High Precision Ohmmeter

SDSU College of Engineering

Motivation

- Connectors degrade over multiple insertion and removal cycles.
- Small resistance changes can impact system performance.
- Current testing method is manual and time consuming.
- Manual data logging limits accuracy and efficiency.
- Need for automated, high-precision measurements.
- GOAL: improve reliability analysis and testing efficiency

Overview

The High-Precision Ohmmeter is an automated system that measures resistance across 20-pin connectors. An STM32 microcontroller controls the system, using a multiplexer and a high-resolution Analog-to-Digital Converter (ADC) for accurate measurements. A touch screen Human-Machine Interface (HMI) allows real-time control and display. The system supports both automatic testing and manual measurements, and logs data to a micro-SD card for analysis.

Specifications

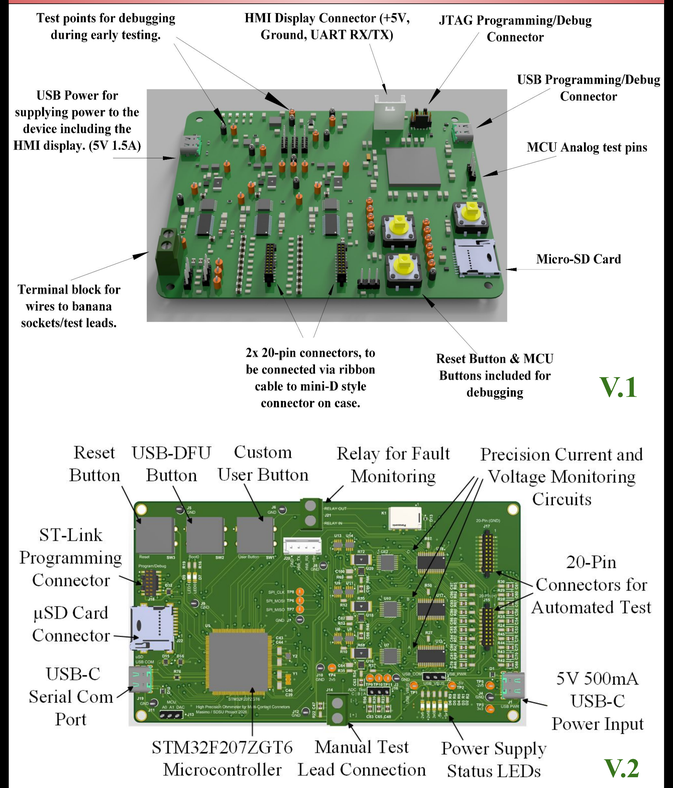
Operating Specifications

Parameter	Description
Manual Mode Function	Resistance measurement between any two points
Automatic Mode Function	Resistance testing for 20-pin connectors
Measurement Range	0 Ω to 10 Ω
Manual Mode Precision	1 mΩ
Automatic Mode Precision	10 mΩ

System Specifications

Parameter	Description
Operating Modes	Manual Mode, Automatic Mode
Sampling Rate (Automated Test)	At least one pin measurement per insertion cycle
Refresh Rate (Manual Mode)	3 Hz
Data Storage	Micro-SD card
File Format	CSV

Hardware



Risks and Prototype

Manual Mode Testing

P.1: Zeroing out the measurement leads.
P.2: Measuring a 50mΩ precision resistor.

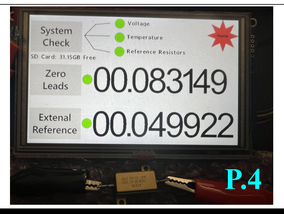
Data Logging

1	Automated Test File											
2	Pin Resistance [Ohms]	Time Measured Since Test Start [Milliseconds]										
3	1.753733	12151	1.126241	12300	1.16523	12448	0.804299	12597	2.092273	12745	2.005102	12894
4	1.754572	13062	1.124699	13210	1.163508	13359	0.804952	13507	2.091924	13656	2.004421	13805
5	1.75437	13970	1.125753	14118	1.16594	14267	0.805529	14415	2.093622	14564	2.004928	14713
6	1.753553	14878	1.125882	15026	1.164794	15175	0.80502	15323	2.092676	15472	2.005467	15621
7	1.755716	15786	1.125536	15935	1.164518	16083	0.805267	16231	2.092749	16380	2.006091	16529
8	1.753519	16697	1.125631	16845	1.164152	16994	0.805214	17142	2.094535	17291	2.005473	17440
9	1.756021	17605	1.124081	17753	1.167316	17902	0.805252	18050	2.090557	18199	2.004308	18348
10	1.753505	18513	1.126027	18662	1.164815	18810	0.805669	18958	2.093378	19107	2.006598	19256
11	1.753471	19422	1.126111	19570	1.16485	19718	0.805396	19867	2.094002	20016	2.004701	20165
12	1.755781	20333	1.124837	20481	1.165275	20629	0.8056	20778	2.093671	20927	2.00478	21076
13	1.755764	21241	1.126781	21389	1.164173	21538	0.805918	21686	2.092672	21835	2.005893	21984
14	1.753897	22152	1.125758	22300	1.164852	22448	0.805271	22597	2.093938	22746	2.003811	22895
15	1.75429	23060	1.126827	23208	1.165652	23357	0.804857	23505	2.094479	23654	2.005869	23803
16	1.753466	23968	1.127013	24116	1.167174	24265	0.805933	24413	2.093627	24562	1.993811	24649

P.3

P.3: Data logging sample from an automated test.

Calibration Mode



P.4: Calibration mode verifying system accuracy using voltage, temperature, and reference checks.

User Interface

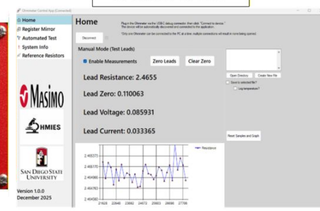
HMI Touchscreen Display

Manual Mode

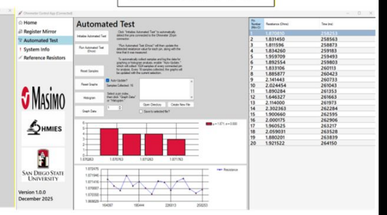
Automated Test

Windows Control Application

Manual Mode



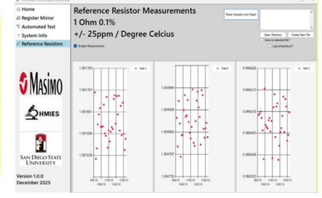
Automated Test



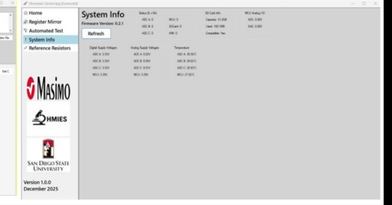
Date & Time

Calibration

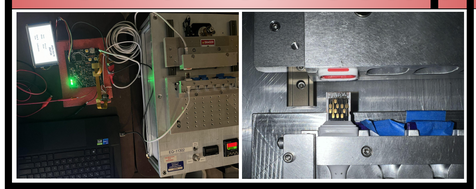
Reference Resistors



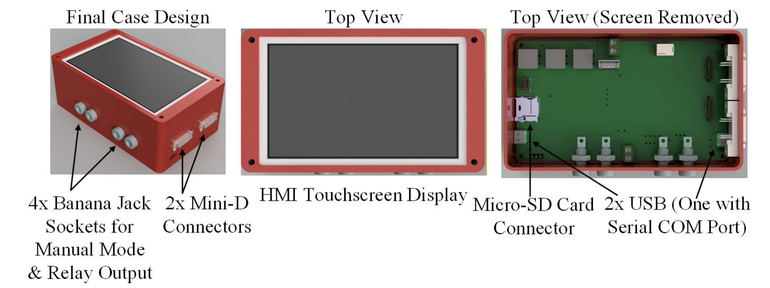
System Info



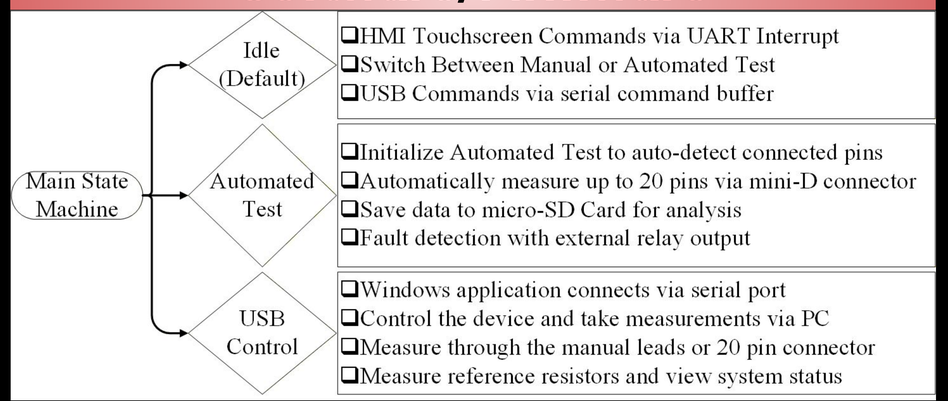
Mechanical Setup



Final Model



Software/Firmware

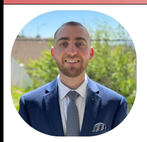


Acknowledgments

We would like to thank:

- Masimo for sponsoring this project and providing resources
- Glenn Pohly for technical guidance and support throught the project
- Professor Paolini and Professor Dorr for their mentorship and feedback

Meet The Team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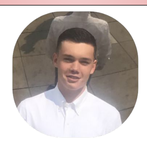
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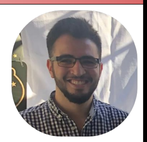
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Spring 2026