GESAA
GE Substation Automation for the world
Substation Automation

> Requirements
> Protective relay hardware
> Protective relay logic
> Relay to relay data communication
> Local/Bay control
> WAN
> SCADA
Requirements:

• Most up to date CPU’s yet expect 20 to 30 year MTBF.
• Built in programmable controller functionality
• High speed relay to relay data communication
• Expandable:
  • I/O
  • Multiple CT and VT Modules with the ability to calculate virtual sources

Solution:

• Modularity
Requirements:

• Reusable code to reduced development time
• Reduce training requirements: family of protective relays with same touch and feel and common hardware components

Solution:

• Design must be based on a Platform
• High speed relay to relay service part of a protocol suite optimized for Utility applications

• Redundant Star fiber configuration:
  • elimination of single point failures

• Readily available proven LAN components

• Open Architecture
- High speed HMI service part of a protocol suit optimized for Utility applications.
- Standard naming convention
- Direct connection to high speed substation LAN.
- User configurable graphics display.
- Primary graphic, control and monitoring functions
Introduction
Information not Data:

Enterprise
- Budget accurately
- Assess cost of service
- Allocate capacity
- Faster service response

Operations
- Remote status and control
- Analyze power quality
- Identify events
- Receive fault records
- Target Maintenance
- Loading trends
Introduction
Substation Automation

- Requirements
  - Protective relay hardware
  - Protective relay logic engine
  - Relay to relay data communication
  - Local/Bay control
  - WAN
  - SCADA
“The engine for substation automation”
The Challenges of the ‘Universal Relay’

- Performance
  - Universal Relay
  - Busbar
  - Transmission Line
  - Generator
  - Transformer
  - Feeder

- Cost ($)

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Protective Relay
High-Speed Data Bus

Power Supply

CPU
Main Processor

DSP & Magnetics
DSP processor + CT/VTs

DIGITAL I/O
Status Inputs / Control Outputs

ANALOG I/O
Analog Transducer I/O

COMMUNICATIONS
(Ethernet, HDLC, UART)

LED Modules

LED Modules

LED Modules

Display

Modular HMI Panel

Keypad

Six Basic Modules

Protective Relay
Physical Realization

19” Chassis (4RU high)

Modules

Power Supply
CPU
DSP & Magnetics
DIGITAL I/O
ANALOG I/O
COMMUNICATIONS

Modular HMI

Protective Relay
Power Supply

- Wide input range
  - 24 - 300 VDC
  - 20 - 265 VAC
- High Efficiency SMPS
  - > 80%

CPU

- High-speed 32-Bit RISC CPU
  - > 50 MIPS, up to 120 MIPS
- FLASH memory
- Easy firmware upgrades
- High-Speed Comms support
  - 10/100Mbps Ethernet LAN
  - Redundant Fiber

DSP + CT/VT

- Modular CT/VT configurations
  - up to 8 CT/VTs
- High-speed digital sampling
  - >16 Bit A/D
  - > 64 samples / power cycle
- High-speed 16-Bit DSP
  - > 32 MIPS, up to 80 MIPS

Protective Relay
**Digital I/O**
- Control outputs
  - Solid State
  - Electromechanical - multiple types
  - Fast activation speeds (< 4ms)
- Status inputs
  - Dry and Wet contacts
  - 18 - 300 VDC
  - Fast detection speeds (< 4ms)

**Analog I/O**
- Transducer type inputs
  - ± dcmA
  - ±Voltage
  - Resistive
- Outputs for Legacy SCADA
  - ± dcmA
- Support multiple I/O configurations

**Communications**
- High-speed Serial
  - Asynchronous (9600 - 115K Baud)
  - Synchronous (56K - 256K Bps)
  - Fiber Optical (Single/Multimode)
  - Channel Redundancy

**Digital I/O unit**
**Analog unit**
**Communication module**
High-Speed Data Bus

- High-Speed Parallel Data Bus: 80 - 100 Mbytes/sec
- High-Speed Serial Communications Bus: 10Mbps
- High-Speed Inter-Processor Serial Data Bus: 16Mbps

Multiple buses allow for high-performance:
- Protection and communications without bottlenecks
CT/VT (I & V) inputs up to 3 modules: 24 (max) 8/module

Status (Binary) inputs up to 6 modules: 96 (max) 16/module

Control (contact) outputs up to 6 modules: 48 (max) 8/module

Analog (Transducer) I/O up to 6 modules: 48 (max) 8/module
Sub-Modules
Sub-Module Types

Current & Voltage

Future

CT, VT

Optical, Digital

Control and Status I/O

Future

Form-A
Form-C
Solid-State
Wet/Dry Input

Analog (Transducer) I/O

Future

±1mA, 4-20mA, 0-5mA
RTD (Pt, Ni, Cu)
±5V, Resistive

Customer - ??

Customer - ??

Protective Relay
‘Plug n Play’

Easy Module Draw-out

Field Wiring Undisturbed

Module Keying

CT Shorting ‘Clips’
The UR Family - One Common Architecture

**TRANSMISSION**
- L60  (Transmission Line: Phase Comparison)
- L90  (Transmission Line: Current Differential)
- D60  (Transmission Line: Distance)

**DISTRIBUTION**
- F3x  (Feeder: Multiple Feeders - Basic Protection)
- F60  (Feeder: Comprehensive w Hi-Z)
- T60  (Transformer: Comprehensive)
- C30  (Control IED)
- C60  (Breaker Management IED)

**SYSTEMS SOFTWARE**
- URPC  (Entry Level HMI, Engineering Tool)
- PMCS  (Full Featured Systems HMI)

**GENERATION**
- G60  (Generator: Comprehensive > 100MVA)
- B30  (Busbar: Basic 6 Feeder)
- B90  (Busbar: Comprehensive up to 30 Feeders)

(Available in 2000)
FEATURES

- FlexLogic™
- Distributed FlexLogic™
- Virtual I/O (reduce hardware cost)
- Expandable I/O
- Flash monory for field upgrades
- Drawout modules for serviceability
- Common modules (reduce spares cost)
- Test mode for forcing contact I/O states
- IRiG-B time synchronization
Substation Automation

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- SCADA
UR FlexLogic™ Engine

Contact Inputs → FlexLogic™

(Gates) (Timers) (Latches)

Elements

Virtual Inputs

Virtual Outputs

Remote Inputs → Contact Outputs

Protective Relay
Introduction to Flexlogic

Pickup
Forward
Remote Forward
AND
Assign Virtual

AND

Operate
<table>
<thead>
<tr>
<th>Function Inputs</th>
<th>Protection Element</th>
<th>Function Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enable</td>
<td></td>
<td>Pickup</td>
</tr>
<tr>
<td>Source</td>
<td></td>
<td>Operate</td>
</tr>
<tr>
<td>Block</td>
<td></td>
<td>Drop Out</td>
</tr>
</tbody>
</table>
### Introduction to FLEX Logic

#### AND Protective Relay

<table>
<thead>
<tr>
<th>Gates</th>
<th>Number Of Inputs</th>
<th>Output Is ‘1’ (= On) If...</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOT</td>
<td>1</td>
<td>input is ‘0’</td>
</tr>
<tr>
<td>OR</td>
<td>2 to 16</td>
<td>any input is ‘1’</td>
</tr>
<tr>
<td>AND</td>
<td>2 to 16</td>
<td>all inputs are ‘1’</td>
</tr>
<tr>
<td>NOR</td>
<td>2 to 16</td>
<td>all inputs are ‘0’</td>
</tr>
<tr>
<td>NAND</td>
<td>2 to 16</td>
<td>any input is ‘0’</td>
</tr>
<tr>
<td>XOR</td>
<td>2</td>
<td>only one input is ‘1’</td>
</tr>
</tbody>
</table>
Truth Tables

**AND**

<table>
<thead>
<tr>
<th>In1</th>
<th>In2</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**NAND**

<table>
<thead>
<tr>
<th>In1</th>
<th>In2</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**OR**

<table>
<thead>
<tr>
<th>In1</th>
<th>In2</th>
<th>Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Truth Tables

Protective Relay
Timers

Pickup

Drop out

Timer #

Pickup Time

Drop out Time

Protective Relay
Counters

**SETTINGS**
- COUNTER 1 FUNCTION:
  - Disabled = 0
  - Enabled = 1

**SETTING**
- COUNTER 1 UP:
  - Off = 0

**SETTING**
- COUNTER 1 DOWN:
  - Off = 0

**SETTING**
- COUNTER 1 BLOCK:
  - Off = 0

**SETTING**
- CNT 1 SET TO PRESET:
  - Off = 0

**SETTING**
- COUNTER 1 RESET:
  - Off = 0

**SETTING**
- COUNT1 FREEZE/RESET:
  - Off = 0

**SETTING**
- COUNT1 FREEZE/COUNT:
  - Off = 0

**CALCULATE VALUE**

**SET TO PRESET VALUE**

**SET TO ZERO**

**ACTUAL VALUE**
- COUNTER 1 ACCUM:

**ACTUAL VALUES**
- COUNTER 1 FROZEN:
  - Date & Time

**FLEXLOGIC OPERANDS**
- COUNTER 1 HI
- COUNTER 1 EQL
- COUNTER 1 LO

**SETTING**
- COUNTER 1 COMPARE:
  - Count more than Comp.
  - Count equal to Comp.
  - Count less than Comp.
Contact Outputs

- Grouped Elements
- Control Elements
- Inputs/Outputs
- Transducer I/O
- Testing

- Commands
- Targets
- Actual Values
  - Front Panel
  - Status
    - Contact Inputs
    - Virtual Inputs
    - Remote Inputs
    - Contact Outputs

- Virtual Outputs
- Remote Devices Status
- Remote Devices Statistics
- Digital Counters
- Flex States
- Clock

**Virtual Inputs // UTS: New Device**

<table>
<thead>
<tr>
<th>VIRTUAL INPUT</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virt Ip 1 (VI 1)</td>
<td>On</td>
</tr>
<tr>
<td>Virt Ip 2 (VI 2)</td>
<td>On</td>
</tr>
<tr>
<td>Virt Ip 3 (VI 3)</td>
<td>Off</td>
</tr>
<tr>
<td>Virt Ip 4 (VI 4)</td>
<td>Off</td>
</tr>
<tr>
<td>Virt Ip 6 (VI 6)</td>
<td>Off</td>
</tr>
</tbody>
</table>

**Contact Outputs // UTS: New Device**

<table>
<thead>
<tr>
<th>CONTACT OUTPUT</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cont Op 1 (H1)</td>
<td>On ( VOff, IOff )</td>
</tr>
<tr>
<td>Cont Op 2 (H2)</td>
<td>On ( VOff, IOff )</td>
</tr>
<tr>
<td>Cont Op 3 (H3)</td>
<td>Off</td>
</tr>
</tbody>
</table>

Protective Relay
Substation Automation

- Requirements
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- WAN
- SCADA
LAN: Local area network

WAN: Wide Area Network
**Protocol:** A common set of rules to govern the exchange of data between nodes on a network.

It determines:

- Initialization of data link
- Services that are supported
- Flow control
- Frame format and sync
- Error control
Messaging Services

• Provides “Common Services” for communicating information including notification of delivery or non-delivery of a message and the reason why not

• Types of services:
  - Initiate Communications
  - Identify
  - Define Data
  - Write Data
  - Program Invocation
  - Etc.

• Existing Standards: FMS, MMS, DNP, IEC
Manufacturing Message Specification (MMS)

• Internationally standardized messaging protocol for real time exchange of data and supervisory and control information between networked devices.

• ISO 9506 standard

• Independents from the application function being performed

• Independents from the developer of the device or application

• Generic to be appropriate for a wide variety of devices and applications:
  ▶ PLC
  ▶ Robot
  ▶ Protective relay

• Based on the OSI model

MMS services and messages are identical
MMS Service Specification

• Defines a set of objects that can exist within a device.

• Defines a set of communication services to access and manipulate those objects.

• Defines the behavior of the device to those communication services.
MMS Services

• Get Object
• Change Object
• Determine Attributes
• Create Object
• Delete Object
Peer to Peer
- Client / Server
- Publisher/ Subscriber

Master / Slave
- Request / Response
- Response Only
LAN Topology: Token RING

Relay to Relay Com
LAN Topology: STAR

Switch Active/ Passive

IED

IED

IED

IED

IED

Relay to Relay Com
• **TOKEN** to gain access to LAN
LAN Access: Token
LAN Access: CSMA/CA

- CSMA / CA
- Carrier science multiple access with crash detection
Data Communication Hierarchy

Communications: OSI Model

- APPLICATION
- PRESENTATION
- SESSION
- TRANSPORT
- NETWORK
- DATALINK
- PHYSICAL
Data Communication Hierarchy
Communications: OSI Model

Data Communication Hierarchy
Utility Communication Architecture (UCA) and Substation Automation
Utility Communications Architecture Version 2

Objective:

• Establish a suite of protocols to meet utility communications needs
Participating UCA Vendors

- GE Power Management
- Basler
- Cooper
- Beckwith
- Tasnet
- SEL
- GE Harris

- Siemens (HMI)
- L&G
- Doble
- Dranetz / BMI
- Modicon / Square D
- ABB
- Alston
Utilities Participating in UCA

- American Electric Power (AEP)
- Indianapolis Power & Light
- Ontario Hydro
- Northern States Power
- Tampa Electric
- ComEd
- Cinergy
- Baltimore Gas & Electric
- GPU
- Nuon

- Enetergy
- TVA
- Duke
- Boston Edison
- Union Electric
- Florida Power Corp
- Southern California Electric
- Wisconsin Electric
- ESKOM
- Polish Power Grid

Relay to Relay Com
UCA 2.0 is defined by a set of Documents

- Introduction
- Communication Profiles
  - TCP/IP
  - OSI
  - Serial
- CASM
  Common Application Service Models
  How MMS Services are used (MMS = Manufacturing Message Specification)
- GOMSFE
  Generic Object Models for Substation and Feeder Equipment
UCA Features

- Client/Server Multiple Connections
- Common Data Objects that can be extended by each vendor
- File Services
- Time Sync
- Reporting
- GOOSE (Generic Object Oriented Substation Event)
- Peer to Peer Communication (Remote I/O is a cast message)
### 7-LAYER UCA MODEL

<table>
<thead>
<tr>
<th>Layer</th>
<th>Standards/Protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Connection-orientated Presentation</strong></td>
<td>MMS 1988, ACSE, ROSE, RTSE</td>
</tr>
<tr>
<td><strong>Connection-orientated Session</strong></td>
<td>MHS 1984, ROSE, RTSE</td>
</tr>
<tr>
<td><strong>Connection-orientated Transport</strong></td>
<td>0, 4</td>
</tr>
<tr>
<td><strong>Connectionless Network</strong></td>
<td>ISDN Q.931, X.25 Packet Layer</td>
</tr>
<tr>
<td><strong>ES - IS Routing</strong></td>
<td>ISDN LAPD</td>
</tr>
<tr>
<td><strong>LLC</strong></td>
<td>ISDN Interfaces</td>
</tr>
<tr>
<td><strong>FDDI</strong></td>
<td>ISDN Interfaces</td>
</tr>
<tr>
<td><strong>HDLCLAPB</strong></td>
<td>ISDN Interfaces</td>
</tr>
<tr>
<td><strong>V.35</strong></td>
<td>ISDN Interfaces</td>
</tr>
<tr>
<td><strong>EIA - 232-D</strong></td>
<td>ISDN Interfaces</td>
</tr>
<tr>
<td><strong>X.21</strong></td>
<td>ISDN Interfaces</td>
</tr>
</tbody>
</table>
## UCA Data Access (Name - based)

<table>
<thead>
<tr>
<th>Data Object Class</th>
<th>Functional Component</th>
<th>Data Item</th>
<th>Attributes</th>
<th>r/w m/o</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOC</td>
<td>ST</td>
<td>Pu</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SG</td>
<td>PuDelTim</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DoDelTim</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>CF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>DC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To access the Phases IOC 1 Pickup
Read PhsIOC1.SG.Pu
GOMSFE

Generic Object Models for Substation and Feeder Equipment

Models defined for:

Protection Elements - P IOC
- PTOC
- PDIS
- RSYN
- etc.

Metering - PXMU

Generic Analog/Digital I/O

etc.
External Trip Delay:  
Input delay (4ms at present)  
+  
Tx/Rx and processing (Typically < 4ms at present)  
+  
Output delay (0.6 ms for Fast Form C)  

= 8.6 ms
UR Communications Profiles

**UCA 2.0 (MMS/Ethernet)**

- **APPLICATION** → MMS
- **PRESENTATION** → RFC1006 - Presentation
- **SESSION** → RFC1006 - Session
- **TRANSPORT** → TP4
- **NETWORK** → CLNP
- **DATA LINK** → IEEE 802.2 (CSMA/CD)
- **PHYSICAL** → IEEE 802.3 (10BaseFL)

**Modbus/TCP/IP/Ethernet**

- **APPLICATION** → MMS, ModBus
- **PRESENTATION** → NOT Implemented/Required
- **SESSION** → NOT Implemented/Required
- **TRANSPORT** → TCP/IP, UDP
- **NETWORK** → Ethernet
- **DATA LINK** → IEEE 802.2 (CSMA/CD)
- **PHYSICAL** → IEEE 802.3 (10BaseFL)

**Modbus/UART/(RS485, RS232, Fiber)**

- **APPLICATION** → ModBus
- **PRESENTATION** → NOT Implemented/Required
- **SESSION** → NOT Implemented/Required
- **TRANSPORT** → UART - 8 Bits, 1 Stop Bit, No Parity
- **NETWORK** → RS232, RS485, Fiber

**Telecom: DS0 (64kbps), T1, E1**

- **APPLICATION** → Proprietary, ModBus,
- **PRESENTATION** → NOT Implemented/Required
- **SESSION** → NOT Implemented/Required
- **TRANSPORT** → HDLC
- **NETWORK** → RS422, G.703, Fiber
- **DATA LINK** → Ethernet
- **PHYSICAL** → Ethernet

Data Communication Hierarchy
Goose Message Demonstration:

Relay to Relay Com
Redundant 10 Base F Bay LAN Topology

Fiber switches
FlexLogic: Relay 1

Contact input  
Contact input  
AND  
Virtual output  

AND  
Virtual output  

Remote output

Relay 2

Remote Input  
Remote input Status Table  

ALARM Light
Substation Automation

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Universal Relay Human Machine Interface - HMI

HMI Demonstration:
- Static Text and Graphics
- Importing bit maps
- Change screens
- Analog signal monitoring
- Push buttons
- Lamps
Introduction
Static text and graphics

HMI
Static text and graphics

Component Properties

Text

Javis Substation

Multiple Lines

Word Break

Horizontal Alignment

Left
Center
Right

Vertical Alignment

Top
Center
Bottom

OK
Cancel
Apply
Jarvis Substation
Importing bit maps
Importing bit maps
Importing bit maps
Change Screens

HMI
Change Screens

Jarvis Substation

Component Properties

General  Next File or Next Screen  Edit  Line  Fill

- Use Next File
  - Next File (set manually or by dropping a file)
    - Path:

- Next Screen (set using drag and drop operation)
  - Screen Title:

Open

Look in:  Urpc

- Data
- Single line
- Class_1
- Class_2
- Single Line
- test

File name:  Class_2
Files of type:  Single Line Files (*.sln)

OK  Cancel
Change Screens
Inserting a Relay
Analog Signal Monitor

New Device.

Text

Cut
Copy
Paste
Order
Grouping
Properties...
Analog Signal Monitor

New Device

118.310 V
Analog Signal Monitor

- Flexlogic Equation Editor
- UTS: New Device 2: Settings: Flexlogic
- Flex Logic Graphic
- UTS: New Device 2: Settings: Flexlogic
- FLEXLOGIC ENTRY
- TYPE
- SYNTAX
- View Group
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Flexlogic
- Set
- LATCH
- Reset
- = VIRT OP 1 (VO1)

HMI

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>H1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID</td>
<td>Cont Op 1</td>
</tr>
<tr>
<td>LED Control</td>
<td>None</td>
</tr>
<tr>
<td>Operate</td>
<td>Virt Op 1 (VO1)</td>
</tr>
<tr>
<td>Seal-In</td>
<td>OFF</td>
</tr>
<tr>
<td>Events</td>
<td>Enabled</td>
</tr>
</tbody>
</table>
HMI

Standard Push buttons
Standard Push buttons
Breaker Symbol Animation

Component Properties

General         Settings         Edit         Line         Fill

Operated:
- Manually
- Automatically

Manual:
- Status: On

Automatic:
Element: New Device 2
Type: Contact Outputs
Contact Outputs: H1

OK         Cancel         Apply         Help
QuickPanel jr - Low Cost HMI

• Control multiple devices: Modbus Master via RS485

• Graphical user interface: single-line, metering, alarms

• Touch Screen: alarms control buttons
Substation Automation

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> SCADA
The UCA Substation

10Mbps Dual Ethernet Fiber switch

Interoperable IEDs

Access to:
• Enterprise
• Internet

Slower Legacy Devices use Gateway

Data Communication Hierarchy
FSC
(Fiber Optic System Communications)
• SONET Technology: 51/155 Mbps
• Ethernet LAN ‘Bridging’ capability
• Creates single Ethernet WAN
• Redundant channels ensure reliability
Remote monitoring and diagnostics:
- Power Quality monitoring
- Equipment Health (Breaker, Transformer) monitoring
- Fault Analysis - data retrieval
- Events and Alarm annunciation

The IEDs (Relays) are a ‘socket’ for providing information and services.
Internet Communications NOW!

View/Retrieve:
- Metering
- Events
- Oscillography

Test a UR F60 Feeder Management Relay over the Internet

Data Communication Hierarchy
Substation Automation

- Requirements
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GESA 2000
GE Substation Automation System Solutions

- Providing innovative product and service solutions for markets and customers worldwide.
W h y  G E

• A Complete System Solution Supplier
• Global Focus With Engineering And Field Support
• Experience Over A Broad Range Of Industries
• A corporate commitment to six sigma quality
• Financial Strength

• Power system consulting
• Application design
• Project management
• Integration services
• Startup and commissioning
• Project financing
• Asset maintenance
• Remote diagnostics

Dedicated to bringing the best Automation solutions to our customers
GE Power Management

GES A - A System Solution that Delivers Productivity

- More Effective Long Term Planning & Loading Decisions
- Real-time Analysis that Avoids Interruptions
- Reduction in the Need for Costly Field Visits
- Precise and Confident Operator Decisions in Restoring Service

Translating data into information at the users fingertips
The Challenge: Putting Information to Work

“On-Line Information”: Your key competitive advantage

Enterprise

• Fine-tune planning
• Streamline settlements
• Budget accurately
• Asses cost of service
• Allocate capacity
• Faster service response

Operations

• Remote status & control
• Analyze power quality
• Identify events, SOE
• Receive fault records
• Target maintenance
• Monitor loading trends
- Sub-second response for Ethernet connected devices
- Dual master redundancy with automatic system control transfer
- Automatic interleaving of events and metering values
- Ethernet substation UCA 2.0 LAN Peer to peer communications
- Remote view nodes and web browser compatible HMI Interface
- Automatic oscillography upload
- Object oriented system tools for reliable, low cost reconfiguration
- Real-time system status and control execution

Maximize your Competitive Edge
Three powerful dimensions to a complete Substation Automation Solution:

- Proven, “off the shelf” components that integrate today’s IEDs
- Ethernet for data transport in the substation and to remote sites
- Pre-engineered software, application tools and device interfaces
Open System Solution -- Relays, Software, Communications, Networking
Smart Screen “Wizards”

- One Line Diagrams
- Event Logger
- IED Faceplate
- IED Tabular Values
- Annunciator Panel
- Alarm List with Sorting Feature
- Trending

Integration Productivity and Reliability

SCADA
Monitors and records all system event characteristics

- Time stamped to nearest milli-second
- Synchronizable to GPS via IRIG-B
- Automatic retrieval from IED to Host
- Storage on host disk
- Automatically forward to operations PC
- Data sort capability included:
  - Standard filters
    - Time
    - Device Type
    - Alarm Condition
  - Custom filters per your needs
• Configurable alarm conditions
  – Any present value can drive an alarm
  – Set range of operation

• Failure Alarms
  – Equipment generated
  – System generated
  – Grouped per IED

• Remote Communication of Critical Alarms

SCADA
Oscillography/Fault Reporting

- Automatic upload from IEDs via your Wide Area Network
- Comtrade format for file storage
- Remote file access
- Full feature viewer with analysis tools
- Interoperability
- Peer to peer communications
- Reliability of software objects and modules
- Modularity of hardware modules and components
- Dynamic reconfiguration
- Real-time state analysis and operation

SCADA
## SUBSTATION AUTOMATION INSTALLATIONS AROUND THE WORLD

### North America
- ConEd
- PSE&G
- PECO
- Salt River

### South America
- Electroperu
- Inepar
- Electronorte
- EDENOR
- Rio Light
- Furnas

### Europe & Africa
- ERZ

### Asia Pacific
- Aliu Zhou
- Zhe Zhang
- Guang Xi
What our Customers Require: That GE is Committed to Deliver

- Access to system application experts -- before, during and after a sale
- Open architecture solutions, built on industry standards - future upgrade path
- Thorough specification of the system to be delivered - fully understood by the user
- Deliver and commission on schedule; within budget - supplier and customer
- Effective operator training - establishing basic user competency
- Return on investment - work together to obtain the expected benefits

Customer Focused

SCADA
HOW TO START ORDERING ON-LINE TODAY

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Click on “Order Products On-line”

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