



CONTROLweb™

3U Modular I/O

User Manual

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Preface

About this manual

This manual is designed to serve as a guideline for the installation, set up, operation and basic maintenance of the CONTROLweb™ Remote I/O Unit. The information contained within this manual, including product specifications, is subject to change without notice. Please observe all safety precautions and use appropriate procedures when handling this product and its related software.

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1 General Information

CONTROLweb™ is a system for providing high density networked I/O in standard 4U, or customer specific modules. Each system consists of the following components

- NetCom card
- I/O cards
 - Digital
 - Analog
 - Interlock
- Card cage with rear and/or side signal distribution

Each node communicates to a master using Modbus/TCP protocol. Setup and data is also available through standard web browser and through the TOOLweb ToolSide Interface (XML over HTTP).



1.1 Theory of Operation

A CONTROLweb unit operates mainly as Ethernet controlled remote I/O. In addition, several features have been added which extend its functionality to provide a unique distributed control architecture and independent monitoring for Fault Detection and Correlation (FDC).

Each of these functions falls under two main technology categories:

CONTROLweb features

- Modbus/TCP slave I/O
- Distributed logic and peer-to-peer control (*future*)
- I/O diagnostics and manual control

Note: CONTROLweb data is related to raw, **physical** entities. All scaling and logical assignment exists in the module controller which hosts the Modbus/TCP master.

TOOLweb features

- Up to 64 variables for offline and real-time data collection
- Logical names and scaling of selected input points
- Collection plans, with selectable frequency
- Web browser based data plots and download to local host
- XML real-time data streaming for FDC/APC applications

Note: TOOLweb data is **logical**, with all scaling and identification residing on the I/O module.

1.2 CONTROLweb 3U Architecture

The 3U architecture provides a modular approach for creating high density modules of I/O, with combinations of DIDO, AIAO, Serial and Interlock. A card cage hosts these 3U Eurocards, and provides rear and/or side signal distribution using standard or customer specific connection points.

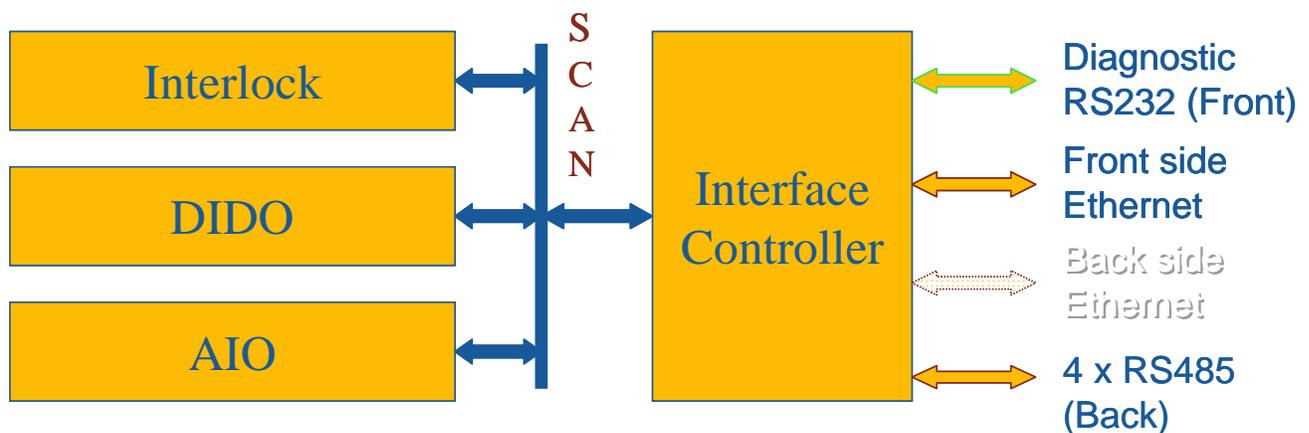
Netcom card is the main processing card:

- Motorola Coldfire 32 bit processor
- Ethernet connectivity and Ethernet switch
- 4 UART's with s/w selectable RS232/485 functionality
- Internal CAN bus controller, for plug-and-play I/O

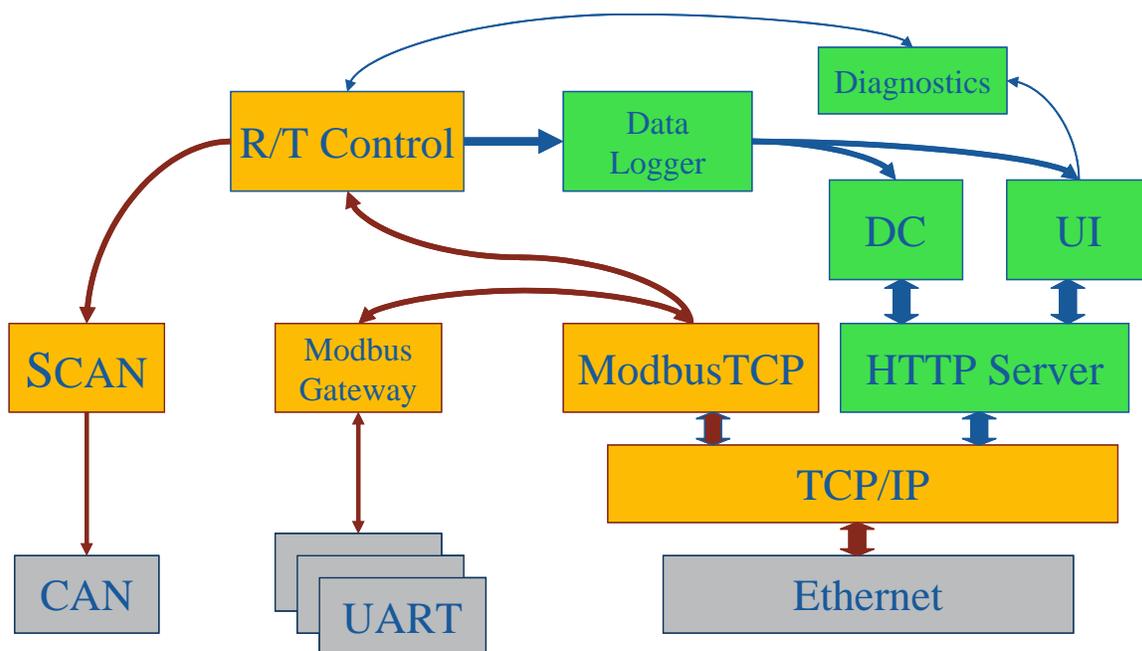
I/O Cards:

- CDN491-C-E Digital I/O Card
 - 48 in/out points
 - Each point in/out
 - 24V, active low
- CDN496-C-E Analog I/O Card
 - 32 analog in, 16 analog out
 - 12 bit, single ended
- CDN497-C-E (Part of CDN500-x-C-E)
 - Interlock Card, dual slot
 - 36 – 68 Relays
 - 8 – 32 DIDO

CONTROLweb 3U Physical Architecture



CONTROLweb 3U Functional Architecture



2 Installation & Setup

The base operation of a CONTROLweb 3U unit, is to provide remote, slave I/O to a control system. This section describes electrical installation and software configuration to provide operation of I/O.

2.1 CONTROLweb Interface Description

Installation instructions will be based upon a standard configuration of modules:

Part Number	Description	Slot
AS00482-02	Card cage, 4U, 4 I/O Slots	0
CDN491-C-E	Card, DIDO	1
CDN496-C-E	Card, AIAO	2
CDN500-x-C-E	Card, Interlock	3

Interfaces

Ethernet Interface – Monitor

Serial Port – Monitor

Power input – DC

Com 1

I/O connectors

Com 2, Com 3



Interfaces

LED indicators

Interlock status – scrolling



Ethernet Interface – Control

I/O connectors

Com 4

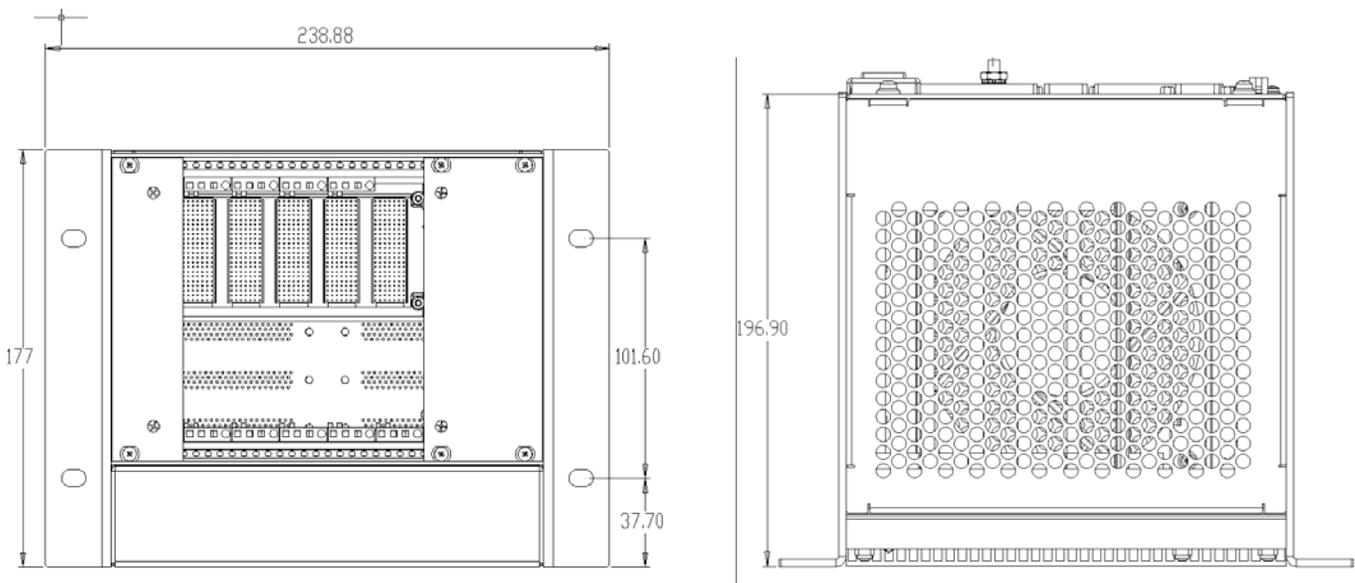
2.2 Mechanical Installation

Install all cards into their correct slots.

Note, card cage can be configured for any combination of I/O cards. Zero ohm resistors are located on the backplane to route the correct power for each type of card. Contact an MKS application engineer for details.

Mount card cage using the 4 front, slotted mounting holes.

Ensure proper ventilation of cage. Air flow moves from bottom (fan tray) to top (perforated cover). Keep at least 1" open on top and bottom of the cage. For thermal verification, running temperature of cards can be monitored from the web based interface.



2.3 Electrical Installation

2.3.1 Power Wiring

Power connector provides inputs for 24, +15, -15 VDC.

Cage Connector: AMP Mate-n-Lok # 194018-1

Mating Connector: AMP Mate-n-Lok # 770016-1

Pins: AMP Socket # 770251-3

Power Connector Pinout

Pin	Description
1	+24V IN
2	24V COMM
3	+15V IN
4	15V COMM
5	-15V IN

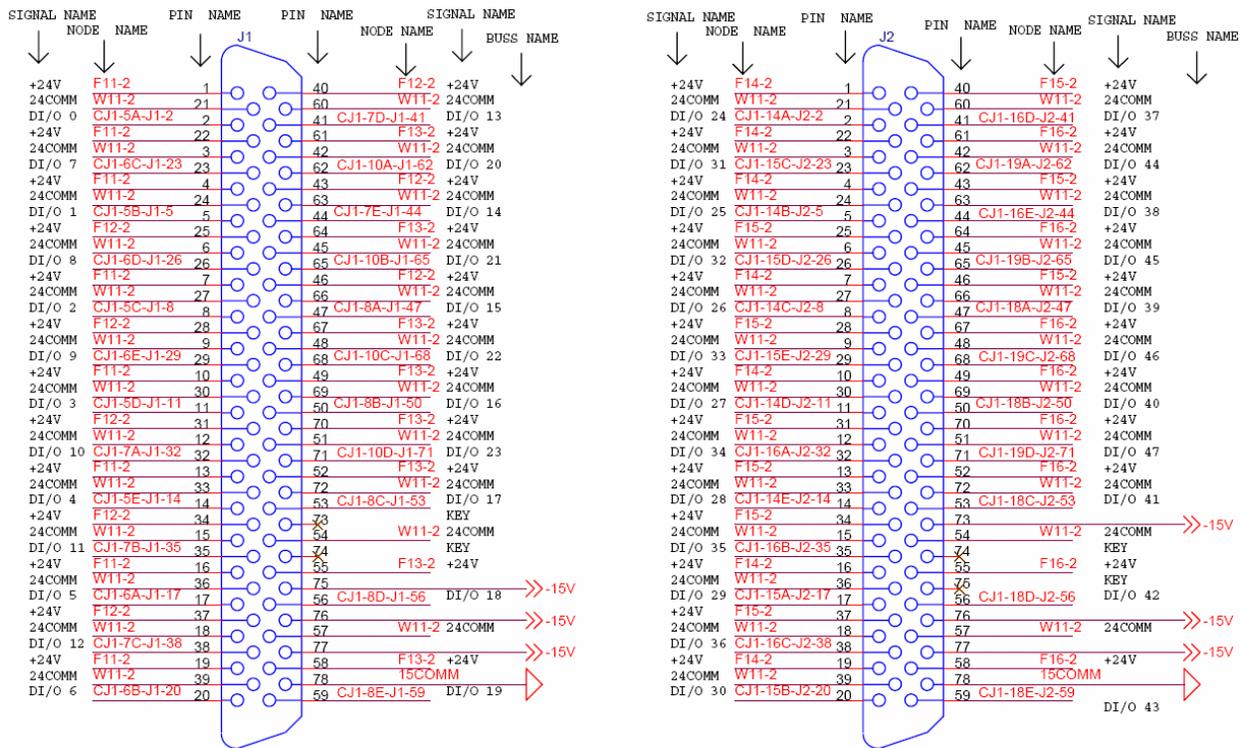
2.3.2 I/O Wiring

Each I/O card slot is assigned to (2) rear signal distribution connectors. Use the below pinouts, in conjunction with the manual for each I/O card, which designates the electrical specifications for that card.

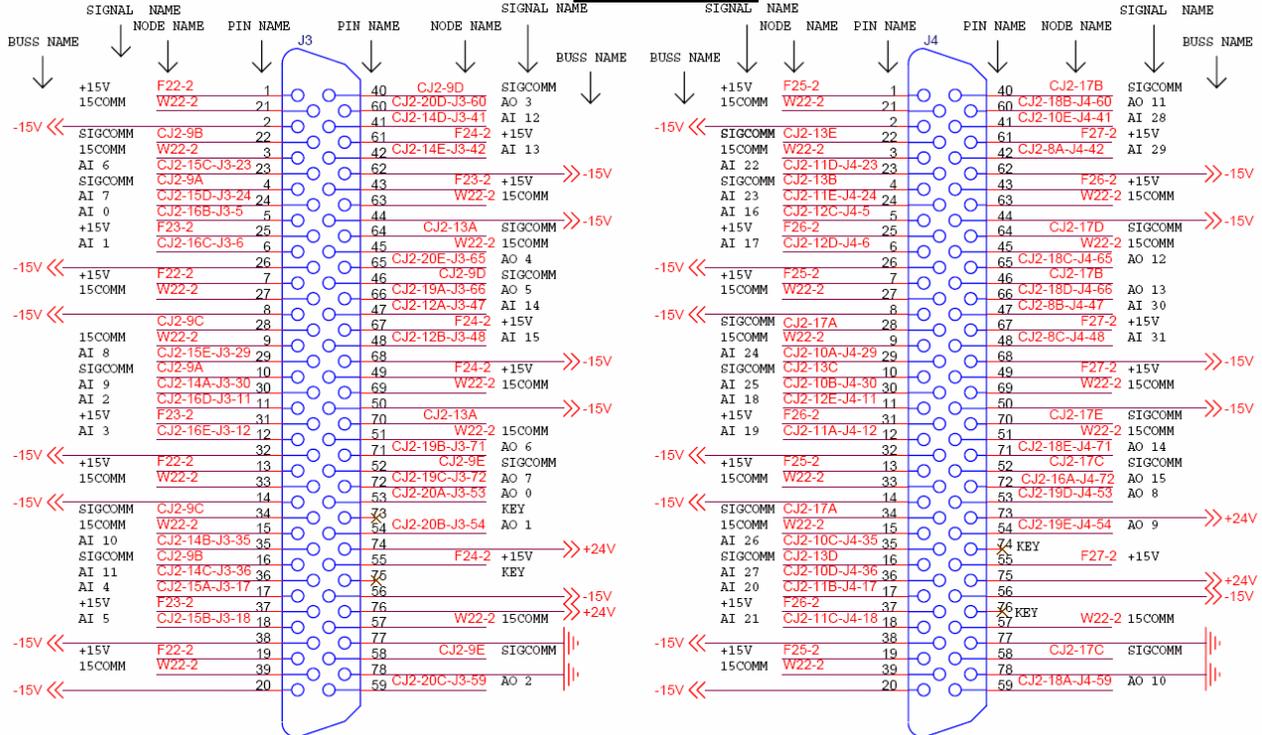
Cage Connector: AMP 748831-1

Mating Connector:

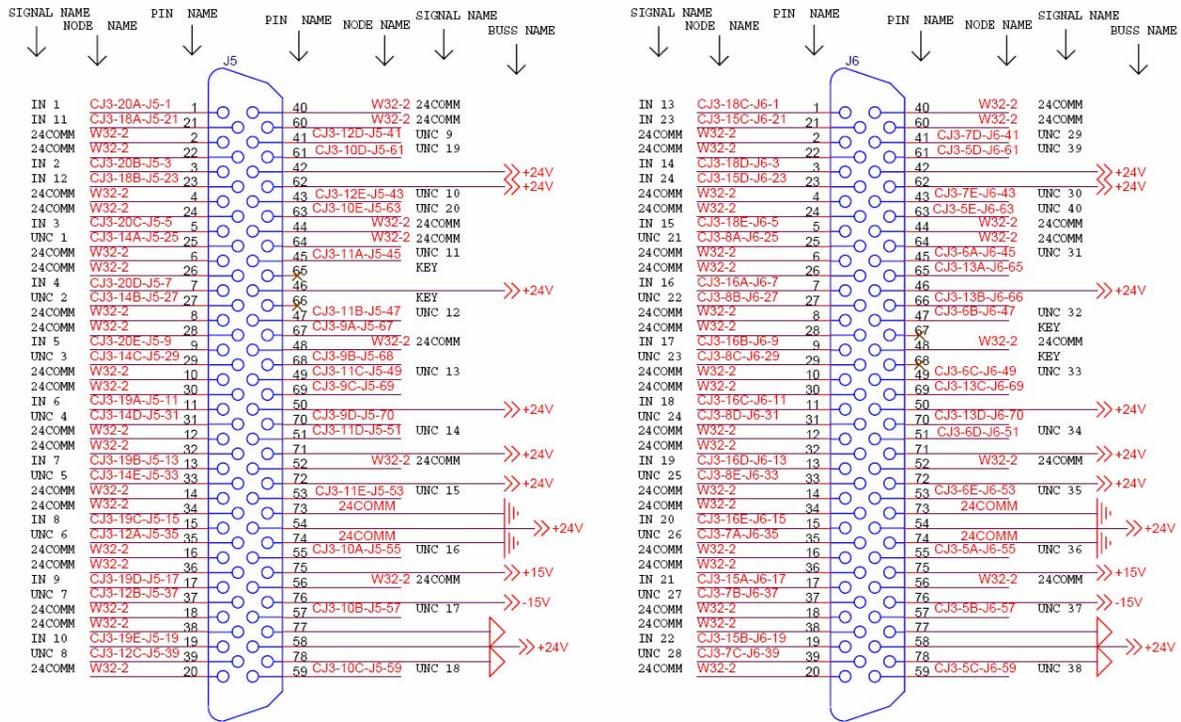
DIDO Signals



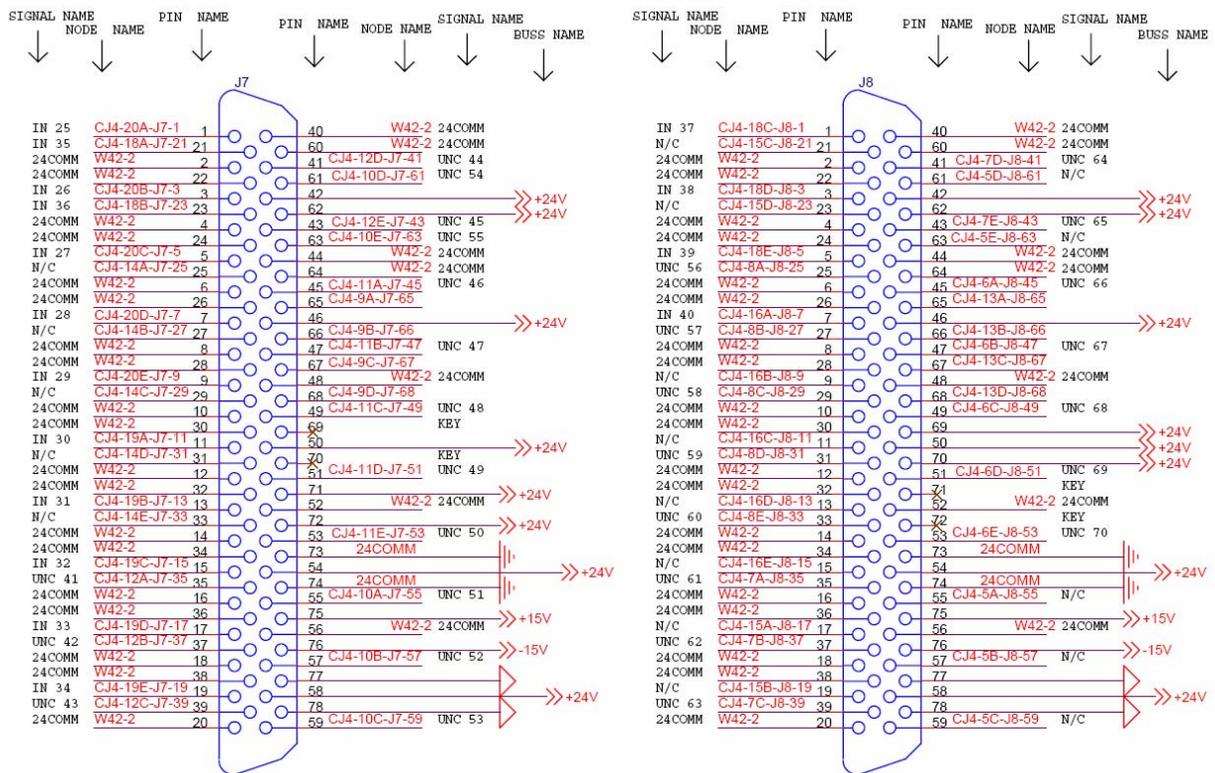
AIAO Signals



Interlock Signals – Slot 3

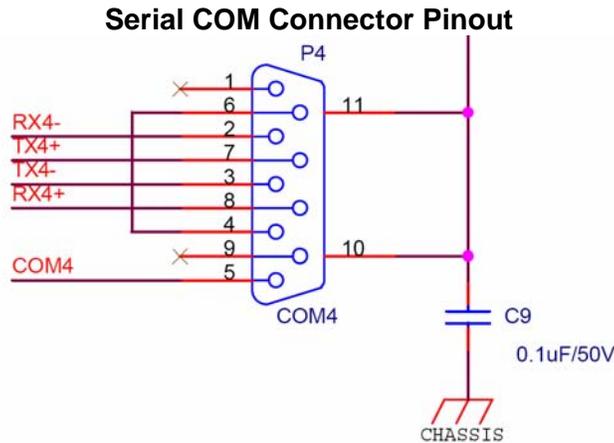


Interlock Signals – Slot 4



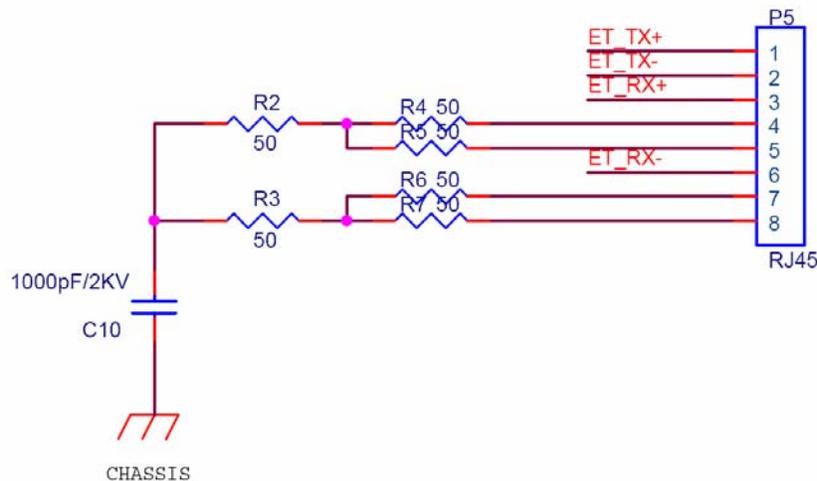
2.3.3 Com Port Configuration

There are 4 available serial communication ports. Each is s/w selectable for RS232/485. Use web browser configuration for all serial port settings.



2.3.4 Ethernet Connector

CONTROLweb 3U contains a single 100BT Ethernet controller, and an Ethernet switch. The rear connector has highest priority, and is intended for all control functions. The front connector, located on the Netcom card, is intended for monitoring functions.



2.4 NetCom Card

The Netcom card is the main processor of the 3U Ethernet I/O system. Netcom manages all connectivity with the master controller, controls all I/O functions and provides a user interface through a built-in web browser.



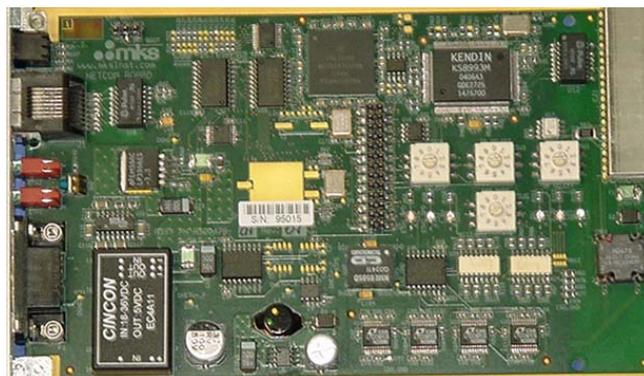
Interfaces

Status LED – Local Module
 Status LED – Remote Network

Ethernet Port – Monitoring

Status LED's – Front Ethernet
 Status LED's – Rear Ethernet

Serial Port - Monitor



2.4.1 IP Address Rotary Switches

IP Address Rotary Switches

IP0, IP1, IP2 - These three decimal digits form a number between 0 to 999 which specifies the last two network segments.

Example: 192.168.y.x

0 - Use automatic IP address configuration using DHCP protocol

1 - 999 - Set the IP address to 192.168.y.x

where

w = current setting of the three switches

x = w mod 256

y = floor(w / 256)

for example, if the three rotary switches are set to 770, the IP address will be set to 192.168.3.2

The netmask will always be set to 255.255.255.0, and the default gateway will be configured so that the first three numbers equal those of the IP address, and the last equals to "1", in the above example the gateway will be set to 192.168.3.1

NOTE: Some combinations of the rotary switch settings may yield to illegal IP address setting, e.g. addresses reserved to local broadcast addresses. Such combination should be avoided. For example, 192.168.0.255 is a reserved address, hence the setting of "255" on the rotary switches must be avoided.

2.4.2 Operation Mode Rotary Switch

All even mode numbers enable the three IP address switches, and allow them to override the current non-volatile memory settings

All odd mode values, lead to using the non-volatile memory setting instead of the switches.

Mode 0,1 - Normal Production Operation Mode, Diagnostics disabled, Network Watch-Dog Enabled

Mode 2,3 - Field diagnostic mode, Normal operation with Watch-Dog, Diagnostics disabled

Mode 4,5 - Not Defined

Mode 6,7 - Not Defined

Mode 8,9 - Manual Configuration mode.

When the Mode switch is set to "9" and the IP address switches are set to "000", the factory configuration parameters, serial number, Ethernet hardware address can be changed.

2.4.3 Indicator LEDs

LOCAL STATUS "LOC"

Off	-	Power Off
Steady Green	-	Not Used
Blinking Green	-	Normal Operation
Green-Amber	-	Local Auto-Configuration in progress
Solid Amber	-	Software initialization in progress
Blinking Amber	-	Self-Diagnostics in progress
Green-Red	-	Thermal Warning
Amber-Red	-	Internal Communication Failure
Blinking Red	-	Safety Warning / Interlock Failure

REMOTE STATUS "REM"

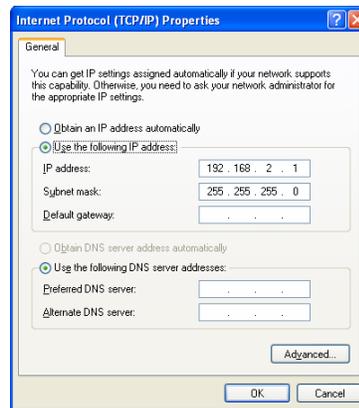
Off	-	Power off, unit self-test
Steady Green	-	Not Used
Blinking Green	-	Network Good, Master Connected, Watch-Dog Enabled
Green-Amber	-	Network Good, Master Connected, Watch-Dog Disabled
Solid Amber	-	Network Good, Waiting for Master to connect
Blinking Amber	-	Network Configuration Error: Wrong IP address, no other network devices
Green-Red	-	Network Auto-Configuration In Progress
Amber-Red	-	Network interface internal error
Blinking Red	-	Not Used (Safety Warning)

3 Quick-Start

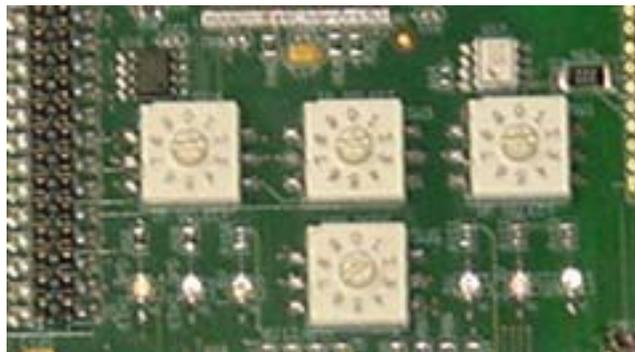
This section provides a quick method to connect to a CONTROLweb 3U I/O module, and manually turn on a digital output, through the web browser interface.

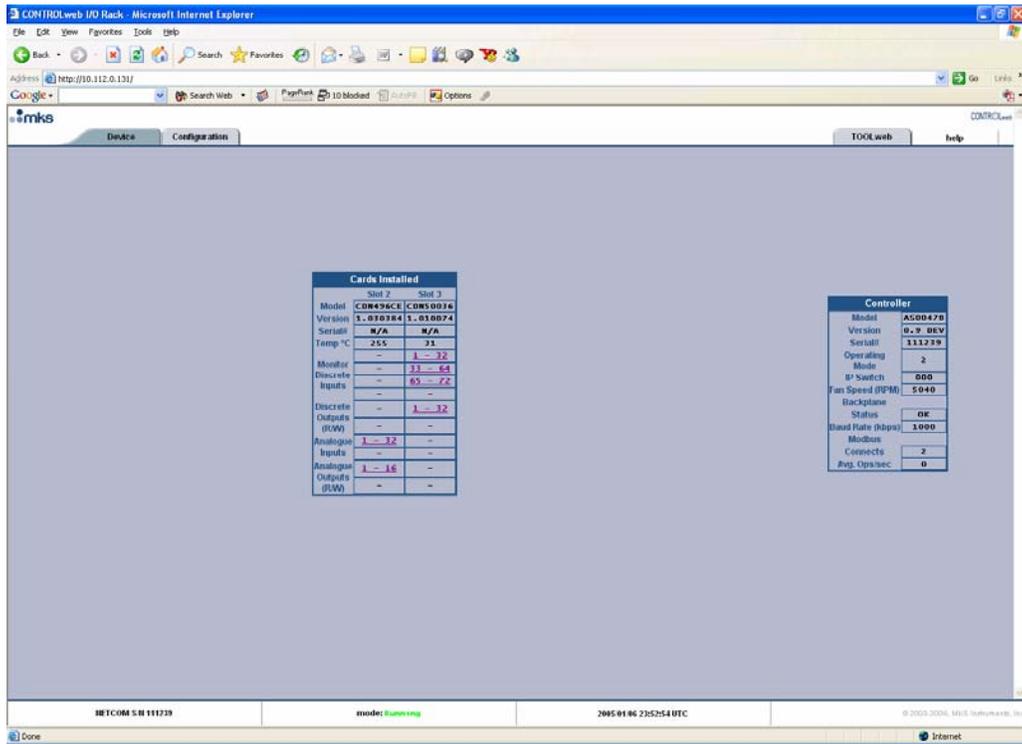
1. Modify your network TCP/IP settings to match the following:

PC IP Address: **192.168.1.1**
PC Netmask: **255.255.255.0**

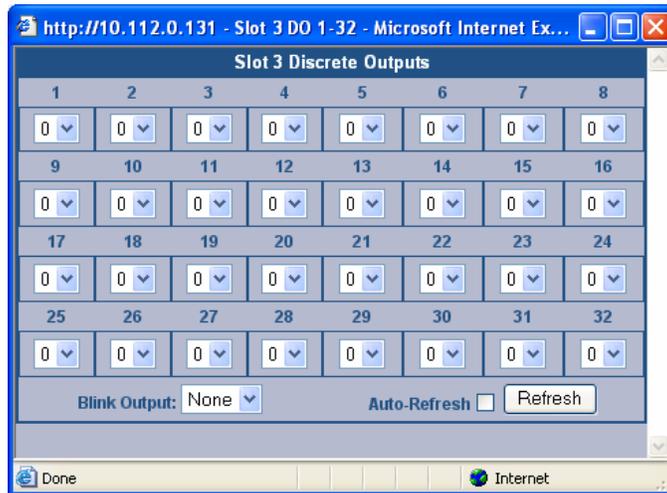


2. Set the IP Address of the CONTROLweb 3U unit to be **192.168.1.2** and Mode for user diagnostics. This is done by setting the Mode Switch to **2**, and the IP Address Switches to **2 5 8** (sets last 2 network segments as .1 .2).
3. Start up a web browser and point it to **192.168.1.2**. You will see the main CONTROLweb configuration page, showing an overview of the cards in the unit, and status





4. Click on the link to Digital Output access.



5. Change an output state by writing a 1 to that location. Note, LED on the DIDO card for that channel, will turn green.

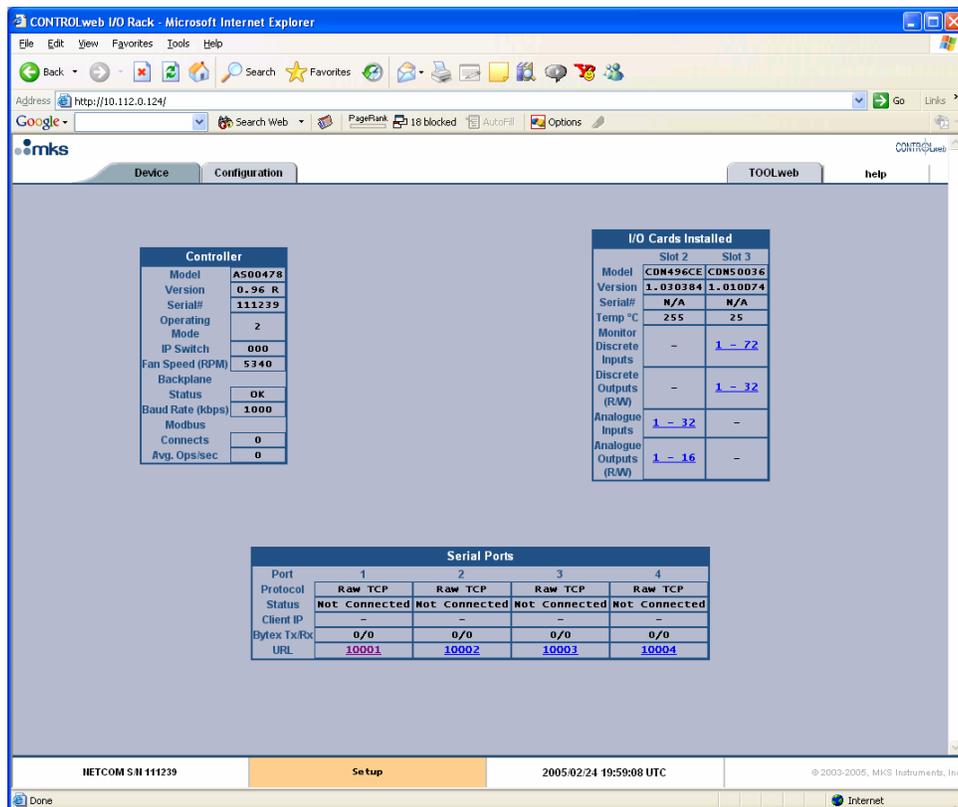
4 CONTROLweb™ User Interface

The user interface is web based. You can access it by simply browsing to the IP-Address of the CONTROLweb node.

Note  Microsoft Internet Explorer versions less than 5.5 may not function as expected due to limitations of the browser.

The main page of the CONTROLweb unit shows a top view of the module. This is referenced as the Device tab.

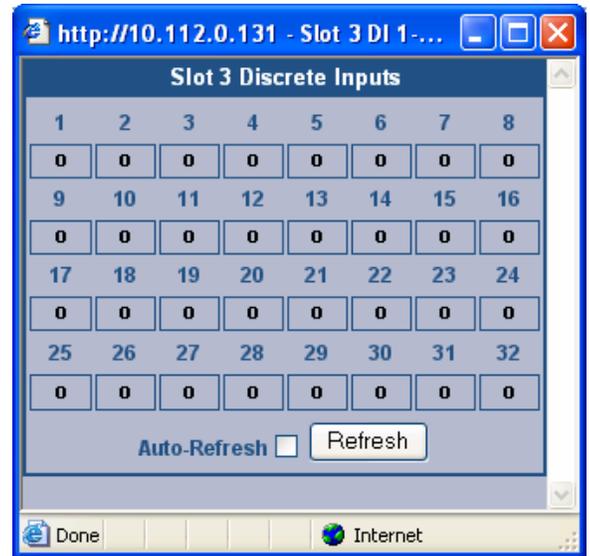
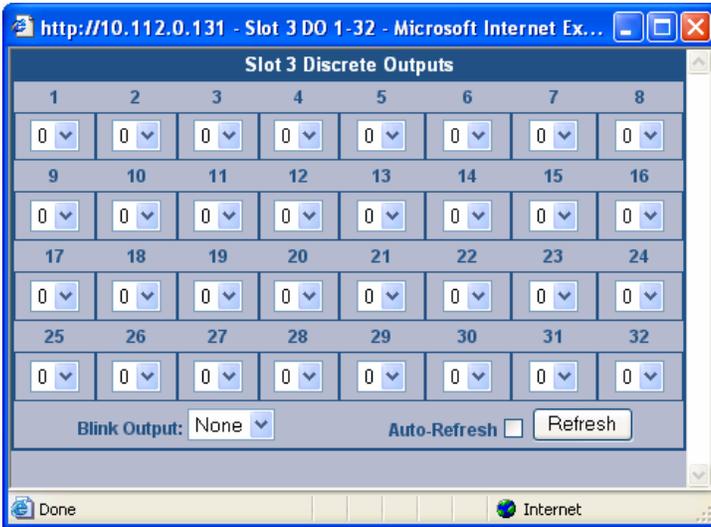
- I/O cards installed are shown in the center of the page.
- Netcom CPU status is shown on the right side of the page. (dynamic)
- Bottom toolbar shows module main clock and status. (dynamic)



4.1 I/O User Interface

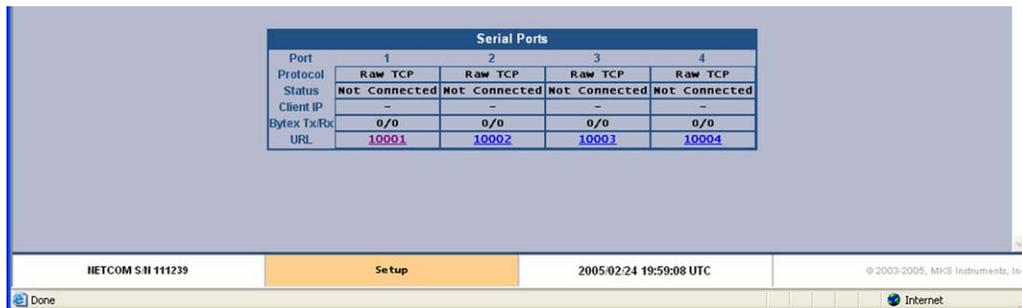
By selecting I/O of interest from the main page, a pop-up will appear for each section of I/O.

- Inputs can be read. (dynamic)
- Outputs can be set manually, in Netcom mode 2 or 3 only. (dynamic)

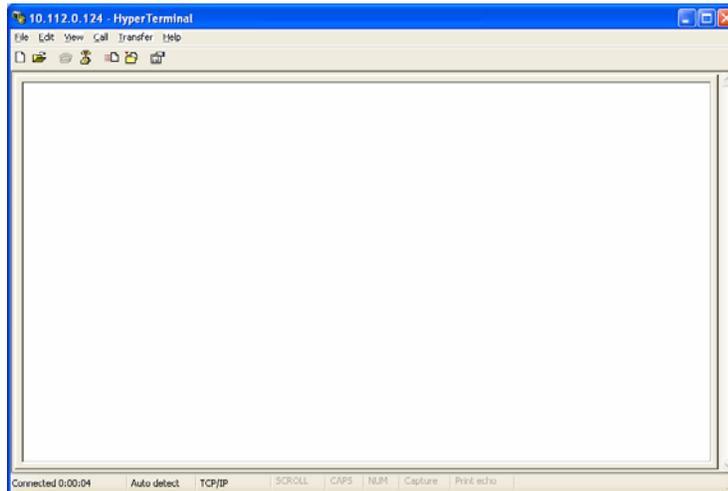


4.2 Communication Port Interface

Click on a port to establish communication using your local Telnet server.



A serial communication session will be established which allows you to communicate to connected serial devices:



4.3 Module Configuration

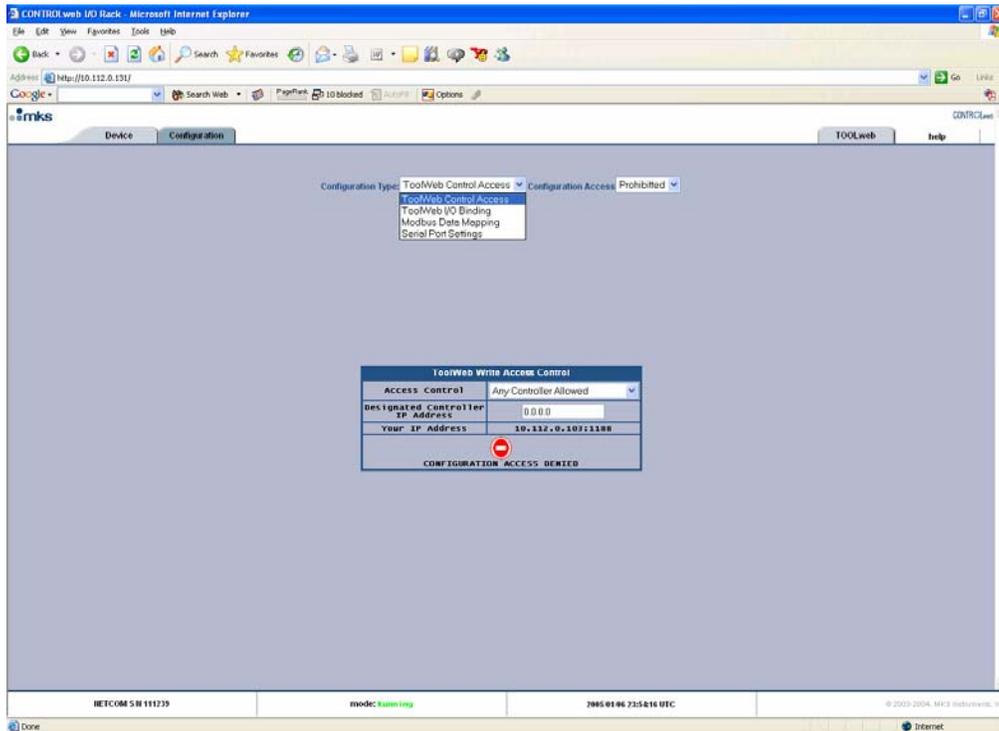
The Configuration tab provides access to all configurable settings for the module. This includes:

- Modbus/TCP Data Mapping
- Serial port settings
- TOOLweb control access
- TOOLweb I/O bindings

Note



Changes to configuration can only happen in Netcom mode 2,3 AND you must gain access within the first 60 seconds after system boot. Changes are locked-out after 60 seconds.



Main Configuration Page

4.3.1 Modbus/TCP Data Mapping

Since CONTROLweb 3U is a modular i/o system, the Modbus/TCP mapping is dynamic, based upon the card content of each system. To see the mapping details, select Modbus Data Mapping:

Modbus Data Mapping			
Data Type	Reference Quantity		Description
Input Reg	10001	4	Time 32 bit sec, 32 bit usec BB
Input Reg	513	32	Slot 2 AI
Holding Reg	513	16	Slot 2 AO
Holding Reg	663	32	Slot 2 AI Shadow
Input	769	72	Slot 3 DI
Coil	769	32	Slot 3 DO
Holding Reg	897	5	Slot 3 DIDO Combined

4.3.2 Serial Port Settings

Serial Port Status						
Port	Protocol	Physical	Baudrate	# bits	Parity	Bytes In/Out Peer Addr
COM1	Raw TCP	RS232 No Flow Control	38400	8	None	Not Connected
COM2	Raw TCP	RS232 No Flow Control	38400	8	None	Not Connected
COM3	Raw TCP	RS232 No Flow Control	38400	8	None	Not Connected
COM4	Raw TCP	RS232 No Flow Control	38400	8	None	Not Connected

5 Modbus/TCP Interface

Use the Modbus mapping details provided through the web browser interface under the Configuration tab. Manual, section 4.2.1.

Map this data in your Modbus/TCP scanner.

For more details, see <http://www.modbus.org>.

6 TOOLweb Interface

TOOLweb is a system-wide program for enabling and gathering real time data from all parts of a process, and providing this data to factory based modules for analysis, FDC and APC.

CONTROLweb modules utilize TOOLweb functionality for the following:

- Web based tools for data analysis and debug, directly from the I/O module
- Real time data acquisition, using XML over HTTP

6.1 TOOLweb User Interface

TOOLweb functions are accessed and configured through the web browser interface. Users must determine the I/O points of interest, those usually referred to as Key Process Variables. Once these variables are named and scaled, they are available for data collection and analysis.

6.1.1 Control Access

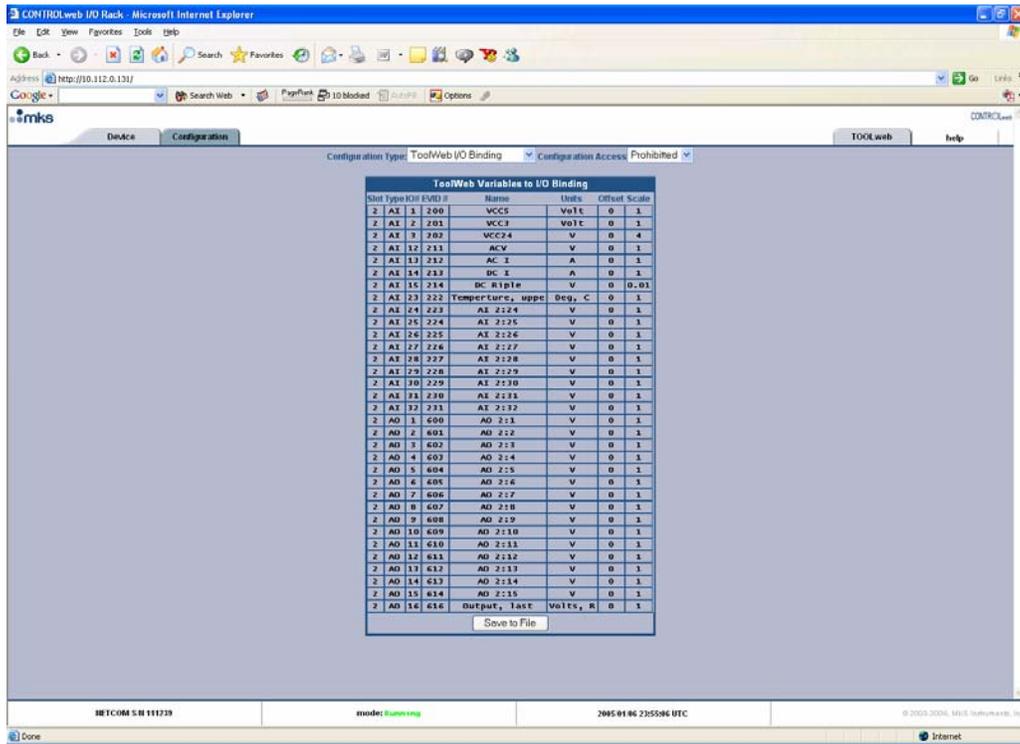
Create the allowed permissions to process data.

ToolWeb Write Access Control	
Access Control	Any Controller Allowed
Designated Controller IP Address	0.0.0.0
Your IP Address	10.112.0.103:1188
 CONFIGURATION ACCESS DENIED	

6.1.2 I/O Bindings

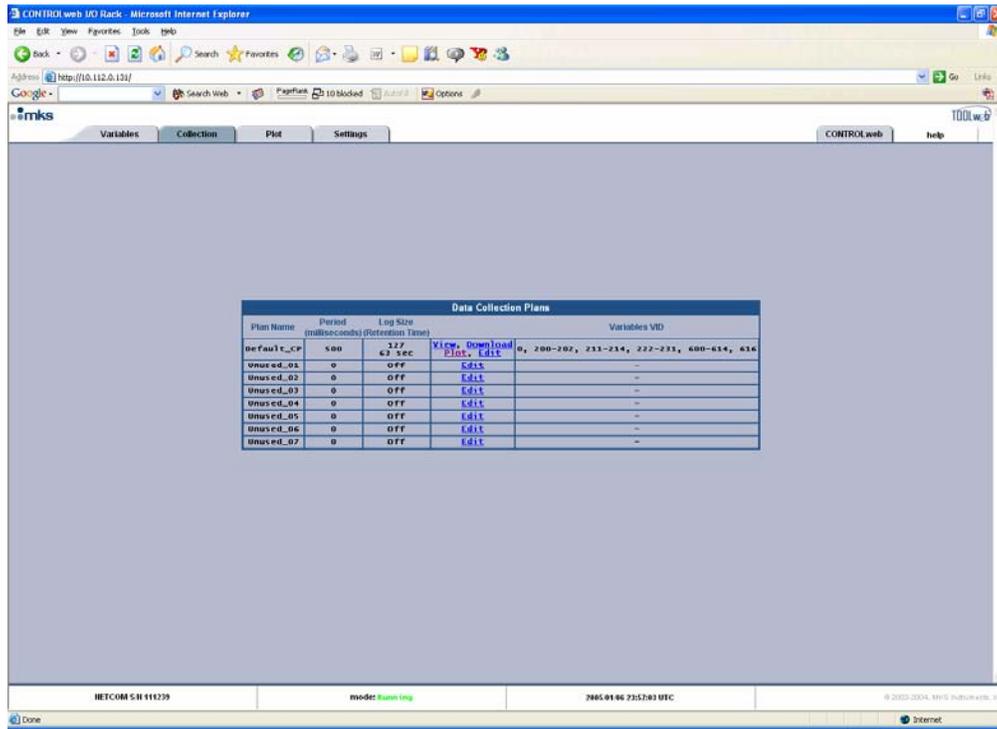
Select the I/O points which will be available for TOOLweb functions. Each point is selected, given a description, and scaled to meaningful process units.

The list can be 1 – 64 variables.



6.1.3 Data Collection Plans

A data collection plan selects the process variables of interest, and the frequency of data collection. Each collection plan can then be viewed using a Charting Applet, or can be downloaded in CSV format to your local PC.



6.1.4 Data Collection Plan Editing

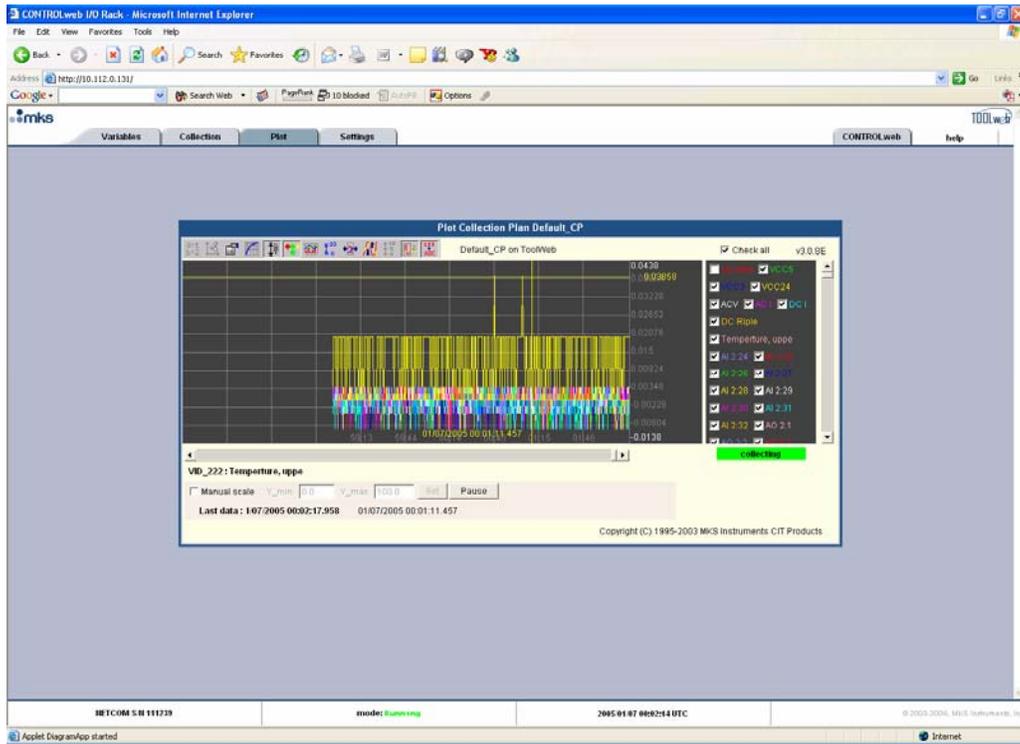
Create a collection plan, and select the key process variables of interest:

Edit Collection Plan #0

Name:	<input type="text" value="Default_CP"/>
Interval (ms):	<input type="text" value="500"/>
Logging:	<input type="text" value="127"/> <input type="text" value="Entries"/>
Active:	<input checked="" type="checkbox"/>
Variables:	<div style="border: 1px solid gray; padding: 2px;"> 0: Up time 200: VCC5 201: VCC3 202: VCC24 </div>
<input type="button" value="Apply"/>	

6.1.5 Charting Applet

Once a data collection plan is configured, you can view the data using a built-in charting applet.



6.1.6 Download Data to Local PC

Collection plan data can also be downloaded in CSV format:

Time	Seq	VID_0	VID_200	VID_201	VID_202	VID_211	VID_212	VID_213	VID_214	VID_222	VID_223	VID_224	VID_225	VID_226	VID_227	VID_228	VID_229
57:51.0	11734	5846	0	0	0.02	0	0.004	0	4.88E-05	0	0	0	0	-0.009	0	-0.004	0
57:51.5	11735	5846	0	0	0	0	0.004	0	0	0	0.004	0	0	0	0	-0.004	0
57:52.0	11736	5847	0.004	0	0.02	0.004	0	0	0	-0.004	0	0	0	0	0	-0.009	0
57:52.5	11737	5847	0	0.004	0	0	0	0	0	-0.004	0	0	0	0	0.004	0	0
57:53.0	11738	5848	0	0	0	0	0	0	0	-0.004	0	0	0	0	0	0	0
57:53.5	11739	5848	0	0.004	0.02	0	0	0	0	0	0.004	0	-0.004	0	0	0	0
57:54.0	11740	5849	0.004	0.004	0.02	0	0.004	0.004	0	-0.004	-0.004	0	0	-0.009	0	0	0
57:54.5	11741	5849	0.009	0.004	0	0	0	0	0	0	0	0	0	0	0.004	0	0
57:55.0	11742	5850	0.004	0.004	0.02	0	0	0	0	-0.004	0	0.004	0	0	0	0	0
57:55.5	11743	5850	0.004	0.004	0	0	0	0	0	0	0	0.004	0	0	0	0	0
57:56.0	11744	5851	0	0.004	0.02	0	0	0	4.88E-05	-0.004	0	0	-0.009	0	0.004	0	-0.004
57:56.5	11745	5851	0	0	0.02	0	0	0	-4.88E-05	-0.004	0.004	0.004	-0.004	0	0	0	0
57:57.0	11746	5852	0.004	0.004	0.02	0	0	0	0	-0.004	0	0.004	0	0	0	0	-0.004
57:57.5	11747	5852	0.004	0.004	0	0	0.004	0	0	0	0	-0.009	0	0	0	0	0
57:58.0	11748	5853	0	0.004	0	0	0.004	0	0	0	0	0	0	0	0.004	0	-0.004
57:58.5	11749	5853	0.004	0.004	0.02	0.004	0	0	0	0	0	0	0	0	0	0	0
57:59.0	11750	5854	0.004	0.004	0.02	0	0	0	4.88E-05	0	0	0	0	0	0	-0.009	0
57:59.5	11751	5854	0.004	0.004	0.02	0.004	0	0.004	0	0	0.004	0	0	0	0	0	-0.004
58:00.0	11752	5855	0.004	0	0.02	0	0	0	0	-0.009	0	0.004	0	0	0	0	0
58:00.5	11753	5855	0.004	0	0	0	0.004	0.004	0	-0.004	0	0.004	0	0	0.004	0	0
58:01.0	11754	5856	0.004	0	0	0.004	0	0.004	0	0	0	0.004	0	-0.004	0	0	0
58:01.5	11755	5856	0	0	0.02	0	0.004	0	0	0	0	0	0	0	0	0	0
58:02.0	11756	5857	0.004	0	0.02	0.004	0.004	0	0	-0.004	0	0	0	0	0.004	-0.009	0
58:02.5	11757	5857	0.004	0	0	0	0	0	0	-0.004	0	0	0	0	0	0	0
58:03.0	11758	5858	0	0	0.02	0.004	0	0.004	0	0	0	0	0	0	0	0	0
58:03.5	11759	5858	0	0.004	0.02	0	0.004	0	0	0	0	0	0	0	0	0	-0.009
58:04.0	11760	5859	0.004	0.004	0	0.004	0	0.004	0	-0.004	0	0.004	0	-0.004	0	0	0
58:04.5	11761	5859	0.004	0	0.02	0	0	0	4.88E-05	0	0.004	0	0	-0.004	0	0	-0.009
58:05.0	11762	5860	0	0	0.02	0.004	0	0	0	0	0	0	0	0	0	0	0
58:05.5	11763	5860	0.004	0.004	0.02	0	0.004	0	0	0	0.004	0	0	-0.004	0	0	-0.009
58:06.0	11764	5861	0.004	0.004	0	0	0	0.004	-4.88E-05	-0.004	0	-0.004	0	0.004	0	0	0

6.2 TOOLweb Toolside Interface

TOOLweb interface is relevant when a SenseLink™ is connected to a BlueBox in a Semiconductor process tool APC and e-diagnostic system.

The following messages are supported via the TOOLweb™ ToolSide Interface:

Message	Supported
CapabilitiesRequest/Response	Yes
Polling	Yes
Tracing	Yes
Bulktrace	No
Events	No
ControlParameter	Yes
SetRequest/Response	No

The names and units as exposed in the CapabilitesResponse are the same as defined in the channel configuration.

Reference the BlueBox Manual for additional details on operating SenseLink™ with BlueBox.

Appendix A - CONTROLweb SPECIFICATIONS

Processor

CPU	32-bit Motorola Coldfire
Memory	8MB SDRAM
Flash	2MB

Communications

Ethernet Port	100BaseT, RJ45 connector with EMI filter, LED indicators
Ethernet Switch	100BT
RS232 Port	TXD, RXD, RTS, CTS signals; DB9 connector
RS232/485 Ports	S/W selectable RS232 (TXD, RXD) or RS485 Serial Baud Rates 300bps to 115Kbps (38.4Kbps maximum with all 3 ports operating continuously).

General

Power Supply	18VDC to 28VDC
Power Consumption	10W minimum + I/O card requirements
Operating Temperature	0C to 50C
Storage Temperature	-20C to 85C
CE	pending

Appendix B – Interlock Card I/O Mapping

Each interlock card represents a total of 72 inputs and 32 outputs. For complete details, see the manuals for CDN497 and CDN498. The table below shows a summary of resources for a complete dual slot interlock card, CDN500-x.

Interlock Card Resources

	DIO	R _{IN} , DPDT	R _{OUT} , DPDT	Uncommitted I/O Pins on J2 connector
CDN497	8 sourcing (1-8)	24 with readback	12	40
CDN498	24 sinking (9-32)	16 with readback	16	32
TOTAL	32	40	28	72

Input Map

Input	Resource	Location
1 – 8	DIO 1 - 8	CDN497
9 – 32	R _{IN} 1 - 24	CDN497
33 – 56	DIO 9 - 32	CDN498
57 - 72	R _{IN} 1 - 16	CDN498

Output Map

Output	Resource	Location
1 – 8	DIO 1 - 8	CDN497
9 – 32	DIO 9 - 32	CDN498

WARRANTY

MKS Instruments, Inc. (**MKS**) warrants that for two years from the date of shipment the equipment described above (the “equipment”) manufactured by **MKS** shall be free from defects in materials and workmanship and will correctly perform all date-related operations, including without limitation accepting data entry, sequencing, sorting, comparing, and reporting, regardless of the date the operation is performed or the date involved in the operation, provided that, if the equipment exchanges data or is otherwise used with equipment, software, or other products of others, such products of others themselves correctly perform all date-related operations and store and transmit dates and date-related data in a format compatible with **MKS** equipment. **THIS WARRANTY IS MKS’ SOLE WARRANTY CONCERNING DATE-RELATED OPERATIONS.**

For the period commencing with the date of shipment of this equipment and ending two years later, **MKS** will, at its option, either repair or replace any part which is defective in materials or workmanship or with respect to the date-related operations warranty without charge to the purchaser. The foregoing shall constitute the exclusive and sole remedy of the purchaser for any breach by **MKS** of this warranty.

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