ControlWave® Micro

The ControlWave® Micro is a highly programmable controller that combines the unique capabilities of a programmable logic controller (PLC) and a remote terminal unit (RTU) into a single hybrid controller. The ControlWave Micro maximizes the performance of a wide range of control systems with a design emphasis on low power consumption, scalability, and modularity.

Due to its small form factor and rugged industrial design, the ControlWave Micro meets the requirements of the most demanding process plant and remote SCADA system environments. The ControlWave Micro can be seamlessly combined with other members in the ControlWave family of products for optimum system architecture.

Features

- ARM processor provides exceptional performance and low power consumption
- Up to two 10/100 MB Ethernet ports
- Up to 11 serial communication ports with built-in modem and radio options
- Three, four, and eight slot base unit with two, four and eight slot I/O expansion base
- Mixed I/O cards for cost effective small RTU applications
- Optional isolated I/O modules
- IEC 61131-3 programming with ACCOL III process control function block library
- Open standards for programming, network configuration, and communication
- Security key-lock to prevent unauthorized access
- Wide temperature range (−40 to 70ºC)
- Class I, Div. 2 hazardous location approval

Base and Expansion Units

The ControlWave Micro base unit is constructed of aluminum and consists of a power module; a CPU module; and a three, four, or eight-slot housing. The CPU and power modules are installed into the first two slots of the housing, and the remaining slots are used to add optional input/output (I/O) modules or communications modules.

Expansion units are constructed of aluminum and add an additional two, four, or eight-slot housing that attaches to the base unit. These additional slots may be used for I/O modules.

CPU Options

The ControlWave Micro is available with either a 33 MHz CPU module for low-power applications or a 150 MHz CPU module for greater processing power.

The 33 MHz CPU module contains 2 MB of battery-backed SRAM, 64 MB SDRAM and 16 MB of flash memory. The 33 MHz CPU module also contains two on-board RS-232 communication ports and one on-board RS-485 communication port.

The 150 MHz CPU module contains 2 MB of SRAM, 64 MB SDRAM and 16 MB of flash memory. The 150 MHz CPU module is available with the following on-board communication port configurations:

- Two RS-232 ports and one RS-485 port
- One Ethernet port, two RS-232 ports, and one RS-485 port
- Two Ethernet ports, one RS-232 port, and one RS-485 port

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Power Modules

The power module is installed in the first slot of the ControlWave Micro base unit and provides power to the rest of the device. Three power modules are available including:

- 6 to 18 volt input power system controller
- 12 to 24 volt input power system controller
- 12 to 24 volt input power system controller with keylock and watchdog alarm output

Communications

The ControlWave Micro base unit is available with up to two on-board RS-232 ports, one RS-485 port, and up to two on-board Ethernet ports, dependant upon your CPU selection. Additional communications modules may be installed into slots three and four of the ControlWave Micro base unit. Available communication modules include:

- Communication module with one RS-232 port and one RS-485 port
- Communication module with one RS-232 port, one RS-485 port, and integral 56 kb dial-line modem
- Communication module with one RS-232 port, one RS-485 port, and one integral FreeWave® 900 MHz spread spectrum radio
- Communication module with one RS-232 port, one RS-485 port, one integral 56 kb dial-line modem, and one integral FreeWave 900 MHz spread spectrum radio
- Communication module with two RS-232 ports and two RS-485 ports

Communication Protocols

The ControlWave Micro supports BSAP (Bristol Standard Asynchronous Protocol), Modbus, FOUNDATION fieldbus, HART, DFI, CIP, DNP3, and serial ASCII as standard features. ControlWave Micro supports the following Modbus protocols:

- Modbus serial and TCP/IP Open Modbus (Ethernet) Gould and ENRON modes
- Master and Slave
- Modbus RTU and ASCII
- Command code 1 through 8, 15, and 16
- Integer and IEEE 4 byte floating point
- User-defined commands at master

Inputs and Outputs

ControlWave Micro I/O modules are designed to maximize usability while minimizing installation and maintenance costs. The base chassis accommodates up to six I/O modules. An I/O expansion base extends the base chassis to support up to a total of fourteen I/O modules. Even further I/O expansion is available with the Distributed I/O System (DIOS) that provides Ethernet connectivity to multiple remote I/O chassis.

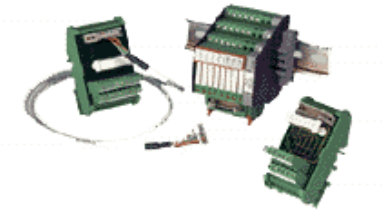
All I/O modules include 8-bit wide bus access and surge protection that meets C37.90-1978 and IEC 801-5.

Local Terminations – Most I/O modules are available with local or remote terminations. Local terminations allow field wiring to be connected directly to the I/O module terminal blocks.

Optional I/O modules with local terminations include:

- 6 DI/DO, 4 AI, 2 HSC, and 1 AO
- 12 DI and 4 DO
- Isolated 12 DI and four DO
- 16 DI (24 V dc input).
- 16 DI (12 V dc input)
- 8 DI (120-240 V ac output)
- 16 DO
- 8 DO (120-240 V ac output)
- 6 AI and 2 AO
- 6 AI
- Isolated 8 AI
- Isolated 4 AO
- 6 TC
- 4 RTD
- 4 HSC (High Speed/Low Speed Counter)
- 8 HART/BTI Interface (2 channels may be AO)

Remote Terminations – Remote terminations consist of remotely mounted terminal blocks that provide a convenient alternative to the standard direct connect termination. Remote terminal blocks allow a concentration of electrical connections from one or more controllers to be located in one area, such as the rear of a cabinet. Remote terminal blocks are often used for enclosure installations because they eliminate the need for point-to-point wiring from the RTU I/O to the field terminal strips. Each remote I/O module has connections to two remote terminal blocks. Remote terminal blocks are DIN-rail mountable and connect to the I/O module with two pre-wired connector cables. To simplify installation, all I/O modules use the same cable.



Remote Terminal Blocks

Optional I/O modules with connections for remote terminations include:

- 6 DI/DO, 4 AI, and 2 HSC (with fuses)
- 6 DI/DO, 4 AI, 2 HSC, and 1 AO (with fuses)
- 12 DI and 4 DO (with or without fuses)
- 16 DI (with or without fuses)
- 16 DI (120-240 V ac output).
- 16 DO, 24 V dc (with or without fuses)
- 16 DO Relay (6 A, without fuses)
- 6 AI and 2 AO (with or without fuses)
- 6 AI (with or without fuses)
- Isolated 8 AI (with or without fuses)
- Isolated 4 AO (with or without fuses)
- 6 TC
- 4 RTD
- 4 HSC (High Speed/Low Speed Counter)
- 8 HART/BTI Interface (2 channels may be AO)

Distributed I/O System

The ControlWave Micro Distributed I/O System (DIOS) is a remotely mounted housing for the installation of additional ControlWave Micro I/O modules. The DIOS supports up to fourteen slots of I/O using the same form factor as the ControlWave Micro. The DIOS supports installation of most ControlWave Micro I/O modules. The remotely mounted DIOS communicates with the ControlWave Micro base unit through a standard Ethernet connection.

The DIOS contains a CPU module used as an Ethernet communication engine that is dedicated to communications between the main processor located in the ConrolWave Micro base unit and the DIOS unit. The CPU module in the DIOS unit also includes power fail/recovery control and battery backed RAM to retain I/O data during short power outages.

Display/Keypad

An optional 4 line by 20 character LCD display with adjustable contrast is available with either a 2-button keypad or a 25-button keypad. Both options are connected to the ControlWave Micro base unit via a standard CAT5 cable.

The display with the 2-button keypad allows you to view site, configuration, and process data on the display. Screens are organized in a series of lists. You can select a list and then manually scroll through the data. Additionally, an automatically scrolling user-defined list of data can be set.

The display with the 25-button keypad performs the same functions as the 2-button display and also allows you to view and modify the ControlWave Micro inputs, process variables, calculated variables, setpoints, tuning parameters, and outputs. Status controls include the alarm state, alarm acknowledge, control, and manual (Auto/Man).

Software

The ControlWave Micro is supported by multiple software packages for programming, system configuration, and diagnostics.

ControlWave Designer – ControlWave Designer is a fully IEC 61131-3-compliant programming environment for the ControlWave Micro. ControlWave Designer includes all five IEC 61131-3 process languages for batch, continuous, and discrete control: Function Block Diagram, Structured Text, Sequential Function Chart, Ladder Logic Diagram, and Instruction List.

ControlWave Designer includes an extensive library of more than 200 basic IEC 61131-3 functions and function blocks common to many IEC 61131-3 based products. These include:

- Flip-flops, Counters, and Timers
- Ladder diagram functions – coils and contacts, etc.
- Numerical, Arithmetic, and Boolean functions – Sine, Cosine, Add, Sub, Square Root, And, Or, etc.
- Selection and Comparison – Min, Max, Greater Than, Equal, Less Than, etc.
- Type conversions – Integer to Real, Boolean to Word, etc.

ACCOL III – In addition to the basic functions and function blocks, ControlWave Designer brings the benefit of over twenty years of SCADA and plant control experience in Emerson's ACCOL III function block library. ACCOL III includes over sixty function blocks valuable for use in oil and gas, water and waste water, and process measurement and control applications. The ACCOL III library includes function blocks for:

- Average, Compare, Totalize
- Scheduling and Sequencing
- PID and Lead/Lag
- AGA gas flow and liquids calculations
- File handling

OpenBSI – Emerson's OpenBSI (Open Bristol System Interface) is a set of network setup, communication diagnostic, and data viewing utilities that provide access to both ControlWave and Network 3000 controllers and RTUs. At the core of OpenBSI is a communication interface through

which other applications communicate. OpenBSI supports both serial BSAP protocol and Ethernet Internet Protocol communication to ControlWave RTUs and controllers.

ObjectServer – OjectServer is an OPC-compliant server that provides direct communication to the ControlWave family of controllers, RTUs, PLCs, and flow computers through the OpenBSI communications interface. It supports serial multi-drop, remote telemetry, and Ethernet communication networks. Unlike traditional OPC servers, ObjectServer is designed to provide reliable access to RTUS that are connected via low-bandwidth, high-latency, and poor-quality networks common with radio, satellite, and cellular connections.

Historical Data Collection

The ControlWave Historical Data Collection system is a time-stamped historical database stored in ControlWave flash memory. OpenBSI collects the historical data either on a scheduled or on-demand basis. The collected data is converted to .CSV and ODBC-compliant file formats for use in spreadsheets and reports. If data is missing due to a communication failure, the data is collected when the communication is reestablished and the PC historical database is backfilled with the missing data. This distributed historical database architecture provides data reliability and integrity during communication or PC failure.

Another important historical feature is the audit system. The audit system is made up of files stored in ControlWave flash memory that contain significant events, and both real-time and historical time-stamped alarms.

The audit system files are collected through OpenBSI and saved as a text file in the PC. This functionality is extremely useful in providing an event trail during communication disruption, PC downtime, or other system problem.

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, the ControlWave Micro provides a total process automation management solution for in-plant LAN-based networks and wide-area network SCADA systems. Access to real-time data and operating conditions, historical data, maintenance, and performance data are available to the global network.

Data Reliability

The ControlWave Micro is designed to provide the optimum level of data reliability by using a distributed database architecture. All data, including time stamped alarms, alarm limits, and historical data, is stored locally in non-volatile flash memory in each ControlWave Micro.

The historical data is collected as un-edited binary data from the ControlWave Micro. The collected data is converted and appended to a .CSV and/or ODBC-compliant database. The original binary historical data is not changed, in compliance with API 21 requirements.

Key Switch

The ControlWave Micro is available with a three-position front panel key switch. The front panel key switch provides a high level of manual security by controlling three modes of operation.

In Run Mode, the ControlWave Micro rejects any attempt to download or modify the running program, either locally or over the network.

In Remote Mode, the ControlWave Micro allows downloading and on-line program modification through the network connection after the security access requirements have been met. Local download and on-line modification of the running program is prohibited.

In Local Mode, the ControlWave Micro allows downloading and on-line modification through either the network connection or through a local serial communication port after the security access requirements have been met.

Multi-User Security Access

The ControlWave Micro employs a user name/password access system protected by a 56-bit encryption technique. You can configure user names and passwords for up to 240 users. Both the user name and the password can be up to sixteen characters in length.

You can customize each user's security level based on 64 access rights, including the ability to read and write data values and files via FTP, access and configure historical and audit data information, edit configuration, run internal diagnostics, and read and reset system status.

ControlWave Micro

CPU Module			
ControlWave Micro 33	Type	32-bit ARM 9 processor, 33 MHz Sleep mode for low power applications	
	Memory	Boot	512 KB
		Flash	16 MB on-board flash
		SRAM	2 MB, battery backed
		SDRAM	64 MB
ControlWave Micro 150	Type	32-bit ARM 9 processor, 150 MHz	
	Security	Key-lock security switch (optional)	
	Memory	Boot	512 KB
		Flash	16 MB
		SRAM	2 MB, battery backed
		SDRAM	64 MB
Clock	Real-time clock provides a full BCD clock calendar with programmable periodic/wakeup interrupt and a programmable clock generator with adjustable spectrum spreading		
	Accuracy	1 second/day at 25˚C	
Communications			
On-Board Ports	RS-232 (1 included and 1 optional)	Quantity	2
		Type	9-pin male D-sub connectors on CPU module
		Baud Rate	Up to 115.2 KB
	RS-485	Quantity	1
		Type	9-pin male D-sub connectors on CPU module
		Baud Rate	Up to 115.2 KB
	Ethernet (optional)	Quantity	Up to 2
		Type	10/100 Base-T Ethernet port with RJ45 connector (two serial ports with dual Ethernet CPU)
Communication Modules (optional)	1 Port RS-232 / 1 Port RS-485	Quantity	1 RS-232 port 1 RS-485 port
		Type	9-pin male D-sub connectors on CPU module
		Baud Rate	Up to 115.2 KB
		Isolation	RS-485 port isolated to 500 Vdc
	2 Port RS-232 / 2 Port RS-485	Quantity	2 RS-232 ports 2 RS-485 ports
		Type	9-pin male D-sub connectors on CPU module
		Baud Rate	Up to 115.2 KB
		Isolation	RS-485 port isolated to 500 Vdc
	Dial-up Modem	Type	Dial-up modem add-on
	Spread Spectrum Radio Kit	Type	FreeWave 900 MHz spread spectrum radio kit add-on

Inputs/Outputs		
I/O Modules (optional)	Mixed I/O	6 DIO, 4 AI, 2 HSC with local terminations or remote terminations with fuses. For more information, refer to *Technical Specifications CWMICRO:MIX*.
	Mixed I/O with A/O	6 DIO, 4 AI, 2 HSC, 1 AO with local terminations or remote terminations with fuses. For more information, refer to *Technical Specifications CWMICRO:MIX*.
	Mixed DI/DO	12 DI, 4 DO with local terminations or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Isolated Mixed DI/DO	12 DI, 4 DO with local terminations. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Isolated DI	16 DI with local terminations or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Isolated DI (24 Vdc)	16 DI with local terminations. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Isolated DI (12 Vdc)	16 DI with local terminations. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Isolated DO	16 DO local terminations, remote terminations with fuses, or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Isolated Vac DI	8 DI with local terminations. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Relay Isolated Vac/Vdc DO	8 normally open relays with local terminations. For more information, refer to *Technical Specifications CWMICRO:DIO*.
	Mixed AI/AO	6 AI, 2 AO with local terminations, remote terminations with fuses, or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:AIO*.
	AI	6 AI with local terminations, remote terminations with fuses, or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:AIO*.
	Isolated AI	8 AI with local terminations, remote terminations with fuses, or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:AIO*.
	Isolated AO	4 AO with local terminations, remote terminations with fuses, or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:AIO*.
	High Speed / Low Speed Counter	4 HSC with local terminations or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:HSC*.
	Thermocouple	6 AI with local terminations or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:TEMP*.
	RTD	4 RTD with local terminations or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:TEMP*.
	HART / BTI	8 AI and two AO channels with support for HART, BTI, or 4-20 mA signals with local terminations or remote terminations without fuses. For more information, refer to *Technical Specifications CWMICRO:HIM*.

Remote Terminal Blocks	AI and AO	Number of Channels	4
		Dimensions	50 mm W by 90 mm H by 67.1 mm D (1.77 in. W by 3.53 in. H by 2.64 in. D)
	DI and DO	Number of Channels	8
		Dimensions	56 mm W by 90 mm H by 66 mm D (2.2 in. W by 3.53 in. H by 2.58 in. D)
	DO Relay	Number of Channels	8
		Dimensions	83 mm W by 99.1 mm H by 94 mm D (3.25 in. W by 3.9 in. H by 3.7 in. D)
	Cable Lengths	46 cm (18 in.) 1 m (39 in.) 2 m (6.5 ft) 4 m (13 ft)	
	Note: Two remote terminal blocks and two cables are required for each I/O module with remote terminations.		

Power			
Input Power	ControlWave Micro Base Unit	6 to 18 Vdc System Controller	
		12 to 24 Vdc System Controller	
		12 to 24 Vdc System Controller with Keylock and Watchdog Output	
	ControlWave Micro Expansion Unit	6 to 18 Vdc System Controller	
		12 to 24 Vdc System Controller	
		12 to 24 Vdc System Controller with Keylock and Watchdog Output	
Operating Range	+5.4 V to +18 V (6 to 18 Vdc System Controller)		
	+10.79 V to +30.0 V (+12 V Input Supply)		
	+21.7 V to +30.0 V (+24 V Input Supply)		
Output Voltages	+3.3 Vdc		
Output Current	10 A max. at 3.3Vdc		
Output Ripple P/P	+3.3 V Output: 50 mV, 110 mVpp @ 30 V input		
Fusing	3 A slow blow 5 x 20 mm fuse		
Surge Suppression	500 Vdc MOV, (PSGND) to CHASSIS 32 V Transient Suppressor from +VIN to -VIN (PSGND) Meets ANSI/IEEE C37.90-1978		
Shutdown	+12 V System	Max. ON Voltage	10.79 V
		Min. OFF Voltage	9.87 V
	+24 V System	Max. ON Voltage	22.33 V
		Min. OFF Voltage	20.41 V
System Controller	5.4 to 18 Vdc input or 10.79 to 30 Vdc input Power-fail detection and recovery sequencer 2-button or 25-key display interface Six LED status indicators Watchdog and Idle and communication LEDs		

Consumption	Micro 33 CPU without Ethernet	0.1 W	
	Micro 150 CPU without Ethernet	1.0 W	
	Micro 150 CPU with Ethernet	1.2 W	
	Micro 150 CPU with 2 Ethernet	2.0 W	
	System Controller 12/24V	0.08 W	
	System Controller 6/12V	0.009 W	
	Exp. Comm, Isolated RS485	0.53 W	
	FreeWave Radio	TX	3.8 W
		RX	1.2 W
	Dial-up Modem	0.8 W	
Physical			
Dimensions	3-Slot Base	86.4 mm W by 152.4 mm H by 147 mm D (3.4 in. W by 6.0 in. H by 5.8 in. D)	
	4-Slot Base	114.3 mm W by 152.4 H mm by 147 mm D (4.5 in. W by 6.0 in. H by 5.8 in. D)	
	8-Slot Base	228.6 mm W by 152.4 mm H by 147 mm D (9.0 in. W by 6.0 in. H by 5.8 in. D)	
	2-Slot Expansion Base	57 mm W by 152.4 mm by H 147 mm D (2.25 in. W by 6.0 in. H by 5.8 in. D)	
	4-Slot Expansion Base	114.3 mm W by 152.4 mm H by 147 mm D (4.5 in. W by 6.0 in. H by 5.8 in. D)	
	8-Slot Expansion Base	228.6 mm W by 152.4 mm H by 147 mm D (9.0 in. W by 6.0 in. H by 5.8 in. D)	
Weight	3-Slot Base	0.7 lbs	
	4-Slot Base	0.8 lbs	
	8-Slot Base	1.5 lbs	
	2-Slot Expansion Base	0.6 lbs	
	4-Slot Expansion Base	0.8 lbs	
	8-Slot Expansion Base	1.5 lbs	
Wiring	Up to size 16 AWG at the removable terminal blocks.		

Environmental		
Operating Temp	−40 to 70°C (-40 to 158°F)	
Storage Temp	−40 to 85°C	
Operating Humidity:	15-95% non-condensing	
Immunity	3 V/m – 80 MHz to 1000 Mhz (IEC 61000-4-3:2002)	
Radiated Emissions	IEC 55022:1998	
Vibration	1.0 g for 10-150 Hz; 0.5 g for 150 Hz to 2000 Hz	
Approvals		
Product Markings for Hazardous Locations	UL/CUL	Class I, Division 2, Groups A, B, C & D T4.
Approval Standards	EMC	EN55022:1998 (Emissions) EN61000-4-3:2002 (Radiated Immunity)

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