



TEST REPORT

Rishabh Instruments Pvt. Ltd.
Trishala, Plot no.C-6, M.I.D.C.
Satpur, Nashik – 422007
Maharashtra (India)

TEST REPORT NO : RIPL/TST/PT1314/71

DATE OF ISSUE : 13/03/2014

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DISCRIPTION OF SAMPLE :

Product Name: Multi Function Energy meter.
Models: Rish EM 2340
Size: 96 x 96 mm.
Specifications: Nominal Input Voltage : 415V L-L
Nominal Current : 1A or 5A Programmable
Input Frequency : 50 / 60 Hz
Auxiliary supply Voltage: 60 to 300VAC/DC
Impulse Constant : 4000 Impulse / KWh
Accuracy : Class 1 (Active Energy)
Class 2 (Reactive Energy)
0.5% (Voltage,current and power)

No. of Sample: 2 nos.

Firmware version : 1.74

Checksum : 0xc48b

PCB Item code-revision : 1. CPU: 20100464-D. 2. Current : 20100465-C 3. Modbus : 20100468-C

Sample received on : 20.11.2013

INSTRUMENTS USED :

Sr. No.	Instrument	Make / Model	Sr. No.
1	Digital Multimeter	Gossen metrawatt: Metra Hit 28S	M49228082
2	Temperature- humidity chamber	ESPEC: 2L-KPH	14010625
3	HV Tester	Laxtronics: HV-10	1109104
4	Three phase source	Zera VCS 320	02-1096-06
5	Reference Multimeter	Zera RMM 3001	02-090-2-Z
6	High Voltage DC Power supply	Aplab : H0615 S	0452415
7	Three phase power calibrator and tester	Calmet : C300	22033
8	Vibration Test System	Saraswati Dynamics – SEV010	---

COMPLIANCE SPECIFICATION:

1. IEC 62053 – 21 : 2003 Static meters for Active Energy class 1.
2. IEC 62053 – 23 : 2003 Static meters for Reactive Energy class 2.
3. IEC 60688: Terms, Definitions and test methods.
4. Product data sheet. Version: D (9/ 3/ 14)

REMARKS: The Sample have passed the specifications tested to.

PREPARED BY : RDS / PBC

CHECKED BY : NVB

APPROVED BY : SDC



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➤ **PART A : Test As Per IEC 62053-21, 23**

Sr. No	Test	Test Condition	Test requirement	Observation	Remark
1	Test of Accuracy requirements: As per IEC62053 - 21, 23: 2003 Clause 8.1				
1.1	Limits of error due to variation of the current (cl no.8.1)	Measure the errors registered at different currents (balanced loads) and various values for Cos ϕ as given in table 6.	Error should be less than limits specified in table 6.	For test result refer table no.1.1 to 1.6	Conform
1.2	Poly phase meters carrying a single phase load. (cl no.8.1)	Measure the errors registered at different currents (single phase load) and various values for Cos ϕ as given in table 7	Error should be less than limits specified in table 7. Variation at balanced and single phase load at In and UPF shall not exceed 1.5% for active energy & 2.5% for reactive energy .	For test result Refer table no. 2.1 to 2.4	Conform
1.3	Initial Startup of the meters (cl.no.8.3.1)	The reference voltage is applied to meter terminal.	The meter shall be fully functional within 5 second.	fully functional within 5 seconds	Conform
1.4	Test of no load condition (cl no.8.3.2)	Voltage :115% of Vref with current circuit open. For active energy Minimum test period is 175 min. For reactive energy Minimum test period is 140 min	The test output of the meter shall not produce more than one output pulse.	No pulse was generated by the meter.	Conform
1.5	Test of starting condition (cl.no. 8.3.3)	Apply Vref with unity power factor. For Active Energy : input current =0.002In. For Reactive Energy input current =0.003In.	Meter should start & continue to register at specified value of current.	Meter start & continue to register at input current 2mA.	Conform
1.6	Test of Meter Constant (cl no. 8.4)	Relation between the test output and the indication in the display shall comply with the marking on the name plate.	Meter constant shall be as declared.	Found as declared. (4000imp/kWh)	Conform

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Sr. No	Test	Test Condition	Test requirement	Observation	Remark
2	Tests of Limits of Error Due To Influence Quantities: As per IEC62053-21 & 23 : 2003. Clause 8.2				
2.1	Influence of Ambient temperature variation	Mean temp.coefficient shall be determined for whole operating range. The operating range shall be divided in to 20K wide ranges. The mean temperature coefficient shall then be determined for these ranges by taking measurements 10K above and 10K below the middle of the range. (Operating range : -10°C to 55°C)	Mean temp.coefficient shall not exceed 1.Active Energy [a] 0.05%/°C for PF=1 & [b] 0.07%/°C for PF=0.5 IND. 2.Re-Active Energy [a] 0.10%/°C for PF=1 & [b] 0.15%/°C for PF=0.5 IND.	For test result Refer table 3.1 to 3.4	Conform
2.2	Influence of voltage variation (± 10%)	Apply input voltage ±10% of Vref with nominal current & [a].PF = 1 [b].PF = 0.5Ind	Variation shall not exceed: 1. Active Energy [a] 0.7% [b] 1.0% 2.Re-Active Energy [a] 1.0% [b] 1.5%	For test result Refer table 4.1 to 4.2	Conform
2.3	Influence of Reversed phase sequence.	Apply Vref. and PF=1, with Input current 0.1In.	Variation shall not exceed 1.5% .	For test result Refer table 5.1	Conform

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2.4	Influence of voltage Unbalance.	Polyphase meters with three measuring elements shall measure and register within the limits of variation in percentage error if following phases are interrupted. [A].3P4W network : one or two phases. [B].3P3W network one of the three phases.	Variation shall not exceed 2.0%.	For test result Refer table 6.1 to 6.2	Conform
2.5	Influence of harmonic components in the current and voltage circuit.	Test condition:-fundamental frequency current $I_1=0.5I_{max}$. Fundamental frequency voltage $U_1=U_n$. Fundamental PF=1. Content of 5 th harmonic current $I_5=40%$ of fundamental current. Content of 5 th harmonic voltage $U_5=10%$ of U_n . Harmonic PF=1.	Variation shall not exceed 0.8%.	For test result Refer table7.1	Conform
2.6	Influence of the odd harmonics in the a.c.current circuit	A phase fired wave form was generated as shown in fig A5. Measurements shall be taken with reference waveform & phase fired wave form .	Variation shall not exceed 3.0%.	For test result Refer table7.2.1	Conform
2.7	Influence of the sub harmonics in the a.c.current circuit	A burst fired wave form was generated as shown in fig A7. Measurements shall be taken with reference waveform & burst fired wave form .	Variation shall not exceed 3.0%.	For test result Refer table7.2.2	Conform

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2.8	Influence of Magnetic Induction of external origin 0.5mT	Magnetic field of external origin of 0.5mT produced by current of the same frequency as that of voltage applied to meter . The meter is placed in the center of a coil of 1m mean diameter, of square cross section and of radial thickness small compared with diameter and having 400At. In absence of the external magnetic field, record the value of display (R). At a constant value of measurand, apply the external field and record the value of display (X)	Variation shall not exceed Active Energy : 2.0% Re-Active Energy : 3.0%	For test result Refer table 8.1 to 8.2	Conform
2.9	Influence of frequency variation ($\pm 2\%$)	Apply input Frequency $\pm 2\%$ of reference frequency with nominal input voltage & current with [a].PF = 1 [b].PF = 0.5Ind	Variation shall not exceed: 1. Active Energy [a] 0.5% [b] 0.7% 2.Re-Active Energy [a] 2.5% [b] 2.5%	For test result Refer table 9.1 to 9.2	Conform

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3.0	Test of electrical requirement: As per IEC62053-21, 23 : 2003 Cl. 7.0				
3.1	Influence of self Heating (cl no : 7.3)	After Apply Ref Voltage for 2 hrs for active energy and 1hrs for re-active energy without any current in the current circuits, then apply the rated max current. The meter error shall be measured at unity PF, immediately after the current is applied, the test shall be carried out for at least 1hrs and in any event until the variation of error during 20minutes does not exceed 0.2%. Same test shall be carried out at PF = 0.5 Inductive.	Variation shall not exceed 1. Active Energy [a] 0.7% at UPF [b] 1.0% at 0.5 Inductive PF. 2. Re-Active Energy [a] 1.0% at UPF [b] 1.5% at 0.5 Inductive or 0.5 Capacitive PF.	For test result Refer table 10.1 For test result Refer table 10.2	Conform
4.0	Test for Mechanical Requirements: As per IEC 62052-11: 2003 Cl. 5.0				
4.1	Vibration Test (cl no.: 5.2.2.3)	The Test shall be carried out according to IEC 60068-2-6 under the following conditions; Meter in non-operating condition, without packing Frequency range 10 to 150Hz. Transition Frequency: 60 Hz. Acceleration: 1g Number of Sweep Cycles per axis: 10	After the test, the meter shall show no damage or change of the information & shall operate correctly in accordance with the standard.	For test result Refer table 11.	Conform

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➤ **PART B : Test As Per IEC 60688**

Sr. No	Test Description	Requirement	Observation	Remark
1	<p>Intrinsic Error test: (As per IEC 688:2012, cl no.4.2)</p> <p>a. Voltage b. Current c. Active, Apparent Power d. Reactive power e. Frequency f. Phase angle</p>	<p>Error should be within</p> <p>a. $\pm 0.5\%$ of U_n b. $\pm 0.5\%$ of I_n c. $\pm 0.5\%$ nominal value d. $\pm 1.0\%$ of nominal value. e. $\pm 0.2\%$ of mid. frequency f. $\pm 3^\circ$</p>	<p>For 3Ø4W see Table 1.1.1 to 1.1.26</p> <p>For 3Ø3W. See Table 1.2.1 to 1.2.13.</p> <p>For 1Ø. See Table 1.3.1 to 1.3.14.</p>	Conform
2	<p>Variation due to Aux supply Voltage (As per IEC 688:2012, cl no.6.2) As per data sheet Auxiliary supply: 60...300V AC/DC</p> <p>a. Apply the nominal value of aux. supply voltage and record the value of display (R). b. At constant value of measurand, reduce the value of Aux. voltage to lower limit and record the value of display (X). c. Then increase the aux supply voltage to upper limit and record the value of display (Y) d. Compute variation(X-R) and (Y-R)</p>	<p>Variation shall not exceed by 100% of class index.</p>	<p>For 3Ø4W see Table 2.1.1 to 2.2.9 AC Aux, 3.1.1 to 3.2.9 DC Aux.</p> <p>For 3Ø3W see Table 2.3.1 to 2.4.5 AC Aux, 3.3.1 to 3.4.7 DC Aux</p> <p>For 1Ø2W. See Table 2.5.1 to 2.6.3 AC Aux 3.5.1 to 3.6.7 DC Aux</p>	Conform
3	<p>Variation due to Aux supply frequency (As per IEC 688:2012, cl no.6.3)</p> <p>a. Apply the nominal value of aux. supply frequency and record the value of display(R). b. At constant value of measurand, reduce the value of Aux. frequency to lower limit and record the value of display (X). c. Then increase the aux supply frequency to upper limit and record the value of display(Y) d. Compute variation(X-R) and (Y-R)</p>	<p>Variation shall not exceed by 100% of class index.</p>	<p>For 3Ø4W see Table 4.1.1 to 4.2.5</p> <p>For 3Ø3W. See Table 4.3.1 to 4.4.5</p> <p>For 1Ø. See Table 4.5.1 to 4.6.5</p>	Conform

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4	Variation due to Ambient temperature (As per IEC 688:2012, cl no.6.4) As per data sheet : -10...55°C a. At Constant value of measurand and at reference temperature, record the value of display (R). b. Increase the ambient temperature to the upper limit (55°C) & allow sufficient time for conditions to stabilize. Record the value of display (X) c. Reduce the ambient temperature to the lower limit (-10°C) & allow the same stabilization to take place. Record the value of display (Y). d. Compute variation (X-R) & (Y-R).	Variation shall not exceed by 0.05% /°C	For 3Ø4W see Table 5.1.1 to 5.2.5 For 3Ø3W. See Table 5.3.1 to 5.4.5.	Conform
5	Variation due to frequency of input quantity(ies) (As per IEC 688:2012 cl 6.5) a. Apply the nominal value of the input frequency and record the value of display(R). b. At a constant value of measurand, reduce the frequency by 10% of F_N & record the value of display (X). c. Increase the frequency by 10% of F_N & record the value of display (Y). d. Compute variation (X-R) & (Y-R).	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 6.1.1 to 6.2.9 For 3Ø3W. See Table 6.3.1 to 6.4.5. For 1Ø. See Table 6.5.1 to 6.6.3.	Conform
6	Variation due to the input Voltage (As per IEC 688:2012 cl 6.6) a. Apply nominal value of the input voltage and record the value of display(R). b. At constant value of measurand, reduce the voltage to the lower limit (-20% of V_N) and record the value of display (X). c. Increase the voltage to the upper limit (+20% of V_N) & record the value of display (Y) d. Compute variations : X-R & Y-R	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 7.1 to 7.2 For 3Ø3W. See Table 7.3 to 7.4 For 1Ø. See Table 7.5 to 7.6.	Conform
7	Variation due to the input Current – For Phase angle and Power factor. (As per IEC 688:2012 cl 6.7) a. Apply nominal value of the input Current and record the value of display (R). b. At constant value of measurand, reduce the current to the lower limit (20% of I_N) & record the value of display (X). c. Increase the current to the upper limit (120% of I_N) & record the value of display(Y). d. Compute variations : X-R & Y-R	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 8.1 to 8.2 for P.A. 8.4 to 8.5 for PF For 3Ø3W. See Table 8.3 for P.A. 8.6 for PF.	Conform

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8	<p>Variation due to power factor (As per IEC 688:2012 cl. 6.8)</p> <p>a. Apply 50% of nominal value of the input Current & power factor of unity lag/lead respectively & record the value of display(R).</p> <p>b. At constant value of measurand, increase the input current to 100% nominal value and reduce the power factor to 0.5lag/lead respectively & record the two values of display (X).</p> <p>c. Compute variations (X-R) for both values.</p>	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 9.1 to 9.2 For 3Ø3W. See Table 9.3 to 9.4	Conform
9	<p>Variation due to distortion of the input quantities. (As per IEC 688:2012 cl. 6.10)</p> <p>a. Apply chosen value of the input quantity with no distortion and record the value of display (R)</p> <p>b. Introduce third harmonic distortion at level 20% maintaining the r.m.s. value constant and record the value of display (X). The phase relationship between the harmonic and fundamental should be varied so as to determine most unfavorable conditions.</p> <p>c. For apparent, active and reactive power transducers the test is performed with distorted current waveform and then repeated the distorted voltage waveform.</p> <p>d. Compute variations (X-R).</p>	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 10.1.1 to 10.1.5 For 3Ø3W. See Table 10.2.1 to 10.2.5	Conform
10	<p>Variation due to magnetic field of external origin (As per IEC 688:2012 cl. 6.11)</p> <p>a. The UUT is placed in the center of a coil of 1m mean diameter, of square cross section and of radial thickness small compared with diameter.</p> <p>b. 400ampere-turns in this coil will produce at the center of the coil, in absence of the UUT, a magnetic field strength of 0.4kA/m. the magnetic field shall be same kind and frequency as that energizes the measuring circuit.</p> <p>c. In absence of the external magnetic field, record the value of display (R).</p> <p>d. At a constant value of measurand, apply the external field and record the value of display (X).</p> <p>e. Compute variation (X-R)</p>	Variation shall not exceed by 100% of class index.	No significant variation in readings observed.	Conform

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Sr. No	Test Description	Requirement	Observation	Remark
11	Variation due to unbalanced currents (As per IEC 688:2012 cl. 6.12) a. Apply all of the input currents, Shall be balanced and adjusted so that the display value is approximately in the middle of the range. Record the value of display (R). b. Disconnect one current, maintaining the Voltages balanced and symmetrical. c. Adjust other currents, maintaining them equal so as to restore the initial value of the display. Record the value of display (X) e. Compute the Variation (X-R).	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 11.1 For 3Ø3W. See Table 11.2	Conform
12	Variation due to interaction between measuring elements (As per IEC 688:2012 cl. 6.13) a. Apply input Voltage of one measuring circuit alone at nominal input voltage. b. Apply the input Current each of the other measuring circuits with nominal input Current. Record the maximum value of display (X) corresponding from zero. Whilst the phase angle between Voltage and Current is changed through 360°. c. If the Auxiliary supply voltage is common to one of the input voltage, this circuit shall be energized with input voltage. d. Compute the variation of the display (X)	Variation shall not exceed by 100% of class index.	For test results see Table 12	Conform
13	Variation due to Self-heating (As per IEC 688:2012 cl 6.14) a. The UUT shall be at ambient temperature and shall have been disconnected at least 4h. b. Energize the UUT at reference conditions (except pre-conditioning time). c. After 1min. and before 3 rd minute, determine the value of display (R). d. Repeat this procedure between 30 th and 35 th minute after energization(X). e. Compute variation (X-R)	Variation shall not exceed by 100% of class index.	For 3Ø4W see Table 13.1 For 3Ø3W. See Table 13.2	Conform
14	Variation due to Continuous operation (As per IEC 688:2012 cl 6.15) a. Energize the UUT under reference conditions for pre-conditioning period. b. Record the value of display (R). c. After a convenient period of continuous operation (6hrs), note the value of display (X). d. Compute variation (X-R).	The UUT shall continue to comply in all respects with the requirements appropriate to its accuracy class.	For 3Ø4W see Table 14.1 to 14.5.	Conform

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15	<p>Permissible excessive inputs (As per IEC 688:2012 cl 6.18) Continuous excessive inputs (cl. 6.18.1)</p> <p>a. Voltage inputs including auxiliary supplies (Aux voltage max.315V), shall be subjected to 120% of the nominal value of the voltage for 24hrs.</p> <p>b. Current inputs shall be subjected to 120% of the nominal value of the current for 24 hrs.</p> <p>c. For power UUTs, voltage and current inputs as above are to be applied simultaneously.</p>	<p>After completion of each of the tests, and after having regained equilibrium with the reference value of the ambient temperature, the UUTs shall comply with the requirements appropriate to its class index.</p>	<p>For 3Ø4W see Table 15.1.1 to 15.1.5</p> <p>For 3Ø3W. See Table 15.2.1 to 15.2.5</p>	Conform
16	<p>High Voltage Test (As per Data sheet) Apply a High Voltage of 4kV AC for 1 min. between</p> <p>a. All the input, Aux Vs Relay+ Modbus + surface of UUT wrapped with metal foil.</p> <p>Apply a High Voltage of 2kV AC for 1 min. between</p> <p>a. All input terminals Vs Aux supply terminals. b. Input voltage Vs Input current c. Current Vs Current (each to each) d. RS485 Vs Relay output.</p>	<p>No flashover of clearances or breakdown of solid insulation shall occur during the test in any of the case.</p>	<p>No flashover and breakdown observed.</p>	Conform
17	<p>Influence of Vibration (IEC60688, cl. 6.23 : IEC60068-2-6) The test is to carried out with following parameters :</p> <p>a. Frequency Range : 10...155...10Hz, b. Amplitude : 0.15mm c. Sweep rate: 1octave/min. d. No. of cycles: 10 in each axis.</p>	<p>No mechanical damage shall be observed. UUT shall functional in all respect after the test.</p>	<p>After Vibration No mechanical damage observed and functions properly.</p>	Conform
18	<p>Test for temperature rise. (As per IEC 688:2012 cl 6.21) The UUT shall be energized as follows for at least 2hrs, during the test the UUT shall not be exposed to forced ventilation nor to direct solar radiation.</p> <p>a. Each current circuit shall carry a current equals to 1.1 times the nominal current. b. Each voltage circuit shall supplied with a voltage of 1.2 times the nominal voltage.</p>	<p>Temperature rise of following parts of UUT shall not exceed by:</p> <p>For Input circuits: 60K For exterior surface: 25K</p>	<p>For test results, See table 16</p>	Conform

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Tests as per Data sheet specifications				
19	THD Measurement. Take measurement by applying distorted wave form up to the 15 th harmonic at different level.	Error should be within specified accuracy limits.	For 3Ø4W see Table 17.1 For 3Ø3W. See Table 17.2	Conform
20	Measurement of burden in Voltage circuit : Current consumption at each phase is measured at nominal input Voltage. VA is calculated from the current and input voltage	Observed VA should be <0.3VA per phase	Sample 1, 2 & 3 Max. observed VA is 0.031VA per phase. See Table 18.1	Conform
21	Measurement of burden in Current circuit : Voltage drop across current terminals is measured at nominal current input and VA is calculated.	Observed VA should be <0.3VA per phase	Sample 1,2 & 3 Max. Observed VA is 0.171VA per phase. See Table 18.2	Conform
22	Measurement of Aux supply Burden Measure the current consumed the auxiliary supply at nominal voltage. Compute the VA consumption.	Aux consumption should be < 6.0VA	Observed max VA Sample1 =5.54VA Sample2 =5.36VA Sample3 =5.47VA See Table 19	Conform

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