Remote monitoring & control solutions for cathodic protection rectifier
FF-AUTOMATION

- Finnish automation manufacturer company
- Focused on remote monitoring & control solutions
- AutoLog® RTU Series
- AutoLog® designer and manufacturer since 1976

RTU = Remote Terminal Unit, SCADA = Supervision Control And Data Acquisition ~ Control Room Application

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AutoLog RTU & SCADA REFERENCES

- **Saudi Aramco**: Remote CP Rectifiers Monitoring for Nation wide Oil & Gas Pipeline Cathodic Protection System

- **Iranian Oil Field Company (NIOC)**: Remote Monitoring & Control of Gas Wellheads and Line Break Valves

- **Khalda Petroleum, Egypt**: Remote Monitoring & Control of Gas Wellheads and Line Break Valves

- **Ventspils Nafta, Latvia**: Automatic remote control for oil tankage area (2nd biggest oil harbour in Europe)

- **Gas Company, Turkey**: Remote LNG gas tank level monitoring using GSM


- **City Gas, South-Korea**, Soul, Wonju, Kunsan, Mokpo cities Remote Monitoring & Control of gas measurements and pipeline cathodic protection.

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Remote Monitoring & Control Solutions
For Cathodic Protection Rectifiers

1. **Stand-alone RTU** is in its own enclosure along with rectifier. Good solution for existing rectifiers and also for new rectifiers.

2. **Integrated RTU** is integrated in the same enclosure as rectifier. Cost effective solution for Rectifier manufacturers. This is also referred as OEM (Original Equipment Manufacturer) solution.

3. **Integrated RTU with remote control**: This is similar solution as 2, but it offers the possibility not only to monitor but to control rectifier remotely. It needs changes to rectifier hardware.

Features of all solutions are explained in more detail later in this document.
Remote Monitoring & Control Solutions
For Cathodic Protection Rectifiers

**Stand-alone RTU** includes the following components:

- AL10SP PLC (Programmable Logic Controller)
  - 5 x Surge Protected Analog Inputs
  - 3 x On-board temperature inputs
  - 4 x Digital inputs, - 4 x Digital Outputs
- Radio modem (optionally some other communication media*)
- HMI display & keypad
- Power 100-240VAC/12VDC (60W)
- 12VDC UPS battery
- IP 54 Stainless steel enclosure, side of pole or wall mounting
- Surfge protection for Antenna
- Optionally antenna and antenna cable
- Terminal strips, wirings, power relay
- Optionally GPS synchronized power interruption

* Optional communication: GSM/GPRS, RS485, Ethernet TCP/IP, PSTN leased line, TETRA, Fiber optic, microwave, etc. Ask more!
Remote Monitoring & Control Solutions For Cathodic Protection Rectifiers

**Integrated RTU** includes the following components:

- AL10SP PLC (Programmable Logic Controller)
  - 5 x Surge Protected Analog Inputs
  - 3 x On-board temperature inputs
  - 4 x Digital inputs, 4 x Digital Outputs
- Radio modem (optionally same other modem*)
- Power 100-240VAC/12VDC (60W)
- Surge protection for Antenna
- Optionally antenna and antenna cable
- 12VDC UPS battery (optional)
- Optionally GPS synchronized power interruption

FF-Automation offers on-site help for installing components inside the rectifier.

* Optional communication: GSM/GPRS, RS485, Ethernet TCP/IP, PSTN leased line, TETRA, Fiber optic, microwave, etc. Ask more!
Remote Monitoring & Control Solutions for Cathodic Protection Rectifiers

Integrated RTU with remote control includes the following components:

- AL10SP Special PLC (Programmable Logic Controller)
  - 5 x Surge Protected Analog Inputs
  - 3 x On-board temperature inputs
  - 3 x Analog Control Outputs
  - 4 x Digital inputs, 4 x Digital Outputs
- Radio modem (optionally same other modem*)
- Power 100-240VAC/12VDC (60W)
- Surge protection for Antenna
- Optionally antenna and antenna cable
- Optionally GPS synchronized power interruption
- Controllable thyristor bridges (Look next page!)

FF-Automation offers on-site help for installing components inside the rectifier.

* Optional communication: GSM/GPRS, RS485, Ethernet TCP/IP, PSTN leased line, TETRA, Fiber optic, microwave, etc. Ask more!
Remote Monitoring & Control Solution 3

**Auto Mode**
- Voltage measuring
- Current measuring
- Constant voltage with current limit
- Constant current with voltage limit
- Remotely controllable
- Remotely monitorable

**Manual Mode**
- Voltage measuring
- Current measuring
- Constant voltage with current limit
- Constant current with voltage limit
- Remotely monitorable

**Integrated RTU with remote control** includes controllable thyristor bridges:

- Voltage and Current control
- Voltage and current measuring
- Main switch position
- Door position etc.

AL10SP Special PLC with thyristor control outputs

Customer replaces Tap switches with controllable thyristor bridges max. 100VDC/100A

FF-Automation can offer help with this.

**Benefits**
- Rectifier voltage and current are remotely controllable
- Simpler rectifier construction, doesn’t need tap switches
- Lower maintenance costs
- Less need for on-site visits

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"Primary purpose of RTU is to transfer rectifier voltage and ampere measurements to control room application database for analysis and so to cut off unnecessary on-site maintenance visits and power consumption.

Secondary purpose of RTU is to offer reliability and robustness for long distance wireless communication, possibility for remote program changes and diagnostics and flexibility in future changes to increase long term usability.

AutoLog RTU’s technical features includes many secondary purpose features to serve the primary purpose to transfer measurement data.

In remote monitoring application, including numerous widely distributed devices, the reliability comes not as an option, but in case of failure, its source should be tracked remotely and automatically."
New optional feature: GPS power interrupter

AutoLog RTU can be equipped with GPS power interrupter. With GPS timing all rectifiers can be synchronised in order to make synchronised rectifier power interruption and pipe-to-soil reference voltage metering.

The power interruption relay can be installed inside the rectifier.

Power interruption schedule / interval can be started and controlled remotely.
Technical Features of PLC
(Programmable Logic Controller)

<table>
<thead>
<tr>
<th>Model</th>
<th>AutoLog 10SP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Inputs</td>
<td>5 pcs</td>
</tr>
<tr>
<td></td>
<td>16-bit resolution, 0-800mVDC, 0-3.2VDC, 0-50VDC, 0-100VDC. 0-x Amperes with external shunt resistor. Input ranges can be selected pointwise using software. Surge protected, opto-isolated. In addition 2 on-board temperature sensors.</td>
</tr>
<tr>
<td>Analog outputs</td>
<td>Only in AL10SP Special PLC with thyristor control outputs</td>
</tr>
<tr>
<td>Digital inputs</td>
<td>4 pcs</td>
</tr>
<tr>
<td></td>
<td>12/24 VDC / max. 8 mA / PNP / opto-isolated</td>
</tr>
<tr>
<td>Digital outputs</td>
<td>4 pcs</td>
</tr>
<tr>
<td></td>
<td>12/24VDC / max. 1A / NPN / opto-isolated</td>
</tr>
<tr>
<td>Serial ports</td>
<td>2 pcs, Modbus master / slave</td>
</tr>
<tr>
<td>I2C port</td>
<td>HMI keypad &amp; display</td>
</tr>
<tr>
<td>Data Logging</td>
<td>E.g. 16 time-stamped measurements x 3000 records</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-30°C...+60°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40°C...+80°C</td>
</tr>
<tr>
<td>Power supply</td>
<td>12 / 24 VDC or 10/18VAC max. 5VA, voltage drop alarm</td>
</tr>
<tr>
<td>UPS battery</td>
<td>12VDC, voltage drop alarm</td>
</tr>
<tr>
<td>Programming</td>
<td>Remote through radio network or locally using programming cable</td>
</tr>
</tbody>
</table>

**Communication**

<table>
<thead>
<tr>
<th>OPT1: Radio modem</th>
<th>AutoLog WSN Radio modem using Modbus RTU protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. distance</td>
<td>With 5W transmitting power and good antenna and clear line of sight ~40 km (longer distances possible using RTUs as repeaters, ask more!)</td>
</tr>
<tr>
<td>Frequency range</td>
<td>Different radio modem models: 138-175, 406-512, 869-870, 820-950MHz</td>
</tr>
<tr>
<td>OPT2: TCP/IP</td>
<td>Modbus TCP protocol</td>
</tr>
<tr>
<td>OPT3: GSM</td>
<td>GSM GPRS and SMS</td>
</tr>
<tr>
<td>OPT4: TETRA</td>
<td>TETRA SDS</td>
</tr>
<tr>
<td>OPT5: PSTN</td>
<td>Dial up telephone connection</td>
</tr>
</tbody>
</table>

**Technical Features**

Programmable Logic Controller

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AutoLog Cathodic Protection RTUs are designed to give protection against high voltage surges from lighting or other sources. As protective devices are used 3-Pole Gas Discharge Tubes.

Characteristics of Gas Discharge Tubes:

- Clamping Voltage: 150 V
- Impulse Sparkover: 100 V/ms 350 V
- Impulse Sparkover: 1000 V/ms 500 V
- Impulse Transverse Delay: 100 V/ms < 75 ns
- Insulation Resistance (IR): 100 V > 10^{10} W
- Impulse Discharge Current: 20kA 8/20ms 1 operation min
- Impulse Discharge Current: 10kA 8/20ms 10 operation min
Control Room SCADA

- FF-Automation has delivered Control Room SCADA system for e.g. Saudi Aramco Cathodic protection rectifier monitoring and control and also to NIOC wellhead monitoring and control system.
- SCADA software is award winning Windows based Indusoft Web Studio
- Remote users can see same views as in Control Room using web thin client technology
- Also redundant SCADA solution is possible

Application for up to 65 Base stations / Server PC, max 94 RTUs / Base station
Flexible online configuration for adding and deleting RTUs, no need for additional development work.
Map view of all Base station locations and status, online configurable BS locations on the map
Map view of all RTU locations and status, online configurable RTU locations on the map
List views: Base station RTUs in same page
Normal polling, configurable polling cycle time
RTUs can be disabled from normal polling one by one
Measurements, alarms and events are stored in SQL database (MySQL / Oracle etc.)
History trend views for all RTU measurements
Communication alarms
Measurement high / low limit alarms
Digital input alarms
Diagnostic alarms
RTU view for each RTU
Automatic RTU clock synchronization with SCADA clock
Manual reading of RTU measurement data log from RTUs to SCADA
Analog and digital output control
And much more!
Advanced Features: History reading

- In case of communication failure, RTU stores and time-stamps all measurement data into its memory.
- After communication break this data can be read automatically or manually to Control room SCADA to fill the measurement data cab.

1. Communication Failure starts
2. Data is stored to RTUs memory
3. Communication Failure stops
4. Stored data is automatically read to Control room SCADA
5. Data can be analyzed in SCADA
Advanced Features: Effective maintenance

- Automatic complete system diagnostics and diagnostic alarms
- Automatic alarm forwarding to maintenance personnel mobile phone
- Remote "software" maintenance task from mobile or Control software
  - Maintenance history report database

1. System Failure
2. Automatic diagnostics
3. Alarm to mobile / e-mail
4. Remote maintenance Tasks
5. On site maintenance
6. Maintenance report to database
AutoLog RTUs & SCADA

FF-AUTOMATION

Cathodic Protection Telemetry System diagram
"Example case"

Control Room SCADA Server

- Graphical Cathodic Protection Application
- Historical measurement, alarm & events database
- Trend, alarm, event, diagnostics, configuration views
  - Configurable polling sequence
  - Alarm forwarding (GSM & e-mail)
- Remote RTU maintenance (program downloading, on-line monitoring, parameter changing)
  - New RTU can be added easily

Radio distance up to 40 km

Up to 64 simultaneous remote users

INTRANET

Up to 94 RTUs per 1 Base Station

65 Base stations

FIBER OPTIC

RTUs can act as repeaters to increase the network coverage

System can operate using only one 460 MHz radio channel

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**Long Life Span**

- Reliable technology
- System is based on open mainstream standards and interfaces
- Easy and cost effective Expandability of I/O, RTUs, SCADA etc.
- Guaranteed spare parts and support
- Effective maintenance
- Good documentation and training
For more information about FF-Automation and the AutoLog® range of control products and automation solutions, please open www.ff-automation.com