PROCON ELECTRONICS

PROLOGIC
VEHICLE DETECTION SYSTEM
USE CASE

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1. Introduction

This document serves to showcase how a Heavy Vehicle Detection system has been successfully deployed using Procon's Prologic Series Modules.

Our customer had a requirement for a standalone system to detect overlength vehicles at risk of a rollover at a curve and to trigger a warning message to the driver if their speed was determined to be too great for their class of vehicle. The vehicle speed was measured at two different locations 50m apart and a decision matrix was used to determine if the vehicle had slowed sufficiently or if they were at risk.

A custom Ladder logic project was written using our ProSoft software which was deployed on a PL101 PLC. The software was configured with a decision algorithm to determine what class and speed of vehicle it will display a warning sign for.

2. System Requirements

The customer required a system that uses inductive loops to measure vehicle classification and speed, in each of two adjacent lanes, at two locations 1 and 2. The speed measurement of the system needed to be capable of measuring heavy vehicle speeds to an accuracy of + 2.0 km/h.

The logic needed to be capable of making decisions on whether to activate its variable message sign (VMS) according to the criteria in figure 1. Different Thresholds were used for vehicle lengths 0-6m, 6-14.5m and 14.5m and above.

The system needed to be able to trigger the warning sign within 0.75 seconds of that vehicle passing the relevant speed measurement point.

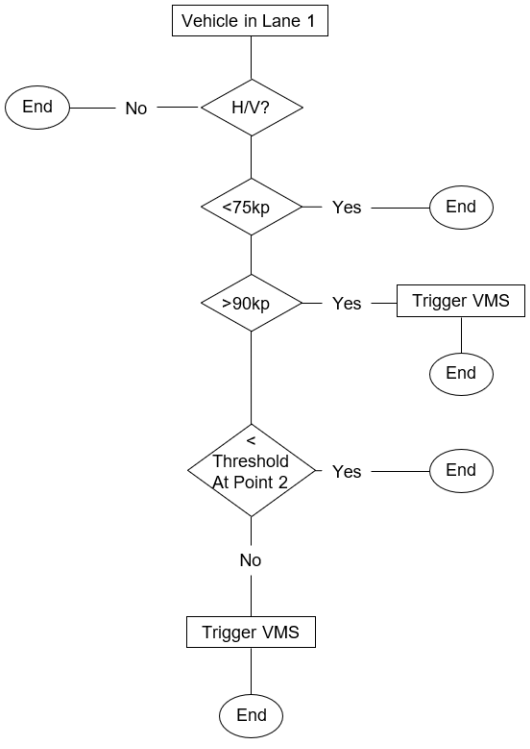

Figure 1. Decision Tree

3. System Overview

The System consists of the following modules, PL101 (PLC), PL424 (4 channel detector) and PL12RO (relay output module).

a. PL101 – PLC module. The PL101 is a programmable logic controller which is programmed using ladder logic via ProSoft PC programming software. The ladder logic program can be customized by the Installer to meet the functional requirements of the system.

The PL101 has an Ethernet communications port. Data can be accessed remotely using the Modbus TCP protocol or using a web browser. The PL101 also includes a high-speed backplane which communicates with the IO modules.

The Ethernet port must be configured with an IP address to be accessible on the network.

The ladder logic program is used to read the PL424 loop detectors and to obtain the speed and length of vehicles travelling over the loops. This information is then used to determine if a relay output on the PL12RO should be turned ON to activate the VMS.

b. PL424 – 4 channel detector modules. The PL424 detector is a high performance 4 channel detector and is setup by configuring parameters in the Modbus registers. Some of the configuration parameters are loop spacing, loop size, loop sensitivity, response times and presence times.

The PL424 uses loop multiplexing to prevent crosstalk between the 4 loops. The loops must be wired in a specific sequence to enable the measurement of the vehicles.

c. PL12RO – 12 relay output modules. This module provides an isolated potential free relay interface.

The System was configured to provide a digital output to the locally installed VMS *(VARIABLE MESSAGE SIGN)* to display a warning message for the drivers to slow down as they approach the curves.

3.1 System Architecture

The system connection configuration is represented in the below diagram.

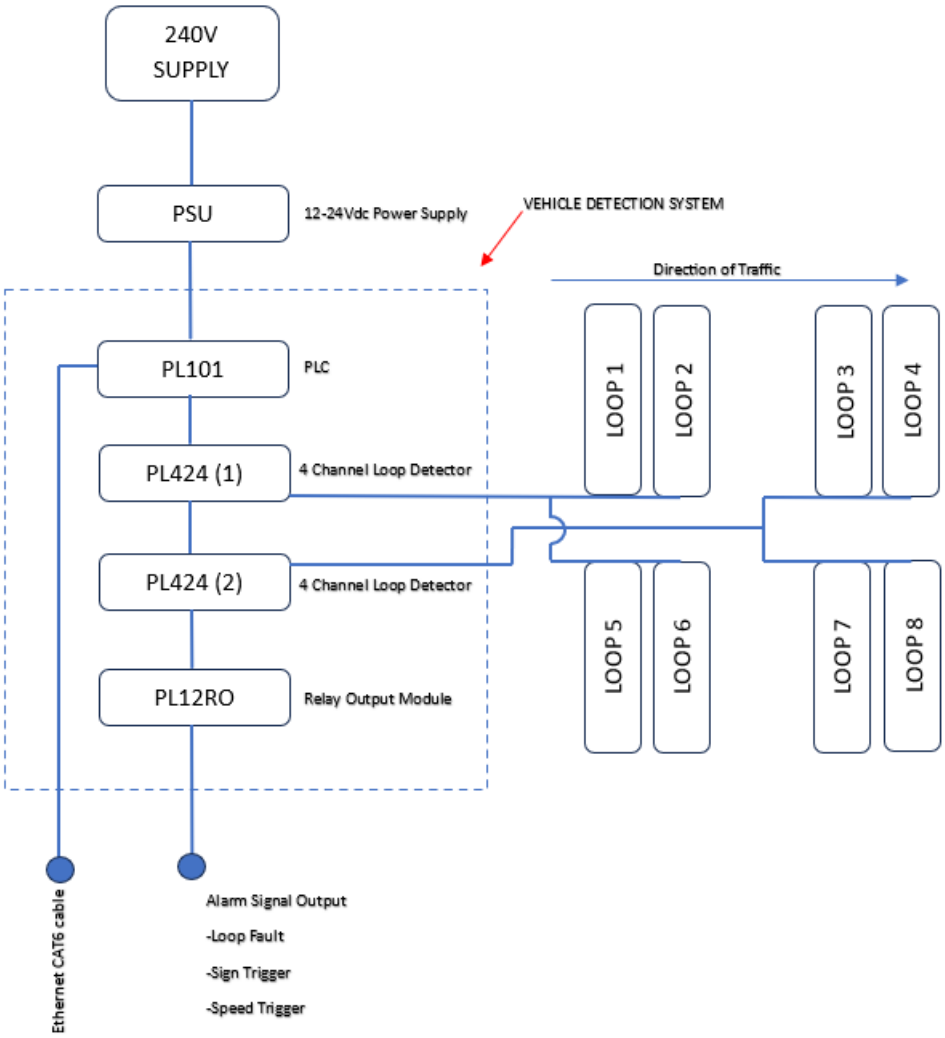

Figure 2. High Level Connection Diagram

System Outputs: The system has the following outputs.

- Ethernet Port: This port facilitates network connectivity to the controller.
- Alarm outputs: The system provides the following output alarms;
  - Loop Fault
  - Speed Triggered
  - Sign Trigger

The system consists of two PL424 4-channel loop detectors, a total of eight loops were required to cover the 2 lanes of traffic. The loops were arranged in pairs as shown in figure 3, this allowed for the length and speed to be measured after a vehicle had passed each loop pair.

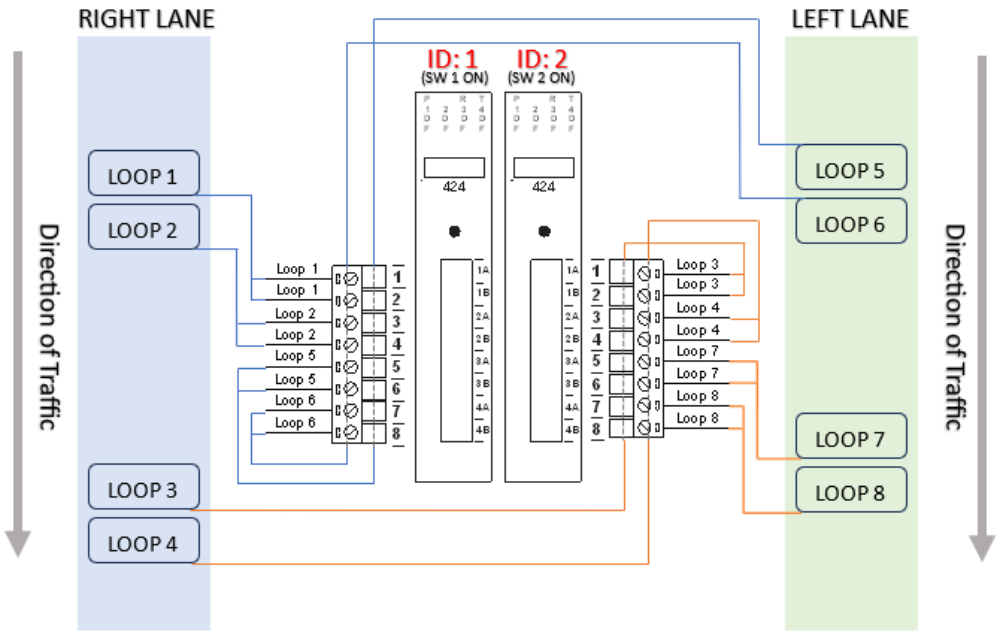

Figure 3. Loop Detector Connection

3.2 System Configuration

The PL424 Loop detectors can be configured using our IO-Studio software. Various Modbus registers can be read and modified such as loop spacing and width or sensitivity settings, you can also read the status of each loop and see the lengths and speeds of the vehicles passing each loop pair (see figures 4 & 5).

For more information and for help with configuration see **PL424 System Guide**.

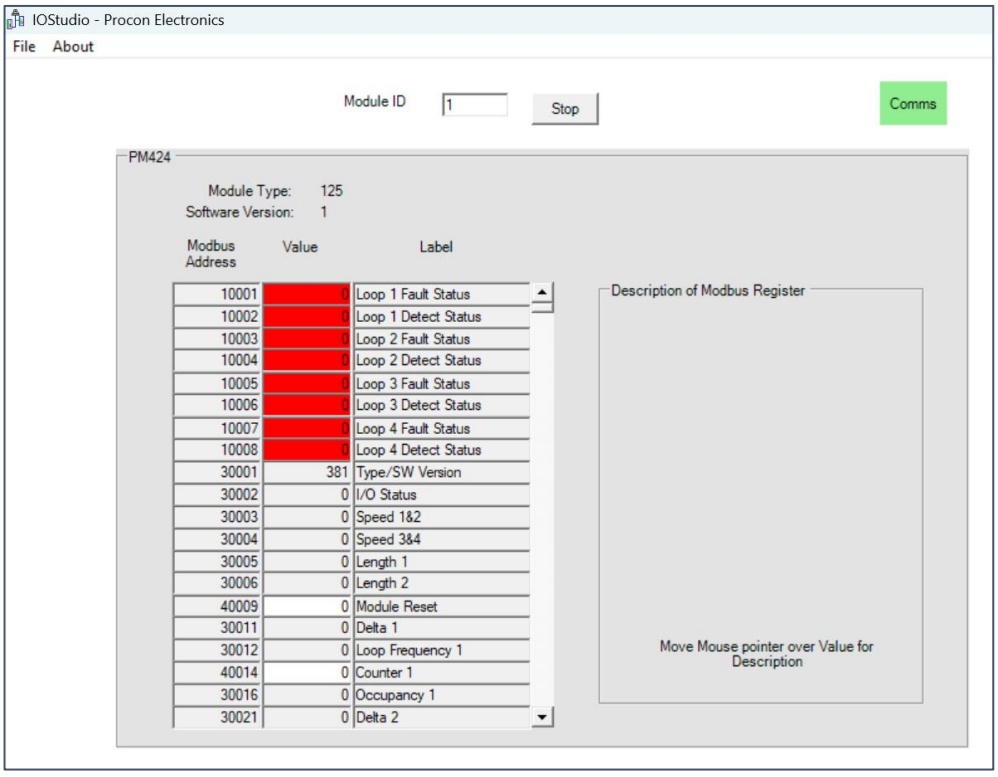

Figure 4. IOStudio Example PL424 Modbus register display

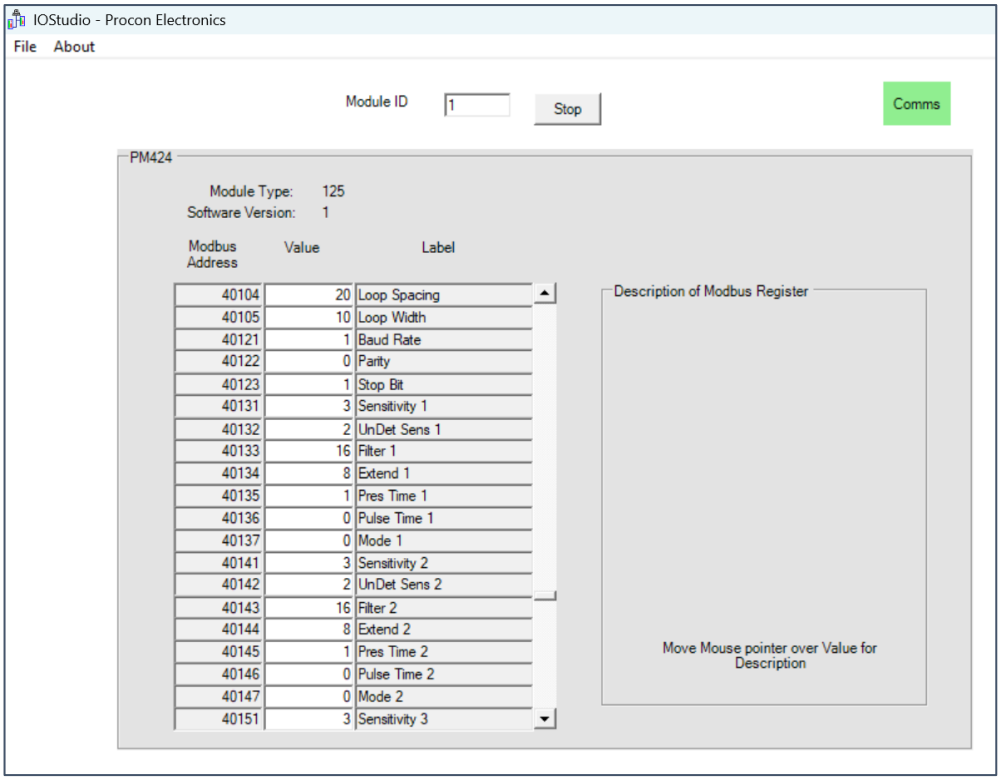

Figure 5. IOStudio example PL424 configuration registers

A custom webpage was written and uploaded to the PL101's inbuilt web server to display the speed and length of the last vehicle as well as the loop fault status. This allowed for remote monitoring of the system via a TCP network (Figure 6).

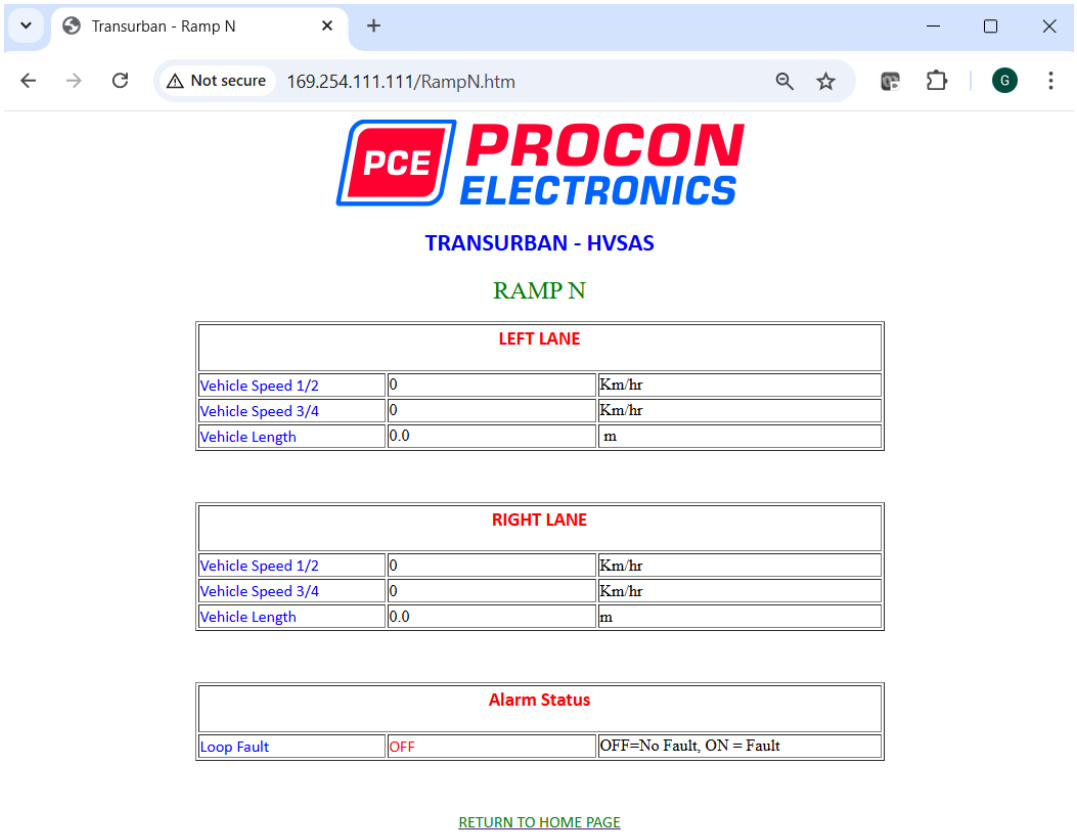

Figure 6. PL101 Ramp N Example Status Page

The completed system was successfully Installed and commissioned by the customers electrical contractors.

Figure 7. Completed Systems Installed in Roadside Cabinets