Bristol® ControlWave® Micro
Hybrid Controller

Bristol® ControlWave® from Emerson Process Management, is a highly adaptable, high performance Process Automation Controller family with exceptional networking capability to provide a complete Process Automation Management Solution. Within this family, ControlWave Micro was designed with an emphasis on low power consumption, scalability and modularity. ControlWave Micro combines the unique capabilities of a PLC, RTU and PAC into a single Hybrid programmable controller to maximize the performance of a wide range of control systems, from small or mid-size applications to large ones. It can also be combined seamlessly with other members in the ControlWave family of products for optimum system architecture. Additionally, due to its small form factor and rugged industrial design, ControlWave Micro offers an outstanding ability to match the requirements of the most demanding process plant and remote SCADA system environments.

- Class I, Div. 2 hazardous location and CE approval

- Open standards for programming, network configuration and communication

Features

- ARM processor provides exceptional performance and low power consumption

- IEC 61131-3 programming with ACCOL III process control function block library

- One or two Optional 100/10 MB Ethernet ports

- Up to eleven serial communication ports with built-in modem and radio options

- 3, 4 and 8 slot base with 2, 4 and 8 slot I/O expansion bases

- Mixed I/O cards for cost effective small RTU applications

- Optional Isolated I/O modules

- Security key-lock to prevent unauthorized access

- Wide temperature range (-40 to +70ºC)

Scalability

ControlWave Micro, through its modular architecture, meets the needs of a wide range of applications, from a compact, cost effective PLC and RTU, to a powerful plant process control system. For a simple RTU application, ControlWave Micro can be configured with two or six I/O slots in a panel mount base package. The RTUs CPU includes three serial communication ports and one or two optional built-in 100/10 Base-T Ethernet ports.

For in-plant control applications, ControlWave Micro is a powerful, flexible PLC. The base unit is used to house the power system, CPU and 2 or 6 I/O modules. Up to 2 communication expansion modules can be installed in the available base I/O slots. The base is expandable up to fourteen I/O slots through 2, 4 or 8 slot plug-on I/O expansion bases.

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Open Standards For Programming, Network Configuration And Communication

Only ControlWave brings the perfect combination of industry standards to minimize learning, engineering and implementation costs.

By adhering to such industry standards as Ethernet, TCP/IP, Microsoft Windows, COM/DCOM, FTP, OLE and ActiveX, ControlWave is able to achieve the highest degree of openness in control system architecture and bring the optimal process efficiency and productivity needed to ensure a successful system implementation.

ControlWave Designer with ACCOL III

To minimize your engineering and development time, we have adopted the international standard for PLC programming, IEC 61131-3. ControlWave Designer is a fully IEC 61131-3 compliant programming environment for the ControlWave family of products. 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 & Timers

- Ladder diagram functions – coils and contacts, etc.

- Numerical, Arithmetic & Boolean functions – Sine, Cosine, Add, Sub, Square Root, And, Or, etc.

- Selection & 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 Bristol ACCOL III function block library. ACCOL III includes over sixty function blocks valuable for use in oil & gas, water & waste and process measurement & control applications. Further, ACCOL III is designed to take full advantage of the significant features offered by ControlWave.

Briefly, this library includes function blocks for:

- Average, Compare, Totalize

- Scheduling & Sequencing

- PID & Lead/Lag

- AGA gas flow and liquids calculations

- File handling

In addition, ControlWave ensures data integrity, in the event of a communication interruption, by storing critical time-stamped alarm and historical data in the controller memory. This data is then securely retrieved when communication is restored.

Specifications

ControlWave Micro 33
CPU

- 32-bit ARM 9 processor: 33 MHz

- Sleep mode for low power applications

- Data Memory : 2 MB SRAM battery backed memory

- File and Historical Archive memory: 8 MB on-board flash

- Real-time clock

ControlWave Micro 150
CPU

- 32-bit ARM 9 processor: 150 MHz

- Sleep mode for low power applications

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- Program execution: 4 MB SD RAM

- Data Memory : 1 MB SRAM battery backed memory

- File and Historical Archive memory: 8 or 16 MB on-board flash

- Real-time clock

- Key-Lock Security switch

Communication

Base CPU

- Two RS-232 and one RS-485 serial communication port with standard 9-pin male D-sub connectors on CPU module, supporting baud rates up to 115.2 KB

- One or two optional 100/10 Base-T Ethernet ports with RJ45 connector (two serial ports with dual Ethernet CPU)

Optional Communication Expansion

Plug-in module – up to two comm expansion modules per CPU base

- One RS 232 and one RS 485 serial communication port: up to 115.2 KB. RS-485 port isolated to 500 Vdc

- One optional internal dial-line modem

- One optional internal 900 MHz spread Spectrum radio

System Controller

- 5.4 to 17 Vdc input or 10.7 to 30 Vdc input

- Power-fail detection and recovery sequencer

- 2 - button and 25 - key Display interface

- LED status indicators - 6 failure status LEDs, Watchdog and Idle and communication LEDs

Chassis

- **3-slot base chassis:** 3.4" W x 6.0" H x 5.8" D (8.64 cm x 15.24 cm x 14.7 cm)

- **4 slot base chassis:** 4.5" W x 6.0" H x 5.8"D (11.43 cm x 15.24 cm x 14.7 cm)

- **8 slot base chassis:** 9.0" W x 6.0" H x 5.8"D (22.86 cm x 15.24 cm x 14.48 cm)

- **2 – I/O slot expansion chassis:** 2.25" W x 6.0" H x 5.8"D (5.7 cm x 15.24 cm x 14.7 cm)

- **4 – I/O slot expansion chassis:** 4.5" W x 6.0" H x 5.8D (11.43 cm x 15.24 cm x 14.7 cm)

- **8 – I/O slot expansion chassis:** 9.0" W x 6.0" H x 5.8"D (22.86 cm x 15.24 cm x 14.7 cm)

Environmental Specifications

- **Operating Temperature range**: -40 to 70°C (-40 to 158°F), storage up to 85°C

- **Relative Humidity**: 15-95% non-condensing

- **Vibration**: 1.0g for 10-150 Hz; 0.5g for 150Hz to 2000Hz

- **RFI Susceptibility**: 3V/m – 80 MHz to 1000Mhz (EN50082-2)

Power Consumption

Micro 33 CPU without Ethernet: 0.1w
Micro 150 CPU without Ethernet: 1 w
Micro 150 CPU with Ethernet: 1.2 w
Micro 150 CPU with 2 Ethernets: 2.0 w
System Controller 12/24V: .08 w
System Controller 6/12V: .009 w
Exp. Comm, isolated RS 485: .53 w
Freewave radio: xmit - 3.8w, rec - 1.2w
MDS TransNet radio: xmit - 7w, rec - 1.6w
Dial-line modem: .8 w

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ControlWave Micro I/O

ControlWave Micro local I/O modules are designed to maximize usability while minimizing installation and maintenance cost.

ControlWave Micro Modular

The I/O modules allow a mix of inputs and output that are a perfect fit for small RTU applications. Yet, I/O expandability allows ControlWave Micro to easily meet the needs of small to medium in-plant PLC applications. In addition, the availability of both local direct and remote DIN rail terminations conveniently accommodate panel design and wiring.

Features

• Convenient pluggable local and remote wiring terminations simplify installation

• Mixed DI/DO and AI/AO modules

• Optional isolated I/O

• Any I/O module can plug into any I/O slot

• Terminal and wire covers neatly dress wiring and protect connections

Specifications

All I/O

• 8-bit wide bus access

• Surge protection meets C37.90-1978 and IEC 801-5

• Terminations are pluggable and accept a maximum wire size of 14 gauge

• Power consumption is stated for each I/O module measured at the input supply and does not include loop power

Available Input/Output Module

Mixed I/O:	6 DIO, 4 AI, 2 HSC, 1 AO
Mixed DI/DO:	12 DI, 4 DO
Isolated Mixed DI/DO:	12 DI, 4 DO
Isolated DI:	16 DI
Isolated DO:	16 DO
120 VAC DI:	8 DI
Relay DO:	8 DO
Mixed AI/AO:	6 AI, 2 AO
Isolated AI:	8 AI
Isolated AO:	4 AO
HS Counter:	4 HSC
Thermocouple AI:	6 AI
RTD AI:	4 AI

Mixed Input/Output Module

Number of points: 4 AI, 1 AO (optional), 6 DI/DO, 2 High Speed Counter Inputs

Digital Inputs and Outputs

• Number of points: 6 non-interrupting inputs or dry contact outputs

• Input Voltage Range: Internally sourced dry contact input - 3.3 Vdc.

• On state: >1.5V, Off state <1.5V

• Input current: selectable 66 microA for low power applications or 2 mA for in-plant noise immunity

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- Digital outputs: Open drain, 100 mA max @ 30 Vdc

- Surge Suppression: 31 Vdc transorb between signal and ground

- Input filtering: 16 ms time constant (contact bounce)

- Status indication: LED board with per point status indicators (enable/ disable selections)

- Power consumption: Includes DOs
  All inputs ON @ 66 microA: .016 watt
  All inputs ON @ 2 mA: .05 watt
  All LEDS ON: add .05 watt

Analog Inputs and Analog Output

- Number of Channels: 4 Analog Inputs and 1 optional Analog Output

- AI Resolution: 14 bit SAR ADC

- AO Resolution: 12 bit

- Input Configuration: Externally sourced. Single-ended inputs - jumper selectable 4-20 mA or 1-5 Vdc

- Input Impedance: 1 megOhm - 1-5 Vdc; 250 Ohm - 4-20 mA

- Input Filtering: 300 ms to 99.9% of input signal

- Input & Output Accuracy:

  0.1% of span at 25 deg C

  0.2% of span -40 deg C to 70 deg C

  0.3% of span -40 deg C to 70 deg C (AO only)

- Output Configuration: Externally sourced

  4-20 mA: 650 Ohm for 24 Vdc source
                    250 ohm for 11 Vdc source

  1-5 Vdc: 5 mA max., 11 to 30 Vdc external
                    source

- Surge Suppression: 30 Vdc transorb between signal and ground

- Power consumption:
  Analog input: .021 watt
  Analog output: .021 watt
  AO ext Loop power @ 24V: .73 watt

High Speed Counter Inputs

- Number of points: 2

- Frequency Range: 0-10 kHz

- Input Voltage Range:

  Internally sourced: 3.3 Vdc

  Externally sourced: 3 Vdc to 24 Vdc

- On state: >1.5V, Off state <1.5V

- Debounce: Yes

- Input current: Selectable 180 microA for low power applications or 2.2 mA for in-plant noise immunity

- Accumulator: 16 bit

- Surge Suppression: 31 Vdc transorb between signal and ground

- Power consumption:
  175 microA input, all inputs ON: .007 watt
  2 mA input, all inputs ON: .004 watt
  All LEDs ON: .022 watt

Mixed Digital Input/Output Module

Digital Inputs & Outputs

- Number of points: 12 non-interrupting inputs and 4 outputs

- Input Voltage Range: Internally sourced dry contact input - 3.3 Vdc

- On state: >1.5 V, Off state <1.5V

- Input current : selectable 66 microA for low power applications or 2 mA for in-plant noise immunity

- Digital outputs: Open drain. 100 mA max @ 30 Vdc.

- Surge suppression: 31 Vdc transorb between signal and gound

- Input filtering: 16 ms time constant (contact bounce)

- Status indication: Optional plug-on LED board with per point status indicators

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• Power consumption: Includes DOs
All inputs ON @ 66 microA: .0186 watt
All inputs ON @ 2 mA: .123 watt
All LEDs ON: add .144 watt

Isolated Mixed Digital Input/Output Module

Digital Inputs & Outputs

• Number of points: 12 non-interrupting inputs and 4 outputs

• Input Voltage: 24 Vdc selectable internally or externally sourced dry contact per point.

• Input current : 5 mA nominal· On state: >19.2 V, Off state <2.4V

• Optical isolation: 1500 V field to logic

• Surge suppression: 500Vdc MOV to chassis; 31 Vdc transorb between signal and isolated ground

• Input filtering: 30 ms time constant (contact bounce)

• Dry contact inputs: 21 Vdc on-board isolated loop power supply for contacts or externally powered voltage inputs

• Output type: solid state open source MOSFET

• Operating voltage range: 10 - 31Vdc

• Maximum operating frequency: 20 Hz

• Current sink capability: 500 mA at 31V

• Status indication: LED board with per point status Indicators

• Power consumption:
All inputs ON: .05 watt
Add for Internally powered DIs
Powered loop: add .114 watt per ON DI
DI loop supply @ 24V: add .432 watt
All outputs ON: .04 watt
All LEDs ON: add .14 watt

Isolated Digital Input Module

• Number of points: 16 – non-interrupting inputs

• Input Voltage: 24 Vdc selectable internally or externally sourced dry contact per point. 48 Vdc externally sourced dry contact.

• Input current : 5 mA nominal

• On state: >19.2 V, Off state <2.4V

• Optical isolation: 1500 V field to logic

• Surge suppression: 500Vdc MOV to chassis; 31 Vdc transorb between signal and isolated ground

• Input filtering: 30 ms time constant (contact bounce)

• Dry contact inputs – 21 Vdc on-board isolated loop power supply for contacts or externally powered voltage inputs

• Power consumption:
All inputs ON: .081watt
All LEDs ON: add .144 watt
DI loop supply @ 24V: add .432 watt
Powered loop per DI ON: add .114 watt

Isolated Digital Output Module

• Number of points: 16

• Output type: solid state open source MOSFET

• Operating voltage range: 10 - 31Vdc

• Maximum operating frequency: 20 Hz

• Current sink capability: 500 mA at 31V

• Optical isolation: 1500 V field to logic

• Surge suppression: 500 MOV to chassis, 31Vdc transorb signal to isolated ground

• Status indication: LED board with per point status indicators

• Power consumption:
All outputs ON: .152 watt
All LEDs ON: add .141 watt

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AC Digital Input Module

- Number of points: 8 - non-interrupting inputs

- Input Voltage: 0-240 VAC externally sourced

- Input Current: 12 mA nominal @120VAC, 60 Hz

- On State: >79V, Off state <20V

- Optical Isolation: 500Vdc field to logic & channel-to-channel

- Input Filtering: 30 ms time constant

- Status Indication: LED board with per point status indicators

- Power consumption:
  All inputs ON: .13 watt

AC Digital Output Module

- Number of points: 8

- Output Type: Normally open relay

- Operating Voltage Range: 30Vdc, 120VAC, 240VAC

- Maximum Operating Frequency: 360 operations per hour under rated load

- Current Sink Capability: 5 A @ 30Vdc, 6 A at 120/240VAC

- Minimum Permissible Load: 10 mA, 5VDC

- Contact Life Expectancy: 100,000 operations with resistive load

  Isolation: 1500Vdc field to logic, 500Vdc channel-to-channel

  Status indication: LED board with per point status indicators

- Power consumption:
  All outputs ON: .25 watt

Mixed Analog Input/Output Module

- Number of Channels: 6 AI or 6 AI/2 AO

- AI Resolution: 14 bit SAR ADC

- AO Resolution: 12 bit

- Input Config: Externally sourced. Single–ended inputs - jumper selectable 4–20 mA or 1–5 Vdc

- Input Impedance: 1 megOhm - 1-5 Vdc;

- 250 Ohm - 4-20 mA

- Input Filtering: 300 ms to 99.9% of input signal

- Conversion Time: 2.3 msec/channel

- Input & output accuracy:
  0.1% of span at 25°C
  0.2% of span -40 °C to 70 °C
  0.3% of span -40 °C to 70 °C (AO only)

- Output configuration: Externally sourced

- 4-20 mA: 650 Ohm for 11 to 30 Vdc external source

- 1-5 Vdc: 5 mA max.

- Surge Suppression: 30 Vdc transorb between signal and ground

- Power consumption:
  Analog input: .011 watt
  Analog output: .014 watt
  AO ext Loop power @ 24V: 1.13 watt

Isolated Analog Input Module

- Number of Channels: 8 AI

- AI Resolution: 21 bit Delta Sigma ADC

- Input Configuration: Internally sourced or Externally sourced. Differential inputs. Jumper selectable 4–20 mA, 0-20 mA, 1–5 Vdc, 0-10 Vdc

- Input Impedance: 1 megOhm - 1-5 Vdc;

- 250 Ohm - 4-20 mA

- Input Filtering: 33 microsec to 99.9% of input signal

- Conversion Time: 33 millisec/channel

- Input & output accuracy:

- 0.1% of span at 25°C

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- 0.2% of span -40 °C to 70 °C

- Common Mode Rejection: 75 db

- Normal Mode Rejection: 90 db

- Electrical Isolation: 500 Vdc channel to bus

- Surge Suppression: 30 Vdc transorb between signal and ground

- Power consumption - 8 inputs:
  Analog input Ext. powered: .2.7 watt
  Analog input Int. powered: 7.4 watt

Isolated Analog Output Module

- Number of Channels: 4

- Output Configurations: 4–20 mA (650 max. drive) and 1–5 Vdc @ 5 mA max.

- D / A resolution: 12 bit

- Accuracy:
  0.1% of span @ 25 °C for current output;
  0.1% +6% of span @ 25 °C for voltage
  0.3% of span @ -40 °C to 70 °C for current
  0.3% +6% of span @ -40 °C to 70 °C for voltage

- Electrical Isolation: 500 Vdc channel to bus

- Settling time: 50 microsecond

- Surge Suppression: 16 Vdc transorb across output signals and (-) output to common

- Power consumption - 4 inputs:
  Analog current output: 3.0 watt
  Analog voltage output: 1.3 watt

Thermocouple Input Module

- Number of Channels: 6 AI

- Input type: B, R, S, J, E, K, T, C, N, +/- 10 mV

- AI Resolution: 16 bit

- Input Configuration: Differential thermocouple

- Voltage input Impedance: 10 megΩ

- Channel data acquisition: 50 microsec

- Conversion Time: 66 millisec for all 6 inputs

- Input Accuracy: Varies by thermocouple type

  0.025% of span at 25°C for 10 mV input

  0.95% of span -25°C to 70°C for 10 mV input

- Common Mode Rejection: 120 db

- Normal Mode Rejection: 80 db

- Electrical Isolation: 500 Vdc channel to channel and channel to bus

- Surge Suppression: 180 Vdc transorb between signal and ground meets IEEE 472.1978

- Cold Junction Compensation: RTD sensor on terminal block

- Local or remote terminations

- Power Consumption - 6 inputs:

  TC analog input: 0.96 watt

RTD Input Module

- Number of Channels: 4 AI

- Input Type; 2, 3, or 4 wire RTD

- AI Resolution: 16 bit

- Voltage Input Impedance: 9.6 KΩ

- Channel Data Acquisition: 50 microsec

- Conversion Time: 3 wire - 266 ms, 4 wire - 200 ms, for all 4 inputs

- Input Accuracy:

  +/- 0.5°C at 25°C

  +/- 1.0°C at -40°C to 70°C

- Common Mode Rejection: 120 db

- Normal Mode Rejection: 80 db

- Electrical Isolation: 500 Vdc channel to channel and channel to bus

- Surge Suppression: 12 Vdc transorb between signal and ground meets IEEE 472.1978

- Local or remote terminations

- Power Consumption - 4 inputs:

  RTD analog input: 0.6 watt

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High Speed Counter Module

• Number of points: 4

• Frequency Range: 0-10 kHz

• Input Voltage Range:
  Internally sourced: 3.3 Vdc
  Externally sourced: 3 Vdc to 24 Vdc

• On state: >1.5 V, Off state <1.5V

• Debounce: Yes

• Input current : selectable 175 microA for low power applications or 2 mA for in-plant noise immunity

• Accumulator: 16 bit

• Surge Suppression: 31 Vdc transorb between signal and ground

• Power consumption:
  175 microA input, all inputs ON: .033 watt
  2 mA input, all inputs ON: .065 watt
  All LEDs ON: add .035 watt

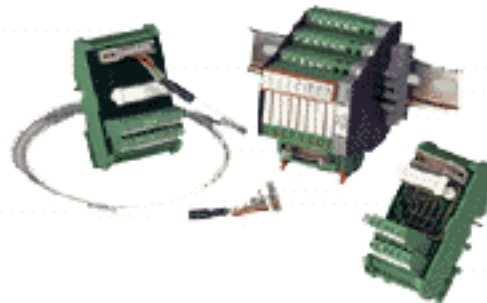## Remote Termination Modules

The remote termination option for ControlWave Micro

I/O modules provide a convenient alternative to the standard direct connect termination. Remote terminations allow a concentration of electrical connections from one or more controllers to be located in one area such as the rear of a 19" cabinet.

All Remote Termination modules are standard DIN-rail mountable and connect to the I/O module with one or two pre-wired connector cables. To simplify installation, all I/O modules use the same cable.

Features

• Removes electrical connections from the controller

• Passive terminations are DIN-rail mountable

• Options for fusing, relays and 120 VAC I/O

• A single common connector cable for all I/O

• Up to 14 AWG wire with compression screw terminals

Available Modules
AI: 4 points with fuses
       2 modules required for 6 AI
AO: 2 points with fuses
DI: 24 Vdc - 8 points, no fuses
       2 modules required for 12 DI or 16 DI
DI: 24 Vdc - 8 points with fuses
       2 required for 12 DI or 16 DI
DI: 120 VAC inputs - 8 points
       16 point Isolated DI only
       2 modules required for 16 DI
DO: 24 Vdc – 8 points, no fuse
DO: 24 Vdc – 8 points, with fuse
DO: 8 points - 6 Amp relay
       16 point Isolated DO only
       2 modules required for 16 DO

Cables Lengths

• 18" cable

• 39" cable

• 6 ½' cable

• 13' cable

Remote Termination Dimensions

AI & AO	3.53" H x 1.77" W x 2.64" D
DI & DO	3.53" H x 2.2" W x 2.58" D
DO Relay	3.9" H x 3.25" W x 3.7" D

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Local Operator Interface Options

ControlWave Micro offers two convenient local operator interfaces; one with a dual-button keypad and one with a 25-button keypad. Both Display/ Keypad assemblies have identical 4 x 20 character LCD displays. They are easily interfaced to the ControlWave Micro System Controller with a standard CAT 5 cable.

Features

- 4 line by 20 character backlit liquid crystal display

- Adjustable display contrast

- Membrane keys with tactile feedback

- Self-adhesive overlay mounts to the enclosure door or panel

- Easy configuration via ACCOL III Function Block

- Scrolling display mode

- Adjustable timer turns off display when not in use

Specifications

- Window size: 1.1" H x 3.1"W (2.8cm x 7.9cm)

- Character size: 4mm H x 3mm W

- Dimensions:
  2-button Display:
  7.4"H x 5.5"W (18.8cm x 14.4cm)
  25-button Display/Keypad:
  7.4"H x 5.5"W (18.8cm x 14.4cm)

- Cable length: 36" max

- Power consumption:
  2.5 mA @ 3.3V (0.008 watts)

- Temperature: -20 to +70 deg C

- Rating: NEMA 4

The 2-button display allows an operator to view site, configuration and process data. The screens are organized in a series of lists. The operator can select from a list of lists and then manually scroll through the selected list of data. Additionally, a scroll list can be defined. The unit can be set to automatically scroll through this list.

**FLOW_RATE_THISHOUR
729.8346**

2-button display example

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```
FLOW_RATE_THISHOUR
729.8346
        CE    ME    AE
 PREV   NEXT   MULT   EXIT
```

25-button display example

The 25-button Display/Keypad performs the same functions and additionally allows the operator entry to view and modify ControlWave Micro inputs, process variables, calculated variables, setpoints, tuning parameters, and outputs used in a measurement or control application. Status bits include the alarm state, alarm acknowledge, control, and manual (Auto/Man). Providing access to such variable information allows the user complete control over the process operation.

ControlWave Micro Distributed I/O System

ControlWave Micro Distributed I/O Sytem (DIOS) units allow for I/O expansion and distribution throughout a plant via standard Ethernet networks. The process control application program resides in the main ControlWave Micro process controller. It controls both local I/O as well as the I/O in the Distributed I/O System units. No control functionality or programming is necessary in the Distributed I/O System unit.

The ControlWave Micro DIOS offers I/O concentration flexibility by supporting from one to up to fourteen slots of I/O using the same base chassis available with main controllers.

The Distributed I/O System unit contains an Ethernet communication engine CPU module dedicated to communications between the main processor and the DIOS unit. The communication engine CPU also includes power fail/recovery control and battery backed RAM to retain I/O data during short power outages.

The ControlWave Micro DIOS CPU is connected to the main ControlWave Micro controller via an Ethernet physical link using TCP/IP. The main ControlWave Micro controller typically uses the

optional dual Ethernet CPU allowing network segmentation between the distributed I/O network and the PLC communication LAN network to ensure the I/O is serviced without bandwidth interference. The ControlWave Micro architecture is a standard Ethernet based network, thereby increasing flexibility and providing an economical, reliable, distributed I/O system.

Hardware Features

- 100/100 Base T Ethernet interface

- Serial communication ports for Ethernet port setup

- One to fourteen I/O modules per Distributed I/O System unit utilizing 3, 4, or 8 slot panel or DIN rail mount base chassis with 2, 4 or 8 slot expansion chassis

- Supports all ControlWave Micro I/O Modules

- Distributed I/O System units are compatible for use with all ControlWave family PAC, RTU and PLC controllers
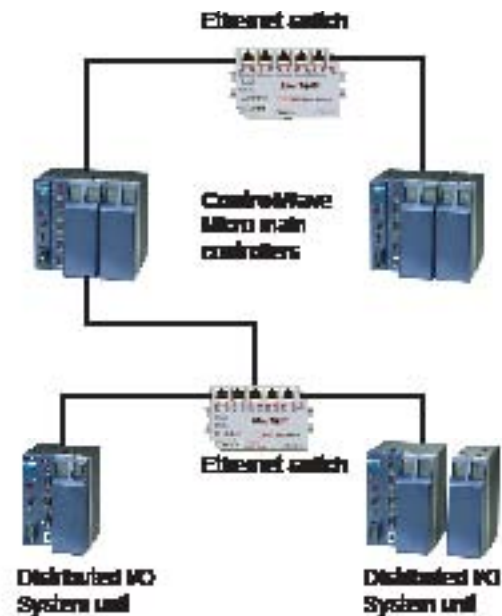
Independent PLC and I/O Ethernet networks

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Scalability

The ControlWave Micro Distributed I/O System allows for increased system flexibility depending on the process I/O count. The units provide a cost effective solution to large I/O count projects, and an economical approach to low or medium I/O count applications.

Specifications

Communication Processor

• CPU: 150 MHz processor

Communication

• One 10/100 Base T Ethernet port with RJ-45 connector

• Isolation: Ethernet port isolated to 500 Vdc

Power Supply and Chassis

• 10.7 to 30 Vdc power input

• Power-fail detection and recovery sequencer

• LED status indicators - 6 failure status LEDs, Watchdog and Idle and communication LEDs

Environmental ratings, physical dimensions, mounting and power consumption specifications are the same as the ControlWave Micro.

OpenBSI

Simply Creative

Emerson's 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 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.

OpenBSI Utilities

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.

• 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 network configuration through NetView

• PC and Network communication diagnostics

• OPC Server for interfacing to most HMI software

• Harvester collects historical data on request or scheduled basis

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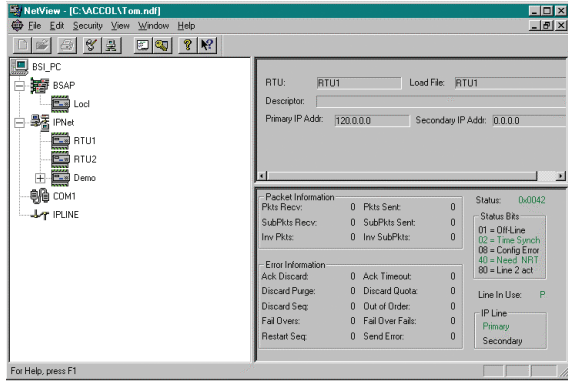
*NetView – Network configuration
and application LaunchPad*

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.

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.
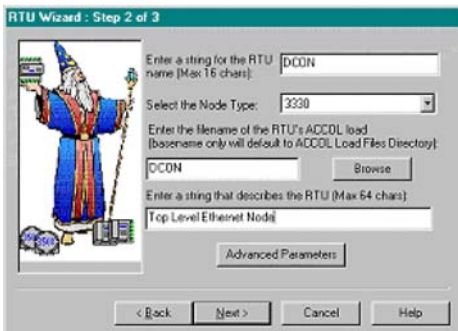
*Configuration Wizard simplifies Network setup*

DataView is an on-line utility used to collect and display several types of process data, including signal values, data array values, signal lists, and audit trail information.
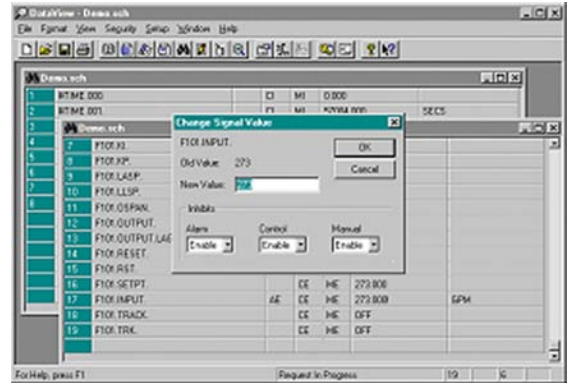
DataView for Real-Time Data

Operators have the ability to alter signal values. Multiple DataView windows may be open simultaneously.

WebBSI - WebBSI is a powerful and flexible software product bringing web technology to all of Emerson's Bristol automation and SCADA products. WebBSI includes a set of ActiveX Controls for reading and writing real-time and historical data, trending, recipe editing and custom display generation. Through these controls, you can use the standard Microsoft Internet Explorer web browser to access Network 3000, TeleFlow and ControlWave products through a set of supplied HTML web pages.
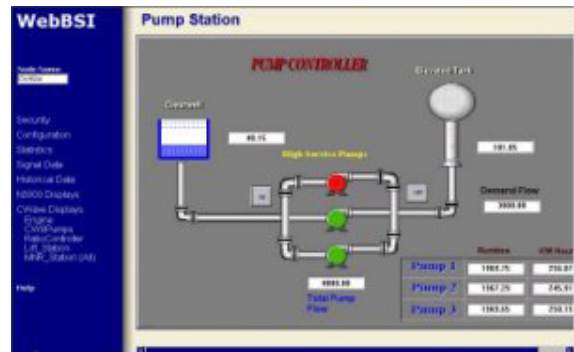
*Custom built web page interface using
a standard web browser*

Bristol® ControlWave® Micro

Real-time ActiveX Controls

One of the many benefits OpenBSI 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

*   Historical – Collect and view historical archive and audit files

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 ActiveX controls.

Required Software

*   Microsoft Internet Explorer

*   Bristol ActiveX controls

*   OpenBSI LocalView or NetView

Historical Data Collection

High Historical Data Integrity

The ControlWave Historical Data Collection system offers exceptional historical data integrity by providing time-stamped historical data storage in ControlWave flash memory. The historical data is collected, through OpenBSI, on a scheduled or demand basis and converted to .CSV and ODBC compliant file formats for use in spreadsheets and 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 provides the greatest data reliability and integrity during communication or PC failure.

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 OpenBSI and presented as a text file in the PC. This functionality is extremely useful in providing an event trail during communication or PC downtime or other system problem.

*   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

Remote Automation Solutions

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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, 2000 & XP

• 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.

Communication Protocols

Like all of Emerson's Bristol products, ControlWave supports BSAP (Bristol Standard Asynchronous Protocol), Modbus, DFI, CIP, DNP3, 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.

BSAP Protocol

All 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 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 Protocol

Modbus - Modbus is often considered a de-facto standard protocol because of its 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

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values and byte order. ControlWave 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

Generic Serial Interface

The Generic Serial Interface is a user programmable 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.

Key-lock Security

The front panel keyswitch on ControlWave provides a high level of manual security by allowing three modes of operation to restrict access to on-line functions.

In *Run Mode,* ControlWave will reject any attempt to download or modify the running program, either locally or over the network.

In *Remote Mode*, ControlWave will allow downloading and on-line program modification through the network provided the security access requirements have been met. Local download and on-line modification of the running program is prohibited.

In *Local Mode*, ControlWave will allow download and on-line modification through either the network connection or through a local serial communication port provided the security access requirements have been met.

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.

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.

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 provides a flexible and secure historical data system that is clearly recognized as a benefit to virtually every industrial application.

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

Watertown, CT 06795 USA	T 1 (860) 945-2200
Mississauga, ON 06795 Canada	T 1 (905) 362-0880
Worcester WR3 8YB UK	T 44 (1) 905-856950

Website: www.EmersonProcess.com/Remote

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Top

1.5625

.75

Front

3.37

1.185

.50

.46 Dia.

.22

P3

P4

P1

P2

5.125

.438

Right Side

3.46

6.00
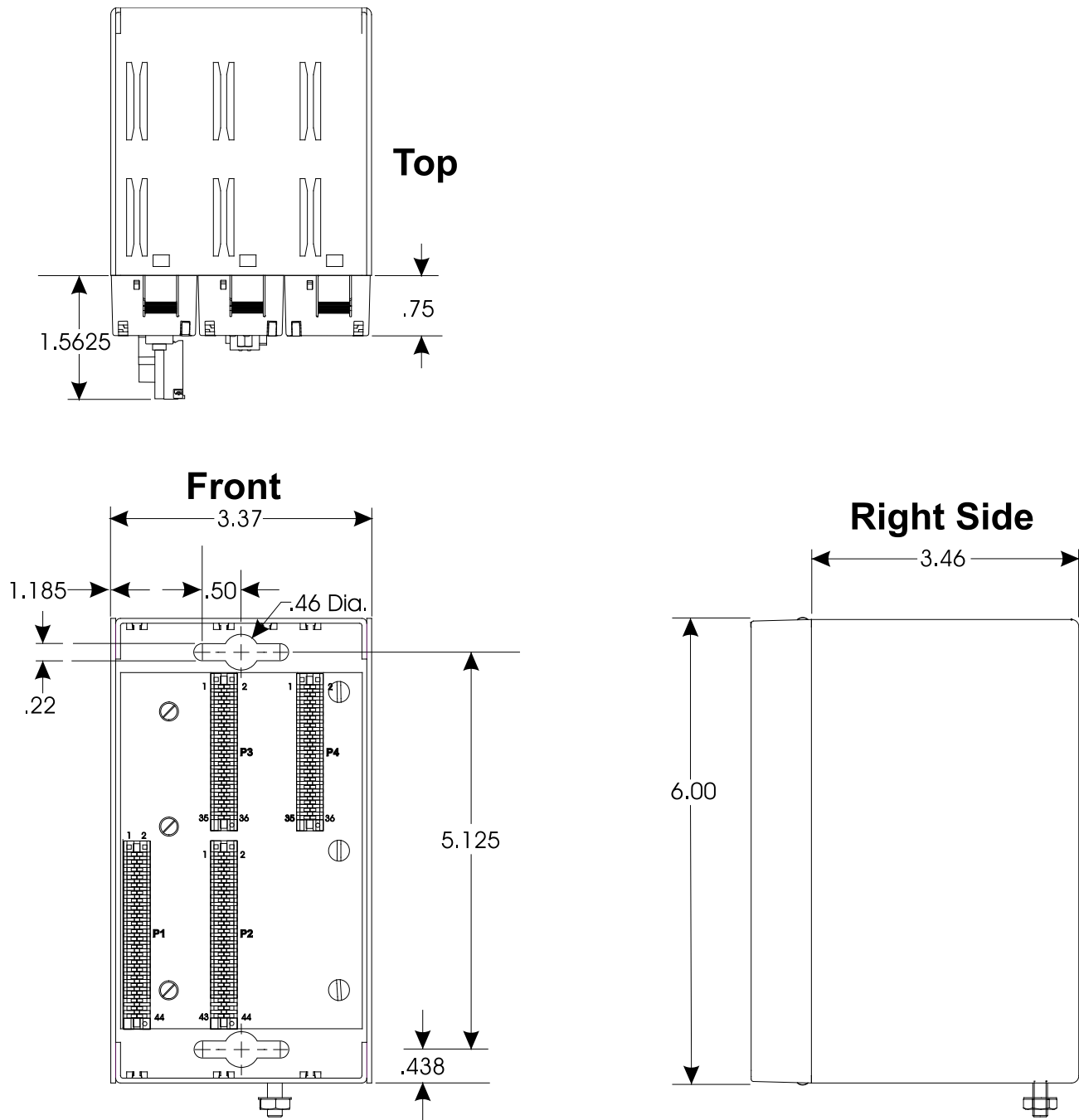
ControlWave Micro 3 slot base chassis

Top

2.34

Front

4.49

1.75   .50

.46 Dia.

.22

P3   P4   P5

P1   P2   P10

5.125

.438

Right Side

3.46

6.00
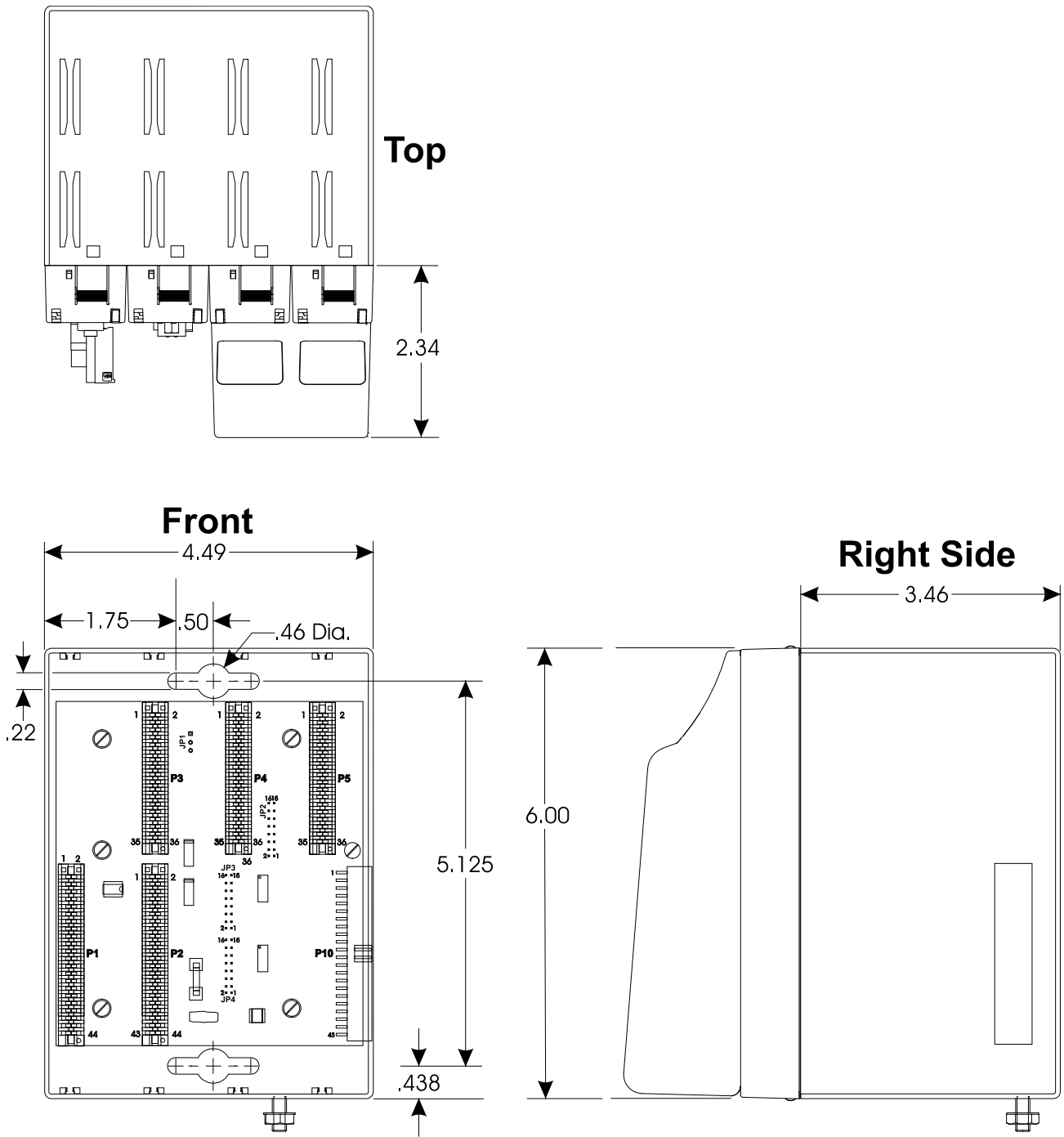
ControlWave Micro 4 slot base chassis

Right Side

3.46

6.00

5.125

.438

Top

2.34

8 7 6 5 4 3 2 1

Front

8.97

.46 Dia.

4.50

.50

1.75

.22
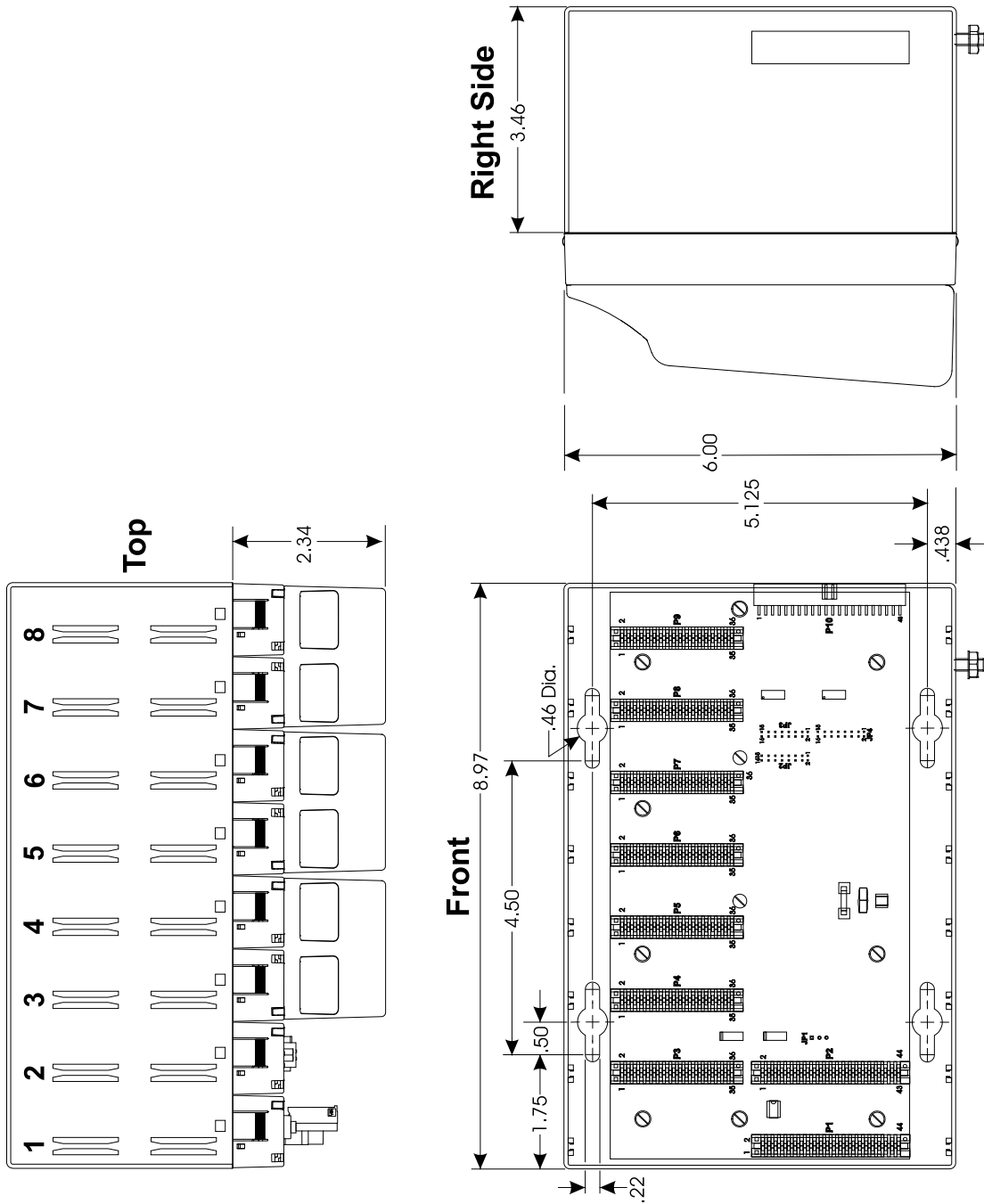
ControlWave Micro 8 slot base chassis

Top

2.34

Left Side

3.46

Front

2.25

.625

.50

.46 Dia.

.22

6.00

5.125

.438
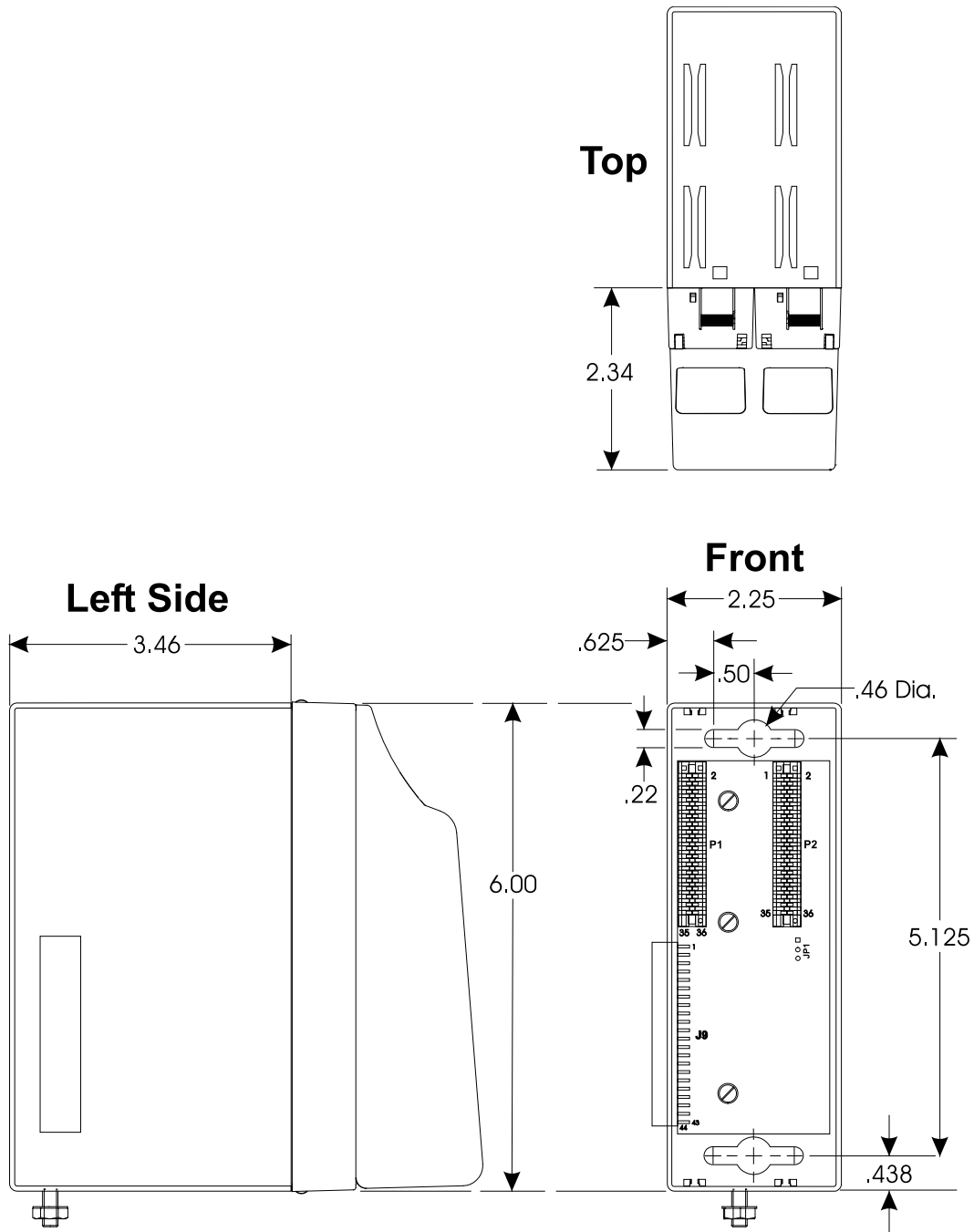
ControlWave Micro 2 slot Expansion chassis

Top

2.34

Left Side

3.46

6.00

Front

4.49

1.75   .50

.46 Dia.

.22

5.125

.438
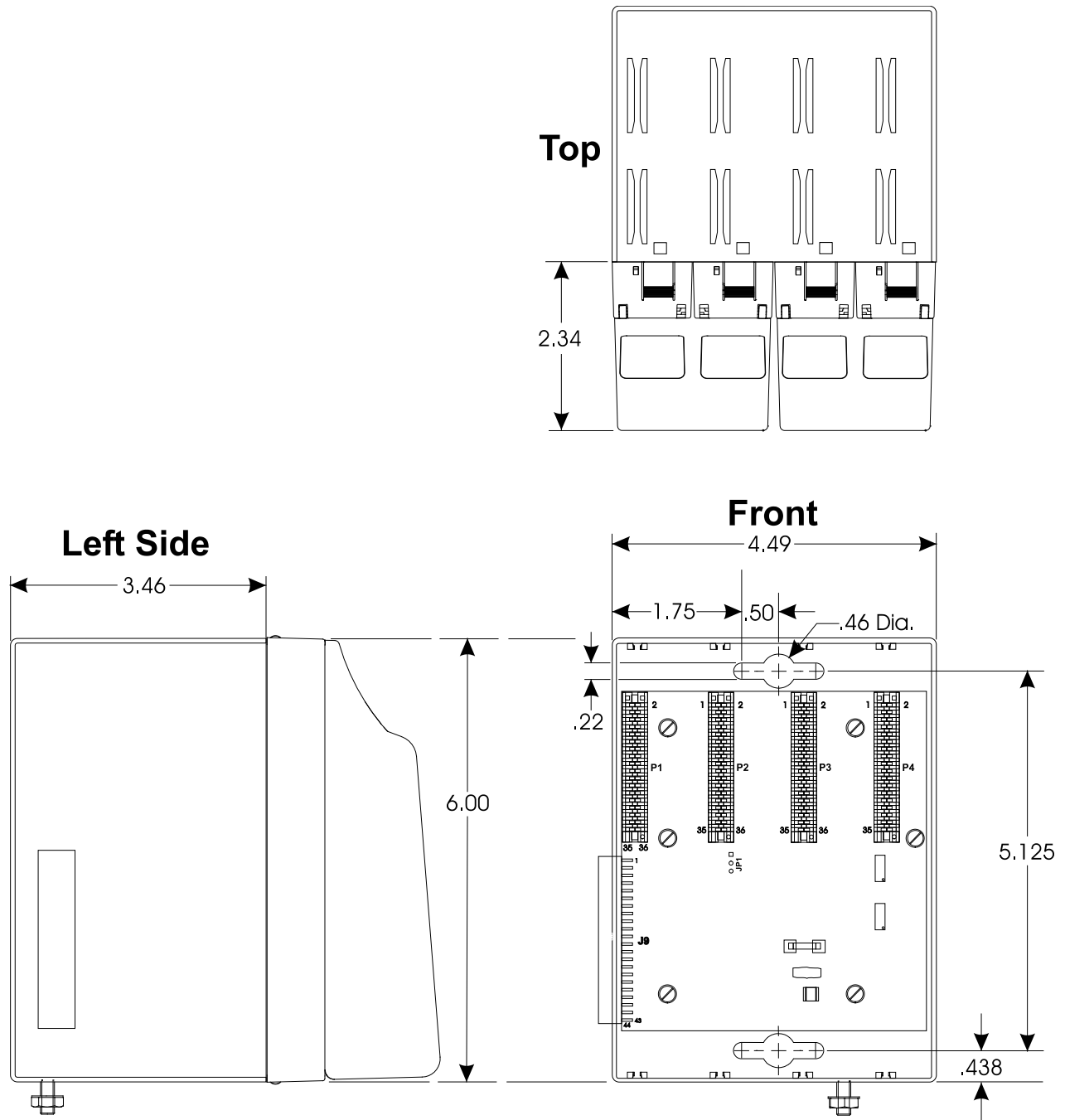
ControlWave Micro 4 slot Expansion chassis

Top

2.34

Front

5.125

.438

8.97

.46 Dia.

4.50

.50

1.75

.22

P8
P7
P6
P5
P4
P3
P2
P1

Left Side

6.00

3.46
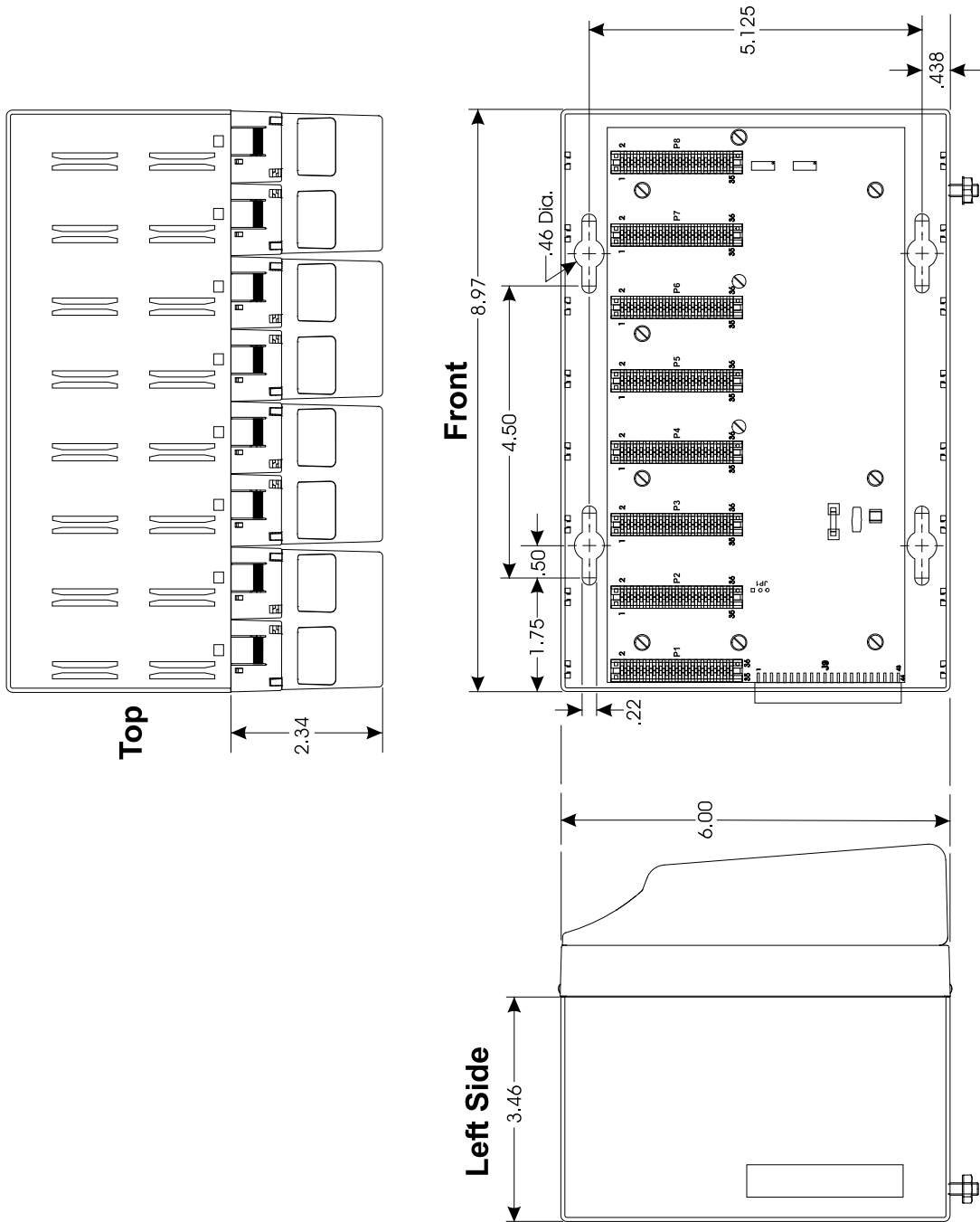
ControlWave Micro 8 slot Expansion chassis

2-button Display

A = Screw (Qty. 4)
B = Display/Keypad Sub-Ass'y.
C = .563" F/F Standoff (Qty. 4)
D = Washer (Qty. 4)
E = User Mounting Panel/Plate
F = Display/Keypad Front Plate

One Piece Gasket

DISPLAY/KEYPAD ASS'Y. BACK VIEW

Connect a Ground Wire to the Base Housing Ground Lug

RJ45 Interface Jack

BACK VIEW PLATE DIMENSIONS

CUTOUT

25-button Display/Keypad

A = Screw (Qty. 4)
B = Display/Keypad Sub-Ass'y.
C = .563" F/F Standoff (Qty. 4)
D = Washer (Qty. 4)
E = User Mounting Panel/Plate/Front Cover
F = Display/Keypad Front Plate
G = #4 Washer & Nut (Qty. 2)
H = Brightness Adj. Pot.

One Piece Gasket

.063 Thick Aluminum Plate

RJ45 Interface Jack

DISPLAY/KEYPAD ASS'Y. BACK VIEW

Connect a Ground Wire to the Base Housing Ground Lug

CUTOUT

BACK VIEW PLATE DIMENSIONS

Bristol® ControlWave® Micro

ControlWave Micro Parts List

DESCRIPTION		PART NO.
Base Housing		
3 slot panel mount base	PSSM, CPU & 1 slot for I/O, No Comm Exp	396560-03-2
4 slot panel mount base	PSSM, CPU & 2 slots for Exp Comm or I/O	396560-02-4
8 slot panel mount base	PSSM, CPU, 2 slots for Exp Comm or I/O and 4 slots dedicated to I/O modules	396560-01-6
System Controller	**Wet-end option (Note 1)**	
6 - 18 V input power System Controller	With display interface, with wet-end interface	396609-02-3
12 - 24 V Syst. Cont., w/o keylock & WD	With display interface, no wet-end interface	396657-02-8
12 - 24 V Syst. Cont., with keylock & WD	With display interface, no wet-end interface	396657-01-0
Micro 33 CPU	**Comm Ports (Note 2)**	
33MHz CPU/2M SRAM, 8M Flash	0 - ENET & 2 - RS 232, & 1 RS 485	396563-07-4
Micro 150 CPU	**Comm Ports (Note 2)**	
150MHzCPU/1M SR,4M SD,8M Flash	0 - ENET & 2 - RS 232, & 1 RS 485	396563-04-0
150MHzCPU/1M SR,4M SD,16M Flash	0 - ENET & 2 - RS 232 & 1 RS 485	396563-05-8
150MHzCPU/1M SR,4M SD,16M Flash	1 - ENET & 2 - RS 232 & 1 RS 485	396563-06-6
150MHzCPU/1M SR,4M SD,16M Flash	2 - ENET & 1 - RS 232 & 1 RS 485	396879-01-2
Micro Distributed I/O Expansion CPU	**Comm Ports (Note 2)**	
Comm Enbing CPU	1 - ENET & 2 - RS 232, & 1 RS 485	396563-08-2
Comm Expansion Module	**Comm Ports (Note: 2 & 3)**	
Comm module, isolated RS 485	1 - RS232 & 1 - Isolated RS 485	396581-01-3
Freewave radio kit **(Note 4)**	Add-on to above Comm module	396582-02-8
Comm Module with MDS Radio **(Note 5)**	MDS radio mounted in Comm module	396581-04-8
Dial-line modem kit **(Not C1D2)**	Add-on to above Comm module	396582-03-6
Display	**Keypad buttons**	
Display - 4 line X 20 character	2 buttons. Also includes 2' display cable	396608-07-8
Display/Keypad - 4 line X 20 character	25 button keypad. Also includes 2' cable	396608-02-7
I/O Expansion Base	**(Note: 6)**	
2 I/O slot panel mount exp base	Up to 2 I/O modules	396559-03-4
4 I/O slot panel mount exp base	Up to 4 I/O modules	396559-02-6
8 I/O slot panel mount exp base	Up to 8 I/O modules	396559-01-8

See NOTES on following page.

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Bristol® ControlWave® Micro

ControlWave Micro Parts List, Continued

DESCRIPTION	PART NO.
Note 1: 6-18V System Controller I/O Limit - Up to 6 I/O modules maximum (2 isolated I/O modules maximum)	
Note 2: RS 485 port is non-isolated.	
Note 3: Comm modules are radio and modem ready. Radios and modems are shipped separately. They may be installed by the customer on comm ports 3 & 4. Comm port 1 is RS 232 & comm 2 is RS 485. Also select cable VASC0032SN or VASC0032SF from DIGITAL ACCESSORIES price pages for Radio Options.	
VASC0032SN SMA to Male N (use with Polyphaser)	
VASC0032SF SMA to Female N (use to connect directly to an antenna cable)	
Note 4: The FreeWave radio requires Comm Expansion module with series control 'J' or better…	
Note 5: The MDS radio is not available for field addition. It is not compatible with Comm module P/N 396587-01-3	
Note 6: One I/O Expansion Base allowed with 12-24 V System Controller. Up to 6 I/O modules maximum with 6-12V SC.	
Note 7: For conformal coating add -C suffix to each part number.	

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Bristol® ControlWave® Micro

ControlWave Micro Parts List, Continued

DESCRIPTION		PART NO.
Local Termination I/O Modules		
Mixed 12 DI, 4 DO without LEDs	Non-Isolated internally sourced dry contact	396567-01-0
Mixed 12 DI, 4 DO with LEDs	Non-Isolated internally sourced dry contact	396567-02-9
Isolated, Mixed 12 DI, 4 DO with LEDs	Isolated, Int. or Ext. sourced dry contact	396804-01-2
16 DI with LEDs (12 VDC Input)	Isolated, Int. or Ext. sourced dry contact	396571-07-7
16 DI with LEDs (24 VDC Input)	Isolated, Int. or Ext. sourced dry contact	396571-02-6
16 DI with LEDs (48 VDC Input)	Isolated externally sourced voltage input	396571-05-0
8 DI with LEDs (120 - 240 VAC Input)	Isolated externally sourced voltage input	396686-01-0
16 DO with LEDs	1/2 Amp Open source output	396572-02-2
8 DO with LEDs (120 - 240 VAC Output)	6A Relay @ 120 VAC externally sourced	396687-01-6
	SEE NOTE 1	
6 AI **(Note 2)**	Externally sourced 1-5 V or 4-20 mA	396569-01-3
Mixed 6 AI, 2 AO **(Note 2)**	Externally sourced 1-5 V or 4-20 mA	396568-01-7
Isolated AI, 8 inputs	Int or Ext sourced 1-5 V or 4-20 mA	396604-01-3
Isolated AO, 4 outputs	Int or Ext sourced 1-5 V or 4-20 mA	396603-01-7
6 TC	B, R, S, J, E, K, T, C, N, + 10 mV	396875-01-7
4 RTD	2, 3, or 4 wire platinum RTD	396876-01-3
4 HSC with LEDs	10 KHz counters	396570-02-0
Mixed I/O Cards (Note 2)		
Mixed 6 DIO, 4 AI, 2 HSC, w/o LEDS	Dry contact DI, Ext. sourced 1-5V or 4-20mA	396630-01-4
Mixed 6 DIO, 4 AI, 2 HSC, 1 AO, w/o LEDS	Dry contact DI, Ext. sourced 1-5V or 4-20mA	396630-02-2
Mixed 6 DIO, 4 AI, 2 HSC, with LEDS	Dry contact DI, Ext. sourced 1-5V or 4-20mA	396630-03-0
Mixed 6 DIO, 4 AI, 2 HSC, 1 AO, with LEDS	Dry contact DI, Ext. sourced 1-5V or 4-20mA	396630-04-9

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Bristol® ControlWave® Micro

ControlWave Micro Parts List, Continued

DESCRIPTION		PART NO.
Remote Termination I/O Modules		
Mixed 12 DI, 4 DO without LEDs	Non-Isolated internally sourced dry contact	396567-03-7
Mixed 12 DI, 4 DO with LEDs	Non-Isolated internally sourced dry contact	396567-04-5
16 DI with LEDs	Isolated, Int. or Ext. sourced dry contact	396571-04-2
16 DI with LEDs (48 VDC Input)	Isolated externally sourced voltage input	396571-06-9
16 DO with LEDs	.5 Amp Open source output	396572-04-9
6 AI **(Note 2)**	Externally sourced 1-5 V or 4-20 mA	396569-02-1
Mixed 6 AI, 2 AO **(Note 2)**	Externally sourced 1-5 V or 4-20 mA	396568-02-5
Isolated AI, 8 inputs	Int or Ext sourced 1-5 V or 4-20 mA	396604-02-1
Isolated AO, 4 outputs	Int or Ext sourced 1-5 V or 4-20 mA	396603-02-5
6 TC	B, R, S, J, E, K, T, C, N, + 10 mV	396875-02-5
4 RTD	2, 3, or 4 wire platinum RTD	396876-02-1
4 HSC with LEDs	10 KHz counters	396570-04-6

Note 1: 8 Point AC DO Card cannot be used in the first slot of the I/O Expansion Chassis.

AC digital output modules are not Class 1,Div. 2 approved

Note 2: The externally source AI's on the mixed I/O cards require external wiring for the 24V device power.

Terminal block connections for the field power are provided on the I/O card for AO's only.

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