Industrial Instrumentation Applications eBook

Temperature
Monitoring
Metering
Network I/O
Remote I/O
Ethernet

Signal Conditioning & Networking Applications
How Acromag I/O Is Used
Acromag I/O is ideal for a broad range of monitoring and control operations where controllers communicate with instrumentation on the plant floor or in the field.

Acromag Advantages
- wide operating temperature ranges (up to -40 to 85°)
- high resistance to RFI, EMI, surges, electrical transients
- high-voltage isolation and built-in surge suppression
- easy to use and maintain
- high channel density to save space
- large inventory of stock items for same day shipping
- special designs and custom services available
- 2-year warranty available at no extra cost
- AS9100 and ISO 9001 certified quality management

Operation in All Locations
- safe zones and hazardous locations (Zone 2)
- explosion-proof locations (Zone 1)
- approvals from CE, UL/cUL, FM, CSA, ATEX, IECex

Controller Interface
- PLCs, PACs, controllers
- DCS distributed control systems
- PCs, embedded computers, SCADA systems
- operator interface terminals and remote terminal units

Continuous Sensors
- temperature
- flow
- speed
- position
- pressure
- level
- weight / load
- drives

Discrete Sensors and Switches
- dry contacts
- solid-state
- valves
- PNP, NPN
- proximity
- lights, horns

Actuators and Analytical Instruments
- drives, motors
- heaters, coolers
- displays, indicators
- power supplies
- valves, positioners
- recorders, analyzers
Application Note:
Ethernet I/O Simplifies Communication Between One PLC and Multiple Remote Locations

Defining the Problem:
A customer has multiple remote locations linked over an Ethernet network, each requiring discrete outputs. They all need to be sent the same communication signal at the same time.

System Requirements:
- All remote sites need to be controlled simultaneously from one central control room via Ethernet protocol

Implementing the Solution:
1. Set up Ethernet communication between master PLC device and the BusWorks XT discrete I/O module (XT1111).
2. Connect the XT1111 module and the remote site discrete I/O modules (989EN) to an Ethernet network.
3. Configure the XT module to use Acromag’s i2o peer-to-peer communication to replicate the PLC’s discrete signal to 8 other multiple locations by IP address.

Featured Products:
- 16-Channel Discrete I/O, Modbus/TCP XT1111-000
- 16-Channel Discrete I/O, with Counter/Timers 989EN-4016
- Software Interface Package XT-SIP

Why Acromag:
Our BusWorks XT Modbus/TCP remote I/O modules include a peer-to-peer feature known as i2o, where two or more slaves can talk to each other without requiring a master. With i2o communication, one signal from the PLC is split by the XT1111 module and sent to multiple locations. The XT1111 automatically re-transmits the discrete level to each 989EN module’s IP address, thus reproducing the status of the original PLC input.
Application Note: Record Building Water Usage with Remote Ethernet I/O

Defining the Problem:
Regulatory Compliance - To meet environmental standards by monitoring the usage and quality of water used by a school. System will record the temperature, pressure, and flow rate for reporting purposes.

System Requirements:
Field instruments used are pressure transmitters (PT), temperature sensors (T/C), and flowmeters (FM) with 4-20mA outputs. Remote I/O convert the analog inputs to Modbus TCP/IP on Ethernet which communicates with the Building Automation System (BAS) for data logging, trending, and histograms.

Implementing the Solution:
1. Configure the module using Acromag Windows® based software via USB connection.
2. Connect the field instruments and verify input status using the software test & polling feature.
3. Program the BAS with the remote I/O network parameters and Modbus registers.

Featured Products:
8 Differential Current Inputs, Modbus TCP/IP XT1211-000
Software Interface Package XT-SIP

Why Acromag:
Acromag provides a simple and cost-effective solution for interfacing data from a number of sensors to building control systems.
Application Note:
Reduce PLC Costs with Signal Conditioners

Defining the Problem:
A small scale bottling operation will be controlled by PLCs. Multiple sensors including conveyor speed (frequency), bearings temperature (RTD), liquid level (4–20mA) and tank pressure (4–20mA) will connect to the PLCs. An affordable solution to convert these various signals to one common signal type will allow procurement of one type of PLC input card instead of multiple cards for many different signals. Also, inserting low cost front-end devices will add extra protection against transients for the higher cost PLC hardware.

System Requirements:
MicroBlox™ are available in 4, 8 or 16 channel boards and include a wide variety of inputs for voltage, current, thermocouple, RTD, frequency and high-speed operation. Each input type has many fixed ranges to select from, no programming or configuration is necessary. These can be mounted on a DIN-rail or backpanel.

Implementing the Solution:
1. Select the microBlox fixed range model for each type of input. All models should have the same output, for example 0 to 5V.
2. Apply either 24V or 5V DC power to the back panel. MicroBlox modules are hot swappable and can be inserted or removed with power applied.
3. Follow the proper wiring practices as detailed in the user manual.
4. Validate the I/O before connection to the PLC input card.

Featured Products:
microBlox, uB45, uB34 and uB32

Why Acromag:
The microBlox is a low cost, high performance series with easy set up and installation. It can be mounted in a wide variety of applications from general purpose to hazardous locations.
Application Note:

Flow Totalization Utilizing Analog Ethernet I/O

Defining the Problem:
A municipality wants to monitor water usage and does not have the capability to scale analog data. They want an all-in-one solution which will read, scale, and totalize the inputs from the flow meters.

System Requirements:
Flow meters producing a DC current (±20mA, 0-20mA, 4-20mA) or voltage (±5V, ±10V) signal. Acromag remote I/O scales and totalizes the analog input to Modbus TCP/IP (units are definable) on a per second, per minute, or per hour basis. The 32-bit scaled data is automatically scaled and ready to be read by a PLC, HMI, or any other Modbus master.

Implementing the Solution:
1. Connect a PC to the 9xxEN, open an internet browser, assign the network parameters and configure the analog input for each channel along with scaling (zero, full scale, and units), time base (per second, per minute, or per hour), totalize options, and input averaging. Make sure to enable floating point support.
2. Simulate input signals and observe the scaled units and totalized value change in the 9xxEN’s test page.
3. The Modbus software/hardware periodically reads the scaled units and totalized value of each input from the 30000 Modbus input registers (or the 43000 holding registers). Two registers of 16-bit unsigned integer values yield a 32-bit totalized value.

Featured Products:
BusWorks Analog I/O modules:
- 958EN-4016: 16 Single-Ended Voltage Inputs
- 967EN-4008: 8 Differential Current Inputs
- 968EN-4008: 8 Differential Voltage Inputs
- 993EN-4016: 16 Single-Ended Current Inputs
- 994EN-4016: 16 Single-Ended Voltage Inputs

Notes:
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Why Acromag:
The unique totalizer feature on the BusWorks analog input Distributed I/O modules make them the perfect fit for this application. Real time application support and 60 years of experience makes Acromag the smart choice.
Application Note:
Minimizing Costs When Transmitting Data Over Cellular Networks

Defining the Problem:
Acromag has a peer-to-peer technology called i2o. It allows 2 or more modules to talk to each other and no network master or special software is required. I2o operates over any standard Ethernet media; Cat 5 or 6 copper, Fiber Optics, Radios or via Cellular. When operating over a cellular network, it is important to minimize the connection time and amount of data since cellular service providers charge by the amount of data being transmitted.

System Requirements:
The application below shows an XT1211-000 module with 8 differential current inputs sampling a 4-20mA signal from a field transmitter and sending the data using i2o to an XT1531-000 with 4 current outputs. The cellular modems at each end are transparent to the Acromag I/O and transmit the data over the network.

Implementing the Solution:
On the i2o mapping page, the XT1211 input module is configured for each input channel. A target IP Address and a Modbus Register (output channel) is selected.

There are 3 important features in the XT’s that allow i2o to be utilized over cellular networks to reduce costs.
1. Update Time – it can be any setting from 5 to 65535 seconds. This is a periodic transmission to update the output status based on the input to output scaling.
2. Keep Target Sockets Open – if this box is not checked, then during the i2o messaging, a socket will be opened, data is exchanged, then the socket closes.
3. Percentage Change – this is the difference in input span between the present input measurement and its last measurement when an i2o message was sent. If the input changes by the percentage change threshold or greater, an i2o message will be sent immediately.

Featured Products:
- **XT1211-000**: 8-channel differential analog current input module
- **XT1531-000**: 4-channel analog current output, 4-channel digital I/O module, Modbus/TCP and i2o protocol.

Notes:
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Why Acromag:
Decades of reliable service and proven technologies offers high confidence in selecting Acromag for general purpose to critical applications. With Acromag’s Busworks XT products, a versatile family supports a variety of network protocols such as Modbus TCP/IP, Ethernet/IP, Profinet and peer-to-peer i2o.
Application Note:

Metering Project - Managing Energy Usage with Ethernet I/O

Defining the Problem:
The university power plant produces both electricity and steam for the campus. The chilled water and steam condensate need to be monitored and recorded by totalizing the pulsed outputs from magnetic, positive displacement, and vortex flowmeters. The volumetric flow rate, along with the liquid heat loss from the steam-to-heat transfer process, is used in steam cost calculations to better manage the energy demand across the campus.

System Requirements:
- The university requires consistent installations that can be duplicated across the campus.
- Communication with the data historian software, eDNA, via modbus TCP/IP over the campus Ethernet network.

Implementing the Solution:
1. Connect a PC to the 989EN-4016, open an internet browser, assign the network parameters and configure the discrete inputs as counters to totalize the flowmeter pulse outputs.
2. Simulate input pulses and observe the count increase in the 989EN-4016 counter test page.
3. The eDNA software periodically reads the current count value of each input from the 30,000 modbus input registers or the 43,000 holding registers. Two registers of 16-bit unsigned integer values yield a 32 bit totalized count value.

Featured Products:
BusWorks Discrete I/O 989EN-4016

Notes:
989EN-4016 modules have 16 discrete I/O where each channel can be an input or an output. Optionally, this model allows the first 8 channels to be used as non-volatile pulse counters with the remaining 8 channels available as local output alarms for their associated input counters.

Why Acromag:
The 989EN-4016 module is an affordable, versatile discrete and counter/alarm remote I/O. With fast installations and Class 1 Div 2 ratings, duplication across the campus was easily achieved. Additionally, the campus data historian software was quickly programmed to communicate with the 989EN solution.
Application Note: Monitoring Stator Temperatures with Remote Profibus I/O

Defining the Problem:
A Power Plant has Hydroelectric Generators with 10 ohm copper 3 wire RTDs embedded in the stator motor windings. The RTDs are far away from a PLC in the control room. The long distance is picking up noise that is interfering with their measurements.

System Requirements:
A Siemens PLC can communicate using Profibus DP / RS485. Install Remote Profibus I/O, Class 1 Div 2 approved, close to the RTDs. Shorter RTDs, with proper shields and grounding techniques, will significantly reduce the noise for more accurate measurements.

Implementing the Solution:
1. Select a Slave Address and configure the 966PB-2006 parameters using a GSD file. Download the file into the PLC.
2. Wire the RTDs, power and Earth Ground.
3. Program the PLC for 50 to 80°C normal RTD temperature ranges.
4. Validate the measurements.

Featured Products:
966PB-2006

Why Acromag:
The Profibus Remote I/O are PNO-certified for interoperability with Profibus equipment ensuring ease of set up and operation. The products are fully isolated and engineered with a Siemens SPC3 intelligent ASIC providing reliable Profibus communications.
Application Note:
Remote Monitoring of Wind Turbines

Defining the Problem:
A large utility company has a requirement to monitor multiple data points on a wind turbine. The turbine head is 300 feet above the ground. The data must be sent to a ground station, saved to a data logger, and displayed on a Honeywell chart recorder. The data will then be downloaded from a remote data collection site.

System Requirements:
At the wind turbine head, several data collection points (both discrete and analog) must be acquired and sent to the ground station using Modbus TCP/IP protocol. The ground station is equipped with a Honeywell chart recorder that also serves as the Modbus master. The system will use Honeywell Ethernet radio links to send the information from the wind turbine head to the ground station, thereby eliminating the need for long Ethernet cable runs.

Implementing the Solution:
1. At the ground station, connect the Honeywell chart recorder to the Ethernet port of one of the Honeywell radio transceivers. Configure the radio transceiver as an Access Point, and set up the chart recorder as a Modbus TCP/IP Master. Configure the chart recorder to communicate to the XT1121-000 and 967EN-4008 Acromag Modbus slave modules.
2. At the wind turbine head, configure the radio transceiver as a Client (slave) device, and connect the Ethernet port to one of the ports on a 900EN-S005 unmanaged switch. Connect the XT1121-000 discrete I/O module and the 967EN-4008 Analog current input module to two of the other ports on the 900EN-S005 switch.
3. Connect the discrete signals to the XT1121-000 inputs, and the analog current signals to the 967EN-4008 inputs.

Featured Products:

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>XT1121-000</td>
<td>Modbus Discrete I/O Module</td>
</tr>
<tr>
<td>967EN-4008</td>
<td>Modbus Analog Current Input Module</td>
</tr>
<tr>
<td>900EN-S005</td>
<td>Unmanaged Ethernet Switch</td>
</tr>
</tbody>
</table>

Why Acromag:
The utility company has used Acromag products in their power plant monitoring and control systems in the past, so they are familiar with the equipment and trust in its accuracy and reliability.
Application Note:
Cellular Telemetry For Remote Power Metering

Defining the Problem:
At a large military complex, current reporting of electrical usage is transmitted from Substations directly to the Electric Utility only. The Public Works division onsite would like to establish a data collection system of the power usage for energy auditing and optimizing operations. Due to obstructions and installation restrictions, the telemetry system would operate over a 3G/4G LTE cellular network using Digi WR21 Cell Routers.

System Requirements:
At the substations, the Electric Power Meters’ pulse outputs to the Utility are re-transmitted to the data collection system via Electrical Isolation Relays. A relay output, 1 pulse = 1 kWh, is connected to an input channel on the 989EN-4016. The current totalized count is converted to Modbus TCP/IP and connected to the Ethernet port on the Cell Router.

Implementing the Solution:
1. Set up a Private APN with a Cell Carrier to reserve internally customer supplied IP Addresses.
2. Configure the Cell Router IP Address using a reserved IP Address. For example, 10.0.0.20.
3. In the Cell Router, configure the Ethernet Port Forward with the IP Address of the device connected to its Ethernet port, either the 989EN-4016 in the field or the Server IP Address in the Control Room. The Server software would send a Modbus TCP/IP message to the IP Address of the Cell Router that would forward it to the 989EN-4016.
4. For multiple field locations, the Cell Router at each site can have a unique IP Address (10.0.0.21, 10.0.0.22, etc), but every Acromag 989EN-4016 connected to it can have the same IP Address (192.168.1.1). This standardizes the set up and allows each Acromag unit to be configured the same way.
5. For the data collection, the Server can request the totalized count from the 989EN-4016 at whatever time interval is desired from hours to days. To do this, program the Server application software to Open and Close a Modbus socket with each message exchange.

Featured Products:
989EN-4016, 16 DIO / up to 8 Counters

Why Acromag:
This military site has standardized on Acromag Ethernet Remote I/O as previous installations have been very reliable, easy to implement and highly cost effective.
Application Note:
Voltage Measurement of Multiple Cascaded Cells

Defining the Problem:
A proper method is needed to measure each cell voltage within a series of cells and withstand high nominal or open circuit voltages. The maximum series voltage is greater than the common-mode range of the connected instruments. This requires isolated floating inputs to measure each cell voltage. Channel-to-channel isolation will extend the common-mode range to the maximum input/output isolation rating. Typical applications include cascaded solar cells, fuel cells and batteries.

System Requirements:
The Acromag microBlox™ products have a maximum continuous input/output isolation voltage of 350V DC. This would be the limit for the maximum series voltage of the cascaded cells. Each cell voltage can be elevated anywhere within the 0 – 350V DC window. Use shielded wiring and minimize the distance between the cells and the microBlox. This will reduce the chances of developing electrical noise and improve measurement accuracy.

Implementing the Solution:
1. The Bluetooth enabled uB41-B model supports input ranges from ±1 up to ±60V DC with 1KHz bandwidth.
2. Configure each module using the Acromag Agility mobile application for an Android or iOS device.
3. Follow the proper wiring practices as detailed in the user manual. Connect earth ground to the minus lead of the first cell in the series (lowest voltage).
4. Test the system connections using the built-in Polling feature in the mobile app. The app will show a digital reading or display a Trending Graph.

Why Acromag:
The microBlox have CE marking and ATEX, UL, cUL ratings for Class 1 Div 2 hazardous locations. With an over-molded housing, channel-to-channel isolation, wide operating temperature (–40 °C to 80 °C), 4g vibration and 25g shock, the microBlox can be mounted in the most severe installations.

Featured Products:
- microBlox
- Agility™ Mobile App for communicating with Android or iOS devices via Bluetooth.
Application Note:
Monitoring Genset Systems in Standby Mode to Ensure Reliable Backup Power

Defining the Problem:
Gensets typically include control systems that monitor and control the engine functions. Primary functions are start/stop control, engine speed, operating parameters, and protection/shutdown. As back-up systems, gensets may operate less than 100 hours per year. While in the standby mode, it is critical to monitor and maintain the genset system to prevent a failure-to-start condition.

System Requirements:
During standby mode, the battery voltage, fuel level, block heater and transfer switch operation must be monitored. With most gensets installed in remote locations, a suitable method to transmit conditions during standby mode back to an instrument shop is required. Remote acquisition over an Ethernet LAN is preferred for short to medium distances. For longer distances, cellular, satellite or cloud services can be required. Analog and alarm status should be displayed for continuous monitoring in the instrument shop.

Implementing the Solution:
1. The microBlox® uB modules accept many types of inputs including battery voltage, low fuel level (4-20mA), heater temp (RTD) and genset ON/OFF (switched voltage).
2. With configuration via Bluetooth® technology, each uB can be set up as a transmitter (0 to 5V output) or an alarm (0 or 5V output).
3. Using i2o: In the field, the XT1221-000 has 8 VI. At the shop, the XT1541-000 has 8 VO.
4. For i2o, map each VI to a VO. Modbus TCP/IP messages are sent over any Ethernet media.

Featured Products:
- microBlox® Configured via Bluetooth® technology:
  - UB31-B, UB32-B, UB34-B
- Ethernet i2o: XT1221-000, XT1541-000
- Acromag Agility™ Mobile App

Notes:
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Why Acromag:
Acromag offers versatile signal conditioners providing transmitter or alarm outputs as well as easy to set up and fast configuration using the Agility™ mobile application. MicroBlox® uB modules offer high performance with wide temperature operation for outdoor applications and vibration/shock ratings for engine monitoring.

Tel 248-295-0880  Fax 248-624-9234  sales@acromag.com  www.acromag.com  30765 Wixom Rd, Wixom, MI 48393 USA

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Application Note:
Retransmitting and Isolating 4-20mA Signals from Remotely-Mounted 3-Wire Gas Detection Sensors

Defining the Problem:
Typically, signals from 3-wire remote sensors monitoring combustible and toxic gases are transmitted directly to the remote gas monitor or controller. However, there are cases when it is desirable to send the signal to more than one destination. This can either be accomplished by retransmitting the existing signal to additional locations or by completely isolating the signal and then sending it to multiple locations.

System Requirements:
A 3-wire remotely-mounted gas detection sensor which transmits a 4-20mA signal. It is important to note that a 3-wire loop is where the sensor and receiver share a ground connection with power, and the sensor uses a third wire to connect to power outside the current loop. You can use either 2-wire (or 4-wire) isolators to retransmit the loop to a 2-wire (or 4-wire) splitter for complete isolation of the output(s).

Implementing the Solution:
1. Acromag’s signal isolators will take a 4-20mA field input and provide isolated 4-20mA output signals. Each channel (splitter units) operates independently and is isolated from the others to prevent interaction between channels.

2. 600T Series isolators and splitters are field adjustable with zero and span trim pots located on the front of the units. TT Series isolators are factory calibrated for 4-20mA in-out. However, re-calibration can be preformed using either our windows software or the Acromag Agility™ mobile application for Android®.

3. Follow the proper wiring practices as detailed in the user manual. Connect earth ground as indicated.

Featured Products:
2-wire Acromag Isolators: 651T-0600, TT236-0600
4-wire Acromag Isolators: 631T-0500 (DC Power), 631T-0100 (AC Power), TT336-0700
2-wire AcromagSplitters: 653T-0600, SP236-0600
4-wire Acromag Splitters: 633T-0500 (DC Power), 633T-0100 (AC Power), SP336-0700

Why Acromag:
Gas detectors are usually installed in hazardous areas. All of these isolators and splitters are designed for UL/cUL Class 1 Division 2 safety rating for that type of environment. All of these transmitters default configuration is for 4 to 20 mA input and output so installation is simple and with up to 1500V of isolation the protection is excellent.

Notes:
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Application Note:
Thermocouple Transmitters Monitor Temperatures in Paint Systems

Defining the Problem:
The area around an auto manufacturer's paint curing ovens is at elevated temperatures affecting the performance of locally installed instrumentation. Placing Signal Conditioners rated for high operating temperatures near the ovens allows the PLC controlling the process to be mounted in a lower temperature area. The Signal Conditioner will convert Thermocouples to 4–20mA outputs. Running current loops over long distances instead of Thermocouples reduces costs and minimizes the potential for measurement errors due to electrical noise.

System Requirements:
An Isolated Thermocouple to Current Signal Conditioner with a high operating temperature, Acromag model TT333-0700, that is rated for −40 to 80°C. The TT333-0700 output powers the loop to the PLC. Also, the plant has standardized on PLCs with less expensive current input cards over temperature input cards. This makes installations and programming throughout the plant more consistent.

Implementing the Solution:
1. Program the TT333-0700 with software from either a Windows based computer or with the Acromag Agility™ Config Tool. This programming application for Android devices is available at no charge from the Google Play Store.
2. Connect the shorter Thermocouples to the locally installed Acromag Transmitters and run 4-20mA copper wires from the Transmitters to the PLC panel.

Featured Products:
Loop powered Isolated Thermocouple Transmitters TT333-0700
Programming options: TTC-SIP software kit or Android based Acromag Agility™ Config Tool application downloaded from the Google Play Store

Why Acromag:
The installation meets manufacturer's process standards while delivering high performance with simple and fast set-ups.
Application Note:  
Signal Conditioners with Built-in Data Logging

Defining the Problem:
A manufacturer of sensors and electrical controls does burn-in testing for troubleshooting purposes. A test system that can operate with either an Android® or iOS® mobile device is preferred.

System Requirements:
The application requires a product that can monitor a variety of signals, provide analog or limit alarm outputs and have data logging capability. The test duration could be several minutes to a day and the results need to be saved in an Excel format.

Implementing the Solution:
1. Download the Acromag Agility™ mobile app from the Google Play™ store or Apple® App Store®.
2. Open the Agility mobile app and go to the configuration screen. Enable the alarm output and enter the set point and deadband. When the set point is reached, this output will be 5V or 0V, normal or reverse acting. It can drive an external relay or feed a TTL input.
3. Navigate to the diagnostic screen where the trending feature is accessed. There are two types of indicators available, a digital display or graphical representation.
4. Enter a polling period from 0.5 sec to 60 sec. With a capacity of 5000 samples, the duration of saved data can be up to 83 hours. This is a moving average where sample # 5001 is added to the total and # 1 is dropped off.
5. Tap save data, then tap start polling. The Agility app automatically creates an Acromag folder in the mobile device and saves the input values to a spreadsheet in that folder. The data then can be emailed by tapping the share button.

Featured Products:
microBlox™ Signal Conditioners
Voltage, current, RTD, thermocouple, frequency and high speed models.

Acromag Agility™ App for Android
Free from the Google Play™ store.

Acromag Agility™ App for iOS
Free from Apple® iTunes®.

Why Acromag:
The microBlox™ signal conditioners provide an innovative, accurate and easy solution that combines signal conditioning functions, transmitter or alarm, and data logging all in one design. Choose from fixed range models or Bluetooth® wireless technology with user-configurable I/O. The miniature hot swappable modules offer the ability to set custom I/O ranges and alarm functions from a smartphone or tablet.
Application Note:
Optimizing Pump Performance with a Panel PC, HMI and Ethernet I/O

Defining the Problem:
Pumps are integral to a wide variety of industries and processes. Monitoring pump performance can lower operating costs, reduce downtime, schedule maintenance and improve process throughput. An automation system is needed with local displaying of real-time parameters, analytical calculations, data storage, trending, set warning and shutdown alarms, issue event driven messages and network communications. Additionally, with vibration monitoring and proactive maintenance, machine condition monitoring can be implemented.

System Requirements:
• An industrial panel PC with Windows® or Linux® OS and a suitable HMI for distributed control and process automation.
• Ethernet I/O to interface the pump sensors with the HMI.

Converting pump analog signals to Ethernet facilitates an easy connection to the PC, simplifies wiring and minimizes electrical noise in harsh environments.

Implementing the Solution:
1. To optimize the pump performance, add the following sensors to monitor:
   • Electrical power: current transformer (CT) with 4-20mA output
   • Flowrate: flowmeter with 4-20mA output
   • Suction pressure at the inlet side: pressure transmitter with 4-20mA output
   • Discharge pressure at the output side: pressure transmitter with 4-20mA output
   • Pump specific speed: (calculated from the shaft RPM, flowrate and the head) Hall Effect speed sensor with frequency output to signal conditioner TT239-0600, converting to 4-20mA

2. An Ethernet connection from the XT1211-000 to the Panel PC for Modbus TCP/IP communications. The HMI will Poll the XT and read back the pump parameters to display and perform calculations.

3. Add a device driver to the PC OS:
   • For a PC running Windows®: add a Modbus TCP/IP ActiveX Control or .NET Control
   • For a PC running Linux®: add an Ethernet Modbus C Library utility to build Modbus TCP/IP commands

Why Acromag:
The Acromag Ethernet I/O interfaces directly with many HMI programs making set up and communications simple and reliable. With 4G vibration and 25G shock ratings, Class 1 Div 2 and ATEX Zone 2 Approvals, these products can be mounted near motors and Hazardous Locations for added flexibility.

Featured Products:
XT1211-000: 8-Channel Differential Analog Current Input
TT239-0600: Transmitter, Frequency/Pulse/PWM Input, 12-32V DC Loop/Local Power

Notes:
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Application Note:
Networking Remote Gas Detectors with Ethernet I/O

Defining the Problem:
In a wastewater treatment plant, remotely mounted gas detectors monitoring Methane CH4 (ceiling), Oxygen O2 (6 ft high) and Hydrogen Sulfide H2S (floor) have analog outputs. The gas levels need to be saved to chart recorders located in a control room a long distance away in the plant. To save on the cost of running copper twisted pair wires, we would like to network the analog outputs for transmission over the Ethernet infrastructure.

System Requirements:
A ControlLogix PLC in the control room can communicate using Ethernet/IP protocol. The Ethernet remote I/O will accept 4 – 20mA inputs from the gas detectors and convert to Ethernet/IP. The PLC will output 4 – 20mA to the chart recorders nearby. Also, the hazardous area requires Class 1 Div 2 instruments.

Implementing the Solution:
1. In the USB configured XT software, set the IP address, network parameters and input scaling.
2. Configure the PLC with Acromag’s ControlLogix application note. This document includes instructions for RSLogix 5000 and RSLinx.
3. With the XT1212-000 software and inputs wired, poll the module and check the measurements using the test page.
4. Validate the Ethernet/IP communications with an Ethernet connection between the XT and the PLC.

Why Acromag:
The XT series of Remote I/O has Class 1 Div 2 ratings for hazardous locations where the Gas Detectors are installed. With simple software configuration and an application note detailing the PLC configuration, installation and testing are easily accomplished.
Application Note:
Splitting Gas Detector Outputs for Monitoring & Process Control

Defining the Problem:
At a remote wastewater pumping station, Methane (CH4) and Hydrogen Sulfide (H2S) are monitored with MSA X5000 Gas Monitors. The 4-20mA outputs must be split to a GasCard XL Controller and Emerson Ovation I/O. The Controller has powered inputs but the Ovation inputs require an external power source. Typical splitters have 2 outputs that are identically powered: either both are sinking or both are sourcing. We need a splitter with independent outputs to interface with our instrumentation.

System Requirements:
The SP family of splitters can be powered by any low voltage DC supply, 9-32V. Loop powered models include 2 independent and isolated outputs that can be wired as either sinking or sourcing to the loads. USB configuration via the Acromag Agility mobile application for Android devices or with a Windows PC.

Implementing the Solution:
1. Download the Agillity mobile application from the Google Play Store or Windows software from Acromag.
2. Configure the module. Scale the input and output ranges independently for normal or reverse acting outputs. Add programmable output clamps or Namur compliant limits if needed.
3. Wire each output for sinking or sourcing power to the load.
4. Review manual to apply earth ground for best practice wiring.

Why Acromag:
One splitter module eliminates having two separate modules that would increase the wiring and cost. Additionally, the SP products have UL/cUL Class 1 Div 2 & ATEX Zone 2 approvals, 4G Vibration, 25G shock ratings and can operate from -40 to 80°C temperatures.