TERIDIAN
SEMICONDUCTOR CORP.

**71M6513
Energy Meter IC**

AN_6513_007

Application Note

MAY 2005

Rogowski Coil Meter Interface using the TERIDIAN 71M6513

The TERIDIAN 71M6513, 3-phase electronic power meter device has been evaluated primarily with Current Transformers as the sensor for determining the accuracy and linearity of the device in electronic meter applications. An alternative current sensor that can be used is the Rogowski Coil. To use a Rogowski Coil, the input signal conditioning circuit to each of the current inputs (IA, IB and IC) of the 71M6513 needs to be modified slightly. A small modification to the meter firmware is also required.

The demo board modification of one of the input signal conditioning legs is given in the figure below. The values of R131 and R25 are chosen to provide the necessary voltage (less than 250mV p-p) for current measurement. The meter firmware compensates for the 90° phase shift in the Rogowski coil. A table is given below that highlights all component changes needed to configure the 71M6513 demonstration board to interface to a Rogowski Coil sensor (TR9L1 of TAEHWA Trans Co).

Input Signal Conditioning Circuit:
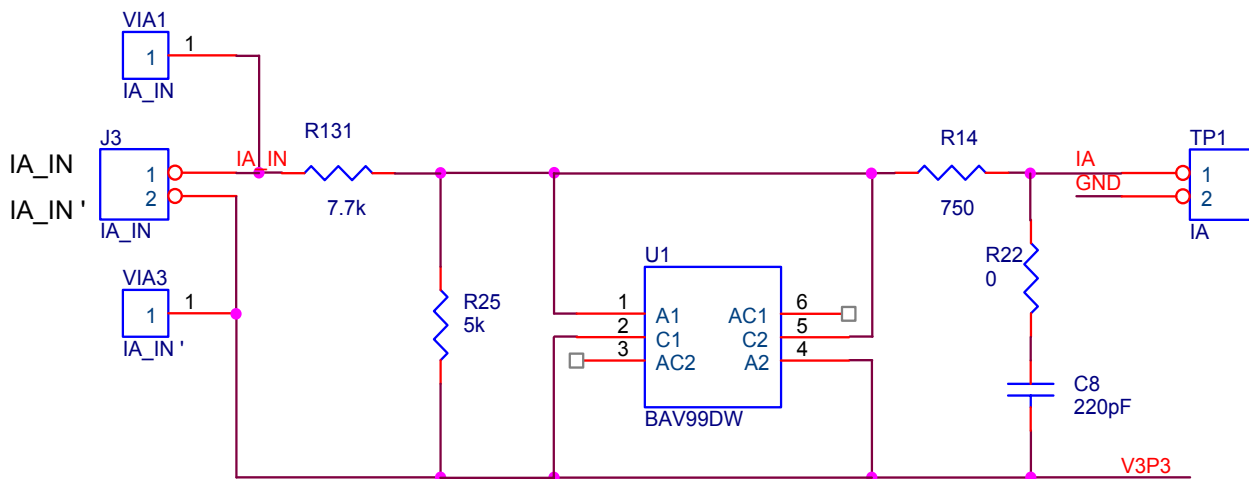
| Component	Current Transformer	Rogowski Coil
R131	0Ω	7.7kΩ
R24	3.4Ω	NC
R25	3.4Ω	5kΩ
R132	0Ω	7.7kΩ
R36	3.4Ω	NC
R37	3.4Ω	5Ω
R133	0Ω	7.7kΩ
R56	3.4Ω	NC
R57	3.4Ω	5kΩ

NC–No Connection

Meter Performance with Rogowski Coil:

The Meter firmware has been modified for accommodating the current input from the Rogowski coil. The Compute Engine performs the integrator function on the current input sample before feeding the current sample information to the power measurement module. The device performance has been verified and is quite good for several test conditions by varying the input current and phase angle between voltage and current as tabulated below. Graphical representation of the performance is pictured on the next page.

Please note that the range of the phase angle adjustment for the Rogowski coil may not be necessary since the core is air. The *PHAADJ_A, PHAADJ_B*, and *PHAADJ_C* variables have default values of -713 for Rogowski coils (usually set to 0 for Current Transformers). A one count increase in this value compensates for a phase shift of .001º.   Also, note that the offset adjustment for the Rogowski coil must be done using the *QUANT* variable at address 0x2F (usually set to 0 for Current Transformers) of the Compute Engine. The adjustment of the *QUANT* variable will depend on the particular Rogowski coil used. The results provided in this application note are with QUANT value of –12500 and –713 for PHADJ factors.
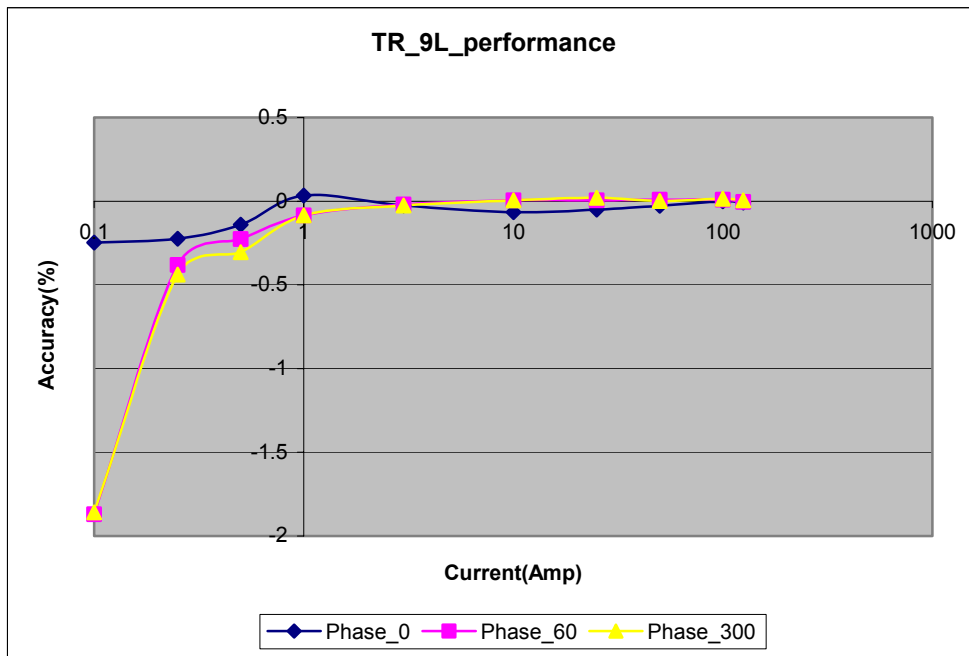
					%Error
step	volt	amp	phase_angle	frequency	Accuracy
1	240	100	0	60	-0.0082
2	240	30	0	60	0.0188
3	240	10	0	60	0.0326
4	240	3	0	60	0.0614
5	240	1	0	60	0.0349
6	240	100	60	60	0.0344
7	240	30	60	60	0.0654
8	240	10	60	60	0.0664
9	240	3	60	60	0.0393
10	240	1	60	60	0.0427
11	240	100	300	60	-0.0688
12	240	30	300	60	-0.0079
13	240	10	300	60	-0.0062
14	240	3	300	60	0.0568
15	240	1	300	60	0.0238
16	240	100	180	60	0.0025
17	240	30	180	60	0.0305
18	240	10	180	60	-0.0042
19	240	3	180	60	-0.0154
20	240	1	180	60	-0.029
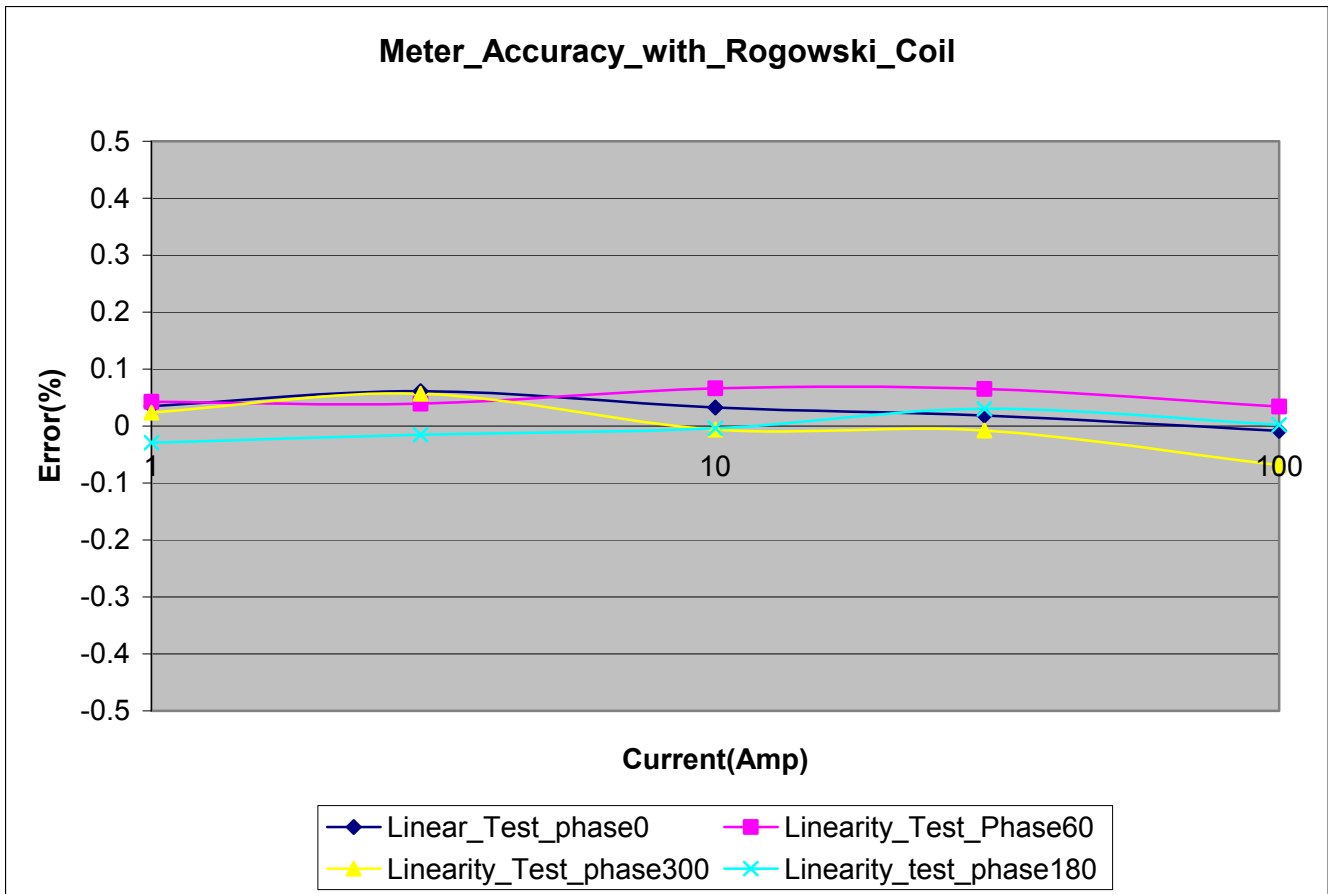
Meter Performance with Taewatrans TR-9L Rogowski Coil:

In a second test, the series resistor was modified to 7.5kΩ, while the parallel resistor was modified to 5.1kΩ. The meter was tested with a Taewatrans type TR-9L Rogowski coil from 0.1A to 125A at 240V line voltage. The results are listed in the table below.

| | | 7.5K series, 5.1k parallel | Offset = -11350 | |
| | | Voltage 240V | Frequency 50Hz | |
step	amp	Phase_0	Phase_60	Phase_300
1	125	-0.0093	-0.0052	0.0042
2	100	-0.0008	0.0096	0.0144
3	50	-0.0281	0.008	0.0021
4	25	-0.0514	0.0054	0.0207
5	10	-0.0653	0.0054	0.0052
6	3	-0.0247	-0.0198	-0.0259
7	1	0.0334	-0.0854	-0.0846
8	0.5	-0.1407	-0.2257	-0.305
9	0.25	-0.2248	-0.382	-0.4387
10	0.1	-0.2469	-1.8697	-1.8577

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