



# Locomotive Technology Guide

**This guide provides a basic overview and troubleshooting of:  
PTC Initialization, Distributed Power Set Up, Trip Optimizer,  
Integrated Trip Optimizer, Integrated Energy Management,  
HPT, & TPOB.**

**The enclosed information is intended to aid in the use of  
locomotive technologies and railroad practices. It does not  
replace rules and instructions contained in System Operating  
Manuals, Timetables, and Operations Bulletins.**

**Effective June 15, 2019**

## Table Of Contents:

PTC-EM	3
GETO	11
GETO-PTC	19
Distributed Power	21
PTC Initialization	41
PTC Restricted Mode	56
PTC Degraded State	62
HPT	65
TPOB	67
EMD SmartConsist	71

## Helpful Contacts:

For assistance and to report PTC or Energy Management issues, contact the PTC/EM Help Desk:

Radio: Tone 1-3-0  
**(404) 582-3524**

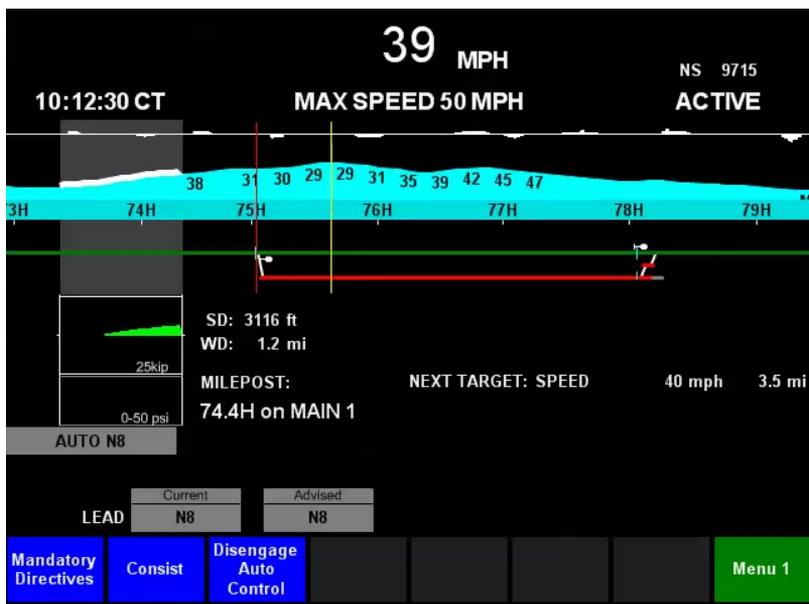
For assistance and to report Mechanical/Distributed Power Issues, contact MOC:

Radio: Tone 1-2-3  
**(404) 877-9585**



# PTC-EM Auto Control

# PTC-EM Auto Control

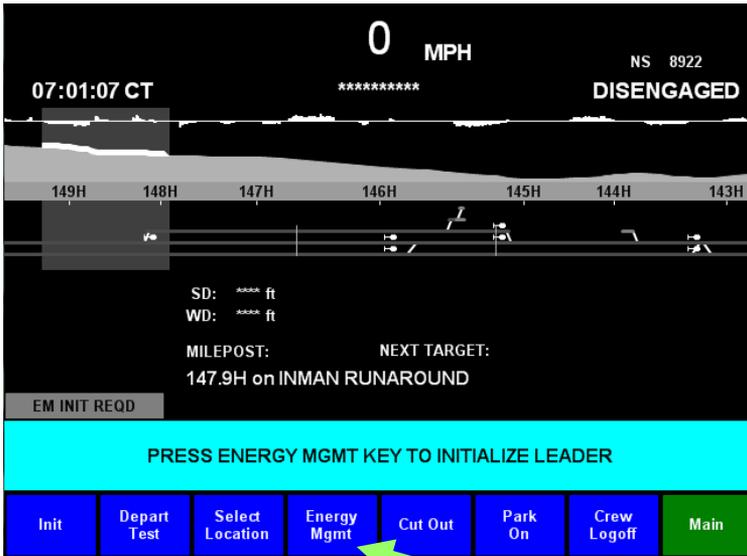


The enclosed information is intended to aid you in initializing PTC—Energy Management and provides a walkthrough of Engaging & Disengaging Auto Control.

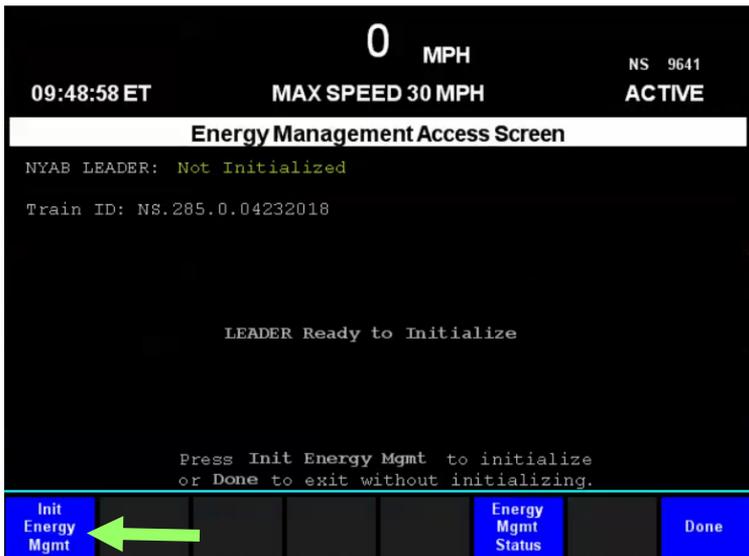
## To Initialize PTC-EM:

After Initializing PTC:

1. Press the **Energy Mgmt** button. (Menu 1)

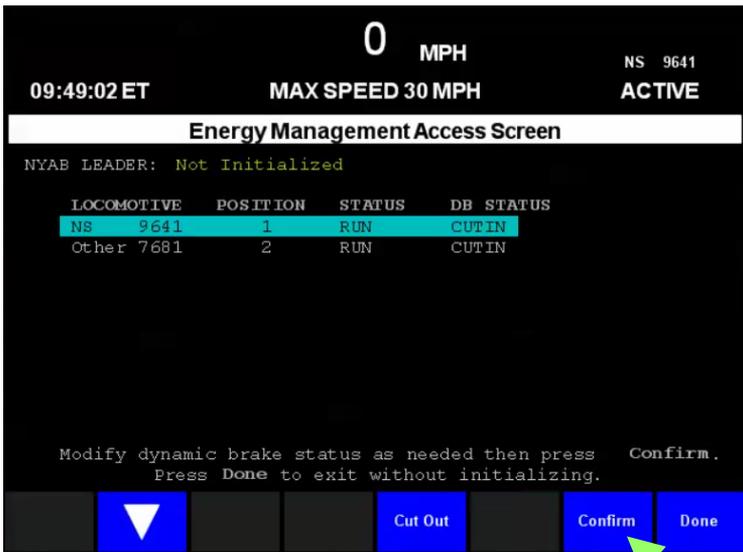


2. Press the **Init Energy Mgmt** button.

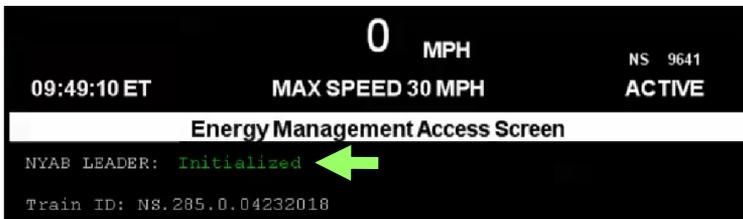


## Initialize PTC-EM (continued)

3. Verify the Dynamic Brake status of all units, If needed select any units that are DB Cut Out and toggle to them with the arrow key and press the **Cut Out** button.
4. Press the **Confirm** key when complete.



5. After pressing Confirm, the Screen should display 'Initialized'. Press the **Done** key.



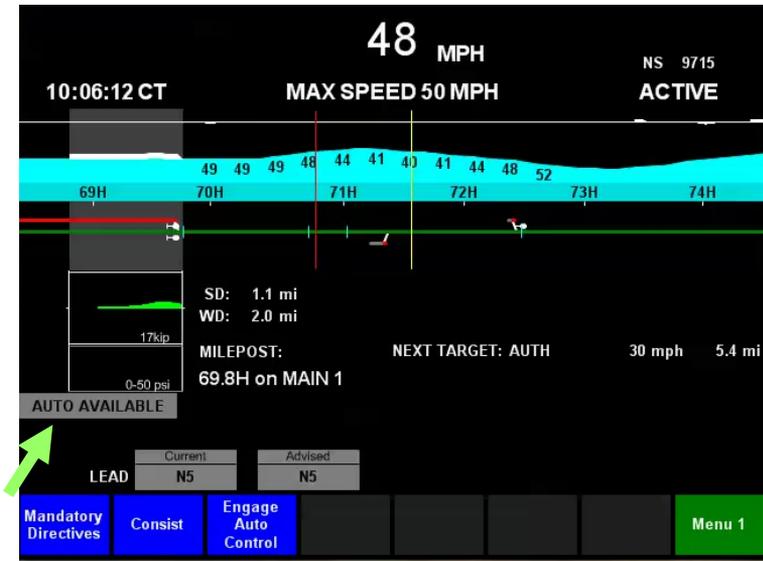
# Auto Control or Advisory Off Units

Once PTC and EM are set up, you are ready to begin your trip.

Depending on the locomotive you will have two options:

1. Locomotive is Auto Control capable:

- Displays 'AUTO AVAILABLE'



2. Locomotive is Advisory Off / not Auto capable

- Does not display 'AUTO AVAILABLE' but will display a range of different status on the control indicator, such as 'EM ADVISDAOFF+' seen below



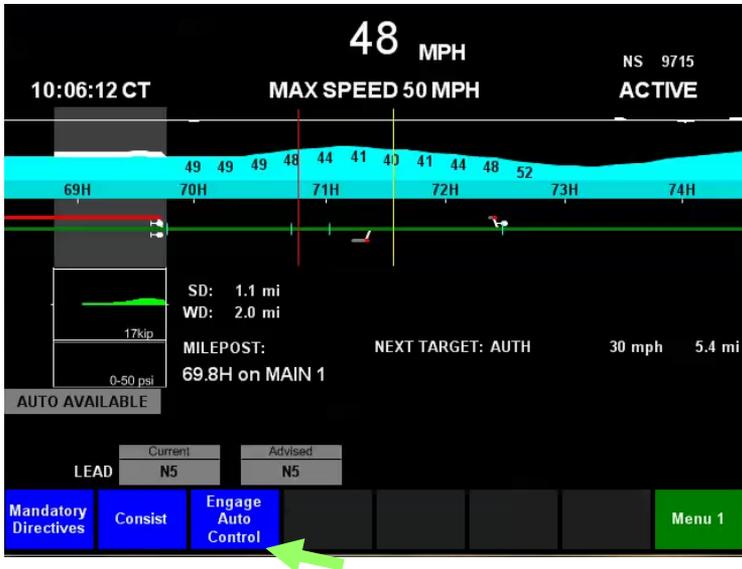
# Engaging Auto Control

## Conditions for Auto to be Available:

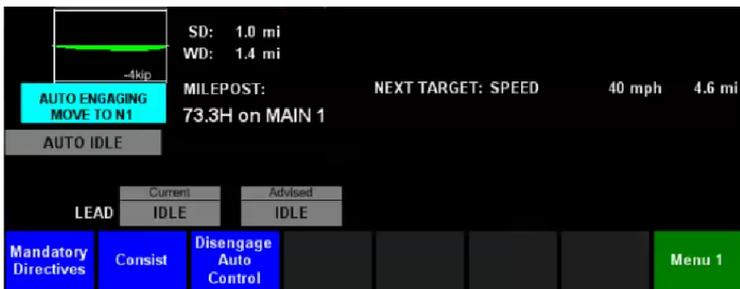
1. Train is equipped with Auto Control Hardware
2. Train is above 5 MPH
3. Not in a Manual Control Zone

## To Engage:

1. Press **Engage Auto Control** key.



2. Move throttle handle to N1

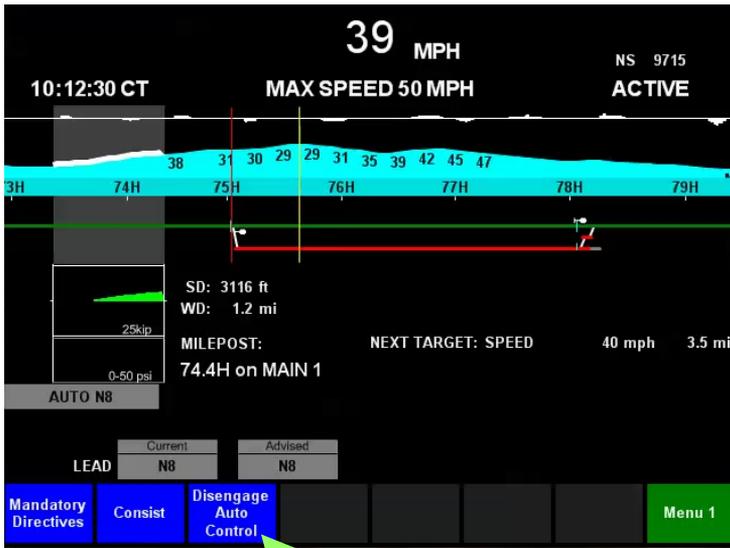


**Auto Control** is now engaged and will control the throttle and dynamic brake.

# Disengaging Auto Control

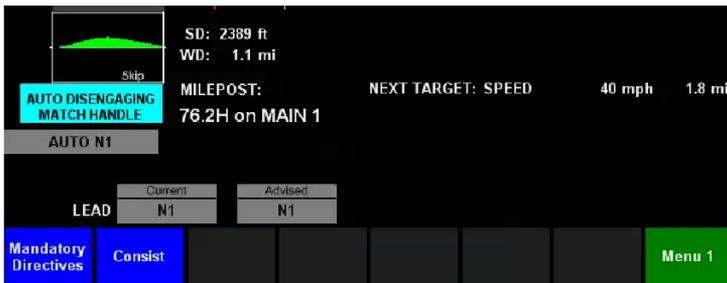
To Disengage:

1. Press the **Disengaged Auto Control** button.



2. Match the current handle position, this will ensure a smooth transition and return to manual control in this notch

*Note: If in dynamic brake, move the throttle handle to idle, then DB handle to the matching brake value or higher.*



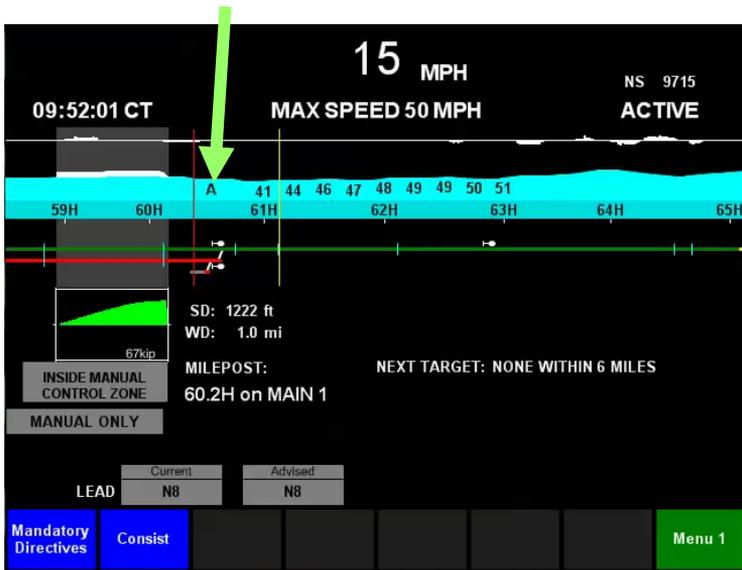
*Note: Any Throttle handle movement while in Auto will force manual control. The process above is a smoother transition, and is the recommended disengage method*

# Manual Control Zones

There will be certain areas that Auto Control usage will not be allowed, these areas are known as Manual Control Zones. The Control Indicator will display:

## *“Inside Manual Control Zone”*

*Note: An “A” will display in the Look Ahead Speeds at the next location that Auto Control should be expected to become available.*



Manual Control Zone conditions could be due to any of the following:

- Train below 5 mph
- Near a zero-speed target or similar PTC target
- Territory not currently authorized for Auto Control

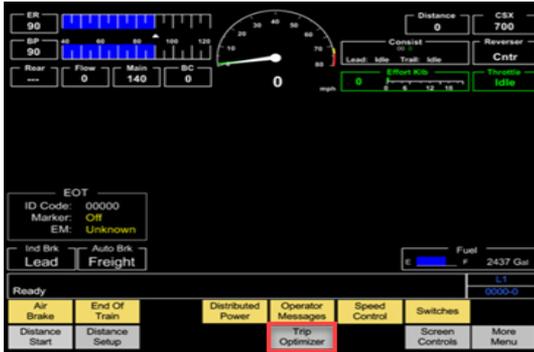


GETO

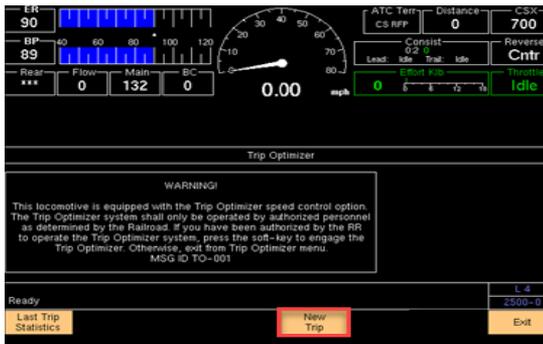
# GE Trip Optimizer

## To Initialize Trip Optimizer:

1. Press the Trip Optimizer button.



2. Press the New Trip button.

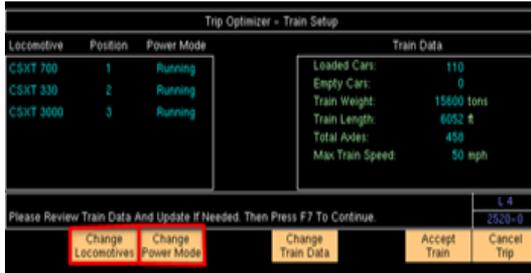


3. Review the Trip Setup.
4. Press the Accept Trip button.



## Loco Setup & Train Confirmation

1. Select the **Change Locomotives** or **Change Power Mode** buttons to edit the locomotives.



2. Use the **Arrow** buttons to select the locomotive change.
3. Select the change desired (**Isolated** or **DB Cutout** buttons).
4. Select the **Accept** button.



### If Edits are Necessary:

1. Use the **Arrow** buttons to select the item to change.
2. Use the **Back Space** button to clear a value and **Number Keys** to enter the new value.
3. Press the **Accept** button.

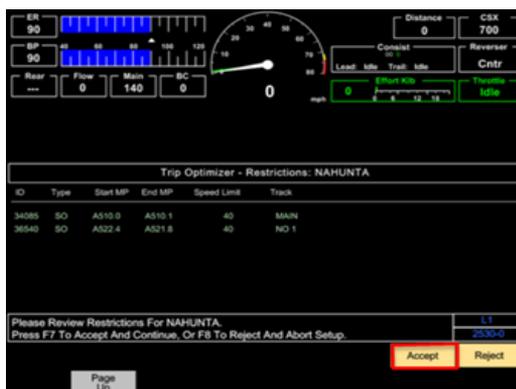
## Verifying Restrictions

Once the train and locomotives are set up, **TO** will require you to verify the speed restrictions that have been passed to it by the back office system.

Press the **Page Down** button as needed to read all restrictions. Note any differences on your paperwork. You will need to operate in **Manual Control** in those areas.

Restrictions should be listed in order by subdivision and match the Train Clearance.

If any discrepancies exist, operate in Manual Control over that portion of your route.



Once you have reviewed all restrictions, press the **Accept** button.

# Engaging & Disengaging Auto Control

## Condition for Auto to be Available:

1. Train is above 12MPH (operates down to 9 mph)
2. Not in a Manual Control Zone

## To Engage:

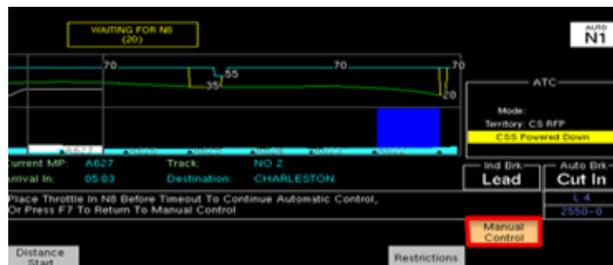
1. Select **Auto Control**.
2. Move throttle handle to N8 or press the **Confirm Auto** button if already in N8. Push the **Auto Control** button FIRST.

**Auto Control** is now engaged and will control the throttle and dynamic brake.



## To Disengage (Two Methods):

1. If indicated Auto Notch IS NOT N8:
  - a) Move the throttle handle to the indicated auto notch on the **TO** screen.
  - b) If in dynamic brake, move the throttle handle to idle, then DB handle to the matching brake value or higher.
2. If indicated Auto Notch IS N8:
  - a) Press the **Manual Control** button.
  - b) Press the **Confirm Throttle** button.



# Auto Independent Distributed Power

## DP Trains While in Auto:

TO will always operate the lead and remote set independently (Fence Up).

## DP Trains Transitioning from Auto to Manual Control:

TO will always return to Manual Control with the Fence Up, and you must normalize the remote set when coming out of Auto.

Distributed Power Operation			
DP Mode	Run - Auto		
ID	A- 2010	B- 1244	
Throttle	N3	NS [NS]	
Load TE	30	67	
Consist TE	2:3 60K	1:1 67K	
BP	90	90	
Flow	1	0	
Remote		Norm	
ER	90	90	
BC	0	0	
MR	140	140	
Ready			L1 23000
		Remote Sand	Exit
			Remote Menu

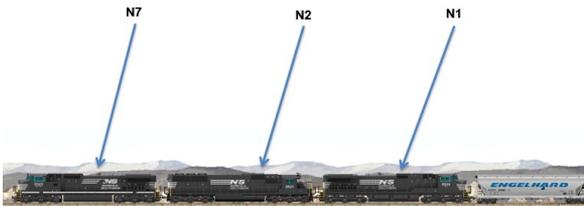
## Smart HPT

GE's version of consist management, Smart HPT, works automatically when a train is at a speed to determine the most efficient throttle position on each locomotive in the consist.

### For Example:

The engineer on the train below places the throttle in N4.

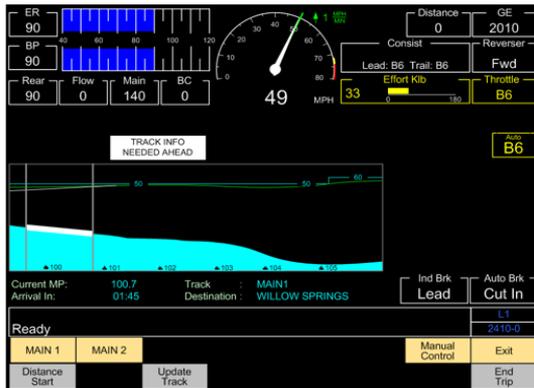
Smart HP can reconfigure the throttle settings in this three unit consist as displayed:



## Approaching Multi-Track

The engineer will be prompted to select the track (via soft key) that the train is or will be traversing.

- TO will automatically prompt the engineer when a choice is required.
- If you fails to respond, TO will transition to **Manual Control**.



### Trip Optimizer on Foreign Units

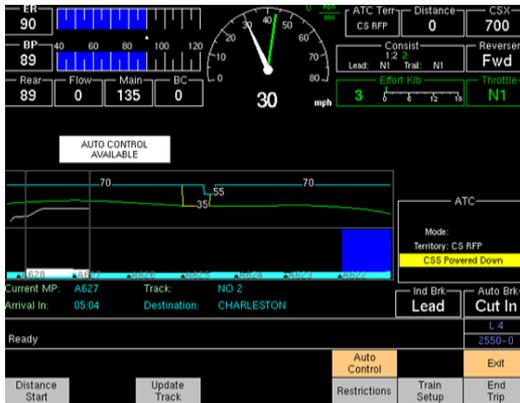
Norfolk Southern engineers have the capability of using TO on the following foreign units:

- CN
- CP
- BNSF
- KCS
- CSXT: Use code A1111111  
(enter 1's until screen won't allow more)

## Ending the Trip

TO will automatically end the trip when the destination is reached as defined in the track database.

The trip can be ended manually by pressing the **End Trip** button.



GE Trip Optimizer is a  
**CLEAR SIGNAL SYSTEM**  
unless integrated with PTC (Next Section)

Engineers will remain responsible for operating in accordance with existing rules governing signal indication. Trip Optimizer will operate accounting for Temporary Speed Restrictions verified by the engineer.



TO PTC

# GETO-PTC Integrated Mode

## TO-PTC Overview

### Always Initialize PTC prior to attempting GETO Initialization

- After PTC Initialization - all GETO information and keys will be on the Locomotive Smart Display
- If GETO-PTC Integrated trip is available - the TO setup button will change to:



- Changes with Integrated TO PTC operation:
  - ⇒ All PTC signal information will be accounted for in TO operation
  - ⇒ All Speed Restrictions in PTC will be accounted for in TO operation
  - ⇒ TO will prompt for Manual control at the Approach signal OR 2 miles before the Stop signal - whichever comes first
  - ⇒ All PTC Targets (Signals/Restrictions above) will be displayed in the TO Rolling Map on the Smart Display - and the Plan Speed Line will dynamically adjust to accommodate these targets



# Distributed Power

- Always set up the Remote locomotive before setting up the controlling locomotive
- Be patient and follow each step in order
- Reference Distributed Power (DP) operating rules in the NS-1

## Prior to DP Setup

- 1) Before DP can be set up on any locomotive consist, you must condition the units for Normal operation. **Note: Conditioning refers to the proper placement of switches, circuit breakers, handles and air brake setup.**  
(See Table 1)
- 2) Set up a DP Unit as the controlling unit in each consist.
- 3) Condition all other units in each consist for Trail.
- 4) Complete the required locomotive inspections and air brake tests on each consist before setting up for Distributed Power.

<b>WARNING</b>	*Ensure that the Brake Pipe is connected and open between the locomotive consists.
	*Properly secure the train and locomotives.

You must condition and set up locomotives in the following order:

- 1) Condition and set up all Remote unit(s).
- 2) Condition and set up the Lead unit.
- 3) Link to the remotes from the Lead unit.

<b>Table 1. DP Unit Equipment Setup</b>	
<b>Switches and Controls</b>	<b>Position</b>
ISOLATION SWITCH	RUN
DP RADIOS	ON
ENGINE RUN	ON
GEN FIELD ON	ON (Lead/Controlling)
	OFF (Remote)
CONTROL FUEL PUMP	ON
DYN BRK CONT CB	ON
Reverser	Centered (Remove the reverser on remote locomotive)
Throttle	Idle
Automatic Brake	Handle off and pinned on Remote locomotive
	Min-Service applied on lead locomotive.
Independent Brake	Applied on lead locomotive.
	Fully applied on Remote locomotive, released after setup.

Table 2. DP Unit Setup Keys	
Key	Function
COUNT UP	Increments selected digit of link unit number or railroad identification.
COUNT DOWN	Decrements selected digit of link unit number or railroad identification.
DIGIT LEFT	Selects digit to the left.
DIGIT RIGHT	Selects digit to the right.
OPPOSITE DIRECTION	Enabled when <b>SAME</b> Direction mode is selected
	Configures this remote unit for operation with the lead controlling locomotive hood in the <b>OPPOSITE</b> direction as this remote.
Same Direction	Enabled when <b>OPPOSITE</b> direction mode is selected.
	Configures this remote unit for operation with the lead controlling locomotive hoods in the <b>SAME</b> direction as this remote.
DONE - Remote Setup	Enabled when a valid lead unit number has been entered.
	Accepts link number and direction setting begins processing link radio messages from lead units and closes the window.
LINK - Lead Setup	Enabled when a valid unit number has been entered in the current position disabled if a duplicate unit number is used.
	Begin radio transmission to link selected remote unit.
EXIT	Closes the display window.
	If the Distributed Power Remote Setup display window is closed using the exit key, then the distributed power state does not change.

## DP Remote Setup

Start at the Remote consist that is closest to the Lead consist.

If linking multiple DP remote consists with BNSF engine in REMOTE LEAD, BNSF unit must be linked first.

1. Cutout Cab Signal and PTC switches in nose of remote units only.
2. Clear all penalty brake applications and air brake faults.
3. Verify lead locomotive number and cab direction prior to setting up the remote locomotive.
4. Set remote locomotive air brakes as LEAD / CUT IN. Clear any PCS.
5. Move the DP circuit breaker (or AUX ELEC on EMD loco) to the ON position (if available). Note: Some foreign locomotives may have the DP circuit hardwired. There will be no circuit breaker.
6. Ensure the fuel pump and engine run switches are in the ON position and the generator field switch is in the OFF position.
7. Center reverser and remove handle. Ensure throttle handle in "IDLE".
8. Place the automatic brake handle in the **HANDLE OFF** position and pin in place. DO NOT CUT OUT THE AUTOMATIC BRAKE.
9. Select the **DISTRIBUTED POWER** key on the computer screen. If this key is not available, push the **MORE MENU** key. Then select the **REMOTE SETUP** or **RADIO REMOTE** key.
10. Enter the lead locomotive number into the computer screen. Change initials if foreign.
11. Select the Remote DP Locomotive's Cab Direction to be SAME direction as LEAD or OPPOSITE direction as LEAD.
12. Verify the lead locomotive's road number and the remote's cab directions are correct. Press the EXECUTE and/or DONE key.  
Note: PCS may open. DO NOT RESET
13. Place independent brake handle in release.
14. Set the rear locomotive headlight to DIM and lock or secure the seat from contacting the controls. Ensure the hand brakes are released and place isolation/engine control switch to RUN. Finally, lock the cab.

## DP Lead Setup

1. Set the air brakes to **LEAD / CUT IN**, Independent brake **APPLIED**, clear any PCS, and Center the Reverser.
2. Set DP, Fuel Pump, Engine Run, Dynamic Brake Cutout, and Generator Field breakers to UP; set Isolation switch to **RUN**.
3. Select the **DISTRIBUTED POWER** key on the computer screen. If this key is not available, push the MORE MENU key.
4. Select the **LEAD SETUP** or **RADIO LEAD** key.
5. Enter remote loco's initials and number. Select the **LINK** key. Screen will show "LINKED OK" and you will receive a penalty brake application.  
  
If LINK is not successful, select **DIGIT LEFT** and retry. If a second remote set is used, repeat step 5 to link the second set prior to recovery.
6. Select the **DONE** key. DO NOT PRESS THE EXIT KEY. The lead unit PCS will match the PCS status of the remote unit. You may receive a screen prompt that states "To clear penalty, move handle to suppression."
7. "Penalty source still present" will display for approximately 1 minute and 50 seconds. You will then be prompted to remain in suppression for an additional 10 seconds.
8. Once the PCS has cleared, when prompted, move the automatic brake handle to release and charge the train line.
9. The prompt "Perform Brake Pipe Test When Ready" will appear. Brake pipe test should be initiated once air flow rate has leveled off and stabilized with a combined air flow of 60 CFM or less.
10. Once these conditions have been met, and air flow has stabilized, press **BRAKE PIPE TEST** and then press **EXECUTE**. The execute button must be pressed within 15 seconds.
11. Follow the prompts and when the test is done, system will display "BRAKE PIPE TEST: OKAY."
12. Press the **DP MAIN MENU** key, then **MODE** key, then press **RUN**, then press **EXECUTE**.
13. Perform a bump test.

## Bump Test

The bump test allows the engineer to ensure that the remote locomotives are loading in the same direction as the controlling locomotives.

Prior to, and when performing this test, always take grade, switches, derails, blue flags, signals and crew member location into consideration.

1. Under normal DP operation, locomotives will operate in SYNCHRONOUS MODE. To conduct the bump test, FENCE MODE must be initiated from the Distributed Power Operation screen.
2. Press **MOVE TO BACK** key, which will display a line separating the lead consist from the remote consists. If **MOVE TO BACK** is not available, select **CONTROL MENU**.
3. Place the control stand in the following setup:  
Reverser **forward**  
Throttle in idle  
Generator field in ON  
Independent brake fully applied  
Automatic brake released
4. Press the **TRACTION** key, then press **EXECUTE** or **YES** and observe that the remote consist goes from "IDLE" to "N1" on the screen and for the load/tractive effort to develop. Slack should run in and "bump" the lead engines. This allows the engineer to determine the remote consist is properly set up and working as intended in the direction intended.
5. Once movement is felt, press the **MOVE TO FRONT** key ensuring the remote consist goes back to "IDLE", load goes to zero, and FENCE is removed. If **MOVE TO FRONT** is not available, select **CONTROL MENU**, then **MOVE TO FRONT**. Center reverser.
6. Bump test is complete.

## Departure Test

Once train is solid and ready for continuity test, do the following:

1. Select the **DISTRIBUTED POWER** key, then press **DP MAIN MENU** key, then press **SYSTEM** key.
2. Brake pipe test should be initiated once air flow rate has leveled off and stabilized with a combine air flow of 60 CFM or less.
3. Once these conditions have been met, and **air flow has stabilized**, press **BRAKE PIPE TEST** and then press **EXECUTE**. The execute button must be pressed within 15 seconds.
4. Press **BRAKE PIPE TEST** and then press **EXECUTE**. The **EXECUTE** button must be pressed within 15 seconds in order to activated the Brake Test.
5. Follow the prompts, and when test is done, system will display "BRAKE PIPE TEST OK".
6. After test is OK, continue with a further automatic brake reduction to 20 psi to complete the Class III Brake test, if required
7. Release the brakes.

**NOTE:** The train leakage test is not required. Do not perform a leakage test unless specifically instructed to do so.

## SET OUT MODE

1. Train must be stopped prior to using Set Out Mode.
2. Make a full service brake pipe reduction with the automatic brake and wait for the exhaust to stop.
3. Press **REMOTE MENU**, then **SET OUT**, then **EXECUTE**.
4. Observe the remote consist change from NORMAL to SET OUT. Flow will change to OUT.
5. It is now okay to cut away.
6. After train is back together, prior to initialization of three-step protection, press **NORMAL**, then **EXECUTE** and ensure the remote's status changes from SET OUT to NORMAL.
7. Three Step Protection can now be initiated and brake pipe restored.
8. Observe that the remote consist status has returned to NORMAL; however, the brake valve will still show OUT.
9. Release the automatic brake when ready. The brake valve on the remote consist will cut back in when it has detected a 3 psi increase on the brake pipe.
10. The remote consist is now in Remote Normal. A train check must be performed. If a Class I or Class III brake test is required, the train check should be initiated before performing the release of the brakes.
11. Ensure locomotive is placed back in RUN mode. Press the **DP MAIN MENU** key, then **MODE** key, then **RUN**, then **EXECUTE**.

# TRAIN CHECK

For circumstances requiring a Train Check, the following procedure should be followed. Train Check can only be performed when the train is stopped.

1. From Distributed Power Remote Session main menu, press **EXIT** key.
2. Press **SYSTEM** key.
3. Apply a minimum 10 psi BP reduction and wait until the brake pipe has stopped exhausting.
4. Press **TRAIN CHECK** followed by **EXECUTE**. The system will place the remote units in BV out and start the train check. The option to perform a train check will not appear until a minimum reduction of 10 psi is in effect.
5. Follow the prompts and release the automatic brake when ready to proceed. When a rise of 3 psi is detected on the remote consist, the remote BV will automatically cut in.
6. Train check may take up to 5 minutes. Once "TRAIN CHECK: OK" message is received, the train may proceed.
7. A test resulting in "Train Check Failed" should be retested. The brake pipe should be fully recharged before attempting TRAIN CHECK again.
8. If the second TRAIN CHECK fails, proceed with Alternate method below (in accordance with DP rules in the NS-1):
  - a. Make a 10 PSI BP reduction with the Automatic brake valve handle.
  - b. Place each remote unit in BV OUT remote operating mode.
  - c. Verify all remote brake valves are cut-out, return all remotes to the NORMAL remote operating mode.
  - d. Release the Automatic brake and verify a rise of 5 PSI of brake pipe pressure at the rear of the train.
  - e. The Mechanical Operations Center (MOC) must be notified if any remote consist brake valves do not cut back in with a rise in brake pipe pressure of at least 3 PSI.

## Ending DP—Lead Unit

Distributed Power must be ended on the Lead DP consist before it can be ended on the Remote DP consists.

1. Before DP Equipment is shutdown or remote link ended:
  - a. Stop and secure the train,
  - b. Fully apply the Independent Brake,
  - c. Place the Throttle in *Idle*, and
  - d. Make a 20 psi automatic brake pipe reduction.
  
2. From the *Right Distributed Power Operations* screen, select **DISTR POWER** to open ***Distributed Power Main Menu***.
  
3. At the ***Distributed Power Main Menu***, press the **END DISTR POWER** key followed by **EXECUTE**. If **EXECUTE** does not appear, ensure the independent brake is fully set.

DP

## Ending DP—Remote Unit

1. End Distributed Power on the Lead consist prior to ending DP on any remote consists.
  
2. From the *Right Distributed Power Operations*, press **DISTR POWER** to open the ***Distributed Power Main Menu*** and press **END DIST PWR**.
  
3. When the menu keys change, press **EXECUTE**. If **EXCECUTE** does not appear, ensure independent brake is fully applied.
  
4. After DP ends, the Remote unit are automatically placed in the Lead-Cut Out mode.

# System Operating Modes

After completing a Brake Pipe test/Leakage test, the System Operating Mode may be **IDLE**. To enable traction and dynamic brake functions on the Remote consists, you must change the System Operating Mode to **RUN**.

To change the system Mode to **RUN**, select **MODE** from the Distributed Power Main Menu. Select **RUN** followed by **EXECUTE**.

\*\* Mode status can be verified on both the *Right* and the *Left* screens

## DP— Operating Modes

**System Mode Run** - Normal DP system mode. All throttle, DB and airbrake functions available. Synchronous and Independent control available.

**System Mode Idle** - initial mode after linking. All airbrake functions available. No throttle control available. Must pass brake pipe continuity test before exiting.

**Synchronous Control** - remotes duplicate traction, dynamic brake and air brake commands from lead DP unit. Commands are sent instantly but may take up to 20 seconds to update on the controlling locomotive's screen.

**Independent / Asynchronous Control** ("The Fence") - allows remote unit to be commanded independently of the lead. Safety interlocks prevent *stretching* or *bunching* the train

**Remote Normal** - all remote traction, dynamic and air brake functions are enabled.

**Remote Idle** - remote throttle remains in idle while all air brake functions are enabled.

**Remote Break Valve Out** - (BV Out) used for troubleshooting air brake troubles and performing alternate method for determining *Brake Pipe Continuity*.

**Remote Isolate** - throttle and dynamic functions are disabled and the brake valve is cut out. This condition may automatically occur during a *Comm Loss*.

**Remote Set-Out** - throttle, dynamic, and air brake functions are disabled and remote is set with emergency and independent brakes fully applied. Brake valve is cut out.

**NOTE: When coming back from Set-out Mode, the rear units must see a rise in brake pipe pressure of at least 3 psi to cause the remove BV to cut back in.**

## Communication Loss

In the event of a comm loss between the Lead and Remote consists, the Remote consist will default to the last valid command received and maintain that condition until comm is restored or, if in throttle, the remote consist enters Comm Loss Idle Down.

If the last valid command (when in throttle) is or becomes undesirable to the operation of the train, an automatic brake application will force the Remote locomotives into Comm Loss Idle Down and tractive effort will be stepped down to idle.

1. **Do not stop if the train if safe train handling can be maintained.** Continue operation through the COMM loss, in most case, DP will reestablish communication automatically.
2. **Never unlink DP on line of road and do not cycle locomotive computer breakers unless specifically instructed to do so.**
3. The only difference between a (momentary) Yellow and (sustained) Red COMM loss is the amount of time of the COMM loss.

## Communication Loss Idle Down

A Communication Loss Idle Down (CLID) is an event where the Remote Consist throttle steps down to Idle at a rate of 3 sec/step to idle, transitions to Remote Isolate, and the remote consist goes to BV out mode. When a CLID occurs while in dynamic brake, DB is maintained at the level at the level indicated at the time of the CLID.

1. CLID occurs when there is a communication loss between the lead and remote DP consists:
  - a. after a sustained comm loss of 90 minutes, or
  - b. the remote senses unexpected air flow, such as occurs when the engineer sets the Automatic Brake, or
  - c. remote consist is in BV out and a communication loss of greater than 45 seconds occurs.
2. When communication is restored after a Comm Loss Idle Down:
  - a. the remote consist must be commanded to Normal Mode, and
  - b. the BV on the Remote Consist **MUST** be cut in by commanding the remote to NORMAL and initiating a release of the Automatic Brake Pipe causing a rise in pressure of at least 3 psi.

# Troubleshooting Comm Loss

Note: DP Link will not be lost except by deliberate unlinking or by an extended Comm Loss Idle Down (CLID) of 90 minutes.

## **COMM LOSS while the train is operating in DB:**

During a DP COMM Loss, while operating in dynamic braking, the remote consist will remain in Dynamic Braking until communication is restored, OR until the train brought to a stop and the brake pipe is reduced to zero via and emergency brake application.

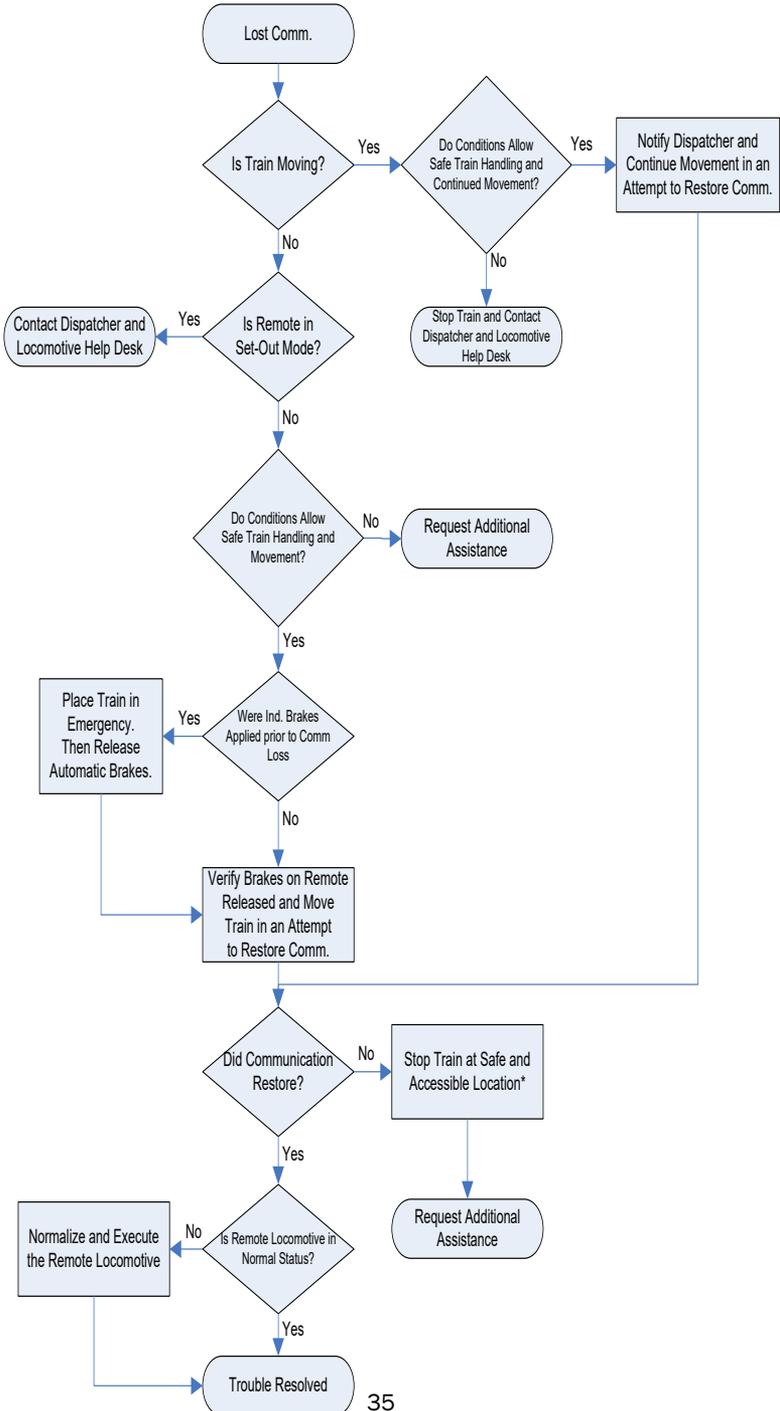
1. Then restore brake pipe pressure. Once the brake pipe pressure reaches 60 PSI the remote consist will go to ISOLATE with the brake valve cut out and the independent brake will release with an automatic brake release. The remote consist will operate like box cars in this state (Isolate, Brake Valve Out).
2. Once communication is reestablished, hit the "Normal" key and release automatic brake (DP needs to see an increase of 3 psi or greater) for remote to return to operation.

## **COMM LOSS while STOPPED:**

Anytime a COMM Loss occurs while the train is stopped, and comm is not restored, move the train to assist in restoring comm. When stopped with the brakes set prior to comm loss, in order to release the independent brakes on the remote consist:

1. Initiate and recover an emergency application of the automatic brake.
2. Once the brake pipe is restored above 60 PSI, the remote consist will transition to Isolate with brake valve cut out. The independent brake will now release with an automatic brake release. Verify brakes release before proceeding.
3. Once communication is reestablished, "Normal" mode must be commanded and the remote consist must realize an increase of brake pipe pressure greater than 3psi initiated by a release of automatic brake for remote to return to operation.

# Troubleshooting Comm Loss



DP

# Line of Road Issues

## **Alarms on trailing unit(s):**

1. Immediately contact MOC and
2. Stop the train at a location where the remote consist can be inspected.
3. If a locked axle is verified, the unit must be set out.

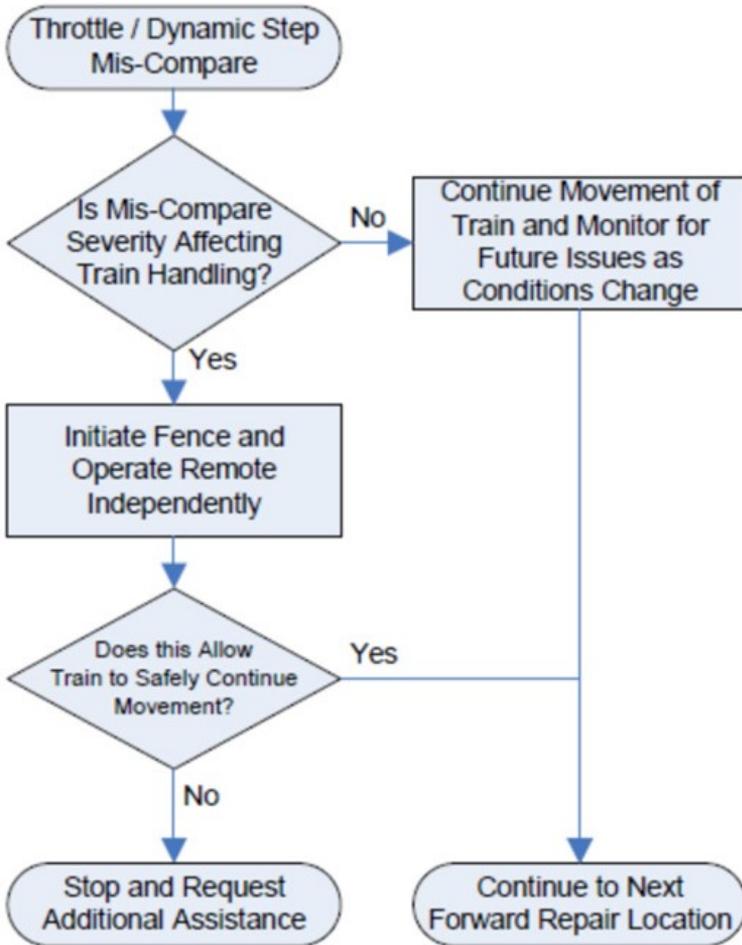
## **Train in Emergency:**

1. If train goes into emergency on line of road. Place remote power in setout mode immediately after train comes to a stop
2. After initiating a release from the lead unit and brake pipe pressure begins to rise in the mid-train and pressure begins to rise on rear EOT or rear remote, immediately place the remote DP in normal mode.

# Troubleshooting Mismatch

- Mismatch is an un-equal distribution of tractive effort or dynamic braking within the train
- Mismatch can be identified by an operator visually detecting mismatch for Dynamic Braking, Direction, or Traction visually on the computer screen.
- If mismatch impacts train handling, Initiate Fence and operate remote independently.
  - If fenced operation allows for safe train movement, continue.
  - If unable to safely operate the train, such as the case of a directional mismatch, stop and request assistance.
- Report to MOC so unit can be forward to repair location.

# Troubleshooting Mis-Compare

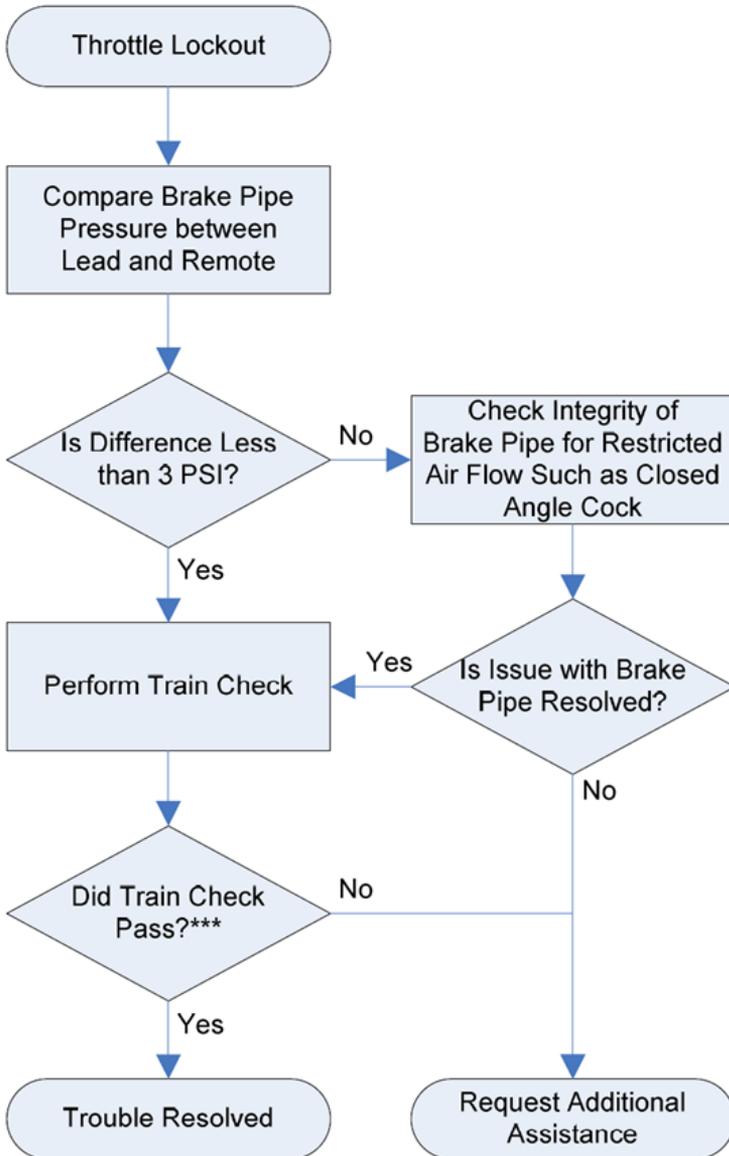


DP

## Throttle Lock Out

- If operator experiences throttle lockout, compare brake pipe pressure between Lead and Remote
- If the difference is less than 3 PSI, perform Train Check
- If the difference is greater than 3 PSI, check integrity of brake pipe for restricted air flow such as closed angle cock. If this resolves the issue, perform Train Check
- If unable to reset – request assistance
- If train check fails, you may retry while waiting on additional assistance.

# Throttle Lock Out



DP

## Contacting Helpdesk

Check these items prior to calling the locomotive help desk.

1. Is train in penalty or emergency?
2. Does the screen show *Lost Comm.*?
3. What does the crew message say on the engineer's screen?
4. If at initial setup, return to set up guide. Follow steps in order and be patient!
5. Contact dispatcher or locomotive help desk with information listed above.  
**Please note the time (in Eastern Time) the issue or event occurred and provide this. This will assist in troubleshooting.**

For assistance and to report Mechanical/Distributed Power Issues, contact MOC:

Radio: Tone 1-2-3  
(404) 877-9585

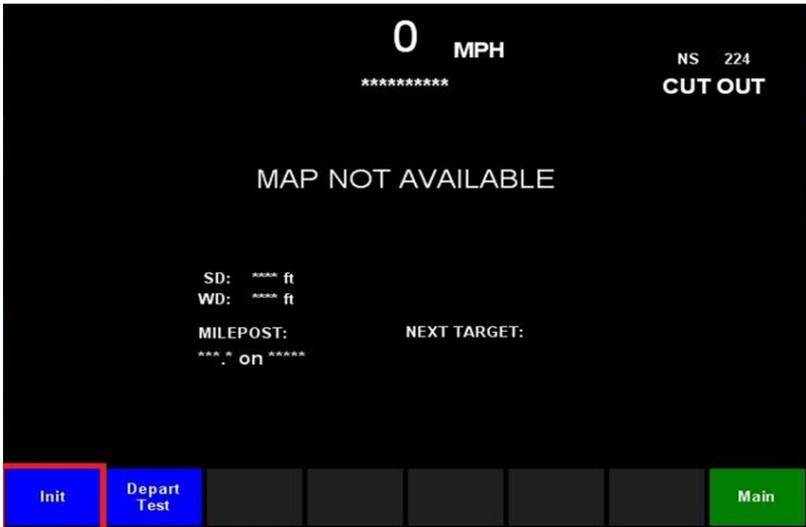


PTC INIT

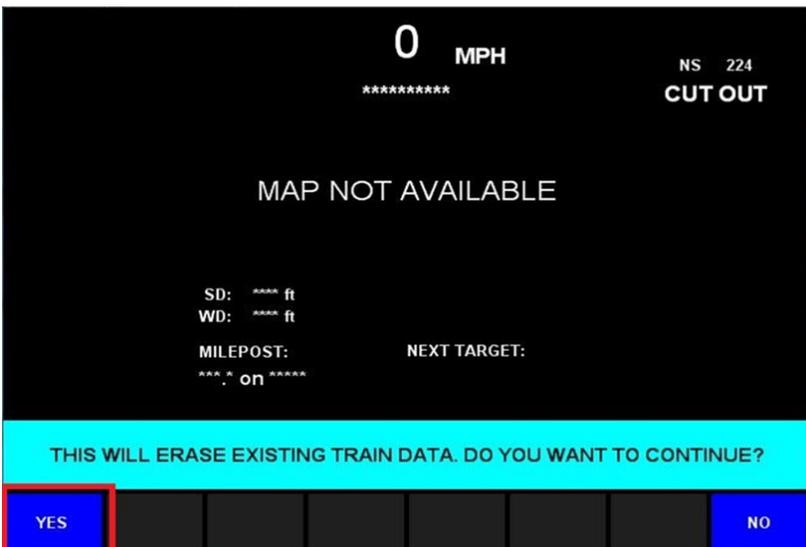
# Positive Train Control Initialization Guide

## To Initialize PTC:

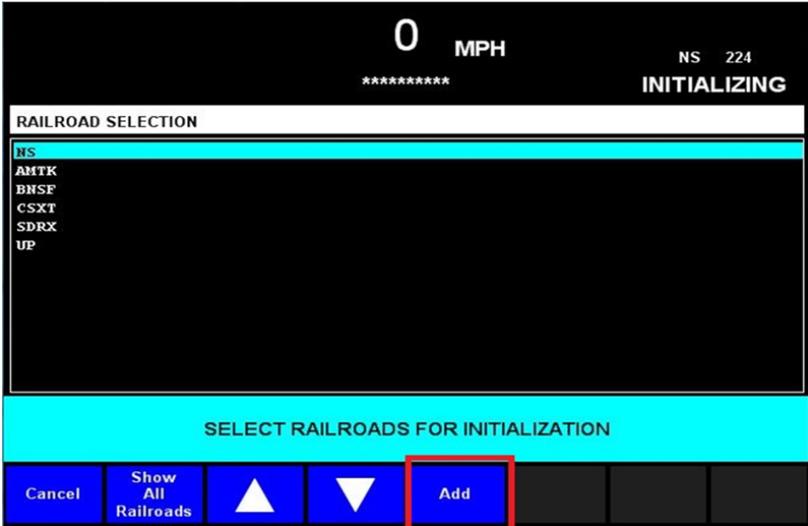
- Press the “INIT” Key.



- Press the “YES” Key.

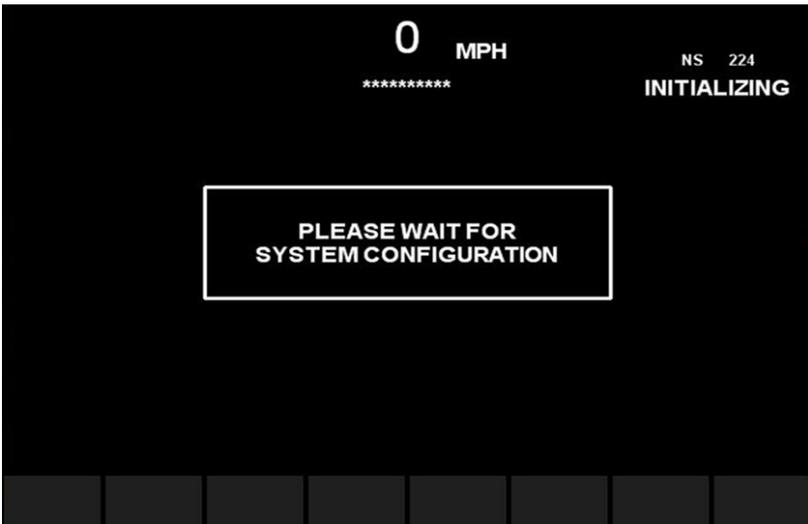


- Highlight and **“Add”** the Railroad that you will be running on, then press **“Submit”**

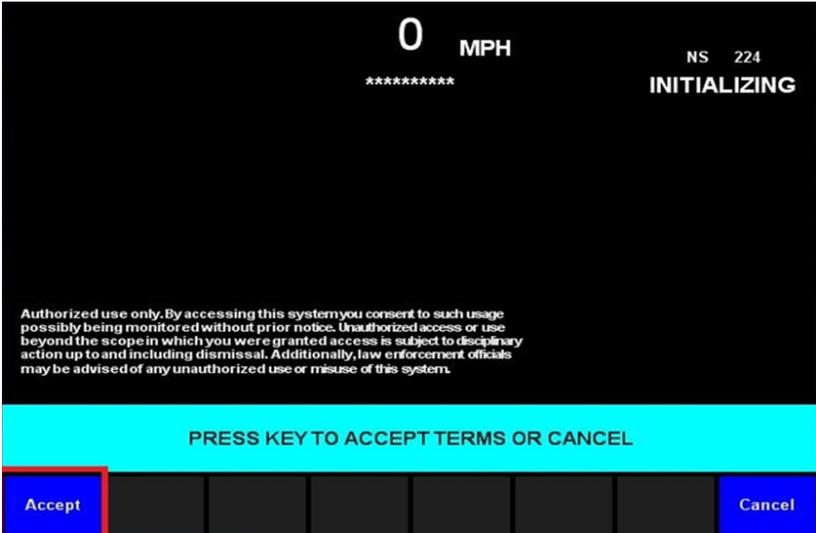


PTC INIT

- System will gather updated information at this time. This can take a few minutes.



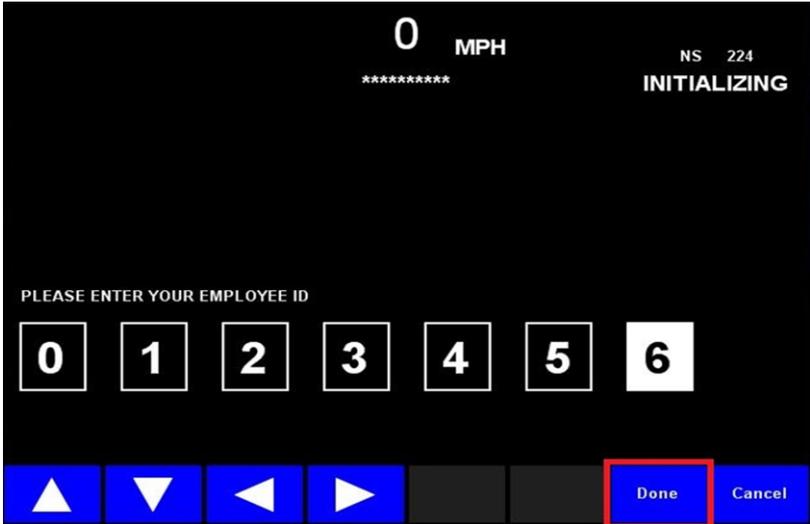
- Press the “Accept” Key.



- Highlight and “Select” the Railroad you work for, the press “Submit”

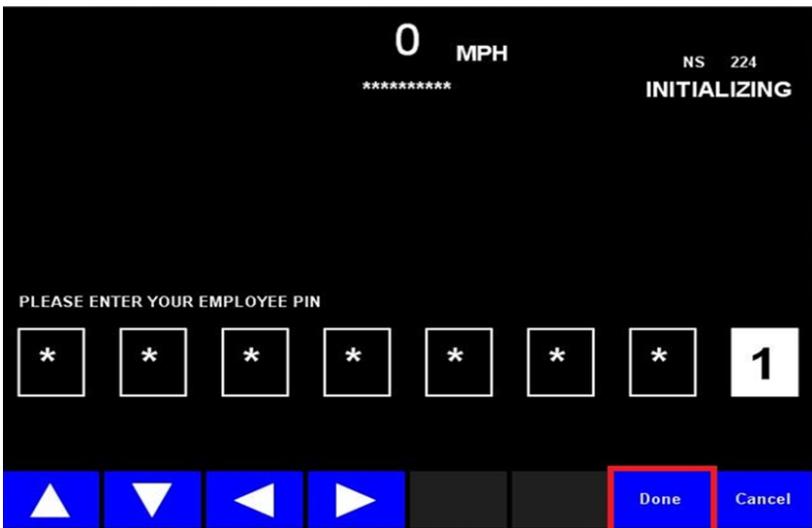


- Enter your Employee ID with arrows provided, when complete press “Done”

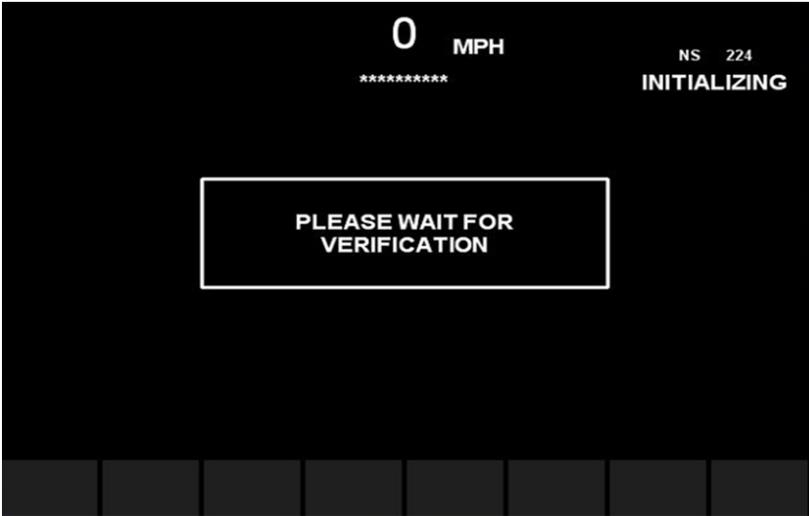


PTC INIT

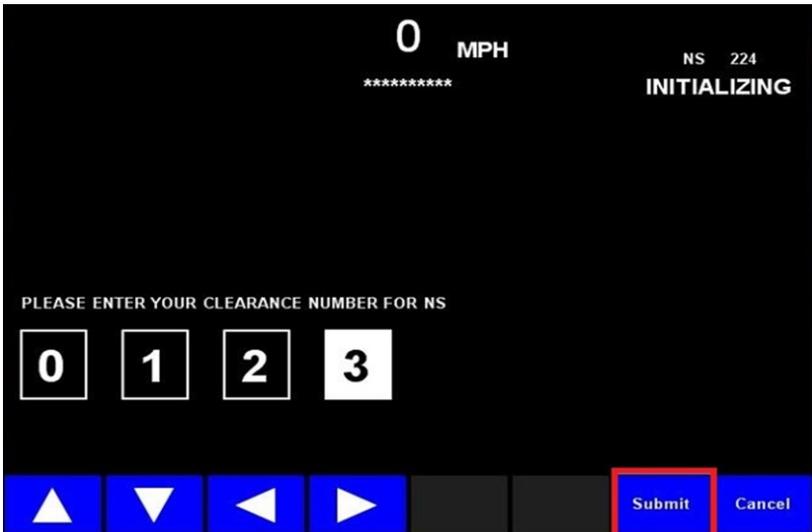
- Enter your Employee Pin with arrows provided, when complete press “Done”



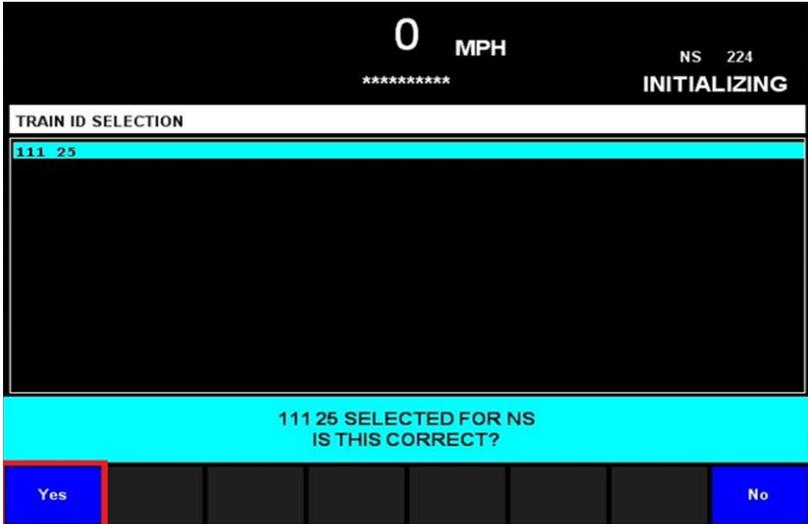
- The system will verify your credentials



- Enter your Train Clearance Number and Press **“Submit”**. *Note: Relief crews must use Train Clearance for train they are boarding.*

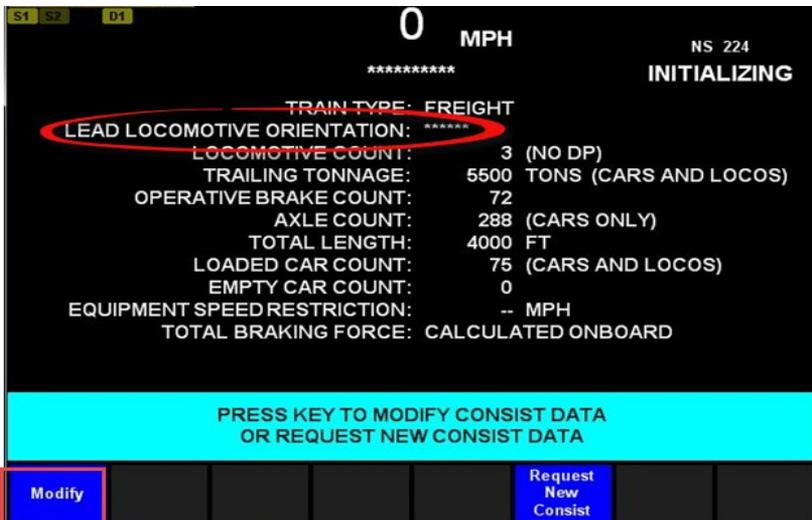


- System will search for Train ID. Highlighted the correct Train ID and Press the “Yes” key.



PTC INIT

- When the consist data screen is displayed, the LEAD Locomotive Orientation will not be selected due to the incomplete data, the option to “Accept” will not be display. Must select “Modify” and enter correct orientation.



- After selecting “Modify”, select “Locos”

0 MPH  
NS 224  
\*\*\*\*\*  
INITIALIZING

TRAIN TYPE: FREIGHT  
LEAD LOCOMOTIVE ORIENTATION: \*\*\*\*\*

LOCOMOTIVE COUNT:	3 (NO DP)
TRAILING TONNAGE:	5500 TONS (CARS AND LOCOS)
OPERATIVE BRAKE COUNT:	72
AXLE COUNT:	288 (CARS ONLY)
TOTAL LENGTH:	4000 FT
LOADED CAR COUNT:	75 (CARS AND LOCOS)
EMPTY CAR COUNT:	0
EQUIPMENT SPEED RESTRICTION:	-- MPH
TOTAL BRAKING FORCE:	CALCULATED ONBOARD

PRESS ACCEPT KEY TO MAKE CHANGES EFFECTIVE

Train Type	Locos	Weight	Operative Brakes	Length	Car / Axle Counts	Eqp-Spd Restrict
------------	-------	--------	------------------	--------	-------------------	------------------

- Indicate the Lead Locomotive and select “Modify Loco” as you would when setting the operational status of a locomotive.

0 MPH  
NS 224  
\*\*\*\*\*  
INITIALIZING

LOCOMOTIVE	POSITION	STATUS	ORIENTATION
NS 224	1	RUN	UNKNOWN
NS 7116	2	RUN	
NS 6107	3	RUN	

Cancel Enter [Up] [Down] Modify Loco Add Loco

- System will search for Train ID. Highlighted the correct Train ID and Press the “Yes” key.



- The details of all locomotives in the consist will once again be displayed. After making any other necessary changes to the locomotive consist, review the orientation of the LEAD locomotive and the operational status of remaining for accuracy. Select “Enter”.

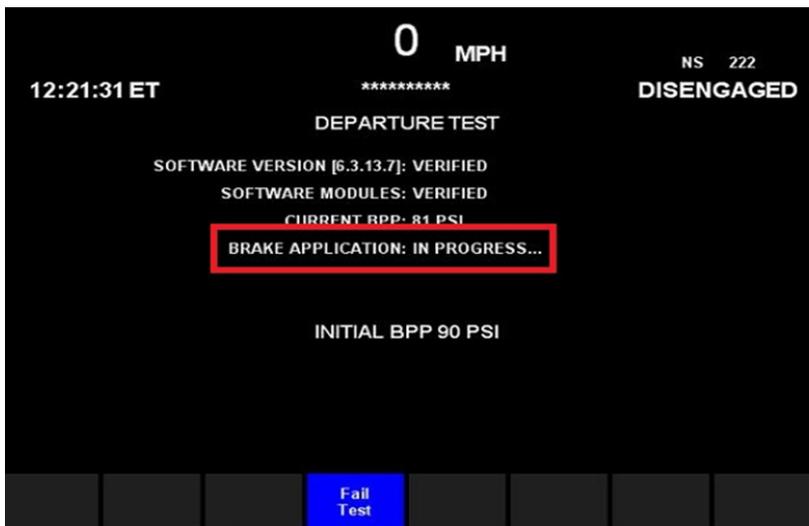


- The “Accept” key will now be available on the Train Consist Screen. Ensure the remainder of the details of the Train Consist are correct, make changes as necessary, and select “Accept”.

- A Departure test may be required at this point. Press “Begin Test” to start.



- Brake application will perform. Do Not press the fail test key.



- “Run Audible Test”. If you hear the alert “Pass Test” key. If you do not hear, press the “Fail Test” key.

0 MPH NS 222  
\*\*\*\*\*  
DISENGAGED

12:22:30 ET

DEPARTURE TEST

SOFTWARE VERSION [6.3.13.7]: VERIFIED  
SOFTWARE MODULES: VERIFIED  
CURRENT BPP: 85 PSI  
BRAKE APPLICATION: PASSED

BRAKE TEST SUCCESSFULLY COMPLETED

PLEASE VERIFY WHETHER YOU HEARD THE AUDIBLE ALERT

Fail Test Re-run Audible Test Pass Test

PTC INIT

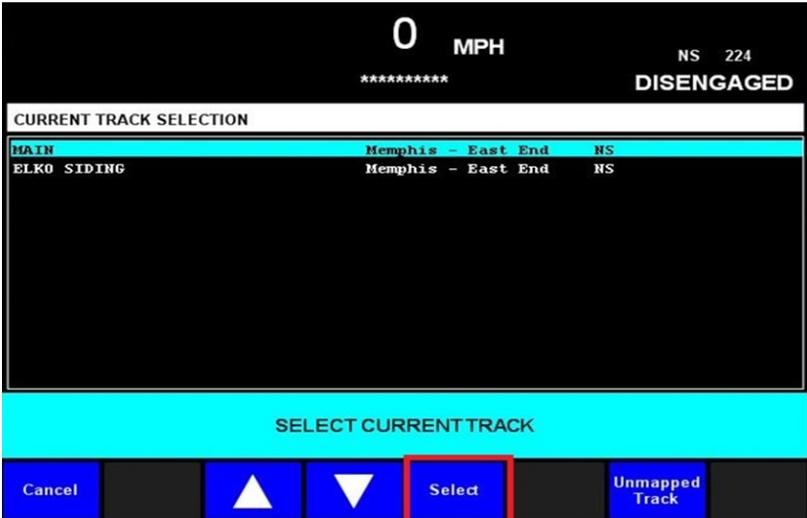
0 MPH NS 224  
\*\*\*\*\*  
INITIALIZING

TRAIN TYPE: FREIGHT  
LEAD LOCOMOTIVE ORIENTATION: FRONT  
LOCOMOTIVE COUNT: 1 (NO DP)  
TRAILING TONNAGE: 1000 TONS (CARS AND LOCOS)  
OPERATIVE BRAKE COUNT: 106  
AXLE COUNT: 424 (CARS ONLY)  
TOTAL LENGTH: 1000 FT  
LOADED CAR COUNT: 101 (CARS AND LOCOS)  
EMPTY CAR COUNT: 10  
EQUIPMENT SPEED RESTRICTION: -- MPH  
TOTAL BRAKING FORCE: CALCULATED ONBOARD

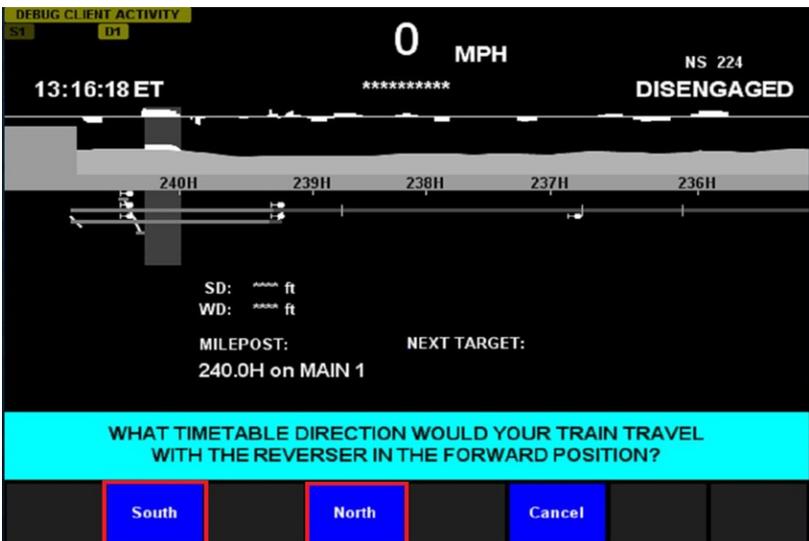
PRESS KEY TO MODIFY OR ACCEPT CONSIST DATA  
OR REQUEST NEW CONSIST DATA

Modify Request New Consist Accept

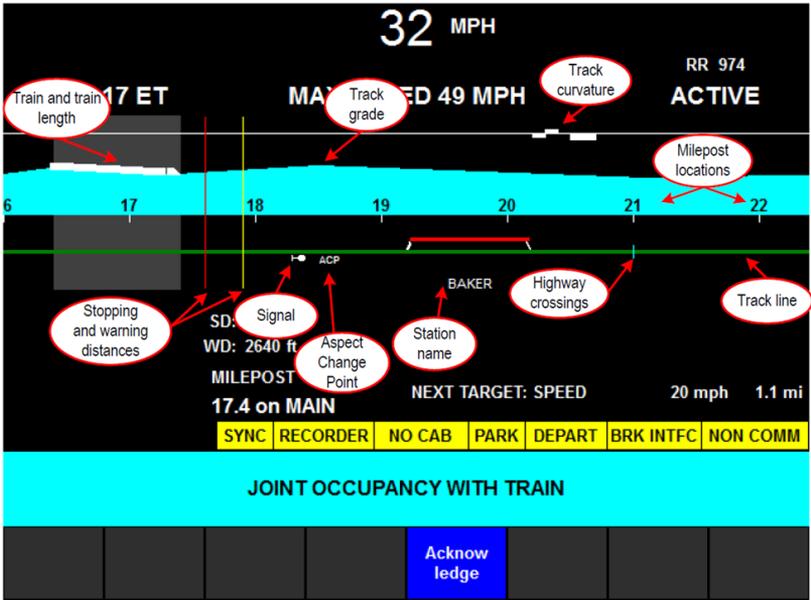
- “Select” your track, when your entire train is on the same track. Then verify selection by pressing “Yes” key.



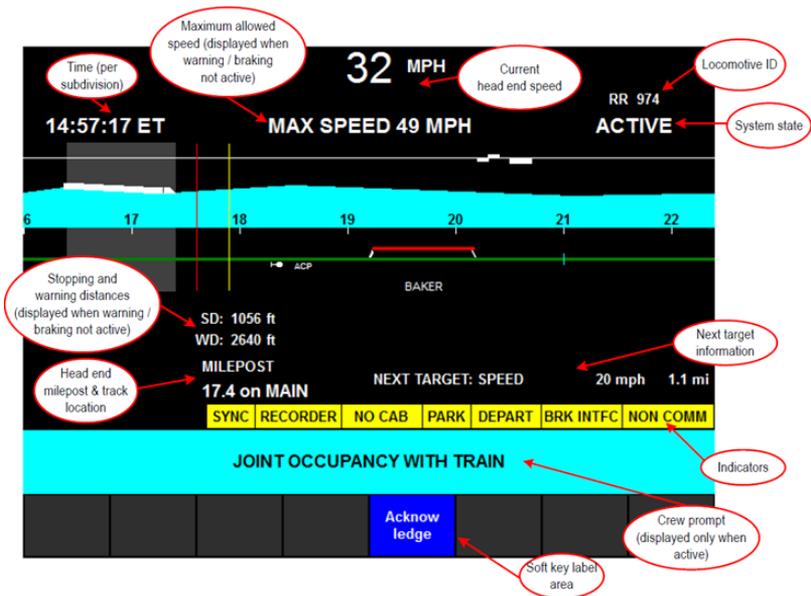
- Select your direction of travel. *Note: PTC will default to decreasing milepost direction.*



# PTC Screen Layout:

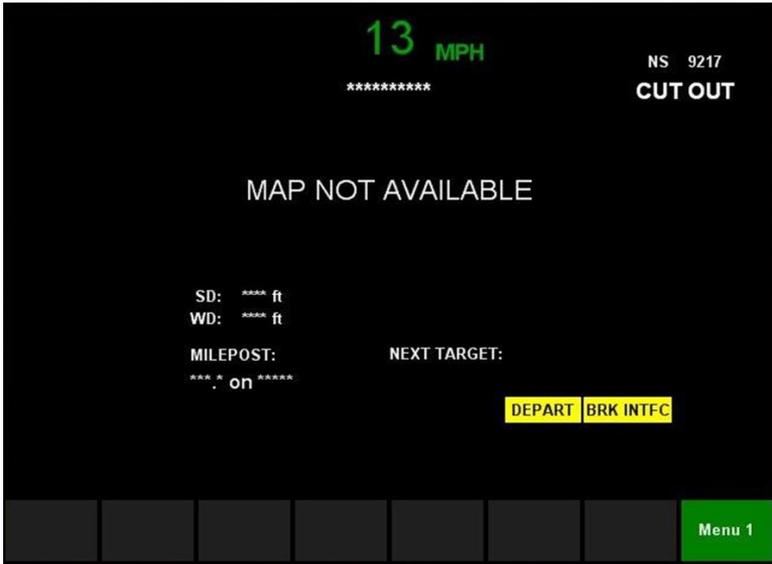


PTC INIT



## PTC Cut-In:

- If the yellow **BRK INTFC** icon is displayed on the PTC screen. The PTC switches must be Cut-In



- Flip the switches in box pictured to Cut-In



## PTC Supplement:

- To modify Locomotives, press “Locos” key on consist screen

0 MPH

RR 974

09:58:09 ET      MAX SPEED 49 MPH      ACTIVE

TRAIN TYPE: FREIGHT

LEAD LOCOMOTIVE ORIENTATION: FRONT

LOCOMOTIVE COUNT: 4 (DP: 103)

TRAILING TONNAGE: 12000 TONS (CARS ONLY)

OPERATIVE BRAKE COUNT: 100

AXLE COUNT: 400 (CARS ONLY)

TOTAL LENGTH: 6000 FT

LOADED CAR COUNT: 100 (CARS ONLY)

EMPTY CAR COUNT: 0

EQUIPMENT SPEED RESTRICTION: 50 MPH

TOTAL BRAKING FORCE: PROVIDED BY OFFICE

PRESS ACCEPT KEY TO MAKE CHANGES EFFECTIVE

Train Type	Locos	Weight	Operative Brakes	Length	Car / Axle Counts	Eqp-Spd Restrict	Accept
------------	-------	--------	------------------	--------	-------------------	------------------	--------

PTC INIT

- The locomotive position, count and orientation should always be checked before departure for accuracy

0 MPH

RR 974

09:58:09 ET      MAX SPEED 49 MPH      ACTIVE

LOCOMOTIVE	POSITION	STATUS	ORIENTATION
RR 974	1	RUN	FRONT
RR 4321	2	ISOLATE	
RR 2143	105	RUN	

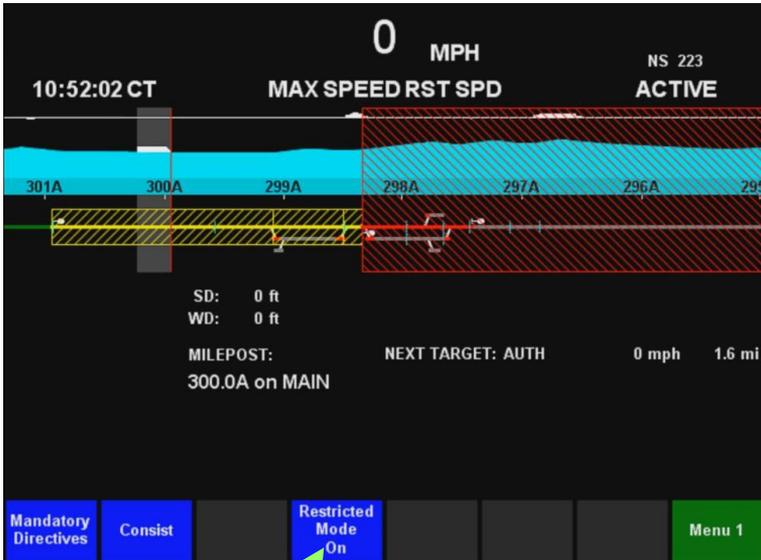
Cancel	Enter		▲	▼	Modify Loco	Add Loco	
--------	-------	--	---	---	-------------	----------	--

## PTC Restricted Mode

- Restricted Mode (ref. Rule 418) is made available to permit trains to perform work events such as:
  - ◇ Work Events
  - ◇ Pick-Ups/Set-Outs
  - ◇ Return Movements
- Restricted Mode is to be used when the train's rear end will remain stationary when performing work events
- When Restricted Mode is in use it is no longer necessary to cut out the PTC system to perform work events
- With this rule addition, Operating Rule 406 "PTC Cut Out" is being revised to remove the exception that allows a Soft Cut Out of the PTC System temporarily to perform switching activities, as *Restricted Mode* should now be used to perform switching activities.
- When an Active PTC train stops for any reason the Restricted Mode soft key will appear

## PTC Restricted Mode

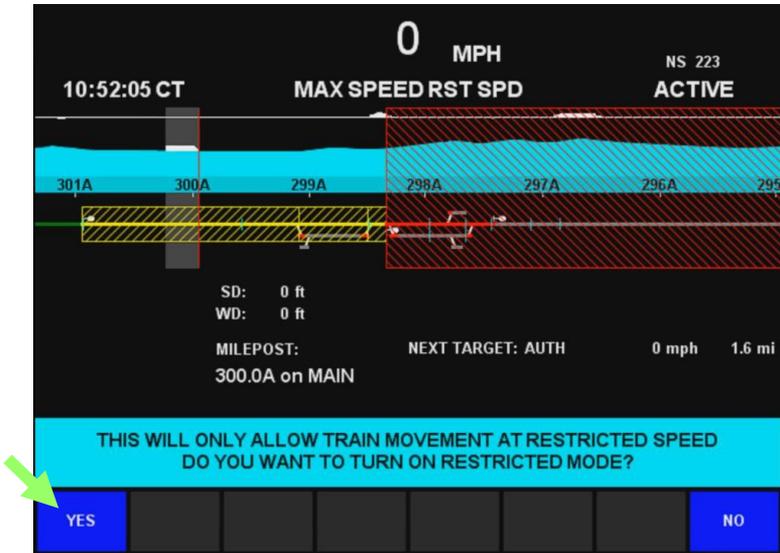
- Selecting Restricted Mode will allow you to perform work events with the train's movement authority such as switching, recoupling within the train, and industry work.



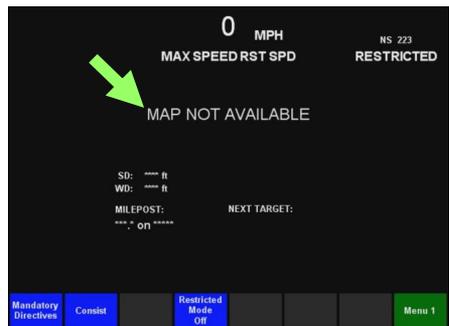
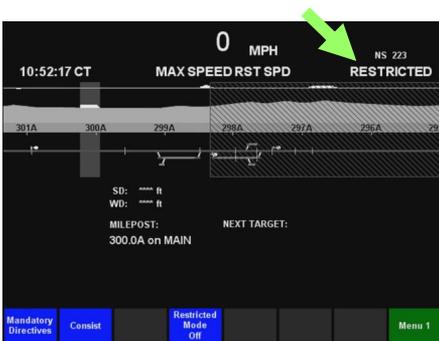
- When selecting Restricted Mode **all movements must be made at Restricted Speed**. Exceeding this will result in enforcement

## PTC Restricted Mode

- While in Restricted Mode, an on screen banner will appear informing you to make all moves at restricted speed.
- Press 'Yes' to transition to Restricted Mode

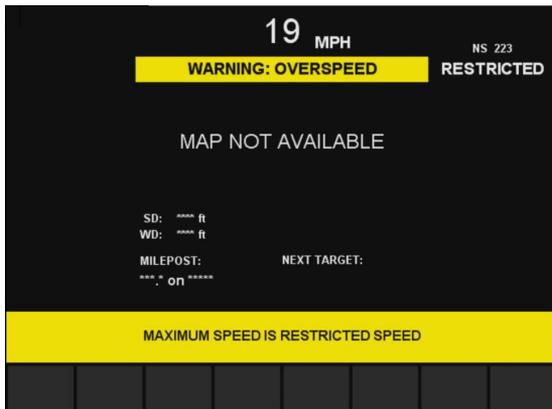


- After you've entered, Map will appear grayed out and then will display "MAP NOT AVAILABLE".



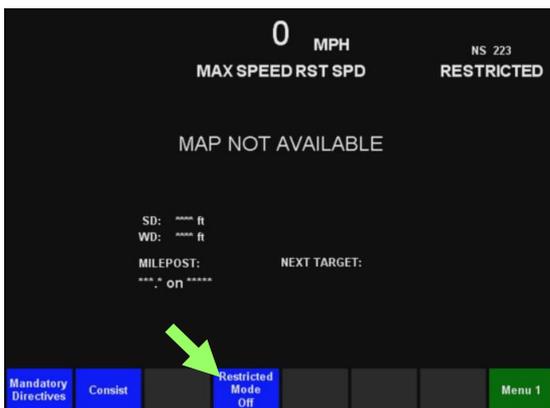
## PTC Restricted Mode

- Now you can perform switching operations at restricted speed because the system is in *Restricted Mode*. You can make forward and backwards movements, on and off of the main track, within the limits of the train's movement authority.
- Speed warnings will appear at 19mph and enforcement anytime speed exceeds 20mph



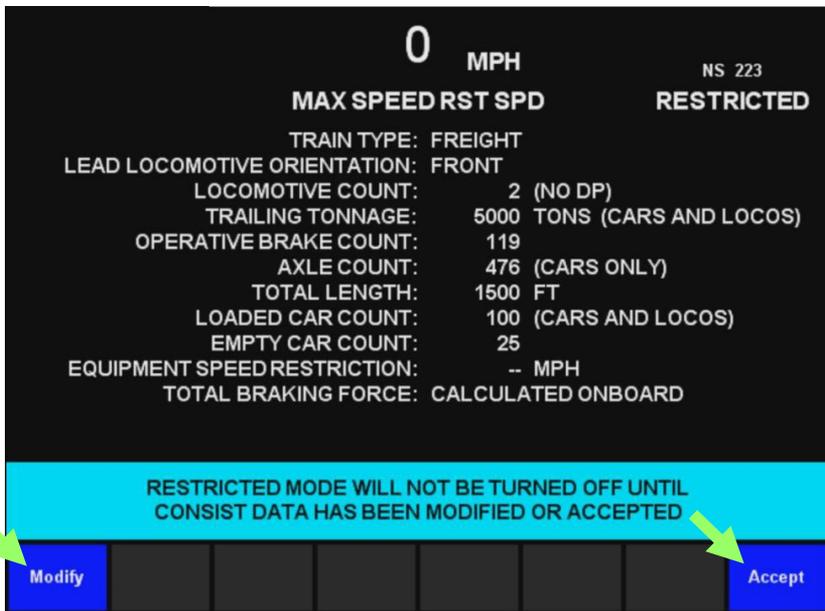
PTC Restricted Mode

- If Restricted Mode is no longer required you can exit while stopped by pressing 'Restricted Mode Off' key, then 'Yes' to Confirm



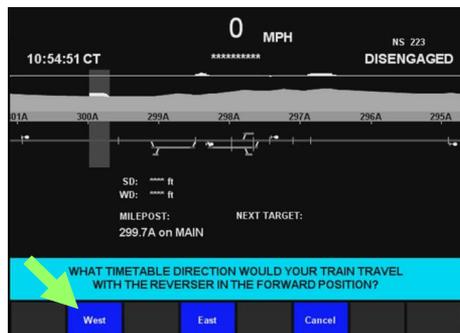
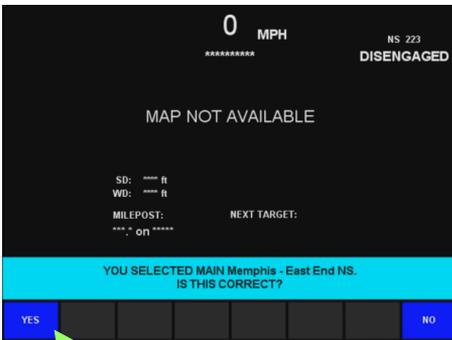
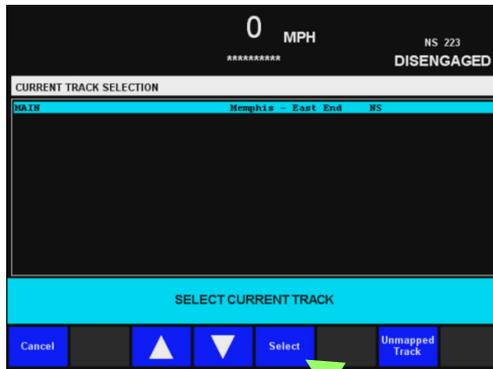
## PTC Restricted Mode

- Upon exiting *Restricted Mode* you need to verify your train consist.
- If you made changes while in *Restricted Mode*, press the “Modify” soft key and follow the on screen instructions to change your train consist.
- If you didn’t make any changes to your train consist, press the “Accept” soft key.
- This is an important step in ensuring PTC will accurately protect your train’s subsequent movement.



## PTC Restricted Mode

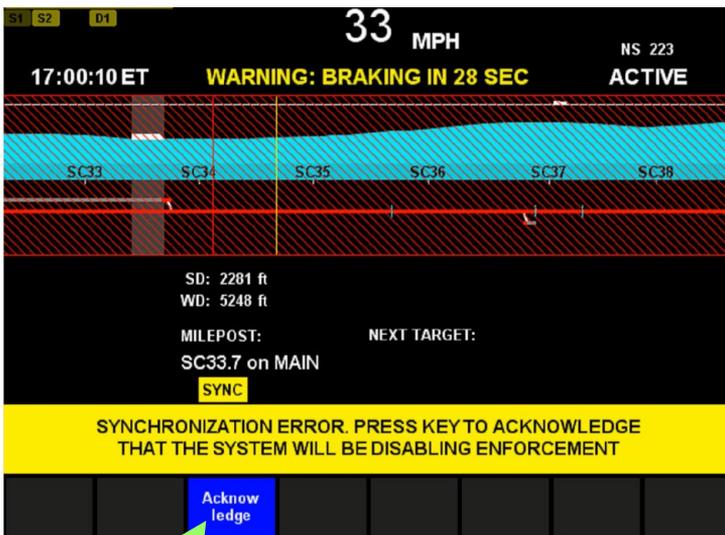
- After you complete your consist update, select and confirm the track that your train currently occupies
- Finally you must select your time table direction



PTC Restricted Mode

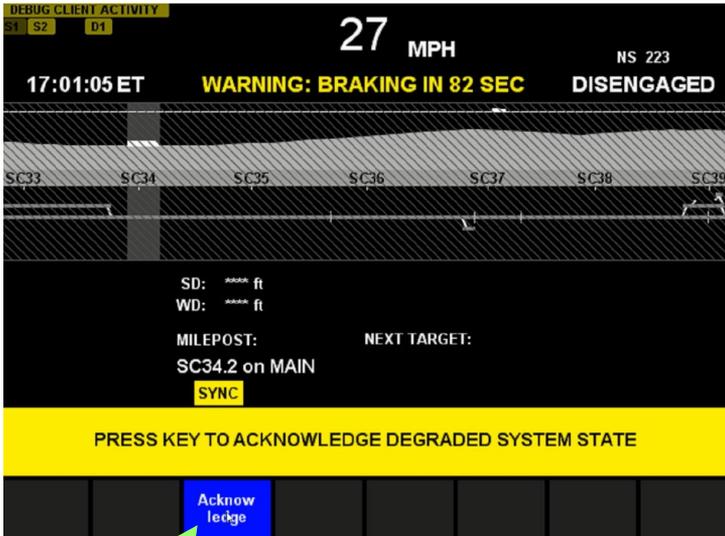
## PTC Degraded State

- The Degraded State screen will be displayed any time the system prompts the engineer for a transition to a disengaged state (other than a normal transition to disengaged for entry track or exiting PTC)
- When the system enters a degraded state, all PTC enforcement protections are suspended.
- The engineer must acknowledge that the train has entered a degraded state by pressing the blue acknowledge button within 120 seconds of entering the degraded state.
- Failing to acknowledge the degraded state will result in an enforcement.



## PTC Degraded State Example

If the system experienced a synchronization error, the synchronization error screen would appear. The engineer would need to press the acknowledge button within 30 seconds to acknowledge the synchronization error. Failure to acknowledge the synchronization error within 30 seconds will result in an enforcement.



PTC Degraded State

After the engineer presses the acknowledge button for the synchronization Error, the degraded state screen will appear. When the degraded state screen appears, the engineer has 120 seconds to press the blue acknowledge button. Failure to press the acknowledge button will result in an enforcement.

When operating in a degraded state, PTC protections are suspended.

## PTC Supplement:

- Consist modifications may be necessary for some trains with a prompt of “Press key to Modify Consist Data or Request New Consist Data”

The screenshot displays a black background with white text. At the top center, it shows '0 MPH'. To the right, it says 'RR 974' and 'INITIALIZING'. Below this, a line of asterisks '\*\*\*\*\*' is centered. The main data is as follows:

TRAIN TYPE:	FREIGHT
LEAD LOCOMOTIVE ORIENTATION:	FRONT
LOCOMOTIVE COUNT:	2 (NO DP)
TRAILING TONNAGE:	12000 TONS (CARS ONLY)
OPERATIVE BRAKE COUNT:	*****
AXLE COUNT:	***** (CARS ONLY)
TOTAL LENGTH:	6000 FT
LOADED CAR COUNT:	100 (CARS ONLY)
EMPTY CAR COUNT:	0
EQUIPMENT SPEED RESTRICTION:	- MPH
TOTAL BRAKING FORCE:	PROVIDED BY OFFICE

Below the data is a cyan bar with the text: 'PRESS KEY TO MODIFY CONSIST DATA OR REQUEST NEW CONSIST DATA'. At the bottom, there is a row of buttons: a blue 'Modify' button, followed by three grey buttons, and a blue 'Request New Consist' button.

- Invalid information is denoted by “\*\*\*\*\*” seen below
- The operator will need to select the “Modify” key, makes changes and then select the “Accept” key.

# HPT - Horsepower Per Ton



# HPT

HPT - Horsepower Per Ton or Engines Online instruction has traditionally been viewed from Train Clearance Items

- HPT moving to Wheel Report in 'HPT Locomotive Instruction' Page
- Will Specifically state Locomotives in Consist to RUN or ISO
- If work is performed follow RUN instructions for tonnage change (seen in column on right)

```
TRAIN: 174G207          PRINTED 02/07/19 01:11PM EST          PAGE 0002 OF 0006
```

---

```
***          HPT LOCOMOTIVE INSTRUCTION          ***
              TRAIN ID          174 07
```

	NS	008316	RUN	
	NS	006931	ISO	
	NS	006918	ISO	

---

LOCATION				IF IN ROUTE WORK PERFORMED
244H	NS	008316	RUN	RUN
	NS	006931	ISO	RUN IF > 04000
	NS	006918	ISO	RUN IF > 08000
Toledo	NS	008316	RUN	RUN
	NS	006931	ISO	RUN IF > 10850
	NS	006918	ISO	RUN IF > 21700

---

- If there is a mismatch with Locomotive consist, simply follow standard L-238 guidelines for Engines Online
- HPT does not change the requirements of L-238 to utilize Energy Management systems such as LEADER and Trip Optimizer

# TPOB - Tons per Operative Brake

TPOB

- Tons Per Operative Brake (TPOB) - function of Tonnage and Operative Brakes to determine maximum authorized speeds for Freight trains
- TPOB thresholds have been set to determine the maximum authorized speeds for freight trains
- Timetable speeds are being revised (refer to active bulletins) for freight trains at/above and below TPOB threshold.
  - ⇒ TPOB Less than threshold = 60 MPH
  - ⇒ TPOB Greater than or equal to the threshold = 50 mph
- Speed Restrictions based on HTUA, Key Trains, or Equipment Restrictions are NOT superseded by TPOB based Speeds
- Higher Speeds based on TPOB do not change the requirements of L-238 to utilize Energy Management systems such as LEADER and Trip Optimizer
- Contact OSS when making pickups and setouts and if there is doubt about accuracy of a train's consist and/or the TPOB value
- Intermodal train speeds are listed separately on most timetable districts and are not affected by this change
- Light locomotive consists of two or more units operate as trains and are not governed by TPOB based speeds
- Trains that originate on foreign lines must obtain a NS Wheel Report so that the TPOB value and car movement restrictions will be provided

# Reference Wheel Report for Train's TPOB Value

TRAIN: 172A818

PRINTED 12/18/18 06:16PM CST

PAGE 0001 OF 0007

NORFOLK SOUTHERN

>>>> THIS TRAIN CONSIST HAS A TPOB VALUE OF 83 . REFER TO TIMETABLE <<<<  
AND/OR OPERATIONS BULLETIN FOR MAXIMUM AUTHORIZED TRAIN SPEED.  
WHEN MAKING PICK-UPS AND SET-OUTS, ADDITIONAL CALCULATIONS MUST BE  
MADE TO DETERMINE TPOB.

>>>> TRAIN CONSIST CONTAINS 03 CARS WITH EOCC DRAFT GEAR, OF WHICH 03 <<<<  
ARE MULTI-LEVELS. REFERENCE TONNAGE PROFILE. ADJUST TRAIN  
HANDLING ACCORDINGLY AND BE GOVERNED BY SP-1 AND SP-3.

THIS TRAIN CONTAINS THE FOLLOWING HAZARDOUS MATERIALS CARS:

\*\*\*\*\*

- The value stated above is '83' - use this value when determining TPOB based speeds

## Train 172A818

	LOADS	EMPTIES	NET TONS	LT WT	GROSS TONS	LENGTH	AXLES	BRAKES
TRAIN TOTALS:	006	002	00353	00315	00669	00625	0032	0008
AHEAD RADIO :	000	000	00000	00000	00000	00000	0000	0000

POWERED UNITS INCLUDED IN LENGTH TOTAL ONLY

- The TPOB should always be on the Wheel Report - Or if any doubt contact OSS - As information, this is how TPOB is calculated:

TPOB

**Train Totals:**      **LOADS – 6**                      **EMPTIES – 2**  
                                 **NET TONS – 353**      **LT WT – 315**  
                                 **GROSS TONS – 669**  
                                 **LENGTH – 625**              **AXLES – 32**  
                                 **BRAKES – 8**

**669 Tons / 8 Operative Brakes = 83 TPOB**  
 (use whole number only, do not round)

## Reference Operations Bulletin for Revised Timetable Speeds

<b>2. MAXIMUM SPEEDS</b>				
<b>Between</b>	Passenger	Rhwy.	Freight TPOB less than 105	Freight TPOB greater than or equal to 105
	MPH			
MP NO 0.4, Meridian, and MP NO 195.6, Oliver Yard <i>Except:</i> MP NO 0.4 to MP NO 0.6, Curves	79	60	60	50
MP NO 0.5 to MP NO 3.2, No. 1 Scale Track, No. 1 Train Yard	15	15	15	15
MP NO 0.6 to MP NO 2.3	30	30	30	30
MP NO 6.6 to MP NO 6.9, Curves	65	60	55	50
MP NO 9.6 to MP NO 9.9, Curve	65	60	60	50
MP NO 10.2 to MP NO 11.1, Curves	65	60	60	50
MP NO 11.2 to MP NO 12.2, Curves	60	60	50	50
MP NO 13.2 to MP NO 14.1, Curves	70	60	60	50
MP NO 15.9 to MP NO 16.2, Curve	70	60	60	50
MP NO 18.9 to MP NO 19.2, Curve	70	60	60	50
MP NO 19.9 to MP NO 20.8, Curves	45	45	45	45
MP NO 21.0 to MP NO 21.7, Curves	60	60	60	50

- Note Freight TPOB less than 105 column - allows use of 60 mph maximum authorized speed
- Note Freight TPOB greater than or equal to 105 column - allows use of 50 mph maximum authorized speed
- Reference Wheel Report for TPOB value - if any doubt exists in this TPOB value, or work has been performed, contact OSS
- ‘105’ is a sample TPOB number for this district and this number may be adjusted. Ensure compliance with TPOB Operations Bulletins
- Division Operations Bulletins are being issued in Summer 2019 to implement a system TPOB value of 120.

# EMD SmartConsist

EMD SC

## SmartConsist Overview

SmartConsist works with the lead unit and one or two online trailing locomotives

- At the initial point of origin the Engineer needs to determine if the lead unit is equipped

**All NS AC traction EMDs are being equipped. The current unit types are SD70ACE, SD70ACU, and SD70ACC**

**Additionally, many UP EMDs are so equipped**

- On all equipped units, a 'Smart Consist' key will be displayed on the FIRE screen
- When accelerating, SmartConsist is active at speeds > 12.5 mph
- When decelerating, SmartConsist is inactive at speeds < 9.5 mph
- SmartConsist works with any trailing locomotives
- SmartConsist is compatible with Distributed Power (DP). Only enter units in the lead set. Do not enter remote locomotives

## SmartConsist Display

Any Integrated-EM trip should Auto-Initialize SmartConsist Automatically if so equipped.

Smart Consist will now display on the main FIRE screen. The current throttle notch by Unit (U) will be displayed 0-8. If in Dynamic (B) will be displayed.

NOTE: If unit is isolated, select the 'None or Isolated' option

The screenshot shows the SmartConsist interface with the following data:

- Location/ID:** 12 Mi, EMDX 107
- Date/Time:** AUG 28, 2016, 12:25 PM CDT
- Speed:** 0.0 MPH
- Throttle:** Idle
- Consist Effort:** 0 kLb
- Tractive Effort:** 0 kLb
- Unit Status:**
  - Unit 2: C44AC
  - Unit 3: None or Isolated
  - Unit 4: None or Isolated
  - Unit 5: SD70ACe
- Smart Consist Status:** ON
- Warning:** CS INOPERATIVE

Control buttons at the bottom include Setup, Enable, Disable, Manual Isolate, and Exit.

EMD SC

For assistance and to report PTC or Energy Management issues, contact the PTC/EM Help Desk:

Radio: Tone 1-3-0  
**(404) 582-3524**

For assistance and to report Mechanical/ Distributed Power Issues, contact MOC:

Radio: Tone 1-2-3  
**(404) 877-9585**

For assistance with TPOB/HPT/ Distributed Power Operation (Non-Mechanical) Issues, contact Centralized RFE:

Radio: Tone 1-1-7  
Northern: **(404) 877-9977**  
Central: **(404) 877-9978**  
Southern: **(404) 877-9979**

