▌ OVERVIEW

1. BACKGROUND OF DARWIN DEVELOPMENT

Personal computers (PCs) have become an essential tool in all parts of society, not just offices. Developments in semiconductor devices such as high-speed CPUs and large capacity DRAMs, and the advent of operating systems with a sophisticated human interface deliver the functionality of large computers with the familiarity of game machines. And progress in communication technology has brought low-cost, high-speed communication between PCs and various networks such as the Internet.

As a result, customers in the instrumentation and control industry now demand data acquisition equipment that can be linked to PCs, for various applications from the laboratory to the site in order to improve work efficiency, quality, and data processing. System flexibility is essential, such as expandability of the types and points of input signals, the adaptability of equipment to distributed systems, minimum cost for the scale and functions, and compatibility with the user's PCs and other media devices. In addition, convenience for "[BOX] = All-in-One" functions, such as in hybrid recorders, which are typical data acquisition instruments, visual monitoring and display by recording on paper, and analog memories are still strongly needed. YOKOGAWA has developed the DARWIN series based on a completely new concept in response to these market needs. The series is briefly outlined below.

2. CONCEPT OF DARWIN

The name 'DARWIN' stands for Data Acquisition and Recording Windows. It also refers to Charles Darwin, the famous evolutionist, to reflect the fact that this data acquisition equipment is continually being developed to adapt to changes in needs, economies, computer and communication technologies, environment, and so forth. The equipment is modularized, with the data acquisition engine as the heart of the measurement system, which converts analog signals to digital signals. The series uses various "Window = interfaces", so that the data acquisition environment can be freely configured to ensure expandability; there are no black-box type restrictions. The series is designed to overcome conventional problems and to offer a flexible response to changes in the environment. This ability to evolve with the times makes the series a new standard for data acquisition equipment.

■ **PC-friendly**
- Multiple PC interfaces
- Multiplication of memory devices
- Complete package software and driver software

■ **User-friendly**
- Freedom of system design
- Excellent human interface
- Environmentally durable and very safe
- Multi-channel, high-speed, accurate measurement

■ **Reasonable Cost**
- Wiring saving by remote measurement function
- Space and instrumentation cost reduction through miniaturization
- Built-in signal converter allows direct input from sensors
- Lower initial investment because no engineering required

3. CONFIGURATION OF DARWIN SERIES

The DARWIN range consists of the DA100 series, which acquires data as PC front end units, the DR series, which can record and acquire data simultaneously, and the DC100 series data collectors, which contribute to the digitization of measured data. The devices incorporate miniature remote multiplexers that combine input modules, integrating the data acquisition engine and the signal converter/scanner with the base module that contains the power supply and the communication control section, as well as computer communication modules and display/record units.

In the DA100, DC100, DR230, and DR240 series, there are two types of units, a stand-alone type and an expandable type, which cover a wide variety of applications. The stand-alone type can efficiently measure up to tens of channels on an 'all-in-one' basis, while the expandable type economically measures up to 300 channels for distributed applications (The DR130 series consists of a stand-alone type only).

DC100 Data Collector

DA100 Data Acquisition Unit

DR230 Hybrid Recorder (Stand-alone model)
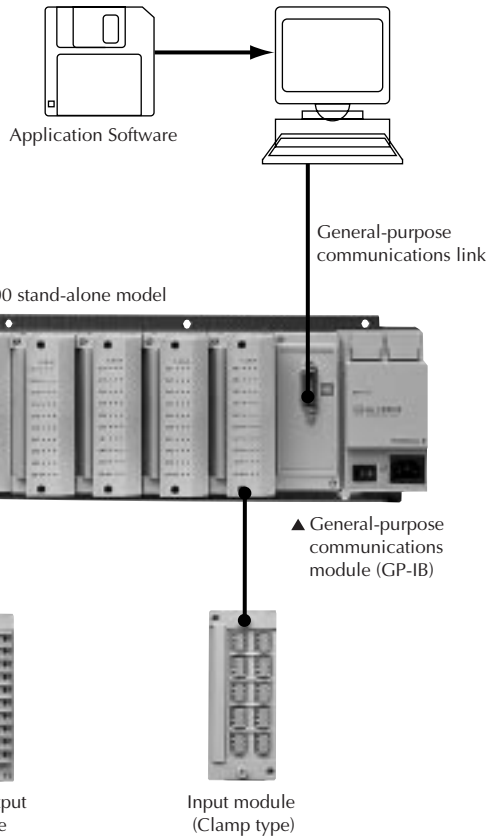
DR240 Hybrid Recorder (Expandable models)
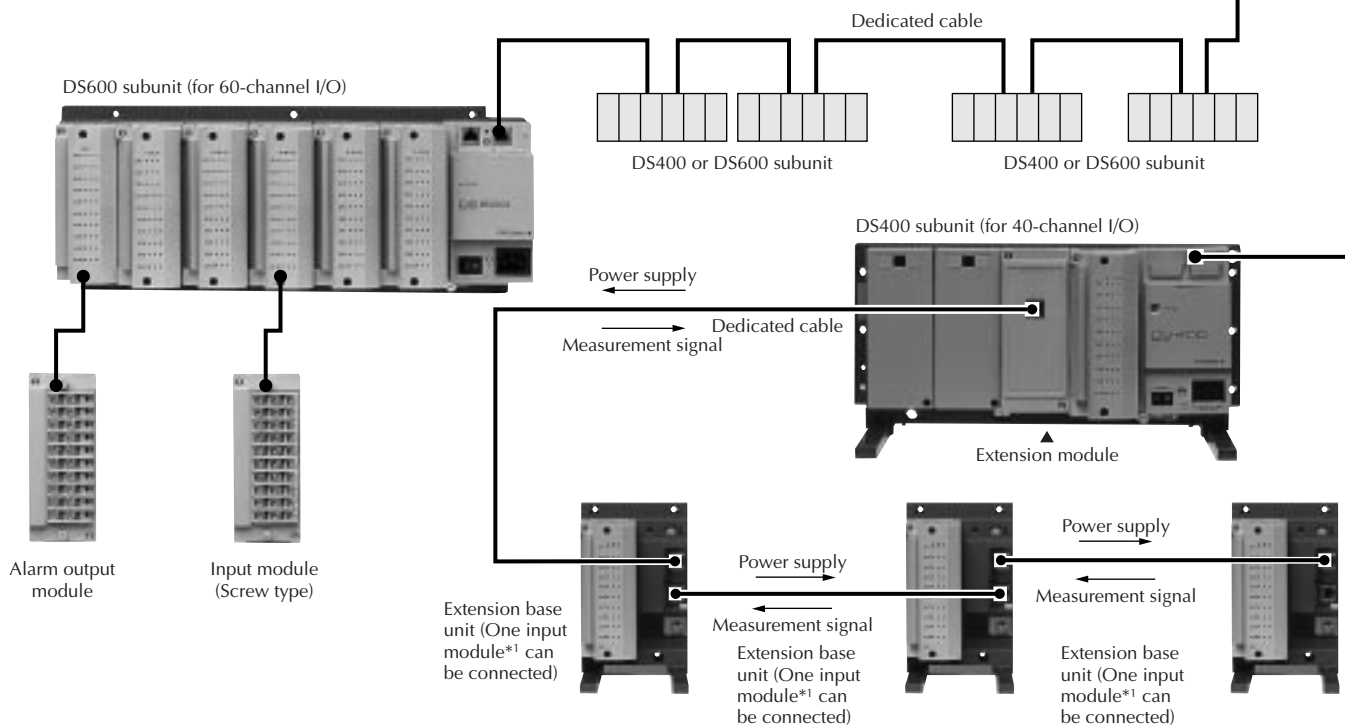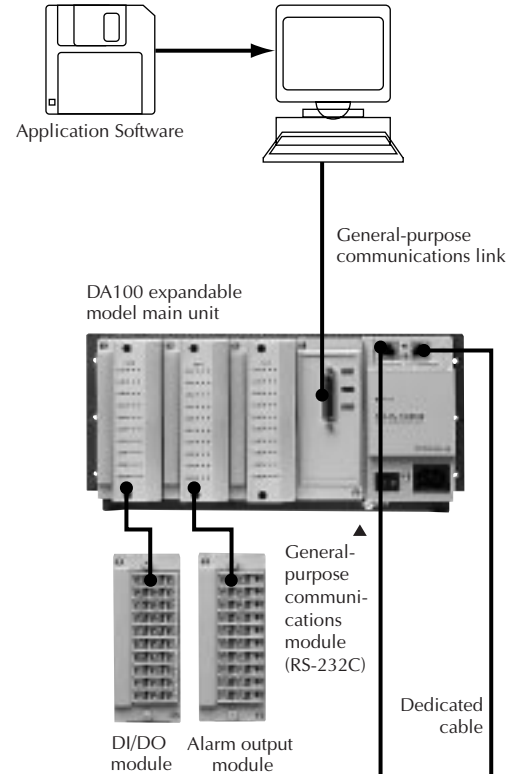
DR130 Portable Hybrid Recorder

■ SYSTEM CONSTRUCTION EXAMPLE

● **DA100 Stand-alone Model**

Application Software

General-purpose communications link

DA100 stand-alone model

▲ General-purpose communications module (GP-IB)

Alarm output module

Input module (Clamp type)

DS600 subunit (for 60-channel I/O)

Alarm output module

Input module (Screw type)

● **DA100 Expandable Model**

Application Software

General-purpose communications link

DA100 expandable model main unit

▲ General-purpose communications module (RS-232C)

DI/DO module

Alarm output module

Dedicated cable

Dedicated cable

DS400 or DS600 subunit

DS400 or DS600 subunit

DS400 subunit (for 40-channel I/O)

Power supply

Dedicated cable
Measurement signal

▲ Extension module

Power supply

Measurement signal

Power supply

Measurement signal

Extension base unit (One input module*1 can be connected)

Extension base unit (One input module*1 can be connected)

Extension base unit (One input module*1 can be connected)

*1: 10-channel universal input module or
10-channel DC V/TC/DI input module

● **Sub-unit**
This is the base which performs the role of an intermediate interface for connecting small I/O modules to the DA/DR and DC main units.Up to six subunits, each of which can contain a maximum of six I/O modules, can be used with one main unit. In addition, a dedicated cable enables the main unit of the system to be connected to each subunit over a total cable length of up to 500 m. This ensures great design flexibility, and makes wiring for remote measure-ment more efficient and less costly.

● **Input/Output Modules**
Miniature multiplexers, whose channels come in multiples of 10, convert measurement signals from analog to digital at an interval of up to 500 ms.
  • Universal input modules for measurement of temperature, voltage, and contact inputs
  • Power monitor modules accept AC voltage and current signals, and measure RMS values, active power, frequency, and so on.
  • Pulse input module for measurement of pulse signals to integrate flow rates, etc.
  • DC current input modules for measurement of 4-20 mA signals
  • Strain measurement modules for output of strain gauge signals
  • Digital input module for measurement of contact inputs
  • Alarm contact output modules for output of alarm information as contact signals
  • DI/DO module for combining alarm contact output, remote control of recorders using contact input, failure output, and chart-end output
  • Retransmission modules convert measurement data or computation data to 1-5 V analog voltage or 4-20 mA analog current signals for output.
    This module can only be installed in the DA100 or DC100.

● **General-puropose Communication Interface Modules**
You can set up the measurement conditions and acquire field data via the following general-purpose communication interfaces:
  • RS-232-C
  • RS-422-A/485
  • GP-IB
  • Ethernet

● **Other Modules**
  • Extension modules and base units allow input modules to be installed up to 30 m away from the main unit or sub unit.
  • A cable adapter is used as a relay terminal for special extension cables, or as a conversion adapter between a special extension cable and another cable.

4. FEATURES
■ **Excellent Environmental Resistance**
The operating temperature of the base modules including input modules, power supply and communication control section ranges from -10°C to 60°C. In response to such diverse uses as for instruments in cars, DC-driven versions have been developed which are rugged and durable.

■ **Remote Instrumentation**
  • YOKOGAWA's own bus cable between high speed communication units can be extended up to 500 m, thus reducing the cost of input wiring.

  • By utilizing an extension module, the power can be directly supplied to up to 3 input modules, providing power for distributed inputs in a limited range because the total length of the power cable can be up to 30 m.

■ **Multiple PC Interfaces**
GP-IB, RS-232-C, RS-422A/485 and Ethernet general-purpose interface modules are provided, enabling measured data to be transferred to a PC on a real-time basis.

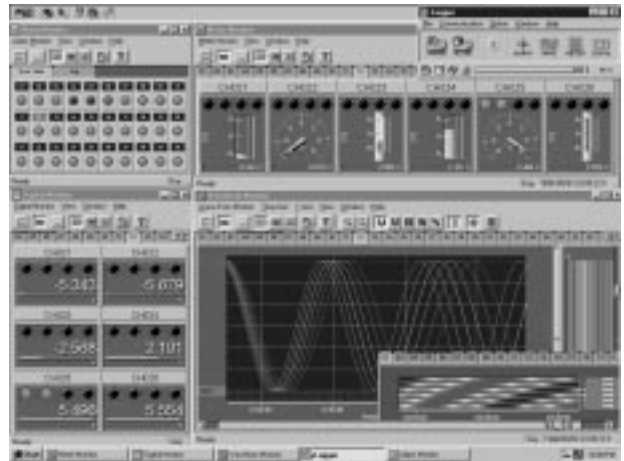■ **Addition of Memory Devices (DR series or DC series)**
The 3.5-inch floppy disk drive can be specified depending on the application.

■ **Data Acquisition Software DAQ32, DAQ32Plus**
The DARWIN DAQ32 software is the standard software for common use with all the data gathering instruments in the DARWIN series. The software includes hardware setup, simplified data logging, simplified data viewing, data conversion (Excel, Lotus 1-2-3 or ASCII format), preference setting, system diagnosis, and calibration functions, all in one package.
DAQ32 Plus includes all of the features of Standard DAQ32, plus various enhancements to the monitoring and data acquisition features. DAQ32 Plus has many features not found in Standard DAQ32, such as 30-window display capability for showing as many as 32 channels in each window (Standard DAQ32 can only display two windows with 10 channels per window), various meter displays (level, analog, thermometer), alarm displays, a DDE server feature, and daily report files.
DAQ32 and DAQ32Plus, which have been developed for use with 32-bit operating systems, are designed to run under Windows 95, Windows 98, Windows 2000 or Windows NT4.0.

● **Offers Remote Monitoring and Multi-location Monitoring via a Network**
The DAQ32 Plus makes it possible to simultaneously monitor data on up to 8 PCs by accessing the monitor server of the DAQ32 Plus from client PCs via Ethernet.
  • **Remote monitoring**
Remote and real-time monitoring is available in cases, for example, where the laboratory is far from the engineering area.
  • **Sharing data**
Up to 8 client PCs can be connected with 1 monitor server, enabling the sharing of real-time measurement data.

5. ELEMENTAL TECHNOLOGY

■ **High Breakdown Voltage Solid State Relay (SSR)**

Developed by YOKOGAWA, the SSR switches the inputs when performing multi-channel measurement. A semiconductor device takes the place of the contacts and drive part of a mechanical relay, thus overcoming the problem of defective measurement caused by faulty or worn contacts of the mechanical type relay. YOKOGAWA's solid state relay has high breakdown voltage (1500 VDC) enhancing safety in the field. Also, its low leakage current (1 nA) enables the very low level voltage signals from a thermocouple to be measured with high accuracy.

YOKOGAWA currently uses this SSR in its hybrid recorders and the advanced μR series of industrial recorders. Over 800 thousand channels of this technology have performed successfully in various field and laboratory applications, thus verifying the reliability of the relay device.

A new surface-mounted version of this highly reliable SSR is used in the DARWIN family. This permits a high degree of miniaturization, low power consumption, long device life and quiet operation.

Table 1   Characteristic Comparison of High Breakdown Voltage Solid State Relay and Electromagnetic Relay

Items		High breakdown voltage solid-state scanner	Electromagnetic relay scanner
Insulation resistance		1,000 V AC	1,000 V AC
Surge resistant voltage		1,500 V AC	1,500 V AC
Allowable common mode voltage		250 V AC	250 V AC
Off-leak current		1 nA or less*1	4 nA or less*2
Thermal e.m.f.		1μ V or less	1μ V or less
Response		0.5 ms or less	10 ms or less
Service life		Semi-permanent	About 50,000,000 times
Measured values of noise immunity*3	CMRR	150 dB	140 dB
	NMRR	60 dB	60 dB
	Input pulse noise (1 kV, 800 ns, 50 Hz)	No erroneous operation/trouble	No erroneous operation/trouble

*1 Ordinary temperature, at 100 V DC impression.
*2 Calculated from the source voltage of coil and the insulation resistance.
*3 At 20 mV range.

■ **Planar Transformer**

A planar transformer is a revolutionary integrated transformer intended to replace the conventional wire-wound transformer, the most antiquated of all electronic components. This small, thin transformer consists of a multi-layer precision thin film coil, enhancing insulation, and also reducing heat and noise emission. This transformer achieves compactness and high performance, while enabling the volume of the power supply unit to be reduced to an amazing 1/2 to 1/4 that of previous power supply units.

All of the transformers in the main unit, subunits and input and output modules of the DARWIN are planar transformers. This is an important factor in achieving the large degree of miniatur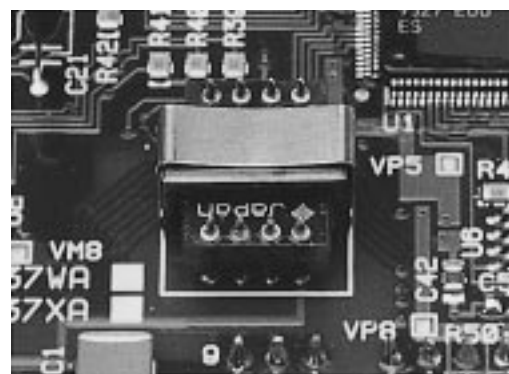ization and weight reduction of the DARWIN series.