Remote I/O – an overview

John Hayward
Product Manager
Measurement & Control
Agenda

• What is remote I/O?
• Choosing your hardware
  – Distributed I/O
  – Modular I/O
• What other features can be included?
  – Intelligent I/O
  – Programmable Automation Controllers
What is remote I/O

• I/O = input / output
  – Monitor and control external signals at a distance “x” from the controller or PC
What is remote I/O?

- Analog I/O signals
  - Pressure, temperature, load cell, volts, mA,
  - pulse
- Example - engine test
  - Water and oil temperature
  - Engine speed
  - Inlet pressure
  - Exhaust flow
  - CO₂ emission
What is remote I/O?

• Digital signals
  – Switch / relay, alarm signal, on/off
• Car park security
  – Camera
  – PIR sensor
  – PC
  – Barrier control
Why use remote I/O?

• Process control / automation
  – PC based SCADA
  – Expand PLC based system
  – Reduce signal conditioning
    • T/C, RTD, strain gauge etc

• Building Management / Access
  – Remote control of barriers and sensors
  – Reduce wiring for upgrades
PC based remote I/O solutions

- Data acquisition outside the PC
- Built in signal conditioning
- Isolation
- Screw terminals
- Ideal for process control and automation
Choosing your hardware

• What is distributed I/O?
  – ADAM4000, ADAM-6000,
  – NuDAM,
  – Acromag
  – Moxa ioLogik E2210

• What is modular I/O?
  – ADAM-5000
  – Moxa ioLogik 4000/ 4200
Distributed I/O – RS485 serial

- Connect up to 256 devices to 1 port
- Communicates up to 1.25km
- RS485, RS232 or USB
- Master/Slave (polling)

<table>
<thead>
<tr>
<th>Model</th>
<th>Protocol</th>
<th>Cost</th>
<th>Warranty</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAM-4000 series</td>
<td>Modbus/ASCII</td>
<td>Low cost</td>
<td>2 yr</td>
</tr>
<tr>
<td>NuDAM series</td>
<td>ASCII</td>
<td>Low cost</td>
<td>2 yr</td>
</tr>
<tr>
<td>Moxa R2110_R2140</td>
<td>Modbus</td>
<td>Medium range</td>
<td>2 yr</td>
</tr>
<tr>
<td>Acromag 900MB /</td>
<td>Modbus/ASCII</td>
<td>High</td>
<td></td>
</tr>
</tbody>
</table>
Distributed I/O - Ethernet

- Point to point connection
  - Copper: 100m
  - Fibre: 120km
  - Wireless: 50m to 14km
- Communicate world-wide – multiple masters
- Redundant communication network
- Additional functionality

<table>
<thead>
<tr>
<th>Model</th>
<th>Protocol</th>
<th>Cost</th>
<th>Warranty</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADAM-6000 series</td>
<td>Modbus TCP/IP</td>
<td>Low cost</td>
<td>2 yr</td>
</tr>
<tr>
<td>Moxa E2210..E2262</td>
<td>Modbus TCP/IP</td>
<td>Medium range</td>
<td>2 yr</td>
</tr>
<tr>
<td>Acromag 900EN</td>
<td>Modbus TCP &amp; Ethernet IP</td>
<td>High performance</td>
<td>5 yr</td>
</tr>
</tbody>
</table>

Amplicon.com
IT and Instrumentation for industry

Sales: +44 (0) 1273 570 220  Website: www.amplicon.com  Email: sales@amplicon.com
Remote I/O selection

- How many channels?
- What range limits, accuracy, reliability?
- What do you want to measure or control?
  - Volts (0-10Vdc), 4-20mA
  - Temperature (T/C, RTD, thermistor?)
  - Strain gauge / Load cell
  - Frequency / pulse counter
  - Status / switch / relay
Choosing your hardware

• What is distributed I/O?
  – ADAM4000, ADAM-6000,
  – NuDAM,
  – Acromag
  – Moxa ioLogik E2210

• What is modular I/O?
  – ADAM-5000
  – Moxa ioLogik 4000/ 4200
Advantech ADAM-5000 series modular I/O

- ADAM-5000/485 (4 or 8 slot) or
- ADAM-5000/TCP (4 or 8 slot)

- 8 analog inputs (ADAM-5017)
- 7 temperature inputs (ADAM-5018)
- 4 analog outputs (ADAM-5024)
- Digital I/O, relays (ADAM-505x)
Moxa ioLogik 4000 series, modular I/O

- Ethernet or RS485/ RS232 communications
- Up to 32 I/O modules
- 124 Analog inputs (V, I, Temp.)
- 512 digital I/O lines
- Built-in power and isolation

Modbus/TCP
Ethernet
Modbus/RTU
RS-485 / 232

Amplicon.com
IT and Instrumentation for industry

Sales: +44 (0) 1273 570 220  Website: www.amplicon.com  Email: sales@amplicon.com
• What is remote I/O?

• Choosing hardware design
  – Distributed I/O
  – Modular I/O

• What other features can be included?
  – Intelligent I/O
  – Programmable Automation Controllers
Intelligent I/O devices

- Peer-to-peer communications
  - No need for controller (PC)

- On-board logic control
  - PLC?

- Active messaging
  - Fast communications and reduced network traffic
Additional features

• Peer-to-peer communications
  – No need for controller (PC)
• On-board logic control
  – PLC?
• Active messaging
  – Fast communications and reduced traffic
Machine Room Monitoring & Control with Click&Go logic

Local control based on temperature
- Turn on/off Alarm Buzzer

Local control based on temperature
- Turn on/off exhaust fan

Remote monitoring and alarm system (over temperature alarm)
- Active Message
- E-mail
- SNMP trap

Best solution for remote site monitoring! Saving your cost!
Click&Go software V2.0
Additional features

• Peer-to-peer communications
  – No need for controller (PC)

• On-board logic control
  – PLC?

• Active I/O
  – Instant event reporting by TCP/UDP
  – e-mail
  – SNMP read/ write/ trap
  – Visual basic, C++, MS.Net
  – (Fast communications and reduced traffic)
How does Active Messaging benefit users?

- **Active Ethernet I/O**
- **Active – Saving Bandwidth**
- **Surveillance Software**
- **Click&Go** Reduce False Alarm
- **Tilt sensor**
- **CGI-Command** to build up front-end alliance with IP camera
Strength of Active Ethernet I/O

- Real-time active I/O event report – Saving Bandwidth
- Click & Go logic – Reduce false alarms
- Simple IF, THEN, ELSE control logic reduce programming effort
- CGI command is supported in Click&Go2.0
Additional features

• Peer-to-peer communications
  – No need for controller (PC)
• Active messaging
  – Fast communications and reduced traffic
• Local logic control
  – Can it replace a PLC?

<table>
<thead>
<tr>
<th></th>
<th>Peer-to-peer</th>
<th>On-board logic</th>
<th>Active messaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moxa ioLogik</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ADAM-6000</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Moxa Active OPC Server

SCADA Software

Standard Interface

OPC protocol

Active OPC Server

Server Internal

Network

Still can save

ioLogik Active Ethernet I/O

Standard Protocol
Modbus/TCP

Moxa Protocol
(Active Message)

Amplicon.com
IT and Instrumentation for industry
Sales: +44 (0) 1273 570 220  Website: www.amplicon.com  Email: sales@amplicon.com
Product Positioning

Remote I/O                  Intelligent I/O               PAC

Advantech
ADAM-5510KW
ADAM-5510TCP
-IEC61131
-C

Advantech
ADAM-5550KW/CE
-IEC61131
-.Net

MOXA
NA-4010
-Remote I/O with Modbus

MOXA
ioLogik E4200

Advantech
ADAM-5000/TCP
-Remote I/O Modbus

Advantech
ADAM-5550KW/CE
-IEC61131
-.Net

Amplicon.com
IT and Instrumentation for industry

Sales: +44 (0) 1273 570 220  Website: www.amplicon.com  Email: sales@amplicon.com
What is a PAC?

In 2001 Automation Research Corporation (ARC) presented “Programmable Automation Controllers Worldwide Outlook” Study.
PLC based control

- Structures:
  - Command or Logic gateway
  - Micro Processor
  - PLC

- Pros: The decode action by hardware, the speed of execution is much higher
- Cons: Can’t do the complex operation or commands
- Focussed on high speed logic control (Digital)
PC-based control

• Structure:

• Pros: Can make complex programs or operation (analog I/O), SCADA etc

• Cons: The Active speed is slower than PLC
What is a PAC?

• High speed DAQ, motion control, digital I/O
• Deterministic I/O at 1 ms
• ProconOS (real-time) + Windows CE
• IEC 61131-3 five standard programming language
• VGA graphics, USB
• Modbus/RTU Master and Modbus/TCP (Server/Client)
• More reliable - no fans or hard disk
On-board intelligence

- ADAM-5000 (TCP or RS485)
  - Modular distributed I/O (dumb slave)
  - Analog input/output
  - Temperature
  - Digital I/O
- ADAM-5510
  - Programmable controller (soft logic)
- ADAM-5550 PAC
  - Programmable Automation Controller