52.1248	49.6694	46.7884	46.7798	49.1339	50.9424	53.2709	48.1032
46.0721	46.8972	49.5683	49.6756	45.9405	49.2563	48.9819	51.4393	49.3611	52.1377
48.3752	51.6463	48.9467	49.5769	53.3548	46.1603	47.5115	54.3013	51.5475	49.8594
46.1936	50.4952	48.4207	50.3556	48.767	49.745	48.7139	53.4341	51.431	50.7825
46.9698	47.4819	48.2525	51.1342	47.962	54.6668	49.1056	54.4931	50.7394	48.6902
43.4206	48.5812	46.6802	48.6081	47.0071	54.1964	52.2824	55.0838	47.8412	51.8651
46.0234	50.389	50.3482	52.577	49.0537	52.0047	51.8281	53.7588	49.2417	50.3525
46.1716	47.4692	50.9222	49.4632	47.2059	46.2239	48.4065	53.5496	46.4748	49.2623
47.7528	50.9601	45.9605	46.7047	50.02	49.1542	50.8553	54.4	48.8401	50.1877
47.8727	50.5003	49.4026	48.2284	51.7995	49.8878	50.4784	53.9038	52.325	49.8564
49.2635	48.1687	52.0434	44.7603	48.7813	50.3469	46.5378	50.9029	48.849	52.4236
45.9837	51.7836	50.5254	46.7215	48.6276	48.0469	47.0685	52.1605	51.7841	47.625
51.2246	49.2196	48.1719	46.5379	46.813	49.5978	50.1481	52.4058	50.9279	51.635
46.797	50.8756	47.4944	47.9877	48.6	47.7548	49.7451	52.0977	52.7349	49.361
47.0734	47.3832	50.8422	51.2347	47.0919	48.9602	47.864	50.5824	50.0407	51.7204
45.9164	52.3164	49.7826	53.1339	47.206	53.2361	47.93	51.8066	54.8801	48.1427
48.1678	50.1182	53.7694	49.1392	49.3509	48.8238	48.7721	49.1247	50.745	49.7535
48.8778	51.1649	52.1237	50.7568	48.8937	50.0266	49.5678	55.0299	54.5264	47.3769
49.4972	49.5152	47.9784	50.6022	50.1829	48.8409	51.0603	55.7824	49.0931	47.0568
48.8543	48.8434	50.981	50.0026	46.2141	48.7419	52.3597	54.4977	52.9037	48.7025
48.8471	54.1254	50.8081	50.4461	47.8245	50.8861	48.6584	54.2301	51.7833	45.7913
47.2801	52.8697	46.057	48.1935	48.5421	53.4121	48.8992	55.9271	51.5019	46.9054
51.3901	51.9499	49.6352	49.0673	46.9096	52.1697	51.3225	53.0288	49.2011	50.4596
47.4945	52.3231	52.0647	49.4542	47.5261	51.7363	49.0229	49.4829	53.1109	46.4395
46.725	50.0913	51.3122	48.067	46.2596	47.1327	48.1618	51.7737	51.7618	50.296
44.3419	53.0282	51.04	49.6217	48.9985	52.7601	50.729	52.625	53.1674	49.2787
48.4307	48.807	53.4057	49.4673	45.4835	49.1448	48.9111	52.2645	51.7085	47.0355
49.9522	50.6973	48.6971	51.8293	48.5125	52.633	50.9908	50.3445	51.0125	49.4919
49.535	51.6314	46.3158	45.1642	50.3096	50.3601	48.6954	51.8203	47.92	50.2742
49.1274	49.973	47.4098	46.6142	52.6518	50.4972	48.2763	55.6712	52.7275	48.7228
50.2212	54.266	46.8588	46.7089	47.0409	53.5478	49.7514	47.6035	50.888	47.0494
47.3831	49.5277	49.0134	51.2888	56.8022	50.9944	50.3289	51.2069	51.4841	48.1388
47.7374	53.1415	49.55	49.3842	50.4923	50.7227	52.405	51.0063	55.0917	47.4854
45.9271	51.1528	46.4377	48.5592	45.6549	50.9094	50.3774	52.545	53.3798	50.5653
48.2388	49.6354	48.7649	45.7342	47.1762	51.4535	51.1461	49.9479	49.5666	49.8632
50.412	50.8847	51.6964	49.6066	45.1087	47.4605	48.084	48.9441	50.1794	47.5201
52.0965	47.7085	49.8646	51.4919	46.6413	46.6411	52.2131	54.35	52.0745	50.5341
49.2457	51.7169	53.3989	48.7963	49.2165	52.0745	49.7776	46.9196	47.8513	48.2259
49.1777	50.1487	51.339	50.6277	50.5919	52.2008	50.5178	52.9416	54.1633	46.36
51.4823	50.1368	47.6408	48.1531	45.6296	52.6997	47.2159	51.7467	51.0525	47.9409
46.3193	50.9642	48.7613	47.5039	46.5752	48.9055	52.8291	48.9362	54.8993	47.3921
44.4958	51.4176	48.5338	46.5008	48.3403	46.7158	48.4372	53.6679	51.3033	48.2203
47.3756	52.0765	46.7876	46.7562	49.5725	51.5761	51.7024	55.2809	52.8574	
47.5803	52.1253	47.887	49.4081	45.3817	49.7749	52.4522	54.0902	50.9631	
48.7419	50.5533	47.5522	47.0004	48.6876	47.3996	54.7892	48.3279	53.4873	
48.7771	50.5162	49.0139	48.3002	49.2112	46.4363	51.7824	51.6115	53.5683	
48.7467	49.8949	46.6578	49.7507	50.2781	48.1422	51.7916	52.6251	55.772	
49.7567	47.3489	49.5518	48.4743	47.9746	49.0396	52.6553	48.8892	54.6471	
45.6884	48.6922	49.6785	46.408	50.6046	49.4122	50.9943	52.398	50.4838	
46.3337	50.4552	49.823	48.6906	49.9493	49.1938	50.4303	50.2111	50.5688	

Time Series Name: Enf-06 Surrrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:



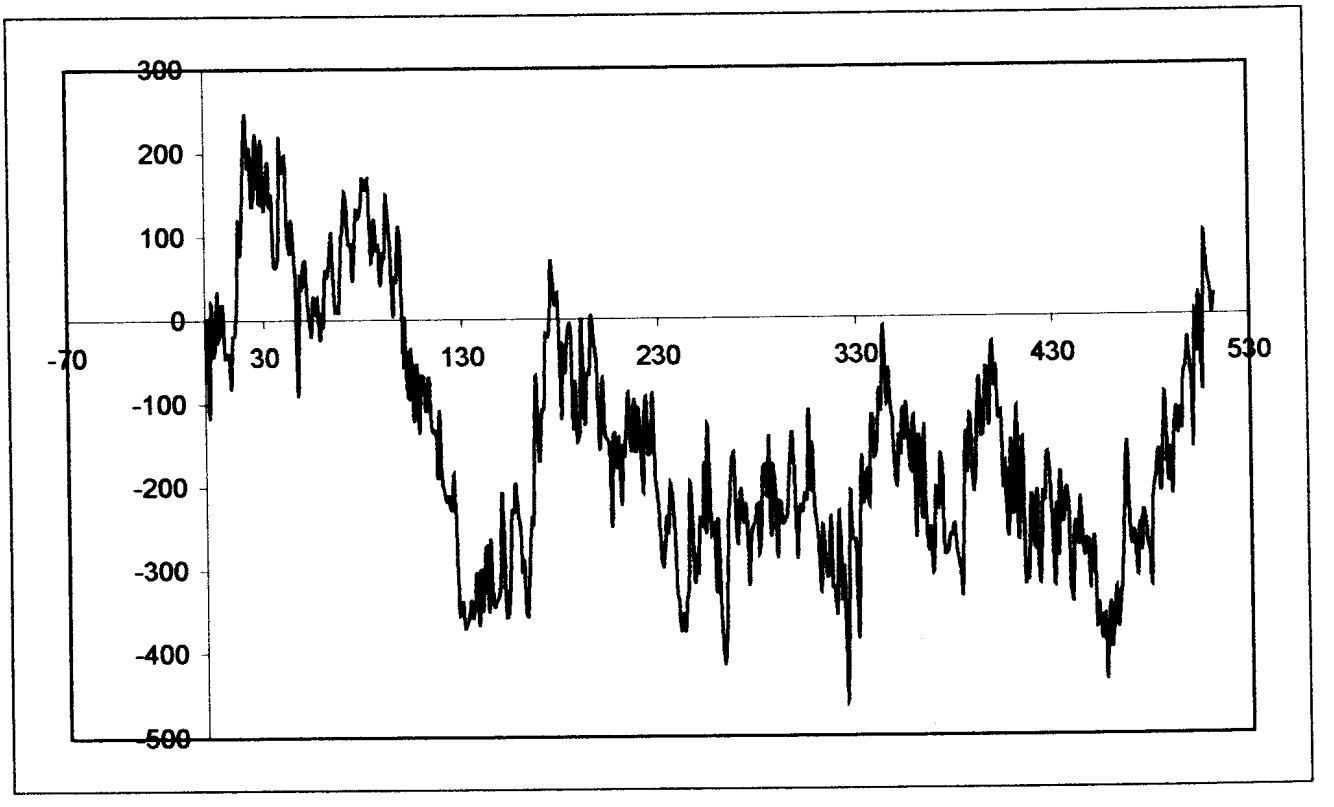
-572.639	-225.245	-395.842	-58.6782	-429.976	-474.423	166.794	165.503	-253.439	-174.288
-546.464	-218.106	-415.501	-232.154	-589.212	-379.363	24.7803	128.902	-183.173	-270.859
-560.795	-70.6839	-683.228	-296.604	-612.062	-206.062	0.29994	323.862	-59.0672	-100.119
-454.516	-345.545	-674.211	-380.535	-521.285	-99.4754	6	343.132	200.262	33.805
-488.193	-198.577	-711.095	-350.538	-374.977	-65.2564	-165.75	163.118	95.6238	165.231
-546.733	-133.296	-562.03	-467.54	-237.371	51.1206	-330.528	222.798	33.0069	241.419
-436.798	-168.905	-685.681	-516.771	56.6029	169.093	-416.121	160.425	-120.017	338.632
-398.064	-206.884	-547.118	-626.388	260.468	245.333	-492.496	222.998	-180.166	311.271
-216.172	-187.532	-583.805	-625.379	423.414	227.878	-544.153	301.343	-196.605	143.617
-207.29	-80.7073	-503.576	-598.734	441.875	100.645	-605.608	221.422	-204.66	96.1721
-8.72995	-46.7545	-616.184	-529.003	198.298	143.036	-677.396	233.839	-299.338	-143.647
12.4617	-8.64021	-719.962	-494.439	206.789	-18.7068	-656.555	308.873	-287.468	-321.006
-96.0826	-97.5126	-809.789	-179.957	280.375	113.255	-503.578	235.731	-80.7228	-406.624
-231.124	-278.344	-537.691	-373.128	176.624	84.3772	-350.682	91.2025	98.9608	-418.234
-366.028	-215.014	-703.031	-374.926	133.118	34.9889	-267.82	71.7277	191.858	-518.967
-442.315	-395.893	-710.288	-457.782	-3.53677	-81.7998	-250.041	91.4025	129.023	-481.935
-456.048	-447.601	-623.99	-361.416	-83.1805	71.1913	-293.409	29.9925	91.5842	-472.255
-372.805	-332.385	-643.503	-502.879	-215.534	23.697	-77.505	-144.774	17.7016	-339.715
-573.879	-186.979	-718.305	-269.563	-302.052	63.9313	-143.17	-131.8	-198.706	-375.666
-637.92	-213.872	-657.255	-354.849	-206.785	107.869	-19.433	-374.277	-245.099	-405.977
-622.235	-208.026	-636.439	-112.239	-227.433	85.6595	-68.974	-186.706	-339.827	-531.329
-511.318	-97.8474	-580.322	163.565	-356.105	326.503	-185.547	-128.583	-458.261	-506.841
-301.695	-134.981	-459.306	298.114	-390.616	395.856	-159.88	-194.65	-268.264	-501.519
-394.277	-45.3223	-407.284	301.458	-237.491	298.539	58.4288	-286.424	-428.706	
-268.854	-159.849	-174.66	92.6735	-356.163	278.942	259.071	-142.532	-449.671	
-444.066	-207.707	-43.0021	-184.117	-387.312	270.501	266.356	-196.23	-495.891	

Time Series Name: Enf-07 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 512

Graphical Representation:



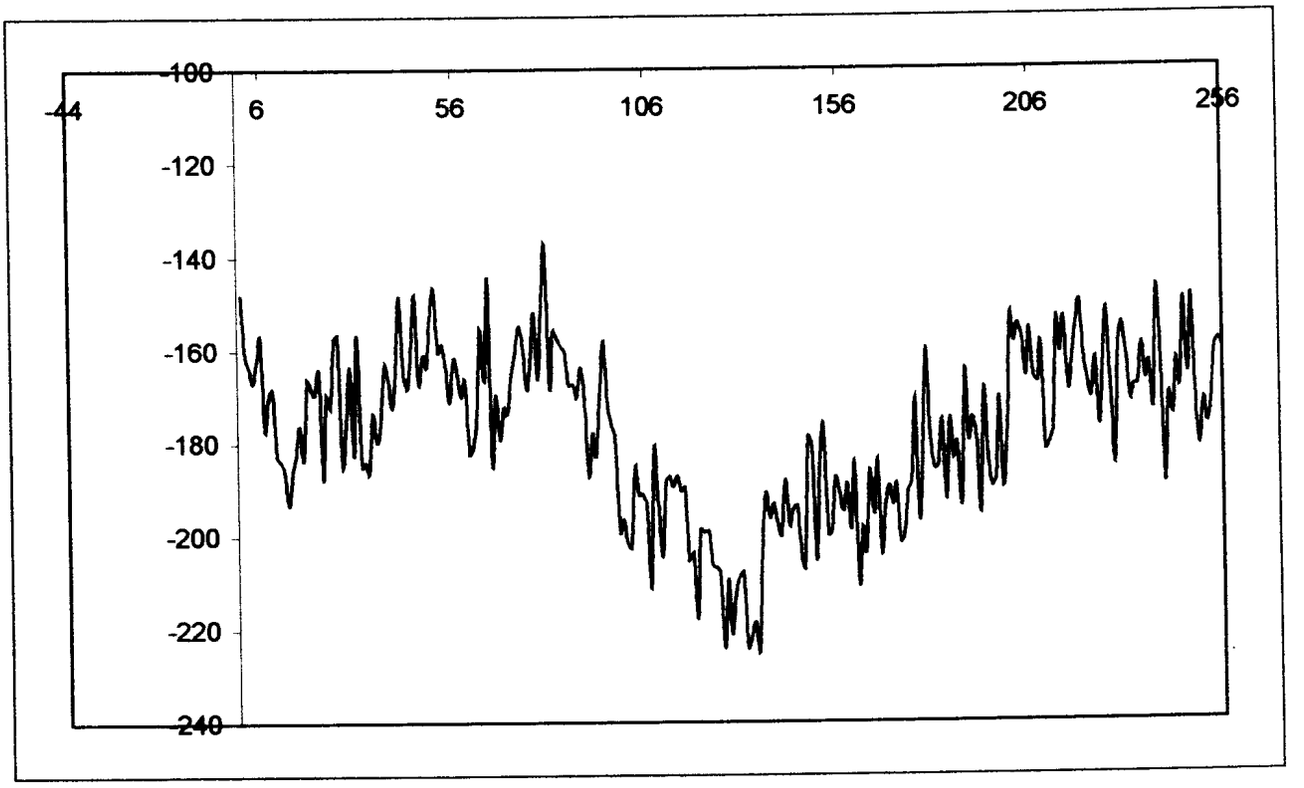
1.8046	-5.33312	-120.555	-237.346	-144.268	-373.936	-275.782	-240.258	-313.018	-273.828
-117.642	-17.5129	-55.514	-248.333	-223.349	-414.948	-311.059	-279.486	-216.964	-256.931
19.198	28.0306	-54.8393	-298.709	-153.101	-389.214	-302.237	-251.852	-240.686	-282.141
-42.508	7.22641	-135.949	-290.252	-164.782	-271.735	-237.954	-306.411	-275.945	-309.684
-35.3128	25.4347	-66.5501	-351.918	-122.965	-218.876	-323.427	-277.361	-208.217	-248.633
34.9307	-23.2802	-67.9861	-356.68	-89.475	-182.082	-322.999	-206.735	-297.091	-281.434
-19.4136	8.72115	-108.892	-273.152	-157.546	-162.52	-353.167	-228.219	-317.862	-234.294
5.9937	-7.18383	-101.66	-237.414	-157.476	-231.8	-235.694	-165.188	-211.408	-244.713
17.1131	59.4151	-69.2847	-244.183	-96.4124	-271.611	-270.291	-176.134	-219.556	-271.913
-44.8074	51.5787	-128.234	-124.484	-159.478	-238.271	-338.724	-283.715	-163.692	-280.27
-39.9953	65.3246	-135.576	-67.53	-106.31	-204.812	-302.168	-283.841	-166.561	-321.088
-42.7536	104.611	-133.711	-167.612	-155.69	-245.859	-459.131	-280.023	-192.651	-218.232
-81.9867	56.7855	-189.875	-133.657	-207.577	-223.221	-362.573	-260.429	-273.254	-197.004
-19.8605	10.6889	-108.777	-108.617	-111.332	-262.786	-210.333	-262.363	-321.24	-174.098
-18.2616	14.993	-189.719	-105.661	-93.424	-320.568	-257.784	-247.744	-225.281	-162.585
9.62896	9.39909	-202.712	-17.5188	-162.813	-259.302	-266.681	-268.823	-286.586	-210.095
117.421	97.4162	-217.99	-21.0193	-157.497	-247.628	-266.5	-288.443	-185.638	-175.813
77.7254	108.969	-211.387	-1.61134	-88.2912	-241.319	-384.616	-303.698	-243.863	-93.8002
127.871	153.364	-224.431	67.5841	-173.984	-225.202	-256.215	-331.258	-233.562	-136.953
208.928	141.238	-228.256	47.661	-206.998	-282.048	-165.612	-224.87	-205.573	-198.597
246.663	90.8796	-185.85	16.5084	-224.934	-259.199	-220.73	-137.905	-219.519	-158.975
185.528	91.1015	-275.677	30.7495	-287.506	-179.87	-211.933	-186.36	-316.248	-213.515
203.735	47.2499	-353.395	-50.5622	-298.182	-175.963	-181.801	-116.823	-339.679	-129.106
137.081	94.8859	-338.945	-119.249	-274.753	-214.751	-224.17	-152.405	-252.367	-110.412
147.161	131.592	-339.198	-32.8134	-237.609	-141.598	-116.982	-208.539	-245.39	-141.819
222.724	121.699	-370.273	-64.684	-256.077	-261.116	-116.487	-195.354	-273.362	-111.799
177.08	135.413	-362.789	-24.3428	-197.438	-177.044	-165.977	-130.795	-216.781	-134.443
139.843	169.487	-355.966	-4.71645	-225.644	-217.155	-147.739	-72.4355	-269.605	-68.8515
216.64	161.596	-337.414	-19.2754	-259.615	-287.239	-85.6019	-141.469	-287.024	-60.2051
133.241	156.432	-358.265	-131.648	-322.471	-220.148	-112.46	-140.647	-266.35	-26.3141
151.756	168.026	-346.032	-74.3444	-339.268	-221.902	-50.9598	-93.1904	-268.719	-50.3582
188.836	70.007	-304.215	-147.002	-375.651	-246.487	-11.1133	-61.2365	-326.033	-76.2055
135.595	80.9784	-367.72	-135.614	-353.674	-241.115	-102.649	-130.618	-285.668	-157.375
150.136	120.413	-300.573	-2.85457	-375.611	-236.491	-61.0739	-50.1695	-266.778	1.61484
66.7303	84.267	-349.661	-48.2918	-339.274	-182.617	-108.281	-30.7671	-369.145	-44.3756
62.6185	89.1017	-304.985	-126.88	-322.039	-157.825	-120.445	-82.732	-342.644	26.5762
73.7647	41.2898	-273.603	-65.2872	-197.848	-139.303	-177.355	-59.9966	-365.098	-48.7831
215.682	79.8772	-350.902	-67.132	-259.906	-216.416	-202.615	-121.289	-386.414	-85.7648
177.804	75.6024	-263.905	3.48896	-317.633	-288.053	-143.586	-113.76	-358.882	97.5715
182.721	148.776	-326.779	-2.79805	-283.747	-231.786	-161.63	-202.63	-434.241	71.6355
195.692	120.061	-345.018	-33.0222	-306.01	-224.921	-108.552	-175.843	-377.792	44.6252
102.569	87.1964	-338.39	-51.0946	-240.666	-232.03	-146.498	-244.164	-342.622	35.1286
79.8517	4.57741	-331.319	-155.634	-248.542	-210.883	-102.889	-260.969	-396.929	1.78981
119.494	51.1882	-302.971	-103.333	-172.646	-217.505	-154.045	-147.216	-348.374	24.4758
85.5348	48.0665	-207.594	-70.2376	-257.513	-109.894	-182.173	-237.055	-324.679	
45.8926	112.083	-270.696	-136.568	-128.605	-207.092	-129.854	-181.411	-372.787	
-90.9192	99.6144	-357.08	-143.887	-192.573	-149.648	-118.786	-110.93	-340.617	
51.719	-52.0303	-351.206	-150.274	-259.347	-221.944	-263.853	-267.566	-321.502	
36.7513	2.90395	-291.118	-249.246	-247.373	-251.637	-144.417	-180.96	-254.72	
67.9178	-82.1704	-229.172	-141.937	-328.549	-288.219	-167.588	-149.492	-173.755	
70.4593	-93.5987	-231.4	-136.006	-240.748	-327.91	-241.459	-318.975	-152.256	
23.0123	-34.5236	-196.295	-177.903	-304.688	-250.751	-129.412	-293.379	-243.109	

Time Series Name: Enf-08 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 256

Graphical Representation:



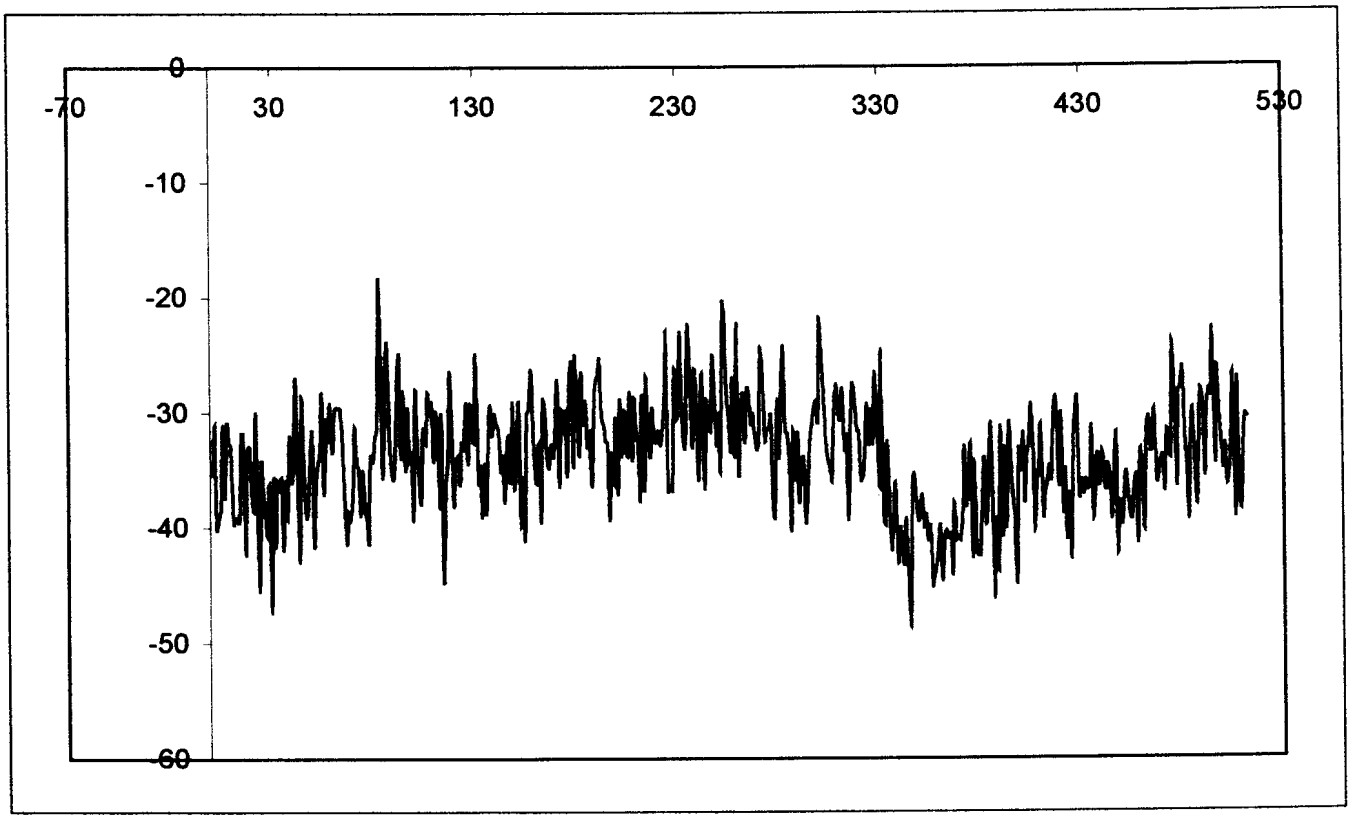
-148.214	-184.389	-158.689	-148.02	-191.051	-207.849	-194.916	-175.402	-159.014	-159.286
-160.925	-177.43	-163.726	-137.963	-193.793	-224.092	-189.033	-192.54	-181.823	-166.841
-163.834	-163.473	-171.147	-168.207	-211.029	-221.887	-198.793	-175.226	-180.579	-163.428
-167.076	-182.564	-161.78	-156.042	-181.185	-218.555	-184.13	-183.388	-177.106	-172.865
-162.035	-156.545	-165.204	-157.642	-191.69	-224.712	-210.737	-180.373	-153.61	-147.13
-157.145	-185.035	-170.006	-159.314	-204.637	-202.881	-198.451	-193.559	-161.05	-163.962
-176.974	-184.067	-166.523	-160.623	-188.509	-190.952	-203.76	-164.722	-153.576	-189.065
-170.391	-186.284	-182.327	-167.609	-187.225	-196.324	-186.102	-179.604	-168.902	-170.367
-168.423	-173.59	-180.989	-167.473	-189.52	-193.303	-195.563	-174.908	-163.095	-174.427
-182.531	-179.848	-174.075	-170.128	-187.171	-197.38	-183.81	-179.986	-155.674	-162.77
-183.809	-175.449	-155.489	-163.82	-190.419	-199.934	-203.931	-195.146	-150.087	-168.161
-185.723	-163.156	-166.528	-169.299	-189.586	-188.111	-194.272	-168.675	-161.978	-149.6
-193.261	-165.77	-144.734	-187.212	-205.087	-197.824	-189.522	-183.47	-167.299	-165.768
-186.652	-172.266	-184.429	-177.86	-203.824	-194.667	-193.465	-189.688	-170.702	-148.922
-182.606	-162.549	-169.665	-182.809	-217.925	-193.724	-188.973	-187.875	-162.512	-171.58
-176.142	-148.374	-179.351	-169.945	-198.732	-204.649	-201.571	-170.459	-176.715	-181.233
-183.619	-164.519	-172.478	-158.033	-199.345	-207.212	-199.311	-189.642	-164.058	-171.441
-166.325	-168.082	-173.619	-171.456	-199.06	-178.88	-190.543	-177.432	-151.837	-176.473
-168.102	-158.865	-164.83	-176.078	-206.294	-182.576	-188.433	-152.762	-170.929	-171.808
-169.385	-148.057	-160.602	-179.167	-206.807	-205.368	-171.039	-158.759	-184.878	-160.762
-164.471	-167.089	-154.884	-199.373	-207.92	-183.212	-196.9	-154.841	-159.778	-158.649
-187.774	-161.081	-158.446	-196.494	-224.298	-176.256	-178.433	-157.655	-154.83	-160.307
-169.896	-163.49	-168.558	-201.454	-209.364	-199.935	-159.909	-166.148	-161.788	
-172.021	-152.518	-161.612	-202.726	-221.152	-198.818	-179.567	-155.7	-171.177	
-157.463	-146.928	-151.925	-185.186	-212.396	-187.755	-185.749	-165.834	-168.359	
-156.673	-160.362	-166.294	-191.127	-208.938	-190.693	-185.253	-167.334	-168.131	

Time Series Name: Enf-09 Surrogate Data

Inhalation Agent used: Enflurane

Number of Points: 512

Graphical Representation:



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-31.1829	-33.2199	-32.5497	-26.2629	-31.2321	-30.9563	-32.0749	-44.2261	-30.8225	-33.8546
-40.0983	-28.2127	-28.2811	-30.0939	-32.9019	-28.3032	-39.4004	-37.9091	-36.4988	-36.9808
-38.9974	-37.1303	-30.2148	-34.7797	-37.7373	-32.6788	-31.8449	-41.0817	-30.0678	-31.6912
-38.4784	-30.7065	-29.0989	-36.0748	-28.4934	-27.8919	-27.5292	-40.8291	-38.8427	-33.1989
-31.1187	-32.4467	-34.2879	-32.698	-36.8362	-27.859	-27.9187	-41.1535	-34.9609	-33.9507
-37.3828	-29.2085	-29.8691	-39.5981	-27.0133	-30.9161	-31.6077	-38.5724	-41.1085	-24.022
-31.0078	-33.4954	-33.0534	-28.8355	-31.1955	-30.031	-31.6794	-32.9452	-37.0923	-29.89
-32.5963	-30.1526	-38.3219	-29.9515	-33.9098	-32.0223	-35.9123	-38.1163	-42.8291	-36.496
-32.8727	-29.5812	-30.0434	-33.799	-29.5777	-33.2826	-35.5839	-36.8246	-33.1971	-28.2494
-39.6623	-29.6592	-44.8517	-34.8264	-32.5726	-32.7636	-33.685	-32.8552	-29.24	-28.0885
-39.153	-29.6303	-36.2376	-32.7707	-32.6819	-24.5857	-29.2578	-42.7149	-28.6774	-26.1941
-39.1054	-31.8387	-34.2867	-33.9172	-31.5809	-27.424	-32.8462	-34.1731	-37.3256	-31.7031
-39.5219	-36.4705	-26.3999	-32.011	-32.8541	-32.4301	-29.8104	-42.217	-35.8912	-34.774
-31.8367	-41.4377	-31.3267	-27.1394	-31.9903	-31.4147	-32.8886	-42.5154	-37.2035	-39.4179
-31.8127	-38.6504	-38.1877	-36.457	-28.4043	-31.4798	-26.5216	-42.5134	-35.8975	-31.7575
-42.3766	-39.4244	-34.3255	-29.8472	-23.1427	-30.2579	-31.146	-36.1209	-36.7525	-29.7762
-33.7179	-37.3233	-33.7738	-31.7586	-36.8238	-38.4992	-36.4129	-33.9409	-36.5807	-35.4313
-32.9417	-31.2702	-36.2827	-29.9649	-36.3484	-39.1593	-24.5088	-39.6875	-31.1931	-37.9439
-35.2088	-34.28	-32.6763	-35.5761	-36.7562	-28.8792	-39.1238	-36.6161	-39.2456	-31.9186
-38.4187	-35.0091	-33.1408	-28.3409	-26.1752	-34.0336	-39.8241	-30.9024	-35.567	-28.0865
-29.943	-38.9377	-29.1003	-25.7384	-30.5483	-29.0699	-32.4899	-38.0474	-33.6335	-29.2724
-36.0923	-35.0012	-34.4607	-34.7537	-29.2032	-24.2284	-40.0779	-46.2174	-36.4376	-35.6504
-45.587	-38.5897	-29.1695	-24.99	-22.9723	-31.7055	-42.0733	-39.2125	-33.5027	-29.7945
-34.4578	-39.3705	-32.1147	-30.749	-30.3615	-31.8016	-39.3174	-43.6482	-34.9846	-28.0403
-37.1516	-41.2673	-32.5621	-33.5532	-33.156	-34.6776	-36.1811	-31.2424	-36.8627	-28.6637
-39.0903	-33.8615	-24.8272	-26.5299	-29.3904	-40.3549	-43.0701	-40.824	-34.5275	-22.7005
-40.7478	-34.2549	-36.2156	-31.0242	-22.3525	-31.7405	-40.056	-33.0946	-35.6667	-34.5359
-36.3307	-32.1215	-34.5827	-28.9793	-27.6446	-35.9183	-41.1448	-40.1296	-39.3323	-26.1404
-47.4146	-31.5997	-39.109	-32.8417	-33.0915	-31.7049	-43.3187	-31.1106	-36.2042	-29.7493
-35.5869	-18.5664	-34.4311	-31.7373	-26.2858	-37.8984	-39.2047	-34.0741	-31.9294	-32.4977
-41.6439	-23.5271	-38.8419	-36.4741	-29.2003	-34.4213	-43.3395	-37.2245	-42.2622	-35.0041
-35.9132	-35.6762	-32.6279	-30.5588	-35.9248	-33.9076	-48.536	-39.0121	-37.7651	-32.8306
-36.7639	-26.4358	-29.3069	-27.5955	-31.7281	-39.6073	-37.9141	-45.0081	-39.8216	-36.3389
-35.6733	-23.8558	-32.0413	-26.6475	-26.7387	-37.4949	-35.2849	-33.3918	-37.2597	-34.8624
-41.9395	-29.7839	-30.0408	-25.3918	-36.6573	-32.4219	-36.9905	-35.1873	-35.1348	-32.4497
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-39.0129	-35.8445	-31.4705	-31.2077	-30.7213	-29.833	-38.8463	-37.9219	-38.9074	-39.2435
-31.9795	-33.9127	-34.9925	-32.4781	-31.5572	-29.0412	-37.2055	-34.0049	-39.3162	-27.0154
-36.0752	-28.1442	-33.7432	-32.6737	-25.1439	-30.878	-39.7943	-32.6143	-36.495	-36.7851
-31.9548	-25.0984	-37.865	-39.4494	-27.965	-22.108	-38.8889	-29.2996	-35.5761	-38.4798
-26.9649	-33.9792	-33.6927	-33.7082	-32.9249	-23.8897	-41.2722	-32.1274	-41.4531	-32.8734
-33.9847	-28.0514	-32.0488	-36.1035	-30.0935	-28.9498	-39.951	-40.2919	-33.468	-30.3133
-42.9998	-35.0954	-36.113	-30.4211	-35.0699	-32.4409	-45.102	-36.1572	-35.7383	-30.5298
-28.8876	-29.5864	-29.0874	-37.1602	-20.4406	-34.0268	-44.3602	-34.8169	-40.1929	
-34.4421	-34.1554	-36.4626	-28.8534	-21.3563	-35.1134	-43.1685	-31.2188	-31.6089	
-39.1287	-33.5411	-35.0262	-33.8252	-28.3264	-35.9866	-41.4703	-39.0046	-30.4827	
-38.836	-39.4055	-28.9984	-29.9	-29.9331	-30.0995	-39.9157	-37.0354	-33.5086	
-35.2301	-28.1605	-39.8337	-31.4814	-33.472	-27.5719	-44.7221	-36.4798	-32.8561	
-31.739	-32.8598	-35.5945	-33.7297	-26.9993	-30.1317	-41.1229	-34.7091	-29.786	
-41.7173	-36.5771	-41.1909	-28.1881	-33.8991	-30.6926	-40.2529	-35.9448	-36.1251	
-36.3313	-37.82	-30.3779	-34.2185	-22.2347	-27.9274	-40.9705	-30.9235	-35.5756	

-82.4073	-136.163	-115.89	-265.325	-286.729	-306.678	-217.695	-128.161	-132.494	-145.004
-116.628	-149.412	-136.033	-197.367	-272.751	-217.951	-130.086	-107.411	-141.715	-98.8255
-102.221	-62.7073	-146.773	-196.498	-251.546	-153.588	-152.577	-25.5669	-164.342	-78.6226
-147.955	-90.572	-64.053	-207.077	-203.87	-142.372	-146.44	-69.5501	-123.784	-142.785
-64.4532	-85.8149	-55.354	-156.738	-267.21	-222.627	-164.987	-61.1147	-120.113	-151.821
-121.842	-111.448	-40.7722	-184.964	-292.47	-222.932	-173.711	-45.7245	-73.0981	-175.049
-108.991	-87.8009	-36.0993	-214.508	-282.859	-129.929	-126.151	0.77295	-31.257	-208.822
-119.799	-205.297	-87.2673	-178.015	-283.616	-219.977	-140.103	9	-97.2932	-52.6759
-58.5532	-124.863	-92.7468	-214.169	-255.014	-173.663	-190.786	-77.0048	-83.3974	-155.103
-179.454	-211.834	-51.7837	-197.387	-244.253	-203.079	-170.646	-97.9415	-104.212	-147.098
-126.069	-162.667	-55.1477	-229.734	-293.296	-263.836	-122.842	-93.8925	-115.011	-98.022
-61.3526	-144.343	-107.811	-282.757	-298.157	-190.315	-78.2408	-135.751	-169.037	-138.666
-65.183	-136.497	-93.0801	-313.692	-246.785	-191.778	-162.227	-163.005	-142.948	-99.1463
-82.1358	-151.745	-78.1855	-276.284	-271.152	-190.774	-91.5176	-115.521	-120.057	-142.215
-162.334	-67.1609	-59.2552	-208.997	-251.563	-191.023	-124.326	-112.025	-108.86	-75.5618
-72.7111	-120.159	-97.3658	-183.463	-219.656	-189.706	-120.531	-91.9271	-79.9748	-116.201
-140.928	-23.2368	-105.498	-115.594	-256.967	-107.145	-103.755	-89.2564	-110.359	-84.1661
-123.081	-36.8373	-61.6276	-281.57	-317.029	-238.053	-158.312	-138.648	-103.169	-112.501
-86.8705	-151.973	4.07087	-230.144	-280.686	-157.14	-122.184	-108.721	-88.2173	-110.718
-131.063	-145.668	-50.8052	-184.442	-223.278	-185.517	-184.48	-111.003	-154.486	-147.809
-91.464	-105.142	-87.7208	-211.742	-310.052	-174.035	-155.642	-68.8953	-39.3877	-82.909
-97.5841	-134.787	-123.388	-193.48	-251.602	-156.904	-134.496	-97.3059	-58.7662	-137.588
-70.5305	-117.114	-144.037	-199.763	-215.272	-249.075	-140.981	-121.593	-41.0459	-101.541
-135.654	-174.907	-77.7405	-280.662	-242.392	-207.375	-115.911	-136.187	-99.1703	-87.7814
-131.414	-153.034	-143.578	-340.292	-292.745	-223.925	-122.514	-149.552	-111.229	-73.5273
-83.7809	-88.1411	-189.259	-334.835	-179.293	-249.483	-109.704	-154.478	-237.378	-45.8997
-78.4345	-23.7684	-183.388	-275.322	-232.766	-209.972	-120.033	-144.429	-225.172	-161.794
-106.331	-125.79	-147.656	-367.908	-271.187	-185.693	-154.793	-167.488	-160.821	-
-97.2059	-35.7727	-223.309	-312.057	-253.872	-197.717	-165.364	-69.0558	-173.435	0.88221
-70.8641	-82.3142	-246.675	-274.441	-238.577	-175.596	-168.295	-131.422	-200.033	3
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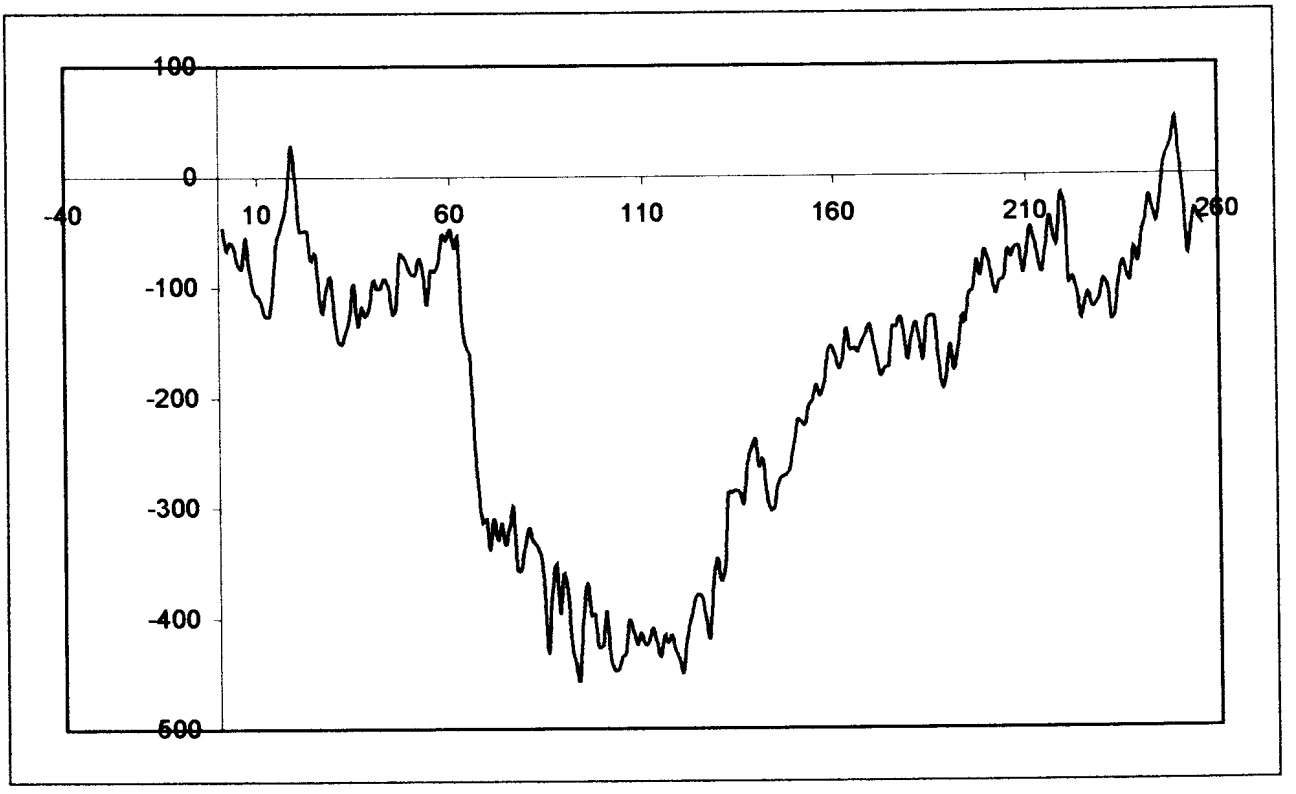
-110.414	-82.0626	-256.172	-181.853	-314.681	-195.759	-136.911	-179.367	-211.951	-31.4315
-87.6023	-90.2777	-212.787	-191.481	-246.58	-170.677	-186.841	-85.7551	-219.925	-46.7061
-93.4754	-126.225	-264.689	-247.381	-202.346	-205.297	-102.13	-124.263	-149.733	-57.5561
-59.7787	-160.7	-285.491	-263.092	-274.032	-185.34	-113.142	-70.1371	-129.466	-17.0539
-68.7775	-165.672	-278.55	-251.118	-231.053	-163.339	-144.099	-116.884	-135.329	-106.612
-1.88454	-173.12	-255.82	-307.255	-235.311	-182.925	-69.697	-153.419	-184.142	-116.103
-17.373	-151.334	-225.69	-298.258	-200.189	-180.332	-91.9866	-115.91	-198.482	-144.798
-77.321	-157.551	-290.567	-381.438	-211.003	-160.996	-121.075	-177.343	-169.527	-181.881
-95.9941	-161.903	-285.468	-374.022	-263.555	-179.032	-128.209	-203.494	-151.979	-117.111
-72.327	-93.064	-213.553	-306.477	-163.733	-249.01	-85.4198	-209.662	-179.881	-79.9738
-103.189	-2.55258	-196.549	-271.978	-264.442	-209.235	-122.054	-232.322	-163.984	-117.885
-132.18	-130.744	-214.573	-237.296	-246.689	-185.758	-113.226	-146.648	-162.944	-108.41
-58.3939	-55.9802	-241.845	-277.31	-258.792	-216.701	-148.91	-104.769	-155.844	-71.4555
-88.2748	-110.707	-210.718	-317.877	-295.362	-162.748	-56.037	-207.575	-118.02	-96.8014
-116.993	-69.9698	-179.142	-290.194	-263.014	-165.072	-116.189	-97.4117	-188.176	-65.6558
-132.978	-149.788	-194.064	-255.807	-228.083	-173.286	-130.791	-114.336	-157.642	-128.702
-108.319	-106.288	-268.859	-303.865	-208.535	-186.968	-85.2856	-92.1989	-199.234	
-92.1918	-95.5292	-316.128	-288.739	-192.962	-150.563	-75.8518	-83.8845	-217.314	
-118.056	-115.106	-349.478	-319.72	-319.485	-174.174	-120.86	-79.0081	-174.912	
-133.995	-173.983	-230.506	-284.572	-218.785	-205.917	-56.7025	-102.519	-151.307	
-147.61	-9.37773	-294.713	-292.584	-251.356	-142.561	-135.073	-130.39	-139.576	

Time Series Name: Iso-01 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 256

Graphical Representation:



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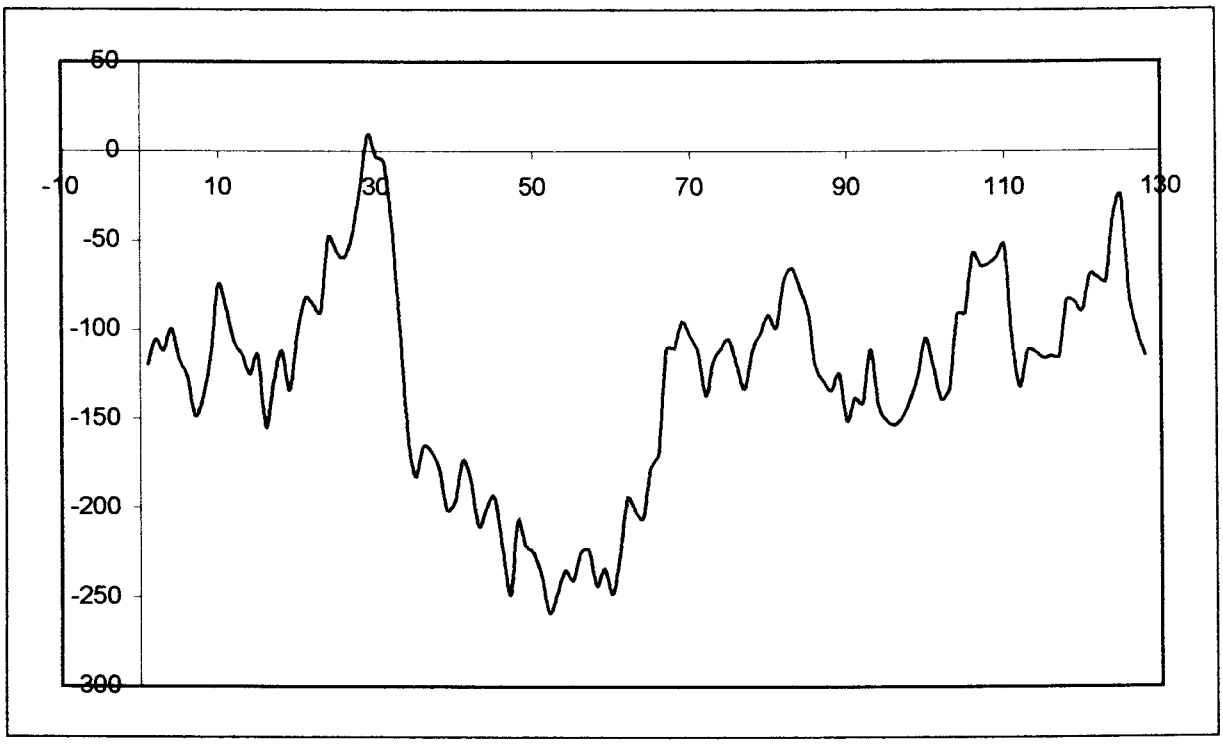
-66.228	-101.444	-115.614	-318.388	-402.312	-287.41	-160.889	-131.134	-73.248	-90.3403
-59.2116	-91.5427	-85.3921	-329.241	-413.357	-286.669	-154.329	-128.058	-47.8631	-96.111
-63.8706	-124.618	-85.6111	-333.989	-424.241	-285.487	-162.068	-128.98	-60.3885	-67.3692
-79.8181	-148.732	-75.9716	-343.685	-413.703	-288.259	-175.11	-167.278	-77.0166	-79.4169
-82.7102	-151.342	-52.812	-377.892	-424.183	-296.79	-163.609	-192.531	-88.7728	-54.388
-54.7041	-139.107	-57.5667	-431.821	-421.939	-261.477	-138.949	-179.553	-66.4337	-41.8356
-82.8168	-125.159	-47.6424	-377.456	-409.297	-245.945	-157.797	-153.701	-38.2789	-19.6573
-103.059	-97.2545	-64.5961	-351.527	-421.01	-239.115	-156.641	-176.288	-56.6037	-33.5145
-107.592	-134.142	-54.6473	-395.646	-435.276	-263.384	-160.101	-156.888	-63.1633	-42.619
-113.079	-117.803	-129.6	-360.654	-416.869	-257.564	-151.409	-128.624	-17.6764	-19.6688
-125.199	-125.912	-154.137	-375.613	-422.542	-290.148	-144.266	-132.602	-32.6423	10.5278
-126.384	-120.235	-163.219	-424.886	-416.279	-303.523	-135.259	-108.386	-97.8561	21.5465
-101.72	-93.9067	-229.369	-442.467	-430.664	-300.272	-151.967	-103.484	-92.999	32.0318
-59.8932	-101.179	-277.892	-455.644	-439.211	-279.269	-166.99	-77.7094	-105.753	50.4544
-48.2835	-99.9606	-312.938	-401.532	-449.683	-272.985	-181.941	-91.0797	-129.245	15.3241
-34.1045	-92.5336	-310.102	-368.806	-419.434	-271.163	-174.502	-69.0745	-118.375	-21.6322
-10.5411	-99.4771	-337.943	-397.434	-400.468	-265.63	-172.259	-77.292	-106.827	-71.4685
28.3248	-124.486	-310.405	-397.268	-384.705	-243.063	-137.493	-95.7997	-119.347	-52.1854
-2.1542	-118.96	-329.334	-426.367	-378.916	-221.578	-137.608	-107.598	-117.413	-31.948
-48.8906	-69.9696	-313.933	-424.235	-381.504	-223.138	-129.098	-96.6796	-110.83	-40.3344
-48.5292	-73.3138	-333.805	-394.382	-403.131	-226.131	-144.876	-94.1453	-95.3238	-46.2712
-49.0652	-81.2902	-316.377	-434.934	-418.092	-208.379	-166.693	-68.604	-102.642	
-74.7271	-87.8684	-300.534	-447.249	-367.16	-203.582	-146.689	-74.5122	-131.242	
-70.1485	-88.55	-356.531	-446.342	-346.809	-189.648	-133.795	-66.8637	-126.64	
-103.557	-73.7414	-356.752	-435.829	-366.926	-199.638	-150.237	-65.7605	-96.5952	

Time Series Name: Iso-02 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 128

Graphical Representation:



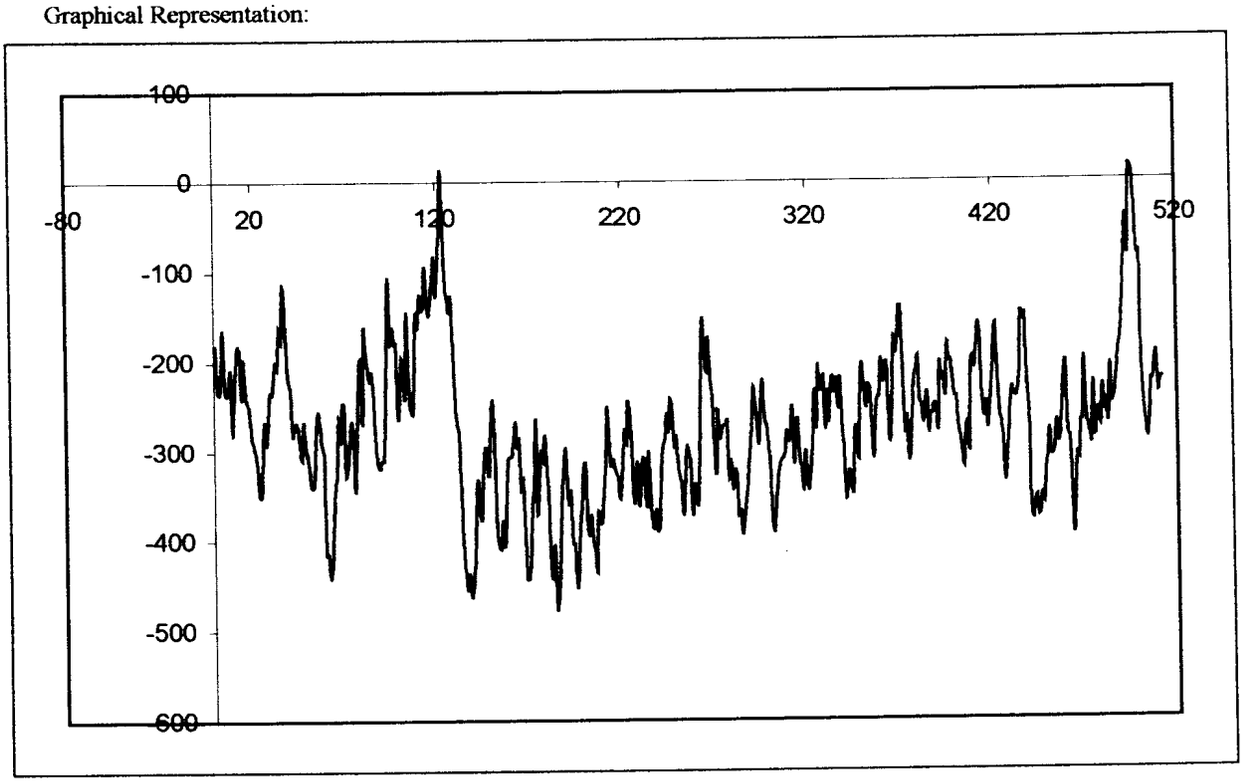
-119.531	-125.009	-47.0969	-196.697	-247.816	-169.314	-101.818	-140.91	-90.4124	-83.5146
-105.76	-114.767	-20.9142	-173.469	-234.982	-111.063	-91.7589	-110.842	-57.3341	-84.297
-111.461	-154.825	9.18675	-184.59	-240.5	-110.149	-98.5258	-142.704	-64.1994	-88.7239
-99.4893	-129.293	-2.73398	-210.234	-224.728	-95.7144	-71.7506	-150.694	-63.0424	-68.809
-117.091	-112.066	-5.74566	-199.938	-223.619	-103.586	-65.5213	-153.499	-59.2707	-70.909
-126.245	-133.991	-41.0025	-193.795	-243.46	-112.738	-76.8819	-149.036	-52.2516	-72.9144
-148.515	-102.05	-98.3461	-222.561	-234.143	-137.028	-90.2074	-138.82	-102.74	-36.4394
-137.594	-82.4192	-159.653	-248.589	-248.032	-118.146	-120.439	-126.218	-132.151	-25.4434
-112.928	-85.5597	-182.395	-207.499	-227.574	-110.459	-128.829	-104.628	-111.541	-79.0072
-74.7804	-90.1964	-165.978	-221.105	-194.908	-105.7	-134.155	-120.629	-112.154	-100.949
-88.0611	-48.2624	-168.285	-225.018	-201.577	-119.871	-124.786	-139.022	-115.971	-114.558
-106.9	-56.0138	-178.128	-238.174	-205.656	-133.03	-150.954	-133.258	-114.505	
-114.124	-59.5557	-201.082	-258.819	-177.329	-111.735	-138.306	-91.098	-115.06	

Time Series Name: Iso-03 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 512

Graphical Representation:



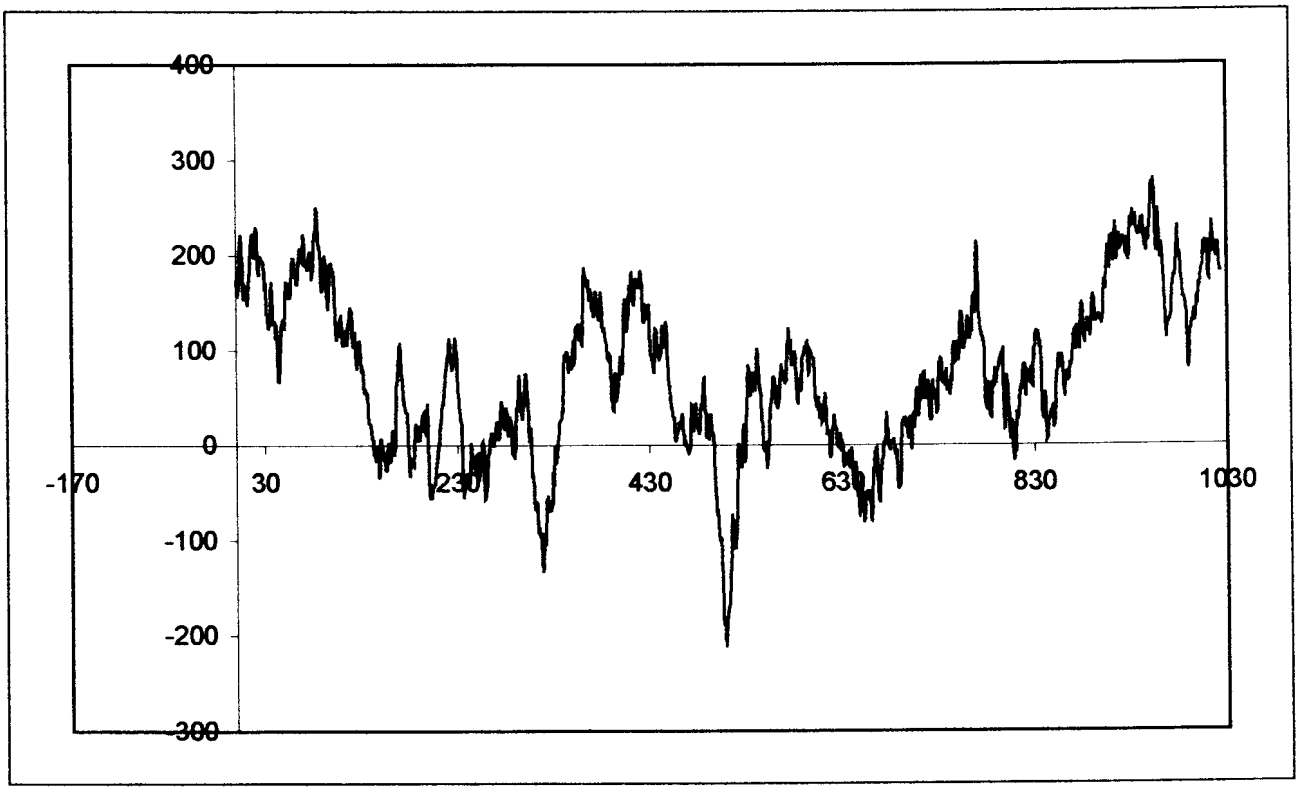
-180.909	-340.221	-228.899	-365.167	-379.506	-360.198	-315.414	-291.664	-246.805	-267.794
-232.833	-325.087	-253.896	-308.698	-345.272	-302.073	-270.816	-246.935	-276.393	-197.671
-235.508	-270.981	-257.941	-306.617	-312.393	-203.138	-265.7	-175.197	-252.429	-261.723
-212.164	-255.535	-209.726	-305.238	-251.643	-152.562	-308.368	-192.582	-218.093	-273.702
-164.452	-272.572	-146.045	-288.626	-284.467	-193.638	-319.89	-175.75	-179.472	-285.204
-228.846	-294.156	-162.628	-266.916	-316.726	-211.809	-345.024	-139.79	-161.536	-293.559
-236.613	-302.843	-124.791	-296.335	-309.51	-174.554	-300.623	-140.221	-217.053	-224.453
-232.257	-414.036	-143.035	-286.62	-317.623	-218.223	-331.42	-219.827	-258.31	-284.152
-209.86	-413.943	-138.748	-341.819	-325.321	-243.37	-344.381	-279.537	-268.167	-259.281
-279.959	-441.44	-93.9421	-331.038	-330.853	-296.734	-320.14	-264.439	-289.34	-255.672
-243.533	-428.5	-126.457	-393.524	-354.242	-325.694	-294.487	-311.423	-334.871	-274.389
-203.846	-376.535	-148.325	-442.661	-313.274	-255.904	-233.511	-307.113	-310.545	-228.806
-181.268	-342.282	-132.757	-442.902	-276	-287.116	-276.055	-255.32	-284.391	-257.034
-186.526	-323.655	-109.813	-425.036	-290.248	-278.698	-204.903	-216.579	-247.201	-245.445
-241.133	-262.77	-82.5701	-362.816	-245.402	-272.572	-233.439	-210.457	-231.457	-268.673
-196.004	-289.62	-127.091	-339.229	-255.386	-272.239	-228.445	-196.211	-240.199	-205.473
-232.042	-245.198	-89.2281	-264.21	-296.611	-266.936	-218.46	-244.365	-241.045	-248.184
-244.371	-247.189	-52.6177	-367.818	-356.916	-330.892	-276.729	-250.307	-233.745	-243.683
-249.821	-326.31	13.499	-330.392	-348.581	-311.137	-233.655	-270.181	-214.224	-221.516
-285.204	-315.596	-49.8751	-302.307	-312.57	-343.501	-268.755	-247.606	-147.242	-196.55
-291.619	-292.357	-108.573	-310.734	-361.681	-321.391	-227.592	-237.6	-155.985	-181.609
-301.406	-266.241	-129.154	-281.995	-332.416	-325.574	-217.962	-282.246	-148.8	-163.549
-316.084	-286.092	-144.631	-314.893	-307.609	-371.921	-235.909	-259.523	-222.179	-128.024
-348.618	-344.633	-127.468	-347.954	-326.925	-366.444	-220.622	-260.946	-256.742	-79.6739
-350.009	-283.351	-187.125	-430.474	-362.948	-393.998	-253.691	-248.452	-364.752	-39.4488
-307.441	-220.235	-239.628	-442.8	-300.59	-377.926	-219.259	-254.279	-377.641	-82.4637
-266.015	-197.142	-269.281	-405.467	-346.754	-350.775	-267.58	-277.694	-361.116	16.5362
-292.023	-268.783	-279.744	-476.169	-381.23	-327.645	-300.516	-204.044	-353.362	14.5977
-263.528	-163.491	-352.42	-466.157	-388.147	-300.502	-353.985	-223.262	-373.473	7.18461
-233.497	-187.589	-412.979	-432.279	-365.916	-273.331	-338.051	-217.639	-368.378	-31.9508
-236.136	-206.814	-435.618	-361.482	-389.768	-229.702	-323.383	-239.875	-348.737	-84.012
-220.598	-221.148	-454.644	-326.061	-386.202	-250.088	-335.284	-181.254	-358.899	-80.1439
-199.009	-211.013	-437.013	-297.095	-322.846	-268.245	-347.626	-200.856	-324.081	-200.555
-207.175	-238.026	-462.906	-323.851	-294.633	-293.503	-274.848	-199.836	-306.018	-249.316
-163.434	-299.416	-451.152	-359.765	-287.541	-248.412	-280.807	-221.437	-277.251	-272.065
-177.019	-315.135	-421.998	-345.263	-258.71	-222.015	-308.365	-241.026	-306.443	-288.223
-114.534	-319.145	-361.937	-402.988	-279.18	-263.988	-224.988	-241.151	-306.403	-268.045
-130.016	-310.371	-331.664	-404.24	-243.32	-271.201	-203.475	-278.014	-298.092	-224.195
-187.415	-309.919	-366.634	-452.358	-249.913	-290.55	-230.547	-284.889	-268.194	-223.86
-221.809	-271.71	-375.415	-442.06	-294.592	-314.255	-253.441	-299.283	-291.925	-202.837
-228.953	-186.066	-315.443	-384.257	-283.177	-379.227	-227.383	-318.156	-284.323	-193.567
-281.652	-105.833	-295.346	-361.083	-312.467	-391.145	-232.73	-279.517	-252.134	-235.791
-273.708	-178.45	-304.588	-319.756	-328.253	-361.542	-278.894	-269.425	-212.938	-223.577
-267.643	-160.713	-327.145	-313.855	-337.433	-338.323	-309.299	-298.714	-203.285	-222.101
-272.611	-179.593	-272.13	-376.872	-371.542	-319.3	-255.979	-203.469	-282.008	
-292.165	-177.711	-242.383	-394.361	-331.241	-312.189	-241.91	-195.999	-286.133	
-308.356	-261.233	-287.597	-370.883	-295.372	-309.166	-240.912	-208.755	-328.302	
-266.8	-238.692	-377.59	-400.374	-302.123	-304.241	-198.656	-179.196	-394.087	
-293.824	-195.491	-404.153	-409.561	-312.964	-278.844	-224.868	-159.038	-347.422	
-303.39	-217.304	-409.157	-434.182	-372.156	-290.634	-205.844	-170.45	-306.098	
-317.424	-238.692	-377.272	-368.324	-337.488	-285.947	-202.728	-245.857	-310.199	
-339.162	-145.205	-406.775	-381.208	-342.732	-250.51	-269.084	-263.123	-268.738	

Time Series Name: Iso-04 Surrogate Date

Inhalation Agent used: Isoflurane

Number of Points: 1024

Graphical Representation:



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156.291	186.353	138.35	-14.8396	-32.583	37.0424	100.758	182.446	0.83181	-22.8969
179.075	181.275	103.996	-32.4646	-30.5985	35.616	123.7	158.339	7	1.28684
194.612	170.454	116.251	-14.0499	-41.2194	28.1193	122.931	148.003	-4.97572	20.7215
220.725	169.448	118.764	-15.7358	-44.5773	39.8933	126.433	146.987	-9.27582	-18.1973
208.684	180.284	104.303	-17.7756	-37.9056	45.7066	126.692	173.734	-5.40032	13.7256
183.143	202.752	80.0347	-21.2285	-8.63514	74.5711	111.027	174.981	4.79613	37.6346
153.789	206.72	101.479	-4.31769	1.21651	73.902	115.891	166.703	42.319	62.4196
169.422	201.22	107.629	21.7574	-22.9406	51.3017	104.185	166.204	36.1284	83.5891
154.169	193.866	109.194	19.4417	-22.3998	48.7612	121.27	167.693	14.3977	68.3394
158.257	221.366	103.644	4.9809	-12.2596	5.89932	162.714	180.493	33.6989	51.6677
147.415	207.313	76.8062	16.3581	-26.924	17.5774	185.934	182.934	43.1678	57.2117
160.49	191.5	81.5975	5.87173	-17.3832	3.72735	172.88	161.117	27.7954	57.1048
176.24	189.141	71.1866	13.5523	-10.222	-33.7697	176.391	131.002	20.5457	75.4094
207.914	185.584	55.2934	16.8751	-36.5061	-30.0624	167.588	129.214	19.2693	65.0181
212.995	195.259	58.3167	30.4128	-29.5214	-49.3256	173.474	147.466	12.0272	60.9003
222.587	193.945	51.8444	33.4633	-12.7645	-67.5983	153.009	132.968	17.7349	76.6679
201.944	203.018	53.9738	14.742	-12.5855	-59.9778	164.414	137.936	41.504	101.1
197.363	199.762	35.8079	32.8217	-1.31204	-61.5578	161.286	145.376	39.316	83.4968
201.408	175.071	22.8366	10.7178	3.16713	-91.9768	142.386	147.069	59.2098	68.2115
229.081	189.811	22.3324	42.7488	-13.1806	-87.2737	149.091	97.6068	69.6495	60.1118
222.237	222.543	15.3112	13.3865	-56.3967	-96.4526	135.294	95.6282	36.6459	49.1991
189.426	217.429	7.5981	-48.0383	-50.1371	-93.1666	146.66	89.9831	32.3665	29.5855
179.325	238.068	4.22882	-55.9429	-38.0035	-116.434	161.828	88.1574	8.32491	16.9342
198.921	249.979	-9.78101	-41.2299	-16.3444	-132.202	147.641	75.994	22.2461	-3.66455
197.517	241.624	-11.0353	-55.0572	-6.72508	-103.933	137.443	94.6898	6.17789	-6.32068
194.192	215.225	-16.6213	-44.4288	-3.16593	-93.9775	131.915	121.475	30.8363	-
193.022	206.953	-9.23229	-43.2853	12.7519	-104.724	131.866	115.096	31.4323	0.24103
181.341	186.007	-1.92155	-40.0467	11.6007	-61.5084	161.105	100.682	15.149	1
164.164	161.791	-33.9303	-29.3863	12.3375	-53.9249	138.561	97.7878	11.9343	-24.505
171.21	171.426	-29.9312	-13.6056	-	-69.0202	119.967	89.5327	-2.72228	-11.3676
138.262	172.786	6.33433	-12.6135	0.65063	-58.274	119.781	95.5036	-31.705	-4.24555
136.97	198.709	-4.98289	3.83594	7	-68.636	123.46	96.8693	-55.3778	13.9262
123.081	193.677	-2.36205	0.56909	6.81265	-65.1502	110.344	125.082	-73.5143	37.3024
125.841	160.869	-14.0746	22.038	10.4217	-61.7953	105.633	103.697	-68.1311	47.7085
146.493	151.809	-14.0054	32.8271	23.9569	-29.0507	93.0883	114.667	-82.0934	63.6469
171.991	143.559	-25.6778	42.582	17.5245	-41.7965	88.2828	110.788	-99.9596	71.6288
137.91	180.922	-25.5756	43.0718	6.23309	-1.8866	96.5619	129.456	-98.0891	68.016
127.646	190.037	-13.2464	55.9331	9.17582	-18.4708	92.1301	106.317	-114.327	61.3711
129.943	191.338	1.62994	72.3132	42.854	-7.92676	58.902	84.3955	-171.331	41.4047
112.287	184.517	-17.3916	80.2705	45.6665	-	43.7775	64.1181	-188.56	44.2732
125.965	183.213	-15.9007	89.8956	38.7989	0.88139	37.2953	49.7512	-189.664	38.3785
103.359	159.021	1.52115	98.4953	34.9246	4	64.146	44.7847	-210.902	56.1975
67.4263	137.989	15.3928	111.798	17.5717	16.6429	75.8587	32.8748	-189.274	61.8608
66.993	111.053	-3.26288	94.9746	28.4015	24.5687	47.0041	30.3794	-177.449	83.8131
85.0911	128.538	-10.1813	93.4316	38.6058	25.8312	53.1243	27.7166	-171.52	76.2026
120.056	122.05	6.1396	79.5303	27.0295	36.2767	56.175	7.79861	-163.432	75.2741
130.82	115.774	54.5265	82.4898	10.0098	35.2847	70.6293	4.89159	-143.097	72.0519
131.195	128.886	71.7057	88.5418	15.8455	72.9767	92.758	16.414	-101.484	64.5721
122.263	136.394	96.3738	112.385	29.3956	94.5463	81.5441	12.6662	-73.9043	68.0448
140.994	120.185	102.075	107.526	22.6191	89.5288	74.8638	23.0938	-97.5655	101.397
172.352	105.036	106.968	86.1895	13.3894	97.7228	87.4973	22.5428	-108.285	110.241
163.445	116.646	93.824	64.096	-9.27609	97.065	132.407	24.5476	-108.313	122.289
170.657	119.796	69.4079	45.1292	-10.0594	76.3127	153.345	32.4346	-85.924	104.491
155.207	113.539	55.2698	38.9138	-13.3859	86.6472	132.558	24.2905	-74.5317	109.64
155.097	105.519	43.9807	28.1034	7.25111	92.2125	120.233	6.13503	-14.9064	83.4295
159.652	119.26	38.1629	15.827	36.1284	80.1906	126.293	0.07282	0.81446	93.8493
187.118	128.482	34.8693	-17.4989	43.5422	83.5606	144.1	92	7	92.6386
196.755	135.97	33.074	-54.4076	72.7018	109.133	167.26	4.73686	-11.8794	97.6707

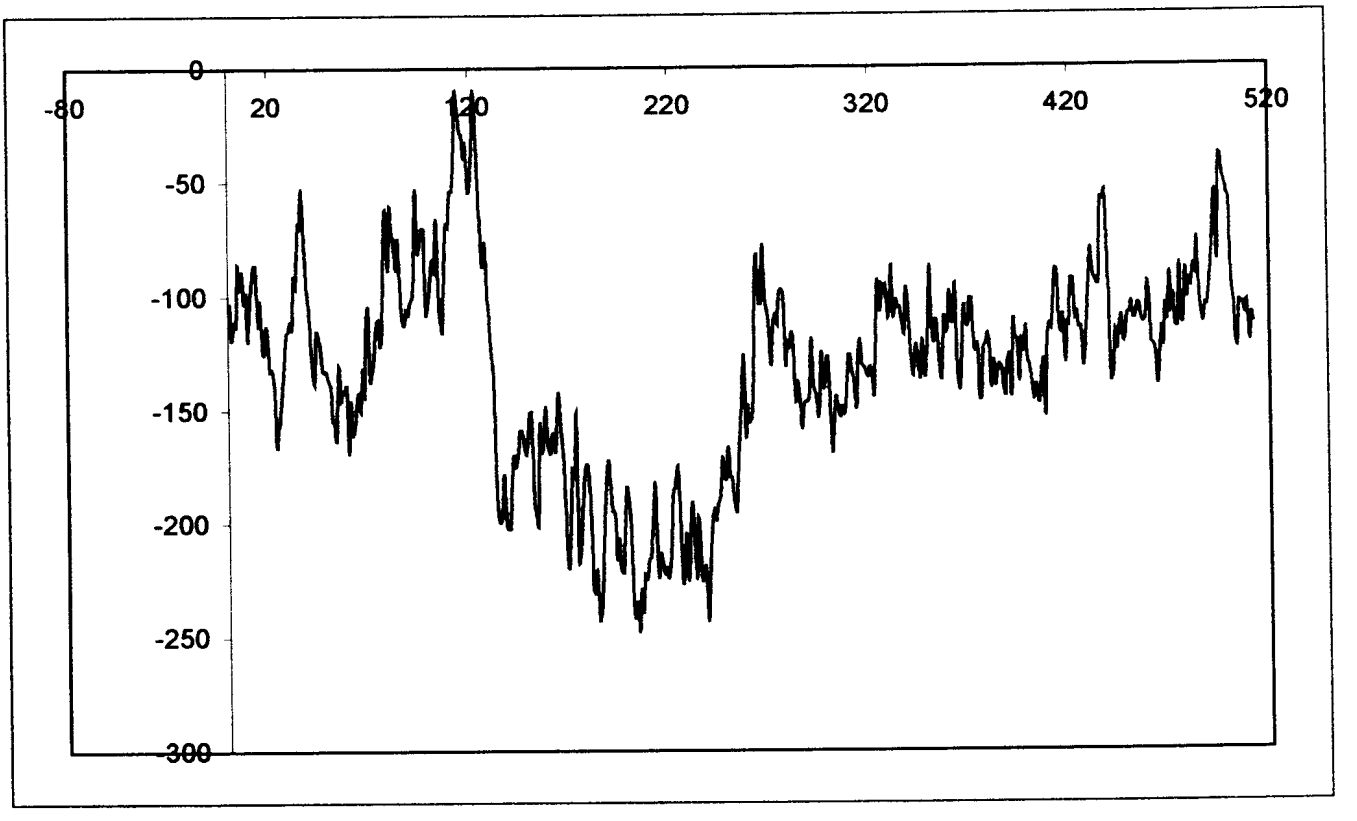
88.1941	3.2183	-17.3544	48.5809	127.244	24.9702	21.9661	131.682	237.022	150.79
55.5702	11.5906	-11.2042	62.4239	112.867	12.3166	52.4701	136.394	234.203	147.677
42.9343	-5.63511	2.8011	64.9369	112.066	-9.21312	73.0783	131.05	238.805	132.43
62.0364	4.77403	3.1266	66.8605	130.182	-16.534	80.1936	133.506	222.3	104.955
68.8314	-9.67004	34.2287	49.2918	118.784	-11.1422	94.2574	127.116	209.678	80.2611
56.6537	-23.164	23.9393	26.1184	153.392	-2.23431	81.7309	142.385	203.01	103.032
58.6621	-16.6868	8.5797	27.3232	158.397	33.9971	88.2919	173.001	209.723	119.807
91.2376	-9.96987	1.79059	49.569	138.04	27.0356	94.0661	163.526	224.394	121.834
94.202	-17.0285	-4.56383	67.528	179.114	44.9148	81.9995	164.3	213.969	130.4
101.779	-20.2001	3.5701	51.5883	213.44	53.1749	70.5602	183.037	231.286	129.556
103.014	-6.56846	2.56461	53.209	201.789	61.9742	50.5804	208.635	263.026	141.217
102.633	-22.5004	1.22305	54.9093	149.224	58.3799	59.2042	191.782	274.941	129.342
110.187	-12.9699	5.78165	32.9272	126.281	83.3845	72.3375	186.344	267.617	148.228
75.5443	-3.59429	-5.12086	41.9137	114.642	69.2576	75.7176	217.627	278.762	155.254
83.8862	-22.1775	-9.60889	86.4454	117.663	84.1684	67.3451	214.627	262.63	147.975
98.8953	-43.0543	-5.79554	68.325	108.674	51.4896	70.4237	219.746	238.374	168.272
95.3257	-39.0307	-32.1352	90.3372	112.399	78.6673	85.5526	192.678	203.345	166.167
92.8588	-19.1458	-46.0694	84.1448	90.0257	67.7731	84.2047	203.458	226.696	175.007
91.1201	-37.1185	-43.4072	68.2557	52.0631	69.9452	88.3123	233.663	247.476	185.201
90.1861	-53.9322	-41.5818	65.3841	38.1827	66.1732	112.243	208.048	213.561	188.048
54.742	-52.2467	-13.6437	70.0538	36.5308	81.0821	116.188	194.478	196.547	211.682
41.0096	-75.5996	24.2614	62.4078	64.3399	70.3669	119.718	206.498	210.536	200.331
39.8964	-55.6561	27.0898	78.8931	38.7031	61.8017	100.287	220.602	204.781	213.997
50.2428	-33.5921	25.9836	57.481	30.8898	100.474	124.508	205.361	182.811	204.527
28.7639	-56.7614	28.4529	58.2868	27.9115	91.7331	122.546	207.918	145.418	213.471
29.8926	-55.7898	18.3198	55.5317	64.442	115.134	120.014	209.985	137.142	180.681
41.7737	-81.0533	24.743	52.4595	65.0793	119.425	100.249	218.341	112.237	173.349
24.3115	-65.8862	6.81263	71.3798	61.6616	112.292	130.485	216.231	122.794	204.998
27.2594	-51.5353	15.1901	66.6612	79.9225	118.903	148.938	214.42	129.855	200.793
36.1133	-49.8728	29.3895	96.2874	64.4705	103.109	134.624	199.371	128.454	234.259
53.5858	-48.3402	8.74652	106.953	75.5747	107.751	122.293	216.439	132.111	217.644
50.6413	-53.9767	-4.46152	86.5305	78.9315	80.3362	106.993	202.574	139.211	207.284
11.2306	-60.7197	29.1235	94.5657	89.4844	44.0426	119.774	193.484	164.902	204.282
12.2952	-62.4031	33.0289	108.019	88.9951	27.0999	119.234	209.435	167.949	197.052
14.7004	-78.8372	18.1681	100.083	95.5333	47.2894	131.917	237.561	176.938	197.828
-6.02937	-25.9034	40.6369	88.9528	84.8548	55.2565	126.252	228.761	177.253	212.338
-13.1486	-29.6039	59.4104	110.52	101.49	42.1144	127.224	245.934	185.115	206.783
-6.00212	-7.27003	37.9093	139.145	73.8535	5.39447	113.969	231.594	207.212	182.024
8.29166	-9.23475	30.2061	138.085	18.7507	9.898	137.746	230.444	229.255	181.26
27.3535	-2.87585	52.8149	130.872	39.104	24.5485	150.051	241.567	198.668	
31.1861	-21.2071	72.302	101.282	72.3345	28.0608	156.303	228.451	202.216	
17.7262	-51.9238	48.1749	102.409	57.8997	35.2513	137.112	226.943	196.772	
15.8207	-60.3134	54.476	108.847	48.9192	31.2901	129.245	220.264	173.902	
1.07302	-29.9132	75.5376	114.935	23.9631	41.0546	131.38	221.359	154.716	
-3.12968	-25.8613	76.1898	134.366	6.31464	18.2778	134.582	220.963	156.096	

Time Series Name: Iso-05

Inhalation Agent used: Isoflurane

Number of Points: 512

Graphical Representation:



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-119.205	-162.935	-111.016	-148.799	-215.238	-133.65	-125.75	-126.907	-130.362	-90.5627
-110.929	-130.606	-115.381	-164.982	-202.047	-90.0251	-119.669	-105.461	-112.249	-106.489
-112.683	-145.776	-80.198	-169.556	-182.201	-81.8165	-130.466	-110.998	-113.674	-100.357
-86.1005	-141.133	-67.9916	-161.278	-206.547	-103.969	-132.123	-113.837	-93.6397	-114.407
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-119.829	-160.926	-10.2844	-162.455	-219.615	-116.661	-144.087	-122.112	-114.914	-89.0518
-101.093	-157.62	-15.4862	-174.84	-224.453	-130.821	-115.756	-145.949	-131.452	-102.038
-93.2657	-147.815	-28.18	-210.233	-214.923	-113.669	-93.6228	-145.768	-125.763	-94.0963
-86.0632	-142.579	-29.0804	-220.07	-188.264	-108.13	-107.407	-123.968	-111.624	-96.5951
-86.5271	-149.93	-39.5366	-202.064	-184.856	-112.878	-96.0563	-122.174	-91.5418	-87.3627
-112.407	-131.675	-32.6535	-176.391	-179.634	-99.6458	-99.9494	-116.962	-79.8128	-91.0972
-101.709	-143.539	-54.2126	-179.621	-175.132	-97.5056	-96.1849	-121.088	-91.0398	-75.5933
-117.074	-109.227	-51.1477	-152.02	-205.621	-99.6578	-110.017	-140.963	-93.2832	-99.1698
-125.498	-105.021	-36.0559	-217.222	-226.659	-130.916	-103.073	-128.969	-95.9693	-110.129
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-122.801	-131.894	-30.6825	-193.144	-204.537	-123.532	-109.313	-134.35	-57.8392	-104.831
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-131.992	-112.939	-68.6509	-174.176	-202.026	-123.116	-106.1	-132.616	-55.2579	-93.6421
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-166.067	-122.101	-76.3018	-197.923	-205.506	-137.689	-111.233	-144.318	-102.354	-69.5249
-158.59	-105.947	-97.4244	-226.959	-224.677	-146.202	-117.296	-129.789	-138.091	-55.4534
-155.403	-77.0526	-106.138	-230.924	-197.846	-158.753	-97.2453	-126.693	-134.702	-85.2683
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-95.8822	-95.0201	-197.415	-184.9	-193.617	-153.762	-120.594	-114.269	-108.351	-103.823
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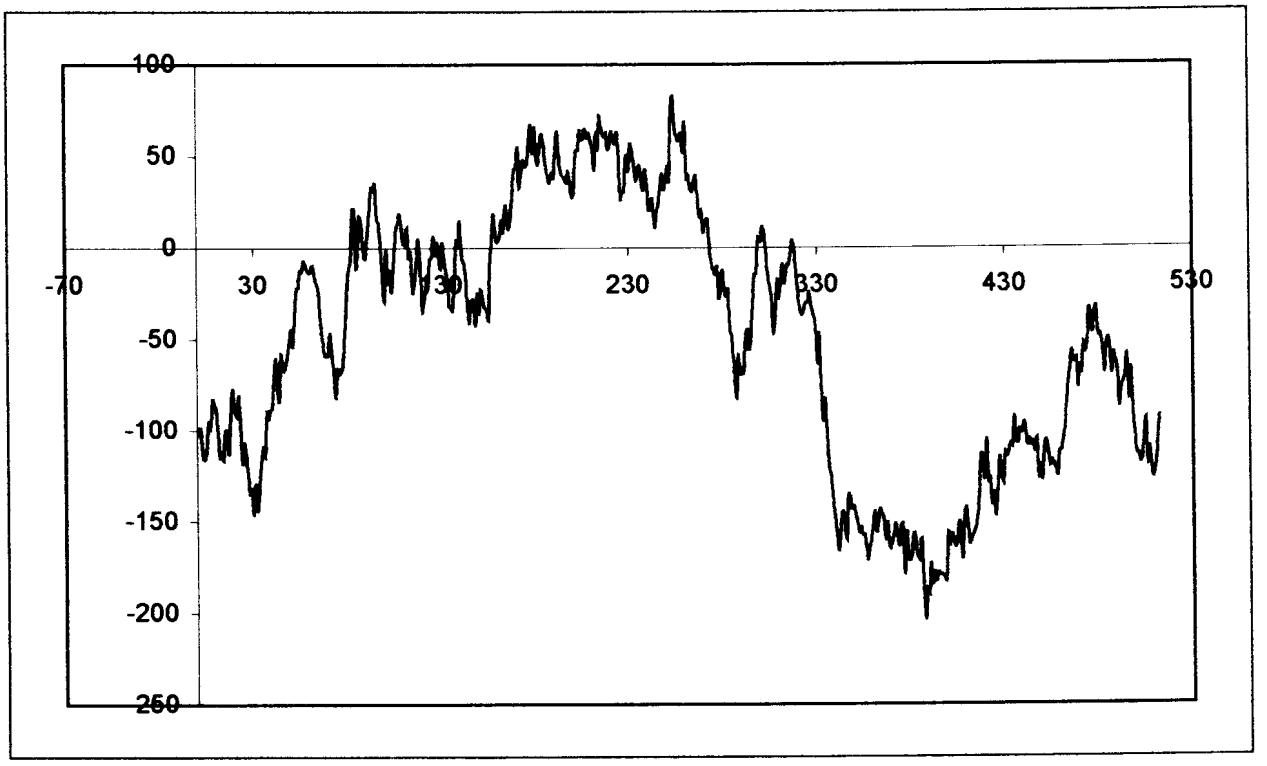
Time Series Name: Iso-06 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 512

Graphical Representation:



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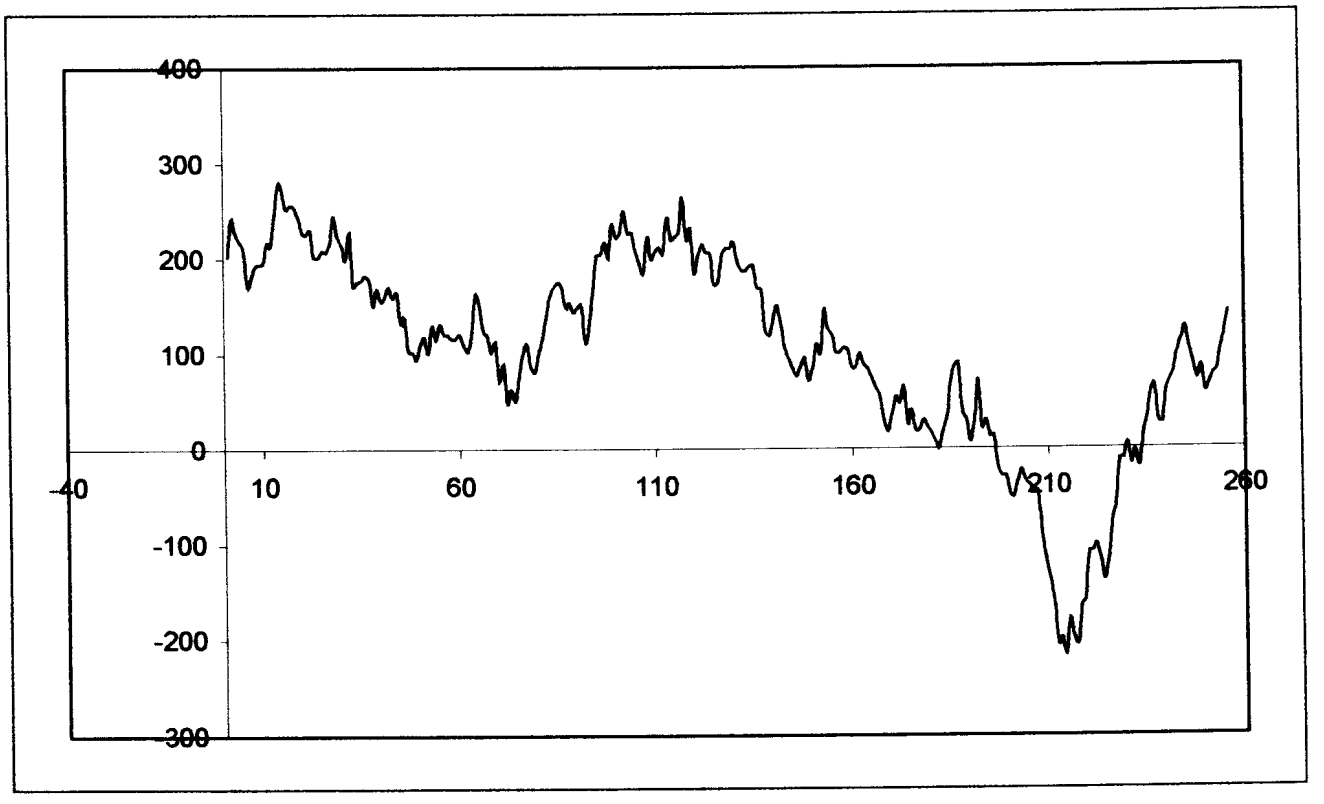
-54.1791	-12.6124	-33.7452	59.4501	62.3352	-38.6742	-153.894	-162.853	-84.0423	
-39.4277	-24.3071	-38.8226	64.8444	52.0661	-17.6266	-144.68	-158.565	-73.1608	

Time Series Name: Iso-07 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 512

Graphical Representation:



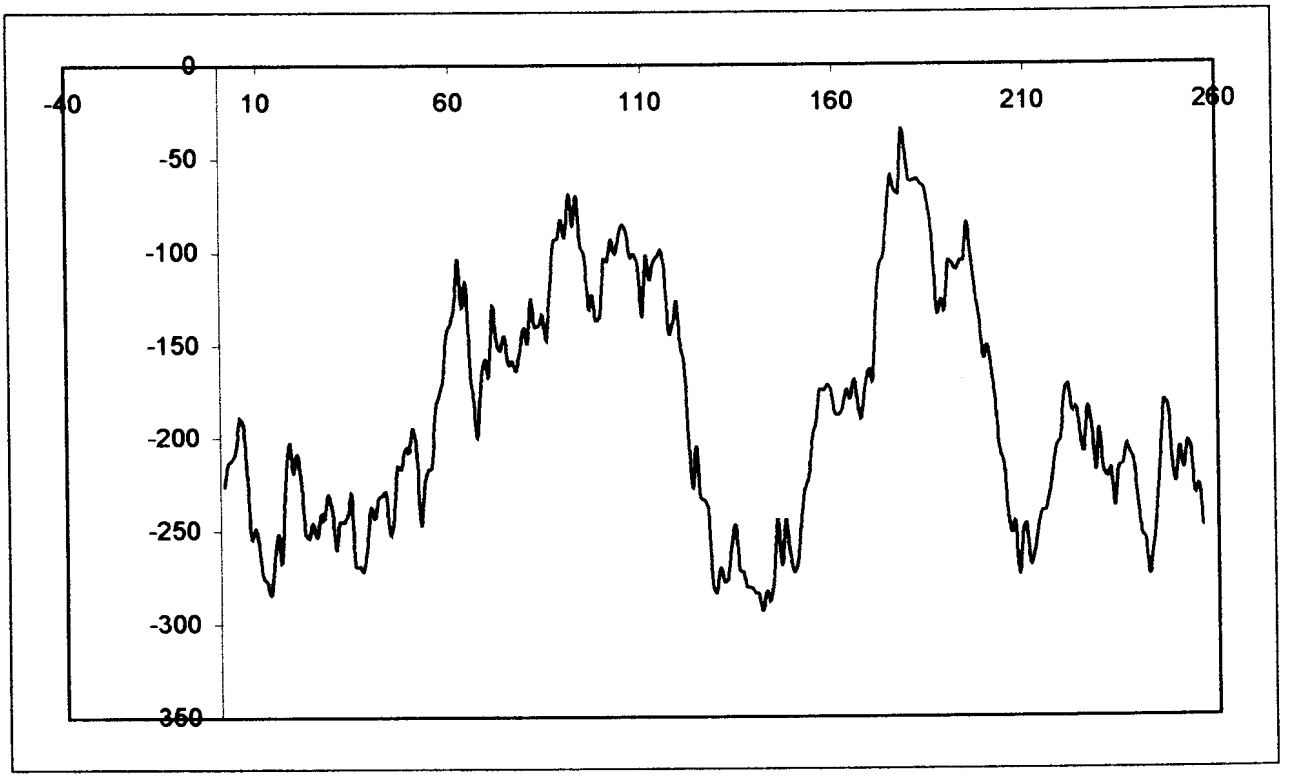
202.522	215.55	130.227	81.6794	206.155	195.802	101.984	0.66642	-46.0556	-19.0253
241.853	244.569	115.14	99.9696	194.344	187.57	105.931	8	-85.6217	13.402
227.553	224.405	131.598	115.151	184.185	186.91	103.652	17.5309	-113.029	29.233
218.097	214.345	120.347	138.65	222.802	191.275	84.7087	33.5623	-136.549	57.6904
210.895	198.019	120.211	160.387	199.543	192.538	86.4806	68.9059	-158.764	66.5462
170.945	226.785	115.379	170.75	207.75	169.194	99.684	87.0249	-205.36	27.9461
179.964	171.431	116.434	174.673	211.725	167.255	88.6615	89.6444	-199.41	26.6459
191.629	175.671	120.585	171.225	204.474	124.66	84.1364	41.4707	-215.884	59.8093
194.342	177.369	109.417	149.385	242.78	118.889	73.4222	28.378	-178.639	71.8282
195.515	182.591	102.128	153.586	219.95	136.037	63.1509	7.04472	-197.297	81.801
216.877	176.638	118.927	143.936	221.493	150.199	55.0038	30.7051	-204.69	100.984
214.041	150.7	161.991	148.767	228.031	129.835	28.7252	72.104	-165.213	114.983
245.471	168.334	152.022	152.104	263.639	105.486	18.1049	21.7318	-158.52	126.752
279.833	155.625	123.71	111.935	219.229	92.6005	38.275	29.754	-108.131	103.321
270.337	160.659	119.426	128.98	231.933	83.1912	54.351	13.0627	-107.508	88.0827
252.546	170.59	101.849	162.191	184.16	76.4008	47.5431	13.2097	-100.952	72.8717
256.178	158.799	112.702	203.286	204.099	87.8718	64.9099	-19.9642	-117.053	86.7965
254.063	165.026	72.1152	203.749	214.431	95.239	25.3877	-28.5617	-137.023	59.4468
243.047	132.768	88.258	217.268	206.41	71.6298	40.3324	-29.5815	-114.488	68.2505
227.727	138.488	47.9757	201.581	204.389	85.1556	18.8754	-48.1487	-75.0282	77.7296
225.145	103.915	62.7713	235.835	172.441	109.666	19.589	-50.0875	-57.5861	81.966
229.688	101.936	50.5592	221.622	176.087	100.184	29.6979	-33.7495	-11.0028	106.396
202.258	94.765	75.142	226.715	202.864	146.222	22.919	-22.35	-10.4451	122.372
201.667	111.157	99.1341	249.666	210.407	126.438	16.6392	-34.6591	6.01776	142.415
208.048	118.105	110.518	226.31	210.975	119.599	7.35222	-38.1789	-16.1073	
207.055	101.239	86.9674	226.404	216.213	101.198		-42.7052	-1.49201	

Time Series Name: Iso-08 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 256

Graphical Representation:



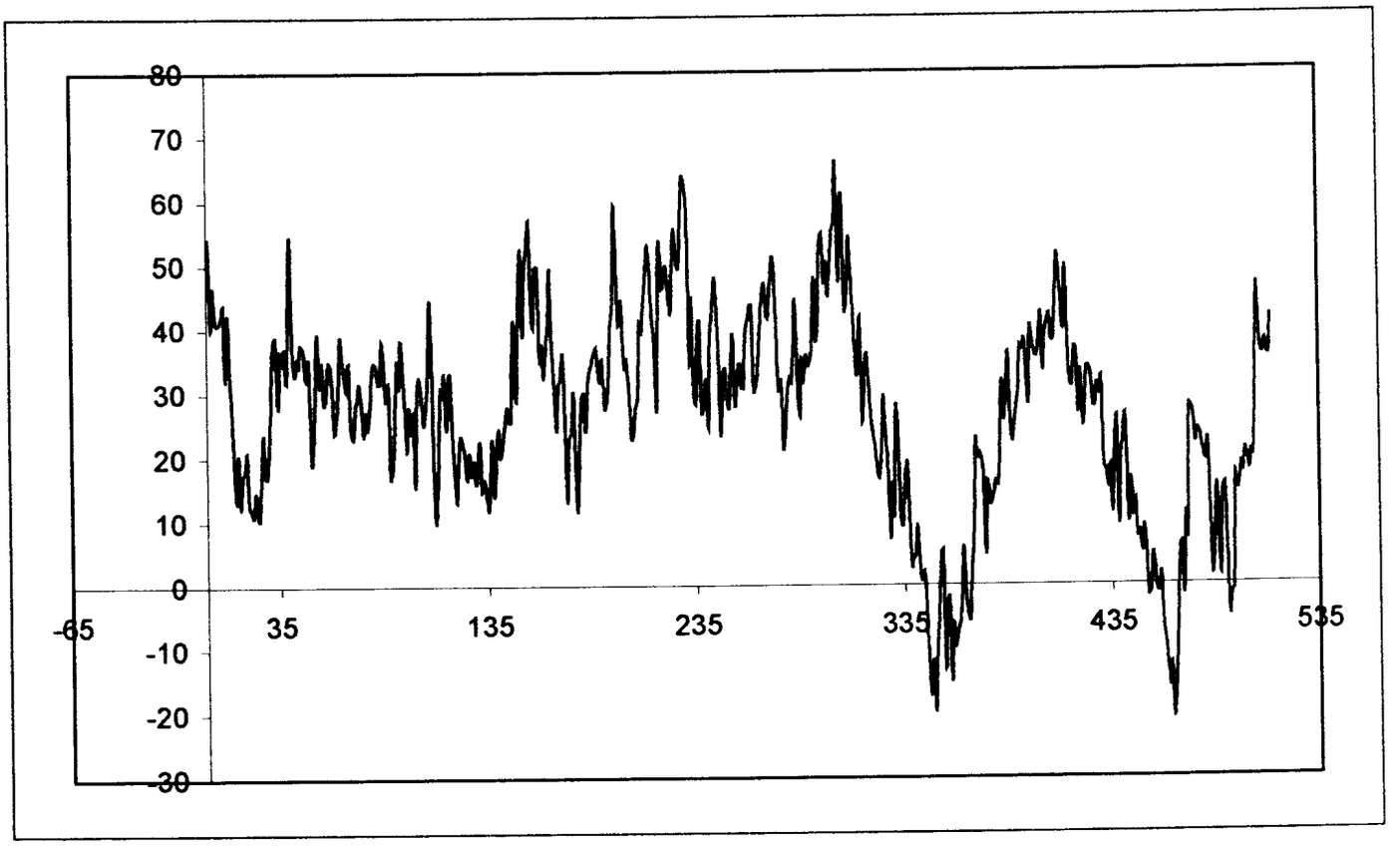
-225.875	-243.269	-225.608	-140.692	-85.5742	-277.73	-174.98	-64.2356	-250.477	-215.373
-213.526	-230.392	-216.966	-148.75	-89.1362	-276.274	-172.026	-66.4825	-247.247	-205.044
-211.812	-239.369	-216.01	-125.451	-103.046	-258.338	-175.919	-79.2286	-268.346	-208.973
-207.078	-259.986	-183.702	-140.109	-101.334	-247.6	-187.391	-98.8895	-261.148	-214.258
-189.45	-244.991	-176.673	-139.082	-108.604	-271.115	-188.067	-133.342	-248.57	-236.411
-193.105	-244.984	-167.144	-134.43	-134.944	-272.371	-183.559	-126.696	-240.247	-252.557
-220.737	-241.632	-144.102	-147.638	-102.456	-280.708	-174.671	-131.786	-239.734	-255.862
-253.645	-230.674	-137.925	-120.969	-115.207	-280.859	-179.671	-105.71	-229.948	-274.289
-248.514	-268.492	-127.947	-94.0143	-106.374	-283.934	-169.245	-106.92	-216.009	-258.61
-259.48	-269.044	-103.523	-93.4148	-102.608	-284.332	-183.452	-110.085	-204.857	-237.97
-274.562	-271.195	-129.545	-82.6045	-99.3137	-293.569	-189.574	-105.668	-201.214	-211.301
-276.898	-259.459	-117.124	-91.7891	-112.441	-282.86	-173.014	-105.407	-175.117	-181.401
-283.756	-237.803	-160.512	-69.0026	-143.966	-287.592	-163.8	-84.8646	-172.108	-184.449
-264.394	-242.985	-180.75	-86.1114	-138.048	-273.438	-169.845	-105.249	-185.869	-214.112
-251.588	-232.407	-200.007	-70.1816	-127.076	-244.442	-128.945	-123.277	-184.804	-225.148
-265.637	-230.964	-166.722	-95.4081	-151.367	-269.059	-108.06	-136.256	-199.264	-206.459
-218.834	-228.989	-157.416	-102.796	-160.855	-244.566	-102.066	-157.649	-208.149	-217.197
-202.496	-251.851	-165.89	-130.382	-204.575	-261.022	-79.0403	-151.075	-184.485	-203.039
-218.545	-243.709	-129.229	-123.203	-227.477	-272.399	-60.2054	-164.278	-194.634	-207.206
-208.544	-215.367	-148.948	-137.335	-204.978	-267.488	-67.0836	-179.784	-218.503	-230.754
-224.929	-216.652	-152.982	-133.762	-232.615	-246.943	-69.0526	-205.943	-195.93	-226.899
-251.152	-205.752	-145.053	-104.351	-233.82	-228.474	-35.1364	-214.224	-217.175	-248.467
-253.673	-207.226	-160.48	-105.119	-239.261	-221.253	-46.4573	-238.342	-221.858	
-245.782	-194.674	-158.809	-93.7688	-278.347	-200.147	-62.3585	-251.614	-217.604	
-253.133	-204.983	-163.917	-101.16	-283.715	-191.777	-62.2949	-245.9	-237.782	
-241.195	-246.821	-154.377	-91.7516	-270.269	-174.548	-61.778	-273.971	-217.109	

Time Series Name: Iso-09 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 512

Graphical Representation:



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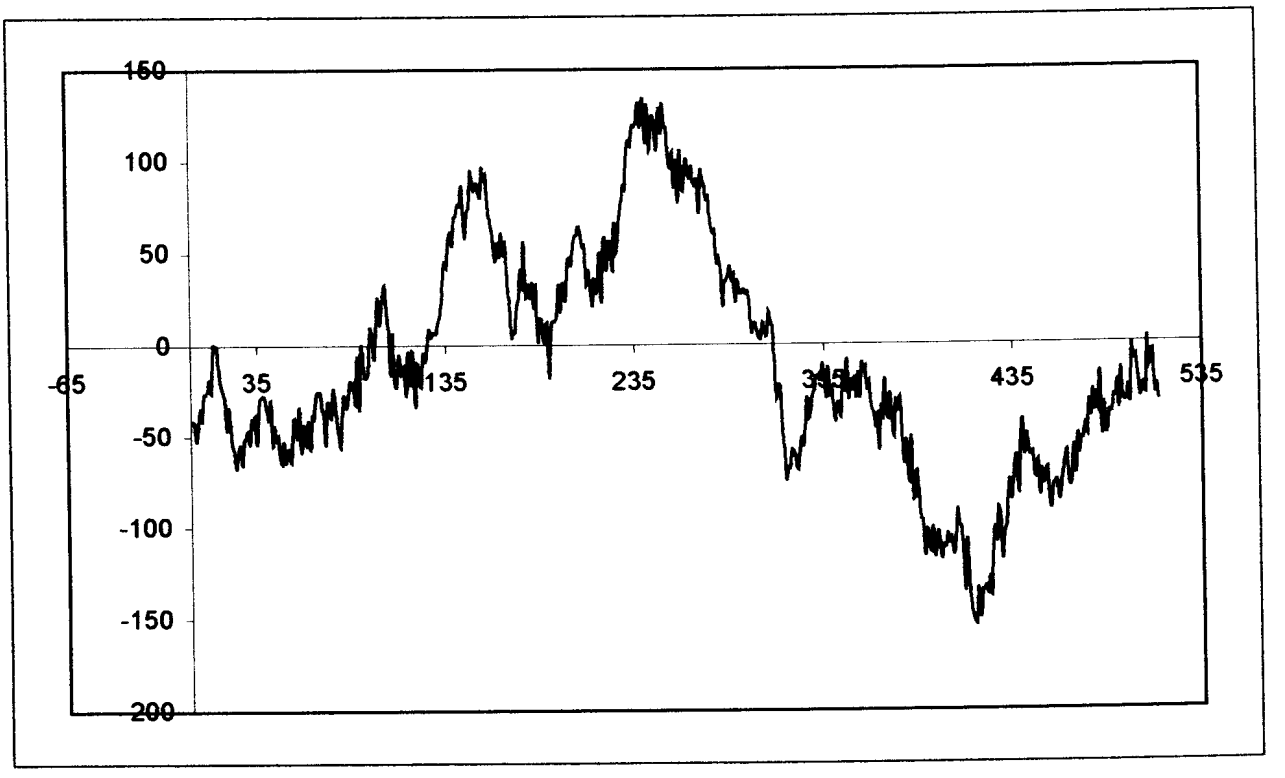
40.0761	31.0949	30.7995	49.6477	43.4345	43.7007	41.6256	-5.52384	36.6645	11.0962
46.5941	34.8847	44.504	49.7359	48.8378	30.0836	25.464	1.82589	26.7461	7.11831
41.9059	28.3582	36.1386	35.3028	53.195	31.385	33.9774	9.34939	33.429	27.8228
40.8512	28.9549	15.6495	37.7344	50.3813	34.6916	36.0261	22.5469	24.8201	27.3605
41.0947	34.9007	9.73289	32.3831	42.9842	39.7144	32.0665	19.63	29.1643	26.2011
41.9817	34.3724	19.9937	37.6058	36.893	44.6986	26.5551	20.5329	33.7943	22.0671
43.6602	31.2357	30.9215	41.4291	27.1078	47.1037	23.0526	19.1527	33.8663	24.0419
32.0467	23.9891	29.379	49.4557	43.3709	42.5603	20.7964	15.265	32.3367	23.5212
42.3703	26.5078	33.0509	38.2343	53.7841	41.5775	18.4281	4.67749	27.6694	21.815
33.6275	30.6102	24.4097	29.3192	46.4218	45.9194	16.5623	15.8362	27.7426	20.2506
27.8342	38.7285	31.8318	24.1724	47.9451	51.1147	21.6247	12.4837	31.2283	19.3206
19.6516	35.314	32.9844	31.3312	49.8142	49.8709	29.4473	12.9902	29.5097	22.2181
12.9801	32.0472	23.549	31.9536	46.8977	39.9794	23.2778	14.2111	32.1755	9.67979
20.5078	30.396	15.8965	36.0491	42.2629	30.4226	19.4683	16.1897	18.472	1.58088
12.0926	34.6546	13.0489	24.3212	50.3667	31.7863	7.01771	15.5213	17.9445	4.64078
17.1494	24.6236	20.667	13.0161	55.6263	21.3955	15.8259	24.0182	15.0632	15.4752
17.8019	22.8819	23.3826	22.9185	51.1957	23.3679	10.8469	31.8407	18.2742	8.454
20.6542	27.4194	21.784	23.7579	49.564	29.0661	27.7461	25.6043	11.1364	1.51105
12.539	29.0763	19.4512	30.3381	57.1093	32.4127	21.1755	31.4098	18.6992	14.3339
11.9207	31.5971	16.6222	19.1039	63.761	31.7037	10.0455	35.9059	25.9191	15.4052
10.849	28.2516	20.7511	11.4971	63.2049	35.8554	8.98371	25.4244	9.28082	6.83245
14.5717	23.4177	17.2739	23.7302	57.5939	44.5077	14.0403	22.2533	20.0296	-4.65574
11.2025	27.205	19.5326	29.3569	35.0558	30.164	19.1511	24.6121	21.7978	-1.45819
10.3504	24.3718	15.8844	29.9123	44.842	26.1765	11.9313	28.1454	26.4023	-0.94957
19.1511	27.9876	18.3911	24.0959	29.7897	35.3051	2.72546	31.2847	17.3131	17.245
23.5509	32.7258	22.5466	31.7911	28.1314	31.4869	3.89818	37.1014	9.54105	15.6465
17.126	34.7368	14.8661	33.4657	38.6935	35.8844	4.55687	36.6203	16.513	14.7144
17.0002	34.5254	16.5852	34.6959	41.1138	34.0326	9.18737	38.1744	11.1236	18.4405
24.239	31.5913	15.597	35.9415	26.7978	34.8035	3.22993	32.5083	12.9548	17.4842
33.5317	31.6187	11.6355	37.117	27.6526	36.6767	0.55281	28.2706	7.55051	20.8888
38.204	38.0031	16.786	33.5896	32.0271	47.9018	1.96871	40.0216	8.17645	20.1122
38.8103	34.6387	22.7654	31.7464	24.6605	38.0632	-3.64001	37.0096	4.96891	17.6704
27.7443	28.8826	13.885	35.1379	39.3338	40.8532	-11.1174	36.0835	9.08444	20.5725
36.3018	31.3447	21.4833	27.6065	41.4587	53.1489	-17.3851	35.501	6.11562	20.029
34.4368	16.7828	24.4302	28.4514	47.9892	54.8118	-11.792	36.9627	-1.81414	28.5217
36.9897	17.7043	20.1683	31.2112	44.3422	47.2231	-19.8196	42.4955	-1.10193	46.2967
31.9743	22.0793	21.5409	39.5372	36.4277	50.2986	-9.95215	33.2715	4.67857	41.4432
45.6991	34.8118	25.569	44.9092	23.2771	44.8575	-5.12755	39.1207	3.25551	36.4104
54.5554	30.8614	27.8272	59.3013	32.9726	51.2791	4.67457	40.4202	-1.06407	35.6668
37.892	38.2232	25.7	51.1237	33.8393	55.2821	5.28739	41.9776	-1.32295	37.958
32.7895	34.9847	25.5634	40.5875	29.5817	56.2242	-12.9699	38.2214	1.68673	35.5384
35.4012	26.7643	41.41	44.5457	27.7165	66.0233	-4.39365	38.0189	-6.46251	35.5709
34.137	20.9443	32.2334	38.7195	34.7923	47.1961	-2.21354	41.9601	-8.25076	41.7176
37.6071	27.8995	29.1771	33.8087	38.9873	59.1061	-15.1005	51.1956	-12.868	
36.9392	23.8822	43.489	35.1762	28.0276	60.7836	-6.10552	49.0266	-15.8582	
33.9331	26.8668	52.5912	28.2917	32.0078	42.8272	-9.8047	44.6563	-12.4023	
31.966	15.4404	38.869	22.8038	34.4426	46.2882	-7.14172	39.8883	-20.8975	
35.094	30.3958	49.4295	23.3536	30.7653	54.2096	-5.94666	49.6575	-14.2363	
19.1831	32.5023	51.8412	27.6006	30.7251	48.5603	-2.99058	37.9026	-6.02692	
21.4416	29.1409	56.824	29.4798	39.1439	42.1414	5.86769	31.3998	4.21369	
29.5654	25.099	44.6466	40.9791	41.4067	32.7333	-2.24993	30.9075	6.16737	

Time Series Name: Iso-10 Surrogate Data

Inhalation Agent used: Isoflurane

Number of Points: 512

Graphical Representation:



-41.7573	-64.1984	26.694	80.5971	64.5077	99.8163	-29.6923	-46.3135	-152.318	-73.4606
-42.7261	-58.4754	32.5981	96.7792	61.9053	77.1272	-22.4139	-39.3542	-153.995	-56.0937
-52.4048	-56.6596	18.1084	89.4103	53.0566	105.404	-23.4641	-58.393	-133.98	-71.7603
-43.8919	-63.2287	6.17302	93.0371	54.3879	89.8101	-47.2295	-34.4472	-150.315	-49.9606
-34.7483	-40.4437	-16.5784	76.0051	32.7377	83.4686	-59.19	-40.6342	-135.926	-60.5922
-41.2034	-41.1469	6.36885	68.3884	40.7843	100.476	-74.6727	-19.4433	-135.157	-52.0719
-27.0331	-50.8038	-20.4062	62.4216	31.8197	97.0183	-67.6281	-34.7461	-132.864	-52.977
-26.5667	-33.8516	-23.2374	53.9556	20.8224	90.4758	-68.7193	-41.0445	-137.377	-44.0897
-24.801	-58.2646	-5.50224	45.2455	35.9869	96.9955	-57.9947	-27.2989	-127.687	-50.2928
-18.8991	-43.6459	-15.9375	55.1225	27.73	87.9664	-59.8352	-41.3185	-138.25	-31.7897
-25.0208	-45.3755	-16.5125	47.9591	29.4137	86.0918	-64.6085	-50.8951	-109.65	-40.7019
0.33647	-55.152	-11.7392	61.0568	50.3891	89.6235	-68.7594	-30.9679	-100.426	-26.3132
7	-41.3404	-27.6387	48.8576	22.8001	71.4244	-57.9278	-37.1475	-108.819	-37.2519
-	-57.5763	-3.70821	55.5575	50.7849	94.7437	-51.3088	-29.3777	-90.8293	-28.2643
0.44881	-39.031	-21.8171	34.0226	58.5612	90.3223	-56.0339	-48.7165	-93.7982	-36.6933
1	-40.5234	-3.39598	22.1148	40.6999	86.6779	-43.58	-65.7691	-118.334	-15.9373
-1.66646	-28.7252	-9.48494	3.95083	56.1411	78.5226	-29.3896	-52.9681	-104.36	-50.6887
-15.1097	-25.5649	-33.9772	5.97471	52.0805	80.1049	-40.5766	-65.6984	-99.4699	-32.9684
-22.1417	-26.2103	-10.5374	6.90012	40.6253	66.5858	-35.5919	-75.7382	-82.1507	-49.8474
-25.3767	-35.4942	-15.438	21.3602	66.1625	60.5774	-27.6245	-51.306	-74.7252	-47.4446
-29.1084	-36.3202	-22.4887	24.9205	50.0762	62.0572	-25.5588	-85.675	-85.7896	-37.561
-46.4928	-54.5662	-4.77156	41.0228	58.2397	43.8467	-18.1862	-84.6326	-72.434	-38.402
-34.0225	-31.3618	-8.9591	31.1606	71.8869	48.0434	-18.1257	-69.5674	-62.1737	-29.1432
-45.2441	-31.5187	-1.74598	56.1132	77.7754	41.9316	-19.7727	-83.2362	-67.2258	-29.9941
-55.1976	-40.0836	8.8356	26.0894	86.6406	20.4966	-10.9436	-96.2822	-81.6529	-21.1753
-58.4884	-24.2137	4.12117	32.8511	84.4411	33.8229	-18.3335	-96.8986	-49.4942	-36.2824
-67.5962	-28.8105	6.79987	25.4909	106.447	34.5282	-29.762	-116.425	-41.9541	-14.2384
-59.9503	-40.8714	6.57469	33.7914	111.131	37.8847	-12.9063	-102.665	-61.4214	-31.3192
-54.4478	-49.0212	6.00034	19.8907	108.425	42.2833	-27.624	-108.623	-49.7739	-32.2538
-65.905	-55.7537	11.5558	32.3477	119.478	34.0945	-23.8092	-114.026	-54.9837	-31.8893
-52.1673	-36.3633	15.3895	1.9003	118.749	37.9568	-34.9908	-100.816	-61.6697	-24.1978
-50.6957	-27.1384	22.9518	13.9647	120.424	22.4205	-42.5494	-116.832	-60.4936	-32.423
-46.5884	-34.4423	36.0125	14.1046	131.592	34.6608	-33.1551	-112.307	-73.2021	-2.00259
-54.2239	-28.0678	45.4941	3.0936	118.012	27.2734	-32.0157	-103.083	-72.7786	-9.55102
-40.8183	-19.5941	42.0554	1.20115	128.4	28.2543	-40.0001	-110.763	-64.5573	-8.06775
-43.4588	-23.6862	56.3327	11.4037	133.519	29.8604	-17.2059	-118.27	-83.9056	-19.5364
-38.6942	-20.6476	61.6066	-18.2132	109.721	27.6611	-26.0107	-110.344	-69.7293	-29.6516
-54.2142	-32.1908	53.7342	5.91901	130.441	28.8893	-8.66379	-111.747	-77.0485	-28.1437
-33.0114	-6.51842	69.6766	12.9083	106.303	23.145	-30.479	-104.202	-72.2471	-22.9538
-28.5724	-35.3418	70.2378	12.6237	118.249	6.47292	-20.2789	-109.386	-68.5079	-27.8689
-28.5145	-0.45549	76.6713	15.7401	124.585	10.6485	-25.4536	-106.036	-86.1699	2.75112
-28.0717	-4.55392	75.4962	32.486	121.251	11.4749	-18.4495	-115.787	-90.9151	-13.7269
-36.4551	-17.5092	86.7706	17.5895	105.421	6.9707	-29.798	-108.521	-78.7847	-6.25568
-40.9249	-17.4863	73.1069	33.2557	128.636	3.44293	-16.0601	-90.936	-76.771	-4.90632
-30.7884	-14.6093	58.0581	28.5173	114.819	2.34884	-29.782	-99.1129	-75.5574	-28.2748
-54.7251	8.81391	71.9722	24.3062	131.195	11.2847	-10.8208	-101.042	-86.0149	-23.6672
-43.9527	3.01767	74.819	44.5062	118.499	8.4301	-16.0566	-111.428	-80.8952	-31.914
-52.1885	-7.65755	93.8769	47.3366	118.421	4.10014	-12.9019	-135.92	-71.1149	
-49.745	8.18591	89.8089	43.0833	98.826	17.896	-25.2215	-107.373	-64.7928	
-61.3037	25.7884	83.6619	51.3908	96.0696	12.1249	-20.7441	-123.215	-59.6832	
-64.7841	11.0612	88.021	58.8823	103.792	9.4637	-34.7594	-142.35	-71.8934	
-52.8639	19.4564	82.8203	59.8235	85.4382	-12.1681	-38.2871	-148.298	-78.4413	