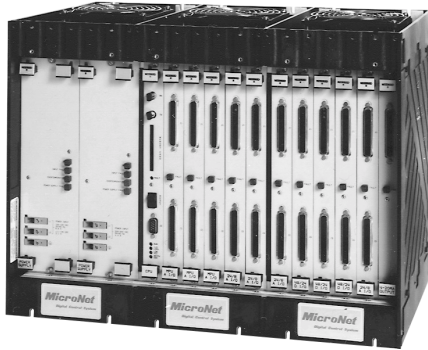# MicroNet™
CONTROL SYSTEM

APPLICATIONS

The MicroNet™ Control System is a state-of-the-art digital controller that is programmable for many types of applications in the control of:

- Gas Turbines
- Steam Turbines
- Hydro Turbines
- Diesel Engines
- Gas Engines

The MicroNet Control System provides a flexible platform to control any prime mover and its associated processes such as high speed control functions, system sequencing, auxiliary system control, surge control, monitoring and alarming, and station control. The MicroNet digital control is available in both simplex and triple modular redundant (TMR) configurations. Each version is expandable into multiple chassis as required by the system size and will support any mix of I/O, including networked, distributed I/O.

PROGRAMMING

The MicroNet Control System provides an IEC1131-3 environment for programming.

- Function Block Diagrams - through Graphical Application Programmer (GAP)
- Sequential Function Charts - through Graphical Application Programmer (GAP)

- Structured Text
- Ladder Logic (On-line Programmable)

GAP software is the graphical programming tool specifically designed for quick and easy implementation of complex control strategies. Gap provides an environment where application engineers can concentrate on control and application issues, not on software coding details.

SYSTEM DESCRIPTION - MicroNet™ DIGITAL CONTROL

The MicroNet control is available in two chassis sizes with either 6 or 12 VME slots. Both have a dedicated power supply section and control section located in a single chassis. The power supply section supports simplex or redundant power supplies.

PROGRAM EXECUTION
The MicroNet Operating System, together with GAP, produces a very powerful control environment. Woodward's unique rate group structure ensures that control functions will execute deterministically at rate groups defined by the application engineer. Critical control loops can be processed within 5 milliseconds. Less critical code is typically assigned to slower rate groups. The rate group structure prevents the possibility of changing system dynamics by adding additional code. Control is always deterministic and predictable.

CPU OPTIONS
Two families of Central Processing Unit (CPU) modules are available which provide different levels of performance and features. Both use the same programming methods and rate group structure.

- Pentium/NT CPU - the newest offering for the MicroNet gives very high performance for the most complex (size, speed of execution, math intensive, etc.) applications imaginable.

- Provides Total System Control

- Expandable to Meet System Needs

- Communication via Serial Ports and EtherNet LAN's

- Available in Either Simplex or TMR Configurations

- Hot Replacement of Modules

- Simplex or Dual Redundant Power Supplies

- Real time Multitasking Operating System with Deterministic Update Rates

- Based Upon Proven NetCon® Control Hardware and Software

- High-Density I/O Modules With Time Stamping
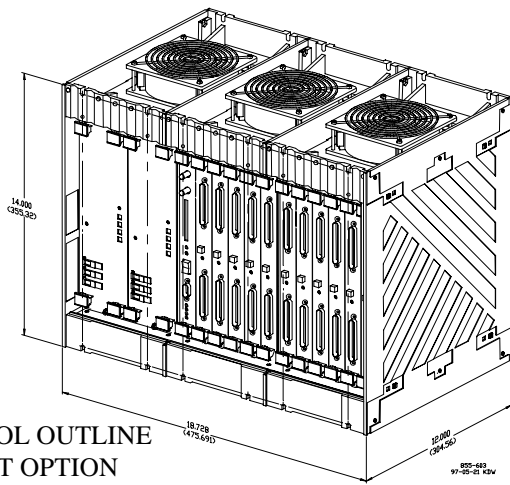
CONTROL OUTLINE
(12 SLOT OPTION

The Windows NT® operating system is enhanced with areal-time extension that, together with the rate group structure of GAP, provides determinism. This CPU is only available in the Simplex architecture.

- Ethernet Port (10/100 BaseT)
- Two RS232 Serial Ports
- Video, Keyboard, Monitor output for local display support
- Program loading over Ethernet TCP/IP network using standard Windows Explorer

• Motorola 68040 CPU - the traditional workhorse of the MicroNet and its predecessor (NetCon) that gives excellent performance for most applications. The proprietary operating system supports both Simplex and Triple Modular Redundant (TMR) architectures. Features include:
- RS232 Serial Port
- Fiber optic port for local display support
- PCMCIA port for program and data file loading
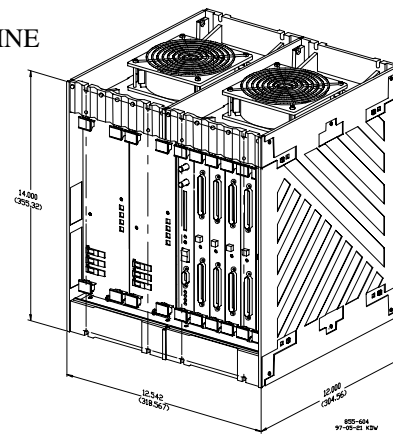
COMMUNICATIONS
The MicroNet supports multiple protocols and physical mediums for communications to DCS systems, PLC's, other controllers, distributed I/O, and actual field devices. In addition to the physical ports available on the selected CPU, other ports are available.
• Ethernet UDP module available for Motorola CPU family
• Serial I/O (SIO) communication card with 4 ports (2 RS232, 2 configurable for RS232, RS422, RS485)
• LON network for LinkNet® Distributed I/O Modules
• Specialized serial communications modules for a variety of specific communications applications such as mechanical device drivers and sensor interfaces

Protocols Supported:
• Modbus (RTU and ASCII) over serial or Ethernet
• Ethernet TCP/IP (Pentium/NT CPU only)
• Ethernet UDP
• Dynamic Data Exchange (DDE)
• Printer Drivers, Modems, Data Loggers
• Custom Proprietary Drivers for communicating to specific devices

HUMAN MACHINE INTERFACE (HMI)
PC-based Human Machine Interface software provides a powerful interface to operators and technicians. Communications to the HMI are through Serial or Ethernet connections. The HMI provides operational and analytical information such as graphical display of operating data, historical trending, event logging, X-Y plotting, system overviews, calibration pages, and other functions.

SERVICE INTERFACE
Woodward offers several software products for service interface. From simple monitoring of any system variable to high resolution plotting of control variables, service tools are available to simplify troubleshooting.

EXPANSION
The MicroNet Control is expandable for systems requiring more I/O than that accommodated in the base chassis. Depending on the type of I/O and control functions required, the expansion can be accomplished by adding an additional MicroNet chassis, LinkNet or other distributed I/O modules, or any combination.

I/O MODULES AND FIELD TERMINATION
The MicroNet digital control can accommodate any combination of Woodward I/O modules to provide maximum application flexibility. Standard I/O modules available are:
• Thermocouple inputs
• Resistance Temperature Devices (RTD)
• Analog inputs (mA, V)
• Discrete inputs
• Discrete outputs
• Magnetic pickup (MPUs)
• LVDT and RVDT position inputs
• Proportional and Integrating Actuator Drivers
• Serial Communication cards (SIO)
• Local Area Network, EtherNet
• Special hardware cards
• Chassis expansion modules
• Relay interface modules
• High-Density Discrete I/O
• High-Density Analog I/O
• High-Density Combo Card

MicroNet I/O modules are designed and tested for the specific needs of Prime Mover control and monitoring. Exceptional accuracy, fast updates, high channel to channel isolation and other features differentiate them from common industrial I/O modules.

Hot-replacement of most modules allows modules to be exchanged while power is applied. Many modules are "Smart Modules" with an on-board micro-controller to manage the module's internal operations and to provide continuous self-diagnostics. Smart modules are self-calibrating and provide periodic on-line calibration monitoring to ensure the integrity of I/O measurement and control. The high-density modules allow for very cost effective I/O and can time stamp discrete signals with 1 ms resolution and analog signals with 5 ms resolution.

Termination of field wiring is accomplished using Woodward Field Termination Modules (FTM's). The FTM's mount to a standard DIN rail and provide easy access to field wiring. Standard cables connect the FTMs to the control I/O modules.

DISTRIBUTED I/O MODULES
Distributed I/O gives a cost effective solution for sequencing and monitoring functions that do not require the performance available with the standard control modules. Distributed I/O is a concept where I/O modules are distributed on a Local Area Network. Modules can be located in the field to minimize the wiring runs of many sensors and devices. Only the network connection comes back to the control system. Distributed I/O can also be located in the control room (in the control cabinet or simply nearby) as an alternate means of gathering I/O.

The MicroNet supports several distributed I/O options. Woodward's LinkNet distributed I/O modules connect to a dedicated LON driver card located in the MicroNet. The Pentium/NT CPU provides a Modbus over TCP/IP Ethernet alternative that allows the use of commercially available Distributed I/O products. Contact Woodward to determine which products are supported.

SYSTEM DESCRIPTION - MicroNet TMR

The MicroNet TMR control system incorporates the features of the MicroNet described above in a Triple Modular Redundant (TMR) control architecture. The MicroNet TMR uses the Motorola CPU architecture (the Pentium/NT CPU does not presently support TMR) with double exchange voting and the same software synchronization routines as the NetCon F/T. The MicroNet TMR consists of three isolated kernel sections. Each section includes its own CPU, CPU power supply and up to 4 I/O modules. The I/O modules can be used for simplex I/O, redundant I/O, triple redundant I/O or any redundancy combination. Each kernel I/O section is expandable into one or more of the MicroNet chassis discussed above. Interface modules provide inter-rack communications.

The kernel sections individually monitor all input data, perform all application calculations and generate all output values and responses. Outputs are assessed with the 2-out-of-3 voting logic. With this configuration any fault or number of faults associated with a kernel can be tolerated without affecting system operation. The advantages of triplex architecture as compared to duplex architecture are as follows:

- 2-out-of-3 voting provides superior fault detection of all I/O, hardware and control algorithms.

- Eliminates single point failures
- Reliability is vastly improved by extending fault coverage to nearly 100%
- Greater flexibility for implementing a variety of fault-tolerant configurations.
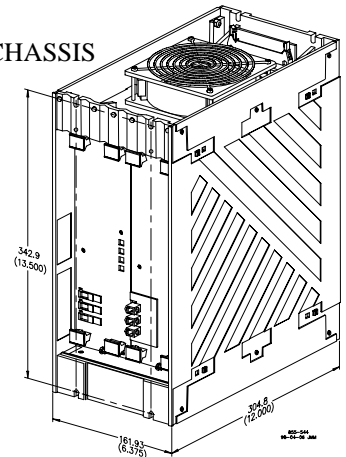- Superior latent fault detection
- On-line serviceability

The high-density MicroNet cards provide first-out indication for monitored system events to reduce troubleshooting time. These cards will time stamp the event within 1 ms for discrete inputs and 5 ms for analog inputs.

The MicroNet TMR uses two power supplies, each of which powers the control from a separate power source. Inside each power supply are three independent power converters, one for each CPU and I/O section. The triplicated power architecture provides maximum protection against hardware failures.
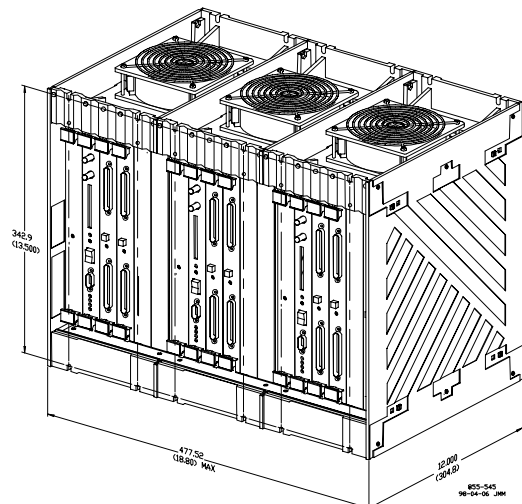
Woodward also provides full TMR relay modules for critical discrete outputs. To accomplish this, a six relay configuration is used. If any one relay fails in a normally open configuration, or if any two relays fail in a normally closed configuration, the contact path is not interrupted, and the fault does not interrupt normal operation. Latent fault detection is used to monitor and detect any relay faults.

The MicroNet TMR control will drive multiple actuator coils and current drivers to support dual redundant and triple redundant field devices.

MicroNet TMR
POWER SUPPLY CHASSIS

MicroNet TMR CONTROL
CHASSIS OUTLINE

SPECIFICATIONS

OPERATING CONDITIONS

Temperature
   0°C to +55°C (32°F to 131°F) ambient air temperature range
   0°C to +50°C (32°F to 122°F) for Pentium/NT CPU

Shock
   MIL-STD-810C, method 516.2-1, procedure 1B

Vibration
   Lloyd's ENV2 test #1

Emissions*
   EN55011, Class A, Gr 1

Immunity*
   EN50082-2 (1995)

Certifications*
   CE, UL/cUL (Class I, Div 2), LR for Cat ENV1 & ENV2, ABS

MicroNet CHASSIS
All versions are bulkhead mounted or adaptable to 19" rack mount back panel.

MicroNet WITH POWER SUPPLY SECTION AND 6 I/O SLOTS
Dimensions
   12.6" wide x 14.3" high x 12.1" deep (320.04 mm wide x 363.22 mm high x 307.34
   mm deep)

Approximate weight
   35 lbs (15.9kg)

MicroNet WITH POWER SUPPLY SECTION AND 12 I/O SLOTS
Dimensions
   18.8" wide x 14.3" high x 12.1" deep (477.52 mm wide x 363.22 mm high x 307.34
   mm deep)

Approximate weight
   53 lbs (24 kg)

MicroNet TMR—18 SLOT CHASSIS
Control chassis dimensions
   18.8" wide x 14.3" high X 12.1" deep (477.52 mm wide x 363.22 mm high x 307.34
   mm deep)

Control chassis weight
   55 lbs (25 kg)

Power chassis dimensions
   6.4" wide x 14.3" high x 12.1" deep (162.56 mm wide x 363.22 mm high x 307.34 mm
   deep)

Power chassis weight
   16 lbs (7.3 kg)

POWER SUPPLY INPUT OPTIONS
18-36 Vdc, 100-150 Vdc, 88-132 Vac (47-63 Hz), 180-264 Vac (47-63 Hz)

*Specifications apply to most components and modules. Some certifications may be
pending. Contact Woodward for further information.

For more information contact:

99/8/F