

# Demand Response Multi-Purpose House Meter User's Guide

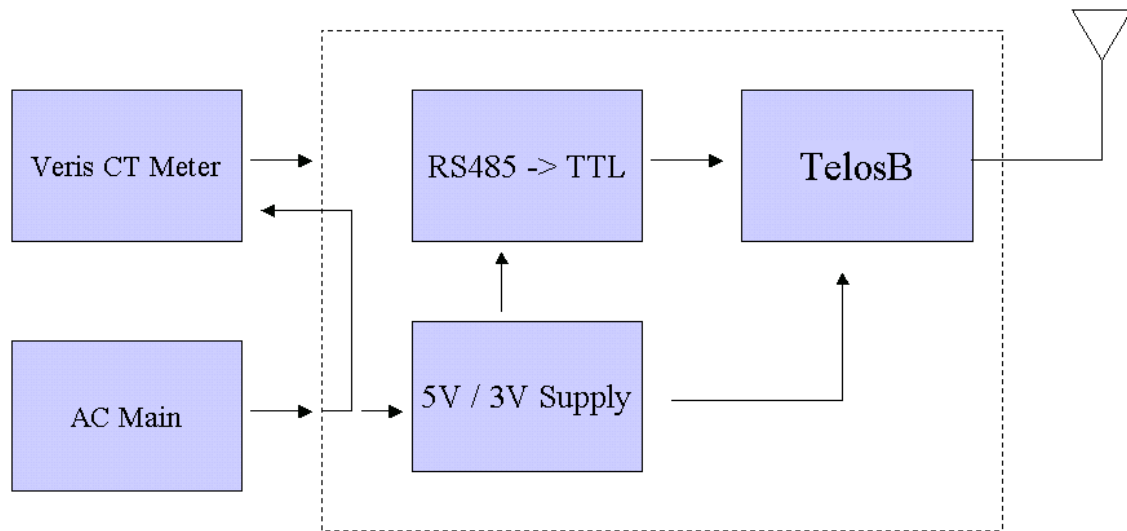


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## 1. Introduction

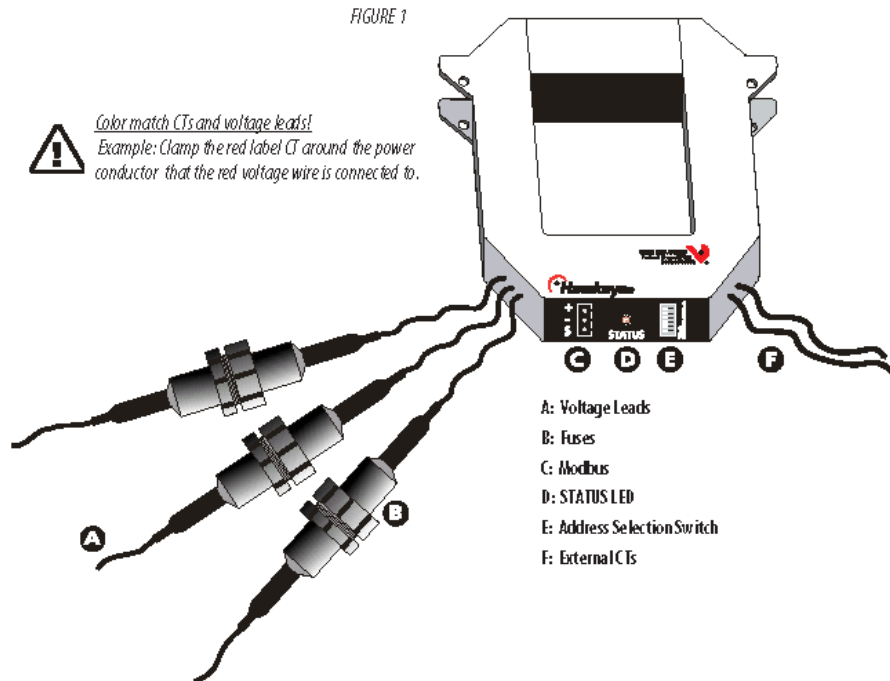
### Block Diagram



The house meter is composed of two major components. The first component is the Veris H8036 100Amp CT based Meter. It hooks to the AC system via 3 CT's and 3 voltage lines. In a residential environment where there is only a single phase, only 2 CT's and 2 voltage lines are used. The other major component is the interface module, which communicates with the Veris Meter. The interface module consists of a RS485 to TTL converter, a 5V power supply that runs off of 100 – 270 AC, and a TelosB mote, which is responsible for messaging with the Veris CT Meter as well as wireless communication with the home DR monitoring system.

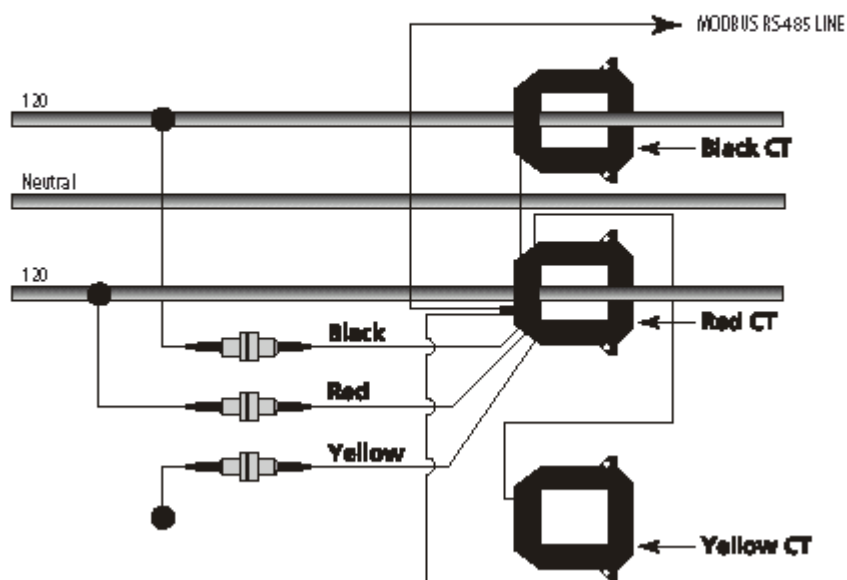
## 2. Getting Started

### 2.1 Installing the Veris CT



#### 2.1.1 Wiring CT Meter to circuit breakers

##### TYPICAL 240/120 VAC 1Ø, 3-WIRE INSTALLATION



## 2.1.2 Setting Veris CT device ID



**1**

Please make sure the device is set to ID 1.

## 2.1.3 Connecting the RS485 cable

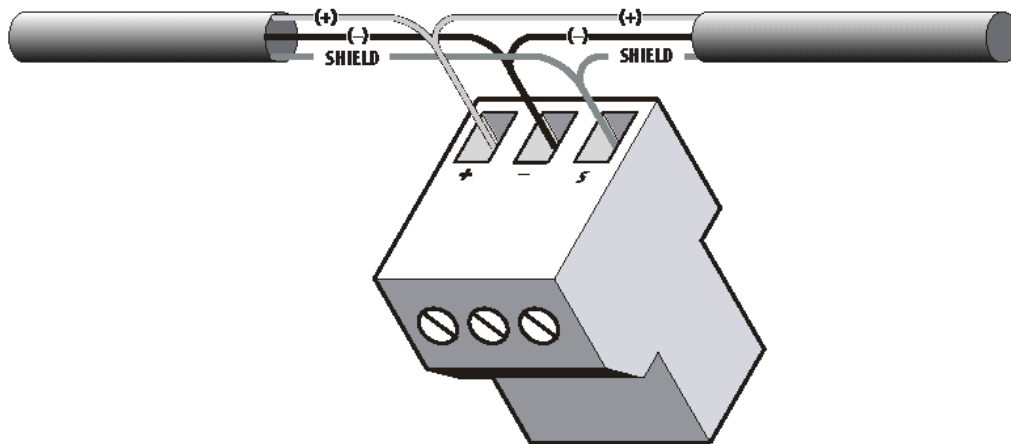


FIGURE 4

### NOTES

1. DO NOT GROUND THE SHIELD INSIDE THE ELECTRICAL PANEL.  
All Modbus wires, including the shield should be insulated to prevent accidental contact to high voltage conductors.
2. The Modbus cable should be mechanically secured where it enters the electrical panel.
3. All Modbus devices should be connected together in a daisy-chain fashion.
4. The Modbus cable should be shielded twisted pair wire BELDEN 1120A or similar



**WARNING:** After wiring the Modbus cable, remove all scraps of wire or foil shield from the electrical panel. This could be DANGEROUS if wire scraps come into contact with high voltage wires!

## 2.1.4 Unused CT and Unused Voltage Contact



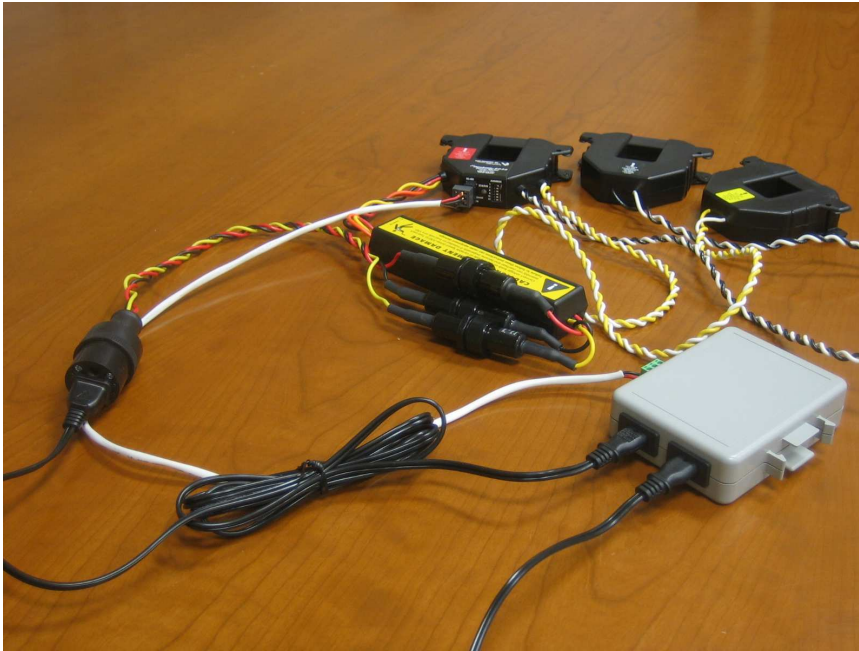
The unused Yellow coded CT will remain unconnected to any lines.



The unused Yellow coded voltage lead is unconnected in the 3-pin receptacle.

## 2.2 Connecting the Telos interface Module

### 2.2.1 Connecting RS485 cable



Notice the white RS485 cable connection between the red CT and the telos interface module.

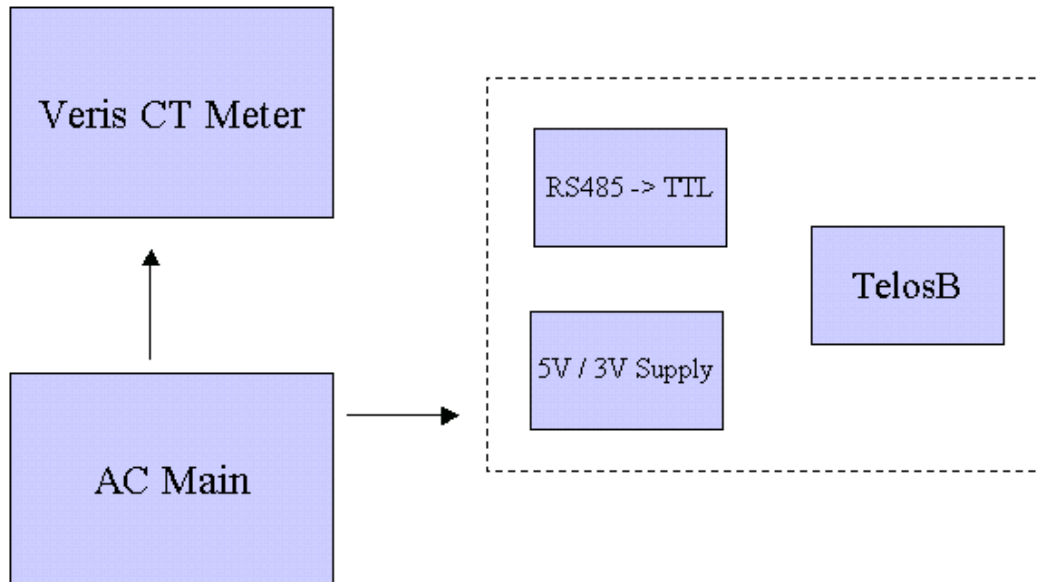
### 2.2.2 AC voltage pass through

The Veris CT Meter requires contact with the AC voltage. The telos interface module also requires contact with AC voltage to supply power to its circuitry. There are two parallel connectors built into the telos interface module to give 2 different wiring options. These 2 parallel connectors are interchangeable.



The first option involves not using the extra connector in the interface module. The Veris CT meter will directly connect to the AC Mains. The mote interface module will also make a direct connection to AC voltages.

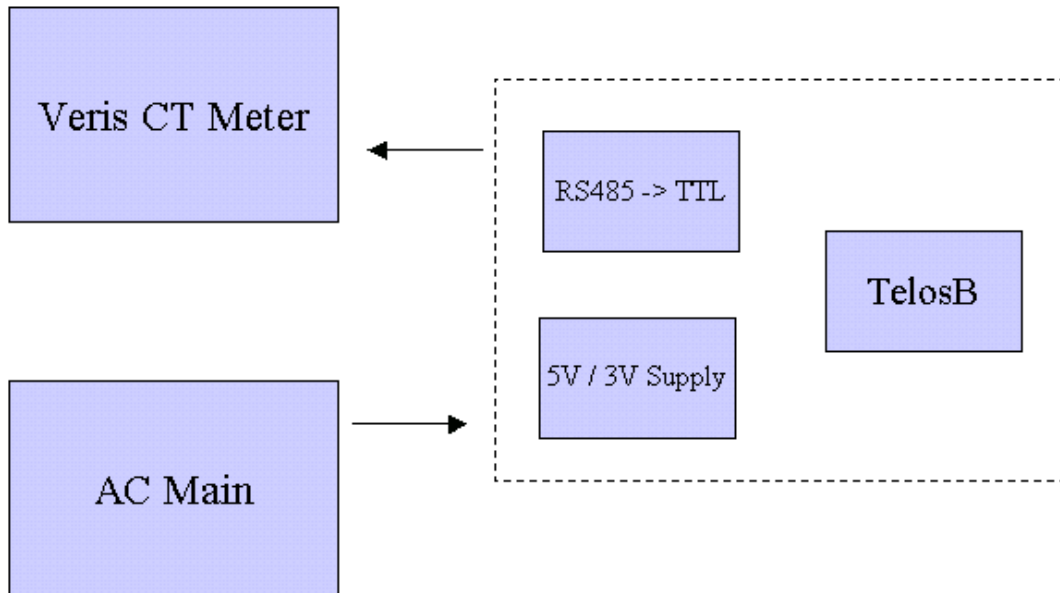
## Option 1



**Warning: This option will leave one of the connectors on the interface module exposed. The exposed module will carry dangerously high voltages! Please use the provided end cap in this situation.**

The second option is to use the AC voltage pass through connector. The AC mains are connected directly to the Telos interface module. The second parallel connector on the interface module will then be connected to the Veris CT Meter passing the AC Mains connection with it.

## Option 2



### 2.2.3 Mounting Brackets

There is a option of using mounting brackets that will allow the interface module to be mounted on a wall.

### 2.3 Reading the Packet Structure

Recall that in addition to interfacing with the Veris CT Meter, the Telos module also transmits energy data wirelessly. The packet structure is as follows.

<b>HEADER</b> (2)	<b>LENGTH</b> (1)	<b>FCF</b> (2)	<b>DSN</b> (1)	<b>DESTPAN</b> (2)	<b>ADDR</b> (2)	<b>TYPE</b> (1)	<b>GROUP</b> (1)	<b>PAYLOAD</b> <b>(MAX 28)</b>	<b>CRC</b> (2)	<b>FOOTER</b> (1)
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	Sensor 1		Sensor 2		...
Mote ID (2)	Sensor ID (2)	Raw Data (2)	Sensor ID (2)	Raw Data (2)	...

ADDR: 0xFFFF  
 TYPE: 0x10  
 GROUP: 0x83

Mote ID: 20

Sensor Description: Current Phase A  
 Sensor ID: 720

Sensor Description: Current Phase B  
 Sensor ID: 721

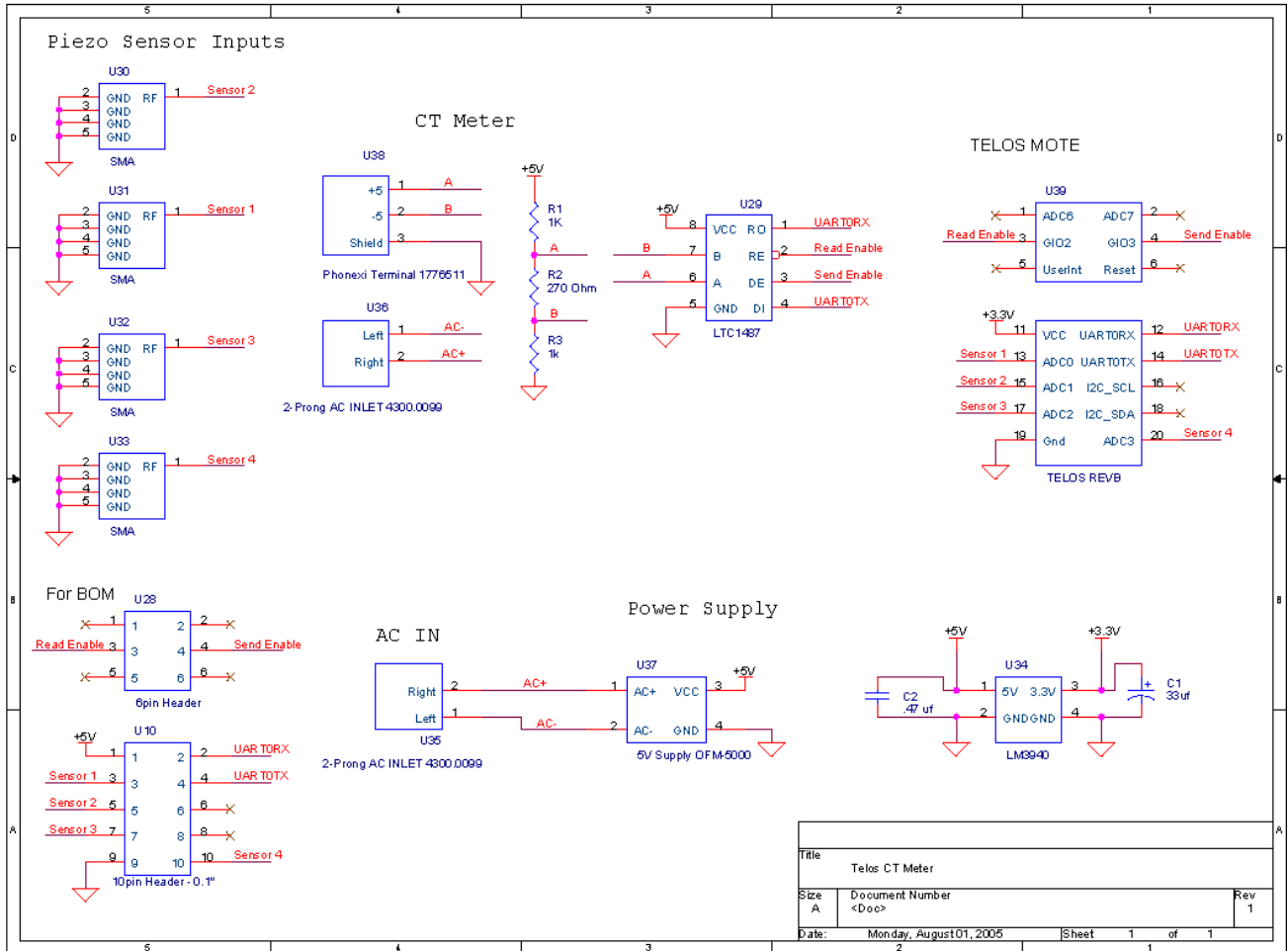
Sensor Description: Power Phase A  
 Sensor ID: 722

Sensor Description: Power Phase B  
 Sensor ID: 723

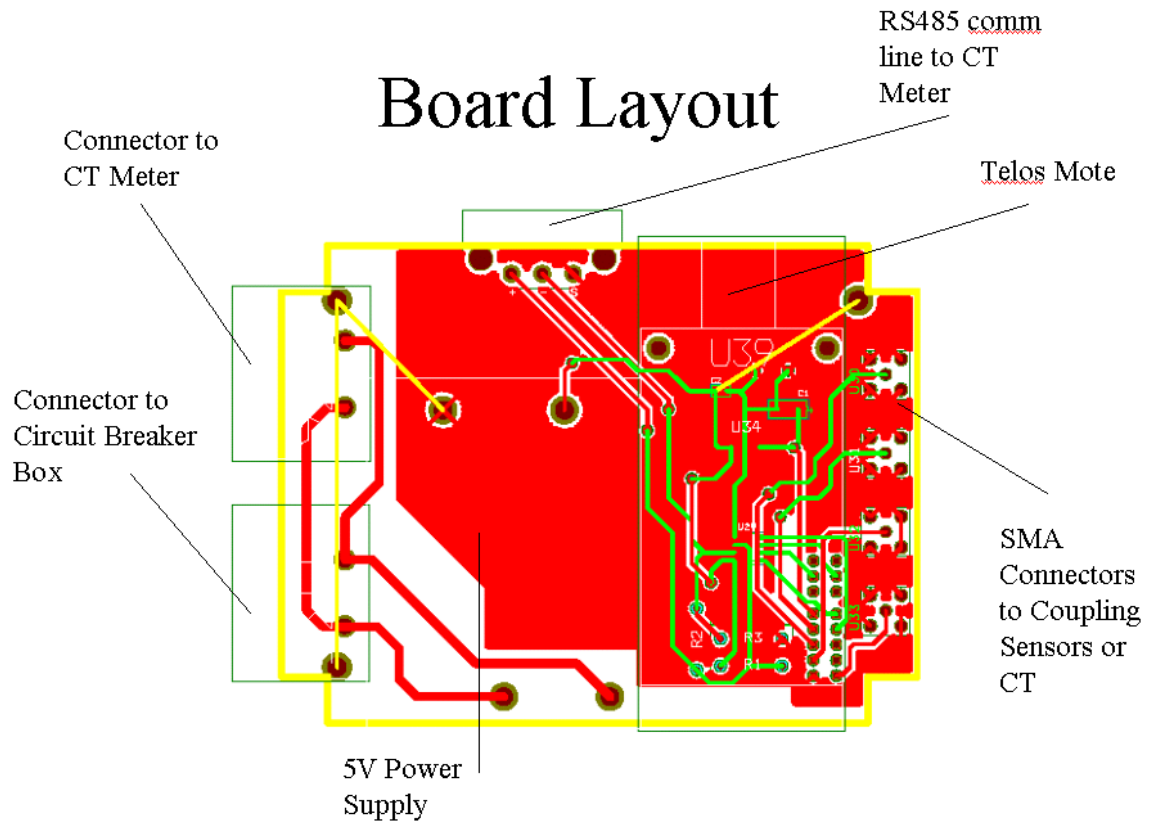
Sensor Description: Voltage AB, RMS  
 Sensor ID: 724

### 3. Hardware

#### 3.1 Schematics



### 3.2 Layout



### 3.3 Pictures



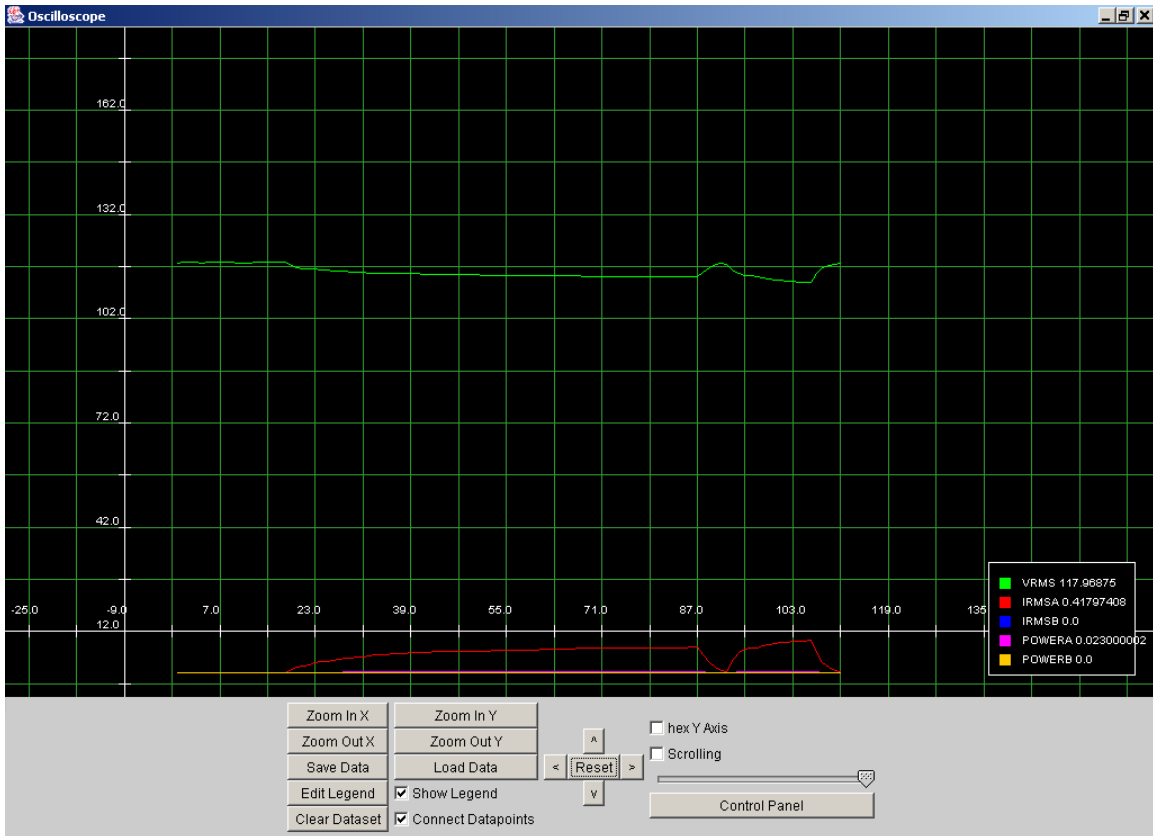


## 5. System integration:

### 5.1 Test App

There is a sample java application written to read and graph the sensor readings. It has sample code for doing the unit conversions from engineering units.

Source code location: /opt/tinyos-1.modbus/tools/java/net/tinyos/hscope



## 5.2 Conversion Table

This table shows the multipliers for all point and amperage ranges:

Addr	Units	100A	300/400A	800A	1600A	2400A
40001	KWH	7.8125e-3	0.03125	0.0625	.125	0.25
40002	KWH	512	2048	4096	8192	16384
40003	KW	0.004	0.016	0.032	0.064	0.128
40004	VAR	0.004	0.016	0.032	0.064	0.128
40005	VA	0.004	0.016	0.032	0.064	0.128
40006	---	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5
40007	VOLTS	0.03125	0.03125	0.03125	0.03125	0.03125
40008	VOLTS	0.015625	0.015625	0.015625	0.015625	0.015625
40009	AMPS	3.9063e-3	0.015625	0.03125	0.0625	0.125
40010	KW	0.001	0.004	0.008	0.016	0.032
40011	KW	0.001	0.004	0.008	0.016	0.032
40012	KW	0.001	0.004	0.008	0.016	0.032
40013	---	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5
40014	---	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5
40015	---	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5	3.0518e-5
40016	VOLTS	0.03125	0.03125	0.03125	0.03125	0.03125
40017	VOLTS	0.03125	0.03125	0.03125	0.03125	0.03125
40018	VOLTS	0.03125	0.03125	0.03125	0.03125	0.03125
40019	VOLTS	0.015625	0.015625	0.015625	0.015625	0.015625
40020	VOLTS	0.015625	0.015625	0.015625	0.015625	0.015625
40021	VOLTS	0.015625	0.015625	0.015625	0.015625	0.015625
40022	AMPS	3.9063e-3	0.015625	0.03125	0.0625	0.125
40023	AMPS	3.9063e-3	0.015625	0.03125	0.0625	0.125
40024	AMPS	3.9063e-3	0.015625	0.03125	0.0625	0.125
40025	KW	0.004	0.016	0.032	0.064	0.128
40026	KW	0.004	0.016	0.032	0.064	0.128
40027	KW	0.004	0.016	0.032	0.064	0.128

## 6. Unused Features

### 6.1 SMA connectors wired to 4 ADC Channels

There are four SMA connectors on the left side of the following picture that is unpopulated. These footprints are connected to 4 ADC lines of the telos mote. This allows easy future integration of any analog sensor onto the line powered telos platform.

