Bristol® ControlWave® LP

Low Power High Performance Process Automation Controller

Bristol® ControlWave® LP, from Emerson Process Management, is a low power high performance process automation controller that performs complex control strategies, collects, time stamps, and stores data, and communicates in local, remote, and wide area networks. ControlWave LP offers the features of an RTU and an automation controller with DCS functionality.

Designed for control and data acquisition applications, the ControlWave LP is easily installed in"remote areas and offers one of the industries widest operating temperature ranges. Additionally, due to its small form factor and rugged industrial design, ControlWave LP offers an outstanding ability to match the requirements of the most demanding process plant and remote SCADA system environments. Above all, Emerson has developed this innovative controller to provide cost-effective solutions by minimizing the time required for installation and configuration.

The ControlWave LP complements the ControlWave and Network 3000 family of process automation controllers and RTU's. The ControlWave LP is compact in size and offers the full programmability of ControlWave Designer IEC 61131 compliant software, and communicates via standard BSAP, as well as other industry standard protocols.

The ControlWave LP is available in an open chassis assembly for mounting to a panel or within an enclosure. The unit is a three-board assembly consisting of a CPU board, a Multifunction Input/Output board, and a Power Supply/Sequencer board. All field I/O connections to the ControlWave LP are readily available via quick disconnect terminals located on the sides of the chassis.

Hardware Features

- Ultra Low Power 486 based processor provides high performance with low power consumption.

- Five asynchronous serial communication ports

- Fixed I/O with optional expansion I/O

- Field device power supply built in

- Small size

- Wide temperature range (-40ºC to +70ºC) Class I, Div. 2 hazardous location and CE approval

Low Power Performance

The ControlWave LP uses the Ultra Low Power (ULP) Intel 486SX processor. The CPU is operated at 3.3 V to reduce power consumption. The unit automatically goes into a low power, quiet mode, during CPU idle time. These features make ControlWave LP the logical choice for low power applications using solar panels and battery backup.

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Specifications

CPU

- Intel Ultra Low Power 486SX 32 bit processor -25 MHz

- Data Storage Memory: 2 MB SRAM battery backed memory

- Historical Archive Memory: Stored in either flash or battery backed SRAM

- Code/ Instruction Memory: 4 MB on-board FLASH

- BIOS: 512 Kbytes Boot-Block FLASH

Communication

- Four RS-232 serial communication ports with standard PC/AT 9-pin male D-sub connectors, supporting baud rates up to 115.2 KB

- One selectable RS 232 or RS 485 serial communication port with standard PC/AT 9-pin male D-sub connector, supporting baud rates up to 115.2 KB

- RS 485 port has line pull-ups and termination resistor

- Modem control on all ports.

- One 10 Base-T Ethernet port with RJ45 connector - Optional.

- Isolation: Ethernet port isolated to 500 Vdc

Power Supply/Sequencer Board

- Input Power: 12 or 24 VDC input: 10 to 22 VDC or 22 to 30 VDC

- Plugs into Multifunction Motherboard

- Provides system isolated + 5 VDC & +/- 12 VDC power

- Fused with power-on switch.

- Master Clear and Power Fail Indication

- Power sequencer for auto power recovery

- Power supply isolation: 500 VDC

- Surge Suppression: 500 VDC MOV PSGND to CHASSIS 32 V Transient suppressor across VIN + to PSGND Meets ANSI/IEEE C37.90-1978

Low Power Mode

ControlWave LP power consumption is highly dependent on the actual application program and whether or not you are using internal loop power to field devices.

Typical power consumption range: 150 to 200 mA @ 24 Vdc

Fixed Multifunction Input/Output Board

The Fixed Multifunction Input/Output Board (FMI/OB) contains four I/O modules with pluggable terminations and a PC-104 Interface for interconnection of fixed and expansion I/O subsystems. The board also provides for electrical isolation to field devices, surge suppression, and LED indicators for Discrete I/O, CPU, and communications functions. The four I/O modules are fixed as follows:

- 16 Discrete Inputs

- 8 Discrete Outputs

- 4 High Speed Counters

- 8 Analog Inputs

Two on-board Field Power Supplies are provided: one for DI and HSC operation and one for AI operation. The output voltages are electrically isolated (500 VDC) and are regulated at 24V.

Fixed I/O Subsystem

ControlWave LP Discrete Input Module

- Number of Points: 16 Fixed

- Input Voltage Range: 12V or 24V

- Input Filtering: 1 millisecond or 30 milliseconds

- Input Configuration: Contact Closure, internally or externally sourced on a point by point basis. Jumper Configurable

- Input Current: 2.5 mA +/- 10%

- '1' State Voltage: 90 % of input voltage range

- '0' State Voltage: 10 % of input voltage range

- Interrupt Generation: On change of state transition on a point by point basis

- Bus Access: Sixteen bit wide

- Electrical isolation: 1500 VDC

- Electrical isolation: 1500 VDC

- Surge suppression: 500Vdc MOV to chassis 38 VDC MOV across input and to Field Common Meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable, maximum wire size is 16 gauge

- Status indication: 16 LED's (one per point)

ControlWave LP Discrete Output Module

- Number of Points: 8

- Output Type: Open Drain

- Max Operating Voltage: 38 VDC

- Max. Operating Freq: 20 Hz

- Sink Current: 100 mA Maximum

- Electrical Isolation: 1500 VDC

- Surge Suppression: 500Vdc MOV isolated common to chassis 38 VDC MOV across input signals and (-) input to chassis Meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable, maximum wire size is 16 gauge

- Bus Access: 16 Bits Wide

ControlWave LP Analog Input Module

- Number of Points: 8

- Input Configuration: Isolated Voltage Input: 1-5V

- Isolated Current Input: 4-20 mA

- Powered Current Loop: 4-20 mA

- Accuracy: 0.1 % of span @ 25 deg. C 0.2 % of span –20 deg.C to + 70 deg. C 0.3 % of span –40 deg.C to + 70 deg. C

- Isolated Voltage/Current: 38 VDC referenced to isolated common

- Powered Current Loop: 0 V referenced to isolated common When a field supply common is connectesd to the AI system the isolated common is connected to the field supply common

- Input Filtering: 300 milliseconds to 99.75% of signal input.

- Channel Settling Time: 300 microseconds

- Conversion Time: 200 microseconds

- On Board References: 1V, 5V - optional

- Surge Suppression: 500Vdc MOV isolated common to chassis 38 VDC MOV across input signals and (-) input to chassis Meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable, maximum wire size is 16 gauge

- Bus Access: 16 Bits Wide

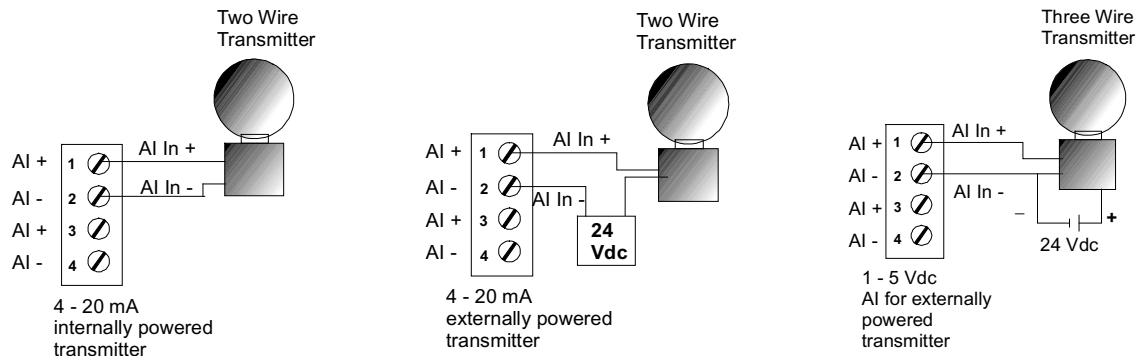### ControlWave LP High Speed Counter Module

- Number of points: 4

- Input Voltage Range: 12V or 24V

- Input Filtering: 10 KHz max.

- Input Filtering: 20 microseconds

- Input Configuration: Set/Reset inputs, contact closure, externally sourced on point by point basis with jumper configurtion.

- Input Current: 2.5 mA +/- 10%

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Two Wire Transmitter

AI +   1
AI -   2
AI +   3
AI -   4

AI In +
AI In -

4 - 20 mA internally powered transmitter

Two Wire Transmitter

AI +   1
AI -   2
AI +   3
AI -   4

AI In +
AI In -
24 Vdc

4 - 20 mA externally powered transmitter

Three Wire Transmitter

AI +   1
AI -   2
AI +   3
AI -   4

AI In +
AI In -
24 Vdc

1 - 5 Vdc AI for externally powered transmitter

- '1' State Voltage: 90 % of input voltage range

- '0' State Voltage: 10 % of input voltage range

- Bus Access: 16-bits wide

- Max Accumulator Value: 65536

- Electrical Isolation: 1500 VDC

- Surge Suppression: 500Vdc MOV to Chasis 38 VDC MOV across input and to Field Common Meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable, maximum wire size is 16 gauge

- Status indication: 4 LED's (one per point)

ControlWave LP Analog Output Module (Optional)

- Number of Points: 4

- Output configurations: 1-5 VDC & 4-20 mA (Individually configured)

- Power Loop: 9 to 30 VDC for 4-20 mA AO 10 to 30 VDC for 1-5 VDC AO

- Accuracy: 0.1% of span @ + 25°C

     0.2% of span @ -20 to 70 °C

     0.3% of span @ -40 to 85 °C

- Common Mode Voltage: 500 VDC (AO ground to chassis)

- Surge Suppression: 16 V Transorb across input to AO Ground Meets ANSI/IEEE C37.90-1975

Environmental Specifications

- Operating Temperature: -40°C to + 70°C (-40°F to + 158°F)

- Storage Temperature: -40°C to + 85°C (-40°F to + 185°F)

- Relative Humidity: 15 – 95 Noncondensing

- Vibration: 10-150 Hz at 1.0G

     150-2000 Hz at 0.5G

- RFI Susceptibility: 3V/M at 80-1000 MHz per EN50082-2

ControlWave LP Packaging

- Physical Size: Mounting Plate is 12.5 inches high x 8.5 inches wide. Unit is 3.5 inches deep.

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ControlWave LP Software

Open Standards For Programming, Network Configuration and Communication.

Only Bristol ControlWave, from Emerson Process Management, brings you the perfect combination of industry standards to minimize your learning, engineering and implementation costs. The intelligent tool suites add an extra dimension to the overall umbrella we call OpenBSI (**O**pen **B**ristol **S**ystem **I**nterface).

- **ControlWave Designer** - Programming Software, I/O Configuration Wizard, and I/O Simulator

- **TechTools** – Diagnostics, Application Downloader, Real-Time ActiveX controls and Setup Wizards

- **OpenBSI Essentials** – NetView/LocalView, DataView, HMI Database Builder, Real Time Active X controls and optional OPC Server

- **HistTools** – Historical Data Collector, Scheduler and File Converter

By adhering to such industry standards as Ethernet, TCP/IP, Microsoft Windows®, COM/DCOM, OLE and Active X, ControlWave is able to achieve the highest degree of openness in control system architecture and bring you the optimal process efficiency and productivity you need to ensure a successful system implementation. To minimize your engineering and development time, we have adopted the best programming standard available in IEC 61131-3. IEC 61131-3 compliant programming is supported by the ControlWave Designer configuration generation tools, offering all five IEC 61131-3 process languages for batch or continuous control, and ladder logic and sequential languages for discrete control, as well as high level languages for maximum flexibility. Additionally, ControlWave is loaded with customized function blocks to simplify the configuration of complicated industrial, water & wastewater, and oil & gas, and industrial control system applications.
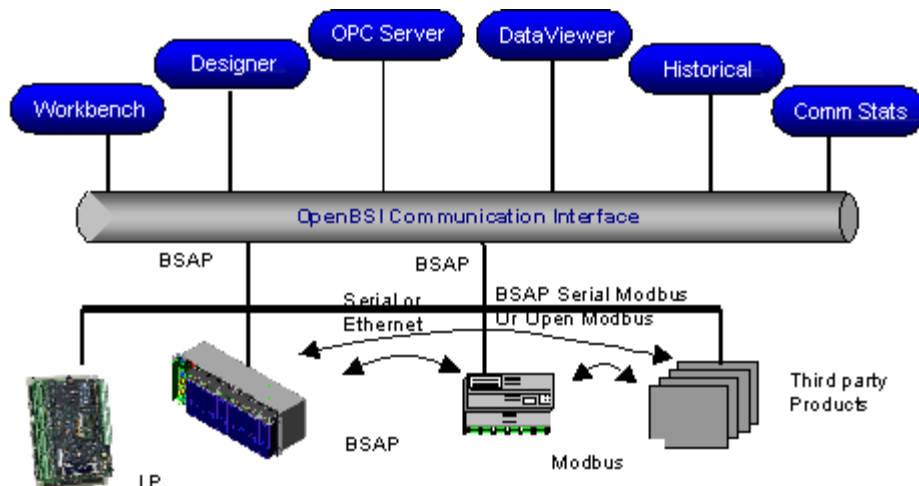
OpenBSI

Simply Creative

OpenBSI (**O**pen **B**ristol **S**ystem **I**nterface) is a set of network setup, communication diagnostic, and data viewing utilities that provide access to both ControlWave and Network 3000 controllers and RTUs. OpenBSI is the only product available in the industry to bring such unique functionality and ease of use to the network level. At the core is the communication interface, written as a Windows 98/NT & 2000 communication server API through which other client applications communicate with the Bristol networks. OpenBSI supports both serial BSAP protocol and Ethernet Internet Protocol communication to ControlWave and Network 3000 RTUs and controllers. Above this communication layer are a group of applications known as OpenBSI Utilities. These client utilities communicate through the server to collect and manage data gathered from the network, generate files based on collected historical data, collect alarms, and monitor and control OpenBSI communications.

OpenBSI Utilities

OpenBSI Utilities provide a full set of communication and data access capabilities for operators directly connected to the ControlWave network as well as remote operators connected through one of the main operator PCs. The OpenBSI includes utilities to easily create the OPC server database from the ControlWave application configuration files, then provide access to those variables to any OPC compliant HMI product for operator display and interaction with the ControlWave network. HistTools – Historical collection and storage

- Communication engine for PC applications

- Supports ControlWave and Network 3000 serial and IP protocols

- RS 232, Dial-line, cellular, radio, CDPD, satellite, and Ethernet connections

- Provides on-line download & signal variable changes

- Allows signal searches based on selective criteria

- Allows network configuration through NetView

- PC and Network communication diagnostics

- OPC Server for interfacing to most HMI software

- Data Collector and Scheduler Utilities Collects historical data on request or scheduled basis

NetView is the basic configuration and application interface for all network operations. NetView uses a tree structure for network graphical display in the Windows Explorer style. Network nodes can be added on-line by simply dragging the node Icon into the tree. This invokes a configuration Wizard simplifying network setup. Through the NetView Wizard, the necessary network parameters are entered for node and IP address, alarm and message routing, and network communication media. Once configured, selecting any node allows direct access to the common OpenBSI utilities to reprogram, download a new application to the node, review communication statistics, view real-time data through DataViewer, and edit controller/RTU properties.


*NetView - Network configuration
and application LaunchPad*

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Local Configuration Wizard allows local communication with any attached ControlWave controller or RTU to download system flashware upgrades, configure cold download parameters, and configure IP and soft-switch parameters.

Configuration Wizard simplifies Network setup

DataView is an on-line utility for ControlWave and Network 3000 nodes used to collect and display several types of process data, including signal values, data array values, signal lists, and audit trail information. Operators have the ability to alter signal values. Multiple DataView windows may be open simultaneously.
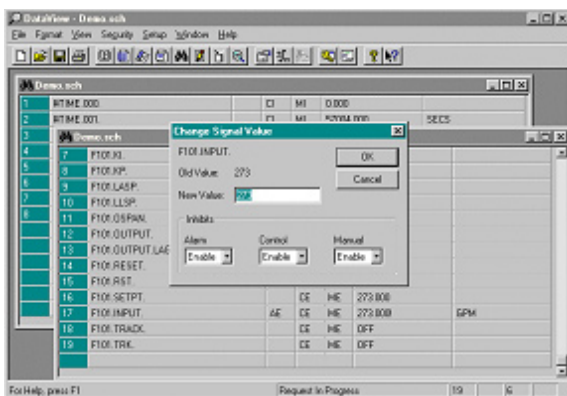
DataView for Real-time data display

TechTools – OPC Server & ActiveX Controls

The Technicians Toolkits consist of a set of configuration wizards and standard web pages which are used to configure a newly installed ControlWave or modify those parameters on an existing controller. The key components of the Technicians Toolkit are:

WebBSI- A set of Active X controls allowing communication access to ControlWave are provided for engineers to develop their own custom web pages using any standard package such as Microsoft® Front-Page. Active X controls allow data to be viewed in any compliant container (such as Microsoft Excel and Word or Visual Basic), or a compliant web page Browser such as Microsoft Internet Explorer.

Real-time ActiveX Controls

One of the many benefits **TechTools** brings to you is our use of open standards such as ActiveX Controls. AcitveX is another of the Microsoft standards, which allow plug and play with any ActiveX container, using Microsoft ActiveX container technology such as Visual Basic, HTML web pages, and Microsoft Excel

The set of available ActiveX Controls provides the basic functions necessary to communicate and collect data from ControlWave.

ActiveX Controls

- Security – 56-bit encryption - allows the user to sign on to the RTU.

- Signal Value – displays signal values in various formats.

- Comm Statistics – works with a standard page that displays the RTU's communication statistics.

- Configuration Info – works with a standard page that displays and allows the user to change RTU Configuration information.
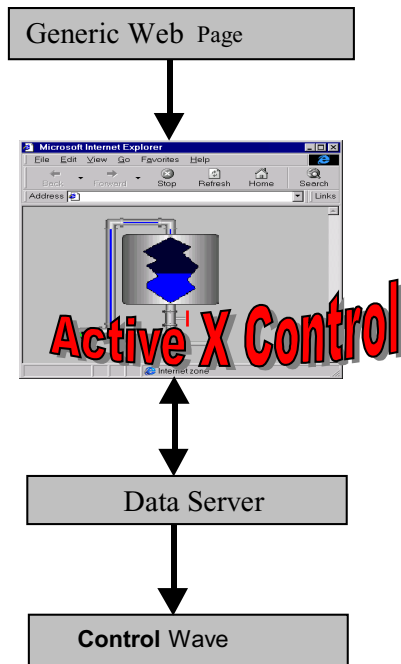
The IP compliant ControlWave opens the door for owner controlled access via Web Pages. Any generic web page builder can be employed to create user defined pages to access ControlWave. The web pages are populated with these pre-configured Active X controls.

Software Required

- Microsoft's Internet Explorer

- Emerson's Bristol Active X Controls

- Emerson's Bristol Data Server

OpenBSI Utilities

High Historical Data Integrity

The ControlWave Historical Data Collection system provides time-stamped historical data storage in ControlWave nonvolatile Flash memory. The historical data is collected, through OpenBSI, on a schedule or demand basis and converted to .CSV and ODBE compliant file formats for use spread-

sheet and database reports. If data is missed due to a communication failure, it is collected when the communication is reestablished and the PC historical database is backfilled with the missing data. This distributed historical database architecture proveides the greatest data reliability and integrity during communication or PC downtime.

Another important historical feature is the Audit storage and collection system. The audit trail is a file stored in ControlWave Flash memory containing significant events and time-stamped alarms. The alarms stored in the Audit system provide a historical archive in addition to the real-time alarm reporting system. This file is also collected through Open-BSI and presented as a text file in the PC. This

- Archive Collection – collection and storage to disk of the ControlWave archive data

- Audit Collection - collection and storage to disk of the ControlWave audit data.

- Exports data files to third party, .CSV & ODBC applications

- DDE compliant for use with other popular Windows applications

OPC Server

With industry demand for open standards, ControlWave answers the call by embracing technologies that open the door for maximizing your efficiency and productivity. The OPC standard was developed by the OPC Foundation comprised of hardware and software suppliers from the process control community. OPC allows the engineer to select best in class hardware and software with confidence in their interoperability. Our OpenBSI OPC Server was among the first to comply with the OPC Foundation alarm and event server specification.

- OPC Data Access 1.0a & 2.0 compatible

- Windows 98/NT & 2000

- Compatible with both ControlWave and Network 3000 systems

- 32 bit multi-threading, multi-processor design

- Automatic database builder

- Integrated real-time data monitor
- Supports OPC Browse interface
- Supports both serial comm and IP Ethernet connections
- Supports COM/DCOM & OLE Automation
- Primary and Background polling scheme
- OPC Alarm & Event Server support

ControlWave Open Network Connectivity

By embracing the open system network technologies available through TCP/IP, Ethernet, OPC, and Microsoft™ DNA, as well as pseudo standards such as Modbus and Open Modbus, ControlWave can provide a total Process Automation Management Solution for in-plant LAN based networks and Wide Area Network SCADA systems.

With the exceptional connectivity provided by the ControlWave network, access to real-time data and operating conditions, historical data, maintenance and performance data are all available to the global network. ControlWave provides the needed information to the plant floor technician, operator, engineer, supervisor and corporate management, even external customers.

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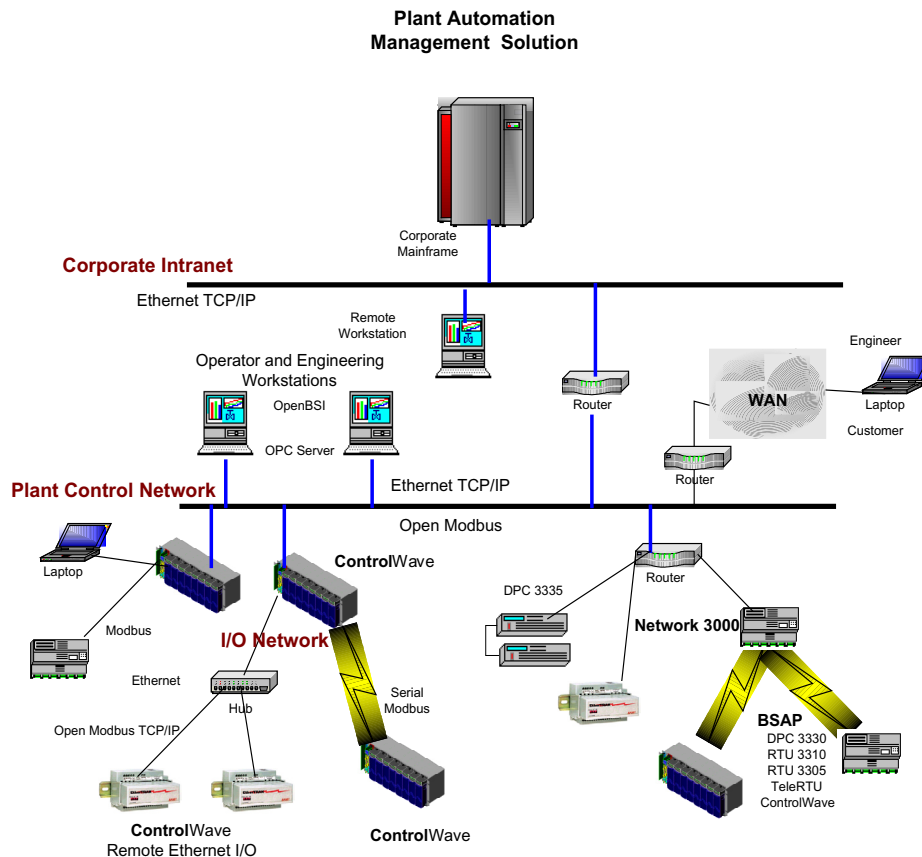
Communication Protocols

Like all Emerson products, ControlWave supports BSAP (Bristol Standard Asynchronous Protocol), Modbus, DF1 and serial ASCII as standard functions. These protocols are implemented in flashware so no additional hardware is required to use any one or a combination of all protocols.

All of Emerson's Bristol Network 3000 and ControlWave RTU and controller products support BSAP protocol. BSAP is widely accepted as providing exceptional data integrity and greatly simplifies communication between controllers. BSAP is provided with interfaces for Master/Slave, vertical networks and Client/Server, horizontal networks. In either case, variable lists are created in each controller that are easily passed from server to client or slave to master.

BSAP meets the definition of an industry-standard, open-architecture protocol because if conforms to ISO standards 2629, 1745 and 2111, it is not proprietary in that Emerson does not charge a license fee and makes the protocol and documentation available to anyone.

While BSAP is an open protocol, the added functionality of the messages passed provide much more capability than is found other networks.

- Global time-synchronization

- Time-stamped Alarm reporting

- Historical archive data transfer

- Audit file transfer

- On-line program editing

- Diagnostics

- Communication statistics

Modbus - Modbus is often considered a de-facto standard protocol because broad usage as either the primary or a secondary offering in many measurement and control related products. Even with its common use, Modbus protocol actually has many variations. Consider Modbus RTU and Modbus ASCII, Master &

Slave, Serial and TCP/IP Open Modbus. In addition there are consideration regarding supported function codes, floating point values and byte order. Emerson's Bristol products supports the following:

- Modbus serial and TCP/IP Open Modbus (Ethernet)

- Master and Slave

- Modbus RTU and ASCII

- Modes 1 - 7, 8, 15 & 16

- IP modes 51, 52 & 53

- Integer and IEEE 4 byte floating point

Allen Bradley DF-1

DF-1 protocol is the primary mechanism to interface to Allen Bradley PLCs and interface devices. ControlWave and Network 3000 both support DF-1 half-duplex master protocol.

Generic Serial Protocol

The Generic Serial Protocol is a Master and Slave protocol used to send and receive messages typically with third party serial ASCII devices. This protocol can be used to interface with such devices and message boards, card readers and many measurement devices.

Multi-User Security Access

Security is an essential element of any open system, particularly those with Internet access. ControlWave employs a User Name/Password access system protected by a 56-bit encryption technique through the TCP connection. There can be up to thirty-two users, who sign-in using their name and password. Both the name and the password can be up to sixteen characters.

The security system provides for up to sixty-four access rights to read and write data values and files via FTP, access and configure historical and audit data information, edit configuration, run internal diagnostics, read and reset system status. It further allows the programming software to read, write and download the ControlWave.

When historical data is collected from ControlWave, it is converted and appended to .CSV and/or ODBC compliant databases but does not destroy the original historical data stored in ControlWave. Thus, a flexible and secure historical data system is clearly recognized as a benefit to virtually every industrial application.

The Secure Data Advantage

ControlWave sets a new standard for providing intelligent control at the point where control is needed. Whether you need control on the plant floor or at a remote site in the "middle of nowhere" ControlWave is the solution for control, communication and secure data to help you make the right operating decisions.

ControlWave was designed to provide the optimum level of data security using a distributed database architecture. All data including time & date stamped alarms, alarm limits, and historical data are stored locally in each industrially rugged ControlWave, thereby distributing your data integrity risk. To further ensure that the data is always current and historically accurate, the historical data is stored in non-volatile flash memory within ControlWave. Historical data is even maintained during and after program downloading.

The Bridge Between Systems

Continuing our tradition of introducing innovative new solutions while maintaining compatibility with existing systems, Emerson again provides a migration path for existing customers by bridging the new ControlWave system with Network 3000 systems already in place. The network bridge is enabled by employing the open architecture technologies afforded by TCP/IP and OPC in both networks. TCP/IP allows seamless Ethernet connectivity to both networks as well as the corporate Intranet so both ControlWave and Network 3000 controllers can reside and communicate on the same LAN. Emerson's Bristol OpenBSI OPC Server facilitates the merging of the two networks for technical, engineering and operator data access. The data source, configuration and path are completely transparent to the OPC client. Real-time data can also be passed between the two communication networks making this a total Plant Automation Management Solution.

Emerson Process Management
Remote Automation Solutions

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