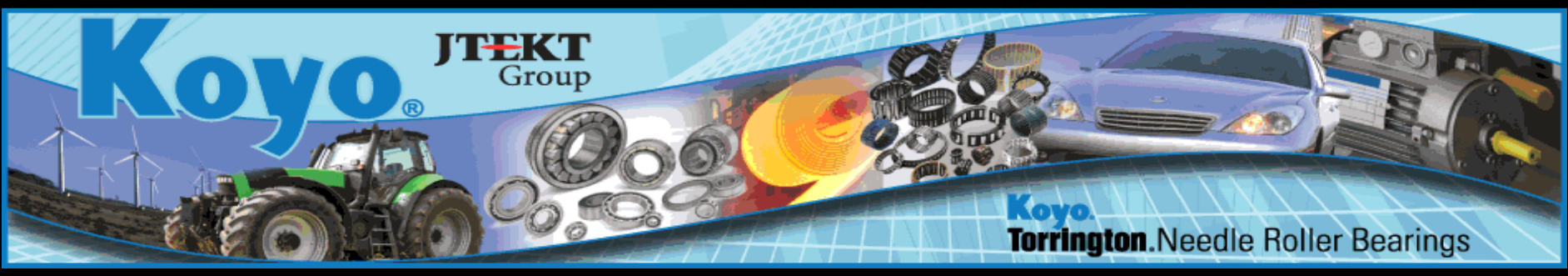


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Senior Design Project

Automated High Volume Bearing Bore Gage

Concept Design Review

Team 22

Seth Norman - *Project Manager (EE Lead)*

Eric Allgeier - *Webmaster*

Kevin Flemming - *Treasurer*

Matthew Boler – *ME Lead*

Christopher Proffett - *Sponsor Liaison*

Team Sponsor

Robert Potts (KOYO Bearings)

Team Advisor

Dr. Cartes

Instructors

Dr. Shih

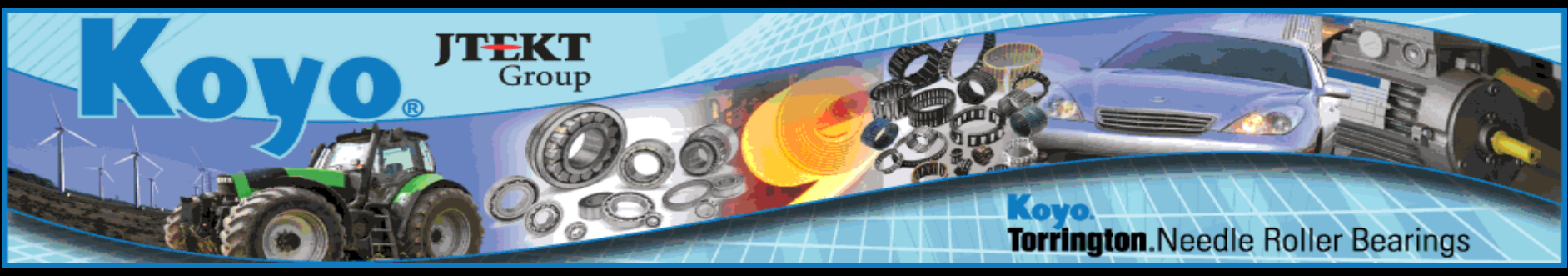
Dr. Amin

Dr. Frank



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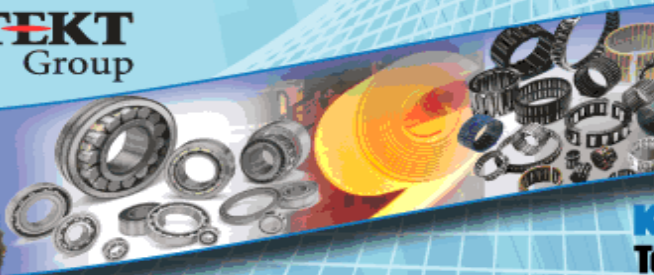
Agenda

- Scope of Work
- Fall Accomplishments
- Design Concept
- Potential Challenges
- Procurement
- Hardware/Software
- Manufacturing
- Safety
- Spring Schedule
- Conclusion



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Automated Bearing Bore Gage

- Measures bore sizes
- Determines pass or fail

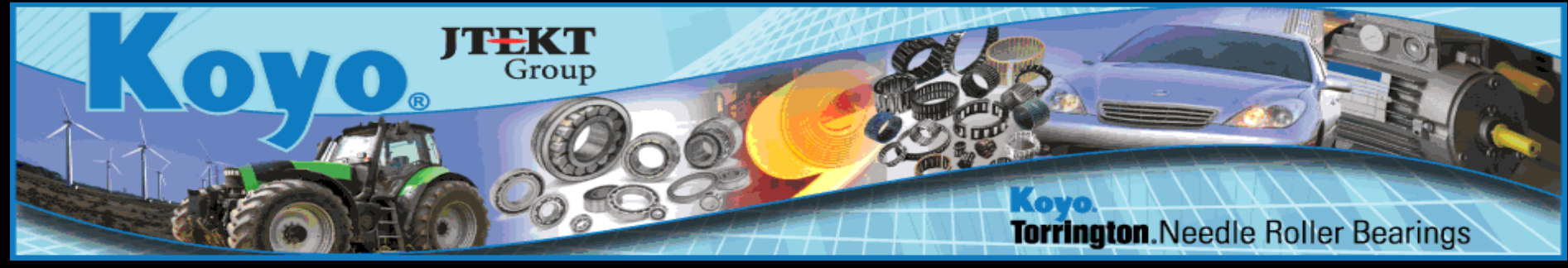
Problem Statement

- Update the automated bearing bore gage
- Maintain measuring quality and sampling rate
- Allow for networking with Koyo

Objectives

- New GUI
- Replace electrical components
- Keep existing pneumatic system





Fall Accomplishments

1. Organize Team
2. Contact Sponsor
3. Initial Research
4. Diagnostic Testing
5. Design Concepts
6. Component Research
7. Design/Component Selection
8. Generate Bill of Materials
9. Submit design proposal to Koyo Bearings
10. Create project objectives for Spring Semester



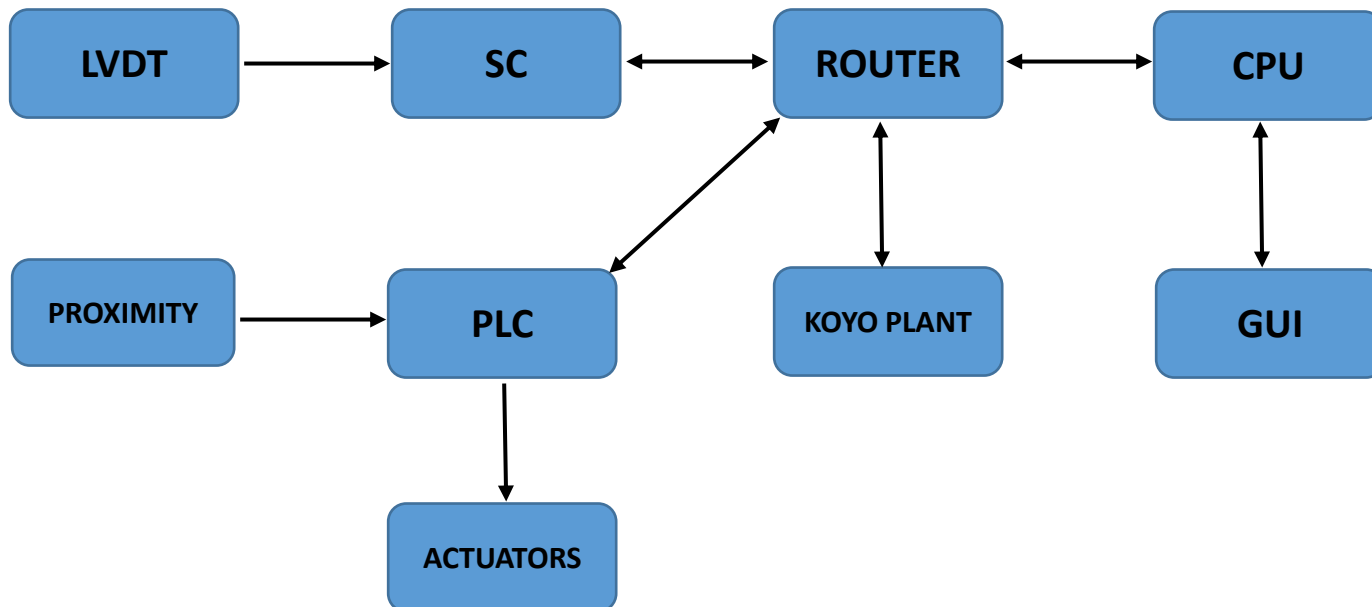
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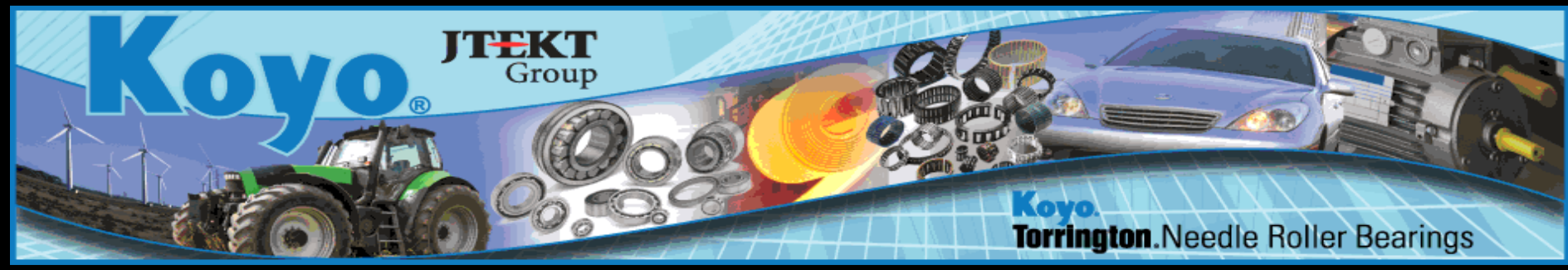
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Design Concept

Uses only a signal conditioning module in conjunction with the PLC and CPU.





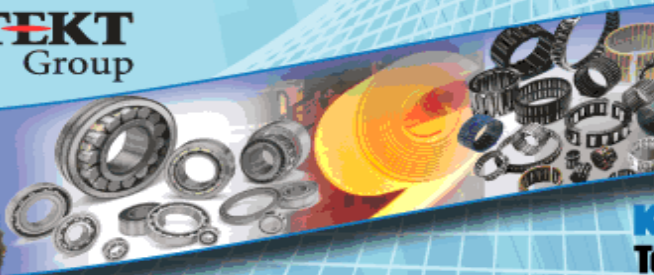
Potential Challenges

- **Creating Graphical User Interface (GUI)**
 - Recreating similar user experience for ease of operation
 - Recreating desired data acquisition algorithms
- **Sending and receiving data from the signal conditioner**
- **Electrical noise interference with the LVDT and the signal conditioner**
- **System integration**



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Procurement

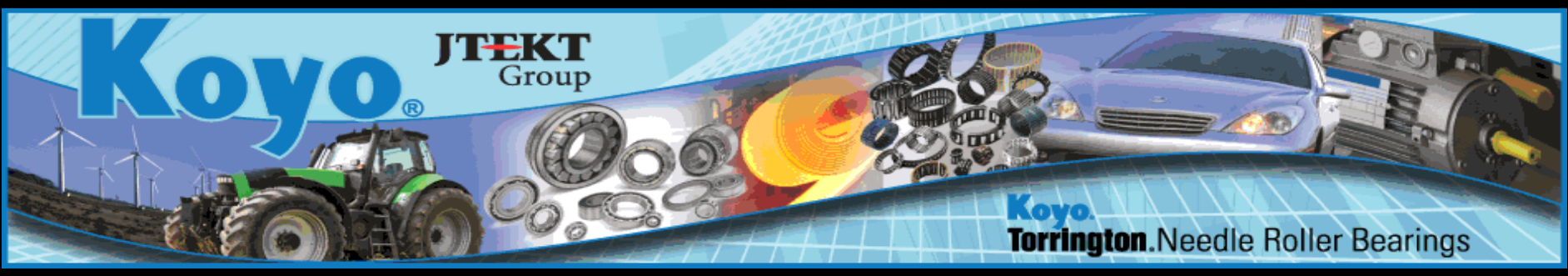
Device	Part Number	Unit Price (\$)	Quantity	Price (\$)
CPU	LENOVO ThinkCentre M92p	*	1	*
PLC	1762-L24AWA	566.20	1	566.20
PLC - Ethernet Module	1761-NET-ENI	950.00	1	950.00
PLC - Software	RSLogix 500	2050.00	1	2050.00
Signal Conditioner	ANR2	895.00	2	1790.00
Power Supply 24V	PSB24-060-P	28.00	1	28.00
Power Supply 12V	PSB12-060	37.25	1	37.25
Router	CTR-Link EIPR-E	299.00	1	299.00
Monitor	ELO 1537L	527.00	1	527.00
Circuit Breakers	QUO110	30.65	1	30.65
Misc. (DIN Rail...)	TBD	TBD	TBD	~100.00
Total			11	6378.10



* Provided by KOYO

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Hardware / Software

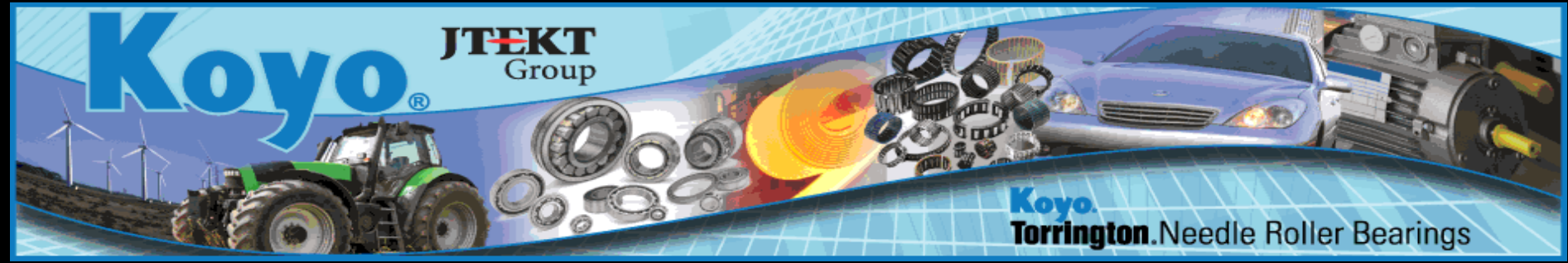
Materials

- 16 gage wire
- 12-24 machine screws
- Wire terminal crimps
- Heat shrink
- Printable wire labels
- Wire Ties
- Din rail (35mm)
- Din rail mounted two screw terminals

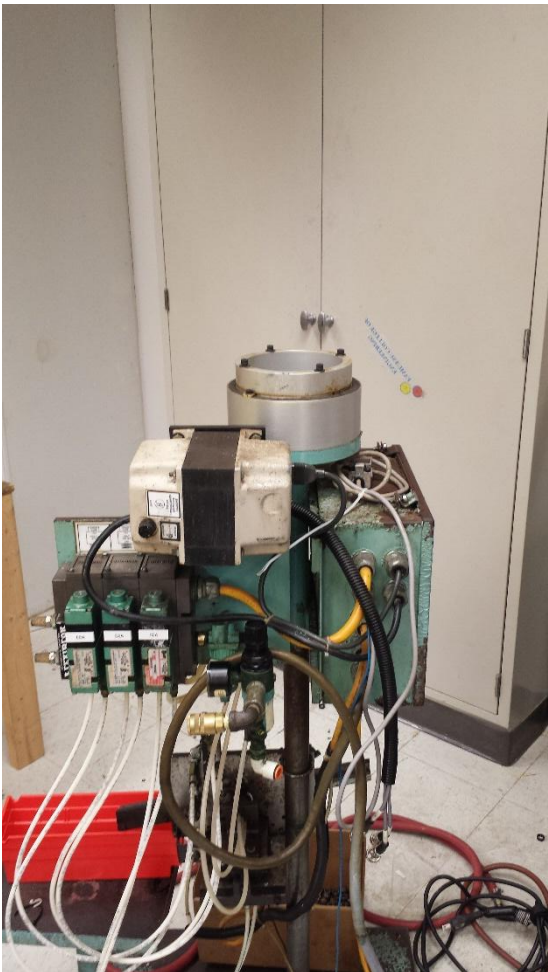
Programming Software

- RSLogix 500 for the PLC ladder logic programming
- Visual C++ for GUI development





Current Platform

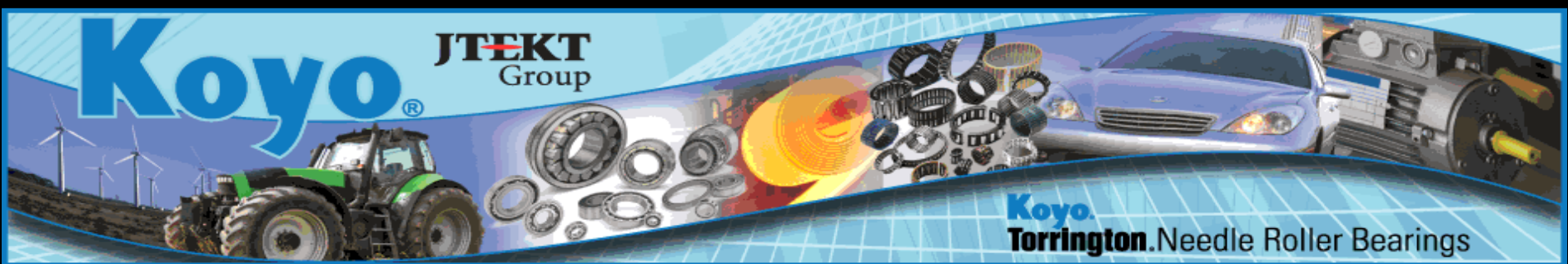


PLC Test-bed



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DWG NO F2014-003 Koyo JTEKT																	
REVISIONS																	
<p>All dimensions are in inches. All tolerances are ± 0.015</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">NUM</th> <th style="width: 40%;">DESCRIPTION</th> <th style="width: 15%;">DATE</th> <th style="width: 35%;">APPROVED</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	NUM	DESCRIPTION	DATE	APPROVED												
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MATERIAL	PROPRIETARY NOTICE <small>THIS DOCUMENT CONTAINS CONFIDENTIAL AND TRADE SECRET INFORMATION, IS THE PROPERTY OF KOYO BEARINGS NORTH AMERICA LLC, AND IS GIVEN TO THE RECEIVER IN CONFIDENCE. THE RECEIVER BY RECEPTION AND RETENTION OF THE DOCUMENT ACCEPTS THE DOCUMENT IN CONFIDENCE AND AGREES THAT, EXCEPT AS AUTHORIZED IN WRITING BY KOYO BEARINGS NORTH AMERICA LLC, IT WILL (1) NOT USE THE DOCUMENT OR ANY COPY THEREOF OR THE CONFIDENTIAL OR TRADE SECRET INFORMATION THEREIN; (2) NOT COPY THE DOCUMENT; (3) NOT DISCLOSE TO OTHERS EITHER THE DOCUMENT OR THE CONFIDENTIAL OR TRADE SECRET INFORMATION THEREIN; AND (4) UPON COMPLETION OF THE NEED TO RETAIN THE DOCUMENT, OR UPON DEMAND, RETURN THE DOCUMENT, ALL COPIES THEREOF, AND ALL MATERIAL, COPIED THEREFROM.</small>	Koyo Bearings North America LLC Housing															
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<small>ProEngineer VERSION</small>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">SCALE</td> <td style="width: 15%;">DRAWING NUMBER</td> <td style="width: 15%;">PAGE</td> <td style="width: 15%;">OF</td> <td style="width: 15%;">REV</td> </tr> <tr> <td>0.150</td> <td>F2014-003</td> <td>1</td> <td>1</td> <td>1</td> </tr> </table>	SCALE	DRAWING NUMBER	PAGE	OF	REV	0.150	F2014-003	1	1	1					
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0.150	F2014-003	1	1	1													

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NUM	DESCRIPTION	DATE	APPROVED

All dimensions are in inches.
All tolerances are ± 0.015

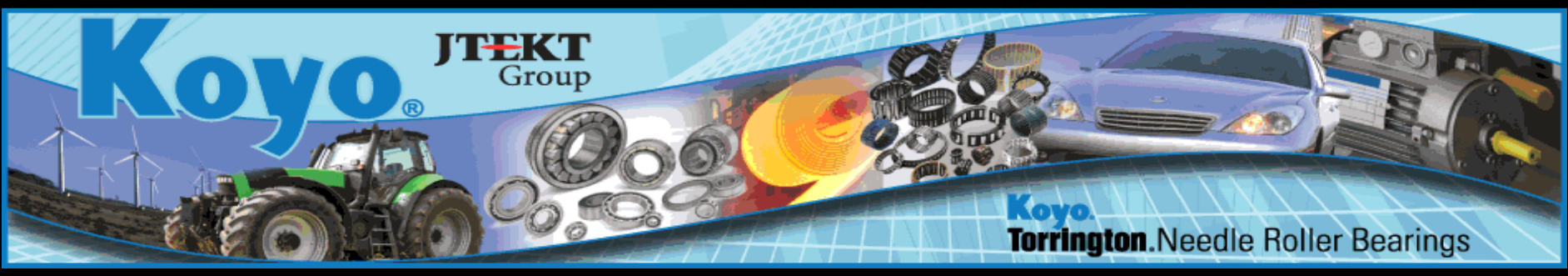
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(clearance for 12-24)
x4

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		SCALE 0.150	PAGE 1	OF 1

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NUM	DESCRIPTION	DATE	APPROVED

Monitor Panel
Part Number F2014-001

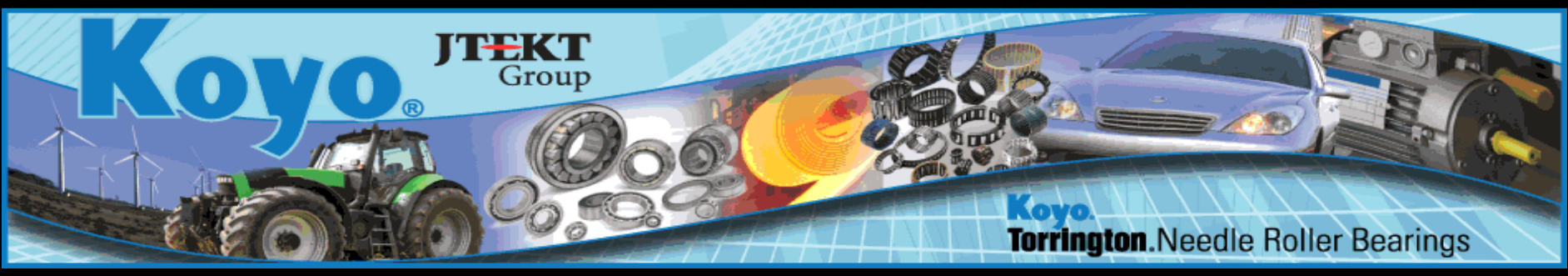
Switch Panel
Part Number F2014-002

Monitor Panel attaches to housing
with tack welds

MATERIAL	PROPRIETARY NOTICE	 THIRD ANGLE PROJECTION	Koyo Bearings North America LLC TITLE <h3 style="margin: 0;">Front Panel</h3>
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		SCALE 0.200	PAGE 1 OF 1

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Mounting Plate Top is to be tack welded to the Mounting Plate Bottom

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A36 Carbon Steel 1/16 inch	THIS DOCUMENT CONTAINS CONFIDENTIAL AND TRADE SECRET INFORMATION, IS THE PROPERTY OF KOYO BEARINGS NORTH AMERICA LLC, AND IS GIVEN TO THE RECEIVER IN CONFIDENCE. THE RECEIVER BY RECEPTION AND RETENTION OF THE DOCUMENT ACCEPTS THE DOCUMENT IN CONFIDENCE AND AGREES THAT, EXCEPT AS AUTHORIZED IN WRITING BY KOYO BEARINGS NORTH AMERICA LLC, IT WILL (1) NOT USE THE DOCUMENT OR ANY COPY THEREOF OR THE CONFIDENTIAL OR TRADE SECRET INFORMATION THEREIN; (2) NOT COPY THE DOCUMENT; (3) NOT DISCLOSE TO OTHERS; EITHER THE DOCUMENT OR THE CONFIDENTIAL OR TRADE SECRET INFORMATION THEREIN; AND (4) UPON COMPLETION OF THE NEED TO RETAIN THE DOCUMENT, OR UPON DEMAND, RETURN THE DOCUMENT, ALL COPIES THEREOF, AND ALL MATERIAL COPIED THEREFROM.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="font-size: 8px;">DRAWN</th> <th style="font-size: 8px;">DATE</th> </tr> <tr> <td style="text-align: center;">KF</td> <td style="text-align: center;">2/3</td> </tr> <tr> <th style="font-size: 8px;">CHECKED</th> <th style="font-size: 8px;">DATE</th> </tr> <tr> <td style="text-align: center;">KF</td> <td style="text-align: center;">2/3</td> </tr> <tr> <th style="font-size: 8px;">APPROVED</th> <th style="font-size: 8px;">DATE</th> </tr> <tr> <td style="text-align: center;">MB</td> <td style="text-align: center;">2/3</td> </tr> <tr> <td style="font-size: 8px;">APPROVED</td> <td> </td> </tr> </table>	DRAWN	DATE	KF	2/3	CHECKED	DATE	KF	2/3	APPROVED	DATE	MB	2/3	APPROVED		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="font-size: 8px;">TITLE</th> </tr> <tr> <td style="text-align: center;">MOUNTING PLATE</td> </tr> <tr> <th style="font-size: 8px;">SIZE</th> </tr> <tr> <td style="text-align: center;">A</td> </tr> <tr> <th style="font-size: 8px;">DRAWINGS NUMBER</th> </tr> <tr> <td style="text-align: center;">M2014-003</td> </tr> <tr> <th style="font-size: 8px;">REV</th> </tr> <tr> <td> </td> </tr> </table>	TITLE	MOUNTING PLATE	SIZE	A	DRAWINGS NUMBER	M2014-003	REV	
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Pro/Engineer VERSION

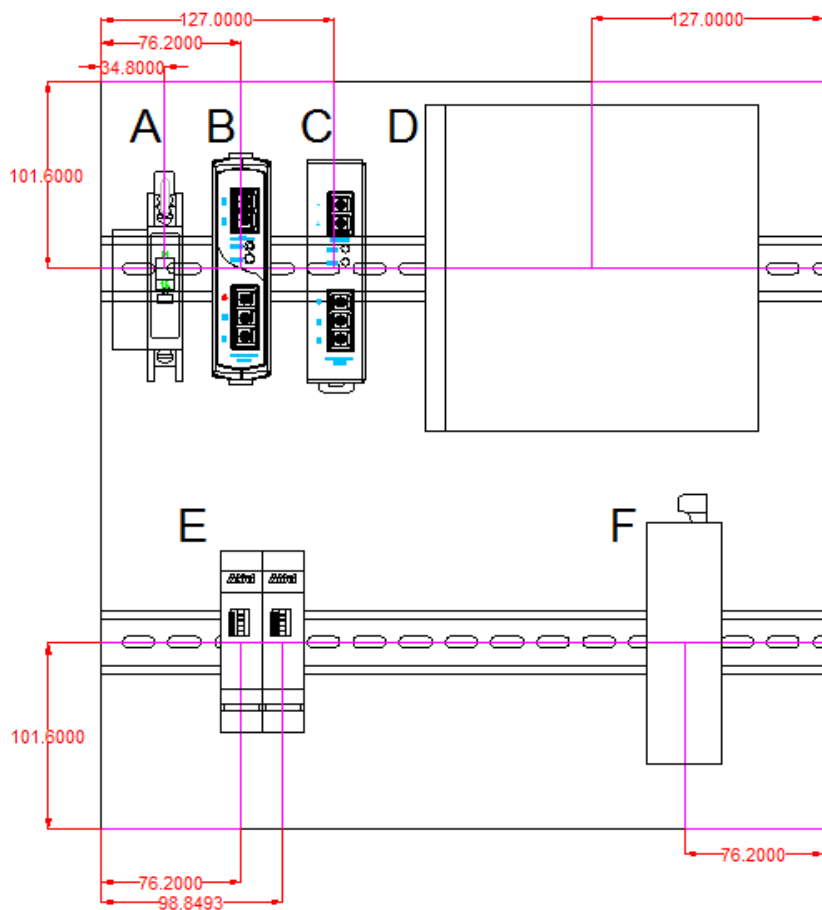


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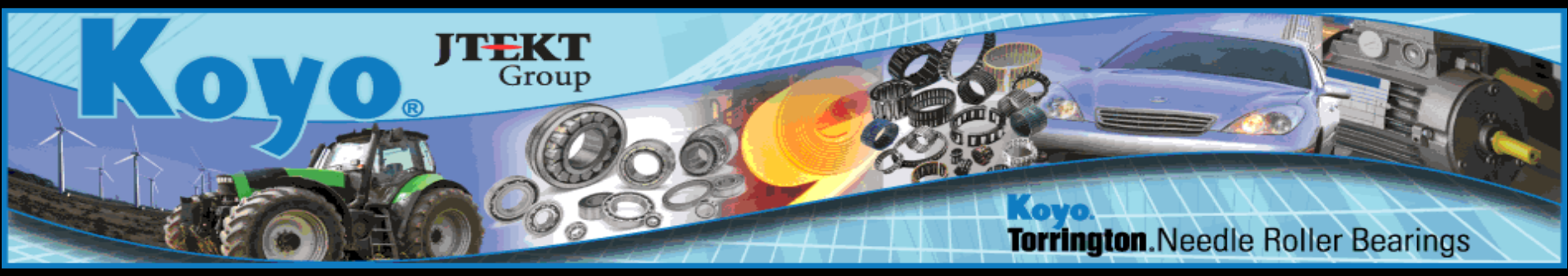
Component Layout



	Part
A	Square D, 10 A single pole breaker
B	12VDC 60W Power Supply
C	24VDC 60W Power Supply
D	ThinkCentre M92p, CPU
E	ANR2 LVDT Signal Conditioner
F	10/100 Ethernet Router

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Manufacturing Recommendations

- Remove old wiring and subsystems
- Modify existing housing system
- Insert new mounting devices
- Insert electrical components
- Run and land wires
- Load PLC and CPU software
- Final testing



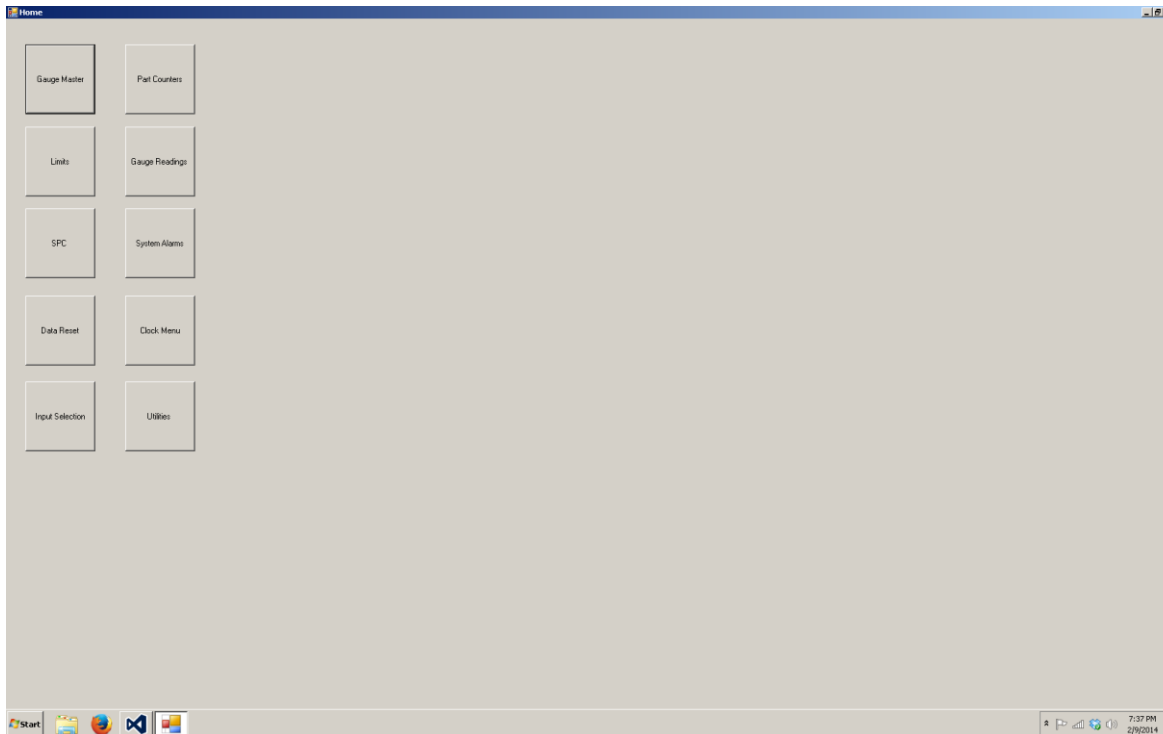
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Graphical User Interface



Completed

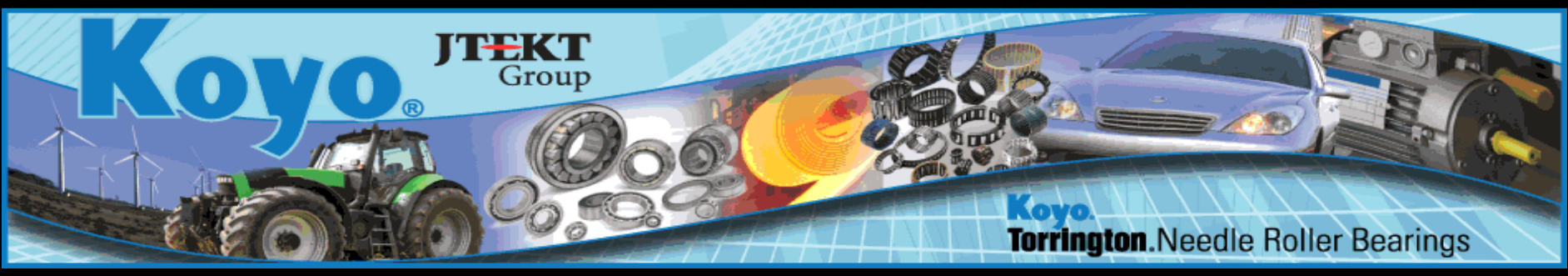
- Design program menu navigation

In progress

- Send and receive data to and from the signal conditioner
- Display histogram of bearing measurement data
- Relating LVDT voltage readings to bearing measurements

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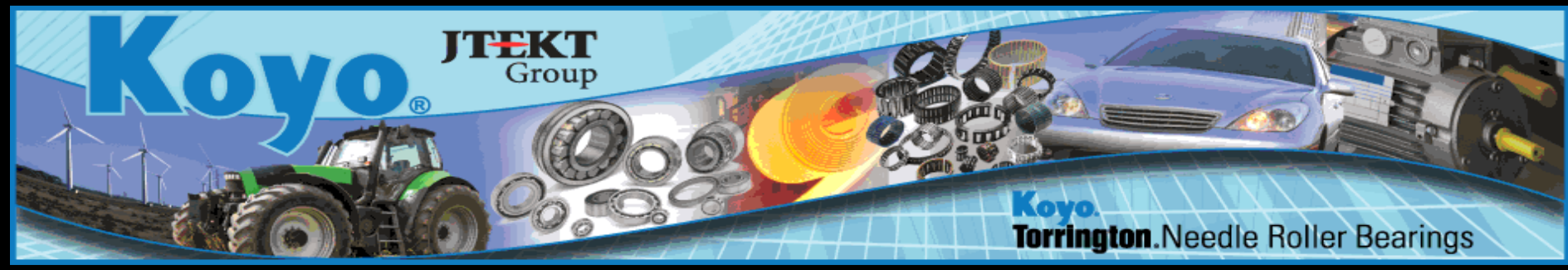


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Safety

- All work to be done on this machine will follow a strict LOTO (Lock out tag out) on all sources of potential energy.
- All potential electrical hazards are contained in the two housings on the machine.
- Both housings have locking mechanisms to keep untrained personnel away from any unnecessary hazards.





Spring Schedule

January

1. Remove old electrical components from the machine
2. Begin build of the GUI
3. Complete test bed

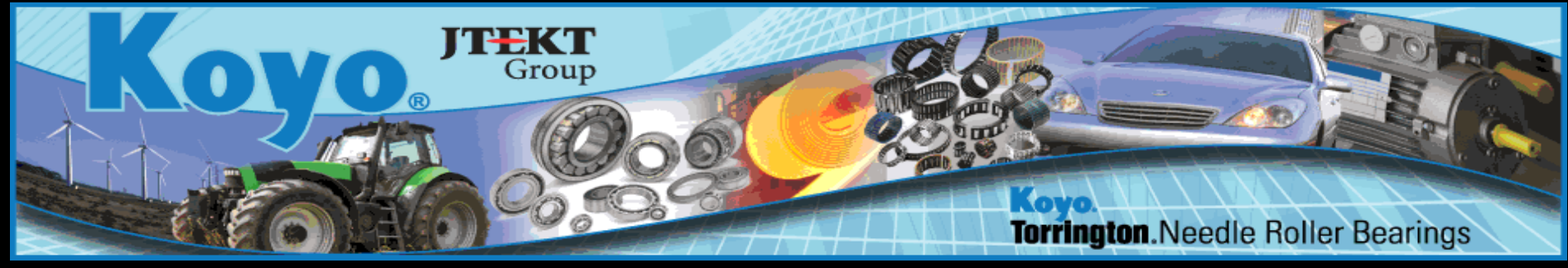
February / March

4. Design and manufacture new housing
5. Program and test all components.

April

6. Debug





Conclusion

- Mechanical aspects meet Koyo Bearing's standards
- Update the electronic components of an Automated Bearing Bore Gage
- Awaiting arrival of electrical components and modified housing
- Developing the graphical user interface





Questions and Comments

References

http://eng.fsu.edu/me/senior_design/2014/team22/

