

# Pennsylvania Trolley Museum



## Operations Training Manual



History that connects us.

# 2024 Edition

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Acknowledgments:

This manual was prepared by... Laura Wells & Bruce Wells with input from PTM Instructors & the operations department. Kevin Zebley Operations Manager. Copyright © 1992, 1993, 1995, 1998, 2018, 2024 - Pennsylvania Trolley Museum, Inc

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This manual is part of the streetcar operations training program at Pennsylvania Trolley Museum.

This manual is issued to:

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Badge Number: \_\_\_\_\_

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# OPENING AND CLOSING THE MUSEUM

## OPENING OPERATIONS AT THE MUSEUM

- Operators should arrive at the west site and check the West Substation blackboard for special notices regarding any operating restrictions that may exist.
- Get a radio and perform the appropriate “call sign” - “WPLD 754 opening transmissions for the day.” (This must be transmitted over channel 1 at the beginning and end of the operating day.) Even if you are the only crew at the museum, take a radio so that others may communicate with you if they arrive while you are on a run.
- Turn on the substation.
- Choose two operating cars for the day, one will be the “City run” (short trip) and one will be the “Interurban run” (Long Trip)
- If you are operating cars out of Founders Carhouse, be sure to rope off or close the doors after you have moved equipment from the building.
- You should only operate cars out of the Trolley Display Building with prior approval. If doing so, make sure stanchions are in place to prevent guests from walking on the tracks where the car was sitting. In cooler months, be sure to close the doors to the building after removing cars from it.
- Move car to apron in front of carbarn and complete a walk-around inspection. Look for items hanging off the car, dragging on the ground, or anything else out of the ordinary.
- Complete your line check, inspect the railway for any fallen debris, damaged overhead or track, and other obstacles that may hinder service.
- Park the car at the Volunteer Blvd platform when you have completed your line check. Be sure to set up one car at the Volunteer Blvd Canopy stop (Interurban run) and one at the cross walk.
- Tidy up the service cars as necessary.

## CLOSING OPERATIONS AT THE MUSEUM

- Park and secure service cars in the carhouse. If cars were run out of the trolley display building, be sure to replace stanchions.
- Be sure to shut off the air compressors.
- Drain condensation from the air tanks (where possible).
- Make sure ALL trolley poles are down.
- Ensure all operating handles have been returned to the ammo box located in their respective car.
- Shut off lights in building and check that doors are locked and alarm is set.
- Turn off trolley power.
- Return radios to the cabinet in the substation. Check to make sure that all other radios are off and properly seated in the charger.

- 
- Make a check of any doors you used to ensure that they are locked:
    - Trolley Display Building
    - Substation(s)
    - Events room (security system, all doors)
  - If a car was malfunctioning, damaged or otherwise not in proper condition write it up on a car condition report.
  - Place car condition reports, if any, in the condition box for the maintenance supervisor.
  - Be sure to log your hours via Volgistics at [pa-trolley.org/timekeeping/](http://pa-trolley.org/timekeeping/)

## SAFETY AT THE MUSEUM DURING DAILY OPERATIONS

- There will be a guide in the TDB offering tours to visitors throughout the day.
- If you are operating cars out of Founders Carhouse, be sure to rope off or close the doors after you have moved equipment from the building.
- If you are operating cars out of the Trolley Display Building, make sure stanchions are in place to prevent guests from walking on the tracks where the car was sitting. In cooler months, be sure to close the doors to the building after removing cars from it.
- Always be aware of pedestrians when moving a car on volunteer Blvd.
- Obey the traffic signals and US&S signals at all times!

## TIMEKEEPING PROCEDURE

Timekeeping is necessary in order to obtain a record of the volunteer hours that you work for the PTM. This information is used to support grant applications to foundations, corporations and government. It is used to help in future museum planning, and is also required by the Internal Revenue Service in our reports to them (individual names are not divulged).

Although no pay is involved, timekeeping of the volunteer hours is very important to the success of the Museum's fund-raising efforts. Donors want to know the extent of the Association's investment including our "sweat equity," in projects being or to be funded. Honest and complete time reporting is every volunteer's responsibility.

Be sure to log your hours via Volgistics at [pa-trolley.org/timekeeping/](http://pa-trolley.org/timekeeping/)

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# DISPATCHING

A dispatcher or supervisor of the day will be assigned to oversee all special events and other operations as necessary. The dispatcher will exercise general supervision of operators, conductors and docents to be certain that they fully understand and observe the rules. The dispatcher will give special attention to the prompt and regular movement of the streetcars according to the current timetable, and will make frequent inspections of equipment. The dispatcher will have jurisdiction at all times over movements of all rolling stock, crew assignments and car assignments. The dispatcher should be available to assist visitors with questions they may have and direct traffic flow around boarding areas. The dispatcher should assist patrons as they wait for, board, and exit the streetcars.

When a dispatcher is on duty, all radio communication with car crews is to be done through the dispatcher. Communication is not to be conducted directly between the museum store and operating crews or directly between streetcars unless instructed by the dispatcher to do so, or unless an emergency exists. During weekday operation in the period between Memorial Day and Labor Day when there is no scheduled dispatcher, one of the staff members will generally serve as dispatch if there is more than one streetcar on the line. When only one car is active, the operating crew shall determine movement of the streetcar.

## TWO-WAY RADIO OPERATION

### ALWAYS TAKE A RADIO WITH YOU WHEN OPERATING A CAR

Because of the concern for safety, Pennsylvania Trolley Museum makes use of two-way radios as an integral part of trolley operations. Use of these radios is licensed and regulated by the Federal Communications Commission (FCC) and we must adhere strictly their rules. Radios, like any other piece of valuable equipment, are to be used and cared for properly and professionally.

Portable radios of the type used at the Museum have a number of controls which you need to become familiar with.

- On-Off/Volume: As its name implies, this knob turns the unit on and off, and also controls the loudness. Set the volume so that you can hear radio transmissions clearly, but not so loud that they are easily understood by your passengers.
- Channel Selector - We use channel 1 is used for normal everyday trolley operations.
- The Push-to-Talk button is depressed to transmit a message to other units.
  - Hold this button down for at least one full second before speaking. At all other times, the radio will receive messages. Improper usage of this device causes incomplete and garbled messages to transmit. Be careful as you hold the unit or set it down that the key is not accidentally depressed.
- Hold the radio, with the plastic “grillwork” speaker facing you, about six (6) inches from your mouth. If you are too far away, the radio will not pick up your voice; if you are too close, your voice will sound fuzzy, garbled, or unrecognizable.
- Do not put your mouth on the speaker; it is unnecessary and unsanitary.

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- Speak clearly and distinctly. When your message is complete, be sure to release the keypad; failure to do so will prevent you from receiving any response, and will also interfere with or obscure communication between any other radios in use on the channel.

## **GUIDELINES FOR OPERATION**

1. Only museum operators, instructors, maintenance crews or other authorized personnel are to use the radio system.
2. Upon removing a radio from the cabinet you are responsible for it. Don't leave it unattended. Transfer it only to an operator who is replacing you, or return it (turned off) to the cabinet in the substation.
3. Friends, relatives, guests, and passengers are not to have access to radios at any time.
4. Keep communications reasonably discreet. Although radio volume controls must be set high enough to hear communications above ambient noise, don't turn your radio up so loud that the passengers can hear every word. Lapel mics are useful if you have difficulty hearing the radio.
5. Personal messages or horseplay on the radio is forbidden.
6. Never use obscenities on the radio. This is forbidden by the FCC of which you are using a licensed channel. Loss of the Museum's frequencies, fines, and imprisonment are possible due to the deliberate misuse of radio frequencies and equipment.
7. Always consider that your transmissions are under scrutiny. We do not have exclusive use of the frequency to which we are assigned. Our transmissions can easily be picked up by inexpensive scanners, and of course the FCC monitors all radio services.
8. The radios are built sturdily, but are not shockproof. Try not to bang them around or drop them.

### **Batteries**

Multiple radio charging stations are located in the radio cabinet in the substation. To recharge, place and properly seat the radio in the charger, ensure the radio is turned off. Upon inserting a radio in the charger, the red "charging" light will come on indicating the radio is now charging. When the charge cycle is complete, the light will be green, indicating that the radio is ready for service.

### **Security**

When you have finished using a radio for the day, please return it to the charger in the radio cabinet. This will insure that there will always be charged radios available for operators and crews. Always keep the radios in your possession, both to prevent them from being lost or stolen and to enable other personnel to remain in contact with you.

### **Communication**

Transmissions on museum radios must be professional, courteous, and as brief as possible. Generally, personal names are not used; rather, car numbers, assignment titles (such as "Dispatcher") or badge numbers should be used. Personal messages are permissible only as they may relate to the operation. The first and last transmissions of the day should include the use of our call sign - WPLD 754, which is prominently displayed on the radio cabinet. A first transmission of the day might be: "WPLD 754, Pennsylvania Trolley Museum commencing daily operation; standby for radio check".

The FCC encourages the use of "Ten Codes" to reduce transmission time. The most commonly used "10 codes" at PTM include: 10-4 - Acknowledged and understood and 10-20 - Current Location

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## RADIO COMMUNICATION EXAMPLES

Typical communication between Dispatch and the operators of rail equipment is illustrated as follows:

*\*\*It is vital for operators to repeat instructions back so that dispatch knows they have understood the order correctly.\*\**

**Example:** Passenger car operating on time table meets unscheduled work equipment on opposite bound movement. The dispatcher knows the approximate location of the passenger car from the time table and the work equipment operator has requested the move from the dispatcher.

Dispatch: "Dispatch to New Orleans 832, what is your twenty?"

Op. 832n: "This is New Orleans 832, we are just leaving Arden Loop"

Dispatch: "10-4 832 you are clear to Fairgrounds. Once there, hold for a meet with M283."

Op. 832n: "10-4 Dispatch, 832 clear to Fairgrounds, will hold for a meet with M283."

Dispatch: "Dispatch to M283, you are clear to Fairgrounds. Once you have made your meet with New Orleans 832 you may continue to Arden."

Op. M283: "10-4 Dispatch, M283 clear to Fairgrounds, hold for a meet with car 832, after meet we may proceed the line."

*832n meets M283 at Fairgrounds.*

Op. 832n: "New Orleans 832 to Dispatch, we have met M283 at fairgrounds, request clearance to Volunteer Blvd."

Dispatch: "10-4, 832 you are clear to Volunteer Blvd."

Op. 832n: "10-4 Dispatch, New Orleans 832 clear to Volunteer Blvd."

**Example:** Passenger car operating on time table encounters a signal malfunction. In this case there is no traffic in front of the car.

Op. 5326: "5326 to Dispatch, we have a dark signal leaving Fairgrounds outbound."

Dispatch: "10-4 5326, you are clear to Arden Loop. Call me for clearance before making your inbound move."

Op. 5326: "10-4 Dispatch, we are clear to Arden Loop, will call for inbound clearance."

*5326 moves from Fairgrounds to Arden Loop.*

Op. 5326: "5326 to Dispatch, request clearance from Arden Loop to Volunteer Blvd."

Dispatch: "10-4 5326, you are clear to County Home Siding. Hold at County home for a meet with M210."

Op. 5326: "10-4 Dispatch, 5326 clear to County Home and hold for a meet with M210."

*M210 meets car 5326 at County Home Siding.*

Op. 5326: "5326 to Dispatch, we have met M210, request clearance to Volunteer Blvd."

Dispatch: "10-4 5326, you are clear to Volunteer Blvd."

Op. 5326: "10-4 5326 proceeding to Volunteer Blvd."

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Dispatch to M210, you are clear to work on signals from Fairgrounds to Arden Loop. I will call you to arrange a meet with the next outbound car.”

Op. M210:”10-4 Dispatch, proceeding to Fairgrounds, will await your call.”

**Example:** Instruction car not on time table is held for move by regular scheduled car operating on time table.

1. Instruction car 14 is given clearance by dispatch to run from track eleven to McClane and back to track 11 as instruction requires.
2. Regular scheduled car 66 running on the time table departs Richfol inbound to Volunteer Blvd..
3. Two minutes before car 66 departs, Dispatch contacts car 14.

Dispatch: “Dispatch to 14, what’s your 20?”

Inst. 14: “This is 14, we are arriving at McClane loop.”

Dispatch: “10-4 car 14, hold at Redman Wye for a meet with car 66, once they have cleared you can proceed back to track eleven.”

Inst. 14: “10-4 dispatch, car 14 will hold at Redman Wye for a meet with car 66 and once clear will return to track eleven.”

Dispatch: “Dispatch to 66, be advised that car 14 is holding at Redman, proceed per timetable.”

Op. 66: “10-4 dispatch, 14 holding at Redman, 66 will proceed per timetable.”

4. 66 departs Richfol on time and proceeds to Volunteer Blvd. When 66 has cleared the main line 14 returns to track eleven.

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# GETTING TO KNOW THE ARDEN ELECTRIC RAILWAY

## LOCATIONS

A set of uniform location designations has been adopted for use on the railway. Please become familiar with them, the maps to the right and on the next page show key locations along our right-of-way. Along the railway, signs are in place identifying most locations. They are attached to the closest appropriate line pole and are duplicated in both directions.

Please keep the following locations in mind at all times when using radios:

1. Arden Mines Loop - Originally this was a small rural mining community located in the vicinity of our track. Arden Mines was a place where many miners and their families lived, in fact, there are still a few dilapidated homes scattered in the woods around the loop. Many of the homes in the village beyond the trees are part of the original “mine patch” including the company store.
2. Bootleg Mine Grove (Yanavich) - This was the location of a large spoil pile generated by a private individual who reopened the coal mining shaft in the grove of trees behind the stop. The field was left un-tilled because of this and grove grew over. During the right-of-way clearing in 1979 the spoil pile was used as the fill for Arden Mines Loop.
3. Tarr - This stretch of track is named for our neighbors, Tarr Concrete. Their supply yard is on a hill just above Arden Mines Rd.
4. Fairgrounds - The ability to ride a trolley to the fair was a tradition from the beginning of the trolley era. Here in Washington County, the trolley has taken people to the fair since the 1910s when the fairgrounds were established at this location. PTM began operating trolleys to this stop in 1979, when the rail connection was reestablished.
5. Founders Car House - The museum was established on this site in 1954 and opened to the public in 1963. Operations originated out of the west campus for the first 60 years the museum was open. This car house was constructed by the founding members of the museum between 1957 and 1961.
6. Streetcar Restoration & Maintenance Shop - In 1975 this building was constructed, again by volunteers, to house the museum shop and provide car storage for the growing collection. Today it serves as its original intended purpose as the shop.
7. County Home - The former location of the Washington County home, originally built in 1872, all that remains of the site are the stairs that led from the trolley stop up the embankment. Industrial buildings now stand in the place the home and its groves once occupied.
8. Reliance - This industrial building and office space is now the administrative center for the museum and houses offices, storage, and the Kathryn and David Black Transit Archives.
9. Enterprise Wye - A wye is a triangular rail junction with a switch at each corner. Like a loop, wyes allow cars to be turned around. Enterprise Wye is named for the streetcar stop that was near this location. Enterprise mine occupied the land south of the railroad in the hillside near the Washington Country Club. A rail yard and coal loading facilities once existed near this stop.
10. Redman Wye - This wye is named for Lou Redman, one of PTM’s founding members. Mr. Redman was a business specialist who negotiated purchases and leases that allowed for the establishment of the museum at the county home and farm stop.

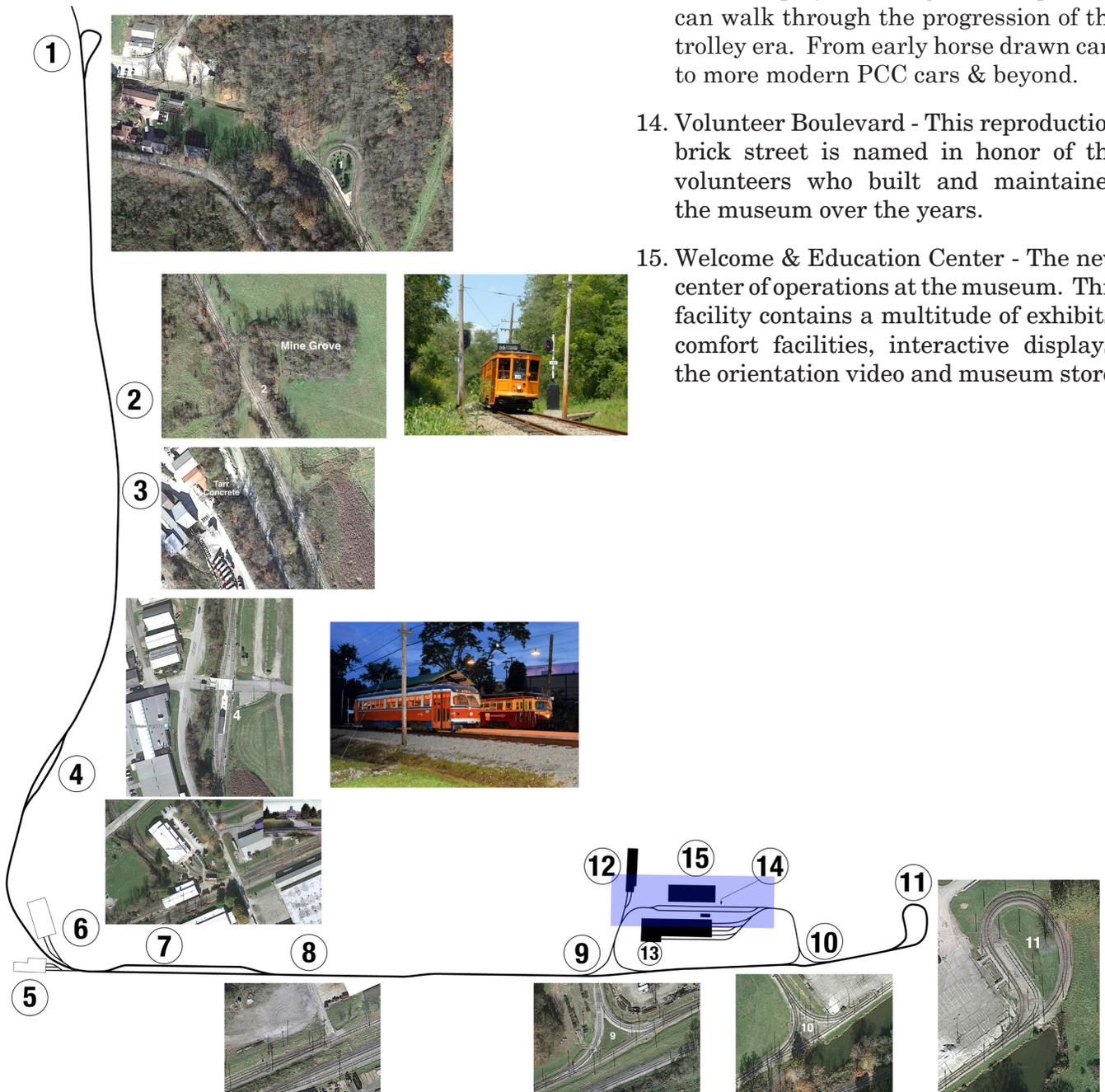
11. McClane School Loop - This loop occupies the eastern edge of the McClane farm next to the site of the former Chartiers Houston Elementary school. Museum volunteers engineered the loop and the rail was donated by the Port Authority of Allegheny County (now Pittsburgh Regional Transit) the rail was bent to the correct radius at cost by the Southeastern Pennsylvania Transportation Authority (SEPTA) in Philadelphia and then installed by museum volunteers

12. Artifact Preservation Building - The construction, restoration and maintenance of our demonstration electric railway requires the acquisition of artifacts and parts needed today and into the future. Restoration and repair parts are stored here vital to their continued operation are stored here.

13. Trolley Display Building - This is our main display building where patrons can walk through the progression of the trolley era. From early horse drawn cars to more modern PCC cars & beyond.

14. Volunteer Boulevard - This reproduction brick street is named in honor of the volunteers who built and maintained the museum over the years.

15. Welcome & Education Center - The new center of operations at the museum. This facility contains a multitude of exhibits, comfort facilities, interactive displays, the orientation video and museum store.



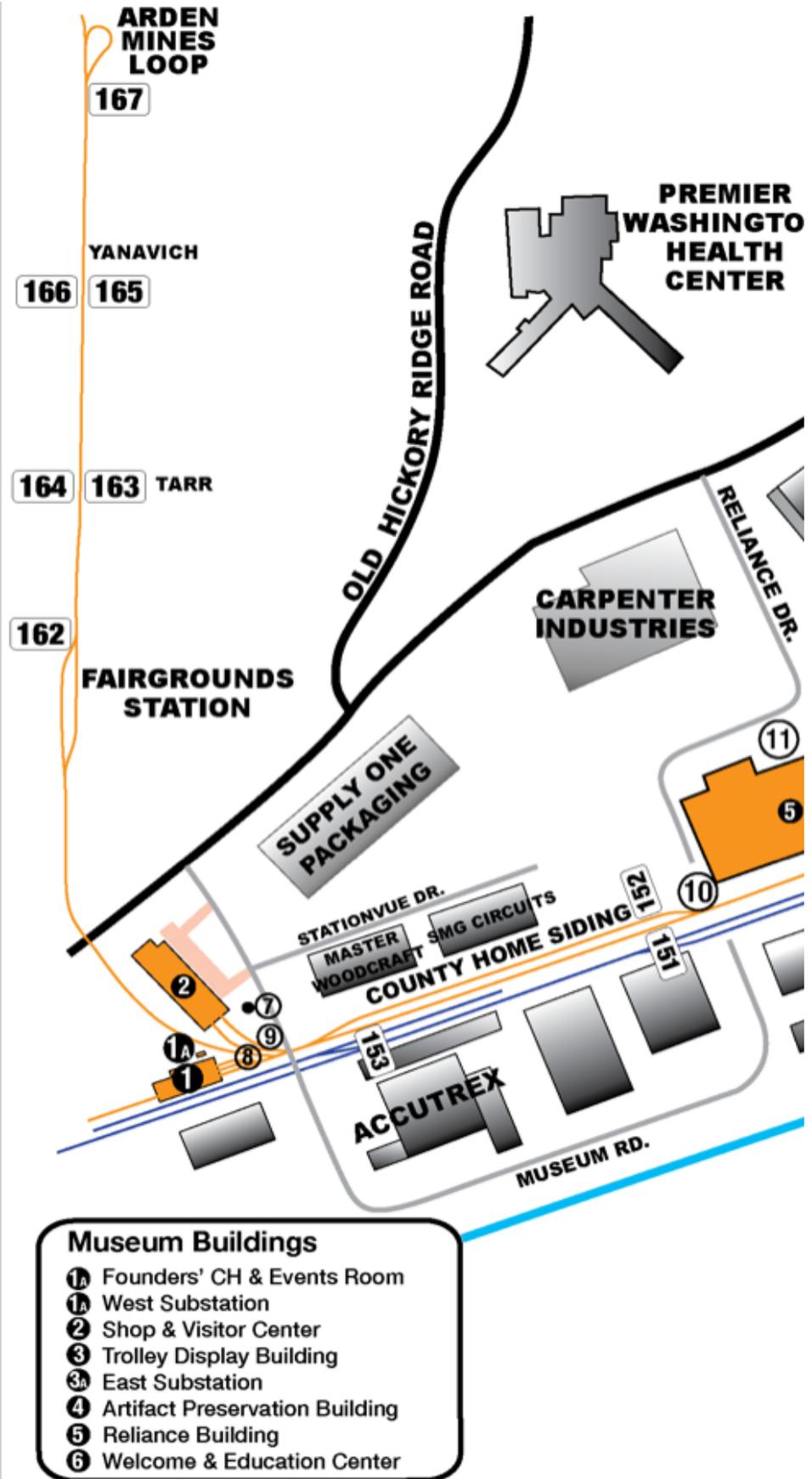
## STOP DESIGNATIONS

Outside of emergencies, Operators should only ever board or discharge patrons at designated stopping points along the line. These points generally have a loading area that makes it much safer to board or disembark the streetcars. The detailed map to the right has been provided to show all areas on and around the right-of-way as well as stop locations and signal designations.

In everyday operations, only the following are considered “designated stopping points”.

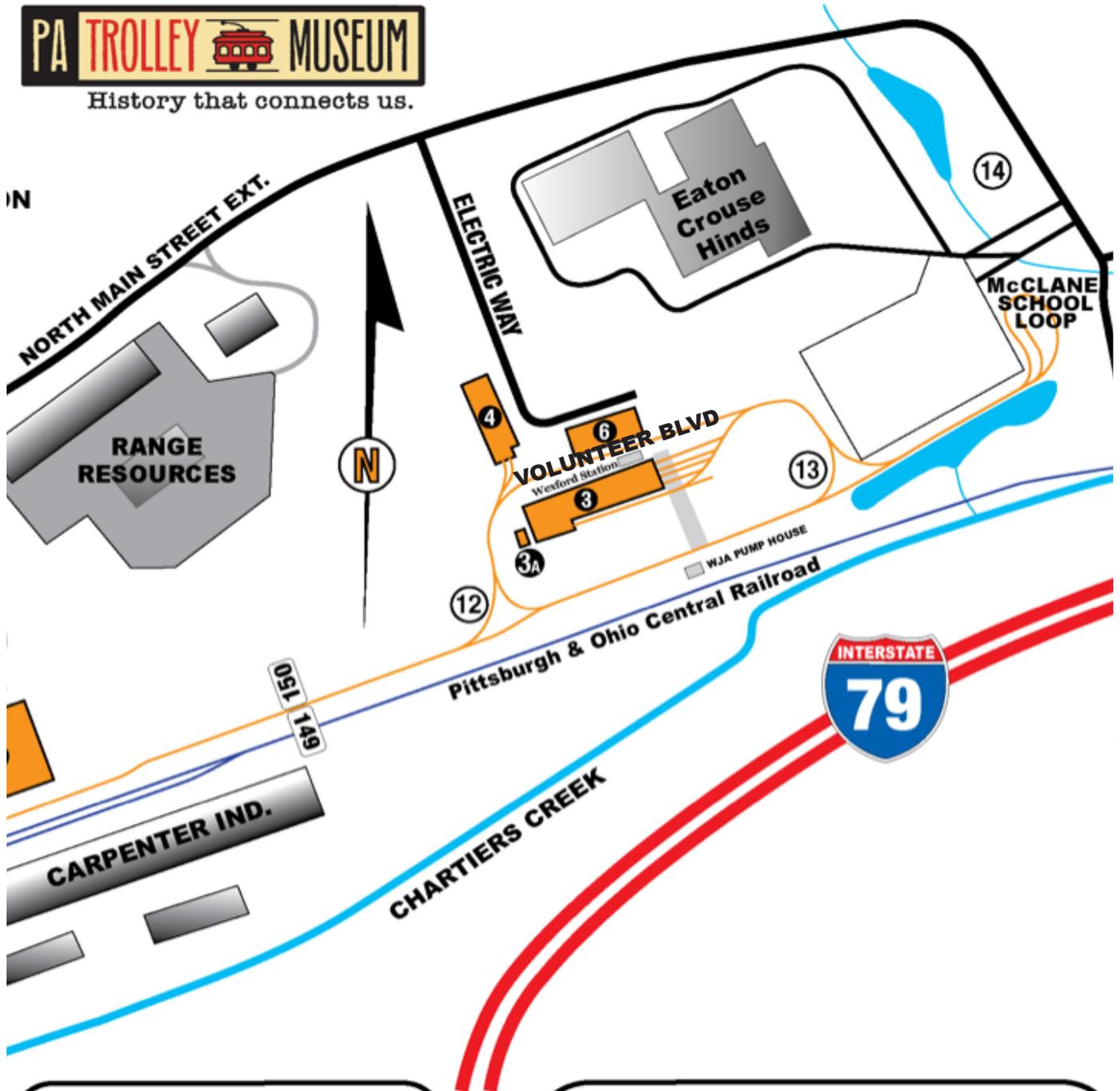
- Volunteer Blvd
- Trolley Display Building
- McClane Loop
- Richfol
- Founders Carhouse
- Fairgrounds
- Arden Loop

During special events or other times of year, these locations may be added to or reduced, be on the look out for operating orders or special bulletins that might change what the “designated stops” include.





History that connects us.



- Structures & Locations Key:**
- 7-Brown Shelter - Butler Shortline
  - 8-Richfol Shelter & Platform
  - 9-West Passenger Shelter
  - 10- Reliance Stop
  - 11-Kathryn & David Black Archives
  - 12-Enterprise Wye
  - 13-Redman Wye
  - 14-Former site of Charters Houston SD, McClane Elementary School

**Pennsylvania Trolley Museum Track and Facilities Layout**

- MUSEUM TRACKAGE** ———— (solid orange line)
- UNDER CONSTRUCTION** - - - - (dashed green line)
- RAILROAD TRACKAGE** ———— (solid blue line)
- MUSEUM BUILDINGS.....** [Orange rectangle]
- NEIGHBORING BUILDINGS....** [Grey rectangle]
- WATER** [Blue wavy line]
- HIGHWAYS** [Thick black line] [Thick red line]

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Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

## BELL & WHISTLE SIGNALS

Bell or Whistle/Horn signals are given for various reasons when operating a rail vehicle. When a vehicle is about to move a signal is given with a bell (or whistle/horn in lieu of a bell). Two bells means the vehicle is about to move in the forward direction relative to the operator, three bells means a reverse movement, or opposite the direction relative to the operator. If operating a single-ended car from the rear or “backup” controller, a signal of three bells should be given before moving the car. One ring of the bell signals a stop. The word “gong” found at various points in the text refers to the bell.

Another common signal is the crossing warning. When approaching a crossing, equipment must signal with the sounding of a whistle or horn. The pattern - . - . , or two long signals, one short and one long, should be used when crossing North Main Street. Some specialty equipment is not equipped with whistles or horns, in this case special procedures must be followed when crossing North Main Street.

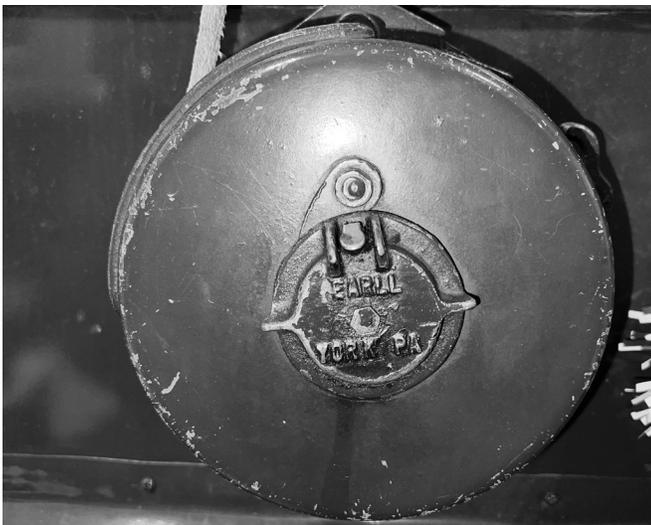
## TROLLEY CATCHERS AND RETRIEVERS

All of the electric passenger streetcars at PTM are equipped with either a “catcher” or a “retriever” to “catch” or “retrieve” the trolley pole should it come off the wire. While catchers are a relatively basic mechanism that simply stops the rope when it begins to rapidly leave the spool, retrievers are more complex. When tripped, a retriever’s internal spring retracts the rope into it with tremendous force, pulling the pole down away from the wire. For this reason, it is important to avoid any rapid movement of the rope. If you feel the retriever grab, let go immediately! Never wrap the rope around the hands when resetting a retriever. Resetting the retriever after it has tripped can be done by pulling rope out of the retriever until the spring is rewound and the mechanism releases. This can be a very difficult task, ask for help if you’re unsure what to do.

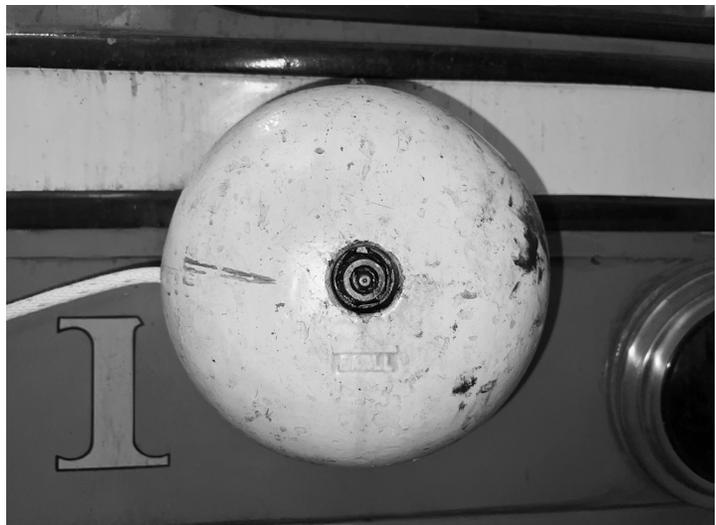


Trolley Rope Catcher

*Cars at PTM equipped with retrievers include PST 14, 66 and 73, P&WCT 78, PRCo 1711, and WP 832.*



Trolley Rope Retriever Classic Style



Trolley Rope Retriever Bowl Style

## LIFE GUARDS AND FENDERS

Many city streetcars are equipped with basket-like device which hangs a few inches above the rails either in front of or under the front the car. The device gets its name from its purpose - to prevent a fallen person from being caught under the wheels. Cars at PTM equipped with a life guard include, PRCo 1138, 4398, 5326, and 832n. The life guard is under the front platform of the car and directly in front of the guard hangs a wooden or light metal framework. Any obstruction on the track will strike this rack first, releasing a trip mechanism which lowers the life guard against the rails. The life guard should then scoop up the obstruction. If this mechanism ever trips, find out why. Once an obstruction is cleared, the mechanism can be reset by stepping down hard on the plunger which has risen six or eight inches above the floor near the controls.

Additionally, PRCo 4145 is equipped with a “Fender” which rides in front of the car, and will catch any obstruction on the track. Always be aware of the swing of the fender when operating or shifting this car.



A Fender



A Lifeguard Trip Mechanism

## ELECTRIC POWER

Trolley line power is provided at 600 volts direct current (DC) through the overhead wire. It is generated from alternating current (AC) electricity provided from West Penn Power using three rectifiers. Two of these are located at the East Substation and one at the West Substation. These three rectifiers are integrated into a single system as follows:

- One of the two rectifiers at the East Substation is the primary power source.
- The rectifier in the West Substation is used for load balancing purposes and comes on-line automatically as needed.

Control of the entire power system is integrated using a radio communications system. Power can be turned on and off from the West Substation by pressing the red button on the wall to turn the power on or by pressing the green button to turn the power off. However these buttons only work if the blue remote light is on. If the blue light is not lit, it will be necessary to operate from the East Substation. For more information refer to “Trolley Line Power Operating Procedures” on the operations webpage.

### Important Safety Warning

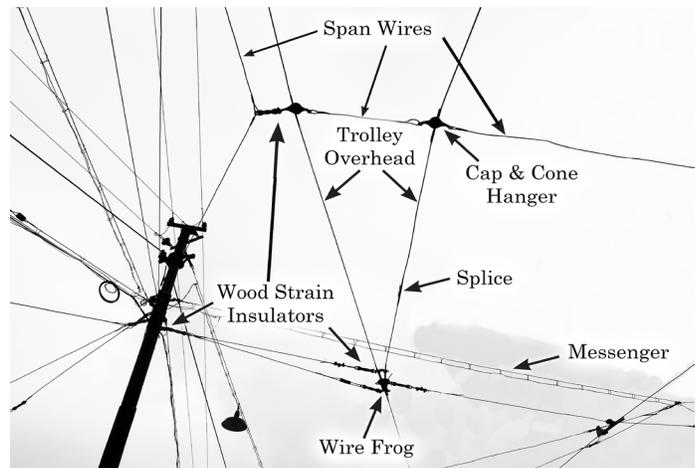
There are a number of cabinets at both substations that are part of the power management system. There are no controls or other components in these cabinets that are part of the regular operating procedures for the power system. These cabinets contain components that are not protected, contain high voltage and amperage and may be energized even when the trolley line power is turned off. The contents of these cabinets are extremely dangerous. **UNDER NO CIRCUMSTANCES ARE INDIVIDUALS OTHER THAN THE DESIGNATED POWER & SIGNAL DEPARTMENT PERSONNEL ALLOWED TO OPEN THESE CABINETS.** In addition, many of the cabinets contain a protection mechanism that will cause the power to be turned off should the cabinet be opened. However, even with the power turned off, there will still be components in these cabinets that are energized and dangerous.

## OVERHEAD

Operators should be familiar with the trolley wire system above them. The basics of overhead construction can be easily seen, and the operator should take time to visually inspect it. Operators need to have enough knowledge of the overhead to spot something that is out of place, loose or broken. Contactors, Section Insulators, Wood Strain Insulators, and Wire Frogs are just some of the items you will see when looking at the overhead wire.



A Wood Strain Insulator



A Section of Overhead Wire

Most of what you will see when first looking at overhead is the span wires that run between line poles or parallel to the trolley wire and suspend the copper overhead wire above the ground. Wood strain insulators are placed at the ends of span wires between the overhead and line poles to insulate them and prevent electricity from reaching the ground. Operators should make a note of what wood strain insulators should look like so they can recognize if one is damaged or broken. In many cases, the wire will be loose or drooping if a wood strain insulator has failed.

Operators should also be aware of the locations of contactors along the railway. Contactors are used for various reasons.

- The Crossing flashers and bells at both North Main Street and Fairgrounds platform are activated by contactors.
- The electric switches located at Museum Road, Redman Wye and The Trolley Display Building yard are activated by powering or coasting through contactors.
- The Nachod signaling system is activated using contactors.



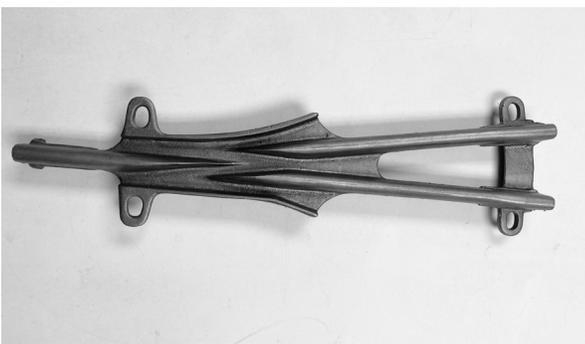
Overhead Contactors

In general, operators should try to cross contactors with the power off (unless throwing a switch) to avoid arcing that may damage to the contactor.

Section insulators are the devices used to isolate different sections of the railway to be turned off independently. Operators should always cross section insulators with power off to prevent arcing as it could damage the electrical equipment. Operators will be able to recognize the passing of an insulator by the blinking of the car lights and/or the often audible thump from the trolley pole.



An Overhead Wire Section Insulator



A Wire Frog

Cap and cone hangers are another common sight on the overhead. These devices are one of the ways used to suspend much of the overhead copper wire to the span wires. Many of them can be seen along the line and can be seen in the bracket arm photo below.

Bracket arms are rigid hangers that are secured to line poles and cantilever over the track to support the wire above the car. The photo below shows what a good bracket arm should look like.

If you come accross any overhead that looks damaged, loose or otherwise malfunctioning, you should report the problem to the dispatcher. If no dispatcher is on duty, report it to an instructor or the operations manager so that they may pass it on to the correct channels to have the problem resolved.

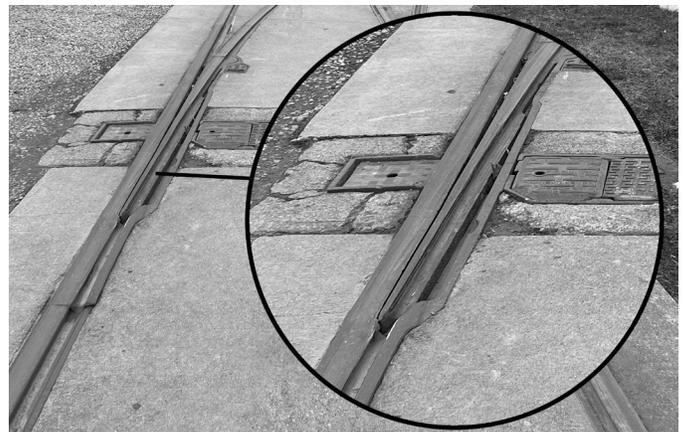
## TRACK

As with the overhead, operators should become familiar with the railway track and the terms associated with it. This is important so as to be able to recognize problems and communicate them effectively.

Operators should always careful when approaching any “special work” but especially at switch points. Any obstruction, such as rocks, sand or even leaves may cause the points not to close completely. As seen in the picture to the right, a standard street switch should have the point pushed hard over with no gap. When approaching both street and T-rail switches, always check to ensure the point(s) have thrown hard over. If you observe a gap in a switch, get out and use a switch iron or switch machine to throw it hard over. If debris or other objects are what is keeping the switch from fully “closing”, you



A Bracket Arm



Standard Single Point Street Switch



Standard T-rail Switch

will need to clean out the switch. Switch brooms are located in the Founders Car House and Trolley Display building. If the switch is clean but the point is not throwing hard over the problem may be related to the switch mechanism itself. This should be reported to the dispatcher. If no dispatcher is on duty, report it to an instructor or the operations manager so that they may pass it on to the correct channels to have the problem resolved.

As you operate the car, continue to observe track conditions. Along the right-of-way you may look out for washouts, especially along the creek. You will see the jointbars that connect each peice of rail, as shown in the photo to the right. At each joint, the rail is also “bonded” which allows for the electricity to easily flow between joints, as shown in the photo below. Should you notice any joints that seem loose or broken or rail bonds the have disconnected they should be reported as well.



Rail Joint bar

If there is an obstruction on the track, even if it seems redundant, do not run over it. Stop the car, remove it, and then proceed. Make note if something has fallen on the track, it may also have damaged the overhead wires. If there is any doubt about any section of track, do not operate the car over it.



Rail Bonds

## TRACK CIRCUITS

Below you will see two types of special devices that relate to the operation of is US&S Signal system (detailed in the operator’s rulebook). As explained in the rulebook, the US&S System is a “track circuit” system. This means that low level currents flow through the track and make a circuit when a connection is made between the rails. In order for this system to function properly along with the bonded rail (the return for the 600v line power) power must be able to flow back to the substation, but also be isolated in the different signal sections.



Insulated Rail Joint



An Impedance Bond

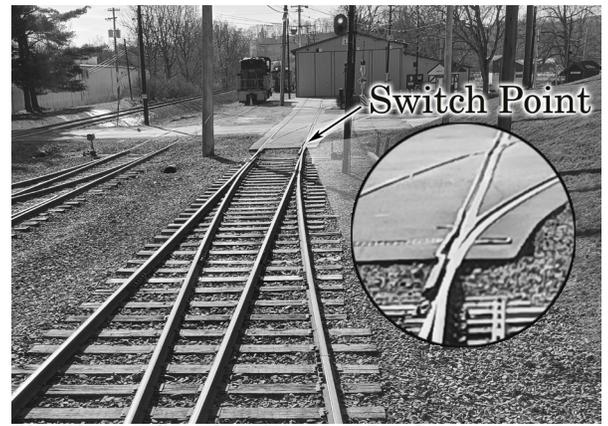
Insulated joints (above) and impedance bonds (left) are necessary for this task. The insulated rail joint ensures the low level signal power is isolated to a track section and the impedance bonds allow for the return of line power to the substation.

If you notice any of these devices looking loose, cut or otherwise broke, notify the dispatcher. If no dispatcher is on duty, report it to an instructor or the operations manager so that they may pass it on to the correct channels to have the problem resolved.

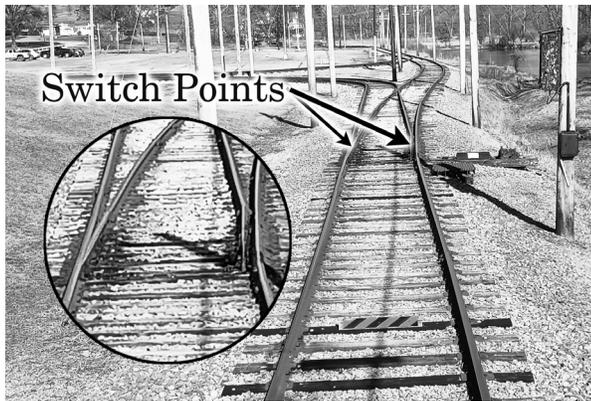
## ELECTRIC SWITCHES

Electric switches are turnouts along the railway that can be activated by drawing current or coasting through contactors on the trolley wire. At the time of this writing there are three (3) electric switches on the railway, Museum Road, Redman Wye and The Trolley Display Building yard switch. Each of these switches is set up to coast for the most common move and power for the less common move, resulting in the following:

1. Museum Road - Power to turn go straight, coast to go right.
2. Redman Wye - Power to go right, coast to go straight.
3. TDB Yard - Power to go left, coast to go straight



The Electric Switch at Museum Road

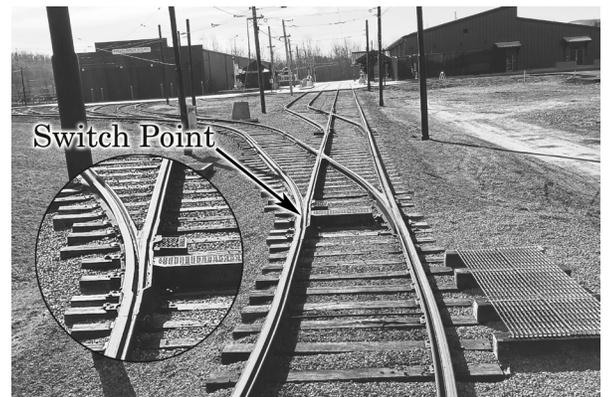


The Electric Switch at Redman Wye

Remember to stop at the marked tie and proceed from a full stop in order to make the “powered” move through any electric switch. Ensure you are not drawing power at the marked tie to make the “coasting” move. *\*\*This varies by car length so you will need to take that into consideration when operating through a powered switch\*\**

In addition, there is a manually operated powered switch at

the throat of the Founders Carhouse yard. This switch can be thrown using a manual switch in the signal case next to the switch.



Electric Switch at the TDB Yard

## THE WHEELCHAIR LIFT

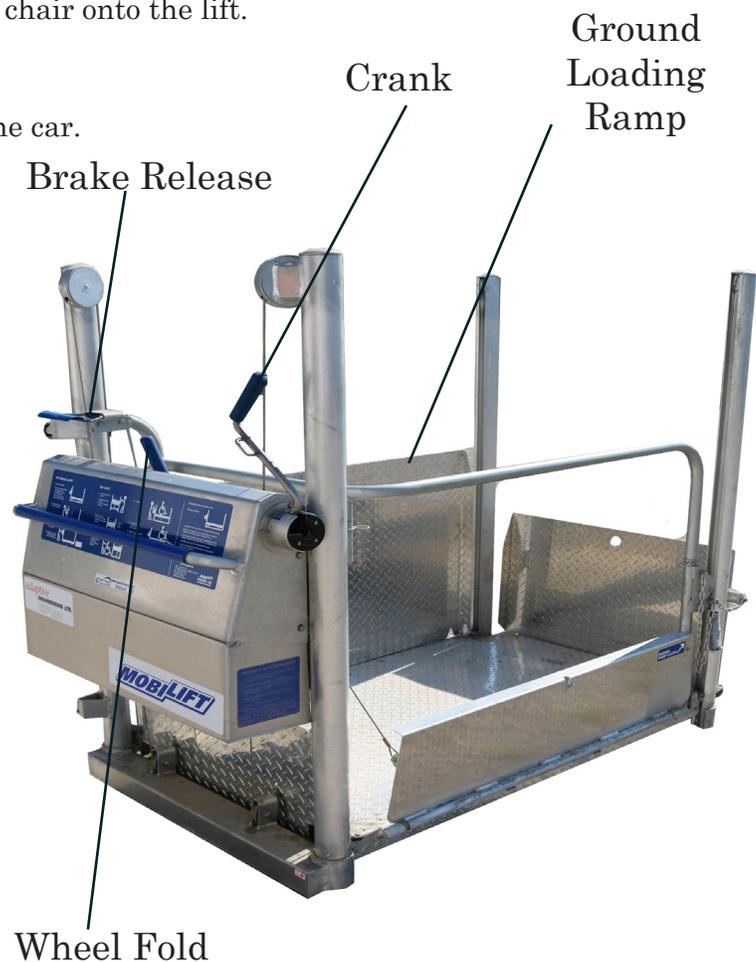
The wheelchair lift must be used anytime a guest who is wheelchair bound is loaded onto a streetcar. At present, there are only 3 cars that are to be used for wheelchairs, 2711, 73 & 66. There are two wheelchair lifts on the property, one at Richfol platform (stored next to the substation) and one inside the Trolley Display Building. The wheelchair lift is to be used only on a smooth concrete surface, do not attempt to take it into gravel or other uneven areas. To move the lift, pull back on the brake release and hold it while maneuvering. Stage the wheelchair lift in the loading area before the guest is ready to board. Below you will find brief instructions on how to operate the lift. The instructions for operation are also covered in a diagram attached to the wheelchair lift.

To prepare for passenger(s):

4. Raise the lift a few inches and fold the wheels. (The lift at Volunteer Blvd does not have folding wheels)
5. Lower the lift back to the ground.
6. Release and lower the ramp.

When a passenger is ready to board:

1. Have them or a handler maneuver the chair onto the lift.
2. Raise and latch the ramp.
3. Release the crank and lift them onto the car.
4. Once at the proper height:
5. Lock the lift crank.
6. Unlatch and lower the ramp onto the deck of the car.
7. Reverse procedures to return the lift to ground level.
8. Park the lift with wheels folded.



# INCIDENT & ACCIDENT PROCEDURES

## Policy and Procedures for Reporting Incidents & Accidents

It is the policy of the Pennsylvania Trolley Museum that incidents and vehicle accidents be reported in accordance with the procedures as defined in this document. These reports are important to the museum and failure to file accurate reports in a timely manner can result in disciplinary action against employees and volunteers.



## INCIDENTS

An incident is defined as a situation, other than a vehicle accident, that represents a violation of museum policies OR a deviation from normal museum operating procedures. Incidents include, but are not limited to:

- Complaint or problem involving the public.
- Theft or loss of property.
- Operational problem(s) other than those situations for which another reporting mechanism exists.
- Illnesses or injuries staff or volunteer issue(s).

As a general rule, any situation that requires follow-up action or has the potential to require follow up action should be considered to be an incident. Situations which represent routine operating occurrences

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Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

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OR are of a minor nature that can be easily resolved OR do not require or have the potential to require follow-up action should not be considered incidents and do not require incident reports. If a museum volunteer or staff member is unsure as to whether or not a situation requires an incident report then they should check with the appropriate department manager or the Executive Director to determine if a report is required.

## Procedures for Reporting Incidents

1. In most situations, a single incident report, prepared by the person with the most knowledge in relation to the incident, should be sufficient. However, if substantial disagreement exists between the persons involved in or witnessing an incident, then each person should prepare an incident report. The Executive Director or other persons assigned to address an incident may request that others involved in or witnessing an incident prepare a report.
2. PTM volunteers and staff will use the INCIDENT REPORT form for the purpose of reporting incidents. In addition, other persons who are involved in or witness an incident and who wish to make a report may use an INCIDENT REPORT form for their report.
3. Reports should be prepared as soon as possible after an incident occurs; however, a person requiring medical attention or other assistance should not delay the receiving of appropriate assistance for the purpose of preparing a report.
4. Reports that (a) only involve one department and (b) involve incidents that can be resolved by a department manager and (c) do not involve the public or illness or injury, should be directed to the appropriate department manager (ex. a report involving power or signal equipment should go to the Power and Signals Manager). Otherwise the report should go to the Executive Director who will determine the appropriate party to address the situation.
5. When possible, reports should be delivered to the department manager or Executive Director. If this delivery is not possible, the report should be placed in the box provided for this purpose in the West sub-station and the department manager or the Executive Director should be notified (by phone or e-mail, as appropriate) of the presence of the report.
6. Reports can be reviewed by the appropriate department manager or the Executive Director or by other parties designated by the museum (ex. museum attorney) for purposes of clarity or completeness of the report. The person preparing a report may be asked to clarify information or provide additional information. However, the person preparing a report should not change or be asked to change the facts, events and observations that they are reporting.
7. No person, other than the person preparing a report, should change, add to or delete from a report and the contents of incident reports should be treated as confidential information.
8. Incident reports must identify the person preparing the report and be signed by this person. Anonymous reports will be considered to be hearsay and, in most situations, hearsay is not considered to be creditable information.

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## ACCIDENTS

While accidents are to be actively avoided, no one is immune from them. An active policy of careful operation practice and situational awareness should help prevent you from becoming involved in an accident.

In the event of an accident involving PTM equipment, an operator or operators involved will follow the appropriate procedures below:

1. Remain calm.
2. Stop the car immediately. Contact the Dispatcher or museum official in charge as soon as possible. Do not move the car until instructed to do so, unless the car is in danger and/or its movement would endanger human life.
3. Determine the extent of injuries, if any. This includes trolley passengers and crew, as well as pedestrians and occupants of other vehicles. Render or direct first aid to any injured parties.
4. If anyone appears the slightest bit shaken by the accident, request an ambulance. The museum official or his/her designee will call for the appropriate emergency personnel. The trolley operator will remain at the scene.
5. Make sure any injured persons have been attended to, distribute the courtesy cards and pencils contained in the emergency packet with the first aid kit. Endeavor to have all passengers completely fill in the card. Please do not permit passengers to leave the car until they have filled out the card, unless they are in peril. Assure the passengers that the card is to record their presence and that it is not a release. The information may be required for a police report and is confidential.
6. Cooperate fully with the police. Answer their questions honestly. It is not necessary to volunteer any information that is not requested.
7. Do not make any statements about the accident to anyone but the police and museum officers. This includes passersby, visitors, or the media. Anything you say could be improperly interpreted.
8. Fill out an accident report before going off duty. Forms may be found in the substation. Personally hand deliver the report to the museum official in charge. An incident is any occurrence that does not involve vehicle collisions. They include, but are not limited to, non-vehicle accidents, injuries, complaints of illness and vandalism.

## Vehicle Accidents

A vehicle accident is defined as a situation in which injury and/or property damage occurs and: A vehicle (rail or non-rail) owned or operated by PTM is involved in the situation OR A PTM volunteer or staff member, while conducting PTM business, is involved in the situation as the operator of or passenger in a vehicle or is hit by a vehicle.

For purposes of applying this policy:

- A vehicle accident that occurs while a volunteer or staff member is commuting to or from the museum and does not involve a vehicle that is owned or operated by the museum is not considered to be museum business and does not require a vehicle accident report.

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- Damage that occurs to a PTM vehicle that is not in motion and does not involve another vehicle and does not result in injury is considered to be an incident instead of a vehicle accident.

## Procedures for Reporting Vehicle Accidents

- Each PTM volunteer or staff member who is involved in or who witnesses a vehicle accident should prepare a VEHICLE ACCIDENT REPORT form. In addition, other persons who are involved in or witness a vehicle accident and who wish to make a report may use a VEHICLE ACCIDENT REPORT form for their report.
- Reports should be prepared on an individual basis without consultation between the people preparing reports as to what occurred, etc.
- Reports should be prepared as soon as possible after an accident occurs; however, a person requiring medical attention or other assistance should not delay the receiving of appropriate assistance for the purpose of preparing a report.
- If possible, reports should be delivered directly to the Executive Director or, in the absence of the Executive Director, the Museum President. However, if this is not possible or if this will significantly delay the delivery of a report, then the report should be mailed or delivered to the Executive Director or Museum President using another appropriate and confidential mechanism.
- Reports should be reviewed by the Executive Director and can be reviewed by other parties designated by the museum (ex. museum attorney) for purposes of clarity or completeness of the report. The person preparing a report may be asked to clarify information or provide additional information. However, the person preparing a report should not change or be asked to change the facts, events and observations that they are reporting.
- No person, other than the person preparing a report, should change, add to or delete from a report and the contents of accident reports should be treated as confidential information.

## EMERGENCY PROCEDURES

Safe operation is our foremost purpose under all circumstances. The best intentions of providing a safe, smooth ride can, however, be upset by some sudden occurrence, and for this eventuality the operator must be prepared to act just as surely as if he or she were providing a normal, smooth stop.

These emergencies involve:

- Necessity for fastest possible stop because of an obstruction on the track, derailment, object caught on the car, etc.
- Failure of normal braking.
- Controller stuck in the “on” position.
- Car sliding when brake has been applied.

This section describes the procedures to be followed in the event of each of the above, with the various types of equipment.

This section includes the following information:

- Fastest Possible Stop.

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- Stopping when Standard Brakes Fail.
  - Controller Stuck in the “On” Position.
  - Car Slide after Application of Brakes.

## FASTEST POSSIBLE STOP:

The following descriptions for fastest possible stops are applicable only if the car does not begin to slide. If the car does start to slide during a full brake application, continue with the procedures described below. A sliding car will not stop as fast as one with the wheels turning in a heavy but controlled brake application.

All Conventional Cars:

1. Move air brake handle into full braking or emergency braking position.

PCC Cars:

1. Push brake pedal to the floor, latching it there.

Cars with “B” Controls and no air brakes (PRCo M37, BVT 1):

1. Move the controller handle to the full braking position.
2. Drop sand.
3. Apply the handbrake.

## STOPPING WHEN THE STANDARD BRAKES FAIL

All conventional cars with “K” controllers (PRC 4145 & 4398, PRT 5326, NOPSI 832, 1758, WP 832, CSR 2227)

1. Move the controller to the “off” position.
2. Move reverse handle to the direction opposite the car’s movement.
3. Move main overhead switch to the “off” position.
4. Move the controller to the full parallel position.
5. Wind up the hand brake. (Do not move the reverse handle again until the car has come to a complete stop.)

All conventional cars with controls using a “Master” Controller (PST 66 & 78, PRC 3756 Rear Controls)

1. Move the controller to the “off” position.
2. Move reverse handle to the direction opposite the car’s direction of movement.
3. Quickly move the controller to the first point, then off again.
4. Wind up the hand brake. (Do not move the reverse handle again until the car has come to a complete stop.)

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PRC 3756 (front controls only): Rear controller see steps above for “Master” Controller.

1. Move the controller to the “ off ” position.
2. Move the dynamic brake handle 90 degrees toward you.
3. Wind up the hand brake. (Do not move the dynamic brake handle back until the car has completely stopped.)

Foot Control Cars:

1. Latch the brake pedal to the floor.
2. Move the reverse handle to the “handle out” position.
3. Wind up the hand brake if the car is so equipped.

## CONTROLLER STUCK IN THE “ON” POSITION

Hand Control Cars:

1. Move the main overhead switch to the “off” position.
2. Apply full braking, if necessary.

Foot Control Cars:

1. Push brake pedal to the floor latching it there.
2. If power continues “on,” turn off the MG switch.
3. Pull the pole if possible.

## CAR SLIDES AFTER THE APPLICATION OF BRAKES

Hand Control Cars:

1. Fully release the brakes.
2. Apply one notch of power.
3. Re-apply brakes gradually.
4. Shut off power as the car comes to a stop.

Foot Control Cars:

1. Push brake pedal to floor. On PCC cars this will activate the rail brake. (Buzzer will sound or Gong will ring when the rail brakes are activated).

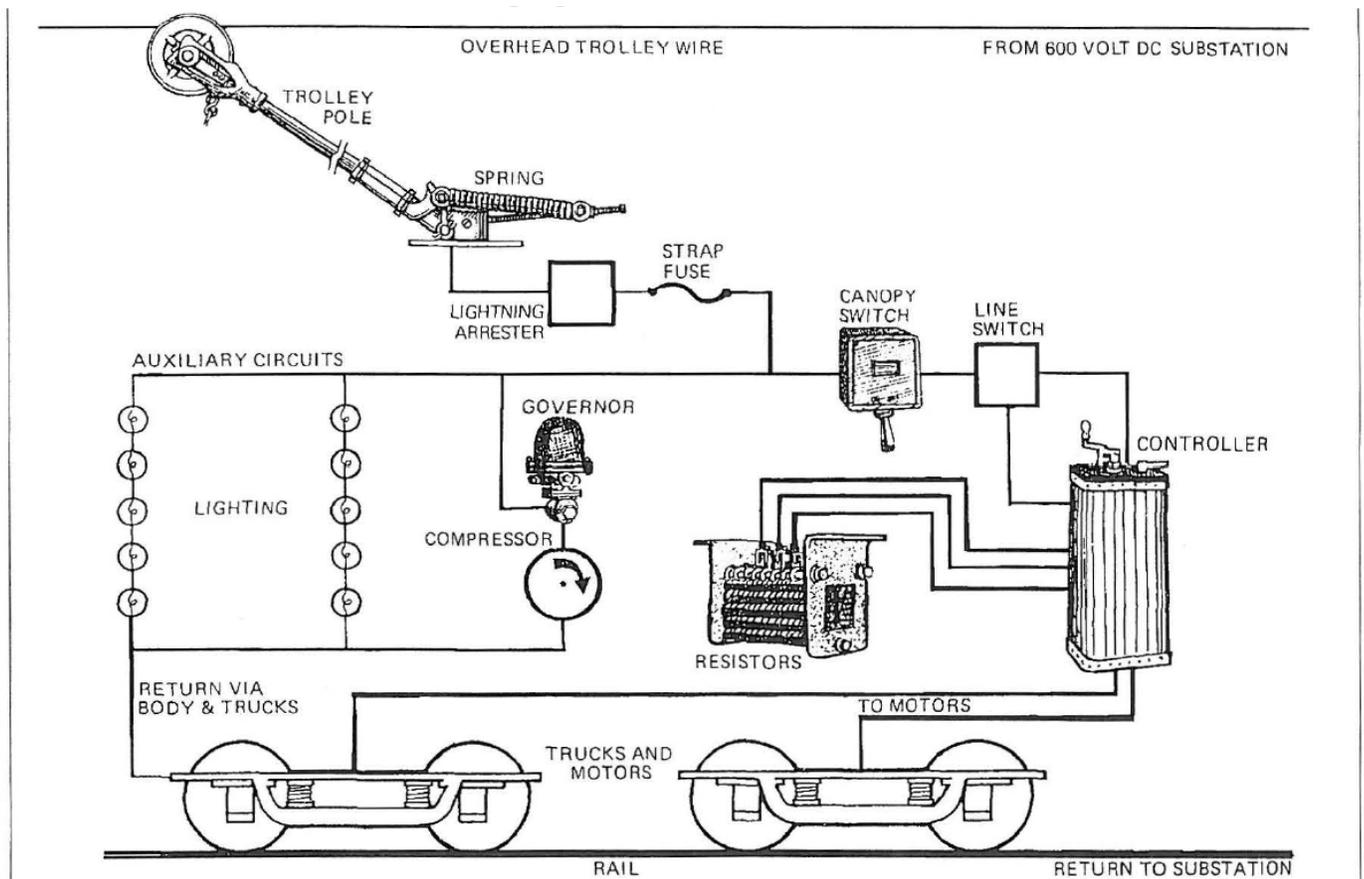
# OPERATION OF ELECTRIC CARS

The purpose of this section is to help each operator understand more clearly the functions of the equipment. This section includes the following:

- How Trolleys Work
- Braking
- Other Important Information

## HOW TROLLEYS WORK

Refer to the diagram below which traces the path of electricity through a trolley car and illustrates the various components used to operate the car. The trolley pole collects power from the wire and supplies it to the car while permitting the car to move freely over the rails. After the trolley pole are protection devices designed to protect the entire car. The lightning arrestor protects against high voltage surges which may be transmitted through the trolley wire. The strap fuse protects against high current which may result from a short circuit in other parts of the electrical system. Following the protection devices are auxiliary circuits. These circuits are for lights, heaters, the air compressor, and low current control power used on some cars. Each of these circuits has an on-off switch to connect them to the main power supplied by the trolley. The main overhead or canopy switch is a high current on-off switch that connects power to the motors through the controller. The controller, line switch, and resistors are devices that control the motors which propel the car.



How Trolleys Work Diagram

Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

The controller is a master switch that controls current to the motors through the resistors during acceleration. It also incorporates a switch that reverses the motors. This switch is operated by a key that locks the control handle in the off position when removed from the controller. With the key pushed forward on the controller, the motor circuit is set for forward direction, and the control handle can be moved. Pulling the key back on the controller does the same for reverse direction. Moving the control handle in a clockwise motion switches circuits at various points through the resistors which limit motor current to safe levels when the car is accelerating. The line switch is a high current switch under the car that protects the switches in the controller.

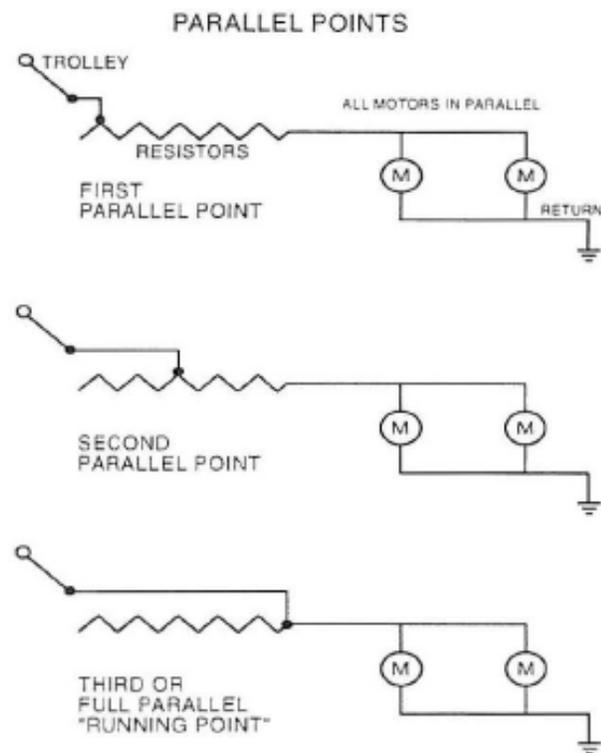
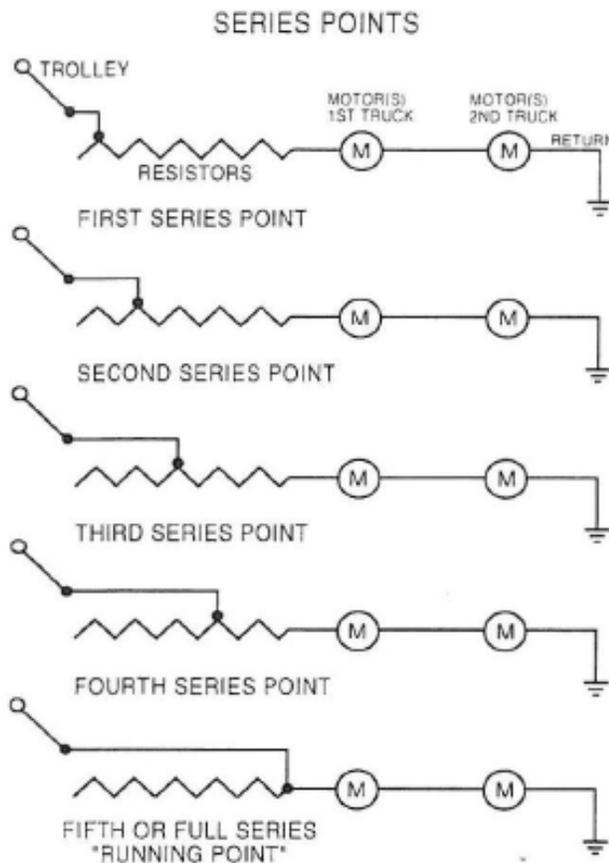
Traction motors used on electric railways are designed to produce the greatest torque or turning force when at a stall. The various control points on the controller allow the torque from the motors to be applied to the wheels in a gradual manner during starting and acceleration of the car. Refer to the Motor Control Diagram. In this diagram two motors are shown, one motor for each truck. This is a simplified diagram and the one motor can represent two motors per truck on a four-motor car where the two motors per truck are permanently wired in parallel.

The circuits, as connected by advancing the controller through the various points, can be divided into two parts. The first points are called series points because the motors are connected in series as the controller is advanced through this section of the controller. In the second part the points are called parallel points because the motors are connected in parallel as the controller is advanced through this section. In the first series point all of the resistors are in the circuit. The car will begin to roll and will accelerate, but the speed will be slow. To increase speed the controller is advanced to the second point, which reduces the amount of resistance in the circuit, and the car accelerates to a faster speed. This notching up procedure is repeated until the last series point is reached on the controller. This point is called "full series" because there are no resistors in the circuit, and each motor is running on 300 volts equally divided across the 600-volt line. This is the first of two "free running" points. In "full series" the car can run indefinitely without wasting electricity as heat dissipated by the resistors, and without danger of burning out the resistors. To further increase speed, the controller is advanced through a gap called "transition" to the parallel points. In the first parallel point the resistors are back in the circuit and the car accelerates because each motor is running on a voltage higher than 300 volts. As the controller is further advanced, more resistance is removed until the last "full parallel" point is reached. In the "full parallel" position there are no resistors in the circuit and each motor is running on the full line voltage of 600 volts. This is the second "free running" point where electrical efficiency is reached. In "full parallel" the car will reach its maximum speed, called "balancing speed", where the rolling friction equals the torque produced by the motors. In "full series" the car will operate at approximately one-half its maximum speed.

## MOTOR CONTROL

The proper notching up of the controller is part of the skill of being a good operator. The points on the controller can be felt as the control handle is advanced. There are notches in the controller that line up the handle at the correct position for each point of the series and parallel circuits. A good operator will feel when the control handle is properly in the notch which reduces arcing of the controller contacts, will advance the control handle through transition from series to parallel quickly and will notch off to the "power off" position quickly in one motion. The line switch will disconnect the motors as soon as the control handle is moved counterclockwise, eliminating arcing when the controller is reset to the "power off" position. The control handle must be moved all the way off, then advanced to the first series point before the line switch will reconnect the motor circuit.

Operators should remember that when the resistors are in the circuit, they are wasting power on every notch except on the two "free running" points. Therefore, the careful operator notches up smoothly and safely without dawdling on the resistance notches. The car is soon up to speed and the operator



Motor Control Diagram

can shut off power and coast. Coasting as much as possible saves electricity. The careful operator is always thinking safety and knows the condition of the rail.

On wet or slippery rail the wheels will easily spin. Correct for a spinning wheel immediately by notching off until the wheel stops spinning and grips the rail, then notch up more slowly to prevent further spinning. Good judgment on the part of the operator provides a smooth safe ride for our patrons.

## BRAKING

There are three basic types of braking used on hand control streetcars:

- Direct mechanical, or hand brakes
- Air brakes
- Dynamic, or regenerative electric brakes

All cars use at least one of these; most cars have provisions for two and some have all three.

**Handbrakes** - handbrakes are generally used in emergencies when all other systems fail. The operator must always be sure the hand brakes are off before moving a car. The hand brake is wound clockwise to apply and counterclockwise to release.

**Air Brakes** - The basic components of an air brake system are the compressor, reservoir, brake valve, brake cylinder, and brake shoes. The compressor, driven by an electric motor, compresses air up to the necessary air pressure. As system pressure reaches the prescribed level, the compressor motor automatically shuts off, starting again only when pressure becomes sufficiently low. The reservoir stores compressed air. On the bottom of each reservoir, or tank, is a drain valve. The reservoir should be drained when the car is put away after each day's use, to remove condensation which accumulates in the tank. On rainy days it is wise to open the drain valve for a few seconds every two hours, as condensation builds up more rapidly. Be sure to only drain the tank when the car is on level track or properly secured to prevent it from rolling away. The brake valve controls pressure in the brake cylinder by admitting air from the reservoir,

or by exhausting air from the cylinder into the atmosphere. There are two main types of brake valves - manual lapping and self-lapping. The brake cylinder employs a piston to convert air pressure into direct mechanical pressure against the brake shoes. The brake shoes do the actual stopping by bearing against the wheels, one shoe per wheel. They are usually made of cast iron, with a surface having a high coefficient friction, and will withstand the heat generated while stopping. If brake smell occurs while running, chances are the brakes are dragging.

In PCC cars equipped with air brakes, the brake shoes are lined with a fibrous composite similar to that of automobile brake pads. This material has even a greater coefficient of friction than that of cast iron. While brakes are applied by air pressure, they are released by a large spring, which brings the brake shoes, linkages and brake cylinder back to their “released” positions when pressure is released from the cylinder. A useful item is an air pressure gauge. A gauge with only one needle indicates only reservoir pressure, but some cars have gauges with two hands. One shows reservoir pressure while the other shows brake cylinder pressure. The cylinder pressure indication is useful in getting the feel of how much air to use in stopping.

Depending on the car, safe operating pressure will be 60 to 110 pounds per square inch (PSI). If a reading is quite low (40 psi or less), trouble is indicated and the car should not be moved. A dangerously high pressure (125-130 psi) could mean that the compressor has failed to shut off. In this event, turn off the compressor immediately.

## STOPPING WITH AIR BRAKES: MANUAL LAPPING

A manual lapping brake valve has three pipes connected to it. One pipe is to the reservoir, another to the brake cylinder, and the third is open to the atmosphere. In the “lap” position, no action takes place. All valve passages are closed, and the pressure (or the lack of it) in the brake cylinder remains constant. In the “apply” position, air rushes from the reservoir to the brake cylinder. If the handle is left in “apply,” after several seconds the cylinder pressure will equal the reservoir pressure. In the “release” position, the line from the reservoir is closed and the cylinder line is opened to the atmosphere. As the handle is held in “release,” the pressure in the cylinder escapes to the atmosphere and the brake shoes return to their relaxed position.

The proper way to stop a car is “one application, two releases.” Here’s how it works:

When approaching a stop, move the brake valve handle to “apply” and hold it there for a second or two, admitting enough air to the cylinder to begin braking. Immediately return the handle to “lap.” If there is an air gauge with a cylinder pressure hand, the initial pressure might be about 30 psi. When the valve remains in “lap,” the cylinder pressure remains constant, and the car begins to slow down. Braking friction increases as the speed between two rubbing surfaces decreases, and the constant braking pressure will have a greater effect as the car slows down.

If the cylinder pressure remains the same, the rate of deceleration will continue to increase until the car grinds to a jerky, strenuous halt. This causes undue strain on the car and the passengers.

The stop can be made smoother by releasing about one-third of the pressure when the car reaches about one-third of its original speed (one release). This will slow the rate of deceleration to a more comfortable level. However, if this new pressure is maintained, the car will still stop with a jerk, so when the car is almost stopped, release about half the remaining air (second release) to bring the car to a nice, easy stop. After the car is completely stopped, full air pressure should be applied to the cylinder to insure that it stays stopped. Be cautious when using this technique not to release too much air. If too much air is released, more must be reapplied. The reapplication may be more than enough, thus requiring another release. This is known as “fanning” and should be avoided.

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## STOPPING WITH AIR BRAKES: SELF-LAPPING VALVES

This type of valve makes the operator's job much easier. It allows for faster, smoother, and more accurate control of braking, and reduces the waste of air. The braking pressure is controlled by a pressure regulator in the brake valve itself. The position of the handle sets the regulator pressure, and as long as the handle remains in one position, the braking pressure for that setting is automatically maintained.

In this type of system, the extreme left position of the brake handle releases all air, setting the brake pressure to zero, or "full release." The extreme right position provides full emergency braking. Positions in between provide varying degrees of pressure for normal service stops.

The same basic principles explained in the section on manual lapping hold true in stopping a trolley equipped with a self-lapping brake valve. Upon approaching a stop, move the brake handle to the right, toward "full apply," stopping in a position which admits a reasonably large amount of pressure into the brake cylinder. When a cylinder pressure gauge is provided, an adequate pressure will measure from 30 to 35 PSI. As the rate of deceleration increases, move the handle a little to the left to reduce the pressure. Keep the handle there until the car is nearly stopped. When the car is nearly stopped, move the handle still farther to the left to smooth the final stop. As soon as the car is completely stopped, move the handle to "full apply" and leave it there until ready to move again.

With practice, operators will find that they are able to stop at the exact spot desired by releasing just the right amount of air at just the right time. Most cars equipped with self-lapping brake controls also have a safety feature known as a "deadman" valve, usually incorporated into the controller handle. This valve must be held down at any time that the brake valve is not in the "full apply" position. If it should be released while coasting or accelerating, or even during light braking, an emergency air relay will be tripped, and all available air pressure from the reservoir will be applied to the brake cylinder. It takes some effort to hold the deadman down, as it was designed so that an unconscious body could not readily hold it down; hence its name and purpose. When preparing to leave a car so equipped, move the brake handle to "full apply" (the position where the handle can be removed) before releasing the deadman.

## SMOOTH OPERATION OF AIR BRAKES

The following are some tips for the smooth operation of air brakes:

When starting cars, move the brake handle all the way from "full apply" to "full release." As the air is releasing, pull on the first point of power. The pressure which has not yet escaped from the cylinder will cushion the start, preventing a jerk. In addition, this practice prevents the car from rolling backwards on a grade, and helps prevent the wheels from spinning on wet rails.

- Plan your stops and learn to judge distances.
- Avoid "fanning" the air.
- Release some air as the car is coming to a stop.
- Always leave a manual lapping air valve in "full apply" position when parking a car - Never leave it in the "lap" position.

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## EMERGENCY DYNAMIC BRAKING

Dynamic braking can be obtained on cars with “K” and “HL” controllers via a sequence of emergency operations, should normal braking fail. This is strictly an emergency procedure. The dynamic braking effect cannot be controlled; it is either all or nothing. This is “regenerative braking,” where the motors are used as generators and will generally only slow the car to 3-4 MPH. Once emergency dynamic braking starts, it is necessary to wind up the hand brake to bring the car to a full stop. Additional information can be found in the “Emergency Procedures” section of this manual.

## STARTING THE CAR

If wheels begin to spin when starting from a stop, notch the controller off, and notch on and off a few times to allow the car to begin to move. It can also be helpful to apply 10 to 20 pounds of air to the brakes before applying power. The air should be held until the car has started to move successfully under its own power. If necessary, sand can be placed on the track to assist the car in starting.

## STOPPING THE CAR

All wheels of a streetcar must be turning for the fastest possible stop, and this is especially true on slippery rails. In a slide, the only contact of friction is the very small area between the wheel and the rail. Normally, the friction contact is the much larger area between the wheel and the brake shoe. If a slide begins, correct it at once. Follow the procedures outlined in the emergency procedures section.

# DESCRIPTIVE NOTES FOR OPERATING PASSENGER CARS

The following section contains detailed guides of operating passenger cars here at PTM. As a general rule, before operating a car, complete a brief inspection of the exterior and interior for any safety or repair issues. Perform a visual inspection of the running gear. Look under the car to determine if there appears to be anything loose or dragging on the ground. If you see any deficiencies, do not move the car and prepare a maintenance report.

## PITTSBURGH RAILWAYS 4145

The 4100 series cars were the last high floor cars built for use on the Pittsburgh Railways Company lines. They were built by the Pressed Steel Car Company in McKees Rocks, PA. These big heavy cars were designed to pull double truck low-floor trailers and served Pittsburgh Railway's busiest routes. Car 4145 entered service on November 25, 1911 and operated into the late 1930s when delivery of the first PCC cars rendered cars of this type surplus.

Because of their heavy construction the Pittsburgh Railways converted about a dozen 4000s and 4100s for use as snow scraping and towing cars in 1940. 4145 was renumbered M459 and placed into service as a snow scraper. It served in this capacity until the closing of the Craft Avenue car house in 1967 when it was declared surplus and placed on the scrap list.



Fortunately it was acquired by the Magee Museum of Transportation and moved to Bloomsburg, PA in 1968. There, Edward Blossom and his restoration team took the car and transformed it back into an operating passenger car. Unfortunately in 1972, Hurricane Agnes spawned storms in the northeastern United States that inundated the museum and destroyed the streetcar line and soaked the entire collection of transportation artifacts, including 4145.

In 1973 the museum was disbanded and the collection was sold to the highest bidders. It was at this time that Gerald Brookins purchased 4145 for his private "Trolleyville" operation near North Olmstead, Ohio. Trolleyville was successful through 2003 when the family of Mr. Brookins sold the property. At this time 4145 was moved to a lakefront location near the Rock and Roll Hall of Fame where the cars were placed on display pending construction of a museum building and re-opening operations along the Cleveland RTA's Waterfront light rail line.

In 2009 without sufficient financing the museum reverted to Brookins Family ownership and a consortium of electric railway museums put together a plan that saw the collection disbanded to the various groups. At this time the generosity of longtime PTM volunteer David Carpenter provided funding for this car to come to Arden for restoration as a wide-gauge operating exhibit, retaining all of the beautiful work done in Bloomsburg forty years earlier.

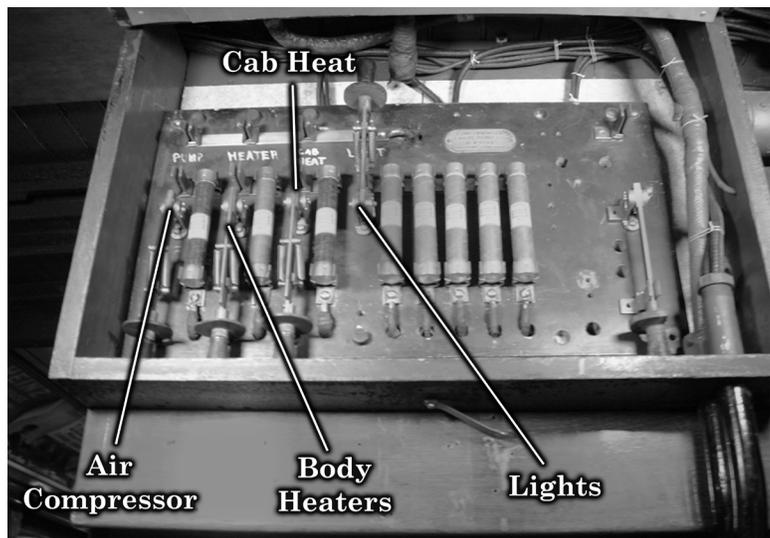
In 2010 PTM shop volunteers in conjunction with Lyons Industries rebuilt the trucks and returned them to the proper 5'-2½" gauge so that the car could again operate on its home track here at the museum. The car was officially rolled out on its 100th Birthday, November 25, 2011 with Santa Claus on board and Dave Carpenter at the helm.

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Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

## Start Up Procedures

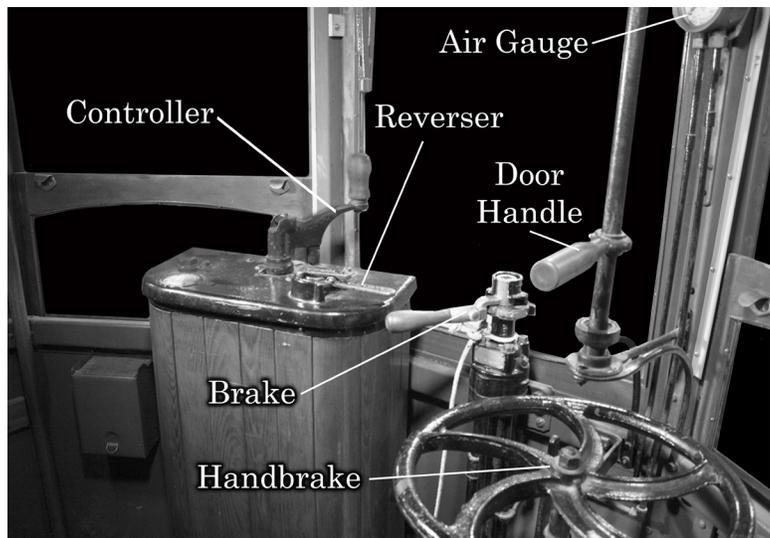
1. Ensure the reverser is not in the controller then put up the pole.
2. Turn the compressor on, this is located in the control box behind the operator's seat. **NOTE:** This box contains areas that are electrically "hot". Exercise extreme caution when turning any switch on or off.
3. Retrieve the handles from the ammo box.
4. Put brakes in full apply position.
5. Make sure the handbrake is released before attempting to move the car.



4145 - Switch Cabinet

## General Operating Procedures

1. 4145 is equipped with a "K" controller with no deadman. There are 5 points in series and 3 in parallel. Operate at free running points (full series or full parallel) when possible; do not operate at other points for sustained time periods.
2. 4145 is equipped with manual lapping brakes with an emergency apply position. See section Stopping with Air Brakes - Manual Lapping for more information.
3. A minimum of two crew members (operator and conductor) is required to operate this car with passengers.



4145 - Controls

## Door Operation and Passenger Loading and Unloading

1. All doors are manually operated.
2. The front doors are operated by the handle located next to the brake valve.
3. The rear doors are operated from the conductor's seat on the rear platform of the car, the upper handle controls the left hand set of doors while the lower handle controls the right hand set of doors. Note: This care is very high off the ground, making stepping into it a challenge for some visitors (and volunteers). Be sure to exercise caution and be ready to assist patrons as they enter the car.

## Heating and Ventilation

1. Clerestory windows can be opened to provide additional ventilation on hot days.
2. Knife switches for the heat are located in the box directly behind the operator.

## Lights

1. Lights are controlled by a knife switch located in the cabinet behind the motorman.
2. Headlight is wired in series with interior lights.

## Backing the Car

1. Reversing this car requires 2 people. Do not attempt to back up the car without someone watching out the rear window or from the ground.
2. Place the reverser in the “reverse” position.
3. Sound the bell three (3) times.

## Emergency and Special Procedures

1. 4145 is equipped with a “K” controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see that main overhead switch is in the “on” position.
  - b. Check to see that the control switch (CTRL/RESET) for controller is in the “on” (right) position.
  - c. Reset the line switch.
3. Lifeguard
  - a. Be aware of the lifeguard’s position at all times, it swings wide away from the car and can potentially become tangled in obstacles.

## Power Down Procedures:

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off compressor.
3. Return brake and reverser handles to the ammo box.
4. Lower the pole.



4145 - Conductor's Stand

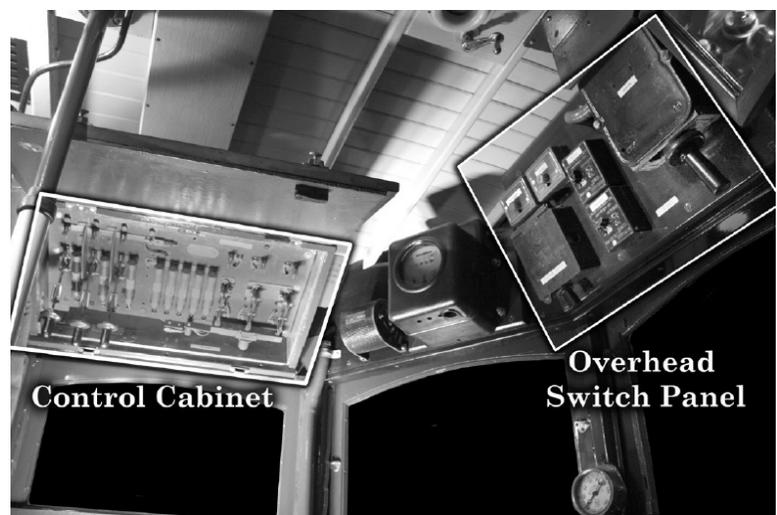
## PITTSBURGH RAILWAYS 4398



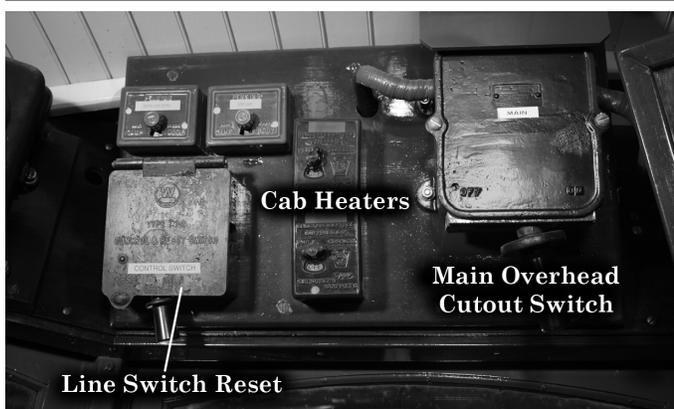
Pittsburgh Railway Company (PRCo) had 1,056 low-floor cars of varying types with 4398 and 3756 the lone survivors. 4398 was one of 213 double-end low-floor cars and was built in 1917. It had a design life of about 20 years but served much longer. The car spent its last years operating out of Glenwood Car House and was assigned to the 99 Glassport-Evans Ave route. In 1950, a loop was installed in Glassport and PCC cars replaced 4398 and other low-floor cars on that end of the line. When service was abandoned on Evans Avenue in 1952 the car was retired. It was kept in storage for emergencies until the museum purchased it in 1956. It was used for special excursions in 1958 and subsequently moved to the museum in 1960. Cars like 4398 were known as “safety cars” because they added safety features such as a deadman. Car 4398’s restoration is the most extensive in the Museum’s history. Over 30,000 hours were spent rebuilding this car.

### Start Up Procedures

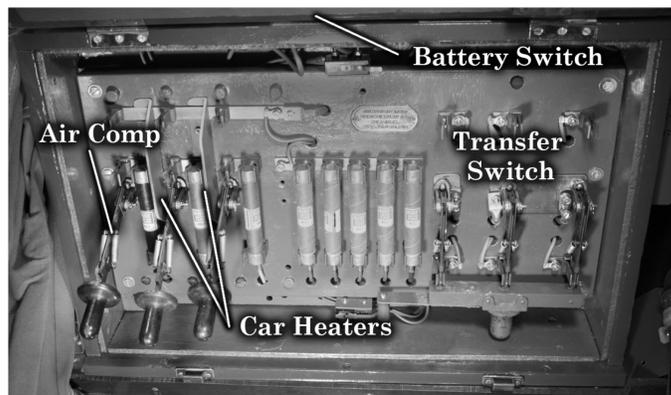
1. Ensure reverser is not in the controller then put up the rear pole.
2. Turn on battery switch above electrical cabinet on #1 end, left side.
3. Check the transfer switch, located in the control cabinet. If switch is not set for the direction that you will be going, change it to the correct position. The “up” position is the #1 end and the down position is the #2 end.
4. Turn the compressor on, this is located in the control box above the operator’s



4398 - Cabinets



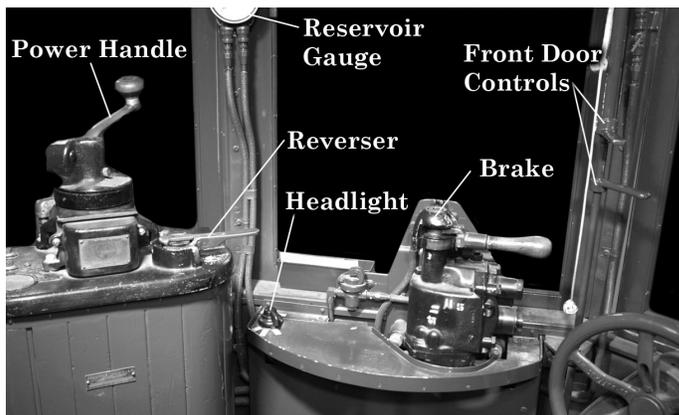
4398 Overhead Switch Panel



4398-Control Cabinet

seat on the #1 end. NOTE: This is a knife switch with a spring mechanism to lessen arcing when opening the switch. This box contains areas that are electrically “hot”. Exercise caution when turning switches on or off.

5. Move the control/reset switch to the reset position and then back to the on position.
6. Perform the brake changeover procedure (described under Changing Ends).
7. Make sure the handbrakes at both ends are released before attempting to move the car.



4398 - Controls

## General Operating Procedure

1. 4398 is equipped with a “K” controller with a “deadman”. The controller handle must be depressed unless the brake handle is in the “full application” position. The foot deadman pedal may also be used, but the controller handle must be held down first before you can use the foot deadman pedal (charging the system). Once the foot deadman pedal is depressed, the controller handle can be released. There are five (5) notches in series and three (3) notches in parallel.
2. 4398 is equipped with self-lapping brakes. The brake full application position (all the way to the right) also allows insertion and removal of the brake handle. See section Stopping with Air Brakes - Self Lapping for more information.

## Door Operations & Passenger Loading and Unloading

1. The front doors are opened/closed by using the two handles to the right of the operator.
  - a. The top handle opens the #1 (left) set of doors
  - b. The lower handle opens if the #2 (right) set of doors.
  - c. On the exterior of the car, on the door side of the anti-climber, there is a small black lever. This lever is attached to the #2 door linkage and can be used to open and close the #2 doors from the outside of the car (when there is sufficient pressure in the air tanks).
2. The center doors are opened/closed by using the push buttons located on the front door engine cabinet above the door handles. The top button opens the doors and the bottom button closes the doors. The center doors should be closed before moving the car. If the car is started with

the center doors left open, the car will move before the doors automatically close. Never close the center doors without making sure that these doors are clear of passengers. As general procedure, the center doors should only be used if there is someone (conductor on the car or someone on the platform) to visually observe that the doors are clear before they are closed.

### Heating and Ventilation

1. Heat for passenger area is controlled by the knife switches in the electrical cabinet at the #1 end of the car.

Note: This box contains areas that are electrically “hot”. Exercise caution when turning any switch on or off.

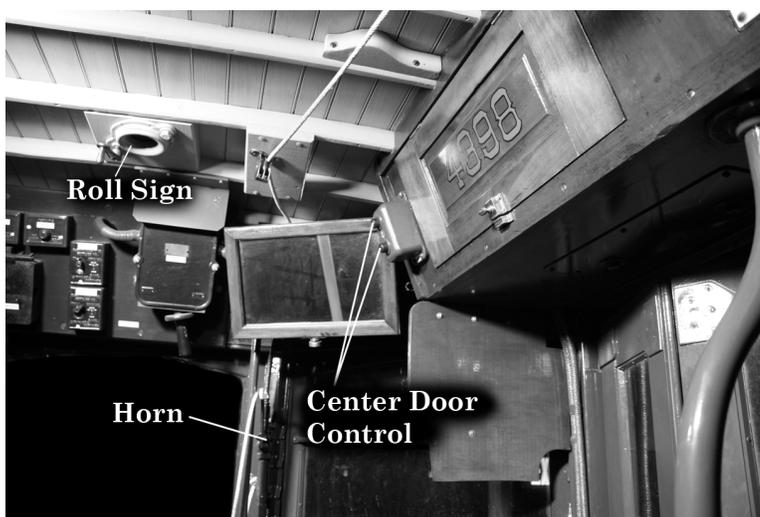
2. Heat for the operator’s cab is controlled by the switches above the center window at the #1 end #2 end of the car.
3. Clerestory windows can be opened to provide additional ventilation on hot days.
4. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.

### Lights

1. Car body lights are controlled by two snap switches located as follows:
  - a. #1 end : Mounted on the upper side of the electrical cabinet.
  - b. #2 end : Above if the leftmost cab window.
2. Headlights are controlled by the three-position switch on dash to the left of the brake valve. The battery switch must be on for the headlights to operate. During night operations, be sure that the headlight is in the low beam position when approaching platforms and when meeting cars at passing locations.
3. Marker lights are on when the battery switch is closed. Direction is controlled by the transfer switch.

### Changing Ends

1. Place brakes in full apply position.
2. Switch the trolley poles.
3. Close all doors.
4. If you are on the #1 end, throw the transfer switch.
5. Move handles to the other end.
6. If the #1 end is the new front-end, throw the transfer switch.



4398 - Door Control

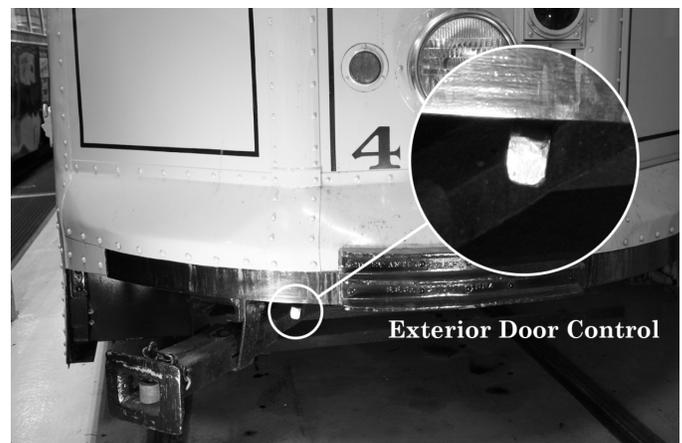
7. Change the air over - Hold down the controller handle, release the brakes and wait. When you hear a second “chuff” or release of air, you may reapply the brakes and release the deadman. This “chuff” sound is the brake system recognizing this brake valve is now active. *If the front doors at either end of the car are open they could close when you transfer the air system and potentially injure on anyone in the doorway, it is important to . If the center doors are open and you transfer control to the other end of the car, you will no longer be able to close the center doors since the door control switch for the former front end of the car will no longer be operative.*
8. Return brake handle to full application position and release the deadman.

### Emergency and Special Procedures

1. 4398 is equipped with “K” controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see that main overhead switches on both ends are in the “on” (right) positions.
  - b. Reset the line switch using the control switch (CTRL/RESET.)
  - c. Check to see that the center doors are closed.
  - d. The car may be in “emergency”. Release the brakes and wait for a minute or until you hear a second “chuff” or release of the brake system. This means the car has come out of “emergency” and is ready to operate.
3. LifeGuard
  - a. If the LifeGuard drops, stop the car as soon as possible and manually lift the LifeGuard back into the locked position.

### Power Down Procedure

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. When putting the car in the carbarn, set the transfer switch to the new front end and perform the brake switchover process.
4. Turn off the battery switch.
5. Return the handles to their ammo box.
6. Exit car through door #2 (from new front end in carbarn) and use the external control (in front of car) to close the door.
7. Lower the pole.
8. Drain condensation from the air tanks.



4398 - Exterior door control

## PITTSBURGH RAILWAYS 3756



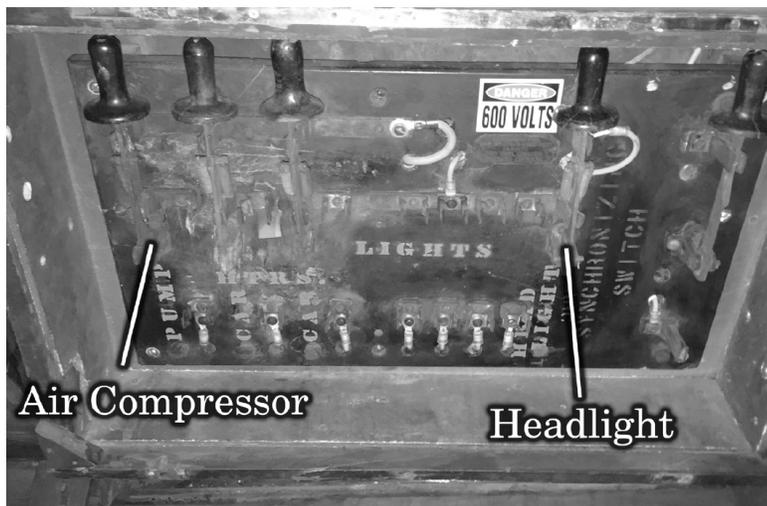
Pittsburgh Railways 3756 is one of a group of twenty cars purchased in 1925 to replace older, heavier wooden interurban cars on the Washington and Charleroi lines. These cars were fitted with couplers and multiple-unit controls so they could be operated on two-car trains. This, however, proved unpopular with both company and riders and the cars were ultimately withdrawn from this service.

As originally built, these cars had a separate smoking compartment and a lavatory. During World War II, the first nine cars of the group (including 3756) were equipped with a left-hand front door and assigned to service on the 23 line, which served the shipyards on Neville Island. Many of the car stops on the island would require patrons to alight on a busy highway were it not for the extra door.

The car was selected for preservation from over 200 available cars shortly before the move to the present museum site in 1954. While it is essentially a single-ended car, 3756 is equipped with operating controls between the rear seats, which simplified moves inside car houses and coupling of multiple unit trains. This feature allowed the car to be operated, to some degree, as a double-ended car in service at the museum.

## Start Up Procedures

1. Ensure reverser is not in the controller then put up pole.
2. Insert brake handle on front end and place in apply position
3. Turn the compressor on, this is located in the control box above the operator's seat. NOTE: This box contains areas that are electrically "hot". Exercise extreme caution when turning any switch on or off.
4. For operations, it is necessary to install the portable headlight. To place the headlight:

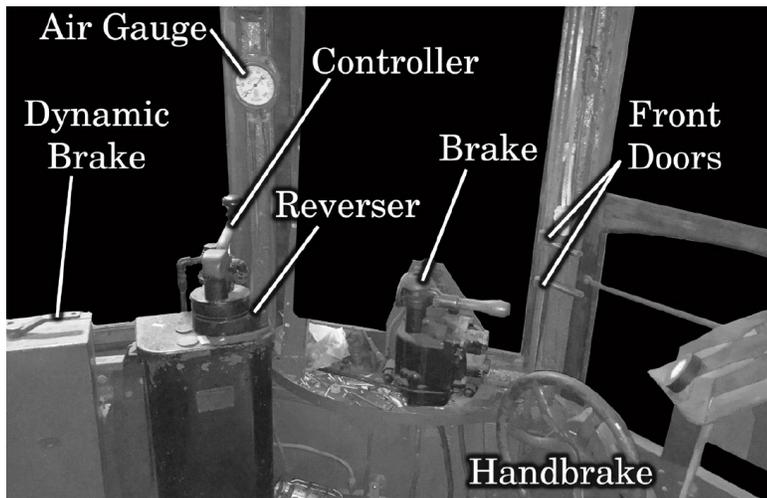


3756 - Control box

- a. Ensure the knife switch for the headlight (located in the control box) is off or "open".
  - b. Retrieve the "golden glow" headlight from behind the operator's seat and mount it to the front of the car. The headlight grounds electricity to the car body so it is very important to mount the light BEFORE plugging it in.
  - c. Carefully insert the plug into the socket located below and to the left of the anti-climber.
  - d. Close the knife switch and the light will come on.
5. Make sure the handbrake is released before attempting to move the car. Note: the handbrake should only be used in an emergency situation.

## General Operating Procedure

1. Operating from the front controller
  - a. 3756 is equipped with Westinghouse HL type control with a deadman. The controller handle must be depressed unless the brake handle is in the "full application" position. The foot deadman pedal may also be used, but the controller handle must be held down first before you can use the foot deadman pedal. Once the foot deadman pedal is depressed, the controller handle can be released. The Controller has five (5) notches in series and four (4) notches in parallel.

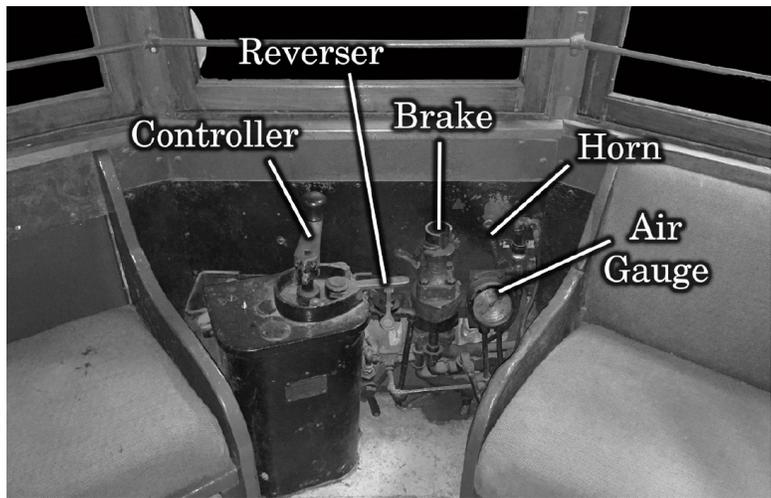


3756 - Front Controls

- b. 3756 is equipped with self-lapping air brakes on the front end, read the section above on Stopping with Air brakes - Self lapping.

## 2. Operating from the rear controller

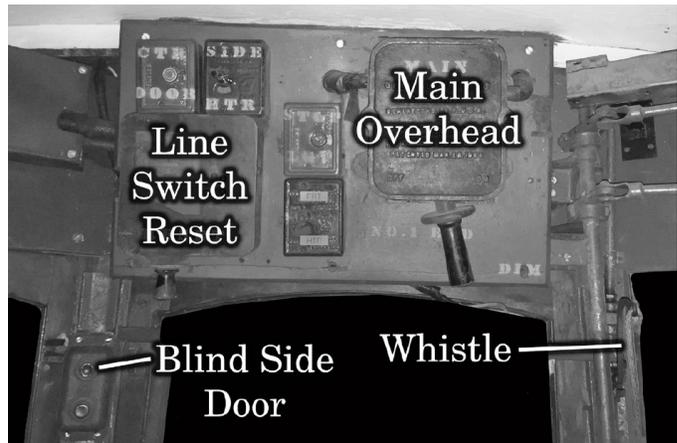
- a. There is no deadman on the rear controller.
- b. The rear brake valve is manual lapping, read the section above on Stopping with Air brakes - Manual lapping.



3756 - Rear Controls

## Door Operations & Passenger Loading and Unloading

1. The front doors are operated from 2 handles located on a post next to the brake valve, the top handle opens the #1 or front pair of doors, the lower handle opens the #2 or back pair of doors.
2. The center doors are opened/closed by using the push buttons located on the front door engine cabinet above the door handles. The top button opens the doors and the bottom button closes the doors. The center doors should be closed before moving the car. A door interlock will prevent the car from drawing power if the center doors are left open. Never close the center doors without making sure that these doors are clear of passengers. As general procedure, the center doors should only be used if there is someone (conductor on the car or someone on the platform) to visually observe that the doors are clear before they are closed.



3756 - Overhead Switches

3. The blind side door is operated by the door controls located on the front window post above the air gauge.

## Heating and Ventilation

1. Heat for the operator is controlled by the switch at the left front of the operator's cab.
2. There is no functional heat in the passenger area.
3. Clerestory windows can be opened to provide additional ventilation on hot days.
4. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.

## Lights

1. The headlight and interior lights are controlled by switches located in the control box.

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## Changing Ends

1. Place brakes in full apply position.
2. Remove the brake handle and reverser and move it to the other end of the car. Insert the brake handle and re-apply brakes.

## Emergency and Special Procedures

1. 3756 is equipped with “HL” control. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. 3756 has the unusual feature of a dynamic brake switch, which may be used in lieu of the way one would initiate dynamic braking on an HL control car. To use it, shut the main controller off, and move the dynamic brake handle clockwise 90°.
3. Car does not run:
  - a. Check to see if the Main Control Switch and the Line Control Switch are in the “On” position.
  - b. Check to see if center doors are closed.
  - c. Reset the control breaker.
  - d. The car may be in emergency. Release the brakes and wait for a secondary release of air indicating the brake system has reset.

## Power Down Procedure

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. Return brake, reverser, and door handles to the ammo box.
4. If it was in use, remove the portable headlight. To do so:
  - a. Open the knife switch for the headlight (located in the control box). This box contains areas that are electrically “hot”. Exercise extreme caution when turning any switch on or off.
  - b. Carefully remove the plug from the socket located below and to the left of the anti-climber. The headlight grounds the electricity to the car body so it is very important to unplug it BEFORE removing the headlight.
  - c. Remove the “golden glow” headlight and return it to its storage place behind the operator’s seat. Ensure the glass lens is facing the wall.
5. Lower the pole.
6. Drain the air tank.

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## NEW ORLEANS PUBLIC SERVICE 832



Car 832 was built for New Orleans Public Service Incorporated (NOPSI) in 1923 by the Perley Thomas Company of High Point, North Carolina. In 1947 this car was featured in Life Magazine when Tennessee Williams play "A Streetcar Named Desire" debuted on Broadway. This car was regularly assigned to service on the Desire line. Although the Desire line quit operation in 1948, the play and the subsequent movie continue to bring fame to New Orleans streetcars.

By 1964 only two streetcar lines remained in operation in New Orleans: Canal Street and St. Charles Avenue. Early that year the decision was made to convert the Canal Street line to bus operation and retain the St. Charles Avenue line as a tourist attraction. That freed 40 cars, most of which were eventually scrapped. Before scrapping the cars, NOPSI offered them to any interested group willing to pay the moving costs. The fact that 832 was made famous on the cover of Life Magazine in 1947, its compatibility of track gauge and the age and excellent condition of the car moved PTM to express interest in this car long before it was removed from service. Because of its long-standing interest, PTM was given the first choice of the cars being retired. New Orleans 832 was delivered to the museum atop a railroad flat car in June 1964 and was immediately placed into operation.

## Start Up Procedures

1. Ensure reverser is not in the controller then put up rear pole.
2. Turn the compressor on using the snap switch located in the control box adjacent to the left hand doors on the #1 end.
3. Retrieve the handles from the ammo box.
4. Put brakes in apply position.
5. Ensure the headlight is set for the proper direction.
6. Check that all four doors are properly closed.
7. Make sure the handbrakes at both ends are released before attempting to move the car.

## General Operating Procedures

1. 832n is equipped with a “K” controller and no deadman, with four (4) series and four (4) parallel points.
2. 832n is equipped with manual lapping brakes. See section Stopping with Air Brakes - Manual Lapping for more information.
3. When removing brake handle, the brake must be in full apply position for a minimum of 10 seconds before removing the brake handle. When installing brake handle, always fully apply the brakes.



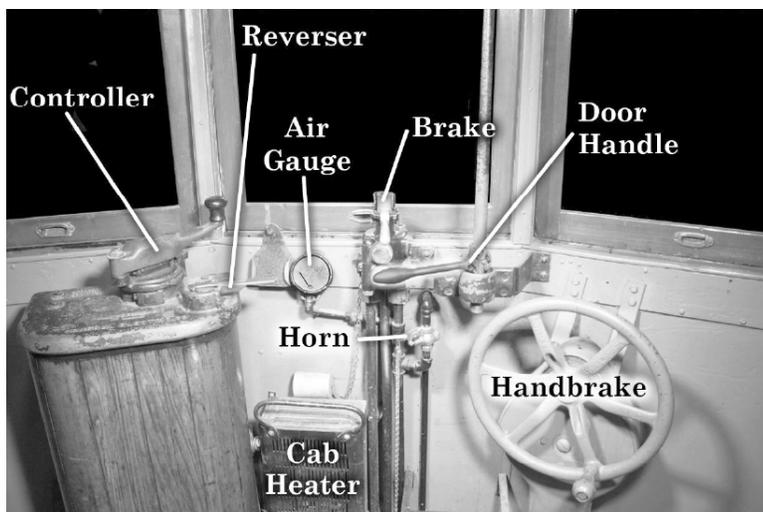
832n - Switch Cabinet

## Door Operation and Passenger Loading and Unloading

1. Door operations are manual with the handle for the right door at the front and the handle for the left door on the pole behind the operator. There is only one door handle for each end of the car so the handle has to be moved when changing which set of doors are opened (right or left).
2. There is no door interlock. Always verify all doors are fully closed and latched before moving the car.

## Heating and Ventilation

1. There are cab heaters but no heaters in the passenger area.
2. Cab heaters are controlled by switches located behind the controller on each end.
3. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.



832n - Controls

### Lights

1. The headlight, headlight transfer, and interior light switches are located in the control box adjacent to the bulkhead on the #1 end.

### Changing Ends

1. Place brakes in full apply position.
2. Switch the trolley pole.
3. Move brake handle and reverser to the other end and re-apply the brakes.
4. Transfer the headlight.

### Emergency and Special Procedures

1. 832n is equipped with a “K” controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check the line switch controls on both ends of the car.
  - b. Ensure the main overhead switch is in the “On” position.

### Power Down Procedures:

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off compressor.
3. Return brake and reverser handles to the ammo box.
4. Lower the pole.
5. Drain air tank.

## WEST PENN RAILWAYS 832



Car 832 represents the Cincinnati Car Company's patented "curved side" design. A dozen of these lightweight, "curved-side" cars were acquired for West Penn Railway's Allegheny Valley Street Railway during the winter of 1929-30. Introduced on Valentine's Day 1930, they afforded patrons the finest accommodations of the day on the routes between Aspinwall, New Kensington and Natrona. Company accountants liked them too, because they required one crewman instead of two.

After the Valley Route was abandoned in 1937, the cars were moved to the company's "Coke Region" division, where they ran on routes to Latrobe, Fairchance, Phillips and South Connellsville. 832 was the last of the series in service, finishing up on the South Connellsville route at the end of rail operations in 1952.

832 was the second car acquired for the Museum and was trucked from West Penn's Connellsville car house to Charleroi car house on the Pittsburgh Railways system in February 1953. In May 1953 the car was operated on a special fundraising "fantrip" and brought from Charleroi to Ingram Car House.

February 7, 1954, West Penn 832 was moved under its own power with Pittsburgh Railways M1 and 3756, to its new home in Washington County along the former Washington interurban right-of-way near the village of Arden.

Seven years of outdoor storage took its toll on 832. By the time the museum started operation in 1962 the car was inoperative and extensive repairs were undertaken. Work on the car was sporadic until 2010 when the restoration effort became the focus of a Transportation Enhancement Grant. A restoration plan was written and bids were received for execution of the work from interested firms. In August 2010 the car and its assorted parts were shipped to Brookville Corporation in Brookville Pennsylvania and work commenced.

West Penn 832 entered service in 2018, following 7 years of intensive work by shop volunteers. This included work on the controls, braking, wiring, roof and the interior finishing of the car.

## Start Up Procedures

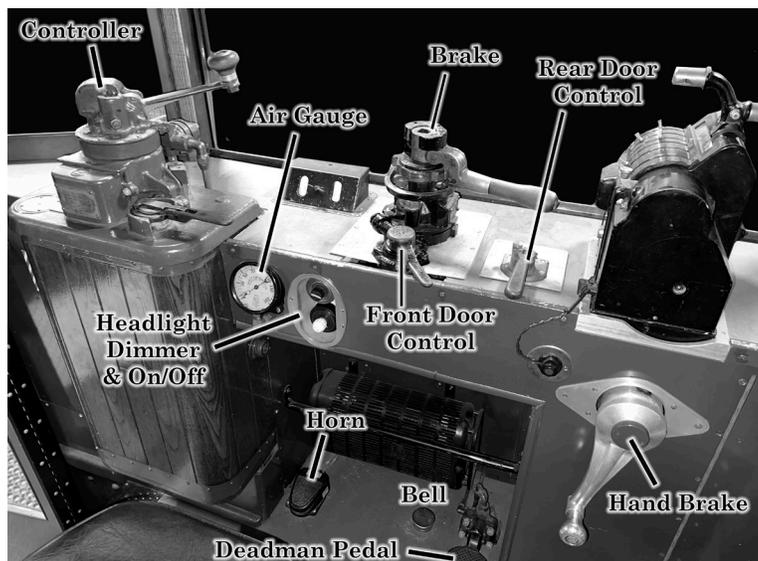
1. Ensure reverser is not in the controller then put up rear pole. This car is equipped with a retriever.
2. Set the door engine valve that was in the “off” position to “on”. It is a good idea to check all door engine valves to be sure they are in the “on” position.
3. Turn on compressor. When pressure reaches about 50 PSI, the system will charge and air gauges will register the pressure. Note: You may have to “cycle” the brakes once to get the system to register. Hold the deadman down, release the brakes all the way and then re-apply.
4. Ensure the headlight is set to the proper direction.
5. Turn on the battery switch located in the #1 end switch cabinet.
6. Make sure the handbrakes at both ends are released before attempting to move the car.



832w - #1 End Switch Cabinet

## General Operating Procedure

1. 832w is equipped with “K” Control with a “deadman”. The controller has five (5) series and four (4) parallel points. The controller handle must be depressed unless the brake handle is in the “full application” position.
2. 832w is equipped with manual lapping brakes with an emergency apply position (far right) and a “door open” position. See section Stopping with Air Brakes - Manual lapping for more information. Note: This brake valve is very sensitive!



832w - Controls

## Door Operations & Passenger Loading and Unloading

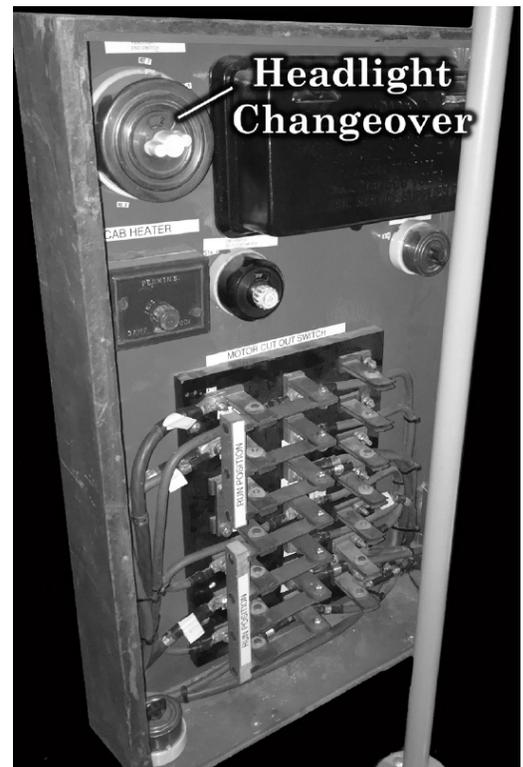
1. The front door selector is integral with the brake valve. The brake handle must be in the “door open” position in order to open the front doors.
2. A door interlock is connected through the door engine, and will prevent the car from drawing current if any doors are open. If the door indicator light is lit, there is a door open. Note: All doors close when the brake handle is removed. Do not remove the brake handle while passengers are leaving or entering the car.
3. The front doors are opened by placing the brake valve in the “door open” position. (about 5 o'clock) The front door selector position controls what doors open. In the center position, both

front doors will open. The left or right position will open each door respectively.

4. The rear right door is the only rear door that can be opened from the operating end. Use the rear door control to open this door. Note: This door will open even if the brake valve is not in the “door open” position, always ensure the door is closed before you release the brakes.
5. Be aware when closing the rear door, first checking to ensure it is clear of passengers. As a general rule, only use rear doors if there is someone visually observing to verify the doors are clear before they are closed.

### Heating and Ventilation

1. Heat for passenger compartment is controlled by two snap switches in the compartment to the right of the operator on the #1 end of the car. Note: This box contains areas that are electrically “hot”. Exercise extreme caution when turning any switch on or off.
2. Heat for operator’s cabs is controlled by a switch in the compartment to the right of the operator on both ends.
3. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.



832w - #2 End Switch Cabinet

### Lights

1. Interior lights are controlled by a switch in the cabinet to the right of the operator on the #1 end.
2. Headlight dimmer switch is located next to the air gauge on the dash.
3. Headlight transfer switch is located in the switch cabinet on the #2 end.

### Changing Ends

1. Place brakes in full apply position.
2. Switch the trolley pole.
3. Move brake and door handles to the other end and re-insert the handles. Place the brakes in the full apply position.
4. Transfer the headlight.

### Emergency and Special Procedures

1. 832w is equipped with “K” control. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. The horn is controlled by an electronic foot pedal next to the operator’s left foot. The battery must be on in order for the horn to work.
3. Car does not run:
  - a. Check to see if the main overhead breaker is in the “On” position.

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Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

- b. Check to see if all doors are closed including checking the to see that the door engine valves are in the “On” position.
- c. The car may be in emergency, check the air gauge, if it reads “0” air pressure, place the reverser in the “forward” position, hold down the deadman and release the brakes. Wait for a secondary release indicating the brake system has reset.

#### Power Down Procedures:

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. Remove the controller handle, reverser & rear door handle and return them to the ammo box.
4. Remove the brake handle and take it to the end facing the carbarn doors. Place it in the “emergency” position.
5. Exit through a door at the end of the car facing the carbarn doors.
6. Lower the pole.
7. Chalk the car when in the first position on any track in Founders Carhouse.
8. Drain the air tank.

## RIO DE JANEIRO TRAMWAYS 1758



Open-sided trolley cars were extremely popular in the early days of the 20th Century, as they offered the public the pleasure of a cool ride on hot summer evenings, and carried millions of passengers to amusement parks, which often were owned by the streetcar companies. As automobiles became popular and competed for street space, the open car became a safety issue, and most fell into disuse by about 1930.

Car 1758 was built about 1911 by Rio de Janeiro Tramway, Light & Power Co. in Brazil, under license from J. G. Brill Co., who supplied the plans and a kit of metal parts for the car. Labor and wood were obtained locally. Originally the car was equipped to haul trailers in the South American city. Though Pittsburgh Railways never operated large double-truck open cars, similar (though slightly longer) cars were operated by West Penn Railways in Westmorland and Fayette Counties.

This car is one of twelve brought to the United States in 1965 under the auspices of the Association of Railway Museums and initially operated at the now-defunct Magee Transportation Museum in Bloomsburg, PA. The car later had three additional owners before being purchased at auction by PTM in 2006. It was rehabilitated in the museum's shop, for appearance and for re-gauging, the latter necessitating considerable engineering and fabrication of new structural and mechanical equipment.

## Start Up Procedures

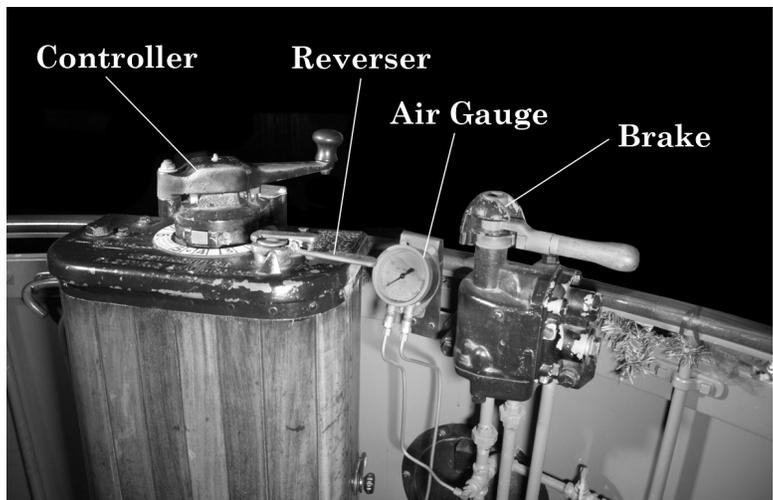
1. Ensure reverser is not in the controller, then put up rear pole.
2. Turn on the compressor.
3. Ensure the headlight is set to the correct end.
4. Make sure the handbrakes at both ends are released before attempting to move the car.



1758 - Switches

## General Operating Procedure

1. 1758 is equipped with a “K” controller with no deadman, there are five (5) notches in series and three (3) notches in parallel.
2. 1758 is equipped with a self lapping brake valve. Read the section above on Stopping with Air brakes - Self lapping.
3. 1758 should not be operated in inclement weather conditions (rain, cold or high wind).



1758 - Controls

## Passenger Loading & Unloading

1. Both the operator and the conductor are responsible for passenger loading and unloading.
2. When tickets are being punched, operator should explain safe loading procedures and conductor should punch the tickets. Punching of tickets should not interfere with the safety instructions.
3. Passengers must be instructed to not step on the toe board (painted yellow on top) when boarding and leaving the passenger compartment and to hold on to the yellow grab bars.
4. Passengers should be advised to leave the passenger compartment either backwards or sideways and to hold onto the yellow grab bars. Children shall not sit on the outboard end of the bench seats while the car is in motion. If there are adults on the bench, children should sit between them.
5. Changing direction of seats should be accomplished with care ensuring not drop the seat.

## Safe Operating Procedures

1. A minimum of two crew members (operator and conductor) is required to operate this car with passengers.
2. While the car is in motion, no one (passenger or crew) may be on the running boards.
3. While the car is in motion, the conductor must be on the rear platform facing forward. The

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conductor's responsibility is to monitor passenger safety and he/she shall not be talking to passengers or performing other activities not related to safe operations.

4. When the conductor observes an unsafe condition (ex. passenger standing or a child on the end of the bench), the conductor should correct them, and may utilize the megaphone to get the attention of the passengers.
5. If it is necessary for other reasons to stop the car, the conductor should use the whistle pedal at the back of the car to signal the conductor to stop the car.
6. Use multiple short blasts of the whistle to signal for an immediate stop.

### Lights

1. Controls for interior lights and headlights are behind operator on #1 end of the car.

### Changing Ends

1. Place brakes in full apply position.
2. Switch the trolley poles.
3. Move handles to the other end and reinsert, then return brake handle to full application position.
4. Transfer the headlight.

### Emergency and Special Procedures

1. 1758 is equipped with a "K" controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see that Line Switch Controls on both ends of the car are in the "On" (right) position.
3. Emergency stopping of car by Conductor (from rear platform).
  - a. Put Line Control Switch in the "off" (right) position.
  - b. Apply hand brake as tightly as possible.

### Power Down Procedure

1. Turn off the compressor.
2. Return the handles to the ammo box.
3. Change the headlight over.
4. Lower the pole.
5. Drain the air tank.

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## CINCINNATI STREET RAILWAYS 2227



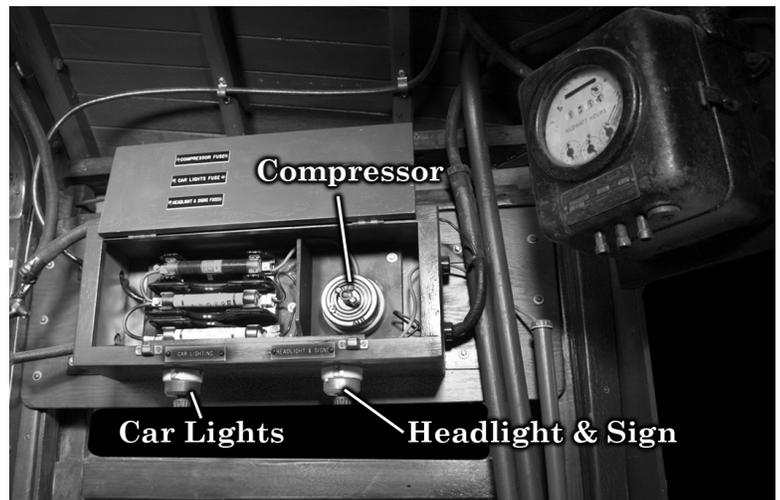
Car 2227 represents the standard design used for Cincinnati streetcars built between 1911 and 1920. In 1919, the Cincinnati Traction Company placed an order with the Cincinnati Car Company for 105 double truck closed deck roof cars to be numbered 2200 through 2304. Car 2227 from this order was in service for most of the time until abandonment of all streetcar operations in Cincinnati on April 29, 1951. In 1948, after the abandonment of streetcar service on the line 2227 served, it was converted to a sand car, and renumbered S-223.

After abandonment of all streetcar service in 1951, a group of railfans in the Dayton area saved the car, and worked for many years to find a permanent home for it. On Labor Day 1964, the car was donated and deeded to Gerald Brookins of Trolleyville in Olmsted Falls, OH. The body of the car was moved to Trolleyville where it underwent a lengthy restoration and was substantially restored. It operated for the public for the first time at Trolleyville's Trolleyfest celebration in 1998. In the years before Trolleyville was closed, many visitors enjoyed riding the only operating Cincinnati Street Railway car in existence.

PTM acquired the car in 2009 after the unfortunate closure of Trolleyville. In 2010, generous contributions by Cincinnati streetcar fans allowed re-gauging and rebuilding of the trucks so that the car could be put in operation. This work was accomplished with thorough planning and the able assistance of Lyons Industries in Ebensburg, Pennsylvania. In addition, PTM volunteers worked over 2000 hours to rebuild mechanical and electrical equipment that have allowed the rebuilt trucks to work flawlessly.

## Start Up Procedures

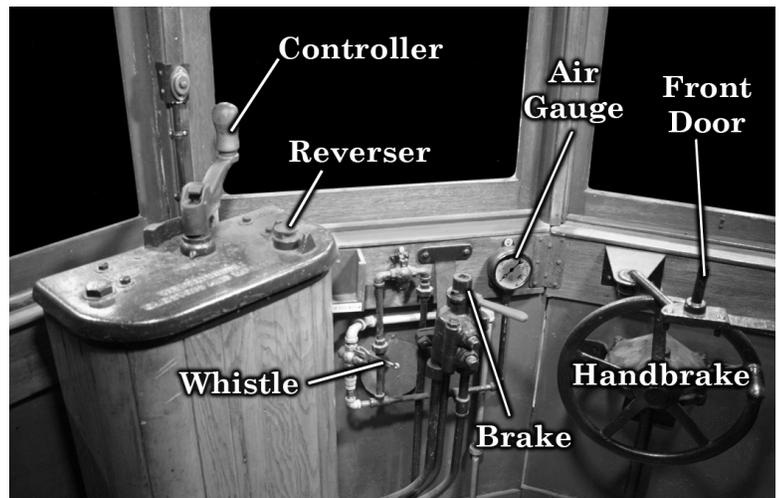
1. Ensure reverser is not in controller then put up pole. Note: This car is equipped with 2 poles, the right hand pole is always to be used, the left hand pole cannot be moved.
2. Turn the compressor on using the switch located in the cabinet above the side window in the operator's area.
3. Retrieve the reverser from the ammo box.
4. Put brakes in full apply position.
5. Make sure the handbrake is released before attempting to move the car.



2227 - Switch Box

## General Operating Procedures

1. 2227 has "K" controller with four (4) series and four (4) points in parallel.
2. 2227 is equipped with manual lapping brakes. See section Stopping with Air Brakes - Manual Lapping for more information.
3. A minimum of two crew members (operator and conductor) is required to operate this car with passengers.



2227 - Controls

## Door Operation & Passenger Loading and Unloading

1. All doors are manually operated.
2. The front doors are operated by the handle located next to the brake valve.
3. The rear doors are operated from the conductor's seat on the rear platform of the car, the left handle controls the left hand set of doors while the right handle controls the right hand set of doors.
4. 2227 is very high off the ground, making stepping into it a challenge for some visitors (and volunteers). Be sure to exercise caution and be ready to assist patrons as they enter the car.



2227 - Conductor's Stand

Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

## Heating and Ventilation

1. There is a cab heater but no heaters in the passenger area.
2. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.

## Lights

1. Body lights, headlight and marker lights are controlled by switches in the box located above the side window in the operator's area.

## Backing the Car

1. Reversing this car requires 2 people. Do not attempt to back up the car without someone watching out the rear window or from the ground.
2. Place the reverser in the "reverse" position.
3. Sound the bell three (3) times.

## Emergency and Special Procedures

1. 2227 is equipped with a K controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check the line switch control.

## Power Down Procedures:

1. If the car heater was used, it must be turned off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off compressor.
3. Return reverser handle to the ammo box.
4. Lower the pole.
5. Drain air tank.

## PHILADELPHIA RAPID TRANSIT 5326



Car 5326 is one of a group of 135 such cars built in 1923 by the J.G. Brill Company for the Philadelphia Rapid Transit Company. Just as Pittsburgh Railways had favored one car design for many years, so too had PRT favored the general design of cars like 5326, to the point where they had over 2,000 cars representing several variations of the same basic design. Brill had built so many cars for PRT over the years that a track was built from the street outside into the Brill plant just for the delivery of new cars!

Because Philadelphia lacks Pittsburgh's hills, the cars didn't need to be as powerful. 5326 has only two motors to drive it, while most of the museum's other eight wheel cars have four motors. In order to get maximum traction from the two powered axles, a distinctive design of truck was used, having two small un-powered "pony" wheels and two larger "driver" wheels.

In April 1958, car 5326 had the distinction of being the first trolley car to ever travel the Pennsylvania Turnpike (even if it was on a truck trailer), as it moved to its new home in Washington, PA. While many of the cars at the museum are the lone survivors of their type, this is not true of 5326.

Restoration of this car, initiated in 1976 as part of the United States Bicentennial celebration, was made possible by a grant from the Pennsylvania Department of Transportation and the Southeastern Pennsylvania Transportation Authority. The extensive work undertaken to return this car to its 1923 appearance spanned a five year period, included overhauling its controls and running gear, and undoing all of the "modernization" applied in 1941. This "labor of love" required more than 3,000 hours of labor by museum volunteers who donated their weekends and vacations to the preservation of history.

## Start Up Procedures

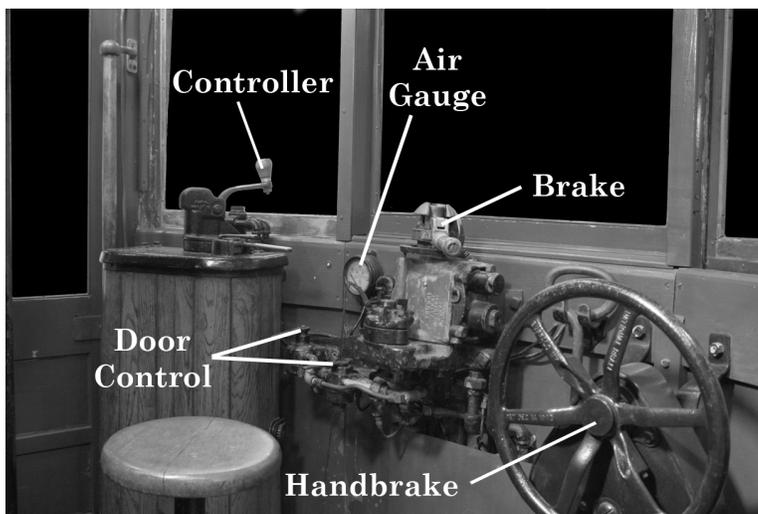
1. Ensure reverser is not in the controller then put up rear pole.
2. Retrieve the handles from the ammo box. Insert brake handle on front end and place in the “door open” position.
3. Turn on compressor. The air compressor switch is in the control box on the #1 end of the car, above the controller.
4. Ensure the headlight is set to the proper direction.
5. Make sure the handbrakes at both ends are released before attempting to move the car.



5326 - Switch Cabinet

## General Operating Procedure

1. 5326 is equipped with a K controller with deadman valves. The control handle must be depressed at all times when operating to prevent the car from falling into “emergency” and coming to an abrupt stop. The Controller has five (5) notches in series and four (4) in parallel.
2. Brakes are self lapping with an emergency position (far right) and a door open position. See section Stopping with Air Brakes - Self lapping for more information.



5326 - Controls

3. The windows on this car are held open by spring brass. It is important you warn visitors to keep clear of the windows as they may fall unexpectedly.
4. Be aware that all doors close when the brake handle is removed. Do not remove the brake handle while passengers are leaving or entering the car.

## Door Operation & Passenger Loading and Unloading

1. Doors are opened and closed using the door controls located at both ends of the cars.
2. Door controls are integral with the brake valve. The brake handle must be in the “door open” position in order to open a door. A door interlock is connected through the door engine, and will prevent the car from drawing current if any doors are open. Note: All doors close when the brake handle is removed. Do not remove the brake handle while passengers are leaving or entering the car.
3. The door interlock prevents the car from drawing power with the doors open.
4. Be aware when closing the rear doors, first checking to ensure they are clear of passengers.

## Heating and Ventilation

1. Some of the upper sash windows can be opened for extra ventilation during the summer months.
2. Heat for passenger compartment is controlled by three (3) knife switches found in a box mounted on the bulkhead on the #2 end of the car. Note: This box contains areas that are electrically “hot”. Exercise extreme caution when turning any switch on or off.
3. Heat for the operator’s cab is controlled by the switches below the left hand windows at the front of the car. Note: The knife switch at the center of the car must be thrown in order for this switch to function.
4. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.



5326 - Heater Switch Box

## Lights

1. The switches for the interior lights and sign-box light transfer are in the box above the left doors on the #2 end of the car.
2. The headlight transfer switch is located above the blind side doors on the #1 end.

## Changing Ends

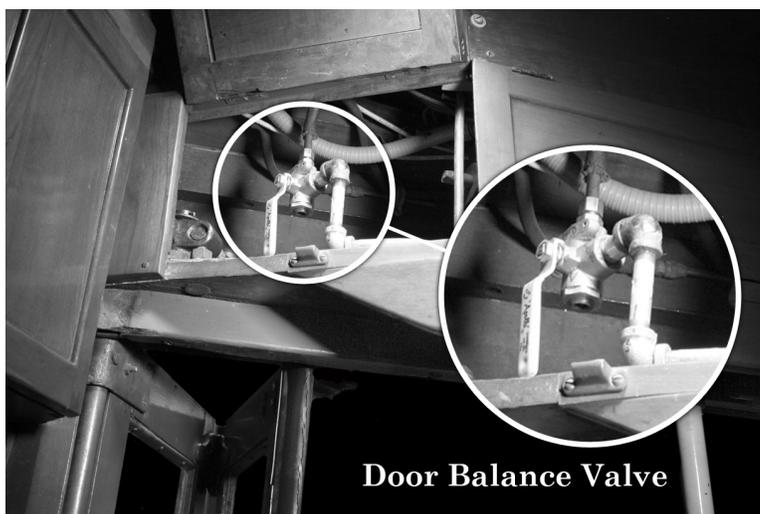
1. Place brakes in full apply position.
2. Change the poles.
3. Transfer the headlight. Note: At present both headlights are on at all times, so there is no need to transfer.
4. Move brake handle to the other end and re-insert. Place the brake handle in the “door open” position.

## Emergency and Special Procedures

1. 5326 is equipped with “K” controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see if the main overhead breaker is in the “On” position.
  - b. The car may be in emergency, push and hold the deadman down and release the brakes. A secondary release of air should tell you the car is out of emergency.
  - c. Check to see if all doors are closed and check the door engine valve are in the “On” position.

## Power Down Procedures

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. Return the controller, brake and reverser handles to the ammo box.
4. Exit through a door at the end of the car facing the carbarn doors. Set the Door Balancing Valve to the "Off" position (aka "balancing" the doors), this will ensure no one gets "locked" out when the car is next used.



5326 - Door Balance Valve in the "balanced" position

5. Lower the pole.
6. Drain the air tank.

## PHILADELPHIA TRANSPORTATION COMPANY 8042



Car 8042 is one of 385 single-end cars purchased in 1923 by the Philadelphia Rapid Transit Company (PRT) the same order that included car 5326. The 535 1923-1926 single-end cars were numbered 8000 through 8534 and were commonly referred to as 8000s (eighty-hundreds). These cars incorporated many advances in design and construction over the older cars used in Philadelphia, such as a greater use of lightweight steel construction instead of composite steel and wood or all-wood framing construction, center exits with sliding doors and an interior step well instead of folding center doors and steps that created clearance problems on narrow streets.

All of the 8000s were equipped with center exits and a conductor's booth for "Peter Witt" type operation. They were also equipped with safety-type control equipment and could be operated by one man. In 1940, PRT, was reorganized as the Philadelphia Transportation Company (PTC) and a general program of rehabilitation was undertaken. Older cars were retired and remaining cars were modernized with a new paint scheme, including wings around the headlights, a painted interior, upholstered seats and new lighting. These "Modernized" cars were referred to as "Paintliners" for publicity purposes.

Car 8042 was chosen for preservation because it was the last car to operate on the York Road to Willow Grove line (Route 55) on September 8, 1940. PTM acquired this car through the sponsorship of the Electric City Trolley Museum in Scranton, PA in 2005, after which a cosmetic restoration was undertaken to make the car an attractive exhibit.

In 2017 8042 was moved into the Restoration Shop

## Start Up Procedures

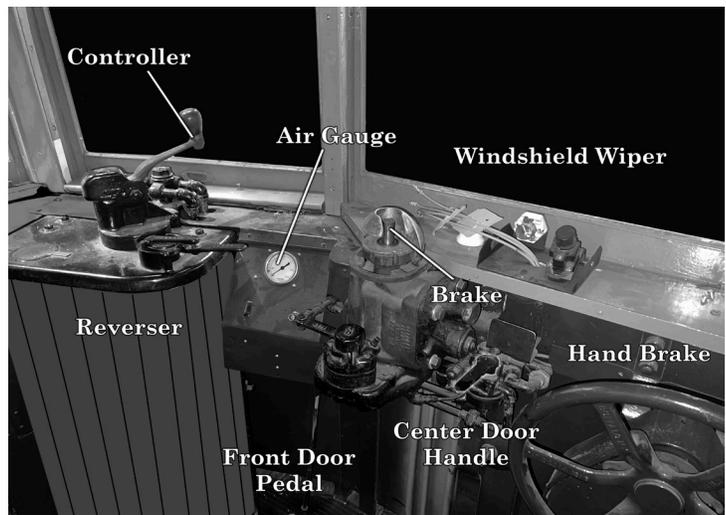
1. Ensure reverser is not in the controller then put up the pole.
2. Retrieve the handles from the ammo box. Insert brake handle on front end and place in the “door open” position.
3. Turn on compressor. The air compressor switch is in the control box on the end of the car, above the controller.
4. Ensure the headlight is on
5. Make sure the handbrake is released.



8042 Compressor & Reset Switches

## General Operating Procedure

1. 8042 is equipped with a K controller with deadman valves. The control handle must be depressed at all times when operating to prevent the car from falling into “emergency” and coming to an abrupt stop. The Controller has five (5) notches in series and four (4) in parallel.
2. Brakes are self lapping with an emergency position (far right) and a door open position. See section *Stopping with Air Brakes - Self lapping* for more information.
3. The windows on this car are held open by spring brass. It is important you warn visitors to keep clear of the windows as they may fall unexpectedly.



5326 - Controls

4. Be aware that all doors close when the brake handle is removed. Do not remove the brake handle while passengers are leaving or entering the car.

## Door Operation & Passenger Loading and Unloading

1. Doors are opened and closed using the door controls located next to the brake valve. The handle on the right opens the center doors, the handle to the left can be activated by foot and opens the front doors depending on the position of the handle.
2. Door controls are integral with the brake valve. The brake handle must be in the “door open” position in order to open the doors. Note: All doors close when the brake handle is removed. Do not remove the brake handle while passengers are leaving or entering the car.
3. The door interlock prevents the car from drawing power with the doors open.
4. Always check doors for passengers before closing them.

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## Heating and Ventilation

1. Some of the upper sash windows can be opened for extra ventilation during the summer months.
2. Heat for passenger compartment is controlled by three (3) knife switches found in a box above the side windows on the platform of the car. *Note: This box contains areas that are electrically "hot". Exercise extreme caution when turning any switch on or off.*
3. Heat for the operator's cab is controlled by the switches above the left hand windows on the front platform. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.

## Lights

1. The switches for the interior lights and sign-box light transfer are in the box above the left doors on the #2 end of the car.
2. The headlight transfer switch is located above the blind side doors on the #1 end

## Backing the Car

1. Reversing this car requires 2 people. Do not attempt to back up the car without someone watching out the rear window or from the ground.
2. Place the Reverser in the reverse position.
3. Sound the bell three (3) times.

## Emergency and Special Procedures

1. 8042 is equipped with "K" controller. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see if the main overhead breaker is in the "On" position.
  - b. The car may be in emergency, push and hold the deadman down and release the brakes. A secondary release of air should tell you the car is out of emergency.
  - c. Check to see if all doors are closed and check the door engine valve are in the "On" position.

## Power Down Procedures

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. Return the controller, brake and reverser handles to the ammo box.
4. Exit through a door at the end of the car facing the carbarn doors. Set the Door Balancing Valve to the "Off" position (aka "balancing" the doors), this will ensure no one gets "locked" out when the car is next used.
5. Lower the pole.
6. Drain the air tank.

## PHILADELPHIA SUBURBAN TRANSPORTATION COMPANY 66 & 73



Philadelphia & West Chester Traction Company (P&WCT) cars 66 & 73 were two of 32 center entrance steel cars placed in service between 1919 and 1926. Both 66 and 73 were built by J.G. Brill and put into service in 1926. These cars represented a significant departure from their predecessors. Wicker seats replaced high-back velvet seats and separate compartments for smoking and non-smoking were eliminated. While still requiring a two person crew to operate a single car (motorman and conductor), these cars could be combined into two-car multi-unit trains allowing a three person crew to operate the combined cars.

During the 1930s, Philadelphia Suburban Transit Company (the successor to P&WCT) began using one-person cars to handle base service. Cars 66 & 73 continued to be used for rush hour and emergency service and the cars were updated with a new paint scheme and new seat coverings in 1949 with the delivery of the “Louis”. These cars saw continued occasional use until 1970 when SEPTA (Southeastern Pennsylvania Transit Authority) declared car 66 surplus. 66 car was transported to the Pennsylvania Trolley Museum where it was refurbished.

Car 73 remained in Philadelphia and was rebuilt by SEPTA in 1972 as the centerpiece of their “Media Mall” promotion. After the novelty (and funding) wore off, regular trolley service was resumed in Media and car 73 was retained for charter and work service until it was declared surplus by SEPTA and acquired by PTM in 1990. 73 is currently undergoing rehabilitation at the museum with the plan to use it in two-car train service with car 66.

*Photos in this section are from 66, while 73 will have the same switches & cabinets they may look different.*

## Start Up Procedures

1. Ensure reverser is not in the controller then put up rear pole. This car is equipped with a retriever.
2. If the doors are closed, enter the car through one of the operator's cab doors. **DO NOT MANUALLY OPEN THE CENTER DOORS.** See Door Operations & Passenger Loading and Unloading section for more information on the doors.
3. Retrieve the handles from the ammo box. Insert brake handle on front end and place in apply position.
4. Turn on compressor located on the bulkhead in the #1 end cab.
5. Set the headlight to proper direction using the switch located above the center doors.
6. Make sure the handbrakes at both ends are released before attempting to move the car.



66 - Operator's cab Exterior Door Control

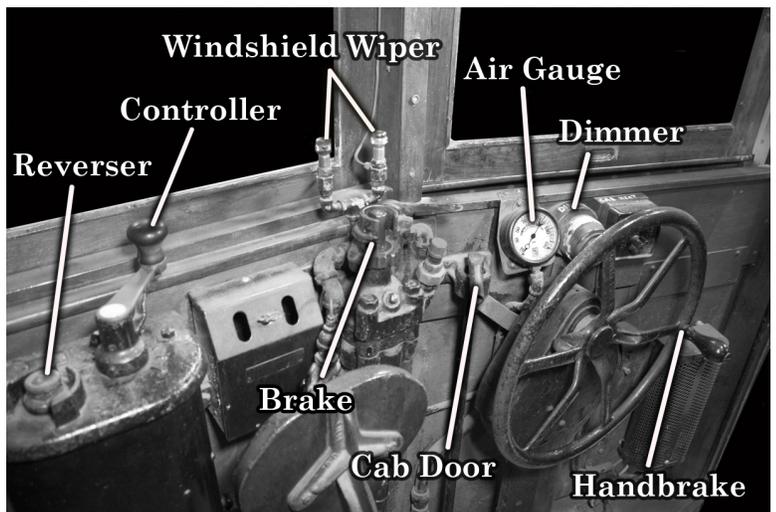
## General Operating Procedure

1. Car 66 is equipped with HL control with no deadman. The controller has five (5) notches in series and four (4) notches in parallel.
2. 66 is equipped with manual lapping brakes with an emergency apply position (far right). See section Stopping with Air Brakes - Manual Lapping for more information.
3. A minimum of two crew members (operator and conductor) is required to operate this car with passengers. Because of this, the control switches are distributed between the operator's cabs and the conductor's station.
4. Door interlocks will prevent the car from taking power unless the center doors are fully closed. Low intensity indicator lights to the right of the controller indicate when the door is closed (light is on when door is closed).



Air Compressor

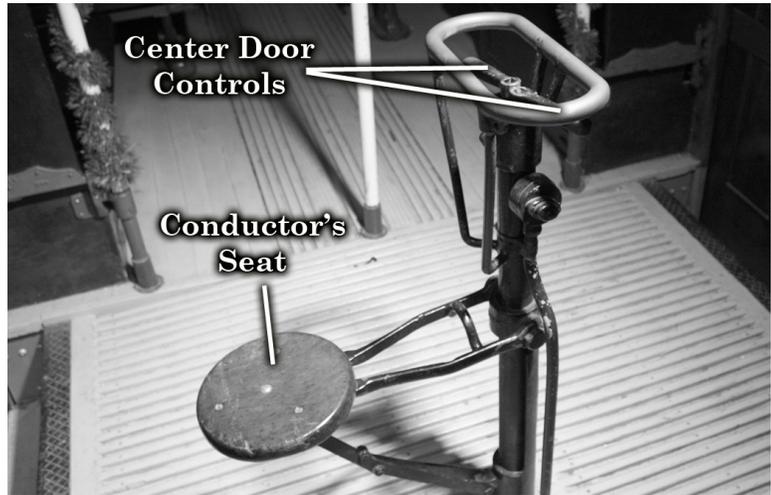
66 - Air Compressor Switch



66 - Controls

## Door Operations & Passenger Loading and Unloading

- Center (passenger) doors are opened and closed using the door controls at the conductor's station in the middle of the car. When you are facing a set of doors, the handle on the right controls this set of doors. Be sure that the step is all the way down before allowing passengers to enter or leave the car.
- Do not manually open or close the center doors. Turn on the compressor and wait until there is sufficient pressure (25 to 30 psi) to open or close the doors.
- The exterior door in each of the operator's cabs are controlled by the handle in the cab. Always ensure the floor trap is closed before closing the door.
- If there is sufficient pressure in the air tank, you can operate the cab door from the outside by pushing or pulling on the linkage that is located just to the left of steps. If you are attempting to close the doors via the linkage and it won't move, go into the operator's cab and move the handle from the far left position. Do not confuse the linkage for the door with the valve linkage lever for the air brake line to the coupler which is located just to the rear of the door control linkage.
- The operator's cab doors can be opened and closed manually if there is not sufficient pressure in the air tank to open or close them via the lever. Use these doors to enter and leave the car at the start and end of operations.



66 - Operator's cab Door Control

## Heating and Ventilation

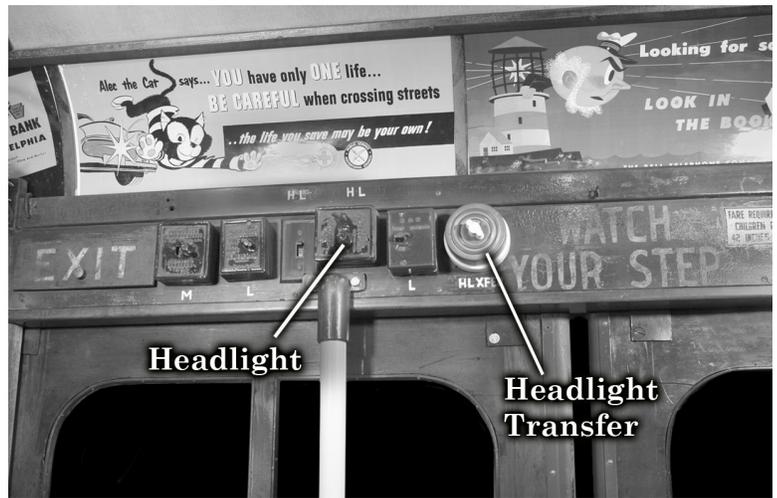
- Heat for the passenger compartment is controlled by the three (3) knife switches located in a box to the left of the center doors. Note: This box contains areas that are electrically "hot". Exercise extreme caution when turning any switch on or off.
- Heat for the operator's cab is controlled by the switch to the left of the operator. Note: The knife switch at the center of the car must be thrown in order for this switch to function.
- Turn off all heaters at least 30 minutes before the car is placed in the carbarn.
- The windows on this car are held open by spring brass. It is important you warn visitors to keep clear of the windows as they may fall unexpectedly.



66 - Heater Switch Box

## Lights

1. The interior lights, headlights, and headlight transfer (2 clicks) are controlled by switches above the center doors. *\*\*The headlight transfer switch for 73 is the round switch, but is not on the end of the row.*
2. Headlights can be dimmed by using the switch located behind the handbrake in the operator's cab. When operating at night, be sure to dim the headlight when approaching platforms or other cars.



66 - Headlight Switches

## Changing Ends

1. Place brakes in full apply position.
2. Switch poles.
3. Transfer the headlight.
4. Move brake handle to other end of the car and re-apply brakes.

## Emergency and Special Procedures

1. 66 is equipped with "HL" control. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see if the Main Control Switch and the Line Control Switch are in the "On" position.
  - b. Check to see if center doors are closed.

## Power Down Procedure

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. When putting the car in the carbarn exit through the motorman's door at the end of the car facing the carbarn doors.
4. Return brake, reverser, and door handles to the ammo box.
5. Lower the pole.
6. Drain the air tank.

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## PHILADELPHIA & WEST CHESTER TRACTION COMPANY 78



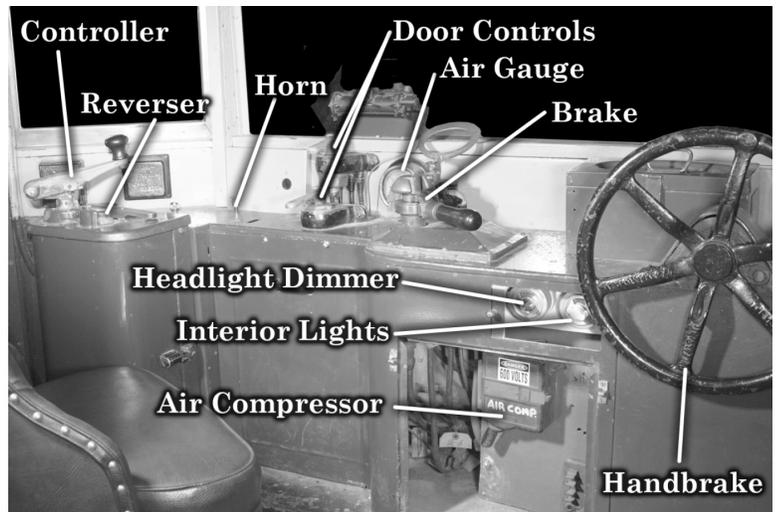
Car 78 was one of 10 cars purchased in two groups from Brill in 1932-33. These lightweight, one-man cars were an attempt to combat a sharp decline in riders and revenue. These cars were designed for one-man operation, equipped for high speed service, and employed lightweight aluminum construction. They were cheaper to operate and used less power. Their high speed equipment cut the operating times and made the service more attractive. These improvements combined with fare reductions and consolidation of other competing forms of transit in the area enabled the building of one of the most successful privately owned transportation companies in the country.

A consolidation of streetcar and bus operations by P&WCT in the early 1930s gave rise to changing the corporate name to Philadelphia Suburban Transportation Company and the Red Arrow Lines logo was adopted.

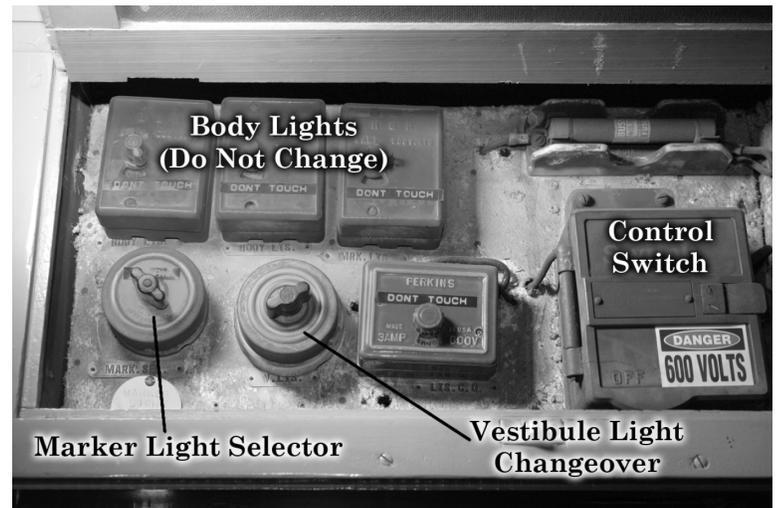
Car 78 was in service until 1982. During its last 15 years, the car was used primarily for rush hour service. After being withdrawn from service, the car was acquired by the Museum in September 1982. Once at the museum the car underwent rehabilitation where it was restored to its as built appearance, and sports the pre-Philadelphia Suburban Transportation Company livery.

## Start Up Procedures

1. Ensure reverser is not in the controller then put up rear pole. This car is equipped with a retriever.
2. Retrieve the handles from the handles box on the #1 end.
3. Insert brake handle into the front end and place in full apply position.
4. Insert door handles on front end and set right front door to the open position.
5. Set the front door engine valve to “on” position. It is a good idea to check rear door engine valve to be sure it is in the “on” position.
6. Turn on the air compressor. When pressure reaches about 50 PSI, the system will charge and air gauges will register the pressure.
7. Ensure the headlight is set to the proper direction.
8. Ensure the vestibule light is set to the rear platform (#1 End Control Cabinet)
9. The marker lights are set independently on each end. The rear of the car should display red while the front displays green. The current setting is indicated by colored lights on the dash panel in front of the operator.



78 - Controls & Air Compressor



78 - #1 End Control Cabinet

10. Make sure the handbrakes at both ends are released before attempting to move the car.

## General Operating Procedure

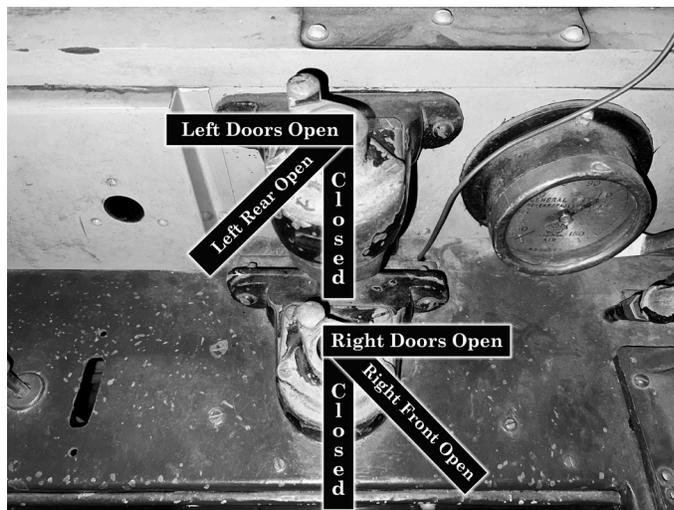
1. 78 is equipped with General Electric PC Control. The control is equipped with a deadman so the controller handle must be depressed unless the brake handle is in the “full application” position. The foot deadman pedal may also be used. It is recommended that you use the foot release during normal operations so that you can sound the horn with your left hand while keeping your right hand on the brake controller. There are three points on the controller that activate 19 points on the controller under the car.
  - a. Point 1 (Switching) activates point 1 on the controller. This point is used for starting the car from a stop, and moving the car through the yard and when parking in the carbarn.
  - b. Point 2 (Series) activates points 2 thru 10 on the controller. When placed in Point 2, the car will automatically accelerate to full series.

c. Point 3 (Parallel) activates points 11 thru 19 on the controller. When placed in Point 3, the car will automatically accelerate to full parallel.

2. Brakes are self lapping with an emergency apply position (far right). See section Stopping with Air Brakes - Self lapping for more information.

### Door Operations & Passenger Loading and Unloading

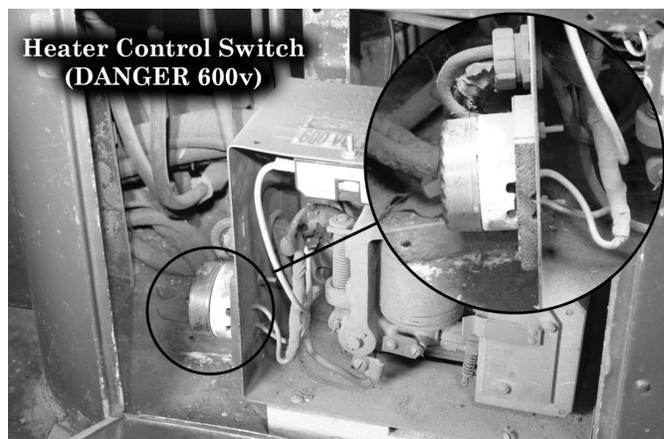
1. Doors are opened and closed using the door controls located at both ends of the car.
2. Door interlocks will prevent the car from taking power unless all doors are fully closed. The car will not take power with the doors open. The door interlock is connected through the door engines and if any of the door engine supply valves are off (balanced), the car will not draw power.
3. Be aware when closing the rear doors, first checking to ensure they are clear of passengers. As a general rule, only use rear doors if there is someone visually observing to verify the doors are clear before they are closed.



78 - Door Controls

### Heating and Ventilation

1. Heat for passenger compartment is controlled by a switch in the compartment below the operator controls on the #2 end of the car. Note: This box contains areas that are electrically “hot”. Exercise extreme caution when turning any switch on or off.
2. Heat for the operator’s cab is controlled by the switches below the left hand windows at the front of the car.
3. Turn off all heaters at least 30 minutes before the car is placed in the carbarn.



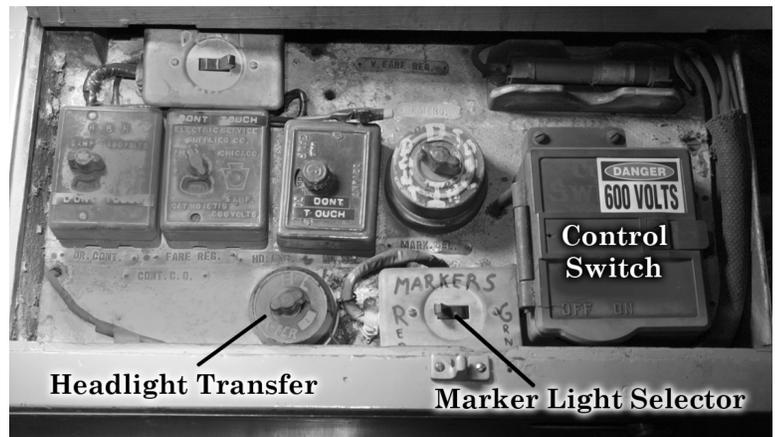
78 - Heater Switch

### Lights

1. Car body and marker lights are controlled by switches in cabinets above and to the left of the operator.
2. Interior lights are controlled by the right hand switch located behind the sliding door located just to the left of each hand brake.
3. Headlight dimmer switch is the left hand switch located behind the sliding door located just to the left of each hand brake.
4. Headlight transfer switch is located in the upper cabinet on the #2 end.

## Changing Ends

1. Place brakes in full apply position.
2. Change the trolley pole.
3. Move brake and door handles to the other end and re-insert the handles. Place the brakes in the full apply position.
4. Transfer the headlight.



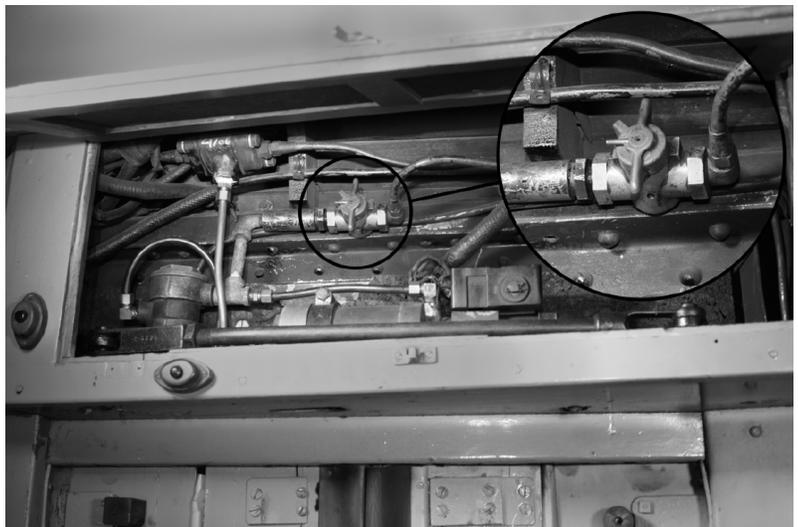
78 - #2 End Control Cabinet

## Emergency and Special Procedures

1. 78 is equipped with HL control. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Check to see if the main overhead breaker is in the “On” position.
  - b. Check to see if all doors are closed including checking the to see that the door valve engines are in the “On” position.
  - c. The car may be in emergency, check the air gauge, if it reads “0” air pressure, place the reverser in the “forward position”, hold down the deadman and release the brakes. Wait for a secondary release of air indicating the brakes have released.

## Power Down Procedures:

1. If any of the car heaters were used, the heaters must be off for at least 30 minutes before the car can be put into the carbarn.
2. Turn off the compressor.
3. Exit through the large door at the end of the car facing the carbarn doors. Set the Door Balancing Valve to the “Off” position (aka “balancing” the doors), this will ensure no one gets “locked” out when the car is next used.
4. Return brake, reverser, and door handles to the handles box.
5. Lower the pole.
6. Drain the air tank.



78 - Door Valve in the “balanced” position

## PHILADELPHIA SUBURBAN TRANSPORTATION COMPANY 14 & 24



The St. Louis cars were delivered in May and June 1949 and represent what many consider to be the last interurban cars built in America. Their arrival permitted Red Arrow to retire a group of Jewett-built interurbans dating to 1913, and several two-man center door cars like cars 66 & 73. While these cars are equipped with the same high-speed running gear as the Brilliners, they also have multiple unit capabilities (can be coupled together in pairs) and two-way radios. These important features were required to expand service along the rapidly developing West Chester line, which operated on single track over the majority of its 19-mile length.

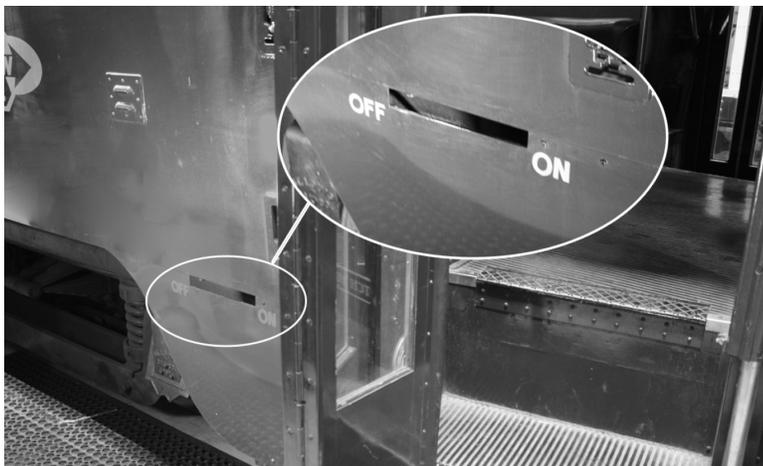
In 1954, the widening of Pennsylvania Route 3 brought the decision to abandon the line to West Chester, after which the “Louies” became the mainstay of operation for the remaining rail lines. Cars 14 and 24 were withdrawn from regular service in September 1982 following acceptance of 29 new LRVs by SEPTA.

Two St. Louis-built cars were selected for preservation here at the Museum because they demonstrate the operation of streetcars in multiple unit. Work on 14 was the most complex trolley restoration undertaken by our crews at the time. Pennsylvania Trolley Museum volunteers began work on this project in the summer of 1997 and returned to car to service at the Museum in June 2004.

*Photos in this section are from 14, while 24 will have the same switches & cabinets, they may look different.*

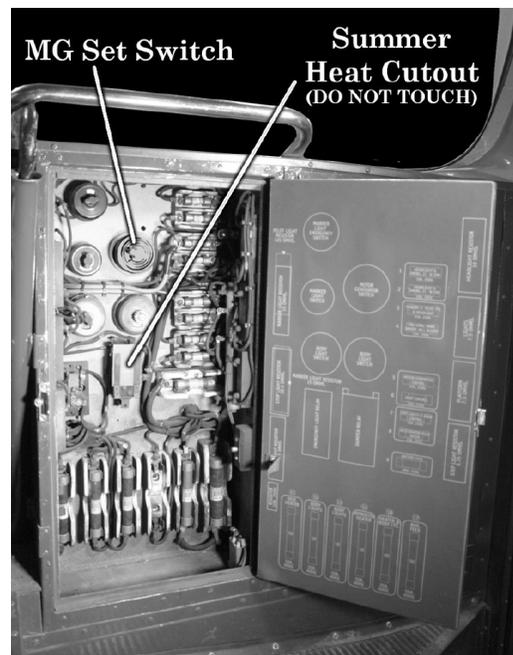
## Start up Procedure

1. Place the rear pole on the wire. This car is equipped with a retriever.
2. Turn the battery switch on. This is located in a slot on the outside of the “A” #1 end of the car in the opening just behind the double doors. Pushing the bar to toward the front of the car turns on the batteries. The car will not run without the batteries turned on.
3. Enter the car. All doors are balanced when the hook is in the “handle out” (center) position. They can be easily opened or closed by hand.



14 - Battery Switch

4. Open the switch cabinet just below the “A” (#1) end windshields. It contains numerous fuses and switches. Locate the large snap switch marked MG SET on the location guide pasted inside the locker door, and turn this switch on. The MG set should come on immediately. Close the locker door. Note: This box contains areas that are electrically “hot”. Exercise extreme caution when turning any switch on or off.
  - a. If the batteries are not turned on, the MG will not start.
  - b. If the battery switch is on and the MG will not come on, the batteries may be discharged. If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.



14 - Switch Cabinet

5. Observe the voltmeter on the dashboard to be sure it reads between 30 - 38 volts. If it does not read within this range do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
6. Retrieve the reverser handle from the handles box located on the “A” (#1) end of the car.
7. The end transfer switch must be set to the end you wish to run from. This switch is located at the “A” (#1) end in the dashboard below the right window, above the snap switch equipment locker. Insert the square protrusion on the bottom of the reverser hook into the switch, and turn all the way until the marks line up with the end from which you wish to run. Make sure the switch is turned all the way.
8. Make sure the handbrake at both ends is released before attempting to move the car. The chain should only be protruding slightly from the mechanism. If the brakes seem to be dragging, or if the car stops while going through tight curves, check the handbrake at both ends.

Procedures in this manual are to be used in conjunction with operator qualification performed by a PTM Instructor. Operators must be qualified by an instructor prior to operating rail vehicles.

## General Operating Procedure

1. This car operates much like a PCC or other foot control car, the main difference being that it has three positions on the accelerator pedal. When the accelerator is depressed slightly, it engages “switching” or the 1st point. When depressed further, the pedal engages “low rate” acceleration, when depressed to the floor, “High rate” acceleration is engaged. Avoid running for prolonged periods in switching point.

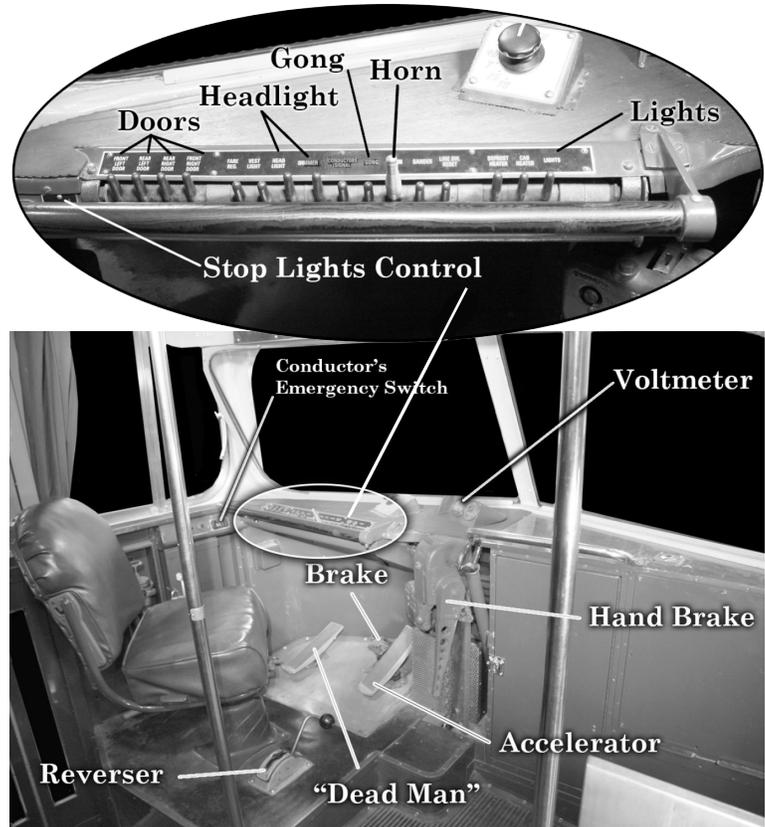
2. Familiarize yourself with the gang switch panel, and be aware of where commonly used switches such as the doors, gong, and horn are located. Up, or toward the windshield, is the “on” position for gang switches. Be aware, some switches are not active when the reverser handle is in “handle out” or the center position.

3. The reverser handle, or hook, is inserted into the center of the reverser slot on the floor to the right of the operator’s seat. The reverser “wing” must face forward. The reverser hook has 3 positions. When placing the car in forward, reverse, or “handle out” position, depress the brake pedal slightly, this will free up the linkage and make the handle much easier to move.

- a. Forward: This position is all the way toward the front. In this position the car will move in the forward direction and the hook is captured.
- b. Handle Out: This is the middle position, in which the hook is positioned directly up and down and is where the hook can be inserted or removed. Throwing the hook to this position while the car is in motion will result in an emergency stop and may possibly damage the car.
- c. Reverse: This is all the way toward the back. In this position the car will move in the reverse direction, and the hook is captured.

4. There are three pedals on the floor in front of the operator.

- a. The left pedal is a Deadman pedal and must be depressed whenever the car is operated from this end. Do not release this pedal when the car is in motion or an emergency stop will occur.
- b. The middle pedal is the Brake, and has an adjustable braking rate, depending on how far down it is pressed.
- c. The right-most pedal is the Accelerator. The accelerator has three positions. When depressed slightly, the accelerator will engage “switching” or the 1st point. When depressed further, the pedal engages “low rate” acceleration, and when depressed to



14 - Controls & Gang Switch

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the floor it engages “high rate” acceleration. It is vital that operators avoid running for prolonged periods in switching point.

5. Coast by releasing the accelerator pedal completely to avoid accidentally falling into “switching point”. Coast as much as possible.
6. To brake, press down the Brake pedal. As with an automobile, the harder you press the brake, the more brake you will get. The brakes have a tendency to grab, so be ready to back off slightly should this occur. Pressing this pedal to the floor puts the car into emergency. Remember that braking at an unnecessarily high rate is uncomfortable to your passengers and can cause flat spots on the wheels should they lock up.

### Door Operation and Passenger Loading & Unloading

1. Doors are operated from 4 switches on the gang switch panel. Each door is marked with their corresponding door, i.e. Front Right Door
2. The doors are interlocked to remove all power to the motors when open. The car cannot run with doors open. Develop the habit of holding the door switches between your thumb and forefinger so that if a passenger attempts to board as you are closing the door, you can immediately reopen it.

### Heat & Ventilation

1. A thermostat controls the opening and closing of damper fans for ventilation in warmer months.
2. Heat is also controlled by the thermostat inside the car. When the temperature drops below a certain point, the thermostat will automatically turn the heat on. Note: During summer months the heat is “cut out”, and will not function even if the temperature drops below the thermostat’s range. If the heat is not working on a cold day, follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
3. There is a cab heater located at the operator’s feet at each end of the car.
4. Turn off cab heaters at least 30 minutes before the car is placed in the carbarn.

### Lights

1. Interior light switches are located on the gang switch panel in front of the operator. If the interior lights are off, “emergency” battery lights in the center of the aisle turn on.
2. The headlight and dimmer switches are located adjacent to each other on the gang switch panel.
3. A switch for the red stop lights is located to the left of the gang switch panel along the wall. This switch will manually engage the lights.
4. The marker lights are controlled by the change over switch.

### Changing ends

1. Place the car in service latch. Remove the reverser.
2. If you were operating from the “A” (#1) end, insert the hook in the end transfer switch and set to the “B” (#2) end.
3. Change poles. When the reverser is removed, all doors balance, you can re-enter the car at the new front end.

4. If you were previously operating from the “B” (#2) end set the end transfer switch to the “A” (#1) end.

### Emergency and Special Procedures

1. 14 & 24 are foot pedal cars, but not PCCs that are equipped with air brakes. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Brake pedal lock - When pushed all the way in, the brake pedal can rock back to lock in place and hold the car in “emergency”. To unlock the pedal, place your foot on it and gently rock it forward.
3. Car does not run:
  - a. If the battery switch is on and the MG will not come on, the batteries may be discharged. If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
  - b. Observe the voltmeter on the dashboard to be sure it reads between 30 volts and 38 volts. If it does not read within this range do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
  - c. Ensure the end transfer switch is set to the end you’re attempting to operate from.
  - d. Ensure the reverser is fully engaged for the direction in which you wish to operate.
  - e. The car may be in emergency, place car back into service latch and attempt again.

### Power Down Procedure

1. Ensure pedals are properly service latched.
2. When putting the car in the carbarn, set the end transfer switch to the new front end.
3. Return the reverser to the handles box located on the “B” (#2) end.
4. Turn off the MG set.
5. Turn off the battery switch by pushing the lever to the left. Leaving the switch on will cause the batteries to discharge.
6. Close the doors manually.
7. Lower the pole.
8. Drain the air tank.

## PITTSBURGH RAILWAYS COMPANY 1138



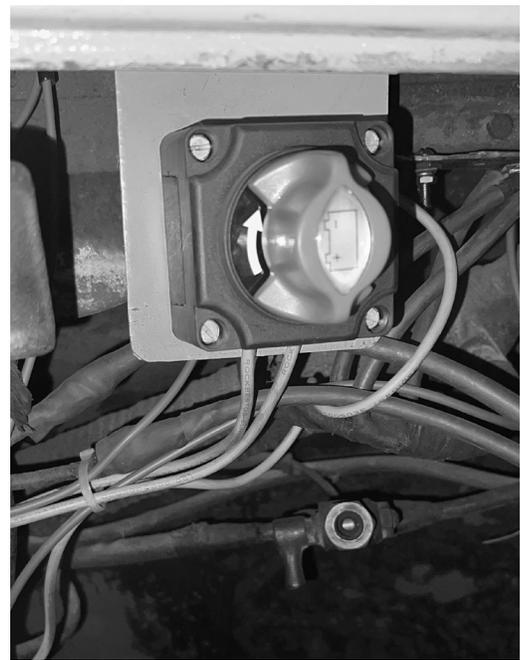
Car 1138 is a very early example of a PCC streetcar – one of 201 cars delivered to Pittsburgh Railways in the first two years of production. The PCC car represented a major leap in streetcar design – it was designed to effectively compete with the automobile (which it could out-accelerate) through improvements in engineering and performance, not to mention style.

Acquired by the Pennsylvania Trolley Museum in 1961, 1138 was restored by volunteers in the late 60s and again in 2000, this time to its mid-1950s appearance. It is one of three PCC cars heavily overhauled through the courtesy of Adtranz (now Bombardier Transportation) in their Elmira, New York facility.

In 2022 PTM volunteers began rewiring the car to update the old corroded wires. After undergoing extensive testing, the car finally returned to passenger service in 2024.

## Start up Procedure

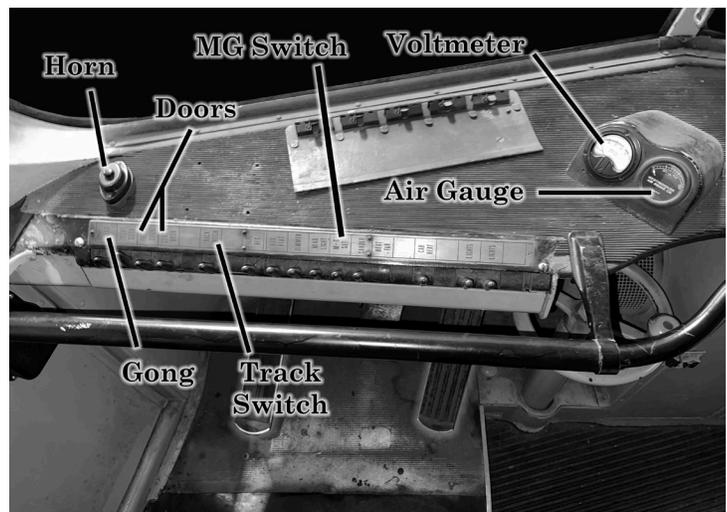
1. Put up the pole. *If the rope has been left in the upper position it may become necessary to use the pole stick to retrieve it. The pole stick a wooden stick behind the operator's seat.*
2. Enter the car and open the front right cabinet, turn on the red battery switch.
3. Turn on the MG using the switch on the dash.
4. Retrieve the reverse handle ("hook") from the ammo box located behind the operator's seat.
5. Note the voltage on the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.



1138 - Battery Switch

## General Operating Procedure

1. The left pedal is a Deadman pedal and must be depressed whenever the car is operated from this end. Do not release this pedal when the car is in motion or an emergency stop will occur.
2. The middle pedal is the Brake, and has an adjustable braking rate, depending on how far down it is pressed (like an automobile).
3. The right-most pedal is the Accelerator. Also like an automobile, the farther down you press this pedal, the faster the car will accelerate.
4. To brake, press down the brake pedal. As with an automobile, the harder you press the brake, the more brake you will get. Pressing the brake pedal completely down puts the car into Emergency and should not be done unless an emergency stop is required.
5. To back up, pull the hook back as far as it will go. Do not attempt to back the car without someone watching out the rear window. Return the hook to the forward position after the backup move has been completed.
6. The reverser is located on the floor along the right of the seat. It has three positions:
  - a. **Remove/Emergency:** This position is all the way toward the front, and is where the hook can be inserted or removed. Throwing the hook to this position while the car is in motion will result in an emergency stop and may possibly damage the car.
  - b. **Forward:** This is the middle position, in which the hook is positioned directly up and down.



1138 - Gang Switch

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In this position the car will move in the forward direction, and the hook is captured.

- c. Reverse: This is all the way toward the back. In this position the car will move in the reverse (backup) direction, and the hook remains captured. Coast by returning the accelerator pedal to the resting position.

### Passenger Loading & Unloading

1. Doors are controlled by 3 switches on the gang switch panel. Switches are marked for their respective doors. The two front doors are each on individual switches, while the center doors are controlled by one switch. Note: You should develop the habit of holding the switches between the thumb and forefinger when closing the doors; this way the reverse operation is quick should it be needed. Use the mirrors to view the center door area to verify that they are clear.
2. The center doors are interlocked with the power circuit; the car will not draw power with the center doors open.

### Heating & Ventilation

1. The cab heat switch on the gang switch activates the resistance heater in front of the operator's feet. Use it as needed, but never put the car away with this switch on.
2. Turn off all heaters at least 30 minutes before the car is placed in the Carbarn.

### Backing the Car

1. Reversing this car requires 2 people. Do not attempt to back up the car without someone watching out the rear window or from the ground.
2. Place the Reverser in the reverse position.
3. Sound the bell three (3) times.

### Lights

1. Interior lights are controlled by a switch on the gang switch panel.
2. The headlight and dimmer switches are located on the gang switch panel.

### Emergency and Special Procedures

1. 1138 is an air car with foot pedal control. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Brake pedal lock - When pushed all the way in, the brake pedal can rock back to lock in place and hold the car in "emergency". To unlock the pedal, place your foot on it and gently rock it forward.
3. If you cannot reach the pole rope, you will need to use the stick to reach it. The stick should be located behind the operator seat.
4. Car does not run:
  - a. Ensure the MG set is turned on.
  - b. If the battery switch is on and the MG will not come on, the batteries may be discharged. If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.

## Power Down Procedures

1. If any of the car heaters were used, they must be off for at least 30 minutes before the car can be put into the carbarn.
2. Ensure the pedals are service latched properly.
3. Remove the hook and return it to the ammo box.
4. Close all the doors except the first door.
5. Shut off the battery switch.
6. Exit via the front doors, manually closing them behind you.
7. Lower the pole. *If the rope has been left in the upper position it may become necessary to use the pole stick to retrieve it. The pole stick a wooden stick behind the operator's seat.*



1138 - Catcher & Pole Rope

## PITTSBURGH RAILWAYS COMPANY 1711



Car 1711 is one of the last 100 units, delivered in 1948-49, and differs in many ways from the cars that came before it. From the outside, the most distinctive changes included the sealed windows (to prevent accidents) with small standee windows in a row above. On the front of the car, bright triangular wings again outlined the headlight and small dash lights flanked the top corners. On the roof, a cowling running the length of the roof provided intake for the car's ventilation system. Inside, a new seating arrangement allowed all of the passengers to face forward, while four large Sturtevant fans punctuated the ceiling, providing fresh air in lieu of open-able windows.

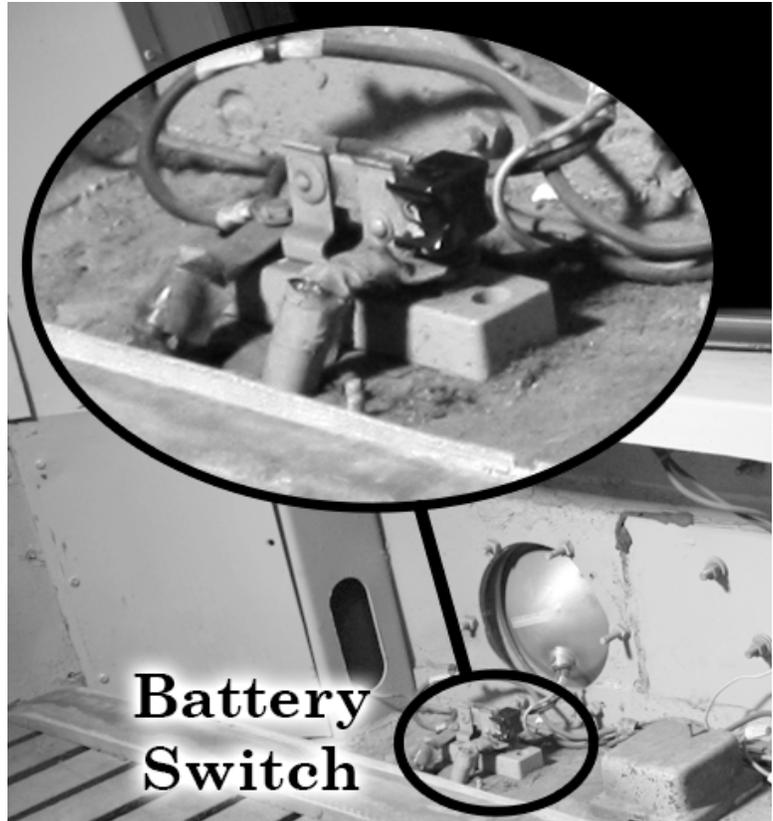
A special group of 1700s (numbers 1700-1724) were equipped with special running gear for service on Pittsburgh Railways' long Charleroi and Washington interurban lines: a package shelf in place of the first seat behind the operator, a ticket printer, an emergency tool kit, a spare trolley pole secured in special brackets on the roof and a roof-mounted headlight. After acceptance, 1711 was one of seven cars assigned to Tylerdale car house in Washington. It was chosen for preservation at PTM because it operated on the line which became our museum home, and also because it was historically significant as the last car to carry regular passengers from Washington to Pittsburgh early on the morning of August 30, 1953.

Car 1711 was retired from active service in August 1988, and acquired from Port Authority Transit in April 1990. On the way to the museum, 1711 was detoured to the BarrCannon Body Company in Meadowlands, PA, where workmen overhauled it inside and out, under the watchful eye of founding member George Tucker, who also generously donated the cost of the work performed.

Subsequently, 1711 was sent to the Adtranz (now Bombardier) facility in Elmira, NY for a complete structural rebuild. During that process, the interior was restored to the original 1949 appearance.

## Start up Procedure

1. Put up the pole. This car is equipped with a retriever.
2. Enter the car and walk to the rear. Move the left rear seat back. Close the battery knife switch to turn the batteries on. Replace the seat.
3. Walk to the front of the car. and move the front door switches on (up toward the windshield). Open the front breaker panel door near the power pedal and turn on all the breakers except Aux Heat and Heat/Ceiling Fans. *NOTE: You may turn on the heat/ceiling fans if the weather warrants it.*
4. The MG set will come on when the breaker is turned on. If it does not, the car is out of order and must not be run. Complete the power down procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.



1711 - Battery Switch

5. Retrieve the two reverse handles (“hooks”) from the ammo box located behind the operator’s seat. The hook with the silver knob is for the backup controller while the hook with the black knob is for the front controller.
6. Note the voltage on the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.



1711 - Control Breaker Box

## General Operating Procedure

### 1. Operating from the Front Controller.

a. Verify that the backup controller changeover switch is set to the front controller position. If it is not, the front controller will not work.

b. The left pedal is a Deadman pedal and must be depressed whenever the car is operated from this end. Do not release this pedal when the car is in motion or an emergency stop will occur.

c. The middle pedal is the Brake, and has an adjustable braking rate, depending on how far down it is pressed (like an automobile).

i. To brake, press down the brake pedal. As with an automobile, the harder you press the brake, the more brake you will get. Pressing the brake pedal completely down puts the car into Emergency and should not be done unless an emergency stop is required.

d. The right-most pedal is the Accelerator. Also like an automobile, the farther down you press this pedal, the faster the car will accelerate.

i. Coast by returning the accelerator pedal to the resting position.

ii. To back up, pull the hook back as far as it will go. Do not attempt to back the car without someone watching out the rear window. Return the hook to the forward position after the backup move has been completed.

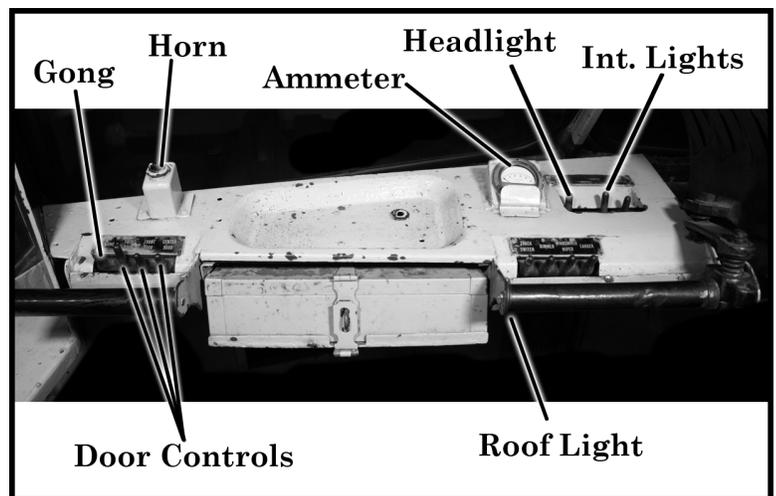
e. The reverser is located on the floor along the right of the seat. It has three positions:

i. Remove/Emergency: This position is all the way toward the front, and is where the hook can be inserted or removed. Throwing the hook to this position while the car is in motion will result in an emergency stop and may possibly damage the car.

ii. Forward: This is the middle position, in which the hook is positioned directly up and down. In this position the car will move in the forward direction, and the hook is captured.



1711 - Controls

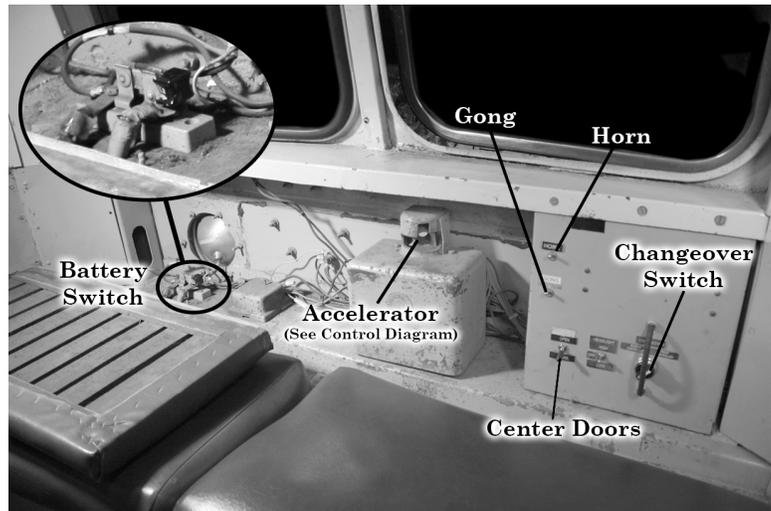


1711 - Gang Switch

- iii. Reverse: This is all the way toward the back. In this position the car will move in the reverse (backup) direction, and the hook remains captured.

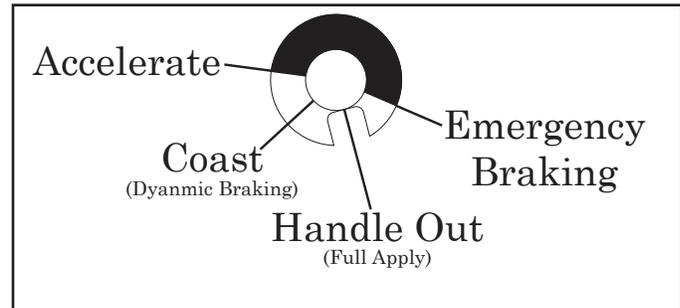
2. Operating from the Rear Controller.

- a. Insert the front reverse lever (on the proper handle, the knob points toward the front doors) in the reverser slot (on the floor to the right of the operator's seat) and push all the way back towards the rear of the car .



1711 - Backup Controller

- b. Close all doors using the Gang Switches. Walk to the rear of the car.
- c. At the backup control panel, set the Controller switch to backup position.
- d. Insert the backup hook into the backup controller.
- e. The Center Door switch is interlocked with the backup controller. The doors will not open if the controller is in the accelerate or coast positions. If the doors are open and the control handle is moved into accelerate or coast, the doors will automatically close but the car will not move.



1711 - Control Diagram

- f. The backup controller has four operating positions or points. These are:
- i. Service Brake - This is the only position where the hook can be inserted or removed, and is the braking position to use for normal service stops. This position gives a fully blended braking force, changing from dynamic brake to drum friction brakes as the speed drops. The drum brakes hold the car when it is stopped. Service Brake position functions the same as the brake pedal at the front end of the car, with the exception that there is only one braking rate available.
  - ii. Emergency Brake - This is one position to the right of Service Brake. Here the maximum brake force is obtained. Full dynamic brakes, full drum friction brakes, and full track brakes are applied. A warning buzzer will also sound when this position is selected. Do not use this braking position unless there is an emergency requiring the fastest possible stop.
  - iii. Coast - This is one position to the left of Service Brake. In this position, all of the brakes in the car are released. When the car is in motion, power is removed and a slight braking force will be noted.
  - iv. Accelerate - This is two positions to the left of Service Brake. In this position power is applied and the drum controller accelerates the car.

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- g. Before backing the car, sound three rings of the gong or blasts of the horn. Note: The Horn and Gong switches are spring loaded.
  - h. Move the hook to the left through coast position to accelerate. The car will now begin accelerating.
  - i. Allow the car to accelerate to the desired speed. The hook can then be moved to the Coast position. Doing this will make for a smooth ride.
  - j. To accelerate again, move the hook one click left to Accelerate. When the desired speed is reached move one click right to Coast.
  - k. To brake the car, move the hook to Service Brake. Note that there is a constant, non-adjustable dynamic braking rate. Good operators will practice stopping using the Service Brake to develop a feel for the stopping distance.
  - l. Always move back into Coast when traveling under wire frogs, contactors or section insulators. Remember that you are “back-poling”.
  - m. If an emergency stop is required, move the handle quickly to the extreme right emergency brake position. Maximum braking will occur, and the buzzer will sound. After the car has stopped move the controller to the Service Brake position to hold the car.
  - n. The hook can be moved between positions as often as needed. There are no restrictions, and to maintain speed it will be necessary to frequently go between Accelerate and Coast positions.

### Passenger Loading & Unloading

1. Front controls - Doors are controlled by 3 switches on the gang switch panel. Switches are marked for their respective doors. The two front doors are each on individual switches, while the center doors are controlled by one switch. Note: You should develop the habit of holding the switches between the thumb and forefinger when closing the doors; this way the reverse operation is quick should it be needed. Use the mirrors to view the center door area to verify that they are clear.
2. Rear controls - Only the center doors can be controlled from the backup controller. The switch is labeled on the backup controller box.
3. The center doors are interlocked with the power circuit; the car will not draw power with the center doors open.

### Heating & Ventilation

1. The Heat/Ceiling Fans breaker controls the ceiling fans. The fans will come on if it is above 70 degrees. Unless the fans are desired, leave the breaker off. If this breaker is on and it is cold outside, the under car vent dampers will automatically direct waste heat from the control resistors up into the car, instead of venting it outside, after the car has been run awhile. The Aux Heat breaker turns on the baseboard 600-volt resistance heating. It comes on only if the Heat/Ceiling Fans breaker is also on. Aux Heat should be used only when it is very cold outside.
2. The cab heat switch on the gang switch activates the resistance heater in front of the operator’s feet. Use it as needed, but never put the car away with this switch on.
3. Turn off all heaters at least 30 minutes before the car is placed in the Carbarn.

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## Lights

1. Interior lights are controlled by a switch on the gang switch panel.
2. The headlight and dimmer switches are located on the gang switch panel.
3. The dash lights come on when the headlight is on.
4. The roof headlight is controlled from a switch located under the gang switch panel.

## Changing Ends

1. Changing from the front controller to the backup controller.
  - a. While holding the brake pedal about 2/3 of the way in, slowly release the Deadman.
  - b. Slowly release the brake. It will latch about 4 inches from the floor, in the Service Latch position.
  - c. Push the reverse lever in the reverser slot (under the motorman seat ) all the way back towards the rear of the car.
  - d. Close all the doors using the Gang Switches. Verify that the “Cab Heat” gang switch is away from the windshield. Walk to the rear of the car.
  - e. Follow the instructions for the operation of the backup controller.
2. Changing from backup controller to front controller.
  - a. With the backup controller set to Service Brake, remove the backup hook.
  - b. Verify that the center doors are closed.
  - c. Set the Controller switch on the backup control panel to the front controller position.
  - d. Replace the seat cushions.
  - e. At the front of the car, set the reverse handle in the middle position (straight up and down). This sets the reverser to the forward direction.
  - f. The car is now ready to be operated from the front.

## Emergency and Special Procedures

1. 1711 is an all electric car. Refer to the Emergency Procedures section on page 17 for information on dealing with potential emergency situations.
2. Brake pedal lock - When pushed all the way in, the brake pedal can rock back to lock in place and hold the car in “emergency”. To unlock the pedal, place your foot on it and gently rock it forward.
3. Car does not run:
  - a. Ensure the MG set is turned on.
  - b. If the battery switch is on and the MG will not come on, the batteries may be discharged. If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.

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- c. Check the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.
  - d. Ensure the switch on the backup controller is set to whichever end you desire to operate from.
  - e. Ensure the reverser is fully engaged for the direction in which you wish to operate.

### Power Down Procedure

1. If any of the car heaters were used, they must be off for at least 30 minutes before the car can be put into the carbarn.
2. Ensure the pedals are properly service latched.
3. Remove the hook and return both to the ammo box.
4. Close all the doors except the first door.
5. Open all of the breakers in the front breaker panel.
6. Open the battery knife switch behind the left rear seat.
7. Check the backup control panel. Ensure the controller switch should be set to front; the center doors switch should be down.
8. Ensure the back seat cushion is replaced.
9. Exit via the front doors, manually closing them behind you.
10. Lower the pole.

## PORT AUTHORITY TRANSIT 1713 - THE TERRIBLE TROLLEY



Pittsburgh railways 1713 was built in 1949 by St. Louis Car Company as part of the last order of PCCs in Pittsburgh and the same order as its sister car 1711. 1713 operated first as part of Pittsburgh Railways Company and then as Port Authority Transit until 1998 when it was retired.

However, the car became an icon in the early 1980s after The Pittsburgh Steelers football team won four Super Bowl championships (1975, 1976, and 1979) In 1980 when the Steelers were on their way to their fourth Super Bowl, 9-year-old girl Kim Severs, wrote to then Pittsburgh Mayor Richard Caliguiri to propose painting a trolley in black and gold to celebrate the team's successes. He passed her note along to the Port Authority Transit of Allegheny County. Within weeks, PAT had repainted Car 1713 with the Steelers logo and colors, as well as the jersey numbers of many of the team's star athletes.

It was termed the "Terrible Trolley," an allusion to the "Terrible Towel," a pep-rally gimmick cooked up by Steelers sportscaster Myron Cope, who urged fans to bring gold-colored dish towels to home games and twirl them during crucial on-field plays as a symbol of support. The Steelers then licensed and sold many thousands of Terrible Towel-branded items.

After "sporting" scheme for most of the 1980s, the car was repainted as a "Throwback" to its original Red and Cream Pittsburgh Railways colors before finally wearing the white, black and gold into its retirement from service in 1998.

In 2022 a local news station expressed interest in a story about Pittsburgh's trolleys and their connection to local sport teams. Volunteer Bruce Wells indicated that the terrible trolley was the most notable of these and not only did it still exist but it was actually available for acquisition. PTM quickly pursued this lead knowing what an iconic part it played in Pittsburgh's sport and transit history. In June of 2023, 1713 "The Terrible Trolley" arrived via flat bed from Ohio.

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### Start up Procedure

1. Put up the pole.
2. Turn the battery switch on
3. Open the front breaker panel door near the power pedal and turn on all the breakers except Aux Heat and Heat/Ceiling Fans. On is toward the windshield. NOTE: You may turn on the heat/ceiling fans if the weather warrants it.
4. The MG set will come on when the breaker is turned on. If it does not, the car is out of order and must not be run. Complete the power down procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.
5. Retrieve the reverse handle (“hook”) from the ammo box located behind the operator’s seat.
6. Note the voltage on the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.

### General Operating Procedure

1. The left pedal is a deadman pedal and must be depressed whenever the car is operated from this end. Do not release this pedal when the car is in motion or an emergency stop will occur.
2. The middle pedal is the brake, and has an adjustable braking rate, depending on how far down it is pressed (like an automobile).
  - a. To brake, press down the brake pedal. As with an automobile, the harder you press the brake, the more brake you will get. Pressing the brake pedal completely down puts the car into Emergency and should not be done unless an emergency stop is required.
3. The right-most pedal is the accelerator. Also like an automobile, the farther down you press this pedal, the faster the car will accelerate.
  - a. Coast by returning the accelerator pedal to the resting position.
  - b. To back up, pull the hook back as far as it will go. Do not attempt to back the car without someone watching out the rear window. Return the hook to the forward position after the backup move has been completed.
4. The reverser is located on the floor to the right of the seat. It has three positions:
  - a. Remove/Emergency: This position is all the way toward the front, and is where the hook can be inserted or removed. Throwing the hook to this position while the car is in motion will result in an emergency stop and may possibly damage the car.
  - b. Forward: This is the middle position, in which the hook is positioned directly up and down. In this position the car will move in the forward direction, and the hook is captured.
  - c. Reverse: This is all the way toward the back. In this position the car will move in the reverse (backup) direction, and the hook remains captured.

### Passenger Loading & Unloading

1. Doors are controlled by 3 switches on the gang switch panel. Switches are marked for their respective doors. The two front doors are each on individual switches, while the center doors are

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controlled by one switch. Note: You should develop the habit of holding the switches between the thumb and forefinger when closing the doors; this way the reverse operation is quick should it be needed. Use the mirrors to view the center door area to verify that they are clear.

2. The center doors are interlocked with the power circuit; the car will not draw power with the center doors open.

### Heating & Ventilation

1. The Heat/Ceiling Fans breaker controls the ceiling fans. The fans will come on if it is above 70 degrees. Unless the fans are desired, leave the breaker off. If this breaker is on and it is cold outside, the under car vent dampers will automatically direct waste heat from the control resistors up into the car, instead of venting it outside, after the car has been run awhile. The Aux Heat breaker turns on the baseboard 600-volt resistance heating. It comes on only if the Heat/Ceiling Fans breaker is also on. Aux Heat should be used only when it is very cold outside.
2. The Cab Heater switch on the gang switch panel activates the resistance heater in front of the operator's feet. Use it as needed, but never put the car away with this switch on.
3. Turn off all heaters at least 30 minutes before the car is placed in the Car barn.

### Lights

1. Interior lights are controlled by a switch on the gang switch panel.
2. The headlight and dimmer switches are located on the gang switch panel.
3. The dash lights come on when the headlight is on.
4. The roof headlight is controlled from a switch located under the gang switch panel.

### Emergency and Special Procedures

1. 1713 is an all electric car. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Brake pedal lock - When pushed all the way in, the brake pedal can rock back to lock in place and hold the car in "emergency". To unlock the pedal, place your foot on it and gently rock it forward.
3. Car does not run:
  - a. Ensure the MG set is turned on.
  - b. If the battery switch is on and the MG will not come on, the batteries may be discharged. If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.

## PORT AUTHORITY TRANSIT 4004



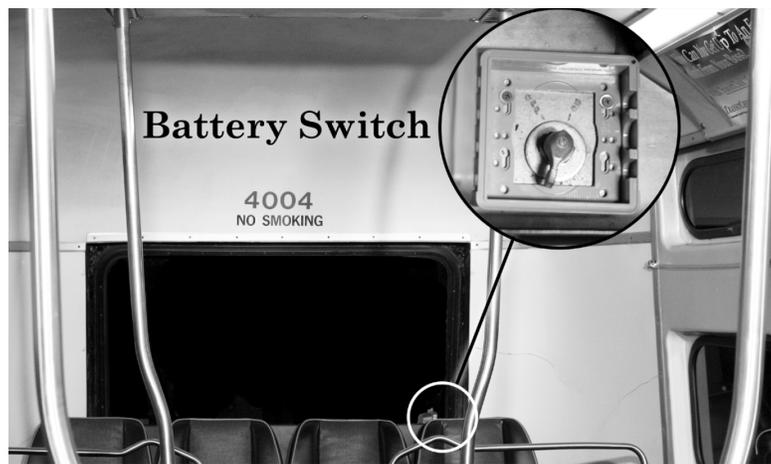
When some of Pittsburgh's South Hills trolley lines were being upgraded to light rail standards and new equipment was being purchased, the Port Authority of Allegheny County undertook a program to re-manufacture 1949-vintage PCC cars for use on the Library and Overbrook routes. At the time these lines were not being rebuilt and required operation using the smaller lighter cars traditionally used on these lines.

Originally slated to include 45 cars, the program ended with only a dozen rebuilds, due to cost realities. Those that were finished, however, were essentially new cars, with all-new electrical and running gear of the type and style that they were originally equipped.

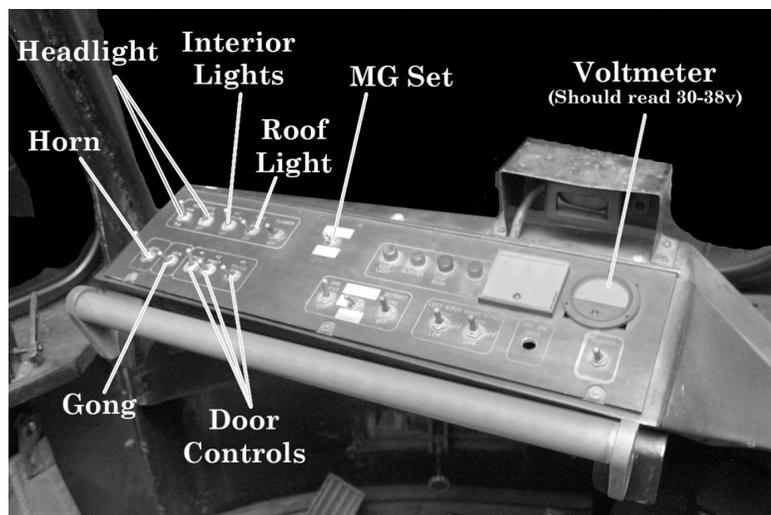
In September 1999 car 4004 was the last PCC to operate in revenue service, ending 63 years of PCC car operation in Pittsburgh. It was donated to the Pennsylvania Trolley Museum by the Port Authority, who generously stored the car until the new Trolley Display Building was completed, and then repainted it before delivery.

## Start up Procedure

1. Put up the pole.
2. Enter the car and walk to the rear. Behind the rightmost seat there is a small plastic box, open the cover and turn the battery switch on.
3. Walk to the front of the car. Turn on the MG set located on the gang switch panel. *The MG set should come on when the switch is turned on. If it does not, the car is out of order and must not be run. Complete the power down procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.*
4. Retrieve the reverser hook from the ammo box located behind the operator's seat.
5. Note the voltage on the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.



4004 - Battery Switch Location



4004 - Gang Switch

## General Operating Procedure

1. The left pedal is the deadman pedal and must be depressed whenever the car is operated. Do not Verify that the backup controller changeover switch is set to the front controller position. If it is not, the front controller will not work.
2. The left pedal is a deadman pedal and must be depressed whenever the car is operated from this end. Do not release this pedal when the car is in motion or an emergency stop will occur.
3. The middle pedal is the brake, and has an adjustable braking rate, depending on how far down it is pressed (like an automobile).
  - a. To brake, press down the brake pedal. As with an automobile, the harder you press the brake, the more brake you will get. Pressing the brake pedal completely down puts the car into Emergency and should not be done unless an emergency stop is required.
4. The right-most pedal is the accelerator. Also like an automobile, the farther down you press this pedal, the faster the car will accelerate.
  - a. Coast by returning the accelerator pedal to the resting position.
  - b. To back up, pull the hook back as far as it will go. Do not attempt to back the car without someone watching out the rear window. Return the hook to the forward position after the

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backup move has been completed.

5. The reverser is located on the floor along the right of the seat. It has three positions:
  - a. Remove/Emergency: This position is all the way toward the front, and is where the hook can be inserted or removed. Throwing the hook to this position while the car is in motion will result in an emergency stop and may possibly damage the car.
  - b. Forward: This is the middle position, in which the hook is positioned directly up and down. In this position the car will move in the forward direction, and the hook is captured.
  - c. Reverse: This is all the way toward the back. In this position the car will move in the reverse (backup) direction, and the hook remains captured.

#### Door Operation and Passenger Loading & Unloading

1. Doors are controlled by 3 switches on the gang switch panel. Switches are marked for their respective doors. The two front doors are each on individual switches, while the center doors are controlled by one switch. Note: You should develop the habit of holding the switches between the thumb and forefinger when closing the doors; this way the reverse operation is quick should it be needed. Use the mirrors to view the center door area to verify that they are clear.
2. The center doors are interlocked with the power circuit; the car will not draw power with the center doors open.

#### Heat & Ventilation

1. A thermostat controls the opening and closing of damper fans for ventilation in warmer months.
2. Heat is also controlled by the thermostat inside the car. When the temperature drops below a certain point, the thermostat will automatically turn the heat on.
3. During summer months the heat is “cut out”, and will not function even if the temperature drops below the thermostat’s range. If the heat is not working on a cold day, follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
4. The Cab Heater switch on the gang switch panel activates the resistance heater in front of the operator’s feet. It must be turned off at least 30 minutes before putting the car in the carbarn.

#### Lights

1. Interior lights are controlled by a switch on the gang switch panel.
2. The headlight and dimmer switches are located on the gang switch panel.
3. The roof headlight is controlled by a switch on the gang switch panel.

#### Backing the Car

1. Reversing this car requires 2 people. Do not attempt to back up the car without someone watching out the rear window or from the ground.
2. Place the Reverser in the reverse position.
3. Sound the bell three (3) times.

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## Emergency and Special Procedures

1. 4004 is an all electric car. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car will not run.
  - a. Check to see the MG set is turned on.
  - b. If the battery switch is on and the MG will not come on, the batteries may be discharged. If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
3. Check the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.
4. Ensure the reverser is fully engaged for the direction in which you wish to operate.

## Power Down Procedure

1. If the cab heater was used, it must be off for at least 30 minutes before the car can be put into the carbarn.
2. Ensure the pedals are properly service latched.
3. Remove the hook and return it to the ammo box.
4. Close all the doors except the first door.
5. Turn the MG off.
6. Turn the battery switch off.
7. Exit via the front doors, manually closing them behind you.
8. Lower the pole.

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## PHILADELPHIA TRANSPORTATION CO. 2711



Philadelphia Transportation Company (PTC) had a large fleet of PCC streamliners, of which 2711 represents one of the more recent. Originally built for service on the busy 23-Germantown Avenue line, the car came equipped for 2-man operation – almost unheard of in 1947, but traffic on the route more than covered the extra operating cost.

As PTC gave way to SEPTA (Southeastern Pennsylvania Transportation Authority) in 1968, the 2700's continued in service and remained after several trolley lines had been discontinued. Because of their age, many cars went through a general overhaul rebuilding in the 1980s to extend their useful life another ten years, including the replacement of the hand-cranked windows with school bus style windows and seating from scrapped former transit buses. But once that time was up and new cars were acquired, streetcar operation was sharply curtailed and the cars were surplus.

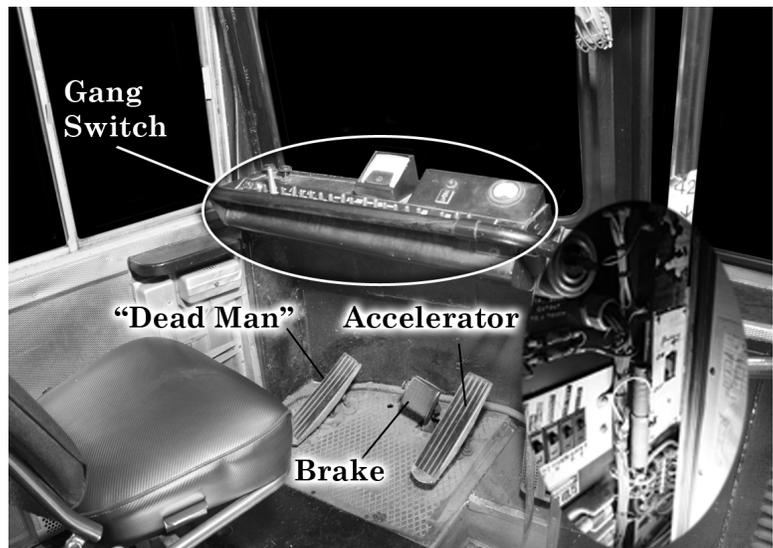
In 1999 car 2711 was acquired by PTM for the purpose of having a wheelchair accessible car for operations. The generosity of corporate partner Adtranz (now Bombardier), that built people mover cars and components in nearby West Mifflin, allowed the car to be taken from Philadelphia to their factory in Elmira, New York where crews restored it to the original 1947 appearance. As a work car, 2711 had many of its seats removed which facilitated reworking of the interior.

## Start up Procedure

1. Put the pole up.
2. Retrieve the reverser hook from the overhead storage bin located above the operator's seat.
3. Turn on the battery located in the dash compartment in the front of the car, behind the "Danger 600V" sign. Note: This box contains areas that are electrically "hot". Exercise extreme caution when turning any switch on or off.
4. Turn on the MG set located on the gang switch panel. *The MG set should come on when the switch is turned on. If it does not, the car is out of order and must not be run. Complete the power down procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.*
5. Note the voltage on the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.

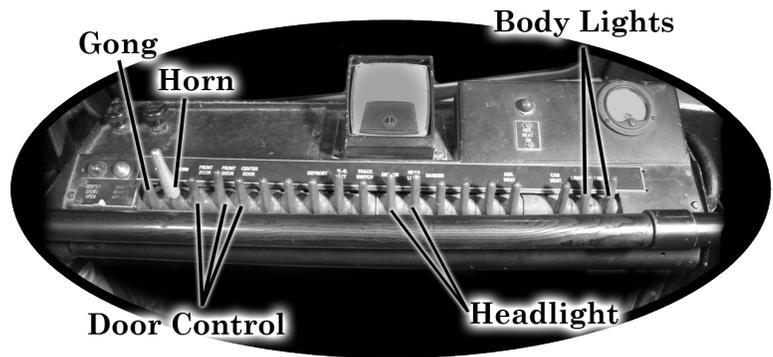
## General Operating Procedure

1. Operating from the Front Controller.
  - a. Verify that the backup controller changeover switch is set to the front controller position. If it is not, the front controller will not work.
  - b. The left pedal is a deadman pedal and must be depressed whenever the car is operated from this end. Do not release this pedal when the car is in motion or an emergency stop will occur.



2711 - Controls & Battery Switch

- c. The middle pedal is the brake, and has an adjustable braking rate, depending on how far down it is pressed (like an automobile).
  - i. To brake, press down the brake pedal. As with an automobile, the harder you press the brake, the more brake you will get. Pressing the brake pedal completely down puts the car into Emergency and should not be done unless an emergency stop is required.

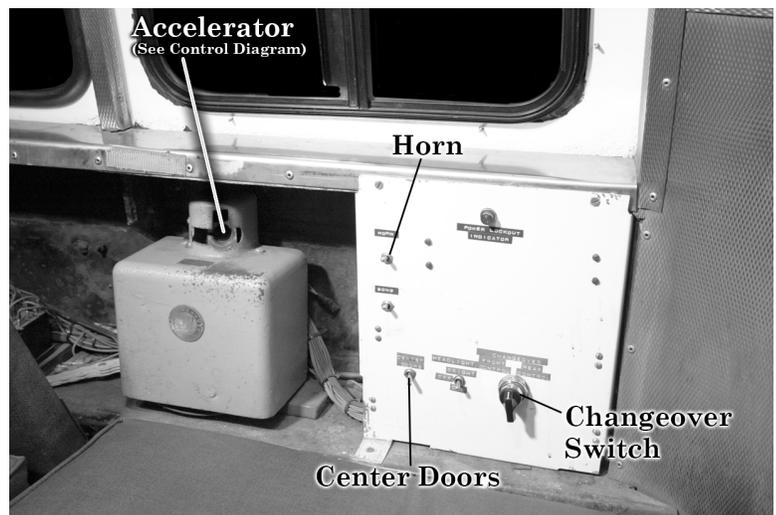


2711 - Gang Switch

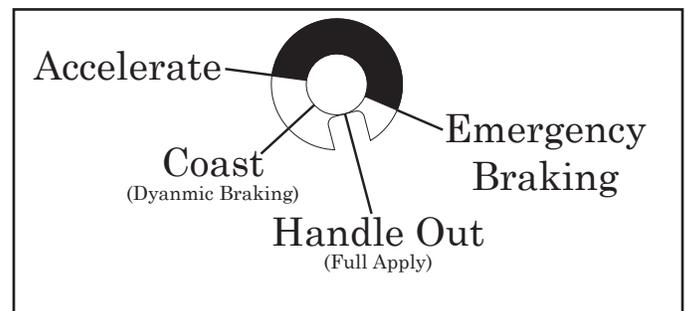
- d. The right-most pedal is the accelerator. Also like an automobile, the farther down you press this pedal, the faster the car will accelerate.
  - i. Coast by returning the accelerator pedal to the resting position.
  - ii. To back up, pull the hook back as far as it will go. Do not attempt to back the car without someone watching out the rear window. Return the hook to the forward position after the backup move has been completed.
- e. The reverser is located on the floor along the right of the seat. It has three positions:
  - i. Remove/Emergency: This position is all the way toward the front, and is where the hook can be inserted or removed. Throwing the hook to this position while the car is in motion will result in an emergency stop and may possibly damage the car.
  - ii. Forward: This is the middle position, in which the hook is positioned directly up and down. In this position the car will move in the forward direction, and the hook is captured.
  - iii. Reverse: This is all the way toward the back. In this position the car will move in the reverse (backup) direction, and the hook remains captured.

## 2. Operating from the Rear Controller.

- a. Insert the front reverse lever (on the proper handle, the knob points toward the front doors) in the reverser slot (on the floor to the right of the operator's seat) and push all the way back towards the rear of the car .
- b. Close all doors using the gang switches. Walk to the rear of the car.
- c. At the backup control panel, set the controller switch to backup position.
- d. Insert the backup hook into the backup controller.
- e. The center door switch is interlocked with the backup controller. The doors will not open if the controller is in the accelerate or coast positions. If the doors are open and the control handle is moved into accelerate or coast, the doors will automatically close but the car will not move.



2711 - Back-up Controller



2711 - Control Diagram

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- f. The backup controller has four operating positions or points. These are:
    - i. Service Brake - This is the only position where the hook can be inserted or removed, and is the braking position to use for normal service stops. This position gives a fully blended braking force, changing from dynamic brake to drum friction brakes as the speed drops. The drum brakes hold the car when it is stopped. Service Brake position functions the same as the brake pedal at the front end of the car, with the exception that there is only one braking rate available.
    - ii. Emergency Brake - This is one position to the right of Service Brake. Here the maximum brake force is obtained. Full dynamic brakes, full drum friction brakes, and full track brakes are applied. A warning buzzer will also sound when this position is selected. Do not use this braking position unless there is an emergency requiring the fastest possible stop.
    - iii. Coast - This is one position to the left of Service Brake. In this position, all of the brakes in the car are released. When the car is in motion, power is removed and a slight braking force will be noted.
    - iv. Accelerate - This is two positions to the left of Service Brake. In this position power is applied and the drum controller accelerates the car.
  - g. Before backing the car, sound three rings of the gong or blasts of the horn. Note: The Horn and Gong switches are spring loaded.
  - h. Move the hook to the left through Coast position to accelerate. The car will now begin accelerating.
  - i. Allow the car to accelerate to the desired speed. The hook can then be moved to the Coast position. Doing this will make for a smooth ride.
  - j. To accelerate again, move the hook one click left to Accelerate. When the desired speed is reached move one click right to Coast.
  - k. To brake the car, move the hook to Service Brake. Note that there is a constant, non-adjustable dynamic braking rate. Good operators will practice stopping using the Service Brake to develop a feel for the stopping distance.
  - l. Always move back into Coast when traveling underwire frogs, contactors and/or section insulators. Remember that you are “back-poling”.
  - m. If an emergency stop is required, move the handle quickly to the extreme right emergency brake position. Maximum braking will occur, and the buzzer will sound. After the car has stopped move the controller to the Service Brake position to hold the car.
  - n. The hook can be moved between positions as often as needed. There are no restrictions, and to maintain speed it will be necessary to frequently go between Accelerate and Coast positions.

#### Door Operation and Passenger Loading & Unloading

1. Front controls - Doors are controlled by 3 switches on the gang switch panel. Switches are marked for their respective doors. The two front doors are each on individual switches, while the center doors are controlled by one switch. Note: You should develop the habit of holding the switches between the thumb and forefinger when closing the doors; this way the reverse operation is quick should it be needed. Use the mirrors to view the center door area to verify that they are clear.

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2. Rear controls - Only the center doors can be controlled from the backup controller. The switch is labeled on the backup controller box.
  3. Develop the habit of holding the switches between the thumb and forefinger when closing the doors; this way the reverse operation is quick should it be needed. Use the mirrors to view the center door area to verify that they are clear.
  4. The center doors are interlocked with the power circuit; the car will not draw power with the center doors open.

#### Wheelchair Safety Procedures

1. To allow wheelchairs to board through the center doors, you must remove the middle stanchion. This is done by pulling out the cotter pin in the top anchor pin, removing the anchor pin, and then pulling the stanchion straight up. Immediately replace the anchor pin in its slot and re-insert the cotter pin. The stanchion should be stored in the substation until reinstalled.
2. The hand-operated wheelchair lift is used to load patrons onto 2711. Wheelchairs cannot be directly transferred from a van and truck because of the outward folding center doors. Wheelchair lift details are discussed elsewhere in this manual.
3. Remind wheelchair attendants that they must duck to get in through the center doors if they're pushing a wheelchair. Patrons in wheelchairs should clear without a problem.
4. The side-facing bench seats and the table fold against the wall to allow space for the wheelchairs. Simply raise the bench seats until the yellow release handle latches (pull the yellow handles to release the seats for lowering). The table folds downwards; lift, fold up and latch the legs under the top, then gently allow it to swing down to the side of the car. There is no latch holding the table to the wall.
5. Wheelchairs can be placed next to the windows in any open location. They may not be placed in the aisle ways so as to impede access. For safety reasons, aisle ways must be kept clear at all times when moving the car. Up to 10 wheelchairs can be accommodated without blocking the aisles.
6. There are no wheelchair tie downs on 2711. Ensure that the brakes are properly set on all wheelchairs before moving the car.
7. Wheelchairs must be set facing the front of the car.
8. When operating with wheelchair bound patrons, give them the most comfortable ride possible. Try to avoid fast starts and stops and/or jerky movements.
9. A two-person crew is required at all times when transporting wheelchairs. The conductor should be watching the wheelchair bound patron(s) at all times when the car is in motion.

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## Heat & Ventilation

1. The heat is controlled by a thermostat. If it is cold outside, the under car vent dampers will automatically direct waste heat from the control resistors up into the car, instead of venting it outside, after the car has been run awhile.
2. The Aux Heat switch turns on the baseboard 600-volt resistance heating. Aux Heat should be used only when it is very cold outside.
3. The Cab Heater switch on the gang switch panel activates the resistance heater in front of the operator's feet. Use it as needed, but never put the car away with this switch on.

## Lights

1. Interior lights are controlled by a switch on the gang switch panel.
2. The headlight and dimmer switches are located on the gang switch panel.

## Changing Ends

1. Changing from the front controller to the backup controller.
  - a. While holding the brake pedal about 2/3 of the way in, slowly release the Deadman.
  - b. Slowly release the brake. It will latch about 4 inches from the floor, in the Service Latch position.
  - c. Push the reverse lever in the reverser slot (under the motorman seat ) all the way back towards the rear of the car.
  - d. Close all the doors using the Gang Switches. Walk to the rear.
  - e. Follow the instructions for the operation of the backup controller.
2. Changing from backup controller to front controller.
  - a. With the backup controller set to service brake, remove the backup hook.
  - b. Verify that the center doors are closed.
  - c. Set the controller switch on the backup control panel to the front controller position.
  - d. Replace the seat cushions.
  - e. At the front of the car, set the reverse handle in the middle position (straight up and down). This sets the reverser to the forward direction.
  - f. The car is now ready to be operated from the front.

## Emergency and Special Procedures

1. 2711 is an all electric car. Refer to the Emergency Procedures section at the beginning of this manual for information on dealing with potential emergency situations.
2. Car does not run:
  - a. Ensure the MG set is turned on.
  - b. If the battery switch is on and the MG will not come on, the batteries may be discharged.

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- If this is the case, do not attempt to run the car. Follow the power down procedure to secure the car, make note of the problem on the chalkboard in the substation, and complete a car condition report form.
- c. Check the dashboard voltmeter. It should be between 33 and 40 volts (ideal: 37 volts). If the voltage is not within this range the car is out of order and must not be used. Complete the shutdown procedure, record the malfunction on the chalkboard in the substation and complete a car condition report form.
  - d. Ensure the switch on the backup controller is set to whichever end you desire to operate from.
  - e. Ensure the reverser is fully engaged for the direction in which you wish to operate.

#### Power Down Procedure

1. If the cab heater was used, it must be off for at least 30 minutes before the car can be put into the carbarn.
2. Ensure the pedals are properly service latched.
3. Remove the hook and return both to the ammo box.
4. Close all the doors except the first door.
5. Turn MG off.
6. Turn the battery switch off.
7. Check the backup control panel. Ensure the controller switch should be set to front and the center doors switch should be set to “closed”.
8. Ensure the back seat cushion(s) are in place.
9. Exit via the front doors. Manually close them behind you.
10. Lower the pole.

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# GLOSSARY

## CAR CONTROLS

Automatic Acceleration Controller - Similar in function to a “K” controller, except that this controller operates a secondary control mechanism that automatically times the power application. P&WCT 78 has an automatic acceleration controller.

Braking Points - The points of a “B” controller through which electric braking is applied.

“B” Controller - Similar to the “K” type, though larger, “B” controllers also controls electric braking in addition to motor power. BVT 1 has a “B” controller.

Canopy Switch (Main Overhead) - Used to manually disconnect overhead current to the traction power circuit.

Controller - A system of electrical switches used to control current to the motors.

Free Running Points - “Full Series” or “Full Parallel.” At either of these points there are no resistors in the motor circuit, and the car can run indefinitely without resistors overheating.

“HL” Controls - The master/remote control systems in cars such as PRCo 3756 or PSTCo 66. “HL” refers to the high/low current of the remote and master controllers, respectively.

“K” Controller- The large, “drum” type controller located on the motorman’s platform which controls forward and reverse power to the motors. PTC 5326 has a “K” controller.

Line Switch - An electrical contactor, located beneath the car, which turns trolley power to the motor circuit on and off. It is operated by a set of low-current contacts in the controller.

Master Controller - The system of switches, or motorized drum, which actually controls the motor current in a multiple-unit or remote control system. When individual switches are used, each switch is operated magnetically or pneumatically from the remote controller. Similarly, a motorized drum controller can be advanced by a remote control. PRCo 3756 has a Westinghouse master controller that uses switches; PST 66 has a similar General Electric controller. MVT 3000 has an electro-pneumatic master control system. PCC cars have an electric master control drum .

No.1 End - On a double-ended car, this is normally the end where switches for lights, compressor, control, end changing, etc. are located.

No.2 End - On a double-ended car, this is the end opposite to the No. 1.

Parallel Points - Those control points, three or four in number, in which the motors are connected in parallel.

Point - One of several positions on a hand operated controller. Marked by Lines on the top of the controller, they indicate spots where certain sequences of contacts are made for certain (usually acceleration) functions.

Power Points - The points of a controller through which power is applied to the motors.

Remote Controller - The small, hand-operated controller used by the motorman to advance the master controller in a multiple-unit or remote control system. This unit, mounted in the operator's cab, is much smaller than a "K" or "B" controller. Although it is similar in function to the full size controllers, a remote controller switches low voltage, low current electricity that moves the master controller, instead of the actual motor current.

Resistors or Resistor Grids - A series of cast iron grids which are used in conjunction with the controller to limit current flow to the motors while accelerating.

Series Points - Those control points, four or five in number, in which the motors or motor sets are connected in series.

Strap (ribbon) Fuse - Often referred to as the roof fuse because it is mounted on the roof of most cars that have one. This is a thin, replaceable strip of copper designed to melt in the event of extreme short circuit. Serving mainly as a backup, this device should not "blow" if the car's other fuses and breakers are working properly.

Switching Point - For cars with automatic accelerating controls, this is the first point on the controller. In the switching point, the car will move slowly and will not accelerate beyond a brisk walk.

Unit Switch - One of the several remotely operated, high current switches that make up a master controller.

## BRAKES

Application - Each time air is admitted into the brake cylinder.

Brake Valve - On cars equipped with air brakes, this is a hand operated valve which controls the application and release of air to and from the air brake cylinder.

Deadman - A valve or switch, either incorporated into the controller handle or foot operated (or both). In the event of the incapacitation of the operator, his or her foot or hand will slip from the deadman, causing the car to come to an emergency stop.

Dynamic Brake - a method of braking in which the traction motors are reversed and used to generate electricity which is dissipated in the resistor grids to help slow down the car.

Fanning - The improper habit of continually moving between "apply" and "release" until the car stops.

Hand Brake - A wheel or handle which manually applies pressure to the brake shoes through a direct mechanical linkage.

Lap - The position on a manual lapping brake valve at which air is neither being applied to or being released from the cylinder.

Manual-Lapping Valve - A brake valve in which the pressure in the brake cylinder is controlled by the length of time the handle is held in the "apply" or "release" position before returning it to the "lap", or neutral, position.

Release - Each time air is vented from the brake cylinder.

Self-Lapping Brake Valve - A brake valve in which the pressure to the brake cylinder is set by the position of the brake handle. While the handle is in one position, the pressure is maintained by a pressure regulator built into the valve.

## OVERHEAD

Cap and Cone Hanger - A specially shaped hanger that threads into span wire in which a “ear” is threaded into.

Ear - A brass clip used to suspend the trolley wire from a supporting span wire without obstructing the trolley wheel’s movement.

Messenger - The term used for the cable on which metal loops are placed that carry support wires for the railway. Support wires can range from signal cable to the large gauge “feeder” wire that helps to power wire sections that are great a distance from the substation.

Overhead - A general term encompassing the trolley wire, its system of suspension and all associated hardware.

Section Insulator - A device spliced into the trolley wire which permits a section of wire to be disconnected, or two power supply systems to be separated. The insulating section is made of wood, about eight inches long.

Span Wire - Steel cable that runs between poles and next to the copper trolley wire and is used as the main support to suspend the trolley wire in the air.

Splice - A device used to reconnect the two ends of wire when it breaks or is replaced.

Substation - A general term used to describe all of the equipment involved in providing high voltage direct current trolley power. Wire Frog - The cast device attached to the overhead wires to guide the trolley wheel through the junction of two trolley wires at a track switch.

Overhead Wire - The term used to indicate the copper wire on which the trolley poles are placed that carries the 600v DC current from the substation to the streetcars.

Wood Strain Insulator - A component of the overhead used to insulate the line current from reaching the ground. These insulators are placed at both ends of span wires as well as between any components connected to the trolley wire.

## TRACK

Ballast - The crushed stone or slag that support the ties and keeps the track from moving out of line, while still permitting water to drain.

Gauge - The distance between rails. Standard (railroad) gauge is 4’ 8-1/2”. Track gauge at the Pennsylvania Trolley Museum is 5’ 2-1/2”.

Girder Rail - Larger than T-rail, girder rail has a flangeway rolled into it, making it more suitable for paved trackage.

Guide Rail - An extra rail added to the inside of curves to prevent derailment.

Impedance Bond - An impedance bond provides continuity between the railway’s track circuits for the DC propulsion current.

Insulated Joint - Required in trackwork to support the operation of signalling track circuits. Both track circuit currents (of a low current) and traction return currents from the streetcar have to pass through the rails.

Joint bar - Specially shaped metal bars bolted to the ends of two rails to join them in a rail track.

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Rail Bond - A short length of copper cable attached or welded to each rail end at a rail joint. Its purpose is to electrically bridge the gap in the rail to improve the ground return for trolley power.

Rail Frog - The cast or fabricated junction where two rails cross after a switch.

Switch - The movable point (for a girder rail switch) or points (for an open trackage switch) which guides the car to one of two tracks.

Switch Machine - The device used to move the switch points of an open track switch.

T-Rail - Symmetrically shaped rail used mainly in open (non-paved) track.

Tie - The large wooden beam that supports the rails and holds them in gauge.

Turnout -The complete assembly of a switch. Includes the switch machine, frog, and associated hardware.

## MOVEMENTS

Bump - When one operating car arrives behind another at a stop and “pushes” or requires the waiting car to leave the stop.

Expedite - Quick acceleration of a car to operating speed in order to shorten trip duration.

Gong - Refers to the sound made when the bell is rung.

Hold - Command given when a car is to wait for certain circumstance before it departs.

Meet - A planned arrangement when one operating car encounters another along a passing siding or other area of track that allows the cars to pass and continue on their way.

One bell - A signal indicating a piece of equipment to stop or a signal indicated a piece of equipment is stopped or “holding”.

Two bells - A signal indicating a piece of equipment is about to move in the forward direction relative to the operator.

Three bells - A signal indicating a piece of equipment is about to make a reverse movement, or opposite the direction relative to the operator.

Crossing Signal - Refers to the signal used at the approach to a road crossing. Equipment must signal with the sounding of a whistle or horn. The pattern – – • – , or two long blasts followed by one short and one long, should be used when crossing a main road.

Thank you for operating  
with us!

