UNC500

HARDWARE MANUAL

Revision 1.3

new generation
building security

RBH
ACCESS
TECHNOLOGIES
INC.

Revision History

Editor	Revision	Comment	Date mm/dd/yy
DM	1.0	First Release	
DM	1.1	Added IP Search section	04/02/12
RB	1.2	Removed reference to fire input Removed partial firmware upgrade (formats) Added dip-switch 5 and 8 Added Revision History Updated copyright Added DNET2 selection	03/14/14
RB	1.3	Changing output voltage from 12V to 12-14V	07/21/14
DM	1.3	Added ULC text. Editing of text.	08/08/14

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Contents

Introduction

The UNC500 has been designed to take over the functionality of the Axiom NC100 (network controller), an RC-2 (reader controller) and an LIF (local area network interface). The network interface can also contain a POE (power over Ethernet) converter.

ULC-S319-05 III

***** For ULC-S319-05 III compliance, all wiring into the chassis mount panel's cabinet must enter through metal conduit. Also be sure to mount the panel in a protected area.**
***** For ULC-S319-05 III compliance, the rack mount panel's housing must have external tamper switch to detect the housing's removal from the rack. Also be sure to mount rack in a protected area.**

Battery Protection: Please note – To protect the battery from being drained during shipping/storage, there is paper between the battery and the panel that must be removed before powering up the controller.

Earth

The controller contains several layers of protection against induced high voltage transients from static discharge, lightning, and power line spikes. In order for this protection to be fully effective, a good connection to earth ground is essential. Wire this connection to a metal cold water pipe or similar structure. Do not connect directly to the AC earth. Use 16 AWG or heavier cable and keep the length as short as possible (*less than 50 feet [15meters]*).
Although the UNC500 has multiple possible ground connection points, the ground connections are normally made at the Host port (CH1). This leaves the ground connections at CH2 and CH3 ports available for cable shield connections.

Communication

The UNC500 has three RS485 ports and an Ethernet 10/100 interface. Depending on the hardware configuration all three channels may not be available. Communications from the host computer running Axiom software can be achieved in the following ways; either via Ethernet through a socket interface or via RS485 through a direct connection to a designated channel. The Ethernet interface may be single or dual ported 10/100 Mbs, depending on how the board is configured. The UNC500's RS485 channels 1, 2, or 3 may be programmed as 'HOST', 'DNET','DNET2', 'UNC-NET', or 'CNET'. Use the DIP switch to select baud rate for Host communications as 9600, 38400, 57600, or 115200.

Networks

There are three networks supported by the UNC500 these are:
1) **Host Communications** through the Ethernet or direct connection.
2) **Device Communications** for devices such as additional RC-2s starting at address 2, Alarm Keypads, IOC-16 controllers, and PC100.
3) **Controller Communications** for controllers such as additional UNC500s or for NC100s via:
   a. **UNC-NET** a protocol designed for RS485 communications between UNC500's only.
   b. **CNET** for connection with NC100's (*only available on CH3*).

Outputs

There are four form C relays and four open collector outputs that can be programmed as general purpose or default applications. Although the contacts are rated at 12 amperes at 125vac the surge protectors prevent voltages greater than 40vac or 56vdc from being applied. The recommended use of the relays is to provide isolated outputs for driving electric strikes or magnetic locks at a maximum voltage of 24v.
The open collector outputs are current limited to 100 milli-amperes direct current only.

Auxiliary Power

A thermal fuse protected power output rated at 500 milli-amps 12 - 14Vdc.

Inputs

There are eight inputs used for sensor connections. Four are configured as general purpose and four are either programmed for default application or for general purpose. The software provides configuration information used to decode the state of the contacts. The following table illustrates the seven circuit type assignments. Note that when an input is armed it will only report alarm or restore states. All "normal" states are translated to "restore" and all other states are translated to "alarm".

Reader Interface

Two standard wiegand interfaces provide the following connections for typical proximity readers:

1) Thermal fuse protected power (500ma @12 - 14VDC).
2) Wiegand data interface.
3) Reader tamper input (s). Initially if open it will be ignored but once a short is connected it will report a reader tamper alarm whenever the input is opened.
4) LED and beeper outputs are open collector current limited to 100ma.

OSDP readers are also supported.

Fuse Monitoring

Besides monitoring the battery voltage the UNC500 also monitors the input voltage (DC), auxiliary voltage (aux) and the reader voltage (reader) and reports to the host whenever the state changes.

Diagnostic LED's

Each RS485 circuit has a red and green LED to indicate when a signal is received or transmitted.
Diagnostic 1 is a bicolour LED when red indicates receiving data from the host and when green indicates transmission of data.
Diagnostic 2 will flash slowly when connected to the host and quickly when not connected.
Diagnostic 3 will flash when a power problem such as a low battery or low auxiliary power is detected.

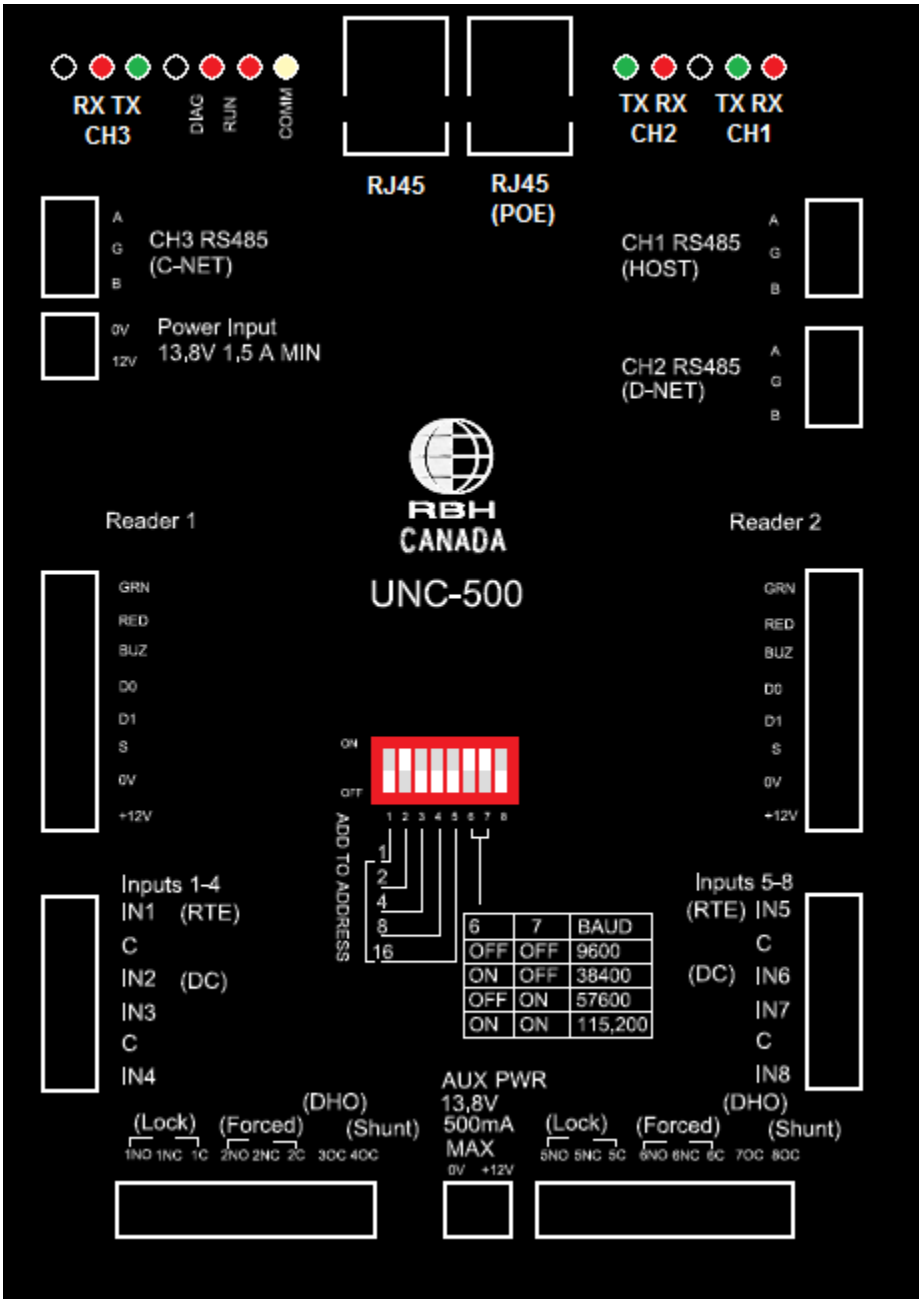
Tamper Detection

A tamper wire may be connected to JP1 located close to the power resistors on the board. A short to this input is normal and an open is alarm.

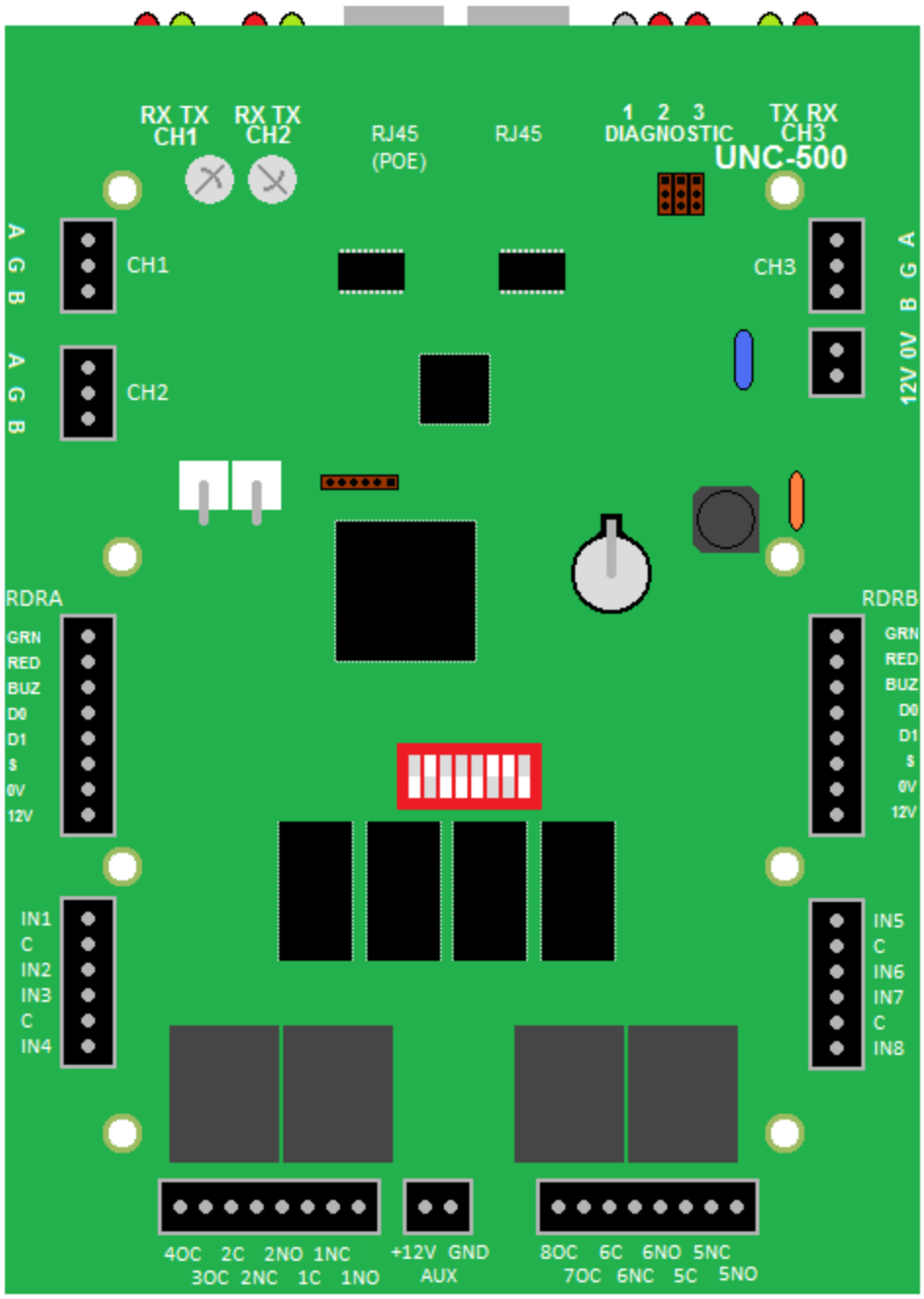
UNC500 Controller

The AxiomV™ access control system consists of one or more network controllers (**NC-100** or **UNC500**). All information required by the controller is downloaded from the PC and stored locally non-volatile flash memory. This information includes configuration data, cardholder records, access levels, schedules, and all other records necessary for the operation of the system. The controller operates independent of the PC and all decision-making is performed locally, even in the event of total power loss.
The UNC500 contains a powerful 32-bit micro-controller and has either 2Mb, 4Mb, or 8Mb of RAM.

UNC500 Silkscreen Legend



Chassis Mount



Rack Mount

***** For ULC-S319-05 III compliance, all wiring into the chassis mount panel's cabinet must enter through metal conduit. Also be sure to mount the panel in a protected area.**
***** For ULC-S319-05 III compliance, the rack mount panel's housing must have external tamper switch to detect the housing's removal from the rack. Also be sure to mount rack in a protected area.**

Power Options

Direct Connection to Power Supply

The UNC500 controller requires 13.8vdc @ 1.5A to be supplied from an external source.

POE

Power can also be provided if the unit has a POE option through the Ethernet cable. A 35W POE converter is required [*AT compliant*].

Battery Back-Up

The UNC500 has a built-in battery charger and battery monitor and can covert power from POE or direct to maintain the battery. There is a 24 hour scheduled battery test that is performed on the battery.

RS485 Applications

There are up to three RS485 ports that can be programmed to any application. The default settings are (CH1) HOST, (CH2) D-NET and (CH2) UNC-NET.

Application name	Description
HOST	The Host port connects the UNC500 to a PC through an RS485 interface.
D-NET	The D-NET (Device Network) connects local device controllers (RC-2, IOC-16, SafeSuite™ Panels, NIRC2000, or NURC2000) to the UNC500 controller on a high-speed bi-directional RS485 network. Connect CH2 on the UNC500 to CH1 on the first device controller, and then connect it to CH1 on the next device controller on the D-NET and so on. (see the D-NET diagram on page16)
D-NET2	For legacy systems requiring class "A" redundant daisy chaining.
UNC-NET	The UNC-NET (Controller Network) connects the UNC500 controller to other on a high-speed bi-directional RS485 network. CH3 on the master controller connects to CH3 on the next UNC500 on the network or to CH1 on the next NC-100 controller in the network (*if the Arcnet option is added*). (*See UNC-NET diagram on page16*.)

DIP Switch Settings

The UNC500 DIP switch controls the device's address and serial port baud rate. The system must be powered down if the controller address is changed using DIP switches 1 through 5. DIP switch changes for a change in baud rate are processed immediately and do not require a power down.

Note: To Reset Panel – All DIP switches must be off.

DIP Switch	
DIP Switch	Function
1 - 4	Controller Address
5	Ethernet Secure Mode *
6,7	Controller Baud Rate
8	*Disable Internal RC-2 **

*Available in version 101.70 and up.

Controller Addressing

Use DIP switches 1, 2, 3, and 4 to select the controller address. The address is binary coded and the switch settings for all fifteen possible addresses are given below.

Controller Addressing				
Switch 1	Switch 2	Switch 3	Switch 4	Address
On	Off	Off	Off	1 (Master)
Off	**On**	Off	Off	2 (Slave)
On	**On**	Off	Off	3 (Slave)
Off	Off	**On**	Off	4 (Slave)
On	Off	**On**	Off	5 (Slave)
Off	**On**	**On**	Off	6 (Slave)
On	**On**	**On**	Off	7 (Slave)
Off	Off	Off	**On**	8 (Slave)
On	Off	Off	**On**	9 (Slave)
Off	**On**	Off	**On**	10 (Slave)
On	**On**	Off	**On**	11 (Slave)
Off	Off	**On**	**On**	12 (Slave)
On	Off	**On**	**On**	13 (Slave)
Off	**On**	**On**	**On**	14 (Slave)
On	**On**	**On**	**On**	15 (Slave)

Master Controller

Each network must have a single unit designated as the master controller. The master controller connects to the PC. Setting the DIP switch address to 1 will automatically designate a unit as the master controller.

Slave Controller

All controllers addressed 2 through 15 are referred to as slave controllers.

Ethernet Secure Mode

When dip-switch 5 is on the IP locator program cannot locate the unit on the Ethernet and therefore cannot make any changes or reset the unit.

CH1 RS485 Port Baud Rate Selection (Master Only)

The controller's serial port baud rate is set with controller DIP switches 6 and 7. This setting determines the speed used to communicate with the PC; the controller baud rate must be the same as the baud rate set for the port within the AxiomV™ software. The default baud rate is 9600.

Controller Baud Rate Selection		
DIP Switch 6	DIP Switch 7	Baud Rate
OFF	OFF	9600
ON	OFF	38400
OFF	ON	57600
ON	ON	115200

Disable Internal RC-2

When dip-switch 8 is on the internal RC-2 is disabled and the #1 RC-2 is polled on the d-net. This is to allow the UNC500 to replace an existing NC100.

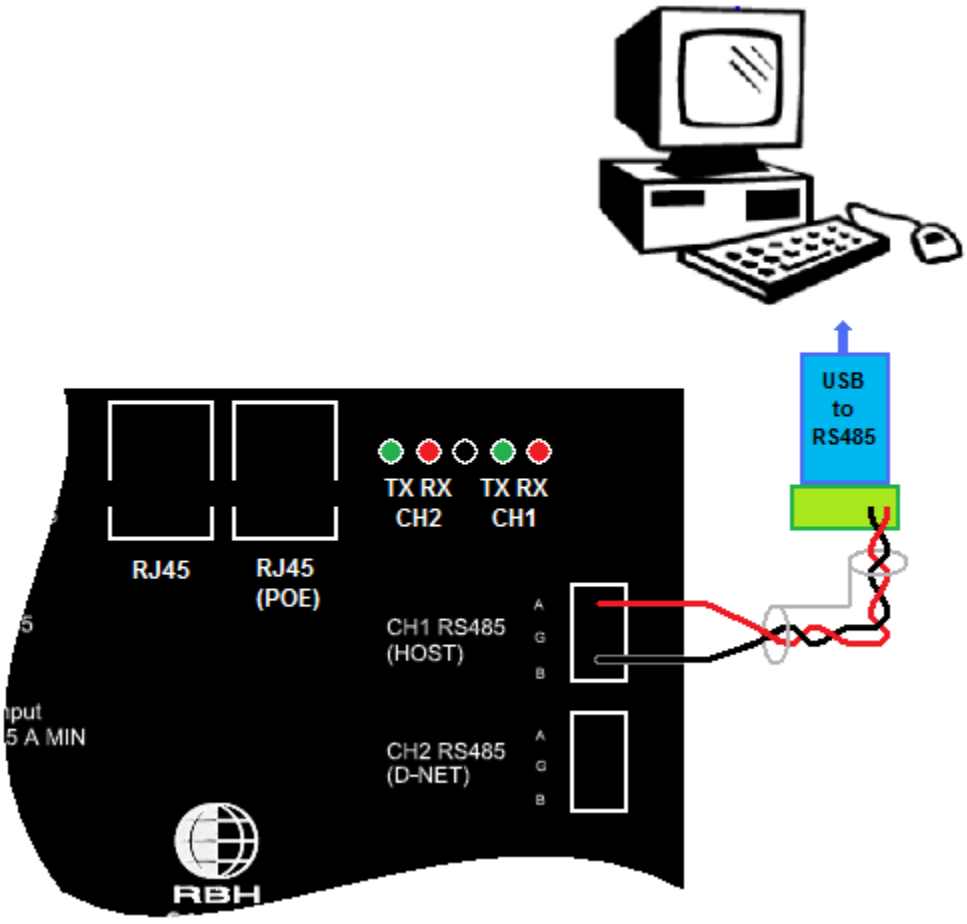
PC Connection

The master controller is connected to either a serial port on the PC or through the local Ethernet via a static IP address. The means of communication is configured in the AxiomV™ software under *Network Properties/Port Type*.

RS485 Connection

The RS485 interface allows the distance between the controller and the PC to be up to 4000 feet (*1200 meters*) at 38.4k baud. RS485 requires a twisted pair cable 22AWG. Termination is built into the UNC500 and the USB-RS485 module.

PC to UNC500 Connection – RS485 Wiring



Cable Specification

Twisted pair, shielded, 18 to 22 AWG

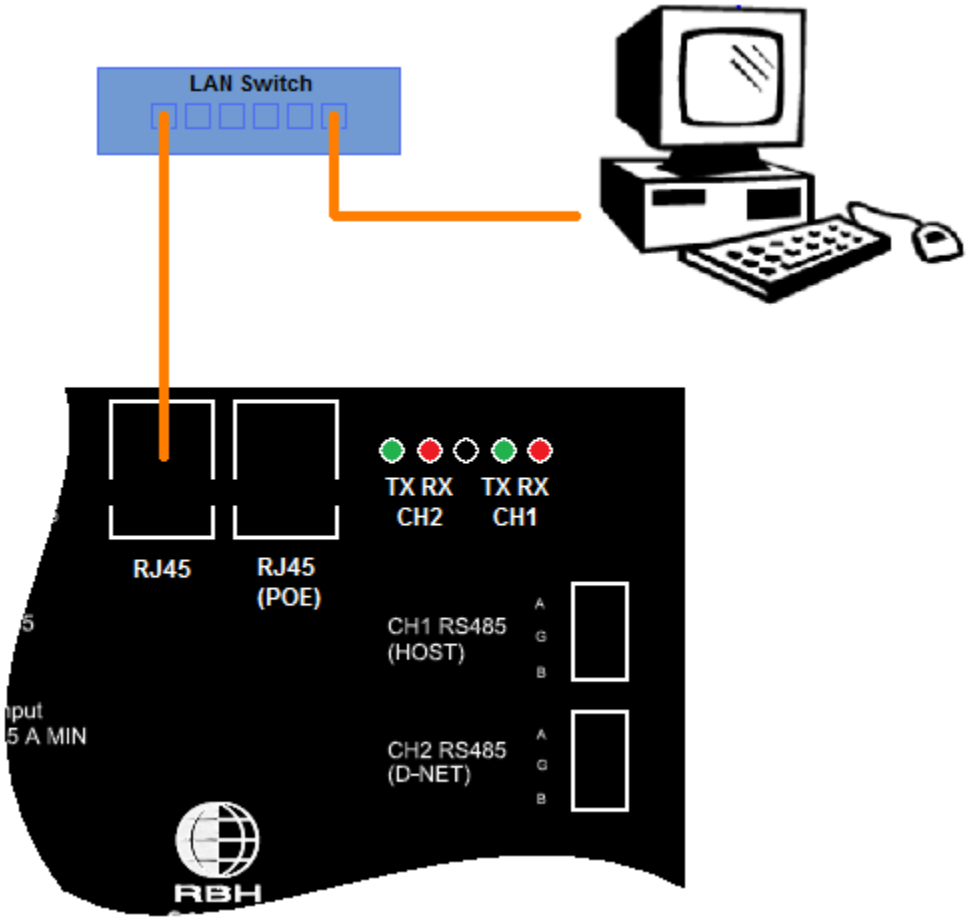
Maximum Cable Length

4000 feet (*1200 meters*)

UNC500 TCP/IP Connection

The master controller in some installations may not be directly connected to the PC and may be linked by the local Ethernet. The system supports a static IP address only [*default address is 192.168.168.125*]. To change the IP address of the unit you can either use IPLocator [*a utility program provided by RBH*] or Telnet.

PC to UNC500 Connection - LAN



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Telnet

To program the UNC500 through Telnet you first have to set all DIP switches off. Connect to the panel with an Ethernet cable and configure your computer to have IP address 192.168.168.20 [***remember to reconfigure your machine's IP address back when you are done***]. In the 'cmd' window type the following 'telnet 192.168.168.125'. If a connection is made the following message will be displayed.

Telnet Opened on port 23

2 MEG RAM detected.

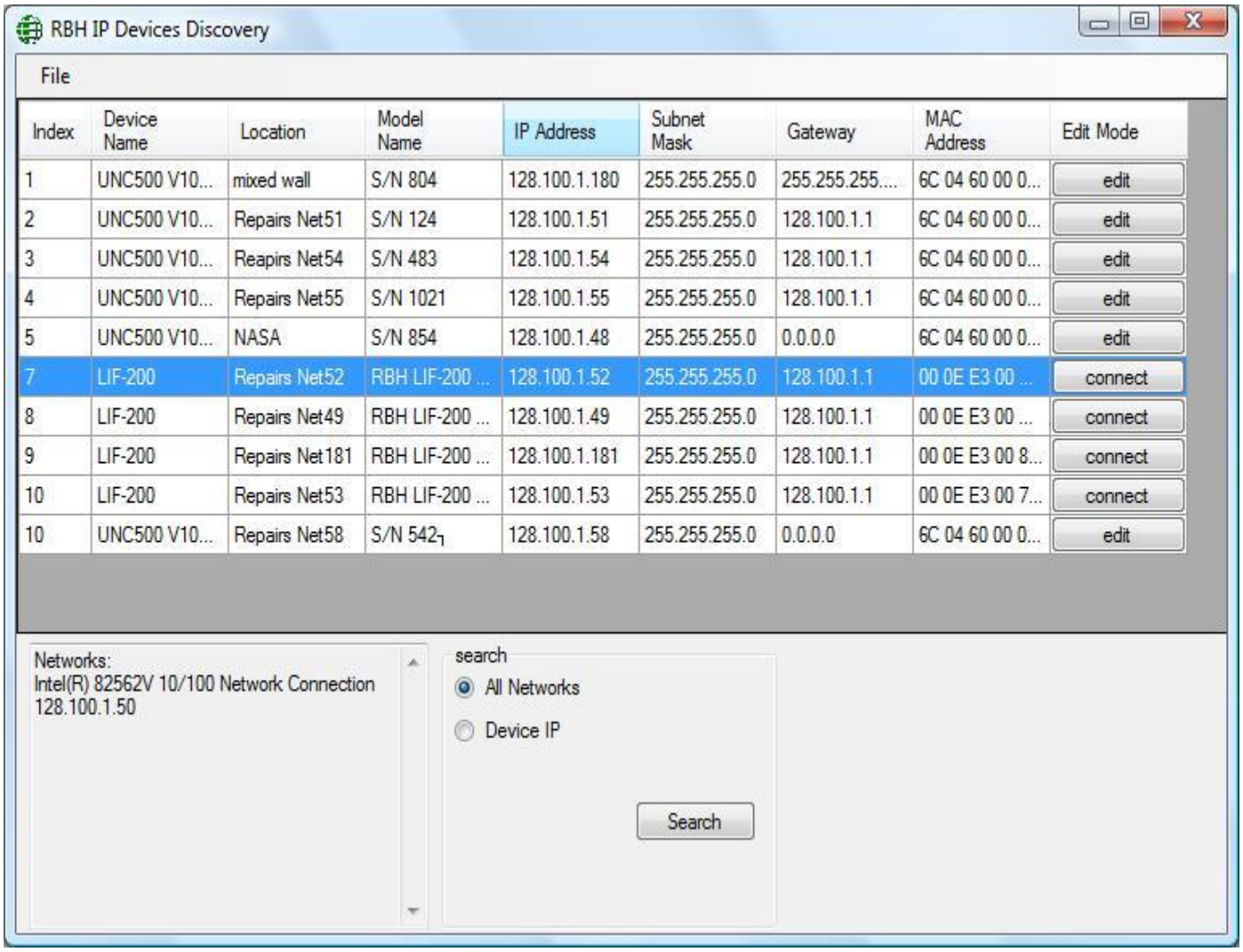
A password is required in order to change user parameters. The default password is '*password*'. The password can be changed by the user. After entering the password the following items are available for the use to alter.

Name	Defaults	Description and notes
IP ADDRESS	192.168.168.125	Local Ethernet address.
SUBNET MASK	255.255.255.0	Local Ethernet mask
IP GATEWAY	0.0.0.0	For future use when DNS option becomes available.
PORT NUMBER	3002	Primary port number.
ALT PORT NUMBER	3003	Alternate port number applies to "LAN" application.
CH1 APPLICATION	HOST	Com channel #1 application located on the side opposite the power input.
CH2 APPLICATION	DNET	Com channel #2 application located below #1.
CH3 APPLICATION	UNC-NET[1] NCNET NONE	Com channel #3 application located on the same side as the power input. To use this channel the three jumpers must be in the "r" position. (*If you are connecting to NC-100s set the value to "C-NET", and the jumpers must be set to the "A" position.*)
Telnet Password	password	This is a string of up to 10 characters that allows the user access to this program.

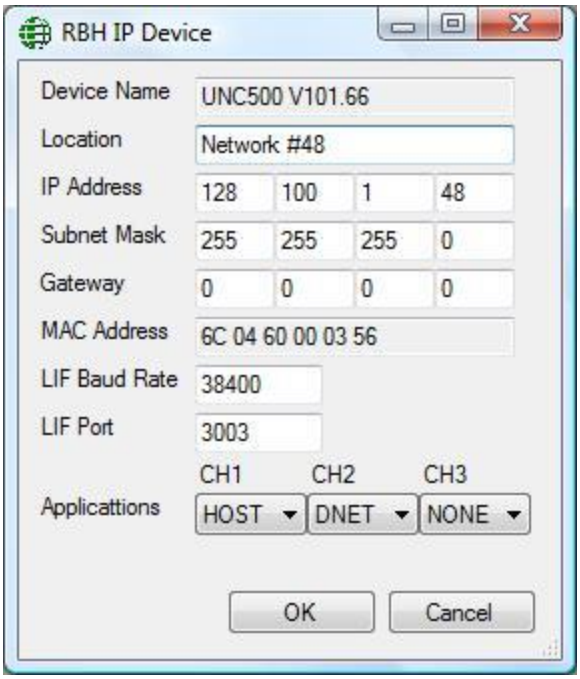
[1] Channel 3 default selection depends on the version of firmware in the UNC500.

IP Search

When the IP Search program finds an Ethernet connected panel with the correct requirements it will display under “Edit Mode” an edit button. When pressed, the software will allow the editing of the following items; Location Text, IP data, LIF/LAN application parameters, and Channel Applications.



Make changes to the various items displayed. After entering the data and clicking on “OK” the unit will re-boot. Please note that except for “NONE” no application is allowed to be duplicated. (*This means that only one channel can be HOST and only one can be DNET, etc*.)

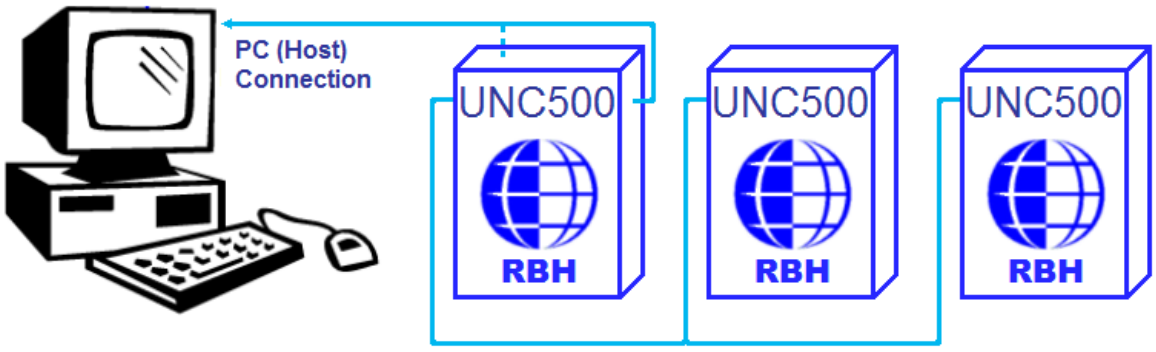


Setting DIP switch #5 ON (up) will disable this feature on the panel. It won't even be listed in the IP Search screen.

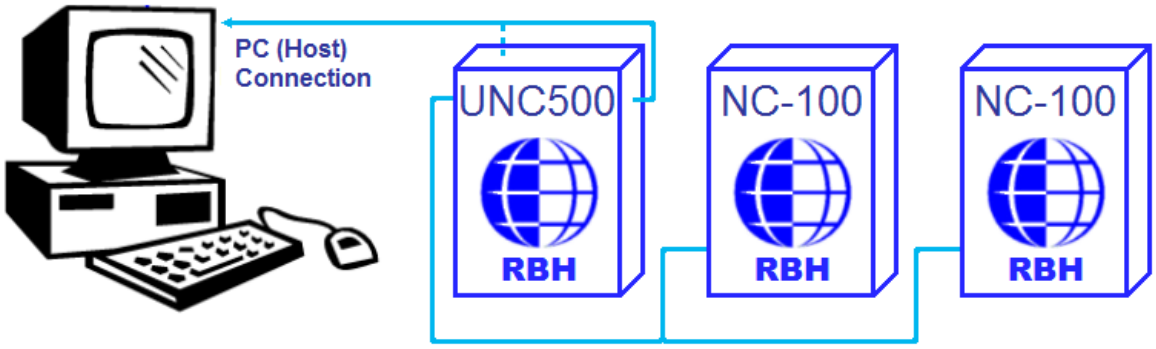
CNET (Controller Network)

Up to fifteen network controllers can be linked together and feed into a single communication port on the PC. Controller number 1 is designated the master controller and may be connected to the PC using serial or TCP/IP communications. The remaining controllers are referred to as slaves and can only communicate to the PC through the master unit.

UNC-NET (Controller Network)

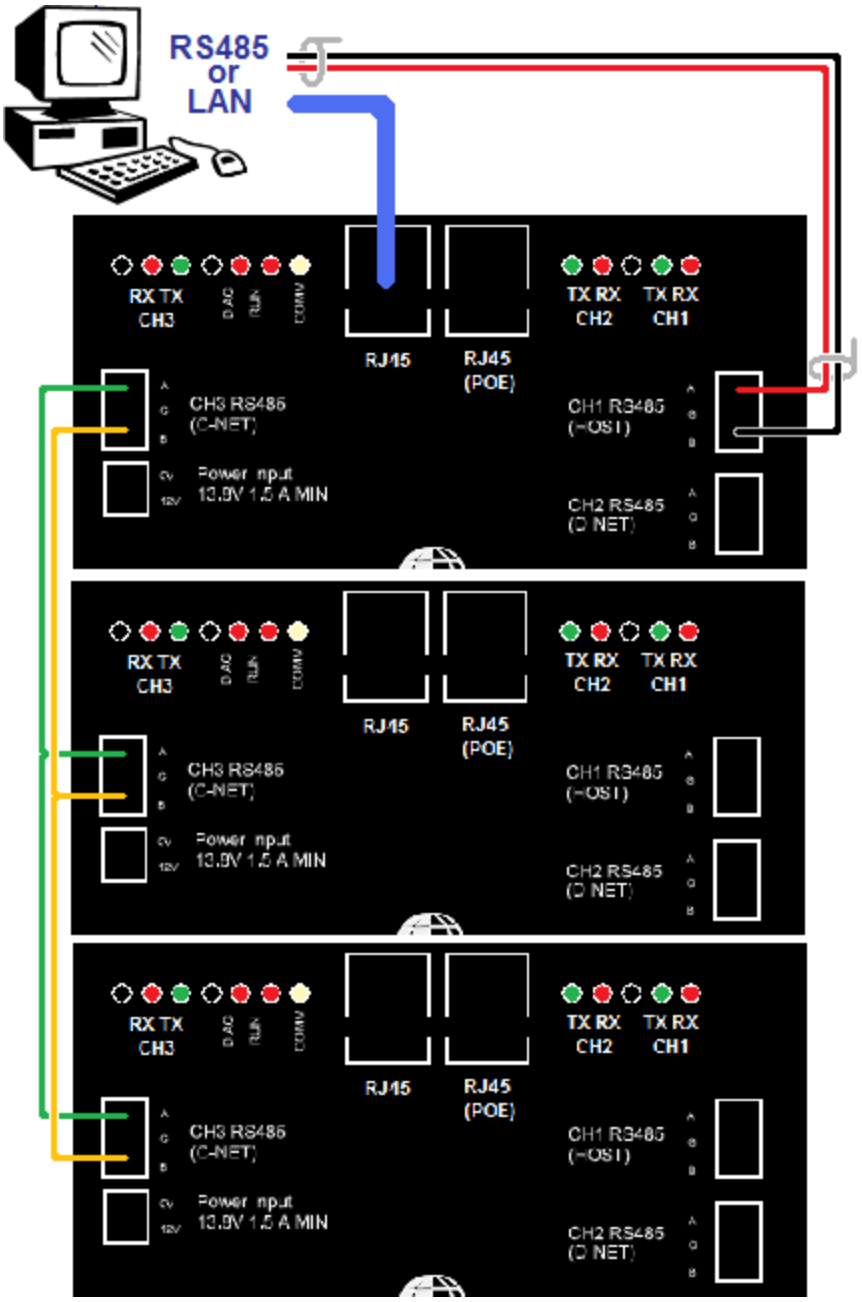


CNET (Controller Network)



UNC500 controller can only be connected to NC-100 controller if the Arcnet option has been added [C-Net]. To get the Arcnet to function you need to set jumpers JP5, JP6, & JP7 to 'A' (*for Arcnet*), and configure CH3 in the Telnet setup to be 'none'.

When combining UNC500s and NC100s; connect CH2 of the previous panel and CH1 of the next panel to CH3 (C-NET) of the UNC500. Since the C-Net is a loop; the previous panel to the first panel is the last panel, and the next panel from the last panel is the first panel.



UNC-NET Cable

Use 20 to 22 AWG shielded stranded twisted pair cable for all C-NET connections.

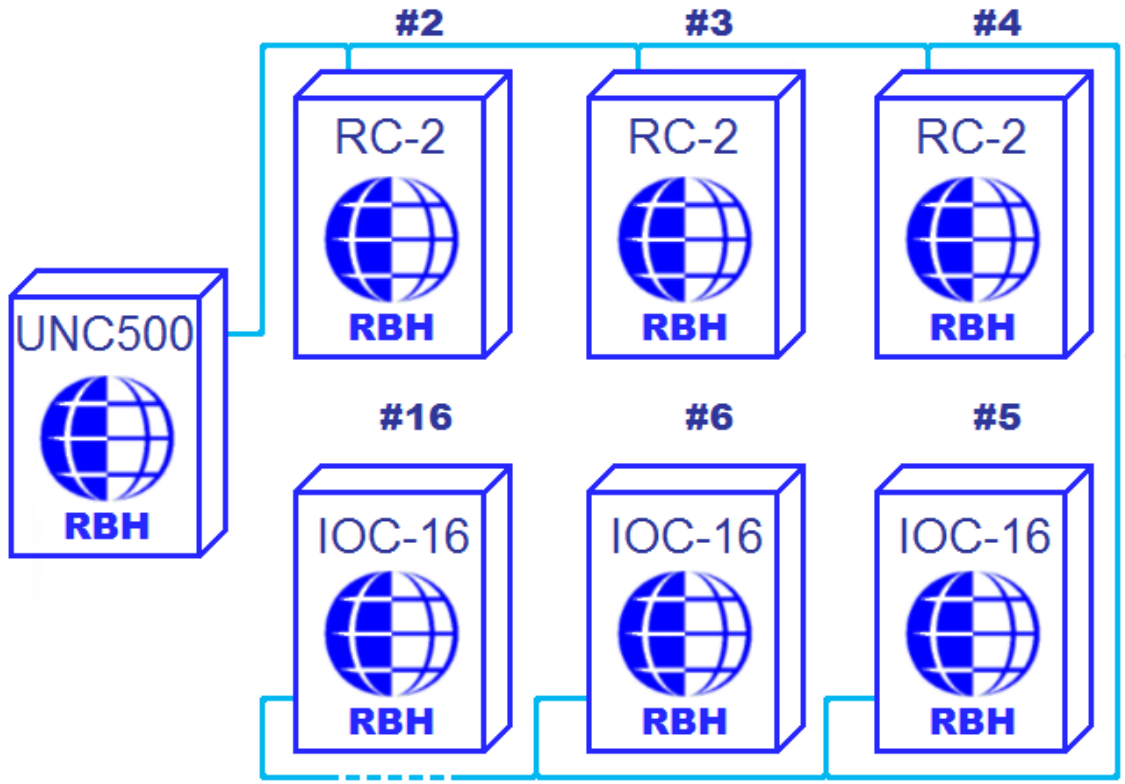
UNC-NET Maximum Cable Length

The maximum distance for any link in the C-NET is 2500 feet (*760 meters*) and the total length cannot exceed 10000 feet (*3000 meters*).

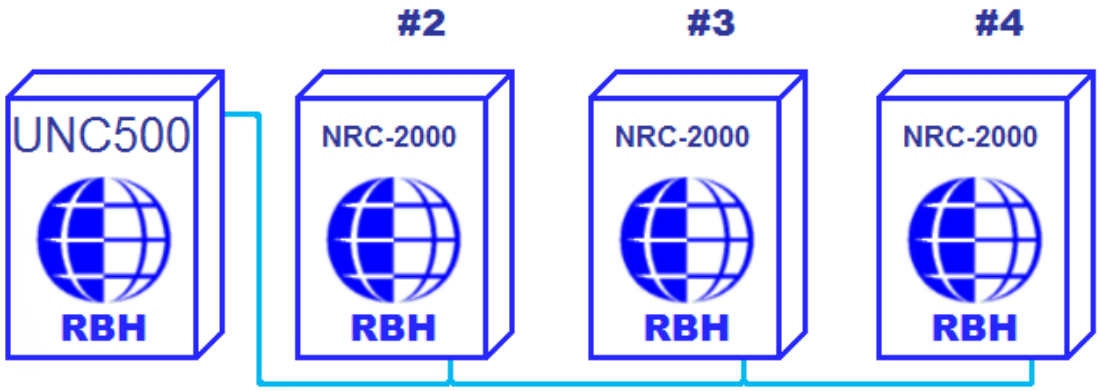
D-NET Device Network

Up to four RC-2 reader controllers, and up to sixteen IOC-16 input/output controllers, may be connected to each network controller in the C-NET using high speed RS485 communications.

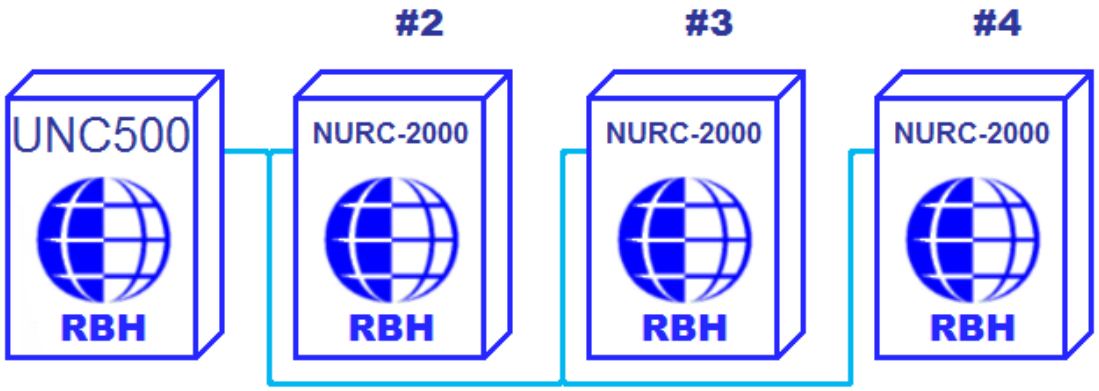
D-NET (Device Network)



NIRC2000 panels may be used in place of RC-2 panels.



NURC2000 may also be used in place of RC-2 panels.



The D-NET connects IOC-16, RC-2, SafeSuite™ panels, PC-100, NIRC2000, and NURC2000 devices in a daisy chain fashion (parallel connection) to the network controller. Device controllers do not have to be addressed sequentially. However, using sequential device controller addressing is recommended as this makes your cabling diagrams easier to follow and simplifies troubleshooting as the devices are in the correct numerical sequence.

Device Controller Address Assignment	
Address	Device Controller
1 – 4	RC-2, NIRC2000, NURC2000
5 – 20	IOC-16, PC-100
1-255	SafeSuite™ panel

D-NETs comprising SafeSuite™ panels, PC-100, NIRC2000, and NURC2000 devices must have the last unit in the line terminated.

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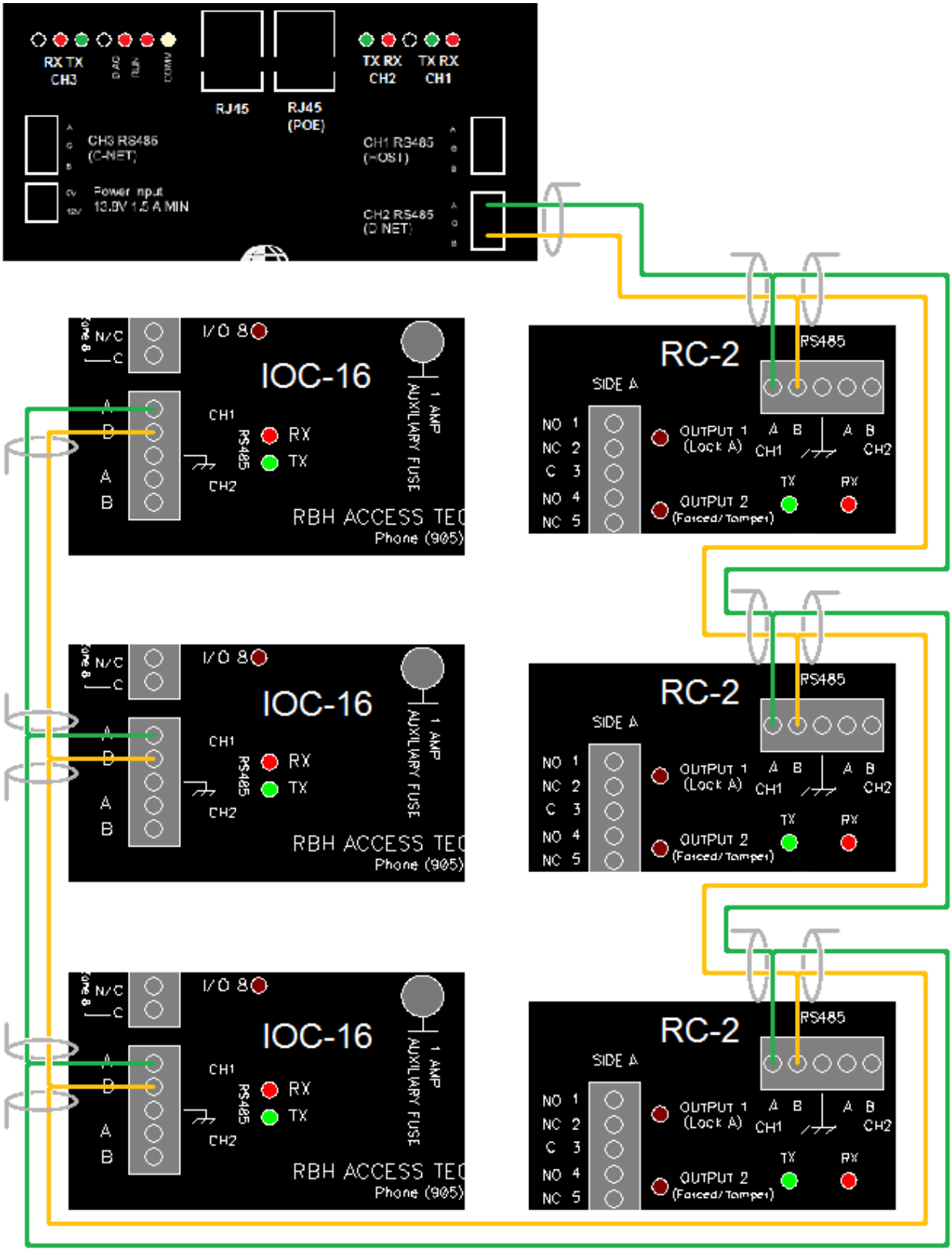
D-NET (Device Network) Connection Example



D-NET Maximum Cable Length

The maximum distance for any link is 3000 feet (*900 meters*) and the total length cannot exceed 15,000 feet (*4600 meters*).

D-NET Cable

Use 20 to 22 AWG shielded twisted pair cable for all D-NET connections. Shielded cable is recommended to minimize problems that can arise in electrically noisy environments. In addition, shielded cable may be necessary to prevent the network from interfering with signals on other cables in the same trunk.

Inputs

The UNC500 has eight fully supervised inputs, four on side A and four on side B. Each input is individually programmable from the PC. The UNC500 employs digital filtering to eliminate the effect of interference on the input loops and verifies all loop changes before reporting to the controller. Loop resistance is continuously monitored using a built in eight bit analog to digital converter and can be viewed from the PC, providing the service technician with a valuable diagnostic tool and allowing marginal circuit loops to be detected and repaired before a full blown fault develops.

Each input has four states: Restore, Alarm, Trouble, and Illegal. Trouble is reported if a short or break is detected on a supervised circuit and illegal is reported if the measured loop resistance lies between valid states. For example, if the circuit type is programmed as '2 resistor normally closed', 1k represents a restored state and 2k represents an alarm state. If the loop resistance changes by more than 15% but not enough to enter the next state, an illegal state is reported.

Request to Exit (Input IN1A, IN5)

The Request to Exit [RTE] input is connected to a push button mounted on the door or to a motion detector mounted near the door. A normally open or normally closed button can be used and the circuit type can be programmed from the PC. Activating the RTE input will unlock the door. The RTE can be disabled by time zone. This input can be used as a general purpose input if RTE operation is not required. If not used, leave the default RTE settings in the AxiomV™ software configuration.

Door Contact (Input IN2, IN6)

The Door Contact [DC] input monitors the state of the door. Forced entry, door held open alarm, and door held open warning require monitoring of the door state. This input can be used as a general-purpose input if the door contact is not required. If not used, leave the default RTE settings in the AxiomV™ software configuration.

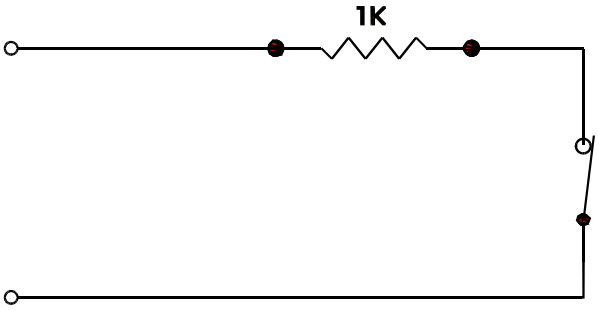
Input Circuit Types

The RC-2 supports seven different input circuit types ranging from no resistor for low security applications to two resistor normally closed circuits where the highest security is required.

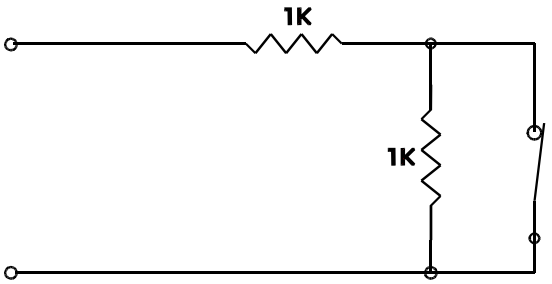
Normally Closed, No Resistor	
Loop Resistance	State
Short	Restore
Open Circuit	Alarm

Normally Open, No Resistor	
Loop Resistance	State
Short	Alarm
Open Circuit	Restore

Normally Closed, One Resistor	
Loop Resistance	State
Short	Trouble
1k	Restore
Open Circuit	Alarm



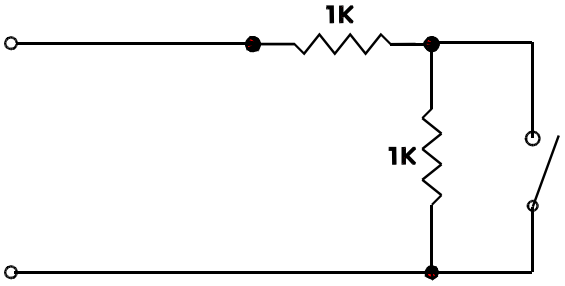
Normally Closed, Two Resistor	
Loop Resistance	State
Short	Trouble
1k	Restore
2k	Alarm
Open Circuit	Trouble



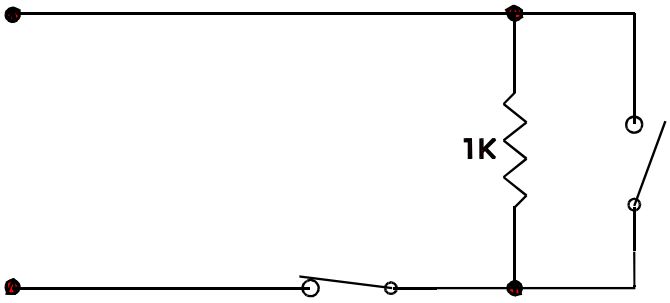
This circuit provides a high degree of supervision and detects both short and open circuit fault conditions. Use this circuit in high security applications.

Normally Open, One Resistor	
Loop Resistance	State
Short	Alarm
1k	Restore
Open Circuit	Trouble

Normally Open, Two Resistor	
Loop Resistance	State
Short	Trouble
1k	Alarm
2k	Restore
Open Circuit	Trouble



Normally Open And Normally Closed, One Resistor	
Loop Resistance	State
Short	Alarm
1k	Restore
Open Circuit	Alarm



This circuit type is used where normally open and normally closed contacts are used in the same loop.

Outputs

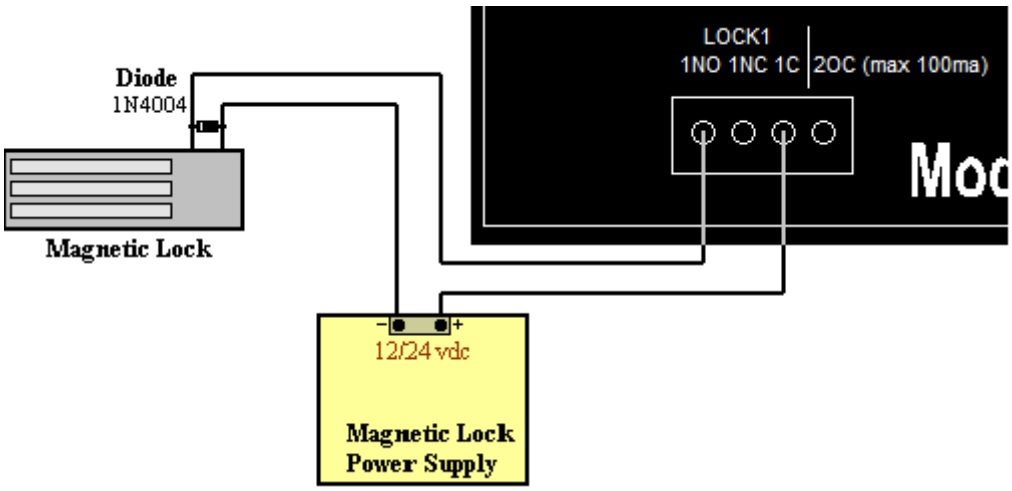
The UNC500 has eight outputs, four on side A and four on side B. The Lock and Forced/Tamper outputs are dry contact relays capable of switching 12Amps@125vac. The Door Held Open and Alarm Shunt outputs are electronic drivers and can switch 100ma. Outputs are programmable from the PC as normally energized or normally de-energized. Normally energized outputs are used for fail-safe operation where it is essential that the output return to a safe state when the system fails due to power loss.

Electronic outputs are 'switched negative' which means that they switch the power negative to the terminal. When the output is off, the output terminal is electronically disconnected. Outputs can be programmed to operate in a default mode described below or they can be used as general-purpose outputs. However, the output definition in the AxiomV™ configuration software should never be left blank. If the output is unused, use the default output definitions provided in the AxiomV™ configuration software.

Switching Inductive Devices (Locks, Bells)

Exercise caution when switching an inductive load. Inductive devices include external relay, solenoids, bells, and door locks. All of these devices generate extremely high voltage spikes (*several thousand volts*) when applied power is removed. Possible disruption of operation could occur if this interference gets on to the electronic circuit board.

This interference can be suppressed by placing a diode (*1N4001 or similar*) across the lock or other inductive device being switched. Connect the diode cathode (*end with band*) to the positive terminal and the other end to the negative terminal. The diode must be placed at the device being switched and not at the controller.



Default Output Operation

Lock Output (Relay Output)

For magnetic locks, the relay should be configured from the PC as On State de-energized for fail-safe operation. If power fails (*AC and battery*), the power to the magnetic lock is removed and the door is opened.

Forced / Tamper (Relay Output)

The Forced/Tamper output turns on if the door is forced open or if a reader tamper is detected. This output remains on for as long as the alarm condition exists.

Door Held Open (Electronic Output)

The Door Held Open output turns on if the door is held open longer than the programmed limit. This output remains on until the door closes. During the warning period, this output will pulse every second.

Alarm Shunt (Electronic Output)

The alarm shunt output turns on when the door is unlocked. This output turns off when the door is re-locked if the door is closed at that time; otherwise the output turns off when the door closes. Normally the shunt output is used to bypass a door contact monitored by a secondary alarm panel.

Access Point Operating Modes

Two Person

The Red LED flashes slowly.
In Two Person Mode, two valid cards are required for access. The reader Buzzer beeps rapidly after the first card is presented. A second valid card must be presented within ten seconds for access to be granted.

High Security

The Red LED flashes quickly.
In High Security Mode, only cardholders with *High Security Privilege* are allowed access.

Unlocked

The green LED turns on to indicate the door is unlocked.

Tamper

The Buzzer sounds continuously.

Lockout Alarm

The Buzzer beeps rapidly.
A lockout alarm occurs when a user-defined number of 'Access Denied' messages occur. These messages can include 'Invalid Card Number', 'No Access at this Time', 'No Access at this Reader', or 'Invalid PIN Code'.

Door Held Open Warning

The Buzzer beeps slowly.

Door Held Open Alarm

The Buzzer sounds continuously.

Keypad / Reader Combination

The Buzzer emits a short beep every second after a card is presented, until a PIN is entered.

Access Granted

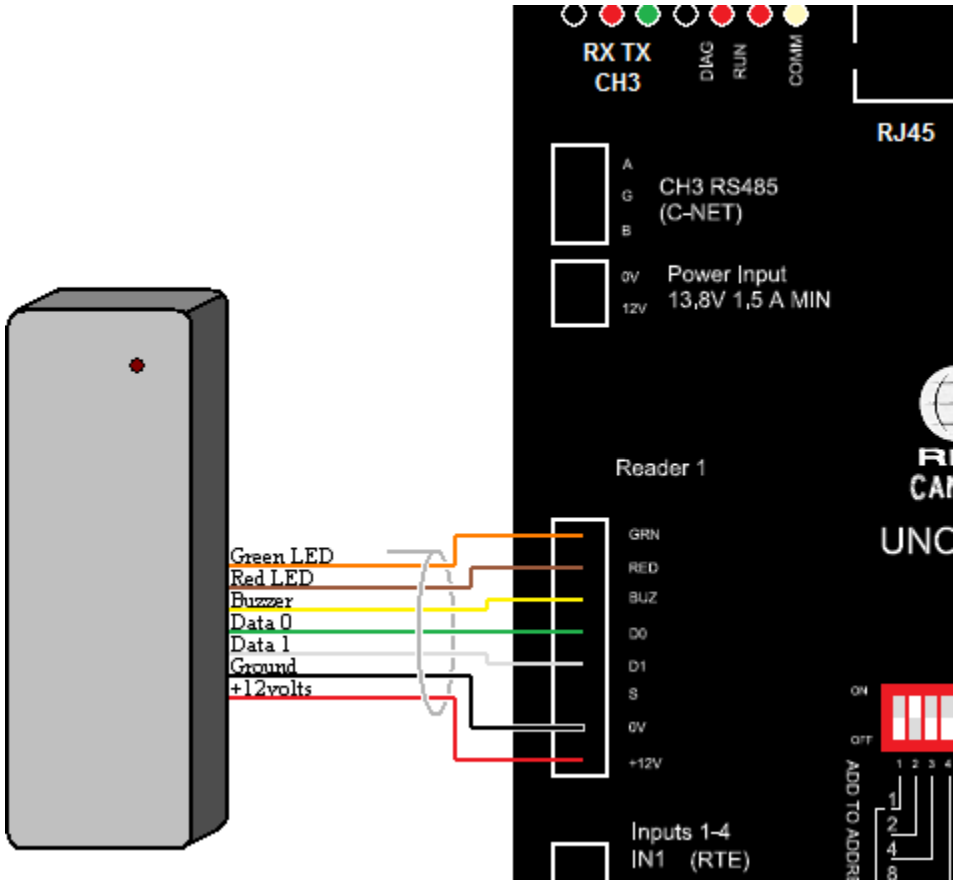
The Buzzer emits one long beep and the green LED turns on for the duration of the unlock time.

Access Denied

The Buzzer emits two short beeps and the red LED flashes twice.

Reader Connection

RC-2 to 12-Volt Reader Connection Diagram[2]



Cable Specification

7-conductor[3], stranded, shielded cable (*not twisted*), 20 to 22 AWG

Maximum Cable Length

20 to 22 AWG Cable: 500 feet (*150 meters*)

[2] Reader wire colours may vary for different reader manufactures. Please verify your wiring.
[3] Some readers only require 6-conductors since they only have one LED wire (wired to GRN).

N I R C 2 0 0 0 & N U R C 2 0 0 0

The NIRC2000 uses an IRC2000 board and the NURC2000 uses a URC2000 board to provide most of the functionality of the RC2 board to the Axiom system. The NIRC2000 and NURC2000 firmware is based on RC firmware so that they will have the same features (as much as possible).

Modification

Due to the lack of internal power supply and fewer I/O lines the NIRC2000 and NURC2000 do not provide the following functionality:

Reader Tamper

The reader tamper inputs can be used to monitor AC failure and low battery. Reader "A" tamper is used for AC voltage detection and should be shorted to ground to avoid "AC FAIL" message, if the power supply modifications are not done. Reader "B" tamper is used for battery voltage detection and should be left open to avoid the "BATTERY FAIL" message, if the power supply modifications are not done.

Cabinet Tamper

Cabinet Tamper always reports normal.

Fuse monitoring

Due to the lack of a power supply Fuse Monitoring always normal.

Dual RS485 Redundant Communications

Both panels only have a single channel so they must be wired differently.

Technical bulletin TB53 will show how to modify the NIRC2000 board and how to connect to the power supply to monitor for 'Battery Low' and 'AC Failure'.

***** For ULC-S319-05 III compliance, all wiring into the chassis mount panel's cabinet must enter through metal conduit. Also be sure to mount the panel in a protected area.**
***** For ULC-S319-05 III compliance, the rack mount panel's housing must have external tamper switch to detect the housing's removal from the rack. Also be sure to mount rack in a protected area.**

UNC500 Specification

Controller Power Requirements: 13.8 – 15 vdc @ 1.5A

Current Consumption: 250mA (*panel only*)

Processor: 32 bit micro controller

Flash ROM: Download firmware upgrades from the PC to UNC500

Memory: 2M, 4M, or 8M

System Capacities: Units C-NET Network Maximum of 15
RC-2 Controllers per network control 4 (*8 card readers*)
IOC-16 Controllers per network control (*320 Inputs or Outputs*)

Clock/RAM backup battery: 3v Lithium battery

C-NET (NC-100 to NC-100):	Network Type	ARCNET LAN
D-NET (NC-100 to RC-2 and IOC-16):	Network Type	RS485 High Speed Network
	Ports	Supervised RS485 ports
Local PC & Remote Communications:	Type	TCP/IP Ethernet, RS485

Real Time Clock: Built-in as standard

Watch Dog Circuit: Built-in as standard

Board Dimensions: **H** 7⅜ in x **W** 5¼ in (*18.7 x 13.3 cm*)

Operating Temperature: 0 to 70°C (*35 - 150°F*)

Operating Humidity: 20 to 85% RH (*non-condensing*)

Cable Specification

PC To Controller (Ethernet):

CAT5 communications cable

PC To Controller (RS485):

Twisted pair, shielded, stranded 18 to 22 AWG
Maximum Cable Length
4000 feet (*1200 meters*)

UNC-NET:

Twisted pair, shielded, stranded 20 to 22 AWG
Maximum Ring Section Cable Length
2500 feet (*750 meters*)
Maximum Total Ring Cable Length
10000 feet (*3000 meters*)

D-NET:

1 twisted pair, shielded, 20 to 22 AWG
Maximum Ring Section Cable Length
3000 feet (*900 meters*)
Maximum Ring Length
15000 feet (*4600 meters*)

RC-2 to Reader:

20 to 22 AWG, 6 or 8-conductor, stranded, shielded (*not twisted*)
Maximum Cable Length
20 to 22 AWG Cable 500 feet (*150 meters*)

Input Port Circuit Loop:

2-conductor, 20 to 22 AWG
Maximum Cable Length
1000 feet (*300 meters*)

***** For ULC-S319-05 III compliance, all wiring into the chassis mount panel's cabinet must enter through metal conduit. Also be sure to mount the panel in a protected area.**
***** For ULC-S319-05 III compliance, the rack mount panel's housing must have external tamper switch to detect the housing's removal from the rack. Also be sure to mount rack in a protected area.**