

# NORAXON Wireless Sensor Series

For Noraxon Direct Transmission Systems



# **NORAXON Wireless Sensor Series**

**For Noraxon Direct Transmission Systems**

- 1 DTS 3D Accelerometer**
- 2 DTS 2D Electrical Goniometer**
- 3 DTS 1D Mechanical Goniometer**
- 4 DTS Footswitch**
- 5 DTS 2D Inclinometer**
- 6 DTS Localized Pressure (Flexiforce)**
- 7 DTS Research Handgrip Dynamometer**
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- 10 DTS Analog Input Sensor**

## Wireless DTS 3D Accelerometer Sensor For Noraxon Wireless DTS Systems

- Measures the acceleration forces and vibration in G
- 3 dimensions can be measured simultaneously
- Small dimensions and very lightweight
- Scaling available in standard 2G/6G or optional 16G set



### Product Overview

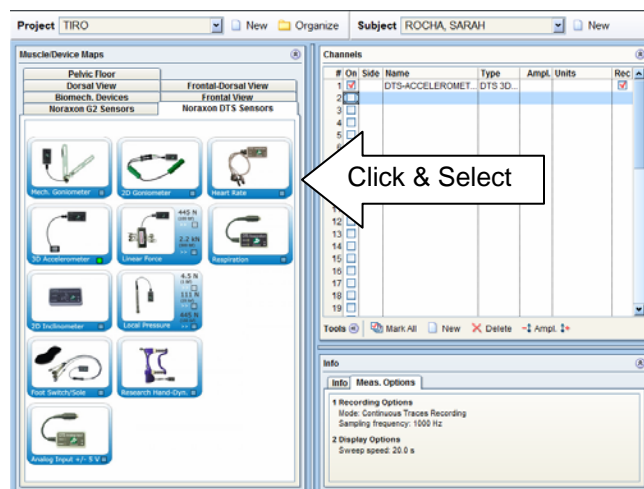
This compact and lightweight acceleration sensor is especially designed for use with human and animal surfaces and body segments. Due to the small size and light weight, it is easy to attach and provides accurate data. Attached to non biological material and bodies, it can measure impact forces up to 6G (Standard) or up to 16G (optional version).

### Small and lightweight construction

Due to its small size (22 by 16 mm), the sensor is easy to attach to any surface. Its very low weight (0.2 oz / 5.7 g) avoids sensor-related swinging artifacts.



The 3D Accelerometer is available as a sensor type in MyoResearch XP.



MyoResearch XP Sensor selection screen

## Application Examples

The sensor construction guarantees an effective use in a variety of application areas, such as medical research, sports analysis, rehabilitation, ergonomics and robotics. It can be used to detect ground contact (heel strike) in walking and running, motion vibration in medical tremor analysis or impact and shock impulses in sports specific equipment or ergonomical tools.



The Accelerometer is mounted (double sided adhesive tape) to the tibia bone, addressing acceleration data in gait analysis



The accelerometer is mounted to a lever arm of a weight stack training machine, addressing vibration effects within axis rotation

By using a double sided adhesive tape, the accelerometer can easily be used to measure the tremor of patients



## Specifications

### System

- Nominal Output Range: +/- 2g , +/- 6g
- Max. Shock Survival: +/- 10,000g
- Sensitivity: 2g: +/- 2 V/g    6g: +/- 0.67 V/g
- Error due to temperature: -0.025% / °C (from 25°C)
- Bandwidth: 5Hz – 1.8kHz
- Operating Range: 0 - 70°C

### Cable

- Cable Length: 3.5 in (8.89 cm)

### Physical (sensor only)

- Sensor Length: 0.75" (1.90cm)
- Sensor Width: 0.56" (1.42cm)
- Sensor Height: 0.25" (0.63cm)

### Physical (probe only):

- Length: 1.70" (4.31 cm)
- Width: 0.97" (2.46 cm)
- Height: 0.55" (1.38 cm)
- Weight: 0.5 oz (141.74 g)

## Wireless 2D Electrical Goniometer with flexible axis for Noraxon Wireless DTS system

- Measures angular displacement
- Measures one or two dimensions
- Easy to use flexible axis
- Available in 5 sizes



### Product Overview

The flexible goniometer developed by Biometrics LTD UK has been an established standard worldwide. Due to its flexible axis construction and five available sizes, it can be used on most body joints. It is available in a one or two axis configuration measuring e.g. flexion/extension and lateral flexion (spine) in one application.

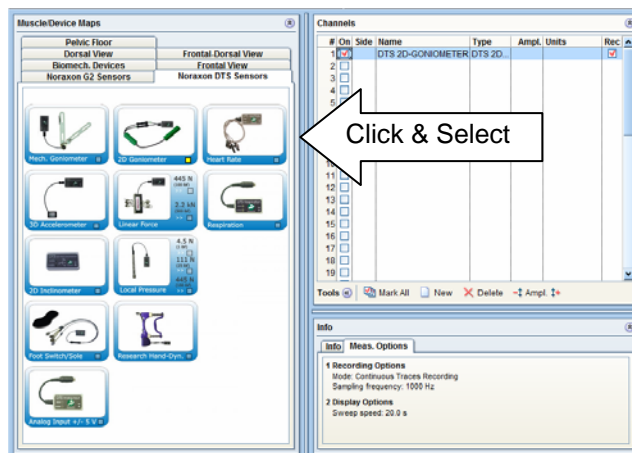
### Versatile use due to flexible axis

A flexible spring connection between the two goniometer blocks compensates for any joint migration and surface prolongation, which is especially helpful in shoulder joint and spine motion. It also allows for placement of the sensor on uneven surfaces. Some examples of the Biometrics 2D Goniometer sensors are:

- SG65 = wrist
- SG75 = wrist (large)
- SG110 = elbow, ankle, neck
- SG150 = knee, hip
- SG150B = back



The sensor has a predefined measurement setup configuration in all the Noraxon software packages and is operational in a few seconds:



MyoResearch XP sensor selection screen

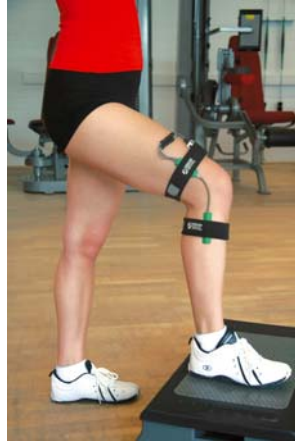
## Application Examples

The Biometrics sensor line addresses all major joints of the human body (elbow, shoulder, knee, hip and spine). The flexible design allows for use in numerous application areas, such as medical research, sports analysis, rehabilitation, ergonomics, and robotics. The sensor may be attached with Velcro straps or adhesive tape.

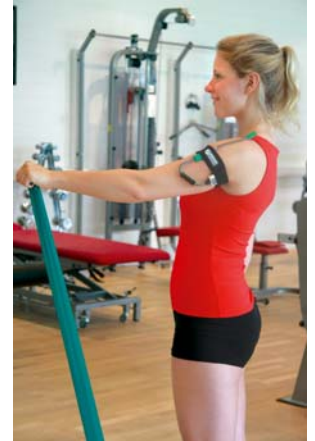
**HIP – SG150**



**KNEE – SG150**



**SHOULDER - SG110/SG150**



**SPINE – SG150B**



**ELBOW – SG110/SG150**



## Specifications

### Features:

- Flexible Axis Goniometer that measures in 2D
- Useful in a variety of research areas including: Medical Research, Rehabilitation, Sports, Ergonomics and Robotics.

### Typical Performance of sensor:

- Nominal Output Range: +/- 180 degrees
- Sensitivity: 25mV/degree
- Accuracy: +/- 2 degrees
- X-Y crosstalk < 5 degrees for deflections under 60 deg
- Cable length: 2.5 in (6.35 cm)

### Physical (probe only):

- Length: 1.70" (4.31 cm)
- Width: 0.97" (2.46 cm)
- Height: 0.55" (1.38 cm)
- Weight: 0.5 oz (141.74 g)

## Wireless DTS 1D Mechanical Goniometer for Noraxon Wireless DTS System

- Measures angular displacement
- Gliding mechanism to compensate for axis motion
- Flexible arms for uneven surfaces

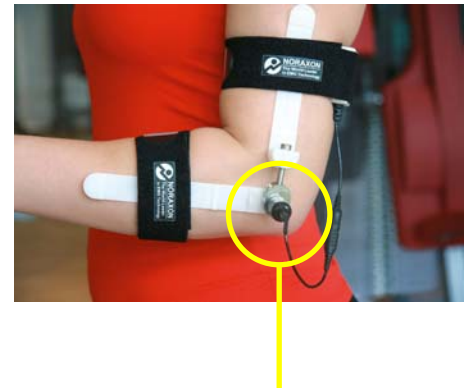


### Product Overview

The mechanical goniometer is designed for the uni-axial joint motion measurement of all major regions. It is an accurate and cost effective solution for knee, elbow, shoulder, hip and ankle joint measurements. The special construction allows for flexible use and adjustment in size.

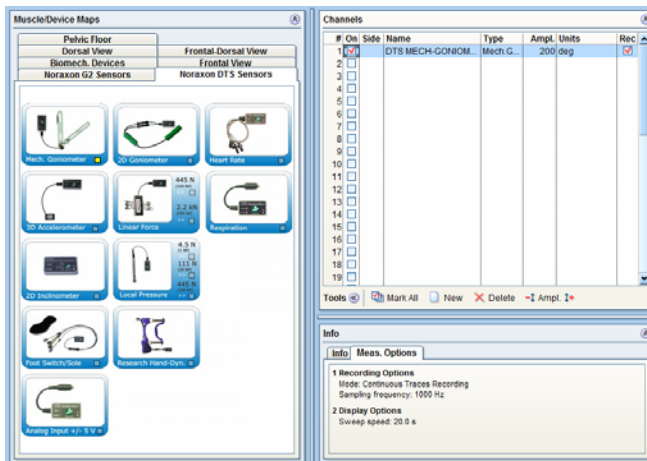
### Adjustable and flexible construction

A special gliding mechanism allows for dynamic prolongation of one arm and compensates for axis movement with ROM measurements. One arm can also rotate around its own axis. Both arms are made of flexible plastic material. This construction allows the adjustment of the sensor to uneven or rounded surfaces.



Gliding mechanism to compensate axis motion

The sensor has a predefined measurement setup in all the Noraxon software packages and is operational in a few seconds:



MyoResearch XP  
sensor selection screen

## Application Examples

The sensor covers a variety of application areas in medical research, sports analysis, rehabilitation, ergonomics, and robotics. The adjustable construction guarantees a widespread use on all major joint regions. The goniometer may also be adjusted in 2 dimensions allowing the sensor to be used on ankle joints. The sensor can be attached with Velcro straps or adhesive tape.



Application for the knee joint.



Application for the elbow joint.

## Specifications

### Features:

- Accurate, cost effective solution to measure knee, elbow, shoulder, hip and ankle joint angles.
- Useful in a variety of research areas including: Rehabilitation, Sports, Ergonomics and Robotics.

### Typical Performance of sensor:

- Nominal Output Range: +/- 160 degrees
- Sensitivity: +/- 25mV/ degree

### Power (DTS Sensor):

- Run time: 8 hours
- Charge time: < 3 hours

### Physical (DTS Sensor):

- Length: 1.65" (4.2cm)
- Width: 0.94" (2.4cm)
- Height: 0.51" (1.3cm)

## Wireless DTS Footswitch 2/4-FSR & Insole Sensor For Noraxon Wireless DTS Systems

- 2 - 4 small foot switch sensors per foot/side/lead
- Marks Heel strike and Toe off events during gait
- Adjustable sensitivity
- Creates a reliable foot contact signal
- Easy to replace sensors

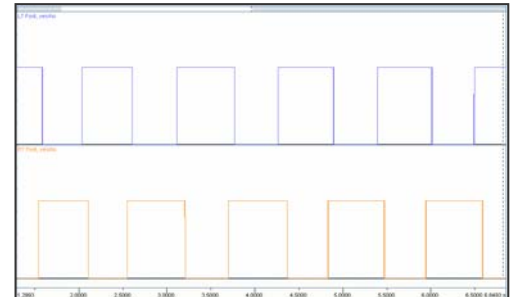


### Product Overview

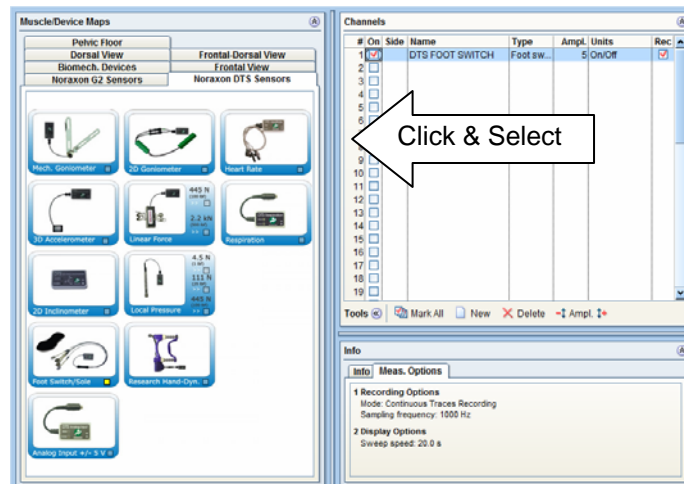
The Wireless DTS Footswitch sensor consists of 4 FSR (force sensitive resistor) switch sensors or Insoles. They can be mounted on the heel and the toe or metatarsal region. It is designed for quick and easy use in clinical gait analysis. Each lead has a built-in sensitivity switch which allows for the adjustment of the switch threshold for in-shoe measurements. The FSR sensor consists of a thin circular film pad that is easy to attach.

### Bilateral Ground Contact

During walking, each side creates a ground contact on/off signal. Within this scheme, any ground contact increases the signal to high level and swing phase drops the signal back to zero. This established switch scheme can be used to trigger unilateral and bilateral gait phases.



The sensor has a predefined measurement configuration in all the Noraxon software packages and is operational in a few seconds:



MyoResearch XP  
sensor selection  
screen

## Operation Examples

The wireless DTS Footswitch has universal functionality covering easy and quick to use setups for clinical gait screening, running and jump testing. If damage occurs due to heavy impact or shear forces (running/jumping), broken sensors are easily replaced. The special connector allows easy replacement, but keeps the sensor from falling out during testing.



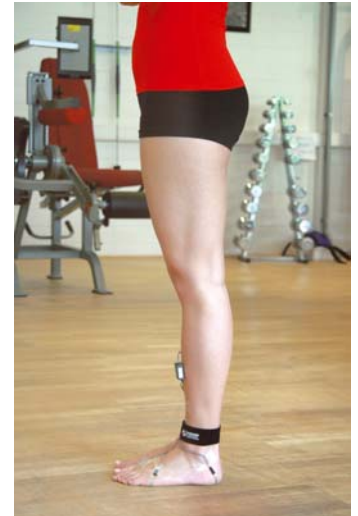
### 4 possible attachment sites on the bottom of the foot

The most established setup is: heel, metatarsal 1 and 5, toe. Double-sided tape on the back of the sensor assists in positioning it correctly. Additional taping may be required to guarantee a stable position.



### B&L Foot Switch Sole

Noraxon's DTS Footswitch is compatible with the well-established foot switch soles manufactured by B&L Engineering CA – U.S.A. This sole has a separation of fore and back foot region. The benefit is the speed of setup and ease of use - a perfect tool for clinicians. The sole can be ordered from Noraxon as an accessory or in place of the single FSR-sensor leads.



## Specifications

### System

FSR Sensor response time ~2 ms  
Power: 3.7 Volts, 190 mAH Lithium Polymer Battery  
Battery Run Time: 8 hours per charge

### Physical

Length: 1.34 in (3.4 cm)  
Width: 0.95 in (2.4 cm)  
Height: 0.55 in (1.5 cm)  
Weight (sensor probe only): 0.6 oz (17g)  
Weight (sensor probe with cable): 1.0 oz (28.3g)

## Wireless DTS Two Dimensional Inclination Sensor for Noraxon Wireless DTS system

- Measures range of motion in 1D or 2D
- Can be used for the spine & extremities
- Can be mounted on training machines



### Product Overview

The **inclination sensor** measures the angle relative to gravity and can simultaneously detect two motion directions, e.g. coupling patterns - combined saggital and frontal movements during cervical flexion.

### Light Weight and User Friendly

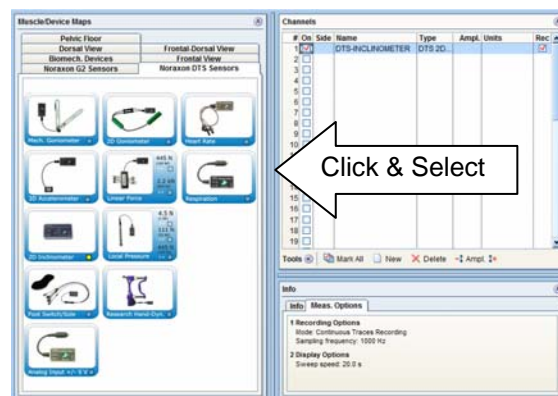
It is the **most compact inclination sensor available** on the market and has wireless functionality to Noraxon TeleMyo DTS System. The inclinometer is a universal motion detector and may be used for all body segments and joints. Due to its **two dimensional capabilities**, it reduces evaluation times as it allows the user to measure joints in two directions without sensor repositioning. The inclinometer is **easily applied** with double sided adhesive tape (see picture right side) or Velcro straps (see applications)

If it is mounted on a lever arm of any training machine, it can be used as motion trigger signal. This is especially helpful for training in predefined motion ranges or if an accurate position signal is required for e.g. EMG and force measurements.

Free motion can be controlled by using the inclination sensor signals as a biofeedback signal.

The sensor measurement range is +/- 90 if both x and y axis are used simultaneously and +/- 180 if only one axis is used.

The sensor has a predefined measurement setup in all the Noraxon software packages and is operational in a few seconds:

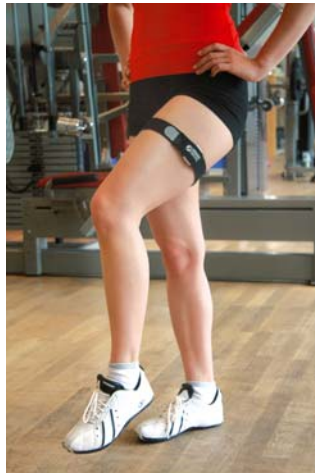


MyoResearch XP sensor selection screen

## Application Examples

The sensor can be used to detect the joint motion of most major joint regions:  
Hand – Arm – Shoulder – Head – Trunk – Thigh – Shin - Foot.

- Trunk Flexion / Extension and Lateral Flexion
- Shoulder Abduction/Adduction and Extension/Flexion
- Hip/Knee Extension/Flexion and Abduction/Adduction
- Head Flexion/Extension and Lateral Flexion
- Machine Motion Sensor mounted on the lever arm



## Specifications

### Features:

- Measures two joint directions without sensor repositioning
- Small and lightweight

### System:

- Nominal Output Range: +/- 180 degrees
- Max. Shock Survival: +/- 1000 G
- Sensitivity: 25mV/degree
- Accuracy: +/- 2 degrees

### Physical (sensor only):

- Length: 1.70" (4.31 cm)
- Width: 0.97" (2.46 cm)
- Height: 0.55" (1.38 cm)
- Weight: 0.5 oz (141.74 g)



## Wireless DTS FlexiForce<sup>®</sup> Localized Pressure Measurement for Noraxon Wireless DTS system

- Measure pressure force between body and external surfaces, tools, machines
- Very thin and flexible sensor construction
- Available in three pressure ranges



### Product Overview

The sensor manufactured by TekScan Inc., USA is a versatile, easy to use sensor for localized pressure. It can be used whenever pressure force between the human body, (e.g. hand, finger and foot) and any surface is investigated. The use of industrial tools, training machines, computer devices (PC mouse) or medical orthosis can be investigated together with EMG and other biomechanical sensors.

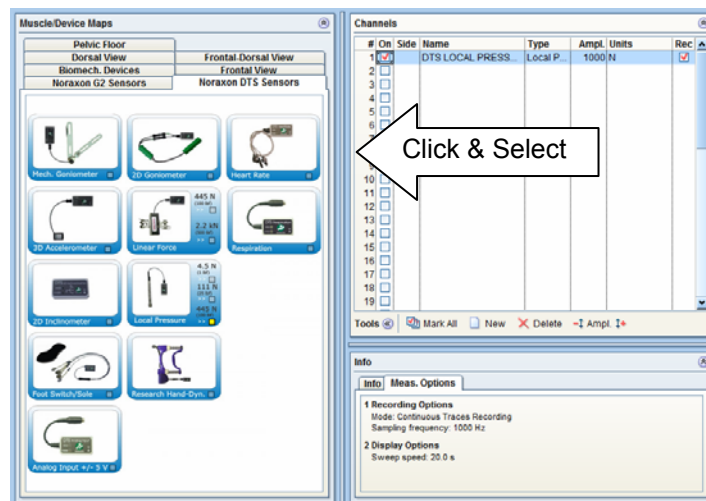
### Thin and flexible construction

The FlexiForce<sup>®</sup> sensor works on a resistive principle and is available in three pressure ranges and four lengths.

It has a sensitive measurement area of 9.53 mm diameter and is very thin and flexible to conform to curved surfaces.



The sensor has a predefined measurement setup in all the Noraxon software packages and is operational in a few seconds:



MyoResearch XP sensor selection screen

## Application Examples

The sensor covers a variety of application areas in medical research, sports analysis, rehabilitation, ergonomics, and robotics. Due to the thin flexible shape, it can be mounted on fingertips, hand bones, toe, heel or any other prominent bony body area.

1. FlexiForce mounted to the heel, suitable for gait studies, impact testing jump and sports performance
2. FlexiForce mounted to hand bones, allows detecting of hand and grip pressure force.
3. FlexiForce mounted on a golf club. Measures the grip/swing force with golf stroke



## Specifications

### Features:

- Thin flexible sensor that is easily placed on a prominent bony body part
- Useful in a variety of research areas including: Rehabilitation, Sports, Ergonomics and Robotics.

### Physical (sensor only):

- Thickness: 0.008" (0.208mm)
- Sensing Area Diameter: 0.375" (9.53mm)
- Tail Length: 7.75" (197mm), 6" (152mm), 4" (102mm), 2" (51mm)
- Width: 0.55" (14mm)

### Typical Performance of sensor:

- Linearity (Error):  $\leq \pm 5\%$
- Repeatability:  $\leq \pm 2.5\%$  of full scale
- Hysteresis:  $< 4.5\%$  of full scale
- Response Time:  $< 5 \mu\text{sec}$
- Sensitivity (uncalibrated)
  - 0-1 lb sensor = 11 N
  - 0-25 lb sensor = 110 N
  - 0-100 lb sensor = 440 N

### Physical (probe only):

- Length: 1.70" (4.31 cm)
- Width: 0.97" (2.46 cm)
- Height: 0.55" (1.38 cm)
- Weight: 0.5 oz (141.74 g)

## Wireless Jamar Compatible Handgrip Dynamometer for Noraxon Wireless DTS systems

- Easy detection of handgrip force
- Accurate measure of handgrip force
- Adjustable grip width

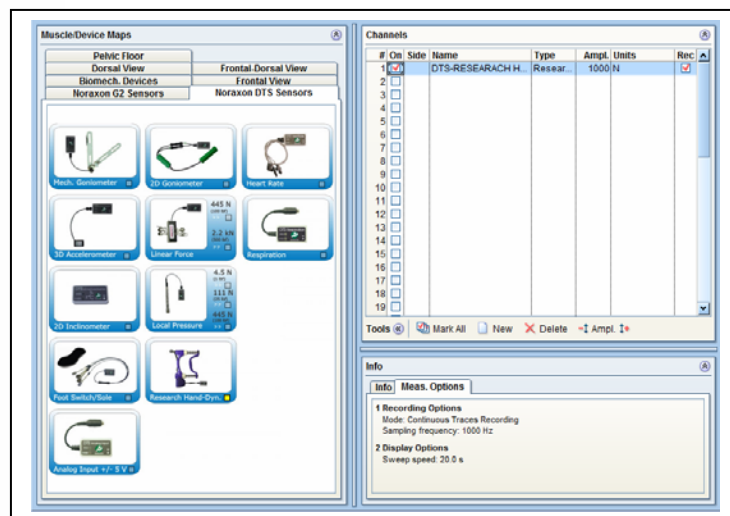


### Product Overview

The Jamar compatible handgrip dynamometer is designed for research studies. A built-in electronic (strain gauge) force sensor accurately detects the handgrip force at five selectable grip widths. The sensor does not require any setup calibration.

### Product features

The durable and solid built sensor can be used together with EMG and/or other biomechanical sensors from Noraxon sensor line. The sensor has a predefined measurement setup configuration in all the Noraxon software packages and is operational in a few seconds.



MyoResearch XP sensor selection screen

## Application Examples

The isometric handgrip dynamometer can be used in a variety of application areas (e.g. ergonomics, sports science, medical and clinical research). Grip force may also be used in investigations for elderly people, fatigue studies, disability assessment for neurological patient and combined measurements of force and EMG.



### Compatibility to Jamar Norms

The Jamar compatible handgrip dynamometer is a well established research and application tools. It has been used in a variety of research and normative studies. The special sensor construction accurately manages shear forces and variability in grip positions and guarantees excellent test reproducibility.

## Specifications

### Features:

- Durable sensor used to measure handgrip force
- 5 grip positions from 13/8 to 33/8" (35 – 87 mm)
- Used in many application areas including ergonomics, sports science, medical and clinical research.

### System:

- Range: 0-200 lb-F (0-899 N)
- Sensitivity: 25 mV / lb-F (5.56 mV / N)

### Physical (probe only):

- Length: 1.70" (4.31 cm)
- Width: 0.97" (2.46 cm)
- Height: 0.55" (1.38 cm)
- Weight: 0.5 oz (141.74 g)

## Wireless Linear Force Measurement Load Cell for Noraxon Wireless DTS System

- Measures pull and push force
- Can be used for static force tests with cable and training equipment
- Available in two sizes/ranges



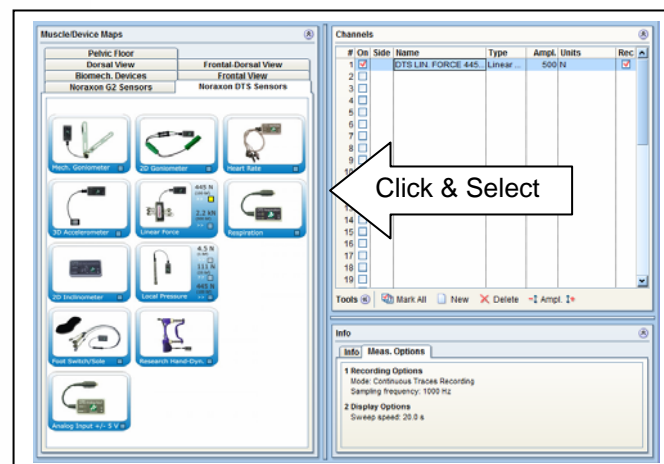
### Product Overview

The DTS Force Sensor is a precision load cell allowing measurement of both tension and compression. The sensor is available in two sizes / measurement ranges:

- 0-100 lb-F ( 0-444 N)
- 0-500 lb-F (0-2224 N)



The sensor has a predefined measurement setup in all the Noraxon software packages and is operational in a few seconds:



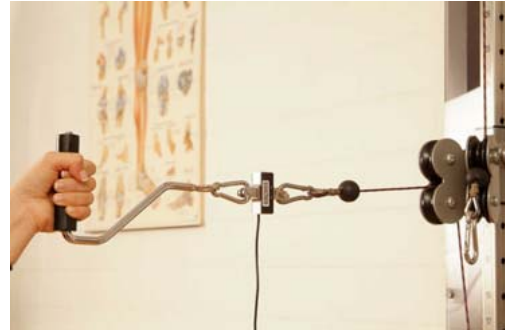
MyoResearch XP DTS sensor selection screen

## Application Examples

The sensor can be used with any commercial cable training machine. This arrangement allows you to create numerous test positions to test static force in a functional manner. Such test setups can be used to document therapy and training improvements.



Force cell used in a commercial cable training machine



The sensor can be integrated with most cable machines

A special adapter allows you to attach the sensor to weight stack belts of exercise machines without cutting the belt. The same sensor will work on various machines.



Special Belt Adapter

## Specifications

### Features:

- Accurately measures forces up to 100 or 500 pounds
- Measures both tension and compression (negative output)

### Limits:

- Input Force Range: +/- 500 lb-F (+/- 2224 N)
- Sensitivity for 500 lb Sensor: 10mV / lb-F (2.27 mV / N)
- Sensitivity for 100 lb Sensor: 50mV / lb-F (11.35 mV / N)

### Physical (probe only):

- Length: 1.70" (4.31 cm)
- Width: 0.97" (2.46 cm)
- Height: 0.55" (1.38 cm)
- Weight: 0.5 oz (141.74 g)

## Wireless DTS Heart Rate Sensor For Noraxon Wireless DTS Systems

- Measures the heart rate
- ECG signal and heart rate can be reviewed in MyoResearch XP
- Small dimensions and very lightweight



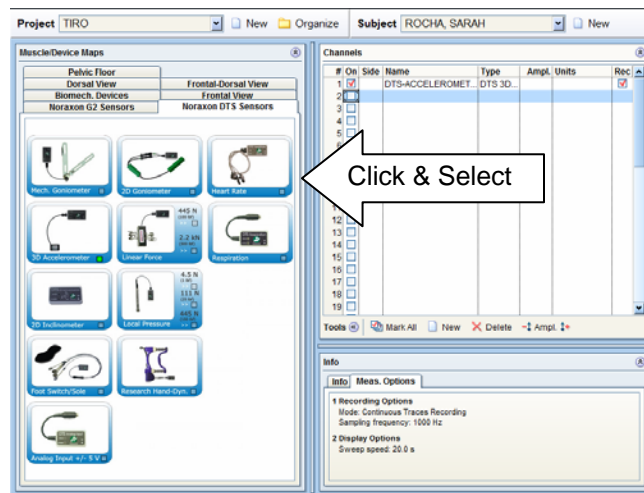
### Product Overview

This compact and lightweight heart rate sensor is especially designed for use with human and animal surface. Due to the small size and light weight, it is easy to attach and provides accurate data. The DTS Heart Rate sensor measures the heart rate. The ECG signal and heart rate can be reviewed in MyoResearch XP. The DTS heart rate sensor is for documentation purposes only. It is not to be used for diagnostic purposes.

### Small and lightweight construction

The DTS Heart Rate Sensor can be attached to the body in any convenient location.

The DTS Heart Rate is available as a sensor type in MyoResearch XP.

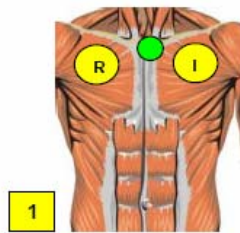


MyoResearch XP Sensor selection screen

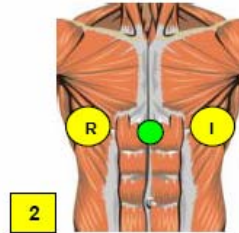
## Application Examples

The sensor construction guarantees an effective use in a variety of application areas, such as medical research, sports analysis, rehabilitation and ergonomics. It can be used to measure heart rate during rest and during dynamic movements.

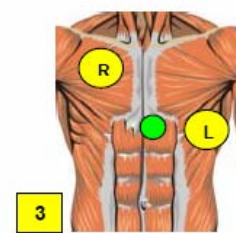
## Lead and Electrode Placement



**1**  
Fig 1: Electrodes are placed below the clavicle.



**2**  
Fig 2: Electrodes are placed below the breast.



**3**  
Fig 3: Right electrode is placed below the clavicle. Left electrode is placed below the breast.

The DTS Heart Rate Sensor can be attached to the body in any convenient location. For Dynamic Movements, it is recommended to use double-sided tape attached to the sensor and body and also use a strap. Ensure that the strap will not impede movement or breathing.

## Technical Specifications

### System

- 1st order high-pass filters set to 1 Hz +/- 10% cutoff
- Input impedance > 100 Mohm
- CMR > 100 dB
- Input range: +/- 6.3 mV
- Gain: 500
- Heart Rate range: 40-250 bpm

### Power

- 3.7 Volts, 190 mAH Lithium Polymer Battery
- Battery Run Time: 8 hours per charge
- Charge Time: < 3 hours

### Physical

- Length: 1.7" (4.3cm)
- Width: 0.97" (2.5cm)
- Height: 0.54" (1.4cm)
- Weight: 0.8oz (22.7g)

### Lead Lengths:

- Reference Lead: 4.3" (11cm)
- ECG Leads: 7.6" (19.5cm)

## Wireless DTS Analog Input Sensor For Noraxon Wireless DTS System

- Accepts non-Noraxon within the specifications required for the Analog Input Probe
- Allows devices with +/- 10V analog signal to be used with the DTS System
- DTS Analog Input sensor can be reviewed in MyoResearch XP
- Small dimensions and very lightweight

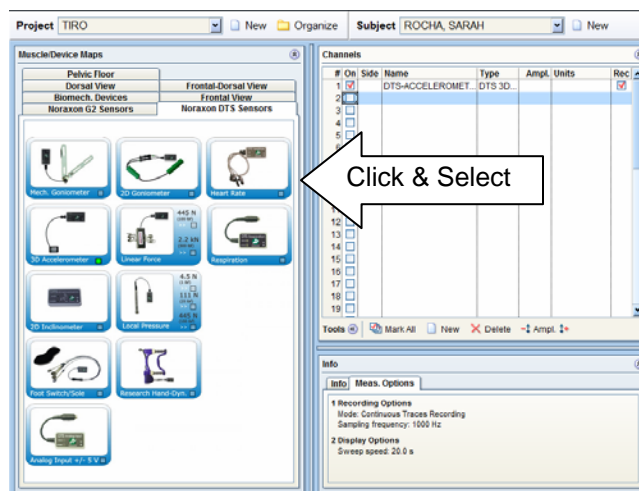


### Product Overview

The DTS Universal Analog Input Probe accepts non-Noraxon sensors within the specifications required for the Analog Input Probe. This probe gives users the freedom to select the appropriate sensor for their application.

The DTS Analog Input Probe allows a device with +/- 10V analog signal to be used with the DTS system. This sensor gives users freedom to select the appropriate device for their research. The device must be self-powered because the sensor does **not** provide power to the device attached to it.

The DTS Analog Input is available as a sensor type in MyoResearch XP.



MyoResearch XP Sensor selection screen

## Application Examples

The sensor construction guarantees an effective use in a variety of application areas, such as medical research, sports analysis, rehabilitation, ergonomics and robotics. It was designed in order to give freedom to the users to choose any sensor according to their own application.

## Analog Probe Mating Connector



2.5 mm phone plug

## Technical Specifications

### **Sensor**

- 2.5mm mono phone jack, SIGNAL on tip and COMMON on shield.
- +/-10V range
- Accuracy: +/-20mV
- Noise: < 5mV RMS
- Sampling Rate: 1500 or 3000 samples per second
- Input frequency range: 0-500Hz or 0-1000Hz, adjustable

### **Physical**

- Sensor Length: 1.7 in (4.3 cm)
- Sensor Width: 0.95 in (2.4 cm)
- Sensor Height: 0.55 in (1.5 cm)
- Sensor Weight: 0.8 oz (23g)

### **Power**

- 3.7 Volts, 190 mAH Lithium Polymer Battery
- Battery Run Time: 8 hours per charge
- Charge Time: < 3 hours