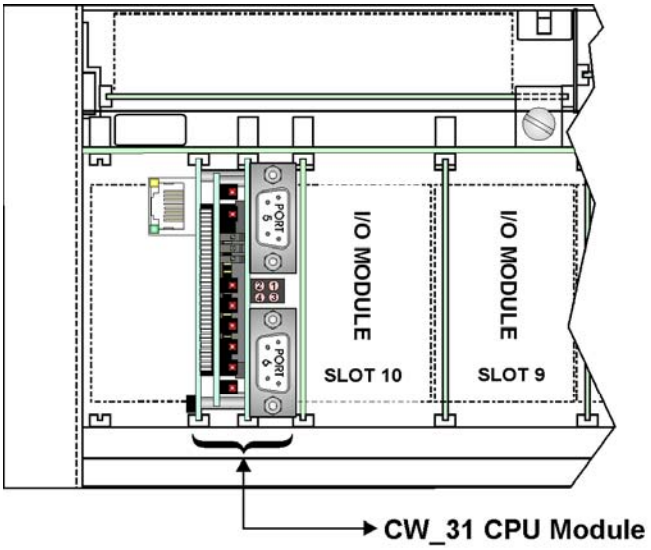
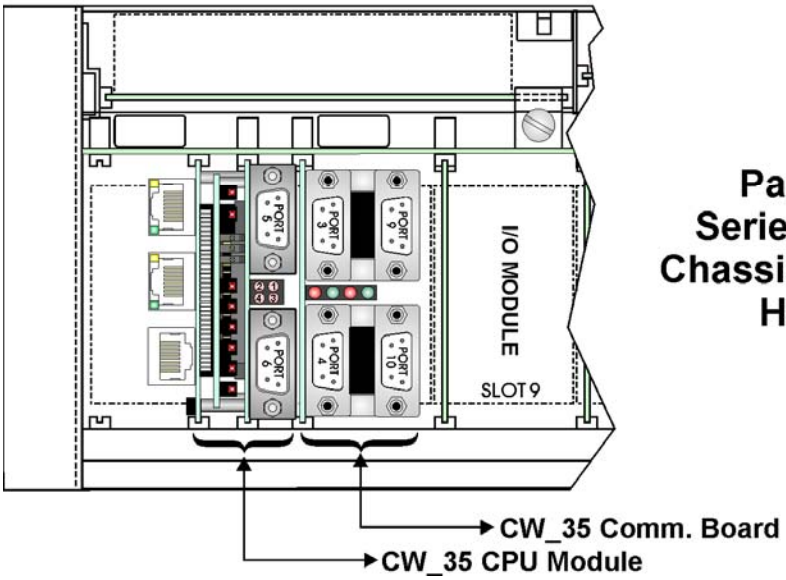
ControlWave_35 & ControlWave _31
HARDWARE INSTALLATION GUIDE

For upgrade of the following 33XX Series Products:
3335 DPC & 3331 RIO



Partial View Series 3331 RIO Chassis with CW_31 Hardware



Partial View Series 3335 DPC Chassis with CW_35 Hardware

ControlWave

IMPORTANT! READ INSTRUCTIONS BEFORE STARTING!

Be sure that these instructions are carefully read and understood before any operation is attempted. Improper use of this device in some applications may result in damage or injury. The user is urged to keep this book filed in a convenient location for future reference.

These instructions may not cover all details or variations in equipment or cover every possible situation to be met in connection with installation, operation or maintenance. Should problems arise that are not covered sufficiently in the text, the purchaser is advised to contact Bristol for further information.

EQUIPMENT APPLICATION WARNING

The customer should note that a failure of this instrument or system, for whatever reason, may leave an operating process without protection. Depending upon the application, this could result in possible damage to property or injury to persons. It is suggested that the purchaser review the need for additional backup equipment or provide alternate means of protection such as alarm devices, output limiting, fail-safe valves, relief valves, emergency shutoffs, emergency switches, etc. If additional in-formation is required, the purchaser is advised to contact Bristol .

RETURNED EQUIPMENT WARNING

When returning any equipment to Bristol for repairs or evaluation, please note the following: The party sending such materials is responsible to ensure that the materials returned to Bristol are clean to safe levels, as such levels are defined and/or determined by applicable federal, state and/or local law regulations or codes. Such party agrees to indemnify Bristol and save Bristol harmless from any liability or damage which Bristol may incur or suffer due to such party's failure to so act.

ELECTRICAL GROUNDING

Metal enclosures and exposed metal parts of electrical instruments must be grounded in accordance with OSHA rules and regulations pertaining to "Design Safety Standards for Electrical Systems," 29 CFR, Part 1910, Subpart S, dated: April 16, 1981 (OSHA rulings are in agreement with the National Electrical Code).

The grounding requirement is also applicable to mechanical or pneumatic instruments that include electrically-operated devices such as lights, switches, relays, alarms, or chart drives.

EQUIPMENT DAMAGE FROM ELECTROSTATIC DISCHARGE VOLTAGE

This product contains sensitive electronic components that can be damaged by exposure to an electrostatic discharge (ESD) voltage. Depending on the magnitude and duration of the ESD, this can result in erratic operation or complete failure of the equipment. Read supplemental document S14006 at the back of this manual for proper care and handling of ESD-sensitive components.

WARRANTY

A. Bristol warrants that goods described herein and manufactured by Bristol are free from defects in material and workmanship for one year from the date of shipment unless otherwise agreed to by Bristol in writing.

B. Bristol warrants that goods repaired by it pursuant to the warranty are free from defects in material and workmanship for a period to the end of the original warranty or ninety (90) days from the date of delivery of repaired goods, whichever is longer.

C. Warranties on goods sold by, but not manufactured by Bristol, are expressly limited to the terms of the warranties given by the manufacturer of such goods.

D. All warranties are terminated in the event that the goods or systems or any part thereof are (i) misused, abused or otherwise damaged, (ii) repaired, altered or modified without Bristol's consent, (iii) not installed, maintained and operated in strict compliance with instructions furnished by Bristol, or (iv) worn, injured or damaged from abnormal or abusive use in service time.

E. THESE WARRANTIES ARE EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED (INCLUDING WITHOUT LIMITATION WARRANTIES AS TO MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE), AND NO WARRANTIES, EXPRESS OR IMPLIED, NOR ANY REPRESENTATIONS, PROMISES, OR STATEMENTS HAVE BEEN MADE BY BRISTOL UNLESS ENDORSED HEREIN IN WRITING. FURTHER, THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF.

F. No agent of Bristol is authorized to assume any liability for it or to make any written or oral warranties beyond those set forth herein.

REMEDIES

A. Buyer's sole remedy for breach of any warranty is limited exclusively to repair or replacement without cost to Buyer of any goods or parts found by Seller to be defective if Buyer notifies Bristol in writing of the alleged defect within ten (10) days of discovery of the alleged defect and within the warranty period stated above, and if the Buyer returns such goods to Bristol's Watertown office, unless Bristol's Water-town office designates a different location, transportation prepaid, within thirty (30) days of the sending of such notification and which upon examination by Bristol proves to be defective in material and workmanship. Bristol is not responsible for any costs of removal, dismantling or reinstallation of allegedly defective or defective goods. If a Buyer does not wish to ship the product back to Bristol, the Buyer can arrange to have a Bristol service person come to the site. The Service person's transportation time and expenses will be for the account of the Buyer. However, labor for warranty work during normal working hours is not chargeable.

B. Under no circumstances will Bristol be liable for incidental or consequential damages resulting from breach of any agreement relating to items included in this quotation, from use of the information herein or from the purchase or use by Buyer, its em-ployees or other parties of goods sold under said agreement.

How to return material for Repair or Exchange

Before a product can be returned to Bristol for repair, upgrade, exchange, or to verify proper operation, form (GBU 13.01) must be completed in order to obtain a RA (Return Authorization) number and thus ensure an optimal lead time. Completing the form is very important since the information permits the Bristol Repair Dept. to effectively and efficiently process the repair order.

You can easily obtain a RA number by:

A. FAX
Completing the form (GBU 13.01) and faxing it to (860) 945-3875. A Bristol Repair Dept. representative will return call (or other requested method) with a RA number.

B. E-MAIL
Accessing the form (GBU 13.01) via the Bristol Web site (www.bristolbabcock.com) and sending it via E-Mail to brepair@bristolbabcock.com. A Bristol Repair Dept. representative will return E-Mail (or other requested method) with a RA number.

C. Mail
Mail the form (GBU 13.01) to

Bristol Inc.
Repair Dept.
1100 Buckingham Street
Watertown, CT 06795

A Bristol Repair Dept. representative will return call (or other requested method) with a RA number.

D. Phone
Calling the Bristol Repair Department at (860) 945-2442. A Bristol Repair Department representative will record a RA number on the form and complete Part I, then send the form to the Customer via fax (or other requested method) for Customer completion of Parts II & III.

A copy of the completed Repair Authorization Form with issued RA number should be included with the product being returned. This will allow us to quickly track, repair, and return your product to you.

Bristol Repair Authorization Form (off-line completion)

(Providing this information will permit Bristol to effectively and efficiently process your return. Completion is required to receive optimal lead time. Lack of information may result in increased lead times.)

Date_____ **RA #**_____**SH** **Line No.**_____

Standard Repair Practice is as follows: Variations to this is practice may be requested in the "Special Requests" section.

- Evaluate / Test / Verify Discrepancy
- Repair / Replace / etc. in accordance with this form
- Return to Customer

Please be aware of the Non warranty standard charge:

- There is a $100 minimum evaluation charge, which is applied to the repair if applicable (√ in "returned" B,C, or D of part III below)

Part I Please complete the following information for single unit or multiple unit returns

Address No. _____ **(office use only)** **Address No.** _____**(office use only)**

Bill to :_____ **Ship to:**_____

_____ _____

_____ _____

Purchase Order:_____ **Contact Name:**_____

Phone:_____ **Fax:**_____**E-Mail:** _____

Part II Please complete Parts II & III for each unit returned

Model No./Part No._____ **Description** _____

Range/Calibration _____ **S/N** _____

Reason for return: ☐ Failure ☐ Upgrade ☐ Verify Operation ☐ Other _____

1. Describe the conditions of the failure (Frequency/Intermittent, Physical Damage, Environmental Conditions, Communication, CPU watchdog, etc.)

_____

_____

_____

_____(Attach a separate sheet if necessary)

2. Comm. interface used: ☐ Standalone ☐ RS-485 ☐ Ethernet ☐ Modem (PLM (2W or 4W) or SNW) ☐Other:_____

3. What is the **Firmware** revision? _____ What is the **Software** & version? _____

Part III If checking "replaced" for any question below, check an alternate option if replacement is not available

A. If product is within the warranty time period but is excluded due to Bristol's warranty clause, would you like the product: ☐ repaired ☐ returned ☐ replaced ☐ scrapped?

B. If product were found to exceed the warranty period, would you like the product: ☐repaired ☐ returned ☐ replaced ☐ scrapped?

C. If product is deemed not repairable would you like your product: ☐ returned ☐ replaced ☐ scrapped?

D. If Bristol is unable to verify the discrepancy, would you like the product: ☐ returned ☐ replaced ☐ *see below?

* Continue investigating by contacting the customer to learn more about the problem experienced? The person to contact that has the most knowledge of the problem is: _____ phone_____

If we are unable to contact this person the backup person is: _____ phone_____

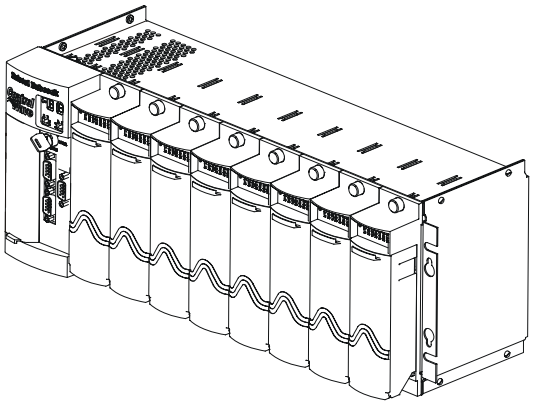
Special Requests: _____

_____

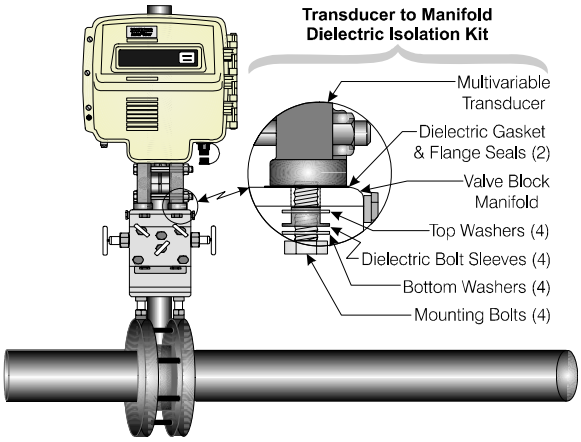
Ship prepaid to: **Bristol Inc., Repair Dept., 1100 Buckingham Street, Watertown, CT 06795**
Phone: 860-945-2442 Fax: 860-945-2220 Form GBU 13.01 Rev. C 04/27/06

Bristol
Training

GET THE MOST FROM YOUR BRISTOL BABCOCK INSTRUMENT OR SYSTEM



- Avoid Delays and problems in getting your system on-line
- Minimize installation, start-up and maintenance costs.
- Make the most effective use of our hardware and software.
- Know your system.



As you know, a well-trained staff is essential to your operation. Bristol Inc. offers a full schedule of classes conducted by full-time, professional instructors. Classes are offered throughout the year at three locations: Houston, Orlando and our Watertown, CT headquarters. By participating in our training, your personnel can learn how to install, calibrate, configure, program and maintain any and all Bristol products and realize the full potential of your system.

For information or to enroll in any class, contact our training department in Watertown at (860) 945-2343. For Houston classes, you can also contact our Houston office, at (713) 685-6200.

A Few Words About Bristol Inc.

For over 100 years, Bristol® has been providing innovative solutions for the measurement and control industry. Our product lines range from simple analog chart recorders, to sophisticated digital remote process controllers and flow computers, all the way to turnkey SCADA systems. Over the years, we have become a leading supplier to the electronic gas measurement, water purification, and wastewater treatment industries.

On off-shore oil platforms, on natural gas pipelines, and maybe even at your local water company, there are Bristol Inc. instruments, controllers, and systems running year-in and year-out to provide accurate and timely data to our customers.

Getting Additional Information

In addition to the information contained in this manual, you may receive additional assistance in using this product from the following sources:

Help Files / Release Notes

Many Bristol software products incorporate help screens. In addition, the software typically includes a 'read me' release notes file detailing new features in the product, as well as other information which was available too late for inclusion in the manual.

Contacting Bristol Inc. Directly

Bristol's world headquarters is located at 1100 Buckingham Street, Watertown, Connecticut 06795, U.S.A.

Our main phone numbers are:

(860) 945-2200
(860) 945-2213 (FAX)

Regular office hours are Monday through Friday, 8:00AM to 4:30PM Eastern Time, excluding holidays and scheduled factory shutdowns. During other hours, callers may leave messages using Bristol's voice mail system.

Telephone Support - Technical Questions

During regular business hours, Bristol's Application Support Group can provide telephone support for your technical questions.

For technical questions about TeleFlow products call (860) 945-8604.

For technical questions about **Control**Wave call (860) 945-2394 or (860) 945-2286.

For technical questions regarding Bristol's **OpenEnterprise** product, call (860) 945-3865 or e-mail: **scada@bristolbabcock.com**

For technical questions regarding **ACCOL** products, **OpenBSI Utilities**, **UOI** and all other software except for **Control**Wave and **OpenEnterprise** products, call (860) 945-2286.

For technical questions about **Network 3000** hardware, call (860) 945-2502.

You can e-mail the Application Support Group at: **bsupport@bristolbabcock.com**

The Application Support Group maintains an area on our web site for software updates and technical information. Go to: **www.bristolbabcock.com/services/techsupport/**

For assistance in interfacing Bristol hardware to radios, contact Bristol's **Communication Technology Group** in Orlando, FL at **(407) 629-9463 or (407) 629-9464**.

You can e-mail the Communication Technology Group at:
orlandoRFgroup@bristolbabcock.com

Telephone Support - Non-Technical Questions, Product Orders, etc.

Questions of a non-technical nature (product orders, literature requests, price and delivery information, etc.) should be directed to the nearest sales office (listed on the rear cover of this manual) or to your Bristol-authorized sales representative.

Please call the main Bristol Inc. number (860-945-2200) if you are unsure which office covers your particular area.

Visit our Site on the World Wide Web

For general information about Bristol Inc. and its products, please visit our site on the World Wide Web at: **www.bristolbabcock.com**

Training Courses

Bristol's Training Department offers a wide variety of courses in Bristol hardware and software at our Watertown, Connecticut headquarters, and at selected Bristol regional offices, throughout the year. Contact our Training Department at **(860) 945-2343** for course information, enrollment, pricing, and scheduling.

PIP-CW_35 Upgrade Kit
ControlWave_35 & ControlWave_31
Hardware Installation Guide

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PIP-CW_35 Upgrade Kit
ControlWave_35 & ControlWave_31
Hardware Installation Guide

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APPENDICES

REFERENCED BRISTOL CUSTOMER INSTRUCTION MANUALS

ControlWave_35 & ControlWave_31
HARDWARE INSTALLATION GUIDE

SECTION 1 - ControlWave_35/31 INTRODUCTION

3335 DPC and 3331 RIOs can be field upgraded to become a **Control**Wave_**35** DPC or **Control**Wave_**3**1 RIO (herein referred to as **CW_35/31**) by utilizing the hardware provided in an installation kit. Upgrade will require removal of the standard DPC 3335/RIO 3331 CPU Module and Comm./ECOM Boards and then adding the **CW_35/31** CPU Module (CPUM) and **CW_35** Communication (CB) Boards provided in the upgrade kit.

ControlWave® products have been designed and integrated as a highly adaptable, high performance Distributed Open Controller family with exceptional networking capability that provides a complete Process Automation Management Solution. The CPU Module and CB Boards were designed with an emphasis on providing high performance with low power consumption and scalability.

The CPU Module utilizes Sharp's LH7A400 System-on-Chip Advanced RISC Machine (ARM) microprocessor with 32-bit ARM9TDMI Reduced Instruction Set Computer (RISC) Core. In addition to the microprocessor and control logic, the CPU Board includes two communication ports that can be individually configured for RS-232 or RS-485 operation, 1MB of battery backed Static RAM (SRAM), 4MB of Synchronous Dynamic RAM (SDRAM), 512kB Boot/Downloader FLASH, 16MB simultaneous read/write FLASH, an I/O Bus Connector, and up to two optional Ethernet ports.

In addition to Idle and Watchdog LEDs, there are six status LEDs located on the CPU LED Board that will display run time status information. Two LEDs are also provided for each Comm. Port.

CW_35/31 DPC/RIOs provide the following key features:

- ARM processor provides exceptional performance and low power consumption
- Up to six independently configurable asynchronous serial communication ports (RS-232/RS-485) and one 3-wire serial RS-232 Utility Port
- Up to two optional Ethernet ports (10/100Base-T) (one on **CW_31**)
- Optional Expansion Comm. Modules (2 Port or 4 Port)
- Wide temperature range: (-40 to +70°C) (-40 to 158°F)
- Utilizes existing DPC 3330/ RIO 3331 Chassis, Power Supply and I/O Boards
- RS-232/RS-485 Comm. Ports provided with LED status Indicators
- Battery backup for the real-time clock and the system's SRAM is provided by a 3.0V, 300mA-hr lithium coin cell battery located on the CPU Board Ass'y.
- Class I, Div. 2 Hazardous Location approval

SECTION 2 - ControlWave PROGRAMMING ENVIRONMENT

The **Control**Wave programming environment uses industry-standard tools and protocols to provide a flexible, adaptable approach for various process control applications in the water treatment, wastewater treatment, and industrial automation business.

The **Control**Wave programming environment consists of a set of integrated software tools which allow a user to create, test, implement, and download complex control strategies for use with Bristol's **CW_351** Distributed Process Controller or **CW_31** Remote I/O Unit.

The tools that make up the programming environment are:

- **Control**Wave **Designer** load building package offers several different methods for generating and debugging control strategy programs including function blocks, ladder logic, structured languages, etc. The resulting process control load programs are fully compatible with **IEC 61131-3** standards. Various communication methods are offered, including TCP/IP, serial links, as well as communication to Bristol's **Open BSI** software and networks.

- The **I/O Configuration Wizard**, accessible via a menu item in **Control**Wave Designer, allows you to define **process I/O modules** in the **CW_35** and configure the individual mapping of I/O points for digital and analog inputs and outputs.

- The **ACCOL3 Firmware Library**, which is imported into **Control**Wave Designer, includes a series of Bristol specific function blocks. These pre-programmed function blocks accomplish various tasks common to most user applications including alarming, historical data storage, as well as process control algorithms such as PID control.

- The **OPC Server** (**O**bject Linking and Embedding (OLE) for **P**rocess **C**ontrol) allows real-time data access to any OPC [Object Linking and Embedding (OLE) for Process Control] compliant third-party software packages.

- A series of **Configuration Controls** are available for setting up various aspects of the system such as historical data storage, system security, and soft switches. Additional **Data Access Controls** are also available for retrieval of real-time data values and communication statistics. The configuration controls and the data access controls utilize **ActiveX** technology and are called through a set of fixed Web pages, compatible with Microsoft® Internet Explorer. Alternatively, developers can place the controls in third-party ActiveX compatible containers such as Visual BASIC or Microsoft® Excel.

- **User-defined Web Pages** - If desired, user-defined web pages can be stored within a PC to provide a customized human-machine interface (HMI).

- **Flash Configuration Utility** – Parameters such as the BSAP local address, IP address, etc. are set using the Flash Configuration Utility, accessible via Open BSI LocalView or NetView.

Note: DPC 3335s or RIO 3331s that are upgraded with "CW_35/31 Hardware," must have their ACCOL application load converted to an IEC 61131 ControlWave Program Load. This is accomplished via the ACCOL Translator (see User Guide D5086).

CREATING YOUR OWN PROJECT:

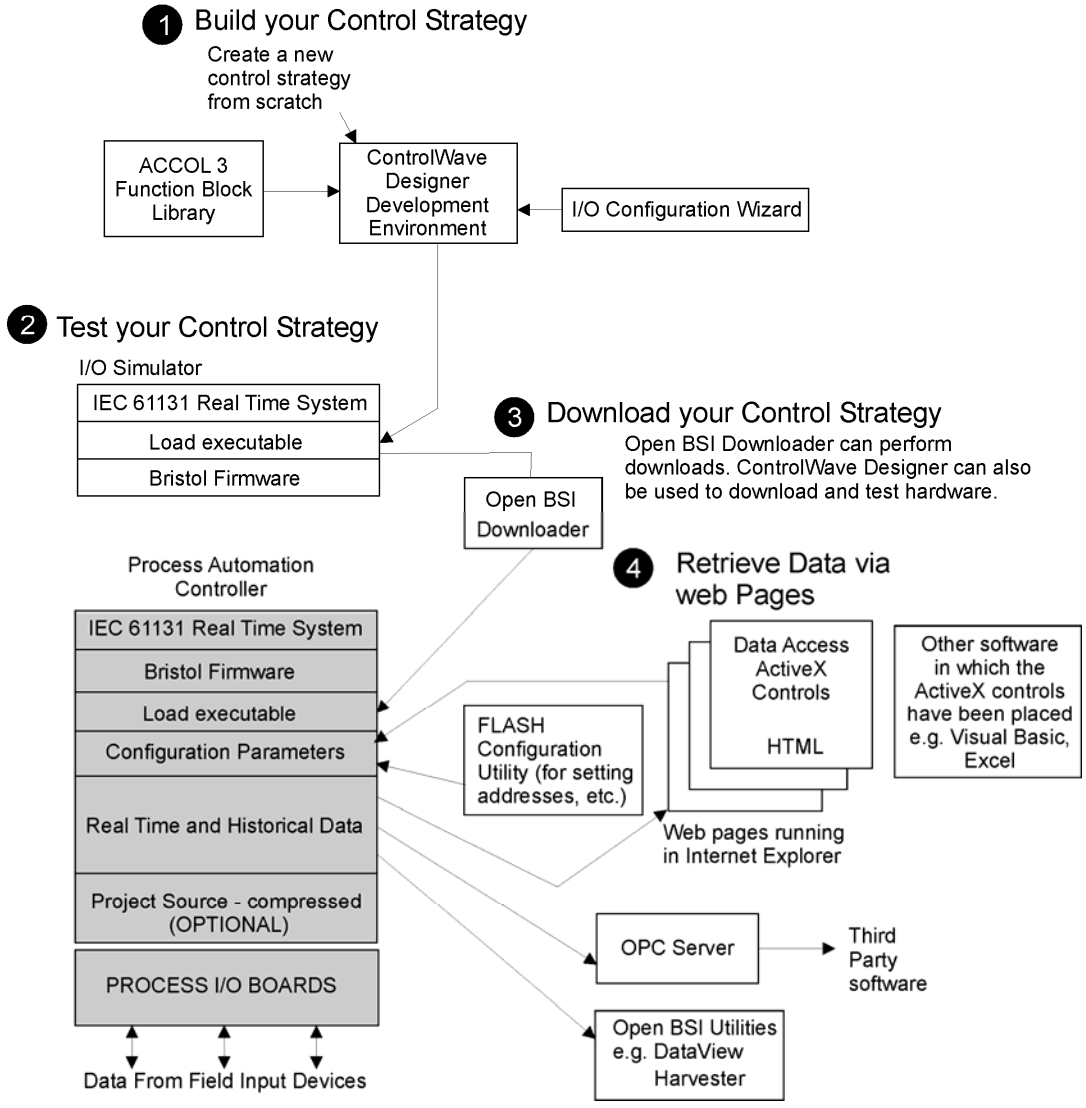


Figure 1 - ControlWave - Control Strategy Software Diagram

SECTION 3 - PHYSICAL DESCRIPTION

CW_35 Upgrade kits are comprised of the following major components:

- **CW_35** CPU Module (CPUM) Overview (Section 3.1)
  CW_35 CPU Board
  CW_35 LED Board
  CW_35 Expansion Board (with 2 Ethernet Ports and a Display/Keypad Jack)
- **CW_35** Communication Board (CB) Overview (Section 3.2)
  2-Port CB or 4-Port CB

CW_31 Upgrade kits are comprised of the following major components:

- **CW_35/31** CPU Module (CPUM) Overview (Section 3.1)
  CW_35/31 CPU Board
  CW_35/31 LED Board
  CW_35/31 Expansion Board (with 1 Ethernet Port)

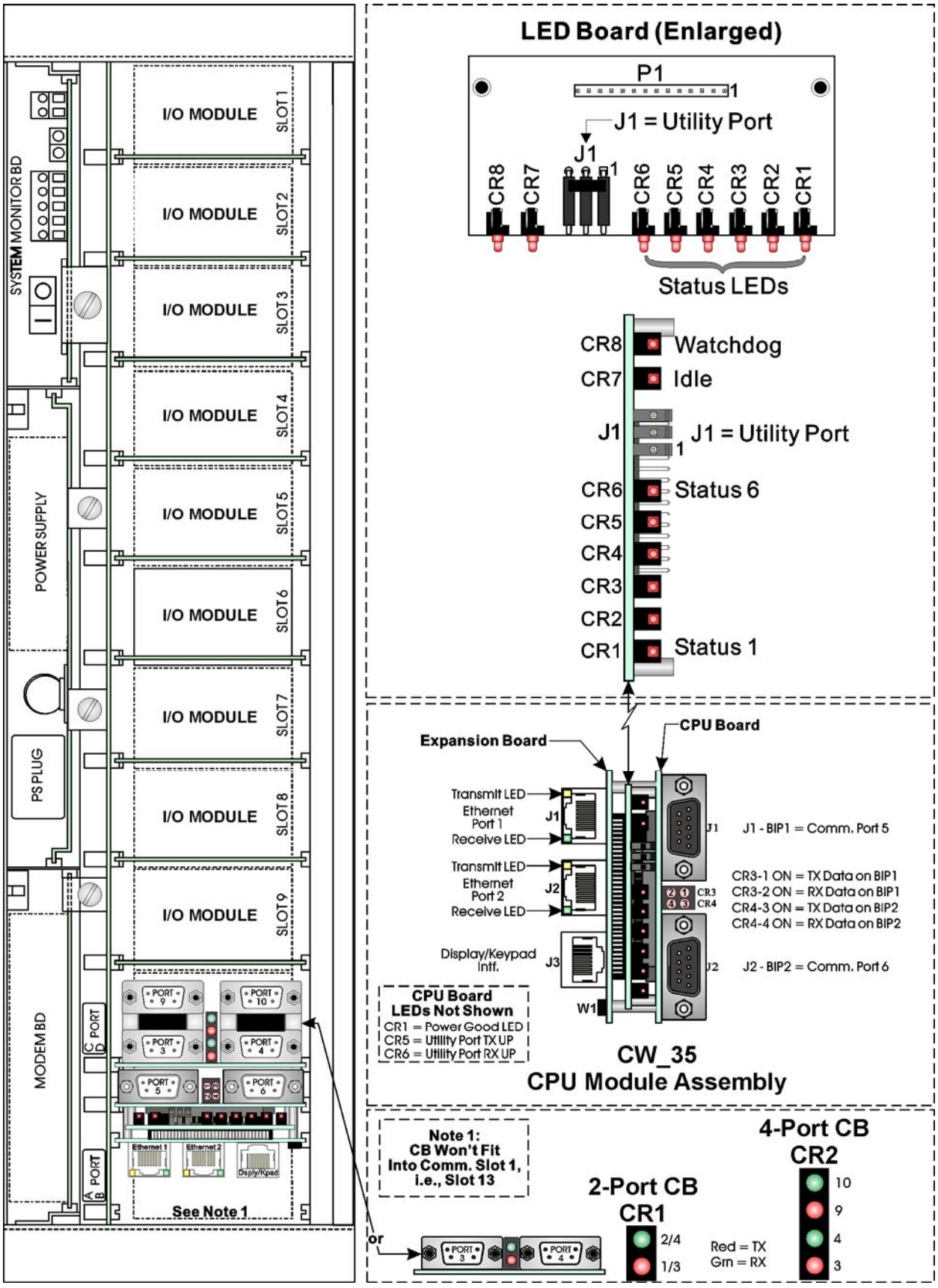


Figure 2A – CW_35 Front View
Showing PC Boards, Module Layout & LED Assignments

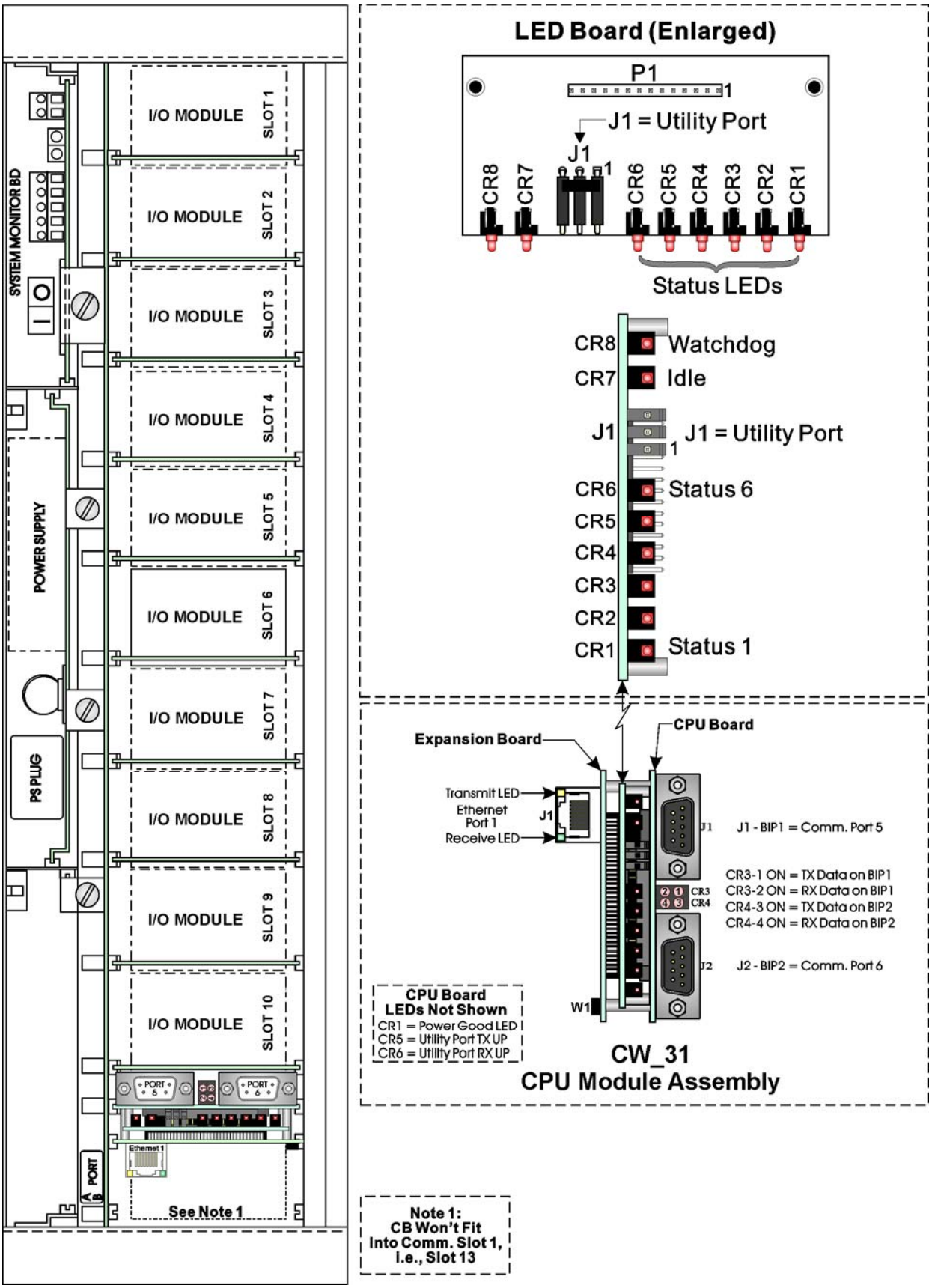


Figure 2B – CW_31 Front View
Showing PC Boards, Module Layout & LED Assignments

3.1 CW_35/31 CPU Module Overview

CW_35/31 CPU Modules (CPUM) provide **CW_35/31** CPU, I/O monitor/control, memory and communication functions. **CW_35/31** CPU Modules operate over an extended temperature range with long-term product reliability. Each CPUM consists of a CPU Board (CPUB), a CPU LED Board and an Expansion Board (EB).

CW_35/31 CPUMs are based on a 32-bit ARM9TDMI RISC Core Processor. The CPU Board is specified to operate on **CW_35/31** (+12Vdc or +24Vdc systems) and with a system clock speed of 150 MHz. In addition to the microprocessor and control logic, the CPU Board includes two independently Jumper configurable communication ports (RS-232/RS-485) (COM5 & COM6), up to two optional 10/100Base-T Ethernet ports (two for **CW_35** & one for **CW_31**), CPU Memory consists of 1MB of battery backed Static RAM (SRAM), 512kB Boot/Downloader FLASH and 16MB simultaneous read/write FLASH.

CPU Boards are provided backup power via a coin cell socket that accepts a 3.0V, 300mA-hr lithium battery. This 3.0V battery provides backup power for the real-time clock and the system's Static RAM (SRAM). Backup power is enabled when Configuration Jumper W3 (just below the battery) is installed in position 1 to 2.

If the 3.3Vdc that powers the unit goes out of specification, a supervisory circuit on the CPU Board switches the battery voltage to the CPU's SRAM and RTC. For maximum shelf life, the battery may be isolated from the circuit by removing the Backup Enable Jumper W3 from position 1 to 2 and then installing it in position 2 to 3. If the Real-time clock looses its battery backup a ControlWave Designer system variable bit (_QUEST_DATE) is set. This bit can be used to post a message or alarm to the PC (see the ControlWave Designer Programmer's Handbook - D5125, System Variables Section).

The system SRAM is specified to have a standby current of 20µA for each part (1MB), (40µA maximum) (plus 2uA for the RTC). A worst-case current draw of 42µA allows a battery life of approximately 7142 hours.

Basic CPU Module components and features are summarized as follows:

- LH7A400 System-on-Chip 32-bit ARM9TDMI RISC Core microprocessor
- Supports process control loads that are fully compatible with IEC 61131-3 standards
- 512KB FLASH Boot/Downloader, 29LV040B, 90 nS, 8-bit access
- 1MB SRAM, 3.3V, 256 x 16, 70 nsec., with Battery Back-up
- 4 MB SDRAM via two 1M x 16, 100MHz SDRAMs configured as a 1M x 32-bit array.
- 16MB simultaneous read/write FLASH, 90 nsec.
- 2 user configurable serial Comm. ports (RS-232/RS-485) (COM5 & COM6) (compatible with existing 3335/3331 communication cables)
- I/O Bus Interface, control for up to 12 I/O Boards
- MAC address in serial EEPROM
- Spread Spectrum clock for lower EMI
- Serial Real Time Clock with battery backup
- 8-Position general-purpose switch bank plus a 4-Position recovery switch bank
- Coin cell socket accepts a 3.0V, 300mA-hr lithium battery

SW2 = GENERAL PURPOSE DIP SWITCH
NOTE: Except for SW2-4, ON = Factory Default)

SW#	Function	Setting
SW2-1	Watchdog Enable	ON = Watchdog circuit is Enabled OFF = Watchdog circuit is Disabled
SW2-2	Lock/Unlock Soft Switches	ON = Write to Soft Switches and FLASH files OFF = Soft Switches, configurations and FLASH files are locked
SW2-3	Use/Ignore Soft Switches	ON = Use Soft Switches (configured in FLASH) OFF = Ignore Soft Switches Configuration and use factory defaults
SW2-4	Core Updump See Section 3.6	ON = Core Updump Disabled OFF = Core Updump Enabled via Mode Switch SW1 or W1 on CEB
SW2-5	SRAM Control	ON = Retain values in SRAM during restarts OFF = Force system to reinitialize SRAM
SW2-6	System Firmware Load Control	ON = Enable remote downloading of System Firmware * OFF = Disable remote downloading of System Firmware
SW2-7	N/A	
SW2-8	Enable WINDIAG	ON = Normal Operation (don't allow WINDIAG to run test) OFF = Disable boot project (allow WINDIAG to run test)

* = Boot PROM version 4.7 or higher and System PROM version 4.7 or higher

SW3 = COMM. PORT 5 CONFIGURATION DIP SWITCH
SW4 = COMM. PORT 6 CONFIGURATION DIP SWITCH

SW#	Function	Setting
SW3/4-1	TX+ to RX+ Loopback	ON - Loopback for Diagnostics (2-Wire) OFF - Loopback Disabled (4-Wire)
SW3/4-2	TX- to RX- Loopback	ON - Loopback for Diagnostics (2-Wire) OFF - Loopback Disabled (4-Wire)
SW3/4-3	100 Ohm RX+ Termination	ON - End Nodes Only
SW3/4-4	100 Ohm RX- Termination	ON - End Nodes Only
SW3/4-7	RX+ Bias (End Nodes/Node)	ON - 4-Wire = Both End Nodes OFF - 2-Wire = One End Node Only
SW3/4-8	RX- Bias (End Nodes/Node)	ON - 4-Wire = Both End Nodes OFF - 2-Wire = One End Node Only

SW1 = LOCAL/RECOVERY MODE DIP SWITCH

SW#	Function	Setting
SW1-1/2	Recovery/Local Mode	Both ON or OFF = Recovery Mode SW1-1 OFF & SW1-2 ON = Local Mode
SW1-3	Force Recovery Mode	ON = Force Recovery Mode (via CW Console) OFF = Recovery Mode Disabled
SW1-4	Not Used	N/A

CPU BOARD JUMPER CONFIGURATION

W3 - 1 To 2 = Enable Battery Back-up
2 To 3 = Disable Battery Back-up

W5 - 1 To 2 = Enable Power Good LED (CR6)
2 To 3 = Disable Power Good LED

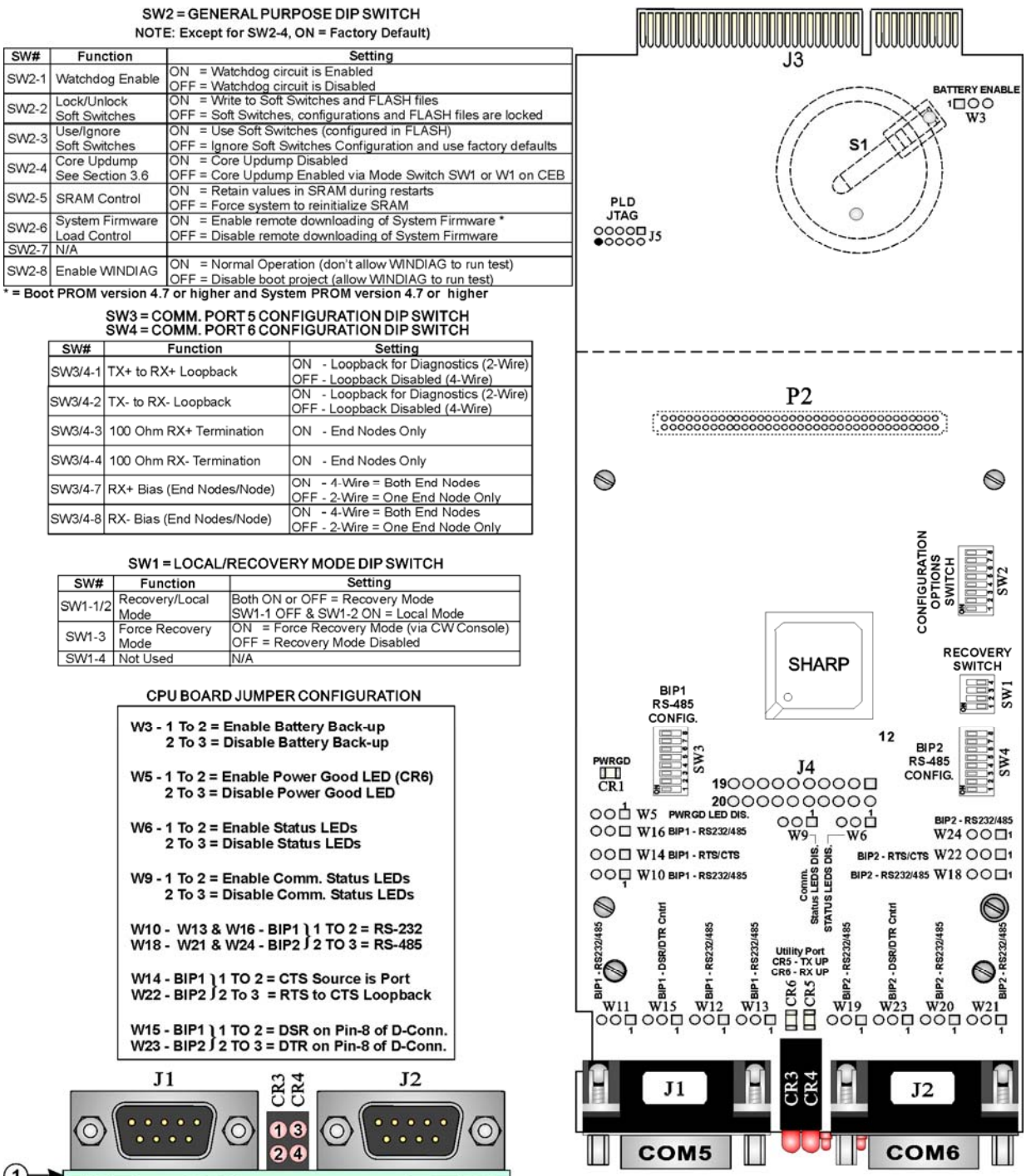
W6 - 1 To 2 = Enable Status LEDs
2 To 3 = Disable Status LEDs

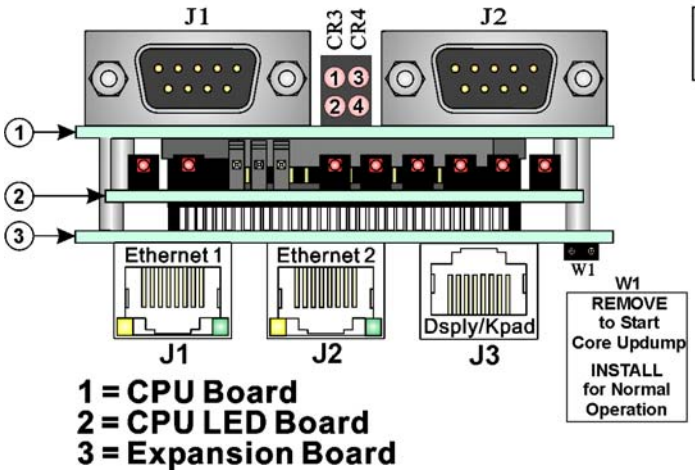
W9 - 1 To 2 = Enable Comm. Status LEDs
2 To 3 = Disable Comm. Status LEDs

W10 - W13 & W16 - BIP1 } 1 TO 2 = RS-232
W18 - W21 & W24 - BIP2 } 2 TO 3 = RS-485

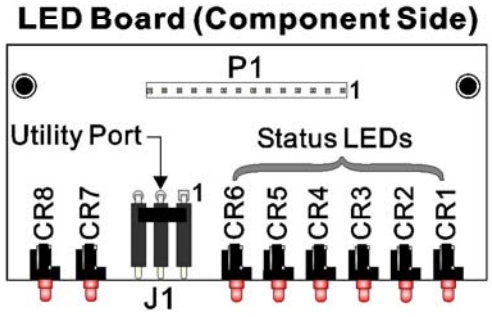
W14 - BIP1 } 1 TO 2 = CTS Source is Port
W22 - BIP2 } 2 To 3 = RTS to CTS Loopback

W15 - BIP1 } 1 TO 2 = DSR on Pin-8 of D-Conn.
W23 - BIP2 } 2 TO 3 = DTR on Pin-8 of D-Conn.





W1
REMOVE to Start Core Updump
INSTALL for Normal Operation



Note: Expansion Bd. Connectors J2 & J3 aren't available on CW_31s

Figure 3 – CW_35/31 CPU Module Component Identification Diagram

- LEDs: CPUB has 4 Serial Comm. Port LEDs (two for each port) plus Power Good, Utility Port TX and Utility Port RX LEDs; CPU LED Board has Six Status LEDs plus Watchdog and Idle LEDs and the EB has TX and RX LEDs built into the Ethernet Ports
- 3-wire (RS-232) Utility Port: Provides compatibility with existing FLASH load cable used with the 3335 CPU.

3.1.1 CW_35/31 CPU Board Serial Comm. Port Connectors

The CPU Board supports up to two serial communication ports (COM5 and COM6). These ports are supported by Female D-Type connectors (see Table 10 for Comm. Port D-type connector pin assignments). Connector J1 (BIP1) supports Comm. Port 5 while connector J2 (BIP2) supports Comm. Port 6. When configured for RS-485 operation Comm. Port 5 and Comm. Port 6 receivers are enabled by DTR the RS-485 driver is enabled by RTS. An eight position DIP-Switch (SW3) is assigned to Comm. Port 5 and another (SW4) is assigned to Comm. Port 6. These switches provide user configuration of RS-485 port receiver biasing and termination as well as 2-wire or 4-wire operation (see Section 1.3.5). Configuration Jumpers on the CPU Board RS-232/485 configuration and control of BIP1/BIP2 communication ports (see Section 3.1.4).

The following information is provided to support use of CPU Board Serial Comm. Ports:

- When configured for RS-232 operation, CPU Board Comm. Ports support RTS, DTR, CTS, DCD and DSR modem control signals.
- RS-232 transceivers are enabled by the port's DTR signal, i.e., when DTR goes high the port becomes active.
- Each RS-232 transceiver has one active receiver while in the power-down mode (disabled). DCD is connected to the active receiver.
- When configured for RS-485 operation, the CB Comm. Port receiver is enabled by DTR while the driver is enabled by RTS.
- For RS-485 operation, an eight-position DIP switch (one per port) enables receiver biasing and termination as well as two-wire and 4-wire selection.

3.1.2 CW_35/31 CPU Board Memory

Boot/downloader FLASH
Boot/download code is contained in a single 512Kbytes FLASH IC. 4-Position DIP-Switch SW1's position 3 allows start-up menu options to be displayed or boot-up from system FLASH. If SW1-3 is ON when a reset occurs, the boot-up code will cause a recovery menu to be sent out the Utility Port to a terminal program running on an external host computer. *Note: Recovery Mode will also be initiated if CPU Board Switch SW1 positions 1 and 2 are both set **ON** or **OFF** when a reset occurs.*

FLASH Memory
The base version of the CPU Board has 16Mbytes of 3.3V, simultaneous read/write (DL) FLASH memory. System Firmware and the Boot Project are stored here.

System Memory (SRAM)
The CPU Board has 1Mbyte of static RAM, implemented with two 256K x 16, 70 nanosecond asynchronous SRAMs. All random access memory retained data is stored in SRAM. During power loss periods, SRAM is placed into data retention mode (powered by a backup 3.0V lithium battery). SRAM's operates at 3.3V and are packaged in a 44-pin uTSOP. Critical system information that must be retained during power outages or when

the system has been disabled for maintenance is stored here. Data includes: Last states of all I/O, historical data, retain variables and pending alarm messages not yet reported.

Synchronous Dynamic RAM (SDRAM)
The **CW_35/31** CPU Board contains 4 Mbytes of Synchronous Dynamic RAM (SDRAM) implemented with two 1M x 16, 100MHz Synchronous DRAMs. The running application is stored here. This allows the system to run faster than it will from the FLASH memory. SDRAM is not battery-backed.

3.1.3 CW_35/31 CPU Board Configuration Jumpers

CW_35/31 CPU Boards are provided with 18 Configuration Jumpers that function as follows:

- W3 - Enable/Disable Battery Back-up Selection
  1 to 2 = Enable Battery Back-up
  2 to 3 = Disable Battery Back-up

- W5 - Power Good LED (CR1 on CPU Bd.) Enable/Disable Selection
  1 to 2 = Enable Power Good LED
  2 to 3 = Disable Power Good LED

- W6 - Status LEDs (on LED Bd.) Enable/Disable Selection
  1 to 2 = Enable Six Status LEDs
  2 to 3 = Disable Six Status LEDs

- W9 - Serial Comm. Port Status LEDs (on CPU Bd.) Enable/Disable Selection
  1 to 2 = Enable Serial Comm. Port Status LEDs
  2 to 3 = Disable Serial Comm. Port Status LEDs

- W10 -- BIP1 (Comm. Port 5) Configuration Selection **Note: W11, W12, W13 & W16 ditto**
  1 to 2 = Set for RS-232 Operation
  2 to 3 = Set for RS-485 Operation

- W14 - BIP1 (Comm. Port 5) Control
  1 to 2 = CTS Source is from Port
  2 to 3 = RTS to CTS Loopback

- W15 - BIP1 (Comm. Port 5) DSR/DTR Control
  1 to 2 = DSR on Pin-8 of D-type Connector
  2 to 3 = DTR on Pin-8 of D-type Connector

- W18 -- BIP2 (Comm. Port 6) Configuration Selection **Note: W19, W20, W21 & W24 ditto**
  1 to 2 = Set for RS-232 Operation
  2 to 3 = Set for RS-485 Operation

- W22 BIP2 (Comm. Port 6) Control
  1 to 2 = CTS Source is from Port
  2 to 3 = RTS to CTS Loopback

- W23 - BIP2 (Comm. Port 6) DSR/DTR Control
  1 to 2 = DSR on Pin-8 of D-type Connector
  2 to 3 = DTR on Pin-8 of D-type Connector

3.1.4 CW_35/31 CPU Board Configuration Switches

Four configuration DIP-Switches are provided on the CPU Board. Eight-bit DIP-Switch SW2 is provided for user configuration settings while four-bit DIP-Switch SW1 provides forced recovery functions. Eight-bit DIP-Switch SW3 provides loopback, termination control, and receiver bias settings for the Comm. Port 5 when it has been configured for RS-485 operation (via jumpers W10 through W13 and W16). Eight-bit DIP-Switch SW4 provides loopback, termination control, and receiver bias settings for Comm. Port 6 when it has been configured for RS-485 operation (via jumpers W18 through W21 and W24).

Table 1 – CW_35/31 CPU Board (General Purpose Switch SW2) Assignments
Note: Except for SW2-4, ON = Factory Default

Switch	Function	Setting - (ON = Factory Default)
SW2-1	Watchdog Enable	ON = Watchdog circuit is enabled OFF = Watchdog circuit is disabled
SW2-2	Lock/Unlock Soft Switches	ON = Write to Soft Switches and FLASH files OFF = Soft Switches, configurations and FLASH files are locked
SW2-3	Use/Ignore Soft Switches	ON = Use Soft Switches (configured in FLASH) OFF = Ignore Soft Switch Configuration and use factory defaults
SW2-4	Core Updump See Section 3.6	ON = Core Updump Disabled OFF = Core Updump Enabled via Recovery Switch (SW1)
SW2-5	SRAM Control	ON = Retain values in SRAM during restarts OFF = Force system to reinitialize SRAM
SW2-6	System Firmware Load Control	ON = Enable remote downloading of System Firmware* OFF = Disable remote downloading of System Firmware
SW2-7	N/A	
SW2-8	Enable WINDIAG	ON = Normal Operation (don't allow WINDIAG to run test) OFF = Disable boot project (allow WINDIAG to run test)

*** = Boot PROM version 4.7 or higher and System PROM version 4.7 or higher**

Table 2 – CW_35/31 CPU Board (Switch SW1) Assignments
Recovery Mode/Local Mode Control (Note: SW1-4 not used)

Switch	Function	Setting
SW1-1/2	Recovery/Local Mode *	Both ON or OFF = Recovery Mode SW1 OFF & SW2 ON = Local Mode
SW1-3	Force Recovery Mode	ON = Force Recovery Mode (via CW Console) OFF = Recovery Mode disabled

*** Note: Only the CPU Switch SW1 setting listed in this table have been tested.**

Table 3 – CW_35/31 CPU Board Switch SW3/SW4 Assignments
RS-485 Loopback & Termination Control (COM5 = SW3 & COM6 = SW4)

Switch	RS-485 Function Switch ON	Setting
SW3/4-1	TX+ to RX+ Loopback/2-Wire	ON - Only for Diagnostics
SW3/4-2	TX– to RX– Loopback/2-Wire	ON - Only for Diagnostics
SW3/4-3	100 Ohm RX+ Termination	ON - End Nodes Only
SW3/4-4	100 Ohm RX– Termination	ON - End Nodes Only
SW3/4-7	RX+ Bias (End Nodes/Node)	ON - 4-Wire = Both End Nodes ON - 2-Wire = One End Node Only
SW3/4-8	RX– Bias (End Nodes/Node)	ON - 4-Wire = Both End Nodes ON - 2-Wire = One End Node Only

3.1.5 CW_35/31 CPU Module LEDs

CW_35/31 CPU Modules are equipped with up to 15 LEDs (plus 2 LEDs in each Ethernet Jack). Table 4 provides CPU Module LED assignments. Table 5 provides definitions for the six Status LEDS.

Table 4 – Assignment of CW_35/31 CPU Module LEDs

LED Ref.	Function	Color	Location
CR1	Power Good	Green	CPU Bd. - Next to SW3 (Not User Viewable)
CR3 (1) - Right	COM5 (BIP1) TX	Red	CPU Bd. - Card Edge (Top - Next to J1)
CR3 (2) - Left	COM5 (BIP1) RX	Red	CPU Bd. - Card Edge (Top - Next to J1)
CR4 (3) - Right	COM6 (BIP2)TX	Red	CPU Bd. - Card Edge (Bottom - Next to J2)
CR4 (4) - Left	COM6 (BIP2) RX	Red	CPU Bd. - Card Edge (Bottom - Next to J2)
CR5	Utility Port TX	Red	CPU Bd. - Behind CR3/4 (Not User Viewable)
CR6	Utility Port RX	Red	CPU Bd. - Behind CR3/4 (Not User Viewable)
CR1	Status 1	Red	LED Bd. - Bottom
CR2	Status 2	Red	LED Bd.
CR3	Status 3	Red	LED Bd.
CR4	Status 4	Red	LED Bd.
CR5	Status 5	Red	LED Bd.
CR6	Status 6	Red	LED Bd.
CR7	Idle	Red	LED Bd.
CR8	Watchdog	Red	LED Bd. - Top

Note: Optional Ethernet Port Jacks are equipped with two LEDs that function as follows: yellow = TX, Green = RX activity.

Two red LEDs provide for the following status conditions when lit: WD (CR18 on the LED Board - Indicates a Watchdog condition has been detected) & IDLE (CR7 on the LED Board - Indicates that the CPU has free time at the end of its execution cycle). Normally, the Idle LED should be ON most of the time. When the Idle LED is OFF, it indicates that the CPU has no free time, and may be overloaded). The green Power Good LED (CR1 on the CPU Board) is on when power is within specification. Six status LEDs provide run time status codes.

Table 5 - System Status Codes for Status LCDs
CW_35/31 CPU Module LED Board (see Figures 4 & 5)

LED 6 CR6	LED 5 CR5	LED 4 CR4	LED 3 CR3	LED 2 CR2	LED 1 CR1	Status In Hex	Indication Definition
0	0	0	0	0	0	00	Application Running
0	0	0	0	0	1	01	Unit in Diagnostic Mode
0	0	0	0	1	1	03	Unit Running Diagnostics
0	0	0	1	0	0	04	Flash XSUM Error
0	0	0	1	0	1	05	Error Initializing Application Device
0	0	0	1	1	1	07	Flash Programming Error
0	0	1	0	0	0	08	Using Factory Defaults *
0	0	1	0	0	1	09	Battery Failure Detected *
0	0	1	0	1	0	0A	Currently Loading the Boot Project
0	0	1	0	1	1	0B	System Initialization in Progress
0	1	0	0	0	0	10	Waiting in Recovery Mode
0	1	0	0	1	0	12	Error Testing SRAM
1	0	0	0	0	0	20	Application Loaded
1	0	1	0	0	0	28	Stopped at a Break Point

Table 5 - System Status Codes for Status LCDs
CW_35/31 CPU Module LED Board (see Figures 4 & 5) (Continued)

LED 6 CR6	LED 5 CR5	LED 4 CR4	LED 3 CR3	LED 2 CR2	LED 1 CR1	Status In Hex	Indication Definition
1	1	0	0	0	0	30	No Application Loaded
1	1	1	0	0	0	38	Running with Break Points
1	1	1	0	1	1	3B	Waiting for Power-down (after NMI)
1	1	1	1	1	0	3E	Waiting for Updump to be Performed
1	1	1	1	1	1	3F	Unit Crashed (Watchdog Disabled)

*** = Flashed at startup**

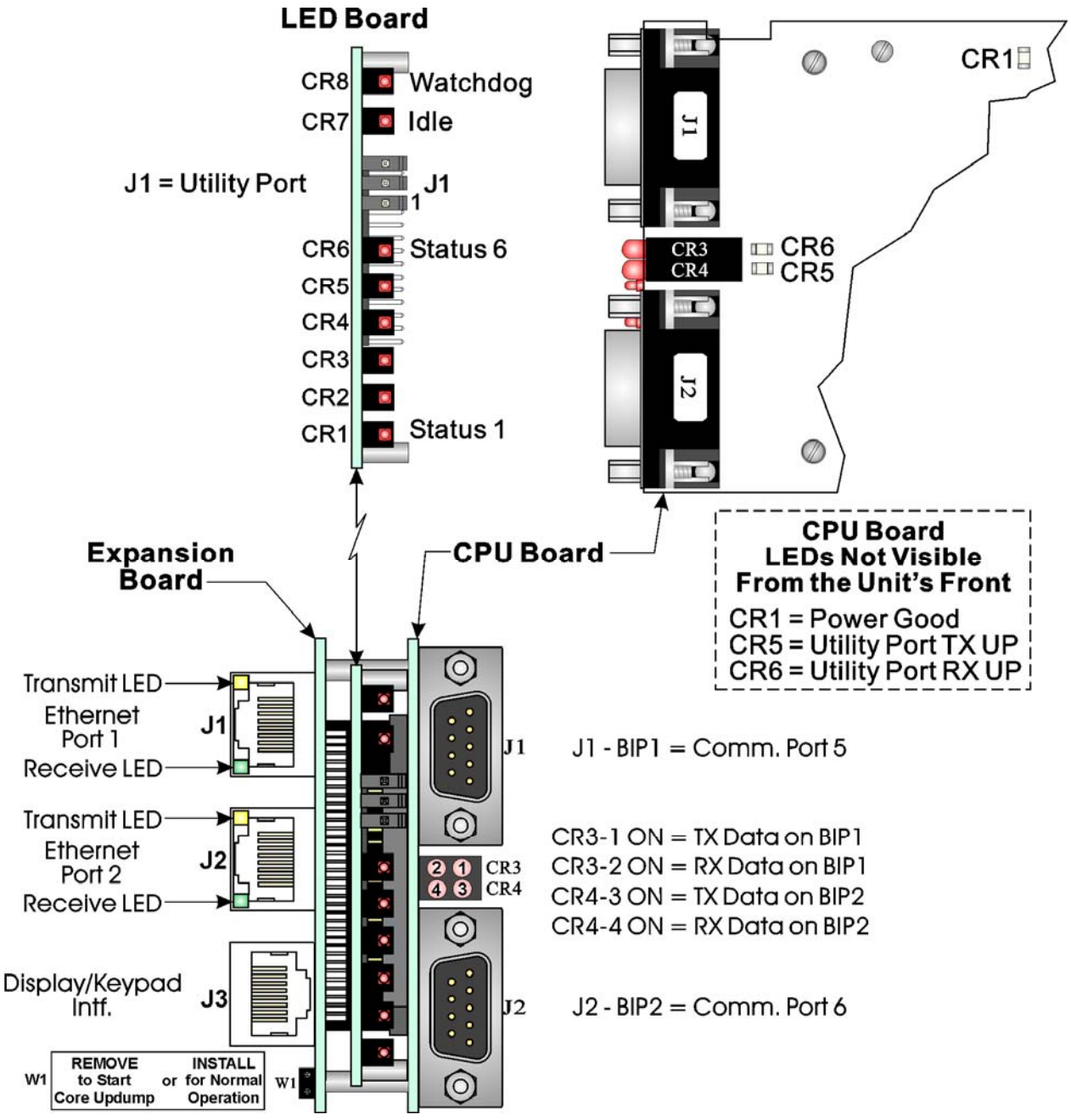


Figure 4 – CW_35/31 CPU Module LED Identification
(Note: EB Connectors J2 & J3 not available for CW_31s)

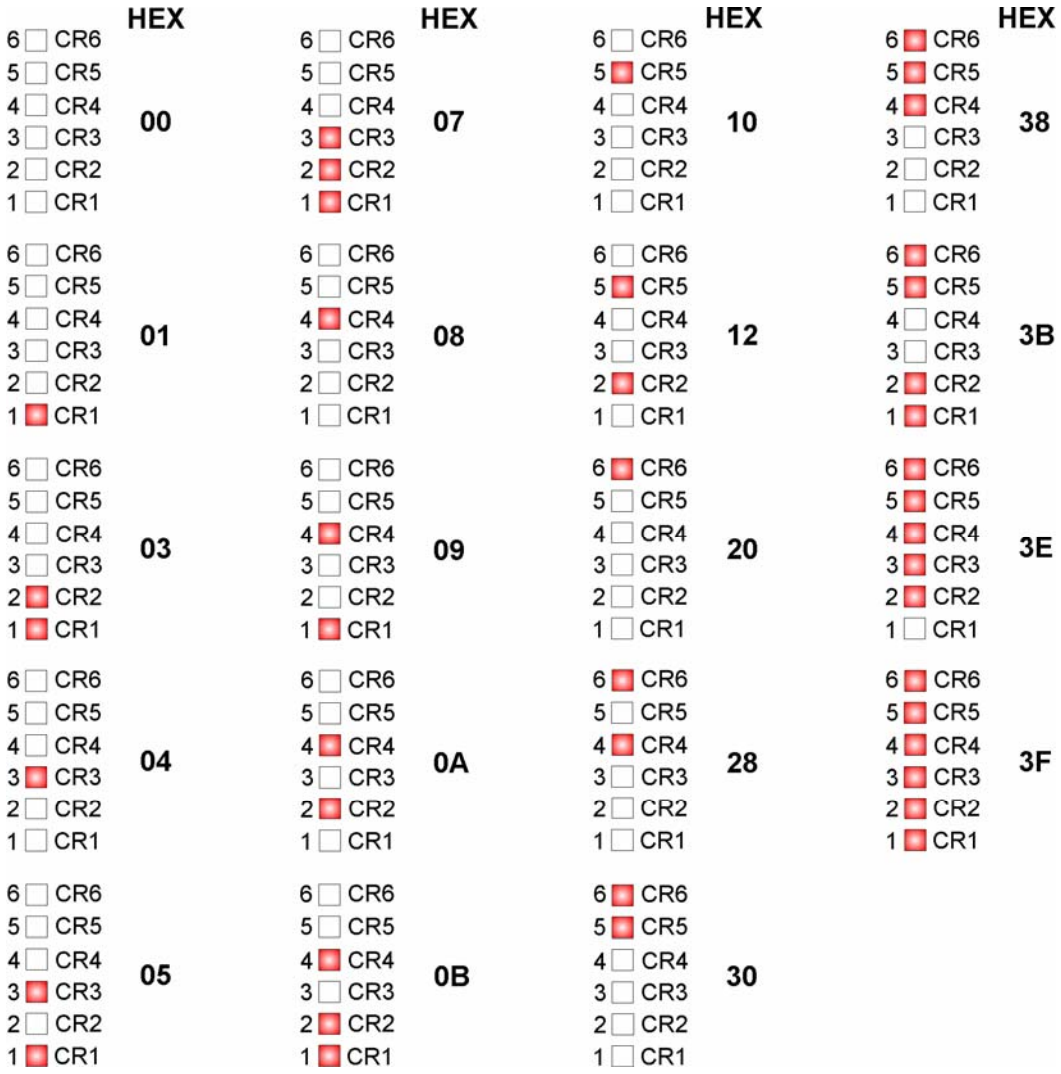


Figure 5 – CW_35/31 CPU Status LED Hexi-decimal Codes

3.1.6 CW_35/31 Expansion Board Ethernet Ports

Connection to the Ethernet can be established via one or two Ethernet Ports situated on the CPU Module's Expansion Board (EB). Ethernet Ports utilize 10/100Base-T RJ45 modular connectors (J1 & J2) that typically provide a twisted pair interface to an Ethernet Hub. Ethernet Port Jacks are equipped with two LEDs that function as follows: yellow = TX, Green = RX activity. **Note: Ethernet Port 2 isn't available on CW_31 EBs.**

3.1.6.1 Ethernet CPU Engine 10/100Base-T Connectors J1 & J2

8-pin 10/100Base-T Connectors J1 and J2 typically provide connection to a twisted pair Ethernet via an Ethernet Hub. Both ends of the Ethernet cable are equipped with modular RJ45 connectors. A typical hub provides eight (8) 10/100Base-T RJ45 ports (with port 8 having the capability to link to another hub or to an Ethernet communication port. The cable used between a CPU Module Convergence Expansion Board's Ethernet 10/100Base-T connector and an Ethernet Hub has a one-to-one wiring configuration as shown in Figure 7. Table 6 provides the assignment and definitions of the 8-pin 10/100Base-T Connector P2.

It is possible to connect two nodes in a point-to-point configuration without the use of a Hub. However; the cable used must be configured such that the TX± Data pins are connected to the RX± Data pins (swapped) at the opposite ends of the cable (see Figure 6).

Table 6 - Ethernet 10/100Base-T Connector P2 Pin Assignments

Pin #	Description	Pin #	Description
1TX+	Transmit Data+	5	Not Connected
2TX-	Transmit Data-	6RX-	Receive Data-
3RX+	Receive Data+	7	Not Connected
4	Not Connected	8	Not Connected

Note: TX & RX are swapped at Hub's.

The maximum length of one segment (CPU to Hub) is 100 meters (328 feet). The use of Category 5 shielded cable is recommended.

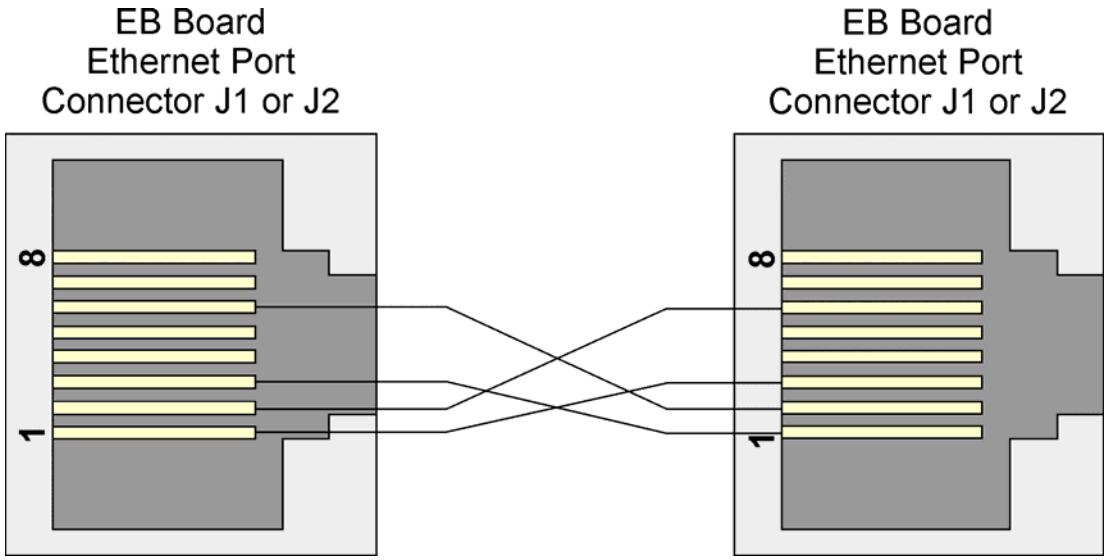


Figure 6 - Point-to-Point 10/100Base-T Ethernet Cable

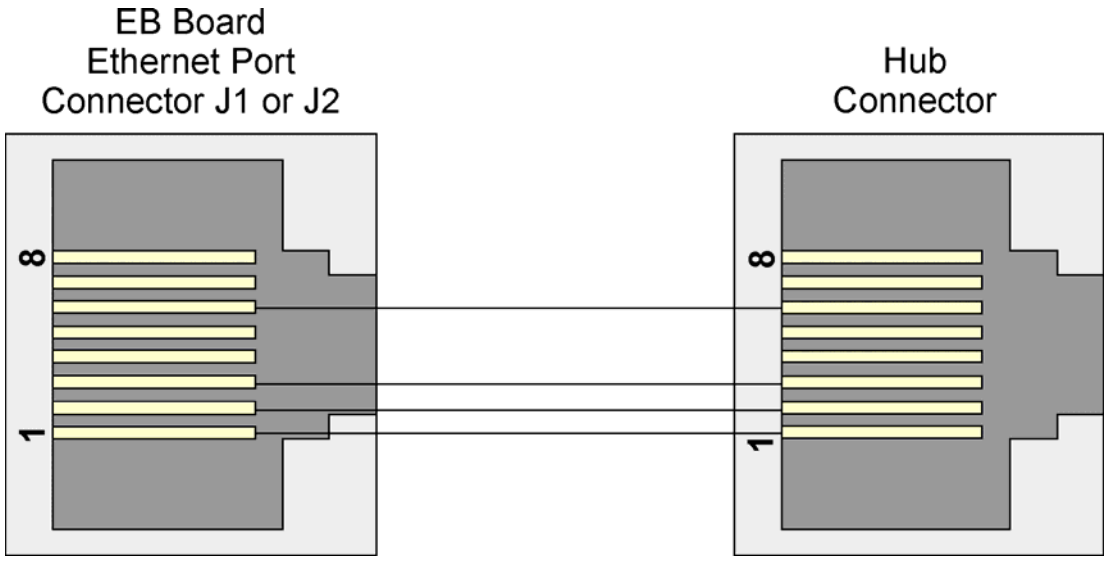


Figure 7 - Standard 10/100Base-T Ethernet Cable (CPU Board to Hub)

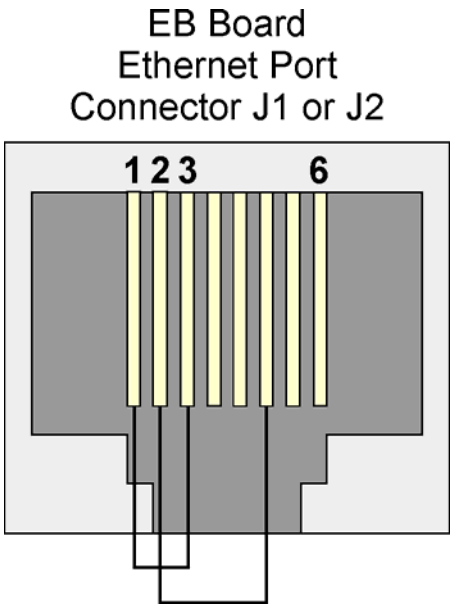


Figure 8 – 10/100Base-T Connector (P2) with Cable Configured for Loopback

3.2 CW_35 Communication Board (CB) Overview

Communication Boards (CB) provide either four or two communication ports that utilize 9-pin, D-Type, female connectors. These communication ports are compatible with existing 3335 Comm. Port cables. One CB can be installed in a **CW_35**. It should be noted that a CB won't fit into the first Comm. Slot, i.e., Chassis Slot 13 (see Figure 2). CB Board communication ports are labeled as follows:

4-Port CB contains Ports 3, 4, 9, & 10 (resides in Communication Socket #2).
2-Port CB Contains Ports 3 & 4 (resides in Communication Socket #2).

Note: The communication port numbering scheme is compatible with your existing ACCOL application program.

Standard 9-Pin D-Type Connectors are used in the two port version of the CB and dual stacked D-Type Connectors are used on four port versions. When the DPC contains a 4-Port CB, a maximum of six serial Comm. ports are available (four on the CB and two on the **CW_35** CPU Board). When a 2-Port CBs is installed in a **CW_35** DPC, a maximum of four serial Comm. ports are available (two on the CB assembly and two on the **CW_35** CPU Board).

The communication ports can be configured for an RS-485 or RS-232 interface. The former is required for BSAP network communications, while the latter is required for devices such as a PC or other RS-232 device. However; these ports can also be configured for other applications. For example, port 3 can be configured to interface with a PC while ports 4, 5, 6, etc. can be configured for use with options such as modems. *It should be noted that internal chassis mounted modems, RASCL "redundancy," and use of a Hand Held Terminal aren't supported.*

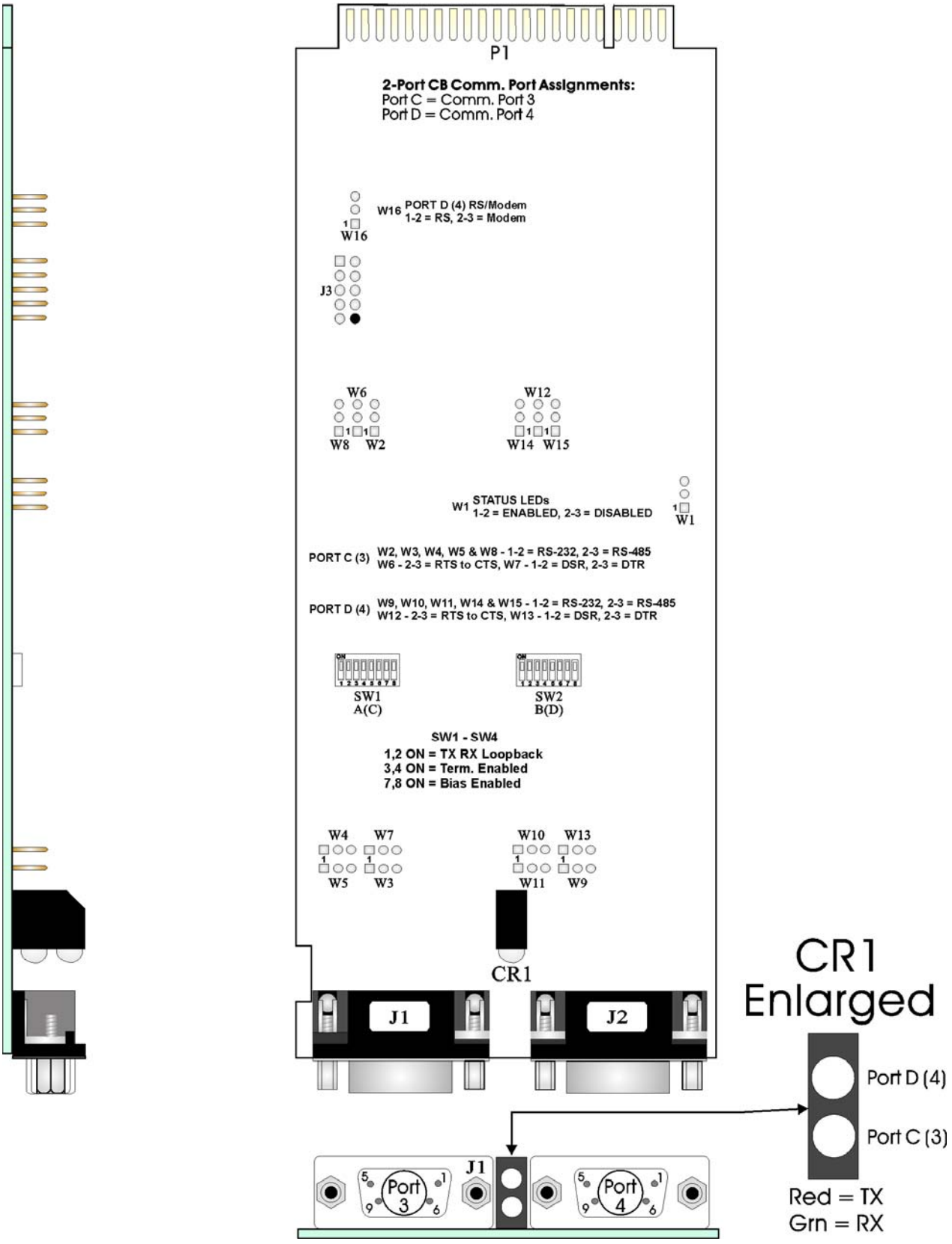


Figure 9 - CW_35 - 2-Port CB Board Component Identification Diagram

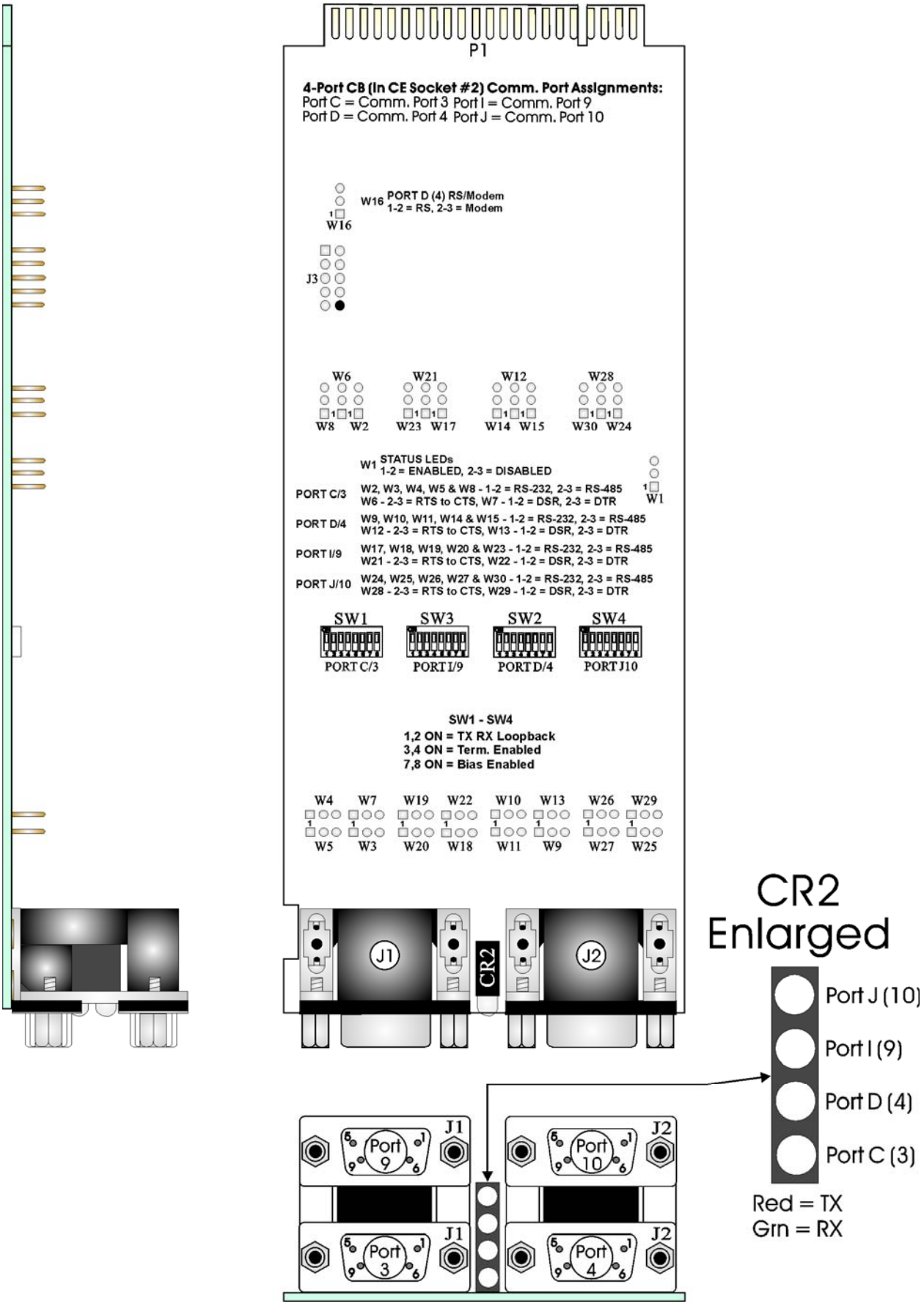


Figure 10 - CW_35 - 4-Port CB Board Component Identification Diagram

3.2.1 Setting CB Board DIP Switches

The procedure for setting DIP switches is identical for the two different board versions except that the 4-Port Communication Board contains four DIP switches while the 2-Port CB contains two DIP switches. When an individual switch (toggle) is pressed to the right it is set to its ON position (see Figure 11). Switches SW1 through SW4 control port configuration and are assigned as follows:

SW1 - Controls Port 3
SW2 - Controls Port 9
SW3 - Controls Port 4
SW4 - Controls Port 10

Switch functions are provided for RS-485 operation, in Table 7.

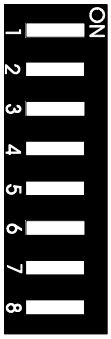


Figure 11 - Enlarged View of SW1-SW4

Table 7 – CB Board DIP Switches SW1 - SW4 - RS-485 Configuration Selections

SW1- SW4	Function	Setting
1	TX+ to RX+ Loopback	ON = Loopback Enabled, 2-Wire OFF = Loopback Disabled, 4-Wire
2	TX– to RX– Loopback	ON = Loopback Enabled, 2-Wire OFF = Loopback Disabled, 4-Wire
3	RS-485 Termination	ON = Termination Installed OFF = No Termination
4	RS-485 Termination	ON = Termination Installed OFF = No Termination
5	OFF	
6	OFF	
7	RS-485 Bias Termination	ON = Bias Enabled OFF = No Bias
8	RS-485 Bias Termination	ON = Bias Enabled OFF = No Bias

Setting switches SW1 through SW4 does not complete the set-up configuration. The jumpers listed in Table 7 must also be set to complete the procedure.

3.2.2 Setting CB Board Configuration Jumpers

The 4-Port CB and 2-Port CB Boards contains up to twenty-one configuration jumpers to set various communication parameters. Figures 9 and 10 provide the location of the configuration jumpers. CB configuration jumpers are set according to Table 8.

Table 8 – CB Board Configuration Jumper Settings

Jumper	Description	Setting	Configuration
W1	Comm. Port Status LED Control	1 to 2 2 to 3	Enable Comm. Status LEDs Disable Comm. Status LEDs
W2	Port 3 Configuration	1 to 2 2 to 3	Port 3 = RS-232 Port 3 = RS-485
W3	Port 3 Configuration	1 to 2 2 to 3	Port 3 = RS-232 Port 3 = RS-485
W4	Port 3 Configuration	1 to 2 2 to 3	Port 3 = RS-232 Port 3 = RS-485
W5	Port 3 Configuration	1 to 2 2 to 3	Port 3 = RS-232 Port 3 = RS-485
W6	Port 3 C RTS/CTS Control	1 to 2 2 to 3	Port 3 CTS Source is from Port C Port 3 RTS to CTS Loopback
W7	Port 3 DSR/DTR Selection	1 to 2 2 to 3	Port 3 Pin 8 = DSR Port 3 Pin 8 = DTR
W8	Port 3 Configuration	1 to 2 2 to 3	Port 3 = RS-232 Port 3 = RS-485
W9	Port 4 Configuration	1 to 2 2 to 3	Port 4 = RS-232 Port 4 = RS-485
W10	Port 4 Configuration	1 to 2 2 to 3	Port 4 = RS-232 Port 4 = RS-485
W11	Port 4 Configuration	1 to 2 2 to 3	Port 4 = RS-232 Port 4 = RS-485
W12	Port 4 RTS/CTS Control	1 to 2 2 to 3	Port 4 CTS Source is from Port D Port 4 RTS to CTS Loopback
W13	Port 4 DSR/DTR Selection	1 to 2 2 to 3	Port 4 Pin 8 = DSR Port 4 Pin 8 = DTR
W14	Port 4 Configuration	1 to 2 2 to 3	Port 4 = RS-232 Port 4 = RS-485
W15	Port 4 Configuration	1 to 2 2 to 3	Port 4 = RS-232 Port 4 = RS-485
W16	Port 9 RS-XX/Modem Control	1 to 2 2 to 3	Port 9 = RS-232 or RS-485 Port 9 = Modem
W17	Port 9 Configuration	1 to 2 2 to 3	Port 9 = RS-232 Port 9 = RS-485
W18	Port 9 Configuration	1 to 2 2 to 3	Port 9 = RS-232 Port 9 = RS-485
W19	Port 9 Configuration	1 to 2 2 to 3	Port 9 = RS-232 Port 9 = RS-485
W20	Port 9 Configuration	1 to 2 2 to 3	Port 9 = RS-232 Port 9 = RS-485
W21	Port 9 RTS/CTS Control	1 to 2 2 to 3	Port 9 CTS Source is from Port I Port 9 RTS to CTS Loopback
W22	Port 9 DSR/DTR Selection	1 to 2 2 to 3	Port 9 Pin 8 = DSR Port 9 Pin 8 = DTR
W23	Port 9 Configuration	1 to 2 2 to 3	Port 9 = RS-232 Port 9 = RS-485
W24	Port 10 Configuration	1 to 2 2 to 3	Port 10 = RS-232 Port 10 = RS-485
W25	Port 10 Configuration	1 to 2 2 to 3	Port 10 = RS-232 Port 10 = RS-485
W26	Port 10 Configuration	1 to 2 2 to 3	Port 10 = RS-232 Port 10 = RS-485
W27	Port 10 Configuration	1 to 2 2 to 3	Port 10 = RS-232 Port 10 = RS-485

Table 8 - CB Board Configuration Jumper Settings (Continued)

Jumper	Description	Setting	Configuration
W28	Port 10 RTS/CTS Control	1 to 2 2 to 3	Port 10 CTS Source is from Port J Port 10 RTS to CTS Loopback
W29	Port 10 DSR/DTR Selection	1 to 2 2 to 3	Port 10 Pin 8 = DSR Port 10 Pin 8 = DTR
W30	Port 10 Configuration	1 to 2 2 to 3	Port 10 = RS-232 Port 10 = RS-485

3.2.3 CB Board LED Indicators

The CB Boards provide a TX and RX indicator for each communication channel. TX will light when the channel is transmitting data and RX lights when the channel is receiving data. Depending upon the data activity, the LEDs may blink or appear continuously lit during communication activity. The LEDs will be out when there is no activity (see Figures 9 & 10).

3.2.4 CB Board Communication Port Information

CB Boards will have 2 or 4 serial communication ports that are supported by 9-pin female D-type connectors that have pinouts the same as DPC 3335 ECOM Boards (see Figures 9 & 10 and Table 9. All CB Board Comm. Ports can be individually user configured for RS-232 or RS-485 operation.

Table 9 - CB Board RS-232/RS-485 D-Type Connector Pin Assignments
Note: Identical to CW_35 CPU Bd. Ports 5 & 6

Pin #	Signal RS-232	Description: RS-232 Signals	Signal RS-485	Description: RS-485 Signals
1	DTR	Data Terminal Ready Output	TXD+	Transmit Data +
2	TXD	Transmit Data Output	TXD–	Transmit Data –
3			RXD+	Receive Data +
4	RXD	Receive Data Input	RXD–	Receive Data –
5	RTS	Request To Send Output		
6	CTS	Clear To Send Input		
7	DCD	Data Carrier Detect Input		
8*	DTR/DSR	Data Terminal Ready/ Data Set Ready Input		
9	GND	Ground	GND	Ground

* Jumper Configured, typically set for DTR on Pin-8

The following information is provided to support use of CB Board Serial Comm. Ports:

- When configured for RS-232 operation, CB Comm. Ports support RTS, DTR, CTS, DCD and DSR modem control signals.
- RS-232 transceivers are enabled by the port's DTR signal, i.e., when DTR goes high the port becomes active.
- Each RS-232 transceiver has one active receiver while in the power-down mode (disabled). DCD is connected to the active receiver.
- When configured for RS-485 operation, the CB Comm. Port receiver is enabled by DTR while the driver is enabled by RTS.
- For RS-485 operation, an eight-position DIP switch (one per port) enables receiver biasing and termination as well as two-wire and 4-wire selection.

SECTION 4 - ControlWave_35/31 CONFIGURATION

There are seven (7) main steps required to configure a **CW_35** DPC. This document provides an overview of these steps with an emphasis on the installation and configuration of the hardware. This section is also intended to serve as a reference for users who may have already upgraded at least one **CW_35** DPC or **CW_31** RIO.

4.1 Step 1 - Hardware Configuration

This involves unpacking the **CW_35/31** upgrade hardware, setting switches and setting jumpers on the new **CW_35/31** boards, replacing the unit's CPU and ECOM Boards with the **CW_35/31** CPU and Comm. boards, reconnecting any permanent communication cables, and connecting a communications cable to a PC workstation to facilitate downloading the application load. **Note: In the case of the RIO 3331 upgrade to a CW_31, the 3331 ECOM Board must be removed and will not be replaced.** To upgrade the DPC 3330 to a **CW_35** or RIO 3331 to a **CW_31**, follow Hardware Configuration steps 1 through 5 below:

1. Remove the **CW_35/31** boards from their carton. Remove all communication cables and the CPU and ECOM Boards from the unit being upgraded. (see Figures 2, 3, 9 & 10 as required). **Note make sure the Comm. Cables are identified for proper reinstallation.**

2. Make sure that the Lithium Backup Battery has been enabled, i.e., Backup Battery Jumper W3 on the **CW_35/31** CPU should be installed across jumper posts 1 and 2. Configure the **CW_35/31** CPU Board's DIP Switches and Jumpers. Section 3.1.5 provides information on Switch Settings. Jumper and Switch settings are provided in Sections 1.3.4 and 1.3.5, respectively. Install the CPU Board into the **CW_35/31**.

3. Configure the DIP Switches and Jumpers on the CB (if provided) (see Figures 9 and 10). Sections 3.2.1 and 3.2.1 provide information on CB Board DIP Switches and Jumpers, respectively. Install the CB Board into the **CW_35** (see Figure 2).

4. Connect the communication port cables removed in step 1. Connect Ethernet Port 1 and Ethernet Port 2 (if present) to their assigned networks (see Section 3.1.71). Connect the **CW_35/31** CPU's 3-Wire Utility Port to a Communication Port of a PC (typically PC COMM. Port 1).

   A **CW_35** can be configured as a Master or Slave node on either a MODBUS network or a BSAP network; the **CW_31** can be configured as a Slave. A variety of communication schemes are available. Three serial communication ports are contained on the **CW_35/31** CPU Module. 2 or 4 serial communication ports are contained on the **CW_35** CB Board. These communication ports are discussed in Section 3.1.1 through 3.1.6 (CPU) and 3.2, through 3.2.4 (CB). 1 or 2 Ethernet communication ports are available on the CPUM's Expansion Board (1 for the **CW_31** and 2 for the **CW_35**). Serial RS-232/485 communication ports are designated as follows:

   CW_35/31 CPU Module:

   COM5 - Port BIP1: (9-Pin Female D-Type Connector J1) RS-232 or RS-485 operation (Configured by CPU Board Jumpers W10 through W16) (RS-485 operation utilizes CPU Switch SW3). **Note: This port was named BIP1 on original DPC 3335s.** When set for factory defaults, COM5 defaults to 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/ControlWave Designer protocol operation.

COM6 - Port BIP2: (9-Pin Female D-Type Connector J2) RS-232 or RS-485 operation (Configured by Jumpers W18 through W24) (RS-485 operation utilizes Switch SW4). **Note: This port was named BIP2 on original DPC 3335s.** When set for factory defaults, COM6 defaults to 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/ControlWave Designer protocol operation.

Utility Port: (3-Wire Connector J1 on the LED Board) RS-232 (for FLASH Firmware and Core Updumps) (Utilizes CPU Switch SW1). The Utility Port operates at 115.2 Kbaud and utilizes the 1KXModem or Xmodem protocol.

CW_35 CB Boards:

COM3 - Port 3 on CB: (9-Pin Female D-Type Connector J1) (J1 Bottom on 4-Port CB) RS-232 or RS-485 operation (Configured by CB Jumpers W2 through W8) (RS-485 operation utilizes CB SW1). **Note: This port was named C on original DPC 3335s.** When set for factory defaults, COM3 defaults to 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/ControlWave Designer protocol operation.

COM4 - Port 4 on CB: (9-Pin Female D-Type Connector J2) (J2 Bottom on 4-Port CB) RS-232 or RS-485 operation (Configured by CB Jumpers W9 through W15) (RS-485 operation utilizes CB Switch SW3). **Note: This port was named D on original DPC 3335s.** When set for factory defaults, COM4 defaults to 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/ControlWave Designer protocol operation.

COM9 - Port 9 on 4-Port CB: (9-Pin Female D-Type (J1 Top) RS-232 or RS-485 operation (Configured by CB Jumpers W16 through W23) (RS-485 operation utilizes CB SW2). **Note: This port was named I on original DPC 3335s.** When set for factory defaults, COM9 defaults to 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/ControlWave Designer protocol operation.

COM10 -Port 10 on 4-Port CB: (9-Pin Female D-Type) (J2 Top) RS-232 or RS-485 operation (Configured by CB Jumpers W24 through W30) (RS-485 operation utilizes CB Switch SW4). **Note: This port was named J on original DPC 3335s.** When set for factory defaults, COM10 defaults to 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/ControlWave Designer protocol operation.

4.1 Step 1 - Hardware Configuration (Continued)

Communication Ports COM3 through COM6, COM9, COM10 and the Utility Port support serial asynchronous operation as listed above. Communication ports COM3 through COM10 can be configured for local communications, i.e., connected to a PC loaded with **Control**Wave Designer and OpenBSI software. The Utility Port (J1 on the **CW_35/31** LED Board) is used for FLASH firmware loads or Core Updumps. The pin labels for the various RS-232/485 interface connectors are provided in Table 9 (see Figure 12 for RS-232 wiring diagrams and CPUM Utility Port Pin assignments).

RS-232 & RS-485 Interfaces

CW_35/31 RS-232 & RS-485 communication schemes are discussed herein.

RS-232 Ports

An RS-232 interface supports Point to Point, half-duplex and full-duplex communications (20 feet maximum, using data quality cable). Half-duplex communications supported by the **CW_35/31** utilize MODBUS or BSAP protocol, while full-duplex is supported by the Point to Point (PPP) protocol. **CW_35/31** RS-232 ports utilize the cable shown in Figure 12A - Top to interconnect with other devices such as a PC or another **Control**Wave series unit (other than a **CW_10/3035/31**) when the **CW_35/31** is

communicating using the full-duplex PPP protocol. The half-duplex cable of Figure 12A (Bottom), is utilized when the **CW_35/31** is connected to a **Control**Wave series unit other than a **CW_10/3035/31** and is running other than the PPP protocol. If communicating with a Bristol series 3305, 3310, 3330, 3335, or to a **CW_10/30/35/31** DPC/RTU, one of the cables shown in Figure 12B must be used.

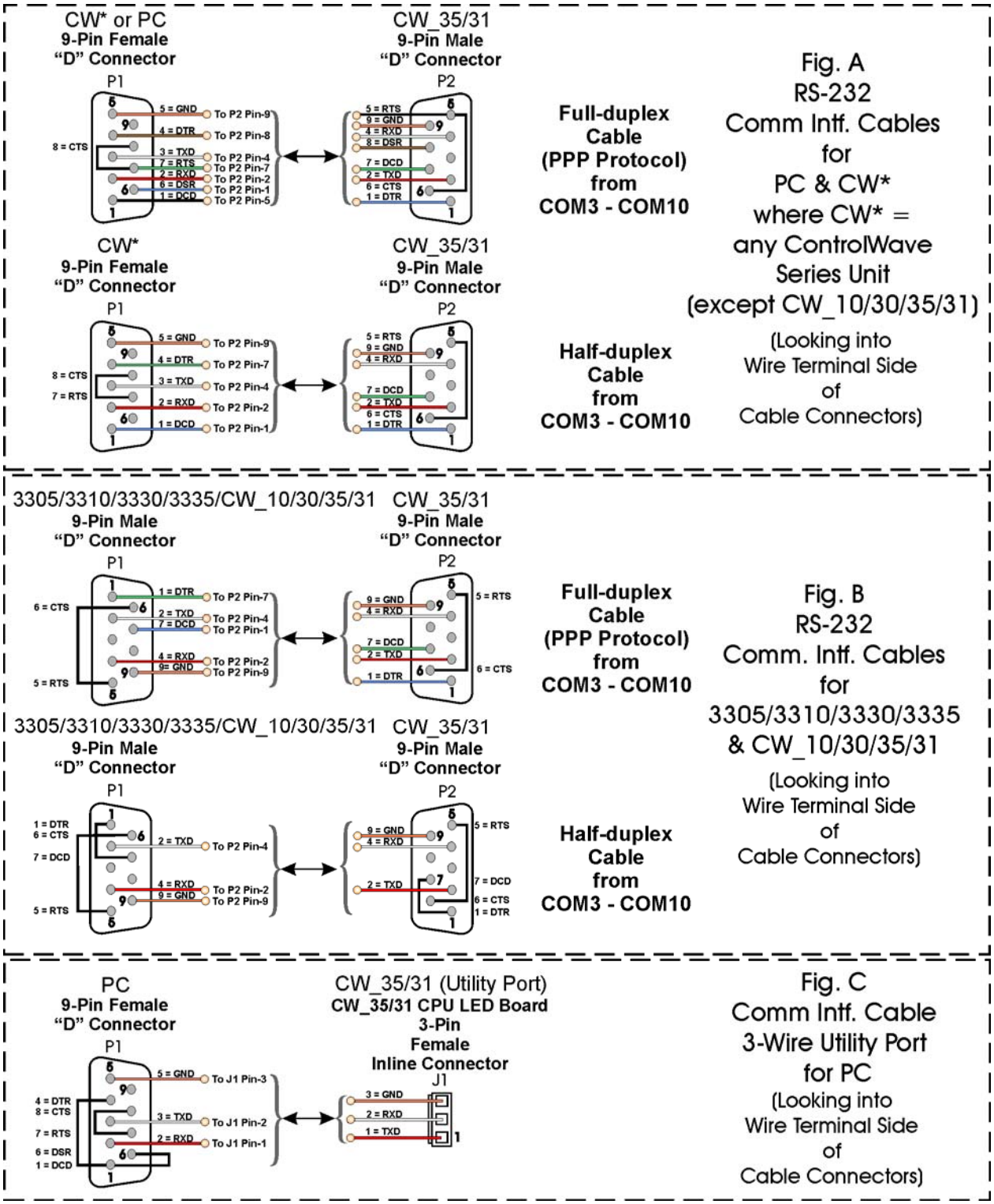


Figure 12 - Communication Port RS-232 Cable Wiring Diagram

CW_35/31 CPU Utility Port (on the LED Board) utilizes the cable shown in Figure 12C.

Note: The following facts regarding **CW_35/31** RS-232 serial communication ports should be observed when constructing communications cables:

- DCD must be high to transmit (except when dialing a modem)
- Each RS-232 transceiver has one active receiver while in powerdown mode (disabled); the DCD signal is connected to the active receiver.
- CTS must be high to transmit.
- When port is set for full-duplex operation - RTS is always ON.
- DTR is always high (when port is active); DTR enables RS-232 Transceivers.
- When port is set for half-duplex operation - CTS must go low after RTS goes low.
- All RS-232 Comm. ports support RTS, DTR, CTS, DCD and DSR control signals.

RS-485 Ports

CW_35/31s can use an RS-485 communication port for local network communications to multiple nodes up to 4000 feet away. Since this interface is intended for network communications, Table 11 provides the appropriate connections for wiring the master, 1st slave, and nth slave. Essentially, the master and the first slave transmit and receive data on opposite lines; all slaves (from the first to the "nth") are paralleled (daisy chained) across the same lines. The master node should be wired to one end of the RS-485 cable run. A 24-gauge paired conductor cable, such as Belden 9843 should be used. *Note: Only half-duplex RS-485 networks are supported.*

Table 10 - RS-485 Port
Connector Pin Assignments (COM3 through COM10))

Pin #	Signal RS-485	Description: RS-485 Signals
1	TXD+	Transmit Data + Output
2	TXD–	Transmit Data – Output
3	RXD+	Receive Data + Input
4	RXD–	Receive Date – Input
9	Power Ground	Ground

Receiver biasing and termination as well as 2-wire or 4-wire selection are enabled by eight-position DIP-Switches situated on the **CW_35/31** CPU Board for COM5 and COM6 or on **CW_35** CB Boards for COM 1 through COM 4 and COM7 through COM10 as follows:

COM3: CB Board Switch SW1 (see Figures 9 & 10) (see Table 7)
COM4: CB Board Switch SW3 (see Figures 9 & 10) (see Table 7)
COM5: CPU Board Switch SW3 (see Figure 3) (see Table 3)
COM6: CPU Board Switch SW4 (see Figure 3) (see Table 3)
COM9: 4-Port CB Board Switch SW2 (see Figures 9 & 10) (see Table 7)
COM10: 4-Port CB Board Switch SW4 (see Figures 9 & 10) (see Table 7)

Table 10 provides the connector pin assignments for all **CW_35/31** RS-485 communication ports. Tables 3 and 7 provide the RS-485 termination and loopback control Switch Settings for the RS-485 Ports on the CPU and CB Boards (respectively).

To ensure that the “Receive Data” lines are in a proper state during inactive transmission periods, certain bias voltage levels must be maintained at the master and most distant slave units (end nodes). These end nodes also require the insertion of 100-

Ohm terminating resistors to properly balance the network. CPU and CB Board switches must be configured at each node to establish proper network performance. This is accomplished by configuring the appropriate CPU/CB Board Switches so that the 100-Ohm termination resistors and biasing networks are installed at the end nodes and are removed at all other nodes on the network (see Table 3 for CPU Boards and Table 9 for CB Boards).

Table 11 - RS-485 Network Connections
(see Table 10 for **CW_35** RS-485 Port Pin # Assignments)

From Master	To 1st Slave	To nth Slave
TXD+	RXD+	RXD+
TXD–	RXD–	RXD–
RXD+	TXD+	TXD+
RXD–	TXD–	TXD–
GND	GND	GND

Note: Pins 1, 2, 3, 4 & 9 of Series 3305, 3310, 3330, 3335 & 3340 RTU/DPC RS-485 Comm. Ports are assigned as follows: 1 = TXD+, 2 = TXD–, 3 = RXD+, 4 = RXD– and 9 = GND.

4.1 Step 1 - Hardware Configuration (Continued)

5. Apply power to the **CW_35/31** DPC/RIO. Continue with Steps 2 through 7 below (Sections 4.2 through 4.7 and 5.1) and the **CW_35/31** will be ready for on line operation.

4.2 Step 2 - Software Installation on the PC Workstation

ControlWave **Designer** software must be installed on the PC. This is accomplished by installing the **Control**Wave **Designer Package** from the Open BSI CD ROM.

You must install the **Open BSI Network Edition**. For information on minimum system requirements and more details of the installation, see the installation procedure in Chapter 2 of the *Open BSI Utilities Manual* (document # D5081).

IMPORTANT:

When you start ControlWave Designer, you will be reminded to register the software. Unregistered software can only be used for a maximum of 30 days. For more information on the registration process, see Chapter 2 of the Open BSI Utilities Manual (document# D5081).

4.3 Step 3 - Establish Communications using either LocalView or NetView, and run the Flash Configuration Utility

Communications must be established with the **CW_35/31** using either LocalView or NetView.

The **CW_35/31** CPU Board ships from the factory with a default Flash configuration. Most users will need to edit this configuration to set the IP address (if using Ethernet – default IP address = 10.0.1.1 with IP Mask = 255.255.255.0), BSAP local address, user accounts, and port parameters. This can be done in one of two ways:

- Either open the supplied Flash Configuration Profile (FCP) file and modify it, directly in the Flash Configuration Utility, or in a text editor,
- or retrieve existing Flash Parameters directly from the unit, and edit them in the Flash Configuration Utility.

Detailed information on the Flash Configuration Utility and LocalView is included in Chapter 5 of the *Open BSI Utilities Manual* (document # D5081). NetView is described in Chapter 6 of that same manual.

4.4 Step 4 - Create an Application-specific Control Strategy in ControlWave Designer

At this point, you can create your application-specific control strategy using **Control**Wave Designer. If you are upgrading this unit from a DPC 3335 ACCOL II-based unit, you can start by using the ACCOL Translator utility to take an existing ACCOL II load, and convert it to a ControlWave Designer project. You will then need to examine the translated project, and modify it, as necessary, to re-work logic that is unsupported in ControlWave Designer.

If you don't have a pre-existing ACCOL load to translate, you can create an all-new project in ControlWave Designer. This involves opening a new project using the '**Control**Wave **MICRO**' template, defining I/O boards using the I/O Configurator, and creating a program using one or more of the five supported IEC 61131 languages (FBD, ST, SFC, LD, or IL). Some of these languages are text based, others use graphical diagrams. The choice is up to you, depending upon your particular application.

The ***Control****Wave* ***MICRO*** *Quick Setup Guide* (document # D5124) includes a simple LD example. Additional examples are included in the manual, *Getting Started with* ***Control****Wave Designer* (document # D5085). More detailed information about **Control**Wave Designer and IEC 61131 is included in the ***Control****Wave Designer Reference Manual* (document # D5088).

The ACCOL3 Firmware Library, which is automatically accessible through the template referenced above, includes a series of function blocks which perform a variety of process control and communication functions. These can be included within your program to perform various duties including PID control, alarming, calculations, etc. Detailed information about each function block is included in the **Control**Wave Designer on-line help files.

On the variables declaration page(s) in **Control**Wave Designer, you will need to mark any variable you want to make accessible to external programs, such as Open BSI's DataView utility, as **"PDD"**. Similarly, any variables which should be collected into a database, or exported using the **O**LE for **P**rocess **C**ontrol (OPC) Server must be marked as **"OPC".** Variables marked as OPC can be built into a text file by the **Open BSI Signal Extractor.** The text file can then be used in the creation of a database for human machine interface (HMI) software such as OpenEnterprise, or Iconics' Genesis. These HMI software packages require that the **"Datatype conversion enable"** option be selected when generating the file using Signal Extractor. Information about the Open BSI Signal Extractor is included in Chapter 12 of the *Open BSI Utilities Manual* (document # D5081).

Once the program has been created, it is assigned to an executable task. The entire project is then saved and compiled.

Debugging of your completed control strategy program can be performed using the built-in debugger, and the I/O Simulator. Optionally, you can also use the I/O Simulator to simulate the outputs on your I/O boards, as your project executes. Note, however, that the I/O Simulator only supports the IPC*xx* resource; therefore, to use it, you will need to add a *second* resource (IPC*xx*) to your project, and make copies of your tasks and global variable worksheets under the new resource.

NOTE:
From this point on, the order of steps may be varied, somewhat, depending upon the requirements of the user's application.

4.5 Step 5 – Create Application-specific Web Pages (OPTIONAL)

ControlWave series controllers, including the **CW_35/31**, can optionally export data to user-created web pages.

A series of ActiveX controls for data collection and configuration are provided on the Open BSI CD that can be included as part of these web pages (For information on the ActiveX controls, see the *Web_BSI Manual* (document# D5087).

You can use whichever HTML creation package you want to create the pages, however, all **Control**Wave web pages must be viewed within Microsoft® Internet Explorer.

The web pages may reside either on the PC workstation, or they can be downloaded into FLASH memory at the **CW_35/31**. If stored at the **CW_35/31**, you must use the ControlView utility to retrieve the page (using FTP) for viewing in Internet Explorer.

4.6 Step 6 – Create an Open BSI Network Containing the CW_35/31, or add the CW_35/31 to an Existing Open BSI Network

In order for the **CW_35** unit to function as part of a Bristol network, it is necessary to include it in the Bristol network.

If no Bristol network exists:

You need to run Open BSI's NetView software on the PC workstation in order to define a Bristol network. A series of software wizards are used to define a Network Host PC, a network, and the DPC/RTUs (controllers) assigned to the network. Finally, communication lines must be specified which handle the address assigned to the **CW_35**. Chapters 3 and 4 of the *Open BSI Utilities Manual* (document # D5081) include 'quick start' examples for performing these steps. More detailed information is included in the NetView chapter (Chapter 6) of D5081.

If a Bristol network already exists:

You will need to add the **CW_35** to the existing network using NetView's RTU Wizard. Chapter 6 of the *Open BSI Utilities Manual* (document # D5081) includes different sub-sections depending upon whether you are adding the unit to a BSAP network, or an IP network.

4.7 Step 7 – Download the Application-specific Control Strategy into the CW_35/31 DPC/RIO

Either **Control**Wave Designer or the Open BSI 1131 Downloader allows you to download your completed control strategy (application load) file into the **CW_35/31** DPC/RIO. Users

download the control strategy into the BOOT Project area of FLASH memory; this ensures that if the **CW_35/31** is reset, or if there has been a failure of the backup battery, that the control strategy can be restarted from the beginning, i.e., from the BOOT Project in FLASH memory.

The Open BSI 1131 Downloader also allows the user to download files (such as user-created web pages) into FLASH memory in the **Control**Wave_**35/31** DPC/RIO. These can then be uploaded to the PC using the ControlView utility. To download the application load, see Section 5.1 titled Downloading the Application Load.

SECTION 5 - OPERATIONAL DETAILS

CW_35 DPCs are shipped from the factory with firmware that allows the unit to be configured in conjunction with an IEC 61131, application program. This section provides information as follows:

- Steps required to download the application load and place the unit into 'Run' mode.
- Steps required to download system firmware.
  Core Updumps

5.1 Downloading the Application Load

Any **CW_35/31** DPC/RIO must have a configured application load before it can be placed into operation. For units being upgraded with the hardware discussed herein, this will require connection of the **CW_35/31** to a PC running Windows NT (4.0 or higher), Windows 2000 or Windows XP Professional and equipped with **Control**Wave Designer software & OpenBSI software. Configuration of the application load must be performed by an individual familiar with the various programming tools. The following software user documentation is referenced:

Getting Started with **Control**Wave Designer Manual - D5085
ControlWave Designer Reference Manual - D5088
Open BSI Utilities Manual - D5081
Web_BSI Manual - D5087

An application load download can be initiated, i.e., from **Control**Wave Designer, or from the OpenBSI 1131 Downloader for **CW_35/31** DPC/RIO Nodes.

1. Make sure that the **CW_35/31** CPU Board's Recovery Switch (SW1) is set in 'Local Mode,' i.e., SW1-1 set to the **OFF** position and SW1-2 set to the **ON** position.

   Note:
   From the factory, COM1 defaults to 115.2 Kbaud (RS-232) using the BSAP Protocol. Don't connect COM1 to a PC unless the PC's RS-232 port in question has been configured for BSAP operation.

2. Once the **CW_35/31** DPC/RIO project has been defined, communications and configuration parameters have been set, perform the download according to either '**Control**Wave Designer' (see D5088 - chapter 11) or 'The Open BSI 1131 Downloader' (see D5081 - Chapter 7).

3. After the download has been completed leave the CPU Recovery Switch (SW1) in the 'Local Mode' position.
4.

5.2 Upgrading CW_35/31 Firmware

CW_35/31 CPU Boards ship from the factory with system firmware already installed. If an upgrade of the system firmware is required, use one of the procedures below to download the new or replacement firmware from the PC. Upgrade of system firmware via LocalView FLASH Mode requires OpenBSI 5.1 (or newer). If you have an older version of OpenBSI, FLASH upgrades are to be performed via HyperTerminal. You will need a binary (*.BIN) system firmware file that is read as follows: c_30450.bin (where c_3 is the product code and 0450 is the release number). Upgrade of an unattended DPC CW_35 or RIO CW_31 can be accomplished from a remote PC. This capability is introduced in Section 5.2.3.

5.2.1 Using LocalView to Upgrade CW_35/31 Firmware

NOTE

Your CW_35 DPC or CW_31 RIO must be set to Recovery Mode ENABLE (ON) prior to per-forming the FLASH upgrade, then set to Recovery Mode DISABLE (OFF) after the upgrade. On CW_35/31s this is accomplished via the CPU Board's Recovery Switch SW1. Set SW1-3 to the ON position for Recovery Mode. After setting SW1-3 to the ON position, turn power OFF and then ON again.

A communication cable (see Figure 12C) must be connected to the Utility Port on the **CW_35/31** CPU Board and to any RS-232 port on the associated PC. The PC's RS-232 port used for this purpose must be set to run at 115.2 Kbaud. **CW_35/31** CPU Switch SW1, position, 3 must be set ON.

Start LocalView, Choose FLASH, Enter A Name, Click on [Create]

Start LocalView by clicking on: **Start → Programs → OpenBSI Tools → LocalView**. The New View Mode dialog box will appear (see Figure 13).

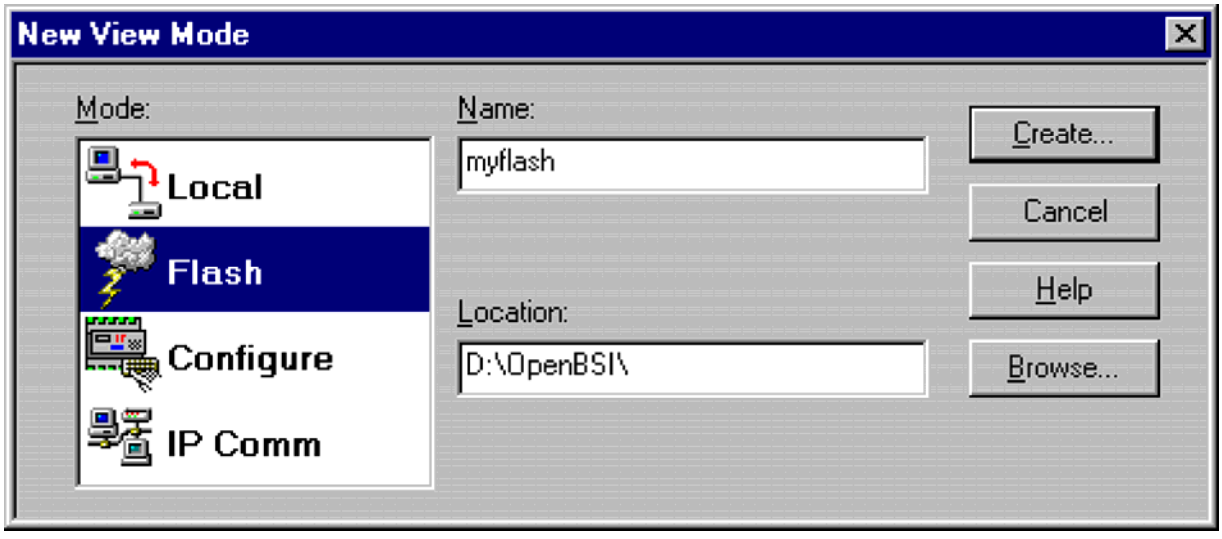


Figure 13 - Local View - New View Mode Menu

"Mode"
Choose 'Flash' for the mode.

"Name"
Enter a name for the View Mode File in the **"Name"** field.

"Location"

If you want to store the View Mode File in a directory other than that shown in the **"Location"** field, enter the new location there, or use the **[Browse]** push button to find the directory.

When the **"Mode"**, **"Name"**, and **"Location"** have been specified, click on the **[Create]** push button to activate the Communication Setup Wizard.

Step 1 - Communication Setup

Choose the communication port you want in the **What port would you like to use:** field. Click on the **[Next]** pushbutton to activate the next wizard.

Step 2 - Flash RTU Setup

In the Flash RTU Setup Wizard, you need not set the RTU type or local address, since these are unused in this mode. Click on the **[Next]** push button to activate the Flash Data Setup Wizard.

Figure 14 - Communication Setup: Step 1 Menu

Figure 15 - Flash RTU Setup Menu

Step 3 - Flash Data Setup

Complete the following fields in the Flash Data Setup Wizard:

"Please enter the name of the binary file to Flash"

To upgrade system firmware, you must specify the path and name of a binary (*.BIN) file on your hard disk containing the firmware.

Click on **[Finish]** to install the specified BIN file in FLASH memory at the DPC.

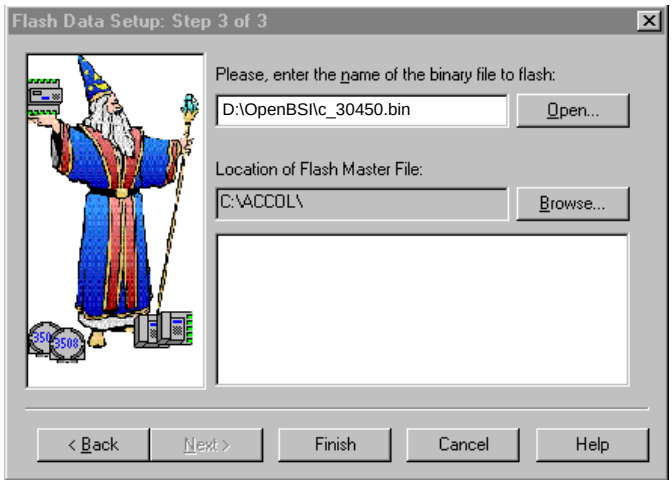


Figure 16 - Flash Data Setup Menu

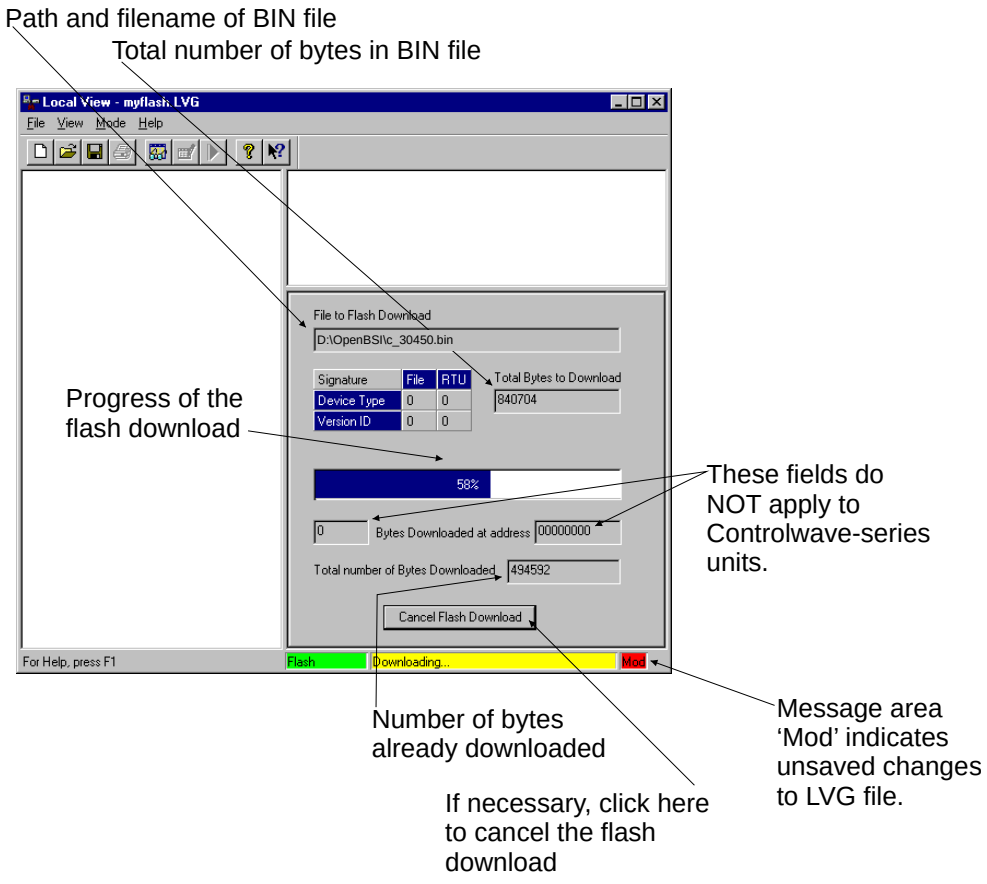


Figure 17 - LocalView Downloading System Firmware Menu

Once the Flash download has begun, you will NOT be allowed to shut down LocalView, unless you cancel the download, or it has been completed.

The progress of the Flash download will be displayed in the window. Any mismatch in file versions, or if the type of .BIN file does not match the type of RTU/DPC, the download will be aborted.

Once the download has completed, set CPU Board Switch SW1-3 to the OFF position and then turn power OFF and then ON again.

5.2.2 Using HyperTerminal to Upgrade CW_35/31 Firmware

A communication cable (see Figure 12C) must be connected to the **CW_35/31** CPUM LED Board's Utility Port and to any RS-232 port on the associated PC. The PC's RS-232 port used for this purpose must be set to run at 115.2 Kbaud. **CW_35/31** CPU Board Switch SW1, position, 3 must be set to the **ON** position.

1. If not already running, apply power to the associated PC.

2. Start the HyperTerminal program on the PC. Note: HyperTerminal is a Windows 95 (or newer) application utility program. If using HyperTerminal for the first time, set the communications properties (for the PC Port being utilized) via the Properties Menu as follows: Bits per second: = 115200, Data bits: = 8, Parity: = None, Stop bits: = 1, and Flow control: = None. After setting the communications properties, click OK.

3. Set the **CW_35/31** CPU Board's Recovery Switch (SW1) for 'Recovery Mode,' i.e., set CPU Board Switch SW1-3 to the ON position.

4. Apply power to the **CW_35** DPC or **CW_31** RIO. The resident BIOS will initialize and test the hardware, this process is referred to as POST (Power On Self Test).

   Unless there is a problem status code 10 (Status LED #5 ON) will be posted to the CPU Board's Status LEDs. Detection of a fault during POST will be posted on the Status LEDs. When the Power On Self Test has completed, a system status code will be posted to the Status LEDs (see Table 5 and Figure 5).

   From the HyperTerminal Recovery Mode menu (Figure 18), press the 'F' key to enter FLASH download. A message will be displayed warning that the FLASH is about to be erased; press the 'Y' key at the prompt. The screen will display dots as the flash devices are being erased; this could take a few minutes.

5. When the FLASH is ready for download the letter C will be displayed on the screen. In the HyperTerminal command bar click on Transfer and then Send File (see Figure 19). In the Send File Dialog Box (see Figure 20), select "1KXmodem" for the protocol, enter the filename of the appropriate .bin file in the format "C_3*xxxx*.bin" (where *xxxx* varies from release to release). Click on the Send button to start the download (see Figure 20). When the HyperTerminal Recovery Mode Menu of Figure 18 appears, the download has completed.

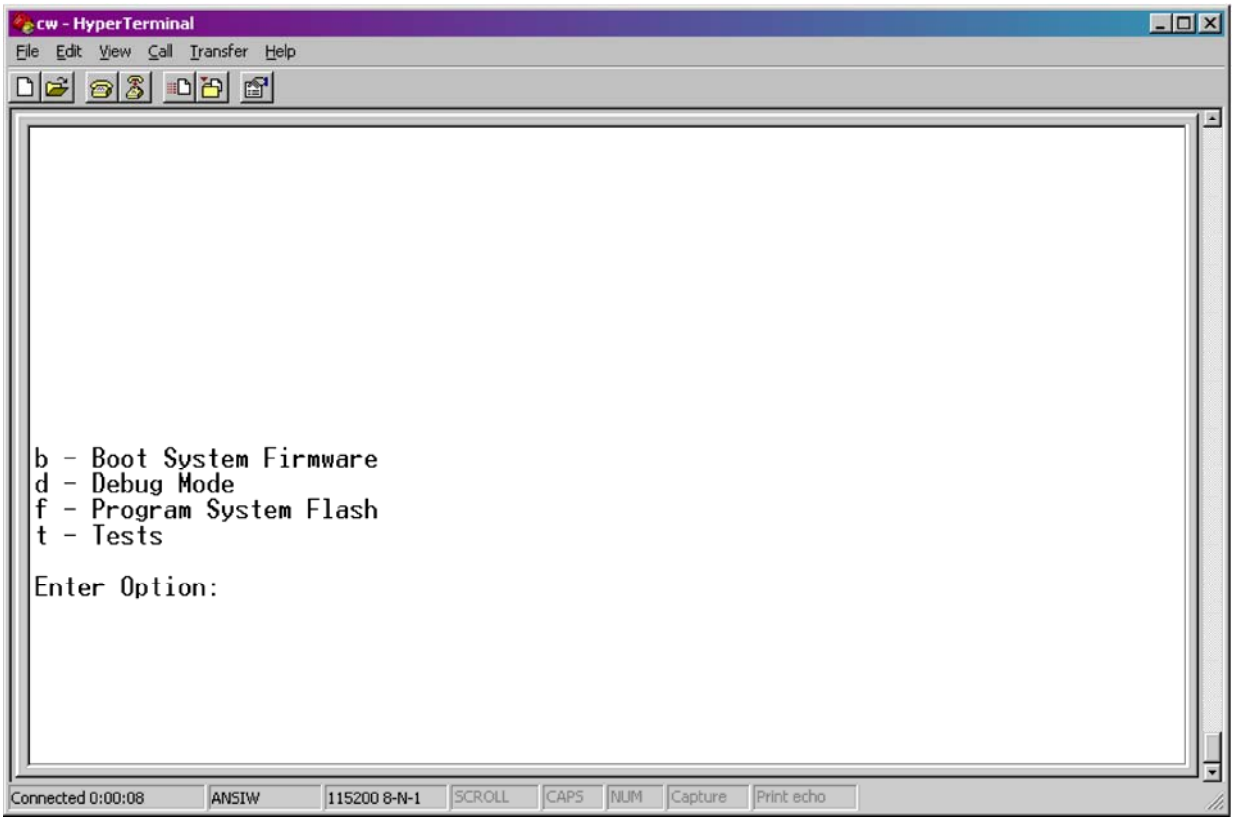


Figure 18 - HyperTerminal Recovery Mode Menu

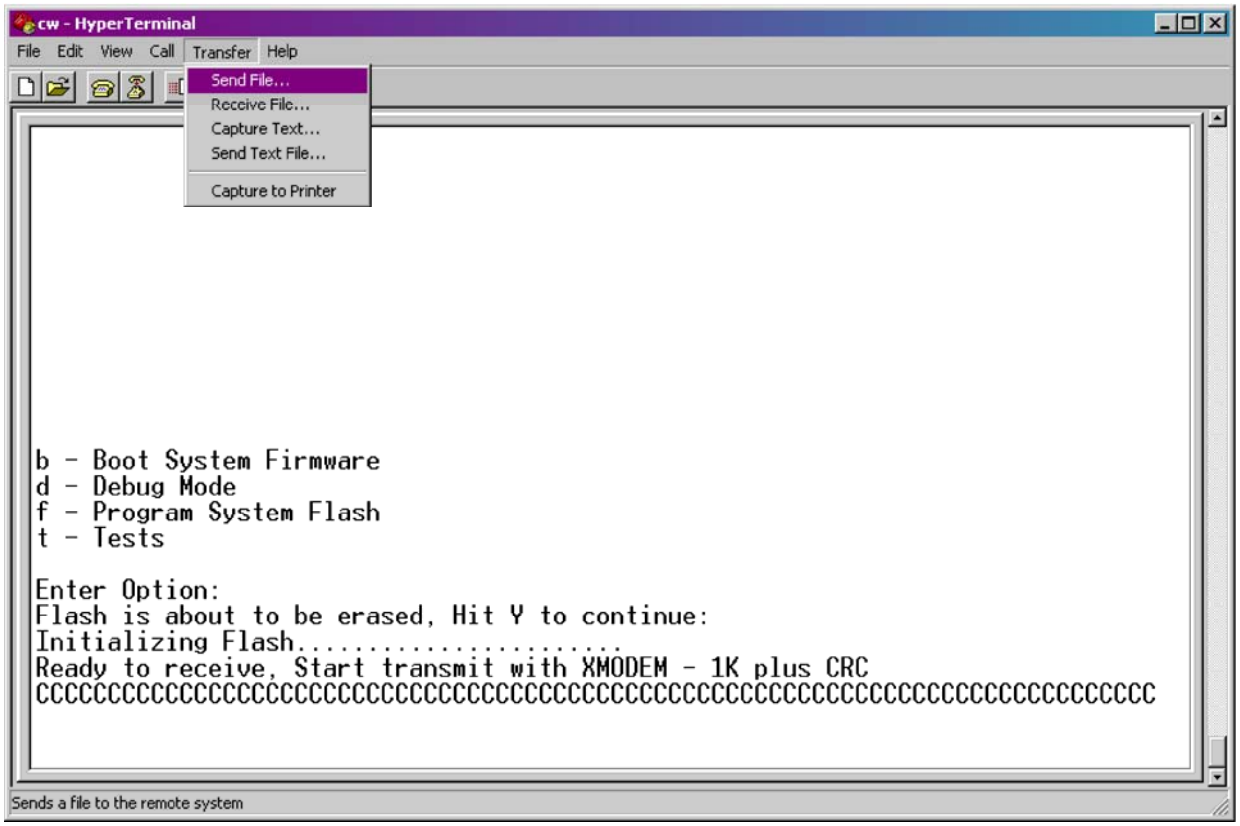


Figure 19 - HyperTerminal FLASH Download Menu (Ready to Download) - (Transfer/Send File Selected)

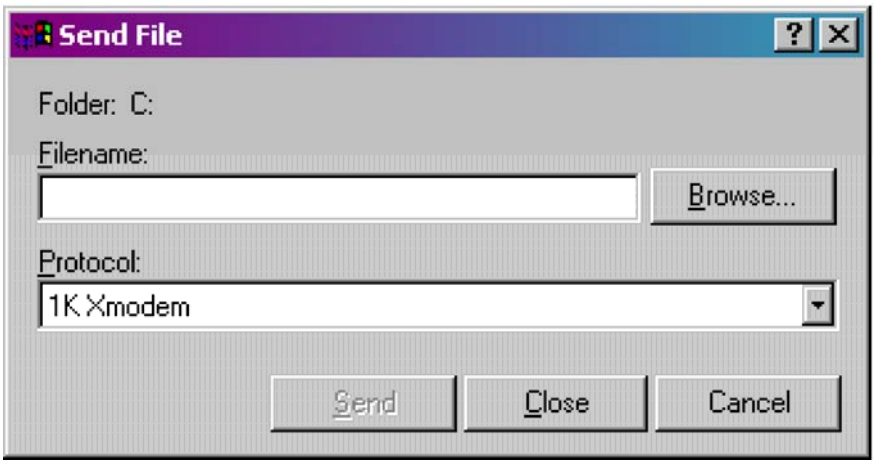


Figure 20 - HyperTerminal Flash Download (Send File Dialog Box)

6. Close the HyperTerminal program. The communication cable connected between the **CW_35/CW_31** (DPC/RIO) and the PC can be removed if desired.

7. Set the CPU Board's Recovery Switch (SW1) for 'Local Mode,' i.e., set SW1-1 OFF and SW1-2 ON). Set SW1-3 OFF and then switch power OFF/ON.

Once the **CW_35** DPC or **CW_31** RIO is running its application load, status codes will be posted to the six Status LEDs on the CPU Board. These Status LED (Hex) Codes are listed in Table 5 (see Figure 5).

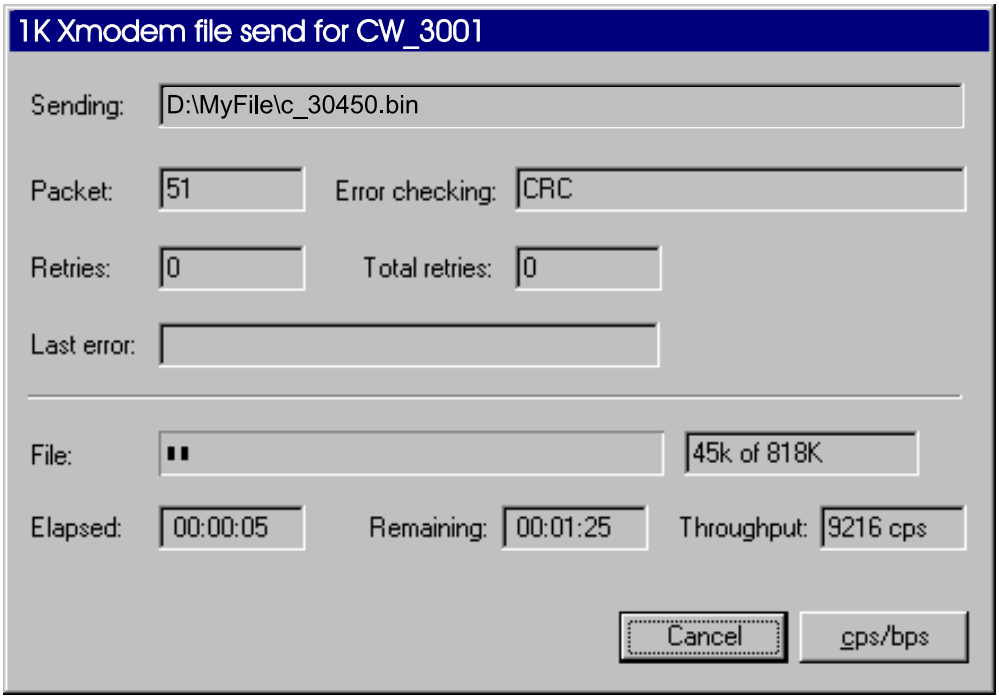


Figure 21 - HyperTerminal FLASH Download (Download in Process)

5.2.3 Remote Upgrade of CW_35/31 Firmware

It is possible to download system firmware into an unattended remote **CW_35** DPC or **CW-31** RIO. This function can only be accomplished if CPU Board Switch SW2-6 (associated with the unit in question) is set in the ON position (factory default). The procedure for

performing a remote download of system firmware is discussed in Appendix J of the Open BSI Utilities Manual (document D5081).

5.3 Core Updump

In some cases a copy of the contents of SRAM and SDRAM can be uploaded to a PC for evaluation by Bristol, Inc. engineers. This upload is referred to as a 'Core Updump.' A Core Updump may be required if the **CW_35** DPC or **CW_31** RIO repeatedly enters a 'Watchdog State' thus ill effecting system operation. A Watchdog State is entered when the system crashes, i.e., a CPU timeout occurs due to improper software operation, a firmware glitch, etc. In some cases the Watchdog State may reoccur but may not be logically reproduced.

'Crash Blocks' (a function of firmware provided for watchdog troubleshooting) are stored in CPU RAM. The user can view and save the 'Crash Blocks' by viewing the Crash Block Statistic Web Page (see Chapter 4 of the Open BSI Technician's Toolkit - D5087). Crash Block files should be forwarded to Bristol, Inc. for evaluation. If additional information is required to evaluate the condition, a Core Updump may be requested by Bristol. Once the file generated by the Core Updump has been forwarded to Bristol, it will be evaluated and the results will be provided to the user.

Follow the five steps below to perform a Core Updump.

1. Set CPU Board Switch SW2-1 OFF (Disable Watchdog Timer). If Switch SW2-4 is ON, set it to OFF (Enable Core Updump). **Note: The factory default setting for SW2-4 is OFF.**

2. Wait for the error condition (typically 3F on CPU Board Status LEDs).

3. Connect the **CW_35/31** Utility Port to a PC (see Figure 12C).

4. Remove **CW_35/31** Expansion Board Jumper W1.

5. Start the PC's HyperTerminal Program (at 115.2kbaud) and generate a file using the 1KX-Modem protocol. Save the resulting Core Updump in a file to be forwarded to Bristol, Inc. for evaluation.

When the Core Updump has been completed, install Expansion Board Jumper W1.

SECTION 6 - GENERAL SERVICE NOTES

Certain questions or situations may frequently arise when servicing the **CW_35** DPC or **CW_31** RIO. Some items of interest are provided in Sections 6.1 through 6.3.

6.1 Extent of Field Repairs

Field repairs to **CW_35** DPCs or **CW_31** RIOs are strictly limited to the replacement of complete modules. Component replacement on a **CW_35/31** Module constitutes tampering and will violate the warranty. Defective **CW_35/31** components (printed circuit boards, LCD Displays, etc.) must be returned to Bristol, Inc. for authorized service.

6.2 Disconnecting RAM Battery

The **CW_35/31**'s Lithium RAM battery cannot be replaced while power is on. Once the RAM battery has been replaced, the unit will still execute its FLASH-based application load (Boot Project) upon power-up, but all of the current process data will have been lost. Upon power-up, the unit will act as though it had just been booted and it will revert back to the initial values specified in its application load. The battery may be disabled by setting the CPU Board's Battery Backup Board Jumper (W3) in position 2 to 3.

6.3 Maintaining Backup Files

It is essential to maintain a backup disk of each application load file to guard against an accidental loss of process configuration data. Without a backup record, it will be necessary to reconfigure the entire application load; that can be a very time consuming procedure. Always play it safe and keep backup copies of your operating system loads. A copy of the application load can be loaded into **CW_35/31** FLASH memory and/or saved to a PC's Hard Drive as a ZIP file.

SECTION 7 - WINDIAG DIAGNOSTICS

Bristol's WINDIAG Software is a diagnostic tool used for testing **CW_35** DPC or **CW_31** RIO electronics including, I/O circuitry, CPU memory, communications ports, etc., for proper performance. The **CW_35/31** must be communicating with a PC equipped with the WINDIAG program. **CW_35/31** CPU Board configuration switch SW2-8 must be set to the OFF (Closed) position to enable diagnostics. Communication between the **CW_35/31** (with/without application loaded) and the PC can be made via a Local or Network Port with the following restrictions:

- **CW_35/31** CPU Board Switch SW2-8 must be OFF to run the WINDIAG program. Setting SW2-8 OFF will prevent the 'Boot Project' from running and will place the unit into diagnostic mode.

- The **CW_35/31** communication port connected to the PC (running the WINDIAG program) must match the speed of the PC. All serial communication ports (except COM1) can be configured for 9600 baud, 8-bits, no parity, 1 stop bit, BSAP/**Control**-Wave Designer protocol operation by setting **CW_35/31** CPU Switch SW2-3 OFF This can also be accomplished via user defined Soft Switches.

- Communication port COM1 is forced to 9600 baud operation when **CW_35/31** CPU Switches SW2-3 and SW2-8 have both been set OFF. COM1 can also be set to 9600 baud operation via user defined Soft Switches.

To use the WINDIAG program place any critical process (associated with the **CW_35/31** unit in question) under manual control. WINDIAG cannot be run while the **CW_35/31** application is running. Set **CW_35/31** CPU Board Switch SW2-8 to the OFF position. Perform steps 1 through 6 below.

1. Start the OpenBSI NetView Program. A menu similar to Figure 22 will appear.

2. To start the WINDIAG program, go to the Start Program's menu, select OpenBSI Tools, then select Utilities Programs and then select Diagnostics.

3. Once WINDIAG has been entered, the Main Diagnostics Menu of Figure 23 will appear.

4. Select the module to be tested. Enter any prompted parameters (slot #, etc.). WINDIAG will perform the diagnostics and display pass/fail results.

5. After all diagnostic testing has been performed, exit the WINDIAG program and then exit the NetView Program if there aren't any other **CW_35/31** units to be tested.

   When you close the NetView program you will be prompted as to whether or not you want to close the OpenBSI program; select Yes.

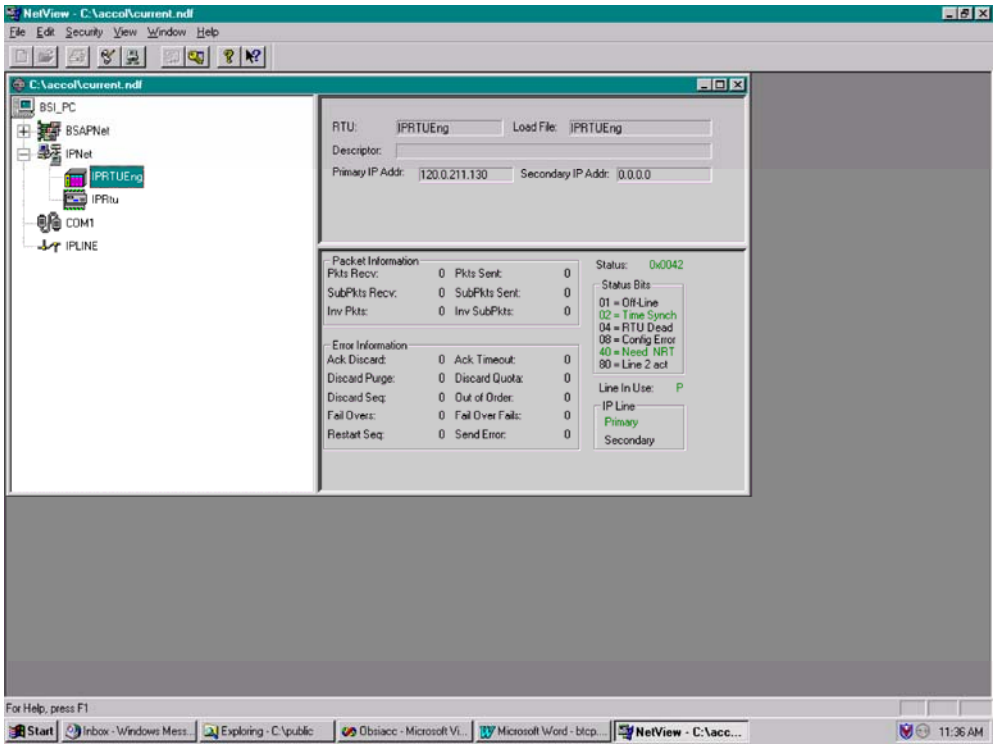


Figure 22 - NetView Startup Menu - Example with Multiple Networks

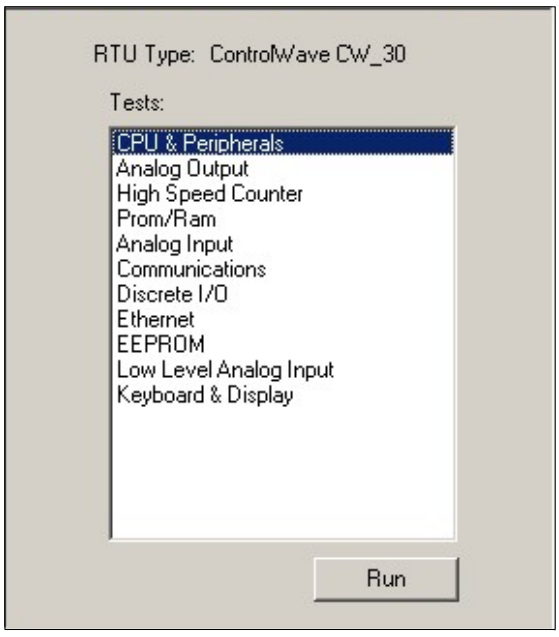


Figure 23 - WINDIAG Main Diagnostics Menu

6. Set **CW_35/31** CPU Board Switch SW2-8 to the ON (Open) position and reboot the unit. The **CW_35/31** DPC/RIO should resume normal operation.

7.1 Diagnostics Using WINDIAG

CW_35/CW_31 electronics can be tested using the WINDIAG program. From WINDIAG's Main Diagnostics Menu (see Figure 23) the following diagnostic tests can be performed:

CPU & Peripherals Diagnostic:	Checks the CPU Board [except for RAM & PROM (FLASH)].
PROM/RAM Diagnostic:	Checks the CPU Board's RAM and PROM (FLASH) hardware.
EEPROM Diagnostic:	Checks I/O Module EEPROM on an I/O Module.
Communications Diagnostic:	Checks all Comm. Ports - The External loop-back tests require the use of a loop-back plug.
Ethernet Diagnostic:	Checks Ethernet Port 1 and 2 on the CPU Module.
Analog Output Diagnostic:	Checks AOs on various AO Modules.
Analog Input Diagnostic:	Checks AIs on various AI Modules.
Low Level Analog Input Diag.:	Checks AIs on the Low Level AI Module.
Discrete I/O Diagnostic:	Checks DIs or DOs on various DI and DO Modules.
High Speed Counter Diagnostic:	Checks HSCs on various High Speed Counter Modules.
Keyboard & Display Diagnostics	Checks Keyboard/Keypad & Display hardware

Information on serial communication port loop-back testing is provided herein. For additional information on WINDIAG tests, see document D4041A.

7.1.1 Communication Diagnostic Port Loop-back Tests

WINDIAG's Communications Diagnostic Menu (see Figure 26) provides for selection of the communication port to be tested. Depending on the type of network (RS-232 or RS-485) and the port in question, a special loop-back plug is required as follows:

Ports 3 through 10 - RS-232:	use a 9-pin male D-type loop-back plug or loop-back wires (see Fig. 24).
Ports 3 through 10 - RS-485:	use a 9-pin male D-type loop-back plug or loop-back wires (see Fig. 25) or configure **CW_35/31** CPU Module Switches (SW3 and SW4) and/or CB Switches (SW1, SW2, SW3 and SW4) for loopback operation (see Tables 3 & 7).

This group of tests verifies the correct operation of the Communication Interface. COM1, through COM10 can be tested with this diagnostic. The **CW_35/31** communication port that is connected to the PC (local or network and used for running these tests) can't be tested until diagnostics has been established via one of the other ports, i.e., to test all **CW_35/31** serial RS-232/485 communication ports (via WINDIAG), communications with the PC will have to be established twice (each time via a different port). It should be noted that the **CW_35/31** communication port that is connected to the PC (RS-232, RS-485 or Ethernet) must be good for WINDIAG to run the Communications Diagnostics

7.1.2 Serial Comm. Port External Loop-back Test Procedure

1. Connect an external loop-back plug or loop-back wires to the Communication Port to be tested (see Figures 24 and 25). For RS-485 Loopback testing, CPU Switch SW3 and/or

SW4 or CB Switches SW1 through SW4 can be configured for loopback operation (see Table 4 or 8).

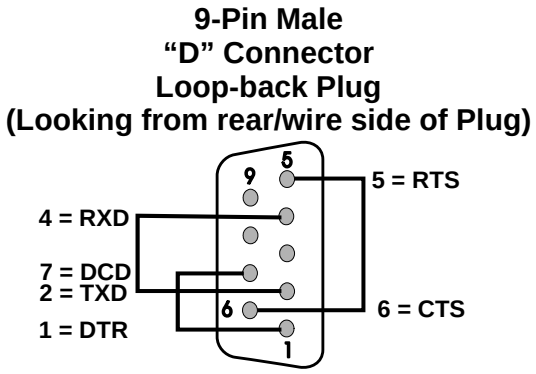


Figure 24 - RS-232 Loop-back Plug/Wires

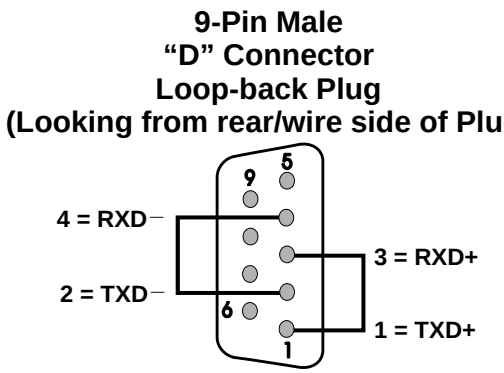


Figure 25 - RS-485 Loop-back Wires

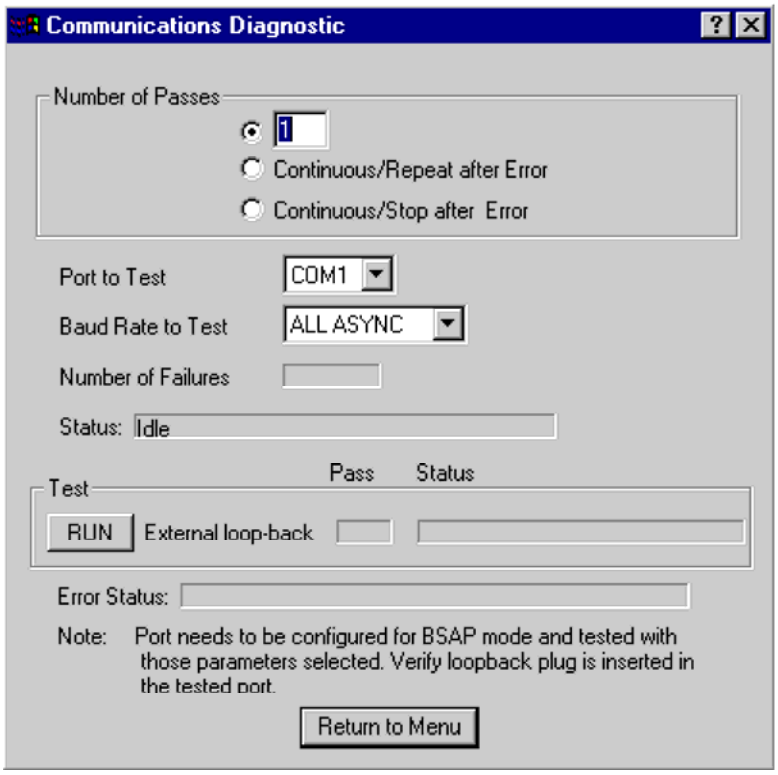


Figure 26 - WINDIAG's Communications Diagnostic Menu

2. Type "1," "2," "3," etc. (up to "10") for the port to test.

3. Set baud rate to test to 115200 baud or ALL ASYNC and the number of passes to 5.

4. Click on RUN button next to External loop-back.

- Test responses:
  a) Success - All sections of test passed
  b) Failure - TXD RXD Failure
  - CTS RTS Failure
- Execution time < 5 sec.

7.1.3 Ethernet Port Diagnostics

The Ethernet Diagnostic menu of Figure 27 is entered from the WINDIAG Main Diagnostic Menu (Figure 23). This menu provides four poke points (three associated with Ethernet circuitry test and one that provides the Return Hardware Address [which resides in FLASH]). These tests verify the operation and integrity of the PCNET (Ethernet) Controller and the Ethernet port hardware on the CPU Board and CB Board.

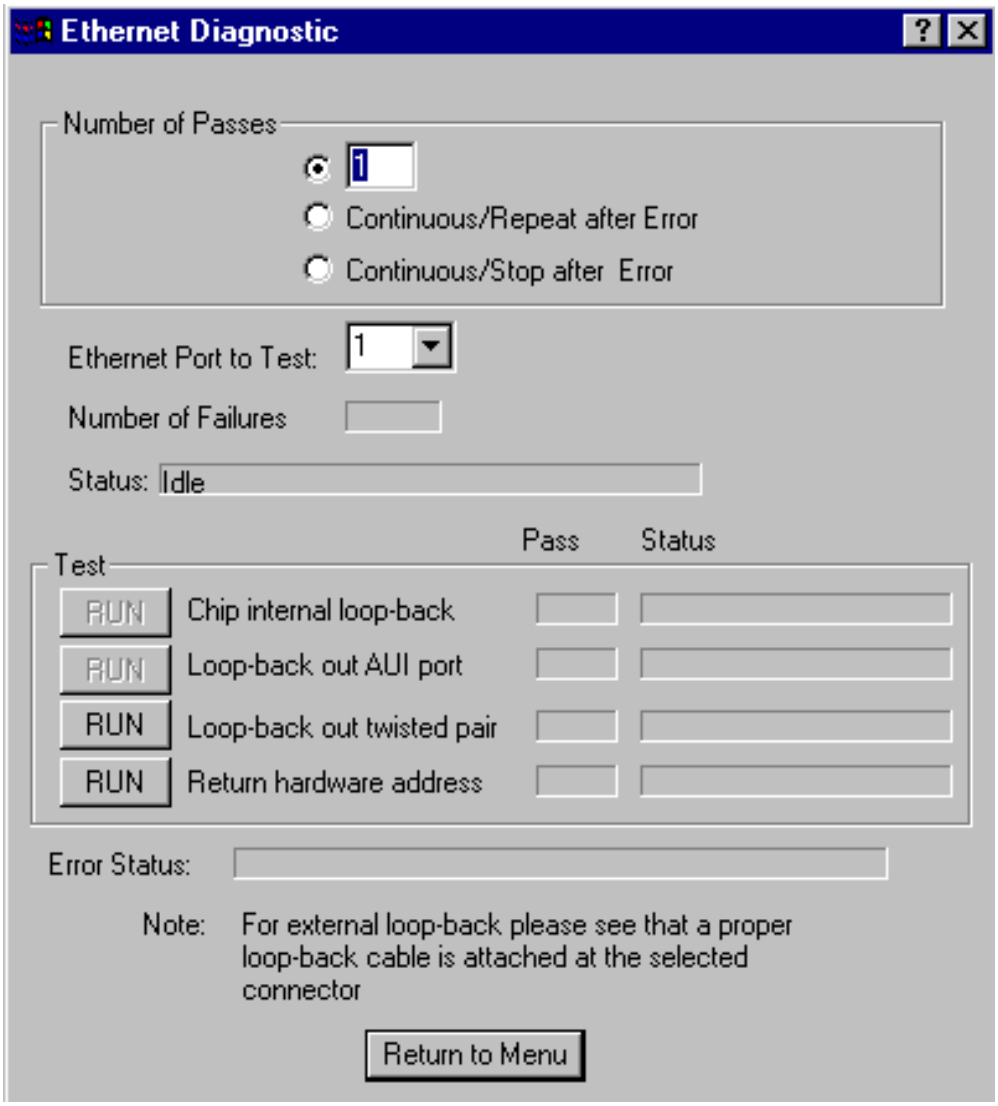


Figure 27 - Ethernet Diagnostic Menu

7.1.3.1 10Base-T (RJ-45 - Twisted Pair) Port Hardware Setup

The 10Base-T Port typically provides an interface (4-twisted pair) to an Ethernet Hub. To configure the system for the Loop-Back Out Twisted Pair diagnostic test either remove the standard R-J45 cable from the CPU Board's R-J45 connector and replace it with an R-J45 cable configured for loop-back, or remove the R-J45 cable associated with the port in question from the hub and install the unterminated end into an RJ-45 Jack configured for loop-back. Table 12 provides the pin identification and description for the RJ-45 port. Pin-1 (TX+) must be connected to Pin-3 (RX+) and Pin-2 (TX-) must be connected to Pin-6 (RX-) for proper loop-back test configuration (see Figure 28).

If the "Loop-Back Out Twisted Pair" Test RUN button is selected while the port is attached to an Ethernet Hub, a Failures Status will be posted.

Table 12 - Ethernet 10Base-T (RJ45) Connector Pin Assignments

Pin #	Pneumonic	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	-	Not Connected
5	-	Not Connected
6	RX-	Receive Data-
7 & 8	-	Not Connected

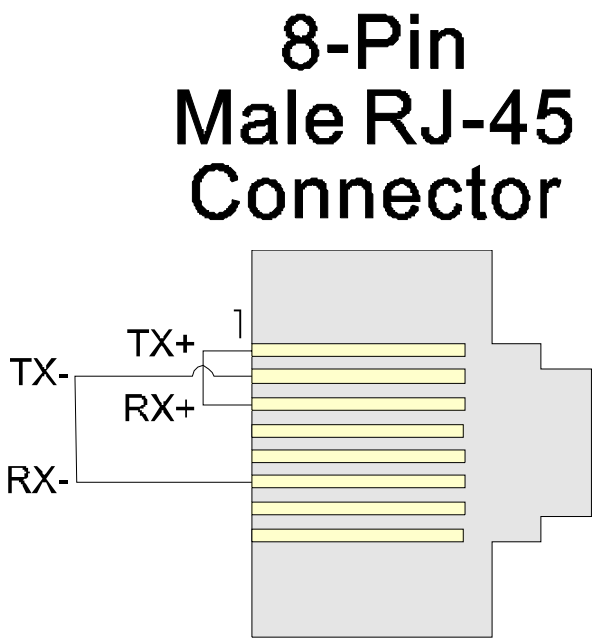


Figure 28 - RJ-45 Ethernet Loop-back Plug

7.1.3.2 Ethernet Port Diagnostic Test Execution

There are four unique test buttons provided on the Ethernet Diagnostic Menu. Note: Only the "RUN Loop-back out twisted pair" and "RUN Return hardware address" tests are applicable to **CW_35/31** units, i.e., the "RUN Chip internal loop-back" and "RUN Loop-back out AUI port" tests aren't applicable. The applicable tests are discussed below.

7.1.3.3 Loop-back Out Twisted Pair Test RUN Button

Set the Number of Passes. Make sure that the port is properly configured with a cable or jack for loop-back testing (see Section 7.1.3.1). Click on the "RUN Loop-back out twisted pair" Test button. The test will proceed and return either 'Success' or one of the following responses under the STATUS column:

Fail
- No Hardware Present
- Loop-back Send Failed
- Loop-back Receive Failed
- Loop-back Compare Failed
- Error Information Returned

When you have finished with Ethernet Diagnostic Loop-back testing, be sure to return the hardware to its normal operating configuration, i.e., disconnect the loop-back cable or jack-plug and reconnect the Ethernet cable to both the **CW_35/31** Ethernet port and the Ethernet Hub.

7.1.3.4 Return Hardware Address Test RUN Button

Set the Number of Passes. Click on the "Return hardware address" Test button. The test will proceed and if successful the hardware address will be displayed. The hardware address will appear as 00-10-41-XX-XX-XX. The prefix 00-10-41 appears for all Bristol Ethernet Comm. ports. The remainder of the hardware address is unique for each board manufactured and is stored in EEPROM. If the error message "Error Information Returned" is displayed instead of the hardware address, and the unit has been programmed with a proper hardware address, the CPU Module should be replaced.

7.1.3.5 Ethernet Port Diagnostic Error/Failure Messages

If either a "No Hardware Present" or "Error Information Returned" message is displayed, ensure that the loop-back test requirements have been properly established (see Section 7.1.3.1). If test requirements have been met and the cable associated with the port test in question is known to be good, the CPU Module should be replaced with a good unit.

In the case of a "Loop-back Send Failed," "Loop-back Receive Failed" or Loop-back Compare Failed" message, check the cable in question. If the cable associated with the port test in question is known to be good, the CPU Module should be replaced with a good unit.

SECTION 8 – DISPLAY/KEYPED ASSEMBLY OPERATION

CW_35s support Display/Keypad assemblies (local or remote) that were present prior to the conversion to the **Control**Wave Platform. Additionally, connector J3 on the Expansion Board accommodates connection to one of two unique remote Display/Keypad Assemblies; one with a dual-button Keypad (see Figure 29) and one with a 25-button Keypad (see Figure 2-30). Both Display/Keypad assemblies utilize identical 4 x 20 LCD Displays. Each Display/Keypad assembly employs a unique microcontroller based Display/Keypad Interface Circuitry (situated on the remote Display/Keypad assembly that drive the LCD Display and interfaces the Keypad. Interface to the **CW_351** is made via a cable equipped with two plugs. This cable connects to the RJ-45 Display Jack (J3) on the **CW_35** Expansion Board and RJ-45 Jack (J1) on the remote Display or Display/Keypad assembly. A potentiometer is provided on the Display or Display/Keypad to set the contrast of the LCD Display.

Figure 2-29 provides mounting hardware information for the Dual-button Display/Keypad Assembly. Operation of the Dual-button Display/Keypad Assembly is discussed in Section 2.4.5.1 of this document.

Figure 2-30 provides mounting hardware information for the 25-button Display/Keypad Assembly. Information on configuring the 'Display Function Block' (required to configure the Display associated with the 25-button Display/Keypad Assembly) is provided in ControlWave Designer's On-Line Help.

Note: Operation of the 25-button Display/Keypad Assembly is discussed in Appendix DKA of this document.

8.1 Operation of the Dual-button Display/Keypad Assembly

The Display will have a timeout of 20 minutes. If there has been no keypad activity for this time the display will "logout," i.e., the display will be turned off and scrolling stopped until a key press occurs. When a key press occurs after a timeout the display will return to the opening screen.

If a shorter timeout of the display is needed for power savings, another timeout may be implemented. The processor connected to the display will control the timeout. When the timeout occurs the display will be blanked, but communications between the CW_35/31 CPU and display processor will still occur. The display processor will ignore posting the messages to the screen when in the low power mode. When a key is pressed the display processor will return to displaying information to the display.

Displays are organized into screens as follows:

Opening Screen:	User defined strings
List Selection Screen:	List Name
	List Number
	<Blank Line>
	<Blank Line>

The List Selection screen is entered from the main opening screen by pressing the right arrow. Once here the operator can select which list is to be viewed. The operator can traverse though different list numbers by pressing the down arrow key. When the list to be scrolled is shown on the display, pressing the right arrow key will bring the operator to the Display Element screen.

Display Element Screen:	<Blank Line>
	<Blank Line>
	Variable Name
	Variable Name

The Display Element screen is entered from the list selection screen by pressing the right arrow. Once here the operator can view the variables in the list. Once entered the first element of the list is displayed and then next element will be displayed after the scroll timeout occurs. The scrolling will continue displaying the next element in the list and then wrapping around to the beginning of the list. The down arrow key will toggle the display through hold and scroll mode. Pressing the right arrow key will bring the operator to the list selection screen.

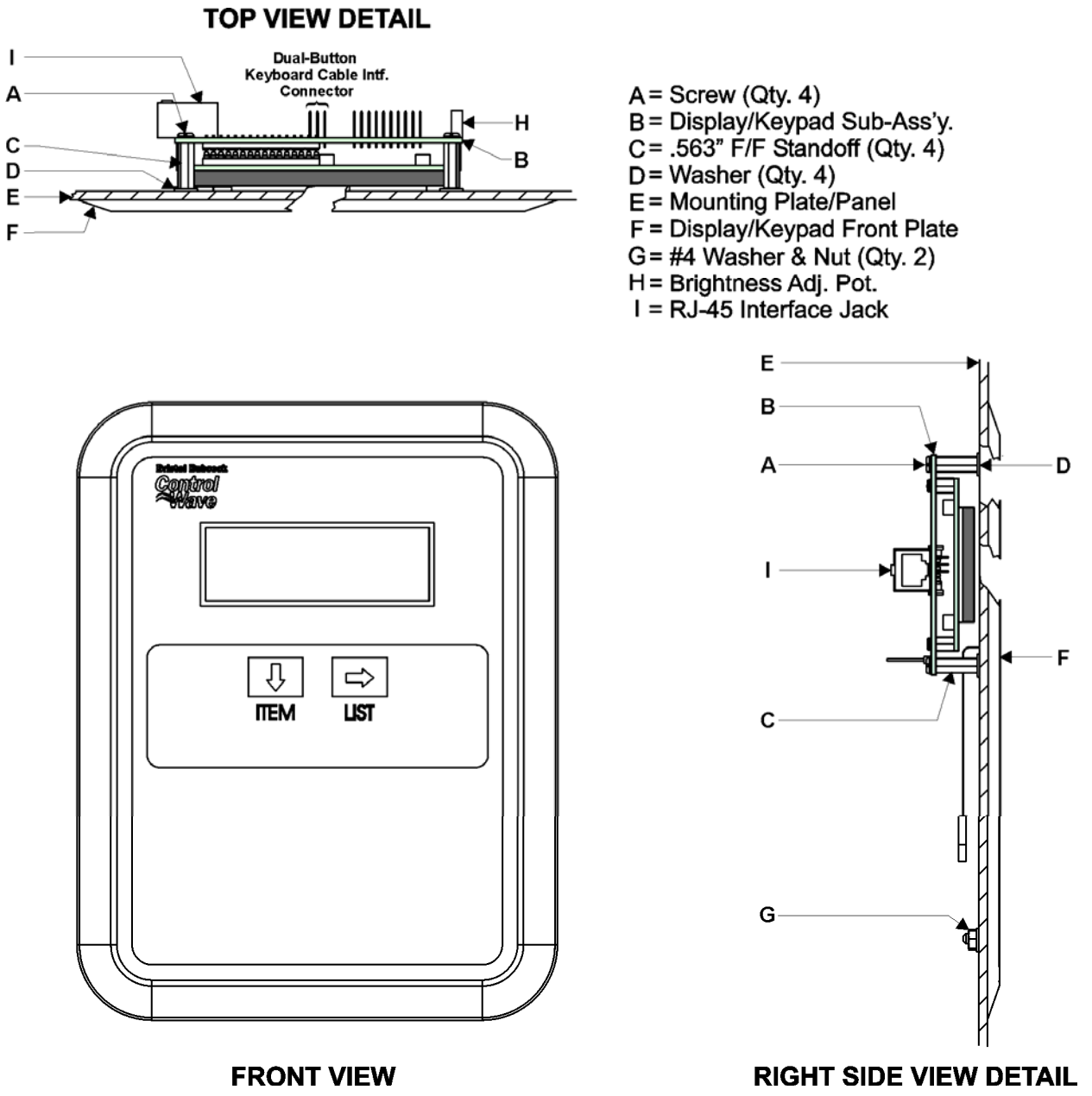


Figure 29 - Dual-button Display/Keypad Assembly Installation Drawing

Display/Keypad Assemblies are supported by **Automatic Mode** and **Manual Mode**.

Automatic Mode

In Automatic mode a set of screens (based on the application load) are displayed. The application programmer provides strings for the opening screen. From there the firmware is responsible for displaying the screens and responding to key presses. Screens are fixed and start off with an opening screen, which displays user information passed into the function block. Users can view a list to select which list is to be scrolled. Once the list to be scrolled has been selected, the user can scroll through the list by pressing the down arrow key. List elements will be displayed automatically, scrolling at a predetermined rate (determined by iiScrollTime). The user may pause on a variable by pressing the right arrow key. Pressing the right arrow key again will cause the list to start scrolling again.

The essence of Automatic mode is that the user can supply inputs into the function that will determine which list can be displayed, but cannot change the menu or display. The user is allowed to select a list and to start/stop scrolling.

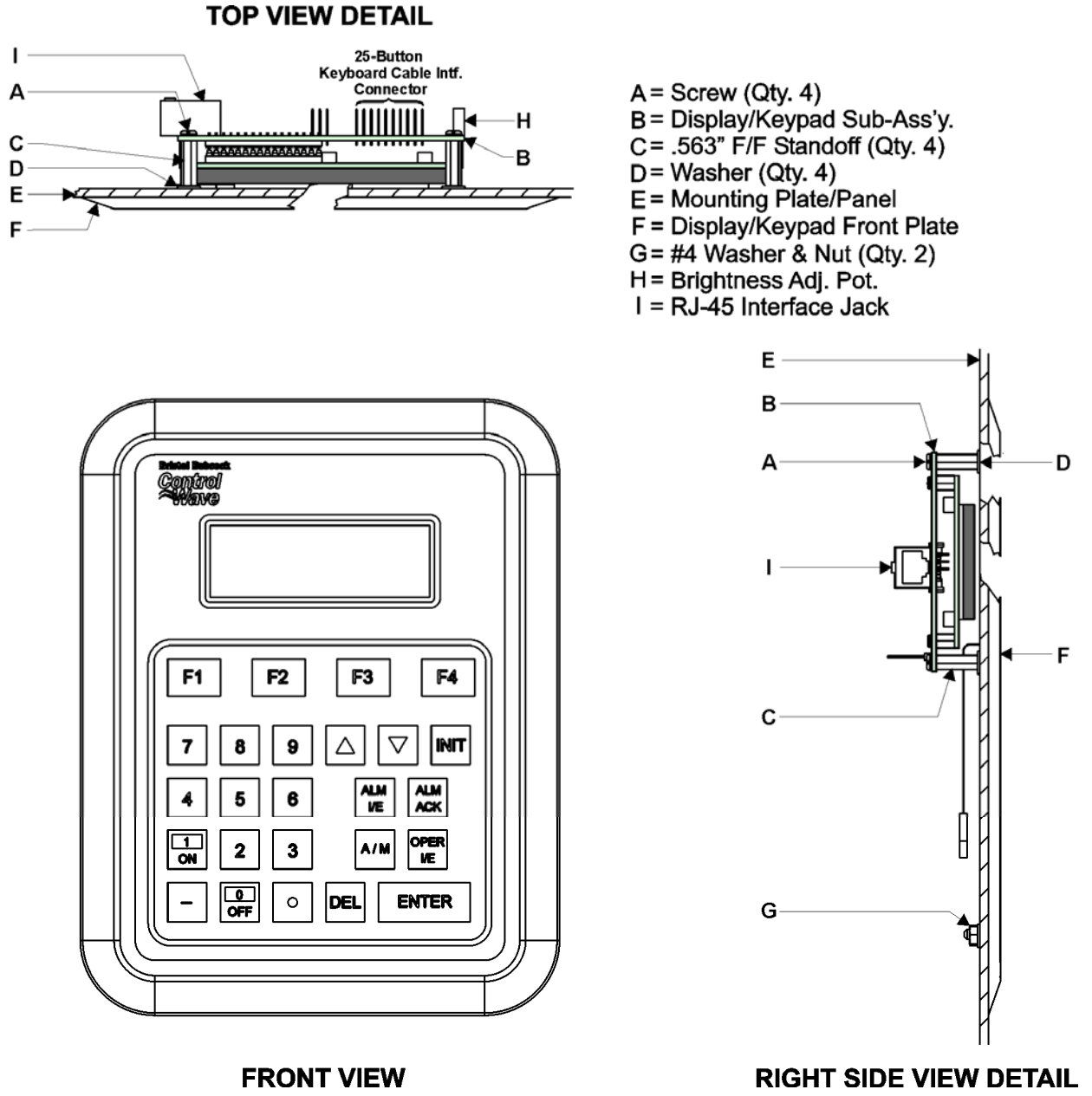


Figure 2-30 - 25-Button Display/Keypad Assembly Installation Drawing

Manual Mode

In Manual Mode the programmer is responsible for creating each screen and displaying the next desired screen, based on key inputs. The programmer has access to all lines of the display and can provide any string that he/she desires to display. Special formats that must be adhered to that allow the programmer to display what they want on the screen are provided in the description of iaScrnSruct in the ACCOL 3 Display function block within ControlWave Designer's On-Line Help. It should be noted that currently, Manual Mode does not support reading Keypad key-presses. **Note: Manual Mode operation requires ControlWave Firmware 4.50 or newer.**

SECTION 9 - CW_35/31 SPECIFICATIONS

9.1 CW_35/CW_31 CPU Module Specifications

Processor: Sharp's LH7A400 32-bit System-on-Chip with 32-bit ARM9TDMI RISC Core

Memory: 16 Mbytes of simultaneous read/write FLASH
1 Mbyte of on-board SRAM
512 Kbytes FLASH Boot/Downloader
4 Mbytes of SDRAM

Real Time Clock: A Semtech SH3000 support IC provides a full BCD clock calendar with programmable periodic/wakeup interrupt and a programmable clock generator with adjustable spectrum spreading.

Connectors: (see Table 13)

Table 13 - CPU Board Connector Summary

Ref.	# Pins	Function	Notes
P1	68-Pin	EB Intf. to P2 on CPUB	Male (on EB)
P1	14-Pin	LED Board (Status/Utility Port Intf.	Male (on LED Bd.)
J1	14-Pin	LED Board (Status/Utility Port Intf.	Female (on CPUB)
J1	3-Pin	Utility Port - RS-232	Male (on LED Bd.)
J1	9-Pin	Serial Comm. Port 5 (BIP1)	Female D-Sub (on CPUB)
P2	68-Pin	CPU Bd. Intf. to P1 on CEB	Female (on CPUB)
J2	9-Pin	Serial Comm. Port 6 (BIP2)	Female D-Sub (on CPUB)
J2	8-Pin	Ethernet Port 1	RJ-45 - 10/100BaseT (on EB)
J3*	8-Pin	Ethernet Port 2	RJ-45 - 10/100BaseT (on EB)
J3*	8-Pin	Display/Keypad Interface	RJ-45 (on CEB) see Section 8
J3	80-pin	Backplane I/O Bus Interface	3335 Backplane Intf. (on CPUB)

*** = Not available on CW_31 Remote Input/Output (RIO) units**

9.1.1 CPU Module Communication Port Specifications

CPUM Comm. Ports:

<u>LED Board</u>
J1: 3-pin In-line – Utility Port (RS-232)
<u>CPU Board</u>
J1: 9-pin D-Type Female Connector - Serial Comm. Port BIP1/COM5 is configurable for RS-232 or RS-485 operation
J2: 9-pin D-Type Female Connector - Serial Comm. Port BIP2/COM6 is configurable for RS-232 or RS-485 operation
<u>Expansion Board</u>
J1: 8-pin 10/100Base-T (Female) Ethernet Port 1
J2: 8-pin 10/100Base-T (Female) Ethernet Port 1

Baud Rate: 300 to 115Kbps for RS-232 or RS-485
See Table 9 for connector pin assignments

9.1.2 CPU Module 3.0V Power Supply Specifications

Input: +5Vdc

Output Voltages: +3.3Vdc ±1%

Output Current: 0.6A Max. @ 3.3Vdc

Output Ripple P/P: +3.3V Output: 10mV

9.1.3 CPU Module Environmental Specifications

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

Relative Humidity: 0-95% Non-condensing (Operating & Storage)

Vibration: 1g acceleration over 10 to 150 Hz
.5g acceleration over 150 to 2000 Hz

RFI/Emissions: In conformity with the following standards: ENV 50140 Radio-frequency electromagnetic field amplitude modulated EMV

9.2 CW_35 Comm. Board (CB) Specifications

9.2.1 CB Board Connectors

Table 14 – CB Board Connector Summary

Ref.	# Pins	Function	Notes
P1	44-pin	Backplane Interface.	CW_35 COM Bus Interface
J1 Bottom	9-pin	RS-232/485 Serial Comm. Port 3	Female D-Type: (Bottom Left)
J2 Bottom	9-pin	RS-232/485 Serial Comm. Port 4	Female D-Type: (Bottom Right)
J1 Top	9-pin	RS-232/485 Serial Comm. Port 9 **(Not On 2-Port CCBs)**	Female D-Type: (Top Left)
J2 Top	9-pin	RS-232/485 Serial Comm. Port 10 **(Not On 2-Port CCBs)**	Female D-Type: (Top Right)

9.2.2 CB Board Communication Port Specifications

CB Board Comm. Ports: see Table 14

Baud Rate: 300 to 115Kbps for RS-232 or RS-485
See Table 9 for connector pin assignments

9.2.3 CB Board 3.3V Power Supply Specifications

Input: +5Vdc

Output Voltages: +3.3Vdc ±1%

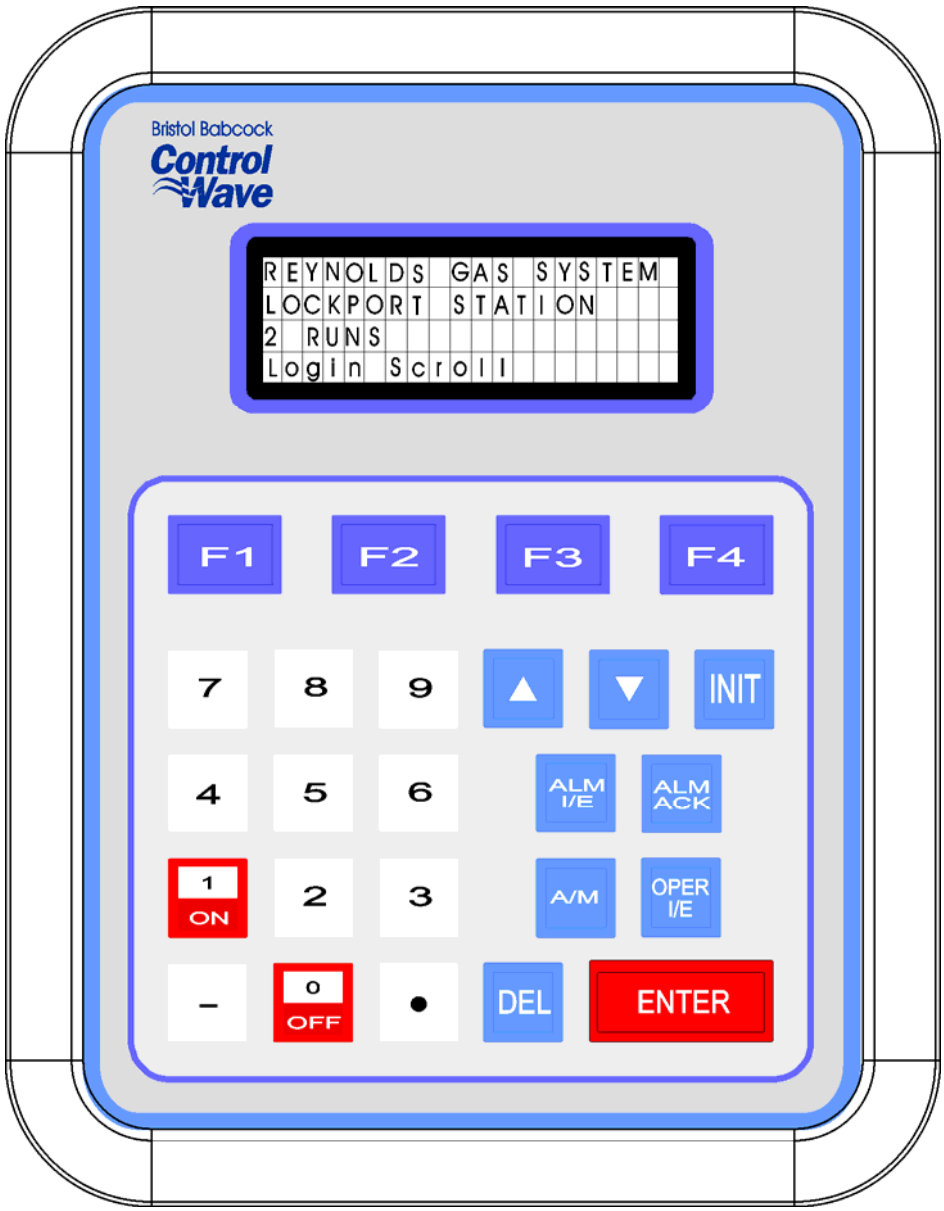
Output Current:	0.6A Max. @ 3.3Vdc
Output Ripple P/P:	+3.3V Output: 10mV

9.2.4 CB Board Environmental Specifications

Temperature:	Operating:	-40 to +185 °F (-40 to +85 °C)
	Storage:	-40 to +185 °F (-40 to +85 °C)
Relative Humidity:	0-95% Non-condensing (Operating & Storage)	
Vibration:	1g acceleration over 10 to 150 Hz .5g acceleration over 150 to 2000 Hz	
RFI/Emissions:	In conformity with the following standards: ENV 50140 Radio-frequency electromagnetic field amplitude modulated EMV	

ControlWave_35 DISPLAY/KEYPAD (with 25 Keys) ASSEMBLY GUIDE

Appendix DKA



ControlWave

APPENDIX DKA

ControlWave_35 DISPLAY/KEYPAD (with 25 Keys) Assembly Guide

TABLE OF CONTENTS

NOTE: The Dual-button Display/Keypad Assembly is discussed in Section 8.1 of PIP-CW_35 Upgrade Kit.

Appendix DKA
DISPLAY/KEYPAD ASSEMBLY GUIDE

DKA1.1 OVERVIEW

Bristol Display/Keypad assemblies provide a local, user interface for the **Control**Wave **3335** (**CW_35**) DPC. These assemblies allow an operator or engineer to view and modify variable values and associated status information, via an ACCOL3 Function Block. Variables can include inputs, process variables, calculated variables, constants, set-points, tuning parameters and outputs used in a measurement or control application. Status bits include alarm state, alarm acknowledge, control, manual, and questionable data.

Setting up the Display/Keypad is a simple matter of configuring a Display Function Block in the ControlWave Designer project.

The Display/Keypad is comprised of a four line by twenty character liquid crystal display, with adjustable LCD Contrast, and a 25 button membrane key matrix. Each key has a microswitch for positive tactile feedback. This means that as you firmly depress the keys, you will feel it click as it engages. In the case of the **CW_35** DPC, the Display/Keypad is located (typically panel or Enclosure Front Cover mounted) within the proximity of the **CW_35** and is installed in the field by field service personnel, user, integrator, contractor, etc.

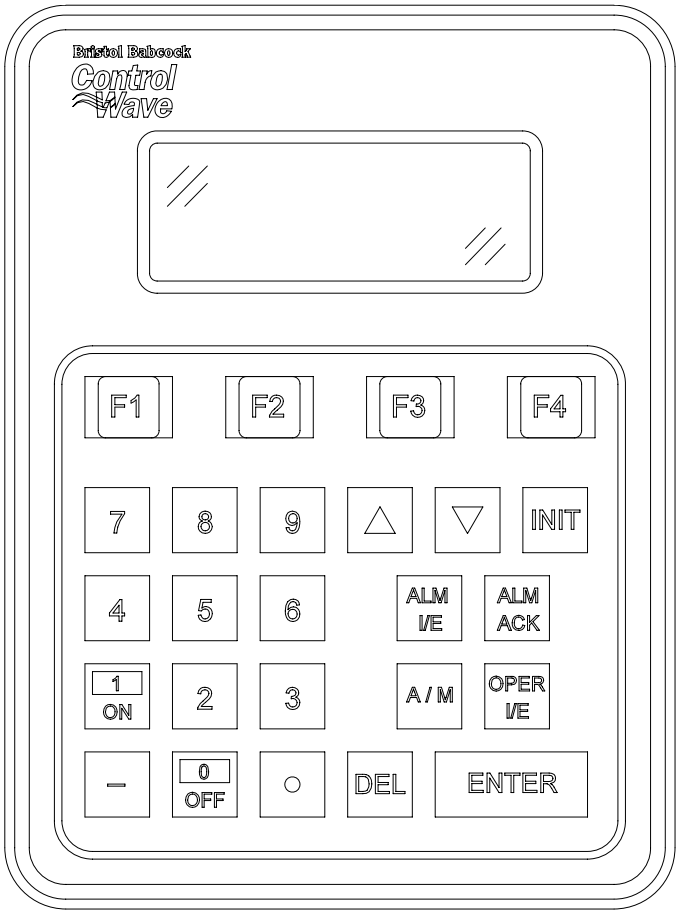


Figure 1 - Display/Keypad Assembly – 25 Button Keypad & 4 X 20 Display

Display/Keypad Assemblies are supported by **Automatic Mode and Manual Mode**.

Automatic Mode
In Automatic Mode a set of screens (based on the application load) are displayed. The application programmer provides strings for the opening screen. From there the firmware is responsible for displaying the screens and responding to key presses. Screens are fixed and start off with an opening screen, which displays user information passed into the function block. Users can view a list to select which list is to be scrolled. Once the list to be scrolled has been selected, the user can scroll through the list by pressing the down arrow key. List elements will be displayed automatically, scrolling at a predetermined rate (determined by iiScrollTime). The user may pause on a variable by pressing the right arrow key. Pressing the right arrow key again will cause the list to start scrolling again.

The essence of Automatic Mode is that the user can supply inputs into the function that will determine which list can be displayed, but cannot change the menu or display. The user is allowed to select a list and to start/stop scrolling.

Manual Mode
In Manual Mode the programmer is responsible for creating each screen and displaying the next desired screen, based on key inputs. The programmer has access to all lines of the display and can provide any string that he/she desires to display. Special formats that must be adhered to that allow the programmer to display what they want on the screen are provided in the description of iaScrnSruct in the ACCOL 3 Display function block within ControlWave Designer's On-Line Help. It should be noted that currently, Manual Mode does not support reading Keypad keypresses. **Note: Manual Mode operation requires ControlWave Firmware 4.50 or newer.**

If you're setting up the keypad, follow the configuration instructions provided in Section E3 of this appendix.

If your keypad has already been set up, Section E4 will tell you how to use the keypad and interpret the display.

DKA2.1 DISPLAY FUNCTION BLOCK DESCRIPTION

Keypad and display control/configuration are handled by the DISPLAY Function Block. This function block allows an operator to view/change variable data or to be allowed to scroll through lists of variable data based upon their login privileges.

In order for the keypad and display to operate, the ControlWave Designer project must include a properly configured DISPLAY Function Block. Use ControlWave Designer to configure this function block and assign the parameters according to the four steps covered in Section 3.

DKA2.1.1 DISPLAY Function Block Parameters

Referring to Figure 2, various DISPLAY Function Block Parameters are available. For information on configuring the Display Function Block, please reference on-line help in ControlWave Designer.

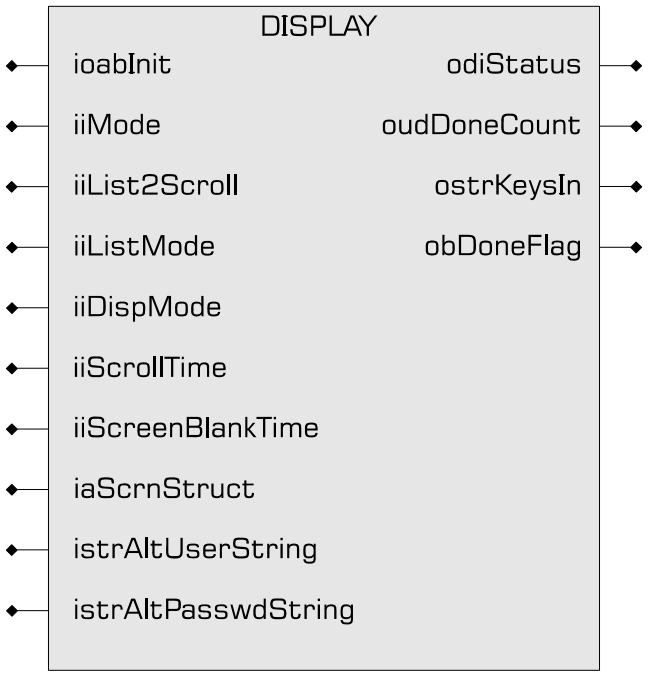


Figure 2 - ACCOL3 DISPLAY Function Block Parameters

DKA3.1 PREPARING THE ControlWave PROJECT

In order for the keypad and display to operate, the ControlWave Designer project must include a properly configured Display Function Block. Once the Keypad is operating, a user who has signed on with a password can scroll through the names of variable lists and choose a list to read or change. Use Up Arrow and Down Arrow keys to select the Username and use the numeric keys to enter your password. The steps that follow describe how to configure this function block.

Step 1: Creating the Identifier Display

The Identifier Display is the first display to appear when the Display Function Block is initialized and begins to execute. This display will look similar to Figure 3. Each of the first three lines of the display contains the text value of a string variable. These string variables are created utilizing iaScrnStruct parameters of the Display Function Block (See Figure 2) and your computer keyboard. Since this is the first display that the user will see, you may want the display to contain general information such as the node name of the controller or the process that the controller is monitoring.

The bottom line on the display is called the legend line. It shows which function keys are currently active and their purpose. Function keys are those keys on the Keypad that are marked ([F1] through [F4]). Function key assignments are preconfigured and cannot be changed. Using function keys is described in Section KDA4.1, Using the Keypad.

The legend line in Figure 3 shows that the user has two choices: to Log-in (using [F1]) or scroll (using [F2]).

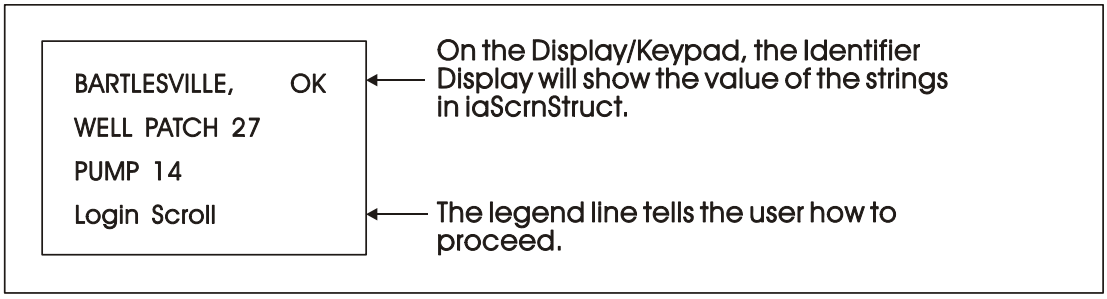


Figure 3 - Creating the Identifier Message

Step 2: Defining a Scroll List

Once the Keypad is operating properly, you can automatically scroll through a list of variables created via DISPLAY Function Block Parameters iiList2Scroll and iiListMode. Scrolling can be done without entering a password. The variables in the list are displayed one at a time and in the same order in which they were entered in the variable list.

Later, we'll discuss other variable lists that can be accessed with the keypad. To distinguish this list from others, let's call this variable list the Scroll List.

Enter the number of a variable list to be scrolled. This variable list becomes the Scroll List. The Scroll List can contain different types of variables (that is, logical, analog and string). You can create a specific scroll variable list or use any list in the ControlWave Project.

Each variable in the Scroll List will be displayed for the number of seconds defined by the iiScrollTime parameter. If you don't specify a time for this parameter, the hold time will be two seconds. If you signed-on and then started scrolling you will be signed-off in 20 minutes if no keys are pressed. If you don't want to automatically stop scrolling after 20 minutes, sign-off (INIT key) before starting scrolling.

Step 3: Assigning Passwords

A valid RTU username/password combination must be entered to go beyond the initial displays. Passwords can be any combination of numbers up to 16 digits in length, from 0000000000000000 to 9999999999999999. If none are specified, the default values are system for User-name and 666666 for Password (read/write access).

Step 4: Status Information

Enter a variable name on the odiStatus terminal.

See On Line Help in ControlWave Designer for Status Values.

The next section describes how to use the Keypad to access variable information.

DKA4.1 USING THE KEYPAD

The Identifier Display is the starting point from which you can go to other displays. It shows an identification message and the words Login and Scroll at the bottom of the screen (see Note 1). The identification message may contain the name of the controller, the plant equipment it is monitoring, or the variables you can expect to see when you use this display.

Note 1 : If your display shows something else, press the [F4] key until you see the words Login and Scroll on the bottom line.

If your screen is blank, turn the brightness screw clockwise. This screw is located to the left of the Keypad (looking at the rear of the 25-Button Display/Keypad Assembly (see Figure 14). If no letters appear, the controller has not been programmed properly to operate the keypad.

The words Login and Scroll at the bottom of the screen are on the legend line. It tells you which function keys (that is, key [F1] through [F4]) are active and their purpose at that time.

Up to four legends can appear on the legend line. The legend on the far left corresponds to the function of the [F1] key. The assignment for the [F4] key is on the far right. Keys [F2] and [F3] are described to the left and right of center. When no legend appears, that function key is not active at that time. For example, in Figure 4 only [F1] and [F2] are active.

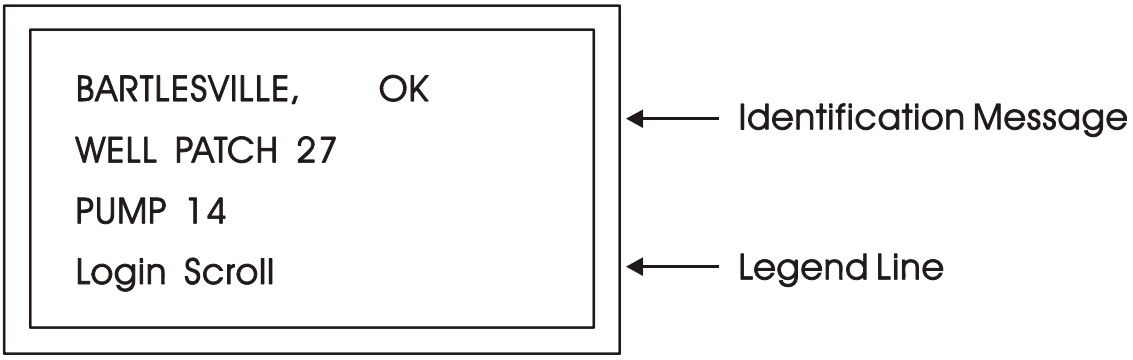


Figure 4 - The Identifier Display

From the Identifier Display, you have two choices. Pressing [F1] will allow you to sign-on if you have a password. By pressing [F2] you can activate automatic scrolling through a list of variables.

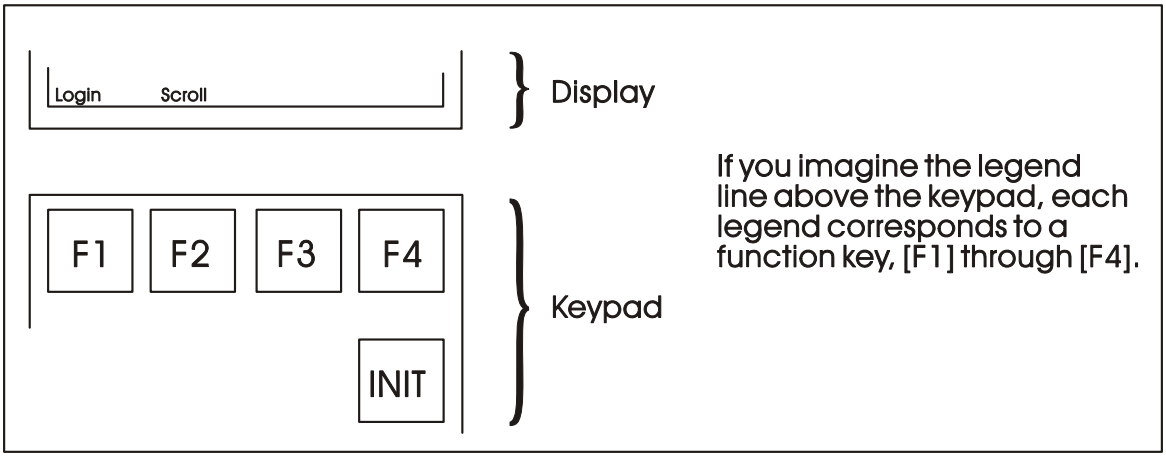


Figure 5 - Identifier Display Legends and Corresponding Keypad Alignment for 25 Button Membrane Key Matrix Keypad System

DKA.1.1 Scrolling

To begin automatic scrolling, press [F2] from the Identifier Display (Figure 4). Variable information will appear on the screen and remain there for 1 to 30 seconds (default = 2). The

variable name appears on the first line. The variable value appears on the second line and status information appears on the third line. An example is shown in Figure 6.

When all variables in the list have been displayed, they will be shown again in the same order. This is called Single Variable Mode.

Pressing Mlti [F2] activates Multiple Variable Mode. Multiple Variable Mode displays up to three (3) variables and their values on the screen simultaneously. Pressing Sngl [F2] terminates Multiple Variable Mode and returns you to Single Variable Mode.

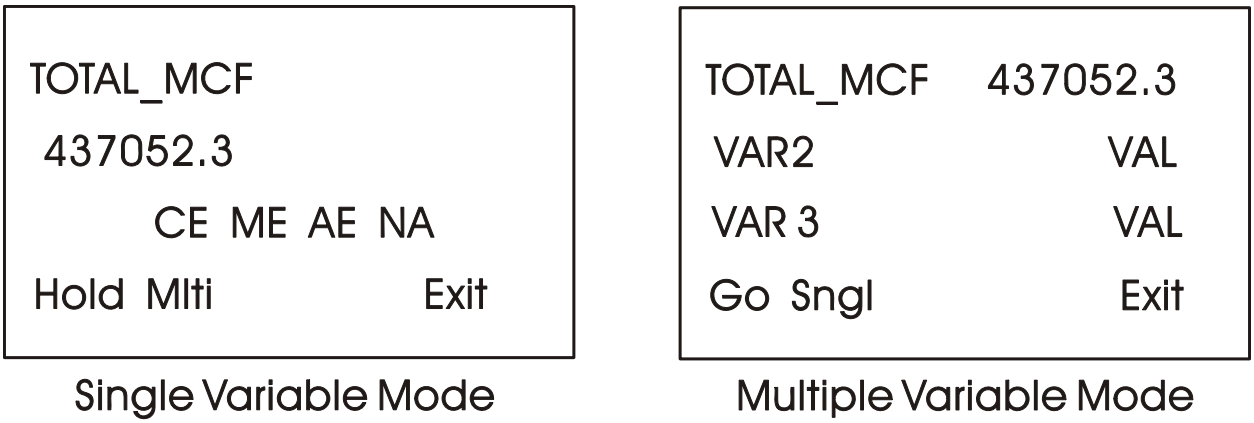


Figure 6 - Scrolling

Press HOLD [F1] to halt scrolling. Changing variable values will continue to be displayed.

Press GO [F1] to resume scrolling.

Press EXIT [F4] to return to the Identifier Display (Figure 4).

DKA4.1.2 Signing-On

To access the List Menu, you must first sign-on with a proper password. From the Identifier Display (Figure 4), press [F1]. The screen will look like Figure 7A or 7C. If the display looks like Figure 7C:

> Someone else has already signed on. Go to the paragraph below that starts "Once you have successfully signed on,…".

If the display looks like Figure 7A:

> Select the Username (default = system) by using the Up and Down Arrow Keys. If the Username system is displayed and no other Username is available (i.e., no others have been assigned), press [ENTER].
>
> Enter a password using the 0 to 9 keys. For security, asterisks will appear as you enter the digits. If you make a mistake, press [F1] and try again or use the delete key to delete the previously pressed key action. The default password is 666666 (used when a password is not known or no password has been assigned). After typing the password, press [ENTER].
>
> If your password is not recognized, the asterisks will be erased after you press [ENTER]. Check your password and try again.

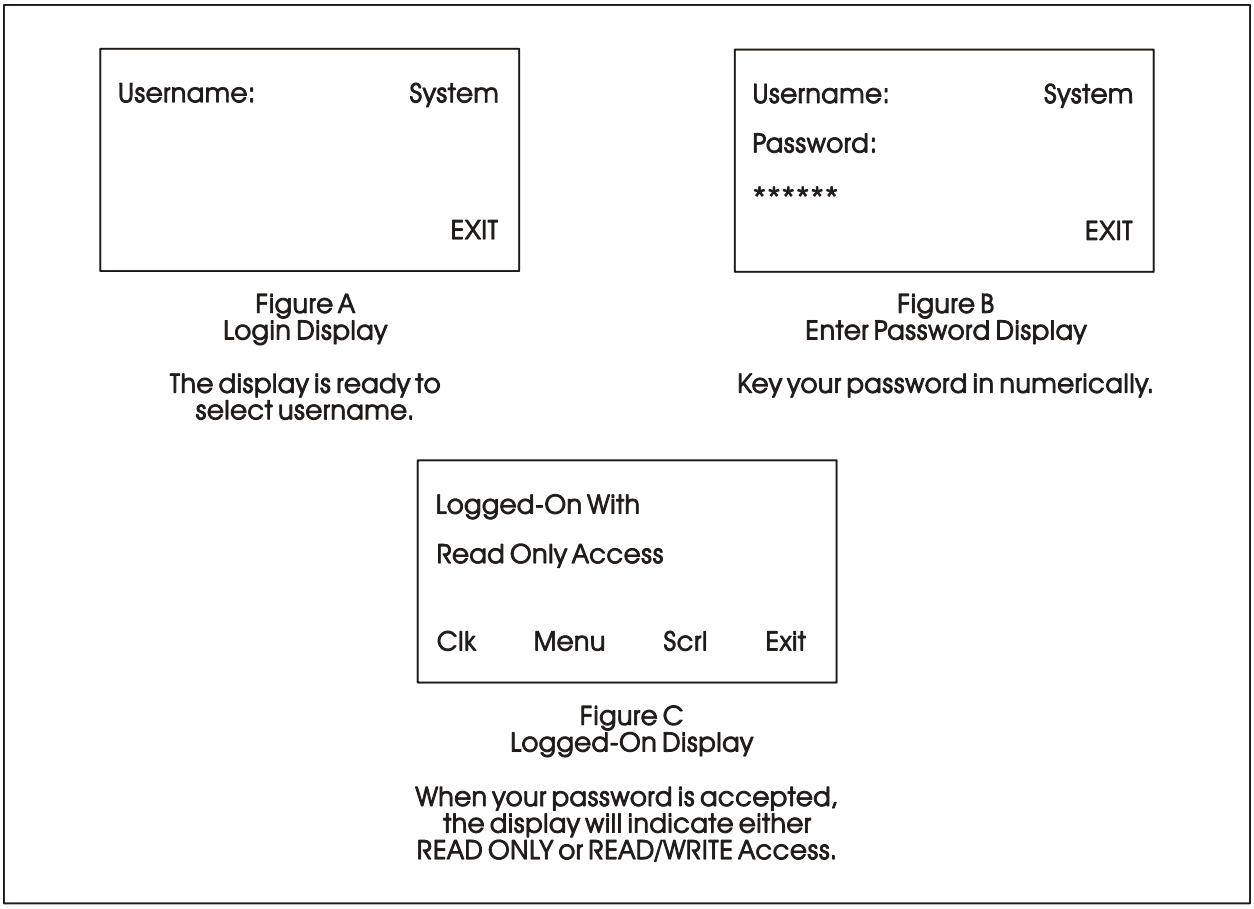


Figure 7 - Logging On

Once the correct password has been entered, the display will look like Figure 7C.

When the second line shows READ/WRITE, you can read and write variable parameters. When it shows READ ONLY you cannot change variable parameters. You are only permitted to read variable information. If your display shows READ ONLY and you want to change variable values, sign-off (press the [INIT] key) and log on with a username and password that provides Read/Write privileges.

Once you have successfully signed on, the legend line will show that you have four options. You can view and change the time and date of the local clock, access more variable lists, Scroll, or return to the Identifier Display. Use function keys F1 through F4 to select the next menu (F1 = Clock, F2 = Menu, F3 = Scroll list & F4 = Exit). Let's start by setting the local clock.

DKA4.1.3 Using the Clock Functions

From the Logged-On Display (Figure 7C), press [F1]. The screen will show the present date and time and will look like Figure 8. Follow the instructions below to change the time or date. When you're finished, press [F4] to exit.

Today's date is shown in the first line in the format month/day/year.

The current time is shown in the form of hours:minutes:seconds.

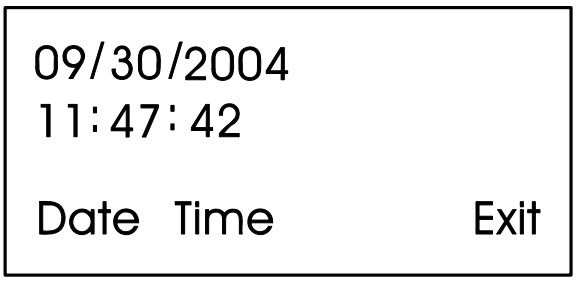


Figure 8 - Clock Display

DKA4.1.3.1 Changing the Time

From the display shown in Figure 8, press Time [F2]. Colons (:) will appear on the third line. Enter the new time there and press [ENTER]. Valid times range from 00:00:00 to 23:59:59. Invalid entries will be ignored. The display will be updated to show the new time.

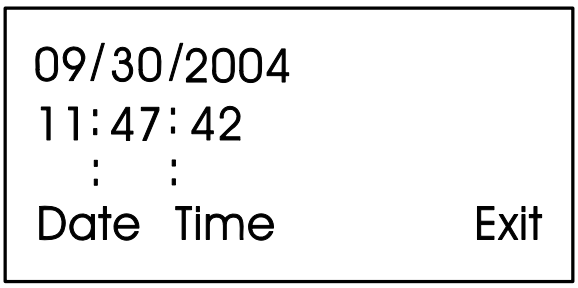


Figure 9 - Time Set Display

If you make a mistake while entering the new time, use [DEL] to backspace and delete one character at a time.

DKA4.1.3.2 Changing the Date

From the clock display (Figure 8, press [F1]. Slash marks (/) will appear on the third line. Enter the new date there and press [ENTER].

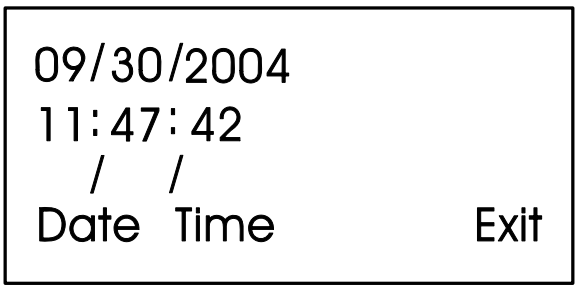


Figure 10 - Date Set Display

If you make a mistake while entering the new date, use [DEL] to back space and delete one character at a time. Press [F4] to return to the Logged-On Display (Figure 7C).

DKA4.1.4 Choosing a Variable List from the List Menu

The List Menu is another area where variable information can be seen. As explained earlier in this section, your first opportunity to read variable information is by choosing the

SCROLL function from the Initial Display. The variable name and value are presented from the Scroll List. This function is available to all users even without signing-on.

The List Menu will show other groups of variable which you can choose to read. This information will be more detailed than the Scroll List.

To get to the List Menu, choose MENU (press [F2]) from the Logged-On Display (Figure 7C).

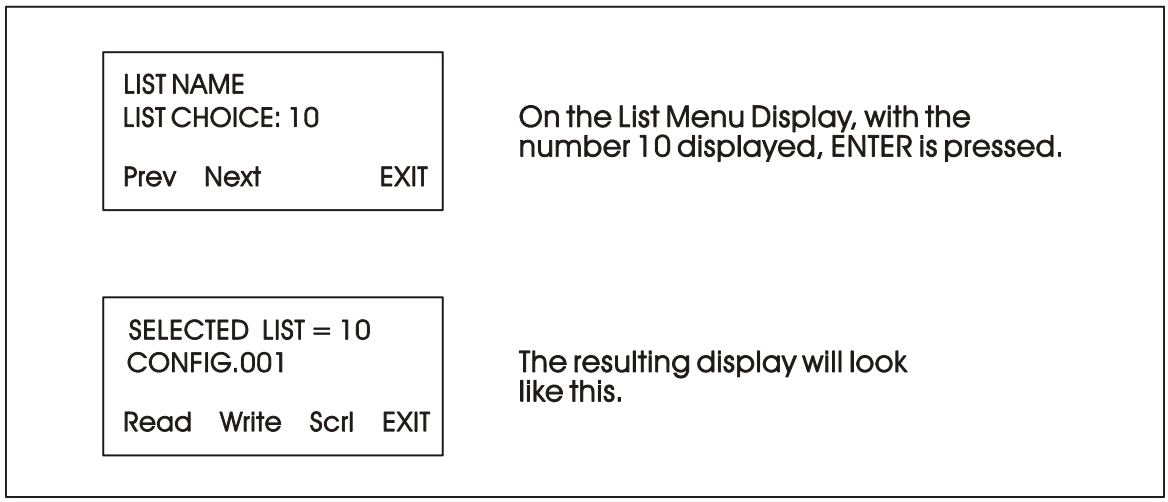


Figure 11 - Using the List Menu Display

The first variable list number in the menu will appear on the second line.

Press PREV (F1) and NEXT (F2) to see the other variable lists that are available in the List Menu. You can also use the Up and Down Arrow Keys to scroll through the various lists. To move directly to a list, enter the list number, then press [ENTER].

DKA4.1.5 Moving Through a Variable List

After READ (F1) or WRITE (F2) has been pressed, the display will show the first variable in the list. An example is shown in Figure 12. Each time NEXT (F2) is pressed; the display will show the next variable in the list. PREV (F1) will show the previous variable. You can also use the Up and Down Arrow Keys to move through a list.

Automatic wraparound occurs in either direction. When you reach the end of the list, [F1] will display the first variable again. At the top of the list, [F2] will display the last variable.

DKA4.1.6 Changing Variable Parameters

From Figure 11, you can change variable parameters by pressing F2 [Write]. Then follow the directions summarized below (see Note 2).

Note 2: If your display does not contain the legend Write in the legend line, your password will only allow you to read variables. If you want to change variable values at this time, you must first log-off and then log-on using the correct password. See your Systems Engineer for the correct password.

Before making any changes, first check the signal inhibit status field (See Figure 12). When

the display shows ME (manual enable) you can change variable parameters. When it shows MI (manual inhibit), you cannot alter the parameters of this variable. If the field indicates MI, press the OPER I/E key to change it to ME.

To change an analog value:

Press CHNG (F3) to clear the third line. Use the number keys 0 through 9 to enter the new value. The minus sign and period are also permitted. Press [ENTER].

If you make a mistake, press CHNG (F3) and enter the number again or use the [DEL] key to erase a character.

Another way to enter new values is by using the arrow up and arrow down keys (located below the [F3] key and left of the [INIT] key). These keys will raise and lower the value by 1% of the displayed amount.

To change the status of a logical variable:

Press CHNG (F3), then use either the down and up arrow keys or the [0/OFF] and [1/ON] keys to change the state of a logical variable. If the [0/OFF] and [1/ON] keys are used, you must also press [ENTER].

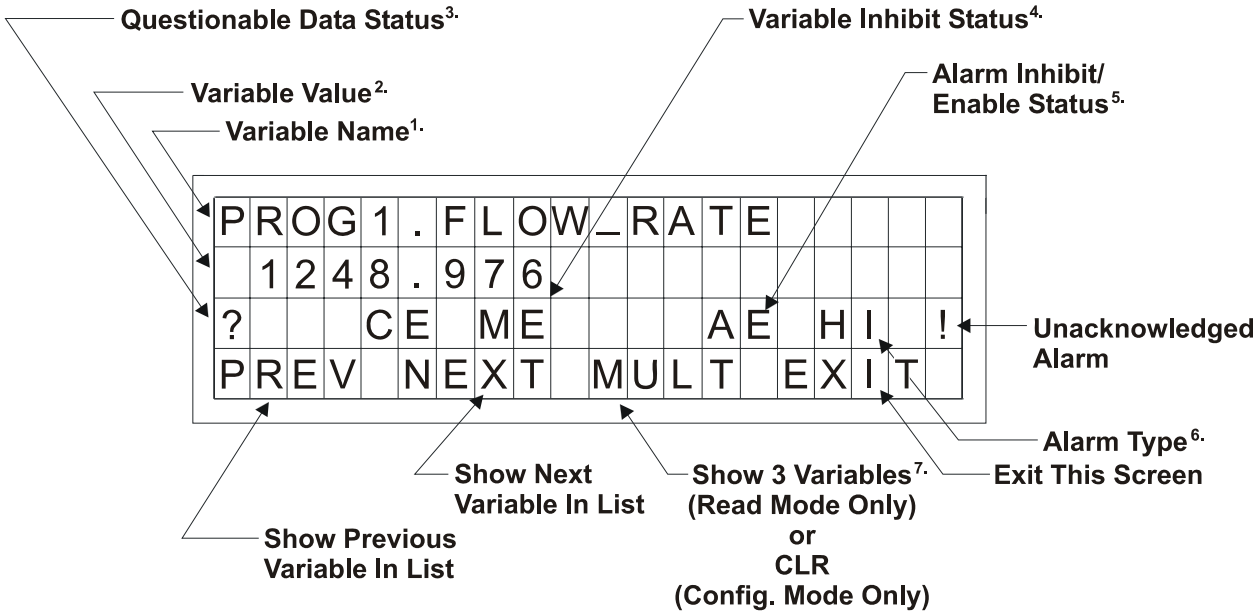


Figure 12 - Interpreting Variable Information

To acknowledge an alarm:

Press [ALM ACK].

To change the alarm enable/inhibit status for alarm variables:

Press [ALM I/E] key. (Note: This will only inhibit alarm reporting, and not alarm level detection.)

Notes for Figure 12

1. Variable Name (Example 1: @GV.FLOW_RATE) (Example 2: @GV.TOTAL_FLOW_RATE)

2. Value - analog value, string value, or logical value. Values which cannot fit in this field will be shown as asterisks.

   Analog values are displayed in floating point format, for example, 0.0125, 99.627, and 1287.66. When the value cannot be shown in floating point format, scientific format is used (1.287668E+10 or 1.25E-02 for example).

3. Questionable Data Status - for analog variables, column 1 will be clear if the status is valid. It will display a question mark if the status is questionable.

4. Variable Inhibit Status

   CE (Control Enable) means this variable can be updated by the ControlWave project.
   CI (Control Inhibit) means the variable cannot be updated by the ControlWave project.
   ME (Manual Enable) means the variable can be changed manually.
   MI (Manual Inhibit) means the variable cannot be changed manually.

5. Alarm Enable (for alarm variables only)

   AE - variable is alarm enabled (changes will be reported).
   AI - variable is alarm inhibited (changes will not be reported).

6. Alarm State

For Analog Variables:		For Logical Variables:	
HH	- high-high alarm	TA	- true alarm
HI	- high alarm	FA	- false alarm
LO	- low alarm	CA	- change-of-state alarm
LL	- low-low alarm		

   ! - alarm is unacknowledged

Notes for Figure 12 (Continued)

7 Multiple Signal Display

In Read Mode, pressing MULT (F3) will display the variable name extension, value, and units for three variables at one time. These variables include the variable displayed when NEXT (F2) was pressed and the next two variables in the list. Press SNGL [F3] to return to viewing one variable at a time (see Figure 12A).

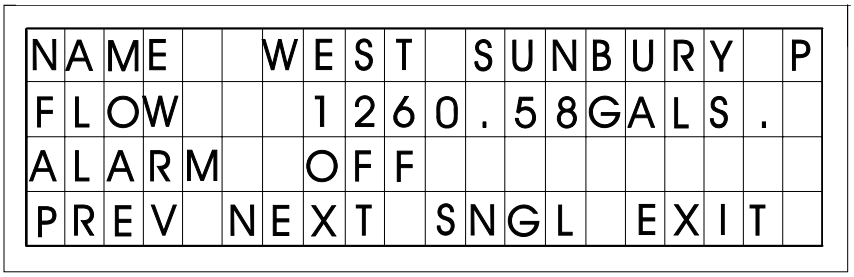


Figure 12A - Example of MULT Display in READ Mode

Variables are shown below as they would appear in SNGL mode.

1) String
SITE_NAME
WEST SUNBURY PUMP STATION
CE ME

2) Analog
TOTAL_FLOW_RATE
1260.578
CE MI

3) Logical
FLOW_ALARM
OFF
CE MI AE NA

DKA4.1.7 Signing-Off

Once you have logged-on, use the [INIT] key at any time to log-off. When this key has been pressed, the screen will look like Figure 13. Press Yes (F1) to sign-off. You are signed-off when the Identifier Display (Figure 3C) appears.

If you do not want to log-off, press Exit (F4) to leave the Log-Off Display.

Once you are signed-on an automatic sign-off will occur if 20 minutes has elapsed since the last key was pressed.

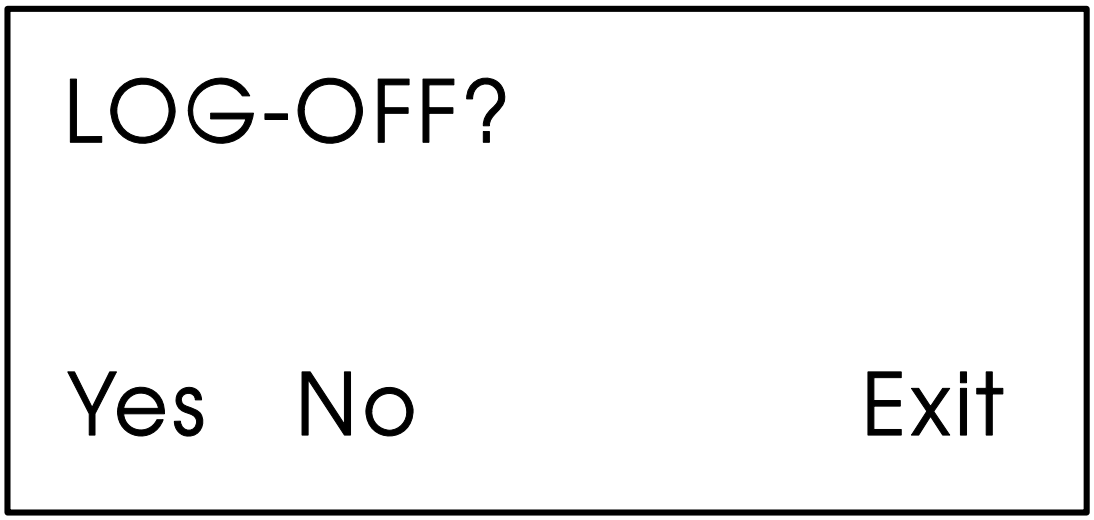


Figure 13 - Log-Off Display

DKA5.1 KEYPAD IDENTIFICATION & INSTALLATION INFO.

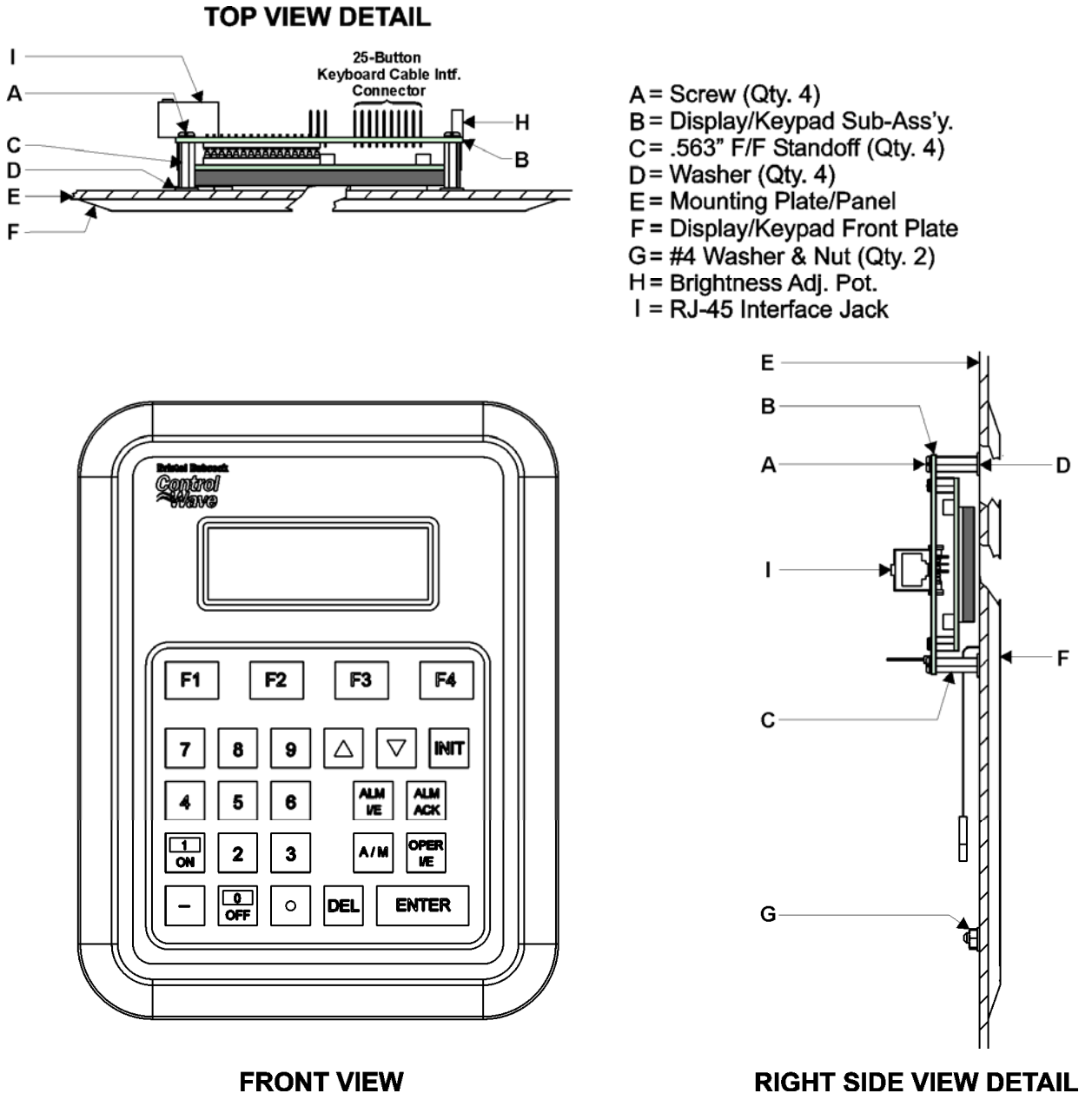


Figure 14 - 25-Button Display/Keypad Assembly Installation Drawing

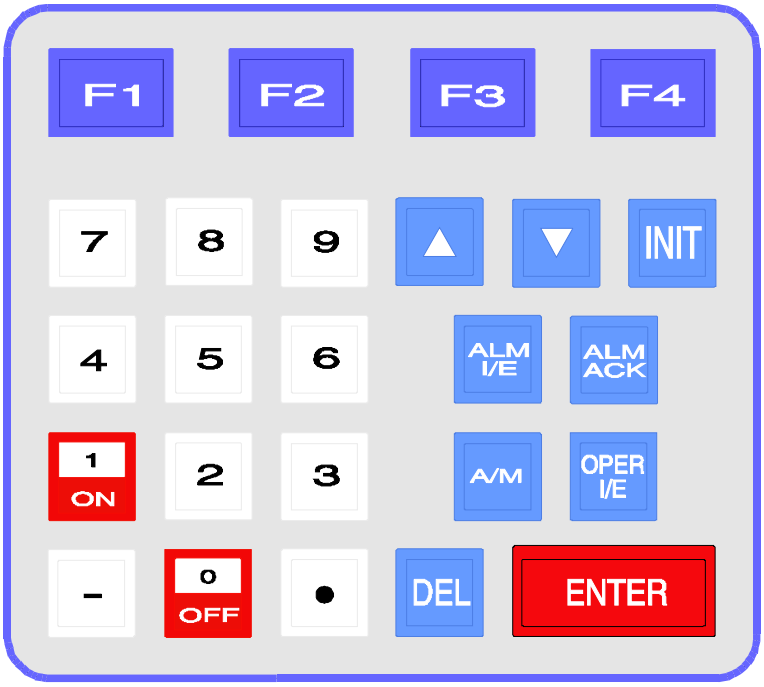


Figure 15 - 25 Button Keypad

Table 1 - 25 Button Keypad Keys

KEY	FUNCTION
F1, F2, F3, F4	Function keys will take on a variety of different functions depending on the situation. The function of these keys is listed on the legend line (bottom line) of the display.
INIT	The INIT key is used to terminate the keyboard session and sign-off.
0 to 9, -, .	These keys are used to change the value of analog variables in the CONFIGURATION mode. The 0/OFF and 1/ON keys are used to change the state of logical variables.
Δ	Each press of this key will raise an analog variable value by 1% of the displayed value or turn a logical variable ON.
∇	Each press of this key will lower an analog variable value by 1% of the displayed value or turn a logical variable OFF.
ALM I/E	Use this key to enable or inhibit alarm variables.
ALM ACK	Use this key to acknowledge alarms.
A/M	Toggle between AUTO (CE) and MANUAL (CI) with this key.
OPER I/E	Toggle between manual inhibit (MI) and enable (ME) with this key.
DEL	Use this backspace key to erase digits that have been entered on the keypad.
ENTER	This key is used to enter new data from the display into the controller, e.g., password or variable values.

ControlWave_35 & ControlWave_31
Material Safety Data Sheets

A Material Safety Data Sheet is provided herein to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. This standard must be consulted for specific requirements.

Material Safety Data Sheets are provided in the order listed in Table Z-1 below.

TABLE Z-1
MSDS for ControlWave_35 & ControlWave_31 Instruction Document
(PIP-CW_35 Upgrade Kit)

Manufacturer	General Description	Part Number
DURACELL	3V Lithium Manganese Dioxide Battery	DL 2450

Bristol, Inc Part Number = 395620-01-5

The 3V Lithium Manganese Dioxide Battery is situated on the CW_35 or CW_31 CCPU Board.

Gillette
Environment
Health and Safety

37 A Street
Needham, MA 02492
Tel 781.292.8151

MATERIAL SAFETY DATA SHEET

NAME: DURACELL LITHIUM MANGANESE DIOXIDE COIN BATTERIES

CAS NO: Not applicable **Effective Date:** 8/8/03 **Rev:** 3

A. — IDENTIFICATION

	%
Manganese Dioxide (1313-13-9)	65-75
Propylene Carbonate (108-32-7)	10-15
Lithium (7439-93-2)	5-10
Graphite, synthetic (7440-44-0)	5-10
1,2-Dimethoxyethane (110-71-4)	1-10
Lithium Perchlorate (7791-03-9)	<1.5

Formula: Mixture — Mixture

Molecular Weight: NA

Synonyms: Lithium Manganese Dioxide Coin Cells: 3V-DL2016; DL2025; DL2430; DL2450; DL2032; DL1616; DL1620

B. — PHYSICAL DATA

Boiling Point	Melting Point	Freezing Point
NA °F NA °C	NA °F NA °C	NA °F NA °C
Specific Gravity (H_2O=1)	**Vapor Density (air=1)**	**Vapor Pressure @ ____ °F**
NA	NA	NA mm Hg
Evaporation	**Saturation in Air**	**Autoignition Temperature**
(Ether =1)	(by volume@ ____ °F)	____ °F ____ °C
NA	NA	NA
% Volatiles	**Solubility in Water**	**pH**
NA	NA	NA

Appearance/Color: Coin cells. Contents dark in color.

Flash Point and Test Method(s): 1,2-Dimethoxyethane (Approximately 3-7% of contents): 42.8 °F, 6°C (Closed Cup)

Flammable Limits in Air (% by volume): Lower NA % Upper NA %

C. — REACTIVITY

Stability				Polymerization			
	[X]	stable	[ ] unstable		[ ]	may occur	[X] will not occur

Conditions to Avoid	Conditions to Avoid
Do not heat, crush, disassemble, short circuit or recharge.	Not applicable
Incompatible Materials	**Hazardous Decomposition Products**
Contents incompatible with strong oxidizing agents.	Thermal degradation may produce hazardous fumes of manganese and lithium; oxides of carbon and other toxic by-products.

*** IF MULTIPLE INGREDIENTS, INCLUDE CAS NUMBERS FOR EACH** **NA=NOT AVAILABLE**

Footnotes

Not applicable

D. — HEALTH HAZARD DATA

Occupational Exposure Limits PEL's, TLV's, etc.)

8-Hour TWAs: Manganese Dioxide (as Mn) - 5 mg/m^3 (Ceiling) (OSHA); 0.2 mg/m^3 (ACGIH/Gillette)
1,2-Dimethoxyethane - 0.15 ppm (Gillette)
Graphite (all kinds except fibrous) - 2 mg/m^3 (synthetic, ACGIH); 15 mg/m^3 (total, OSHA); 5 mg/m^3 (respirable, OSHA)

These levels are not anticipated under normal consumer use conditions.

Warning Signals

Not applicable

Routes/Effects of Exposure

These chemicals and metals are contained in a sealed can. For consumer use, adequate hazard warnings are included on both the package and on the battery. Potential for exposure should not exist unless the battery leaks, is exposed to high temperature, is accidentally swallowed or is mechanically, physically, or electrically abused.

1. Inhalation	Not anticipated. Respiratory (and eye) irritation may occur if fumes are released due to heat or an abundance of leaking batteries.
2. Ingestion	An initial x-ray should be obtained promptly to determine battery location. Batteries lodged in the esophagus should be removed immediately since leakage, burns and perforation can occur as soon as 4-6 hours after ingestion. Irritation to the internal/external mouth areas may occur following exposure to a leaking battery.
3. Skin	a. Contact Irritation may occur following exposure to a leaking battery. b. Absorption Not anticipated.
4. Eye Contact	Irritation may occur following exposure to a leaking battery.
5. Other	Not applicable

E. — ENVIRONMENTAL IMPACT

1. Applicable Regulations	All ingredients listed in TSCA inventory.
2. DOT Hazard Class -	Not applicable
3. DOT Shipping Name -	Not applicable

While lithium batteries are regulated by IATA and ICAO, the type of lithium batteries offered for sale by DURACELL are considered non-hazardous per provision A45 of the IATA Dangerous Goods Regulations and provision A45 of the ICAO Technical Instructions For The Safe Transport Of Dangerous Goods By Air. Per section A45 of the IATA and ICAO regulations, properly marked, labeled and packaged DURACELL consumer lithium batteries, which are of the solid cathode type, with less than 1g lithium per cell and less than 2g lithium per battery, are exempt from further regulation. When these batteries are separated to prevent short circuits and properly packaged in strong packaging (except when installed in electronic devices), they are acceptable for air transport as airfreight without any other restrictions. In addition, when installed in equipment or when no more than 24 cells or 12 batteries meeting the A45 provision are shipped, they are not subject to special packaging, marking, labeling or shipping documentation requirements. Thus, these batteries are not considered hazardous under the current regulations and are acceptable for air transport.

Environmental Effects

These batteries pass the U. S. EPA's Toxicity Characteristic Leaching Procedure and therefore, maybe disposed of with normal waste.

F. — EXPOSURE CONTROL METHODS

Engineering Controls

General ventilation under normal use conditions.

Eye Protection

None under normal use conditions. Wear safety glasses when handling leaking batteries.

Skin Protection

None under normal use conditions. Use butyl gloves when handling leaking batteries.

Respiratory Protection

None under normal use conditions.

Other

Keep batteries away from small children.

G. — WORK PRACTICES

Handling and Storage

Store at room temperature. Avoid mechanical or electrical abuse. **DO NOT** short or install incorrectly. Batteries may explode, pyrolize or vent if disassembled, crushed, recharged or exposed to high temperatures. Install batteries in accordance with equipment instructions. Replace all batteries in equipment at the same time. Do not carry batteries loose in pocket or bag.

Normal Clean Up

Not applicable

Waste Disposal Methods

No special precautions are required for small quantities. Large quantities of open batteries should be treated as hazardous waste. Dispose of in accordance with federal, state and local regulations. Do not incinerate, since batteries may explode at excessive temperatures.

H. — EMERGENCY PROCEDURES

Steps to be taken if material is released to the environment or spilled in the work area

Evacuate the area and allow vapors to dissipate. Increase ventilation. Avoid eye or skin contact. **DO NOT** inhale vapors. Clean-up personnel should wear appropriate protective gear. Remove spilled liquid with absorbent and contain for disposal.

Fire and Explosion Hazard	Extinguishing Media
Batteries may burst and release hazardous decomposition products when exposed to a fire situation. See Sec. C.	As for surrounding area. Dry chemical, alcohol foam, water or carbon dioxide. For incipient fires, carbon dioxide extinguishers are more effective than water.

Firefighting Procedures

Cool fire-exposed batteries and adjacent structures with water spray from a distance. Use self-contained breathing apparatus and full protective gear.

I. — FIRST AID AND MEDICAL EMERGENCY PROCEDURES

Eyes

Not anticipated. If battery is leaking and material contacts eyes, flush with copious amounts of clear, tepid water for 30 minutes. Contact physician at once.

Skin

Not anticipated. If battery is leaking, irrigate exposed skin with copious amounts of clear, tepid water for a least 15 minutes. If irritation, injury or pain persists, consult a physician.

Inhalation

Not anticipated. Respiratory (and eye) irritation may occur if fumes are released due to heat or an abundance of leaking batteries. Remove to fresh air. Contact physician if irritation persists.

Ingestion

Consult a physician. Published reports recommend removal from the esophagus be done endoscopically (under direct visualization). Batteries beyond the esophagus need not be retrieved unless there are signs of injury to the GI tract or a large diameter battery fails to pass the pylorus. If asymptomatic, follow-up x-rays are necessary only to confirm passage of larger batteries. Confirmation by stool inspection is preferable under most circumstances. If mouth area irritation/burning has occurred, rinse the mouth and surrounding area with clear, tepid water for at least 15 minutes.

Notes to Physician

1) For information on treatment, telephone (202)-625-3333 collect.
2) Potential leakage of less than 50 milligrams of propylene carbonate (CAS #108-32-1) and dimethoxyethane (CAS #110-71-4).
3) Dimethoxyethane readily evaporates.
4) Under certain misuse conditions and by abusively opening the battery, exposed lithium can react with water or moisture in the air causing potential thermal burns or fire hazard.

Replaces # 1461

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