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The NuminaGroup of Companies

ATOP Cableless Pick-To-Light Installation Guide

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Section 1
Overview

ATOP's cableless pick-to-light system is both powerful and simple to install. This guide provides an outline of the steps required to lay out, install, configure and troubleshoot an ATOP system.

A typical pick-to-light system consists of pick-to-light controllers, cabling, and individual pick indicators, all made by ATOP. Pick indicators are available in a variety of configurations, including both numeric and alphanumeric displays, and light beacon indicators. Indicators of different types can be combined as needed within a system.

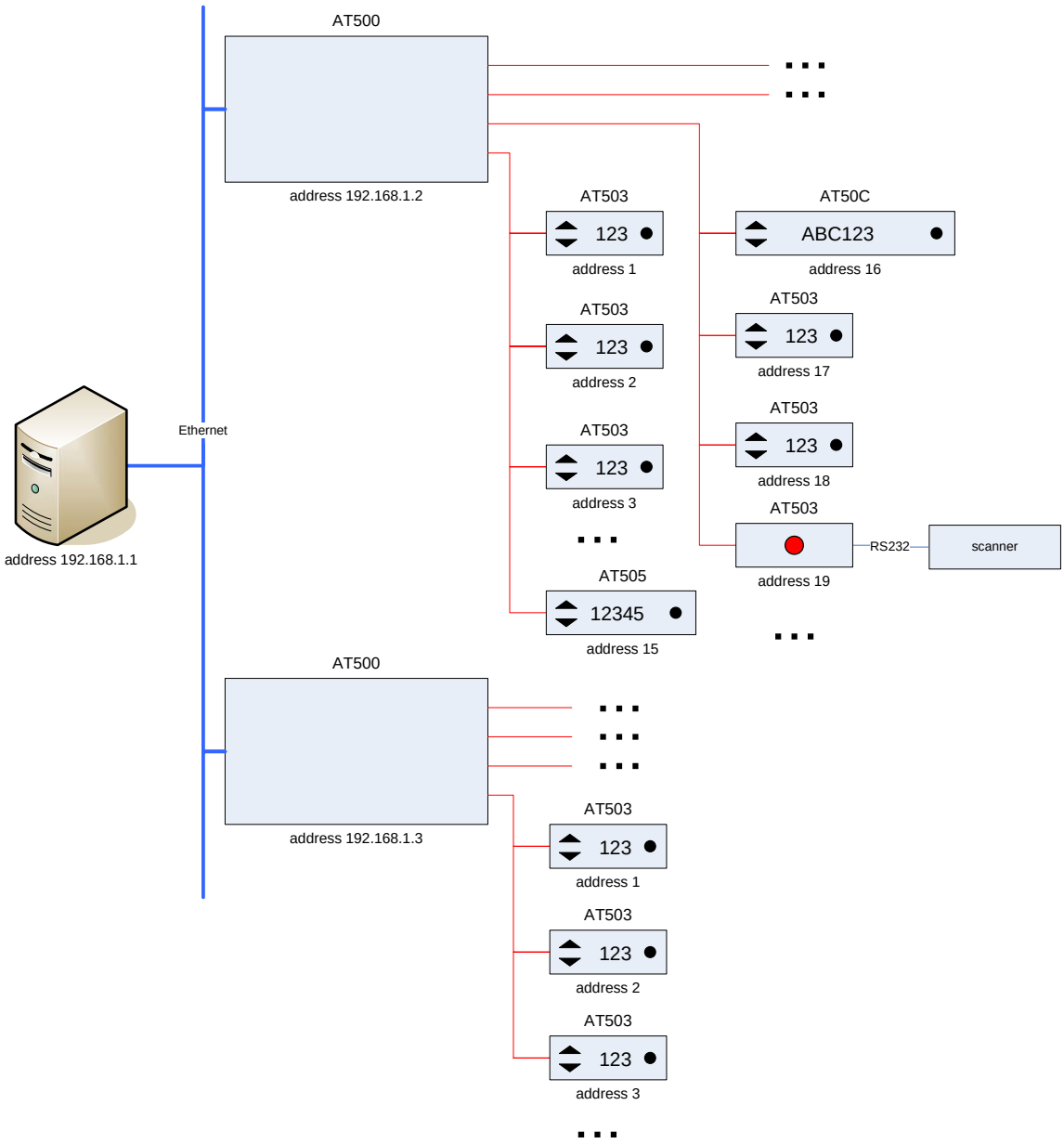


Figure 1: Typical pick-to-light system schematic

A computer, with appropriate software, is required to direct the pick-to-light system. The computer and ATOP controllers communicate via TCP/IP over Ethernet. The controllers communicate with the individual pick indicators via an RS-485 network. Each controller has four RS-485 channels, which perform double-duty as power distribution to the pick indicators. Each channel can support up to 30 devices, for a total of up to 120 devices per controller. Any number of controllers can be installed on the Ethernet network, for a virtually unlimited number of pick indicators in any pick-to-light system. Each pick device is individually addressed (1-120) by the controller to which it is connected (each device is connected to only one controller).

In addition to pick indicators, ATOP manufactures an RS485/RS232 converter module, the AT503, that allows the pick-to-light system to communicate with RS232 devices such as scanners and displays through the RS485 network, without the need for additional cabling or communications hardware. The converter modules are addressed by the controller as just another device.

Each pick indicator (or converter, etc.) is microprocessor controlled, and is responsible for managing only its own internal functionality. An AT503 3-digit pick indicator, for example, is programmed to update the indicator display based on the increase and decrease buttons and to send an RS485 confirmation message out when the confirmation button is pressed. The AT503 RS485/RS232 converter is programmed to receive RS232 messages and to send them back to the AT500 controller via RS485, and to receive messages from the controller and send them out via RS232.

The AT500 controller acts a communications gateway between the computer, with which it communicates via Ethernet, and its array of pick devices. The AT500 is in constant communication with every attached device, and can detect the failure of any device immediately.

The computer directing the pick to light system is responsible for maintaining a database of devices, for implementing the business rules that determine what gets displayed on each pick indicator, and for handling communications with the AT500 controllers. Typically, each pick display is known by an operational label such as its pick location. For example location ‘B2-4’ may be the operational label for the pick location in rack B, row 2, 4th from the left. The database must associate this location (this device) with the controller to which it is connected, and the address given to the device. Thus the AT505 5-digit pick indicator in the example schematic above may be represented in the database as both ‘B2-4’ and ‘192.168.1.2:15’.

To illustrate the system operation, consider the example of a typical parts pick. The control computer determines that it needs to light up pick indicator ‘B2-4’ with quantity 17. By referring to the device configuration database table, the control software determines that indicator ‘B2-4 is wired to controller ‘192.168.1.2’, and has an RS485 address of 15. The control software sends a message to ‘192.168.1.2’ indicating that device 15 should display quantity 17, and light up its LED. ‘192.168.1.2, in turn, broadcasts a similar message over its RS485 network. Device ‘B2-4’ sees this message, recognizes that the message is intended for it, because the message matches the address of the device, and lights up its display. The indicator handles the increase and decrease buttons by itself, updating the display as necessary, perhaps to reflect an updated quantity of 16 (there wasn’t enough product in the location to fully satisfy the pick). When the confirmation button is pressed, the indicator sends a message over the RS485 network, indicating that device 15 confirmed a quantity of 16. ‘192.168.1.2’ receives this message, and relays a similar message over Ethernet to the control computer. The control software recognizes that device 15 on ‘192.168.1.2 is the indicator ‘B2-4,’ and records the actual pick quantity in another database table.

Numina Group’s Pick-To-Light Java Toolkit implements all of the low-level communications and messaging functionality, leaving the application developer with only the task of implementing the specific business rules of the particular pick-to-light system being developed.

Section 2
Installing the hardware

In addition to ATOP hardware, installing a complete pick-to-light system requires a few commonly available items including fasteners and wire. No special tools are required.

The ATOP PLA2 (2m length) and PLA3 (3m length) plastic channel supports the indicators and associated internal cabling. The plastic channel can be cut to length using a chop saw with a fine-tooth blade or abrasive disk. The channel is installed before the other ATOP components, typically using self-tapping screws screwed directly into the racking or other structure that will be supporting the pick-to-light hardware. Mount the channel so the back (shown as the bottom in the figure below) is vertical. Avoid placing screws in places where a pick indicator will later be installed—the screw head will not allow the indicator to be inserted properly into the channel. Other methods may be used to mount the channel to the underlying structure, but be sure that any adhesive, etc. used does not damage the channel and is strong enough to support the channel in an industrial environment.

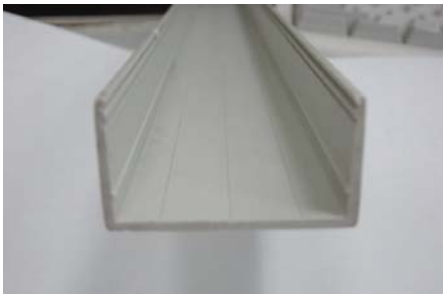


Figure 2: PLA2/PLA3 plastic channel

After the plastic channel is in place, the CBAR conduction bar is installed. The conduction bar consists of two continuous strips of metal conductor with a plastic backing, and provides both the power and communications connections between the AT500 controller and the individual pick indicators. Cut the conduction bar to length (CBAR can be purchased in 100m rolls) using metal shears, taking care not to allow the metal strips to touch. Debur the edges at each cut using a file, if necessary. The conduction bar is most easily mounted inside the channel using self-adhesive Velcro. A 1in length of Velcro every 24in will support the conduction bar. It is not necessary to rigidly fasten the conduction bar in the channel, as the pick indicators, when they snapped into the channel, also hold the conduction bar in place. Do not use screws to fasten the conduction bar to the channel, as they may short-circuit the conduction bar.

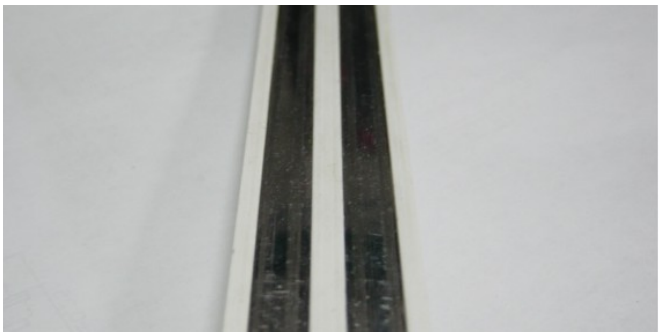


Figure 3: CBAR conduction bar

To connect the AT500 controller to the conduction bar, use 2-conductor UL/CSA SPT-2 16AWG cable ("zip cord"). The cable attaches to the screw terminals in the back of the AT500 and to AT590 terminal blocks mounted on the conduction bar.

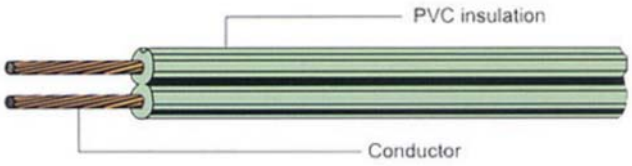


Figure 4: 2-conductor cable

Figure 5: AT500 controller. Conduction channel 1 is highlighted.

The AT590 terminal block attaches to the conduction bar magnetically, making installation and later configuration changes quick and easy. Be sure to maintain the polarity of the connections between the AT500 controller and the conduction bar. The terminals labeled '1A', '2A', etc. on

the AT500 should be wired to the ‘A’ terminals on the terminal blocks, and the terminal blocks must be mounted so the ‘A’ terminal is above the ‘B’ terminal. The insulation on one conductor in the SPT cable is ridged to make maintaining polarity easier. Pick devices are also labeled with an ‘A’ and ‘B’, and care should be taken to maintain the polarity of the connections through to the devices. Terminal blocks cannot be placed on the conduction bar where pick devices will later be installed.

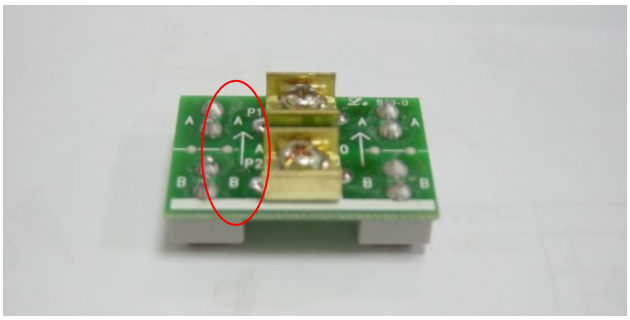


Figure 6: AT590 terminal block. ‘A’ and ‘B’ polarity markings are highlighted.

The pick devices simply snap into the plastic channel and are held to the conduction bar magnetically. They can be easily moved by snapping them out of the channel and placed in another location, and damaged devices are easily replaced in this way.

To finish an installation, use the ENDCV end cover and PLACV channel cover. The end covers snap into each end of the plastic channel, and a circular knock-out can be removed to bring the 2-conductor cable out of the channel, using flexible plastic conduit if desired. The channel cover is cut to length after the pick devices are placed onto the channel, and should snugly fit the spaces between devices. The channel cover snaps into the channel, and like the other ATOP components, can be easily moved if necessary.

Figure 7: ENDCV channel end cover with flexible conduit

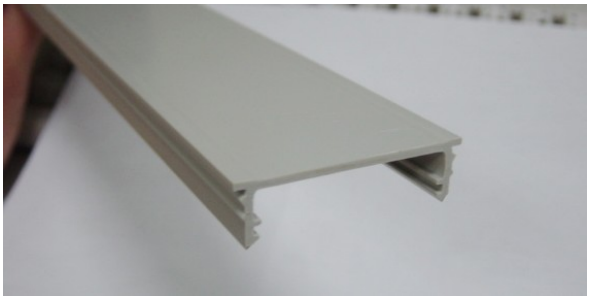


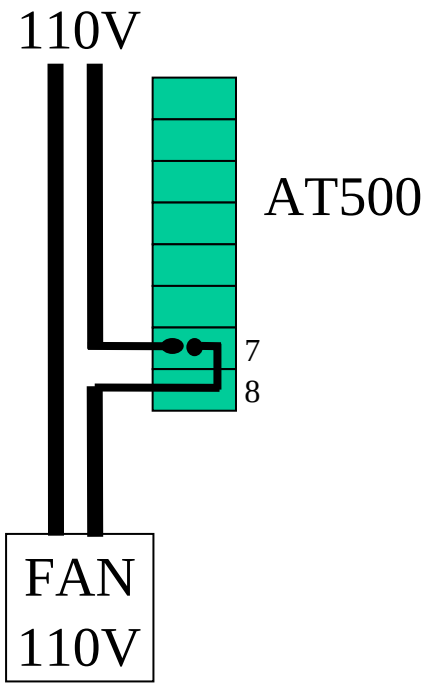
Figure 8: PLACV channel cover

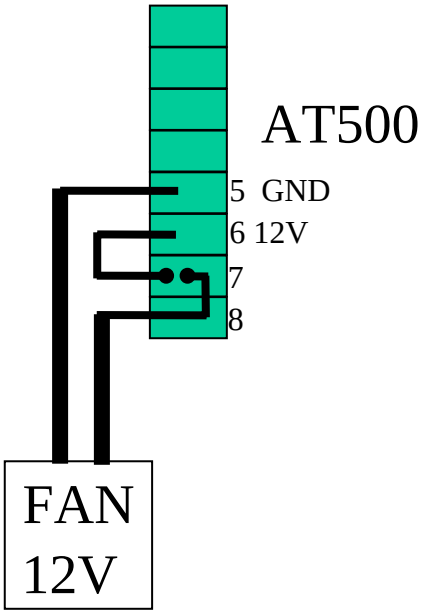
The AT500 can be connected directly to an appropriate AC outlet. Operating limitations include:

- 320W power consumption
- 115/230V 50/60Hz AC
- 0°C to 50°C operating range, -20°C to 70°C storage range
- 90% humidity, non-condensing

The controller can be mounted using the mounting ears supplied by ATOP, or it can simply be set on its rubber feet. It is best to keep dust out of the controller, so an enclosure for the AT500 may be needed in some environments.

The I/O connector on the back of the AT500 provides a thermostatically (45°C) controlled dry-contact closure at terminals 7 and 8 for controlling a cooling fan. Pins 5 and 6 can be used to provide GND and +12VDC to power a DC fan, or pins 7 and 8 can switch an externally powered AC fan.


110V
AT500
7
8
FAN
110V

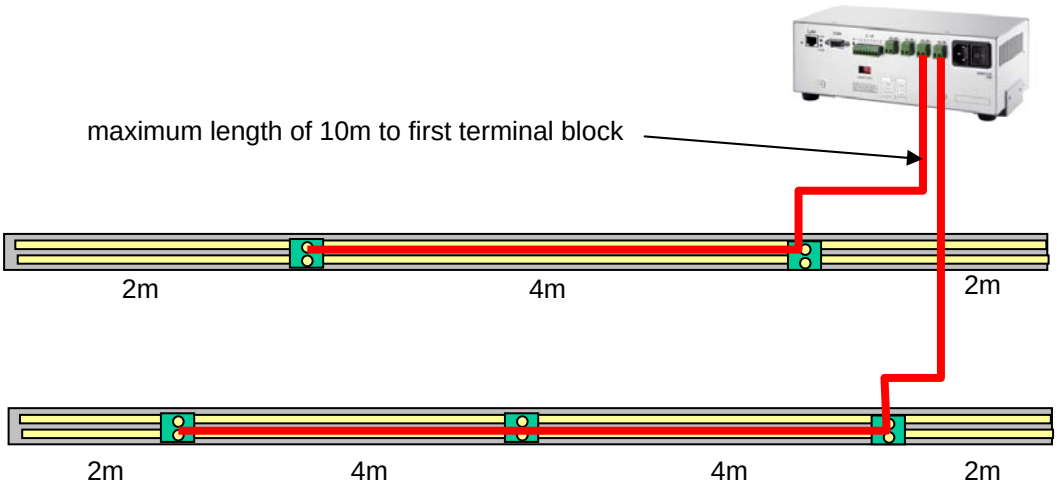

AT500
5 GND
6 12V
7
8
FAN
12V

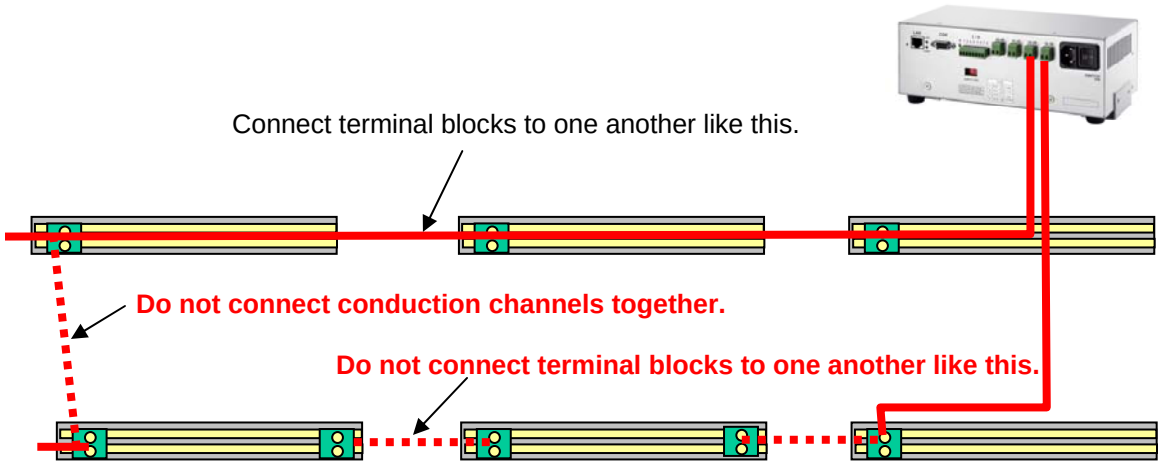
Section 3
Layout considerations

In general, the layout of a pick-to-light system starts with the pick indicators. Pick indicators should be mounted close to the associated pick location, where they are visible, where an operator can easily reach their buttons, and where they are unlikely to be damaged.

Once the indicators are laid out, care must be taken to arrange the conduction bar, terminal blocks and 2-conductor cable properly. If these components are not arranged properly, some pick devices may not receive sufficient operating voltage from the power supply in the AT500 and may work intermittently or not at all. It is important to consider that the 2-conductor cable is a much better conductor of electric current than the conduction bar. Therefore,

- No device on the channel should be more than about 2m from a terminal block
- All terminal blocks must be connected back to the AT500 through 2-conductor cable, not through conduction bar
- Keep the conduction channels (1-4) separate. Do not connect two or more channels to the same piece of conduction bar.





An additional limitation to consider is the maximum number of pick devices connected to any AT500. While the AT500 can support up to 120 devices, it is usually better to limit installations to 80 devices per controller, with 20 or fewer devices per conduction channel. The limit of 120 can be considered in cases in which the controller is very close to the nearest terminal block and devices are packed very densely on the channel.

Section 4
Configuring the devices

4.1 Configuring the AT500 pick controller

The AT500 pick controller normally needs to be configured only when new. The only user-configurable parameter is the network IP address, which can be changed using the monitor.exe program, which is supplied on the Numina PTL distribution disk. To simplify the procedure, run monitor.exe from a laptop or other computer to which no other AT500 controllers are networked. Plug in the new AT500, and connect a network cable to it. If you are not using a hub or switch between the computer and controller, you will need to use an Ethernet crossover cable.

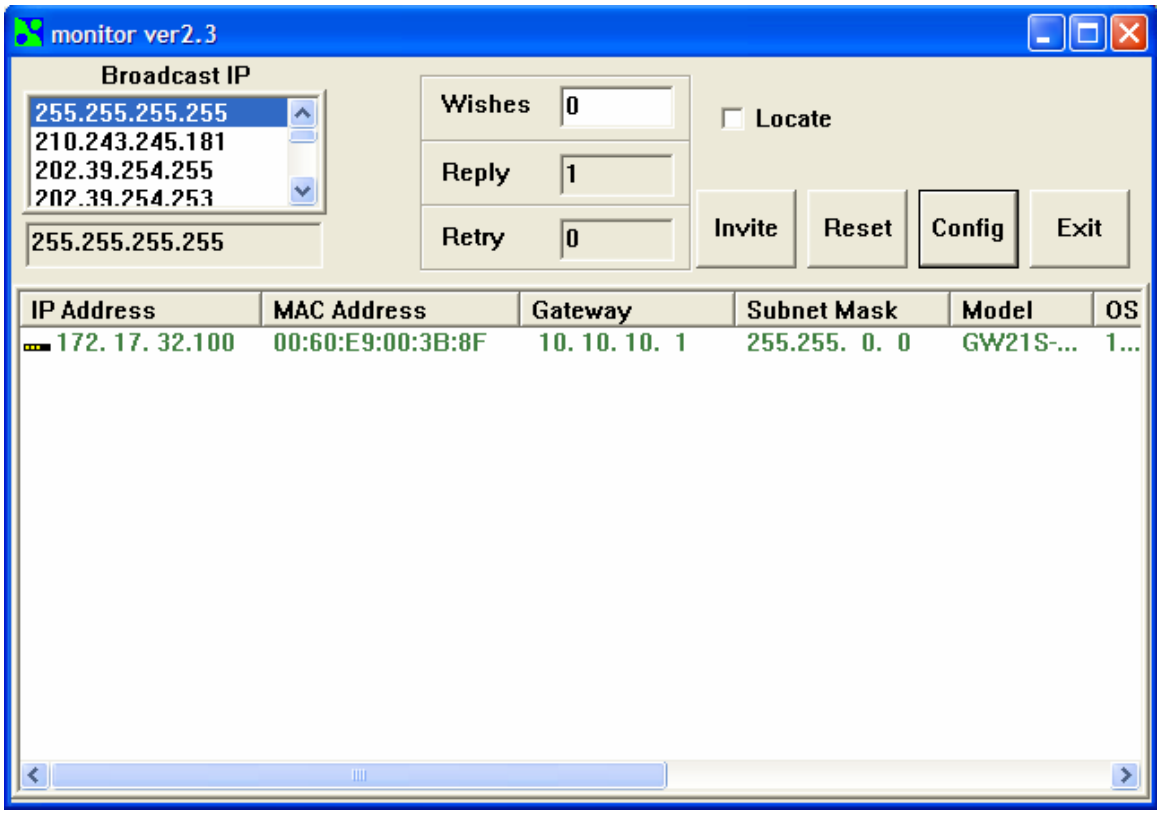


Figure 9: monitor.exe screen

Run monitor.exe (you will need the file gw21le.dll, also on the distribution disk, in the same directory), and click the Invite button. You will see the MAC (hardware) address of the new controller and its default IP address. It is a good idea to record the MAC address, and write it and the IP address somewhere on the controller. Select the controller by clicking the IP address (a default IP address appears on the screen), then click the Config button. Enter the new IP address, and click the Config Now button. You do not need to change the GateWay, Mask, or any other parameters. The new AT500 is now ready for use.

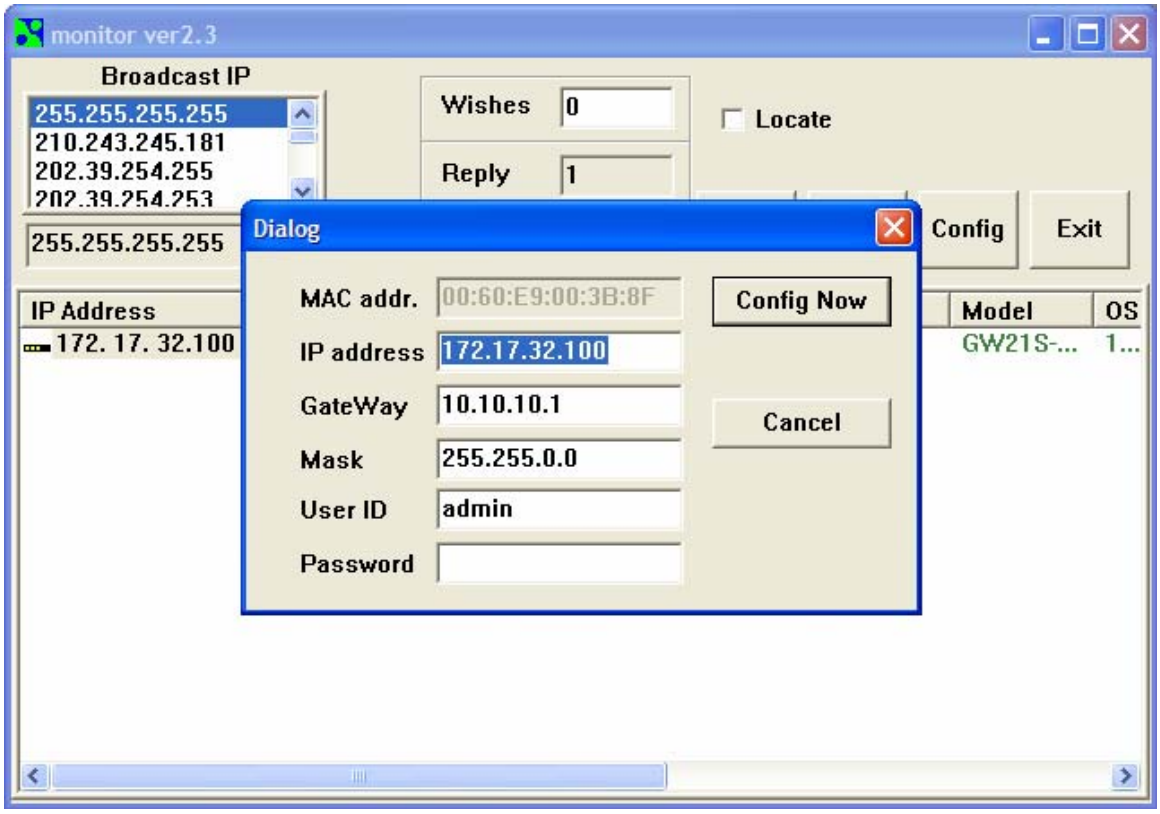


Figure 10: assigning an IP address to an AT500

After setting the network IP address, run the PTLSetup application, also provided on the Numina PTL distribution disk.

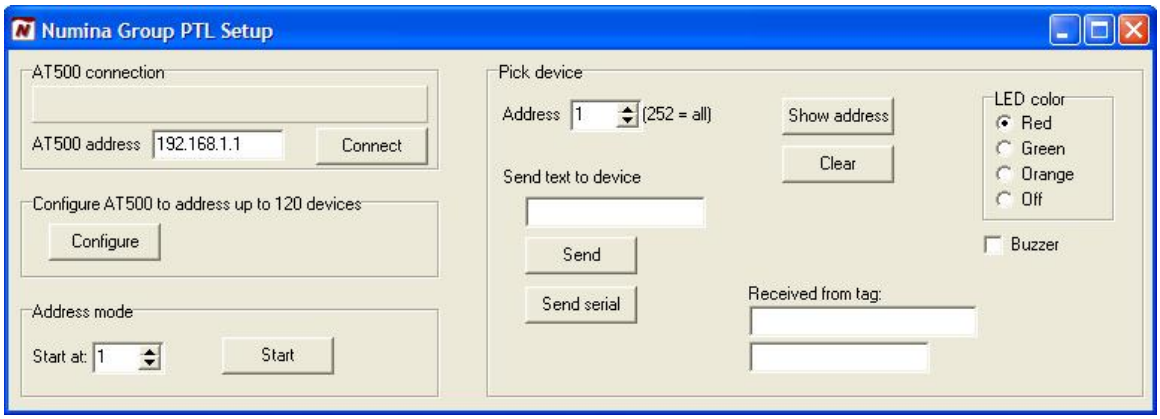


Figure 11: the Numina PTL setup application

Enter the IP address for the PTL controller in the upper left corner of the window, then press the Connect button. Then press the Configure button. This procedure allows the controller to recognize up to 120 devices connected to the RS-485 chain.

4.2 Configuring pick devices

Pick indicators with LED displays (numeric and alphanumeric) can be configured in two ways: by using the buttons on the indicator, or by using the AIT (address installation tool). To set the RS485 (1-120) network address, press the increase, decrease and confirm buttons together for three seconds, and release. You should see the current address of the device inside brackets (e.g., '[017]'). The default address for a new indicator is 001. You will first see the hundreds digit flashing, indicating that you can change it by using the increase or decrease buttons. When the hundreds digit is correct, press the confirm button, and the tens digit will flash. Repeat this procedure until all three address digits are set. Press the confirmation button to accept the new address, and the display will show the new address. Press the confirmation button once more, and the display will clear.

The AIT can be used to the set the address on any ATOP cableless pick device, and must be used on any device which does not have both buttons and an LED display, for example the AT503 RS485/RS232 converter. To use the AIT (which is essentially an AT505 5-digit pick indicator on a piece of plastic channel), plug the AIT power supply into a wall outlet and into the AIT, and switch on the AIT. About a third of the red LED on the left of the indicator will illuminate, indicating that the AIT is in standby. Place the device you are addressing on the conduction bar on the right of the AIT. It is not necessary to snap the device into the channel; the conduction bar is intentionally bowed out to make placing the device on the bar easier. Press and hold the confirmation button on the AIT until the AIT display reads 'Ait 1.0' and the LED is fully illuminated. The display on the AIT shows the current address of the other device. Use the AIT indicator to enter the new address for your device, as in the previous paragraph.

A third option for setting the addresses on pick devices equipped with both buttons and LED displays is to use the address mode feature of the Numina PTLSetup application. This method is the fastest and easiest method for addressing pick devices. In PTLSetup, press the Start button underneath "Address mode". Every pick device connected to the controller will flash the starting address (defaults to '1') indicated to the left of the Start button. Press the confirmation button on the device that should have this address, and every pick device now flashes the next address (e.g., '2'). To address all of the devices, simply walk down the channel, pressing the confirmation buttons in order, and an entire rack of pick indicators can be addressed in seconds. Press the Clear button to leave address mode and clear the pick indicator displays.

4.3 Test pick devices

The PTLSetup application can be used to manually control pick indicators. After establishing a connection with the AT500 controller, enter the device address (1-120, or enter 252 to control all devices at once). Use the field below the address to type in a value (numeric or alphanumeric) and press the Send button. The display should update immediately. Use the LED and buzzer controls on the right of the screen to control the tri-color LED and buzzer in pick indicators that are so equipped.

The Show address button is used to force a pick indicator to display its RS485 (1-120) address. The Clear button clears the display on the pick indicator. The Send serial button allows you to force an AT530 RS485/RS232 converter to transmit a serial message over its RS232 port.

The fields beneath the text "Received from tag" display messages sent from individual pick indicators to the AT500, and can be used to test the bidirectional communications between the controller and the pick devices.

Section 5
Troubleshooting

Below are listed some common error conditions, the probable causes and the corrective action to take.

- **A pick indicator shows 'FF' on the display.** This indicates that the pick indicator is not in communication with a pick controller. Because the indicator is obviously powered, it must be wired to a controller, but the controller is not polling the indicator via the RS485 network. This situation almost always indicates that the address of the indicator is outside the range polled by the controller. Be sure that the indicator has an address between 1 and 120 (inclusive). The controller needs to be configured to communicate with all 120 possible device addresses; use the address-mode function on Numina's PTLSetup application.

- **A pick indicator is not lit up.** Pick indicators are not always lit up. A system typically lights up indicators only when there are picks for the corresponding pick location. I you think an indicator should be lit up and it is not, check the connection between the indicator and the conduction bar behind it. The indicator is held to the conduction bar by magnets, at least two of which (an 'A' and a 'B') need to be in contact with the bar. When an indicator is first powered up, it goes through its power up sequence, during which it flashes various numbers, ending with the unit's RSS485 address.

- **Several pick indicators are not lit up.** If several adjacent pick indicators do not light when expected, it could be a problem in the wiring between the indicators and the controller, or in the controller itself. The wiring between the indicators and the controllers uses what looks like lamp cord or "zip" cable, a two-conductor cable that is run from screw terminals on the controller to magnetic terminal blocks mounted on the conduction bar that runs behind the indicators. When measured with a DC voltmeter, the voltage between the two conductors should measure approximately 7.2 V. If you do not see 7.2 V at the conduction bar, but you see 7.2 V at the controller with the two-conductor cable unplugged, there is likely a short between the two conductors. If you do not see 7.2 V at the controller with the two-conductor cable unplugged, there is likely a problem inside the controller. The controller normally recovers automatically to external shorts; simply unplug all cables from the controller and power cycle it. If the problem persists, the unit will need to be repaired.

- **The wrong pick indicator lights up when picking.** This is likely due to either an error in the pick-to-light system configuration database tables, an error in the pick indicator addressing, or an error in the computer software. Use the Numina PTLSetup application to test the functioning of individual pick indicators. If the problem cannot be traced back to an error in addressing, it is likely a database configuration or software issue.