



23rd IMEKO TC4 International Symposium 第五届全国电磁计量大会

2019年9月17日—20日 中国·西安
17-20 September 2019 Xi'an, China

会议手册

Conference Handbook

<http://www.imeko2019.org/zh-cn/index.html>

Introduction of IMEKO TC4

The 23rd Technical Committee 4 (Measurement of Electrical Quantities) of IMEKO (IMEKO TC4) International Symposium take place in Xi' an, China from 17 to 20 September, 2019. It is organized by International Measurement Confederation (IMEKO), co-organized by Chinese Society for Measurement (CSM), National Institute of Metrology, China (NIM) and Xi' an Jiaotong University (XJTU).

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IMEKO TC4 was officially established in 1984. The main interest of IMEKO TC4 is related with theoretical and practical aspects of the measurement of electrical quantities by electronic instruments. TC4 provides a forum for the dissemination of ideas about electrical and electronic measuring techniques and principles of implementation of information and communication technology for the measurement and enhancement of the accuracy.

Technical committee TC4 deals besides classical issues related with the measurement of electrical and magnetic quantities with the processing of measurement data both by hardware and software tools. Electronics and informatics offer a flexible tool for instrumentation. It enables to process measured data, and recover additional information about the process to be observed from them. Moreover, digital post-processing provides a large variety of error reduction methods including autocalibration and selftests. Accuracy of electronic instruments is determined by the conversion between analog and digital domain and possible interferences from the various error sources. Recommendation based on the Another objective of TC4 activities is aimed on the continuous updating of standards according to progress in the electronic instrumentation.

IMEKO TC4 International Organising Committee



Chairman
Prof. Alexandru Sălceanu (Romania)



Deputy Chairman
Prof. Dušan Agrež (Slovenia)



Scientific Secretary
Prof. Ján Šaliga (Slovak Republik)



23rd IMEKO TC4 International Symposium

— IMEKO-TC4 Programme —

	17 September	18 September	19 September	20 September
	Tuesday	Wednesday	Thursday	Friday
6:00		Breakfast 6:00-8:00	Breakfast 6:00-8:15	Breakfast 6:00-8:45
8:00		Bus to Xi'an Jiaotong University 8:15-9:00		
8:30				
9:00		Opening Session&Plenary Session 9:00-10:30	Oral Session 8:30-10:30	
9:30				
10:00		Coffee Break 10:10-10:30		
10:30		Laboratory Tour 10:30-11:30	Coffee Break 10:30-11:00	
11:00				
11:30		Back to Hotel 11:30-12:15	Poster Session 11:00-12:30	
12:00				
12:30		Lunch (Veranda Cafe) 12:15-13:30	Lunch (Veranda Cafe) 12:30-13:30	
13:00				
13:30		Oral Session (ChangLe Room) 13:30-15:30	Oral Session 13:30-15:30	Social Activities 9:00-16:30
14:00				
14:30				
15:00				
15:30	Welcome Registration 15:00-19:00	Coffee Break (YongNing Ballroom) 15:30-16:00	Coffee Break 15:30-16:00	
16:00		Poster Session 16:00-17:30	TC4 Meeting for Committee 16:00-17:30	
16:30				
17:00				
18:00			Banquet (YongNing Room) 17:30-19:30	
19:00				
20:00	Cocktail (Lobby Bar) 19:00-21:00	Dinner (Veranda Cafe) 17:30-22:00		
20:30				
21:00				

	Time	Number	Title	Authors
Oral	September 18 (XJTU) 9:00-10:10		Data Analytics for Smart Energy Cyber-Physical System Security	Shiyan Hu
			Review on Recent Progress in Condition Awareness of Electrical Equipment towards Ubiquitous Power Internet of Things	Guogang Zhang
	September 18 13:30-15:30	799259	Uncertainty in uncalibrated microwave resonant measurements	Kostiantyn Torokhtii *, Enrico Silva ,Andrea Alimenti ,Nicola Pompeo
		820091	RF Attenuation Measurement System Using VNA at BSN	Windi Kumia Perangin-Angin
		786041	Displacement Measurements in UME Oscillating-Magnet Kibble Balance	Haji Ahmedov *,Beste Korutlu ,Recep Orhan
		798863	Amplitude estimation using three-parameter sine fitting algorithm in the Planck-Balance	Shan Lin *,Christian Rothleitner ,Norbert Rogge
		799895	Calibration of lock-in amplifiers in the low-frequency range	Alessandro Cultrera *,Luca Callegaro ,Ngoc Thanh Mai Tran ,Massimo Ortolano ,Vincenzo D'Elia
		820473	Microvolt Josephson Voltage Standard Using a Dual-Channel Programmable Array Chip Developed at NIM	HONGHUI LI *,Wenhui Cao ,Zengmin Wang ,Jinjin LI ,Qing He
	September 19 8:30-10:30	820561	Applications of Programmable Josephson Voltage Standard on Magnetic Measurements	Zengmin Wang, Honghui Li, Yuan Gao, Yunfeng Lu ,Qing He
		823311	Compressed sensing with model based reconstruction	Imrich Andras ,Jan Saliga ,Linus Michaeli
		820403	Contribution of Interharmonic Component on the Interpolated DFT Frequency Estimator	Daniel Belega, Dario Petri, Dominique Dallet
		823205	DAC testing: recent research directions	EULALIA BALESTRIERI *,PASQUALE DAPONTE ,SERGIO RAPUANO ,LUCA DE VITO ,FRANCESCO PICARIELLO ,IOAN TUDOSA
		820565	Excitation frequency dependent deviations during the "velocity mode" of BI measurements in the Planck-Balance	Norbert Rogge *,Shan Lin ,Christian Rothleitner ,Suren Vasilyan
		782737	Woodhouse Energy Consumption Measurement System for Diagnostics of Thermal and Technical Properties of Buildings Envelope	Jakub Svatos *,Jan Holub
	September 19 13:30-15:30	823209	Experimental Assessment of a Novel CS-based Acquisition Method for ECG Signals in IoMT	Francesco Picariello *,Luca De Vito ,Eulalia Balestrieri ,Pasquale Daponte ,Sergio Rapuano ,Ioan Tudosa
		783013	Interlaboratory Comparison for Electric Power Measurements at Industrial Frequency in Ukraine	Stanislav Karpenko *,Oleh Velychko
		783409	Dynamic Error Testing of Electricity Meter Based on Distorted m-sequence Dynamic Test Signal	Xuwei Wang *,Jing Wang
		820505	Study Upon the Influence of Human Body Torso Stance on the Inductive Coupling	Alexandru Salceanu *
		797889	Autonomous Groundwater Monitoring Station with Wireless Communication	Ondrej Hanus ,Jan Mikes ,Jakub Kakona
		820095	MV Surge Arresters Monitoring Using Drone Technology	Alessandro Mingotti *,Diego Cavaliere ,Lorenzo Peretto ,Roberto Tinarelli ,Gaetano Pasini
Poster	September 18 16:00-17:30	782737	Woodhouse Energy Consumption Measurement System for Diagnostics of Thermal and Technical Properties of Buildings Envelope	Jakub Svatos *,Jan Holub
		763387	Indium tin oxide thin films prepared by dc magnetron sputtering for transparent heating	Xueshen Wang *,Pingwei Lin ,Xinhua Chen ,Longfa Zhang ,Shuo Liu ,Jianhua Li
		799377	Development of Quantum voltage noise source chip for Johnson noise thermometer system	Qing Zhong *,Yuan Zhong
		820461	No oscillator output frequency counter automatic test equipment	Guan Zexin *,Li Wenqiang ,Zhao Yan ,Ma Xuefeng ,Sun xiaoyan ,Wang dalong ,Yan Hongrui
		798285	A new simple ECG signal model	Jan Saliga *,Pavol Dolinsky ,Imrich Andras ,Linus Michaeli
		798807	Study on Charge Standard for calibrating PD Measurement Equipments	Na Liu *,Shengyou Gao ,Caijun Yang ,Lu Huang
		798721	Measurement Procedure For External Magnetic Field in UME Kibble Balance	Haji Ahmedov *,Beste Korutlu ,Lev Dorosinskiy ,Recep Orhan
		820031	The IEEE TC-10 Standards: Update 2019	Sergio Rapuano *,Luca De Vito ,John Jendzurski ,William B. Boyer ,Steven J. Tilden ,Nicholas G. Paulter
		799733	Remarks on the revised SI System	Waldemar Nawrocki

	Time	Number	Title	Authors
Poster	September 18 16:00-17:30	820181	Calibration of current measuring network for wet contact of leakage current tester	Xuefeng Ma ,Wenqiang Li
		820529	Comparsion of different kinds of frequency scanning methods used at low temperature	Liu Wenjing ,Zhang Haiyang ,Gao Bo ,Pan Changzhao ,Han Dongxu ,Hu Jiangfeng , Song Yaonan ,Chen hui ,Luo ercang ,Laurent pitre ,Kong Xiangjie
		833291	Design of ATE Calibration Device Based on Microelectric Reference Materials	Yong Hu
		833301	A method of calibrating ATE while test	Houping Zhou
		763385	Investigation of nano-SQUIDS with Dayem bridges by e-beam lithography and reaction ion etching	Qing Zhong *,Xueshen Wang ,Jinjin Li ,Yuan Zhong
		752301	The EMPIR Joint Research Project GIGS: Graphene Impedance Quantum Standard	Luca Callegaro
		820551	Temperature influence on the frequency response of the Keysight 3458A digital multimeter	Yolanda A. Sanmamed *,Javier Diaz de Aguilar ,José R. Salinas ,Raúl Caballero , Francisco García Lagos
		862979	Online Calibration of Smart Meters	Fangxing Liu, Chengbin Liang, Qing He
		862977	Influence of Line-loss to Online Measurement of Smart Meters based on AMI	Chengbin Liang, Fangxing Liu, Qing He
		820263	Electrical Characteristics of Pantograph Arcs in DC Railways: Infrastructure Influence	Andrea Mariscotti *,Domenico Giordano
		763397	Influence of Fast Fluctuation of Dynamic Load Current on Dynamic Error of Smart Electricity Meter	Xuwei Wang *,Shanshan Ma ,Da Lu ,Yubo Yang ,Jing Wang
	September 19 11:00-12:30	763405	The Whole-system Model of Smart Electricity Meter	Xuwei Wang *,Lan Qiu ,Jing Wang
		765975	Evaluation the Uncertainty Influence Depends on Harmonic Voltage Distortion for Precision Power Measurements	Stanislav Karpenko *,Oleh Velychko ,Irina Karpenko
		798231	Analysis of MV Cable Joints Equivalent Impedance and its Variation vs. Temperature	Alessandro Mingotti *,Lorenzo Peretto ,Roberto Tinarelli ,Abbas Ghaderi
		799411	Inductive Current Transformer Core Parameters Behaviour vs. Temperature Under Different Working Conditions	Alessandro Mingotti *,Abbas Ghaderi ,Lorenzo Peretto ,Roberto Tinarelli
		820583	Metrology, Electrical Energy Markets and Engineering Education at University of Novi Sad (Serbia)	Platon Sovilj *
		820503	Study Upon Specific Absorption Rate: Far Field Source Outside and Subject Inside the Building	Alexandru Salceanu
		827543	A Method for Decomposing Dynamic Load Signals and Its Application	Xuwei Wang *,Ling Zheng ,Jing Wang ,Lan Qiu ,Bo Li ,Min Cao
		827553	The Dynamic Error Analysis of the Current Transformer	Xuwei Wang *,Rui Xue ,Jing Wang ,Lan Qiu ,Bo Li ,Min Cao
		763393	Research on A New Active Power Measurement Algorithm	Xuwei Wang *,Meng Zhu ,Da Lu ,Yubo Yang ,Jing Wang
		799811	Relevance of Harmonic Active Power Terms for Energy Consumption in Some Railway Systems	Andrea Mariscotti *
		820261	Discussion of Power Quality Metrics suitable for DC Power Distribution and Smart Grids	Andrea Mariscotti *
		799227	Microwave Characterization of 3D-printer Dielectric Materials	Andrea Alimenti *,Kostiantyn Torokhtii ,Nicola Pompeo ,Emanuele Piuze ,Enrico Silva
		821335	A High Isolation Analogue Switch and its Application in Digital Sampling Bridge	Jing Gu
		797165	Bilateral comparison of voltage transformer measuring systems of NCHVM and PTB	Xue Wang *,Enrico Mohns ,Chunyang Jiang ,Hong Yang ,Peter Raether
		763005	Linking results of RMO comparisons and inter-laboratory comparisons for AD/DC voltage transfer difference	Oleh Velychko *,Tetyana Gordiyenko
		821417	Design of Small Capacitance Standards Based on Analytical and Simulation Approaches	Xiaoyuan Wu
		820415	Detecting cracks on graphite commutators using estimated amplitude of resistance	Dusan Agrez *,Nejc Klevisar Klevisar
		820519	Power spectrum measurement of high frequency angle modulated digital signal from output power spectrum of a digital divider	Leonidas NIYONKURU ,Gerd VANDERSTEEN ,Leo VAN BIESEN
		763119	Damiano Crescini *,Alessio Galli ,Davide Alghisi ,Farid Touati	Waldemar Nawrocki



Author: Shiyan Hu

Title 1: Data Analytics for Smart Energy Cyber-Physical System Security

Researchgate home: https://www.researchgate.net/profile/Shiyan_Hu2

Biography:

Professor Shiyan Hu received his Ph.D. in Computer Engineering from Texas A&M University in 2008. He has served as an Associate Professor (with Tenure) and Director of Center for Cyber-Physical Systems at Michigan Technological University. He was a Visiting Associate Professor at Stanford University from 2015 to 2016. His research interests include Cy-

ber-Physical Systems and Cyber-Physical System Security.

Prof. Hu is the Chair for IEEE Technical Committee on Cyber-Physical Systems. He is the Editor-In-Chief of IET Cyber-Physical Systems: Theory & Applications. He is an Associate Editor for IEEE Transactions on Computer-Aided Design, IEEE Transactions on Industrial Informatics, IEEE Transactions on Circuits and Systems, ACM Transactions on Design Automation for Electronic Systems, and ACM Transactions on Cyber-Physical Systems.



张国钢

题目：面向泛在电力物联网的电力设备状态感知研究进展综述

张国钢，毕业于西安交通大学，获博士学位（2004），现任职于西安交通大学电气工程学院，副教授，博士生导师。电力设备电气绝缘国家重点实验室固定研究人员，国家能源先进电网与装备可靠性及寿命评估技术重点实验室 EMC 实验室负责人，先进电力储能技术研究中心、智能化电器教育部工程研究中心、陕西省智能电器及 CAD 工程研究中心、电器装备及智能化系统研究所主要成员。2010 年起，任西安交通大学电气工程学院电器教研室副主任、常务副主任。2015 年起，担任中国电工技术学会低压电器专业委员会委员，SAC/TC27 标委会委员。2017 年 -2018 年，CSC 访问学者，赴德国访问交流。



第五届全国电磁计量大会

— 会议安排 —

	9月17日 星期二	9月18日 星期三	9月19日 星期四
6:00		早餐 6:00-8:00	早餐 6:00-8:15
8:00		乘车前往西安交通大学学术报告厅 8:15-9:00	
8:30			
9:00		开幕式及大会报告 9:00-10:10	口头报告(永宁殿3) 8:30-10:30
9:30			
10:00		茶歇 10:10-10:30	
10:30		口头报告 10:30-11:30	茶歇(永宁殿) 10:30-11:00
11:00			
11:30		乘车返回君乐城堡会议酒店 11:30-12:15	张贴展览 11:00-12:30
12:00			
12:30		午餐(雅庭西餐厅) 12:15-13:30	午餐(雅庭西餐厅) 12:30-13:30
13:00			
13:30		口头报告 (一楼永宁殿3) 13:30-15:30	口头报告(永宁殿3) 13:30-15:30
14:00			
14:30			
15:00			
15:30	报到注册 (酒店大厅) 15:00-19:00	茶歇(一楼永宁殿) 15:30-16:00	茶歇(永宁殿) 15:30-16:00
16:00		张贴展览 16:00-17:30	张贴展览 16:00-17:30
16:30			
17:00			
18:00			
19:00			
20:00	晚餐 (雅庭西餐厅) 19:00-22:00	晚餐(雅庭西餐厅) 17:30-22:00	
20:30			
21:00			

	时间	论文编号	标题	作者
口头报告	18日上午(西交) 9:00-10:10		Data Analytics for Smart Energy Cyber-Physical System Security	Shiyan Hu
			Review on Recent Progress in Condition Awareness of Electrical Equipment towards Ubiquitous Power Internet of Things	Guogang Zhang
	18日上午(西交) 10:30-11:30	857111	能量天平悬挂系统初始位姿识别方法	白 洋,王大伟,李正坤,鲁云峰,许金鑫,贺青
		842399	直流(静态)电荷量测试仪校准源研制	焦海妮,王逸洲,孙文,段长生,张军齐
	18日下午 13:30-15:30	841405	一种基于滑窗TLS-ESPRIT算法的超谐波动态分析方法	赵伟,赵东芳,庄双勇,黄松岭
		858525	NIM新一代二端对电容电桥装置	杨雁,黄璐,王维,陆文俊,陆祖良
		802901	金高准确度直流电压标准源技术	严明
		844081	提高守时系统可靠性的关键技术及方法研究	班亚,袁静,刘洪静,王锐,杨帆
		843081	基本电荷量常数定值综述	刘民,彭明
		802902	宽频精密电参量溯源技术 助力高端仪器国产化	胡武林
		842395	交流注入法电池内阻测试仪电阻参数的校准方法	冯建,胡俊杰,李若诗,胡斌
	19日上午 8:30-10:30	837169	基于GNSS的高可靠智能电网授时方法研究	张晗,黄艳
		802903	最新高速高精度标准数字多用表在计量和测试中的广泛应用	杨胜利
		827471	基于FPGA的北斗驯服铷原子频标装置的研制	王亚军,张磊,谷扬,黄艳,康婷婷
		821205	X波段空中辐射场测量中的天线设计与应用	景洪,郝文析,刘英君,宗子健,刘敏
	19日下午 13:30-15:30	847079	霍尔大电流传感器频率特性分析	陈少华,张军齐,焦海妮,王逸洲,崔邵颖
		841227	5730A多能源校准方案研究	杨胜利,毛玉苹
		841607	基于任意波形发生器的高压短路试验测量系统校准方法和装置的研究	林志力,周小猛,苗本健
		842585	一种基于感应比例电桥平衡法的同步分解标准器校准装置	金海彬,李小舟,王乾娟,唐蓓蓓,游立
		836899	卫星电源动态参数测试系统设计	金海彬,孙晨昕,丁明理,颜晓军
		844411	时分双工通信信号的功率计量	王立春
张贴展览	18日下午 16:00-17:30	842377	一种提高矩形脉冲电流幅度测量准确度的方法	孙智,高海峰,李晶晶
		842413	参考级直流标准电压源自动校准系统研究	李晶晶,王乾娟,孙智,金海彬,罗春妹,黄文钰
		842491	一种薄膜材料电阻率测试用环形电极设计	国北辰,陈少华,王书强,蔡建臻,孙超,王伟
		837329	高电压脉冲校准装置研究	颜晓军,金海彬,王书强
		844225	激光泵浦的铯-氮磁力仪的信号特征	伏吉庆,贺青,张伟

	时间	论文编号	标题	作者
张贴展览	19日上午 11:00-12:30	842359	高稳定度标准电阻跟踪测量研究	蔡建臻,黄晓钉,潘攀,国北辰,游立,王伟,陈少华
		822505	基于卫星定位的网约车计程计时检测技术研究	康婷婷,黄艳,王亚军,刘燕,王跃修
		852509	基于自动平衡电桥的LCR阻抗测量仪设计	唐蓓蓓,吴康,金海彬,颜晓军,王书强
		862057	采用电补偿方案的新一代立式计算电容装置	黄璐,杨雁,陆祖良,王维
		841609	惯性导航设备升沉数据测试系统研究	王锐,徐新平,袁静
		842411	1 mT~2.5 T磁强计的校准	徐昱,曹艳,陈桂英,周新华
		854708	1000 V多盘感应分压器标准建立	王维,杨雁,黄璐
		843583	原子时各算法分析与对比	王锐,罗亚雄,袁静,班亚,杨帆,江力
		842449	基于希尔伯特变换的信号解调算法及其在飞机供电特性参数测试系统中的应用	李小舟,金海彬
		837333	一种新型的交流阻抗计量标准研究	颜晓军,唐蓓蓓,李亚琛,吴康,游立
	19日上午 11:00-12:30	839527	任意阶次多项式最小二乘拟合不确定计算方法与最佳拟合阶次分析	许金鑫,由强
		842461	时钟免维护固件易升级单相电能表设计	巨汉基,王晨,丁恒春,袁瑞铭,张建辉,彭鑫霞,尹建丰,郭皎
		841613	基于虚拟仪器面向对象编程技术在计量自动校准程序中的开发	白丁蔚,彭诚,李军,侯旭玮
		842487	一种基于图像处理的交通运动目标快速检测方法	汤元会,张黎辉
		841551	新型量子霍尔电阻样品计量应用研究	蔡建臻,黄晓钉,潘攀
		842405	卫星太敏模拟器校准技术研究	王凯,佟雷,殷聪如,刘民,唐友东,李峥
		842475	基于粒子群算法的电能表用负荷开关优化研究	李文文,袁瑞铭,鲁观娜,叶雪荣,吕言国,郭磊
		842335	静电电压测量仪校准装置平板电极影响因素分析	史鹏飞,倪大志
		837171	高频标准电感器溯源标定方法探讨	梁琼崇,李升春,赵敏
		847063	基于风险评估的实验室内部质控管理	王乾娟,李晶晶,罗春妹,金海彬,王薇
		841611	基于机器人技术的手持式数字万用表全自动校准系统开发	彭诚,丁蔚,侯旭玮
		841167	高精度穿心电流表设计	王逸洲,焦海妮
		841345	磁传感器测试研究进展	李建
		837175	电能表EMS在线测试系统的综合去耦网络研究	刘建波,杨梅,李文强,马雪峰,闫红蕊,赵燕
		853307	基于同轴线相位法的两相流含气率测量研究	方立德,郎月新,韦子辉,李小亭,赵宁
	19日下午 16:00-17:30	842419	一种用于高压损耗计量的精密相位测量装置	游立,金海彬,赵伟,侯旭玮
		837281	可编程导电电阻自动测试系统的设计	殷聪如,桑尚铭,温星曦,罗震

张贴展览

时间	论文编号	标题	作者
19日下午 16:00-17:30	846466	使用功率积分方法精确测量剩余调幅	欧阳慧泉,李全力,雷红美
	847167	手持式数字多用表自动校准装置研制	康婷婷,张磊,王跃佟,方非,付运涛
	844271	谐波对函数发生器幅度校准的影响	王晓宁,Chris Eio,黄渤
	842373	基于威布尔分布和极大似然法的智能电能表寿命预测方法研究	王锐,杨帆,袁静,徐新平
	841587	智能电表可靠性预计标准对比研究	谢鑫,王黎敏,张红雨,陈锋凯,周韶园,洪涛
	820741	绝缘油介电强度测试仪专用校验装置的设计	赵燕,汪心妍,管泽鑫,刘建波
	827551	电能计量应用人工智能的设想	刘宇,张一萌,李征
	846637	脉冲大电流校准及溯源技术研究	王书强,张军齐,崔绍颖,吴端
	846641	国内外标准电阻器研究综述	崔绍颖,焦海妮,惠蓓蓓,颜晓军,张军齐,王逸洲
	842381	两种常用非正态分布的概率密度函数合成	费添豪,王锐,班亚,徐新平
	847309	用数字多用表校准直流电位差计应注意的问题	张跃进,韩忠
	842463	相对介损带电检测仪计量标准装置研制	梁国鼎,王昊,金月红,付济良,卢冰,汪泉
	841159	拆回电能表智能分拣与仓储系统的设计与应用	李雪城,程诗尧,朱锦山,史鹏博,李铭凯,李蕊,张智鹏
	862213	能量天平及千克单位重新定义研究进展	李正坤,许金鑫,白洋,鲁云峰,胡鹏程,刘永猛,王大伟,由强,张钟华,贺青,谭久彬
	862649	串并联型电阻分压器相角偏差的自校验方法	石照民,张江涛,潘仙林,宋莹
	802905	基于约瑟夫森量子电压的谐波电压测量方法研究	徐熙彤,贾正森,王磊,周天地,潘仙林,石照民
	802906	基于SNS型约瑟夫森结阵的双路驱动方法研究	周天地,贾正森,王磊,徐熙彤,潘仙林,石照民
	802907	基于约瑟夫森量子电压的交流功率测量系统及方法研究	贾正森,王磊,徐熙彤,周天地,潘仙林,石照民



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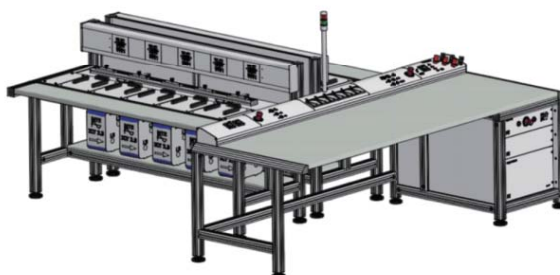
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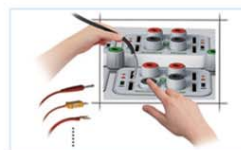
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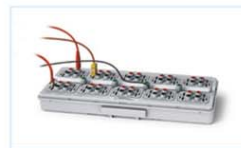
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- 5 A Current Input with 10 Current Ranges
- 240 V/120 V Voltage Input Ranges
- Line to Neutral and Line to Line Voltage Measurements
- Full Power Factor Range
- Total Harmonic Distortion Analysis
- Complete Waveform Analysis
- Phasor Analytical Representation
- Single-Phase/Three-Phase Series of Wattmeter/Power Analyzers



2020A Power Analyzer

- Basic Power Accuracy $< 0.005 \%$
- 5 A Current Input with 10 Current Ranges
- 240 V/120 V Voltage Input Ranges
- Line to Neutral and Line to Line Voltage Measurements
- Full Power Factor Range
- Total Harmonic Distortion Analysis
- Complete Waveform Analysis
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(PF=1)

W4416型低热电势四线扫描开关由杭州翰维电子科技有限公司研制。

基于专利技术实现了通道典型热电势优于20 nV，最大热电势优于50 nV的国际主流指标。

本产品为16通道输入-A/B通道输出-四线制工作模式，适用于构建精密电阻、固态电压标准、标准铂电阻温度计等自动化校准测试系统。本产品兼容国外主流扫描开关的通讯指令，并新增“通道查询”功能，可实时查询通道切换状态，提高了测试系统的构建灵活性和安全性。



规格 / 参数

通道热电势	典型值：< 20 nV
	最大值：< 50 nV
继电器触点	寿命：< 10,000,000次
	初始接触电阻：0.05 Ω (max)
	最大允许电流：2 A (< 10V)
	最大允许电压（闭合时）： 100 V (<1mA)
	最大允许电压（断开时）：600 V
泄漏电阻	> $10^{13} \Omega$
输入/输出	输入：16通道 - 4线制
	输出：2通道 - 4线制
	端子类型：碲铜镀金
控制方式	前面板控制 & 远程控制
通讯接口	标配：24针 IEEE488接口 选配：9针 RS-232接口

注：本公司提供自动化校准测试系统控制软件开发服务

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Chengdu Kaipu Electronic Technology CO.,LTD. is specialized in research, developing, and manufacture of electronic measuring instruments. Our primary products are capacitance standards and capacitor array, inductance standards and inductor array, custom instruments and related auxiliary to provide excellent stability and accuracy for standards transfer of capacitance and inductance, and instrument calibration.

CH-18 PRECISION DECIMAL STANDARD CAPACITANCE BOX

- Zero-switch capacitance: $<0.000005\text{pF}$
- Capacitance range: $1\text{pF} \sim 1.111110\mu\text{F}$
- Minimum step size: 1pF
- Accuracy: $\pm(0.01\%+0.000005\text{pF})$
- Capacitance dial switching: Six-digit decimals system
- Output mode: three-terminal or four-terminal



ZK-2712 STANDARD INDUCTOR



- Inductance range: $100\mu\text{H} \sim 10\text{H}$
- Accuracy: $100\mu\text{H}, 10\text{H}: \pm 0.05\%$
 $1\text{mH} \sim 1\text{H}: \pm 0.02\%$
- Operating frequency: $100\mu\text{H} \sim 1\text{H}: 1,000\text{Hz}$
 $10\text{H}: 100\text{Hz}$
- Output mode: Three-terminal or four-terminal

CH-14D PRECISION DECIMAL LARGE-CAPACITANCE BOX

- Zero-switch capacitance: $<0.00005\text{pF}$
- Capacitance range: $1\mu\text{F} \sim 1,110\mu\text{F}$
- Minimum step size: $1\mu\text{F}$
- Accuracy: $\pm 0.05\%$
- Capacitance dial switching: Three-digit decimals system
- Output mode: four-terminal



ZK-2716A PRECISION DECIMAL STANDARD INDUCTANCE BOX



- Inductance range: $1\mu\text{H} \sim 1.11111\text{H}$
- Accuracy: $\pm(0.02\%+0.05\mu\text{H})$
- Operating frequency: $1,000\text{Hz}$
- Output mode: Three-terminal or four-terminal

CH-11 HIGH-ACCURACY STANDARD CAPACITOR

- Capacitance range: $1\text{pF}, 10\text{pF}, 100\text{pF}, 1\text{nF}, 10\text{nF}, 100\text{nF}$ and $1\mu\text{F}$
- Accuracy: $1\text{pF} \sim 1\text{nF}: \pm 5\text{ppm}$
 $10\text{nF} \sim 100\text{nF}: \pm 15\text{ppm}$
 $1\mu\text{F}: \pm 25\text{ppm}$
- Output: three-terminal or four-terminal
- Operating frequency: $1,000\text{Hz}$



CH-12 STANDARD CAPACITOR



CH-12 series capacitor is a multifunction product, It can be used to verify or calibrate capacitance bridges, and also very useful for production line or laboratories. We can supply the follow models from $0.1\text{pF} \sim 1\text{mF}$.

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| Test Frequency: | Accuracy: |
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| • $10\mu\text{F} \sim 1,000\mu\text{F}: 100\text{Hz}$ | • $10\mu\text{F} \sim 1,000\mu\text{F}: \pm 0.05\%$ |
| Output mode: four-terminal | |

ZK-2718A PRECISION STANDARD INDUCTANCE BOX



- Inductance range: $1\mu\text{H} \sim 500\text{H}$
(in 3-step increments of 1, 2, and 5.)
- Accuracy: $\pm(0.05\%+0.05\mu\text{H})$
- Operating frequency:
 $1\mu\text{H} \sim 1000\text{mH}: 1,000\text{Hz}$
 $1\text{H} \sim 500\text{H}: 100\text{Hz}$
- Output mode: Three-terminal or four-terminal

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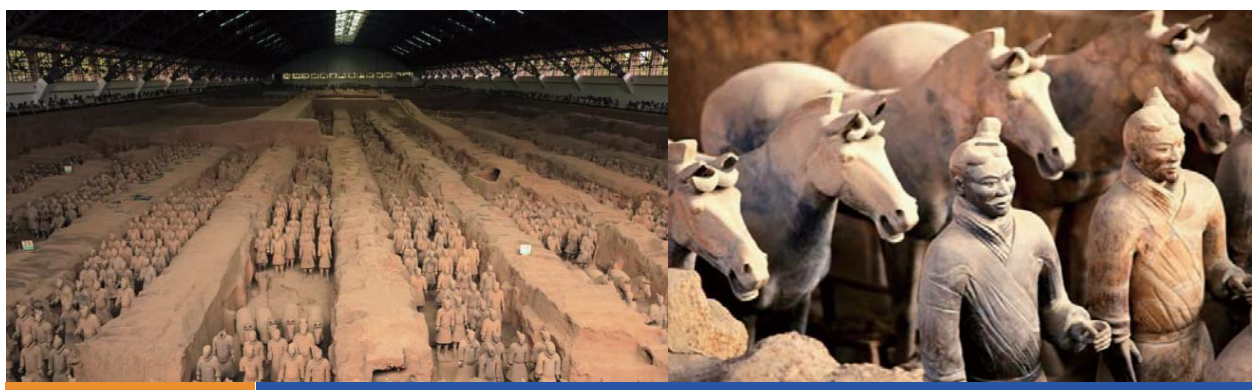
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Scenic spot 1:

Emperor Qingshihuang's Terracotta Army Museum/ 秦始皇兵马俑博物馆



Emperor Qingshihuang's Terracotta Army Museum is China's largest ancient military museum. In 1961, the state council of the People's Republic of China will be Emperor Qinshihuang's Mausoleum Site as the national cultural relic protection unit. In 1987, the emperor qinshihuang and Terra Cotta Warriors pit "by UNESCO world heritage list approved listed in the", and is known as "eighth wonder of the world".

Emperor Qingshihuang's Terracotta Army Museum is made up of three different sizes of the pit composition, respectively Numbers for number 1 pit, 2 pit, 3 pit. The total area of the pit is nearly 20,000 square meters, and there are about 8,000 terracotta figures and horses of similar size to real people and horses in the pit, and tens of thousands of practical weapons.

秦始皇兵马俑博物馆是中国最大的古代军事博物馆。1961 年，中华人民共和国国务院将秦始皇陵定为全国文物重点保护单位。1987 年，秦始皇陵及兵马俑坑被联合国教科文组织批准列入《世界遗产名录》，并被誉为“世界八大奇迹”。

秦始皇兵马俑由三个大小不同的坑组成，分别编号为一号坑、二号坑、三号坑。三个俑坑总面积近 20000 平方米，坑内共有同真人、真马大小相似的陶俑、陶马约 8000 件，实用兵器数以万计。

Scenic spot 2:

Huaqing Palace Heritage Site/ 华清池



Huaqing Palace Heritage Site, also known as Tang Huaqing Palace Site, is located at the northern foot of Mount Lishan, Lintong District, Xi'an City, Shaanxi Province. It is 30 kilometers from Xi'an in the west, Mount Lishan in the south, and Weishui River in the north.

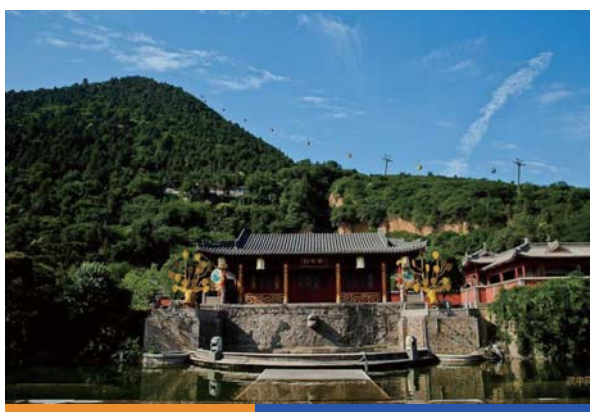
Historical documents and archaeological excavations prove that Huaqing Palace Heritage Site has a history of 6,000 years of hot spring utilization and 3,000 years of royal garden architecture. In 1982, Huaqing Palace Heritage Site was listed as one of the first batch of key scenic spots in China. On May 8, 2007, it was approved as a national 5A scenic spot. In January 2015, it merged with the two scenic spots of "Mount Lishan" and upgraded to "Tang Huaqing Palace Site".

华清池，亦名华清宫，位于陕西省西安市临潼区骊山北麓，西距西安 30 公里，南依骊山，北临渭水，是以温泉汤池著称的中国古代离宫。

历史文献及考古发掘的资料证明，华清池具有 6000 年温泉利用史和 3000 年的皇家园林建筑史。1982 年，华清池被列为全国第一批重点风景名胜区，2007 年 5 月 8 日，华清池景区被批准为国家 5A 级旅游景区。2015 年 1 月，与 "骊山" 两大景区合并升级为 "华清宫"。

Scenic spot 3:

Mount Lishan Scenic Area/ 骊山风景名胜旅游区



Mount Lishan, a branch of the qinling mountains with an altitude of 1302 meters, is an isolated barrier fault-block mountain formed in the weihe rifting belt during the late yanshan uplift.

Mount Lishan is an important part of huaqing palace scenic area. Mountain heritage sites numerous, beautiful natural landscape, all over the beacon tower, laomu temple, laojun temple, evening pavilion, remontory pavilion, shangshan lake, qixi bridge, sunde garden, yuxian bridge, three cave and many other famous scenic spots. Zhou, qin, han, tang dynasty, here has been as a royal garden.

骊山是秦岭山脉的一个支脉，海拔 1302 米，是燕山晚期上升形成的突兀在渭河裂隙带内的一个孤立的地垒式断块山。

骊山是华清宫景区的重要组成部分。山上文物胜迹众多、自然景观秀丽，遍布着烽火台、老母殿、老君殿、晚照亭、兵谏亭、上善湖、七夕桥、尚德苑、遇仙桥、三元洞等众多著名景点。周、秦、汉、唐以来，这里一直作为皇家园林地。

Welcome to Xi'an



Bell Tower



Tang Paradise



Big Wild Goose Pagoda



Musical Fountain
(The largest in Asia)



Famen Temple



South Gate of the City Wall



Shaanxi History Museum



Famen Temple



Drum Tower



Small Wild Goose Pagoda



Muslim Quarter



Gao's Grand Courtyard

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