![SLU logo]

# Rein tension measures as indicator of horse-rider communication

*Tygelspännings mätningar som en indikator på häst ryttare kommunikation*

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**Examensarbete, 15 hp, Etologi och Djurskyddsprogrammet**

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# Summary

The purpose of this study was to gather knowledge about the functioning of the rein tension meter and test it for future studies of match and mismatch between rider and horse. We looked specifically into the possibilities to use a rein-tension meter to determine the quality of cooperation between horse and rider. We examined whether a rider shows a specific tension pattern and also if certain patterns could be recognised for a specific horse.

During the study, a manual with pictures and text was written to support the practical use of the meter. The manual describes in a simple way the first steps in the installation and use of the meter. A test has been carried out in which four riders were riding three horses through a specific track while their rein tension was measured continuously by the meter.

The results were then evaluated and interpreted using the Signal Scribe program to get the diagram for each rein showing the tension in the rein for each second. It was concluded that by using various tools like a video camera to record the rides and the horse and riders behaviour or a judge judging the communication between rider and horse, the meter can be a valuable additional tool to read the communication between rider and horse and also read the specific pattern of a rider or horse which can explain way rider and horse have problems working together. This way specific training can be individualised to better the match between the two parties.

# Sammanfattning

Den här studien redogör för ifall man kan använda sig av en "rein tension" mätare för att avgöra hur samarbetet mellan häst och ryttare fungerar. Den undersöker ifall ett samband mellan en ryttare och ett specifikt "spänningsmönser" finns och ifall en häst ger vissa utslag i tygels spänning.

Syftet med studien är att samla kunskap om "rein tension" mätaren och testa den inför kommande studier då man vill använda mätaren vid forskning på matchning och fel matchning mellan ryttare och häst.

Under studiens gång har en manual med bilder och text skrivits om mätaren som enkelt beskriver de första stegen i installering och användning av mätaren. Ett test har genomförts där fyra ryttare har ridit på 3 hästar och genomfört en specifik bana medans deras tygelspänning har blivit avläst av mätaren.

Resultatet har sedan tolkats med hjälp Signal Scribe för att få ut diagram för varje tygel som visar spänningen i tygeln för varje sekund. De visar att med hjälp av olika verktyg som filmkamera eller en domare som dömer ritten, kan man använda tygelspännings mätaren för att avläsa kommunikationen mellan ryttare och häst och även avläsa specifika mönster hos en ryttare eller häst vilket kan förklara varför ryttare och häst har problem att samarbeta. Tack vara "rein tension" mätaren kan man individualisera träningen för att få en bättre matchning mellan ryttare och häst.

# Content

# 1. **Introduction**

This study is part of a larger international effort with the purpose to increase the knowledge of the unique relationship between horse and rider. The end goal is to improve the matching of horse and rider in order to improve the welfare of both rider and horse through decreasing the amount of injuries and accidents and as a secondary effect improve and individualize the training methods and making a better match when buying a horse. Parameters need to be developed to measure horse-rider match. These may include horse-based parameters (behaviour, heart rate), observer evaluations, self evaluation of the rider and specific performance parameters (e.g. results in competition). The main goal of the present project is to practically develop the measurement of rein tension for future use as a measure of cooperation between horse and rider.

The aim with this project is to learn how to apply and use the rein tension meter. We want to learn step by step how the meter works and write a practical manual (to complement the manual that is delivered with the system) to ease the use of the meter in later experiments.

There are several reasons to why a horse is sold, the rider may have become to big for his or her pony or the rider needs another horse type to be able to participate in a specific part of the sport that the rider desires, the owner can have economic problems that makes the cost to keep a horse to big or that the horse is difficult to handle or that the horse and rider mismatch each other or it does not fit into the new family. This is only an extract of reasons to why horses are sold and change home. Certain reasons we cannot influence, if you have become to big for your pony it may be worse to continue to ride on the horse or just to let it to stand without any activation. Other reasons like the one where the horse is considered difficult to be ridden or difficult to be handled in the stable we are able to influence. By increasing the knowledge about how horses' are learning and communicate more riders would be pleased with their horses and more horses would get a better welfare. We need to learn what factors that affect the match between horse and rider. For example the rider's personality and the temperament of the horse have a great influence on the horse rider interaction and the interaction affect the match. To be able to find the different factors that affect the mach we need ways to measure the match between horse and rider.

## 1.1. **The horse as a companion animal**

Why do humans have pets?

A lot of people have pets and in the western societies the pet owners spend an enormous amount of time, affection and money on their pets. If the bond between a pet and its owner is broken it has been shown that the human feels grief that can be compared with the grief of losing a close human companion (Archer, 1997). Some studies indicate that the grief of an animal companion is brief but intense (Dunn et al. 1992). The bonds between humans and their companion animals are in some cases seen as a substitute for the parent-children bond and that the human sees him/herself as a parental figure in the relation to the animal. Animals can also be substitutes for other human contact. Single humans for instance play more and have stronger attachment with their cat than humans who have a human companion (Archer, 1997). In an animal-human relationship it often looks like the animal gets the best out of the relationship, but the human gains on owning an animal in more ways than just feeling comfortable in their presence (Archer, 1997). Pet owners are shown to have a smaller risk to develop some cardiovascular diseases like high systolic blood pressure and plasma cholesterol (Anderson 1992, Anderson et al. 1992) and they experience less stress and psychosomatic symptoms. Pets seem to treat their owners with

affection and love (Archer, 1997) and a lot of riders think that his/her horse sees them as caretakers, protectors and friends (Keaveney, 2008).

A horse is not a big dog!

Horses recognize their own names, beg for treats and try to please their owners just like cats and dogs but they are not the same (Keaveney, 2008). One of the things that divide the average horse-man relationship and the average cat/dog-man relationship is the horse's big size. Horses are a lot bigger than our other domestic animals that we have for companion and this introduces a risk for the owner (Brandt, 2004). Another difference is that even if the human invests lots of money and love in his/her horse he/she will not have the same relationship with the horse as with the dog, because the horse spends most of its time with other horses and the owner will never be a part of that herd (Keaveney, 2008). The most common companion animals are also predators like us. We seem to have it easier to read their body language and put human characteristics into these animals (Keaveney, 2008). Horses are not predators and react in different ways to certain stimuli than cats and dogs (Keaveney, 2008). Horses are special because they are a source for the human companion to give unconditional love to, whereas the cat and dog often are seen as companions who always give unconditional love to the human (Keaveney, 2008).

Usually a companion animal is thought to strengthen the family. However, this is not the case in horse companionship partly because it takes the human away from the family. So why do we have this relationship with horses? They are a lot bigger then our usual pets and they can cause us danger both on and off the ground (Keaveney, 2008) and keep us away from our family.

Why do humans have horses?

Many horse owners have strong feelings for their horse and they say they enjoy the communication they have with their horse and horse owners also say that they get an emotional support from their horses (Keaveney, 2008). A horse is not always enthusiastic to see its owner and horse owners talk about the fact that they have to earn the horse's trust and affection. Nonetheless the horse owner enjoys the emotional and physical connection with his/her horse just the same as the dog owner enjoys the connection whit his/her dog. One specific part of the horse handling that is important for both the human and the horse is the grooming. Mutual grooming is part of social behavior and bonding in the natural horse herd and even if it is given by a human it gives the horse a calming effect and lowers the heart rate and the owner gets a chance to bond with the horse (Keaveney, 2008). A big part in the relationship is the riding, riding a horse gives a level of physicality, intimacy and intensity that is unique in the relationship with animals (Keaveney, 2008).

The horse owner feels that they are working together whit the horse when they are riding, working as a team towards the same goals (Keaveney, 2008). Horse owners believe that their horse enjoys working and learning new things and they believe that the horse trusts them as a guide (Keaveney, 2008). Another part of the relationship is that the owner has respect for the horse, its strength and big size, and then seems to expect that the horse will respect the owner.

In the end the horse teaches the human a lot of him/her self and the relationship with other humans just like pet animals. But the independency of the horse also learns the human patience, respect, confidence, empathy, trust, attentiveness to others and control over ones own emotions (Keaveney, 2008). Horse owners learn communication skills during training with the horse and these can be applied in communication with other humans (Keaveney, 2008).

## 2. **Communication**

### 2.1. **Communication horse to horse**

Horses communicate with each other through signals from one individual to another (Simones, 1999). A lot of these signals are innate to the horse and used in their natural communication. Other signals can be learned through training (Simones, 1999). The horse uses signs that are visual and acoustical, they use tactile interactions and chemical exchanges (Waring, 2002). The most important signals for the horse are the visual ones and are given to other horses using body postures and movements. No other of the livestock animals has such a large span of different visual signs (Jensen, 1983). The signals are most often a way of saying something about the senders condition (Simones, 1999) for instance about intentions, social status, present activity, identity, mood, emotions, physiological condition and awareness of the environment (Waring, 2002). The signals can be added to each other to give different meanings and different strengths of the signal, an aggressive body postures can for instance be supplemented with an aggressive sound (Jensen, 1983). The sending horse is not always aware of the signals it is sending. When the animal who receives the message translates it into information and then emits signals back to the other horse relevant to the information it just has received, a two-way communication is established (Waring, 2002). In the social group that horses live in communication is fundamental to make the interactions work and communication is often established between horses but can also occur between horses and humans ore another species (Waring, 2002).

The differences between the nature of the horse and the nature of a human are so big that even if a horse and a human spend all their time together they will never see the world in the same way (Keaveney, 2008). The way a horse sees its surroundings is literary different from the way humans see it, the horse has the largest eye of all animals and has a horizontal visual field up to $215^{o}$ (Waring, 2002). Even though the horse has a wide field of view it seems like the horse is losing that ability when focusing its eyes at something (Fraser, 1992). When ridden "on the bit" with the facial surface in a vertical position and the head flexed, a blind spot appears in front of the horse (Waring, 2002). Horses are pray animals and have evolved to be able to see, hear and flee from predators unlike humans that are predators themselves (Keaveney, 2008) so they see the world different (Waring, 2002) which makes it hard for humans to read horses.

### 2.2. **Communication rider to horse**

There are three parts in horse training, the presentation of the stimulus, the horse that responds to the stimulus with a behaviour and the rider/trainer to reinforce the behaviour, and this is called the stimulus-response-reinforcement chain (Heleski et al., 2008).The traditional method to train horses is to use negative reinforcement and positive reinforcement (Warren-Smith and McGreevy, 2007). Both positive and negative reinforcement are helping the horse to find out what behavior is asked for by the specific stimulus and the chance that it will show the right behaviour next time the stimulus is used increases (Heleski et al., 2008). The removal of the stimulus when the right behaviour is shown is defined as negative reinforcement but in the beginning of training using a novel stimulus the horse doesn't know the right behavioral response and then positive reinforcement is used. The stimulus stays and all the wrong behaviors are ignored until the right one is shown and then a reward is given, an encouragement or a treat for example

(Heleski et al., 2008). Negative reinforcement can be difficult to apply right because the stimulus must be removed at the same time as the wanted behavior appears and it can implement fear. But if it is used appropriately it is said to be very effective in training animals and some even say that it is the most effective way to replace one behavior with another (Warren-Smith and McGreevy, 2007). Due to the fact that horses are prey animals and are motivated to avoid stimuli it seems likely they are especially sensitive to negative reinforcement (Warren-Smith and McGreevy, 2007).

When the horse is ridden positive reinforcements like treats can be hard to implement and therefore not as likely to reinforce the behaviour. Most horse trainers and riders use negative reinforcement even if they are not always aware of that (Warren-Smith and McGreevy, 2007) and have little knowledge of the learning theory (McGreevy, 2007). This may explain why most problems in the handling of riding horses arise from misunderstanding or miscommunication between handler and horse (Visser et al., 2008). When negative reinforcement is used inappropriately conflict and resistance are induced in the horse can be habituated to the stimulus and the response may become insensible to the stimulus. An example is when the horse is ridden by a rider that holds tension to the rain for too long and the horse reduces its performance (Matute, 1994) and becomes non-responsive (mal and McCall, 1996). This often leads to an increasing strain of the stimulus and this starts a cycle (Warren-Smith et al., 2005). The horse can also be sour and dangerous if it doesn't have a chance to relieve itself from the stimulus (McGreevy, 2007). However, different horses need different amounts and pressure of the stimulus for a standard response (Warren-Smith et al., 2005). The use of both kinds of reinforcement is to be preferred in every day training (Warren-Smith and McGreevy, 2007).

If the communication between the horse and rider doesn't work it can lead to conflict behaviours that lower the horse's welfare and can put the handler in danger (McGreevy, 2007). The cooperation between horse and handler is of large importance since a good collaboration between them decreases stress, frustration, risk of injuries and accidents (Visser et al., 2008). If the cooperation works the performance of the equipage will be higher. The cooperation is affected by the rider's personality, knowledge and skill and the abilities, experience and temperament of the horse. It is known that some riders fit better (match) with some kind of horses than with others (Visser et al., 2008).

In order to communicate with horses we use different aids, led, rein, seat and voice (Terada et al, 2006). The rider uses the horse's sensitivity in order to communicate with horses through signals from the hand to the horse's mouth by a bit (Warren-Smith et al, 2007). All riders want to make their aids as sophisticated as possible and horses can learn to listen to very small signals (Warren-Smith et al, 2007). When riding a horse a lot of communication is sent from one body to the other (Brandt, 2004). For instance if the human is nervous the horse will sense that (Keaveney, 2008).


### 2.2.1. Rein aids

The first important thing to know when you focus on the reins is that the rein aids only are allowed together with weight and led aids (Svenska ridsportsförbundet, 2003). With the reins the rider can:

- Relent
- Restraining
- Guidning
- Regulate

- Led
- Support

The hand that holds the rein has to be following to allow a soft support to the bit (Ståhlberg, 1995). If the reins fit loosely or the hands are bouncing the horse will feel a disagreeable jerk in the mouth for every step it takes (Ståhlberg, 1995). By following the horse's movements the rider prevents that the reins lock the horses head and interrupt the horse's natural movement (Ståhlberg, 1995). The reins can be used in different ways for different effects (Svenska ridsportsförbundet, 2003) but the handling of the reins should always be smooth and never jerk the horse in the mouth (Ståhlberg, 1995).

Restraining aid

Restraining aid must always be used together with a concessional rein aid. The restraining aid is made when the hand is closing for a quick moment or depending on the amount of intensity that's needed the hand may be turned some and if the aid is not answered to it can be repeated (Svenska ridsportsförbundet, 2003) or the hand can be moved backwards towards the hip (Ståhlberg, 1995). It is important not to be left hanging in the reins once the horse has given in to the aid and give the horse a concession (Ståhlberg, 1995). The meaning of the restraining aid is to make the horse reduce the pace (Ståhlberg, 1995).

Concessional aid

The concession rein aid can follow the restraining and is then the movement of the hand back to its original place, the restraining is always followed by a concession (Svenska ridsportsförbundet, 2003). There shall be an interplay between both these aids and that can only be if the hand is upright and the wrist is elastic (Svenska ridsportsförbundet, 2003). A concession can also be done from the hands original place by opening the hand or move it towards the bit in a smooth move and back again so that the contact with the horse's mouth doesn´t change (Svenska ridsportsförbundet, 2003). The concession can be a reward for the horse and a way of making it go faster ore lower its head (Svenska ridsportsförbundet, 2003).

Constraining aid

The constraining aid is used when the horse walks against the rein or is ridden "over the bit", but it can also be used in sensitive horses as a restraining aid (Svenska ridsportsförbundet, 2003). It is made by the hand that stays on its place but is closed hardly and doesn't relent until the horse gives in and the light contact is established again. It is important that the aid is supplemented by a strong seat and the led aids are taking the horse forwards (Svenska ridsportsförbundet, 2003)

Regulating rein aid

The regulating rein aid is a complement to the aid which is bending the horse in the neck and is the movement of the outside hand as it gives as much rein as the inner hand takes when bending the horse by the neck (Svenska ridsportsförbundet, 2003). This makes it possible for the horse to move its head after the inner hand's signals, the regulating rein aid also makes sure that the horse is not over bent and settles how much the horse will bend in the neck (Svenska ridsportsförbundet, 2003).

Leading rein/open rein

The leading rain shows the horse the way it is supposed to go (Svenska ridsportsförbundet, 2003). The aid is taken from the hand's original place and out from the horse in the direction the horse is wanted to go. When the aid is complete the hand is moved back to

place and a concession is given. The aid is often combined with the restraining aid that is bending the horse (Svenska ridsportsförbundet, 2003)

Supporting aid

If the horse needs extra help to listen to one led aid for example in a movement to the side, the rider can use a supporting aid (Svenska ridsportsförbundet, 2003). The hand and led aids together frame the horse and move the horse to the side (Svenska ridsportsförbundet, 2003).

Rein tension

The difference in rein tension in different gaits and activities are not well documented because it has been difficult to make a rein tension meter that does not affect the horse and rider (Clayton et al. 2005) or is too expensive to use in every day training (Warren-Smith et al. 2005).

Research by Clayton et al. (2005) shows that a smoother bit gives more tension in the reins than a more sever bit. And another study showed that the tension varies between different gaits and one study also says that the frequency of the tension spikes varies in the different gaits (Clayton et al. 2005). The two-beat rhythmic gait trot has two spikes per stride and canter has one spike per stride and the spikes were temporally related to the footfalls of the horse and the nodding of the horse's head (Clayton et al. 2003).

A mismatch between horse and rider can sometimes appear as jerks or struggles between the two parties. A mismatch does not depend on either the horse or rider but is a two way communication and both individuals have to work together to make a good match. My definition of a good mach and good communication between a rider and a horse are when the horse are working in a accurate way on the rein whit out locking bothered by the rider and when the riders signals to the horse are answered to without any delay, the horse and rider are working together as a team.

The rein tension meter can be a good tool to use to measure the pressure between the rider's hand and the horse's mouth and also the timing of releasing the pressure (Warren-Smith et al. 2005) and also to measure mismatches. If a horse and rider isn't a good match it should be shown by the rein tension.

When a horse and rider work together they use very small signals to communicate (Warren-Smith et al. 2007) and a mismatch should give a different kind of tension in the reins. When riding the horse "on the bit" the rider wants to have a light contact with the horse's mouth but when the horse and rider do not work together either the contact get a too heavy pressure and the rider feels like the horse is trying to pull the reins away from the rider, or the horse does not have any contact with the rider's hands at all.

I predict that riders have a specific pattern in their rein tension that is connected to their riding style and thus also appears if they switch horse. It can be an extra pressure in one of the reins or a way of using the reins in a specific moment.

### 2.2.2. Bitts

The use of bitts is a controversial matter as it puts a pressure on the horse's mouth, tongue, lips, cheek, nose and bars of the mouth (Bennett et al. 2006). Many people consider it to be a cruel training method when wounds are registered on all the places where the bit lies in the mouth (Cook, 2003). Bitts induce pain and in response the horse tries to escape the pain for example through opening one's mouth and to jar on the head (Cook, 1999). To have one or several bitts in mouth is not something that the horses are 'designed' for. If the horse has

a narrow space in the mouth and the horse get a bite in the mouth that takes up a big part of the mouth a lot of physiological functions can be disturbed. According to Cook (1999) will there also be an increased swallow activity when a bite is intercepted in the mouth, as it stimulates the brain that there is something in the mouth and chewing reflexes starts that involves lips, tongue and jaws. The respiration can also be disturbed because air runs in through the corners of the mouth beside the bite and then disturb the respiration's process that normal horses exude through the nostrils (Cook, 1999). Cook (1999) considers also that the horse are set for behaviors that collide when the bite in the mouth says that it is time to give energy to the MAG intestine channel in order to melted feeds and then the saddle is a signal that the horse soon will be activated and then sends signals that prepares the body for exercise.

Despite that bites have several negative aspects is it not an instrument for the rider to punish the horse or to hang for balance (Bennett, 2006). The well-trained rider works to be able to communicate with the horse primarily with the seat and led aids (Bennett, 2006).

## 3. **Material and methods**

### 3.1. **Methods**

This project was divided into two parts, the part where we tested the meter and learned how to use it and the part where we research whether the meter can be used to test the cooperation between the horse rider therefore we compare the result from the meter with the opinion of the rider and a jury.

#### 3.1.1.  Testing the rein tension meter

To be able to use the rein tension meter in a test we first needed to have an understanding of how the meter works. Therefore, we first worked 'without the horse' with the meter and a computer, installed the software and connected al the meter's components together. Then we applied the meter on a horse to see that the meter worked as it was supposed to. In this step I used some hobby riders that are locals at Varaorters RF.

During these two steps of the project we have taken all the information we collected about the meter and written an easy understandable manual for the meter to be a complement to the official manual. The manual has a lot of pictures and figures to make it easier to read. In the manual we give pointers to follow and how to avoid specific difficulties using the meter (Enclosure 1). We also testes if the rein tension meter were measuring accurate, by hanging weights on the reins and see if they measure the same and the true weight on the diagram. We used 2 weights, both 230gram, and hanged them in one rein each.

#### 3.1.2.  Measuring the horse-rider communication

The second part of the project was carried out at a stable owned by a highly qualified show jumping trainer for one day at the 18 of May. There we used the meter on four students that are training there and three of their horses. The horse and rider were asked to ride a predetermined course (Figure 1) that involves some easier tasks whit five parts. The first part is trotting over three bars then the second part is trotting in a figure of eight. The third part are changes in gate,  trot-walk-halt-walk-trot and the fourth part are a 15m circle in canter whit two cavaletti at each side of the circle. The fifth and final part is a small fence

in canter on a striate line. In a try to degrease the any disturbances we built the course
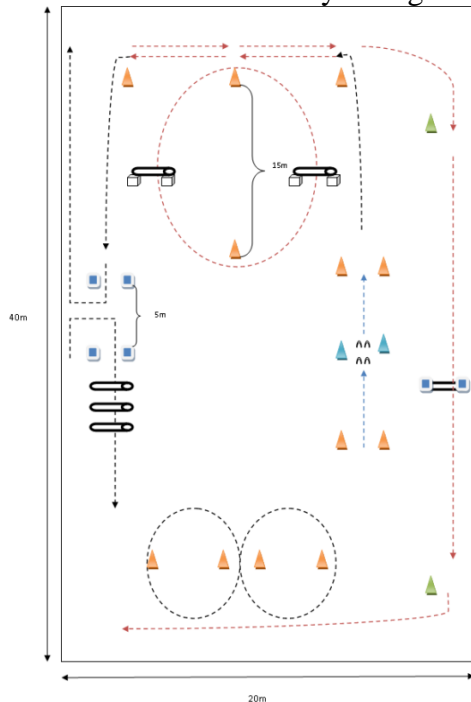


inside.

**Figure 1**. The court that the riders and horses rode, Blue= Walk, Black= Trot, Red= Canter.

During the course the rein tension meter collected data from the reins and afterwards we could see the rein tension on a chart in the computer. The sample frequency of the measurements is 100 times per second. When the rider had finished the course he or she would answer some questions on their opinion of the communication with the horse during their ride. The questions were about the control by the rider, the obedience of the horse and if the horse were willing to manage the task that it were presented for. There were also questions on the teamwork between the rider and the horse and about the rider's ability to manage the task (Enclosure 2). Each question have a line that in one end have "low" and in the other end "High", to fill it in the rider will cross the line where he or she sees it suitable. By not having any grades on the line we don't influence the riders to choose a specific place on the line to cross. The questions have all to do white the communication and mach between the rider and horse and to see if riders think that the cooperation is working or not are good to compare whit the result of the meter to easier understand the meters diagram.

When the rider and horse are working through the course a judge also observed the equipage and then gave her opinion on how the communication between the horse and its rider was. After the rider and trainer have given their assessment of the ride we can compare these with the chart from the rein tension meter in the computer.

Every rider did ride the same court on three different horses and we get a total of 12 rides. By repeating the test and by switching horses and rider's maybe we can see if the meter can be used to measure communication between horse and rider by looking at the chart given by the signal scribe program and compeer it whit the video and also see if the characteristics of the tension measures are specific for a horse or a rider. In the diagram we can look for peaks or troughs that can indicate a struggle or we can see that in one rein there is much more tension than in the other that can indicate that either the horse or the rider are in an incorrect way seeking support by the other. To be able to measure if the

rider and horse is a good match with each other we need to find how miscommunication is shown on the cart. Maybe that can be done by watching a video of the mismatch and at the same time study the chart.

### 3.2. **Animals**

For this study we have used six horses between 6 and 18 years of age of different breeds, size and sex. All the horses were familiar with the surroundings they were tested in and were well capable to handle the task that they were given. First I tested the meter with three horses at my riding school in Vara. It is a stable with two indoor arenas and one outdoor arena.

The three horses that were used to try out the rein tension meter were ridden by their owners and were trained in jumping, dressage as well as eventing in easy level of competing in Sweden. They are training for an instructor once or twice a week and riding their horses 4-6 times a week. They are competing from 90cm to 120cm in jumping and LB and LA in dressage one of the riders is competing as a debutant in eventing. All rider-horse combinations were tested at Varaortens ryttarförening one time each during 6-7 of May in the outdoor arena.

The three horses that were used for the experiment were ridden both by their own rider but also by three other riders who were not accustomed to the horse. The horses are used to wearing different kind of equipment and would probably not change their behaviour because of the small data logger that is strapped to their bridle. These horses were competing on national level of jumping and the riders were one student from the Hippolog program at SLU and the other three riders were students of the trainer living and training at jump club. The experiment were conducted in Enköping at the facility of the jump club in there indoor arena that were 20x40m large.

### 3.3. **Equipment**

For these tests we used a rein tension meter (Figure 2) from Crafted Technology, Biomedical Electronics, Signal Scribe Quadflow, Australia and its program "Signal Scribe" with is a setup and analyses program for windows. More info on this equipment can be found on www.reintensin.net. The rein tension meter measures the tensions in the left and right rein and stores the data in a data logger that is fixed to the bridle. The data are later downloaded into a computer for further analyses and submitted in to a diagram (Figure 3).



**Figure 2**. Rein tension meter adapted on a horses bridle.
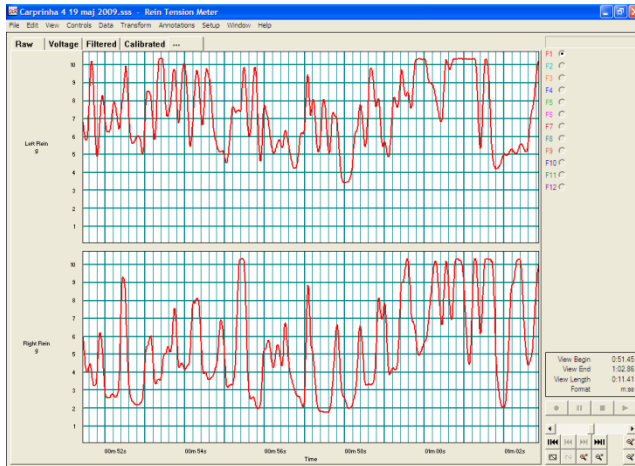
**Figure 3**. Diagram from signal scribe program.

We also used a video camera to record the rides to also be able to observe behavioural responses relevant to the match between the horse and rider and to be able to further interpret the signals from the rein tension meter. For analyses we use Minitab 15 and Microsoft Excel.

### 3.4. **Analysis**

The answerer of the questions was measured by the centimeters from "low" to the place where they have put the cross. The maximum rage were 8.5cm and minimum where 0cm. It is not always that the rider and judge have the same opinion and then we will put judge's opinion first because she sees bout the rider and the horse's reactions.

When the data from the rein tension meter and the video of the course are compared we colored the diagram where different colors were used to indicate different parts of the court so that the different parts of the court can be compared between rides. We can export the data from the signal scribe program choosing those graphs we want, left rein and right rein and then we get the graph in number form in two columns one for the right and one for the left rein. That data we then can put in Minitab for analyses. There we can get some box plots and see whether there are differences that can used to determine if the rein tension meter can be used to find mismatch. In Mini tab the data were corrected so that the result in the diagram and table were accurate and not showing the wrong differences between the reins.

In the signal scribe program we also counted the amount of peaks and valleys on the charts. For practical reasons so there wouldn't be too hard to count the peaks that some time were difficult to separate from each other I chose a high rage over 1100g and a low rage under 300g.

## 4. **Results**

The testing of the rein tension and signal scribe program ended up in a 12 pages long manual for the rein tension meter with photos of the meter and images for every step on the way to install the drivers for the logger and install and activate the signal scribe program (Enclosure 1). The test were we were hanging weights in the rein showed that the left rein measured 100gram more than the right rein that were showing the accurate weight on the diagram.

The four riders that were chosen for the second part of the project rode the court three times each on three horses but only ride number one and ride number three were recorded by the data logger so only these data are analyzed, after this called horse one and horse two. The rides had a mean duration of 1minute and 57 seconds.

## 4.1. **Can we use the rein tension meter to indicate horse rider communication?**

What are possible indicators of good/bad communication?

My definition of good communication is, as mentioned earlier, a rein aid that is smooth from the rider to the horse and listened to by the horse without any delay. If the horse is showing any discomfort by having a rider on its back then the rider and horse are not working as a team and the communication is not as good as it can be. The charts of rein tension given by the signal scribe program may give indications for good or bad communication. We could look at the peaks and valleys, how often are there peaks of a special strength, if they are followed by valleys and how long the peaks are. In the charts we can also see how much tension there is in the reins at all times and if there is a difference in the tension in left and right rein. By comparing the charts with the scores given by the judge and riders after the ride we can see if the communication worked between rider and horse according to the judgments and look at the charts to see how good or bad match looks like on the chart.

The judge and riders evaluation of the rid

| | Horse 1 | | | | | | | | Horse 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | | V | | K | | O | | J | | V | | K | | O | |
| | R | J | R | J | R | J | R | J | R | J | R | J | R | J | R | J |
| The riders control | 4.2 | 6.9 | 5.2 | 6.1 | 7 | 7.1 | 5.1 | 7.7 | 4.2 | 6.9 | 5.7 | 6.2 | 6.3 | 5 | 2.9 | 3.8 |
| The horses obedience | 5.2 | 6.4 | 4.9 | 4.3 | 7.1 | 5.5 | 5.6 | 7.6 | 4.2 | 6.3 | 5.7 | 5.7 | 4.2 | 4.5 | 2.7 | 1.9 |
| The horses willingness to solve the task | 5.2 | 6.3 | 6 | 3.8 | 8.3 | 5.6 | 7.4 | 6.7 | 4 | 6.2 | 5.6 | 4.6 | 0.5 | 2.4 | 3.7 | 2 |
| The horses ride ability | 5.3 | 6.2 | 6 | 4.3 | 8.3 | 5.6 | 6.4 | 6.9 | 4.1 | 6.3 | 5.4 | 4.7 | 4 | 2.3 | 3.2 | 2.6 |
| Cooperation between horse and rider | 3.9 | 5.7 | 5.3 | 4.0 | 7.7 | 5.7 | 4.9 | 8 | 4.2 | 7.6 | 5.6 | 5.5 | 6.6 | 5.6 | 2.3 | 2 |
| The riders ability to solve the task | 4.1 | 5.6 | 5.1 | 4.5 | 7.5 | 5.9 | 3 | 8.1 | 4.1 | 7.6 | 5.5 | 5.5 | 6.7 | 6.9 | 2.7 | 1.9 |
| Mean | 4.7 | 6.2 | 5.4 | 4.5 | 7.7 | 5.9 | 5.4 | 7.5 | 4.1 | 6.8 | 5.6 | 5.4 | 4.7 | 4.5 | 2.9 | 2.4 |

**Figure 4**. The different score of judge and riders judgments of each ride for all riders (R=Rider, J Judge, J, V, K, O =Riders) max= 8.5.

The judge and the riders did not evaluate the rides the same way. Some of the riders were always lower in their scores then the judge but one of the riders gave higher scores at most of the questions than the judge gave him (Figure 4). From earlier research (Visser et al. 2003) we know that riders and judge do not have the same experience of the ride, the question is which one are the best indicator of the communication between rider and horse. I believe that the most accurate score to use is that of the judge because the judge does not judge its own performance and does not have its own self-esteem and self-reliance influencing the score.

What is the average rein tension of rider?
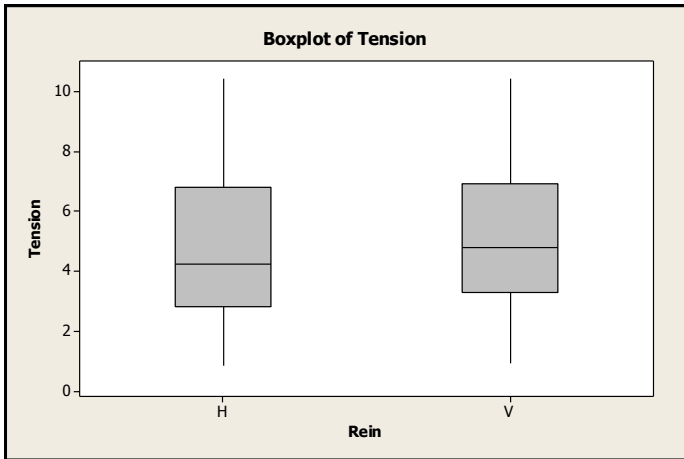
**Figure 5.** The average rein tension in right (H) and left (L) rein in 100 gram (Mean H=497.99g L=524.83g)

The rein tension depend bout on the rider and the horse, the mean tension for the tension in the reins is 502 grams and has a range between 84 gram and 1044 gram. The tension between reins varies a little (Figure 5) with mean for right rein at 497 gram and mean for left rein at 502 gram after been corrected for the difference in the meter.
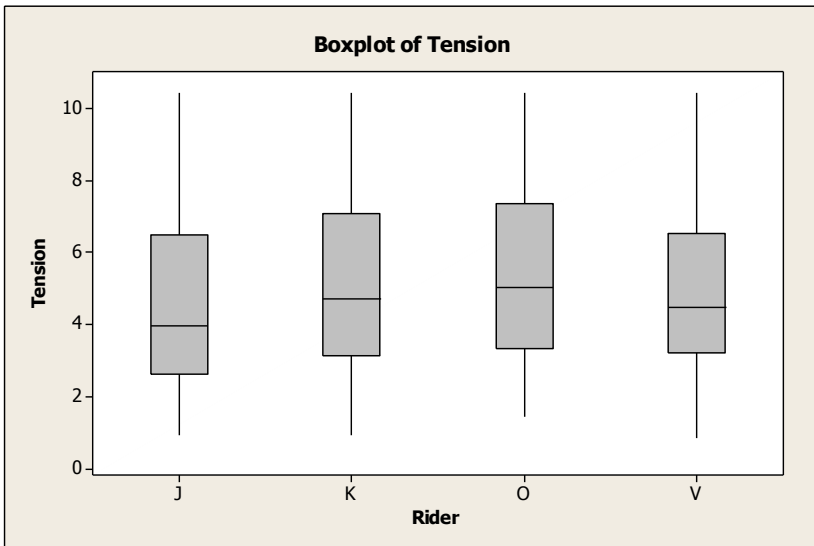


**Figure 6.** The deferens in rein tension between riders (mean J=475.07g K=521.7g O=54948g V=503.96g)
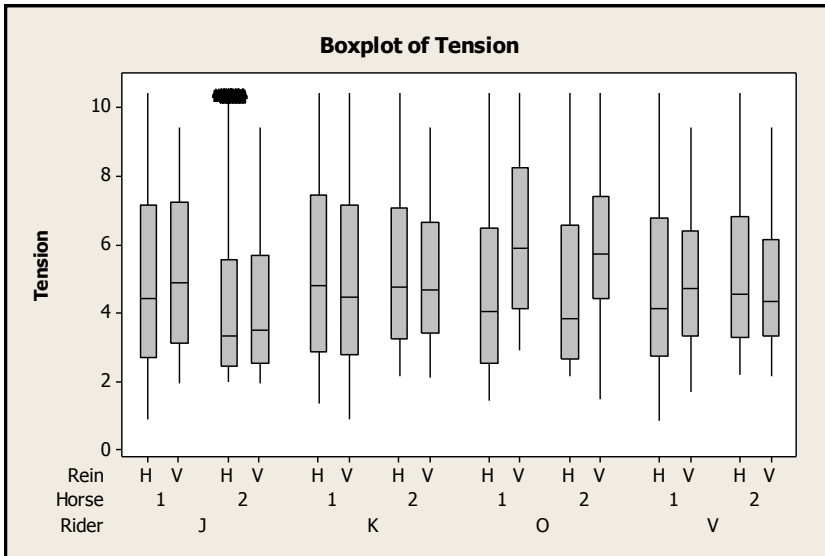
**Figure 7.** Rein tension in 100 grams, for each rein for each rider on horse one and horse two.

The mean tension in the reins differs somewhat between the four riders (Figure 6) but the minimum and maximum rein tension differs very little, the maximum is the same in all the riders at 1044 gram as said above and the minimum has a variation at 64.3gram. The rein tension variation in the left and right rein can be a result of one rider that has more tension in the left rein then in the right rein on both horses (Figure 7) with the mean for right rein at 480 gram (maximum 1044g, minimum 142g) and left rein at 618 gram (maximum 1040g, minimum 149g).

Can rein tension be linked to the scores by the judge and riders?
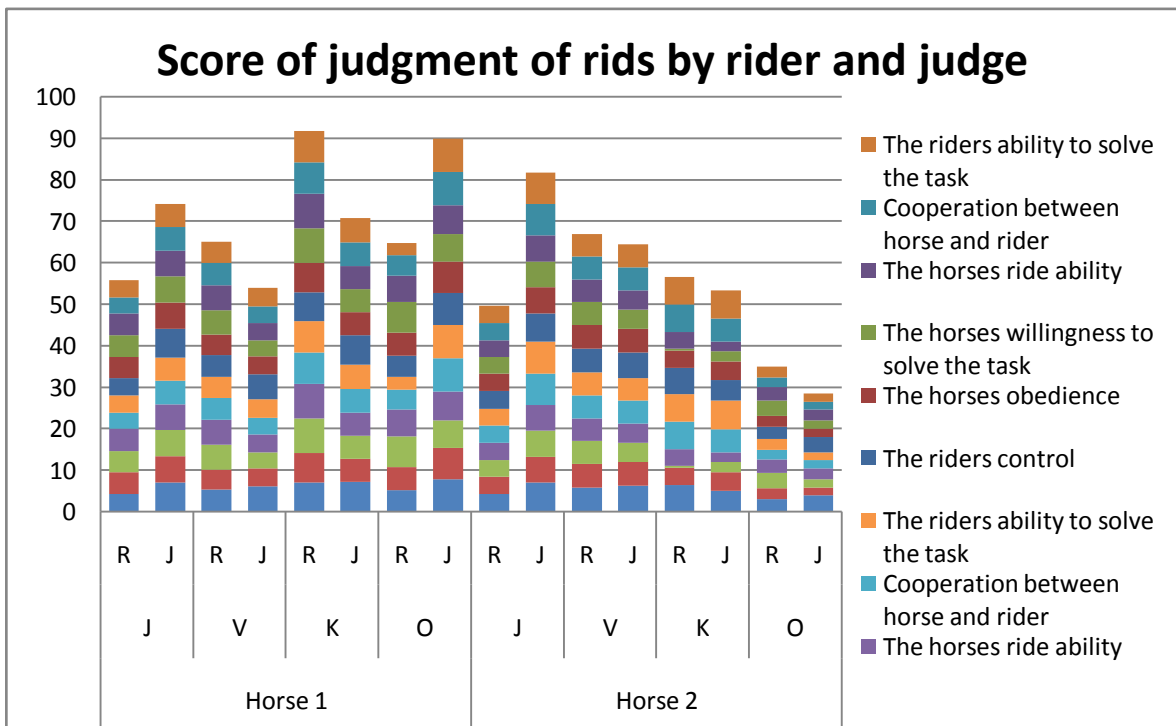


**Figure 8.** The different score of judge and riders judgements of each ride for all riders (R=Rider, J Judge, J, V, K, O =Riders), first the scores on horse 1 then on horse 2.

Comparing the graph that shows the score of the riders and judge (Figure 8) with the one that shows the rein tension for every rider's left and right rein for each horse (Figure 7), we can see that J on horse two has the lowest means (436g) on the tension and also a high score from the judge but not from herself. This can indicate that a low amount of tension in the reins is an indicator of a good communication. But rider O on horse 1 got the highest score by the judge and has a quite high mean (550g) and rides with different tensions in the two reins. When we look at what different questions they get the higher or lower score, rider J gets lower scores than rider O on all the questions but the difference is larger in the horse's willingness, ride ability and obedience (Figure 4) which can be affected by the horse's level of training.

Peaks and valleys on the rein tension chart
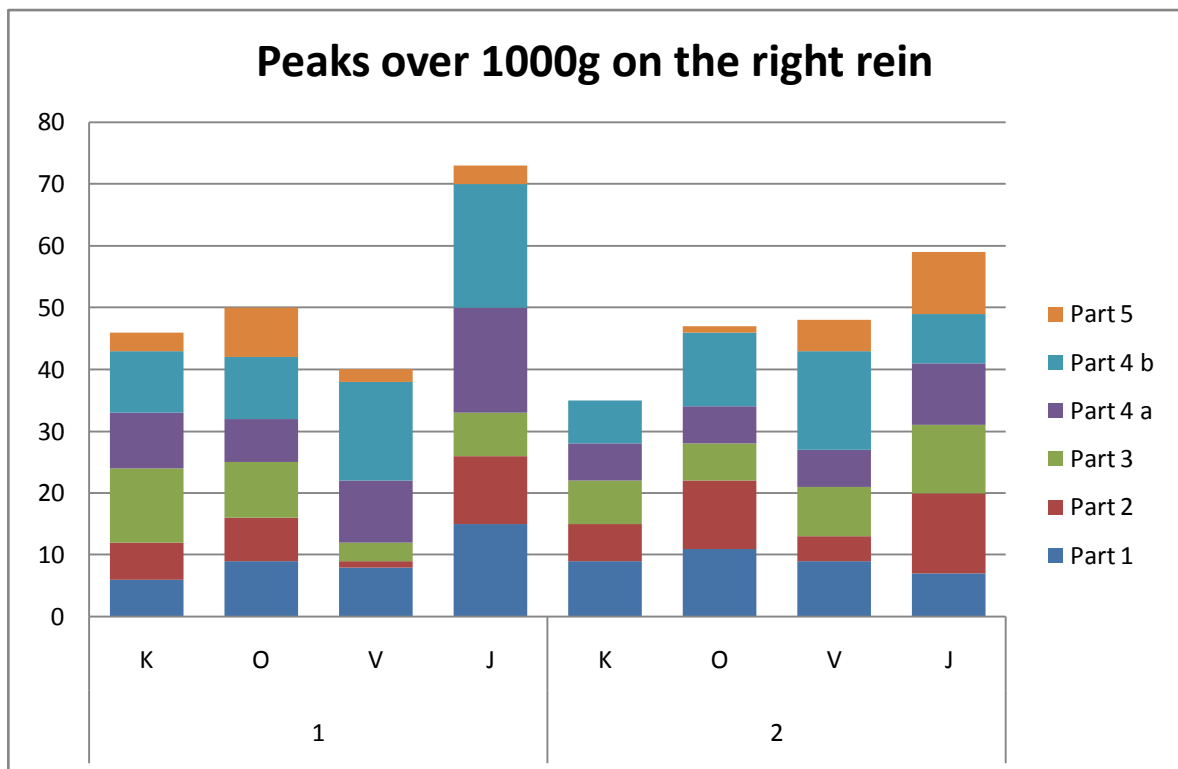


**Figure 9.** Number of peaks over 1000g for each rider on the right rein and for every part of the court and bout horses.

On the chart given by the signal scribe program we can see all the peaks and valleys of the rein tension, some peaks are higher then others and some valleys are deeper. The diagram above (Figure 9) shows the number of peaks over 1000g on the right rein for all the four riders on both the horses and also shows how many peaks there are in the different parts of the court where part 4a and 4b is canter in left and right lap.

## 4.2. **Are specific rein tension patterns characteristic for the rider or the horse?**
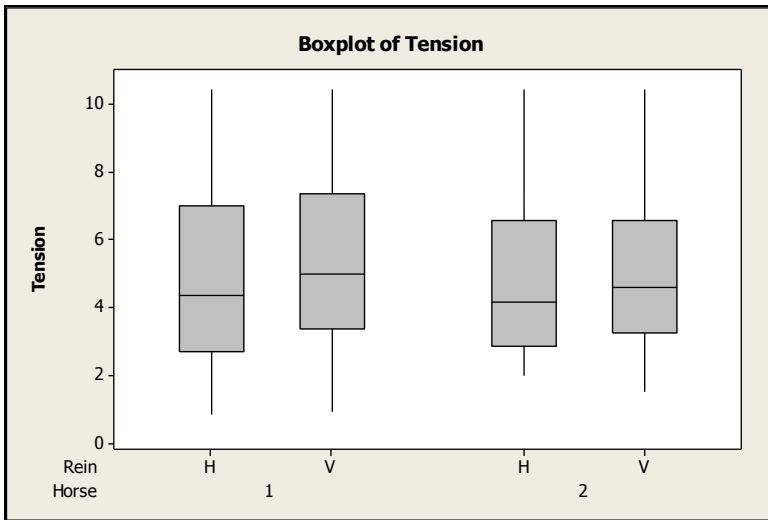


**Figure 10.** Tension in left and right rein for bout horses in 100 grams.

The boxplots of the horses tension in the left and right reins (Figure 10) and the boxplot of the riders tension in left and right rein (Figure 7) indicate that horses and riders have specific rein tension intensity, one horse has more tension in the reins than the other and one rider can ride with more tension in left rein than right rein.
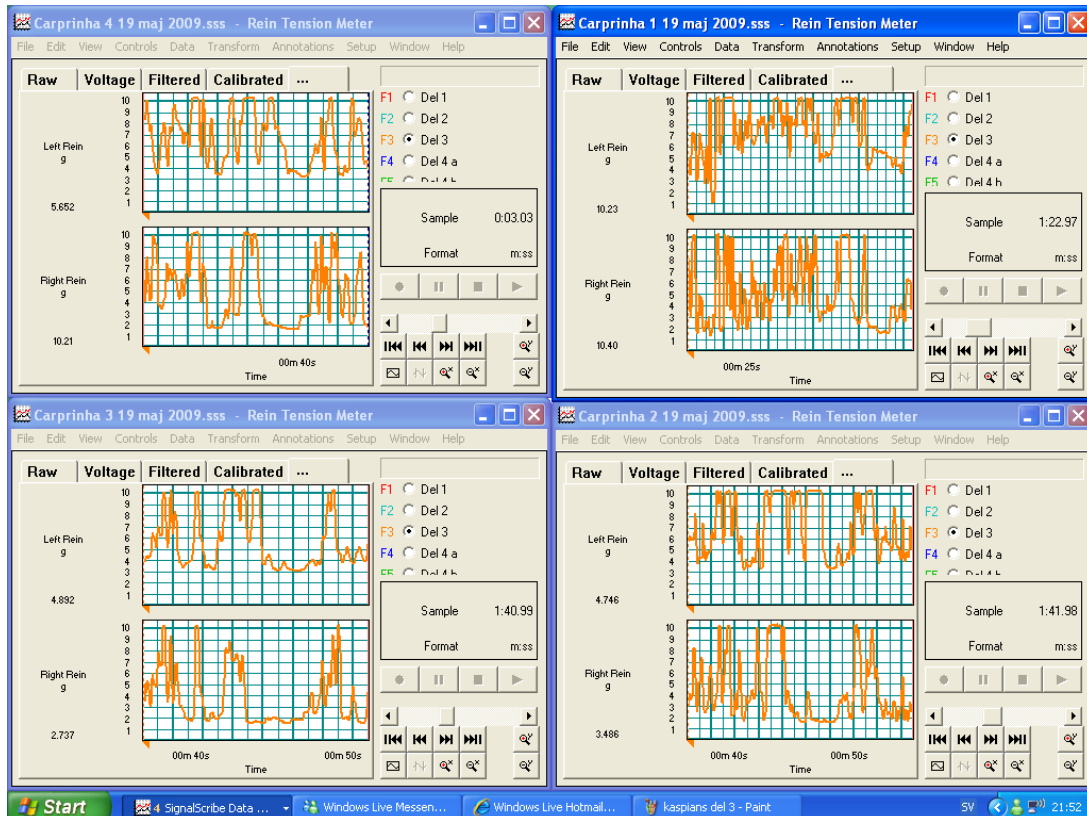


**Figure 11.** Horse number one and the halt on all four riders.
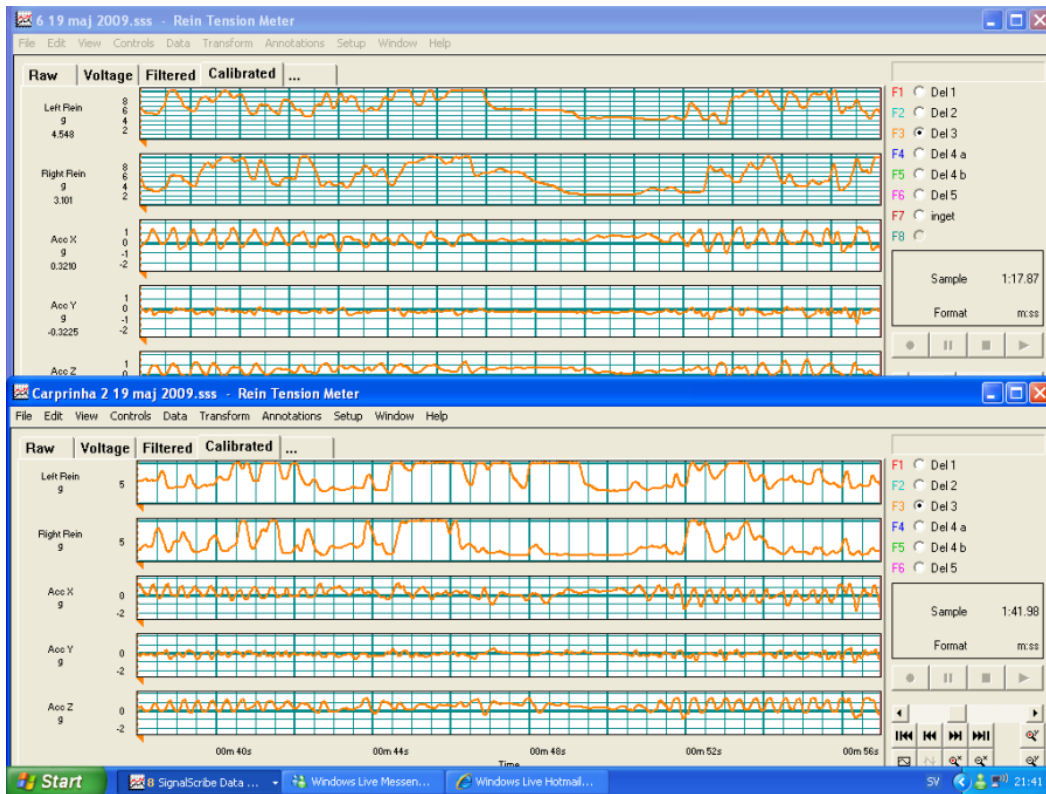
**Figure 12**. Rider K´s part three (trot-walk-halt-walk-trot) on both horses.
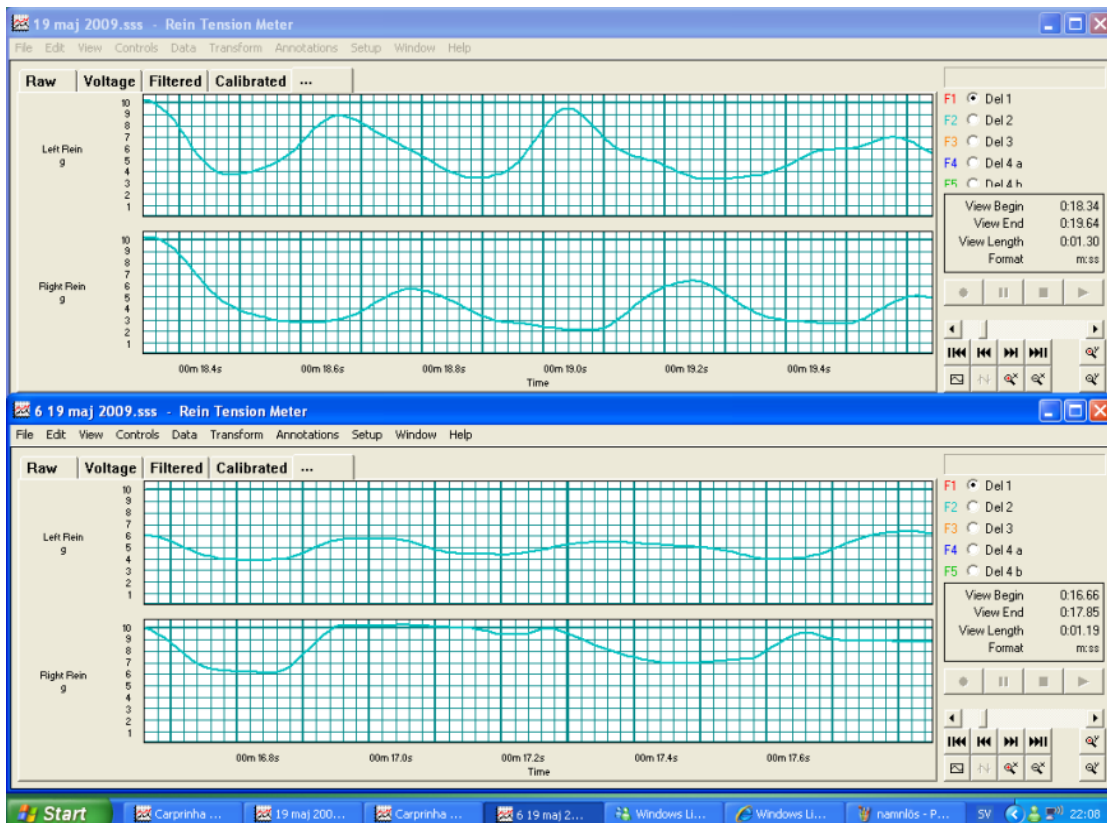


**Figure 13.** A comparison between rider J and rider V on the same horse and on the same place on the court.

By studying the charts given by signal scribe we can't read out a specific pattern that is characteristic just for horse number one without more rides and more data. But by marking

the different events and then looking at the charts we get a more clear view (Figure 11). This way we can compare different parts of the court with the different riders on one horse (Figure 11) or we can see how a specific rider rides at one part of the court (Figure 12) and even compare the difference in rein tension one rider to another on the same horse at the same place at the court (Figure 13).

## 5. **Discussion**

### 5.1. **Can we use the rein tension meter to indicate horse rider communication?**

On the charts given by signal scribe we can't see how or why there is a peak above the ordinary but by looking at a video we can link the signal to the horse's behaviour. Aversive or avasive behaviours or signs of discomfort can be identified. By studying many videos of horses and riders working the court and at the same time studying the chart given by the signal scribe I believe that you can learn to see the difference between the different types of peaks. One difference that can be seen in the chart are how fast an aid is given, as said above a restraining rein aid always should be followed by a concessional rein aid and the time for the concessional to come can be seen. This way we can see fore how long time the rider is giving the rein aid. Depending on how long, often or how strongly an aid has to be given before the wanted behavior is shown we can get a picture if the rider or horse are a good match or not. If the match is good the aid is not supposed to have a long duration or a need to be repeated.

To see if one horse and one rider are matching or not we probably need to see more than just one temporary measuring because the daily mood of the rider or horse might influence the result, by measuring the rein tension at the beginning and continuously during the training session and to measure over more days minimalises the effect of daily mood swings of the horse or the rider.

A point that the trainer pointed out is that the tension depends on how the rider rides the horse, the more you drive the horse forward to the hand by the led aids the more tension there will be in the reins. To get a full picture of the cooperation of the horse and rider we do need to measure all the aids of the rider and the movement of the horses back legs and the horse behaviour. To make this kind of measurements knowledge of the horses behaviour and natural movements is needed and of course a budget because the equipment is expensive and still under development.

One interesting thing is that both of the riders that got the highest score by the judge got them when they were riding on the horse they usually were riding and training which may indicate that the communication between a horse and a human gets better with training.

But it has to be noted that when the tension in the rein is light this does not always mean that the communication is good. For instance if the horse is soar in the mouth or has a bit that is too sharp it might do what the rider is asking with a light contact in the reins but the horse's body language may show that the horse is uncomfortable or in pain. This then suggests that the communication is not a two way communication or a good communication.

## 5.2. **Are specific rein tension patterns characteristic for a rider or horse?**

If a rider uses the rein tension meter many times and on a lot of horses the rein tension meter can be used to find a specific pattern for this rider. The same is with one horse that is ridden by many riders. One important thing is that they always have to ride the same court or way every time so there aren't any differences between the rides. One problem with this is that the rein tension meter can't determine whether the horse or the rider is pulling the rein and that can affect the pattern that we are looking at in the signal scribe program. In diagram 3 we can see that the rider O rides with different tension in right and left rein in both horses. Since the other riders don't show this we can say that it is the rider that makes the difference and then a trainer can make a specific training program to reverse the problem and improve the communication and match between the rider and these horses. A specific pattern does not have to be a bad thing if the rider has a pattern that works with the horse the pattern is good for the match.

## 5.3. **To think about for next time**

One thing to think of next time a court like this should be ridden is to make sure that there aren't too many parts at the court. Now we had 5 parts and they were a little too tight to make it fit on the 20x40m inside arena. Perhaps it would be enough with only the parts with canter over the cavaletti on the circle, the fence and the trot-walk-halt-walk-trot parts. It is better to get a few parts that are well ridden and all riders and horses get them the same instead of a lot of parts that are put tight together ore make the riders confused.

The rein tension meter has to be calibrated for the next time it is used, even though the meter is new and imported directly from Australia it is not measuring the same left and right. A 100 gram difference does not seem to be a big deal but as every chart given by the signal scribe program that are showing the left-right rein tension are giving a false result that the left rein have more tension than the right.

When working with the rein tension meter or different kind of data it is important to have a good back up. In the field it is also good to have a spare computer and an extra memory card so that whatever happens the data will not be lost.

# 6. **Conclusion**

I believe that the rein tension meter can be used to support the measurement of the mismatch or match between the rider and horse, but it needs additional information for example behavioural analyses from video recordings and judgments from a judge. The rein tension meter would be good to use together with equipment that measures all the riders signals to the horse and the horse's responses.

# 7. **Acknowledge**

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Enclosure 1

## Rein tension meter

### Preparing the rein tension meter

The rein tension meter consists of 1 SignalScribe data logger (1), 1 pair of reins with load cells (2) and 1 mini SD memory card (1 GB) (3). There are also a USB cable (4) and an adapter for the memory card (5).
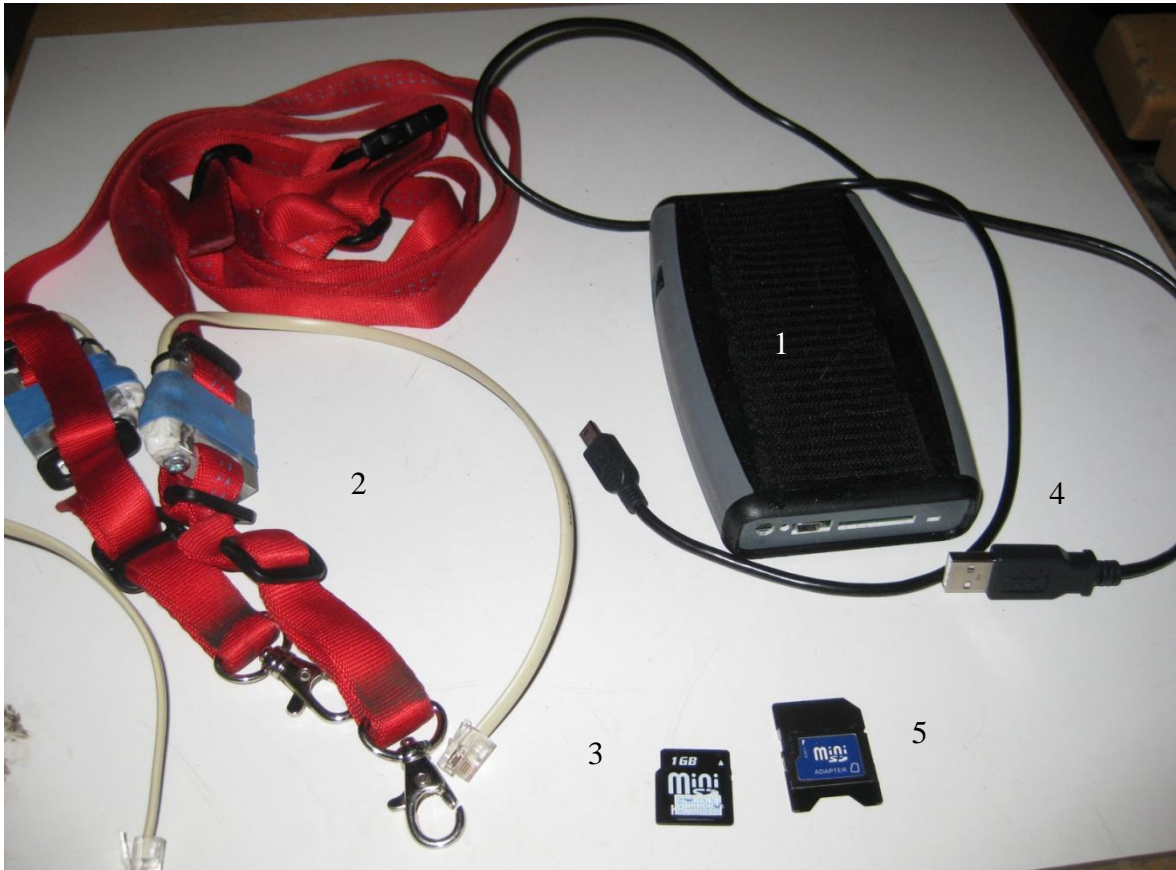


On the up side of the data logger is the attachment for the bridle, the batteries are placed in the other side if the data logger. In the front of the data logger there are a USB connecter for the USB cable and a memory card reader, the arrows are showing the way on the memory card is inserted, just make sure that the text on the memory card is up. There are also an on/off button and a red lamp which tells what the data logger is doing, if it is on or off, recording or not.

### Installing the rein tension meter

Go to the website
                                                    1

http://www.signalscribe.com/downloads/signalscribe_download_2-0-9630.htm and download first the "logger device driver". Save the file as "ssusb232.inf". Sometimes the computer changes the extension to ".txt" and then it won't work. Save it in a folder on your desktop, a suggested name for that one is 'rein tension driver', so that you know where you put it.

Turn on the data logger and connect it with the computer by the USB cable, make sure that the memory card is plugged in. Windows will now find a new device and start up a

program for installing new drivers. Do not do an automatic drive finder but choose manual selection by ticking "no not this time". Then click 'next'.
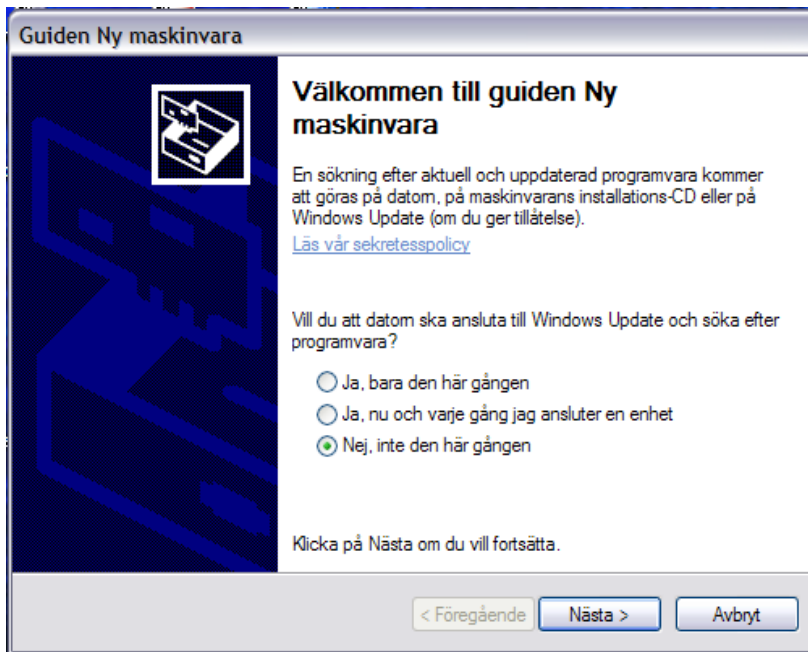


Then you indicate that you want to choose from a list and click 'next'.
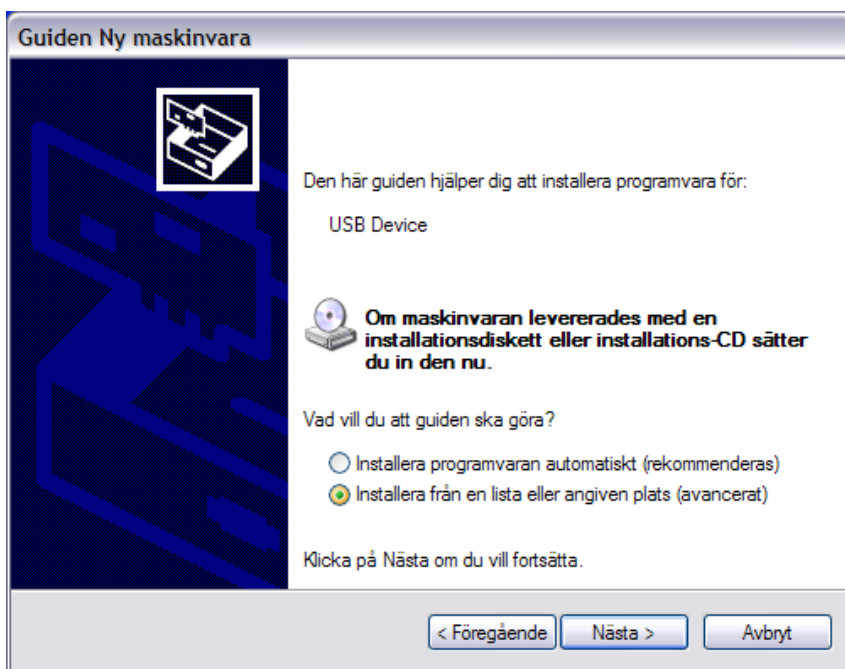


Then you press 'brows'e and you go to the folder 'rein tension driver' where the file is, select the file and then 'next'.

Then the driver is installed after you press 'finish'.
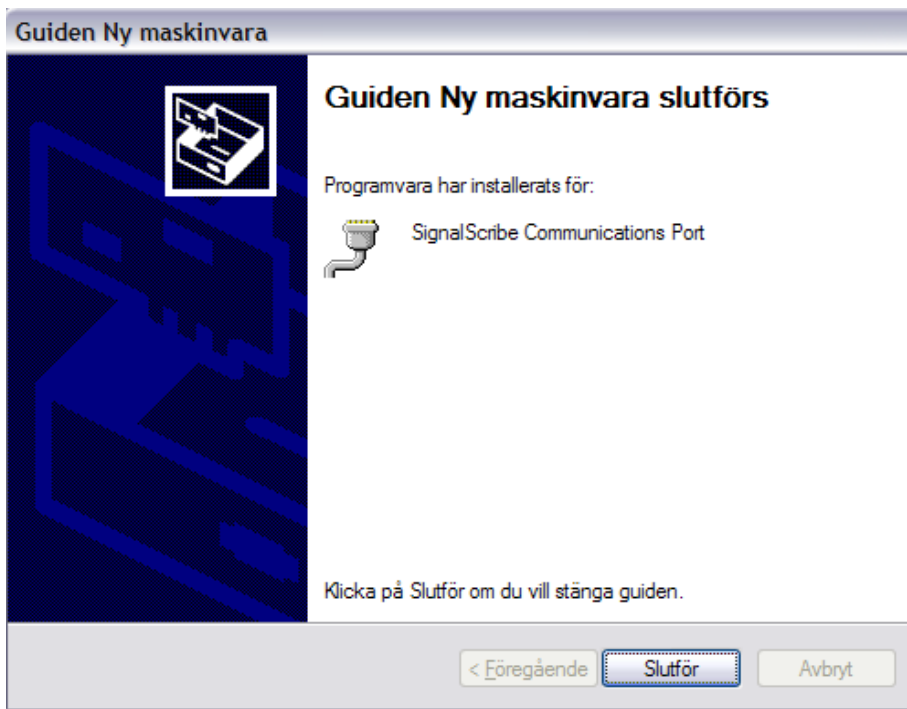
When the driver is installed you download and install the software. Press activate and choose activate whit logger. When the logger is installed you don't need a serial number to activate.

If your computer has its USB ports connected to a high number com port there may be some complications installing the program and the serial number and activation code are required.

Then you turn of the Signal Scribe program and go to
http://home.exetel.com.au/robac/signalscribe/downloads/signalscribe_update_2-0.htm
there you download an update that make the program identify com9 to com20. Install the update the same way as the driver.
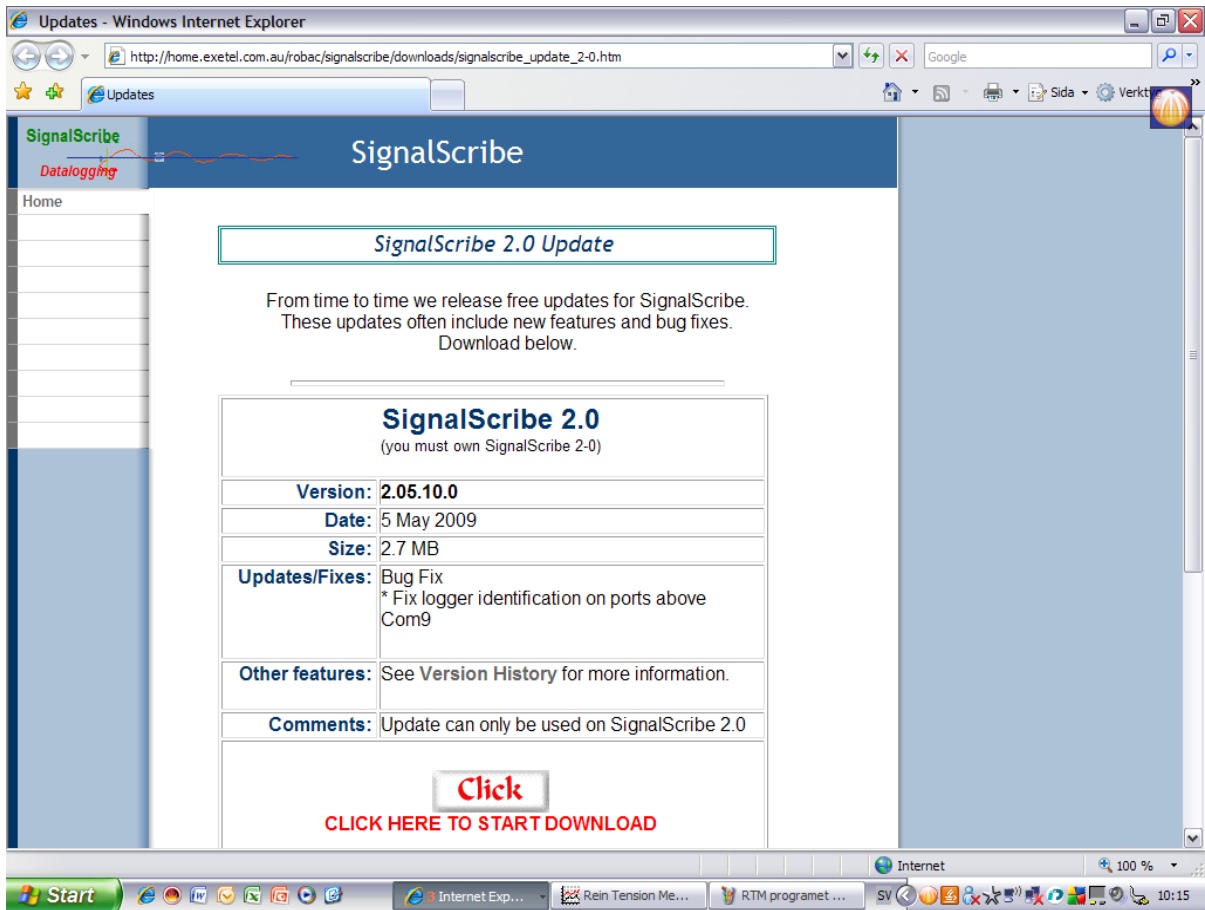
Then open the Signal Scribe program and connect the logger and turn it on.

**Activation of the Signal Scribe program**
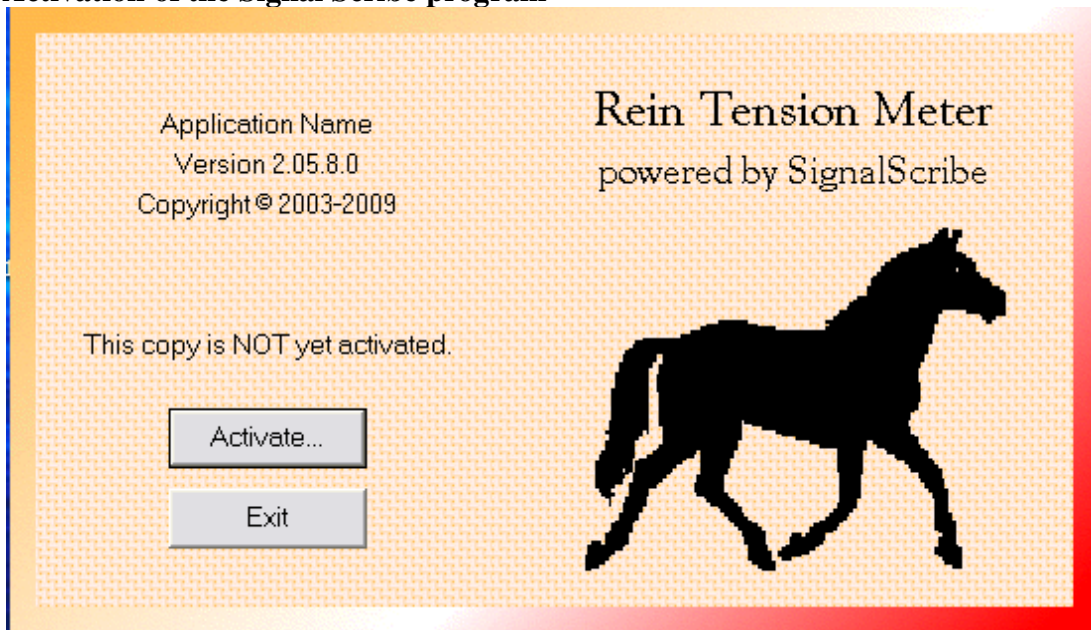


Open the Signal Scribe program and press activate.
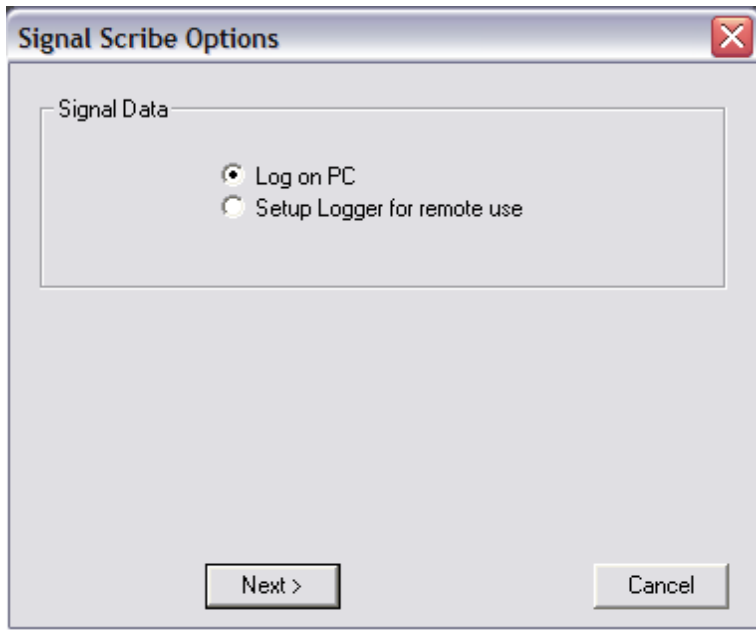
Fill in the name and serial number.



Mark method 2 and click 'next'.

**Use the Signal Scribe program**
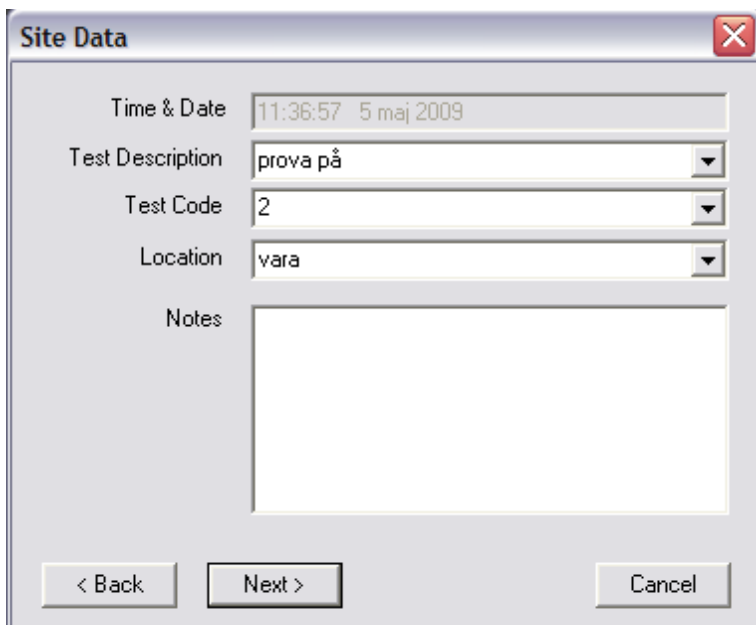
Open *file* and chose *new*. Then you can either choose to work with the logger connected to the computer (*log on PC*) or to prepare the logger to be used in the field (*Setup Logger for remote use)*
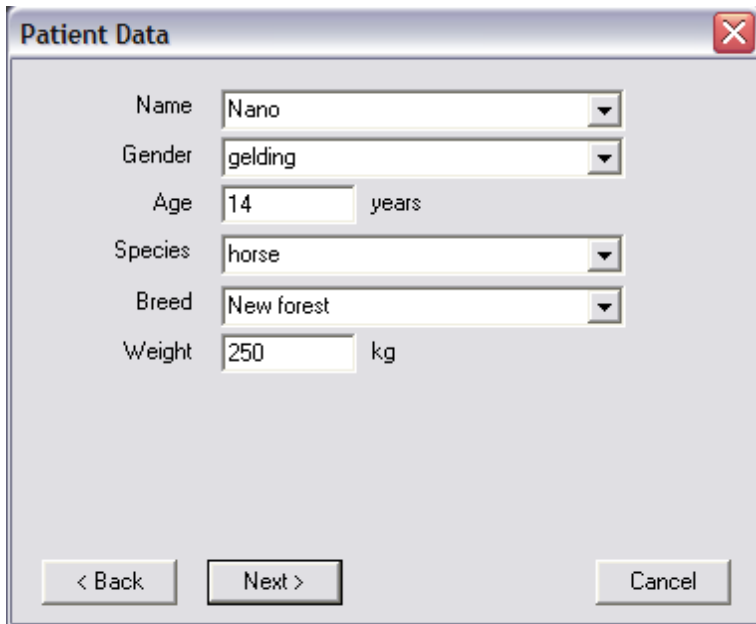
**Log on PC**

Mark log on PC and Next.



Write down the site information. Next.
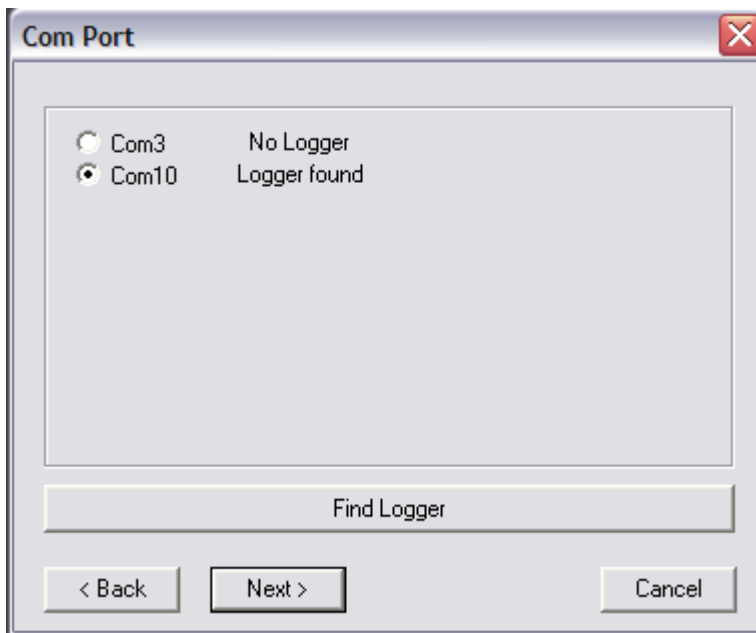
And then the information on the horse. Next.



The program will find your Com ports and then press *Find logger* after the logger has been found mark the Com port and next.
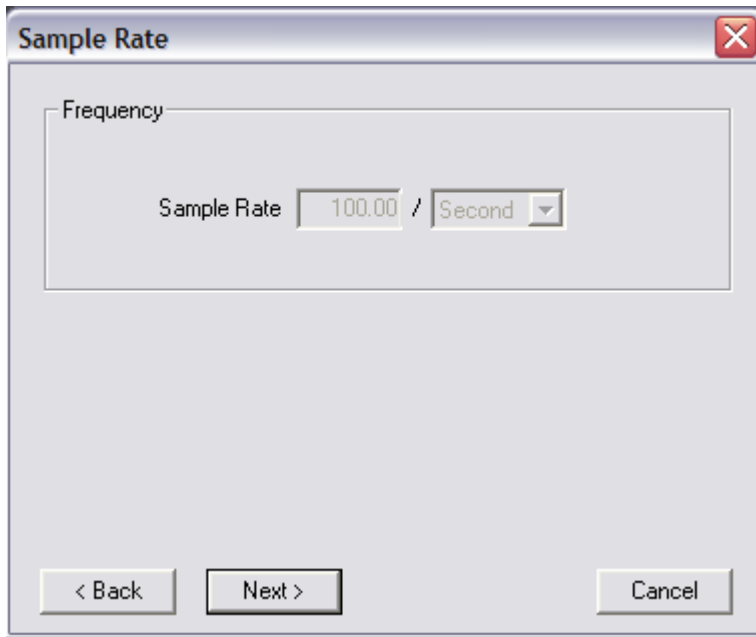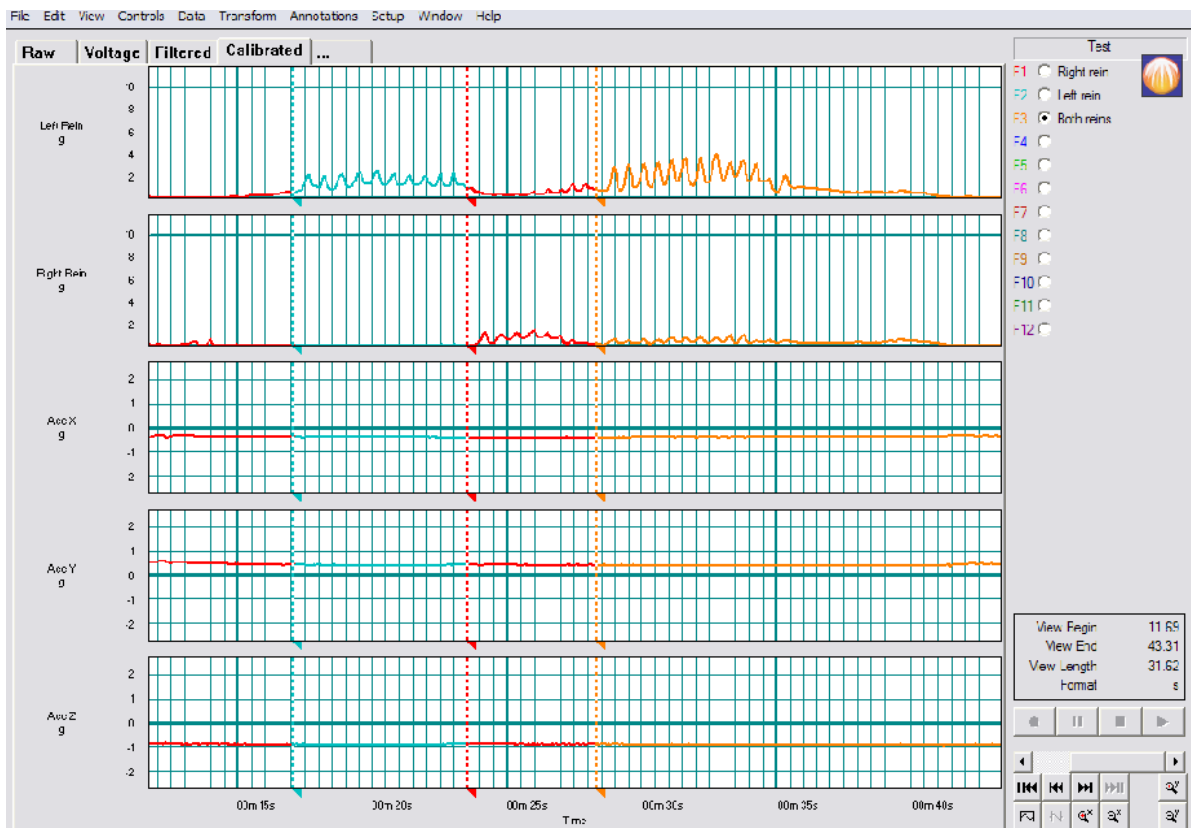
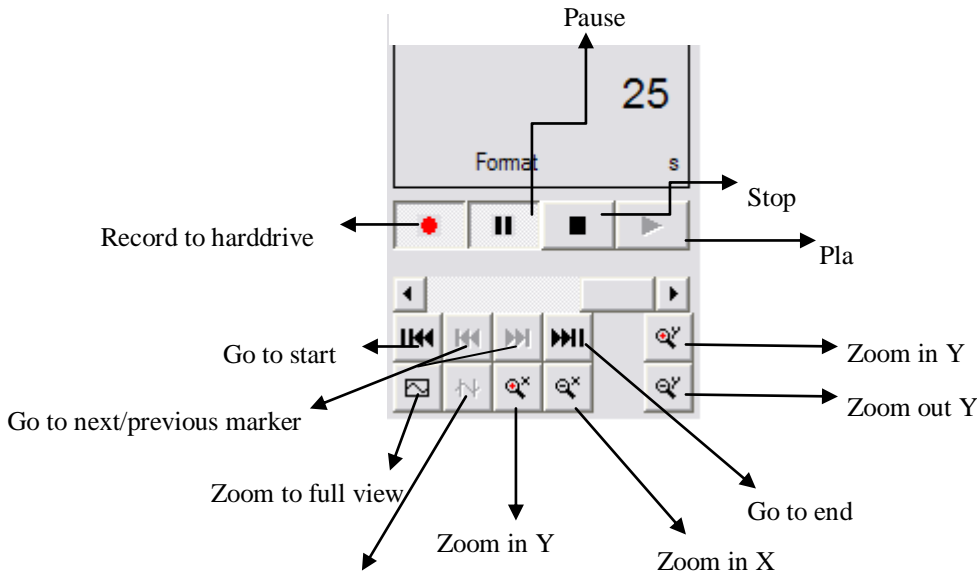The frequency of samples per second is shown and next.
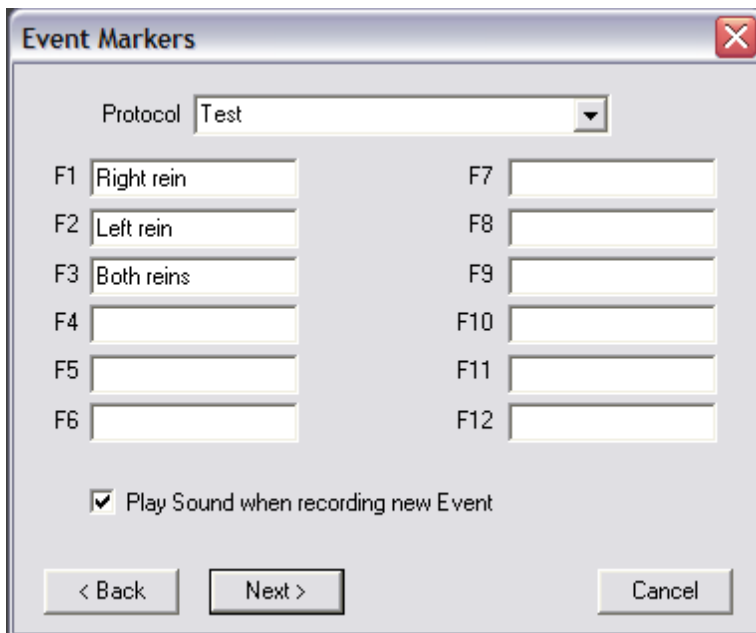


Then you can write down different types of events. For example different gaits or different obstacle as fences. Next.
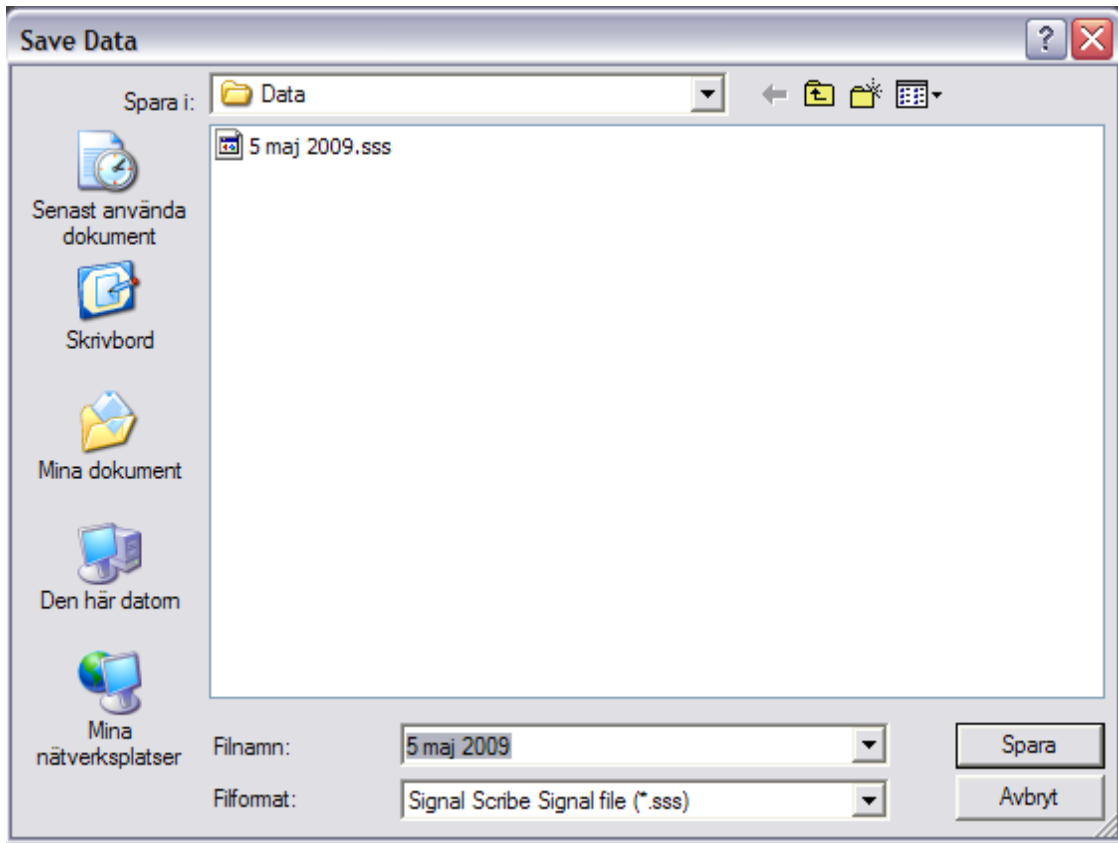
Then the program creates a file where the records and info about the record ate saved before the measures can begin. Save.
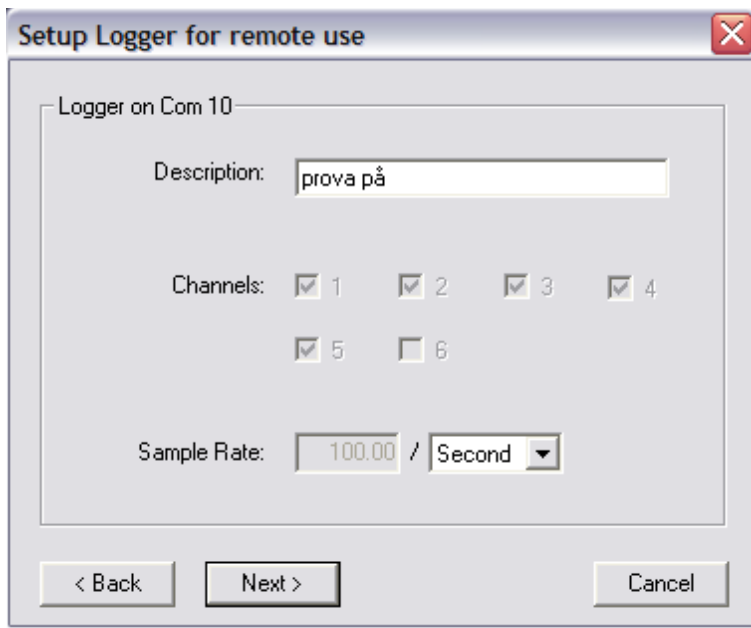
As soon as you have pushed save you can see the tension in the reins on the diagram. The records are started when you have pressed the record bottom. Then you can change the different events whit the F (F1-F12) bottoms to end the records press the stop bottom.
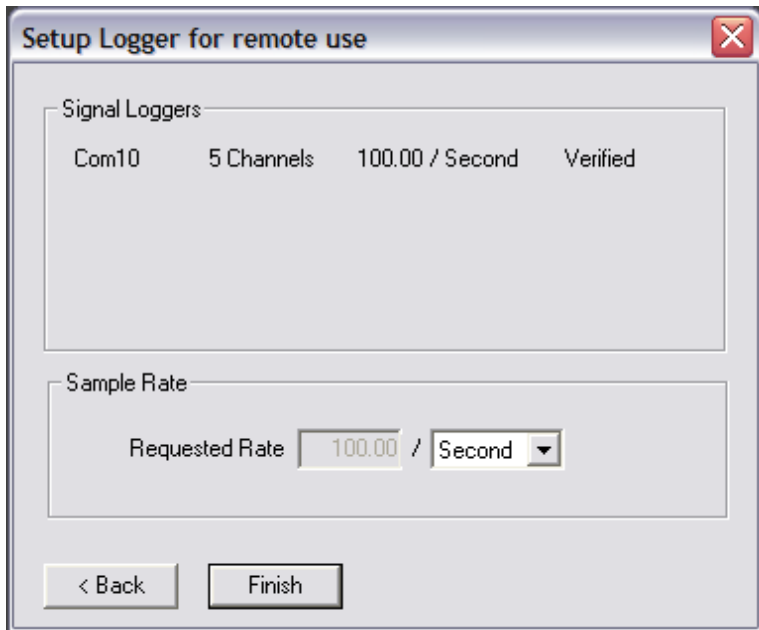
Pause

25

Format                s

Record to harddrive

Stop

Pla

Go to start

Zoom in Y

Zoom out Y

Go to next/previous marker

Zoom to full view

Go to end

Zoom in Y

Zoom in X

**Use the ]** Zoom to epoch **d**

Open *file* and chose *new*. Choose *Setup Logger for remote use*. Next.

### Setup Logger for remote use

Logger on Com 10

Description: prova på

Channels: ☑ 1  ☑ 2  ☑ 3  ☑ 4

☑ 5  ☐ 6

Sample Rate: 100.00 / Second

< Back   Next >   Cancel

Then you describe the test ahead and select a sample rate. Next.

**Setup Logger for remote use**

Signal Loggers

Com10        5 Channels        100.00 / Second        Verified

Sample Rate

Requested Rate    100.00    /    Second ▼

< Back        Finish

Then the logger will verify the settings. Finish.

Disconnect the logger from the USB cable and turn of the logger. When the logger shall be used connect the reins to the bridle, and connect them to the logger. Strap the logger to the underside of the bridle and turn the logger on and start the recording.

**Turn on the logger:** Push and hold button 3 seconds and the beeper beeps 3 or 4 times and there is a slow flash. As long as there are a slow flash the logger is on and not recording.

**Turn off the logger:** Push and hold button 3 seconds and the beeper beeps 1 long time and there are no more flashes. .

**Record start:** Push the button briefly, a rapid flash instead of the slow flashes and a long beep.

**Record stop**: Push the button briefly, a long flash (2 seconds) and then slow flashes, 2 beeps.

After the records have been made remove the mini SD card and plug it directly into the computer or using the adapter. Then open the Signal Scribe program and go to *File*, then *Import*. Go to the memory card and there you can find files named ss-log**.ssc.
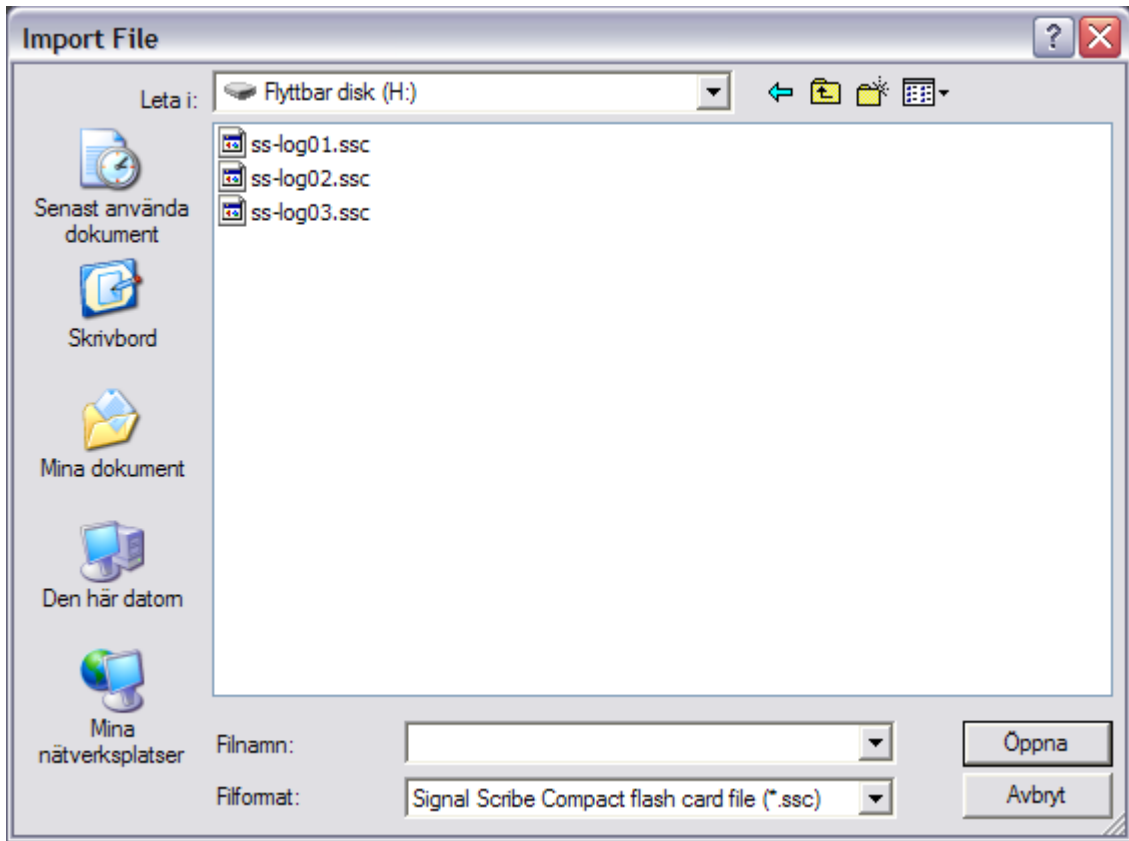
Import the file that you want and you get the results in the diagram. When importing the file you are asked to write down the site data and patient data as above. Then the file will be saved. Save.
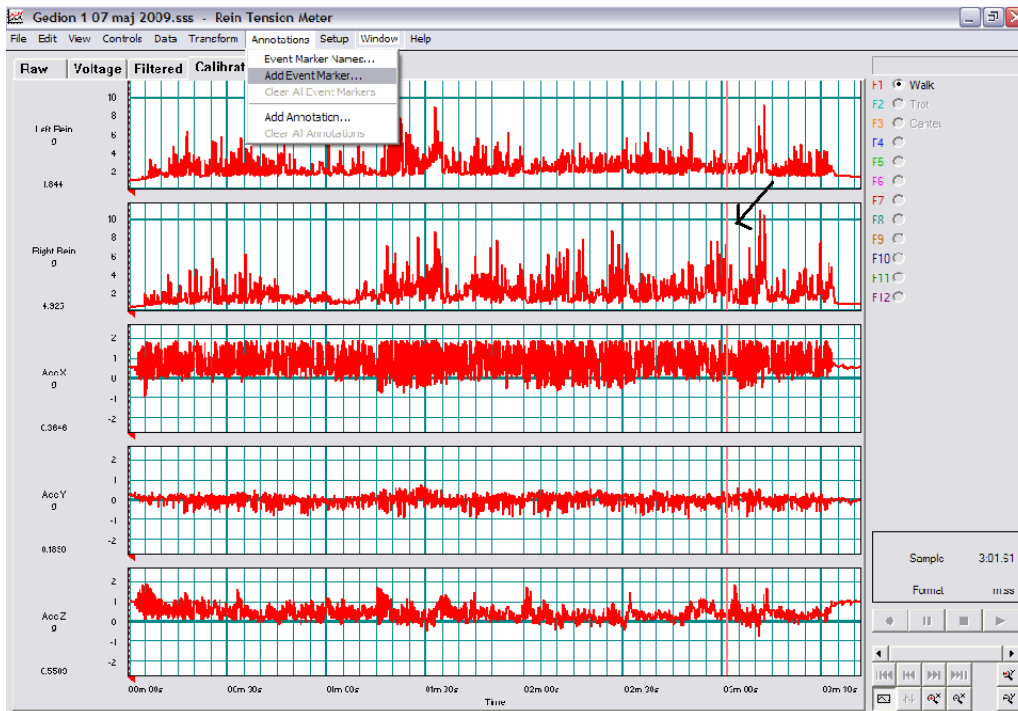


When you see the diagram you can start working with it. Go to *Annotations* and *Event Marker Names*... to add the different events. To add the events to the chart mark the place where you want the new event to start. Se the marker at the picture. And go to *Annotations* and *Add Event Marker*... chose the marker you want and ok.
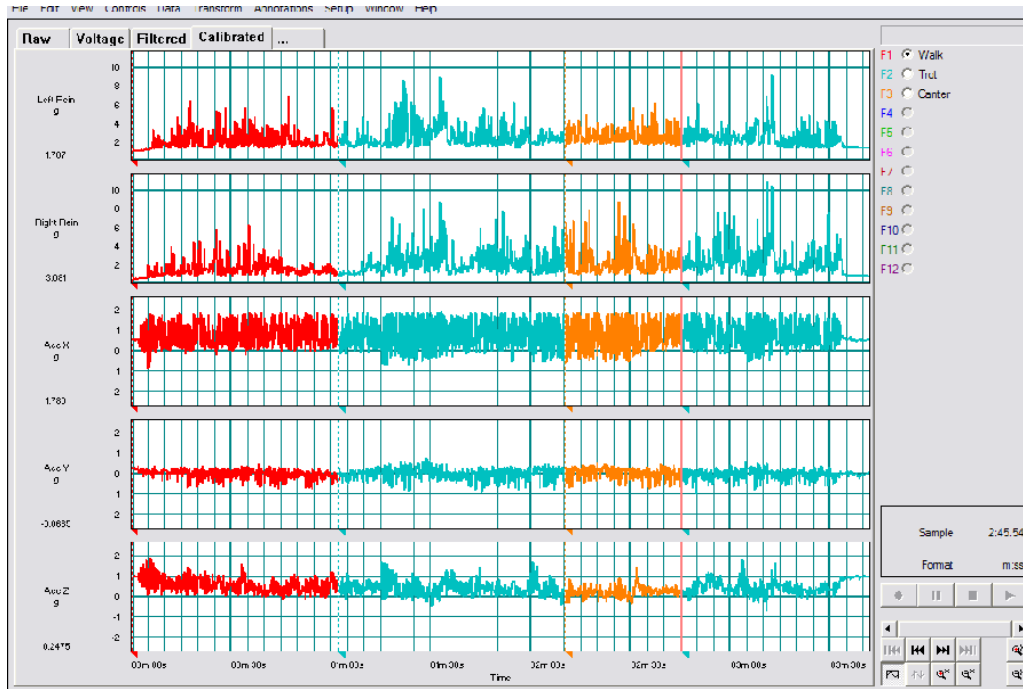
This way you can easily see what is happening in different parts of the chart.

Enclosure 2

Skattning av samspel mellan häst och ryttare

Ryttare:_____         Häst:_____

Gör en bedömning av ritten och sätt ett kryss på varje skala.

Ryttarens kontroll

Låg |————————————————————————————| Hög

Hästen lydnad

Låg |————————————————————————————| Hög

Hästens vilja att lösa uppgiften

Låg |————————————————————————————| Hög

Hästens ridbarhet

Låg |————————————————————————————| Hög

Samspel mellan häst och ryttare

Låg |————————————————————————————| Hög

Din Ryttarens förmåga att utföra uppgiften

Låg |————————————————————————————| Hög

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* **Avhandlingar:** Här publiceras masters- och licentiatavhandlingar

* **Rapporter:** Här publiceras olika typer av vetenskapliga rapporter från institutionen.

* **Studentarbeten:** Här publiceras olika typer av studentarbeten, bl.a. examensarbeten, vanligtvis omfattande 7,5-30 hp. Studentarbeten ingår som en obligatorisk del i olika program och syftar till att under handledning ge den studerande träning i att självständigt och på ett vetenskapligt sätt lösa en uppgift. Arbetenas innehåll, resultat och slutsatser bör således bedömas mot denna bakgrund.

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