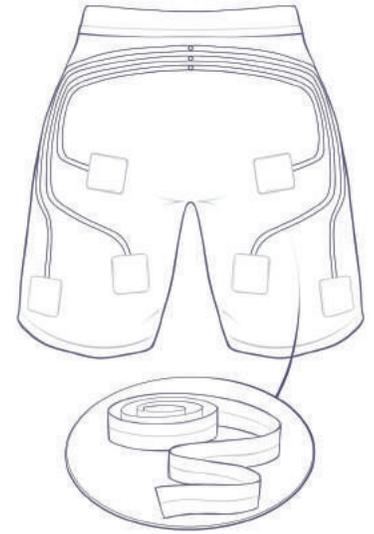


# PhantomTape X

Are you an e-textile brand or manufacturer and you are looking for a reliable, washable, stretchable, comfortable textile wire? PhantomTape X is your solution.

Electrostimulation is booming for sports and rehabilitation, fitness tracking for endurance training, ECG acquisition shirts are used in cardiology, safety workwear, and large-scale patient monitoring will change how medicine is applied today. Most available solutions are not comfortable, or durable, and require a complex production process. Nanoleq's PhantomTape X creates a paradigm shift in the industry. PhantomTape is a thermobonding tape, which has a stretchable conductor. It is thin, comfortable, washable and corrosion resistant thus survives sweat and rain exposure. Also, it is ready to be laminated and connected to various garments which makes it possible for textile manufacturers to easily form reliable electrical connections without electronics expertise and without the need for crimping or soldering. Be part of the future with PhantomTape.



High SNR



Light Weight



Stretchable



Washable



Easy to Laminate



Optimal  
Skin Adhesion



Resistant to sweat &  
washing according to  
ISO 3160-2

## PhantomTape X Structure

PhantomTape X consists of a highly conductive stretchable cable located in between two protective and minimally insulating layers. The first is an "Insulating thermally adhesive layer", that facilitates lamination and electrical connection on any textile by Hot-Pressing. The second one is an "Insulating Textile" layer which protects the stretchable conductor, as well as gives minimal electric insulation.



- Ø 1.2 mm soft wire inside with 80% elasticity.
- Withstands over 100 wash cycles.
- High conductivity:  $< 3 \Omega/m$  under stretch.
- Different connection methods (electrodes, buttons)
- Wide variety of colors available

## Simple Textile Integration

PhantomTape X contains a thermo-adhesive backing and can be hot-pressed to the garment in a single step. The electrical connection can be established easily and reliably, e.g. to magnetic or snap buttons, via Nanoleq's PhantomLink connection patch. It is an ideal solution for electrodes that are placed distant from the electrical unit.



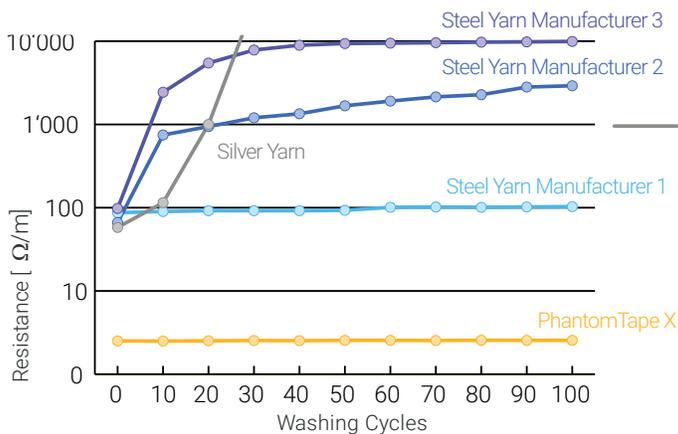
Lamination temperature	130 - 150 °C
Lamination time	20 - 30 s
Electrical connection to: (instructions available)	ElectroSkin, Snap Buttons, Magnetic Buttons, Phantom- Link, Magnetic Buttons, Textile Connectors

# PhantomTape X

## Washing & Stretching

Washing is problematic for most wires and conductive yarns. Standard copper wires quickly show signs of corrosion at exposed parts. Noble metals are much more resistant but expensive. Polymer yarns with thin silver coatings are available and affordable, but not stable when washed. Stainless steel yarns are an obvious alternative but suffer from increased contact resistance after washing.

PhantomTape X contains corrosion-resistant wires, which are coiled around an elastomer filament. Each multistrand contains several metalcore conductors, individually protected with a silver layer and polymer reinforcement strands. The winding matrix in PhantomTape X minimizes friction and pitting corrosion while maximizing conductivity and elasticity. Below, the electrical resistance behavior of PhantomTape X is compared with silver and different stainless steel yarns after repeated washing & stretching.



Washing method: Miele WT1, express program @ 30 °C, Miele TwinDos detergent. Additionally, 500 stretching cycles with 30% elongation were done after every 10 washing cycles (only for PhantomTape X, the silver and stainless steel yarns were not elastic).

## Textile Protection Layers

PhantomTape X was compared to standard methods of embedding conductive yarns in textiles (embroidery, textile cover) regarding electrical insulation. For the test, 2 electrodes were laminated onto a piece of textile, connected via one wire each to an electro stimulator. Two droplets of artificial sweat were dispensed onto the fabric between the wires. With only a fabric used as an „insulator“ or no insulation at all, current leakages occurred, the resistance between the electrodes dropped below 10kOhm, and the electrostimulation was not working anymore.

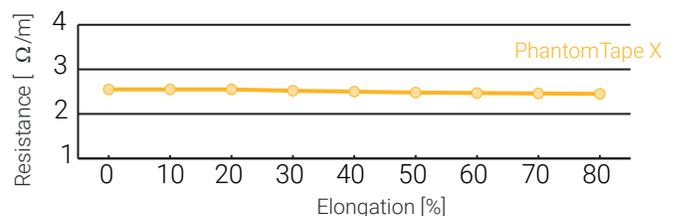
Embroidery without Insulation	immediate leakage
Conductive Yarn inside textile tunnel (2 layers of 0.3mm 72% PA, 28% EA)	current leakage after 2s
PhantomTape X	no leakage after 1h full immersion in artificial sweat

## Physical Parameters

Resistance	< 3 Ω/m
Maximum Elongation	80 %
Maximum Current	1.4 A
Lamination Temperature	130 - 150 °C
Force/Elongation	0.18 N/%
Width	10 mm
Thickness of Tape	0.6 mm
Thickness of Tape + Conductor	1.5 mm

## Electrical Resistance with Elongation

The resistance of PhantomTape X is stable with elongation.



## Exposure to Sweat in use

Exposure to sweat and the related wetting and drying processes can be problematic for smart textiles, especially in the combination with an applied current that can initiate electrochemical processes. PhantomTape X was tested with a simulation of heavy use (100 training units of electrostimulation) and as well with the accelerated sweat test according to ISO 3160-2. It performed well, without mechanical or electrical failure. The minor discoloration was seen in the accelerated test with concentrated sweat solution.

	before	after
Simulated Heavy Use 100 units of electrostimulation: 40mA current peaks @ 100 Hz, 30 min each, repeated spraying with artificial sweat	2.54 Ω/m	2.57 Ω/m
Accelerated Sweat Test according to ISO 3160-2: 24h in concentrated solution @40 °C	2.54 Ω/m	2.56 Ω/m visible discoloration

For testing the stability of prolonged wearing, PhantomTape X was worn directly on the skin. Next to sweat, this test rules out additional potential damage sources like sebum, UV exposure, detergents, creams, and repetitive friction. The test was done in comparison to the steel yarn, which performed best in the washing tests.

## Applications

Sports

MedTech

Workwear

Wellbeing

