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Instrumentation Division

Instrumentation Division (ID) was established during the year 1976 with an aim of identifying the problems encountered by Power Utilities and Energy Meter manufacturers in the area of Generation, Transmission and Distribution and also to provide consultancy services. Many problems were identified by the division, developed and provide solutions. Some of the them are Cable fault Locator, Earth fault Indicator for floating DC Control cables, Time Synchronizing Unit, Single and Three Phase Static Energy Meters, Electronic Trivector meters, Powered Support Characteristics Recorder for Underground Coal mines. Instrumentation Division has obtained Patent for Cable fault locator and Time Synchronizing Unit while Earth fault Indicator for floating DC Control cables, Single and Three Phase Static Energy Meters, Electronic Trivector meter Technology was transferred to private entrepreneurs for commercialization. During the year 1995, it was decided to it was decided to render services in new area i.e. Testing and certification. In 1995, Energy Meter Testing Laboratory was established at a cost of ₹ 85 lakhs. The project was funded by Ministry of Power. Energy Meter testing Laboratory was established with an aim to cater the requirements Power Utilities as well as Energy Meter manufacturers. Subsequently calibration and Relay testing Laboratories were added. During the year 1998, EMI/EMC Laboratory was added to Energy Meter Testing Laboratory. With this facility, ID established full state of the art Technology for energy meter testing under one roof.

Instrumentation Division also established Mobile Energy Meter Testing Laboratory during the year 2007 with an objective to verify the performance of energy meter (In-service) at Consumer premises on behalf Power Utilities or public Grievances Cell as the case may be. At present the mobile energy meter testing lab is stationed at New Delhi.

1.0 PREAMBLE

The Central Power Research Institute known as CPRI came into existence during the year 1960 under Central Water and Power Commission (Power Wing).

Subsequently, on recommendation of the Committee set up by the Ministry of Power in 1975 the Government of India, CPRI was recognized as an autonomous society in the year 1978 and registered under Karnataka Societies Act.

CPRI is devoted to Research and Development, Consultancy and Testing and certification.

One of the main early laboratories was Insulation Laboratory which had provided testing and certification of Solid Dielectric materials.

2.0 DEVELOPMENTS

CPRI established Instrumentation Division during the year 1976 with an aim to provide solutions to the instrumentation related problems referred by Power Utilities and manufacturers in the area of Power Generation, Transmission and Distribution. The Division was also aimed to provide consultancy services.

During the last three decades, Instrumentation Division had involved in R&D activities and

provides solution to problems referred by Power Utilities, manufacturers. Some of the problems were identified by the division itself.

3.0 RESEARCH ACTIVITIES

List of R&D activities carried out by the division are as given below:

i. Cable fault locator for LV & HV Cables.

ii. Long duration timer.

iii. Earth fault indicator for floating DC control cables.

iv. Negative Phase sequence Indicator.

v. 11 kV Live line detector.

vi. Microprocessor based winding fault detection system for transformers.

vii. Microprocessor based cable fault locator.

viii. Microprocessor based on line transformer oil Resistivity Meter.

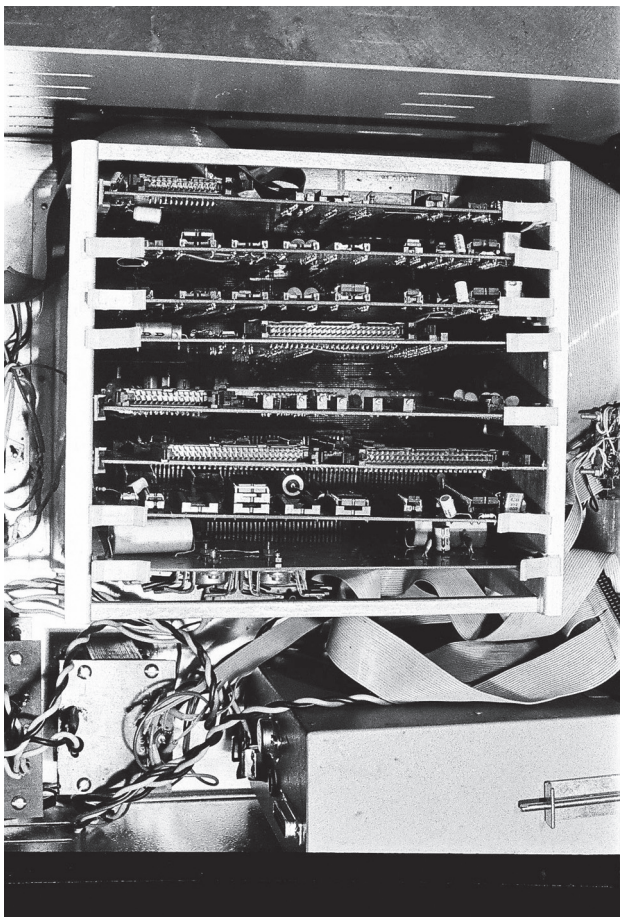
ix. Microprocessor based Single Phase Static Energy Meter.

x. Microprocessor based Three Phase Static Energy Meter.

xi. Microprocessor based Trivector meter.

xii. Technology development and performance evaluation of communication technologies for Automatic Remote Meter Reading (AMR).

POWER LINE DISTURBANCE MONITOR



POWER LINE DISTURBANCE MONITOR

xiii. Design, development & fabrication of Vibration Exciter.

xiv. Time synchronizing unit.

xv. Street light controller.

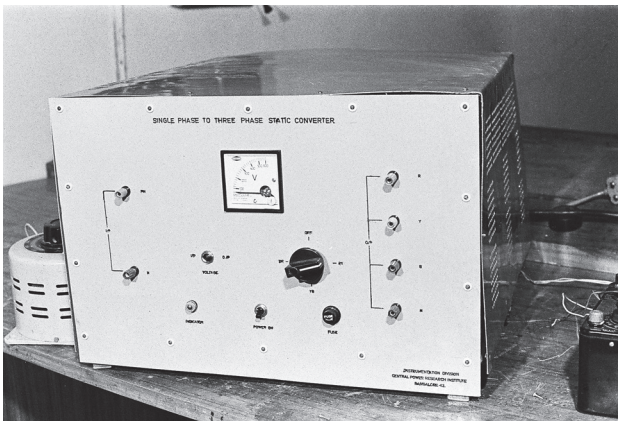
xvi. Microprocessor based Powered support characteristics Recorder for underground coal mines–Sponsored by Central Mines Planning and Design Limited (CMPDL), Ranchi (Bihar).

xvii. Effects of Harmonic influence on Energy Meters.

xviii. Analysis of Dissolved Gas in Transformer oil based on Expert System.

xix. Development of Street light controller.

xx. Single Phase Prepaid Energy Meter.



PROTOTYPE MODEL DEVELOPED IN INSTRUMENTATION DIVISION

xxi. Field testing of Single Phase Pre-paid Energy Meter.

xxii. Automatic Meter Reader (AMR).

xxiii. Microprocessor based Power line Disturbance Recorder.

xxiv. Fibre Optics based current transformer for EHV lines using Faraday's principle.

xxv. Study of effects of Electrical Fast Transients (EFT) Electromagnetic and magnetic field on Static Energy Meters and other Electronic gadgets.

xxvi. Study of effects harmonics on Energy Meters.

xxvii. Establishment of Bi-directional Communication channel between a Sub Station and HT Consumer using 11 kV feeder.

xxviii. Custom Power device – Joint Project with CDAC and IISc. The project has been completed with installation and testing of 500 kVA STATCOM & M/s. P.K. Steels, Calicut and installation UPFC at Trivandrum.

xxix. Active Power Line conditioner.

xxx. Development of 5 kVA UPS.

xxxi. Development of Controller for Integrated Wind Power Energy System – Sponsored by MNES.

xxxii. Development of Controller for Integrated Wind Power Energy System using sterling engine and Diesel wind.

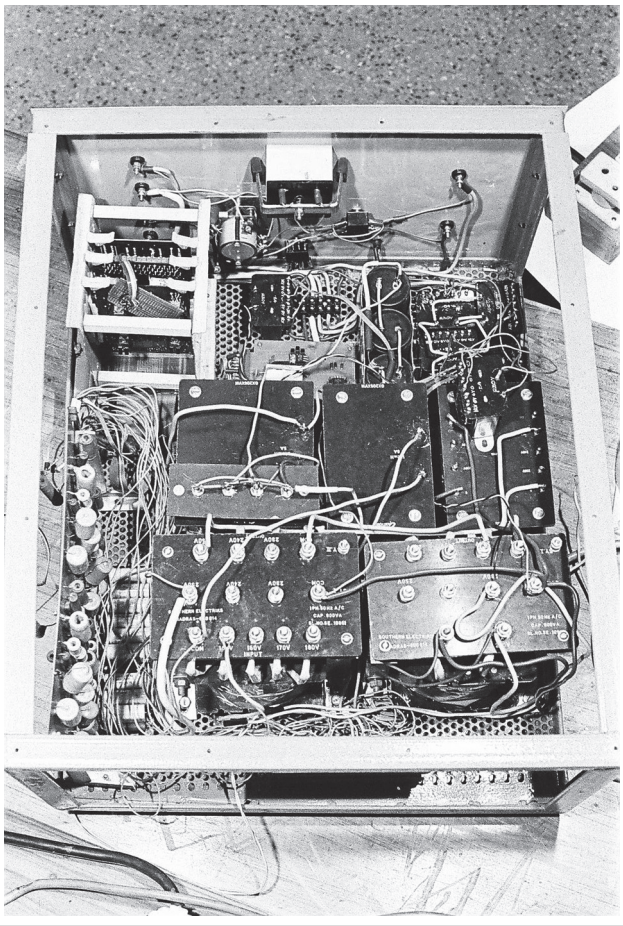
xxxiii. Development of Earth Leakage protective device for Underground Coal Mines.

xxxiv. DC-DC Converter employing Pulse Width Modulation (PWM) Technique – Sponsored by M/s. Universal Instruments.

xxxv. Development of 1 kVA standalone type Photo Voltaic System.

xxxvi. A novel Slip speed control of Induction Motor driven from a voltage fed Inverter.

xxxvii. Development of Solid state Trigatron for High Voltage Lab.



TOP VIEW OF PROTOTYPE MODEL DEVELOPED IN INSTRUMENTATION DIVISION

3.1 R&D Initiatives In Energy Metering

- In the area of Distribution, **Energy metering** has been identified as an important theme and CPRI has been earmarked as the Lead organization for this area of activity.

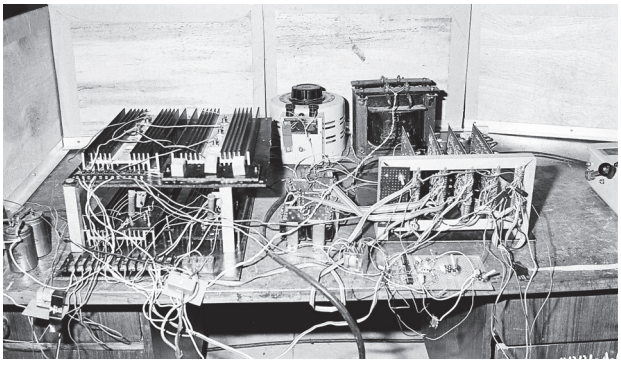
CPRI has initiated two project proposals

- Influence of load pattern on health and performance of static energy meters – Field studies and laboratory simulation for improvement of reliability
- Advanced metering technologies – Development of a total prepayment metering system – pilot project

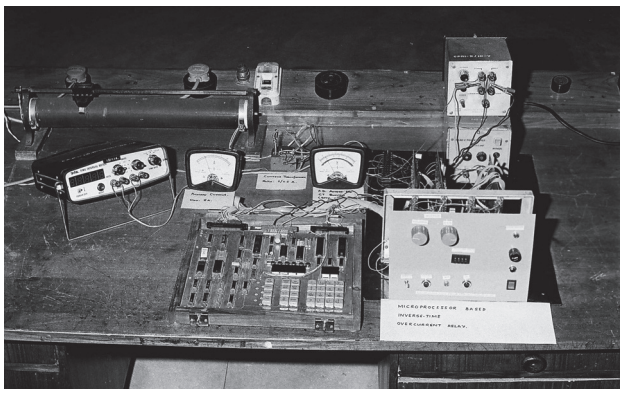
4.0 FIELD INSTALLATION ANDSMONITORING

Instrumentation Division has design, developed and fabricated "Earth fault indicator for floating DC control cables". After successfully tested at laboratory, the earth fault indicator was successfully installed & commissioned at Nasik Super Thermal Power Station, Nasik, Tata Power Company, Mumbai And Vijayawada Super Thermal Power Station, Vijayawada. Subsequently the technology was given to private entrepreneur for commercialization.

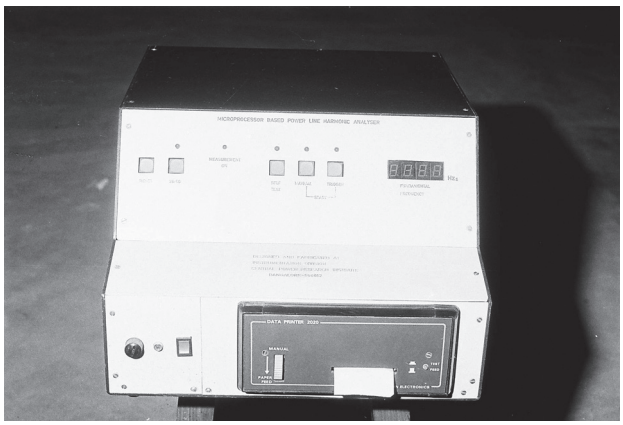
Instrumentation Division has developed Microprocessor based SIM card operated Single Phase Prepaid Energy Meter an alternative to conventional kWh/Static tariff Energy Meter.



PROTOTYPE MODEL OF PROJECT TITLED 'A NOVEL SLIP CONTROL OF INDUCTION MOTOR'



PROTOTYPE MODEL DEVELOPED IN INSTRUMENTATION DIVISION



MICROPROCESSOR BASED 'THIRD HARMONIC CURRENT INJECTION TEST FACILITY FOR ENERGY METERS'

After verifying its performance in the laboratory, about 25 nos. of prepaid energy meters were fabricated and installed at one of the residential apartment identified by BESCOM for field monitoring. Instrumentation Division monitored the performance of prepaid energy meter with prevailing loads and Power supply over a period of 6 months. The field performance was found to be satisfactory.

Instrumentation Division also carried out Residual Life Analysis (RLA) studies of C&I for the following Thermal Power Stations:

- GNDTP, Patiala.
- Harduagang Thermal Power Station (HTPS), Kasimpur, Units 1 and 3 to 7.
- Bhusval Thermal Power Station (BTPS).
- TDTPS, Panipat Unit-1.

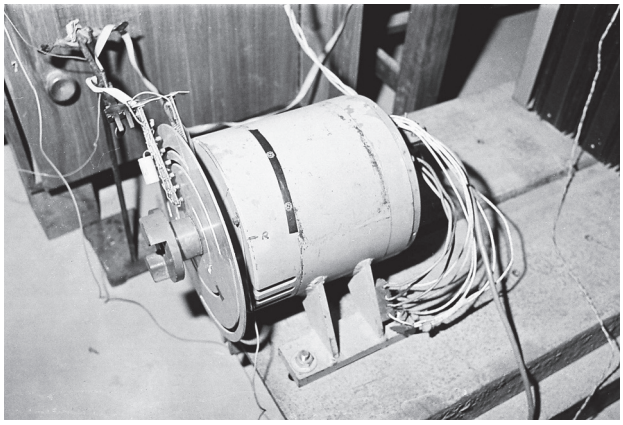
Further Instrumentation Division also provided Consultancy services as a Retainer Consultant for Koradi Thermal Plant. Consultancy also provided to Bhusval TPS, HTPS, Kashimpur and TDPTS, Panipat on protection relays.

SINGLE PHASE CARD OPERATED PRE-PAID METER

5.0 CONSULTANCY SERVICES

Instrumentation Division rendered consultancy services to various DISCOMs, Vigilance departments and Honorable Courts in the area of energy metering by analyzing the type of Power theft done unscrupulous Consumers and submitted detailed report.

Instrumentation provided solution to the problem referred by Bihar State Electricity Board (BSEB), Patna. BSEB requested CPRI to provide solution so that the Energy meter should register energy correctly under the influence of High Voltage / High frequency disturbance signals. A suitable circuit was designed, fabricated and implemented.



LAB LEVEL TESTING FOR 'A NOVEL SLIP CONTROL OF INDUCTION MOTOR'

Instrumentation Division is also rendered services to

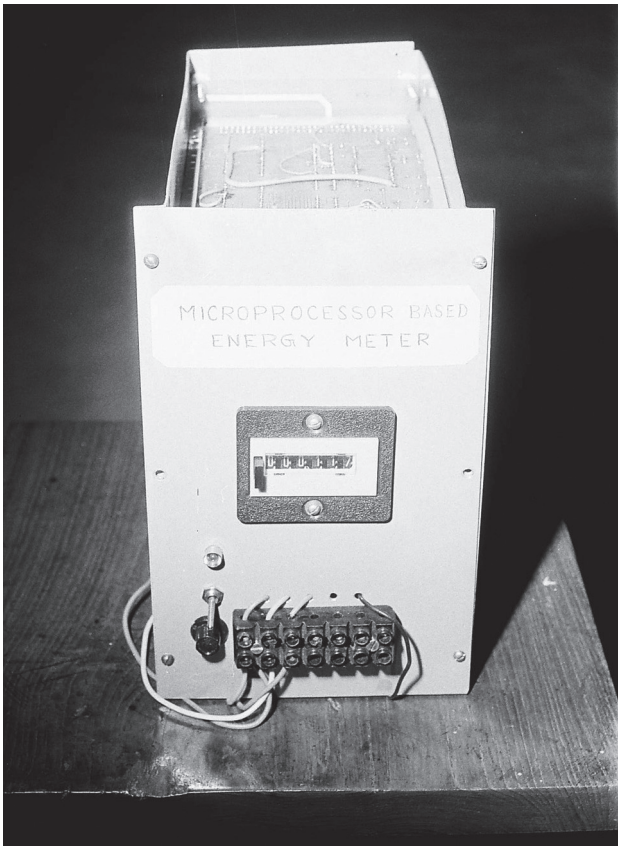
i) Canara Bank, MICR Centre, Bangalore regarding Power Supply problems for the Cheque sorting machine.

ii) Power Supply problems of the Port trust at Cochin Port Trust.

iii) Evaluation of "Total Metering Solution" – Work was taken up to promote the development of Total Metering Solution

MOBILE ENERGY METER TESTING LABORATORY

(TMS) in line with the technology development mission of Govt. of India for achieving 100% metering in Power Sector.



PROTOTYPE MODEL DEVELOPED IN INSTRUMENTATION DIVISION

6.0 THIRD PARTY INSPECTIONS (TPI)

Instrumentation Division contributed one more important area viz. Third Inspections. Third Party Inspection was carried out for ABT meters at Obra Thermal Power Station, Obra, Uttar Pradesh by measuring the accuracy (On-line) of ABT meters at site and issued Field report.

Instrumentation Division also contributed by testing the performance (on-line) of Energy Meters at Consumer premises on behalf of Power Utilities at New Delhi. More than 1000 m were tested.

Instrumentation Division also contributed in the area of Third Party Inspection by conducting Quality Inspection on randomly selected Energy Meters as per Standards and as well as DISCOMs Guaranteed Technical Particulars (GTP) at manufacturers premises on behalf DISCOMS. Instrumentation Division conducted TPI for the following Power Utilities:

a) Bangalore Electricity Supply Co. Ltd. (BESCOM), Bangalore.

b) Central Power Distribution Co. of AP Limited (APCPDCL), Hyderabad.

c) Eastern Power Distribution Co. AP Limited (APEPDCL), Visakhapatnam.

d) Dakshin Haryana Bijlee Vitaran Nigam Ltd. (DHBVNL), Hissar.

e) Uttara Haryana Bijlee Vitaran Nigam Ltd. (UHBVNL), Punchakula.

f) North Delhi Power Distribution Limited (NDPL).

g) BSES Rajdhani Power Distribution Ltd. (BRPL), New Delhi.

h) BSES Yamuna Power Distribution Limited (BYPL), New Delhi.

i) Power Distribution Department (PDD), J&K Govt., Jammu/Srinagar.

j) Tripura Power Corporation Ltd. (TPCL), Agarthala.

k) Assam Power Distribution Co. Ltd. (APCL), Gauwathi.

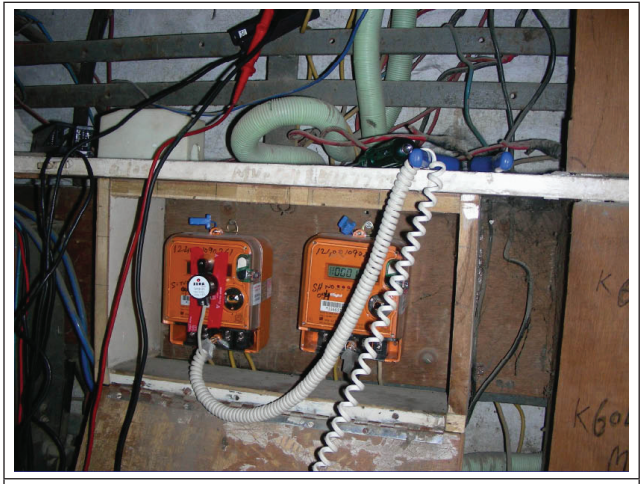
MOBILE ENERGY METER TESTING LABORATORY (INSIDE VIEW)

Instrumentation Division also carried out Third Party Inspection of C&R panels and Relays. Details are given below:

- C&R Panels at M/s. Easun Reyrolle, Hosur (Tamil Nadu) on behalf of Haryana Vidyut Prasaran Nigam Limited (HVPVNL).
- C&R Panels at M/s. Easun Reyrolle, Hosur (Tamil Nadu) on behalf of Jammu & Kashmir Electricity Board.
- Relays at M/s. Alstom, Chennai on behalf of Vishakapatnam Port Trust.
- Distance Protection Relay at M/s. ABB, Bangalore on behalf of Haryana Vidyut Prasaran Nigam Limited (HVPVNL).

7.0 MOBILE ENERGY METER TESTING LABORATORY

Public Grievances Cell (PG Cell), Govt. of NCT, New Delhi and Delhi Electricity Regulatory Commission (DERC), New Delhi have requested CPRI to establish a Mobile Laboratory for Energy Meter Testing Consumer premises at New Delhi on behalf them. During the year 2007, the Instrumentation Division established a Mobile testing Laboratory at New Delhi to cater the requirements of PG Cell and DERC. More 2500 m were tested at Consumer premises and issued field report at site. The mobile lab is still in service. The mobile Lab and test facility available are traceable to ISO/IEC:17025 Standard. Meter will be tested according to the IS:15707 Standard.



FIELD TESTING AT CONSUMER PREMISES

FIELD TESTING AT CONSUMER PREMISE

8.0 TESTING AND CERTIFICATION

The Instrumentation Division has facilities for testing and certification in the following areas:

a) Calibration Laboratory.

b) Energy Meter Testing Laboratory.

c) UPS Testing Laboratory.

d) Relay Testing Laboratory.

a) Calibration Laboratory

The Calibration Laboratory has facilities for calibrating electrical panel meters. Using FLUKE 5500 model, both Analogue and Digital panel meters viz. Voltmeter, Ammeter, Single Phase Power meter, Frequency meter, Multimeters etc.

FLUKE 5500 A MULTI PRODUCT CALIBRATOR

10-POSITION FULLY AUTOMATIC TEST BENCH FOR ENERGY METER TEST BENCH

6-POSITION FULLY AUTOMATIC TEST BENCH FOR ENERGY METER TESTING

During 2010, the Calibration was upgraded by adding one more thrust area i.e Calibration Power and Energy. With this, the Calibration Laboratory has capability to calibrate Reference Sub standard (RSS) meter up to accuracy class 0.05. The Laboratory is equipped with state of the technology. The three Phase Phantom Load Source is a programmable type, which deliver current continuously up to 100 A per phase and 120A per phase for short duration. The high precession reference standard meter being used is of class 0.02 accuracy which measure the energy recorded by the Meter Under Test (MUT) and compute the error in % internally and finally display it on the screen.

The Laboratory has calibrated precision reference meter of Class 0.05, 0.1 & 0.2 accuracy and many Accuchek make Single and Three Phase Calibrators submitted by Power Utilities.

The Calibration Laboratory and test equipments being used for calibration are traceable to ISO/ IEC:17025 Standard.

SET UP FOR CALIBRATING 0.05 CLASS PORTABLE REFERENCE METER

b) Energy Meter Testing Laboratory (EMTL)

The Energy Meter Testing laboratory was established during the year 1995 under MOP funds with an objective to cater the requirements

COMBINATION WAVEFORM GENERATOR

VOLTAGE DIPS AND INTERRUPTION

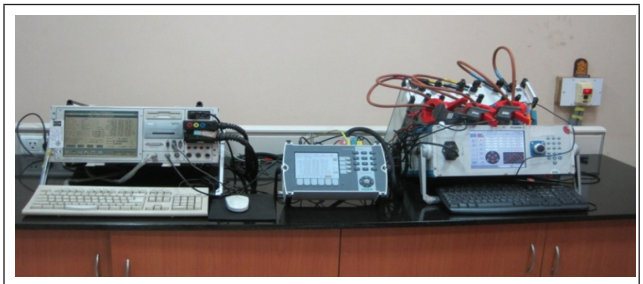
of Power Utilities as well as Energy Meter manufacturers. EMTL was equipped with State of the art technology. EMTL has facility to check the performance of Energy Meters (Electromechanical as well as Static) from Class 0.2 to Class 2.0 according to the National and International Standards. EMTL has also got facility conduct tests as per DISCOMS Technical specification as well as manufacturer specifications. EMTL also got facility to verify Guaranteed Technical Particulars (GTP) claimed

SHORT TIME OVERCURRENT SET UP

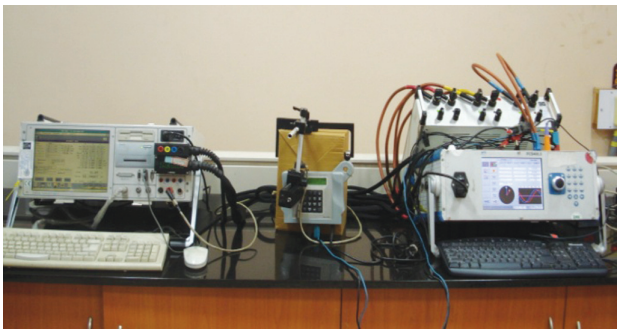
REFERENCE METER OF CLASS 0.1

GLOW WIRE TEST SETUP

by Energy Meter Manufacturers on behalf of Power Utilities.



SET UP FOR CALIBRATING 0.1 CLASS PORTABLE REFERENCE METER



SET UP FOR CALIBRATING SINGLE PHASE ACCUCHECK MAKE CALLIBRATOR

SET UP FOR CALIBRATING THREE PHASE ACCUCHECK MAKE CALLIBRATOR

During the year 1999, Instrumentation Division augmented EMTL Lab. by adding one more important test facility viz. EMI/EMC. At EMI/EMC Lab. the following test facilities are available for Energy Meters as per IS standard and CBI&P Technical report:

i) Immunity to hf field test (i.e. Susceptibility test).

ii) RI Measurement.

iii) Electro Static Discharge (ESD) test.

iv) Electric Fast Transient (EFT) test.

During the year 2003, the Instrumentation Division had replaced Semi Automatic Energy Meter test bench with fully automatic test bench. The 10 position fully automatic energy meter test bench is capable to check the performance of energy meters up to 10 nos. simultaneously which reduces total testing duration. The automatic test bench supply required source (Voltage and Current separately) to all 10 m, records error in%, display and store in a non-volatile memory simultaneously. The test bench also generates test report. One more additional feature viz. Harmonic Generation and measurement up to 50th Harmonic is also provided to check effects harmonic influence on Energy Meter.

EFT GENERATOR

Many Power Utilities and Energy Meter manufacturers in India are availing the services rendered by Instrumentation Division. Many Foreign Customers representing

United Kingdom (UK), Sultanate of Oman, South Africa, Bangladesh etc.

are availing the services by submitting energy meters for testing.

In order to meet demands from Power Utilities as well as Energy Meter manufacturers, the EMTL has augmented lab. by adding two more 6 position test bench and its associated test equipment.

GTEM CELL (80 MHz TO 1000 MHz AT 10 V/mtr.) FOR HF FIELD TEST

ELECTRO-STATIC DISCHARGE GENERATOR WITH DISCHARGE GUN

Both EMTL Lab and test equipments being used are traceable ISO/IEC:17025 standard.

C) UPS testing Laboratory

UPS testing Laboratory was established to cater the requirements of End user as well UPS manufacturers. Testing will be conducted according to the Technical Agreement had between Purchase and Seller since standard is not available at present. UPS Laboratory has got facility to test up to 10 kVA. More than 10 kVA, Instrumentation Division Engineers will witness the test being carried out by the manufacturer representative at manufacturer premises in presence of Purchaser.

d) Relay Testing Laboratory

Instrumentation Division had set up a Comprehensive test facility for Protective Relays. The Laboratory was equipped with automatic computer controlled test benches for carrying out accuracy and operating characteristics. Additional Software was made available for Dynamic Transient testing and import of fault data from EMTP simulation and Digital Fault Recorder is also possible. Electro-mechanical, Static and Numeric relays can be tested in this laboratory.

Both Relay Lab and test equipment being used are traceable ISO/IEC:17025 standard. All types of relays like Current/Voltage operated, Differential, Distance, Directional, Frequency and Power Frequency, etc. can be tested.

The Relay Testing Laboratory is shifted to Power System Division.

9.0 TRAINING IN ABROAD AND INDIA

In order to gain knowledge and also to have better interaction with other organizations, the following Officers were deputed abroad for training, Inspection of test equipment, as a faculty member, etc.:

i) Shri Madhusudan Kadloor, Joint Director is deputed to CESI, Italy for 2 months to undergo training on Data Acquisition System and Optical fibre during the year 1988.

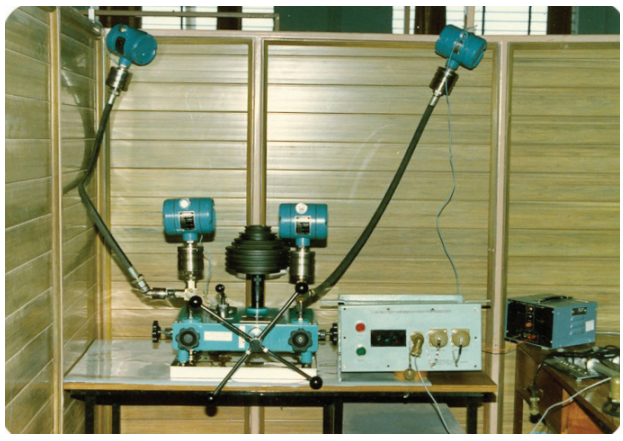
ii) Shri Madhusudan Kadloor, Joint Director deputed to M/s. EM Test Systems, USA for a period of 1 week for inspection of EMI/EMC test equipments as per Purchase Order.

DATA DOWNLOADING INTO PC FROM 'POWERED SUPPORT CHARACTERISTICS RECORDER'

iii) Shri Madhusudan Kadloor, Joint Director deputed to Malaysia as a Faculty member to train TNBE Engineers on Principle and testing of Energy Meter.

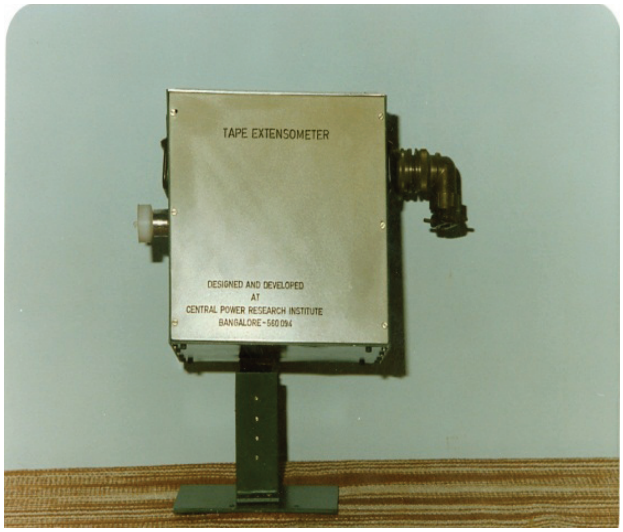
iv) Shri. A. R. Ravikumar, Joint Director was accompanied the delegation led by Shri. Arvind Jadhav, Joint Secretary, Ministry of Power to understand the implementation of Pre-paid metering technology in South Africa during July 2004.

v) Mrs. Sudha S, Engineering Officer was deputed to M/s. Metering Testing Equipment (MTE) AG, Germany for a period of one week to undergo training and inspection of fully automatic test bench against Purchase Order during June/July 2004.



LAB TESTING OF PRESSURE TRANSDUCER USED FOR 'POWERED SUPPORT CHARACTERISTICS RECORDER'

vi) Mrs. Geetha P, Engineering Officer was deputed to M/s. Metering Testing Equipment (MTE) AG, Germany for a period of one week to undergo training and inspection of fully automatic test bench against Purchase Order during June/July 2004.



TAPE EXTENSIOMETER USED IN 'POWERED SUPPORT CHARACTERISTICS RECORDER' FOR DISPLACEMENT MEASUREMENT

BATTERY CHARGER USED IN 'POWERED SUPPORT CHARACTERISTICS RECORDER' FOR CHARGING INTRINSICAL SAFE RECHARGEABLE BATTERIES

10.0 SEMINAR, WORKSHOP AND TRAINING PROGRAMME

Instrumentation Division conducted Seminar. Workshop and Training programmes

INSTALLATION AND COMMISSIONING OF PROJECT 'POWERED SUPPORT CHARACTERISTICS RECORDER' IN UNDERGROUND COAL MINE NEAR DHANBAD (BIHAR STATE)

periodically to Power Utilities, Manufacturers, Consultants, Academicians, etc. to aware latest technology. Following are the list Seminar / Workshop / Training programmes conducted by Instrumentation division:

a) Two days training programme on "Energy meter testing" during Feb. 2004.

b) Five days Residential training programme on Test facility for Energy Meter testing at CPRI for Engineers representing Bhutan Electricity Company, Bhutan during 2005.

c) Training programme on "Energy Meter and Protective Relays" during 2005.

d) Five days Residential training programme on Test facility for Energy Meter testing at CPRI for Engineers representing Bhutan Electricity Company, Bhutan during 2006.

e) Training programme on "Energy Meter testing" for Engineers representing Punjab State Electricity Board (PSEB), Chandigarh during 2007.

f) Training programme on "Energy Meter and Protective Relays" for Engineers representing Rajasthan Rajya Vidyut Prasaran Nigam Ltd. (RRVNL), Jaipur during 2008.

g) Two days Workshop on "Energy meter testing and its challenges" during March 2010.

h) One day Workshop on "Metering Standard – National and International Standards" during March 2011.

11.0 PLANNING FOR THE FUTURE

11.1 Research and Development

One of the trust areas of Research and Development is the development low cost Energy Meter. The objective is to develop low cost meter by proving all features including tamper detection, Logging and retrieval data stored in the meter.

11.2 Test Facilities

Instrumentation Division is planning to augment the Energy Meter Testing Laboratory to cater the requirements of Power Utilities and Manufacturers. It is proposed to add latest testing equipments to conduct meter testing as per National and International Standards.

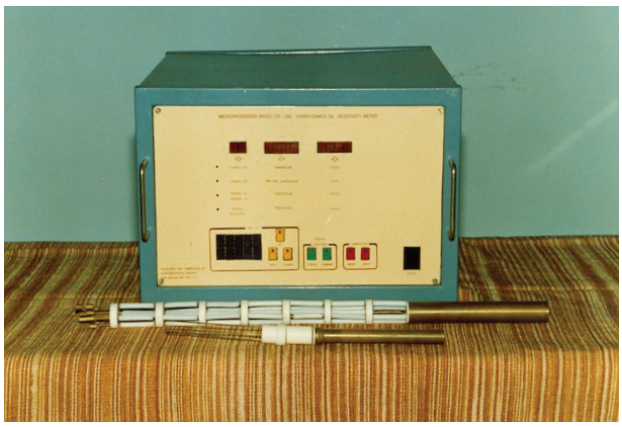
Instrumentation Division is also planning to establish the following new testing laboratories:

- Pre-paid Energy Meter Testing according to the IS Standard.
- Testing and analysis of Harmonic Influence on Electrical gadgets.
- UPS testing laboratory up to 100 kVA.

INDICATOR FOR FLOATING DC CONTROL CABLES

12.0 PUBLICATIONS

1) "A Comprehensive test facility for Energy meter testing at CPRI", by Madhusudan Kadloor – Published in IEEMA Journal, 2005.



MICROPROCESSOR BASED ONLINE OIL RESISTIVITY METER

2) "Vector Controlled Induction Motor Drive using Tutsim" by A. R. Ravi Kumar – Published in IEEMA Journal, 1995.

13.0 INVITEE TALKS

a) K.B. Manjunath and Madhusudan Kadloor were invited to deliver lecture on "Test facility for Energy Meter testing at CPRI" – Organized by Mangalore Electricity Supply Company (MESCOM). August 2004.

b) A.R. Ravi Kumar was invited to speak on pre-paid metering at Third Annual Conference on "IT in Power: The next steps" – Organized by Power line, New Delhi. Sep. 2004.

c) Mrs. Sudha S was invited to deliver lecture on "Test set up and testing of Energy Meters" – Power System Training Institute (PSTI), Bangalore.

e) Madhusudan Kadloor was invited to deliver lecture on "Development Winding Fault Detection System for Transformers and On-line Transformer Oil Resistivity meter" – Engineering Staff College of India, Hyderabad.

f) Madhusudan Kadloor was invited to deliver lecture on "Comprehensive test facility for energy meter testing" - Engineering Staff College of India, Hyderabad.

g) Madhusudan Kadloor was invited deliver lecture on "Powered Support Characteristics Recorder for Underground Coal Mines" – Central Mine Research Institute (CMRI), Dhanbad.

h) Madhusudan Kadloor was invited to deliver lecture on "Comprehensive test facility for energy meter testing" - Power System Training Institute (PSTI), Bangalore.

i) Madhusudan Kadloor was invited to deliver lecture on "Comparison of Standards for Energy Meter Testing" - Power System Training Institute (PSTI), Bangalore.

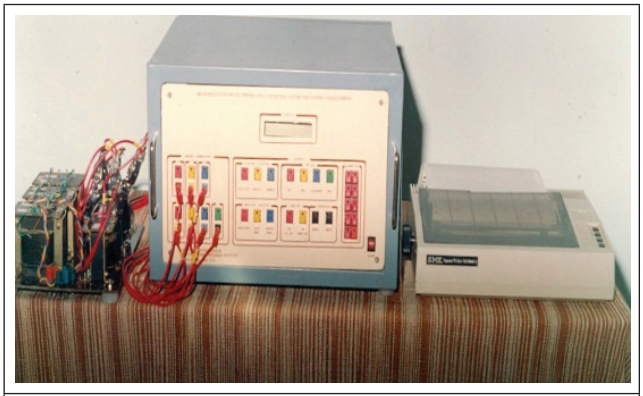
j) Madhusudan Kadloor was invited to deliver lecture on "Single Phase Pre-paid Static Energy Meter" - Power System Training Institute (PSTI), Bangalore.

k) Madhusudan Kadloor was invited to deliver lecture on "Energy Meter Testing as per National and International Standards" – PR&DI, Bangalore.

l) Madhusudan Kadloor was invited to deliver lecture on "Tamper prevention measures in Energy Meter" – Power Grid Corporation, Bangalore.

m) Madhusudan Kadloor was invited to deliver lecture on "Power theft and its analysis to reduce commercial losses" – Power Grid Corporation, Bangalore.

n) Madhusudan Kadloor was invited to deliver lecture on "Single Phase Pre-paid Static Energy Meter" - Power Grid Corporation, Bangalore.



MICROPROCESSOR BASED ONLINE WINDING FAULT DETECTION SYSTEM FOR TRANSFORMERS

o) Madhusudan Kadloor was invited to deliver lecture on "Fundamental and application on EMI/EMC" – UHVRL, CPRI, Hyderabad.

p) Madhusudan Kadloor was invited to deliver lecture on "Energy Meter Testing facility at CPRI" at National Seminar on "Power India by 2020" being organized by The Institution of Engineers (India) West Bengal State Centre and CPRI, Bangalore.

SINGLE PHASE PREPAID ENERGY METER

14.0 CONCLUSION

Instrumentation Division which was a part of Insulation Division has subsequently become an independent division during the year 1976. The division involved mainly on Research and Development and developed and gave suggestion. Some of the projects developed are patented and technology transferred. Few projects were successfully installed and commissioned at site.

During the year 1994, Instrumentation Division entered into new area i.e Testing and Certification for commercial products. The Division established Calibration Lab, Energy Meter Testing Lab. and Relay Testing Lab. and conducted commercial testing/Calibration and issued Test Reports / Calibration Certificates.

In order to cater the requirements of Power Utilities in New Delhi, Delhi Electricity Regulatory Commission (DERC) and Public Grievances Cell (PG Cell), Govt. of NCT, New Delhi, Instrumentation Division established Mobile Energy Testing Laboratory which has facility to conduct on-line testing of Energy Meter at Consumer premises in presence of Power Utility representative from DERC or PG Cell as the case may be. Testing will be done according to the IS:15707, 2006 Standard and issue field report to Consumer at site.

The testing activities in the division have gone up and quantum of sample testing is also increased. In order to cater the requirements, the division is planning to add latest testing instruments by which testing duration may significantly get reduced.

Instrumentation division is also planning to undertake R&D projects and to establish new testing laboratories.

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