Programmable Logic Controller for Three Phase Soft-Starter

Problem Statement

- Eaton requires a control system to verify Ethernet IP communication protocol for the Reduced Voltage Soft-Starter (RVSS) system
- A Human Machine Interface (HMI) is needed to interface with the system
- The control system starts and stops 3 RVSS units
- Starts and faults must be counted with this system

Requirements

<table>
<thead>
<tr>
<th>Number</th>
<th>Requirement Description</th>
<th>Verification Type</th>
<th>Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control system communicates to Reduced Voltage Soft-Starter (RVSS) over Ethernet IP</td>
<td>Demonstration Interface</td>
<td>X</td>
</tr>
<tr>
<td>2</td>
<td>Control system communicates to Human Machine Interface (HMI) over Ethernet IP</td>
<td>Demonstration Interface</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>Control system starts and stops three RVSSs</td>
<td>Demonstration Functional</td>
<td>X</td>
</tr>
<tr>
<td>4</td>
<td>For normal test condition of MV motor, RVSS must alternate 4 minutes on and 12 minutes off</td>
<td>Demonstration Functional</td>
<td>X</td>
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<tr>
<td>5</td>
<td>For high current test condition of MV motor, RVSS must alternate 38 seconds on and 28 minutes off</td>
<td>Demonstration Functional</td>
<td>X</td>
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<tr>
<td>6</td>
<td>Control system counts starts and faults on three RVSSs</td>
<td>Demonstration Functional</td>
<td>X</td>
</tr>
<tr>
<td>7</td>
<td>Control system records warnings and faults on three RVSSs</td>
<td>Demonstration Functional</td>
<td>X</td>
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<tr>
<td>8</td>
<td>Timing for starts and stops is configurable via PLC</td>
<td>Demonstration Functional</td>
<td>X</td>
</tr>
</tbody>
</table>

HMI Concepts

- Concept A: Eaton XP Series
  - Software: Visual Designer or Galileo
  - Availability: In-stock (Engineering team)
  - Cost: No additional cost
- Concept B: Rockwell PanelView 5310
  - Software: Studio 5000 View Designer
  - Availability: 1-2-week lead time
  - Cost: $2186.71 (10" screen)
- Preferred Concept: Concept A
  - An Eaton product (Branding)
  - The Engineering team had one available to use
  - Visual Designer license available from Engineering
  - No additional cost to project

Final Design

- Block Diagram
- RSLogix Ladder Logic Example (>280 rungs)
- HMI Screens

Results

- RVSS Control System
- High Current Test Mode Screen
- High Current Mode Metering

Summary

- Project completed
- All testing has been performed
- Sponsor has observed the operation/functionality of the HMI and Ethernet communication
- Transitioning the control system to the Engineering team so they can start reliability testing
- Engineering team plans to start a RVSS 1350 times and monitor any warnings / faults

Team & Acknowledgements

- Joseph Foxx, BSECET
- Dylan Lavallee, BSECET
- Sponsor: Stan Simms, Eaton
- Mentor: Andy Ritenour, WCU