

Pre-term babies face many developmental challenges due to the decreased prenatal gestation time. This article explores the risks associated with premature births and explains how MTS Sensors helped KCBioMedix® to produce the NTrainer System®, an innovative device that enables infants to surpass sucking barriers.

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CHALLENGES AFFECTING PRE-TERM BABIES

PREMATURE BIRTH RATES

The number of premature births in the US is a stunning number – well over 500,000 annually. Worldwide the number becomes staggering: 13 million, or about 10% of all births. Premature is a term generally accepted to describe an infant that arrives before full gestation and has not reached sufficient in-utero development to sustain life without some form of extraordinary care.

Normal average gestation is 40 weeks with a range of 38 to 44 weeks. In premature births, 5% occur at less than 28 weeks and are considered extremely premature. 15% are severely premature at 28–31 weeks, another 20% moderately premature at 32–33 weeks, while 60–70% are considered late preterm at 34–36 weeks.

RISKS ASSOCIATED WITH PREMATURE BIRTHS

These early arrivals are at risk of not adequately continuing the development process. Studies show that a minefield of potential problems await them that may develop into chronic, perhaps life-long, life threatening health issues due to underdeveloped organs and associated neurological systems that govern them. Among them are neurological disabilities, palsies, and even mild hemorrhages, cardiovascular deficiencies, respiratory problems, gastrointestinal and metabolic insufficiencies, hematologic complications, and infections.

It's a wonder that many of these preemies (premature babies) successfully negotiate this minefield and go on to lead healthy, productive lives. But many don't as well. Complications seem to inversely track the gestational age. In fact one study of school age preemies found that 46% of those born with gestational ages of 22 to 25 weeks experienced moderate to severe complications.

A premature newborn's ability to fight, overcome and even survive these challenges is severely handicapped if it can't learn to breathe and eat normally. Without these abilities, development slows, or worse.

Full term infants have a fully developed set of lungs, a well-connected neural pathway system to operate them, and the ability to coordinate eating, swallowing and breathing without getting them confused. Helping the infant to coordinate these actions, nature has a way to stimulate or flex the mechanisms involved in these processes to help train the neural pathways to develop properly. When interrupted, the development sidetracks or doesn't happen at all. This can lead to delayed or



LOOKING AHEAD

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- NTrainer System® & How it Works
- The Sensor's Role

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even impaired development of motor skills, sensory perceptions and auto-response development. The likely result is feeding and breathing tubes used for extended periods, with the potential for side effects. Feeding and breathing tubes, it's been found, exacerbate the problem by short circuiting nature's training stimulators, causing the infant's sucking and feeding to atrophy. Therefore, the earlier a preemie can develop viable eating and breathing, the earlier supplement tubes can be removed, the faster proper nourishment takes place and the faster completion of interrupted development can resume.

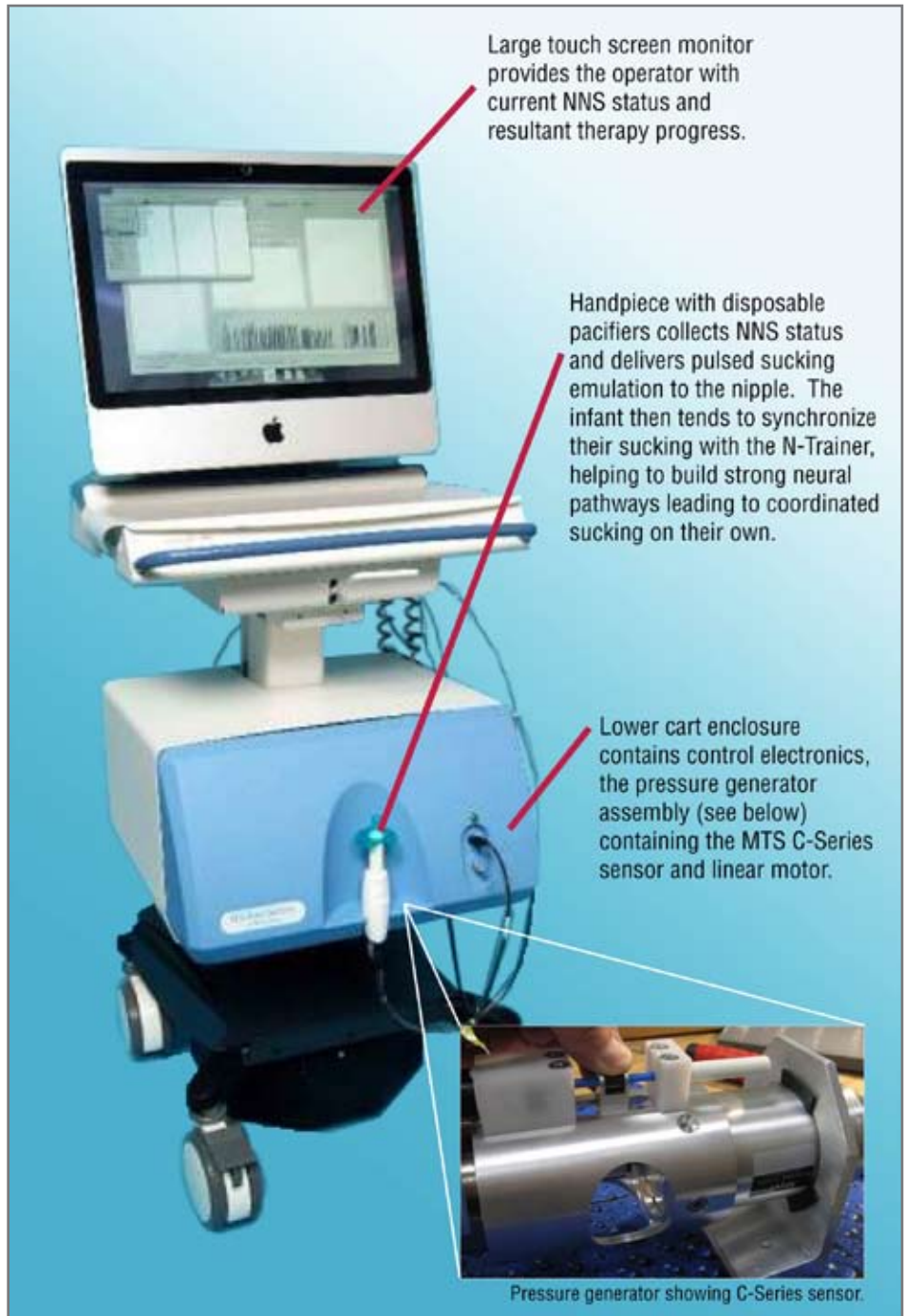
ENABLING SUCKING DEVELOPMENT

Training these neural pathways to develop properly is the business of KCBioMedix, Inc. This company, located near Kansas City, has developed a system to mimic the natural stimulation for development of the sucking mechanism associated with eating.

HOW IT WORKS

A product called the NTrainer System® consists of a hand held device with a naturally shaped pacifier that moves and changes shape as though the infant was sucking properly. When inserted in the infant's mouth, the infant's response is to synchronize its mouth motions to that of the pacifier, helping the infant make the neural pathway development necessary to eventually do it on its own. Known as the non-nutritive suck or NNS, this is a vital developmental element in coordinated sucking, breathing and swallowing leading to unassisted natural feeding.

Linked to a console, the hand held device uses gentle air pulses supplied by a computer controlled pneumatic pressure generator to mimic sucking. Sensors in a hand held probe provide a time profile analyzed by software to aid the operator's evaluation and documentation of the infant's NNS quality. Operators can select reference NTrainer therapy pulses for different protocols. NNS is currently assessed by inserting a gloved clinician's finger into the infant's mouth to estimate a premature infant's NNS status. The NTrainer removes the subjectivity associated with this method and provides quantifiable results for use in determining appropriate levels of therapy.



KC BioMedix NTrainer System®, Patents Pending. Photo courtesy of KC BioMedix, Inc.



THE SENSOR'S ROLE

Pulsed air to the pacifier is supplied by a voice-coil-type linear motor operating a pneumatic generator. Pump stroke is measured by an MTS C-Series sensor mounted parallel to the pump piston.

KCBioMedix, Inc. chose the C-Series magnetostrictive sensor because it was activated by a permanent magnet and it has a small sensor element footprint, making it less intrusive in the pump design. Plus the no-wear nature of the C-Series ensured reliability.

Administered 3-4 times daily for 3 minutes, the infant's NNS pattern becomes more highly organized and more closely replicates normal function over a 10-day period.

KCBioMedix, Inc. will offer the NTrainer System to the over 1100 neonatal intensive care units ("NICUs") in the United States. Outside the US, the NICU population that could benefit from this tool is estimated at about 1700 locations.

ABOUT THE COMPANIES

MTS Sensors, a division of MTS Systems Corp., is the global leader in the development and production of magnetostrictive linear-position and liquid-level sensors.

MTS Sensors Division is continually developing new ways to apply Temposonics® magnetostrictive sensing technology to solve critical applications in a variety of markets worldwide. With facilities in the U.S., Germany, Japan, and China, MTS Sensors Division is an ISO 9001 certified supplier committed to providing customers with innovative sensing products that deliver reliable cost-effective sensing solutions.

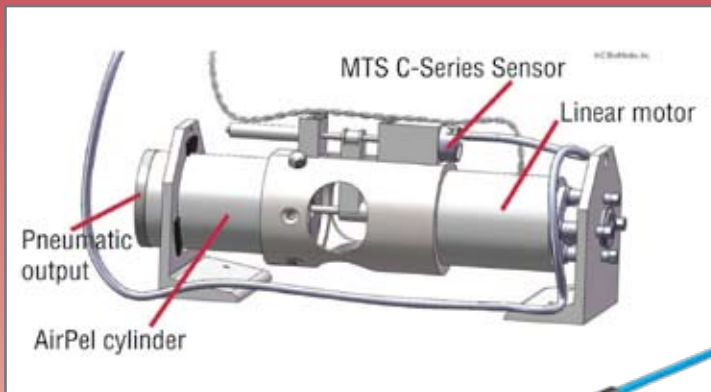


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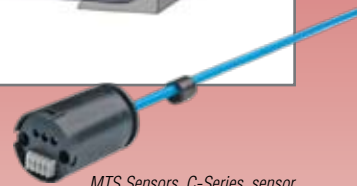
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The Temposonics C-Series Sensors

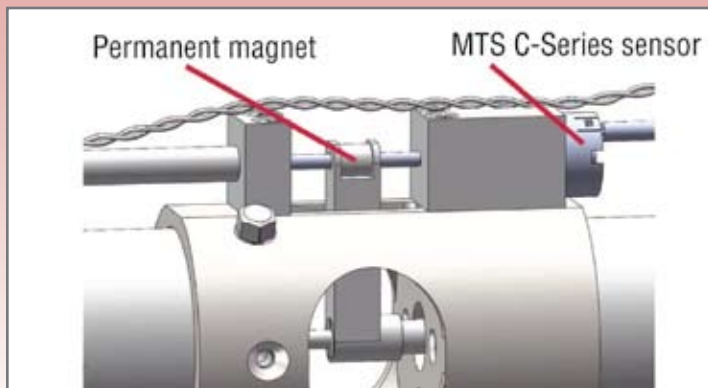
Designed for use in higher-volume OEM products such as medical devices, small cutting/fastening/forming tools, and various consumer products, the C-Series is the smallest magnetostrictive sensor available and the lowest cost, making it useful to high volume OEMs with constrained space and budgets.



3-D drawing showing MTS C-Series sensor. Drawing courtesy of KC BioMedix, Inc.



MTS Sensors C-Series sensor.



3-D drawing showing permanent magnet and MTS C-Series sensor. Drawing courtesy of KCBioMedix.

KC BioMedix, Inc. develops innovative medical products to solve feeding issues in premature infants. Its first breakthrough device, the NTrainer System®, enables neonatal care units to assess and then provide therapy to develop infant non-nutritive suck – a vital skill that has been linked to faster transition to oral feeds, more rapid weight gain, shortened hospital stays, and reduced hospital costs.

For further information on Temposonics Linear Position Sensors, visit us at www.mtssensors.com or email us at sensorsinfo@mts.com.