Installation and Reference

Manual for the

POWER PRO DCC ™

Digital Command Control

RU01-Pro Wireless Adapter

Fits Versions 1.3 and 1.2 of NCE ProCab.

Version 1.0

Operate your cab without “plugging in”

Features:

- Add wireless capability to your ProCab
- Two way communication with the cab
- All features of your ProCab are available without plugging in
- Installs entirely with in your cab - no soldering!
- Uses ANY battery chemistry: Alkaline, NiCad, NiMH, Lithium, Lead Acid
- Low battery indication right on the display of your cab
- 40+ hours of operation (typical) with Alkaline batteries
- Includes battery clips and antenna
- Automatic switchover to bus power when plugged in
- Graceful degradation of operation when approaching maximum range

Additional items needed:

- 11/64” (3.25mm) and 11/32” (8mm) drill bits
- Four AAA battery cells
- Hobby knife with a sharp #11 or #16 blade

No guarantees are made by NCE or authorized NCE dealers as to the suitability of this product for its intended use.
As with all radio products, communication integrity in the presence of interference can not be guaranteed.

About your wireless adapter:

The RU01-Pro is designed to eliminate the need for tethered operation of an NCE ProCab. All present and planned features of the cab are usable while untethered from the cab bus. The adapter is battery powered and will supply power for both cab operation and the adapter itself. Although the RU01-Pro adapter is designed to operate at any voltage from 2 to 16 volts we recommend the use of 4 AAA cells. The ProCab has a built in battery chamber holding 4 AAA battery cells. The transmitter power of the RU01 is .00025 Watts. By comparison your cell phone can put out 3 Watts or 12,000 times the power of the ProCab. For this reason a general discussion of wireless communications follows.

Wireless communications:

We are continuously asked about the operating distance of the wireless cab. There are many factors governing the useful range of wireless products. The RU01 operates in the ISM (Industrial, Scientific and Medical) radio band at 916.5 MegaHertz (Mhz). Many cordless phones, wireless computer networks, home automation systems, and wireless security devices also operate in this portion of the radio band and all contribute to radio interference. In any radio system, propagation of the radio signal will suffer in the presence of 'in band' intererence. When devices operate in the same frequency band they may contribute interference to the point where your cab may not work at all. On the other hand your wireless cab may interfere with the operation of the other devices you already own. Radio waves are like one big telephone 'party line' where everyone is talking at once. A device using these radio waves must attempt to sort out what 'voices' are relevant to its operation and which ones are 'noise'. If there is too much noise it can't do this successfully and will operate poorly or not at all.

Indoor radio propagation is an issue for special consideration. The human body readily absorbs RF energy in the frequency band used by the RU01 cab radio. Placement of the base station can mitigate blocking of the radio signal due to human body absorption. In most indoor situations 'dead spots' can be found where reception is very difficult. These can occur even if there appears to be a direct line of sight between the transmitter and receiver. These dead spots, or 'nulls', are the result of multiple radio transmission paths between two points caused by reflections off metal objects such as steel beams, screen wire, concrete rebar, metal door and window frames, ceiling tile frames, model railroad track, etc. Nulls occur where the path lengths differ by an odd ½ wavelength (about 6 inches at 900 MHz). Deep nulls are usually very localized and can be avoided by moving slightly, usually only a few inches. When performing complex tasks involving many messages displayed on the ProCab, communications between the cab and command station may take longer than expected thus slowing down your programming. In these instances you may find it more expedient to plug in the cab while doing extensive programming or system setup.

The transmitter power of the RU01 is .00025 Watts. By comparison your cell phone can easily put out 3 Watts or 12,000 times the power!

Pre-installation checkout:

Before beginning installation of the RU01 it is best to ensure the ProCab is within the specified range of procab addresses for wireless operation. Your ProCab must be in the range of 3 to 18 for proper operation with the RB01 base station. Address 2 is reserved for future special wireless products and will work sluggishly or not at all. To set the cab address of your ProCab: unplug it from the operating cab bus, hold down the "SEL LOCO" button while plugging in the cab. Type in the desired cab address followed by "ENTER". Press "ENTER" 3 more times then the "PROG/ESC" button. The cab should now be set to the new address. Make sure it operates properly then unplug it so installation can begin.

Installation in Version 1.3 ProCab

Open the cab:
Place the cab face down on a clean soft surface and remove the nine cover screws. Remove the rear cover. Set the front cover of the cab with main circuit board aside.

Drill the holes:

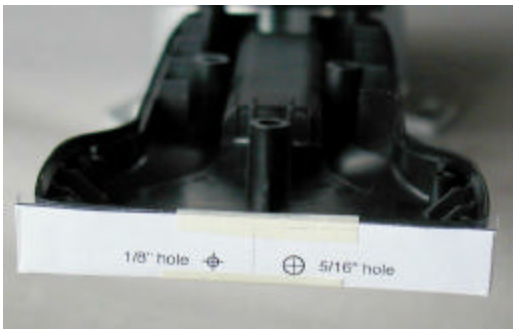
1. Cut the drill template from the back page of this manual. (Cut on the heavy lines)
2. Fold the template along the thin lines. Attach the template to the cab bottom as shown in Photo #1 with tape. Make sure the top edge of the template aligns with the top edge (open edge) of the cab bottom
3. Use a small drill such as 1/16" (1.5mm) to drill pilot holes at both marked locations on the template.
4. Enlarge both holes with a 11/64" drill. (.161", #20 and 4.25mm are the same size)
5. Now enlarge the hole marked 11/32" hole to 11/32" (.312" or 8.0 mm)
6. Carefully clean the burrs from the edges of the holes using a hobby knife.
7. Using flush cutting "rail nippers" or pliers remove the small tab inside the top of the cab between the holes you just drilled.
8. Remove any of the remaining plastic tab with a sharp hobby knife or sandpaper. Any remaining plastic here will prevent the antenna from making proper contact with its connector.
9. Test fit the radio circuit board in the holes. Adjust the holes with a hobby knife until the circuit board will seat flush up to the edge of the cab. See photo #2

Install the battery clips:

10. Turn over the cab bottom and remove the small (2-56) screw from the battery compartment door.
11. Remove the battery door to expose the battery compartment.
12. With the narrow end of the cab back toward you insert the red wire (attached to a battery clip) through the left hole of the battery compartment. Press the clip down into the cab bottom until it fully seats (see photo #4).
13. Install the black wire with its battery clip in the right hand hole in the same manner.
14. Locate the 'double' battery clip and install it at the opposite end of the battery compartment as shown in photo #5

Install the radio circuit board:

15. Turn the cab bottom over exposing the inside of the back.
16. Locate the 9 pin wire harness and insert one end of it into the 9 pin connector on the radio circuit board. Make sure it is fully seated.
17. Remove the backing from one side of the foam tape square and affix it to the center of the smooth side of the radio circuit board.
18. Remove the backing from the remaining side of the foam tape. Tilt the circuit board so the connector and red LED go in to the holes at the top edge of the cab bottom before the tape sticks the plastic cab back.
19. Stick the circuit board down flat on the cab bottom.
20. Using a small screwdriver connect the black wire to the terminal of the radio circuit board marked "BLK"
21. Connnect the red wire to the other terminal.
22. Place the cab top parallel to the cab bottom and connect the remaining end of the 9 pin wire harness to the mating connector on the ProCab main circtui board.
23. Dress the wires as shown in photo #6 and use scotch tape to fix the wires in place so they won't interfere with th eoperation of the thumbwheel or closing of the cab.
24. Carefully reassemble the cab bottom to the top while paying close attention to make sure no wires are caught between the cab halves.


1/8" hole
5/16" hole

25. Replace the 9 cover screws taking care not to over tighten and strip the holes.
26. Insert the batteries using the polarity indicators moled in to the battery compartment.
27. Attach the antenna. Do not over tighten.

Installation photos:

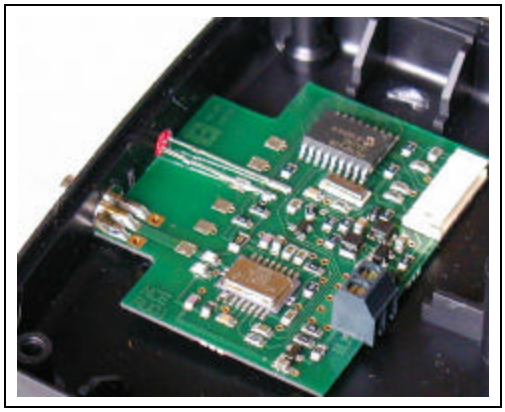


Photo 1
Photo 2

Photo 3 not used

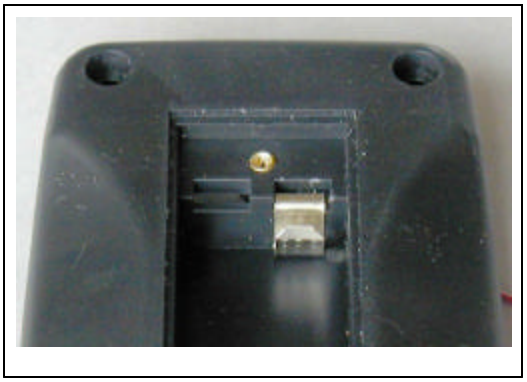


Photo 3
Photo 4

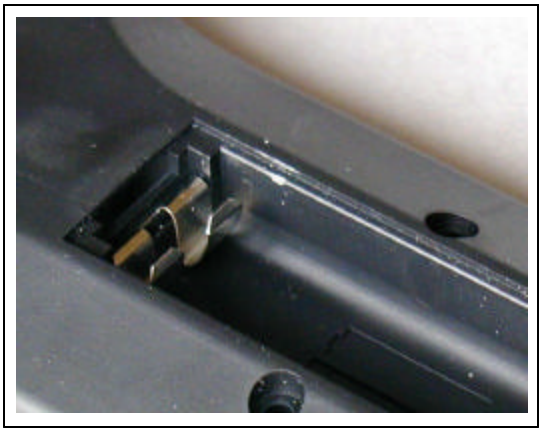


Photo 5

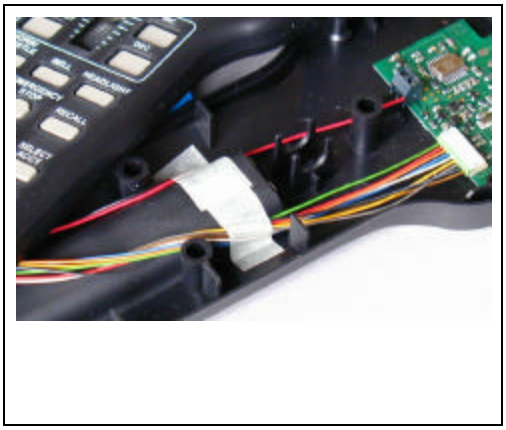


Photo 6

Installation in version 1.2 ProCab:

Open the cab:
Place the cab face down on a clean soft surface and remove the nine cover screws. Remove the cab back and discard it. The new cab back will be used for the rest of the installation. Set the front cover of the cab with main circuit board aside. Use a hobby knife to make a small cut in the two circuit board traces indicated in the drawing below (Figure 1). Make sure there is a 1/16" gap in the trace so there will be no possibility of the gap conducting power. After cutting the circuit board traces continue installation with step #1 of the version 1.3 installation instructions.

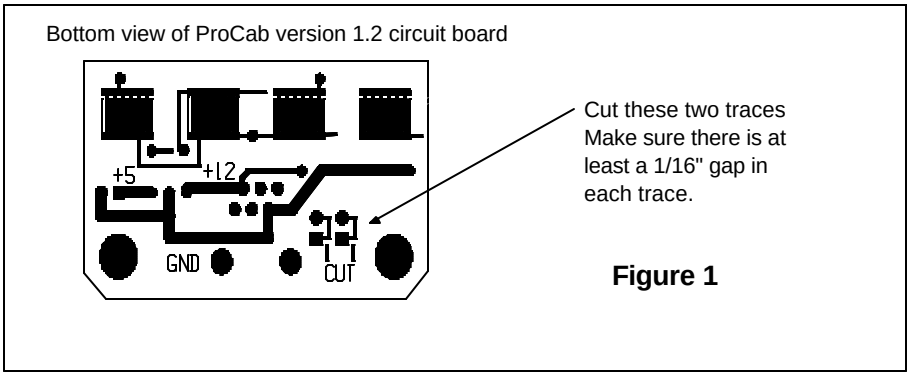


Figure 1

Optional Cab bus switch:

Note: Version 1.2 ProCabs will NOT automatically revert to cab bus operation when plugged in to the cab bus. If you are technically inclined you can add an optional manual switch to use the cab when plugged in to the cab bus. See figure 2 below for a diagram of this switch wiring.

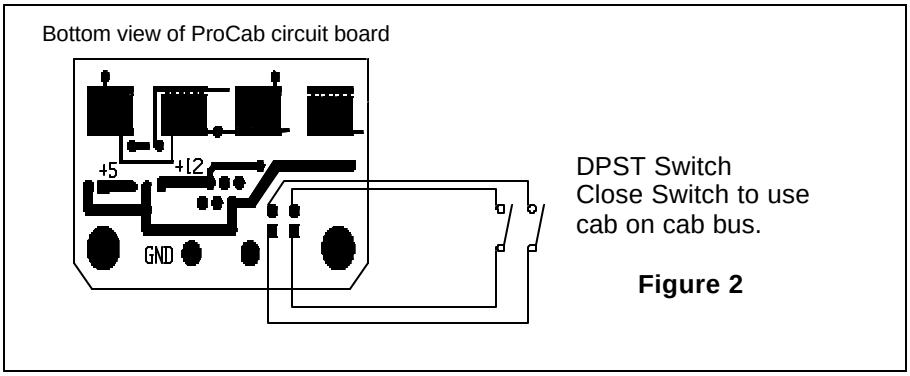


Figure 2

Close the switch when on cab bus and open it when on radio. Leaving the switch in the closed position will result in very short battery life and erratic operation of hte radio.

Operation of the Cab:

To turn on the cab:
Press "EMERGENCY STOP". The display will activate and show the 'version message' but the backlight of the LCD display will not be on. The 'version message' will not disappear until the cab successfully communicates with the RB01 base station. After the cab communicates with the base station normal operations can begin just as if you were plugged in to the cab bus.

Description of LED activity:
The LED on top of the cab will flicker every time it communicates with the base station. A regular 'pulse' of this LED indicates good quality communications. The flickering will become erratic when you are getting out of range from the base station. You can use this LED activity to 'map out' weak signal areas and 'nulls' of the layout room.

Priority is placed on commands getting from the cab to the base station. As you approach the maximum range of the cab, updates to the LCD display will lag behind the commands being sent to the base. If the base station is not able to complete sending display updates it will try to re-send them 16 times before giving up. The base station LEDs flash brightly when it is trying to send display update information.

To turn off the cab:
Press "EXPN" and select option #1 (TURN CAB OFF).

Automatic shutdown:
As it comes from the factory, the cab will automatically shut itself off after 5 munites of inactivity. This time can changed from 1 to 9 minutes by pressing "EXPN" and selecting option #2 (SETUP RADIO). Press 1 through 9 to select the number of minutes before the cab automatically shuts off. If you enter 0 the cab will never automatically shut off and you will have to manually shut it off. Press enter to skip setting/changing the Layout ID. The cab should return to normal operation.

Low Battery:
The word BATTERY will appear in the upper right corner of the LCD display when the battery voltage drops to about 3 volts. The cab will continue to operate until the battery voltage drops to about 1.5 volts. This message can be disabled by pressing "EXPN" and pressing "1" at the prompt asking if you want to disable the low battery warning. Another indication of low battery is the LCD backlight will start to flicker (when it is on).

Layout ID:
The layout ID is used in situations where multiple layouts using the NCE wireless are running in the same area. When the ID is set to 0 all layout IDs are ignored by the cab and it will communicate with any base station it hears. When set to 1,2 or 3 the layout ID must match between the cab and base station. The layout ID is set by pressing "EXPN" and selecting option #2 (SETUP RADIO). Press "ENTER" to skip setting/changing the automatic shutdown timer. Press 0 to 3 to set the Layout ID. Only values of 0 to 3 are accepted. Press enter and the cab should return to normal operation.

Turning on the LCD backlight:
The LCD backlight comes for 3 seconds on when you press any key which might require reading the LCD display such as SEL LOCO, PROG/ESC, MACRO, etc. Each subsequent key press will extend the time the light stays on by 3 seconds. Pressing the "SHIFT" key will also turn on the backlight. On Version 1.2 cabs the backlight is controlled by the BACKLIGHT button on the cab.

Tips:
When you press a button on the ProCab press and hold for about a second. You don't have to press harder than normal but pressing slightly longer results in better performance.

We recommend having several UTP or UTP-DIN panels located around the layout where you can plug in the cab in case the battery goes dead or conditions such as severe interference cause loss of control via radio. We usually hang a short cab cable about 2 feet long from a small number these panels to facilitate plugging in in an emergency.

You may find it more expedient to plug in the cab while doing extensive programming or system setup. When performing complex tasks that require many messages to be displayed on the ProCab, communications between the cab and command station may take longer than expected thus slowing down your programming..

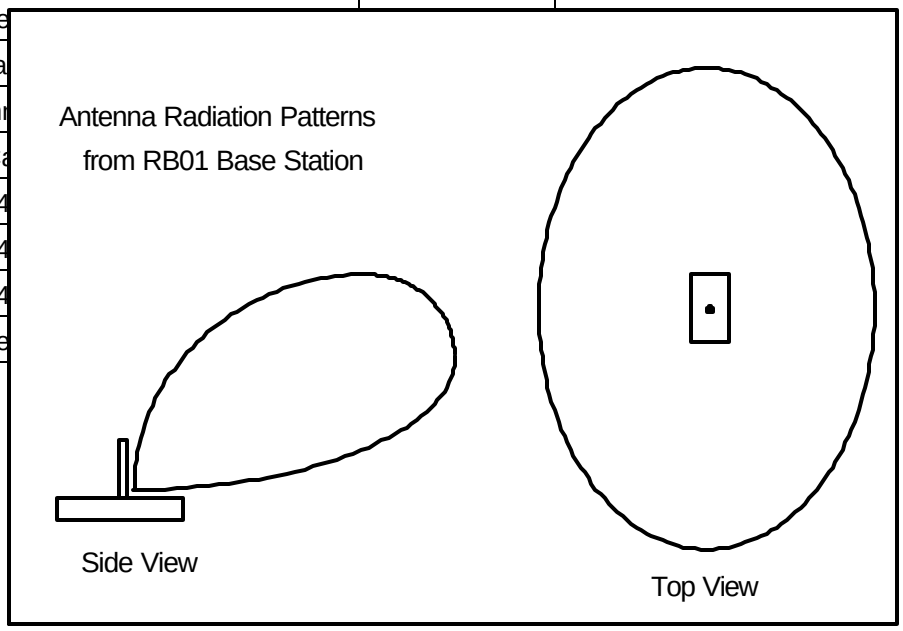
The LED on the cab flashes every time it sends a cab status update to the base station. You can use this flashing to map out the dead spots in the layout room. The cab is communicating best when the LED has a steady flicker. Move about the room noting where the spots wher the flashing stops or becomes erratic. Then move the base station to a different location until you get good reception at at the most important operating spots.

The cab may not operate when you get within 1 foot (300mm) of the base station (other cabs will still operate normally). The LED on the cab will flicker but the will not seem to communicate with the base station. This is due to 'overloading' of the base station receiver. We've found that if you cover the antenna with your hand it will attenuate the signal enough for reliable communication. Due to the extreme low power of the cab radios we've had to make the radio receivers in the base station very sensitive. This can result in the receiver being overloaded when a cab is too close.

The ProCab with wireless seems to propogate the radio signal better to the sides of the cab than to the front or rear. Turning the radio sideways to the base station will sometimes result in better communications.

Description	Price (US $)
ProCab bottom w/ battery door	$10.00
Procab top	$10.00
Rubbe	
ProCa	
Antenn	
Pro Ca	
Cab04	
Cab04	
Cab04	
Rubbe	

The cab will work much better with the antenna vertical rather than pointing the antenna at the base station. In crowded layout rooms



we've had good luck attaching the base station to the ceiling with the antenna pointing down. See the diagram below for how the radio signal propagates from the antenna.

Legalese:
The RU01-Pro, RU01-4/5 and RB01 wireless adapters for NCE cabs are RF products and may only be used in countries in which the units have been Type Approved or Certified for sale and operation. Use of these products in countries where they are not certified may result in interference to other critical radio services and legal penalties.

FCC ID: NC4RU01
This device complies with Part 15 of the FCC rules. Operation is subject to the following conditions (1) this device may not cause harmful interference and (2) this device must accept any interference received,

including interference that may cause undesired operation.

Warranty

This product is fully factory tested and warranted against manufacturing defects for a period of 1 year. As the circumstances under which this product is installed can not be controlled, failure of the product due to installation problems can not be warranted. This includes misuse, miswiring, operation under conditions beyond the design range of the product. No guarantees are expressed or implied as to the suitability of the product for its intended use by the purchaser. No guarantees can be made as to the communications range or performance of this product in the presence of radio or other electromagnetic interference. It is possible that interference can cause undesired operation including loss of control of speed, direction etc. Damage to purchaser's equipment due to loss of control is not warranted or covered by NCE.

For warranty or non-warranty replacement send the decoder (and any payment, if required) to:

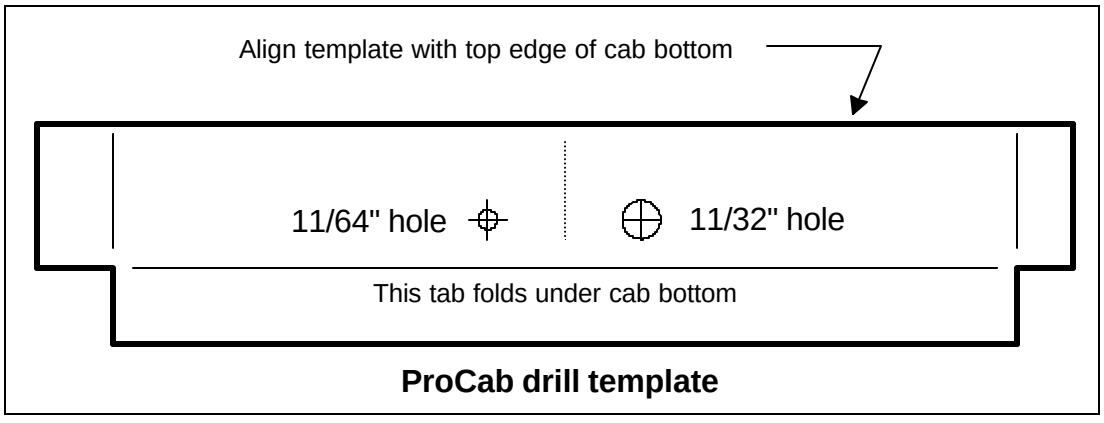
NCE Warranty Center
899 Ridge Road
Webster, New York 14580

Spare Parts:

Spare parts for your cab or RU01 wireless adapter may be ordered from the list below. $4 US will be added to your order for US priority mail and packaging. Check or credit card will be accepted.

Address all parts orders to :

NCE Spare Parts
899 Ridge Road
Webster, NY 14580



ProCab drill template