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Contactless Connectivity

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EVERY CONNECTION COUNTS

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- What is Contactless Connectivity?
- What are the benefits and applications?
- What are the technology options considered?
- What has been implemented and how does it work?
- Next generation requirements for RF link
- Q&A and Demonstration







TE Connectivity Introduction

IN A WORLD WHERE EVERYTHING IS CONNECTED, EVERY CONNECTION COUNTS

Invested in Engineering, Invested in Your Success.

\$13+B ANNUAL REVENUE OF SALES PER YEAR INVESTED IN R&D 20,000 PATENTS ISSUED OR PENDING 8,000+ ENGINEERS 95,000+ EMPLOYEES

1 3 GLOBAL DESIGN CENTERS

Global Scale, Local Strength

AMERICAS

ASIA (excluding China)

CHINA

EMEA





Well Positioned in Industries That Are Growing



Broadest Range of Connectivity Solutions



connectivi

Connectivity for any Application





Contactless Connectivity Introduction

connectivity

Contactless Connectivity: what is it?

A hybrid interconnection system, based on both contactless power and contactless data technology, which can easily mate (and un-mate) over a short distance (so without using mechanical contacts)



Industrial Solution



Key Customer Requirements & Benefits

- Improved reliability:
 - Contactless connectivity delivers robust power & data without wires or physical contact; hermetically sealed
- Greater flexibility:
 - Unlimited range of motion, vibration, tilt, misalignment, rotation and through materials (eg through walls of tanks).
- Improved safety:
 - No arcing; ideal in hazardous environments
- Cost savings:
 - No wear and tear improves up-time and reduces maintenance



Contactless Connectivity – Industrial Driving TCO Reduction & New Applications





Application example – Robotic



Ariso benefits:

- ✓ Freedom of movement in x/y/z
- ✓ Rotation and tilt
- ✓ Unlimited mating cycles
- \checkmark No need to clean connectors
- Robot can pick its own tool automatically

Customer value:

- \checkmark More productive robots
- ✓ More uptime



Contactless Connectivity - Technology Options

Data Link	Pro	Challenges
Capacitive coupling	Low EMI. Also suitable for ring structures.	Requires significant plate area, challenging for tiny rotating couplers
RF, 60 GHz (OOK, ASK, QAM)	Large bandwidth (>1 Gbps), low latency (nanoseconds)	Should generate a circular polarized wave to support rotation
RF, 2.4/5 GHz (e.g. GFSK, MSK, ASK)	Easy near field antenna design (simple loop), RF solutions widely available. Up to 2 Mbps.	No high bandwidth without OFDM, but that increases latency.
RF, sub GHz (e.g. FSK)	Easy near field antenna design (simple loop), RF solutions widely available	Low bandwidth (sub Mbps)
Via ICPT power link	No separate antenna needed	Low bandwidth (10-100kbps)
Optical	Very high bandwidth possible (> 10Gbps)	Sensitive to dust and dirt, precision optics & lenses needed
Power Link		
Inductively coupled power transfer (ICPT)	High power density / reasonable distance / high efficiency possible, technology available	Can not penetrate metal
Capacitive Power Transfer (CPT)	Can penetrate (floating) metal, low EMI	Low power density, short range
Ultrasound / vibration	Can penetrate well through matter (hulls)	Research phase, depends on medium. Low power levels still.



Contactless connectivity

Transparency - "Act like a normal connector"





Contactless connectivity

Transparency – "Act like a normal connector"







Information is TE Confidential & Proprietary Do Not Reproduce of Distribute

What did we implement? Ariso LP1 platform best in class contactless coupler solution for sensor applications

- M12 diameter for 6 Watt output power
- Highest power density: ~0.5 Watt/cm3
- Best in class Power-over-Distance: 1/3 of the diameter = up to 4 mm Z-distance for M12
- Dynamic tuning: high efficiency over variable loads and distances
- Reliable data link: uses redundancy in 2.4 GHz transmission & minimized far field interference
- Safety: reverse polarity (RPP), overload (OLP), over-temp (OTP) and foreign object protection (FOP)
- EMC & safety compliant (CE)



Technology Behind the Scenes

Inductive Power Transfer











2.4 GHz loop antenna design fitting M12



 \Rightarrow Fits the M12 design



2.4 GHz Loop antenna & matching circuit performance





Next generation Target System specification Data link

- Peer-2-Peer \rightarrow no sharing of media like WiFi
- Short range \rightarrow up to 20 mm
- Dynamic pairing
- Transparent
- RF link to be able to support multiple types of wired interfaces
- Small form factor \rightarrow preferably smaller than 4 x 4 mm



Next generation Target System specification Data link

- Low power consumption \rightarrow preferably less than 100 mW
- Low latency $\rightarrow \leq 1 \ \mu s$
- Circular Symmetry: antenna should allow for rotation
- High Speed $\rightarrow \geq$ 5 Gbps bit rate on wired interface
- Robust to misalignment, rotation, tilt, ...
- Robust to different media between the Tx and Rx





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Conclusions

- TE created the smallest form factor (M12) solution for contactless couplers with the highest power density (~0.5 W/cm³). Evaluation kit available
- A multi-disciplinary TE team, with expertise in magnetics, RF, mechanical, thermal and circuit design & simulation has been established for creating (customized) contactless connectivity solutions.

Next steps

 Research & development of high speed (industrial) communication standards using new RF link solutions

• Exploring and enabling new applications





Live demonstration of Ariso LP1







Questions





Ariso Websites

- Ariso general website: <u>www.arisocontactlessconnectivity.com</u>
- Evaluation kit, digital version: www.te.com/catalog/pn/en/2229389-1
- Evaluation kit, analog version: www.te.com/catalog/pn/en/2229389-2
- Publication on PowerByProxi:

www.powerbyproxi.com/communications/news/powerbyproxi-announces-5m-in-series-c-funding-te-

connectivity-and-powerbyproxi-announce-partnership-to-develop-industrial-wireless-power-solutions/





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