

**SPECIFICATION FOR COMMON METER READING
INSTRUMENT (CMRI)
Specification No. C.E.(Distribution)/MM-IV/001 Dt.02-06-2006**

1. SCOPE & OBJECTIVE

- 1.1 This specification is in supplement to the CBIP Technical Report No:88 (Revised July 1996) Specification for ac Static Electrical Energy Meters – First revision.
- 1.2 This specification outlines the basic requirements of common meter reading instrument as a two way communicating interface between various makes of static electrical energy meters and a base computer station for the purpose of exchange of data.
- 1.3 This specification presents hardware and software requirements for common meter reading instruments in separate sections together with various input and output peripherals like bar-code readers and printers.
- 1.4 This specification applies to local electronic reading of static meters where a meter reading instrument is connected one to one, to ac static electrical energy meter only through physical access to such a meter.
- 1.5 This specification also applies to use of the common meter reading instrument for manually entering readings from electromechanical/ electronic registers of Ferraris / static electrical energy meters without communications facility for the purpose of subsequent transfer to a base computer and / or a printer.
- 1.6 The objective of this specification is to outline a single instrument suitable to be carried in hand from one meter installation to the next in-order to download / upload data from / to meters manufactured by different meter manufacturers with adequate data security and facility of fraud prevention but without interfering the performance of any particular manufacturer's system.
- 1.7 Considering the fact that several systems are in practical use already, particular care has been taken to maintain compatibility with the existing systems and/or system components and their relevant protocols. Since standardization is not existing at present in respect of optical interface, reference has been made in Appendix-C regarding the various interfaces now being in use.

2. REFERENCES: The required relevant provisions from the following standards have been used in the specifications:

- (1) CBIP Report No. 88 (July 96) specification for ac static Electrical Energy Meters first revision
- (2) IS 13010/1990 Specification for ac Watt-hour meters class 0.5, 1 and 2.
- (3) IS 13779/1999 Specification for ac static Watt-hour meters class 1 and 2.
- (4) IEC 687 / 1992 Alternating Current Static Watt-hour meters for active energy Class 0.5 S and 0.2 S.
- (5) IEC 1036 / 1996 Alternating Current Static Watt-hour meters for active energy (Class 1 and 2)

- (6) IEC 529 Degree of protection provided by enclosures.
- (7) IS 12063 / 1987 Classification of degrees of protection provided by enclosures of electrical equipment.
- (8) IS 9000 / 1979 Basic environmental testing procedures for electronic and electrical items.
- (9) IEC 1000 Electromagnetic compatibility.
- (10) IEC 1000-4-2/1995 electrostatic discharge immunity test.
- (11) CISPAR 22: Limits and method of measurement of radio disturbance characteristics of information technology equipment.
- (12) IEC 1000-4-3/1995 Radiated, radio frequency electromagnetic field immunity test.

3. DEFINITIONS

AC Static Electrical Energy Meter Base Computer Station (BCS)	Meter in which current and voltage act on solid state (electronic) elements to produce output proportional to Wh, VArh, Vah., The computer system located at user station for the purpose of receiving data via the meter reading instrument from ac static electrical energy meters and also for sending instructions to the meters via meter reading instrument.
Common Meter Reading Instrument (CMRI)	It is a meter reading instrument with necessary accessories which is capable of interrogating with various makes of ac static electrical energy meters when loaded with the corresponding meter specific software(s) called meter reading instrument program(s).
Meter Reading Instrument (MRI)	Hand held portable equipment for transferring data to or from ac static electrical energy meters from or to the base computer station or an external peripheral.
MRI resident software	The software program (s) by virtue of which the MRI is enabled to collect tariff / metering data from ac static electrical energy meters of a particular make and down loads it to the corresponding meter specific billing / analysis software program (s) which is /are loaded into a base computer station.
Protocol	A set of rules governing the transmission of data between two devices.
Third Party Software	These are software packages that are expected to co-exist in the CMRI for special applications such as Manual meter reading, data entry, display of balance Memory, printing etc.,

4. REQUIREMENTS

4.1 Physical Characteristics

- 4.1.1 **Size** CMRI shall be handy and small in size for ease of portability. The maximum dimensions shall not exceed 250 x 100 x 60 mm (L x W x H). However the display portion could be wider.
- Weight** Weight of CMRI including batteries shall not exceed 1 kg.

- 4.1.2 Enclosure:** The casing shall be of electrical insulating material of high thermal stability and mechanical strength.
- 4.1.2.1 Its degree of protection shall be IP 67, depending on requirements as per IEC 529 / IS 12063.
- 4.1.2.2 For details of this level of protection against penetration of dust and water reference may be made to clause 5.2.1. of this document.
- 4.1.2.3 The CMRI enclosure shall be solvent resistant.
- 4.1.2.4 The CMRI shall be provided with a suitable holding strap for proper gripping.
- 4.1.3 Ruggedness**
- 4.1.3.1 CMRI shall be able to withstand harsh field environment without physical damage or loss of data. The tests for their requirement are given in the testing procedures as detailed in clause 5.0 of this specification.
- 4.1.4 Display:** The Display of CMRI shall have the following characteristics:
- (a) Easy readability in varying ambient light conditions.
 - (b) Alpha Numeric display of 4 –lines and 16-characters per line on the screen.
 - (c) The size of the upper case alpha character shall be minimum 4 mm.
 - (d) The contrast and intensity control to get a clear display in varying ambient light.
- 4.1.5 Key Board:** The key board of the CMRI shall have the following attributes.
- (a) Any alphanumeric character shall be available with sequential operation of maximum 3 keys.
 - (b) Long operational life i.e. minimum 100,000 operations.
 - (c) Feedback for key press acknowledgment to user.
 - (d) Legible and non-fading keypad imprints.
- 4.1.6 Input/Output ports (I/O ports):** The CMRI shall have two serial input/output port (s).
- 4.1.6.1 Both ports shall be serial port, RS-232C compatible.
- 4.1.6.2 One port is to be used for data downloading from the meter and uploading the same to BCS, while the second port may be used for convenience of connecting peripherals such as bar - code reader, Printer, battery charger, loader charger etc.
- 4.1.7** The CMRI shall be able to provide power supply for optical sensor used for meter reading applications. Pin-9 of DB-9 connector should provide the requisite power supply for the optical probe.
- 4.1.8 Climatic requirements**
- 4.1.8.1 Temperature range

Specified operating range	-10 deg. C to 50 deg. C
Limit range for storage and transport	-25 deg. C to 70 deg. C

4.1.8.2 Relative humidity

Annual Mean	< 75%
For 30 days, these days being spread in a natural manner over one year	95.00%
Occasionally on the other days	85.00%

4.2 Physical Interface

4.2.1 Interface between Meter and CMRI

4.2.1.1 The interface between a meter and CMRI consists of 2 parts.

- a) Meter optical sensor terminating into a 9 pin D type male connector with a cable of 500 mm ± 10 mm length with electrical circuit. Also USB port have to be provided. A separate attachment for 9 pin to USB shall also be provided.
- b) This cable will be supplied by the meter manufacturer.
- c) CMRI cable should have matching 9 pin D type female connector of 1500 mm ±10 mm length with electrical circuit.
- d) This cable shall be supplied by the CMRI manufacturer.

4.2.2 Interface between CMRI and Base Computer Station

4.2.2.1 Suitable cable for communication between CMRI and base computer station shall be provided. This communication shall be serial RS 232 C. On the BCS end of the cable a 9 pin D type female connector shall be provided.

4.2.2.2 The cable shall be supplied by the CMRI manufacturer.

4.2.2.3 The cable specified in Clause 4.2.1 (b) can also be used for communication between CMRI and BCS

4.2.3 Both connecting cables described above in 4.2.1 & 4.2.2 shall be made of flexible material and shall be shielded.

The two ends of each type of cable shall be stress relieved.

Hardware & Software Requirements

4.3.1 Operating Systems

4.3.1.1 To facilitate use of various meter specific MRI programs in one CMRI. MS DOS version 6.0 or higher operating systems shall be used. The facility to upgrade the BIOS/OS by a CMRI supplier shall be available without exposing the hardware of the CMRI.

4.3.1.2 The additional programs necessary to transfer application programs with serial ports shall be provided by CMRI supplier.

4.3.2 Memory

- a) The CMRI shall have a memory capacity of 8 MB SRAM (Static RAM) with battery backup and upgradeable.
- b) BIOS/OS on FLASH/EEPROM Memory of 256 KB.

4.3.3 Communication

4.3.3.1 The CMRI shall be able to communicate in three different modes.

- a) Downloading/Uploading data from/to the meter
- b) Uploading/Downloading data to/from the base computer station.
- c) CMRI shall have flexible baud rate ranging from 300 Baud to 19,200 Baud and optionally to higher baud rates to cater communication needs stated above.

4.3.4 Real time clock

4.3.4.1 A real time Clock shall be provided in the common meter reading instrument and shall have the following features:

4.3.4.2 **Power requirement** The clock shall have a minimum of 15-days battery backup

4.3.4.3 **Calendar** The clock shall have a 20 year calendar

4.3.4.4 **Time drift** The time drift of the real time clock, considering all influencing quantities shall not exceed 20 seconds per day

4.3.5 Time Setting Facility and Security

4.3.5.1 The common meter reading instrument shall have the facility to get its time set from the base computer station. The date-time setting facility from the keyboard of CMRI should be inhibited, but the same should be possible only from BCS, with proper security.

4.3.5.2 The meter specific MRI programs shall have the ability to use CMRI real time clock to tag all time related events.

4.3.5.3 **Data Security:** The CMRI shall provide adequate security for data and software. In meeting this requirement, normal delete functions using 'DEL' command (as in normal IBM-PC) should be inhibited. No operator shall be able to delete any file created by meter reading software in CMRI or from Billing Computer.

4.3.6 Power Supply (Battery)

4.3.6.1 The common meter reading instrument shall have the following features for its power requirements:

- a) The common meter reading instrument shall be powered by rechargeable battery.
- b) In the event of failure of rechargeable battery, the user should be able to replace the batteries / battery pack, without opening the manufacturers' seal or compromising on Ingress Protection specifications like IP-65 / IP-67.
- c) The average capacity of a charged battery shall be sufficient to communicate with meters and base computer station for atleast
 - i) SIX HOURS while communicating through optical interface of meters and
 - ii) EIGHT HOURS without powering I/O ports for optical interface or printer etc.
- d) To reduce the equipment down time and inventories, there shall be provision to charge the CMRI battery without being removed from the equipment. A suitable battery charger for automatic charging of MRI battery shall be provided ex. Loader charger.
- e) There shall be a provision for AUTO POWER SAVE, which shall force the instrument in the power saving mode in-case of no-activity within 5 minutes.
- f) The battery used for data retention in SRAM shall have a minimum of three years backup capacity.
- g) The MRI shall have battery low indication and automatic cut off to avoid further drain of the battery. The battery status should be indicated in the form of Bar-Graph in the LCD display itself, clearly indicating the amount of charge available

4.4 Communication protocol & software

4.4.1 Protocol

4.4.1.1 The communication protocol is kept open considering the existing meter communication protocols in use.

4.4.1.2 The compatibility of the existing and the future protocols is important. The open approach shall ensure development of newer and more effective communication methods.

4.4.2 Software

- a) The CMRI supplier shall provide following software:
 - i. Embedded MS-DOS 6.0 or higher operating system
 - ii. Necessary software for loading application programs via A serial port for uploading and down loading between CMRI and base computer station.

- b) The following software shall be made available by each meter manufacturer, whose meters are to interface with the CMRI
 - i. Software to be resident in CMRI for the purpose of reading and programming the specific make(s) of static meters.
 - ii. BCS software for accepting data from CMRI, processing, generating reports and downloading instructions from BCS to CMRI

4.5 Data security

4.5.1 The meter manufacturers are responsible for maintaining the security of the data extracted from the meters up to down loading to BCS using Manufacturer's specific algorithms in the software.

5. TYPE TESTS

5.1 Test(s) of mechanical requirement:

5.1.1 Free fall test

5.1.1.1. The CMRI shall be subjected by the method specified in IS 9000 (part VII – Sec 4) 1979 to fall free as detailed below.

- a) Number of falls 2
- b) Height of fall 1000 mm
- c) Method of release To allow free fall from horizontal position of normal suspension, with a minimum disturbance at the moment of release with LCD display facing upwards.

5.1.1.2 After conclusion of the test there shall not be any physical damage and loss/change of data. The functionality of the CMRI shall not be affected.

5.1.2 Shock Test

5.1.2.1 The CMRI shall be subjected to shock test by method specified in section 1 of IS 9000 (Part 7 – Sec 1) – 1979 to shocks as described below.

- a) Peak acceleration 400 m/s x s (40.g)
- b) Pulse shape Half sine wave
- c) Pulse duration 18 ms
- d) Number of shocks Two in both directions of three mutual perpendicular axes (total of 12 shocks)

5.1.2.2 The test shall be conducted on a different test specimen for each direction of shock (also on a specimen different from one to be used for the vibration test)

5.1.2.3 After conclusion of the test there shall not be any physical damage and loss/change of data. The functionality of the CMRI shall not be affected.

5.1.3 Vibration test

5.1.3.1 The CMRI shall be subjected by the method specified in IS 9000 (part 8): 1981 to vibrations as detailed below.

- | | | |
|----|--|--|
| a) | Range and sweep frequency | 10-150-10 Hz |
| b) | Cut-off frequency | 16.7 Hz |
| c) | Amplitude (between 10 Hz and 16.7 Hz) | 4 mm peak to peak |
| d) | Acceleration (between 16.7 Hz to & 150 Hz) | 2.2 g (g = acceleration due to gravity) |
| e) | Sweep rate | One octave per minute |
| f) | Duration | 1 hour in each direction. |
| g) | Directions | Along three mutually perpendicular axis (in the directions of upper and lower, right and left, back and forth) |

5.1.3.2 The test shall be conducted on a different test specimen for each direction of vibration.

5.1.3.3 After conclusion of the test, there shall not be any physical damage and loss/change of data. The functionality of the CMRI shall not be affected.

5.2 Tests of Climatic influences

5.2.1 Tests of Protection against Penetration of Dust and Water

5.2.1.1 These shall be carried out according to IS:12063 under the following conditions:

- a) Protection against penetration of dust
CMRI in non-operating condition

The test should be conducted with sample lengths of cable (exposed ends sealed) of the types specified by the manufacturer in place. First characteristic digit 6 (IP 6X)

Any ingress of dust shall be only in a quantity not impairing the operation of the CMRI.

- b) Protection against penetration of water

CMRI	OFF
Second characteristic digit	7(IPX7)

Ingress of water in a harmful quantity shall not be possible when the enclosure is immersed in water under defined conditions of pressure and time.

5.2.1.2 After conclusion of the test, the CMRI shall show no damage or loss/change of the data. The functionality of the CMRI shall not be affected.

5.2.2 Dry Heat test

5.2.2.1 The test shall be carried out according to IS:9000(Part III – Section I and V of 77), under the following conditions:

CMRI	OFF
Temperature	+ 70 ⁰ C ± 2 ⁰ C
Duration of the test	72 hrs

5.2.2.2 After conclusion of the test, the CMRI shall show no damage or loss/change of the data. The functionality of the CMRI shall not be affected.

5.2.2 Cold Test

5.2.3.1 The test shall be carried out according to IS:9000 (Part II- Section III of 77), under the following conditions:

CMRI	OFF
Temperature	- 25 ⁰ C ± 3 ⁰ C
Duration of the test	72 hrs.

5.2.3.2 After conclusion of the test, the CMRI shall show no damage or loss/change of the data. The functionality of the CMRI shall not be affected.

5.2.4 Damp Heat Cyclic Test

5.2.4.1 The test shall be carried out according to IS: 9000 (Part V of 81), under the following conditions:

- CMRI powered up
- Variant 1
- Upper temperature: + 50 deg.C ±3 deg. C
- No special precautions to be taken regarding the removal of surface moisture.
- Duration of the test: 6 cycles

5.2.4.2 24 hours after the conclusion of the test there shall not be any physical damage and loss/change of data the functionality of CMRI shall not be affected.

5.3 Tests for Electromagnetic Compatibility (EMC)

5.3.1 The tests shall be carried out according to IEC: 1000-4-2 (1995), under the following conditions:

Test voltage	15 kV air discharge
Number of discharges	10
Severity level	4

After application of the electrostatic discharge the CMRI shall show no damage or change of data. The functionality of the CMRI shall not be affected.

5.3.2 Test of Immunity to Electromagnetic HF Fields

- 5.3.2.1 The test shall be carried out according to IEC: 1000-4-39/1995, under the following conditions:
- | | |
|---------------------|--------------------|
| CMRI | ON |
| Frequency band | 80 MHz to 1000 MHz |
| Test field strength | 10 V/m |
- After conclusion of the test, the CMRI shall show no damage or loss/change of the data. The functionality of the CMRI shall not be affected
- 5.3.3 **Radio Interference Measurement**
The test for radiated disturbance shall be carried out according to table 4, clause 6 of CISPR 22 for frequency range of 30 Mhz to 1000 MHz.
- 5.3.4 All the equipments offered, shall be fully type tested as per the relevant standards. In case the equipment of the type & design offered, has already been type tested within last 5 years from the date of opening of tender, the tenderer shall furnish the type test reports alongwith the offer. The purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative, at purchaser's cost.
- 5.3.5 The type test shall be carried out at approved laboratory by National Board of Accreditation of Laboratories(NABL) & the accreditation certificate shall be enclosed with the offer alongwith type tests reports.
- 6.0 **Guarantee:-** The Common Meter Reading instrument (CMRI) shall be guaranteed for the period of five years from the date of receipt at store The Common Meter reading Instruments found defective within the above guarantee period shall be replaced/ repaired by the supplier free of cost within one month of receipt of intimation. If the defective Common Meter Reading Instruments are not replaced/repaired within the specified period above, the M.S.E.D.C.L. shall recover an equivalent amount plus 15% supervision charges from any of the bills of the supplier.
- 7.0 **PACKING:-**
- 7.1 The CMRI shall be suitably packed in order to avoid damage or disturbance during transit or handling. Each CMRI may be suitably packed in the first instance to prevent ingress of moisture and dust and then placed in a cushioned carton of a suitable material to prevent damage due to shocks during transit. The lid of the carton may be suitably sealed. A suitable number of sealed cartons may be packed in a case of adequate strength with extra cushioning, if considered necessary. The cases may then be properly sealed against accidental opening in transit. The packed cases may be marked to indicate the fragile nature of the contents.
- 7.2 The following information shall be furnished with the consignment :
- Name of the consignee
 - Details of consignment
 - Destination
 - Total weight of consignment
 - Sign showing upper/lower side of the crate
 - Sign showing fragility of the material.
 - Handling and unpacking instructions.
 - Bill of Materials indicating contents of each package and spare materials.
- 8.0 **TRAINING OF ENGINEERS:-** The successful supplier/contractor shall train Engineers of the purchaser free of charge at their works for familiarization of design, application, operation and maintenance of the CMRI.

**GENERAL TECHNICAL PARTICULARS (GTP) OF
COMMON METER READING INSTRUMENT (CMRI)**

Sr. No	Parameters	TEXT
1	Name of Manufacturer/ Supplier	TEXT
2	If Manufacturer, in-house or licensed technology (YES/NO)	BOOLEAN
3	Is the Company ISO 9001:2000 qualified for this product (attach copy of certification) (YES/NO)	BOOLEAN
4	Conformity to Common Meter Reading Instrument (CMRI) detailed in CBIP TR No. 111 of May 1997.(YES/NO)	BOOLEAN
5	Size: (l x w x h) as 250*100*60 with tolerance of +/- 5%.	NUMERIC
6	Weight: Less than 1.0 kg including batteries (YES/NO)	BOOLEAN
7	Degree of protection – IP67 (YES/NO)	BOOLEAN
8	Strap for proper gripping.(YES/NO)	BOOLEAN
9	Ruggedness: Drop tested for 1 meter height(YES/NO)	BOOLEAN
10	Display: 4 lines and 16 characters or more(YES/NO)	BOOLEAN
11	Display: LED Backlit(YES/NO)	BOOLEAN
12	Key Board: minimum 100000 operations life (YES/NO)	BOOLEAN
13	Key Board: Feed back for key press acknowledgement to user.(YES/NO)	BOOLEAN
14	Key Board: Non-fading keypad imprints for all alphanumeric characters/ symbols.(YES/NO)	BOOLEAN
15	Key Board: Each English alphabet and numbers shall have a separate key. (YES/NO)	BOOLEAN
16	Input / Output ports: Min. two RS-232 Serial Ports(YES/NO)	BOOLEAN
17	Baud Rate	NUMERIC
18	Hardware: Processor used	TEXT
19	Memory: 8 MB SRAM with battery backup(YES/NO)	BOOLEAN
20	Real Time Clock: 20 year calendar (YES/NO)	BOOLEAN

Sr. No.	Parameters	TEXT
21	Operating System used	TEXT
22	Basic Communication Software Utilities provided (YES/NO)	BOOLEAN
23	Interface with standard bar-code scanner (YES/NO)	BOOLEAN
24	Security: Time Setting Facility only from BCS (YES/NO)	BOOLEAN
25	Data Security: Inhibition of DEL command from CMRI keyboard (YES/NO)	BOOLEAN
26	Power supply (Battery) (YES/NO)	BOOLEAN
27	Average capacity of charged battery – minimum 8 hours (YES/NO)	BOOLEAN
28	Auto Power Save mode in 5 minutes (YES/NO)	BOOLEAN
29	Replacement of Batteries / battery pack, without opening the manufacturers' seal. (YES/NO)	BOOLEAN
30	Capacity of battery used for SRAM backup	TEXT
31	Bar graph indication for battery status	TEXT
32	DOS Operating System loaded in CMRI, with license sticker. (YES/NO)	BOOLEAN
33	Communication software (YES/NO)	BOOLEAN
34	BCS software for generating ledger reports.(YES/NO)	BOOLEAN
35	Software to estimate the memory space available at any time.(YES/NO)	BOOLEAN
36	Compatible to execute .exe files working in PC (YES/NO)	BOOLEAN
37	Data Logging with Date and Time (YES/NO)	BOOLEAN
38	Free fall test (YES/NO)	BOOLEAN
39	Shock Test or Bump Test (YES/NO)	BOOLEAN
40	Vibration test(YES/NO)	BOOLEAN
41	Protection against penetration of dust and Water – IP-65 (YES/NO)	BOOLEAN
42	Dry Heat Test (YES/NO)	BOOLEAN
43	Cold Test (YES/NO)	BOOLEAN
44	Damp Heat Cyclic Test (YES/NO)	BOOLEAN
45	Test of Immunity to Electrostatic Discharges (YES/NO)	BOOLEAN
46	Test of Immunity to Electromagnetic HF Fields (YES/NO)	BOOLEAN
47	Radio Interference Measurement (YES/NO)	BOOLEAN