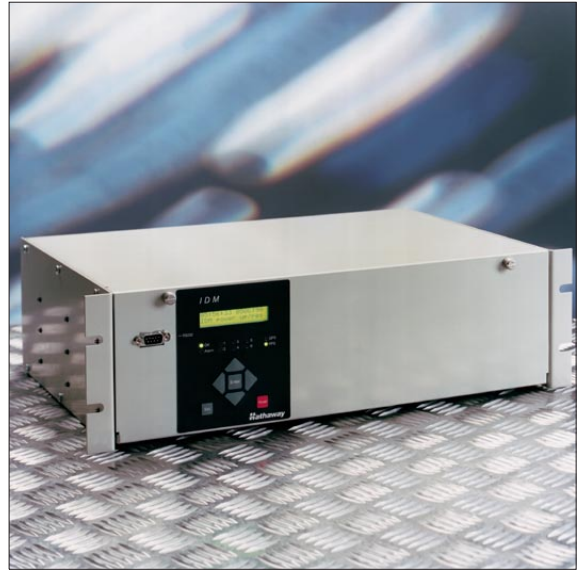


IDM



**DATA
ACQUISITION
SYSTEM**

The IDM – a compact and economical multifunction data acquisition system

Rendering *all* other systems obsolete IDM

Unrivalled product profile

- Advanced multifunctional distributed data acquisition system
- Fully multitasking operation system - VxWorks
- Supports multiple concurrent applications
- Flexible network communications - fibre and twisted pair Ethernet (TCP/IP) and RS232 with conventional modems (PPP)
- *Replay Plus* Master Station configuration and analysis software

State of the art technology

- Powerful 16/32 bit micro-controller
- 16-bit analog resolution
- 16Mb of memory
- 10Mbit/s Ethernet network
- Integral DSP processor
- Surface mount technology throughout
- Internet communications

A true multifunction device

- Fault location and fault recording
- Disturbance recording
- Transient and continuous slow scan
- Power quality recording
- Power system stability monitoring
- Sequence of events recording
- Quality of supply monitoring
- Measurement functions
- Circuit breaker monitoring

High performance *Replay Plus* software

- Full communications, configuration display and analysis
- Record viewer and printing
- Real time phasors
- Powerful analysis tools
- Interface to Microsoft Access database - user configurable record analysis
- Compatible with existing installed base of DFR IIs

Technical Overview

Introduction

The IDM is a distributed multifunctional data acquisition system designed to address the data recording requirements of a modern distribution or transmission substation. The product, when coupled with *Replay Plus*, a Master Station software package, provides a powerful platform for the acquisition, analysis and reporting of data from power system substations. In addition to the fault and disturbance recording capabilities of the IDM, upgrades incorporate the following functions:

- Power system monitoring (triggered and continuous recording)
- Phasor measurement
- Event recording / power quality recording
- Equipment condition monitoring
- SCADA I/O

Each of these functions operates completely independently from any other function within the IDM and the use of an industry standard multitasking operating system provides added security. Individual Data Acquisition Units (DAUs) are networked on a twisted pair or fibre optic Ethernet LAN using TCP/IP protocol for communications. PC based Local Storage Units can be added to the LAN to provide mass storage and Windows Master Stations can also be added to provide local analysis capabilities. This IDM network can be connected directly to wide area networks or can be accessed directly using industry standard dial-up networking. The architecture of the IDM and the use of TCP/IP in the communications software allows direct connection to the Internet. The DAUs can be synchronised to 1 μ s using an internal or external GPS clock and this provides synchronous sampling in all DAUs with the ability to make system wide phasor measurements.

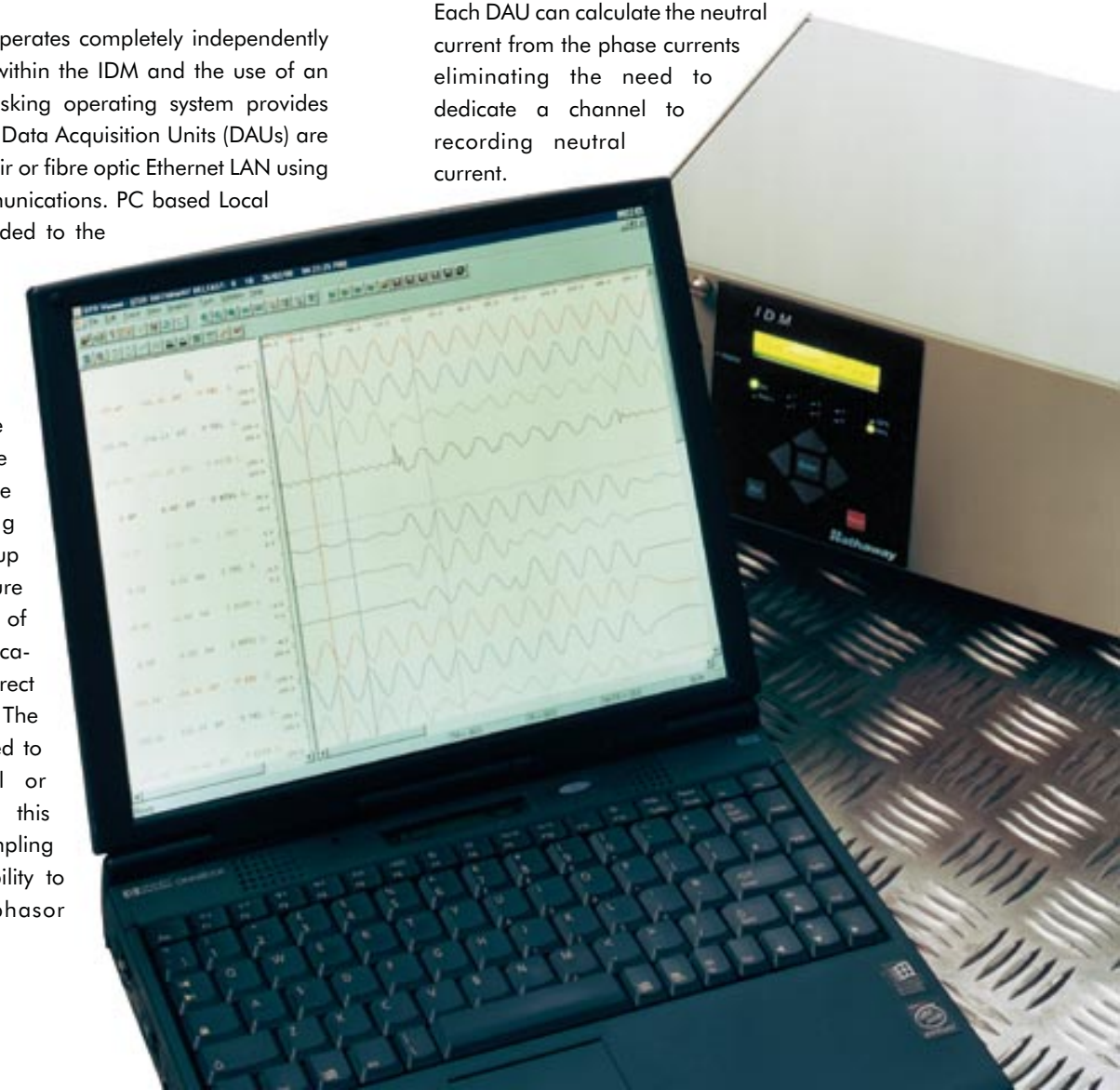
DAU Installation

Each IDM DAU is equipped with a powerful 16-bit processor, DSP processor, 16-bit A/D converter and 16Mb of memory. This provides sufficient processing power to carry out data acquisition on all analog inputs and to compute in real time watts, vars, sequence components and phasor quantities for up to three lines. These quantities are calculated on a cycle by cycle basis and the values are time-tagged to a resolution of 1 μ s.

DAUs are available in two formats:

- A 3U model with 10 analog channels and 16 or 32 events
- A 6U model with 16 analog channels and 32 events

All DAU signal conditioning is internal and the DAUs are designed to be installed in the relay panels associated with the circuits being monitored; the 3U DAU can be used to monitor up to two circuits if a common set of voltages is available. Each DAU can calculate the neutral current from the phase currents eliminating the need to dedicate a channel to recording neutral current.



Unequalled price and performance . . . the future of data acquisition today

Fault and Disturbance Recording

The fault recording function records all primary analog quantities at sample rates of up to 6.4kHz (7.68kHz on 60Hz systems) and can be triggered on under and / or over level, or rate of change of any primary or calculated quantity. Calculated quantities include negative and zero sequence voltages and currents, frequency, harmonics, watts and vars. In addition to the conventional fault record, which is typically one or two seconds long, each IDM DAU can simultaneously record up to eight channels of transient slow scan data around the time of the fault recorder trigger. This data can be sampled at 10/12Hz or 50/60Hz and up to thirty minutes of data can be recorded. This information can be used to analyse the response of the power system before, during and after real system faults.

Event Recording

The event recording function within the IDM will capture and time-tag all changes of state on the event inputs. This data can then be output to a local printer in a similar format to a conventional event recorder or transferred as a data file to a remote Master Station.

Power System Monitoring

More sophisticated triggering and longer duration recording of power system disturbances is provided by the power system monitoring function. For this application a Local Storage Unit or PC is attached to the IDM LAN to provide the mass storage required for storing the volume of data generated by this type of recording. Each IDM can calculate a number of power system quantities for each of the lines being monitored on a cycle by cycle basis.



DAU Rear Panel showing Extensive Connections

Each measurement is accompanied by a time-tag with a resolution of 1 μ s giving, in the case of phasors, system wide phase information accurate to less than 0.5 degrees. The data for each of these quantities is transferred on a continuous basis to the LSU or PC on the network. Data is stored here in a cyclic buffer on the hard disk for a period of up to 30 days and may be transferred to a remote location at any time without interrupting the recording process. In this way a continuous history of the power system is recorded and saved for later analysis when required.

Triggering algorithms are provided in the LSU that can detect step changes or oscillatory transients on calculated power (real and reactive), voltage and frequency signals. When a trigger condition is detected a trigger message is sent to the Master Station. The Master Station can then be configured to automatically retrieve data in one or more user defined Profiles .

Real Time Phasors

In addition to recording power system quantities, the IDM has the capability to provide real time phasor information to remote locations. The ability to transfer real time phasor information from a number of locations on a power network to a central point provides a source of data for developing an application to provide real time power system stability information.

Power Quality Recording

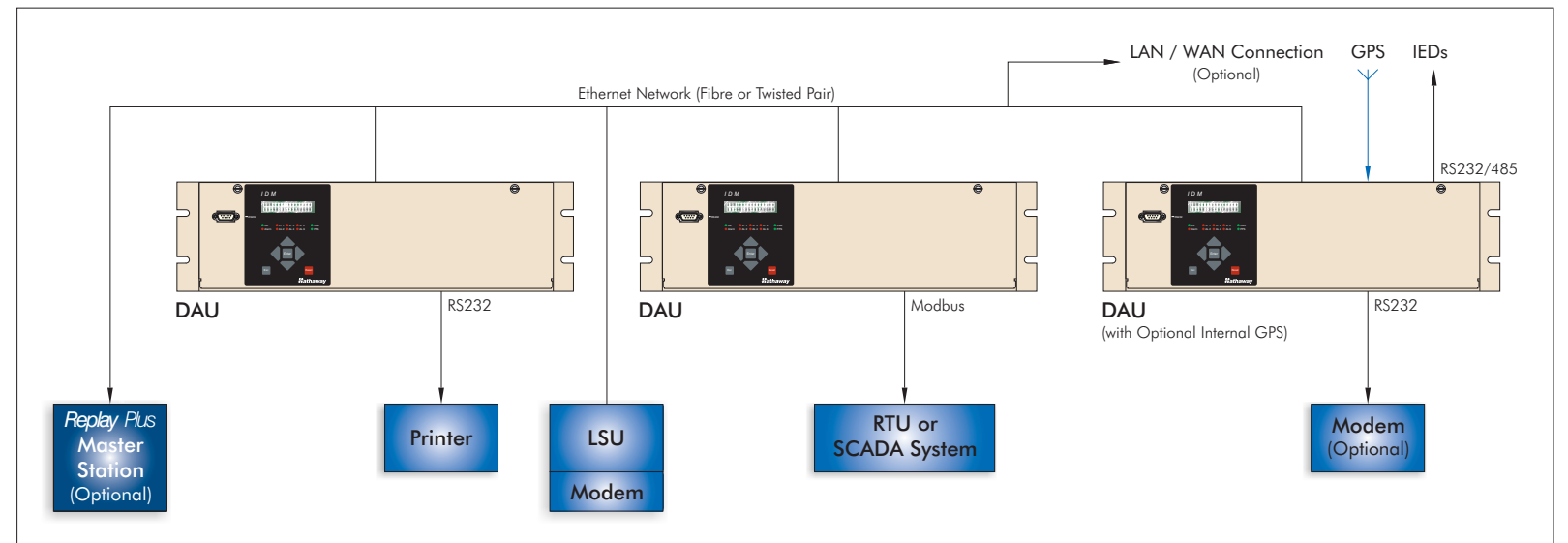
The IDM can be programmed to take measurements of the supply voltage at regular intervals. The quantities calculated and recorded include RMS voltage, harmonic content, frequency, sequence components, etc.

The power quality function will also capture and record the magnitude and duration of voltage dips caused by faults and other system incidents.

This data is stored in a database in the recorder and can be transferred automatically to a remote Master Station for subsequent analysis.

SCADA I/O

The SCADA I/O function can be used to eliminate transducers and provide measurement information over a serial connection to an intelligent RTU using the Modbus protocol.



Substation Monitoring with the IDM Network

The internal DSP in the IDM can calculate RMS voltage and current and single and three phase power (real and reactive). In addition, this SCADA port can be used to report the status of all event inputs to the RTU. This RTU port can also be used to control secure SBO (Select Before Operate) relay outputs fitted in the distributed DAUs.

*The SCADA I/O feature is a new development and will require detailed discussion with users to identify specific requirements.

Automated Analysis of Fault Records

It has long been appreciated that data from fault records has many applications in addition to the analysis of the performance of power system protection. However the extraction of data for applications such as equipment condition and power quality monitoring can be a time consuming task. Using the IDM with the *Replay Plus* Master Station software automates this task and presents the resulting information in a usable format.

As each record is retrieved by *Replay Plus* it is automatically analysed and the resulting summary parameters are stored in a database table. Analyses functions developed using Microsoft Access queries are provided for a number of applications including protection performance, equipment condition monitoring and power quality. These functions automatically process the summary information, compare calculated quantities against user specified limits and generate reports summarising the results. Alarm messages are used where immediate action is required in response to calculated results. The use of an Access database provides open access to the summary parameters and the analysis functions allowing third party support and enhancement.

DFR Upgrades

An upgrade package for existing Hathaway DFR IIs, based on the IDM hardware, is available to provide the extra functionality of the IDM. This upgrade involves changing a number of cards within the DAU, while still retaining the original signal conditioning and isolation electronics, transforming it into a new fully integrated power system monitoring device.



DFR II and Upgrade Cards

Unrivalled specification with *Replay™ Plus* . . . the **Leading 32-bit Master Station**

Technical Specification*

Overview

- 10 or 16 analog, 16 or 32 event acquisition unit
- Relay outputs for alarms
- Scan rates to 7.68kHz
- Built in self-checking functions
- Analog resolution 16-bits
- 16Mb of DRAM

Enclosure

- 19" x 3U x 287mm - 10 channel model.
- 19" x 6U x 287mm - 16 channel model.

Front Panel

- 2 row x 16 character LCD display. Ten status LEDs.
- Membrane keypad.

Supply Voltage

- 80 - 300Vdc and 110V or 220Vac.
- 24Vdc and 48Vdc models available.

Relay Outputs

- Two alarm outputs with Form C contacts for failure alarm and operate signal.
- Additional 8 alarm outputs (optional).

Analog Channels

- The 10 channel DAU is equipped with 9 AC channels and 1 DC channel. The 16 channel DAU has 16 AC channels with optional DC response available on all channels.

Currents:

- 1A or 5A (nominal).

Voltage:

- 80V or 150V.

Accuracy:

- Better than 0.5%, CMRR >85db, phase angle error 0.5 degrees, frequency response 3db @3000Hz.

Event Channels

16 or 32 event channels:

- Input rating 24/48V, 125V or 250V.
- Event circuits isolated in groups of eight (dry or wet contacts). Bipolar common (i.e. common +ve or -ve).

Communications

- Ethernet network. TCP/IP protocol. Integral twisted pair and fibre interfaces. RS232 / RS485 port for remote communications and RS232 port for local configuration.

Memory:

- Up to 16Mb of DRAM.

Real Time Clock

- Can be synchronised to 50/60Hz line voltage, internal or external 1pps or GPS clock. Free running accuracy of one second per day.

Printout

- Local printout available using a serial printer on any serial port. (DAUs can be networked to one printer).

Fault Recording

Record lengths:

- Pre-fault time:- 50ms - 5s.
- Fault time:- 100ms - 5s (controlled by op limiter).
- Post-fault time:- 100ms - 1s.

Sample rate:

- 32, 64 or 128 samples per cycle.
- 50 cycles:- 1.6kHz, 3.2kHz or 6.4kHz.
- 60 cycles:- 1.92kHz, 3.84kHz or 7.68kHz.

Triggering:

- Level (over and/or under) and rate triggers on all analog channels.
- Settings from 5% to 95% of channel full scale.
- Each analog trigger has an individual operation limiter that can be set from 100ms to 5s. Analog triggering accuracy shall in all cases be better than 0.5% of channel full scale. Level triggers are equipped with hysteresis to prevent unwanted triggering.
- Event triggers on open, close, both or none.
- A user selectable event debounce (0 - 10ms) is provided.
- Negative sequence triggering, zero sequence triggering, frequency level and rate of change triggering are also provided.
- Frequency level triggering is under and over (i.e. Window). Settings in steps of 0.1Hz up to ±2 Hz.
- Level triggers will also be provided on calculated quantities such as MW, Mvar, etc.

Data analysis:

- Record summaries, including record priority information, are stored in a separate database so that they can be retained even if records are overwritten. This database has a capacity for up to 128 summaries.

Communications and configuration:

- Fully configurable using *Replay™ Plus* software.

SER Output

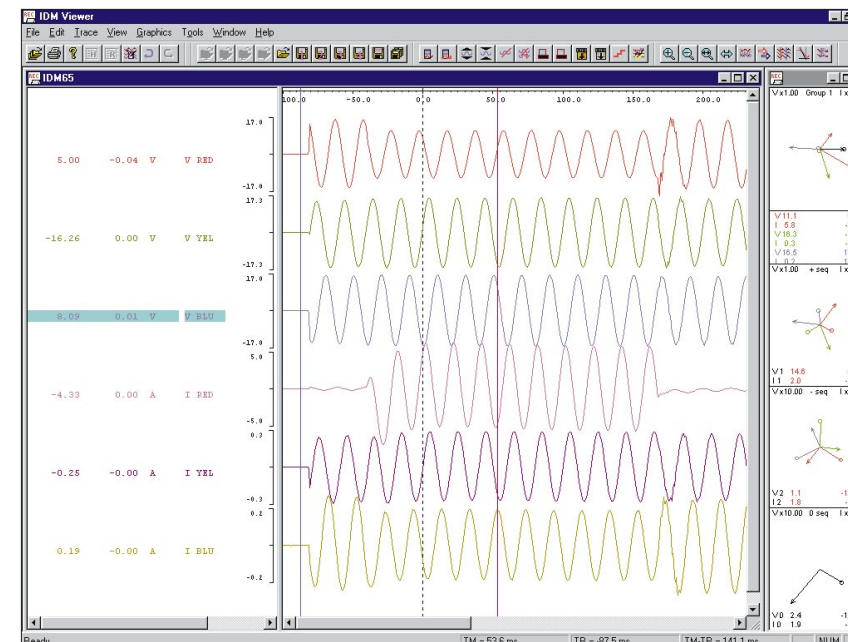
- Data associated with changes in event inputs or operation of analog triggers is recorded and output locally or remotely in conventional SER format.

*Hathaway's policy of continuous product improvement may mean that equipment supplied differs slightly from this specification.

Replay™ Plus

Replay™ Plus is a Master Station software package running on Windows 95/98 or Windows NT. It provides full configuration, data retrieval, display, analysis and printing capabilities. Predefined display screen configurations can be used to allow data to be displayed quickly in an easily interpreted format. As each record is transferred to the *Replay™ Plus* Master Station, analysis software extracts a series of parameters that can be used for later analysis. These parameters are stored in an open database, Microsoft Access, where additional software and queries can be used to perform protection performance, power quality and plant condition analysis. Data can also be transferred to third party applications using SQL.

- Tightly integrated, powerful 32-bit Windows 95/98/NT application
- Supports DFR, SER and slow scan functions
- Graphical manipulation of full record data
- Time and magnitude zoom
- Overlay multiple records
- Controlled editing, transmitting and archiving of configurable parameters
- Sequence components analysis
- Harmonic analysis
- Calculation of watts, vars, frequency, etc



Advanced Record Display, Analysis and Manipulation

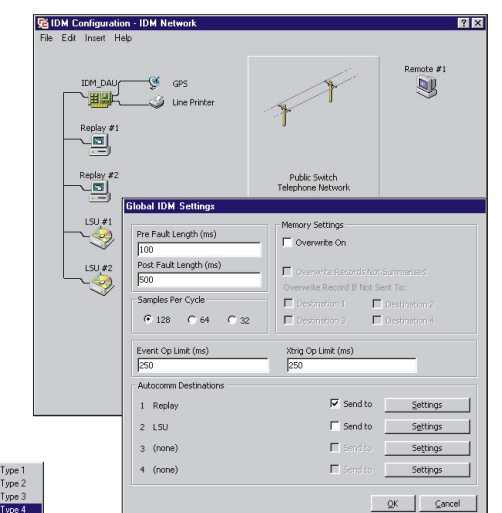
Profiles™ and Data Retrieval

Retrieval of data is controlled by the Master Station and can be carried out manually or automatically by polling. Data can also be retrieved using one of a number of user defined templates or *Profiles™*. These can be used to retrieve data around a specified time (e.g. a trigger time) with the data retrieved coming from user selected channels on one or more IDMs. As a result of a trigger detected by one IDM, data can be automatically retrieved from both ends of a number of transmission lines and stored in one or more record files.

In this way, data from various parts of the power system can be automatically retrieved and made available for immediate display and analysis in a convenient manner.

Profiles™ can also be used to retrieve power system monitoring data from multiple sites creating a single record containing system wide information, including phasors.

Replay™ Plus is fully compatible with existing installed Hathaway DFRs (i.e. DFR 1200s and DFR IIs).



Replay™ Plus Demonstration

A demonstration copy of *Replay™ Plus* is available on 3.5" diskettes or on a CD-ROM. Contact Hathaway for details.



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