Distributed Power Quick Reference

PB-24003 03/12

CONVENTIONAL LOCOMOTIVE SET-UP

Distributed Power is essentially two or more conventional locomotive consists configured to communicate with each other by means of radio and brake pipe air signals. Prior to beginning the DP linking process, it is essential the locomotive consists have been properly set-up and tested as conventional consists:

- Each consist must have one DP equipped locomotive set up as a controlling (i.e. lead) locomotive.
- Controlling locomotives must have:
  - Air brake controls set to Lead/Cut-in
  - Equalizing Reservoir Feed Valve set @ 90 psi.
  - No active Air Brake Computer faults.
- Trailing locomotives may be MU'd to the controlling locomotive in each consist.
- Each consist requires a Locomotive Consist Air Test and Load Test as separate, individual consists.
- After conventional setup and tests are complete, a Brake Pipe (trainline) connection must be established between the locomotive consists prior to DP linking.
  - Do not connect MU hoses and jumper cables between consists.
- Controlling locomotives (lead and remote) must be running for DP set-up. Override auto stop if needed.

LINK SELECTIBILITY

- UP locomotives are equipped to link with foreign-line locomotives, operating as lead or remote, owned by: CSX, KCS, FXE, CPR, NS, CN, and BNSF. Foreign-line locomotives may exhibit *minor* set-up and operational differences from UP locomotives due to optional DP software features specified by the owning railroad. Specific differences are noted in the relevant sections of this guide.

DP SET-UP ON CONTROLLING REMOTE(S)

The following set-up must be completed on controlling remote(s) before linking from lead locomotive:

- Ensure independent brake is fully applied.
- Confirm air brake controls are set to lead/cut-in.
- Ensure reverser handle is removed.
- Make sure Gen Field switch is set to Off.
- Ensure Dyn Brake, Control, Fuel Pump are set to On.
- Set Isolation Switch on back wall to Run.
- Turn on DP Circuit Breaker(s) on back wall.
  - Breaker(s) may be labeled as Data Radio, Dist Pwr, DP 1 or DP 2, DP Radio, etc. depending on locomotive type. *No breaker on SD70ACe.*
- Zero out EOT setting (may require entering 00001).
- Ensure that Cab Signals are cut-out.
  - Depending on locomotive type, switches are located in engineer's screen or the engine nose.
  - Back wall Cab Signal breaker must remain on.
- On engineer's Primary Display screen, press DIST POWER soft key, then press REMOTE SET-UP.
- Enter LEAD locomotive number using soft keys.
- Press the Same/Opposite Direction soft key to set the direction that this engine is facing compared to the lead engine. **Caution: Do not bypass this step.**
- Press DONE or ACCEPT soft key.
- Remote brake valve will cut out within 1 min.
- Place Automatic Brake to Handle Off and Independent Brake to Release. Insert keeper pin in automatic brake handle if equipped.
- Place trailing headlight on dim if rear engine.
- Pull in mirrors and close windows/doors.
- Lock engineer's seat so it does not swivel.
- Release hand brakes on all engines in remote consist.

LEAD ENGINE DISPLAY SCREEN SET-UP

The standard method of engineer's display screen configuration for a Lead locomotive in DP service is:

- One of the engineer's screens displays gauges, speed indicator and an inset DP Main menu; this is called the Primary screen.
- The other screen displays a full size DP Control screen; this is called the Secondary screen.

The user can determine which engineer screen will function as the primary display. The method of screen set-up is determined by locomotive type:

- C45ACCTE & SD70ACe: Default setting is Primary screen on right display. Screen Controls key may be used to modify this default setting if desired.
- C44AC and C44ACCTE: The screen chosen by user to access DP Set-up Menu defaults as the Primary screen. After linking, press DIST PWR key to access DP Control screen on Secondary display.
- SD9043AC: Functions the same as C44AC except screen display selector switch must be set to "both."
- To view the DP Control screen and gauges on a single screen, press DP Combined / DP Operation key from DP Main menu on Primary screen.
- Information in this guide details screens set-up in the standard primary /secondary screen configuration.

LEAD LOCOMOTIVE SET-UP & LINKING

- Ensure lead locomotive is set-up as follows:
  - Air Brake Controls set to Lead/Cut in.
  - Independent Brake fully applied.
- Turn on DP Circuit Breaker(s) on back wall (may be labeled as Data Radio, Dist Pwr, DP1, DP2, etc.). *No breaker on SD70ACe.*
- On engineer's Primary Screen, press Distributed Power soft key, then press LEAD SET-UP key.
- Enter Controlling Remote Locomotive road number:
  - If remote is a UP, enter the 4 digit road number.
  - If the remote is a foreign line, the railroad prefix code must be changed from the UP default to the desired railroad using up and down soft keys prior to entering the 4 digit road number.
  - If the remote has a road number with only 3 numbers, use zero as the first digit.
- Press LINK soft key. System will display "Linked OK" when radio communication is established.
- System will prompt entering of another controlling remote unit. Repeat the above process if an additional remote consist is present.
- Press the DONE or ACCEPT key when all consists have been entered and radio linked.
- Select FTE or CTE operating mode as applicable and execute. *See FTE/CTE Applications in this guide.
- Follow on screen prompts to recover air. Do not attempt release until GO TO RELEASE is displayed.
- Press DIST POWER key on Secondary Screen to activate DP Control Screen.
- DP Control Screen will indicate the air flow on all consists. When flow displays less than 20 CFM on all consists or has been stabilized for 90 seconds, press BP TEST key and Execute from System Menu.
- Apply Minimum Service when prompted.
- System will display "BP Test OK" when complete.
  - If test fails: release air, recharge train and attempt test again. Most BP Test failures are due to air flow not being fully stabilized.
- From DP Main Menu on Primary Display, select MODE key, press RUN and Execute.
- Ensure back wall isolation switch is also set to run.

UNLINKING LEAD LOCOMOTIVE

DP locomotives must be unlinked when a DP train is terminated or when a change is made to the lead locomotive or controlling remote.

- Unlink lead engine first before moving to remote.
- Place throttle in idle, and center the reverser.
- Ensure Independent Brake is fully applied.
- On Primary Screen, press the System key.
- Press UNLINK key and Execute.
- Automatic Brake will apply at a service rate, pause at 15 PSI, and after about 2 minutes will reduce to zero.
  - Wait for Equalizing Reservoir to reach zero. Do not switch any breakers or move brake handle.
- Press the DP Main Menu on Primary Screen when Equalizing Reservoir reaches zero, then press END DIST POWER.
- Turn off DP Circuit Breaker(s) on back wall.
- Follow on-screen prompts to recover air prior to conventional operation.

UNLINKING REMOTE

- System must be unlinked from lead engine first.
- Place the Independent Brake in full application.
- On Primary screen, press END DP and Execute.
- Turn off DP circuit breaker(s) on back wall.
- Follow screen prompts to cut-in and recover air.

BRAKE PIPE COMMUNICATION TEST

- A BP Test will be required when:
  - A DP train is initially made up.
  - Any time cars are added between the lead locomotive consist and any remote consist.
- BP Test is accessed from the System Screen when the train is stopped, independent brake is applied and automatic brake is in release position.
- See Lead Engine Set-Up section of this guide for information on how to perform a BP Test.

DP AUTOMATED LEAKAGE TEST

Use the DP Automated Leakage Test when performing air tests requiring brake pipe leakage to be measured.

- DO NOT use air flow to determine leakage on DP trains. Air flow is an unreliable indicator of leakage in DP applications due to the multiple air sources.
- Press System key on Primary Screen to access DP Leakage Test, then press LEAKAGE key & execute.
- System will automatically make a 20 lb set, cut-out locomotive brake valves, and calculate BP leakage.
- Test will take about 5 minutes to complete.
- Follow screen prompt when "Apply Full Service Reduction to End Test" message is displayed.
- Primary screen will display the amount of leakage when test is complete.
- Release when ready. This will cut-in Brake Valves.
- From DP Main Menu on Primary Screen, press MODE, then press RUN key and Execute.

SET-OUT FUNCTION

Use set-out function when the trainline is separated between lead and remote consists, including instances of unexpected train separation. Set-Out is the only way to prevent the entire train from going to emergency when a DP train is separated. If the train is already in emergency, comply with the first bullet below before recovering air. In all other instances, prior to train separation, make a 20 lb BP reduction and allow it to exhaust, then:

- Press Remote Menu key on the Secondary Display, then press SET-OUT key and Execute. The selected remote is highlighted on display. Repeat process if more than one remote consist is set-out.
- Verify "Set-Out" appears on the remote status line.
- Separate train. A red PCS indication should begin flashing above the remote display upon separation.
- Make switching moves as needed and recouple to train when finished. Do not open the angle cock.
- From Remote Screen on Secondary Display, press NORMAL key and Execute.
- Verify remote status line on display changes from "Set-Out" to "Normal."
- Automatic Brake handle on lead locomotive must be in release before angle cock is opened at coupling or entire train will go to emergency.
- Slowly open angle cock to rear portion of train. BV will cut-in on remote when a 3 lb increase is sensed.
  - 3 lb brake pipe increase must reach remote within 2 minutes of NORMAL key being pressed or train will go to emergency.

PERFORM A TRAIN CHECK

A train check is the only way to verify brake pipe continuity in between locomotive consists on a DP train, and must be performed on a stopped train. Perform the following to initiate a train check, except when relieved by *ABTH Rule 34.4*:

- As soon as train is stopped, make an automatic brake reduction of 10 lbs or greater and allow to equalize.
- Select System from DP Main Menu on Primary Screen, then press TRAIN CHECK and Execute.
- **Note:** An automatic brake reduction of at least 10 lbs must be made before TRAIN CHECK will display.
- Release brakes when ready to depart. "Train Check OK" message will display in less than one minute.
- If "Train Check Fail" message is displayed:
  - Repeat test with a deeper reduction.
  - Perform manual train check by selecting BV Out on remote screen, then press Normal, execute, and release automatic brake reduction.
  - If remote BV cuts in, this satisfies Train Check requirement.
  - If test fails 3 times, inspect train for closed angle cocks or brake pipe obstruction.
  - **Note:** Remote brake valve(s) may occasionally not cut-in after successful train check due to long train length and/or cold weather. See Normalize Remote procedure below to remedy.

NORMALIZE REMOTE

Remote functions IDLE, ISOLATE, BV OUT, SET-OUT will change the status of the remote to the selected function. Use the following procedure to return a remote to normal operation when any of the above are active:

- Make a brake pipe reduction of 10 lbs or greater.
- Using the Remote Menu on the Secondary Screen, press the NORMAL key and execute for desired consist that is in other-than-normal status.
- Release brakes. Remote will return to Normal.
- **Note (1):** Executing the Normal function will normalize all functions currently in effect.
- **Note (2):** BV Out, Isolate, and Set-Out functions cut-out brake valve on remote. Remote must sense a 3 lb. brake pipe increase in addition to Normal command to cut-in remote brake valve.
- **Note (3):** BP rise not required returning from IDLE.

RADIO COMMUNICATION INTERRUPTION

Brief interruption of radio communication (as indicated by an illuminated COMM light on DP screen) is a normal part of DP operation, and is most often caused by environmental interference.

- When communication interruption occurs, keep the train moving if possible, to a location where radio communication is restored.
- A moving train will normally pass through an area of communication interruption without incident due to a feature known as Last Command Hold.
  - Remote locomotive(s) will stay in the throttle position and maintain the brake pipe pressure last communicated for up to 90 minutes.
- If conditions require stopping or slowing the train while in communication loss, make a full service brake pipe reduction. This will disable LCH and command the remote(s) to Comm Loss Idle Down. The following occurs when CLID is active:
  - Remote(s) will not load in power.
  - Brake valve on remote(s) will cut-out.
  - Dynamic brake on remote(s) will be maintained at last command (except BNSF locomotives).
  - If it is necessary to idle a remote that is holding in dynamic brake during comm loss, stop and place the train in emergency.

  Note: Remote brake valve must be cut-in for LCH to function. If brake valve is cut-out, Comm Loss Idle Down will occur at every instance of radio communication interruption exceeding 20 seconds.
- To recover from an emergency application during radio communication interruption, recover the air on the lead locomotive as normal. After any required train inspection, with air flow below 60 CFM on lead consist, the train may be moved to a location where communication is restored.
  - Remote(s) will not load in power or charge the brake pipe. Remote engine brakes will respond to changes in train brake pipe pressure, similar to a freight car.
- When radio communication is restored after an emergency application or Comm Loss Idle Down, the remote will be in ISOLATE status. The engineer must normalize the remote to return to normal DP status. See Normalize Remote section of guide.

FTE/CTE APPLICATIONS

FTE and CTE are DP operating modes which determine the level of tractive effort produced by an AC-powered ***remote*** at low speeds.

FTE/CTE selection must be made on UP and CP lead locomotives immediately after radio linking, and cannot be changed without unlinking and re-linking the system. The two modes operate as follows:

- FTE (Full Tractive Effort) allows the remote to produce up to 100 percent of its potential tractive effort at low speeds (up to 180 klbs on a 12.1 EPA locomotive).
- CTE (Controlled Tractive Effort) limits the potential tractive effort of the remote to 110 klbs (or 11.0 EPA on a 12.1 EPA locomotive) at speeds below 13 mph.
  - CTE greatly reduces the probability of excessive in-train forces at low speeds.
  - Lead locomotive consist power output is not affected by CTE mode.
  - When speed is greater than 13 MPH, CTE-linked remote produces full tractive effort.
  - CTE does not cut-out traction motors; it uses electronic means to limit tractive effort at slow speeds, making it the best option when remote EPA reduction is required by SSI Item 5B and 5C.
  - Follow TCS paperwork instructions for proper linking mode of finished trains.
- Either FTE or CTE can be selected from any UP or Canadian Pacific locomotive equipped with DP when used as a lead locomotive.
- Controlling remote locomotives must be equipped with CTE software (UP and CP only) to operate in CTE mode. CTE equipped locomotives owned by UP can be identified by model type as follows:
  - GEC45AC are all CTE equipped.
  - GE C44AC, if CTE equipped, are designated with CTE as last 3 characters in the model number, e.g. C44ACCTE.
  - EMD SD70ACe *with DP* have CTE software.
  - EMD SD9043 are not CTE equipped.
- UP and CP locomotives that are MU'd to a controlling remote operating in CTE mode will operate in CTE if equipped with CTE software or in FTE if not equipped.
  - CTE Error message while linking indicates that the controlling remote is not CTE equipped. Cut-out traction motor(s) on remote(s) to achieve EPA reduction.

ADD AN ENGINE TO REMOTE CONSIST

- To prevent the entire train from going to emergency when adding non controlling (trailing) locomotive(s) to an actively linked train, do not use Set-Out or BV-Out functions; leave the DP system linked in normal status. Open angle cocks on the locomotive being added first when making air connections.
  - Locomotive consist test can be performed on remote consist using the lead locomotive air brake controls while the remotes are observed from the ground *per ABTH rule 31.8.4.*

MANNED HELPER ADDED TO MID-TRAIN OR REAR OF DP TRAIN

- To prevent train emergency, do not use Set-Out or BV-Out; leave the system linked in normal status. After the manned helper is coupled to the train:
  - The helper engineer must make a 20 lb brake reduction, cut-out the automatic brake, move to handle off, leave the independent brake cut-in and applied.
  - Connect the trainline air hoses. Open the angle cock on the manned locomotive first and then open the angle cock on the locomotive or car.
  - The lead engineer must increase the brake reduction to 20 lbs and observe at least a 5 lb reduction at the rear of the train.
  - Release the brakes and observe at least a 5 lb increase at the rear of the train.