

Installation and Reference
Manual for the

POWER PRO DCC™
Digital Command Control

RU-4/5 Wireless Adapter

Fits NCE CAB04p, CAB04e and CAB05.

Version 1.0

Operate your cab without “plugging in”

Features:

- , Add wireless capability to your Cab
- , Two way communication with the cab
- , All features of your cab are available without plugging in
- , Installs entirely with in your cab - no soldering!
- , Uses ANY battery chemistry: Alkaline, NiCad, NiMH, Lithium, Lead Acid
- , 50+ hours of operation (typical) with Alkaline batteries
- , Includes battery holder 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
- , Two 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 Cab. 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 RU-4/5 adapter is designed to operate at any voltage from 2 to 16 volts we recommend the use of 2 AAA cells. The transmitter power of the RU-4/5 is .00025 Watts. By comparison your cell phone can put out 3 Watts or 12,000 times the power of the RUCab. 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 RU-4/5 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' interference. 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 RU-4/5 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 $\frac{1}{2}$ 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. On occasion, when performing complex tasks communications between the cab and command station may take longer than expected thus slowing down your loco or macro selection. In these instances you may find it more expedient to plug in the cab.

The transmitter power of the RU-4/5 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 RU-4/5 it is best to ensure that your Cab is within the specified range of addresses for wireless operation. Your CAB04/05 must be in the range of 19 to 50 for proper operation with the RB01 base station. To set the cab address of your CAB04/05: unplug it from the operating cab bus, hold down the "SEL LOCO" button while plugging in the cab. Type in the 100 PLUS the desired cab address (example: for Cab address 22 put in 122) followed by "ENTER". The cab should now be set to the new address. Make sure it operates properly then unplug it so installation can begin. If you have an older version of the CAB04 or CAB05 with the internal DIP switch for the cab address consult your cab manual for addressing instructions.

Installation in CAB04p, CAB04e and CAB05

Open the cab:

Remove the four cover screws (no need to remove the knob).

Remove the cab bottom. Set aside the cab top along with the main circuit board.

Remove the battery door from the cab bottom

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. 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. If the circuit board does not lay flat in the case it may be necessary to enlarge the holes just drilled with a hobby knife near the open edge (top) of the cab bottom. See photo #2

Install the radio circuit board:

8. 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.
9. Tilt the circuit board so the connector and red LED go in to the holes at the top edge of the cab bottom. See photo #2.
10. Loop the battery wires up over the circuit board and through slots in the fork shaped clips of the cab bottom as shown in photo #2. Note: the black wire is highlighted with white in the photo.
11. Make sure the battery holder and wires are routed through the open battery door as shown in photo #3
12. 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 circuit board.
13. Dress the wires as shown in photo #3.
14. Carefully reassemble the cab bottom to the top while paying close attention to make sure no wires are caught between the cab halves.
15. Replace the 4 cover screws taking care not to over tighten and strip the holes.
16. Insert the battery holder into the battery compartment of the cab as shown in Photo #4. This may take a bit of jiggling to get in the hole correctly as shown in the photo. When installed correctly it will stay in place on its own but still allow access to the two AAA cells.
17. Insert the battery holder into the battery compartment of the cab as shown in Photo #4. This may take a bit of jiggling to get in the hole correctly as shown in the photo. When installed correctly it will stay in place on its own but still allow access to the two AAA cells.
18. Insert the batteries using the polarity indicators molded in to the battery holder.
19. Attach the antenna. Do not over tighten.

Installation photos:

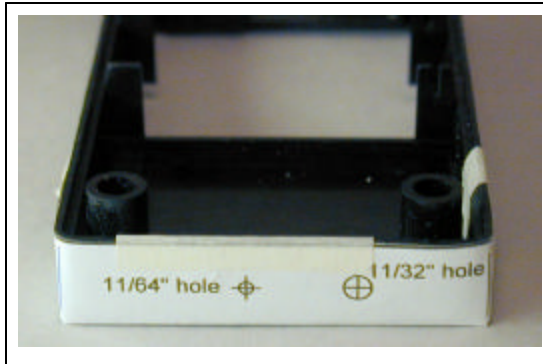


Photo 1

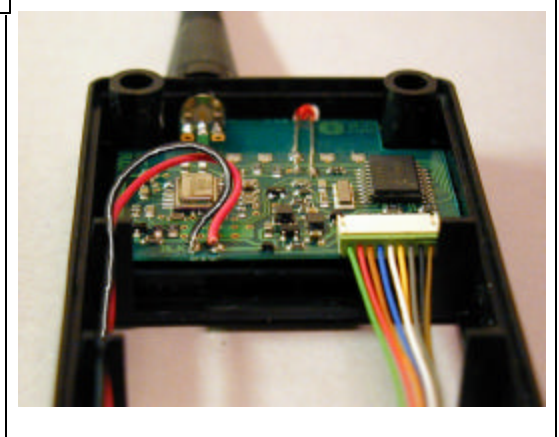


Photo 2

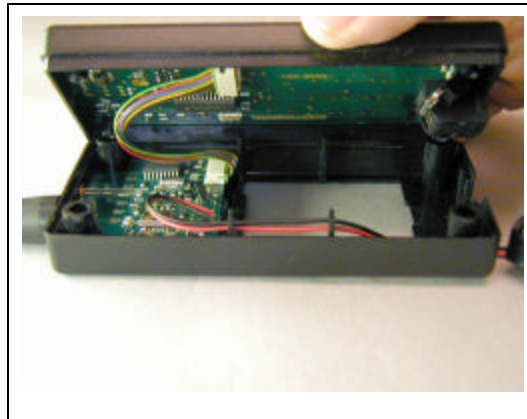


Photo 3

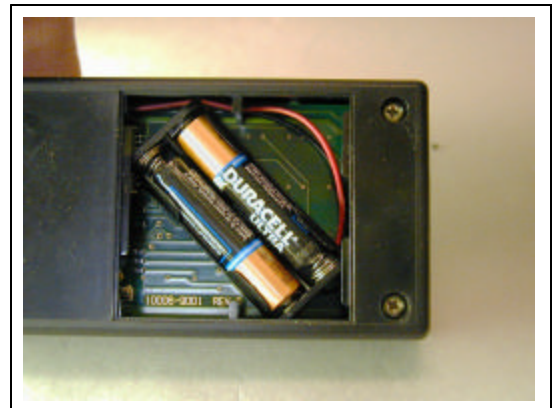


Photo 4

Operation of the Cab:

To turn on the cab:

Press "HORN" and the cab will activate. If the RB01 base station is on, the LED on top of the cab will start flashing. The LED will not flash 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. If the base station is not on or communications are poor the LED will light steadily for about 4 seconds then go off with each button press.

Description of LED activity:

The LED on top of the cab will flash every time it communicates with the base station. A regular 'pulse' of this LED indicates good quality communications. The flashing 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.

Automatic shutdown:

As it comes from the factory, the cab will automatically shut itself off after 5 minutes of inactivity. If this happens, pressing "HORN" will turn the cab on and normal operations can resume.

Low Battery:

The cab will continue to operate until the battery voltage drops to about 1.5 volts. There is no low battery warning on the CAB04p, CAB04e and CAB05 engineer cabs.

Tips:

When you press a button on the Cab 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..

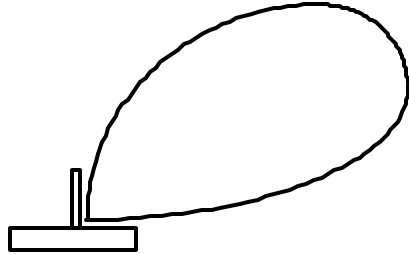
The LED on the cab flashes every time it sends a cab status update to the base station. You can use this flashing to map out the dead spots in the layout room. The cab is communicating best when the LED has a steady flicker. Move about the room noting where the spots where the flashing stops or becomes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

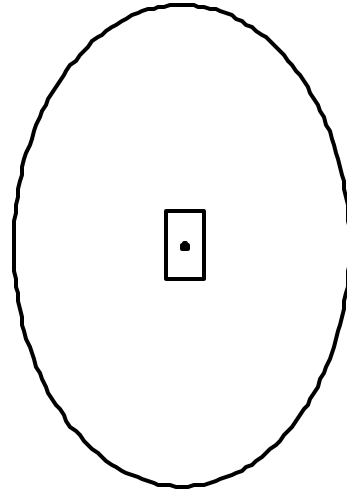
The CAB04/05 with wireless seems to propagate the radio signal better to the sides of the cab than to the front or rear. Turning the radio sideways to the base station will sometimes result in better communications.

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.

Antenna Radiation Patterns
from RB01 Base Station



Side View



Top View

NOTES:

FCC notice and 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

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Spare Parts:

Description	Price (US \$)
ProCab bottom w/ battery door	\$10.00
Procab top	\$10.00
Rubber keypad for ProCab	\$8.00
ProCab battery clip set w/wires	\$3.00
Antenna	\$8.00
Pro Cab screws (set of 9)	\$2.00
Cab04/05 rear cover w/battery door	\$7.00
Cab04/05 screws (set of 4)	\$2.00
Cab04/05 battery holder	\$1.50
Rubber keypad for Cab04/05	\$8.00

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

