MAHARASHTRA STATE ELECTRICITY TRANSMISSION CO LTD
(CIN No.U40109MH2005SGCI53646)

From
Office of the Superintending Engineer
EHV O&M Circle, Pune
Administrative Building, 3rd floor, Block No.404, Rasta Peth, Pune-411 011
E-Mail: se6100@mahatransco.in

REF No. SE/EHV/O&M/CIRCLE/PUNE/TECH/ 1443 **DATE:- 27.06.2023**

E-ENQUIRY (Through MSETCL webpage)

To,
WHOM SO EVER IT MAY CONCERN

Subject:- Supply, Installation, Testing & Commissioning of Microprocessor based MFM at various EHV S/s under EHV O&M Circle, Pune.
…….. ***calling a budgetary offers thereof.***

Dear Sir,

The budgetary offers through mail are invited for the above work as per Schedule 'A' mentioned below:-

Schedule 'A'

Sr.No.	Particulars	UOM	Ex Rate	GST	Unit Rate
1	Supply of Microprocessor based MFM at various EHV S/s under EHV O&M Circle, Pune **as per specifications enclosed herewith.**	No			
2	Installation, Testing & Commissioning of Microprocessor based MFM at various EHV S/s under EHV O&M Circle, Pune	No			

You are requested to quote your lowest rate for the above work. The Terms & Conditions are as follows.

Terms & Conditions:-

1) The rate should be quoted on firm quotation basis.
2) The rates should be exclusive of all taxes. Taxes should be quoted extra.
3) You are requested to submit your best reasonable budgetary offer as per Schedule 'A' for above works on **Email ID: se6100@mahatransco.in upto 11:00 Hrs on dtd. 11.07.2023.**
4) Following documents should be submitted along with your offer:-
   a) Valid Electrical Contractor License.
   b) Work Experience Certificate for similar nature of works in MSETCL or in any Power Transmission Utility in India as mentioned in subject above.
5) **Please note that said budgetary offer is only for estimate purpose & not considered for any bidding & No work order will be issued based on this Enquiry.**

Thanking you,

Yours Faithfully,

Sd/-
(Pramod Bhosale)
Superintending Engineer
EHV O&M Circle, Pune

Technical Specification for Microprocessor Based Multifunction Energy Meters (MFM) - 0.2S ACCURACY CLASS

1.0. Scope:

1.1. This specification covers the design, manufacture, assembly, testing at manufactures works before dispatch and supply of HT (3 Phase 3 / 4 wire) & LT (3-Phase, 4-wire) panel mounted Microprocessor based Multifunction Energy Meter (MFM) of 0.2S accuracy class with RS 485 based Serial communication with MODBUS RTU protocol & Ethernet module over TCP/IP.

1.2. Multi-line digital panel meter for accurate and reliable measurement of electrical quantities (voltage, current, power, frequency, power factor etc.) in industrial and commercial applications. It shall be a large multi-line backlit LCD/TFT panel which enables four or five parameters to be displayed at the same time. RS485 port with Modbus communications or Ethernet capability allows easy integration with energy monitoring system. An expansion module can be fitted for enhanced functionality (pulse input/output, analogue output).

1.3. The meter shall have wide secondary current range support i.e. same meter shall be put up for 1A or 5A rating as per field availability of CT's. The meter shall support 120% Ibasic. Meter required to be commissioned at each substation shall be of 3 phase 4 wire or 3 phase 3 wire as applicable & shall be commissioned for both HT or LT CT.

2.0. Standards:

The equipment shall conform (for testing, performance, safety and accuracy etc.) in all respects the relevant Indian/ International metering standards with latest amendments thereof unless otherwise specified. The following standard should also be complied:

Sr. No.	Standard No.	Title
1.	IS 14697: 2021	AC static transformer operated, watt-hour and var-hour meters, Class 0.2S, 0.5S - Specification
2.	IEC 62053-22:2003	Electricity Metering Equipment (AC) - Particular requirements - Part 22: Static meters for Active Energy (Classes 0.2S & 0.5S)
3.	IEC 62052-11:2003	Electricity metering equipment (AC)–General requirements, tests and test conditions - Part 11: Metering equipment.
4.	IEC 62053-24	Electricity metering equipment- Particular requirements - Part 24: Static meters for fundamental component reactive energy (classes 0.5S, 1S, 1, 2 and 3)
5.	IEC 61557-12	Electrical safety in low voltage distribution systems up to 1000 V AC and 1500V DC - Equipment for testing, measuring or monitoring of protective measures - Part 12: Power metering and monitoring devices (PMD)
6.	IEC 61010-1	General safety requirements for electrical equipment
7.	IEC 61010-2-030	Safety requirements for testing and measuring circuits
8.	IEC 61850	Interoperable Protocol for SCADA interface for SAS
9.	IEC 62053-31	Pulse output devices for Electromechanical and electronic meters (two wires only)
10.	IEC62052-11	Vibration test, Spring Hammer test, Shock test, Resistance to heat and fire Test (Glow Wire Test), Terminal block, Terminal cover & Meter case
11.	IEC 60529	IP54 (for Wall type), IP 53 (front side with gasket)
12.	IEC 61326-1	EMI/EMC
13.	IEC 61000-4-8:2009	Power frequency magnetic field immunity test
14.	IEC 61000-4-11:2004	Voltage dips, short interruptions and voltage variations immunity
15.	IEC 61010	AC voltage test
16.	IEC 61000-4-5	Surge & impulse

3.0. Climatic Conditions:

The meters to be supplied against this specification shall be required to operate satisfactorily and continuously under the following tropical conditions of hot, humid, dusty, rust and fungus prone environment.

Temperature Range:

Specified Operating Temperature	:	-10°C to 55°C
Storage and transport Temperature	:	-25°C to 70°C

Relative Humidity:

Annual mean	:	< 75%
For 30 days, these day being spread in a natural manner over one year	:	< 95%
Occasionally on other days	:	< 85%
Max. Altitude above mean sea level	:	2000 m

4.0. Principal Parameters:

The meter shall be indoor type connected with the secondary side of outdoor current and voltage transformers and mounted in suitable panel/ cubicles.

Sr. No.	Item	Specification
1.	Type of Installation	Panel mount type, Indoor installation
2.	VT secondary	3 x 110/√3V Line to Neutral (3P4W) Line to Line (3P3W)
3.	CT secondary	Ib = 1A to 5 A, Imax =1.2 x Ib **Programmable at site**
4.	Auxiliary AC/ DC Supply	48-300 V DC /85-300V AC
5.	System frequency	50HZ ± 5%

The meter should be suitable for working with above supply variations without damage and without degradation of its metrological characteristics.

5.0. General Requirements:

1. Meter shall be designed & constructed in such way as to avoid introducing any danger in normal use & under normal conditions so as to ensure especially;

- Personnel safety against electrical shock
- Personnel safety against effects of excessive temperature

- Protection against spread of fire
- Protection against penetration of solid objects, dust & water
- Immunity / detection of fraud & pilferage

All parts which are subject to corrosion under normal working conditions shall be protected effectively. Any protective coating shall not be liable to damage by ordinary handling nor damage due to exposure to air under normal working condition.

2. It is not the intent to specify completely herein all the details of the design and construction of material. The material shall, however, conform in all respects to the best industry standards of engineering, design and workmanship and shall be capable of performing for continuous commercial operation in a manner acceptable to the purchaser. The offered equipment shall be complete in all respects including all components/accessories for effective and trouble-free operation according to the specifications. Such components shall be deemed to be within the scope of this specification irrespective of whether those are specifically brought out or not.

3. The terminals shall comply to safety standard as per IEC 61010-2-30.

4. Every meter shall be marked with the following information and marking shall be indelible.

- Manufacturer`s name
- Serial number and Year of manufacture
- Currents (e.g. 3-ph transformer-operated, In 5A, Imax 6A : - /5A)
- Meter class (e.g. Class 0.2, Class 0.5, Class 1)
- Sign of double square for insulating encased meters of protective class II

5. The meter terminals shall be properly marked to identify voltage, Current, Auxiliary and communication ports.

6.0. Technical Requirements:

1. Voltage circuit: The active & apparent power consumption in each voltage circuit of a meter at reference voltage, reference temperature & reference frequency shall not exceed 1.5W and 10VA.

2. Current circuit: The apparent power taken by each current circuit at basic/reference current, reference temperature & reference frequency shall not exceed 1.0VA.

3. Auxiliary supply Voltage: The power consumption for auxiliary power supply shall not exceed 10VA.

4. The meter shall normally operate with the power drawn through the auxiliary AC or DC supply or both. The meter design should enable the auxiliary supply to be switched automatically between the AC and DC voltage, depending upon their availability.

5. Accuracy: Class of accuracy of the meter shall be 0.2S for Active Energy & 0.5S for Reactive Energy measurement. The accuracy should not drift with time. The repeatability of error at 5% at Ib & UPF load shall not exceed 0.1 for class 0.2S & 0.25 for class 0.5S as measured by the dispersion method.

6. Starting Current: The meter should start registering the energy at 0.1% Ib and unity power factor. The meter shall be fully functional within 5sec. after the reference voltage is applied to the meter terminals. When the voltage is applied with no current flowing in the current circuit, the test output of the meter shall not produce more than one output pulse count.

7. Maximum Current: The rated maximum current shall be 120% of basic current (Ib) as per the meter configuration for 1A or 5A.

8. Power Factor Range: The meter shall be suitable for full power factor range from zero (lagging) through unity to zero (leading). The meter shall work as an active energy import and export meter along with reactive (lag and lead) meter. The energy measurement should be true four quadrant type.

9. Influence of supply Voltage: The specified operating voltage range & limit range of operation of meter shall be 0.8 to 1.1Vref. and 0.0 to 1.2 Vref. respectively. The voltage dips & short interruptions shall not produce a change in the register of more than critical change value and the test output shall not produce a signal equivalent to more than critical change value as specified in IS 14697:2021. When the voltage is

restored, the meter shall not have suffered degradation of its metrological characteristics.

10. Influence of short-time overcurrent: The short-time overcurrent shall not damage the meter. The meter shall perform correctly when back to its initial working condition & variation of error shall not exceed as specified in IS 14697:2021. The meter shall be able to carry for 0.5 second, a current equal to 20 times the maximum current with tolerance of + 0 to - 10 percent.

11. Influence of self heating: The variation of error due to self heating shall not exceed ±0.1 & ±0.2 of Imax for class 0.2S & 0.5S meter respectively.

12. Influence of heating: Under normal conditions of use, electrical circuits and insulation shall not reach a temperature which might adversely affect the operation of the meter. The temperature rise at any point of the external surface of the meter shall not exceed 20°C with the ambient temperature at 25°C to 45°C.

13. Insulation: The meter and its incorporated devices, if, shall be such that they retain adequate dielectric qualities under normal conditions of use, taking account of the atmospheric influences and direct voltages to which they are subjected under normal conditions of use. The meter shall withstand the impulse voltage test as specified per IEC61000-4-5 (EMC) - part-4.

14. Electromagnetic compatibility (EMC): The meter shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharge do not damage or substantially influence the meter. The test shall be carried out according to IS 14700 (Part-4/Sec:2). The meter shall also not generate, conducted or radiated noise which could interfere with other equipment. The test shall be carried out according to IS 6873 (Part-2/Sec:1) or IS 2071 (Part 1).

15. The meter will have a built in "Real Time Clock" with an accuracy of ± 2 minutes per year or better. Meter shall have a built-in clock, having an accuracy of <2 min/year or better. The clock shall be correctly set at the manufacturer's works.

16. The meters shall be suitable for being connected directly through its terminals to VT's having a rated secondary line- to- line voltage of 110 V, and to CTs having a

rated secondary current of 1A or 5A. Any further transformers/ transducers required for their functioning shall be in-built in the meters. Necessary isolation and/or suppression shall also be built-in, for protecting the meters from surges and voltage spikes that occur in the VT and CT circuits of extra high voltage switchyard.

17. The active energy measurement shall be carried out on 3 phase, 4 wire principle with an accuracy as per class 0.2S for active energy. The reactive energy measurement shall be carried out on 3 phase, 4 wire principle with an accuracy as per class 0.5S for reactive energy.

18. The meters shall compute delta/cumulative values of energies and store in the non-volatile memory at each successive integration period block. The period should be configurable from 5 to 30 minutes. The instant parameter values shall be configurable to store in non-volatile memory as well at each successive integration period block. It shall be configurable to select instant values to log for the instantaneous parameters.

19. Display: The meter shall have Graphical TFT/LCD with backlight or large four line seven segment seven digit display with green backlight or Colour TFT display for proper depicting of values in user friendly manner like values with unit, negative signs, quadrant info. etc. The meter should have a provision to display quality of supply for Voltage/Current/Power limit variation which can be configured for threshold limits through software.

20. Display sequences: The display shall be of Graphical LCD /TFT with backlight or large four line seven segment seven digit display with green backlight or Colour TFT type and soft push button/touch buttons. The configuration option shall be available in the meter with password protection. The display shall indicate direct values (i.e. without having to apply any multiplying factor) of measured/ computed parameters as per the meter commissioning.

21. Each meter shall have provision for below parameter groups in the meter:

- Instantaneous parameters
- Energy registers
- TOU (Time of Unit)/TOD (Time of Day) registers

- General historical registers
- Maximum demand registers

There will be a facility to configure the display parameters.

22. Active, reactive and Apparent energies shall also be made available by meter in separate energy registers as –

- Active forwarded energy
- Apparent forwarded energy
- Active Import Total (Q1+Q4)
- Active Export Total (Q2+Q3),
- Net Active total (Imp – Exp) or (Exp-Imp)
- Apparent while active import (Lag+lead)
- Apparent while active export (Lag+lead)
- Reactive import (Q1+Q2)
- Reactive Export (Q3+Q4)
- Reactive lag
- Reactive lead
- R-Phase Active Import
- Y-Phase Active Import
- B-Phase Active Import
- R-Phase Active Export
- Y-Phase Active Export
- B-Phase Active Export

23. The meter shall be capable of measuring & displaying the following electrical quantities within specified accuracy limits for polyphase balanced or unbalanced load:

- Active Energy, Reactive Energy, Apparent Energy, Maximum demand (kVA/ kW), Cumulative maximum demand (kVA/kW), Rising demand with elapsed time, count for number of MD reset, real time, date and segment check display.
- Instantaneous parameters such as phase wise voltage, currents, power factors, overall kVA, kW, kVAr, frequency and self diagnostic feature may also be displayed either in the meter.

24. Maximum Demand (MD) Registration: The meter shall continuously monitor and calculate the average demand of configured parameter during the integration period set and the maximum, out of these shall be stored along with date and time when it occurred in the meter memory. The maximum demand shall be computed on fixed or sliding block principle as per the configuration. The maximum registered value shall be made available in meter readings. The integration period shall be set as 15 minutes that shall be capable to change to other integration period (5/15/30 minutes).

25. Maximum Demand Reset: Following provisions shall be available for MD reset in meter –

- Auto billing at predefined date and time (12 configurable billing dates)
- Manual via common MD reset button

26. TOD (Time of day registers): The meter shall have TOD registers for below energies and MD values:

- Active forwarded energy
- Apparent forwarded energy
- Active Import Total (Q1+Q4)
- Active Export Total (Q2+Q3),
- Net Active total (Imp – Exp) or (Exp-Imp) (required with negative sign)
- Apparent while active import (Lag+lead)
- Apparent while active export (Lag+lead)
- Reactive import
- Reactive Export
- Reactive lag
- Reactive lead
- R-Phase Active Import
- Y-Phase Active Import
- B-Phase Active Import
- R-Phase Active Export
- Y-Phase Active Export
- B-Phase Active Export

Maximum eight time of day registers including universal (0-24 hrs) register can be defined. It shall be possible to program number of TOD registers and TOD timings.

27. Data loggers: Each meter shall have a non-volatile memory in which one individual loggers should be available to store the cumulative/consumption energy values and instantaneous parameter values for each successive configurable integration period block. The integration period shall be configurable for each logger. It can be configurable for 5, 15 or 30 minutes for instantaneous & energy values. The meter should be able to store 45 days or 60 days of logger values at 5 minutes or 15 minutes respectively.

The following parameters will be available for logging:

- All energy parameters
- Pulse count
- Phase voltage
- Line voltage
- Line current
- Power factor
- THD voltage
- THD current
- Frequency

28. Billing parameters: The predefined date and time for registering the billing parameters shall be 00.00 hours of the first day of each calendar (billing) month. Also, it will be possible to configure the billing dates for specific date of calendar month on specific year or every year. Each meter shall store the following parameters.

- Active forwarded energy
- Apparent forwarded energy
- Active Import Total (Q1+Q4)
- Active Export Total (Q2+Q3),
- Net Active total (Imp – Exp) or (Exp-Imp)
- Apparent while active import (Lag+lead)
- Apparent while active export (Lag+lead)
- Reactive import
- Reactive Export
- Reactive lag
- Reactive lead

- R-Phase Active Import
- Y-Phase Active Import
- B-Phase Active Import
- R-Phase Active Export
- Y-Phase Active Export
- B-Phase Active Export

29. Daily snapshot parameters: The meter shall store the snapshot (or value) of configured parameters at configured time for last 45 days.

30. Data Communication Capability: The meter shall have modular communication with following communication ports,

- RS485 port
- Modbus TCP/IP over Ethernet
- Pluse input/output module (Optional)
- IEC 61850 (Optional)

However RS485 & Modbus TCP/IP over Ethernet port should be communicated simultaneously with different software i.e. SCADA & Local Energy Management software.

31. The meter should be compatible for SCADA application over RS485, Ethernet or Pulse Input/Output or IEC61850.

32. Measurement of harmonic energy/phase current:

- The meter shall be capable of measuring total energy at reference frequency, fundamental energy at reference or harmonic energy may also be provided.
- For meters employing digital multifunction techniques, the capacity of measuring harmonic power/energy depends on sampling rate for digitizing voltage/current waveforms, which determines the order of harmonices for total power/energy measurements.
- The meter display should depict the total harmonic distortion (THD) of current, voltage and power quantities up to 63rd order.

33. The meter should display Daily, Weekly and Monthly energy consumption on display.

34. Tampered Events: The meter shall have feature to detect and log the occurrence and restoration of the following tampered events.

- Over voltage
- Under voltage
- Current reversal
- Current missing (phase wise)
- Current unbalance
- Missing voltage (phase wise)
- Voltage unbalance
- Feeder Supply Fail

Compartment wise event logging shall be available in the meter. The events (occurrence + restoration), in total, shall be stored in the meter memory on first in first out basis.

35. The meter shall have LEDs for measurement of Import/Export Active & Reactive Energy.

36. Meters should be type tested for following type test as per relevant Indian / International standards at **Third party NABL accredited lab** and the Type tests reports shall not be **older than Five years**.

Sr. No.	**Tests**				
	R: Routine test/A: Acceptance test/T: Type test		R	A	T
1.	Tests for accuracy requirements:	1.1) Test on limits of error	R	A	T
		1.2) Test of meter constant	-	A	T
		1.3) Test of starting condition	R	A	T
		1.4) Test on no-load condition	R	A	T
		1.5) Repeatability of error test	-	A	T
		1.6) Test of influence quantities	-	-	T

2.	Test of electrical requirements:	2.1) Test of power consumption	-	A	T
		2.2) Test of influence of supply voltage	-	-	T
		2.3) Test of influence of short time overcurrents	-	-	T
		2.4) Test of influence of self-heating	-	-	T
		2.5) Test of influence of heating	-	-	T
		2.6) Test of abnormal voltage condition	-	-	T
3.	Tests of electromagnetic compatibility (EMC):	3.1) Test of immunity to electrostatic discharge	-	-	T
		3.2) Fast transient burst test	-	-	T
		3.3) Test of immunity to electromagnetic HF fields	-	-	T
		3.4) Radio interference suppression	-	-	T
4.	Test of climatic influences	4.1) Dry heat test	-	-	T
		4.2) Cold test	-	-	T
		4.3) damp heat test	-	-	T
5.	Test of Mechanical requirements:	5.1) Vibration test	-	-	T
		5.2) Shock test	-	-	T
		5.3) Spring hammer test	-	-	T
		5.4) Tests of protection against penetration of dust and water	-	-	T
		5.5) Test of resistance to heat and fire	-	-	T

7.0. GURANTEED TECHNICAL PARTICULARS:

Sr. No.	Particulars	Desired by purchaser
1	Manufacturers name of country of manufacture.	Should be specified by supplier
2	Type/Model details of equipment.	Should be specified by supplier
3	Indian / International standards for the offered MFM shall be as per clause -2.0 of TS.	Yes required
4	Type of Mounting	Panel mount flush type, Indoor installation
5	Accuracy class: • Active energy measurement • Reactive energy measurement	 0.2S as per IS:14697 0.5S as per IS:14697

6	VT secondary	100 ...500V L-L (57.7 … 288V L-N) **(Programmable on site)**
7	VT Primary	11kV…765kV LL **(Programmable on site)**
8	Measuring Voltage range	Upto 120% of rated value
9	Impulse withstand capacity	6kV
10	CT secondary	Ib = 1A to 5 A **(Programmable on site)**
11	CT Primary	1. …….9999A **(Programmable on site)**
12	Measuring Current range	10mA to 6A
13	Minimum Starting current	0.1% Ib at UPF
14	Maximum current	1.2 x Ib
15	Current Overload withstand capacity	20 x Imax for 0.5sec at rated frequency (CAT-III)
16	Frequency in Hz	50Hz±5%
17	Sampling Frequency	6kHz per Phase or better
18	AC/DC Auxiliary supply	48-300 V DC or 85-300V AC
19	Power consumption per phase: • Voltage Circuit • Current Circuit • Auxiliary supply	• Voltage circuit < 1.5W & 10VA/phase, • Current circuit < 1.0VA/phase @1A Ibasic & @5A Ibasic, • Auxiliary supply: < 10.0VA with RS485 communication port
20	P.F. range	Zero (lagging) through unity to Zero (leading)
21	Operating temperature range for meter in Deg C.	-10°C to 55°C
22	Storage temperature range for meter in Deg C.	-25°C to 70°C
23	Non condensing operating humidity range for meter in %.	< 75% RH (Annual minimum)
24	Display type	Graphical TFT/LCD with backlight or large four line seven segment seven digit display with Green backlight or Colour TFT display.
	Display Parameter Digit Resolution	Upto six decimals
	No. of simultaneous display parameters	4 or 5
25	Device dimensions in mm (H x W)	96 x 96
26	Display units for Energy &Power	**Programmable on site** (Kilo/Mega/Giga for Energy & Power)
27	Calibration LED	**Programmable on site** for import/export Active & Reactive Energy.
28	Ingress Protection class	Front: IP 54, Rear: IP20

29	The quoted MFM model should be type tested as per IS:14697 from Third party NABL accredited lab & reports not be older than Five years.	Yes required
30	Warranty support required - MFM shall be warranted for 120 months from the date of supply.	Yes required
31	The meter shall have following dual communication capabilities: • RS485 port (MODBUS RTU) • TCP/IP Ethernet (Optional) • Pluse input/output module (Optional) • IEC 61850 (Optional) (Expansion capability via add-on pluggable Ethernet module)	Yes required
32	Load survey data for 45 days or 60 days at 5 or 15 minutes integration period shall be available.	Yes required
33	Maximum demand support with integration period of 5,15,30 minutes.	Yes required
34	Daily/Midnight energy snapshot (Values) for 45 days shall be available.	Yes required
35	MD Reset provisions • Auto • Manual	Yes required
36	Average THD measurement for voltage, current and power upto 63rd harmonic.	Yes required
37	Billing parameters shall be recorded in meter	Yes required

Superintending Engineer
EHV (O&M) Circle, Pune

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