



**The IP&E
Specialist**

Energy Management – Battery Storage & Charging Solutions Application Guide

TTI, Inc., – A Berkshire Hathaway Company



The IP&E Specialist

The Specialist in Electronics Component Distribution

Founded in 1971, TTI has steadily grown to become a world leading specialist distributor of electronic components. The company was founded on the premise that passive component purchasing could be made more efficient by offering product specialization, customer-driven service and proprietary supply chain solutions.

Why TTI?

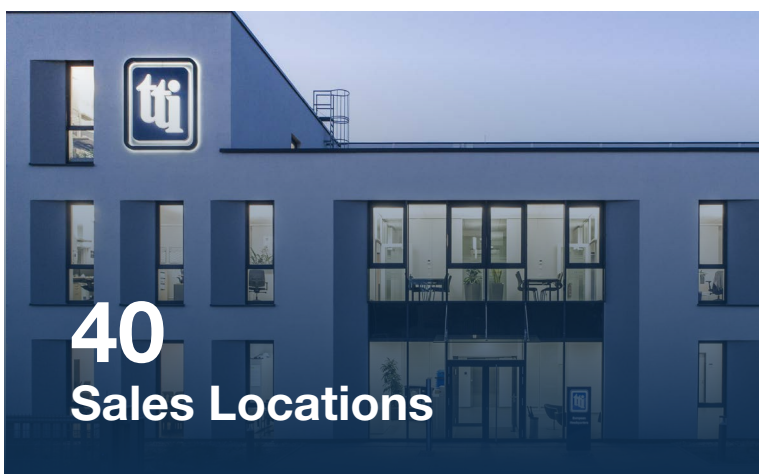
• **Technical Experts** TTI's European team of field-based Sales Engineers and local Product and Technical Specialists are here to support you; from understanding component trends, sustainable sourceability and new product roadmaps, to in depth technical support for your design from our technical engineering experts.

• **Value Added Services** Connector assembly is one of the most important value-added services at TTI, Inc. – Europe. We are specialized in distributing manufacturer controlled and certified connectors and interconnect solutions from globally leading suppliers. Thanks to a large inventory level of connector components, TTI, Inc. – Europe can serve any market requirements.

• **Global Distribution Centers** Our European headquarters is located just outside of Munich, Germany in Maisach-Gernlinden. In total, we have 45.000m² of dedicated warehouse space and local sales and technical support in over 40 locations across Europe. TTI has more than 195.000m² of automated warehousing in North America, Europe and Asia. All are linked into a global warehouse management system that provides superior customer service and overall business efficiencies. Wherever you are in the world, TTI can support you. Year after year, customers rate our inventory availability, on-time delivery and accuracy among the very best in the industry – contact us today to find out what a true specialist has to offer.

• **Quality and Reliability** TTI's global warehouses are all ISO-registered and have received certification to the ISO 9001 and ISO 14001 Standards. TTI Europe is also certified to EN9120/EN9100, IECQ-CECC and ISO/IEC 27001 Standards. Additionally, our European sales branches are ISO 9001 certified. TTI has one global documentation system that ensures that every TTI branch and warehouse in the world follows the same processes.





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Battery Storage & Charging Solutions Application

The market for energy storage systems (EES) is one of the fastest growing markets in Europe, driven by the transformation of the energy mix to become carbon neutral. Factors such as growing renewable energy like solar or wind, government policies and the request of uninterrupted and reliable power supply drive the development of new, more efficient energy management and storage solutions.

Whether you are looking for new solutions in terms of power connectors for batteries, switching loads by high voltage contractors or relays up to a broad range of passive and discrete components – with TTI as your specialized distributor, you have a partner for designing and producing the complete range of such applications.

From the classical inverter to the energy and battery management system, the residential battery system and finally to close the application cycle – down to the EV-wallbox – check out our featured products – they all support these trends and requirements – or simply call your local TTI contact for more information.

Energy Management

- Inverter systems
- Energy controller
- Energy monitoring
- Smart home interfaces

Battery Systems

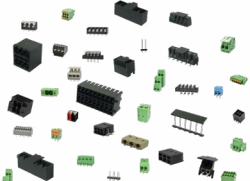
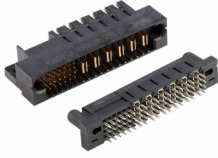
- Battery management systems
- Residential energy storage
- Battery packs
- UPS systems

Charging

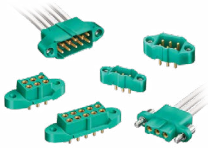
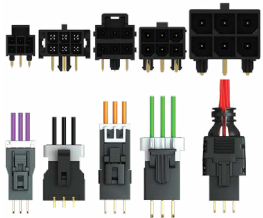
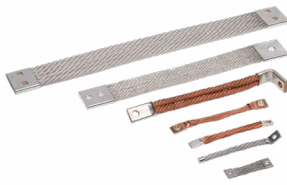
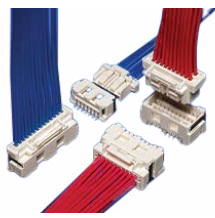
- Mobile application charger
- Industrial charger
- EV home charger (wall box)

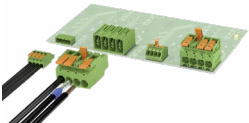
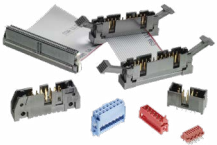
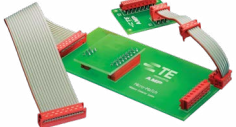


Connectors

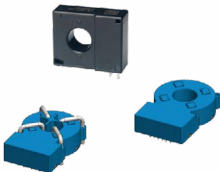
			
Mini Clamp II	Anytek Terminal Blocks	Minitek MicroSpaceXS™	PowerStak®
- Simple installation process - Labour saving IDC termination process - Ease of assembly for system building	- Rising clamp system - Screw pluggable system - Spring pluggable system	- LV214 Severity-3 and USCAR-T2V2 compatible - Terminal positioning assurance (TPA) - Primary and secondary contact retention	- High current carrying capacity with miniaturized shape - Up to 20A per power blade 2 to 10 power blades on 2.0mm pitch
			
			
PwrBlade+™ Connectors	Power Solutions	USB4 Type C Connectors	Modular Jack RJ45 Connector Solutions
High power contact option (up to 75A/contact; 30°C temperature: rise in still air) for cost-effective power delivery in 1U & 2U power supplies or power distribution applications	- Broad range of power connectors, power cable assemblies & power distribution (bus bar) products - Focused on ultra-low contact resistance	- High-speed transmission up to 40Gb/s - Excellent copper alloy material for terminals design - Extended 5A current rating for USB power delivery	- Various shielding options and LEDs - Wide operating temperature: -55 to +85°C 750 mating & unmating cycles
			
			
BarKlip® Series	Surlok Plus	Ecomate® Rugged Metal Connectors	High Voltage RCS
10 points of contact for high reliability - Low halogen housing - Wide operating temperature: -40 to +150°C	1000V DC, up to 300A, IP67/IP69K - Unshielded and wire to device 6 to 95mm² cable sizes	- Suitable for indoor and outdoor applications - EMI/RMI shielding capabilities with appropriate backshell - Operating temperature: -40 to +105°C	- High voltage RCS1100: 1000V - High voltage RSC800: 850V - High current carrying capacity: 375A at 85°C with 95mm² wire sections; 230A at 70°C with 50mm² wire sections
			

Connectors

HARWIN	HARWIN	JAE	KYOCERA AVX
High-Reliability M300 Power Connectors	Kona 8.5mm Pitch High-Reliability Power Connectors	Battery Connectors	Ethertronics Antenna Solutions
- High performance contacts in a compact housing 3mm pitch housing featuring 10A contacts for 18 to 22 AWG cable & board connectors	60A and 3,000V per contact - Beryllium copper & gold plated 6-finger contact design to maintain electrical continuity	- Conform to UL - High currency connectivity - With mis-mating prevention to avoid wrong wiring & short-circuit during assembly	- Internal antennas: off-board & on-board solutions - External antennas: indoor & outdoor solutions - Active solutions: RF band switching & active steering
			
molex	molex	molex	molex
Fit Family Power Connectors	PowerPlane Busbar Connectors	Busbar Solutions	CLIK-Mate Wire-to-Board Connectors
- Fully isolated terminals - Positive locking housings - Polarization and keying to reduce possibility of misalignment	- Multiple points of contact - Low-voltage drop - Current: 80 to 300A - Various termination styles	- Improved heat dissipation - Low characteristic impedance - Powder coat solutions - Tin, nickel & silver plating	- Wide variety of circuit sizes, mounting styles - Dual positive inner lock offers greater mating assurance - Compact 1.50mm pitch
			
molex	molex	molex	PHOENIX CONTACT
EXTreme Ten60Power High-Current Connectors	FCT D-Sub Connectors	IoT Antennas	ES-FT-BPC-B/S Battery Connectors
- Low-profile design: 10mm height - Available in 1 through 9 circuit split-blade power modules - Split-Blade power modules (1 through 9 circuits)	- Plastic & metal backshells - Machined contacts - Waterproof IP67 options available - Effective solutions for a variety of applications	- Poly-flexible, double-sided adhesive tape on antenna - High antenna radiation performance - Ground plane independent design	- Future-oriented connection technology: voltages up to 1,500V - Flexible in use: connections are possible on the front or the rear of the battery module
			

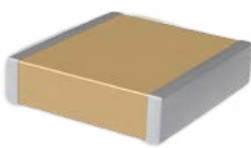
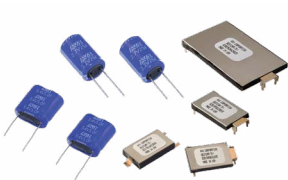
			
Lever-actuated PCB terminal blocks	PV Connectors	AMP-LATCH Ribbon Cable Interconnects	Industrial Ethernet Solution
• Colour-coded actuating lever • Tool-free lever principle • Distinct lever positions give a reliable feedback for opened or closed	• Unique SUNCLIX connection technology • Weatherproof insulation materials and high-quality contacts with minimized contact resistances	• Mass termination capabilities • No need to strip or prepare wire • Variety of centre lines and options	• Extensive temperature range between -40 to +85°C • Minimum product life requirement of 10 years • 260°C PIP soldering reflow capability
			
			
Micro-MaTch Connector Family	Dynamic Series	Heavy Duty Connectors with Dynamic Inserts	Circular Plastic Connectors
• Tin plated contact design • One of the smallest systems available at 1.27mm • UL-recognized	• Vibration resistant • Housings are keyed preventing mis-mating & misalignment • Positive audible locking sound	• Designed for harsh environments • Improved operational efficiency • Reliable & high density contact	• Lightweight, all-plastic and metal-shell connectors • UL 94V-0 rated and made of stabilized, heat resistant, self-extinguishing thermoplastic material
			
			
Snap-Lug Quick Disconnect Power Connectors	Dynamic Mini Series	IPT	Antenna Solutions & Technologies
• Enable connections in confined spaces with a reliable snap-on, quick disconnect connector, without the need for a torque wrench	• Higher reliability due to second lock design • Space saving on board due to low profile • Faster system assembly due to SMT reflow capability	• 850V DC, 1, 2 & 3-way versions • Shielded and wire to device • 16, 25, 35 and 50mm² versions available	• Broad range of antenna types include standard antennas & custom antennas • Bluetooth, WLAN, Cellular and ZigBee
			

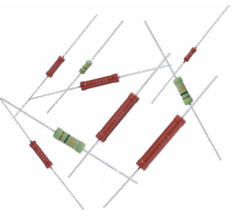
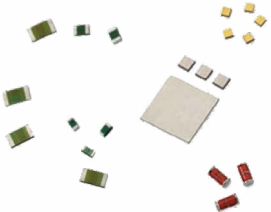
Power Supplies & Sensors

			
LCC Series Conduction Cooled PSU	iHP EV Chargers	TR Series Thermal Runaway Detection Modules	CSCA-A Series Open Loop Device
• 250, 600, 1200W full power • IP65 rated with a wide operating temperature range • No fan needed as conduction/convection cooled	• Up to 24kW & up to 8 outputs • Active PFC & 92% high efficiency • User configurable input range 180 to 660VAC single/three phase	• H2 Sensor module • Analogue, CAN, I2C, SPI communication options • >20 year design life	• Open Loop Hall technology • Ranges up to +/- 900A • Fast response time
			
			
Battery Safety Pressure Sensors	FG-RO5-3A Current Sensors	C/CT Series AC Current Sensors	USP16673 Thermistor Probes
• High accuracy • Low temperature drift • Advance warning for thermal runaway	• AC & DC leak current sensor • Digital output fault detection • Complies to mode 2 of IEC62752 • Mode 3 replacement compatible	• Snap on, compact slimline design • Flat temperature characteristics • UL94 V-0 flame retardant rated case	• Tight tolerance • Ultra thin • 90°C maximum operating temperature
			
			
LRS Series AC/DC Enclosed Power Supplies	HDR, TDR, WDR Din Rail Power Supplies	Energy Meter DRS-100-3P-MOD-01	
• Miniature size & 1U low profile • Protections: short circuit/overload/over voltage • High efficiency & reliability, long life	• Class I & class II isolation • DIN Rail TS 35/7.5 or 15 mountable • Very low load power consumption <0.75W • Compact size	• MID D Certified • Direct connect to 100A • Easy to program & Din Rail mount • Accurate and cost effective	
			

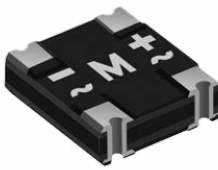
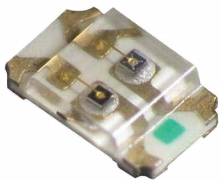
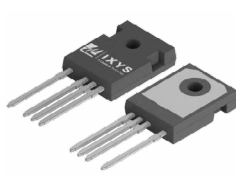
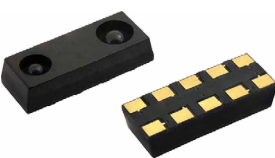
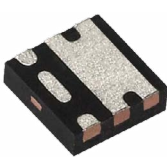
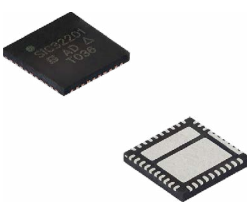
Relays & Switches

			
SKSU Series TACT Switches™	PBA-Series	ZMW Series Mini size snap-acting Switches	DCNLEV50
• 5.3 × 5.4mm downsized package size • Pre-travel area to minimize the wobble of set knob • Both clear click feedback & low sound	• Sealed to IP68 or IP69K, easy to clean robust metal surface	• Mini size snap-acting switches ideal when space is limited • Reliable snap-acting mechanism with long stroke setting	• High current (50A) & high voltage (900V) contactor for charging applications • Epoxy resin ensures hermetic sealing • IP67K sealed
			
			
G7EB PCB AC-Power Relays	G9KA PCB-Power Relays	ESB33 Push Switches	HVC Contactor for DC Switching
• High power & high temperature type power relay with 480VAC 100A current	• High power & high temperature type power relay with 800VAC 200A current	• Low profile, h=6.0mm • SMD type (embossed taping available) • 2-pole 2-throws are available	• Up to 1200VDC • Up to 500A • Bipolar design • Single & Dual coil design available
			
			
High Power Relays K1K 1000V/1.000A	IHVA Series DC Contactors	AV Series Vandal Resistant Switches	HV Rotary Switches
• High performance in a compact, lightweight, hermetically sealed contactor • Designed for up to 1000V/1000A in harsh environment	• Non polarity for contact current • Aux contact available • Coil voltage 12/24/48VDC, ~ 5W	• 250VAC & 5A push button switch	• Mechanical switch which can handle switching currents up to 550A and a voltage of 1000VDC
			

 EAT•N Powering Business Worldwide	 KEMET a YAGEO company	 KEMET a YAGEO company	 knowles PRECISION DEVICES CORPEX • DLI • JOHANSON MFG NOVACAP • SYFER • VOLTRONICS
XLM Supercapacitors	KC Link Ceramic Capacitors	ALS Electrolytic Capacitors	Hi Voltage and Safety MLCCs
- Long lifetime (operating lifespan of up to 20 years) - Maintenance free (no monitoring or user controls required)	- EIA 1812, 2220, and 3640 case size - AEC-Q200 automotive qualified - Flexible termination option available	- Compact size with high CV - Long life, up to 20,000 hours - High ripple current	- Safety capacitors with 305Vac rating - Safety capacitors with 1kVdc rating
			
 KYOCERA AVX	 KYOCERA AVX	 muRata INNOVATOR IN ELECTRONICS	 muRata INNOVATOR IN ELECTRONICS
FFLR / FFVE Power Film Capacitors	Supercapacitors Family	KCA Metal Termination Capacitors	Safety Capacitors
- Self healing technology - FFLR – Voltage range: 600V to 3800V, capacitance range: 105uF to 3000uF - Aluminium cylindrical case filled with polyurethane resin	Superior reliability, AVX passes 4000 hours life tests with results still within specification	- Capacitance from 100pF to 10nF - Operating temperature range: -55°C to +125°C	High impulse tolerance product can help reduce the size of the board
			
 SAMSUNG SAMSUNG ELECTRO-MECHANICS	 TDK	 VISHAY	 YAGEO
Hi Capacitance MLCCs	AC Output Filter Capacitors	EDLC ENYCAP Supercapacitors	High Capacitance MLCCs
- AEC-Q200 qualified - VW 80808-2 qualified - ADAS Applications (1uF to 47uF 6.3V to 25V X7*)	- Optimized AC voltage performance - High ripple current capability - THB: 60°C/95%RH/Vrac/1000h	- Rated capacitance: 5F to 100F - Rated voltage (65°C, 85°C): 3V, 2.6V - Useful life: 2.000h at 85°C	- High capacitance and high voltage at once - Size: 0805 to 1812 - TC: X7R (-55°C ~ 125°C)
			

BOURNS®	KOA	KOA	Littelfuse®
Isomov Hybrid Protectors	Shunt Resistors	High Energy Pulse Resistors	PSX Power Fuses
- Space saving solution (GDT +MOV) - Reduced down time and service cost - Enhanced surge ratings	0.5mΩ to 20mΩ 1W (0805 inch) to 5W (2512 inch) - Current ratings up to 100A	- Non-inductive 25kV pulse voltage (HPC 3, 4, 5) - Power rating up to 5W	- Low watt loss (energy efficiency for BESS applications) - Compact NH 1XL & 3XL sizes - Class aR performance according to IEC 60269-4
			
Littelfuse®	Panasonic INDUSTRY	Panasonic INDUSTRY	SCHURTER ELECTRONIC COMPONENTS
Thermal Sensing Solutions	Thin Film Resistors	Low ESR Aluminium Capacitors	High Performance Fuses
- Custom probe assemblies - High precision thermistors - Custom R-T curves	- Wide resistance range 10Ω to 1MΩ (E-96) - Low current noise, excellent linearity	- Low ESR (down to 12mΩ) - High ripple current (up to 3820mA) - Temperature range: -40°C to +105°C	- High rated voltages up to 500 VAC/VDC 16 rated currents from 1A to 32A - Fast-acting (F) characteristics
			
TDK	Tt Electronics	VISHAY	YAGEO
EMC Filters	Metal Element Inverse Shunts	GBS Vitreous Resistors	Aluminium Housed Power Resistors
1, 2, 3 & 4 line filters - Highest performance by optimized design - Line reactors, output chokes and output filters - Broad range of standard products	- Inverse 1020 & 1225 SMD shunt, 0.1 to 3m Ohms, down to 1% - Ultra-low ohmic values support high energy efficiency in the end product	- High power rating up to 1000W - Excellent pulse load capability - Low ohmic values <1 Ohm	- High power rating: 75W to 500W - Wirewound resistors, high power, aluminium housed, heatsink type - Resistance range: .1Ω to 51KΩ
			

Discrete Semiconductors

BOURNS®	BOURNS®	BOURNS®	Dialight
TBU-DB-Q Series High-Speed Protectors	CD-MMBL110S SMD Bridge Rectifiers	CDSOT23-T24CAN CANbus Protectors	556 - LED PMI Series
• Superior circuit protection • Overcurrent protection • Blocks surges up to rated voltage limit • High-speed performance • Small SMT package	• 1000V/1A rating • Low profile DFN3538 package (3.5 x 3.8 x 1.15mm) • High thermal dissipation	• Single device for two I/O lines • Low capacitance for high-speed CANbus • AEC-Q101 compliant	• Available in a large range of DC & AC voltages • Flat or domed lens, to fit any kind of application • Daylight viewable version • Constant intensity version
			
Kingbright Kingbright Electronic Europe GmbH	Littelfuse®	Littelfuse®	Littelfuse®
KPHBM-2012LVSURKZGKC Bi-Color LED	AQ24CANA CAN Protections	IX4351NE SiC MOSFETs & IGBT Drivers	LSIC1M0120G0080 – 800V SiC N-Ch MOSFETs
• 2.0 x 1.25 x 0.45mm SMD • Low power consumption • Wide viewing angle	• Low clamping voltage • Low leakage current • ESD, ISO 10605, 330pF 330Ω, ±27kV contact, ±30kV air • AEC-Q101 qualified	• Separate 9A peak source & sink outputs • Operating voltage range: -10V to +25V	• Optimized for high-frequency, high-efficiency applications • Extremely low gate charge and output capacitance • Low gate resistance for high-frequency switching
			
VISHAY	VISHAY	VISHAY	VISHAY
VCNL4200 - Proximity & Ambient Light Sensors	SIA477EDJT 12V P-CH MOSFETs	SIC32201 Integrated OR-ing Switches	XMC7K24CA XClamp™ TVS Diodes
• SMD 8.0 x 3.0 x 1.8mm • IRED, ALS, PS, IC integrated • Filtron technology • Dark lens design • Output type: I2C bus (ALS/PS)	• PowerPAK® SC-70 package • Small footprint area • Low on-resistance • RDS(on) rating at VGS = -1.8V • Built in ESD protection	• Integrated 0.45mΩ n-channel current sense MOSFET • Lossless current sense without shunt resistor • Integrated current sensing and reporting circuits	• XClampR™ extremely low clamping voltage • I_{PPM} = 180A with a 10/1000μs waveform • Low leakage current • AEC-Q101 qualified
			



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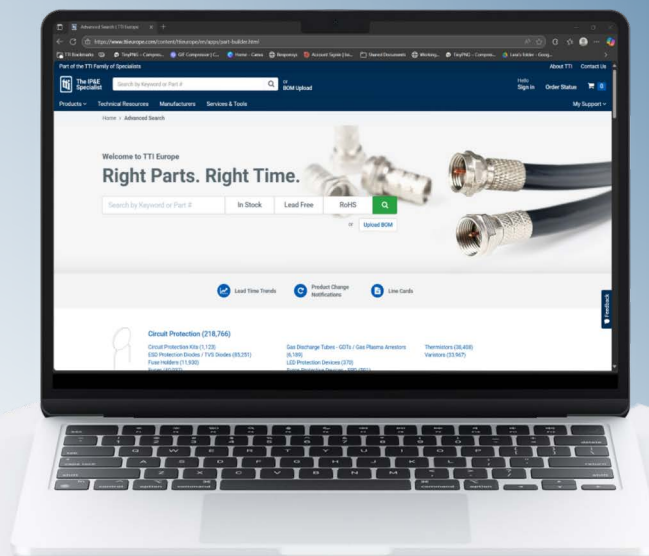
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Corporate Headquarters

TTI, Inc.
2441 Northeast Parkway, Fort Worth, Texas 76106 U.S.A.
T: +1 817 740 9000 | F: +1 817 740 9898
E: information@ttiinc.com

European Headquarters

TTI, Inc.
Ganghoferstr. 34, 82216 Maisach-Gernlinden Germany
T: +49 (0) 81 42 66 80 0 | F: +49 (0) 81 42 66 80 490
E: sales@de.ttiinc.com

European Sales Offices

Austria

Vienna
T: +43 (0) 18 79 85 90
E: sales.vienna@at.ttiinc.com

Belgium

Gent
T: +32 9 274 0670
E: sales.belux@nl.ttiinc.com

Bulgaria

Varna
T: +359 52 51 10 59
E: sales.varna@bg.ttiinc.com

Czech/Slovak Republic

Brno
T: +420 541 126 714
E: sales.brno@cz.ttiinc.com

Denmark

Brøndby
T: +45 (0) 43 29 35 35
E: sales.copenhagen@dk.ttiinc.com

Risskov

T: +45 (0) 38 41 31 00
E: sales.copenhagen@dk.ttiinc.com

Estonia

Tallinn
T: +372 664 81 00
E: sales.estonia@ee.ttiinc.com

Finland & Baltic Region

Espoo
T: +358 98 94 65 200
E: sales.finland@fi.ttiinc.com

France

Brive
T: +33 (0) 5 55 92 92 93
E: sales.france@fr.ttiinc.com
Saint Priest
T: +33 (0) 4 72 81 20 30
E: sales.lyon@fr.ttiinc.com
Bruz
T: +33 (0) 2 99 77 60 84
E: sales.rennes@fr.ttiinc.com
La Ciotat
T: +33 (0) 4 42 84 41 42
E: sales.marseille@fr.ttiinc.com
Elancourt
T: +33 (0) 1 30 13 73 80
E: sales.paris@fr.ttiinc.com

Germany

Berlin
T: +49 (0) 30 8877 40 200
E: sales.berlin@de.ttiinc.com
Dortmund
T: +49 (0) 2301 91 304 0
E: sales.dortmund@de.ttiinc.com
Neu-Isenburg
T: +49 (0) 6102 5999 100
E: sales.frankfurt@de.ttiinc.com
Schorndorf
T: +49 (0) 7181 47514 0
E: sales.schorndorf@de.ttiinc.com
Hanover
T: +49 (0) 5 11 7 80 59 0
E: sales.hannover@de.ttiinc.com
Munich
T: +49 (0) 81 42 66 80 110
E: sales.munich@de.ttiinc.com
Pforzheim
T: +49 (0) 7231 14788 0
E: sales.stuttgart@de.ttiinc.com

Hungary

Budapest
T: +36 1 40 22 111
E: sales.budapest@hu.ttiinc.com

Ireland

T: +44 (0)1494 460000
E: sales.ireland@ie.ttiinc.com

Israel/Ray-Q Ltd.

Airport City
T: +972 3 975 3333
E: sales@ray-q.com

Italy

Civitanova Marche
T: +39 0733 81 8655
E: sales.milan@it.ttiinc.com
Florence
T: +39 (0) 55 094 63 76
E: sales.milan@it.ttiinc.com
Milan
T: +39 02 822 521
E: sales.milan@it.ttiinc.com
Naples
T: +39 081 4245719
E: sales.milan@it.ttiinc.com
Padova
T: +39 049 7802311
E: sales.milan@it.ttiinc.com

Rome

T: +39 06 52362537
E: sales.rome@it.ttiinc.com

Netherlands

Eindhoven
T: +31 (0) 40 290 1616
E: sales.belux@nl.ttiinc.com

Norway

T: +46 85 941 18 00
E: sales.norway@no.ttiinc.com

Poland

Krakow
T: +48 55 279 67 57
E: sales.poland@pl.ttiinc.com

Kwidzyn

T: +48 55 279 67 57
E: sales.poland@pl.ttiinc.com

Portugal

Vila Nova de Famalicão
T: +351 252 493084
E: sales.barcelona@es.ttiinc.com

Romania

Cluj-Napoca
T: +40 (0) 733 339 002
E: sales.romania@ro.ttiinc.com

South Africa

Pretoria
T: +27 86 111 2844
E: sales.southafrica@za.ttiinc.com

Spain

Barcelona
T: +34 (0) 93 645 25 75
E: sales.barcelona@es.ttiinc.com

Madrid

T: +34 (0) 91 416 11 90
E: sales.madrid@es.ttiinc.com

Vizcaya

T: +34 (0) 94 623 25 80
E: sales.bilbao@es.ttiinc.com

Sweden

Gothenburg
T: +46 (0) 31 741 12 90
E: sales.gothenburg@se.ttiinc.com
Stockholm
T: +46 (0) 8 594 11 800
E: sales.stockholm@se.ttiinc.com

Switzerland

Baar
T: +41 (0) 41 76741 90
E: sales.swiss@ch.ttiinc.com

Algeria, Egypt & Tunisia

T: +216 (0) 71 862 693
E: sales.tunis@fr.ttiinc.com

Morocco

T: +33(0) 555 92 92 93
E: sales.morocco@de.ttiinc.com

Turkey

Istanbul
T: +90 (0) 216 688 91 75 76
E: sales.turkey@tr.ttiinc.com

United Kingdom

High Wycombe
T: +44 (0)1494 460000
E: sales.london@uk.ttiinc.com
Manchester
T: +44 (0)161 947 0777
E: sales.london@uk.ttiinc.com

Resellers or Distributors

TTI Connect - Europe
T: +49 8142 6680 168
E: service@tticonnect.com

TTI, Inc. Headquarters Europe



www.tuev-sued.de/ms-zert



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