Modern Multi-Function Recorder Technology and Capabilities

Charlie Childs
Product Manager
Ametek Power Instruments

i-PCGRID Workshop
March 27, 2013
Modern Multi-Function Recorder

• More processing power
  – Advanced algorithms
  – Addition calculation capabilities
  – More in device data analysis
• Increased memory capacity
  – Longer duration recording
  – Additional logging capabilities
  – New data types
  – Data redundancy
• 100% Solid state
  – No moving parts
  – Less power consumption
  – Increased reliability
• High speed communication interfaces
  – Reduced data retrieval times
Multi-Function Recorder Capabilities

• Hi Speed Fault Recording
• Swing/Disturbance recording
• Continual loggers
  – Transient logger
  – Disturbance logger
• Power Quality Monitor
  – RMS/Frequency logger
  – Harmonics logger
  – Voltage Imbalance logger
  – Flicker logger
• IEC61850 Monitoring
• Online Breaker monitor
• Phasor Measurement Unit
• Sequence of Events recorder
• Fault location
Transient Fault Recording

- Verification of the Protection System
- Raw Data & Summarized Report
- Email notification

Automated Event Report

ESDemo3 3/04/2012 17:58:22
On Circuit 1: Rochester
The Fault is Phase 'Ib' to Phase 'Ic' - CLEARED by S/G!
TR-2500 Trigger: Analog rate of change on channel 6 'Iy'
Min Impedance = 4.3 with SD = .2
Over-Current on Phase 'Ib' is : 816.7 A, Phase 'Ic' is : 592.8 A
Voltage Ret. on Phase 'Vbc' is 81%, 'Vca' is 90%, 'Vab' is 97%
Post-Fault current is less than Pre-Fault. Faulted circuit has been isolated!
The Disturbance lasted 270msec.
Relay operated at: 20 mSecs, which is within limits.
Switchgear operated at: 301 mS. This is late by: 86 mSecs.
Swing/Disturbance Recording

- Longer term triggered recording
- System stability related
- Advanced trigger capabilities
  - Power & Frequency oscillation detection
- RMS and Phasor quantities recorded
  - PMU data @ 120 Hz
  - Up to 30 minute records
Swing/Disturbance Recording

Plant Service (4.61) at AMETEK, 00:24:03.466666 Wed 07 Oct 2009 (280)
Analogue over on channel 13 'IC'

Volts
A:-166.2°  B:73.7°  C:-46.0°

Current
A:178.0°  B:39.3°  C:-66.4°

x11 IC 133.45  123.54  -9.91
A

I a Angle 178.04  178.03  -0.0163
Degrees

T1: 00:24:03.48  T2: 00:24:03.70  TD: 00:00.22
hr:min:sec

209.34
0.0000

00:24:03.40  00:24:03.50  00:24:03.60  00:24:03.70  00:24:03.80
hr:min:sec
Continuous Loggers

- Transient Logger
  - High speed transient data
    - 8-24 samples per cycle
    - Stored in a circular buffer (12-24hrs)
  - Lossless data compression
Continuous Loggers

- Disturbance Logger
  - RMS & Phasor quantities
    - PMU data @ up to 60 Hz
    - Stored in a circular buffer (2 weeks or more)
Power Quality Monitoring

- High Accuracy PQ data – IEC61000-4-30
  - RMS/Frequency Profiles
  - Individual Harmonics to the 64th
  - Voltage Imbalance
  - Flicker
- 52 Week circular buffer
- Automated data retrieval
- Automatic compliance report generation
IEC61850 Capabilities

- GOOSE Message Recording
  - Subscription to GOOSE Control Blocks from multiple IED’s
  - Recorded in the SER log
  - Included in all fault/disturbance records
  - Consolidation of data for event analysis
  - Reduced wiring costs

- Manufacturing Message Specification (MMS)
  - Access to event logs & data files
  - Universal data formats

- Sampled Values (SV)
  - Transport of raw point on wave data over Optical Gigabit Ethernet (Process bus)
  - Replaces copper wiring from CT’s/PT’s
Online Breaker Monitoring

- Monitoring of vital parameters
  - Trip Coil currents
  - Position
  - Phase current
- Detect and notify of performance changes
Phasor Measurement Unit (PMU)

- Streaming data per C37.118
  - Phasors from many circuits
  - Multiple data streams
  - Independently configurable

![Diagram]

- Workflow: Waveform → DFT → System Vectors → PMU1, PMU2
- Tuning frequency (From frequency measurement)
Summary

• Modern Multi-Function Recorders have taken advantage of technology advancements
  – Processing power
  – Memory availability
  – Reliability

• Provide Return on investment through additional functionality and automation
  – Advanced internal analysis of events
  – Providing information not just data
  – Automating notification when required