

OPERATING MANUAL

**DC EVOLUTION SERIES
DIESEL-ELECTRIC
LOCOMOTIVE**

ES44DC



***FOR BURLINGTON NORTHERN SANTA FE CORPORATION
ROAD NUMBERS:
7650 – 7799***

FOREWORD

NOTE: *The purpose of this manual is to act as a guide in the operation of this locomotive. For maintenance information, refer to the Locomotive **RUNNING MAINTENANCE** and **BACKSHOP** manuals.*

WELCOME to the GE DC Evolution Series Locomotive. This locomotive is equipped with Consolidated Control Architecture (CCA) and Locomotive System Integration (LSI) –an integrated control system which allows easy access to important operating information.

In an effort to maintain a consistency of terminology between this unit and the other General Electric units (as well as other manufacturer's units) in the fleet, the front of this unit will be called "short hood" (marked with an **F**) and the rear of this unit will be called "long hood".

This Operating Manual is arranged in sections: SUMMARY OF WARNINGS AND CAUTIONS, INTRODUCTION, OPERATING EQUIPMENT, AIR BRAKE EQUIPMENT, OTHER EQUIPMENT, SAFEGUARDS/ALERTS, OPERATION and LOCOMOTIVE OPERATION BY SDIS SCREEN.

The SUMMARY OF WARNINGS AND CAUTIONS Section lists safety-related conditions which require specific action. They are repeated in the text where needed. **Please read this section now, before proceeding to other sections of this Manual.**

The INTRODUCTION Section describes the CCA and Electronic Air Brake systems and gives a general overview of the locomotive. The OPERATING EQUIPMENT Section continues this overview by identifying the associated hardware located in the operating compartment of the nose cab. A brief description of the equipment is also included.

The AIR BRAKE EQUIPMENT and OTHER EQUIPMENT Sections list and explain the principal parts of the air brake system and control equipment found in Control Areas 1 through 9 (Figure 21).

The SAFEGUARDS/ALERTS Section lists, describes, and illustrates the various Alarms, Safeguards, Power Derations and Shutdown situations an operator may encounter.

The OPERATION Section gives step-by-step instructions for locomotive operation as well as listing various functions available for use. The OPERATION and LOCOMOTIVE OPERATION BY SDIS SCREEN Sections will guide the Operating Crew in operation of this locomotive.

Comments are appreciated. Please send any comments to your local GE representative or mail to:

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SUMMARY OF WARNINGS AND CAUTIONS

The following is a summary of safety precautions which must be observed when operating this General Electric Locomotive. WARNINGS indicate the potential for danger to personnel, and CAUTIONS indicate the potential for damage to the equipment. The Manual Section where the precaution is located is listed at the lower right-hand of the precaution. The precautions are repeated where applicable throughout the manual.

THESE INSTRUCTIONS DO NOT COVER ALL DETAILS OR VARIATIONS IN EQUIPMENT NOR PROVIDE FOR EVERY POSSIBLE CONTINGENCY TO BE MET IN CONNECTION WITH INSTALLATION, OPERATION, OR MAINTENANCE. SHOULD FURTHER INFORMATION BE DESIRED OR SHOULD PARTICULAR PROBLEMS ARISE WHICH ARE NOT COVERED SUFFICIENTLY FOR THE USER'S PURPOSES, THE MATTER SHOULD BE REFERRED TO GENERAL ELECTRIC COMPANY. ANY APPLICABLE FEDERAL, STATE OR LOCAL REGULATIONS OR COMPANY SAFETY OR OPERATING RULES MUST TAKE PRECEDENCE OVER ANY INSTRUCTIONS GIVEN IN THIS MATERIAL. PLEASE MAKE A NOTE OF ANY OF THESE RULES IN THE SPACE PROVIDED. GE HAS NO OBLIGATION TO KEEP THESE INSTRUCTIONS UP TO DATE AFTER THE ORIGINAL PUBLICATION. THERE ARE NO WARRANTIES OF ACCURACY, MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE.

CALIFORNIA Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

WARNINGS:

This locomotive is equipped with Auto Engine Start/Stop. The diesel engine may start without operator action. Exercise caution when working around the diesel engine, traction alternator, or Radiator Cab. Ensure that AESS is disabled before performing any maintenance on the locomotive. Failure to do so may result in death or serious personal injury.

OPERATING EQUIPMENT, OPERATION, AESS

Finding the Combined Power handle away from IDLE with the Reverser handle removed indicates that interlocking between handles requires repair or adjustment. Do not attempt to operate unit until condition has been repaired.

OPERATING EQUIPMENT

An illuminated indicator light does not guarantee that the hand brake is fully applied. The operator must verify that the hand brake is properly applied prior to leaving the locomotive unattended per Railroad Operating Procedures.

OPERATION

To ensure safe consist operation, follow specific Railroad Operating Procedure Precautions for setting up units for "Trail" or "Dead".

OPERATING EQUIPMENT, AIR BRAKE EQUIPMENT

Lethal voltages may be present on some circuits. Therefore, before entering the Auxiliary Cab, raise the Barrier Bar to the vertical position.

OTHER EQUIPMENT

The operator must verify that the hand brake is fully released on all locomotives prior to motoring per Railroad Operating Procedures.

OPERATION

WARNINGS: (Cont'd)

In an EMERGENCY situation, when operating as a single unit or part of a multi-unit consist (locomotives only), moving the INDEPENDENT Brake Handle to FULL APPLICATION is the fastest way to develop brake cylinder pressure on the unit/consist up to the full independent brake cylinder pressure setting. Immediately after moving the INDEPENDENT Handle, move the AUTOMATIC Handle into EMERGENCY. Failure to comply with this procedure during an EMERGENCY situation, COULD EXTEND THE STOPPING DISTANCE.

AIR BRAKE EQUIPMENT

*Following an EMERGENCY BRAKE application, if the train is not at rest, brake release **MUST NOT** be attempted. Any movement of the AUTOMATIC Brake Handle to RELEASE while train is moving may cause equipment damage and/or personal injury.*

AIR BRAKE EQUIPMENT, OPERATION, ELECTRONIC AIR BRAKE

Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 45 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

AIR BRAKE EQUIPMENT, OPERATION, ELECTRONIC AIR BRAKE

While servicing the air compressor, open Local Control Circuit Breaker (LCCB, Item 13, Figure 9) to prevent air compressor motor from starting. Motor driven air compressor has hot surfaces and may automatically operate at any time with diesel engine running. Do NOT service air compressor while hot and/or diesel engine running.

OPERATION

*Prior to train movement, Brake application/release and leakage tests **MUST BE** performed at the Railroad specified brake pipe pressure for the entire train. The brake pipe line is to be open throughout the train. Leakage observed and noted **MUST BE** within the specified permissible limit of five psi per minute. Once the acceptable leakage rate is obtained, **NO MANUAL ADJUSTMENTS** are to be made to alter the running brake pipe pressure setting while the train is at the terminal and standing still. Failure to comply with this procedure could result in the inability to control or stop the train.*

OPERATION

*If Locomotive battery power loss to the CCBII System occurs while train is in motion, a **FULL SERVICE** Brake application is automatically made at a **SERVICE** rate (BP drops below 13 psi). Operator may initiate an **EMERGENCY** Brake application from the **EMERGENCY BRAKE VALVE** located on the Crew Member's Desk.*

OPERATION, ELECTRONIC AIR BRAKE

Observe all established Railroad Operating Procedures safety precautions and follow the Electric Parking brake instructions carefully. Keep clear of active brake rigging. Severe personal injury and equipment damage may occur if the Electric Parking brake is inadvertently or improperly applied.

OPERATION

*Monitor the locomotive's direction of travel closely during Plug Loading. If the locomotive reaches zero speed and starts to drift in the opposite direction, immediately return the Combined Power handle to **IDLE**. Failure to do so may result in sustained motion in the wrong direction which could result in personal injury and/or equipment damage.*

SLOW SPEED CONTROL

CAUTIONS:

Before using the Battery Jog function verify that the main reservoir pressure is 60 psi (413 kPa) or more. Verify that the brakes apply and release.

OPERATING EQUIPMENT

During freezing weather, protect the engine cooling system according to Railroad Operating Procedures.

OTHER EQUIPMENT

CAUTIONS: (Cont'd)

Do not discharge the battery excessively by repeated attempts to start the engine. If the first two or three tries are unsuccessful, recheck the starting procedure.

OPERATION

When the locomotive is in an AESS shut down condition, certain actions will deactivate the AESS system and require a manual engine start. If this happens, either start the diesel engine manually or shut down the locomotive according to Railroad Operating Procedures and open the battery switch. This action is necessary to prevent draining the locomotive batteries. The following actions will deactivate the AESS system:

- *raising the barrier bar*
- *moving the locomotive using the Jog function or leaving the EC switch in the JOG position*
- *entering the diagnostic self-test mode*
- *pressing an Engine Stop switch while an AESS automatic shutdown is in process.*

AESS

To avoid wheel flats when hauling dead-in-train, drain main reservoir of unit to less than 25 psi (172 kPa).

OPERATION

In consists comprising units with Auto Engine Start/Stop (AESS), wait 240 seconds after moving the Reverser handle before moving the Combined Power handle. This pause allows units that may have been shut down by AESS to start the diesel engine. Failure to do so may result in alarms and faults and will prevent the consist from loading.

OPERATION

The control system of this locomotive will delay application of dynamic braking. If however, other locomotives in the consist do not have this feature, to prevent equipment damage when changing from power to dynamic braking or from dynamic braking to power, pause 10 seconds with the Combined Power_Handle at IDLE.

OPERATION

In sub-freezing weather conditions, ensure that the toilet is properly drained if the locomotive is shut down for an extended period of time. Failure to do so will result in frozen pipes and damage to the toilet.

OPERATION

After a locomotive engine has operated at full load, allow the engine to run at IDLE for at least five minutes before shutting down. Otherwise, immediate shutdown after such operation could be harmful to some engine components.

OPERATION

To avoid equipment damage, properly set up this locomotive when hauling dead-in-train.

OPERATION

The Electric Parking brake must be disabled prior to maintenance or using the manual Handbrake Wheel (located on the B-side of the Radiator Cab). When the brake is applied manually, spin the Handbrake wheel until the brake shoes are firmly seated on the wheels.

OPERATION

The locomotive will not have water freeze protection when the Maintenance Battery Switch is open. Follow all applicable Railroad Operating Procedures for operation in sub-freezing weather conditions. Failure to do so may result in severe engine damage.

OTHER EQUIPMENT

It is recommended that the traction motors only be manually cut out with the Engine Control switch in START or ISOLATE position (unit isolated) and the Combined Power_Handle in IDLE.

SWITCHES

Do not remove the hard card during a data download. Doing so may cause the SDIS to lock up, requiring a reboot of the locomotive control system computers.

DATA DOWNLOAD



INTRODUCTION

This publication covers the operational description of the Evolution (ES) DC Locomotive. This manual was designed to help the operator to understand some of the terms and component locations.

ACRONYMS AND ABBREVIATIONS

The following is a list of common acronyms and abbreviations appearing in this operating manual.

AAR	Association of American Railroads
AP	Audio Alarm Panel
BC	Brake Cylinder (Pressure)
BP	Brake Pipe (Pressure)
CA	Control Area
CCA	Consolidated Control Architecture
CIO	Consolidated Input/Output
CS	Continuous Service (Position)
DB	Dynamic Braking
DP	Distributed Power
DPR	Distributed Power Radio Module
EAB	Electronic Air Brake
EBV	Electronic Brake Valve
EC	Engine Control
EM	Emergency/Two-Way Status
EOT	End Of Train (Device)
EPCU	Electro-Pneumatic Control Unit
ER	Equalizing Reservoir (Pressure)
ER	Event Recorder
FR	Front to Rear
FRA	Federal Railroad Administration
Fx	Function Key Number
HMI	Human-Machine Interface
HO	Handle Off
HOTD	Head Of Train Device
IPM	Integrated Processor Module
Klbs	Kilo Pounds (Tractive Effort)
LCD	Liquid Crystal Display
LOD	Locomotive Operating Display
LSI	Locomotive System Integration
MBS	Maintenance Battery Switch
MPH	Miles Per Hour
MU	Multiple-Unit
PCS	Power Cutout Switch
PSI	Pounds per Square Inch
PTD	Protocol Translator Device
RU	Replaceable Unit
SDIS	Smart Display Panel

The following is a list of the major systems on board the locomotive:

- Consolidated Control Architecture
- Smart Display Screens (SDIS)

- Consolidated Input/Output
- Engine Control Unit
- Locomotive Propulsion System
- Dynamic Braking System
- Electronic Air Brake
- Maintenance and Diagnostic System
- Locomotive Systems Integration (LSI)
- Event Recorder System
- End-of-Train System (HOTD/EOT)
- Global Positioning Satellite (GPS) System
- Auto Engine Start/Stop (AESS) System

CONSOLIDATED CONTROL ARCHITECTURE

The Consolidated Control Architecture (CCA) system monitors and controls all locomotive functions. The SDIS interfaces to lower level control panels through ARCNet. These controller panels are the following:

- DC Traction Controller (DTC)
- Radiator Fan Controller (RFC)
- Battery Charger Controller (BCC)
- Auxiliary Alternator Controller (AAC)
- Traction Alternator Controller (TAC)
- Engine Control Unit (ECU)
- Traction Blower Controller (TBC).

The CIO processes Input/Output and passes this information to the Smart Displays through a redundant ARCNet network. The Smart Displays communicate with the Protocol Translator through ARCNet. The Protocol Translator interfaces with various locomotive control devices and systems, such as Electronic Air Brake, Head of Train device, Event Recorder, Global Positioning System (GPS), and other locomotive functions. The system includes a common DC power supply.

NOTE: ARCNet is an internal data network designed to move information/ data to the ARCNet components over twisted copper pair wire. The system network architecture, including ARCNet, is illustrated in Figure 1 and the components of the network are described throughout this document.

The locomotive operator interacts with the CCA system through computer screens on the Smart Displays (SDIS). Operator commands from the Smart Display function keys are passed to the Control Panels, which relays the commands to the appropriate locomotive device or system. The Smart Display computer screens (SDIS) also provide information which allows the operator to monitor locomotive performance. For a block diagram of the control system refer to Figure 1.

SMART DISPLAYS (SDIS)

The operator can control and interface with the locomotive through the use of the Smart Display Screens (SDIS) located on the Control Consoles in the Operator Cab. There are three SDIS displays in the Operator Cab, two at the Operator's Operator Control Console, and one in the Crew Member's Area. The SDIS screens are identical 10-inch diagonal, back-lighted, liquid crystal displays. The SDIS keyboard (Figure 2) contains two rows of soft keys. The first row of soft keys contains eight function (Fx) keys, the HELP key and the MENU key. The second row of soft keys contains ten number keys (0-9). The three SDIS's communicate with each other through the use of an ether-net hub. They communicate with the Consolidated Input/Output panel (CIO) over the ARCNet network. The three SDIS's show

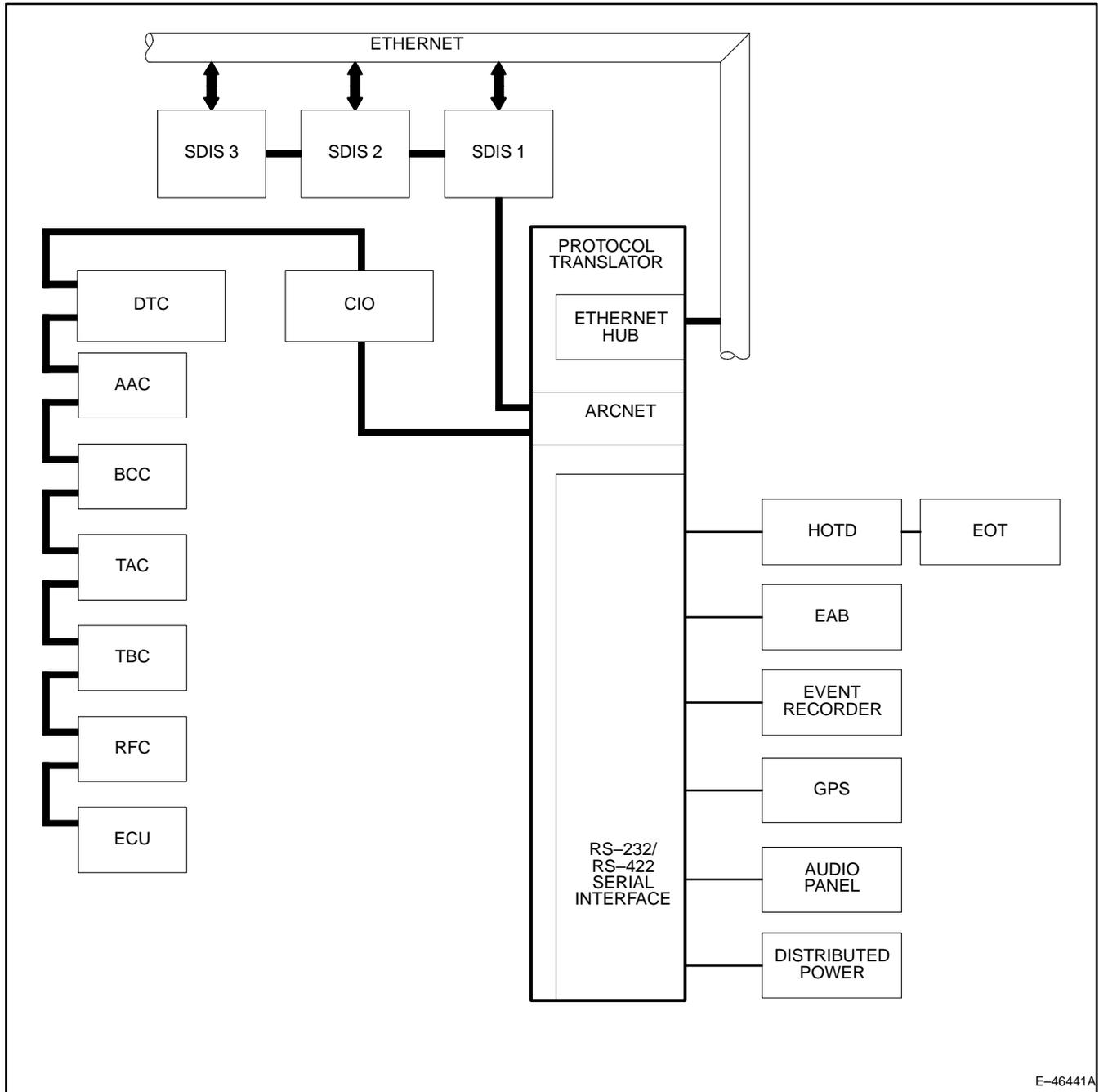


Figure 1. CCA System Block Diagram.

important information pertaining to locomotive operation and also provide interface for the operator to control certain locomotive functions. When a fault occurs during locomotive operation the fault will be displayed on the SDIS. Locomotive diagnostics and self-tests can also be performed from the Smart Display. Interface with the SDIS is accomplished through the use of a pushbutton keyboard located below the display screen.

The display showing the AAR gauges and air pressure indicators is designated as the Locomotive Operating Display. Either display (or both displays at once) on the control stand can be configured as the LOD. One display can be designated as the Human Machine Interface (HMI). The HMI does not display the AAR gauges and train control information;

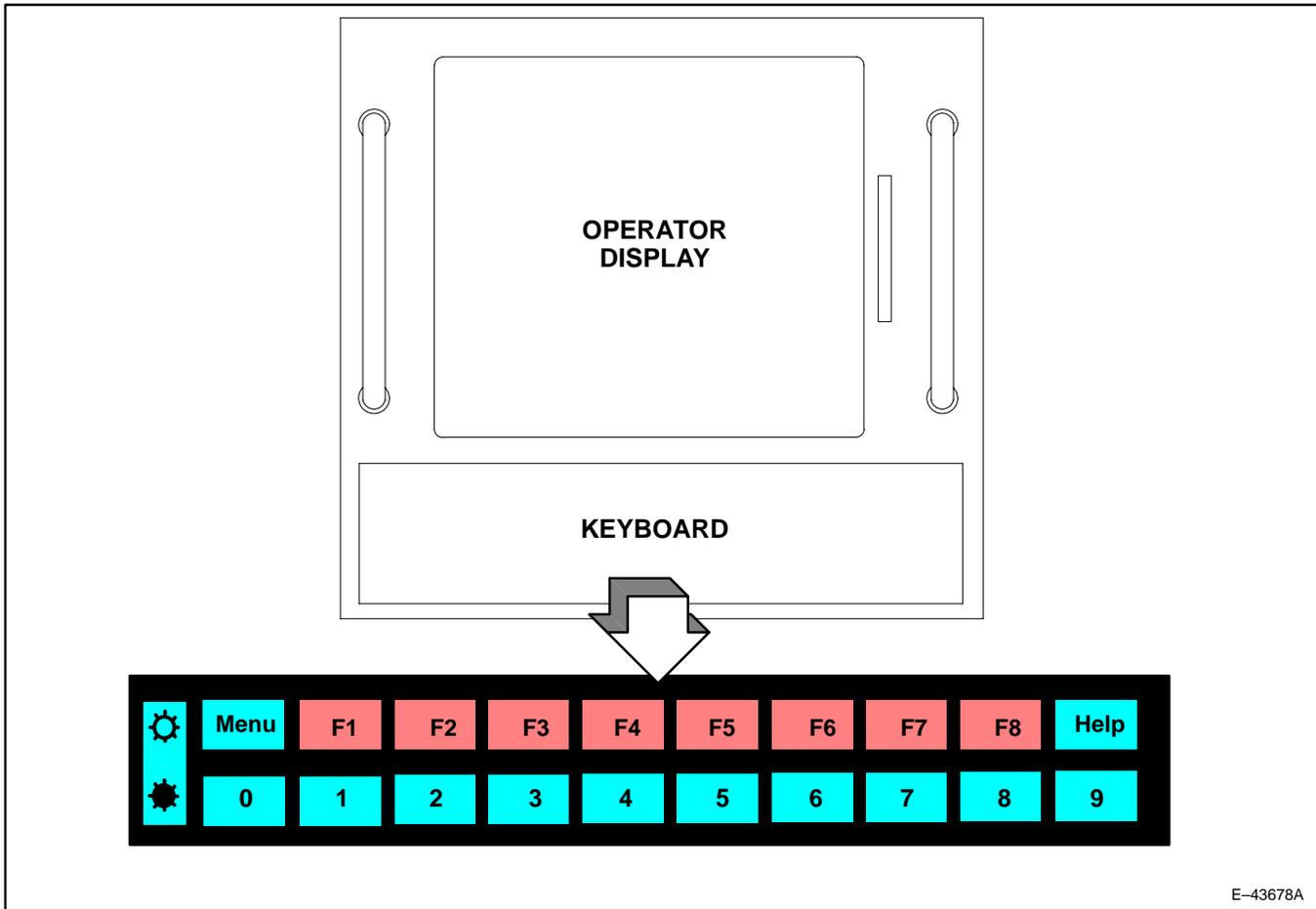


Figure 2. SDIS Keyboard (Typical).

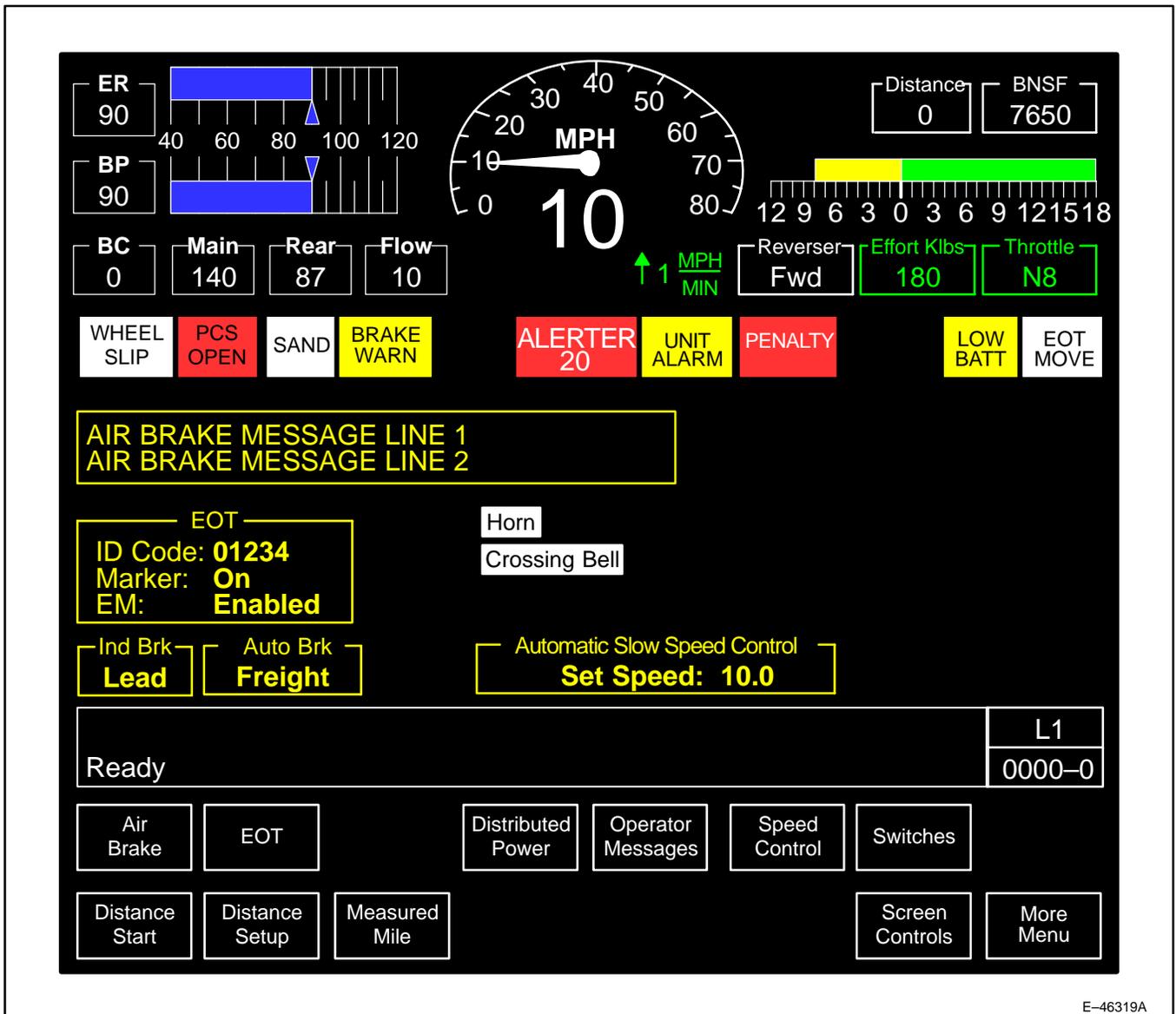
some of the function keys differ from the LOD. The display on the crew member’s console is designated as the Auxiliary Display.

1. **LOD** provides the operator with information on the status of the locomotive (described in the *Operation Screen* section that follows). This display shows continuously updated information essential to the operation of the train.
2. **HMI Display** provides the operator access to additional information not necessary for operating the locomotive. The HMI display is the primary display for monitor, setup and diagnostic information.
3. **Auxiliary Display** provides management information to the train crew. However, the Auxiliary Display **may not** perform any locomotive control functions (for example, Slow Speed Control, or EOT Code); it is a “read only” display with respect to locomotive control.

Operation Screen

This screen (Figure 3) provides a computer–controlled, digital display of the speedometer, load indicator, air and pressure gages. The Operation Screen also displays information on the Electronic Air Brake system and other locomotive functions. The screen shows both analog and digital readouts of speed, load, and air pressure data.

The air pressure data covers Main Reservoir, Equalizing Reservoir, Brake Pipe, Brake Cylinder, and Brake Pipe Air Flow. End of Train (EOT) and Automatic and Independent brake information is also shown on this screen. This screen also displays the annunciator lights for WHEEL SLIP, PCS OPEN, ALERTER, EOT ALARMS, PENALTY BRAKE, AESS, SAND, etc. See the Operating Equipment section of this manual for more information.



E-46319A

Figure 3. Main Operation Screen.

CONSOLIDATED INPUT/OUTPUT (CIO) PANEL

The CIO processes inputs/outputs and passes this data to the Smart Displays (SDIS) through a redundant ARCNet network. The CIO is shown in the system block diagram, Figure 1.

ENGINE CONTROL UNIT

The Engine Control Unit (ECU) is a panel located in CA4 in the auxiliary cab of the locomotive. It controls the diesel engine in response to commands from the CCA control system.

Locomotive Propulsion System

The DC propulsion System utilizes traction motors that are powered by direct current. Three-phase AC from the alternator is rectified to DC to power the DC traction motors.

DYNAMIC BRAKE OPERATION

Dynamic braking is applied to the locomotive only, not to the train.

By means of the Combined Power Handle (Figure 6) on the operator's control stand, the system sets up electrical circuits which convert the DC traction motors into generators, which then act to retard the speed of the locomotive. This retardation sets up a buff force against which the train pushes.

The resistance set up in each traction motor is a magnetic field through which the traction motor armature must rotate. The operator adjusting the position of the Combined Power Handle controls the strength of the magnetic field. The rotation of the armature through the magnetic field generates current, which is dissipated as heat through the dynamic brake grid resistors directly to the atmosphere.

The resistor grids have a fixed maximum horsepower capacity. Therefore, the retarding force available from dynamic braking will vary with speed. Maximum dynamic brake retarding force levels are reached at speeds of 18–23 MPH and drop off rapidly above 23 MPH.

ELECTRONIC AIR BRAKE SYSTEM (EAB)

CCBII, a microcomputer based electro–pneumatic brake control system, is supplied on this locomotive. All logic is under computer control, except for initiation of emergency brake applications by brake vent or through the emergency brake valve on the crew member's console. CCBII is compatible with standard pneumatic air brake systems. Control of Lead/Trail functions and brake pipe cut–in or cut–out is accomplished through SDIS menu selections.

The CCBII system consists of distributed electronics which are linked by a computer network.

The Computer Controlled Brake (CCBII) System includes the following devices:

1. Electronic Brake Valve (EBV) – The EBV signals the handle positions for Automatic and Independent braking. An exception is the initiation of an Emergency Brake application which is propagated mechanically through a vent valve by placing the Automatic Brake handle in the EMER position.
2. Integrated Processor Module (IPM) – mounted in the Electronic Equipment Locker in the nose cab, IPM is the main computer for the CCBII system. IPM also provides binary outputs to drive electro–mechanical relays on the locomotive. IPM communicates with SDIS for crew messaging and diagnostic fault messaging.
3. Electro–Pneumatic Control Unit (EPCU) – mounted in the air brake compartment, consists of modular units which control development of all pneumatic control pressures.

Refer to the **Air Brake Equipment** section of this manual for detailed information on CCBII.

Locomotive Systems Integration (LSI)

The Consolidated Control Architecture system utilizes Locomotive Systems Integration (LSI) industry standard for locomotive control interface. LSI is used to integrate third party systems into the GE control system.

EVENT RECORDER SYSTEM

The Event Recorder System (ERS) records various parameters related to locomotive status and operation. The Event Recorder (ER) can store up to 72 hours of recorded data. Data from the locomotive control system is sampled at 100 millisecond intervals.

Data from the ER can be downloaded via the serial PTU port, SDIS hardcard or a radio download (if equipped). The PTU port can also be used to upload software to the Event Recorder. An indicator light on the unit shows that the unit is operating properly.

END-OF-TRAIN SYSTEM

The End-of-Train system provides a means of monitoring brake pipe pressure on the last car of the train. In two-way configuration, EOT can also vent the brake pipe on the last car during an emergency brake application. The EOT system can be configured for a one-way or a two-way operation. The one-way configuration transmits data from the last car to the locomotive cab. The two-way configuration allows the operator to transmit a command from the cab to the last car to initiate emergency braking from the last car. The two-way system can operate as a secured or unsecured link. The secured link permits communication between two specific units by entering end unit identification codes. The secured, two-way system will not interfere with other locomotive EOT systems, and will not be corrupted by inputs from other RF systems.

GLOBAL POSITIONING SATELLITE (GPS) SYSTEM

The Global Positioning Satellite (GPS) System provides accurate position, velocity, and altitude measurements for use by various locomotive systems. The GPS operation does not require any action by the locomotive crew.

AUTO ENGINE START/STOP (AESS) SYSTEM

The AESS System enhances fuel savings. When this system is active, it shuts the diesel engine down during periods of inactivity. The system monitors certain locomotive parameters and restarts the engine as needed. With AESS, the diesel engine may start and stop without operator intervention. Refer to the AUTO ENGINE START/STOP (AESS) section of this manual for detailed information on AESS.

Refer to the AUTO ENGINE START/STOP Section in this Manual for additional information.



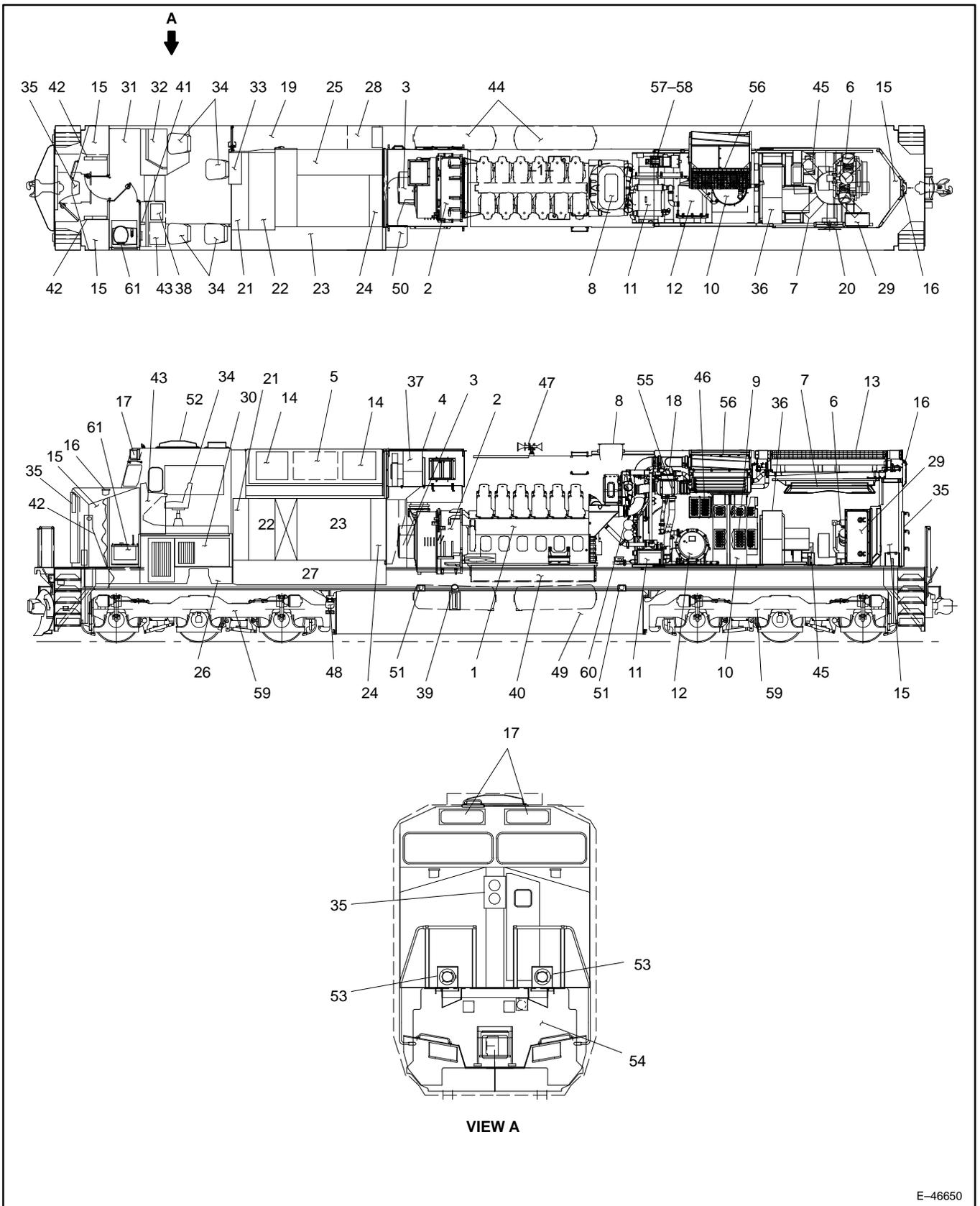


Figure 4. DC Evolution Series Location Of Apparatus (1 of 2).

E-46650

REF.	DESCRIPTION	REF.	DESCRIPTION
1	ENGINE – 12 CYLINDER	32	CONTROL CONSOLE
2	ALTERNATOR	33	ENGINE CONTROL PANEL
3	AUXILIARY ALTERNATOR	34	SEATS
4	BLOWER CAB	35	HEADLIGHT
5	EXTENDED RANGE D.B. CONTACTORS	36	TRACTION MOTOR BLOWER
6	MOTOR DRIVEN AIR COMPRESSOR	37	ALTERNATOR BLOWER
7	RADIATOR FAN	38	REFRIGERATOR
8	ENGINE MUFFLER	39	FUEL GAGE
9	TRACTION MOTOR AIR FILTERS	40	RETENTION TANK
10	ENGINE WATER TANK	41	EMERGENCY BRAKE VALVE
11	LUBE OIL COOLER	42	COLLISION POST
12	LUBE OIL FILTER	43	CREW MEMBER'S DESK
13	RADIATOR	44	MAIN AIR RESERVOIR
14	DYNAMIC BRAKING BOX	45	DIRTY AIR DISCHARGE BLOWER
15	SAND BOXES	46	ENGINE AIR FILTER BOX
16	SAND FILLERS	47	HORN
17	NUMBER LIGHT BOX	48	ELECTRONIC BELL
18	WATER CONTROL UNIVALVE	49	INTEGRAL FUEL TANK
19	BATTERY BOX	50	AIR DUCT
20	HAND BRAKE (ELECTRIC)	51	FUEL FILLER
21	CONTROL AREA NUMBER 1 (CA1)	52	ANTENNA
22	CONTROL AREA NUMBER 2 (CA2)	53	DITCH LIGHTS
23	CONTROL AREA NUMBER 3 (CA3)	54	M.U. RECEPTACLE
24	CONTROL AREA NUMBER 4 (CA4)	55	WATER TO AIR INTERCOOLER
25	CONTROL AREA NUMBER 5 (CA5)	56	AIR TO AIR INTERCOOLER / FAN & SHUTTERS
26	CONTROL AREA NUMBER 6 (CA6)	57	PRE LUBE PUMP
27	CONTROL AREA NUMBER 7 (CA7)	58	FUEL PUMP
28	CONTROL AREA NUMBER 8 (CA8)	59	TRUCKS – HI AD
29	CONTROL AREA NUMBER 9 (CA9)	60	FUEL FILTERS
30	ELECTRIC HEATER & AIR CONDITIONER	61	TOILET
31	ELECTRONIC LOCKER		

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Figure 4. DC Evolution Series Location Of Apparatus (2 of 2).

GENERAL DATA

Operating Cab and Controls Wide Cab with Control Stand and Locomotive System Integration (LSI)
Wheel Arrangement C-C
Weight (maximum) 420,000 lbs (190,509 kg)

Engine Data:

Horsepower – Gross 4500
 Horsepower – Traction 4390
 Number of Cylinders 12
 Model GEVO
 Bore and Stroke (in.) 9.8 X 12.6
 RPM 1050
 Compression Ratio 16.5:1
 Cycle 4
 Turbocharged Yes (7S1712A3)
 Electronic Fuel Injection Yes
 Engine Cooling Fan 1
 Engine Cooling Fan Drive AC Motor
 Air-to-Air Cooling Fan 2

Traction Equipment:

Contactors to GA Bus 6
 Traction and Auxiliary Alternator 5GMG206A
 Traction Motor Blower GDY91
 Alternator Blower GDY100
 Exhauster GDY97
 Blower Drives AC Motors

Air Brake Schedule CCBII Electronic Air Brake System (EAB)

Major Dimensions (Approximately):

Length 73 ft. 2 in.
 Height 15 ft. 5 in.
 Width 9 ft. 11 in.
 Traction Pin Centers 50 ft. 4 in.
 Truck Wheel Base 13 ft. 2 in.

Minimum Track Curvature (radius and degrees):

For Single Unit 273 ft./21°
 For MU 273 ft./21°

Standard Traction Package

Traction Motors (6) 5GEB752AH™
 Driving Wheel Diameter (in.) 42 (New)
 Maximum Continuous Tractive Effort / Speed (mph) 105,680/12.9
 Maximum Starting Tractive Effort 142,000
 Gear Ratio 83/20
 Maximum Speed (mph) – worn wheels 75

Supplies:

Fuel Tank (gal., est. usable) 4800/18,170 liters
 Coolant (gal.) 440
 Lubricating Oil (gal.) 468
 Sand (cu. ft.) 55/1.1 cu. meters

Compressor, Air:

Compressor Drive AC Motor
 Maximum Displacement (cfm) 236
 Type of Cooling Air
 Lubricating Oil (gal.) 16

Air Filtering Devices:

Primary Vortex, Self-Cleaning
 Secondary Engine Air Intake AAF Baggie Air Filter
 Electrical Equipment Air Intake Vortex, Self-Cleaning

™ Trademark of General Electric Co.



OPERATING EQUIPMENT

WARNING: *This locomotive is equipped with Auto Engine Start/Stop. The diesel engine may start without operator action. Exercise caution when working around the diesel engine, traction alternator, or Radiator Cab. Ensure that AESS is disabled before performing any maintenance on the locomotive. Failure to do so may result in death or serious personal injury.*

INTRODUCTION

All of the operating devices both manual and visual used by the operating crew during normal operation are located in the Nose and Operating Cab sections of the locomotive. Most of these devices are located near the Operator's position on the Control Console (Figure 5), the Engine Control Panel (Figure 9) or on the Overhead Console (Figure 10).

DEVICES IN NOSE/OPERATING CABS

Nose Cab

NOTE: *Numbers in parentheses () refer to Items found on Figure 4 of this publication unless noted otherwise.*

The following devices are located in the Nose Cab:

1. Fire Extinguisher – provided for fire safety.
2. Electronic Equipment Locker (31) – see ELECTRONIC EQUIPMENT LOCKER Section later in this section.
3. Toilet Compartment (61).

Operating Cab

NOTE: *Numbers in parentheses () refer to Items found on Figure 4 of this publication unless noted otherwise.*

The following devices are located in the Operating Cab:

1. Floor Duct – enables heating and cooling from the Central HVAC unit (Item 30) to enter into the cab at both Operator and Crew Member sides.
2. Strip Heater – located near the seat track, these supplemental heaters aid in controlling cab temperature and provide a quick heat source on start up. Controls and circuit breakers are located on the Engine Control panel (Figure 9).
3. Control Console (32). Also see Figure 5.
4. Crew Member's Desk (43).
5. Refrigerator (38) – located under the Crew Member's desk facing the stairway into the Nose Cab. The refrigerator is powered by the Inverter located in the Electronic Equipment Locker (Item 3, Figure 17). The refrigerator is protected by a circuit breaker located on the Engine Control panel (Item 3, Figure 9).



Figure 5. Operator Control Console, Top.

CONTROL CONSOLE DEVICES

NOTE: Numbers in parentheses () refer to Items found on Figure 5 of this publication unless noted otherwise.

The following operating devices are located on the control console:

Two-Way Radio

Two-way communications radio operating on an FM band. A handset (1) is mounted on the Control Console and the Crew Member's Desk (Item 3, Figure 11).

Smart Display

The Smart Displays (SDISs) (2) provide the computer displays that allow the operator to set up, control, and monitor locomotive operation.

NOTE: If the SDIS with the Operating Display fails, the control system WILL NOT automatically change the Human–Machine Interface Display (HMI) to the Operating Display. It is the operator’s responsibility to change the HMI Display to the Operating Display on the functioning SDIS either via the Screen Controls screen (3000–0) or by pressing the Menu key twice.

17KC120D Master Controller

The Master Controller (Figure 6), is a two–handle, manually operated, set–up switch used by the operator to regulate locomotive power, dynamic braking and direction. The two handles are the **Reverser** and the **Combined Power**, and their functions are as follows:

1. **Reverser Handle** – Requests the direction of locomotive travel. There are three handle positions; REVERSE, CENTER and FORWARD. This handle is removable when the **Combined Power** Handle is in IDLE.
2. **Combined Power Handle** – Controls diesel engine speed and power (THROTTLE and IDLE) and dynamic braking (DYNAMIC BRAKE and SETUP).
 - a. The near position (handle pulled toward operator) consists of nine handle positions: IDLE and eight power positions “notches”. Indication of the throttle position is given in the window to the right of the handle.
 - b. The far position (handle pushed away from operator) consists of two handle positions: SETUP and DYNAMIC BRAKE; a variable position ranging from 1 (minimum) to 8 (maximum) for selecting desired brake rate. (Level 8 is the farthest from the operator).

Each handle opens and closes cam–operated contacts. The **Combined Power** Handle also rotates a wiper arm on a variable resistor dynamic brake potentiometer. Mechanical interlocking between the handles prevents improper operation of any handle.

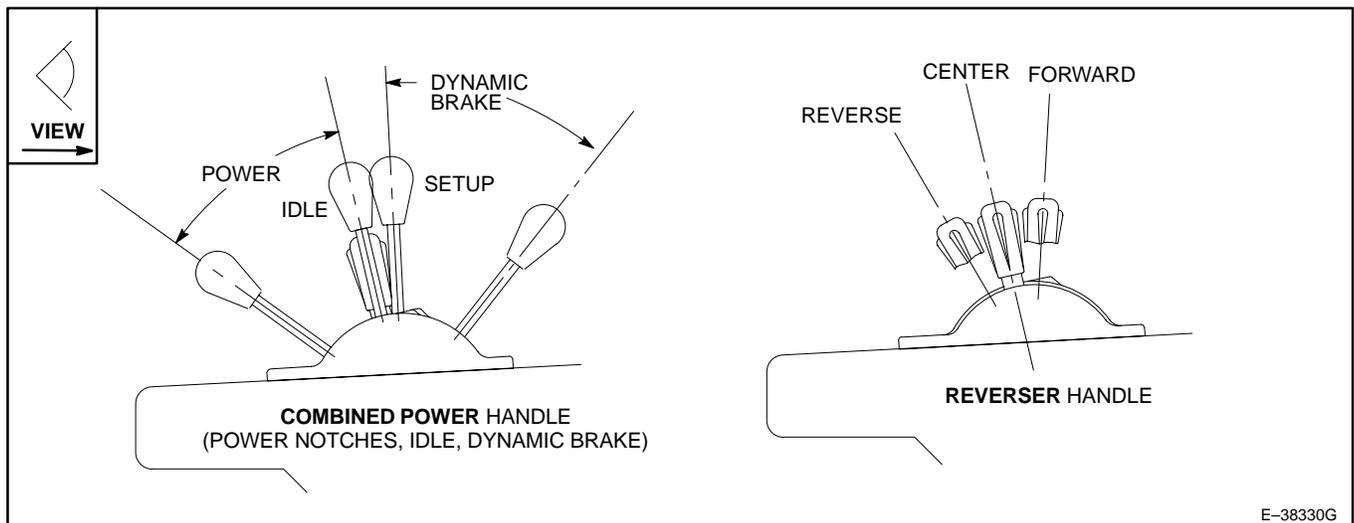


Figure 6. Master Controller Handle Positions.

Mechanical Interlocking

1. REVERSER Handle:

This handle serves as a key to unlock and lock the Reverser. With this handle removed, (it can only be removed in the CENTER position), the controller is locked–up and the **Combined Power** Handle can not be moved from the IDLE position.

The **Reverser** Handle cannot be moved from FORWARD or REVERSE when the **Combined Power** Handle is in: a) Notch 1 or higher of THROTTLE, b) SETUP or c) braking range of DYNAMIC BRAKE.

2. COMBINED POWER Handle:

This handle can be moved into throttle positions at any setting of the **Reverser**, but into dynamic braking positions only when the **Reverser** is in FORWARD or REVERSE positions (not on CENTER).

Operation Of The Master Controller

To operate the controller during locomotive operation, proceed as follows:

LEAD OR SINGLE-UNIT OPERATION

Operating Handle Set-Up (**Reverser** Handle removed):

1. **Combined Power** Handle is in IDLE.

WARNING: Finding the Combined Power Handle away from IDLE with the Reverser Handle removed indicates that interlocking between Handles requires repair or adjustment. Do not attempt to operate unit until condition has been repaired.

2. Insert the **Reverser** Handle.
3. Move **Reverser** Handle to desired position.

OPERATING IN POWER MODE

1. Move **Reverser** Handle to desired position.
2. Move the **Combined Power** Handle to the desired notch.

OPERATION IN DYNAMIC BRAKE MODE

1. Move **Reverser** Handle to desired position.
2. Move the **Combined Power** Handle to SETUP.
3. Pause momentarily, then advance as desired.

OPERATION AS TRAIL UNIT

WARNING: To ensure safe consist operation, follow specific Railroad Operating Procedure Precautions for setting up units for "Trail" or "Dead".

1. **Combined Power** Handle in IDLE.
2. **Reverser** Handle on CENTER and removed.

The **Reverser** Handle cannot be moved from FORWARD or REVERSE when the **Combined Power** Handle is in: a) Notch 1 or higher of THROTTLE, b) SETUP or c) braking range of DYNAMIC BRAKE.

NOTE: Movement of the Reverser Handle out of CENTER will automatically force Air Brake to LEAD.

NOTE: Numbers in parentheses () refer to Items found on Figure 5 of this publication unless noted otherwise.

EOT (Rear) Emergency Brake Toggle Switch

Pressing this spring-loaded toggle switch (13) initiates an End Of Train Emergency Brake Application.

Independent Brake Handle

See **Electronic Air Brake** Section of this manual for more information (14).

Automatic Brake Handle

See **Electronic Air Brake** Section of this manual for more information (12).

Alerter Reset Pushbutton

This yellow mushroom-head pushbutton (10) manually resets the Alerter Safety device. This pushbutton, or other Alerter resets, must be operated at set time intervals or a penalty brake application will occur. See appropriate section of this publication for more information.

Bell and Horn Operation

Horn Operation

One amber Horn pushbutton (8) is located on the Operator's control console and another on the Crew Member's desk (Item 4, Figure 11). The locomotive horn (Item 47, Figure 4) will sound as long as the Horn Pushbutton is pressed. The locomotive Horn is interlocked with the Bell so that the Bell will sound when the Horn sounds. It is necessary to press the Bell Pushbutton to silence the Bell when it has been energized by this Horn interlock.

Bell Operation

Pressing the amber Bell pushbutton (7) causes the locomotive bell to sound. Pressing the Bell pushbutton again will silence the Bell. The locomotive Bell is interlocked with the Horn so that the Bell will sound when the Horn sounds. It is necessary to press and release the Bell pushbutton to silence the Bell when it has been energized by the Horn interlock.

Horn Sequencer Operation

Pressing the Horn Sequencer Pushbutton (Item 15, Figure 5), if locomotive speed is greater than 0.5 mph (40 kph), will produce the following results:

1. Bell will start to ring.
2. Horn will sound in the "Rule 14L" pattern as follows:
 - a. Horn sounds for two seconds, then stops.
 - b. At 400 feet after pushbutton was pressed, horn sounds for another two seconds, then stops.
 - c. At 800 feet after pushbutton was pressed, horn sounds for one second, then stops.
 - d. At 1100 feet after pushbutton was pressed and continuing until locomotive travels another 310 feet, horn will sound.
3. Horn pushbutton must be pressed to stop the sequencer.
4. Bell pushbutton must be pressed to stop ringing.

NOTE: If Horn button is pressed while in Horn Sequencer Operation, the bell will remain ON but horn cycling will stop and the horn will respond to the Horn button command.

Sand Pushbutton

Pressing this blue pushbutton (6) applies sand in front of the leading axle of both trucks when locomotive speed is less than 15 mph. Above 15 mph, manual sanding is not available. A trainline request for sand is also given.

Lead Axle Sand Pushbutton

Pressing this blue pushbutton (5) applies sand in front of the leading axle only, depending on locomotive direction, when locomotive speed is less than 15 mph. Lead axle sanding will occur for a maximum of two minutes, unless the

pushbutton is pressed again within two minutes, stopping the flow of sand. Above 15 mph, lead axle sanding is not available. No call for trainline sand is given.

Rear Headlight Switch

This switch (4) controls the operation of the long-hood headlights and has four positions; OFF, DIM, MED and BRIGHT.

Front Headlight Switch

This switch (3) controls the operation of the short-hood headlights and has four positions; OFF, DIM, MED and BRIGHT. The Road Crossing lights are automatically ON when this switch is in the "MED" or "BRIGHT" position.

Gage Light Dimmer Knob

The dimmer knob (11) is used to brighten and dim the console indicator lights.

SMART DISPLAY OPERATION SCREEN

This section describes the function of the items found on the Main Operating Screen.

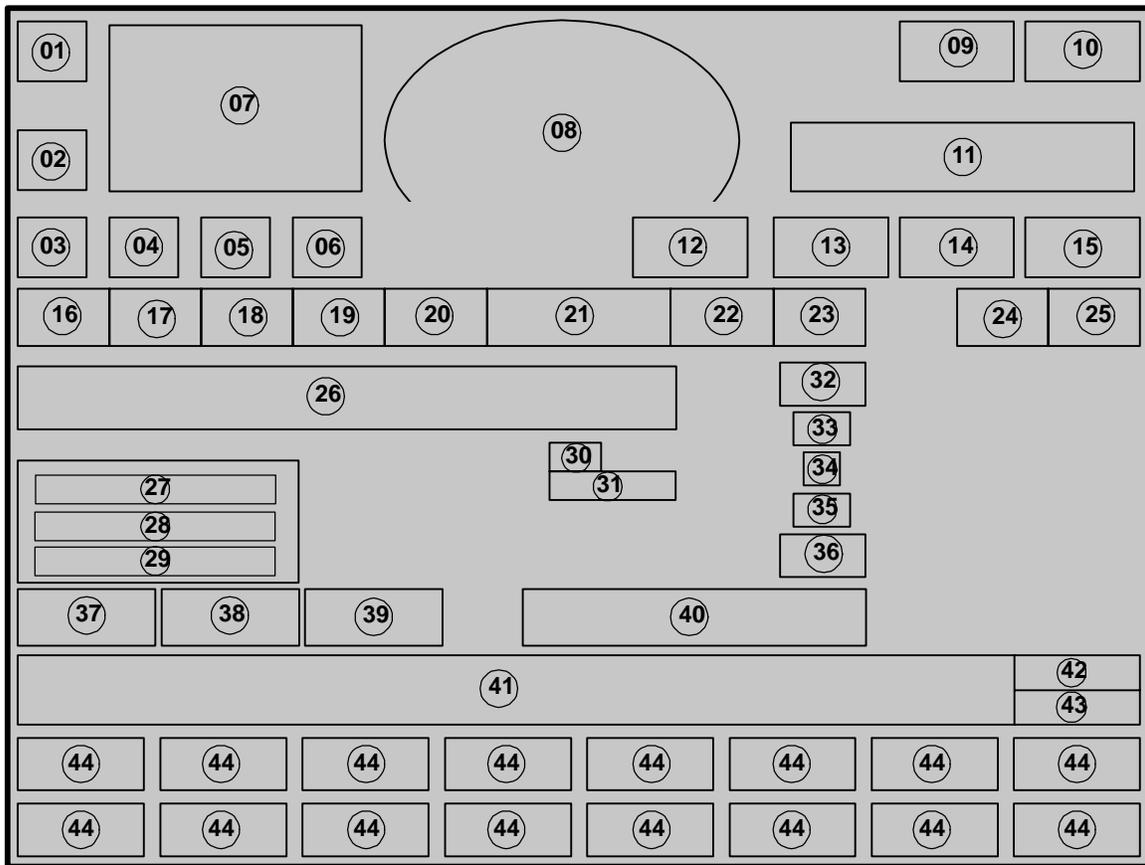
SDIS Screen Informational Areas

The following list of components corresponds with the numbered items presented on Figures 3 and 7, *Sample Operation Screen Informational Areas*:

1. **ER** – indicates Equalizing Reservoir pressure. The range for this digital marker is 0–200 psi. A digital reading of "– – –" indicates an invalid value from the corresponding transducer and "****" indicates Electronic Air Brake (EAB) is not communicating with the control system.
2. **BP** – indicates locomotive Brake–Pipe pressure. The range for this digital marker is 0–200 psi. A digital reading of "– – –" indicates an invalid value from the corresponding transducer and "****" indicates Electronic Air Brake (EAB) is not communicating with the control system.
3. **BC** – indicates Brake Cylinder pressure. The range for this digital marker is 0–200 psi. A digital reading of "– – –" indicates an invalid value from the corresponding transducer and "****" indicates Electronic Air Brake (EAB) is not communicating with the control system.

NOTE: The BC Gage Screen background flashes yellow if the locomotive speed is greater than 10 mph and BC is greater than 3 psi. When the locomotive speed is greater than 10 mph and BC is greater than 10 psi, the alarm bell will ring continuously until reset. Reset is accomplished by releasing the BC pressure.

4. **MAIN** – indicates Main Reservoir 2 pressure. The background turns *red* and flashes at pressures below feed valve pressure + 15 psi. The range for this digital marker is 0–200 psi. A digital reading of "– – –" indicates an invalid value from the corresponding transducer and "****" indicates Electronic Air Brake (EAB) is not communicating with the control system.
5. **REAR** – indicates trainline pressure for the last car if the End–Of–Train (EOT) device is installed. The background turns *red* and flashes for 10 seconds, then steady at pressures below 45 psi. The range for this digital marker is 0–200 psi. If "EOT COMM" alarm is active, or if communication between the control system and EOT is broken, or if EOT is turned OFF, the number will read "****".
6. **FLOW** – indicates air flow in the Brake Pipe. The range for this digital marker is 0–200 cfm. A digital reading of "– – –" indicates an invalid value from the corresponding transducer and "****" indicates Electronic Air Brake (EAB) is not communicating with the control system.
7. **AIR PRESSURE BAR GRAPHS** – The ER and BP pressures are also shown in bar graph form. Range (full scale) is 40–120 psi for the bar graphs. Bar color is *blue*. The *blue* pointer indicates Feed Valve (Equalizing Reservoir) Setting. The bars are empty if invalid data is received.



REF.	DESCRIPTION	REF.	DESCRIPTION
1	EQUALIZING RESERVOIR PRESSURE (ER)	23	PENALTY BRAKE ALARM
2	BRAKE PIPE PRESSURE (BP)	24	EOT SYSTEM ALARM
3	BRAKE CYLINDER PRESSURE (BC)	25	EOT MOVE ALARM
4	MAIN RESERVOIR PRESSURE (MAIN)	26	AIR BRAKE MESSAGE WINDOW
5	LAST CAR PRESSURE (REAR)	27	EOT ID CODE (ID CODE)
6	AIR FLOW GAGE (FLOW)	28	EOT MARKER STATUS (MARKER)
7	AIR PRESSURE (ER AND BP) BAR GRAPH	29	EMERGENCY/TWO-WAY STATUS (EM)
8	LOCOMOTIVE SPEEDOMETER (GRAPHIC AND DIGITAL)	30	CROSSING BELL MARKER
9	DISTANCE COUNTER	31	HORN MARKER
10	ROAD NUMBER AND RAILROAD IDENTIFICATION	32	NOT APPLICABLE
11	TRACTIVE EFFORT BAR GRAPH (BRAKE AND MOTOR)	33	NOT APPLICABLE
12	DIGITAL ACCELERATION INDICATOR	34	NOT APPLICABLE
13	REVERSER HANDLE POSITION	35	NOT APPLICABLE
14	TRACTIVE EFFORT/LOAD METER (EFFORT KLBS)	36	NOT APPLICABLE
15	COMBINED POWER HANDLE POSITION (THROTTLE)	37	INDEPENDENT BRAKE STATUS
16	WHEELSLIP ALARM	38	AUTOMATIC BRAKE STATUS
17	PCS OPEN ALARM	39	DP LEAD/REMOTE STATUS
18	SAND ALARM	40	SPEED CONTROL/POWER REDUCTION INFO
19	BRAKE WARN ALARM	41	OPERATOR MESSAGE WINDOW
20	AESS ALARM	42	OPERATION SCREEN LEVEL INDICATOR
21	ALERTER	43	OPERATION SCREEN NUMBER
22	UNIT ALARM	44	MENU SOFT KEYS

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Figure 7. Sample Operation Screen Informational Areas.

8. **SPEEDOMETER** – The digital portion of the speedometer registers locomotive speed in MPH. The digital portion is displayed in three scales – LO scale which reads from 0 to 4.99 mph in 0.01 mph segments, MED scale which reads from 5.0 to 9.9 mph in 0.1 mph segments and HI scale which reads from 10 – 199 mph in 1 mph segments. The analog portion of the speedometer registers as a graphic with a scale of 0–80 MPH.

NOTE: For overspeed protection (75 mph), the speedometer graphic becomes YELLOW for the overspeed warning speed range and RED for above the overspeed limit.

9. **DISTANCE** – The distance counter displays the distance traveled in feet (up to 99,999 feet) based on the computer input for locomotive reference speed. The counting is bi-directional (counts up when moving forward; back when in reverse). When the counter reaches the 99,999 limit, the counter will reset to –99,999 and continue to count up. When the counter reaches the –99,999, the counter will reset to 99,999 and continue to count down. Press the #1 soft key (DISTANCE START/STOP/RESET) to control counter operation from either Screen 0000–0 or Screen 1200–0).
10. **ROAD NO** – The locomotive road number is displayed in this position. Number range is from 0 to 9999. The block title will be the Railroad ID.
11. **TRACTIVE EFFORT BAR GRAPH** – This graph shows the average dynamic braking or tractive effort (Klbs) from all cut-in traction motors. In dynamic tractive effort, the bar (from 0 to 180 Klbs) is *green*. In dynamic braking effort, the bar (from 0 to –120 Klbs) is *yellow*.

If this graph indicates a problem (e.g., excessive dynamic braking effort), reduce the **Dynamic Braking** Handle position until the bar returns to within normal operating parameters.

NOTE: The Tractive Effort Bar Graph should show “0” during Self Load.

12. **DIGITAL ACCELERATION INDICATOR – (MPH/MIN)** Located adjacent the digital speedometer readout, there is a *green* up arrow in front of the number if acceleration is positive and a *yellow* down arrow if the acceleration is negative.
13. **REVERSER** – This status marker indicates whether the **Reverser** Handle is in “Fwd”, “Cnt” or “Rev” position.
14. **EFFORT Klbs** – This status marker indicates digitally what the tractive effort bar graph (12), located directly above, is displaying. The range is from 0 to 180 Klbs with motoring in *green* and 0 to –120 Klbs with dynamic braking in *yellow*.
15. **THROTTLE** – This status marker indicates the current position of the **Combined Power** Handle. In motoring the green indications can be: “Idle” or “N1” through “N8”. In braking the *yellow* indications can be: “Set-Up” or “B1” through “B8” and the marker label changes from “Throttle” to “Brake”. If locomotive is in MU shutdown condition, “Off” will be displayed regardless of actual handle position.

NOTE: The Alarm Bar indicators are only visible when the specific situation exists.

16. **WHEEL SLIP** – This *white* marker light indicates that the locomotive computer system has detected a trainlined locomotive wheel slip alarm.
17. **PCS OPEN** – This *red* marker light indicates a Penalty or Emergency air brake application has occurred (somewhere in the consist) and power has been limited to IDLE. See *Railroad Operating Rules* for specific application.
18. **SAND** – This *white* marker light indicates that sanding is taking place either manually or automatically as a result of wheelslip. During wheelslip, sanding and the SAND light will automatically turn on, then off.
19. **BRAKE WARN** – This flashing *yellow* marker light indicates that a locomotive in the consist is experiencing excessive dynamic braking current. Reduce the **Dynamic Braking** Handle position until this light goes out.

20. **AESS STATUS** – Text, color and flashing rate changes with AESS status.
21. **ALERTER** – This timer counts down from 25 indicating the time to an Alerter Penalty Brake. The square will flash *red* and the alarm will sound until reset or brakes are applied. See **Safeguards, Alerts and Shutdowns** section of this manual for further information.
22. **UNIT ALARM** – This *yellow* marker light indicates that the locomotive computer system has detected a train-lined locomotive alarm.
23. **PENALTY** – This marker light is used only during MU operation.
24. **EOT SYSTEM ALARM** – (*yellow with black text*) Indicates one of four conditions from the end of train device:
 1. VALVE FAIL – EOT valve circuit failure.
 2. FR NO COMM – EOT communication failure in either the front to rear or both directions.
 3. DEAD BATTERY – EOT dead battery.
 4. WEAK BATTERY – EOT weak battery.

NOTE: *If more than one failure condition is active, only the highest priority condition is displayed.*

25. **EOT MOTION** – This *white* status marker indicates movement status of the EOT Device. Possible indications are: “EOT MOVE”, “EOT FWD” and “EOT REV”.
26. **AIR BRAKE MESSAGE WINDOW** – The *yellow* worded messages (possible two lines) inform the operator of the Electronic Air Brake system status. See **Electronic Air Brake Operation** Section of this document.
27. **ID Code** – shows the EOT ID currently being used (0–99999).
28. **MARKER** – shows EOT marker status, On (*white text*) or Off (*yellow text*).
29. **EM** – Emergency/Two-Way EOT Status, Enabled (*white text*) or Disabled (*yellow text*).
- 30–31. **HORN MARKER AND/OR CROSSING BELL** – These indicators are visible when the locomotive horn or crossing (or both) are sounding.
37. **IND BRK** – This status marker indicates whether the Independent Brake function is in LEAD or TRAIL status.
38. **AUTO BRK** – This status marker indicates whether the Automatic Brake function is in FREIGHT or PASSENGER status.
40. **AUTOMATIC SPEED CONTROL SET SPEED** – This status marker is *white* when the function is active. This feature gives the operator computer controlled speed for slow speed loading/unloading similar to pacesetter type control. The speed can be changed in 0.01 mph increments starting from 0.00 up to and including 4.99 mph and 0.1 mph increments starting from 5.0 up to and including 10.0 mph. Refer to **Slow Speed Control** section of this manual.

NOTE: *If Locomotive is in Manual Power Reduction instead of Auto Slow Speed Control, this field will display % Notch Setpoint.*

41. **OPERATOR MESSAGE WINDOW** – This area may contain up to two lines of text which informs the operator of various operating conditions or conditions which require operator action.
42. **OPERATION SCREEN LEVEL INDICATOR** – This *blue* status marker indicates the level in which the control system is operating.

NOTE: *Several levels of operation are available through the SDIS screens. Only L1 Operation, which is intended for the operating crew, is discussed in this manual.*

43. **OPERATOR SCREEN NUMBER** – This *blue* status marker indicates the number of the Operation Screen being displayed. The number is used for operator reference. All operator screens shown in this manual include the screen number.

44. **MENU SOFT KEYS** – The Menu Soft key contains 16 possible soft key designations. These soft keys change according to the Operator Screen which is displayed. Soft key designation information only appears over active keys (except for number keys “0” and “9” because they are located outside the screen width). The top row (F1–F8 keys) are *tan* and the bottom row (1–8 Whole Number keys) are *grey*.

CONTROL CONSOLE BOTTOM DEVICES

NOTE: Numbers in parentheses () refer to Items found on Figure 8 of this publication unless noted otherwise.

Engine Run Circuit Breaker

The Engine Run circuit breaker (1) controls engine speed. This breaker must be ON in the lead unit and OFF in other units in the consist to control engine speed through the throttle speed and engine run trainlines. When this breaker is tripped, the diesel engine will not run above IDLE.

Generator Field Circuit Breaker

The Generator Field circuit breaker (2) is ON whenever the locomotive is powered and operating as a Lead unit. The breaker may be turned OFF to keep the main generator de-energized when it is necessary to run the engine at speeds higher than IDLE. On Trail locomotives, it should be in the OFF position.

Control Circuit Breaker

The Control circuit breaker (3) provides power to the trainline control positive wire (T/L 13) and other circuits, including the alarm bell. In MU operation, this breaker must be ON on the Lead unit; OFF in Trail units.

Air Conditioner and Heater

This under-floor mounted air conditioning/heating (HVAC) unit provides ventilation, heating and cooling. When the unit is operating, it provides forced fresh air into the compartment, as well as providing conditioned air to the toilet room. The HVAC also de-mists the windshields. The unit is controlled by an eight position rotary selector switch (6).

NOTE: The Heater/Air Conditioner Circuit Breaker (Item 24, Figure 9) must be ON to operate the Central HVAC unit.

NOTE: The fresh air duct should be closed during operation in a tunnel.

Air Conditioning

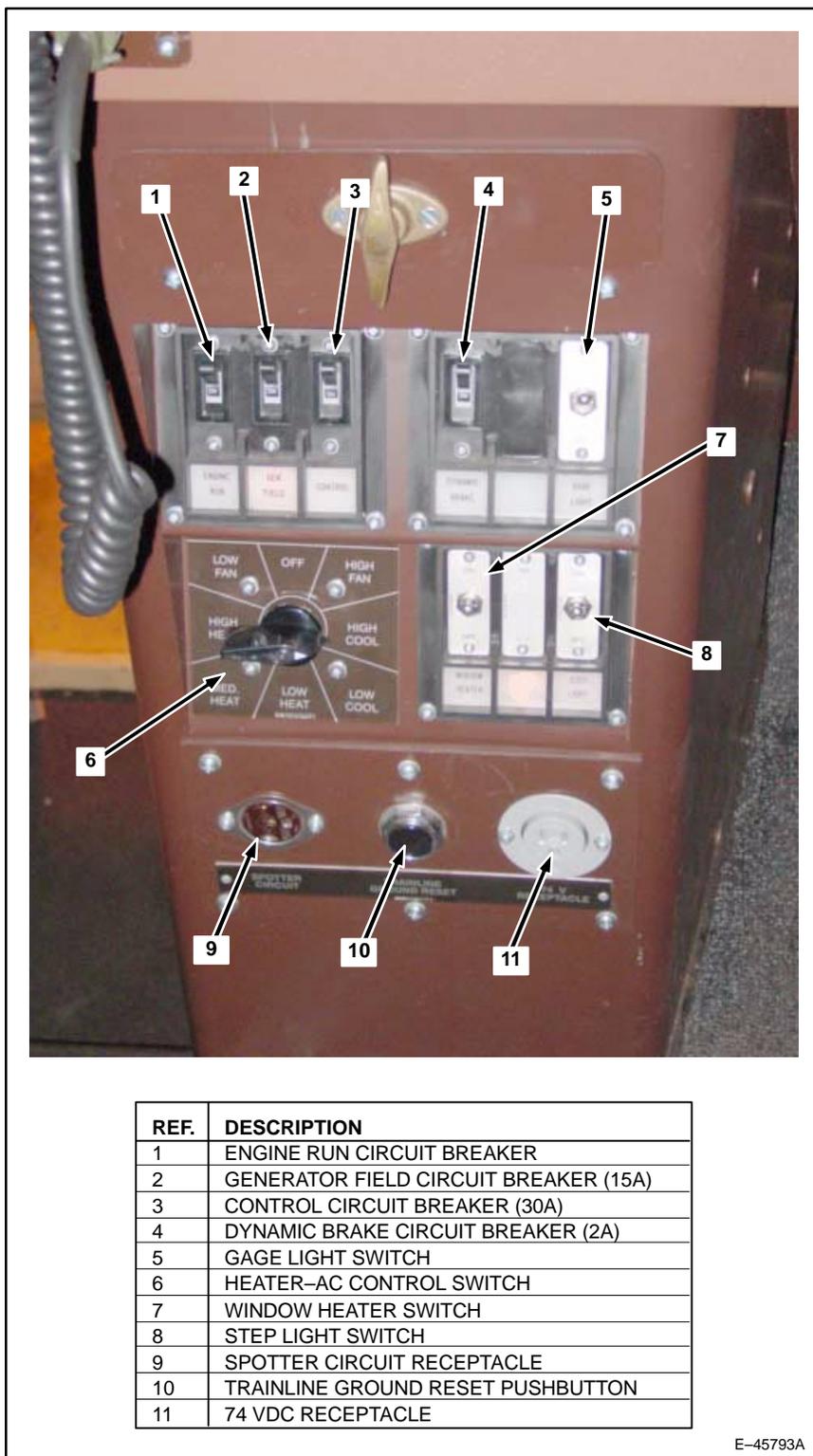
Note the following recommendations and information for better Air Conditioner functioning:

- The air conditioner will cool when Operating Compartment temperature is above 70° F (21° C).
- The air conditioner will **not** cool if outside temperature is below 45° F (7° C).
- The air conditioner will maintain a comfortable temperature if compartment doors and windows remain closed.
- In very hot weather, on initial cool-down, closing the fresh air damper will decrease cool-down time.

Heating

Note the following recommendations and information for better Heater functioning:

- The heater will **not** operate if Operating Compartment temperature is above 80° F (26° C).
- Upon start up, the heater will take 5 to 10 minutes to raise Compartment temperature to a comfortable level. To speed this process, close the outside fresh air damper and turn ON the wall strip heaters.



REF.	DESCRIPTION
1	ENGINE RUN CIRCUIT BREAKER
2	GENERATOR FIELD CIRCUIT BREAKER (15A)
3	CONTROL CIRCUIT BREAKER (30A)
4	DYNAMIC BRAKE CIRCUIT BREAKER (2A)
5	GAGE LIGHT SWITCH
6	HEATER-AC CONTROL SWITCH
7	WINDOW HEATER SWITCH
8	STEP LIGHT SWITCH
9	SPOTTER CIRCUIT RECEPTACLE
10	TRAINLINE GROUND RESET PUSHBUTTON
11	74 VDC RECEPTACLE

E-45793A

Figure 8. Operator Control Console, Bottom.

Operation

The HVAC Control Switch has eight positions as follows:

OFF	Shuts off the Air Conditioner and Heater unit.
LOW FAN	Provides air circulation at low fan speed.
HIGH FAN	Provides air circulation at high fan speed.
LOW HEAT	Provides low heat at low fan speed.
MED HEAT	Provides medium heat at high fan speed.
HIGH HEAT	Provides maximum heat at high fan speed.
LOW COOL	Provides low cooling air at low fan speed.
HIGH COOL	Provides maximum cooling air at high fan speed.

Dynamic Braking Control Breaker

The Dynamic Braking Control breaker (4) is used to provide power to the dynamic braking system of the locomotive. In MU operation, this breaker must be ON on the Lead unit (OFF on Trail units) to control the dynamic braking of other units in the consist.

Gage Lights Switch

This switch (5) turns on the operator's console lens cover lights for the circuit breakers, switches and **Combined Power** handle position indicator.

Window Heater Switch

This switch (6) operates the Window heaters when the Window Heater Circuit Breaker, located on the EC Panel, is ON. There are also LED to indicate whether the switch is in the ON or OFF position.

Step Light Switch

This switch (8) turns on all step lights.

Spotter Circuit Receptacle

This receptacle (9) has been provided to enable use of a spotter button. The spotter circuit enables railroad maintenance personnel to move the locomotive (when the EC switch is in JOG) using battery power. For Spotter Button operation, refer to the decal located on the back of the control console.

Trainline Ground Reset Pushbutton

This pushbutton (10) resets the Ground Relay on locomotives which are equipped for trainline ground reset. This unit will not respond to this input.

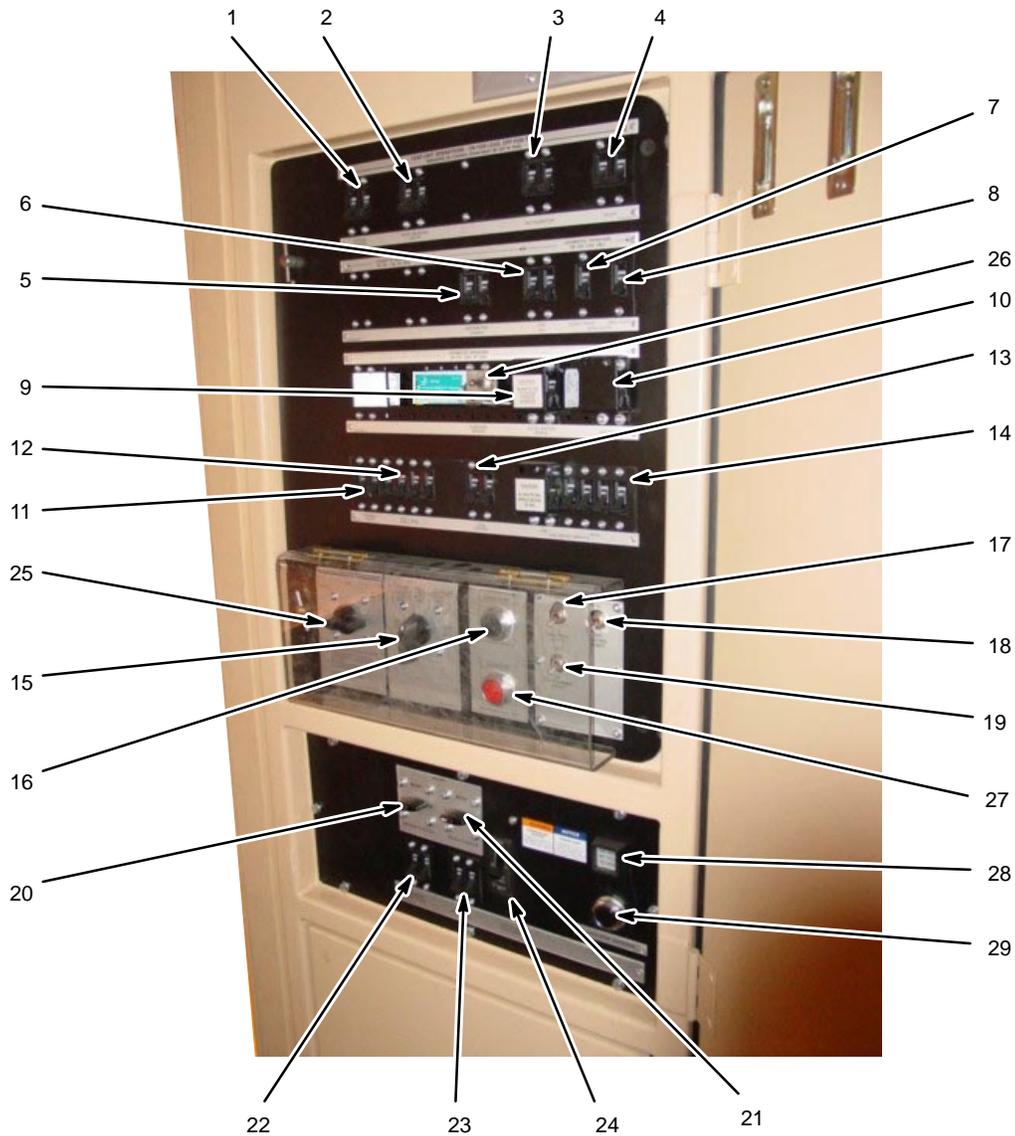
74 VDC Receptacle

This receptacle (11) is supplied from the 74 VDC Battery circuit. It has been provided to enable the use of optional items such as Trouble Lights.

ENGINE CONTROL PANEL DEVICES

NOTE: Numbers in parentheses () refer to Items found on Figure 9 of this publication unless noted otherwise.

The Engine Control (EC) panel (Item 33, Figure 4) is located on the long-hood wall of the Operator's Cab. Mounted on this panel are various switches, circuit breakers, and indicators used during locomotive operation.



REF.	DESCRIPTION	REF.	DESCRIPTION
1	WINDOW HEATER CIRCUIT BREAKER	16	ENGINE START BUTTON
2	ROAD CROSSING LIGHTS CIRCUIT BREAKER	17	CROSSWALK LIGHTS SWITCH
3	REFRIGERATOR CIRCUIT BREAKER	18	CONTROL COMPUTER SWITCH
4	RADIO CIRCUIT BREAKER	19	FRONT NUMBER LIGHTS SWITCH
5	DISTRIBUTED POWER CIRCUIT BREAKER	20	OPERATOR'S WALL HEATER SWITCH
6	CAB FAN CIRCUIT BREAKER	21	CREW MEMBER'S WALL HEATER SWITCH
7	SHORT HOOD HEADLIGHT CIRCUIT BREAKER	22	OPERATOR'S WALL HEATER CIRCUIT BREAKER
8	LONG HOOD HEADLIGHT CIRCUIT BREAKER	23	CREW MEMBER'S WALL HEATER CIRCUIT BREAKER
9	AUTO WATER DRAIN CIRCUIT BREAKER	24	HEATER/AIR CONDITIONER CIRCUIT BREAKER
10	AIR BRAKE CIRCUIT BREAKER	25	ENGINE CONTROL SWITCH
11	RUNNING LIGHTS CIRCUIT BREAKER	26	ELECTRIC PARKING BRAKE CIRCUIT BREAKER
12	FUEL PUMP CIRCUIT BREAKER	27	ENGINE STOP BUTTON
13	LOCAL CONTROL CIRCUIT BREAKER	28	HANDBRAKE NOT FULLY RELEASED INDICATOR
14	CAB DISPLAY COMPUTER CIRCUIT BREAKER	29	AUTO STOP OVERRIDE BUTTON
15	MU HEADLIGHT SETUP SWITCH		

E-46651

Figure 9. Engine Control Panel.

Engine Control Switch

The Engine Control (EC) switch (25) has four positions:

1. **START** – The Engine Start pushbutton is effective only when the EC switch is in **START**. When the engine is running and the EC switch is in **START** position, engine speed is held at **IDLE** and power cannot be applied to the locomotive. The alarm bell will not ring if the engine shuts down.
2. **ISOLATE** – When the engine is running and the EC switch is in the **ISOLATE** position, the engine speed is held at **IDLE** and power cannot be applied to the locomotive.
3. **RUN** – When the engine is idling and the locomotive is to be operated, the Engine Control (EC) switch must be moved to the **RUN** position.

NOTE: If the EC switch is left in the RUN or ISOLATE position when the diesel engine is shut down, the alarm bell will sound.

4. **JOG** – When the locomotive is to be moved using battery power, the EC switch is moved to the **JOG** position. To operate this locomotive (speed limited to 5.0 mph) using Battery Jog, proceed as follows:

CAUTION: Before using the Battery Jog function verify that the main reservoir pressure is 60 psi (413 kPa) or more. Verify that the brakes apply and release.

- a. Center **Reverser** Handle.
- b. Plug Battery Jog Tether cable into provided plug on the control stand.
- c. Place Engine Control Switch in **JOG** position.
- d. Select direction of travel with **Reverser** Handle.
- e. Press pushbutton on end of tether cable to move locomotive.

MU Headlight Set-Up Switch

The MU Headlight Set-Up switch (15) has five positions. Positioning of this switch is determined by location of the locomotive unit in the consist and whether the short hood (**F** end) of the locomotive unit is leading or trailing. Switch positions are as follows:

1. **SINGLE OR MIDDLE UNIT** – Place switch in this position on any locomotive unit operated singly or on all units, except the Leading or Trailing unit, when the locomotive consist is made up of more than two units.
2. **SHORT-HOOD LEAD – LEADING UNIT** – Place switch in this position when the Leading unit is operated with the short hood forward.
3. **LONG-HOOD LEAD – LEADING UNIT** – Place switch in this position when the Leading unit is operated with the long hood forward.
4. **SHORT-HOOD TRAIL – TRAILING UNIT** – Place switch in this position when the final Trailing unit is connected so its short hood trails.
5. **LONG-HOOD TRAIL – TRAILING UNIT** – Place switch in this position when the final Trailing locomotive is connected so its long hood trails.

Engine Start Pushbutton

Press the Engine Start pushbutton (16) to initiate the engine start sequence.

Engine Stop Pushbutton

Press the Engine Stop pushbutton (27) to shut down the engine.

Crosswalk Lights Switch

This switch (17) operates all the locomotive crosswalk lights.

Control Compartment Light Switch

This switch (18) turns on lights in Control Areas 1, 2, 3, 4 and 5.

Front Number Light Switch

This switch (19) operates front number lights.

Strip Heater Circuit Breakers and Output Controls

Located near the floor of the Operating Cab are the Operator's wall strip heater and Crew Member's wall strip heater. Circuit breakers (22, 23) on the EC Panel will cut out the Operator's and Crew Member's wall strip heaters if tripped. The Operator's heater is controlled by the Output Switch (20) which has three positions: OFF, MEDIUM and HIGH.

Air Conditioner/Heater Circuit Breaker

This circuit breaker (24) controls power to the cab air conditioner/heater unit.

Electric Parking Brake Switch

The electric parking brake circuit breaker switch (26) is used to apply power to the electric parking brake.

Auto Stop Override Pushbutton

Press the Auto Stop Override pushbutton (29) to prevent the diesel engine from automatically shutting down. Pressing this pushbutton will prevent an automatic engine shut down for a period of two hours.

NOTE: Pressing the Auto Stop Override pushbutton twice within 30 seconds will shut down the engine after one minute.

DEVICES ON THE OVERHEAD CONSOLE

NOTE: Numbers in parentheses () refer to Items found on Figure 10 of this publication unless noted otherwise.

Crew Member's Desk Light

On the bottom side of the Overhead console is a light (1) for illumination of the desk area. A Switch (3) turns the light on, and a dimmer (2) is provided to control the brightness of the light.

Audio Alarm Panel

The Audio Alarm Panel (7) is used to alert the operator of various operating alarms (from Alerter, EOT, and Over-speed).

Indicating Lights

Indicating lights (8) have been included in the Overhead console to help the operating crew know whether the front top or front bottom headlight is lighted or not.

Radio

This device (9) enables the crew to control the rack-mounted voice radio. See specific *Railroad Operating Procedures*.

Operator's Console Light

On the bottom side of the Overhead console is a light (10) for illumination of the Control Console area. A Switch (12) turns the light on, and a dimmer (11) controls the brightness of the light.

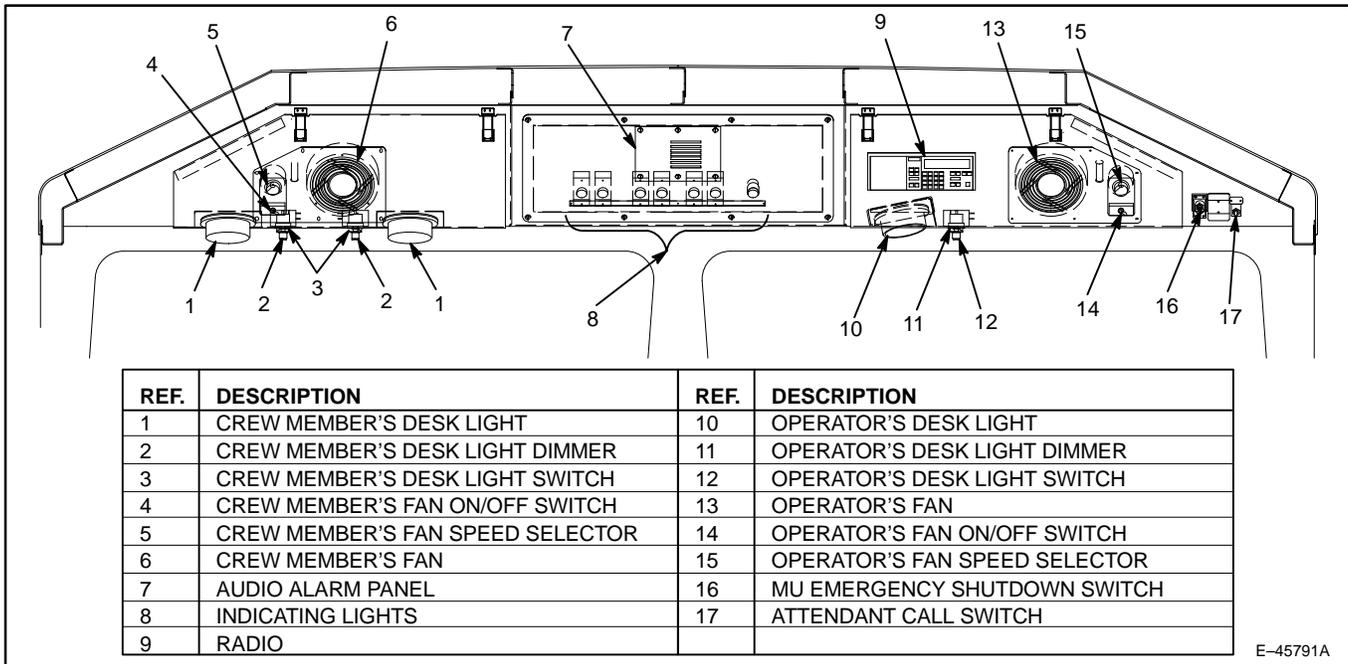


Figure 10. Overhead Control Console.

NOTE: The Engine Stop Switch is used to cut-off the fuel to the engine on the local unit only. The MU SHUTDOWN toggle switch on the overhead console will call for a shut down of the engines on all of the units in the consist simultaneously.

MU Emergency Shutdown Toggle Switch

This toggle switch (16) is provided for Emergency Multiple-Unit Shutdown of all engines.

Attendant Call Switch

The Attendant Call Switch (17) is used to ring the alarm bell in the Operator Cabs of the trailing units in the consist.

Operating Cab Fans

Two fans (6, 13) located on both the Operator's and Crew Member's side of the Overhead console provide additional air circulation in the Operating Cab. An ON/OFF toggle switch (4, 14) and speed control knob (5, 15) control each fan.

DEVICES IN CREW MEMBER'S AREA

NOTE: Numbers in parentheses () refer to Items found on Figure 11 of this publication unless noted otherwise.

Smart Display Panel (Auxiliary) (SDIS)

The Smart Display SDIS (1) is a computer display which may be used to monitor locomotive performance from the crew member's console.

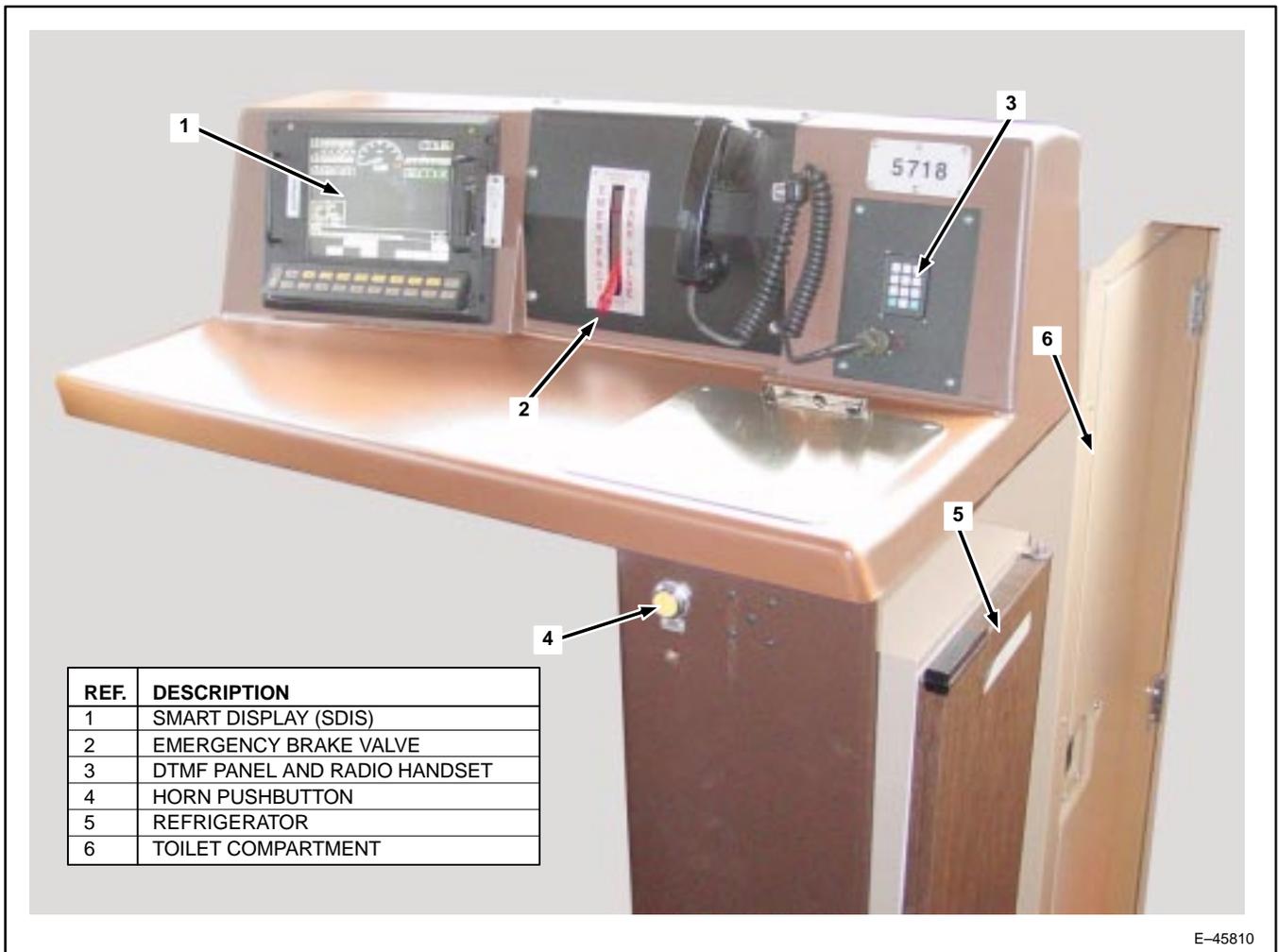
Emergency Brake Valve

The handle of the emergency brake valve (2) is located on the back of the Crew Member's Desk. Lifting this handle causes an Emergency brake application.

NOTE: Operating the Emergency Brake Valve causes the End of Train (EOT) device to vent the brake pipe at the end of the train.

Two-Way Radio Equipment

A keypad and telephone-style handset (3) with Push-To-Talk (PTT) button operates with the two-way radio equipment located in the Overhead Console.



E-45810

Figure 11. Crew Member's Console.

Toilet Compartment

Refer to Figure 18 for more information on the Toilet Compartment (6).

Refrigerator

A refrigerator unit is located under the Crew Member's desk facing the stairway into the Nose Cab. The refrigerator (5) is powered by an Inverter located in the Electronic Equipment Locker. The refrigerator is protected by a circuit breaker located on the Engine Control panel (Figure 9).

Crew Member's Strip Heater

Located near the floor of the Operating Cab is the Crew Member's wall strip heater. The heater is controlled by an Output control (OFF/MEDIUM/HIGH) and circuit breaker (Items 22 and 23, Figure 9) located below the EC Panel.

Horn Pushbutton

The locomotive horn (Item 4, Figure 11) will sound as long as the Horn Pushbutton is pressed. The locomotive Horn is interlocked with the Bell so that the Bell will sound when the Horn sounds. It is necessary to press the Bell Pushbutton (Item 7, Figure 5) to silence the Bell when it has been energized by this Horn interlock.



AIR BRAKE EQUIPMENT

ELECTRONIC AIR BRAKE SYSTEM

WARNING: STOPPING HAZARD. Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 45 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

CCBII, a microcomputer based electro–pneumatic brake control system, is supplied on this locomotive. All logic is under computer control, except for initiation of emergency brake applications by brake vent or through the emergency brake valve on the crew member’s console. CCBII is compatible with 26L Type pneumatic air brake systems.

NOTE: CCBII is an electro–pneumatic system which needs locomotive battery power to function. Verify that the air brake circuit breaker on the EC panel is set to ON.

Control of Lead/Trail functions and brake pipe cut–in or cut–out is accomplished through SDIS menu selections. Refer to the **Electronic Air Brake** section of this manual.

The CCBII system consists of distributed electronics which are linked by a computer network. The Electro–Pneumatic Control Unit (EPCU), mounted in the air brake compartment, consists of modular units which control development of all pneumatic control pressures.

The operator controls the system through the Electronic Brake Valve (Figure 12). The EBV signals the handle positions for Automatic and Independent dynamic braking. An exception is the initiation of an Emergency Brake application which is propagated mechanically through a vent valve by placing the Automatic Brake handle in the EMER position.

The main computer for the CCBII system is the Integrated Processor Module (IPM). The IPM is mounted in the Electronic Equipment Locker in the nose cab of the locomotive. IPM serves as the interface between CCBII and SDIS. IPM communicates with SDIS for Alerter messaging, crew messaging, and diagnostic fault messaging.

CCBII provides a back–up pneumatic brake cylinder control in the event of computer failure or loss of input power from the locomotive. This function is provided by the manifold–mounted DB Triple Valve.

Automatic Brake Handle

The following paragraphs describe the function of the Automatic Brake Handle.

The Automatic Brake handle operates through six detented control positions: RELEASE (REL), MINIMUM REDUCTION (MIN), FULL SERVICE (FS), SUPPRESSION (SUP), CONTINUOUS SERVICE (CS), and EMERGENCY (EMER). The *service zone* is between minimum reduction and full service positions (MIN and FS). The following paragraphs provide a description of these positions:

1. RELEASE (REL) Position – When charging a train or releasing an Automatic Brake application, the Automatic Brake handle should be placed in REL position. Automatic Brakes are released in this position.
2. MINIMUM REDUCTION (MIN) Position – When making a Service brake application, move the automatic brake handle to the MIN position, which will provide a 6 to 8 psi (41 to 55 kPa) reduction. If necessary to increase the reduction, move the handle progressively toward the Full Service (FS) position, bearing in mind that the further the handle is moved into the *service zone*, the greater will be the reduction. The system will automatically maintain brake pipe leakage within the FRA approved range.
3. FULL SERVICE (FS) Position – A Full Service brake application is obtained by moving the brake handle to the FS position. This position will reduce the Brake Pipe pressure by 26–28 psi (179–193 kPa) and increase the Brake Cylinder pressure to 60–64 psi (413–441 kPa).



Figure 12. Electronic Air Brake Controller (EBV).

- 4. SUPPRESSION (SUP) Position – This position provides a Full Service brake application and, in addition, on locomotives equipped with overspeed control and safety control penalty brakes, these applications will be suppressed.

WARNING: To ensure safe consist operation, follow specific Railroad Operating Procedure precautions for setting up units for “Trail” or “Dead”.

- 5. CONTINUOUS SERVICE (CS) Position – The automatic brake handle should be moved to this position when the locomotive is a trailing unit in a multiple–unit consist or is being towed DEAD.

WARNING: STOPPING HAZARD. In an EMERGENCY situation, when operating as a single unit or part of a multi–unit consist (locomotives only), moving the INDEPENDENT Brake Handle to FULL APPLICATION is the fastest way to develop brake cylinder pressure on the unit/consist up to the full independent brake cylinder pressure setting. Immediately after moving the INDEPENDENT Handle, move the AUTOMATIC Handle into EMERGENCY. Failure to comply with this procedure during an EMERGENCY situation, COULD EXTEND THE STOPPING DISTANCE.

WARNING: STOPPING HAZARD. Following an EMERGENCY BRAKE application, if the train is not at rest, brake release MUST NOT be attempted. Any movement of the AUTOMATIC Brake Handle to RELEASE while train is moving may cause equipment damage and/or personal injury.

- 6. EMERGENCY (EMER) Position – An Emergency brake application is obtained by moving the brake handle to the EMER position. The word OPERATOR EMERGENCY will appear in the Air Brake Message Box on the SDIS screen for 60 seconds. The operator will then be instructed to recover by moving the brake handle to RELEASE. Release only after the locomotive comes to a complete stop and the reason for the emergency has been cleared.

NOTE: Placing the Automatic Brake Handle in the EMERGENCY position causes the End of Train (EOT) device (if armed) to vent the brake pipe at the end of the train.

NOTE: *If operating as a lead unit, the brake system imposes a one minute time delay before it is possible to recharge the brake pipe after an emergency application.*

Target Display

The Target Display (Figure 12) provides the operator an instantaneous readout of the target Equalizing Reservoir (ER) pressure. This reading is based on the position of the Automatic Brake handle and the feed valve setting. Movement of the Automatic Brake handle also causes the ER reading on the SDIS screen to decrease at a service rate, eventually settling at the target ER pressure. The Target Display provides the operator an immediate indication of the amount of brake pipe reduction requested.

Emergency Sanding

Emergency sanding is automatically applied when locomotive is moving (speed > 0 mph) in FORWARD and REVERSE directions during all Emergency brake applications until the train comes to a stop. In multiple-unit operation, emergency sanding is applied to all units (when consist speed > 0 mph) equipped with pneumatic or electro-pneumatic sanding equipment.

Independent Brake Handle

NOTE: *Application of independent brakes does not decrease dynamic braking effort.*

Move the Independent Brake handle toward the FULL position to apply the independent brakes. A full Independent application is made when the handle is in the FULL position. The independent brakes are released when the handle is in the REL position.

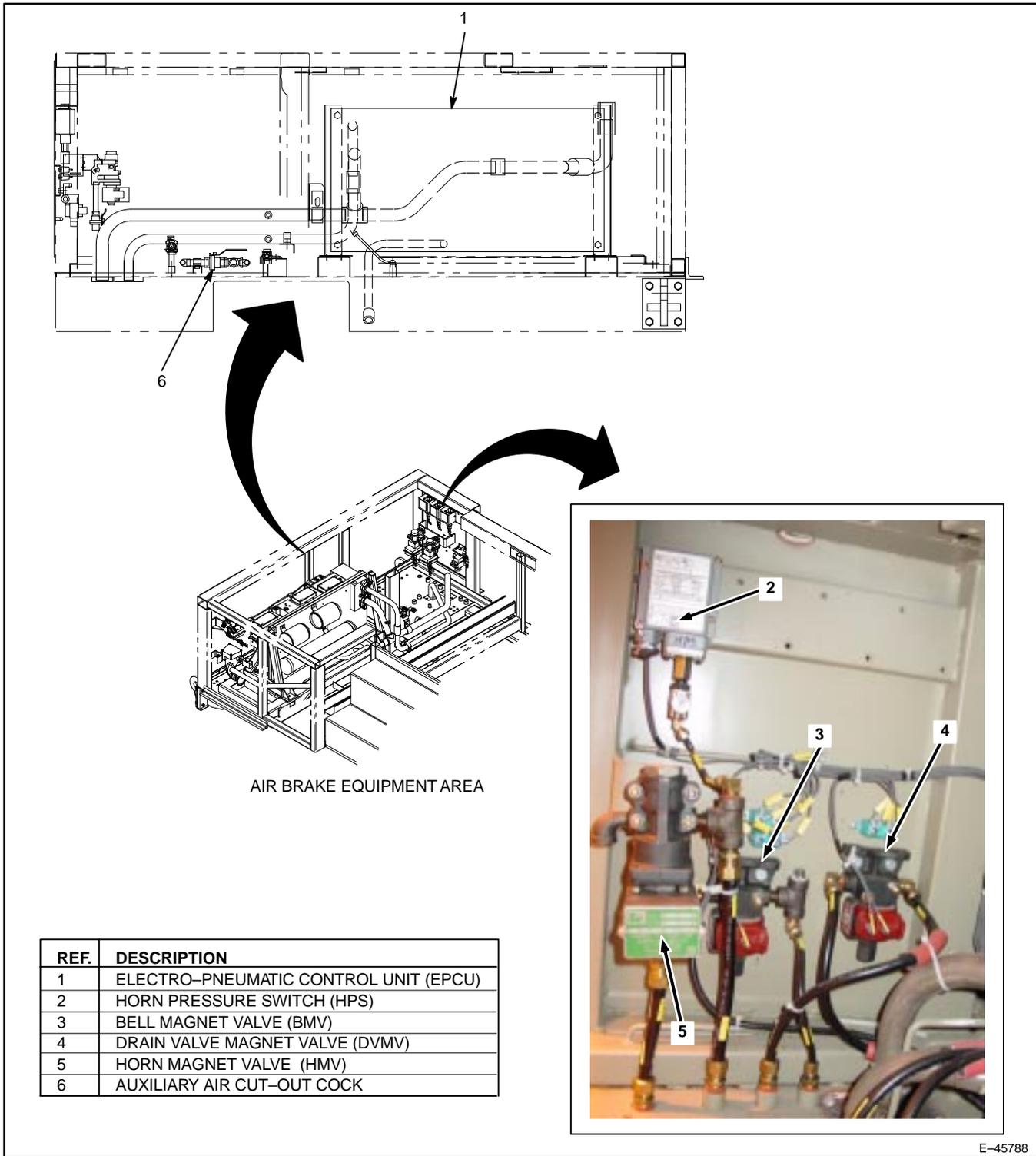
To make an independent release of an Automatic brake application (bail off), lift the ring on the Independent Brake handle. Spring action will return the ring to the original position when released.

WARNING: *To ensure safe consist operation, follow specific Railroad Operating Procedure precautions for setting up units for "Trail" or "Dead".*

The Independent Brake handle should always be in REL position when the unit is a trailing unit in a multiple-unit consist or is being towed DEAD.

AIR BRAKE EQUIPMENT IN AIR BRAKE COMPARTMENT

See Figure 13 for location of equipment in the air brake compartment. Refer to the Air Piping Diagram for specific air brake equipment location.



E-45788

Figure 13. Air Brake Compartment Equipment Location.

CUT-OUT COCKS

The following manually operated cut-out devices are used on this locomotive:

1. Main Reservoir Cut-Out cock – Located on right side of locomotive near the main reservoirs.
2. Main Reservoir Drain cocks – One located on the end of each main reservoir, usually part of automatic drain valves.
3. Air Filter Drain cocks – Located on the main reservoir and auxiliary air filters.
4. Truck (Brake Cylinder) Cut-Out cocks – Located on right side beneath locomotive platform level (one for each truck).
5. Horn Cut-Out cock – Located in air brake compartment.
6. Sander Control Valves and Cut-Out cock – The forward and reverse sander control valves are located inside the right rear radiator cab and the right front nose cab on separate panels (Figure 14). The sand control valve cut-out cock is located here also.
7. Cut-Out Cocks and End Connections in each end of locomotive (Figure 15):
 - a. Brake Pipe cocks (BP).
 - b. Main Reservoir Equalizing (MR).
 - c. Actuating (ACT).
 - d. Independent Application and Release (A&R).
8. Dead Engine cock – Located in air brake compartment on the Electro Pneumatic Control Unit (Figure 16).

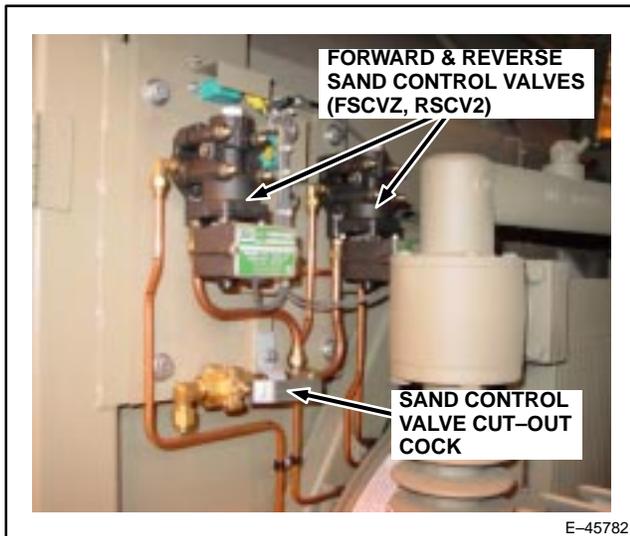


Figure 14. Sand Control Valves and Piping.

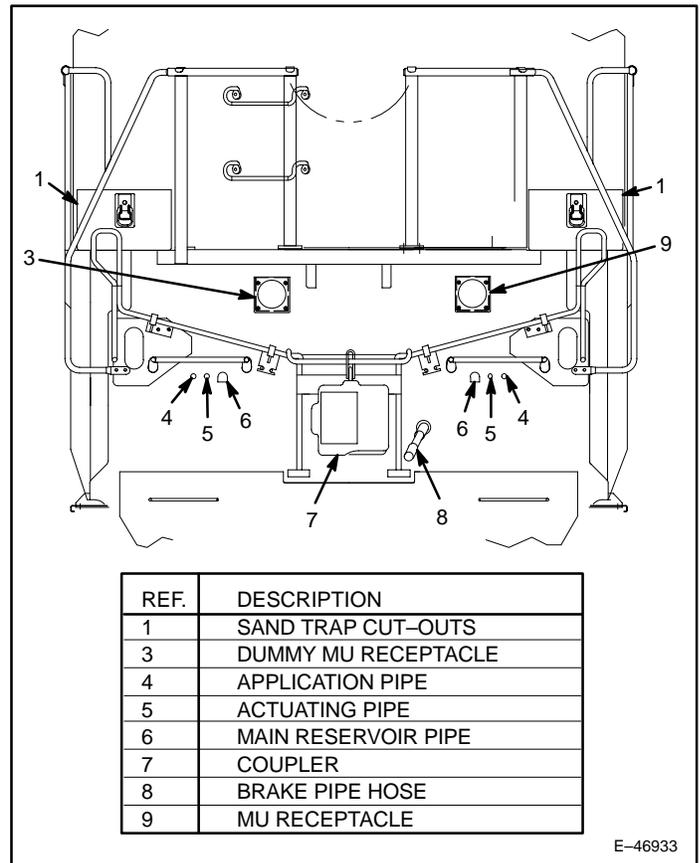


Figure 15. Air Brake End Connections.

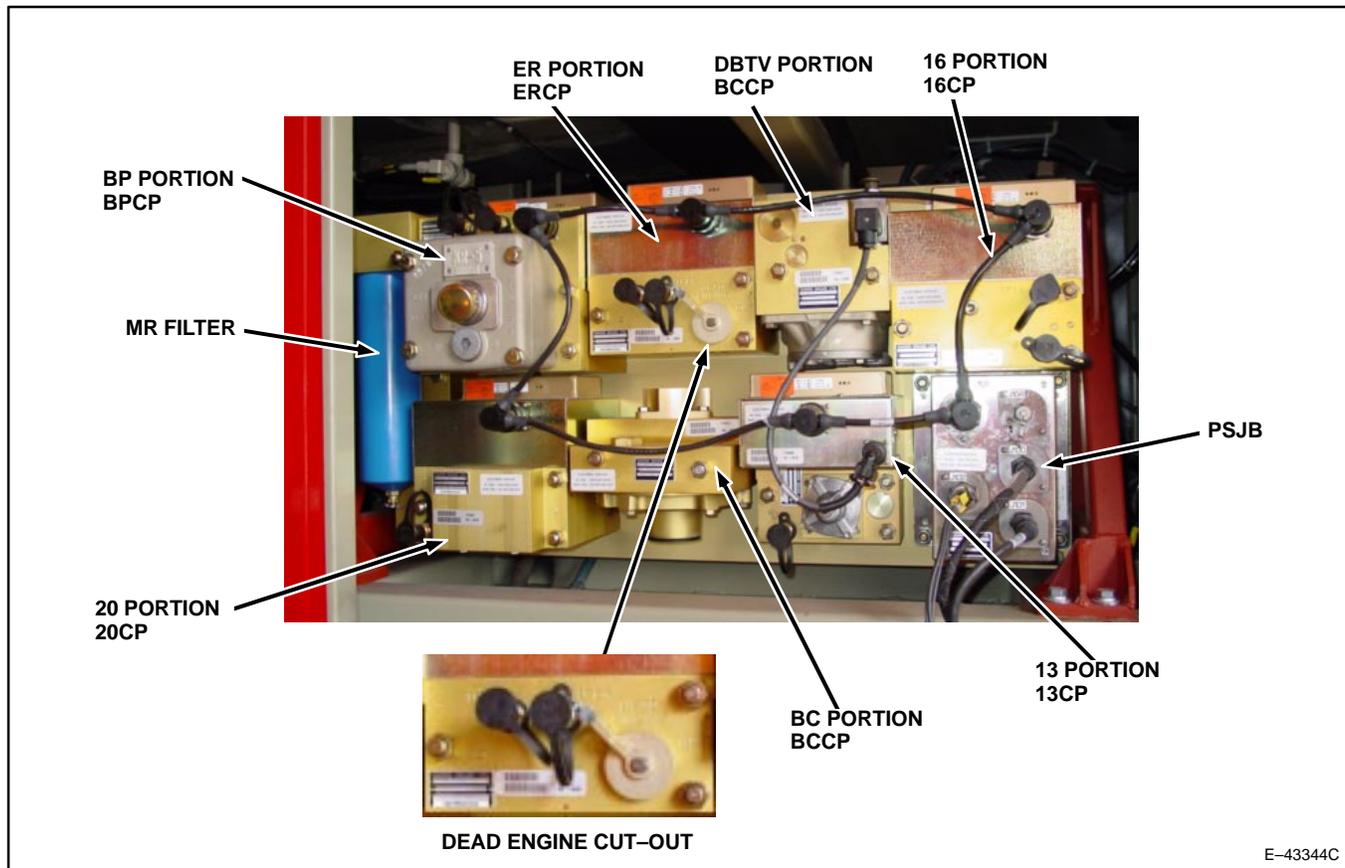


Figure 16. Electro-Pneumatic Control Unit (EPCU) Component Location.

OTHER EQUIPMENT

ELECTRONIC EQUIPMENT ALCOVE

NOTE: Numbers in parentheses () refer to Items found on Figure 17 of this publication unless noted otherwise.

Electronic Equipment Compartment Light

The Electronic Equipment Compartment Light (1) provides illumination of the LSI Rack.

Protocol Translator

The Protocol Translator (2) is mounted in the electronic equipment alcove.. This panel provides communication interface connections between the various locomotive devices and the locomotive Control System. It also provides date, time and location data received from the Global Positioning System.

Electronic Air Brake Equipment

Electronic Air Brake equipment located in the Electronic Equipment Locker:

NOTE: The Electronic Brake Valve is the primary interface between the locomotive operator and the EAB system.

1. The CCBII Integrated Processor Module (IPM, 6) contains the electronics and software which perform the functions necessary to control the overall system operation.

End Of Train System (EOT)

The Head Of Train Device (HOTD, 4) is mounted in the LSI Rack. It is a radio receiver that routes status signals from the EOT device on the last car of the train to the control system and to the operator.

15 Volt Power Supply

The 15 Volt Power Supply (RPS, 5) is mounted in the LSI Rack. It supplies DC power to the equipment in the Electronic Equipment Alcove.

Event Recorder (ER)

The Event Recorder (7) is mounted in the Electronic Equipment Alcove. It receives inputs from the locomotive on-board control systems. It is used to record key data on a timely basis and enable Railroad technicians to retrieve data through the SDIS panels, the PTU port or a radio download (if equipped).

An indicator light on the unit shows that the recorder is operating properly.

Distributed Power System

Various control components for the Distributed Power System are located in the Electronic Equipment Locker. The Radio Module (8) is supplied to enable the crew to control remote consist units.

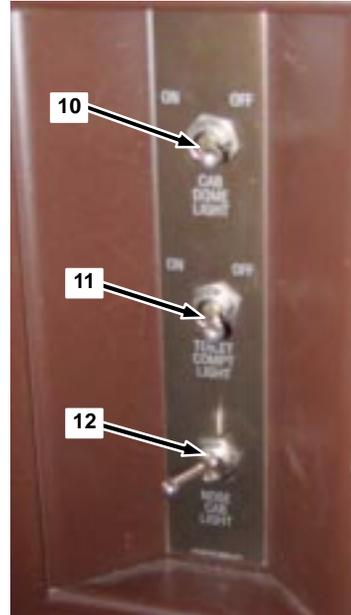
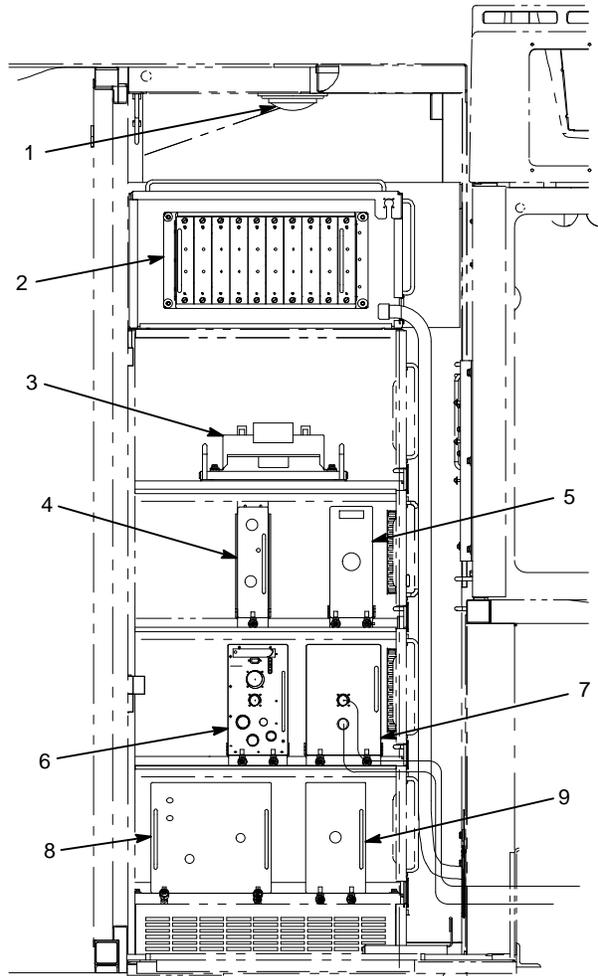
Yard Download Radio

Located on rear-wall (facing compartment) is the YDR (9). This radio allows trackside transmittal of event recorder data.

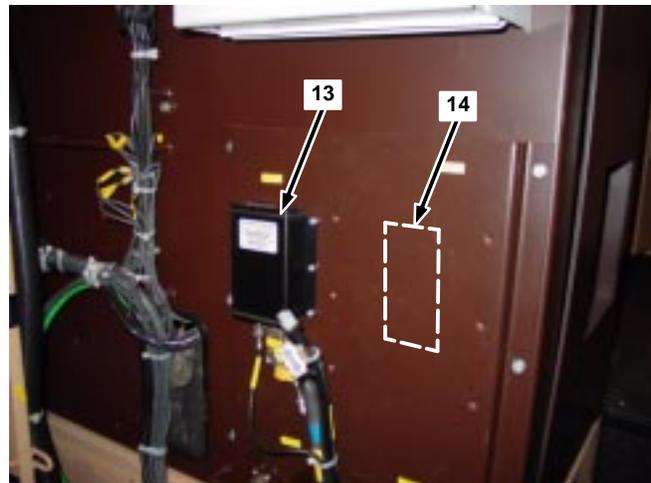
Switches on the Aisle Side of the Operator Control Stand:

Dome Light Switch

This switch (10) turns on the cab dome light.



REF.	DESCRIPTION
1	COMPARTMENT DOME LIGHT
2	PROTOCOL TRANSLATOR
3	INVERTER
4	HEAD OF TRAIN DEVICE
5	15 VOLT POWER SUPPLY
6	INTEGRATED PROCESSOR MODULE
7	EVENT RECORDER
8	DISTRIBUTED POWER RADIO
9	YARD DOWNLOAD RADIO
10	CAB DOME LIGHT SWITCH
11	TOILET COMPARTMENT LIGHT SWITCH
12	NOSE CAB LIGHT SWITCH
13	GPS MODULE
14	CELL MODEM (IF INSTALLED)



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Figure 17. Electronic Equipment Locker.

Toilet Compartment Light Switch

This switch (11) turns on a ceiling mounted light located in the toilet compartment.

Nose Cab Light Switch

This switch (12) turns on the light in the Nose Cab. It is a two-way switch that operates in conjunction with another switch located near the Nose Cab door.

Components on the Back of the Operator Control Stand:

GPS Module

Global Positioning System (GPS) Module (13) receives and relays signals for constant locomotive geographical position, speed, and altitude; it provides a universal time (UTC) reference for the locomotive computers and other systems.

OTHER OPERATOR CAB FEATURES

Toilet Compartment

A toilet compartment (Figure 18) is located in the Nose Cab on the B-side of the locomotive).

Operator's/Crew Member's Dome Lights and Windshield Wiper Valves

Located and controlled above the operator's and crew member's positions are the overhead dome light and wiper controls (Figure 19).

Operator's/Crew Member's Overhead Speaker

Located and controlled above the operator's and crew member's positions are the overhead Cab Speakers (Figure 20).

CONTROL COMPARTMENT EQUIPMENT

The computers, relays, contactors, and control panels which comprise the locomotive control system are located in control areas throughout the locomotive (Figure 21).

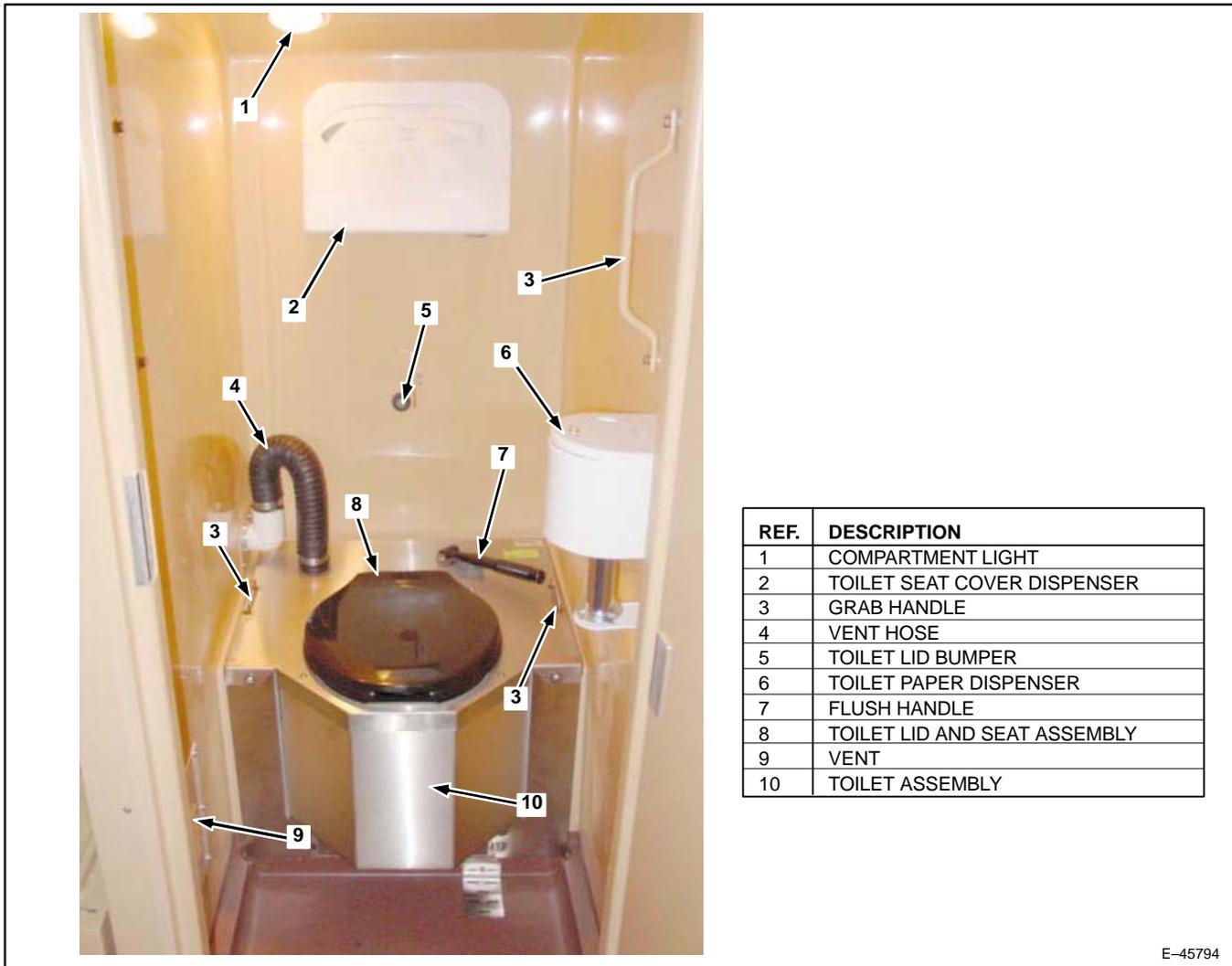
The Electronic Equipment Alcove in the Nose Cab also houses control system equipment. Control Area 1 (CA1) is located in the rear wall of the operator cab. The Auxiliary Cab houses CA2, CA3, CA4, and CA5. CA6 and CA7 are located on the B side and CA8 is located on the A side. CA9 is located in the Radiator Cab. Only trained maintenance personnel should access the equipment in the control areas.

WARNING: Lethal voltages may be present on some circuits. Therefore, before entering the Auxiliary Cab, raise the Barrier Bar to the vertical position.

BLOWERS AND FANS

The DC Evolution Series locomotive uses electric motor-driven blowers to ventilate the traction motors and alternator. An electric motor-driven blower also exhausts dirty air from the spin filters. The radiator fan and air-to-air inter-cooler fans are also driven by an electric motor. The locomotive control system regulates the speed of these motors, either through use of contactors or solid-state control panels.

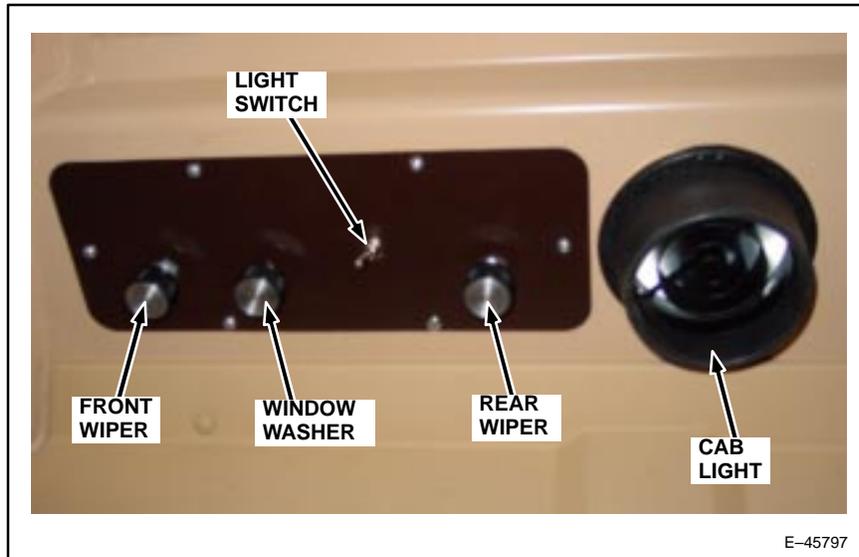
NOTE: If the radiator fan has not operated for 30 minutes, the control system will operate it for 10 seconds to prevent bearing brinelling.



REF.	DESCRIPTION
1	COMPARTMENT LIGHT
2	TOILET SEAT COVER DISPENSER
3	GRAB HANDLE
4	VENT HOSE
5	TOILET LID BUMPER
6	TOILET PAPER DISPENSER
7	FLUSH HANDLE
8	TOILET LID AND SEAT ASSEMBLY
9	VENT
10	TOILET ASSEMBLY

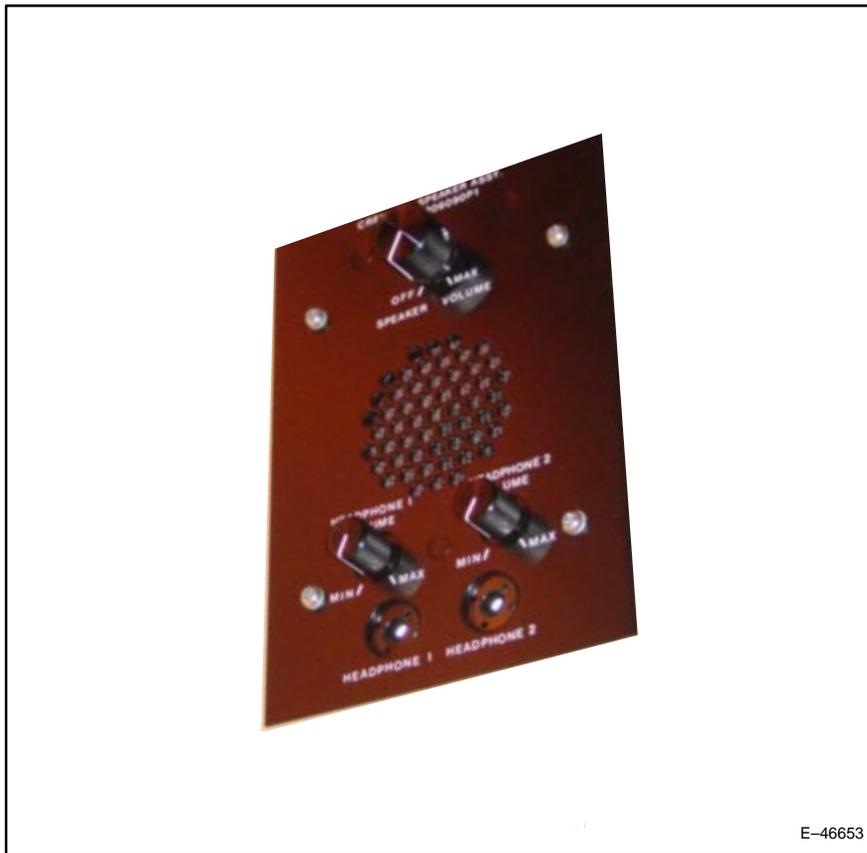
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Figure 18. Typical Toilet Compartment.



E-45797

Figure 19. Overhead Dome Light And Wiper Controls.



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Figure 20. Operator's/Crew Member's Overhead Speaker.

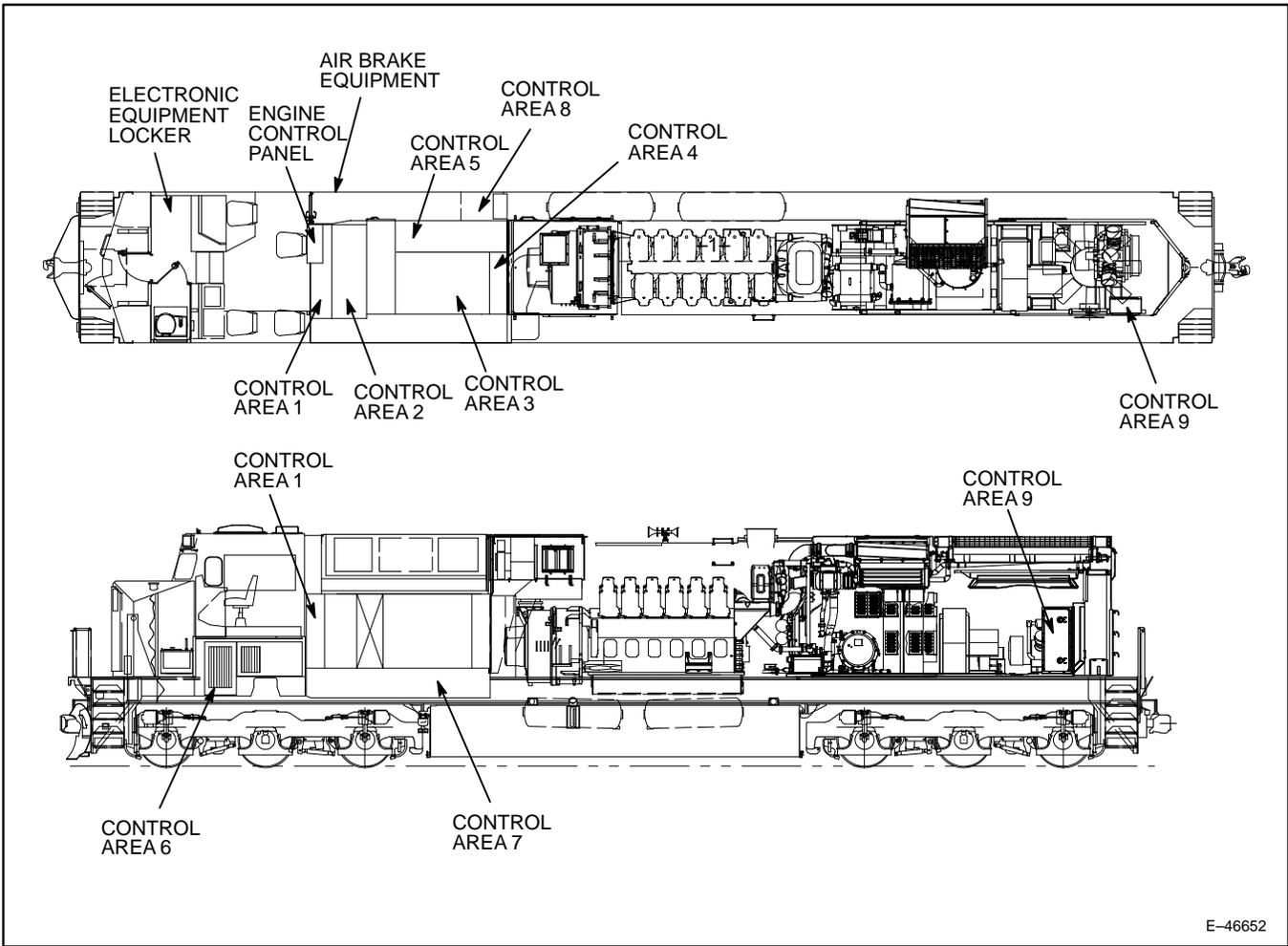


Figure 21. Location of Control Areas.

E-46652

AIR COMPRESSOR

DC Evolution Series locomotives use an air compressor driven by an electric motor (Figure 22). Motor speed and compressor loading are controlled by an SDIS. The Air Reservoir Pressure Sensor (ARPS), found on the compressor control panel (Figure 23), monitors main reservoir pressure and provides a pressure signal through the Concentrated Input/Output (CIO) to the control system.

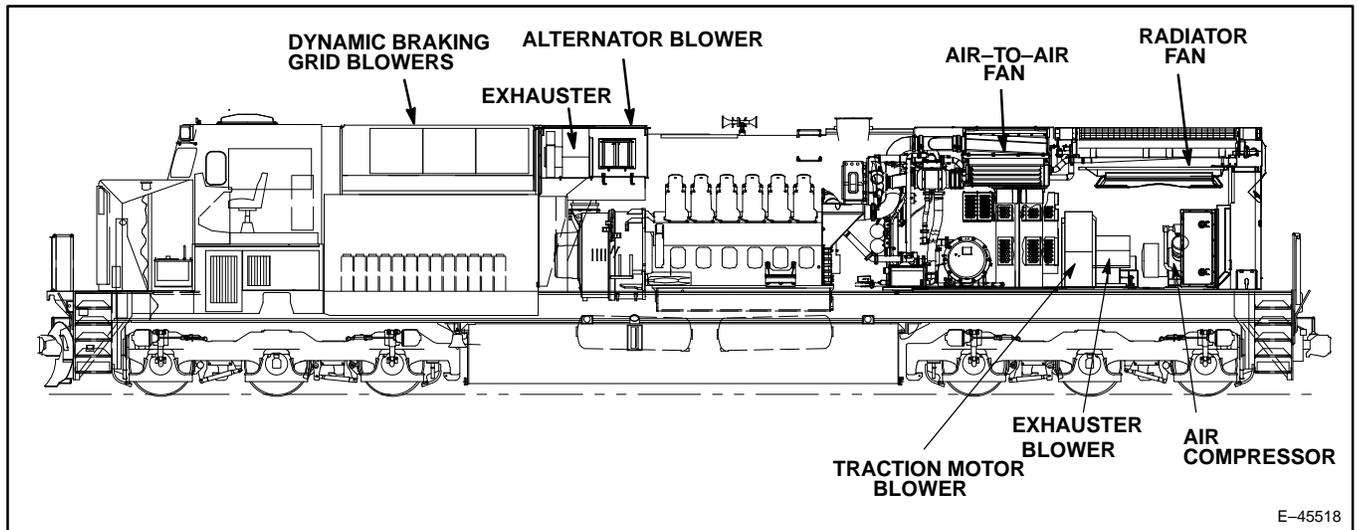


Figure 22. Location Of Equipment, Dynamic Braking, Exhauster And Alternator Blowers, Air-To-Air and Radiator Fan.

Air Compressor Safety Valves

The air compressor has safety valves located on both the intercooler and on the aftercooler. They are set to open at 75 psi (517 kPa) and 180 psi (1240 kPa) respectively.

Air Compressor Magnet Valve Cut-Out Cock

The Air Compressor Magnet Valve Cut-Out cock is mounted on the compressor control panel (Figure 23) located in the Radiator Cab. Closing this cock forces the air compressor to run loaded when the compressor is operating. This panel is accessible from the left side of the locomotive.

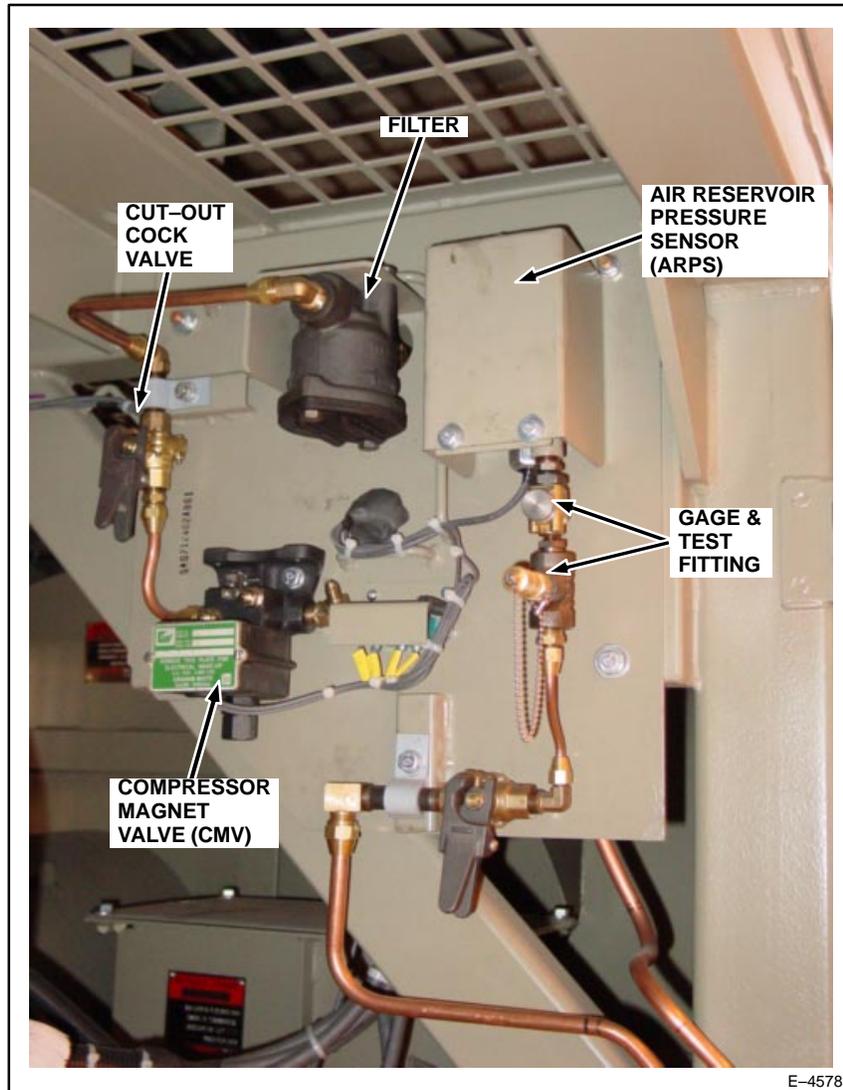


Figure 23. Air Compressor Control Panel (CCP) and Piping.

MISCELLANEOUS EQUIPMENT

Main Reservoir Safety Valve

The safety valve is located in the piping between the MR1 and MR2 main reservoirs. It is set to open at 150 psi (1034 kPa).

OTHER GAGES

1. Engine Lubricating–Oil Dipstick – Located on both sides of the engine. The stick is marked FULL and LOW. Proper level with the engine idling is between FULL and LOW.

NOTE: Overfilling will cause engine to shut down from excessive crankcase pressure.

2. Fuel–Oil Sight Glasses – Mounted on both sides of the main fuel tank (Figure 24) to indicate the level of fuel in the tanks.

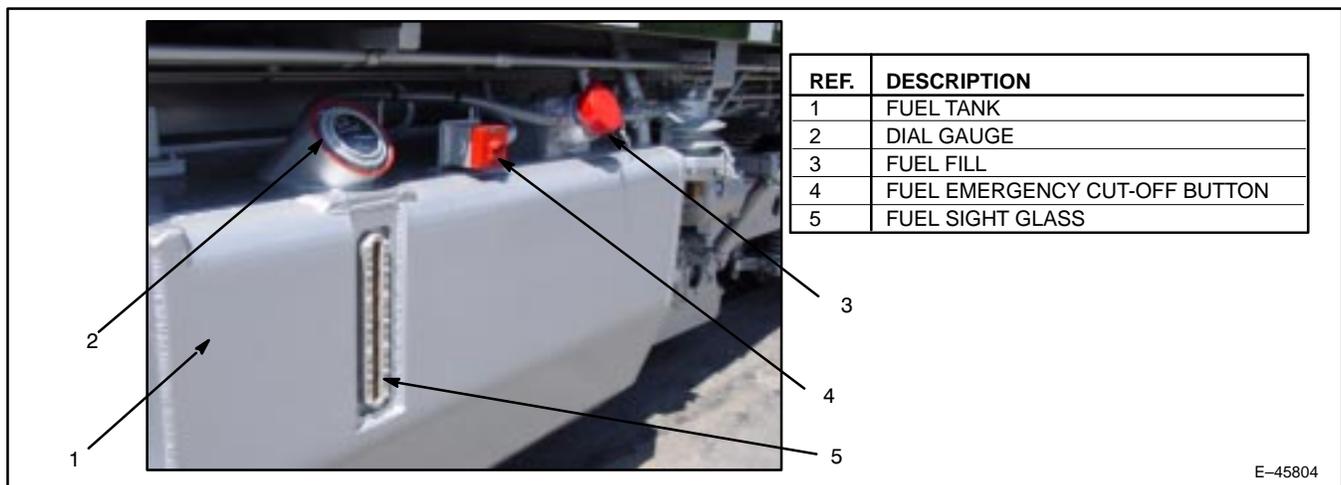


Figure 24. Side Of Fuel Tank Showing Cut-off, Fill, And Gauge.

3. Cooling Water – A water level sight glass (Figure 25) is mounted on the locomotive cooling water fill box and the water tank. The sight glass indicates the level of the cooling water. Markings near the sight glass indicate the proper level for various conditions of the system. These markings are only valid when the green indicating light is ON (Figure 25).

NOTE: When the engine is loaded (water switched to the radiators), the sight glass will be empty.

When filling the system or adding water treatment compound, proceed according to instructions mounted at the water storage tank area or water fill box. Do not overfill.

NOTE: See Figure 31 for the green indicating light location.

4. Compressor Lubricating Oil – A dipstick, located near the fill cap, is used to determine the oil level in the compressor crankcase. Refer to Figure 26.

DRAINING COOLING WATER SYSTEM

The cooling water system may be drained by opening the main water drain valve on the right side of the locomotive near the lubricating–oil pump.

CAUTION: During freezing weather, protect the engine cooling system according to Railroad Operating Procedures.

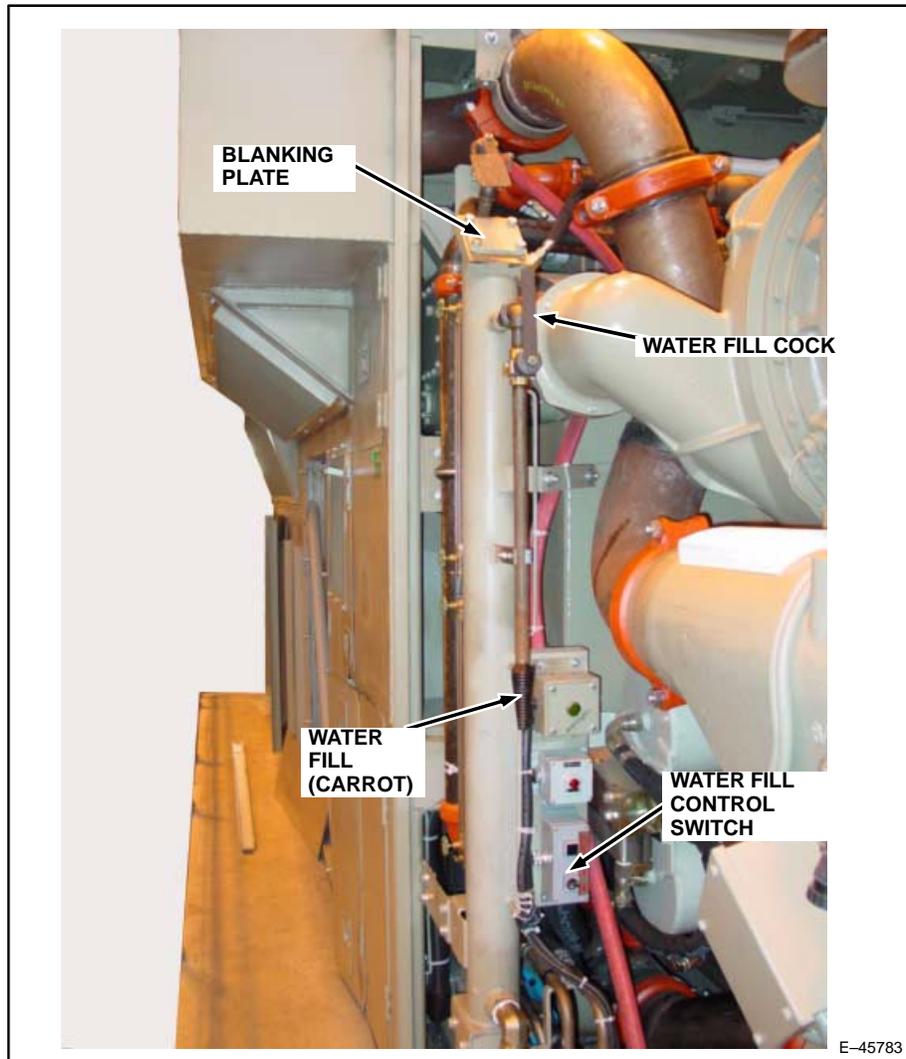
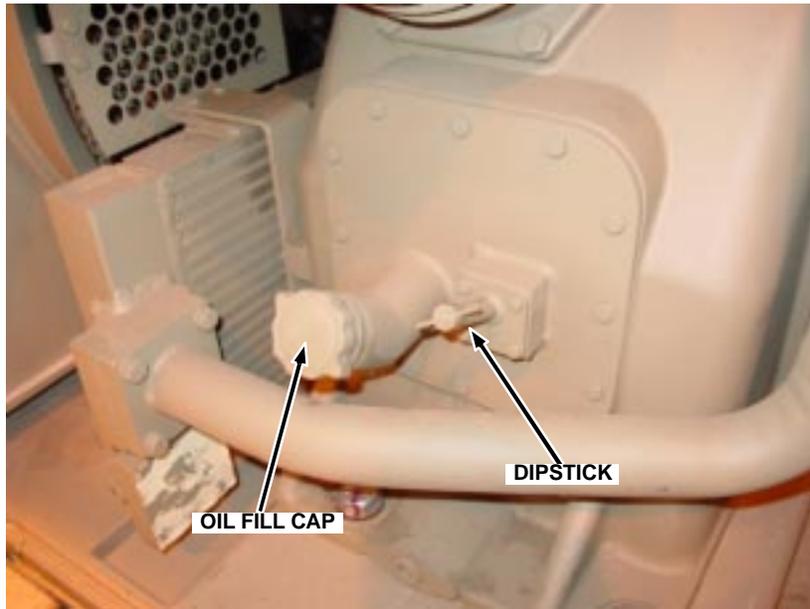


Figure 25. Cooling-Water Fill Box.



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Figure 26. Air Compressor Fill Cap and Oil Level Dipstick.

WINTER OPERATION

Winter/Summer Doors

This locomotive has winter/summer doors in the Engine Cab wall of the engine air intake compartment. These doors provide an additional way of drawing air to the engine in cold climates when snow or ice might block the air inlet screens or plug the plastic primary air cleaners.

With the doors shut, outside air comes in through the primary plastic air cleaners. This outside air then is drawn through the secondary air filters and into the turbocharger.

During the winter, the doors should be open. Warm air, already cleaned by the equipment air system, may be drawn from the Engine Cab, bypassing the engine primary air cleaners. This Engine Cab air then is drawn through the secondary air filters and into the turbocharger.

CAUTION: The Winter/Summer doors should be CLOSED during the summer. If the locomotive is operated during the summer with the doors OPEN, combustion air is excessively heated.

Winter/Summer Fuel Return

This locomotive is equipped with a Winter/Summer Fuel Return (Figure 27). In the Winter position, fuel from the diesel engine is returned to the section of the fuel tank in which the fuel suction line is located. This arrangement warms the fuel to prevent clouding. In the Summer position, fuel from the engine is returned to the fuel tank, preventing overheating of the fuel during warm weather.

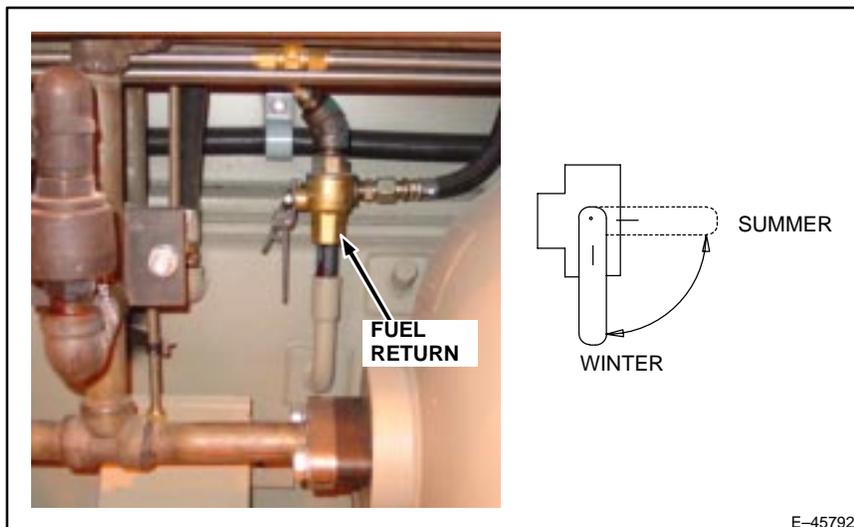


Figure 27. Winter/Summer Fuel Return.

MAINTENANCE BATTERY SWITCH (MBS)

The Maintenance Battery Switch (MBS) is mounted in the Auxiliary Cab on the A side of the locomotive. Opening this knife switch completely disconnects all loads from the locomotive batteries. MBS is shown in Figure 28.

Follow Railroad Operating Procedures for use of the Maintenance Battery Switch. Operating crews need to be aware that the locomotive will not start, nor will any electrical power be available, if MBS is left open.

CAUTION: The locomotive will not have water freeze protection when the Maintenance Battery Switch is open. Follow all applicable Railroad Operating Procedures for operation in sub-freezing weather conditions. Failure to do so may result in severe engine damage.



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Figure 28. Maintenance Battery Switch.



SAFEGUARDS, ALERTS AND SHUTDOWNS

ALERTER

The Alerter Reset Switch (Item 10, Figure 5) manually resets the Alerter Safety device. This switch must be operated at set time intervals or a penalty brake application will occur.

The Alerter promotes safe train operation by monitoring various operator movements to ensure the alertness of the operating crew. If a proper control movement is not detected within a predetermined Reset Time period, an alarm sequence including audible and visual alarms is started requesting an acknowledgement. Lack of response to the system during this time will result in a penalty brake application. This action will command a full service brake application bringing the locomotive to a stop.

The Alerter alarm will flash for five seconds. If no operator response an audible alarm will also sound and the ALERT-ER alarm indicator will continue to flash on the SDIS and continue counting down to Penalty Brake application.

NOTE: The Alerter Function is disabled when Brake Cylinder pressure is greater than 25 psi or Equalizing Reservoir pressure is less than 10 psi.

ALARM BELL

An alarm bell sounds in the operator cab when the locomotive control system detects an abnormal operating condition or fault. Faults may be initiated by the CCA system or by other systems on the locomotive.

When the CCA system detects a fault, a message describing the fault will appear in the message area of the SDIS screen. Depending on the fault, the alarm bell may ring for 30 seconds or ring continuously. Some computer-detected faults do not ring the bell. The Alarm Silence screen (Figure 29) is displayed on the SDIS when the bell is ringing. Pressing the “silence alarm” soft key cancels the ringing of the bell, cancels the Alarm Silence screen, and returns the SDIS to the screen that was displayed prior to the alarm message. Thirty (30) second faults may be allowed to time out, in which case the bell stops ringing and the Alarm Silence screen disappears.

NOTE: Some faults ring the bell continuously and the bell cannot be silenced. If this is the case, the Alarm Silence screen is not displayed.

The bell may ring in response to certain faults, like a trainline alarm from a trailing unit, that are not initiated by the CCA system. The Alarm Silence screen does not appear in this case. The bell can be silenced by resolving the cause of the alarm.

NOTE: Trainline faults must be reset from the unit that initiated the alarm.

The alarm bell rings continuously when the diesel engine is shut down. The EC switch must be placed in the START position to cancel the ringing of the bell.

BARRING-OVER SWITCH

A Barring-Over switch (Figure 30) is located under the diesel engine barring-over access cover. The diesel engine will not start if this cover is not in place.

ENGINE AIR FILTER PRESSURE SENSOR (EAFP)

The EAFP sensor monitors air pressure drop across the engine air filters. When the Engine Air Filter sensor detects an out-of-range condition, engine RPM follows **Combined Power** handle and maximum power is limited to Notch 7.

ENGINE STOP AND EMERGENCY FUEL CUT-OFF SYSTEM

In an emergency, any one of five electric pushbuttons may be depressed momentarily to cut off fuel delivery to the engine. One of these pushbuttons is located on each side of the locomotive platform near the fuel tank. The third, fourth and fifth pushbuttons are located on the Engine Control (EC) panel (Item 16, Figure 9), at the Engine Stop Station (Figure 31), on the A Side of the locomotive near the alternator and at the cooling water fill station.

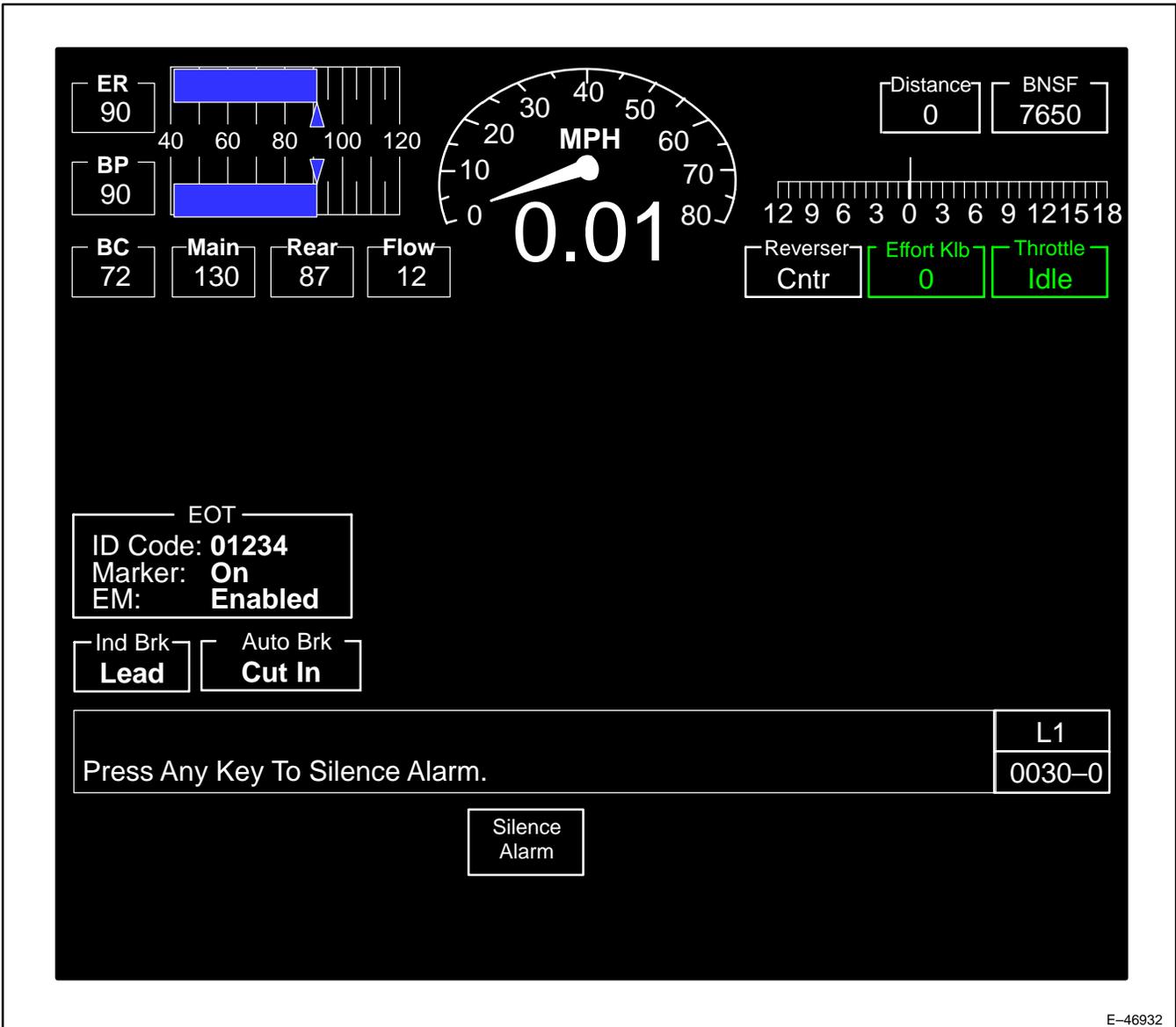


Figure 29. Alarm Silence Screen (0030-0).

GROUND CUT-OUT SWITCH

NOTE: Only trained maintenance personnel should use the Ground Cut-Out switch. Operating crews need to be aware that the locomotive will not load if this switch is left open.

A Ground Cut-Out (GRCO1) switch is mounted in Control Area 2. This is a two-pole switch which connects sensing circuits to detect ground leakage current in the propulsion circuit. One pole of the switch is used to remove the connection from the locomotive frame (chassis ground) to the ground detection circuitry. This is used to remove the "known" ground when performing insulation tests on the locomotive circuits, or to remove the "known" ground when troubleshooting for ground faults. One pole of the switch is used to disable control circuits with the switch open.

The control system detects ground leakage in the propulsion circuits and will derate locomotive performance based on ground leakage. Propulsion link voltage is reduced proportional to ground leakage current as follows:



Figure 30. Engine Barring-Over Switch.

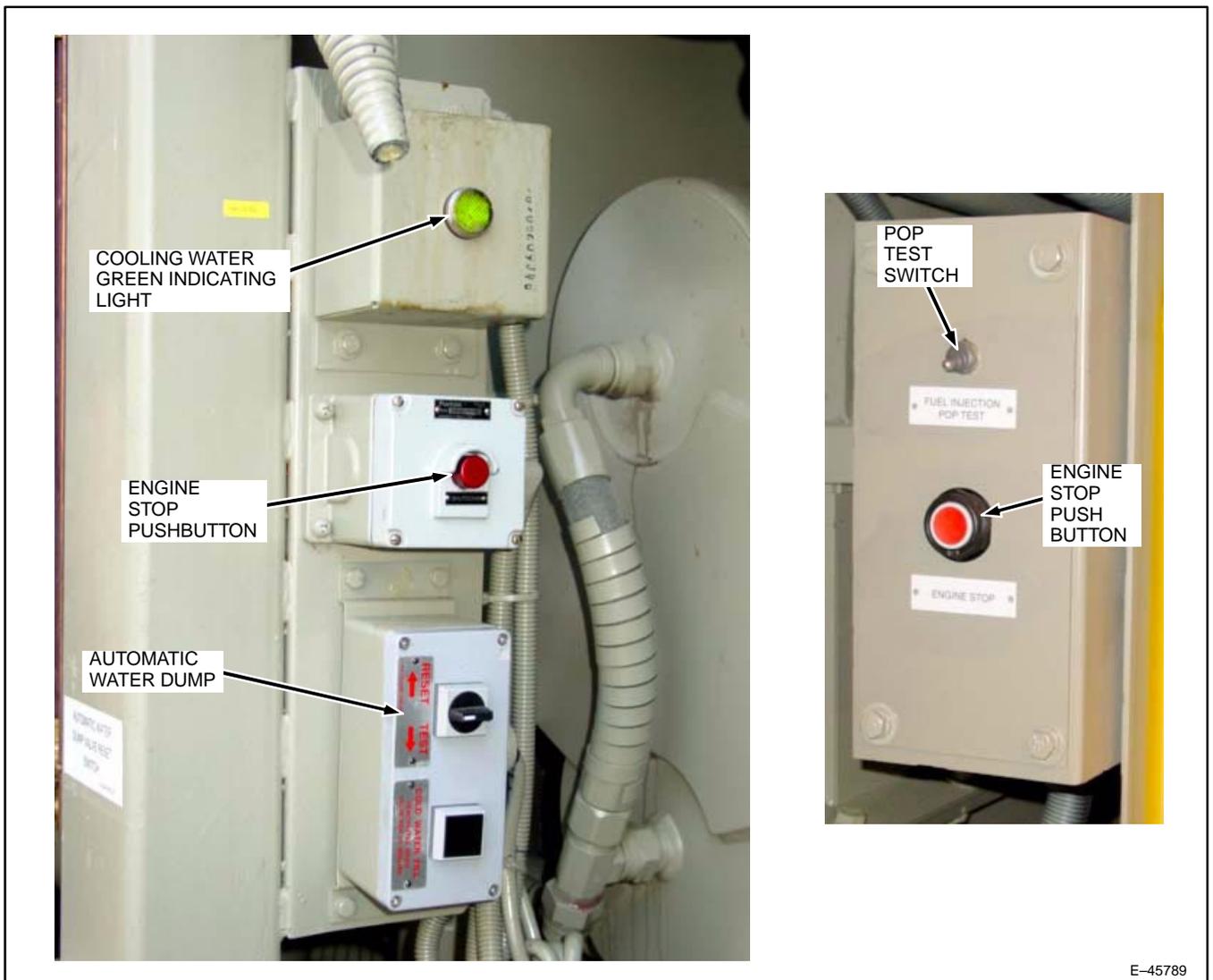


Figure 31. Engine Stop Pushbutton, Cooling Water Indicator, and Automatic Water Dump.

Ground Current Leakage (Amperes)		Result
Motoring or Self Load	Dynamic Brake	
0 to 0.5	0 to 0.25	No deration
0.5 to 0.93	0.25 to 0.47	Propulsion link voltage will be derated in proportion to leakage current.
above 0.93	above 0.47	Considered a “solid” ground fault. Power will be reduced to zero.

When grounds are detected an alarm will sound and faults will be logged.

MOTOR AND SPEED SENSOR CUT-OUT SWITCH FUNCTIONS

NOTE: Under emergency conditions, the locomotive may be operated for a short period of time with one or more traction motors cut-out. Refer to Railroad Rules for specific details of operation.

Traction motors can be cut out manually or automatically. Manual cut out is done on the SDIS using the individual Motor Cut-Out Switch Function. Refer to the **Switches** section in this manual for the procedures to cut out motors and speed sensors.

When a motor or motors are cut out, total power available for traction is adjusted as follows:

Motors Cut-Out	Horsepower Available for Input for Traction
All IN	Full HP
1 Out	Full HP
2 Out	Full HP
3 Out	See Note 1
4 Out	See Note 1
5 Out	See Notes 1 and 2
6 Out	None

NOTE 1: Horsepower available for traction input is limited to 1021 horsepower per each traction motor CUT-IN.

NOTE 2: Speed sensor inputs from at least two traction motors are required for locomotive to load.

NOTE: For Speed Sensor cut-out, note the following:

1. Speed sensors do not need to be cut out on cut-out motors.
2. Speed sensor switches are only to be used to cut out faulty sensors; however, ensure that the sensor is at fault and not indicating a locked axle or excessive wheel slip, etc.
3. When the Motor and Speed Sensor Cutout switch is in the OUT position, the speed signal from that speed sensor is ignored leaving all others active. A STATUS message will appear on the SDIS.
4. A minimum of two motor speed sensors must be operating for the locomotive to load.

DYNAMIC BRAKE CUT-OUT SWITCH FUNCTION

If for some reason the Dynamic Brake function needs to be manually cut out, refer to the procedure in the **Switches** section of this manual.

LOCKED AXLE CUT-OUT SWITCH FUNCTION

NOTE: Before silencing the Locked Axle Alarm using this switch, ensure the wheels ARE rolling. Follow Railroad Regulations regarding use of this switch.

To manually cut out the Locked Axle Alarm, refer to the procedure in the **Switches** section of this manual.

OIL AND WATER TEMPERATURE AND PRESSURE

Horsepower and/or engine speed will be altered if one of the following conditions exist:

Cold Engine

In order to protect a cold engine, restrictions are placed on engine load and speed until engine temperature has reached 140° F (60° C) or higher for more than three minutes. Also, to keep engine operating temperatures within certain limits, engine speed will be altered when temperature drops below certain limits (170° F, 77° C).

Hot Engine

NOTE: The engine will operate at a power deration determined by the control system to maintain a cooler temperature. If it cannot maintain the temperature and derates to zero for five minutes, the system will shut down the engine.

Oil Temperature Between 185° and 212° F

If the engine oil temperature exceeds 185° F for ten minutes, engine RPM is held at 1050 (Notch 8).

If the engine oil temperature exceeds 185° F for thirty minutes, power is derated.

If the engine oil temperature exceeds 212° F, power is derated immediately.

Water Temperature At 230° F and Above

If the engine water temperature exceeds 230° F, power is derated immediately.

Tunnel Strategy

The air-to-air fans are commanded OFF and the air-to-air shutters are closed when the MAT is higher than the ambient temperature (as measured by the Turbo Inlet ambient temperature sensor).

The radiator fan is OFF when the ambient temperature (as measured by the Turbo Inlet ambient temperature sensor) is higher than 150° F.

Low Oil or Low Water Pressure

Low oil and water pressure are monitored by the ECU controller. If low oil pressure or if low water pressure is detected, engine speed and power is reduced, one notch every 20 seconds (water) or three seconds (oil), down to Notch 3. As pressure recovers, notch is increased.

OVERSPEED – ENGINE SHUTDOWN

In the event of an engine overspeed condition, the ECU will shut the engine down.

NOTE: Follow applicable Railroad Operating Procedures for Engine Overspeed Shutdown.

OVERSPEED – LOCOMOTIVE

When a locomotive equipped with overspeed protection exceeds the maximum permissible speed(75 MPH), an Overspeed application is initiated.

1. An audible alarm sounds from the AP.
2. At the same time, the speedometer graphic changes to yellow (alerting the operator) for the overspeed warning speed range and to red above the overspeed limit.
3. A Penalty brake application is initiated immediately if train speed has not been reduced sufficiently.
4. Follow *Railroad Operating Procedures* for proper recovery procedure.

PCS FUNCTION OPERATION

The Power Cutout Switch (PCS) Function is operated from the Electronic Air Brake (EAB) system and the IPM. During a safety control Penalty or Emergency brake application (power knockdown), this function activates. Brake Control Computer signal (through the PCR relay) will affect engine speed (limited to IDLE), available locomotive power (all excitation is removed from the Alternator), and light the "PCS OPEN" warning light on the Operation Screen.

Operating options selected by the railroad will determine how the locomotive control system will react to PCS operation. See *Railroad Operating Rules* and the locomotive air piping and electrical schematic diagram for application to specific locomotives.

To reset the PCS Function:

1. Move the **Combined Power** handle to IDLE.

NOTE: If the PCS Function has been activated while in dynamic braking, the Combined Power handle must be returned to OFF to reset the circuit.

2. For **Penalties**, proceed to **Step 3**. For **Emergencies**, proceed to **Step 4**.
3. Move the Automatic Brake handle to SUPPRESSION and wait at least eight seconds for Power Up, Overspeed or other Penalty applications. Proceed to **Step 5**.
4. Move the Automatic Brake handle to EMERGENCY and wait at least 60 seconds for Trainline, Operator, EOT or Brake Valve Emergencies.
5. Move the Automatic Brake handle, when instructed and ready, to RELEASE.

NOTE: If no EAB message is active and the PCS is open, move the Automatic Brake handle to RELEASE.

WHEELSLIP

The locomotive computers continuously monitor axle speed. The axle (or wheel) speed of all axles are compared. If the differential in speeds is greater than a preset limit, power will be reduced and sand applied. Once the differential in speeds falls within the preset limit, power will be returned to the motors (per engine load rate schedule).

In dynamic braking, the amount of correction is determined by the amount of slide and is accomplished in several steps:

1. Automatically apply sand to the leading axles on this locomotive if a small difference in motor speeds is detected. Sanding continues for three seconds after the slide is corrected.
2. When the **Step 1** limit is exceeded, a small power reduction goes into effect and sanding continues.

3. When **Step 2** limit of wheelslip is exceeded, a moderate power reduction goes into effect and sanding continues.
4. If a large difference in wheel speeds is detected, a quick power output removal accompanied by a trainlined wheelslip indication results and the WHEELSLIP indicator light on the operator display screen appears.

SANDING

Automatic

Sand can be applied automatically as follows:

1. If all locomotive axles are in a wheelslip/slide (synchronous slip) condition.
2. If in motoring, the control does not read the correct traction motor torque per supplied horsepower.
3. If in dynamic brake, the control does not read the correct braking torque per operator request.
4. If in Emergency Brake application, and the locomotive speed > 0 mph.

NOTE: *Automatic sanding is provided in motoring and dynamic brake modes only.*

OPERATOR MESSAGES SCREEN

The Operator Messages Screen provides details on locomotive operating conditions that may affect locomotive performance. Railroad Operating Procedures should guide the operating crew in the use of this screen and its associated functions.

Pressing Key Position F5 (**Operating Messages**) on the Main Operation Screen will display the Operator Messages Full Screen (5000-0, Figure 32). This screen will display all currently active messages. Four function keys may be active on this screen:

NOTE: *The Operator Messages Screen is displayed in half-screen format (screen 5001-0, not shown) when the Operator Messages key is pressed from the SDIS that is being used as the gauge screen. In this case, the AAR required indicators occupy the upper portion of the screen and the messages are displayed in the middle portion of the screen.*

1. Key Position F1 (**Page Down**) – allows the operator to scroll down through the messages. Page Down appears only if there are more messages than would fit on one screen.
2. Key Position F2 (**Page Up**) – allows the operator to scroll up through the messages. Page Up appears only if there are more messages than would fit on one screen.
3. Key Position F3 (**Reset All**) – this function key is displayed only if there are active faults. Pressing it will order the control system to reset all faults which may be cleared in Level 1.

NOTE: *A message on the screen will show “Attempting Reset...” for two seconds. If the summary messages do not go away, the attempt to reset was not successful.*

4. Key Position F8 (**Exit**) – return to Main Operating Screen (0000-0).

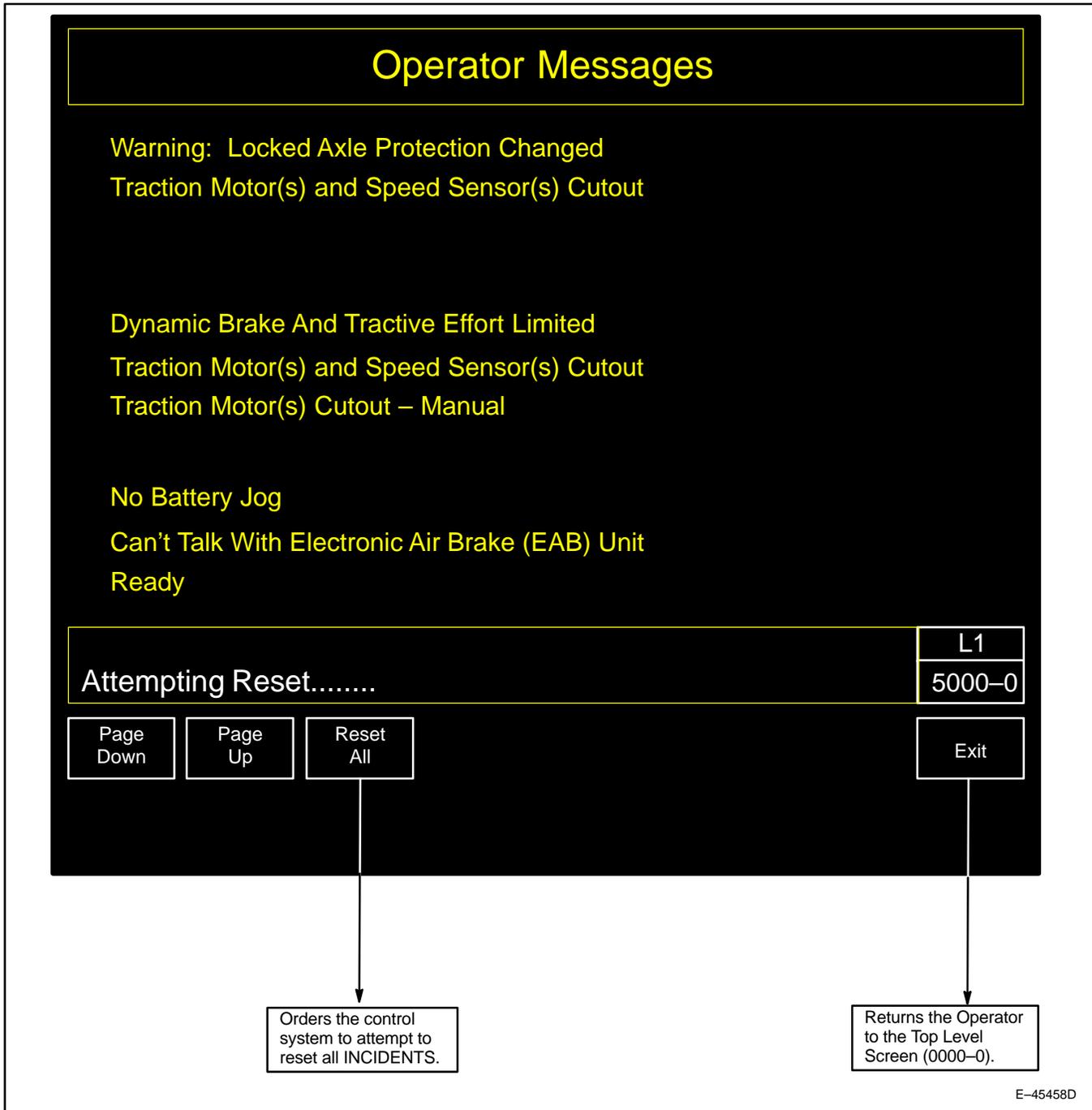


Figure 32. Operator Messages Full Screen (5000-0).

OPERATION

ON POWER-UP

On Power-up, display screens will not appear for up to 60 seconds. The Locomotive Operating display and Auxiliary display default to screen 0000-0 (Figures 33 and 37), while the HMI display defaults to the More Menu screen 0000-1 (Figure 36).

LOCOMOTIVE OPERATING DISPLAY

After the locomotive computers have been powered-up and are operating normally, the Main Operating Screen 0000-0 (Figure 33) will appear on the SDIS and the message block will display any Operator messages. This screen is used to monitor the operational status of the locomotive. Many functions are available in Level 1 from the Main Operating Screen and its subscreen More Menu... (0000-1) (Figure 34).

Top row soft keys will be noted by Fx (F1-F8) and bottom row soft keys by Whole Numbers (1-8) as follows:

Key F1. Air Brake

Pressing this key will display Screen 2000-0 (**Air Brake Setup**). Operating procedures are covered in the **Electronic Air Brake** section of this manual.

Key F2. End Of Train

Pressing this key will display Screen 2100-0 (**End Of Train Setup**). Operating procedures are covered in the **End of Train** section of this manual.

Key F3. Not Applicable

Key F4. Distributed Power

When linked as a Distributed Power Lead unit, pressing this key on the Locomotive Operating Screen 0000-0 will display Screen 2310-0 (**Distributed Power Menu**). Automatically the HMI display will be Screen 2300-0 (**Distributed Power Operation**). When unlinked this key is visible only on the Locomotive Operating display. Pressing the key will then display Screen 2390-0 (**Distributed Power Main Menu – remote session**).

Refer to pertinent section of this Operating Manual for operating procedure.

Key F5. Operator Messages

Pressing this key will display Screen 5000-0 or 5001-0 (**Operator Messages**, Figure 32). Operating procedures are covered in the **Operator Messages** section of this manual.

Key F6. Speed Control

Pressing this key will display Screen 1300-0 (**Slow Speed Control Menu**). Operating procedures are covered in the **Slow Speed Control** section of this manual.

Key F7. Switches

Pressing this key will display Screen 1000-0 (**Switches**). Operating procedures are covered in the **Switches** section of this manual.

Key F8. Not Applicable

Key (1) Distance Start/Stop/Reset

Pressing this key will activate the Distance Counter on **that** SDIS. Soft Key designation will change to **Distance Stop**. Pressing **Distance Stop** causes the Distance Counter to stop counting and the key changes to **Distance Reset**. Pressing **Distance Reset** resets the Distance Counter to 0 or preset value depending on mode, and the key to **Distance Start**.

Key (2) Distance Setup

Pressing this key will display Screen 1200-0 (**Distance Counter Setup**). Operating procedures are covered in the **Distance Counter** section of this manual.

Key (3) Measured Mile (Key displayed while moving)

Pressing this key will display Screen 1100-0 (**Measured Mile**). Operating procedures are covered in the **Measured Mile** section of this manual.

Key (3) Auto Start/Stop (Key displayed while stopped and AESS is active)

Pressing this key will display Screen 4311-0 (**AESS Status Screen**). Operating procedures are covered in the **Auto Engine Start/Stop (AESS)** Section of this manual.

Key (4) Not Applicable**Key (5) Not Applicable****Key (6) Not Applicable****Key (7) Screen Controls**

Pressing this key will display Screen 3000-0 (**Screen Controls**). Operating procedures are covered in the **Screen Controls** section of this manual.

Key (8) More Menu...

Pressing this key will display Screen 0000-1 (**Main Operating Screen, More**).

Key F1). Event Recorder

Pressing this key will display Screen 9300-0 (**Event Recorder Status**). The purpose of this screen is to allow the operator to view the current status of the event recorder as well as the list of parameters being recorded

Key F2). Data Download

Pressing this key will display Screen 9000-0 (**Data Download**). Operating procedures are covered in the **Data Download** section of this manual.

Key F3). Adjustable Parameters (Key Position F3) HMI & Aux only

Pressing this key will display Screen 9700-0 (**Adjustable Parameters**). The purpose of this screen is to display the list of parameters that are railroad modifiable.

Key F4). Not Applicable**Key F5). Not Applicable****Key F6). Trip Monitor HMI & AUX only**

Pressing this key will display Screen 4500-0 (**Trip Monitor**). Operating procedures are covered in the **Trip Monitor** section of this manual.

Key F7). Locomotive Monitor

Pressing this key will display Screen 4000-0 (**Locomotive Monitor**). Operating procedures are covered in the **Locomotive Monitor** section of this manual.

Key F8). Exit

Pressing this key will display the screen one level back or Screen 0000-0 (Main Operating Screen).

NOTE: For the HMI Display, pressing the F8 Exit key will always display Screen 0000-0 (Main Operating Screen).

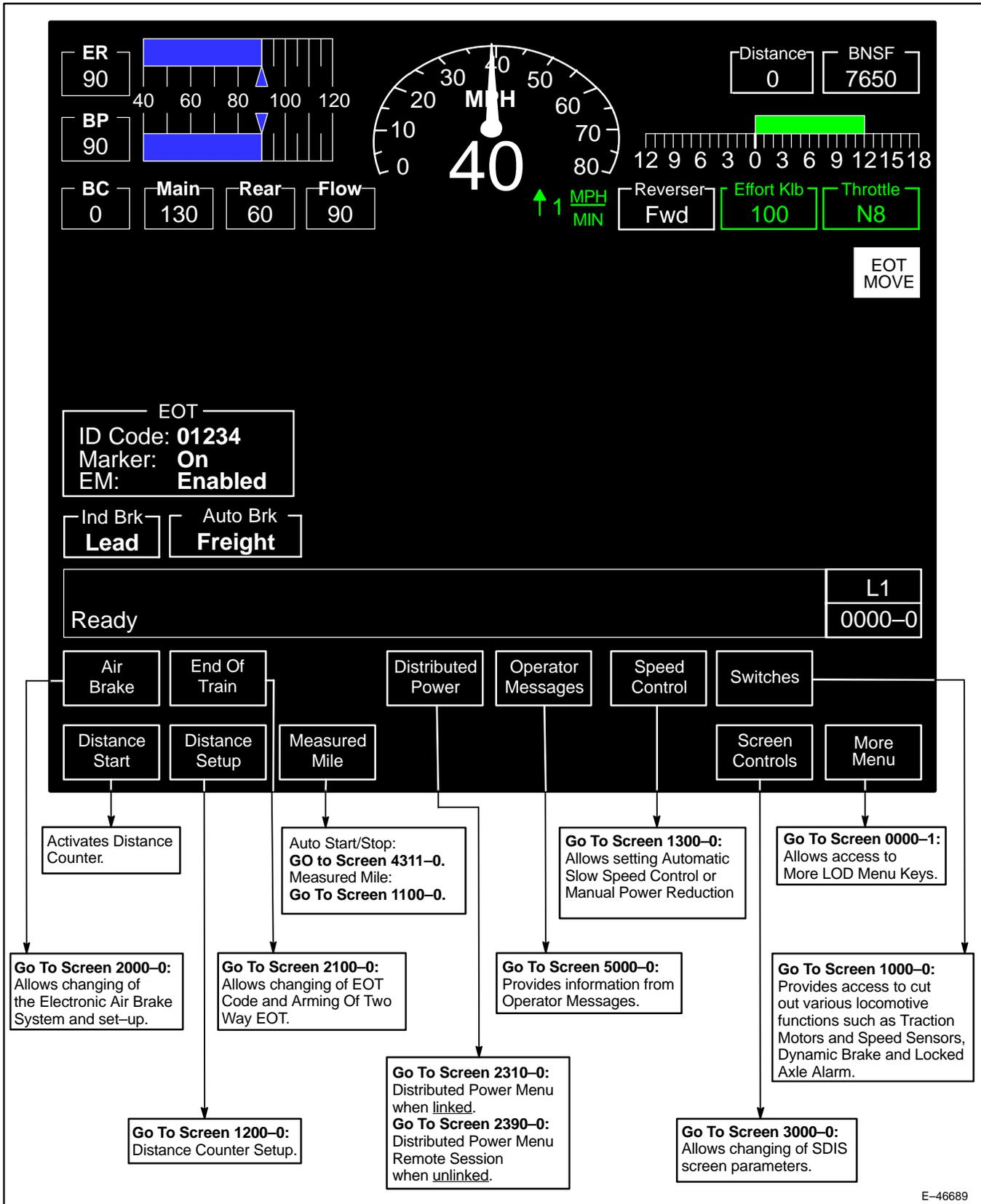
Key 1). Statistics

Allows the operator to view locomotive life statistics. Pressing this key will display Screen 9200-0 (**Statistics**)

Key 2). Not Applicable**Key 3). Not Applicable****Key 4). Not Applicable****Key 5). Not Applicable****Key 6). Not Applicable****Key 7). Screen Controls**

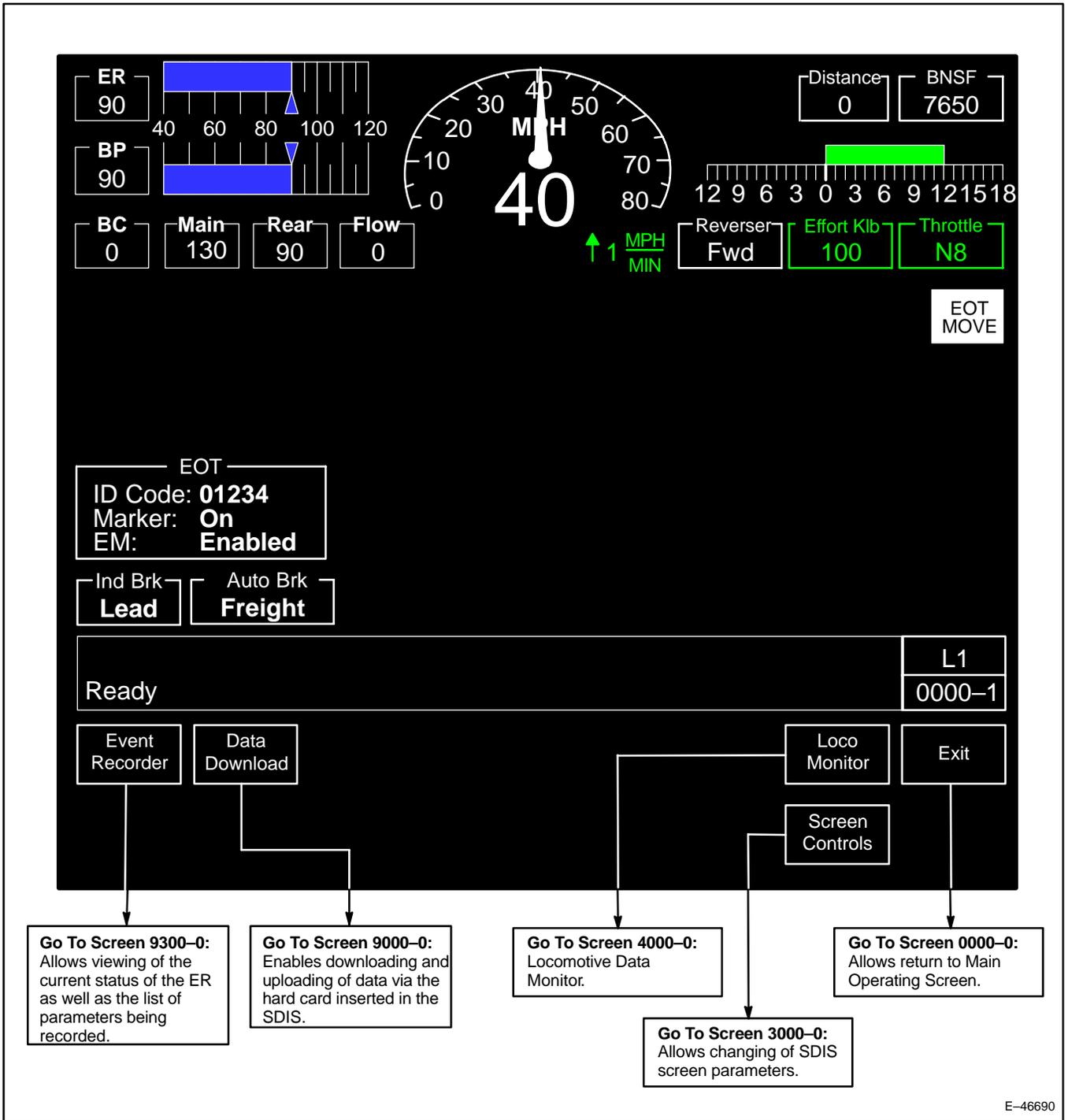
Pressing this key will display Screen 3000-0 (**Screen Controls**). Operating procedures are covered in the **Screen Controls** section of this manual.

Key 8). Not Applicable



E-46689

Figure 33. Main Operation Screen, Locomotive Operating Display (LOD) (0000-0).



E-46690

Figure 34. Main Operation Screen, More Menu... Operating Display (0000-1).

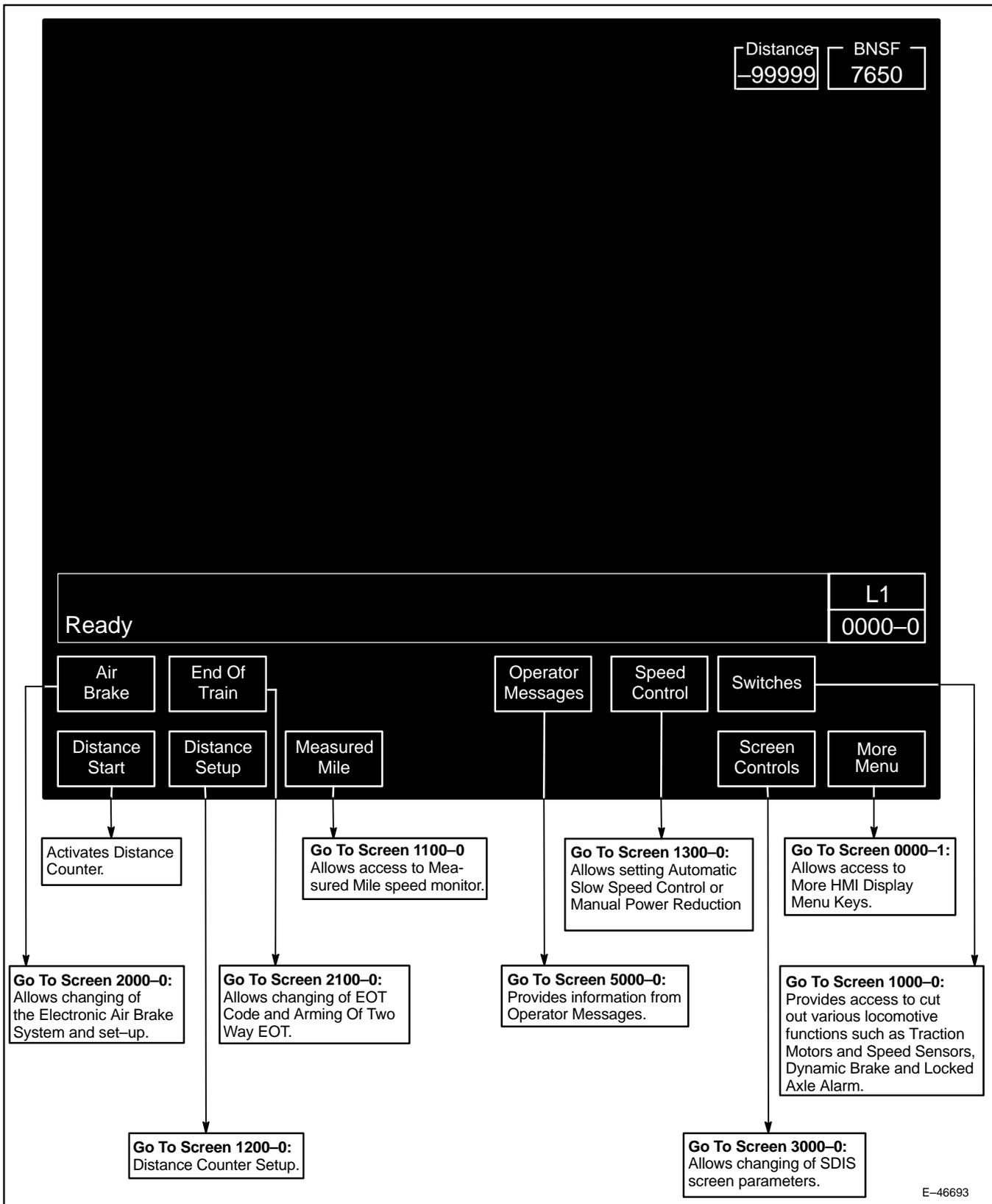


Figure 35. Main Operation Screen, HMI Display (0000-0).

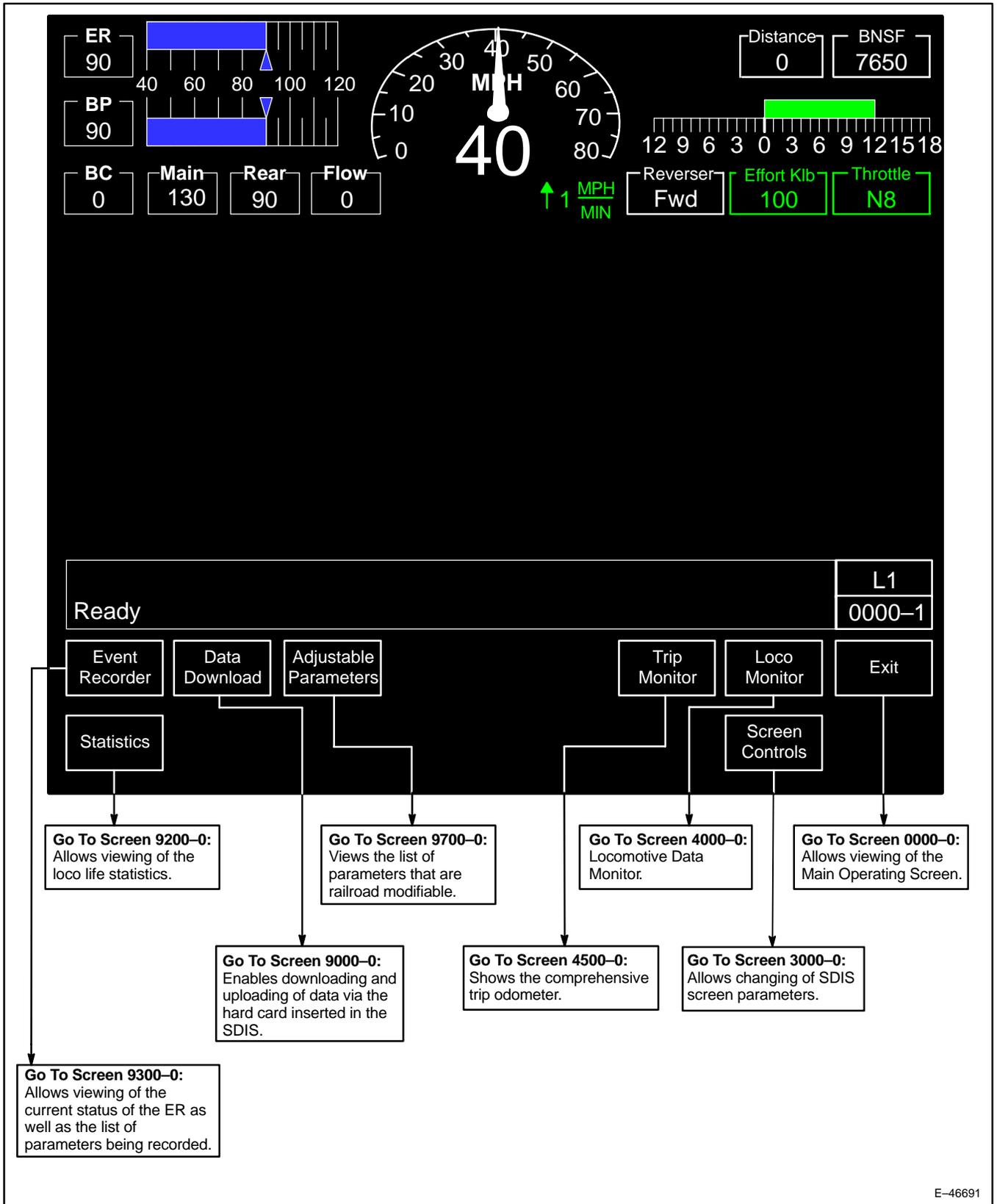
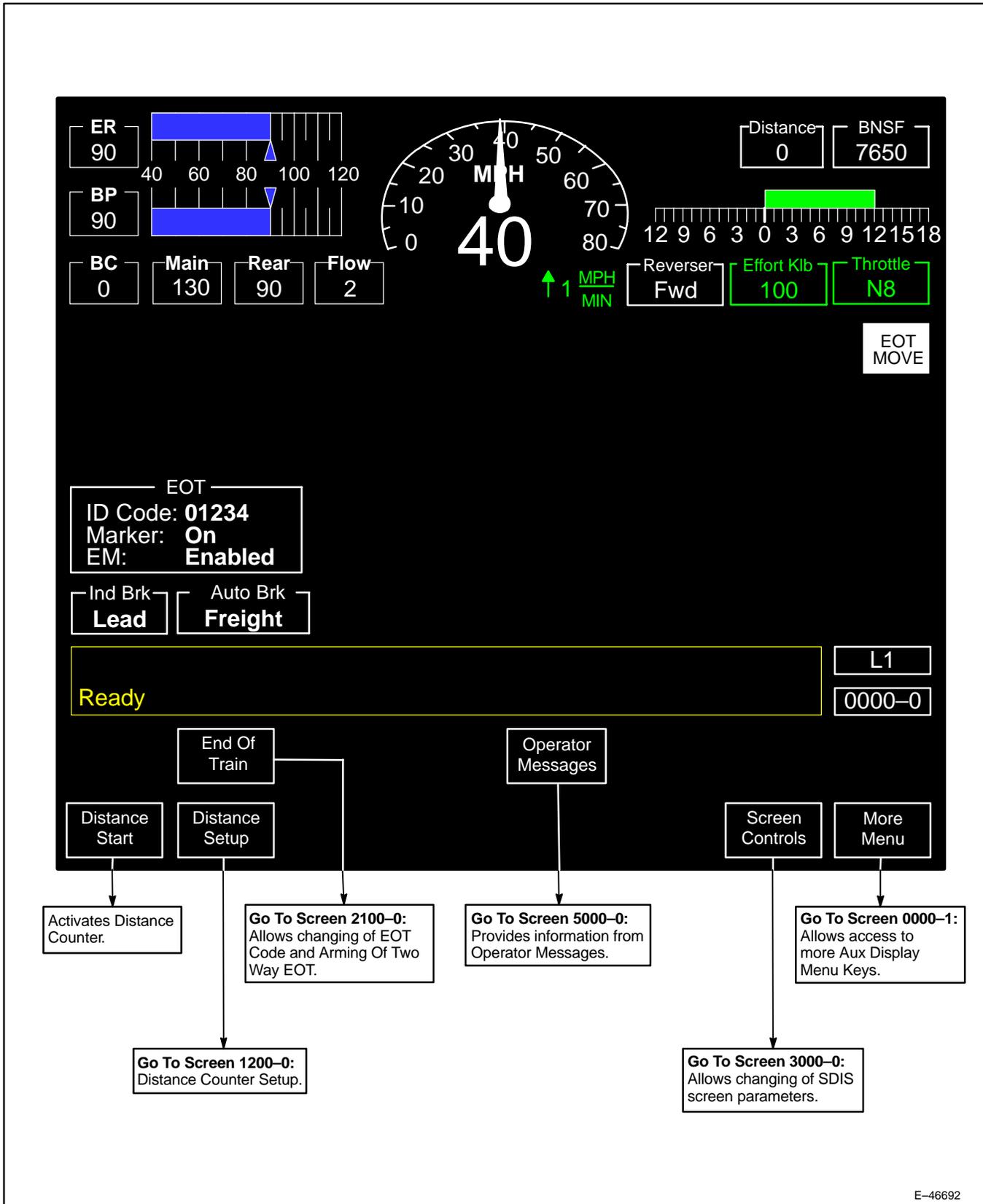


Figure 36. Main Operation Screen, More Menu... HMI Display (0000-1) (Start Up Default Screen).



E-46692

Figure 37. Main Operation Screen, Auxiliary Display (0000-0).

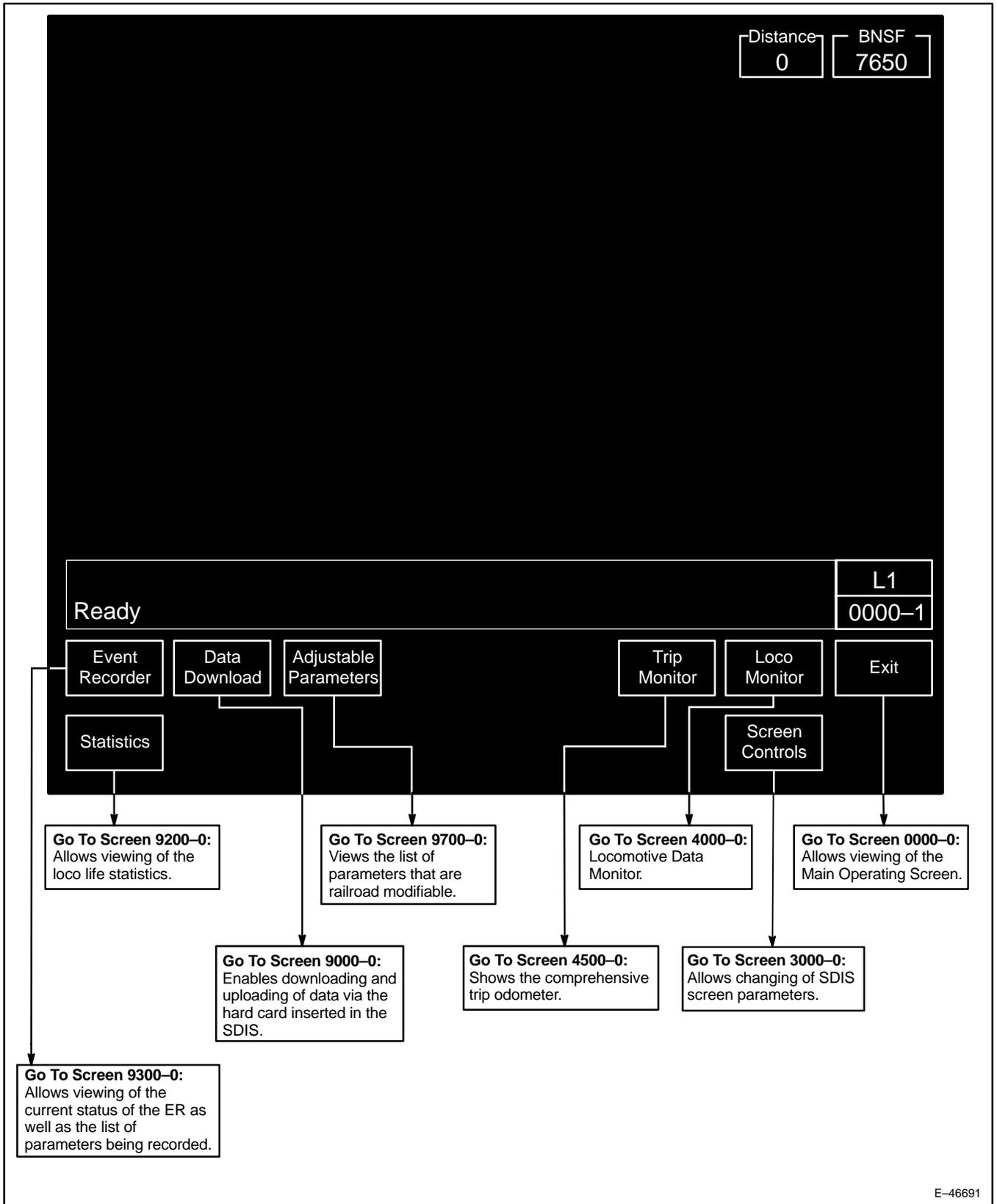


Figure 38. Main Operation Screen, More Menu... Auxiliary Display (0000-1).

PREPARATION FOR OPERATION

The following checks and inspections should be made in accordance with *Railroad Rules and Regulations*:

WARNING: STOPPING HAZARD. Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 45 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.

BEFORE BOARDING LOCOMOTIVE

1. Inspect for broken, worn, loose or dragging parts (brake rigging, brake shoes, wheels, covers, etc.).
2. Check for leaks from outside piping.
3. Properly position all drain and air cut-out cocks.
4. Ensure the brake-pipe cocks are properly positioned.
5. Check for proper connections of the air hoses and jumper cables (if in multiple with other units).
6. Check the fuel supply on the fuel tank sight glass (Item 5, Figure 24).
7. Ensure the dead-engine cock is closed.

AFTER BOARDING LOCOMOTIVE

1. WITH ENGINE SHUT DOWN, remove rags, tools, etc., from moving parts and electrical equipment.
2. Check the diesel engine lubricating-oil supply. Oil level should indicate FULL on the dipstick with the engine shut down or at IDLE. The dipstick is located on the side of the engine and is marked LOW and FULL.

WARNING: While servicing the air compressor, open Local Control Circuit Breaker (LCCB, Item 13, Figure 9) to prevent air compressor motor from starting. Motor driven air compressor has hot surfaces and may operate at any time with diesel engine running. Do NOT service air compressor while hot and/or diesel engine running.

3. Check the air compressor lubricating-oil level.

WARNING: This locomotive is equipped with Auto Engine Start/Stop. The diesel engine may start without operator action. Exercise caution when working around the diesel engine, traction alternator, or Radiator Cab. Ensure that AESS is disabled before performing any maintenance on the locomotive. Failure to do so may result in death or serious personal injury.

4. Check the cooling water supply. Ensure the water drain valve is closed.
5. Ensure the Air Compressor cut-out cock is open.
6. Ensure the Air Brakes are set up properly.
 - a. Select **Air Brake Setup** (Figures 33, 35 or 37) found on Operator Function Menu Screen and verify correct unit status (also refer to *Railroad Operating Procedures*). Ensure unit is setup for LEAD (if Lead unit) with the proper Feed Valve Setting.
 - b. Check the positions of the Automatic and Independent Brake Handles. The Independent handle should be moved to RELEASE position and the Automatic handle to CONTINUOUS SERVICE (CS) position on all Trail units.

7. Move the Engine Control switch to START.
8. Properly position the MU Headlight Selector switch.
9. Ensure the MU SHUTDOWN toggle switch located on the Overhead Console is not engaged.
10. Check that the **Combined Power** Handle is in IDLE and the **Reverser** Handle is on CENTER.

STARTING ENGINE

1. Perform operations as in **Before Boarding Locomotive and After Boarding Locomotive** sections listed previously.

NOTE: Locomotive engine will not start if the MBS is open.

2. Close the Battery Switch located behind the door under the EC panel.
3. Turn ON **ALL** circuit breakers on the EC panel (Figure 9).

NOTE: On Power-up, ensure the Electric Air Brake (EAB) circuit breaker on the EC Panel (Item 10, Figure 9) is ON. A Power Up Penalty might occur. Simply move the brake handle to SUPPRESSION and hold for eight seconds, then return handle to RELEASE.

4. Check the SDISs for any STATUS messages. If the message line reads “Engine Can’t Crank”, “Engine Won’t Start”, or “Please Wait, Power Up In Progress ...”, the unit will not attempt to crank.
5. Verify the Engine Control (EC) switch is in the START position.

NOTE: When starting engines of several locomotives in a multiple-unit consist, start engines one at a time. Close the Control circuit breaker only on one unit at a time. When all engines are running, close the Control circuit breaker on the Lead unit only, open all others.

6. Press the ENGINE START pushbutton and hold until ENGINE START IN PROGRESS screen (Figure 39) appears on the SDIS (only on screens showing the gages). This screen will disappear automatically once the engine is running.

NOTE: This locomotive is equipped with an engine pre-lube function. Starting the diesel engine may take slightly longer than a locomotive without this function.

The following events take place during engine starting:

- a. The fuel pump starts immediately when the ENGINE START pushbutton is pressed. A crank warning bell (located in the Auxiliary cab) will sound for approximately 10 seconds.
- b. There will be a 5 to 10 second delay between the time the ENGINE START pushbutton is pressed and the pre-lube pump starts to rotate, if a pre-lube cycle is required by the control system.
- c. If the Battery Charge and Computer (BCCB) circuit breaker has been cycled, or if the locomotive has been shut down for 30 minutes or more, the diesel engine will receive a prelube cycle. If neither of these conditions is true, the engine will crank immediately. Typical time for an engine pre-lube cycle is 1.5 minutes.
- d. The diesel engine will crank upon completion of the engine pre-lube cycle.
- e. If proper engine lubricating-oil pressure does not build up within approximately 40 to 60 seconds, the control system will log a restrictive fault and the engine will not crank. If the proper parameters are met, the control system will then retry to crank the engine.

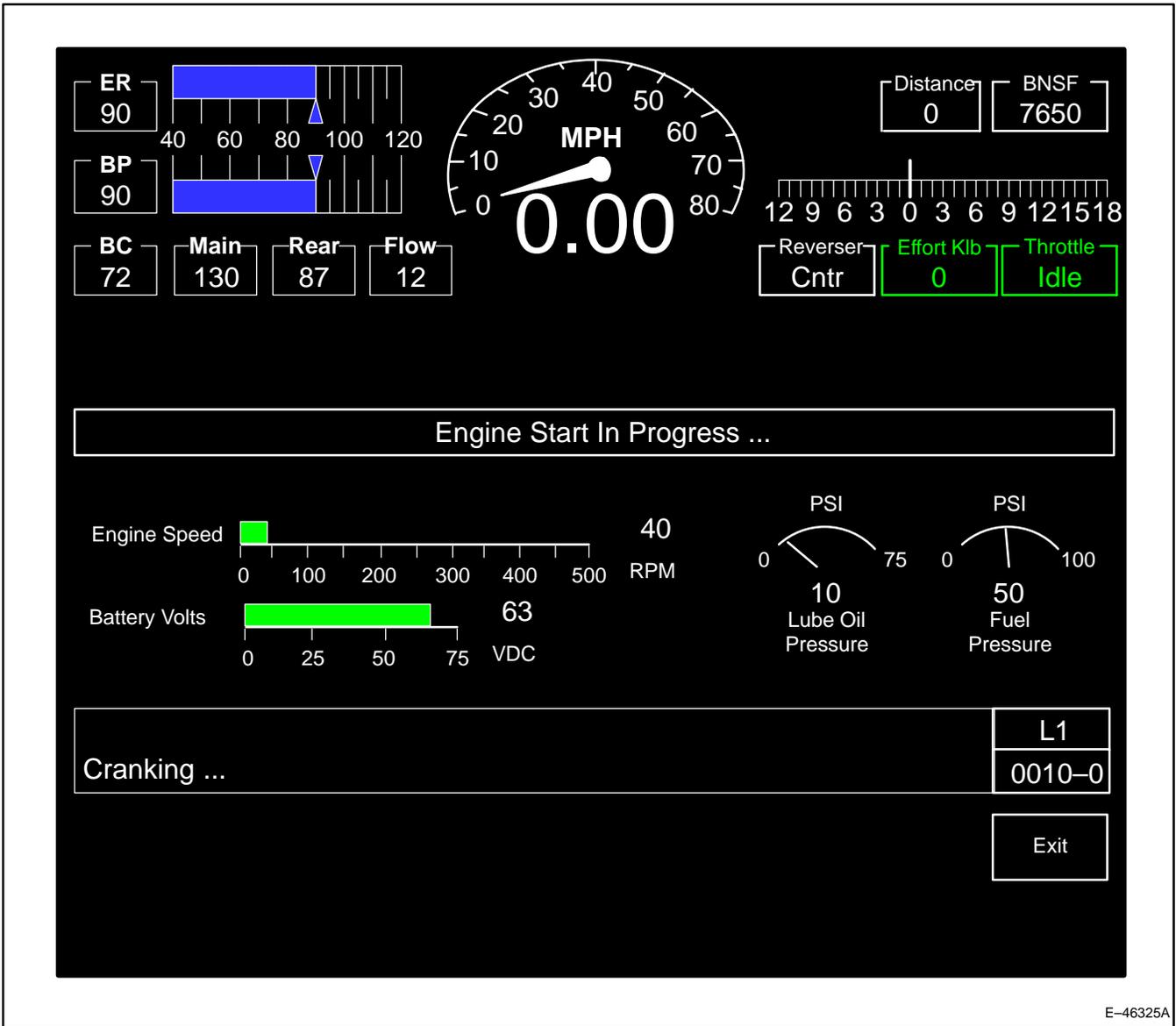


Figure 39. Engine Start In Progress Screen (0010-0).

CAUTION: Do not discharge the battery excessively by repeated attempts to start. If the first two or three tries are unsuccessful, recheck the starting procedure.

7. Check the diesel engine lubricating-oil supply. Oil level should indicate FULL on the dipstick with the engine at IDLE. The dipstick is located on the side of the engine near the lubricating-oil fill and is marked LOW and FULL.

WARNING: This locomotive is equipped with Auto Engine Start/Stop. The diesel engine may start without operator action. Exercise caution when working around the diesel engine, traction alternator, or Radiator Cab. Ensure that AESS is disabled before performing any maintenance on the locomotive. Failure to do so may result in death or serious personal injury.

COLD WEATHER ENGINE STARTING/WARM-UP

During cold weather conditions, when a locomotive has been shutdown for a period of time, locomotive horsepower will automatically be derated until the lubricating oil temperature reaches a predetermined level. This special warm-up period is required to avoid equipment failure from thermal or overload strain. See **Safeguards, Alerts and Shutdowns** section of this manual.

CHARGING A TRAIN

Use the following procedure to charge a train or to bring up pressure in the air reservoirs after they have been drained.

1. Leave the Generator Field circuit breaker in the OFF position (Item 2, Figure 8) and the Engine Control switch in the RUN position (Item 25, Figure 9).
2. Close the Control circuit breaker (Item 3, Figure 8).
3. Insert the **Reverser Handle** (place in CENTER position).
4. Move the **Combined Power** handle to Notch 1. The air compressor speed is twice engine speed when the engine speed is below 525 rpm.

NOTE: *If the main reservoir air pressure is above 130 psi (896 kPa) and is not rising, increasing the engine speed will not raise the pressure.*

BEFORE MOVING LOCOMOTIVE

1. Turn the Engine Control switch to RUN.
2. Check the main reservoir air pressure according to *Railroad Operating Procedures*.
3. Make an Independent air brake application. Remove any blocking of the wheels. Verify that the Release Indicator light (Item 5, Figure 40) is ON at the Electric Parking Brake Control Panel (Figure 40) which is located at the "B" (Crew) side of the locomotive above the platform on the side of the Radiator Cab. Visually inspect the brakes at the rear truck to confirm that they are released. Also verify that the "Handbrake Not Released" light (Item 28, Figure 9) is OFF on the Engine Control Panel. Check with the **Electric Parking Brake Control Panel** Section of this manual for further information.
4. Allow time for the engine cooling water to warm up before using the locomotive in accordance with *Railroad Operating Procedures*. Also review **Safeguards, Alerts and Shutdowns** section of this manual.
5. Check the SDISs for any fault messages. Message line should read "Ready."
6. Ensure End Of Train function is properly set. Press soft key position F2 (**End of Train**) found on the Main Operation Screen (Figure 33) and follow instructions.

WARNING: STOPPING HAZARD. *Prior to train movement, Brake application/release and leakage tests MUST BE performed at the Railroad specified brake pipe pressure for the entire train. The brake pipe line is to be open throughout the train. Leakage observed and noted MUST BE within the specified permissible limit of five psi per regulation*. Once the acceptable leakage rate is obtained, NO MANUAL ADJUSTMENTS are to be made to alter the running brake pipe pressure setting while the train is at the terminal and standing still. Failure to comply with this procedure could result in the inability to control or stop the train.*

* 49 CFR PARTS 232.205 (c) (1) and 232.209 (b) (1).

7. Perform an Air Brake Departure Test in accordance with *Railroad Operating Procedures*.
8. Optional **Brake Pipe Leakage Test** for use without airflow indicator/gage test method; proceed as follows:
 - a. With the brake system fully charged and with the SDIS **Electronic Air Brake Setup** Screen showing LEAD/CUT IN, move the Automatic Brake Handle promptly toward the FULL position until the equalizing reservoir pressure has been reduced by 15 psi (as noted on the display screen); then stop and leave the handle in this position.
 - b. As soon as the brake-pipe pressure has reduced to the level of the equalizing reservoir pressure (continuous blow from brake-valve exhaust) and flow is stable below 60 psi, change the screen to the CUT-OUT position. Immediately observe the Brake-pipe gage on the SDIS and time the pressure drop in accordance with *Railroad Rules and Regulations*.
 - c. At the completion of the brake-pipe leakage test, move the Automatic Brake Handle further toward the FULL position, and reduce the equalizing reservoir pressure slightly (two psi) below the brake-pipe pressure (watch the decrease on the SDIS screen). The brake may later be released by returning the Automatic Brake Handle to the RELEASE position. Return the system to the LEAD/CUT IN Mode.
9. The locomotive is now ready for operation.

NOTE: If power to the CCBII system is lost, the following occurs:

1. *The Alarm Bell will ring.*
2. *The PCS will open interrupting locomotive power. Dynamic Brake operation will be affected per Railroad Operating Procedures.*
3. *The locomotive will go into a PENALTY BRAKE situation and Brake Cylinder pressure will develop to 68 psi maximum.*
4. *Independent Brake control will NOT function. Bail Off of the locomotive will be affected per Railroad Operating Procedures.*
5. *The operator may reset the failure by toggling the Air Brake Computer circuit breaker on the EC Panel.*
6. *If unit is a Trail Unit, also note the following:*
 - a. *Bail-off is still permitted with reapplication limited to further reductions in brake pipe pressure.*
 - b. *There will be no change in air brake, power or dynamic brake conditions.*
 - c. *Independent Brake will apply and release when commanded by the LEAD unit (limited to the A&R pipe pressure).*

WARNING: If Locomotive battery power loss to the CCBII System occurs while train is in motion, a FULL SERVICE Brake application is automatically made at a SERVICE rate (BP drops below 13 psi). Operator may initiate an EMERGENCY Brake application from the EMERGENCY BRAKE VALVE located on the Crew Member's Desk.

WARNING: STOPPING HAZARD. Following an EMERGENCY BRAKE application, if the train is not at rest, brake release MUST NOT be attempted. Any movement of the AUTOMATIC Brake Handle to RELEASE while train is moving may cause equipment damage and/or personal injury.

MOVING A TRAIN

1. Close the Generator Field circuit breaker (Item 2, Figure 8).
2. Move the **Reverser** Handle to the desired direction of movement.

3. Release the brakes completely.

NOTE: *The BC Gage Screen marker flashes yellow if the locomotive speed is greater than 10 mph and BC is greater than 3 psi. When the locomotive speed is greater than 10 mph and BC is greater than 10 psi, the alarm bell will ring continuously until reset. Reset is accomplished by releasing the BC pressure.*

CAUTION: *In consists comprising units with Auto Engine Start/Stop (AESS), wait 240 seconds after moving the Reverser handle before moving the Combined Power handle. This pause allows units that may have been shut down by AESS to start the diesel engine. Failure to do so may result in alarms and faults and will prevent the consist from loading.*

4. Advance the **Combined Power** Handle. The **Combined Power** Handle has notches (IDLE up to Notch 8), with each successive notch representing an increase in power, or locomotive tractive effort.

Starting a train depends on type, length, weight, grade, condition of rail and amount of slack in the train. This locomotive is designed to have easily controlled tractive effort build-up characteristics, with the tractive effort in each notch limited to definite values as the **Combined Power** Handle is moved from the lowest to the highest notch. The operator can easily control the amount of tractive effort required to start and accelerate a particular train. Speed can be controlled as desired by reducing or increasing the **Combined Power** Handle position.

STOPPING A TRAIN

Move the **Combined Power** Handle to IDLE, and apply the dynamic or air brakes according to *Railroad Operating Procedures*. Also see **Applying Dynamic Braking** found later in this section of the manual. If leaving the operator's position after the train has stopped, move the **Reverser** Handle to CENTER.

CAUTION: *The control system of this locomotive will delay application of dynamic braking. If however, other locomotives in the consist do not have this feature, to prevent equipment damage when changing from power to dynamic braking or from dynamic braking to power, pause 10 seconds with the Combined Power Handle at IDLE.*

REVERSING LOCOMOTIVE

1. Bring the locomotive to a full stop.
2. Move the **Reverser** Handle to the opposite direction.
3. Release the brakes.
4. Advance the **Combined Power** Handle.

STOPPING ENGINE

1. Move the **Combined Power** Handle to IDLE.

CAUTION: *After a locomotive engine has operated at full load, allow the engine to run at IDLE for at least five minutes before shutting down. Otherwise, immediate shutdown after such operation could be harmful to some engine components.*

2. Open the Generator Field circuit breaker (Item 2, Figure 8).
3. Move the Engine Control switch to START.
4. Press the Engine Stop pushbutton on the Engine Control Panel.
5. To shut down all engines when in multiple-unit operation, use the MU SHUTDOWN toggle switch located in the Overhead Console.

NOTE: *On some older units this will not turn off the fuel pumps. Pushing the STOP pushbutton on each unit will turn them off.*

6. Secure the locomotive in accordance with *Railroad Rules and Procedures*.

BEFORE LEAVING LOCOMOTIVE

1. Release the air brakes after uncoupling from the train. Apply the Electric Parking brake as follows:

WARNING: *Observe all established Railroad safety precautions and follow the Electric Parking brake instructions carefully. Keep clear of active brake rigging. Severe personal injury and equipment damage may occur if the Electric Parking brake is inadvertently or improperly applied.*

- a. Make a full Independent Brake application.
 - b. Verify that the Electric Parking brake switch (Item 26, Figure 9) is ON.
 - c. Press the APPLY button (Item 3, Figure 40) on the Parking Brake Control Panel (Figure 40) located in the Radiator Cab.
 - d. Visually inspect the parking brake chain for tightness and verify proper brake shoe to wheel contact.
 - e. The parking brake can be applied manually if it does not respond to the electric application procedure. Refer to the **Parking Brake Control Panel** section on page 81 of this manual.
2. Leave the **Combined Power** Handle in IDLE.
 3. Close the windows and doors.
 4. Open all switches and circuit breakers as described in **Control Console Equipment** and **Engine Control Panel** paragraphs located in the **Operating Equipment** Section of this manual.
 5. Open the Battery switch.
 6. In freezing weather, precautions must be taken to see that the cooling water does not freeze. See **Draining Cooling Water System** paragraph found in the **Other Equipment** Section of this manual, and follow *Railroad Rules* for this situation.

CAUTION: *In sub-freezing weather conditions, ensure that the toilet is properly drained if the locomotive is shut down for an extended period of time. Failure to do so will result in frozen pipes and damage to the toilet.*

SAFETY CONTROLS

After a Penalty brake application has occurred, normal locomotive operation is restored in the following manner:

1. Move the **Combined Power** Handle to IDLE.
2. Move the Automatic Brake handle to SUPPRESSION.
3. Wait at least eight seconds, then move the Automatic Brake handle to RELEASE, when ready.

DYNAMIC BRAKE OPERATION

Dynamic braking is applied to the locomotive only, not to the train.

Applying Dynamic Braking

Applying dynamic braking is done in the following manner:

1. Move **Combined Power** Handle to IDLE.

2. Move the **Combined Power** Handle to SET-UP position; pause, then advance the **Combined Power** handle into the BRAKING sector as desired.
3. After the slack is compressed, manipulate the **Combined Power** Handle until the desired braking effort is obtained. Observe and correct braking effort during the initial period of Dynamic Braking application.
4. The amount of braking effort obtainable varies with the position of the **Combined Power** Handle for various speeds. Maximum braking effort is obtained in the FULL BRAKING position at 20 MPH.

NOTE: *Wheelslip warning may occur while in dynamic braking. This indicates wheels are sliding. Sand is applied automatically to the wheels of the sliding unit. If the warning continues, reduce the Dynamic Braking Handle position.*

Use Of Air Brakes During Dynamic Braking

NOTE: *When brake cylinder pressure is greater than 13 psi, dynamic braking effort is decreased. The amount of reduction depends on locomotive speed. At 20 MPH (approximately) or above there is no decrease in dynamic braking effort. Below 20 MPH dynamic braking effort is reduced as locomotive speed is reduced to a minimum dynamic braking effort at 0 MPH.*

When necessary, the automatic air brake may be used in conjunction with the dynamic brake. Automatic air brakes will apply on the train but not on the locomotive.

Release Of Dynamic Braking

Release dynamic braking by moving the **Combined Power** Handle to the OFF position.

OPERATING AS A LEADING UNIT

To operate the locomotive as a Lead unit of a consist, first make the necessary preliminary preparations for operation then proceed as follows:

NOTE: *Refer to ELECTRONIC AIR BRAKE section of this manual for Air Brake Setup if more information is needed.*

Air Equipment Set-Up

1. Move the Automatic Brake Handle to the CONTINUOUS SERVICE (CS) position.
2. Move the Independent Brake Handle to the FULL position.
3. Test the air brake in accordance with *Railroad Rules*.

Electrical Set-Up

1. Close the Generator Field and Control circuit breakers. (The Control circuit breaker must be closed on the Lead unit only.)
2. Close the Dynamic Brake circuit breaker.
3. Close all circuit breakers on the Engine Control (EC) panel (Figure 9).
4. Move the MU Headlight Set-Up switch to the required position (Item 15, Figure 9).
5. Insert the **Reverser** Handle into the Controller and move to the desired direction.
6. Operate the locomotive in accordance with *Railroad Operating Procedures*.

OPERATING AS A TRAILING UNIT

NOTE: Refer to *ELECTRONIC AIR BRAKE* section of this manual for *Air Brake Setup* if more information is needed.

Air Equipment Set-up

1. Make a Full Service application with the Automatic Brake handle.
2. Move the Automatic Brake handle to the CONTINUOUS SERVICE (CS) position.
3. Place the Independent Brake handle in the REL position.

Electrical Set-Up

1. Move the **Reverser** Handle to CENTER and remove the handle.
2. Open the Generator Field, Control and Dynamic Brake circuit breakers on the control console.
3. Follow the instructions for setting circuit breakers for operation as a Lead unit as a Trail unit. The instructions appear on the label of the Engine Control Panel.
4. Place the MU Headlight Set-Up switch in the proper position (Item 15, Figure 9).

CHANGING OPERATING ENDS

To change operating control from the cab of one locomotive unit to the cab of another, proceed as follows:

Vacating Unit – Air Equipment Set-Up

1. Make a Full Service brake application.
2. Allow time for all air blowing sounds to stop (SDIS gage will read 64–67 psi); then use the SDIS screen to set unit for Trail.
3. Place the Automatic Brake Handle in the CONTINUOUS SERVICE (CS) position; place the Independent Brake Handle in the REL position.

Vacating Unit – Electrical Set-Up

1. Move the **Reverser** Handle to CENTER and remove the handle.
2. Open the Generator Field, Control and Dynamic Brake circuit breakers on the control console (Figure 5).
3. Follow the instructions for setting circuit breakers for operation as a Lead unit as a Trail unit. The instructions appear on the label of the Engine Control Panel.
4. Place the MU Headlight Set-Up switch in the proper position (Item 15, Figure 9).

Operating Unit – Air and Electrical Equipment Set-Up

Set-Up the air brakes and electrical equipment on the operating unit as described in **Operating As a Leading Unit** “Air Equipment Set-Up” and “Electrical Equipment Set-Up” paragraphs found in this section of the manual.

TO OPERATE WITH OTHER TYPES OF UNITS

This locomotive is equipped with a traction motor thermal simulator which computes traction motor temperatures. This simulator will reduce locomotive output as required to protect the traction motors.

If the units in the locomotive consist are geared for differing maximum speeds, do not run at speeds in excess of that recommended for the unit having the lowest maximum permissible speed.

Similarly, do not operate at low speeds long enough to exceed the specified traction motor ratings on any of the units in the locomotive consist. A locomotive with high horsepower per axle will develop more tractive effort at any given speed than will units of lower horsepower per axle and will, therefore, tend to overload sooner at lower speed.

DEAD HEADING (DEAD-IN-TRAIN)

CAUTION: To avoid equipment damage, properly set up this locomotive when hauling dead-in-train.

1. Place the Independent Brake handle in the RELEASE position and the Automatic Brake handle in the HANDLE OFF (HO) or CONTINUOUS SERVICE (CS) position.
2. If functional, set the **Air Brake Setup** screen to TRAIL/CUT-OUT position.
3. Open Electric Air Brake (EAB) circuit breaker (Item 10, Figure 9).

CAUTION: To avoid wheel flats, drain main reservoir of unit to less than 25 psi (172 kPa).

4. Move the dead-engine cock found on the Electro-Pneumatic Control Unit (EPCU) to IN.
5. Connect the brake pipe hose(s) on either end of the locomotive.

ELECTRIC PARKING BRAKE CONTROL PANEL AND MANUAL OVERRIDE

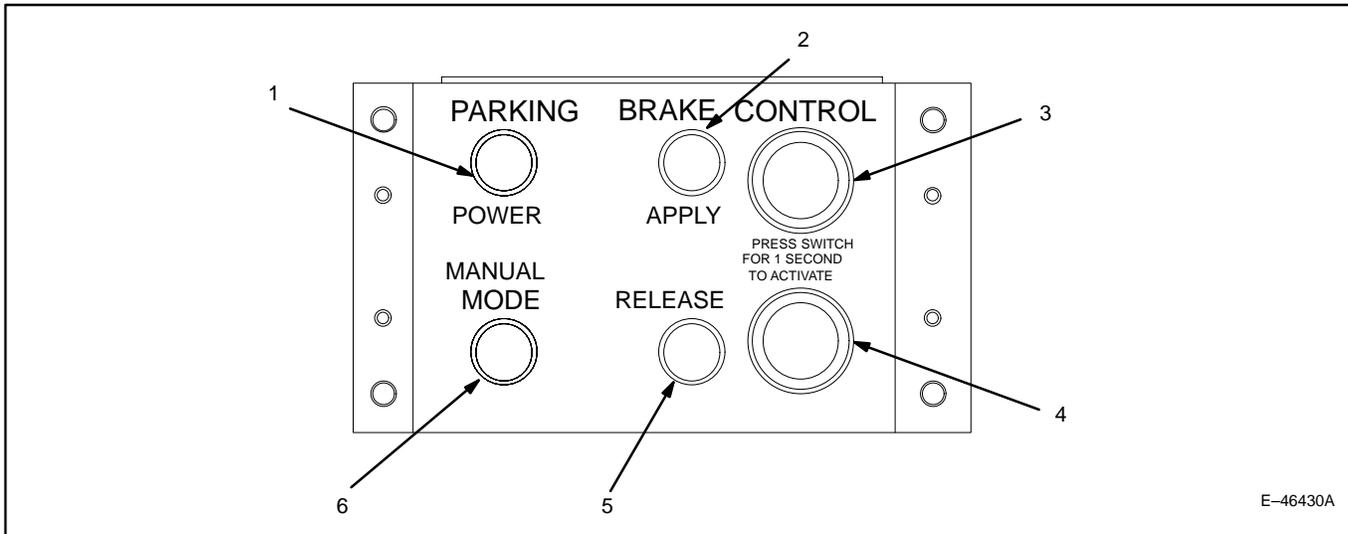
The Parking Brake Control Panel (Figure 40) and manual handbrake wheel (Figure 41) are located on the "B" (Crew) side of the locomotive above the platform on the side of the Radiator Cab. It has four indicators that show the status of the parking brake system. All items below are listed in Figure 40 unless indicated.

1. POWER – This indicator (Item 1) is lit when power is available.
2. APPLY – This indicator (Item 2) is lit when the parking brake is applied.
3. APPLY SWITCH (Item 3) – Pressing this switch applies the parking brake.
4. Release SWITCH (Item 4) – Pressing this switch releases the parking brake.
5. RELEASE – This indicator (Item 5) is lit when the parking brake is released.
6. MANUAL MODE – This indicator (Item 6) is lit when the parking brake system is in manual mode and must be operated with the hand wheel.

WARNING: An illuminated indicator light does not guarantee that the hand brake is fully applied. The operator must verify that the hand brake is properly applied prior to leaving the locomotive unattended per Railroad Operating Procedures.

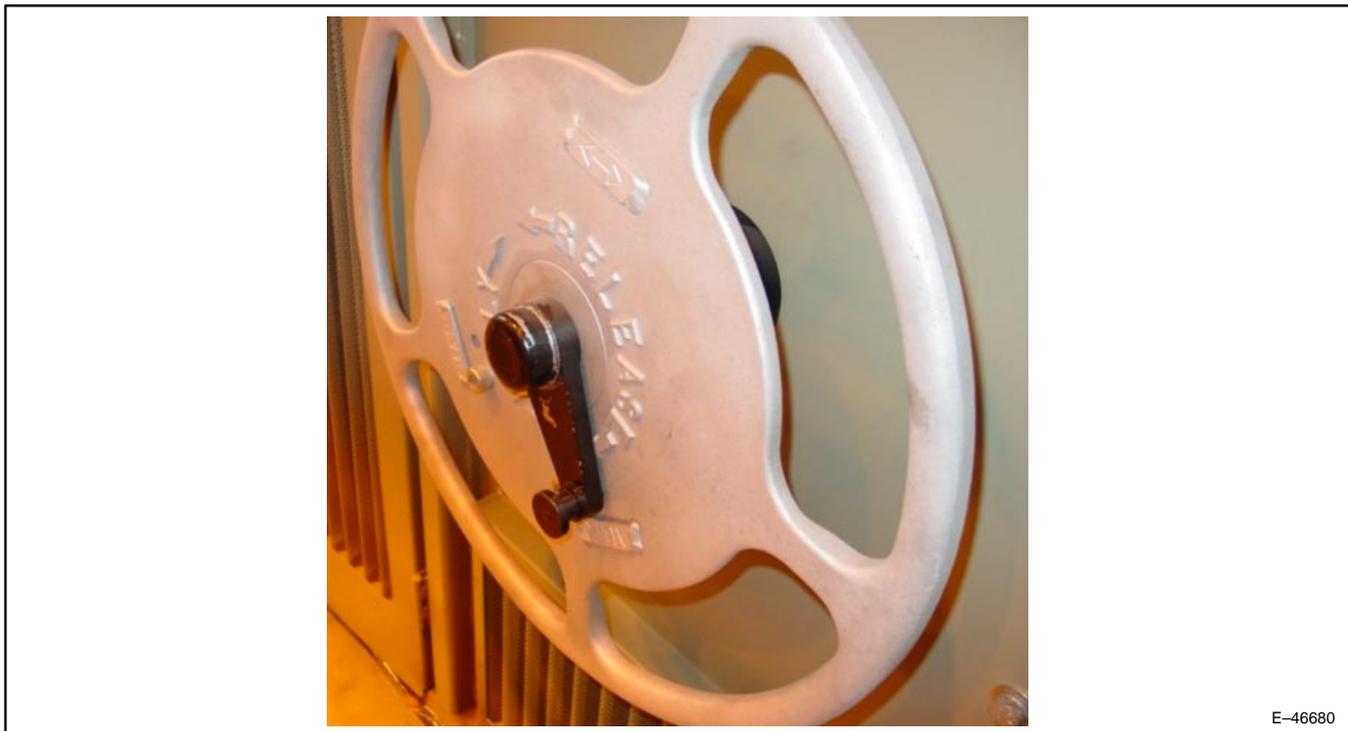
The brake is electrically operated by a set of push-button switches (Items 3 and 4). The brake can be activated by pushing the APPLY (Item 3) or RELEASE (Item 4) button for 1 second and releasing. Once the brake is activated for APPLY, the control system automatically shuts the brake off once a full brake set has been reached. During release, the automated control shuts off the brake when the brake chain is fully released. The brake can be stopped at any time by pressing either the APPLY or RELEASE switch for less than 1/2 second.

Power to the brake unit is controlled by a circuit breaker switch (Item 26, Figure 9) located in Operator's cab. The circuit breaker should normally be left in the ON position. This breaker should only be turned off if the locomotive is in the shop for repair or there is a technical problem with the brake unit.



E-46430A

Figure 40. Electric Parking Brake Control Panel.



E-46680

Figure 41. Manual Handbrake Wheel

On initial power-up, The APPLY and RELEASE lights (Items 2 and 5) may alternately flash signaling that the brake unit may not be in a fully applied or fully released position. To place the brake in a known position, press and hold either the APPLY or RELEASE button for 1 second and release. This will activate the brake and allow the brake to reach the desired position.

The POWER light (Item 1) is intended to let the operator know the brake unit is active. The light should be on continuously when the brake unit is powered. If the POWER light begins flashing or is not illuminated, the system has detected an internal fault. If an internal fault is detected or if the brake fails to initialize during power up, remove and apply power at the circuit breaker switch (Item 26, Figure 9). If cycling the power doesn't clear the fault, the circuit breaker should be

turned off and tagged out. The brake unit should then be operated in the standard manual mode until repairs can be made at the next qualified service facility

To change the brake from the Auto to Manual mode, pull the knob of the selector handle (Figure 41) and rotate the handle to the MANUAL position. Verify the selector handle knob is fully engaged. If the handle becomes difficult to engage, rotate the hand wheel 180 degrees and re-engage the lever. The MANUAL indicator (Item 6) should illuminate.

Handbrake wheel is then turned clockwise with a ratchet-type resistance until the brake shoes lock against the wheels.

To release the brake turn the hand-wheel counter-clockwise (loosening the brake linkage until the ram end stop of the actuator screw is reached) until a slight resistance is felt – DO NOT OVER-FORCE when releasing the brake.

When returning the selector handle to AUTO position, the MANUAL light may temporarily stay illuminated until the internal gearing aligns. Press and hold the APPLY or RELEASE button to activate the brake and the MANUAL light will turn off. The brake remains fully functional in the AUTO mode until the selector handle is again changed. Returning to the Auto mode, the Handbrake Wheel spins freely with no resistance.

WARNING: Observe all established Railroad safety precautions and follow the electric parking brake instructions carefully. Keep clear of active brake rigging. Severe personal injury and equipment damage may occur if the electric parking brake is inadvertently or improperly applied.

CAUTION: The electric parking brake must be disabled prior to maintenance or using the manual hand-wheel. When the brake is applied manually, rotate the Handbrake wheel until the brake shoes are firmly seated on the wheels

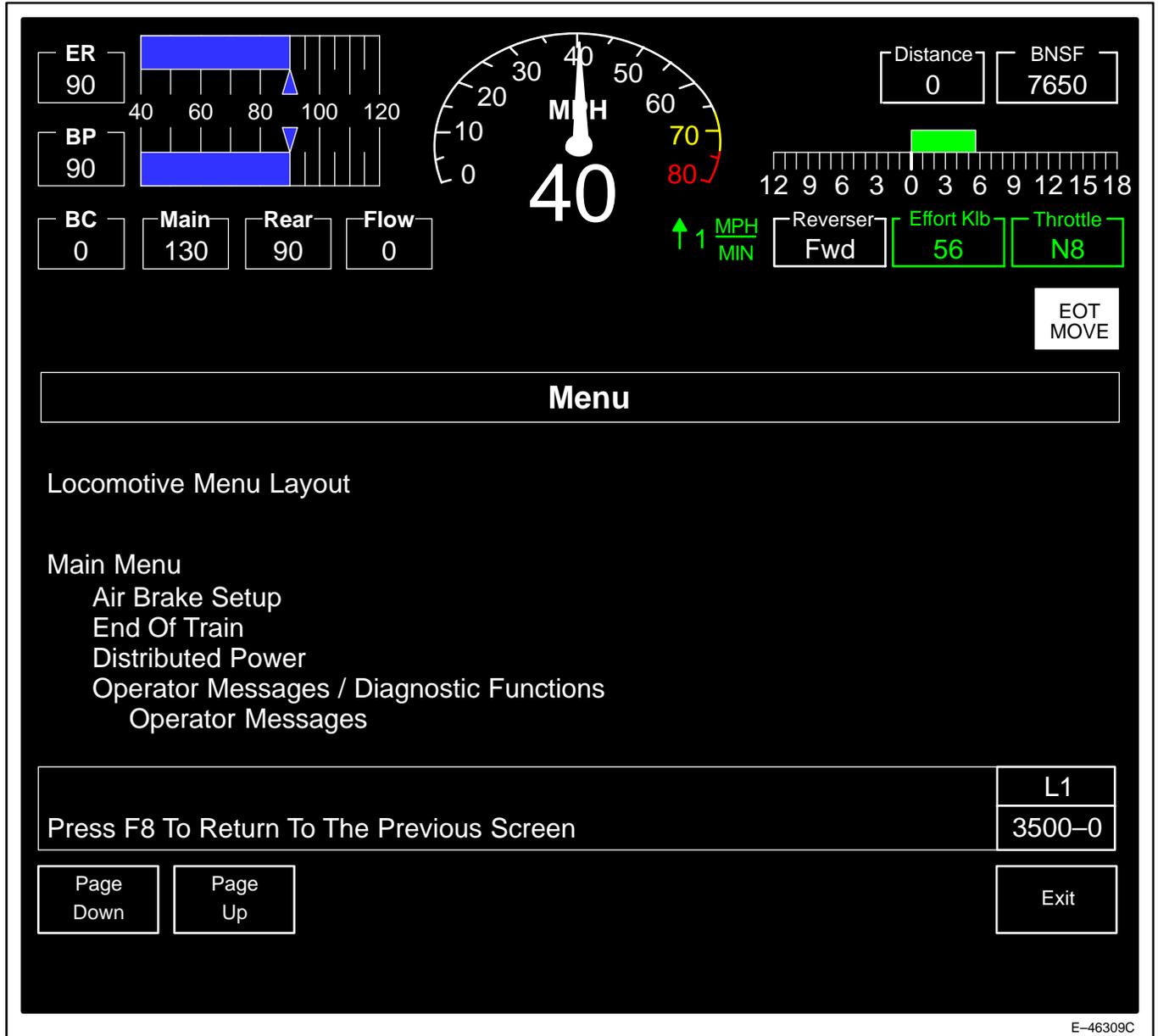
WARNING: The operator must verify that the hand brake is fully released on all locomotives prior to motoring per Railroad Operating Procedures.



LOCOMOTIVE OPERATION BY SDIS SCREEN

The remaining sections of this Operating Manual are presented in order of the soft keys from the Main Operation Screen (0000-0, Figures 33, 35, or 37) and the Main Operation Screen, More Menu...Screens (0000-1, Figures 34, 36, or 38).

Pressing the MENU key will produce the DC Evolution Series MENU screen (3500-0) on the SDIS (Figure 42).



E-46309C

Figure 42. DC Evolution Series Menu Screen (3500-0).



ELECTRONIC AIR BRAKE

INTRODUCTION

The Air Brake Setup (Figure 43) function receives data from the IPM. Operators use this screen to verify or adjust Air Brake settings of the controlling unit. Screen parameters may **NOT** be changed if the unit is moving (faster than 0.1 mph). If the current setup is not correct for the current consist and/or trip, proceed to the Operation Section that follows.

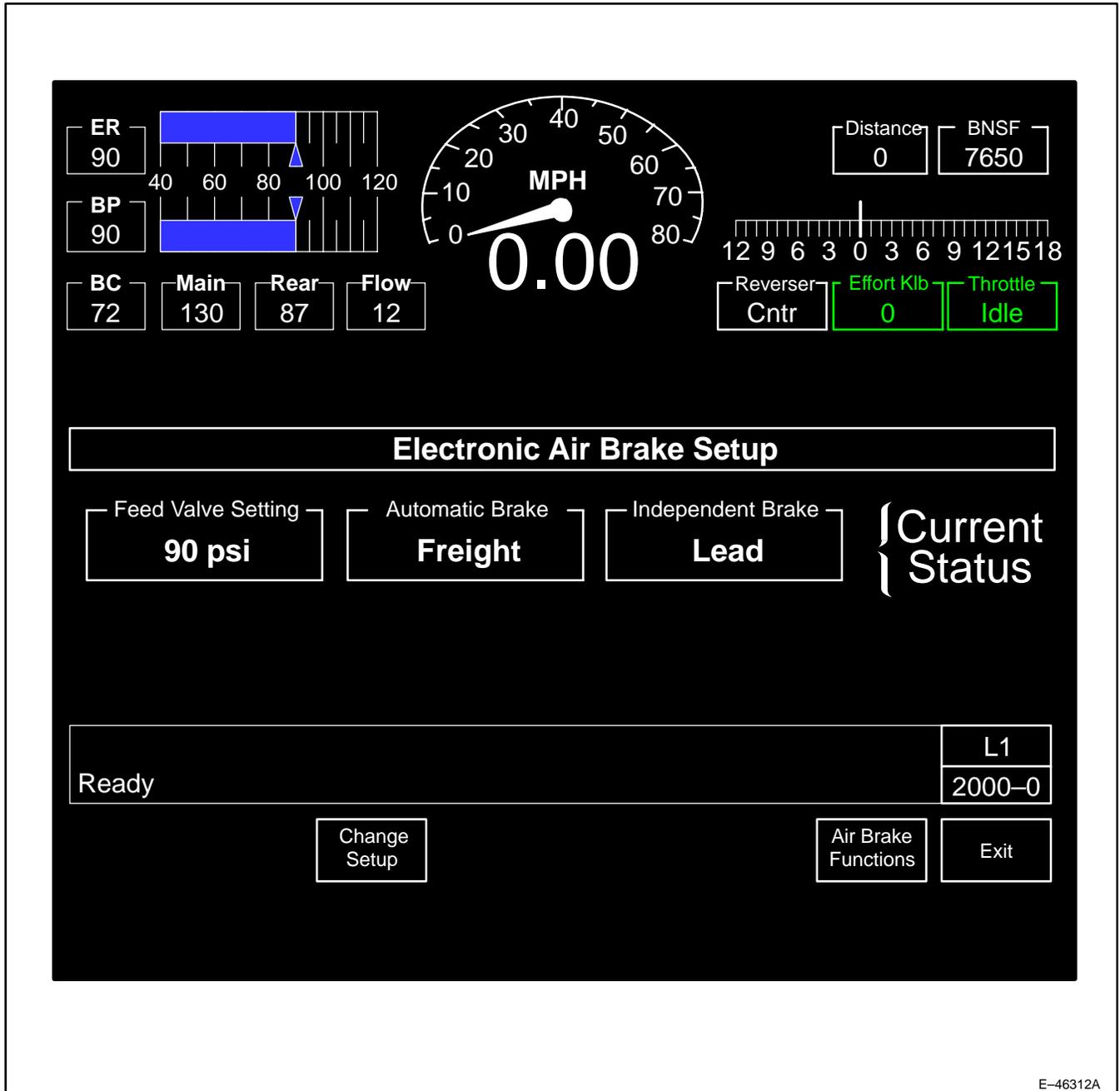


Figure 43. Electronic Air Brake Setup Screen (2000-0).

OPERATION

Pressing soft key position F1 (**Air Brake**) on the Main Operation Screen (screen 0000-0, Figures 33 or 35) will display screen 2000-0 (Figure 43). Trail units will have a similar screen as shown in Figure 44. Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

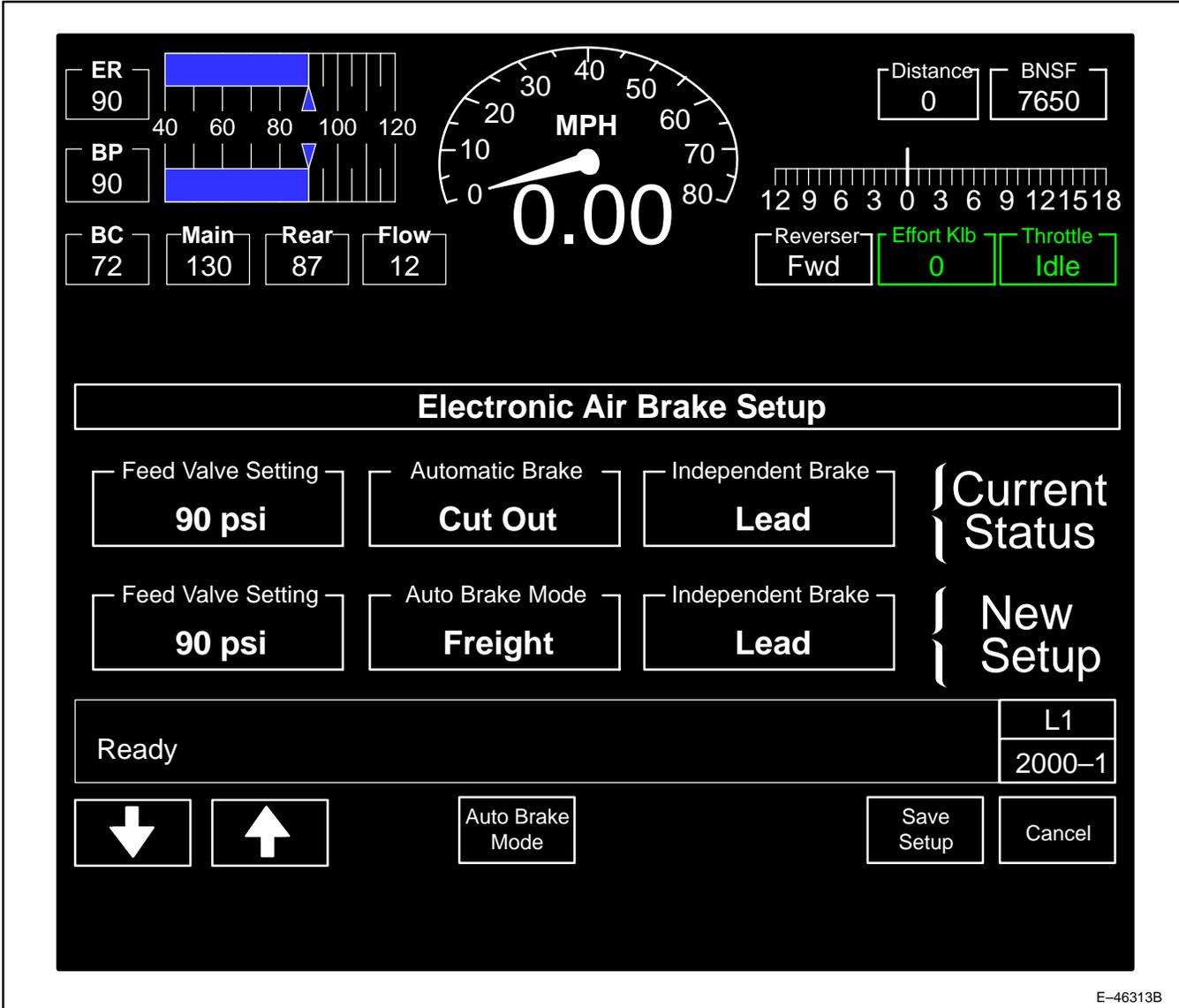


Figure 44. Electronic Air Brake Change Setup Screen (2000-1).

NOTE: No changes made on screen 2000-1 are acknowledged by the brake computer until they have been saved twice using “Save Setup” soft key.

1. Pressing key position F3 (**Change Setup**) will display screen 2000-1 (Figure 44). Six keys are available on this screen as follows:
 - a. Press key position F4 (**Auto Brake Mode**) will toggle the Automatic Brake displayed indicator. This key is only active if Independent Brake reads **Lead**.

- b. Press key position F6 (**Trail/Lead**) to toggle the displayed Independent Brake indicator if the **Reverser** handle is on CENTER. Selecting **Trail** also selects **Cut Out** for the Automatic Brake. When **Trail** is selected, key position F4 (**Auto Brake Mode**) is not available.
- c. Press key position F7 (**Save Setup**) twice to notify the Electronic Air Brake Computer of the new operating parameters. The screen will automatically change to the Air Brake Setup screen (2000-0).
- d. Press key position F8 (**Cancel**) to quit the Setup screen and return to screen 2000-0 with the original settings.

NOTE: Anytime the Reverser handle is not on CENTER will cause “Reverser Must Be Centered For Trail” to be displayed.

2. Pressing key position F7 (**Air Brake Functions**) will initiate a remote session with the air brake computer and will display screen 2090-0 (**Air Brake Data**) if locomotive is not moving and BC pressure is greater than 25 psi. **This screen is controlled by the Air Brake Computer System, refer to the NYAB CCBII publication.**
3. Pressing key position F8 (**Exit**) will return the operator to the Main Operation screen 0000-0.

ELECTRONIC AIR BRAKE SET-UP, LEAD

To operate the locomotive as a Lead unit of a consist, set-up the air brakes as follows:

NOTE: Ensure all other locomotives in the consist are set up in Trail before attempting to set this locomotive to Lead.

1. Place the Automatic Brake handle in RELEASE (REL) and the Independent Brake handle in FULL.
2. Press soft key position F1 (**Air Brake**) on the Main Operating Screen (screen 0000-0, see Figures 33 or 35) to display screen 2000-0.
3. Press soft key position F3 (**Change Setup**) to display screen 2000-1 (Figure 44).
4. Press soft key position F6 (**Lead**) to toggle the displayed Independent Brake indicator to Lead if the **Reverser** handle is on CENTER.
5. Press soft key F7 (**Save Setup**) twice. Verify that the BC pressure increases.
6. Press soft key position F3 (**Change Setup**) to display screen 2000-1 (Figure 44). Use the soft keys F1 and F2 to adjust the Feed Valve Setting for the Equalizing Reservoir (ER) as required.
7. Press soft key F4 (**Freight**) to cut in the Automatic Brake for direct release or **Passenger** for graduated release.
8. Press soft key F7 (**Save Setup**) twice to save this set-up.
9. The Independent and Automatic Brakes are now cut in. Press F8 (**Exit**) to return to the Main Operation Screen (0000-0).

NOTE: This locomotive is equipped with the Forced Lead Function. On a Trailing locomotive, set up as Trail Cut Out, moving The Reverser handle from the center position will force the EAB system to change locomotive set-up to Lead/Cut Out if the Generator Field Circuit Breaker (Item 2, Figure 8) is ON.

ELECTRONIC AIR BRAKE SET-UP, TRAIL

To operate the locomotive as a Trail unit of a consist, set-up the air brakes as follows:

1. Ensure the **Combined Power** handle is in IDLE and the **Reverser** handle is removed.

2. Move the Automatic Brake and Independent Brake handles to FULL SERVICE (FS) and FULL.
3. While the system is exhausting press soft key position F1 (**Air Brake**) on the Main Operating Screen (screen 0000-0, see Figure 33 or 35) to display screen 2000-0.
4. Press soft key position F3 (**Change Setup**) to display screen 2000-1 (Figure 44).
5. After Brake Pipe exhaust ceases, place Independent Brake handle in RELEASE (REL).
6. Press soft key position F6 (**Trail**) to toggle the displayed Independent Brake indicator to Trail. Selecting **Trail** also selects **Cut Out** for the Automatic Brake. When **Trail** is selected, key position F4 (**Auto Brake Mode**) is not available.
7. Press soft key F7 (**Save Setup**) twice.
8. The Independent and Automatic Brakes are now cut out. Press F8 (**Exit**) to return to the Main Operation Screen (0000-0).
9. Place the Automatic Brake handle in CONTINUOUS SERVICE (CS).

AIR BRAKE TROUBLESHOOTING

TABLE 1. EMERGENCY OR PENALTY BRAKE WARNING INDICATIONS.

MESSAGE	INDICATION	RESET STRATEGY
AUTOMATIC BRAKE EMERGENCY	SOLID* YELLOW	1
EMERGENCY BRAKE VALVE EMERGENCY	SOLID* YELLOW	2
TRAINLINE EMERGENCY	SOLID* YELLOW	2
EOT EMERGENCY	SOLID* YELLOW	2
ALERTER SIGNAL PENALTY	SOLID* YELLOW	3
CAB SIGNAL PENALTY	SOLID* YELLOW	3
OVERSPEED PENALTY	SOLID* YELLOW	3
AIR BRAKE POWER UP PENALTY	SOLID* YELLOW	3
IPM TIME OUT (EAB CANNOT COMMUNICATE WITH SDIS)	SOLID* YELLOW	3
NOTE: Messages listed above are in order of importance.		
* Non-Flashing		

Reset Strategies:

1. Move Automatic Brake Handle to EMERGENCY and WAIT until the RESET message appears or the fault disappears.
2. Move AUTOMATIC Brake Handle to EMERGENCY for 60 seconds, then move to RELEASE position.
3. The operator *may* reset this failure by moving the Automatic Brake Handle to SUPPRESSION and hold for at least *eight* seconds, then return handle to RELEASE.

NOTE: *If the above Reset Strategy does not reset the situation, proceed as follows:*

1. *Toggle the Air Brake Computer circuit breaker on the EC Panel (Figure 9) and wait for system to power on.*
2. *Move the Automatic Brake Handle to SUPPRESSION and hold for at least eight seconds, then return handle to RELEASE.*
3. *If the alarm bell cannot be reset or the alarm re-occurs (possible problem with Brake System), the operator should leave the circuit breaker open; the CCBII System back-up will provide normal brake operation as a Trail Unit (Independent Brake cylinder pressure will be limited to the A&R pipe pressure).*

WARNING: STOPPING HAZARD. *Under no circumstances should a train be permitted to continue in operation if the brake pipe air pressure falls below 45 psi. If this situation occurs, the train must be stopped and the brake pipe recharged to the railroad particular setting. Failure to comply with this warning may result in the inability to control or stop the train.*

WARNING: *If Locomotive battery power loss to the CCBII System occurs while train is in motion, a FULL SERVICE Brake application is automatically made at a SERVICE rate (BP drops below 13 psi). Operator may initiate an EMERGENCY Brake application from the EMERGENCY BRAKE VALVE located on the Crew Member's Desk.*

WARNING: STOPPING HAZARD. *Following an EMERGENCY BRAKE application, if the train is not at rest, brake release MUST NOT be attempted. Any movement of the AUTOMATIC Brake Handle to RELEASE while train is moving may cause equipment damage and/or personal injury.*



END OF TRAIN

INTRODUCTION

The End Of Train (EOT) function, through the HOTD (Head of Train Device), receives data from the rear-of-train-mounted transmitter/receiver or EOT device. This function allows the operator to gather pertinent system data and ensure adequate notification on trainline breaks. The setup screen (Figure 45) allows the operator to change the EOT ID and ensure EOT system communications.

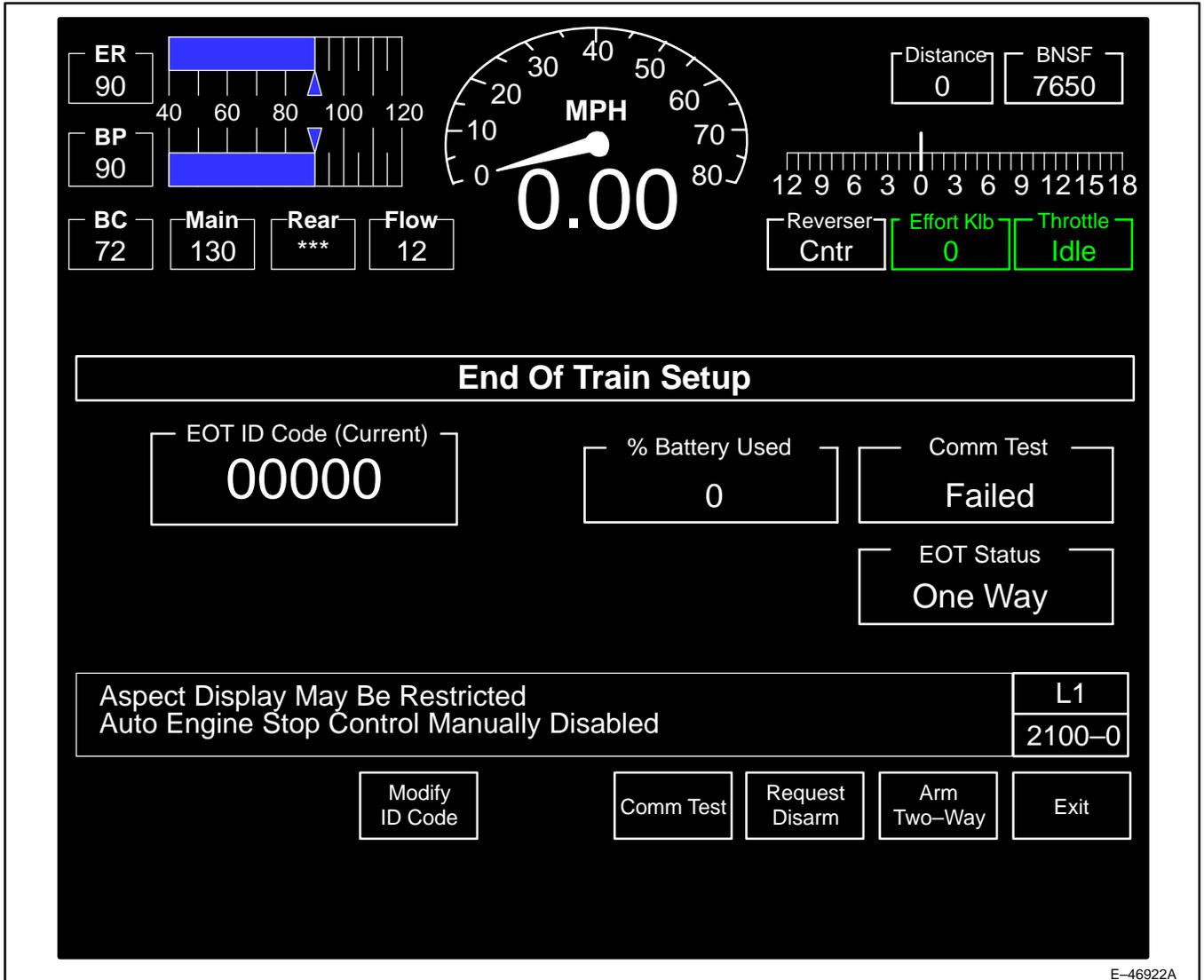


Figure 45. End Of Train Setup Screen (2100-0).

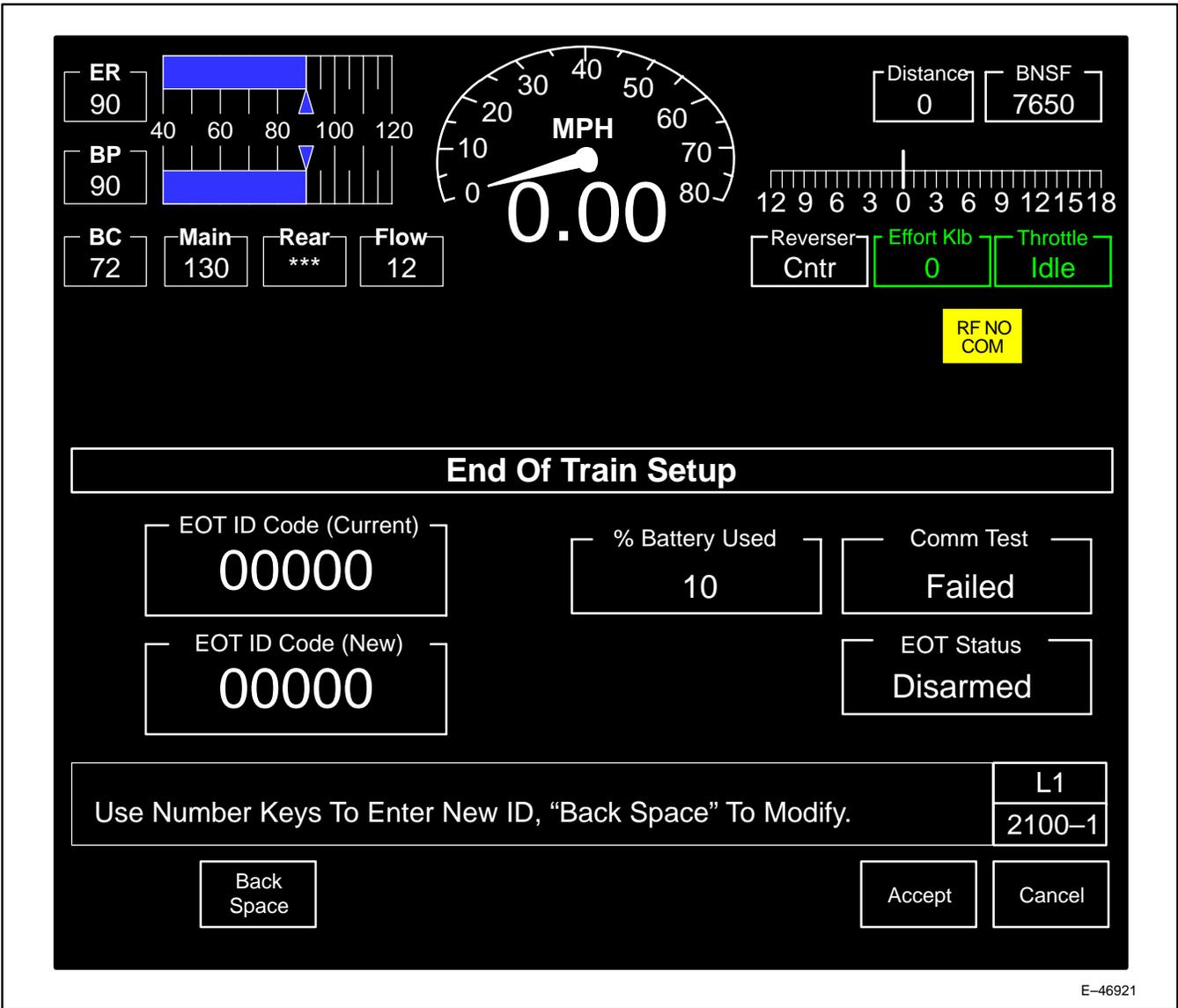


Figure 46. End Of Train Change Setup Screen (2100-1).

OPERATION

Pressing soft key position F2 (**End of Train**) on the Main Operating Screen (screen 0000-0, see Figure 33, 35 or 37) will display screen 2100-0 (Figure 45). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key position F3 (**Modify ID Code**) will display screen 2100-1 (Figure 46). Three keys are available on this screen as follows:

NOTE: Modify ID soft key is not available if EOT is armed, the locomotive is in motion, or another display is on the screen and this key is NOT available on the Auxiliary Display.

- a. Key position F2 (**Back Space**) – will allow removal of one digit (per press) from the entered code.
- b. Key position F7 (**Accept**) – will record and notify the control system of the new EOT ID code. The screen will automatically return to the EOT Setup Screen (2100-0).

- c. Pressing key position F8 (**Cancel**) will return the operator to the EOT Setup screen (2100-0) **without** a change to the EOT ID code.
 - d. All the numeric keys (0-9) are active and are used to enter EOT ID number.
2. Key position F5 (**Comm Test**) will be present depending upon system status. This key is NOT available on the Auxiliary Display.
 3. Key position F6 (**Request Disarm**) (visible only when the system is armed), will allow the operator to disarm the two-way EOT. Pressing this key will display screen 2100-2. Two keys are available on this screen as follows:
 - a. Key position F7 (**Disarm Two way**)—will cause the system to disarm.
 - b. Key position F8 (**Cancel**) – will return the operator to the previous screen without disarming the system.
 4. Key position F7 (**Arm Two Way**) (visible only when EOT Status = Arm Now), attempts to arm EOT.
 5. Key position F8 (**Exit**) will return the operator to the Main Operation screen (0000-0).

NOTE: Communication with the EOT is restricted to the Lead Locomotive only. On Trail Locomotives, the EOT System functionality, status information and emergency braking are disabled.

OPERATING PROCEDURE

1. On Power Up, if EOT and HOTD EOT Codes do not match, press F3 (**Modify ID Code**) and enter the correct EOT ID (Figure 45).
2. Perform a Communications Test on the system by pressing F5 (**Comm Test**) (Figure 47).

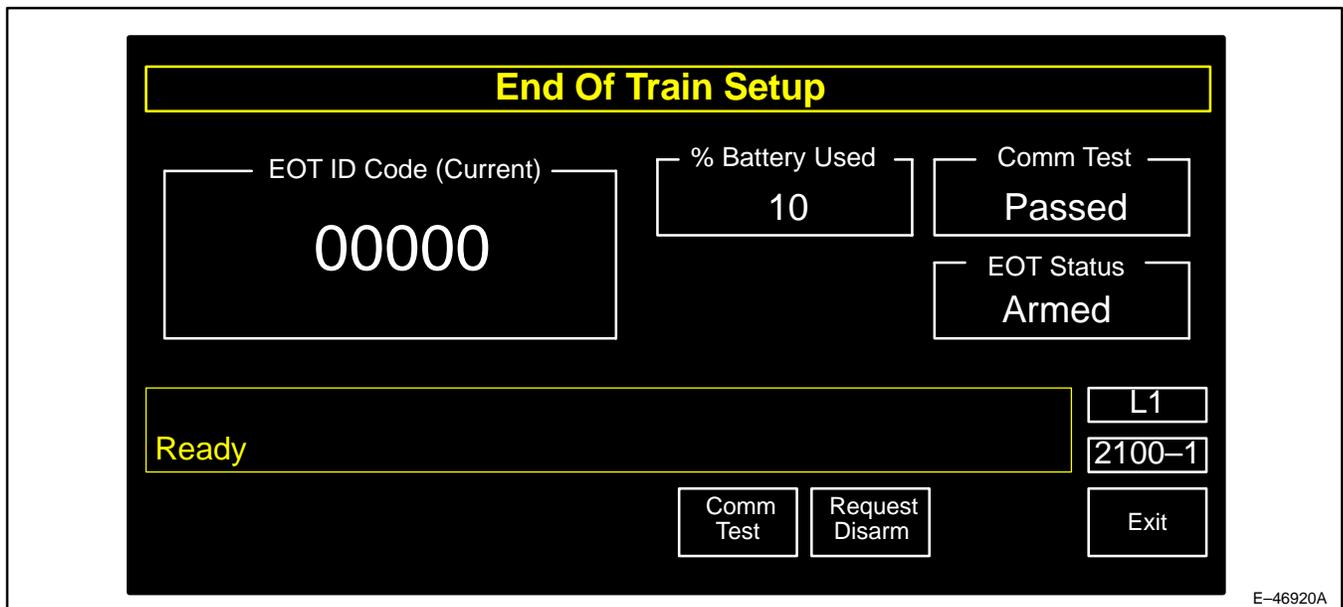
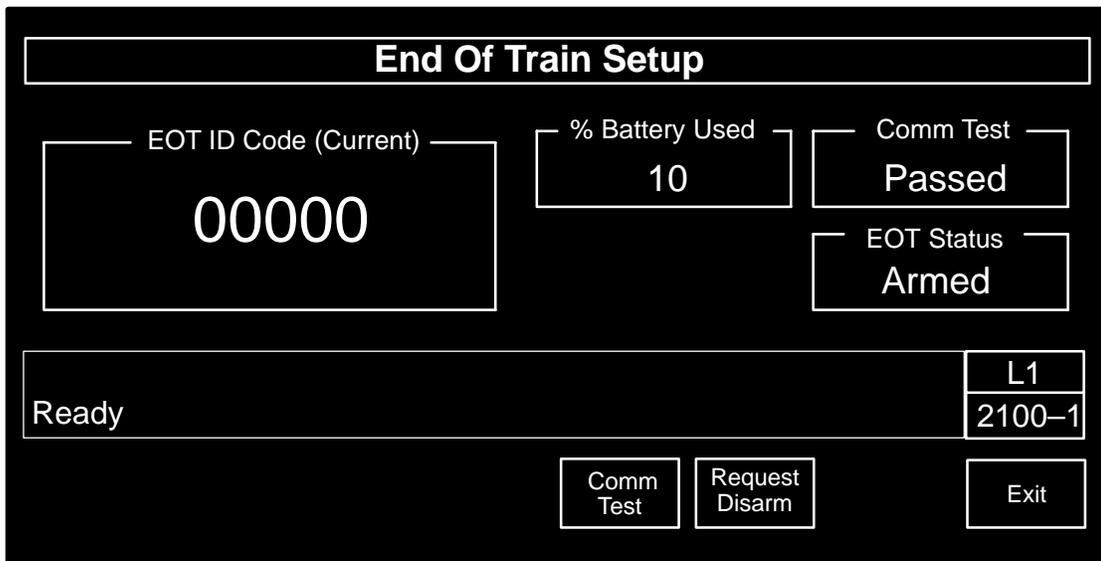
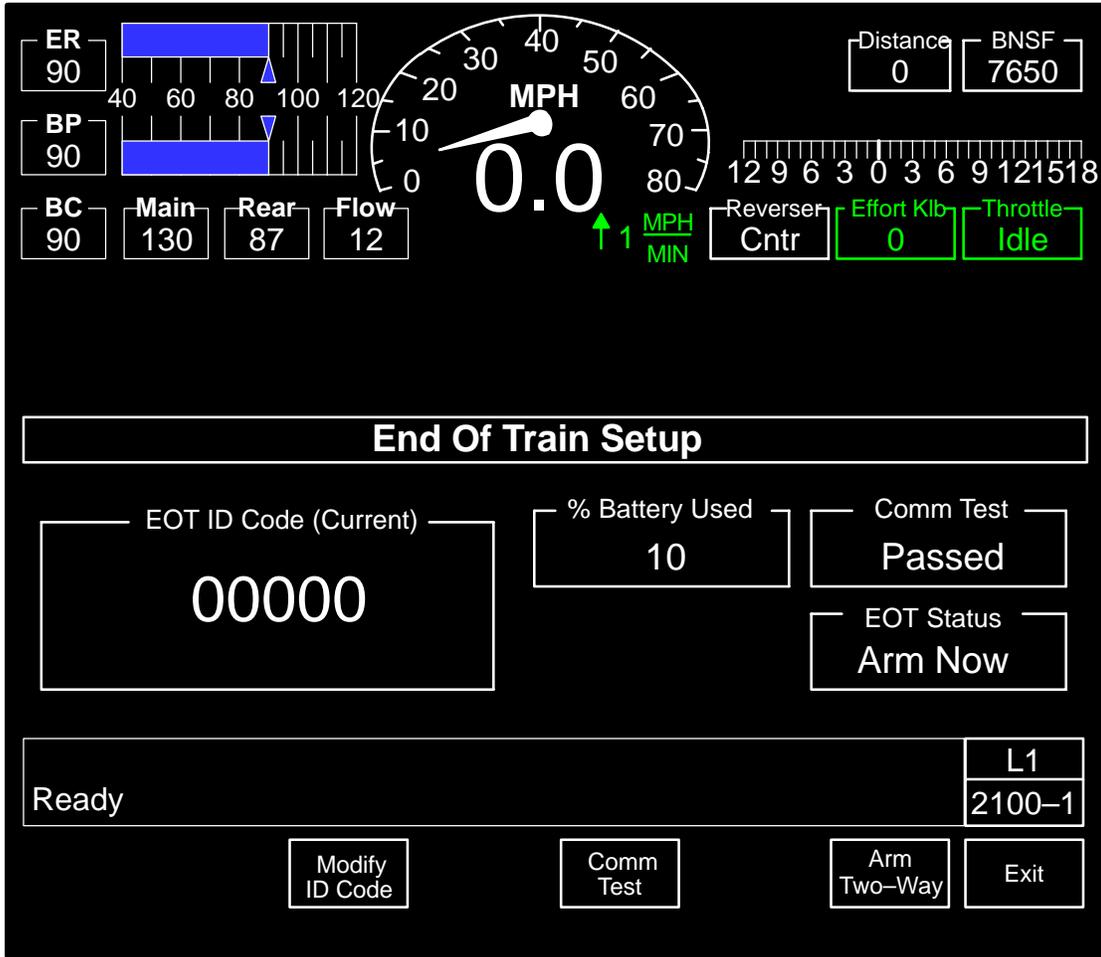


Figure 47. EOT Code Entered And Comm Test Pressed.

3. Once the Test has passed, have Crew Member press the test button on the EOT. If test passes, soft key F7 (**Arm Two Way**) will appear (Figure 48). Arm the EOT System by pressing F7 (**Arm Two Way**) (Figure 48) within five seconds. The F7 key disappears and F6 (**Request Disarm**), appears (Figure 48).

NOTE: *Pressing the EOT Emergency Brake toggle switch (Item 13, Figure 5) on the control console initiates an emergency brake application, causing the EOT device to vent the brake pipe at the end of the train. Follow Railroad Rules and Regulations for operation of this switch. The EOT device will also vent the brake pipe in response to emergency brake applications triggered by the following conditions:*

1. *Automatic Brake handle (Item 12, Figure 5) moved to Emergency;*
2. *Emergency Brake Valve on the crew member's console operated;*
3. *Trainline Emergency;*
4. *Internal Electronic Air Brake fault which causes an emergency brake application.*



E-46336B

Figure 48. EOT System Ready For Operation.



DISTRIBUTED POWER SYSTEM OPERATION SUMMARY

NOTE: *The following information is summary in nature. Please refer to the Locotrol LEB System Operator's Manual for more detailed system operation information.*

NOTE: *The AESS system is disabled when Distributed Power is active.*

INTRODUCTION

The Distributed Power Control (DPC) System, is integrated with the Electronic Air Brake (EAB) and Consolidated Control Architecture (CCA) systems and is designed to provide synchronous automatic and independent control from a control locomotive in the lead position to remote consists located in the train. Up to six remote consists can be controlled. The system provides control of the remote (rearward) units by command signals transmitted over a radio link from the lead locomotive. Operation of the system is such that several trains equipped with Distributed Power can operate on the same radio frequency and within radio range of each other without interface. The Smart Display (SDIS) screens are the operator's interface with the Distributed Power System.

In conventional trains operating *without* the Distributed Power System, all locomotives are controlled by the operator in the Operating Cab of the lead unit. The controls are connected through the electrical train lines and control the applied voltages to the respective locomotive control functions. In trains operating *with* the Distributed Power System, the division of locomotive power (i.e., the placement of locomotives at the front and at other points in the train) makes available the full potential of locomotive power; however, there are no train lines between the separated units. The Distributed Power System system employs digital control, utilizing radio equipment as a telemetry link, to provide the precise timing necessary for coordinated operation of the lead and remote locomotives. The Distributed Power System comprises six modules: the Protocol Translator (PTD), the Integrated Processor Module (IPM), the Radio Module (DPR), the Electro-Pneumatic Control Unit (EPCU), and the Electronic Brake Valve (EBV). These modules operate in conjunction with the Concentrated Input/Output (CIO) and SDISs.

NOTE: *This interface includes distributed power initiation, lead and remote setup, unit linking, brake pipe continuity and leakage testing, train checks, lead and remote consist control, independent control of remote consist, remote consist information viewing, unlinking of units, and distributed power termination.*

OPERATION

As stated in the **INTRODUCTION** Section, the Distributed Power System provides *synchronous* or *asynchronous control* (motoring, dynamic braking and air brakes) of multiple remote locomotive consists within a single train. Only one locomotive in each consist (lead or remote) needs to be equipped with the integrated Distributed Power System. In addition to commands passed from lead to remote units, status information is passed forward from the remote units for operator display.

For *synchronous control*, the operator uses the normal Master Controller and Independent and Automatic brake handles of the lead unit to send commands to the propulsion and air brake systems of all locomotives in the lead consist. The Distributed Power System in the lead unit receives these commands via the lead locomotive trainlines and the communication link to the EAB. These commands are then relayed via radio link to the remote lead unit of each remote consist in the train. Upon receiving commands from the lead unit, each remote interprets the radio messages and passes the commands onto the trainlines and EAB.

For *asynchronous control* or independent control of the remote units, the operator uses the normal Master Controller, the Independent and Automatic brake handles and the Distributed Power System SDIS Screens. Through the use of the SDIS Screens, the operator may choose to place the remote units into two operating groups, front and back. The front group would be under *synchronous control* of the lead unit and the back group would be independently controlled

(traction and dynamic braking) by the operator via the Distributed Power System screens. For example, braking can exist on the lead consist and motoring can exist on the remote consist. Safety interlocks do not allow traction on the front of the train and braking on the rear unless the **Reverser** handle is in the reverse position.

NOTE: *When the CCA system receives the REMOTE serial message from the Distributed Power System, CCA will eliminate the electronic air brake set-up screens, disable the integrated alerter function on the remote unit.*

OPERATING PROCEDURE

NOTE: *When setting up for Distributed Power operation, the ENGINE RUN circuit breaker must be set manually to ON in the Lead locomotive in each remote consist. If this is not done the remote consist will not load.*

Once the train has been made-up properly and the Distributed Power System lead and remote units have been set up, pressing key position F6 (**Distributed Power**) on the Main Operation Screen (screen 0000-0, Figure 33) will display screen 2300-0 (Figure 49) on the HMI display and screen 2310-0 (Figure 50, DP Menu Screen) on the Operator display (LOD). From the DP Menu screen, press F5 (Operation Screen) to display screen 2301-0 (Figure 51). The active keys and a brief description of operation are as follows:

1. Pressing key position 8 (**Remote Menu**) will display screen 2300-1 (Figure 52).
2. Pressing key position 8 (**Control Menu**) will display screen 2300-0 (Figure 49). Keys are available on this screen:

NOTE: *Refer to Figures 49 and 52 for Sample Distributed Power Main Menu Screen Informational Areas.*

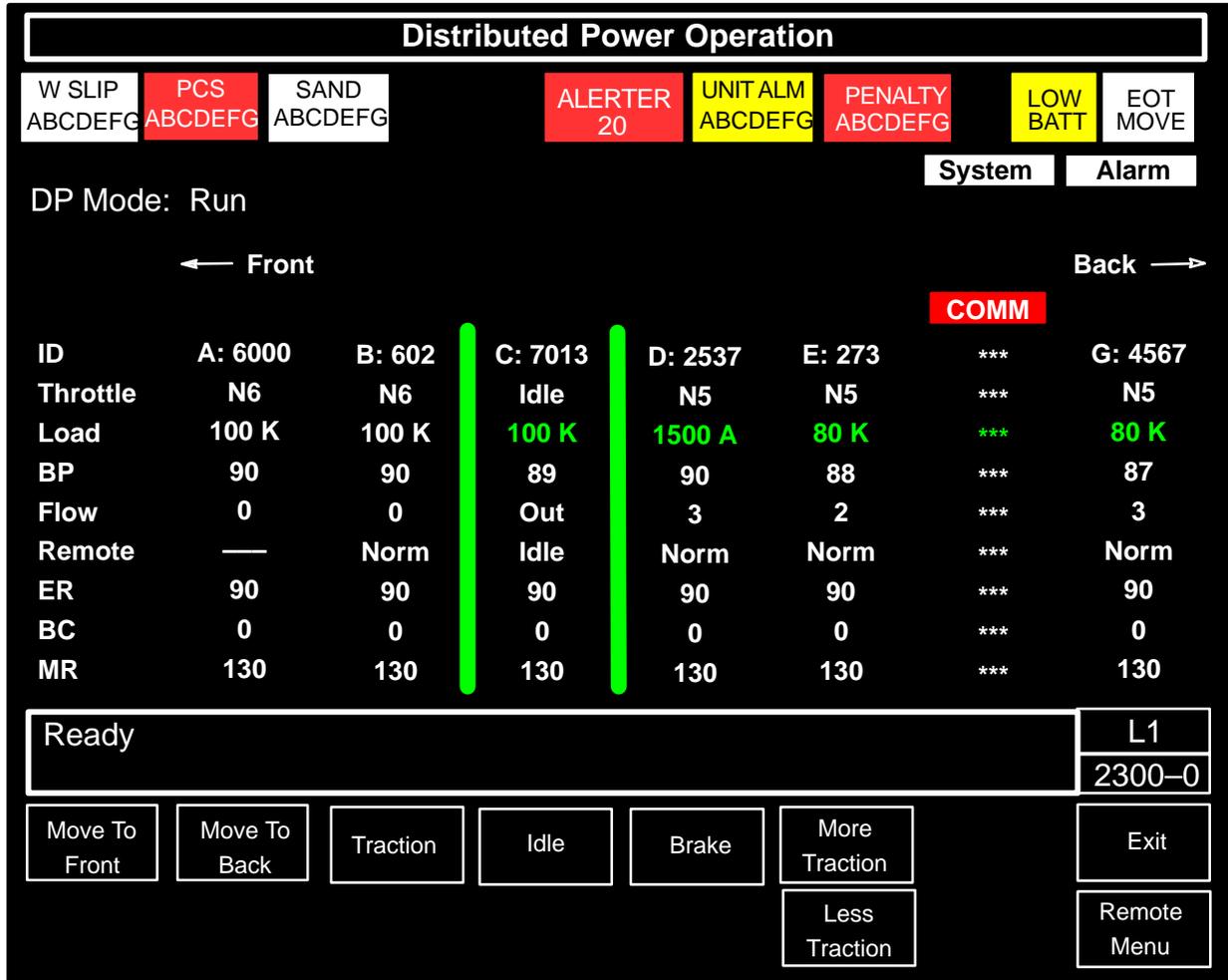
- a. Pressing key position F1 (**Move To Front**) will reassign the next consist from the back group to the front group. Once pressed, this key will become inactive for three seconds.
- b. Pressing key position F2 (**Move To Back**) will reassign the next consist from the front group to the back group. Once pressed, this key will become inactive for three seconds.
- c. Pressing key position F3 (**Traction**) will order the back group to traction (after F4 soft key **Execute** is pressed).

NOTE: *When either F3 or F5 soft keys are pressed, F4 becomes Execute and F8 becomes Cancel. and all other soft keys will disappear (Figure 53). After pressing F1 or F2, all soft keys will return to their normal state.*

- d. Pressing key position F4 (**Idle**) will order the back group to Idle.
- e. Pressing key position F5 (**Brake**) will order the back group to Dynamic Brake (after F4 soft key **Execute** is pressed). Refer to **NOTE** following **Step c**.

NOTE: *The F3, F4 and F5 soft key matrix (see following Table) assumes the lead unit is running Short-Hood Lead.*

- f. Pressing key position F6 (**More Traction** or **More Brake**) depending on whether the back group is in Traction or Brake Mode, will increase the back group traction (or dynamic braking) by one throttle (brake) position (step).
- g. Pressing key position F7 (**Less Traction** or **Less Brake**) depending on whether the back group is in Traction or Brake Mode, will reduce the back group traction (or dynamic braking) by one throttle (brake) position (step).
- h. Pressing key position F8 (**Exit**, will to go to screen 2300-2 (Figure 53). On HMI screens this key appears only if the locomotive is stopped with brakes on (BC greater than 25).



E-45469A

Figure 49. Distributed Power Operation Screen (2300-0), HMI Display.

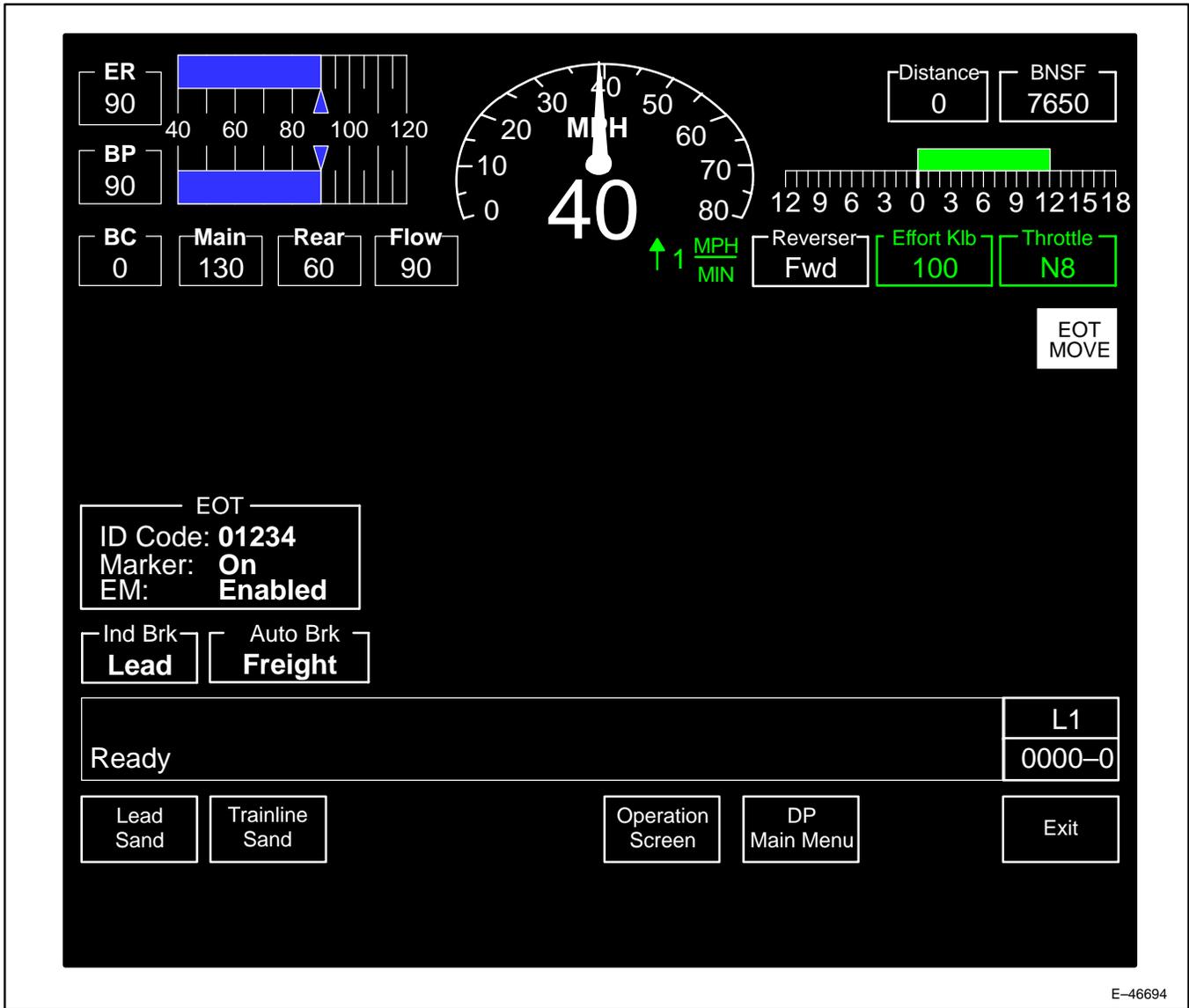
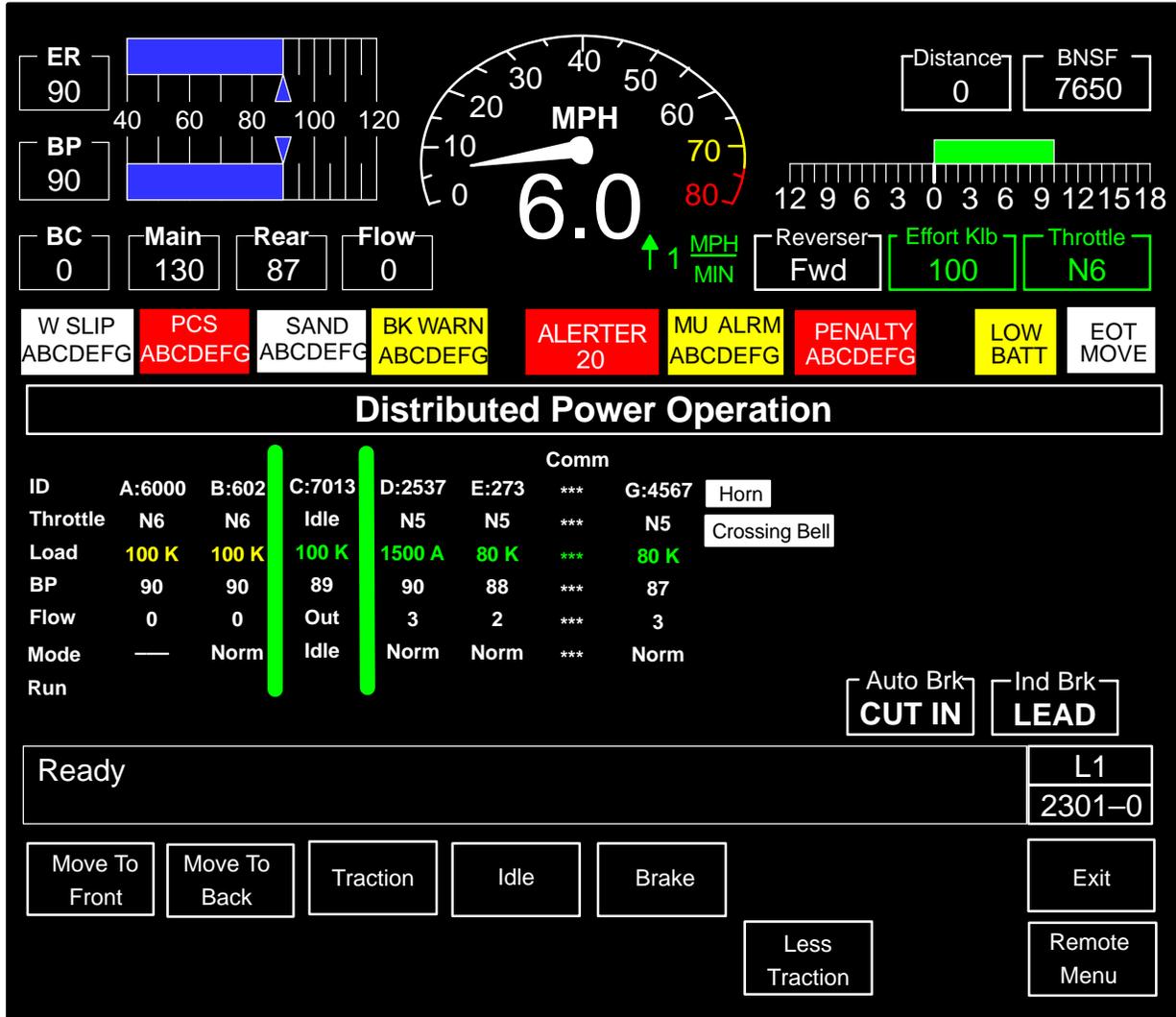


Figure 50. Distributed Power Menu Screen (2310-0).



E-45473B

Figure 51. Distributed Power Operation Half Screen (2301-0), LOD Display.

Distributed Power Operation

W SLIP
ABCDEFGH

PCS
ABCDEFGH

SAND
ABCDEFGH

ALERTER
20

UNIT ALM
ABCDEFGH

PENALTY
ABCDEFGH

LOW
BATT

EOT
MOVE

System

Alarm

DP Mode: Run

←← Front
Back →→

	A: 6000	B: 602	C: 7013	D: 2537	E: 273	Comm	G: 4567
ID	A: 6000	B: 602	C: 7013	D: 2537	E: 273	***	G: 4567
Throttle	N6	N6	Idle	N5	N5	***	N5
Load	100 K	100 K	100 K	1500 A	80 K	***	80 K
BP	90	90	89	90	88	***	87
Flow	0	0	Out	3	2	***	3
Remote	—	Norm	Idle	Norm	Norm	***	Norm
ER	90	90	90	90	90	***	90
BC	0	0	0	0	0	***	0
MR	130	130	130	130	130	***	130

Ready

L1

←

→

Idle

Normal

Brk Valve
Out

Isolate

Set Out

Exit

Engine
Stop

Control
Menu

2300-1

E-45470B

Figure 52. Distributed Power Operation Remote Screen (2300-1), HMI Display.

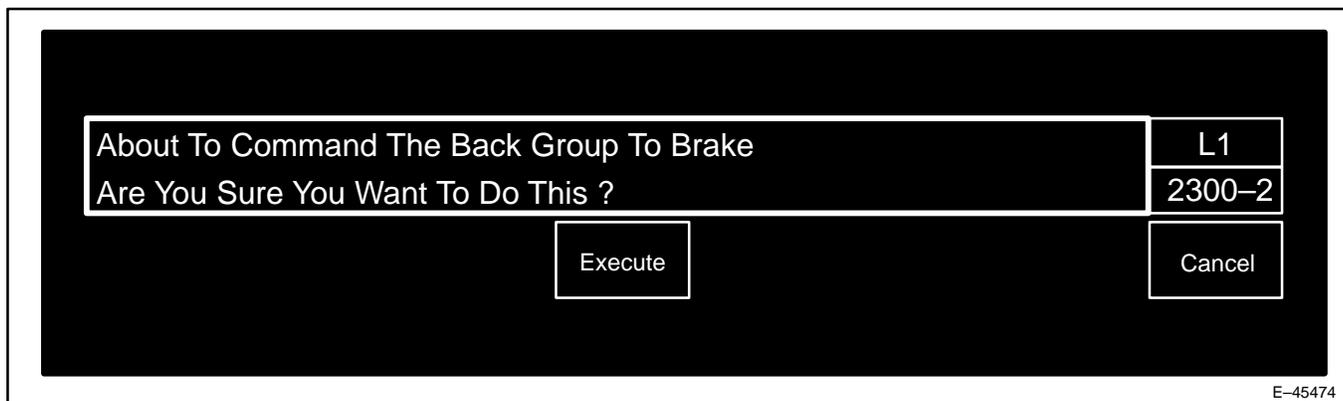


Figure 53. DP Operations Main Menu (Execute/Cancel) Screen (2300-2).

F3, F4 AND F5 SOFT KEY MATRIX.

FWD	REV	FRONT GROUP	BACK GROUP	F3	F4	F5
X	-	TRACTION	TRACTION	<NO KEY>	IDLE	<NO KEY>
X	-	TRACTION	IDLE	TRACTION	<NO KEY>	<NO KEY>
X	-	IDLE	TRACTION	<NO KEY>	IDLE	BRAKE
X	-	IDLE	IDLE	TRACTION	<NO KEY>	BRAKE
X	-	IDLE	BRAKE	TRACTION	IDLE	<NO KEY>
X	-	BRAKE	TRACTION	<NO KEY>	IDLE	BRAKE
X	-	BRAKE	IDLE	TRACTION	<NO KEY>	BRAKE
X	-	BRAKE	BRAKE	TRACTION	IDLE	<NO KEY>
-	X	TRACTION	TRACTION	<NO KEY>	IDLE	BRAKE
-	X	TRACTION	IDLE	TRACTION	<NO KEY>	BRAKE
-	X	TRACTION	BRAKE	TRACTION	IDLE	<NO KEY>
-	X	IDLE	TRACTION	<NO KEY>	IDLE	BRAKE
-	X	IDLE	IDLE	TRACTION	<NO KEY>	BRAKE
-	X	IDLE	BRAKE	TRACTION	IDLE	<NO KEY>
-	X	BRAKE	IDLE	<NO KEY>	<NO KEY>	BRAKE
-	X	BRAKE	BRAKE	<NO KEY>	IDLE	<NO KEY>
-	-	IDLE	IDLE	<NO KEY>	<NO KEY>	<NO KEY>

NOTE: The status of the Back Group (Traction, Idle or Brake) is taken from the Commanded State of the First Remote in the Back Group.

NOTE: The status of the Front Group (Traction, Idle or Brake) is taken from the Lead Unit throttle information.

NOTE: All Locomotives are Idled when Reverser Handle is on CENTER.

SLOW SPEED WHILE DISTRIBUTED POWER ACTIVE

In Distributed Power Slow Speed operation, the **Combined Power** handle should be set to Notch 1. The operator does not need to increase the throttle setting beyond Notch 1. Other than the setting of the **Combined Power** handle, the Distributed Power Slow Speed function is identical to non-Distributed Power Slow Speed, described in the **Speed Control** section of this manual.

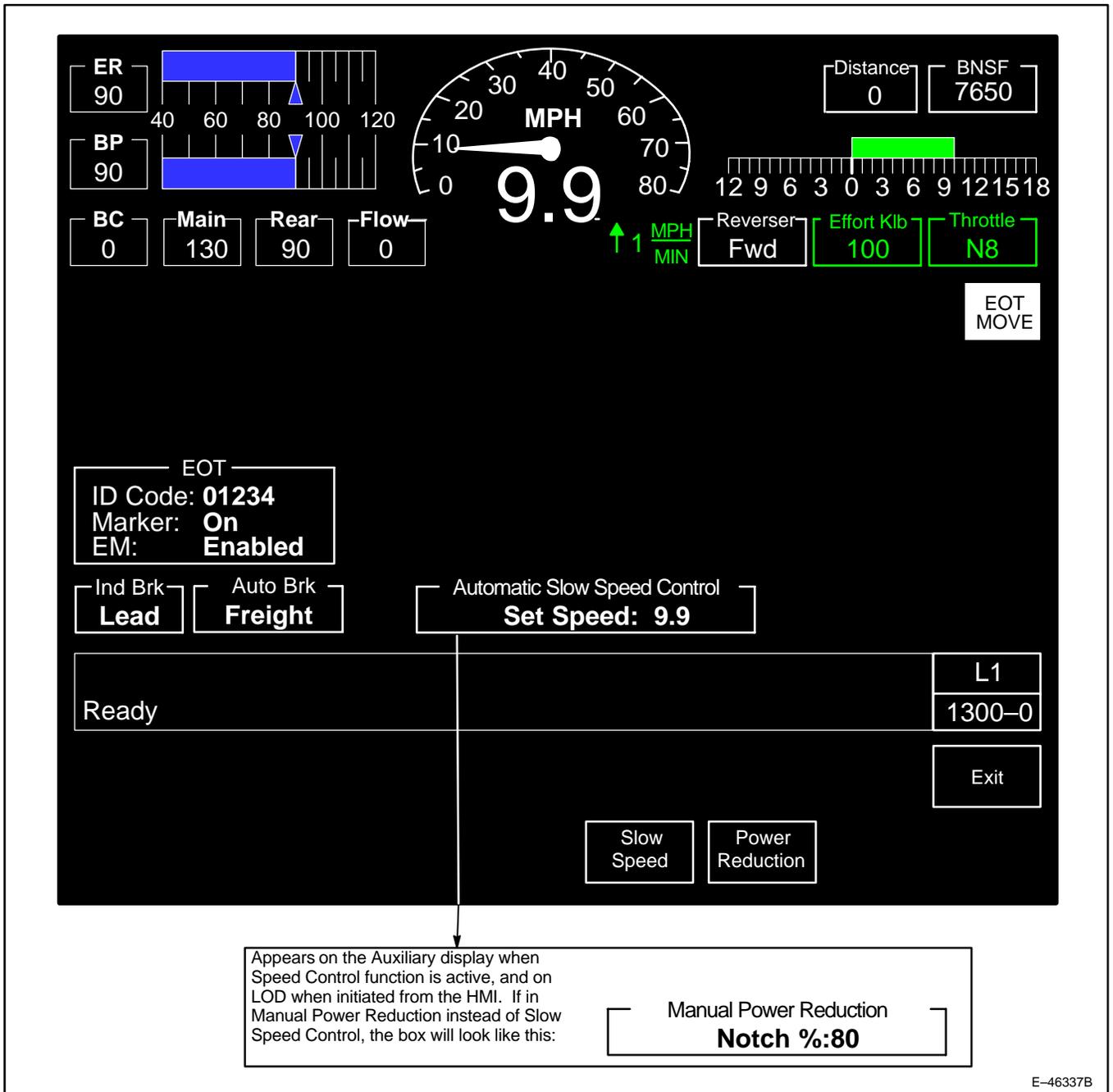


SLOW SPEED CONTROL

INTRODUCTION

The Slow Speed Control function (Figure 54) allows the operator to have finer speed control of locomotive operations for loading/unloading similar to a pacesetter or a hump control feature.

NOTE: This function is NOT available at the Auxiliary Display or if the locomotive is set up for Trail. "Speed Control Prohibited! Conditions Do Not Allow. Press F8 to Exit" will appear in the Message box.



E-46337B

Figure 54. Speed Control Menu Screen (1300-0).

OPERATION

Pressing soft key position F6 (**Speed Control**) on the Main Operating Screen (screen 0000-0, see Figure 33 or 35) will display screen 1300-0 (Figure 54). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key position F8 (**Exit**) will return the operator to the Main Operation screen (0000-0).
2. Pressing key position F6 (**Slow Speed**) will display screen 1320-0 (Figure 55). Eleven keys are available on this screen as follows:

NOTE: *Slow Speed soft key is NOT available if the locomotive is moving faster than 15.0 mph.*

NOTE: *On Power Up, the Slow Speed and Plug Mode functions will be OFF and the Target Speed setpoint will be defaulted to 5.0 mph.*

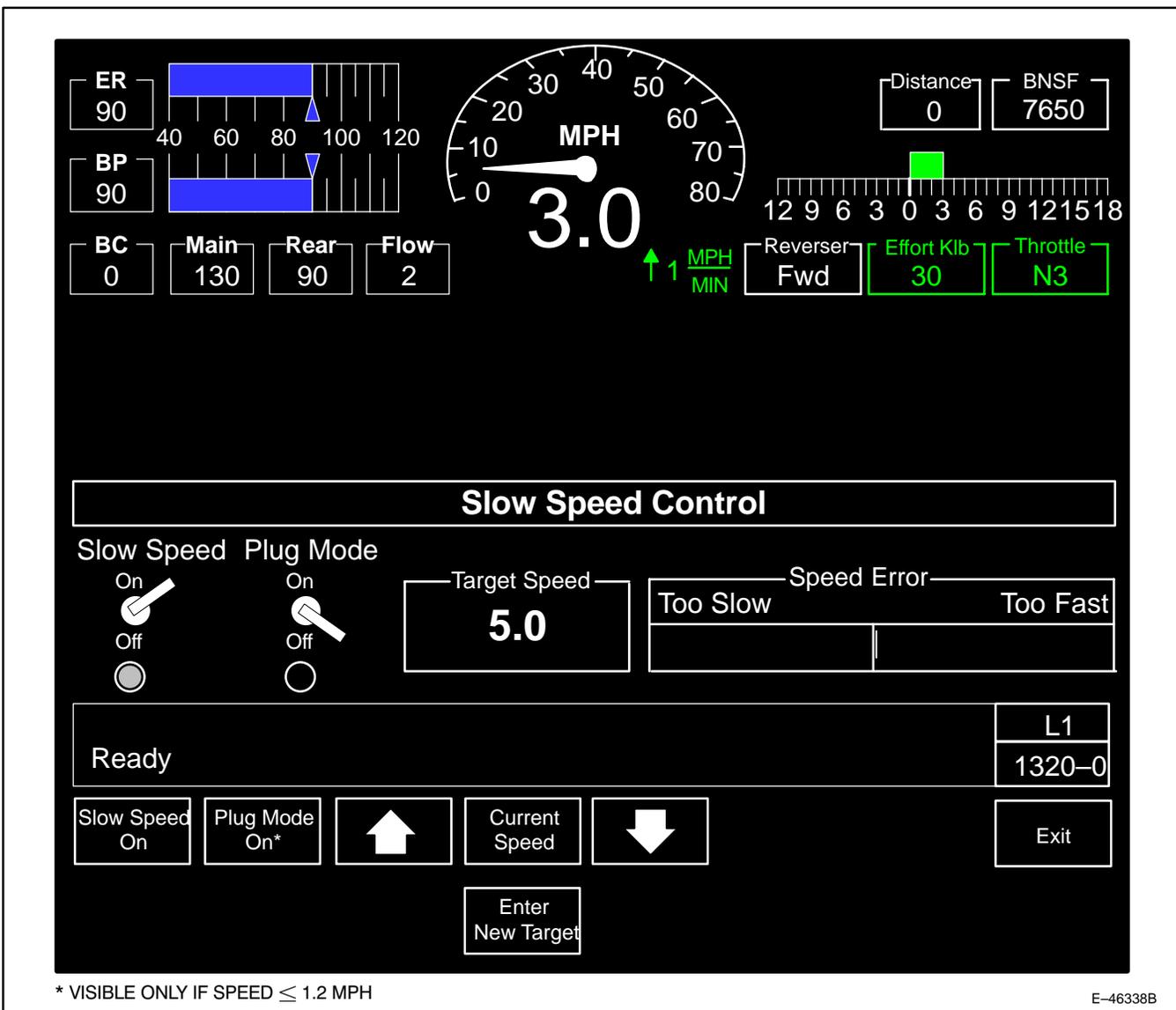


Figure 55. Slow Speed Control Setup Screen (1320-0).

NOTE: The Speed Error Gage tracks the actual locomotive MPH against the set MPH when this function is ON (gage disappears when this function is OFF). The Speed Error Gage will read zero (no bar graph) if the locomotive is not currently loading.

- a. Key position F1 (**Slow Speed Off**) – will order the locomotive control system to turn the Slow Speed function OFF. The toggle switch indicator will go to OFF and the graphic indicator light will go OUT. Key F1 will change to read **Slow Speed On**.
- b. Key position F2 (**Plug Mode On**) – will order the locomotive control system to turn the Plug Mode function ON. The toggle switch indicator will go to ON and the graphic indicator light will come ON. Key F1 will change to read Plug Mode Off. Refer to the Plug Loading heading in this section for further information on using this function.

NOTE: Key Position F2 (Plug Mode On) will only be visible if speed 1.2 MPH.

- c. Key position F3 (“**Up Arrow**”) – will increase the Target Speed by one unit of resolution per press.

NOTE: Unit of resolution depends on the set Target Speed. The unit of resolution will be 0.01 mph if target speed is between 0.10–4.99 mph. The unit of resolution will be 0.1 mph if target speed is between 5.0–10.0 mph.

- d. Key position F4 (**Current Speed**) – will order the Slow Speed function to use the current locomotive speed for the Target Speed set point.
- e. Key position F5 (“**Down Arrow**”) – will decrease the Target Speed by one unit of resolution per press.

NOTE: Unit of resolution depends on the set Target Speed. The unit of resolution will be 0.01 mph if target speed is between 0.10–4.99 mph. The unit of resolution will be 0.1 mph if target speed is between 5.0–10.0 mph.

- f. Key position F8 (**Exit**) – will bring up screen 1320–2, on which the message “Slow Speed Control Will Be Turned Off If This Screen Is Exited! Are You Sure?” will be displayed. Two keys are available: **Yes** orders the control system to turn Slow Speed and Plug Mode **OFF** and return the operator to the Main Operation screen (0000–0) and F8 (**Cancel**) returns the operator to screen 1320–0 with Slow Speed Control still on.
- g. Key position 4 (**Enter New Target**) – will display Slow Speed Control Change (Figure 56) screen (1320–1). Six keys are active on this screen as follows:
 - 1) Key position F4 (**Decimal Point**) – will enter a decimal point when needed to set new Target Speed.
 - 2) Key position F6 (**Back Space**) – will allow removal of one digit (per press) from the entered Target Speed value.
 - 3) Key position F7 (**Accept**) – will record and notify the control system of the new Target Speed value. The screen will automatically return to the Slow Speed Setup Screen (1320–0).
 - 4) Key position F8 (**Cancel**) – will return the operator to the Slow Speed Setup screen (1320–0) **without** a change to the Target Speed value.
 - 5) Numeric keys will allow the operator to enter the numbers to change the Target Speed value.
3. Pressing key position F (**Power Reduction**) will display screen 1310–0 (Figure 57). Seven keys are available on this screen as follows:

NOTE: On Power Up, the Power Reduction Mode function will be OFF, and the Notch Power % setpoint will default to 100%.

- a. Key position F1 (**Reduction On**) – will order the locomotive control system to turn the Power Reduction function ON. The toggle switch indicator will go to ON and the graphic indicator light will go ON. Key F1 will change to read **Reduction Off**.

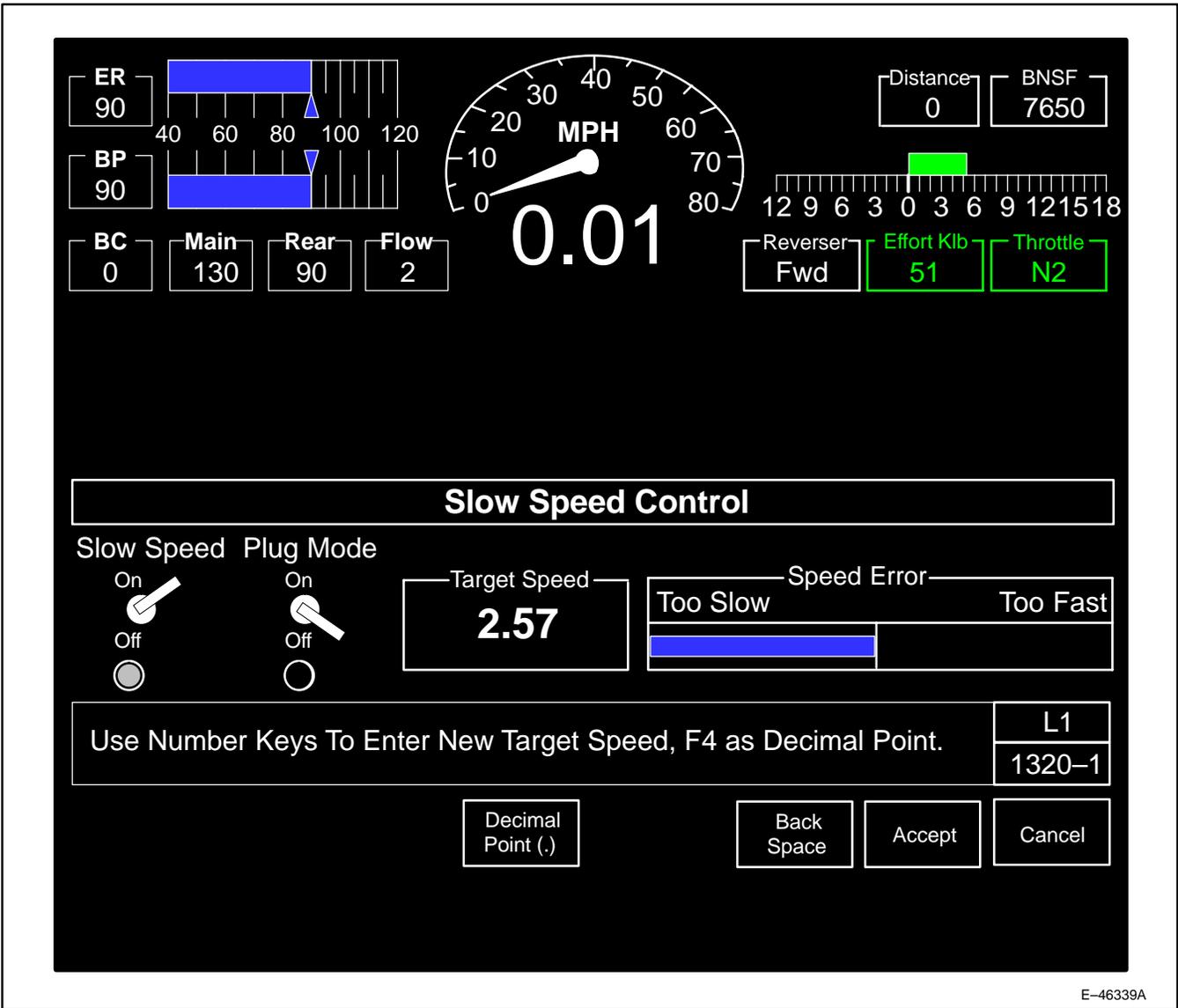


Figure 56. Slow Speed Control Change Screen (1320-1).

- b. Key position F5 (“**Up Arrow**”) – will increase the Notch Power % by 5% per press. Key disappears at 100%.
- c. Key position F6 (“**Down Arrow**”) – will decrease the Notch Power % by 5% per press. Key disappears at 0%.
- d. Key position F8 (**Exit**) – Key position F8 (**Exit**) – will bring up screen 1310-1 (Figure 58), on which the message “Manual Power Reduction Will Be Turned Off If This Screen Is Exited! Are You Sure?” will be displayed. Two keys are available: **Yes** orders the control system to turn Power Reduction off and Mode to MU and return the operator to the Main Operation screen (0000-0), and **Cancel** returns the operator to screen 1310-1 with Manual Power Reduction still on.

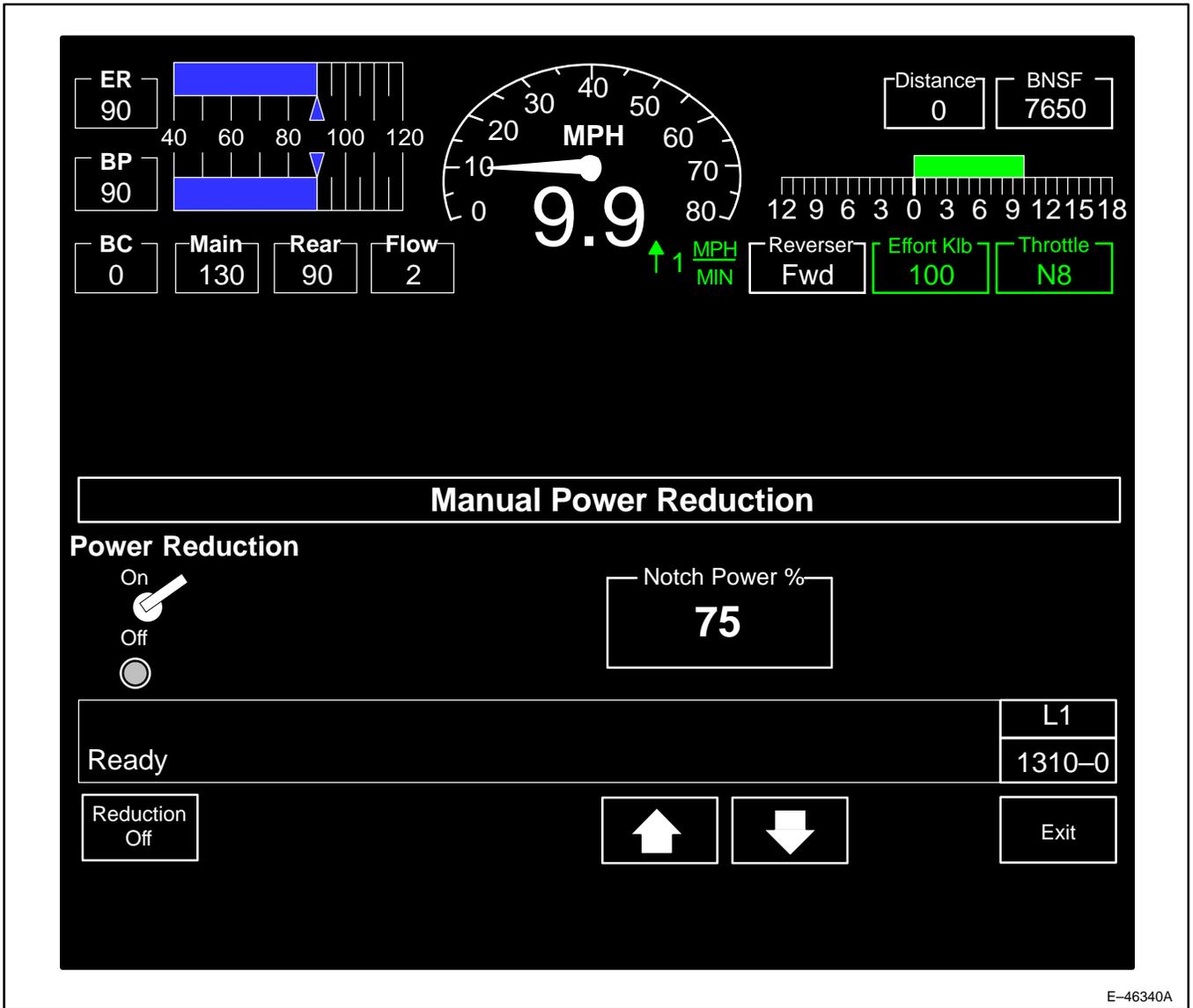


Figure 57. Manual Power Reduction Screen (1310-0).

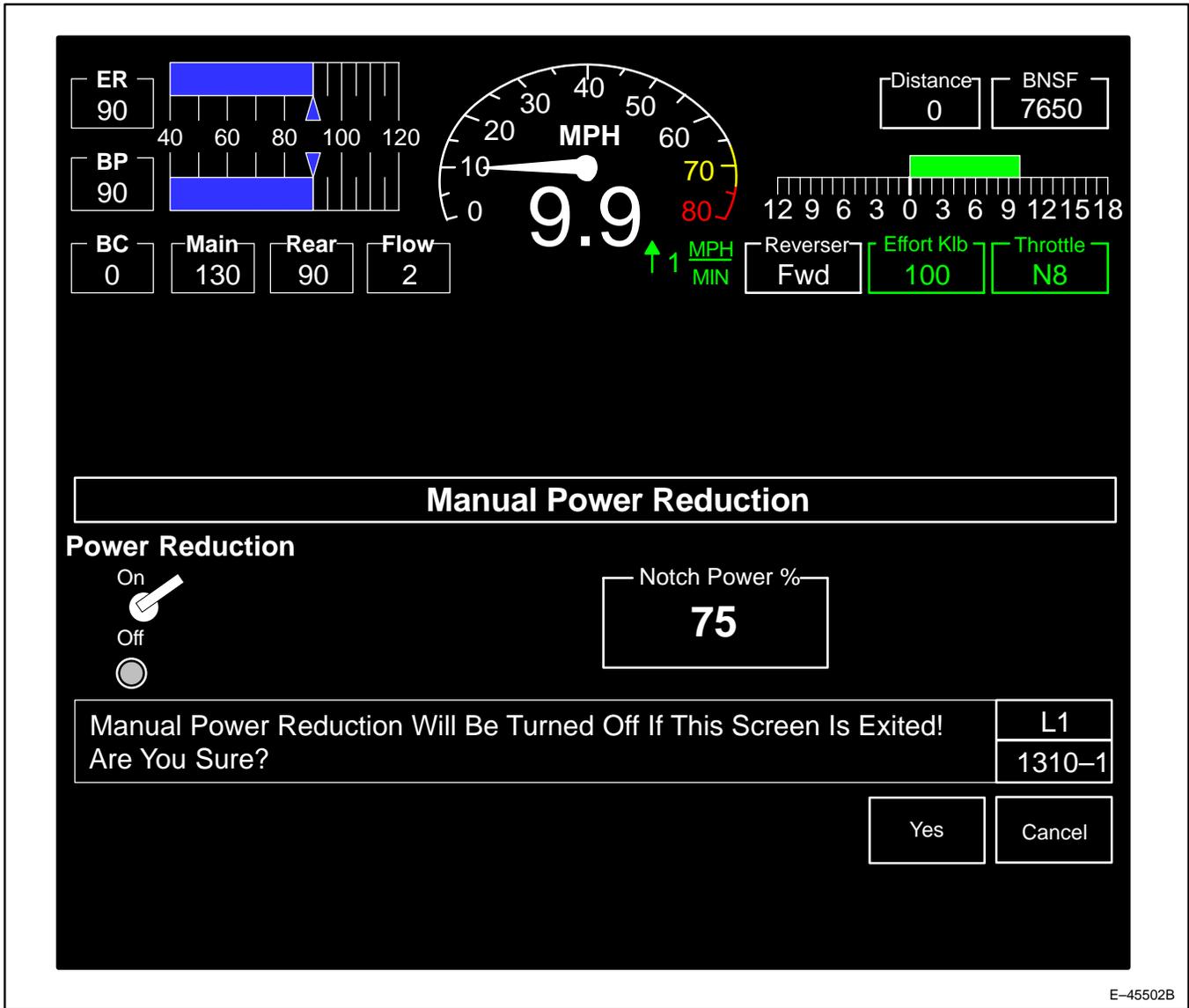


Figure 58. Manual Power Reduction Exit Screen (1310-1).

PLUG LOADING

Plug Loading is the mode of operation in which the **Reverser** handle is placed in the position opposite of the intended direction of travel of the locomotive and the **Combined Power** handle is placed in a powered Notch. This technique is required when operating on a downgrade and the locomotive must hold back the train to limit speed. This function is typically used while the cars on the train are being loaded. For the Plug Loading function, a **Light** train load is defined as one or more powered locomotives and 15 or fewer empty cars per locomotive.

NOTE: *If the train load is not Light, follow applicable Railroad Operating Procedures and settings for this operation.*

WARNING: *Monitor the locomotive's direction of travel closely during Plug Loading. If the locomotive reaches zero speed and starts to drift in the opposite direction, immediately return the Combined Power handle to IDLE. Failure to do so may result in sustained motion in the wrong direction which could result in personal injury and/or equipment damage.*

Use the following procedure for Plug Loading:

1. If the train is **Light** as defined above, isolate all but the lead locomotive in the consist.
2. Place the **Reverser** handle in the position opposite of the direction of desired motion.
3. On screen 1320-0 (Figure 55) press key position F1 (**Slow Speed On**) and key position F2 (**Plug Mode On**) to turn both Slow Speed and Plug Loading ON. Status is indicated by the switch and LED above each key position.
4. Place the **Combined Power** handle in Notch 1 and verify that Train Load is set to **Light**.
5. Release the Independent Brake.
6. Wait for speed to stabilize.
7. If, after a few seconds, speed has not stabilized and more slowing force is needed, increase power (move the **Combined Power** handle to a higher throttle position). Monitor locomotive speed closely. Train Load may need to be set to **Medium** or **Heavy** as the cars on the train are loaded.
8. Press key position F2 (**Plug Mode Off**) on screen 1320-0 to turn Plug Loading OFF.
9. Press key position F1 (**Slow Speed Off**) on screen 1320-0, Speed Control Menu to turn Slow Speed Control OFF.
10. Press key position F8 (**Exit**) to return to screen 1300-0 (Figure 54), Speed Control Menu.



SWITCHES

INTRODUCTION

The purpose of the Switches Screens is to allow the operator to view and control the various system functions which were formerly accessed by physical switches but are now integrated into the DC Evolution Series Locomotive control system.

OPERATION

Pressing soft key position F7 (**Switches**) on the Main Operating Screen (screen 0000-0, Figure 33 or 35) will display screen 1000-0 (Figure 59). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

1. Pressing soft key position F1 (**DB**) will order the locomotive control system to cut-out the Dynamic Brake function. The DB switch graphic will change state.

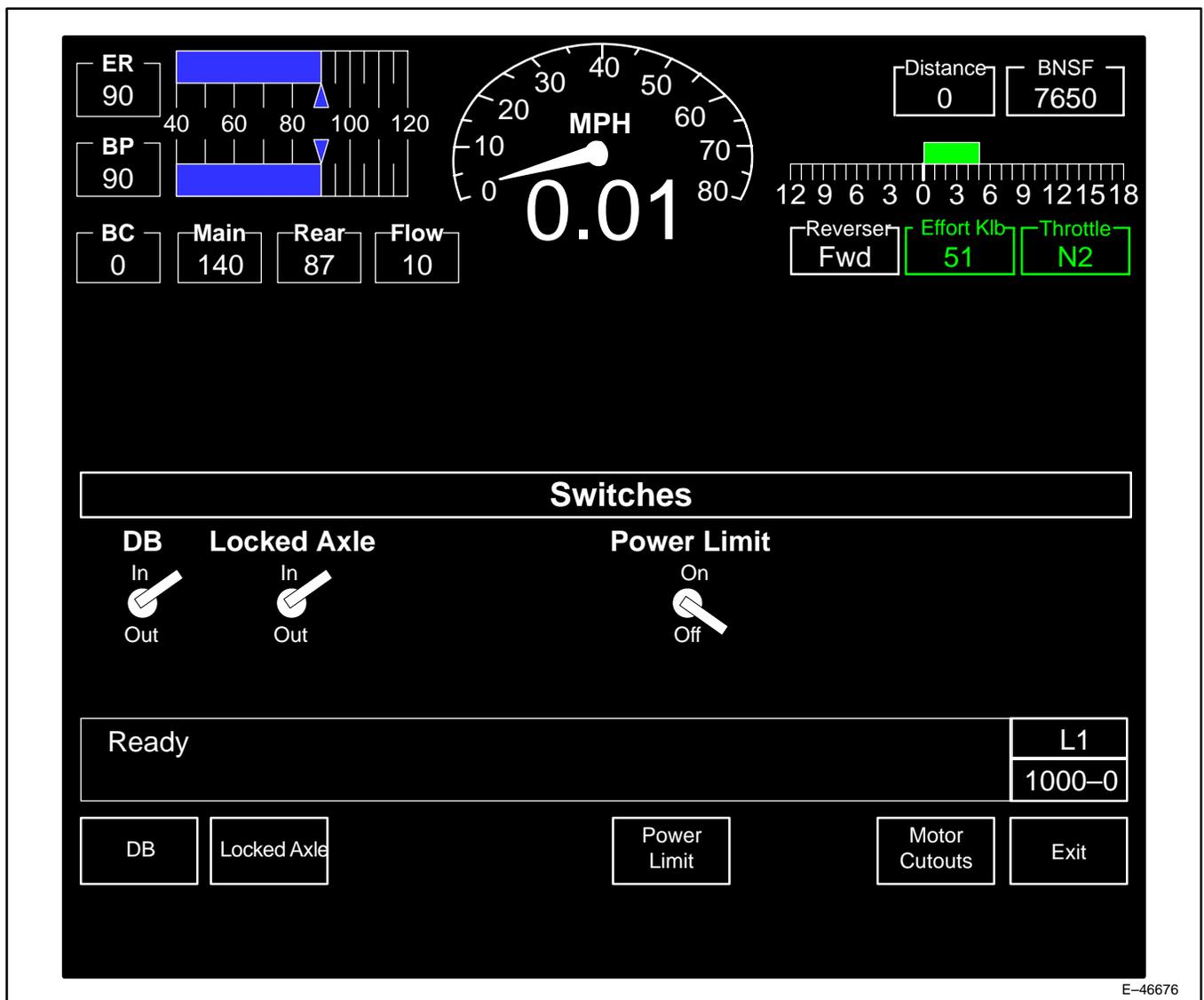


Figure 59. Switches Cut Out Screen (1000-0).

NOTE: If the Dynamic Brake Switch is in the cut-out position, upon request for Dynamic Brake, the control will drop power to IDLE. Follow Railroad Regulations governing use of this switch.

- 2. Pressing key position F2 (**Locked Axle**) will order the locomotive control system to cut-out the Locked Axle Alarm function. The Locked Axle switch graphic will change state.

NOTE: Before silencing the Locked Axle Alarm using this switch, ensure the wheels ARE rolling. Follow Railroad Regulations regarding use of this switch.

- 3. Pressing key position F5 (**Power Limit**) will order the locomotive control system to move to Notch 7.
- 4. Pressing key position F7 (**Motor Cutouts**) will display screen 1010-0 (Figure 60). Fourteen soft keys are active on this screen as follows:
 - a. Press key positions F1-F6 (**SSCO1-6**) to manually cut out a faulty speed sensor.

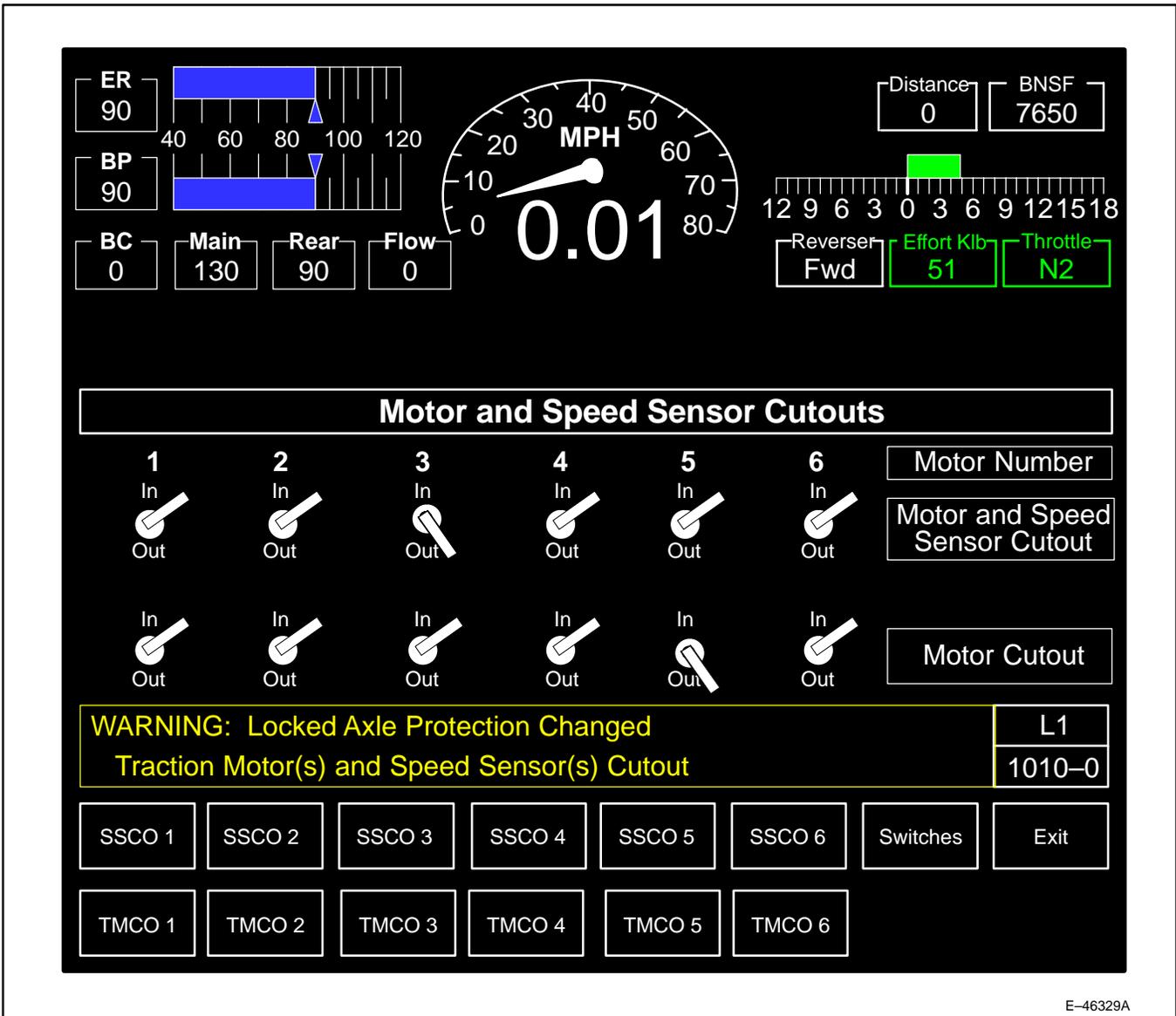


Figure 60. Motor And Speed Sensor Cutouts Screen (1010-0).

NOTE: For Speed Sensor cut-out, note the following:

1. Speed sensors do not need to be cut out on cut-out motors.
 2. Speed sensor switches are to be used only to cut out faulty sensors; however, ensure that the sensor is at fault and not that it is indicating a locked axle or excessive wheel slip, etc.
 3. When the Motor and Speed Sensor Cutout switch (Figure 60) is in the CUT OUT position, the speed signal from that speed sensor is ignored. A STATUS message will appear on the SDIS.
 4. A minimum of two motor speed sensors must be operating for the locomotive to load.
- b. Pressing key position F7 (**Switches**) will transition the display back to the Switches Screen (1000-0).
- c. Pressing key position F8 (**Exit**) will return the operator to the Main Operating Screen (0000-0).

CAUTION: It is recommended that motors only be manually cut out with the Engine Control switch in START or ISOLATE position (unit isolated) and the Combined Power handle in IDLE.

- d. Press key positions 1-6 (TMC01-6) to manually cut out a faulty traction motor. Note that a STATUS message appears on the SDIS.

NOTE: For Traction Motor cut-out, note the following:

1. Refer to Railroad Rules for specific details of operation.
2. Under emergency conditions, the locomotive may be operated for a short period of time with one or more traction motors cut-out.
3. If an Incident condition such as excessive current or too great a rate of change of current is detected, automatic cut-out is done by the microcomputer control.
4. Pressing key position F8 (Exit) will return the operator to the previous screen.

DYNAMIC BRAKE CUT-OUT SWITCH FUNCTION

If for some reason the Dynamic Brake function needs to be manually cut out, proceed as follows:

1. On the SDIS, press key position F7 (**Switches**) on the Main Operation Screen (0000-0, Figure 3).
2. The Switches Screen will appear.
3. Press key position F1 (**DB**) to order the control system to cut out the Dynamic Brake function. The DB switch graphic will change state.

NOTE: If the Dynamic Brake Switch is in the cut-out position, upon request for Dynamic Brake, the control will drop power to IDLE. Follow Railroad Regulations governing use of this switch.

LOCKED AXLE CUT-OUT SWITCH FUNCTION

NOTE: Before silencing the Locked Axle Alarm using this switch, ensure the wheels ARE rolling. Follow Railroad Regulations regarding use of this switch.

To manually cut out the Locked Axle Alarm, proceed as follows:

1. On the SDIS, press key position F5 (**Switches**) on the Main Operating Screen (0000-0, Figure 3).
2. The Switches Screen will appear.
3. Press key position F2 (**Locked Axle**) to order the control system to cut out the Locked Axle Alarm function. The Locked Axle switch graphic will change state.

Power Limit Switch

This switch (8) has two positions, NORMAL (OFF) and NOTCH 7 (ON). When the locomotive consist is in Notch 8 and the lead unit is slipping excessively, the Power Limit switch can be moved to NOTCH 7 to reduce power while the trailing units are operating at full power. This will reduce the tractive effort on the lead unit and will usually improve the ability of the locomotive to hold the rail under bad rail conditions.

NOTE: Unless directed otherwise by Railroad Regulations, ensure Power Limit Switch is in NORMAL position on ALL units before operating the train.

DISTANCE COUNTER

INTRODUCTION

The Distance Counter (Figure 61) displays distance travelled in feet. This function allows the Crew to set, reset or preset the counter for trip information. The counter operates independently from the counter on the other SDISs. The counter counts “up” when the locomotive is moving short-hood forward and “down” when the locomotive is in reverse unless changed through use of screen keys.

NOTE: Each SDIS has its own independent Distance Counter. An operator cannot access or control the Distance Counter on another SDIS.

OPERATION

NOTE: On Power Up, the Distance Counter Preset will be initialized to 0. The Distance Counter Mode will always reset to Count Up from Zero state on Power Up.

Pressing soft key position 2 (**Distance Setup**) on the Main Operating Screen ... More (Screen 0000-0, Figures 33, 35, or 37) will display screen 1200-0 (Figure 61). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

NOTE: Key Positions F4 and F6 (Modify Preset and Count Up/Down) are NOT available if distance counter is active.

1. Pressing key position F4 (**Modify Preset**) will display screen 1200-1 (Figure 62). Three keys are available on this screen as follows:
 - a. Key position F4 (**Back Space**) – will allow removal of one digit (per press) from the entered distance value.
 - b. Key position F7 (**Save Preset**) – will record and notify the control system of the new Distance Preset value. The screen will automatically return to the Distance Counter Setup Screen (1200-0).
 - c. Pressing key position F8 (**Cancel**) will return the operator to the Distance Counter Setup screen (1200-0) **without** a change to the Distance Counter Preset value.
 - d. Numeric key positions are active to enter numbers on screen 1200-1.
2. Key position F5 (**Distance Start**) will control the Distance Counter as follows:

NOTE: Pressing key 1 on Screen 0000-0 will also control the Distance Counter as described.

- a. If distance displayed on the screen is **0** and the *Distance Counter Mode* is “Count Up From Zero”, pressing this key will command the counter to count up from zero and key will change to read **Distance Stop**. Press this key again and the counter will stop and the key label will now read **Distance Reset**. Pressing this key again will reset the counter to **0** and the soft key will return to **Distance Start**.
 - b. If distance displayed on the screen is a preset value and the *Distance Counter Mode* is “Count Down From Preset”, pressing this key will command the counter to count down from the preset and key will change to read **Distance Stop**. Press this key again and the counter will stop and the key label will now read **Distance Reset**. Pressing this key again will reset the counter to the preset value and the soft key will return to **Distance Start**.
3. Key position F6 (**Count Down**) will change the Distance Counter Mode to **Count Down From Preset**. The Distance Counter will reset to the Preset Value. Key position F6 will now read **Count Up**. If **Count Up** is pressed, the Distance Counter will reset to 0 and the Mode will revert to **Count Up**. The stored preset will be unchanged.
 4. Key position F8 (**Exit**) will return the operator to the Main Operation screen (0000-0).

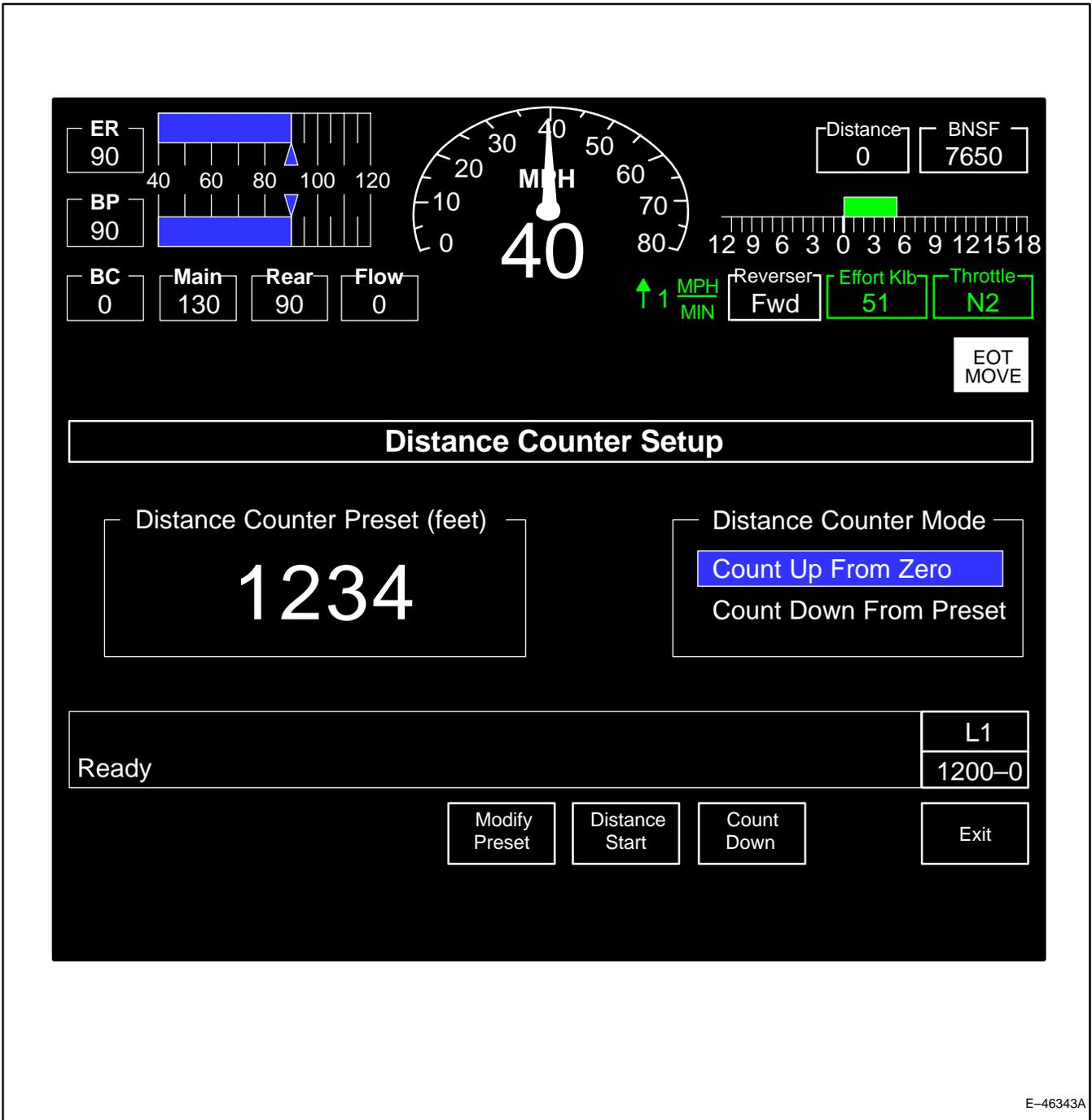


Figure 61. Distance Counter Setup Screen (1200-0).

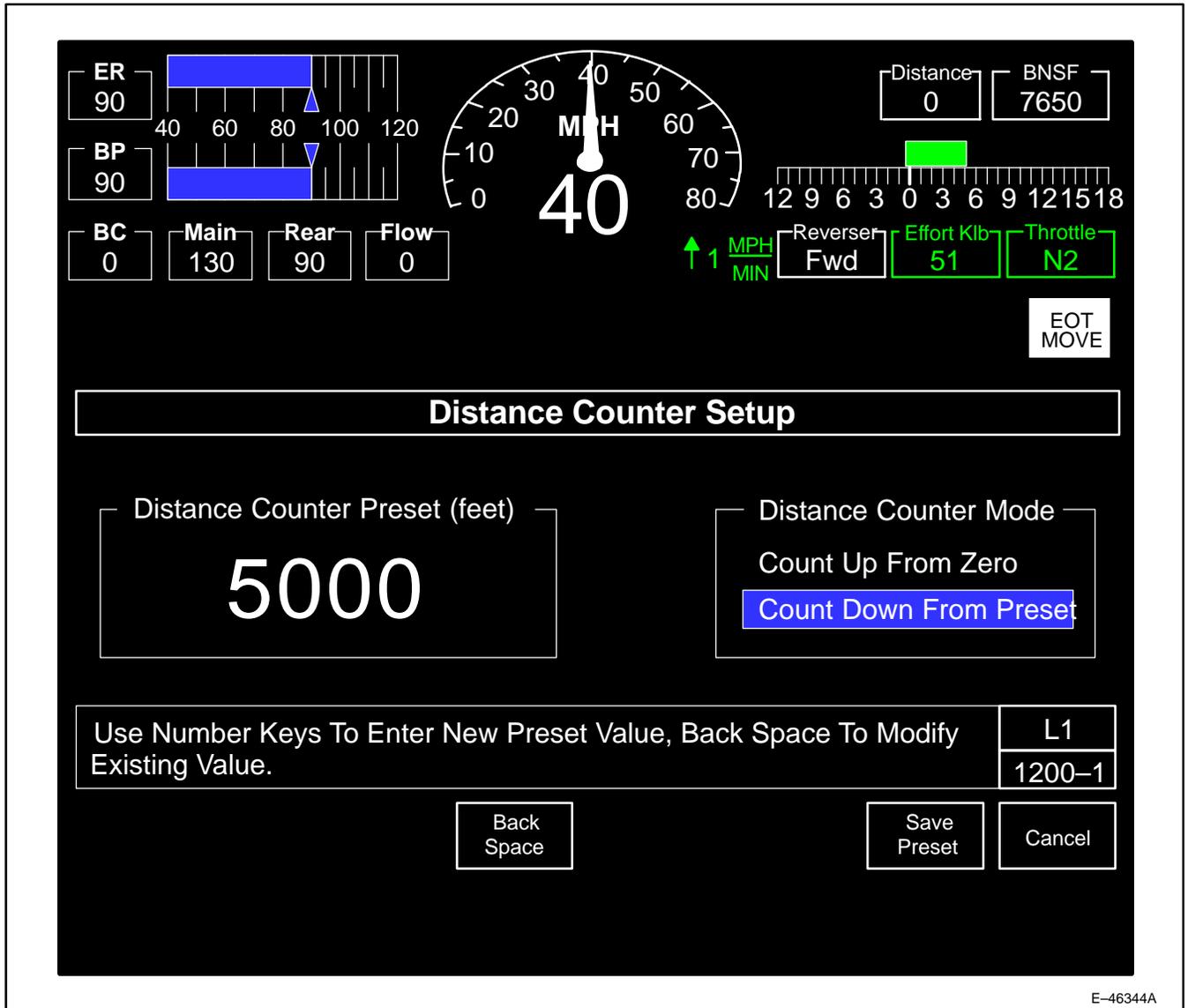


Figure 62. Distance Counter Change Setup Screen (1200-1).



MEASURED MILE

INTRODUCTION

The purpose of the Measured Mile Function is to assist the operator in conducting a measured mile check.

OPERATION

Pressing soft key position 3 (**Measured Mile**) on the Main Operating Screen (screen 0000-0, see Figure 33 or 35) will display screen 1100-0 (Figure 63). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

NOTE: Accuracy of this test depends upon maintaining a constant speed throughout the measured mile.

1. At beginning of measured mile press F3 (**Start Mile**). The Operator message area will read "Timing Measured Mile ... ". The **Start Mile** button will change to **Stop Mile** as the test is running.

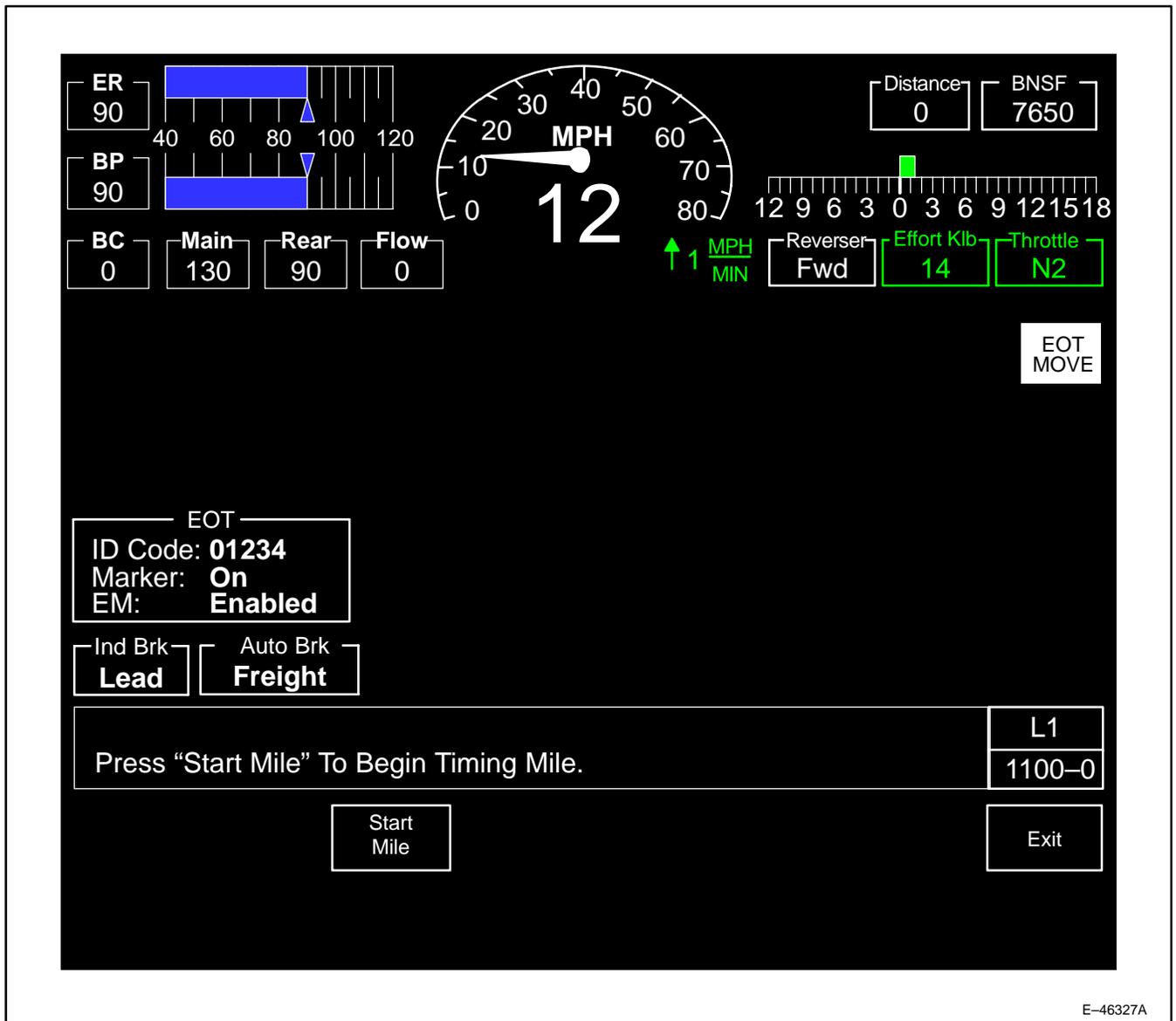


Figure 63. Measured Mile Operation Screen (1100-0).

2. Upon the end of the measured mile press F3 (**Stop Mile**). The computer will stop the test and compute the average speed. The **Stop Mile** button will change to **Start Mile** after it is pressed.
3. The Operator message area will read “Average Speed Assuming A Measured Mile Was xxx.xx MPH” (Figure 64).
4. **Exit** will return the operator to the Main Operating screen 0000-0. If *Measured Mile* is in progress, this key will read **Cancel**.

NOTE: If Cancel is pressed while timing is in progress, the Measured Mile function will be cancelled (message “Measured Mile Cancelled” will appear) and Main Operating screen (0000-0) will appear.

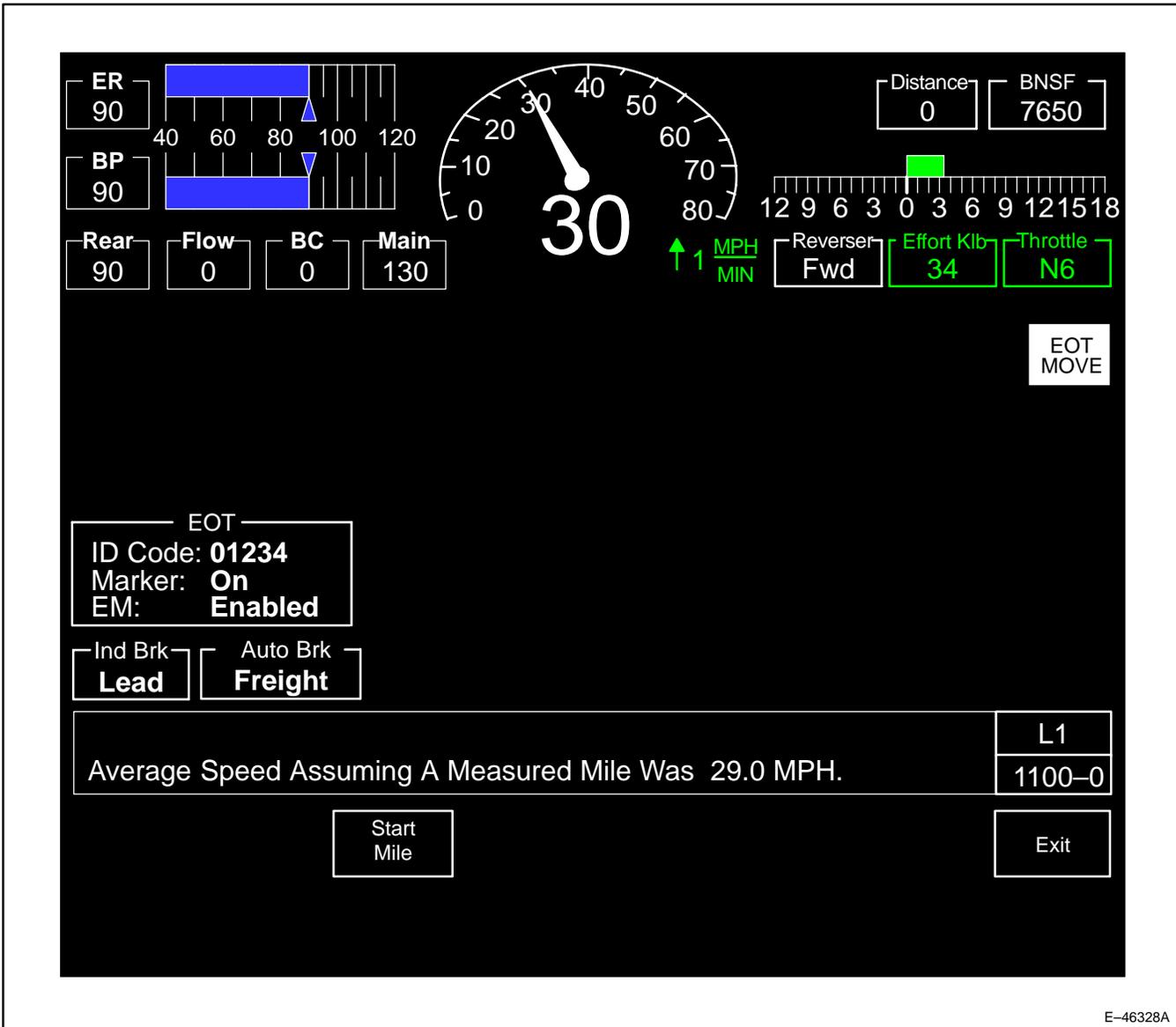


Figure 64. Measured Mile Operation Screen Average Speed (1100-0).

AUTO ENGINE START/STOP (AESS)

INTRODUCTION

The AESS System enhances fuel savings. When this system is active, it shuts the diesel engine down during periods of inactivity. The system monitors certain locomotive parameters and restarts the engine as needed. With AESS, the diesel engine may start and stop without operator intervention.

WARNING: *This locomotive is equipped with Auto Engine Start/Stop. The diesel engine may start without operator action. Exercise caution when working around the diesel engine, traction alternator, or Radiator Cab. Ensure that AESS is disabled before performing any maintenance on the locomotive. Failure to do so may result in death or serious personal injury.*

NOTE: *Locomotives with AESS are identified by warning decals applied in the Operating Cab and at several locations on the exterior of the unit.*

NOTE: *The AESS system is disabled when Distributed Power is active.*

The diesel engine will shut down automatically only during inactivity (parked idle) periods. Any powered operation or movement of the locomotive will prevent the AESS system from shutting down the diesel engine. The maximum AESS shut down time is 90 – 210 minutes, depending on ambient temperature and oil temperature. There are a maximum of eight shut downs in a twenty-four hour period. If AESS begins the shut down process (indicated by the ringing bell and the STOP-IN-PROGRESS indicator) and the process is aborted three consecutive times, AESS becomes inactive for 24 hours.

NOTE: *If AESS is active, the time to shut down is displayed in the alarm bar (ex: AUTOSTOP 0:09:58) (Figure 66).*

AESS SUSPEND enables the operator to postpone (suspend) a pending shutdown for 2 hours by pressing and releasing the Auto Stop Override pushbutton (Item 29, Figure 9) located on the Engine Control Panel. When the locomotive is in AESS SUSPEND, any of the following actions will cancel SUSPEND mode:

1. Moving the **Combined Power** handle out of IDLE.
2. Moving the **Reverser** handle out of CENTER.
3. Releasing the Independent and Auto brakes.
4. Movement of the locomotive.
5. Raising the barrier bar.
6. Any locomotive restrictions.
7. Entering self-load or self-test.
8. Setting the EC switch to JOG (if equipped).

NOTE: *Pressing the Auto Stop Override pushbutton twice within 30 seconds will shut down the engine after one minute.*

CAUTION: *When the locomotive is in an AESS shut down condition, certain actions will deactivate the AESS system and require a manual engine start. If this happens, either start the diesel engine manually or shut down the locomotive according to Railroad Operating Procedure and open the battery switch. This action is necessary to prevent draining the locomotive batteries. The following actions will deactivate the AESS system:*

- *raising the barrier bar*
- *moving the locomotive using the Jog function or leaving the EC switch in the JOG position*
- *entering the diagnostic self-test mode*
- *pressing an Engine Stop switch while an AESS automatic shutdown is in process.*

The operator is able to view information displayed on the AESS screens.

1. When AESS is inactive, the Main Operation Screen will display as screen 0000-0 (Figure 65).

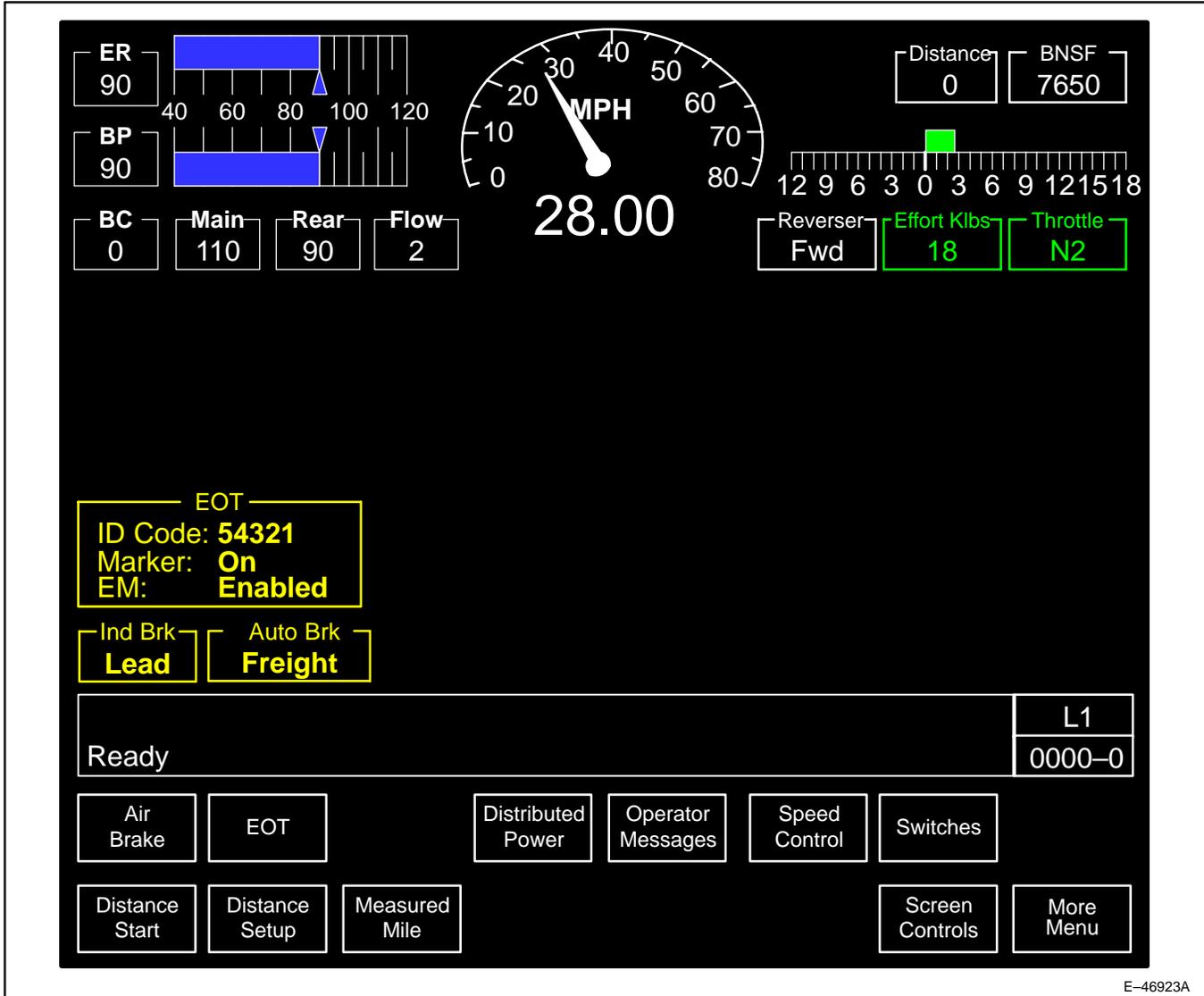


Figure 65. Main Operation Screen, AESS Inactive.

- When AESS is active, the Main Operation Screen will display as screen 0000-0 (Figure 66).

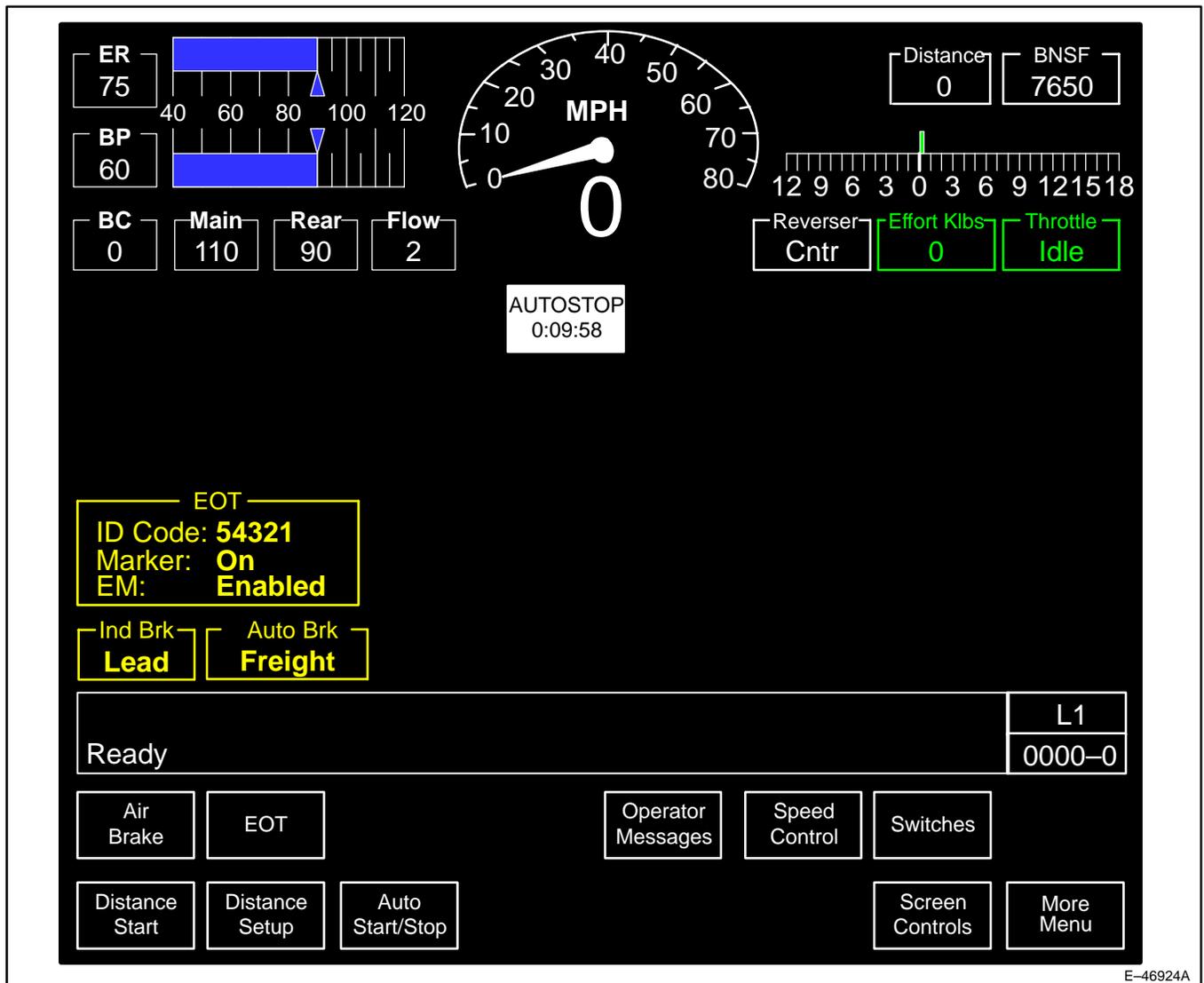


Figure 66. Main Operation Screen, AESS Active.

OPERATION

The active keys and a brief description of operation are as follows:

- Pressing key position 3, Auto Start/Stop, when AESS is active will display screen 4311-0 (Figure 67).
- Pressing key position F8, Exit, will close the AESS display.

Activating the AESS System

AESS is automatically activated when the locomotive control system is powered up as long as the following conditions are met:

- The Engine Control (EC) switch is in any position except JOG (If equipped).
- There are no current locomotive restrictions.
- The barrier bar is closed.

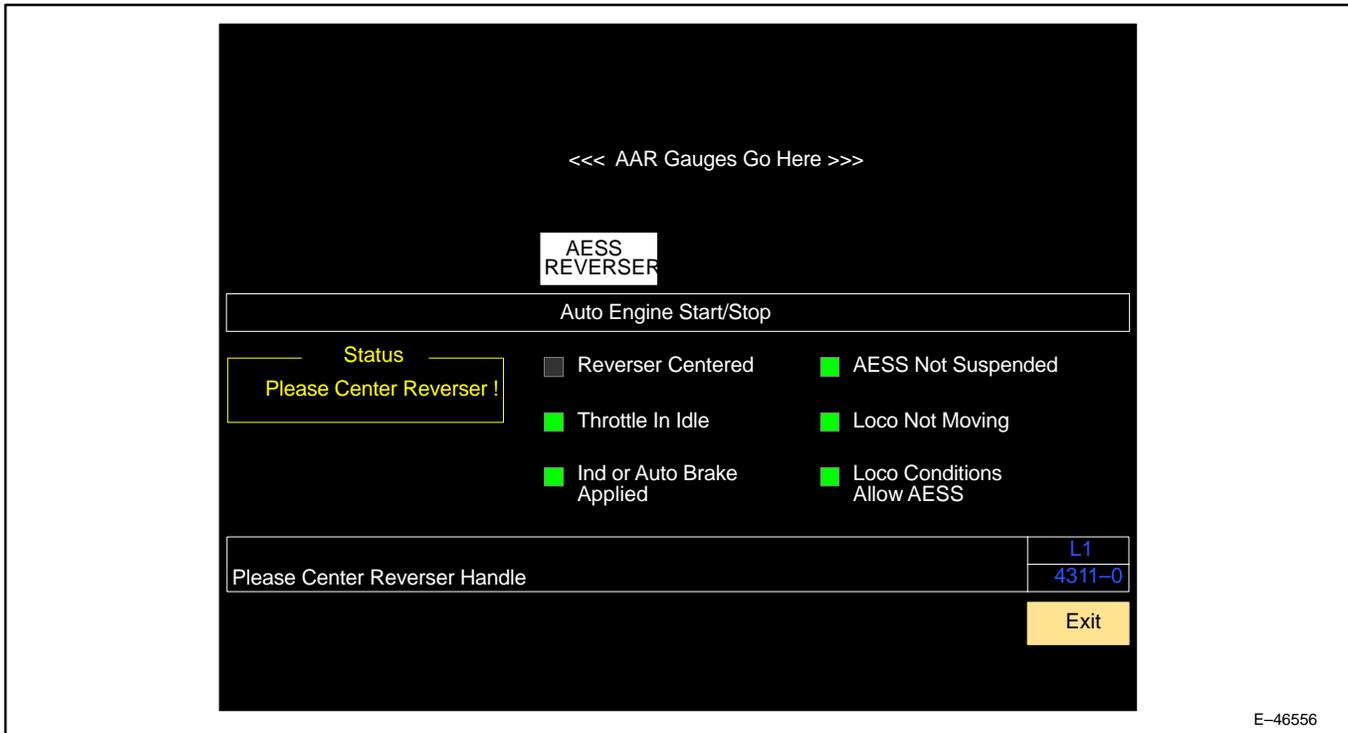


Figure 67. AESS Status Screen.

4. All traction motor speed sensors are functional.
5. The locomotive is not in self-test or self-load.

NOTE: AESS will not restart the engine after a manual shutdown.

Deactivating the AESS System

Any of the following actions will deactivate the AESS system:

1. Setting BCCB to OFF on the Engine Control panel.
2. Raising the barrier bar.
3. Placing the EC switch in the JOG position.
4. Entering locomotive self-test mode.

NOTE: Pressing an Engine Stop switch while the locomotive is in an automatic shutdown period will not deactivate the AESS system.

Conditions for Automatic Shut Down

These conditions must exist for 10 minutes prior to automatic engine shutdown.

1. All AESS permissions (certain locomotive system parameters) are within limits.
2. The **Reverser** is in the CENTER position.
3. The **Combined Power** handle is in the IDLE position.
4. Brake cylinder pressure is greater than 22 psi (152 kPa).

5. Locomotive speed is zero.
6. The Auxiliary Cab door is closed and the Barrier Bar is down.

Conditions for Automatic Start Up

NOTE: The SDIS must display AUTO ENGINE START CONTROL ACTIVE and ENG AUTO/STOPPED indicator for an Automatic Start Up to take place.

Any AESS trigger (certain locomotive system parameters) outside of its limits will initiate Automatic Start Up. Releasing the locomotive brakes and moving the Reverser handle out of CENTER will also initiate Automatic Start Up. In either case, engine start will occur as long as the following conditions are also met:

1. Engine stop was from an automatic shutdown.
2. The EC switch does not remain in the JOG position after automatic shutdown.
3. The Barrier Bar remained closed during the automatic shut down period.
4. Self-test mode has not been used.

AESS SDIS Messages

The following messages may appear in the operator message line on the SDIS display:

Message	Meaning
CENTER REVERSER HANDLE	Center the Reverser handle.
Auto Engine Stop Control is Active MMM:SS	Auto Stop may occur.
Conditions Out Of Range: Auto Stop Pending	Auto Stop is pending due to locomotive conditions.
Auto Stop in Process	Auto Stop/Start in process.
Auto Engine Start Control is Active	Auto Start is possible.
Auto Start in Process	AESS stopped the engine and Auto Start is possible.
Manual Start Required	AESS stopped the engine, but due to locomotive, AESS faults Auto Start is not possible.
Auto Stop Not Active	Auto Stop is not possible.
Please Keep Notch in IDLE	Keep notch in IDLE for Auto Stop.

AESS SDIS Alarm Bar Indicator

The AESS indicator will be illuminated whenever AESS is active. The current AESS system status is summarized by the indicator text (Figures 66 and 67).

Indicator Text	Meaning
<no indicator>	AESS inactive.
AUTOSTOP hh:mm:ss	Auto stop may occur in hh:mm:ss.
AUTOSTOP PENDING	Auto stop pending.
STOP IN PROCESS	Auto engine stop is in progress.
ENG AUTO STOPPED	Auto engine start control is active.
START IN PROCESS	Auto engine start is in process.
MANUAL START REQ	A manual start is required.
AESS REVERSER	All conditions for the auto stop sequence have been met except for the REVERSER handle being off center.
AESS THROTTLE	All conditions for the auto stop sequence have been met except for the COMBINED POWER handle not being in IDLE.

AESS Bell Warnings

The AESS System provides warnings to operating and maintenance personnel that an automatic engine start or stop is about to occur. The bell also sounds to indicate AESS error conditions.

NOTE: *The AESS warning bell is located on the outside of the rear wall of the Auxiliary Cab, near the traction alternator, on the operator's (A) side of the locomotive. It is NOT the bell that rings in the Operating Cab.*

Bell	Condition Indicated
Rings for 30 seconds while the engine is running	Automatic shutdown is about to occur.
Periodic ringing (rings for one second at five minute intervals)	The locomotive is in an automatic shutdown period.
Rings for 30 seconds while the engine is not running	Automatic start is about to occur.
Rings for 30 seconds when a non-AESS action occurs	The AESS system transitioned from enabled to disabled or from disabled to enabled.

Main Reservoir Drain Valves

The AESS System requires use of electrically controlled, pneumatically activated Main Reservoir Drain Valves. The drain valves (spitters) allow moisture to be removed from the main reservoirs. During AESS engine shutdown, the drain valves are deactivated to maximize fuel savings. Refer to the **Air Brake Equipment** and **Other Equipment** sections of this manual for the location of the Main Reservoir Drain Valves and the Drain Valve Magnet Valve.

SCREEN CONTROLS

INTRODUCTION

Screen Controls (Figure 68) enables the operator to change on which (or both) SDIS display the Main Operation (gages) Screen (0000-0) will be displayed. The operator may also view the SDIS brightness level and gain access to a higher operating level through use of this screen.

NOTE: Operator Display(s) showing gauges will act as Locomotive Operating Displays (LOD) and those which do not will act as Human-Machine Interface (HMI) displays or Auxiliary (Aux) displays.

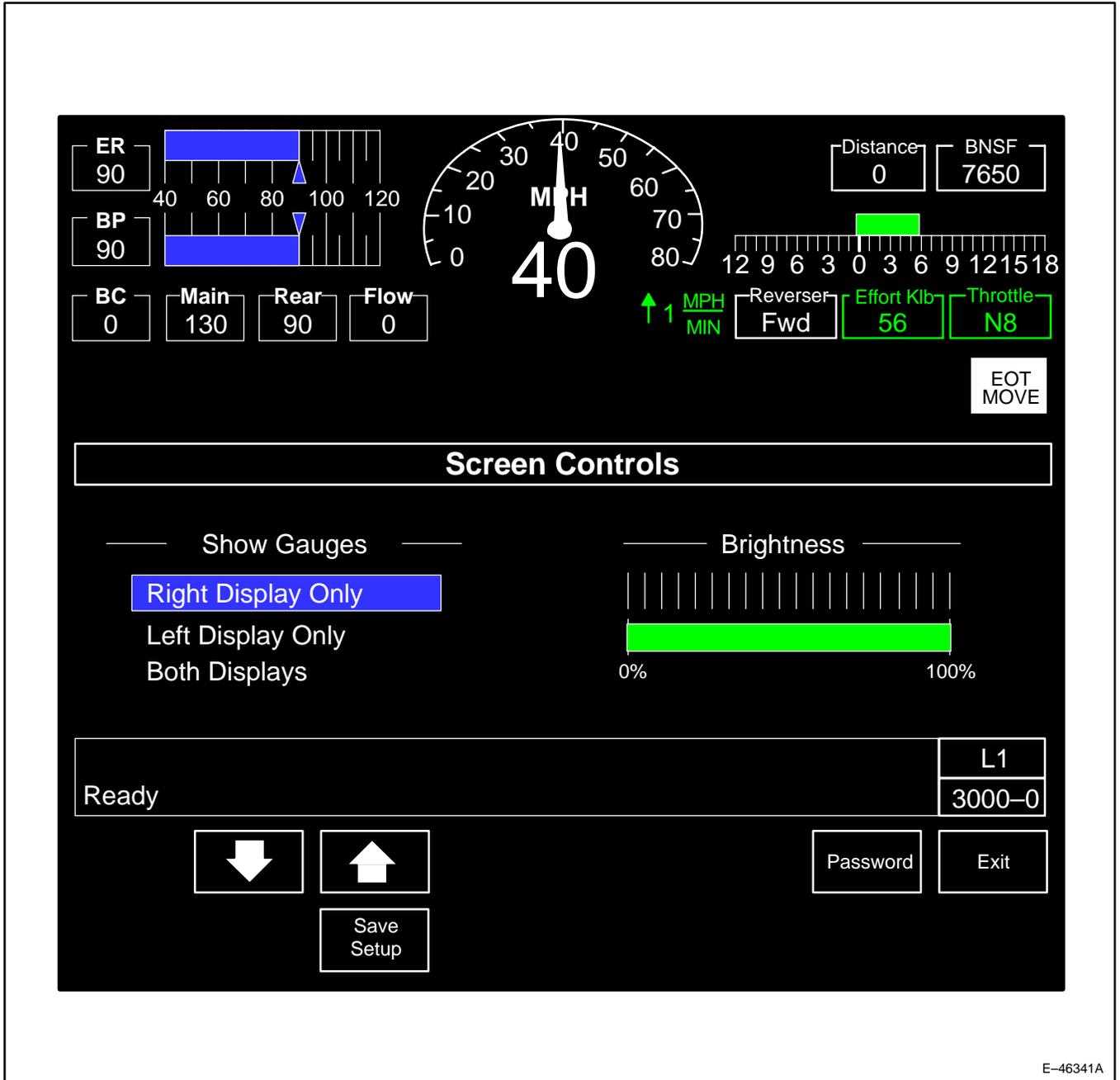


Figure 68. Screen Controls Setup Screen (3000-0).

OPERATION

Pressing soft key position 7 (**Screen Controls**) on the Main Operation Screen (screen 0000-0, see Figure 33, 35 or 37) or the Main Operation Screen, More Menu (Screen 0000-1, Figures 34, 36, or 38) will display screen 3000-0 (Figure 68). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

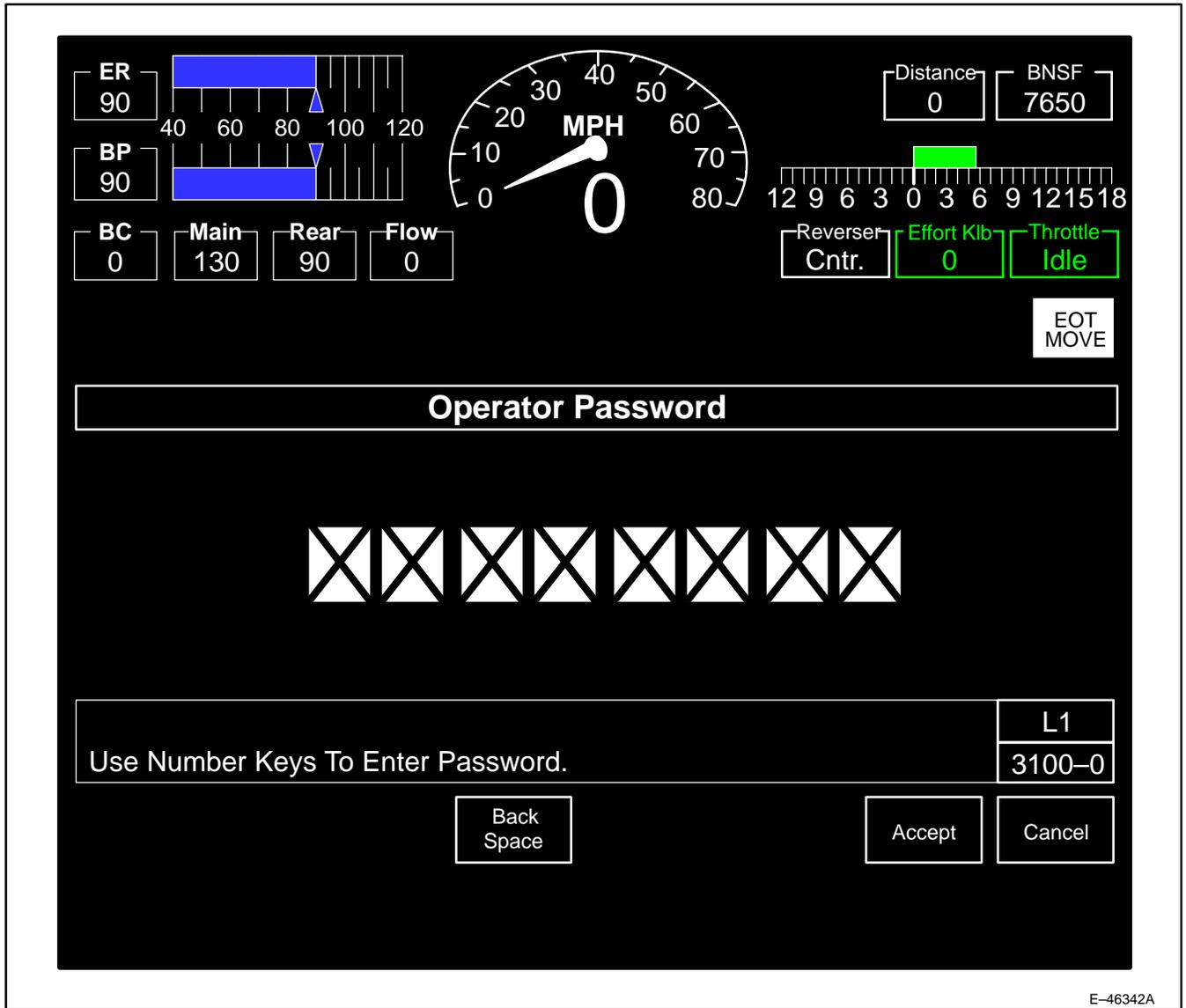
1. Pressing key position F2 ("**Down Arrow**") will scroll down through the Main Operation Screen location choices. If at the bottom, it will wrap to the top. (Not available on Aux. Display).
2. Pressing key position F3 ("**Up Arrow**") will scroll up through the Main Operation Screen location choices. If at the top, it will wrap to the bottom. (Not available on Aux. Display).
3. Pressing key position F5 (**Password**) will display screen 3100-0 (Figure 69). Five keys are available on this screen as follows:

NOTE: *This screen is used to gain access to different operating levels and is not needed for Level 1 operation.*

- a. Key position F4 (**Back Space**) – will allow removal of one digit (per press) from the entered Password value.
- b. Key position F7 (**Accept**) – will verify with the control system for the validity of the entered Password.

NOTE: *Gaining access to a higher operating level on one SDIS will automatically change the operating level on all SDISs.*

- c. Pressing key position F8 (**Cancel**) will return the operator to the Screen Controls Setup screen (3000-0) **without** a change to the Operator Password.
 - d. Numeric key positions are active to enter numbers on screen 3100-0.
4. Pressing key position F8 (**Exit**) will return the operator to the Main Operation screen (0000-0) or Main Operation Screen, More Menu (0000-1) **without** a change to main Operation Screen location, if the setup has not been saved.
 5. Pressing key position 3 (**Save Setup**) will save the setup and notify the control system of the new SDIS choice(s) for the Locomotive Operating Display.



E-46342A

Figure 69. Operator Password Change Screen (3100-0).



DATA DOWNLOAD

INTRODUCTION

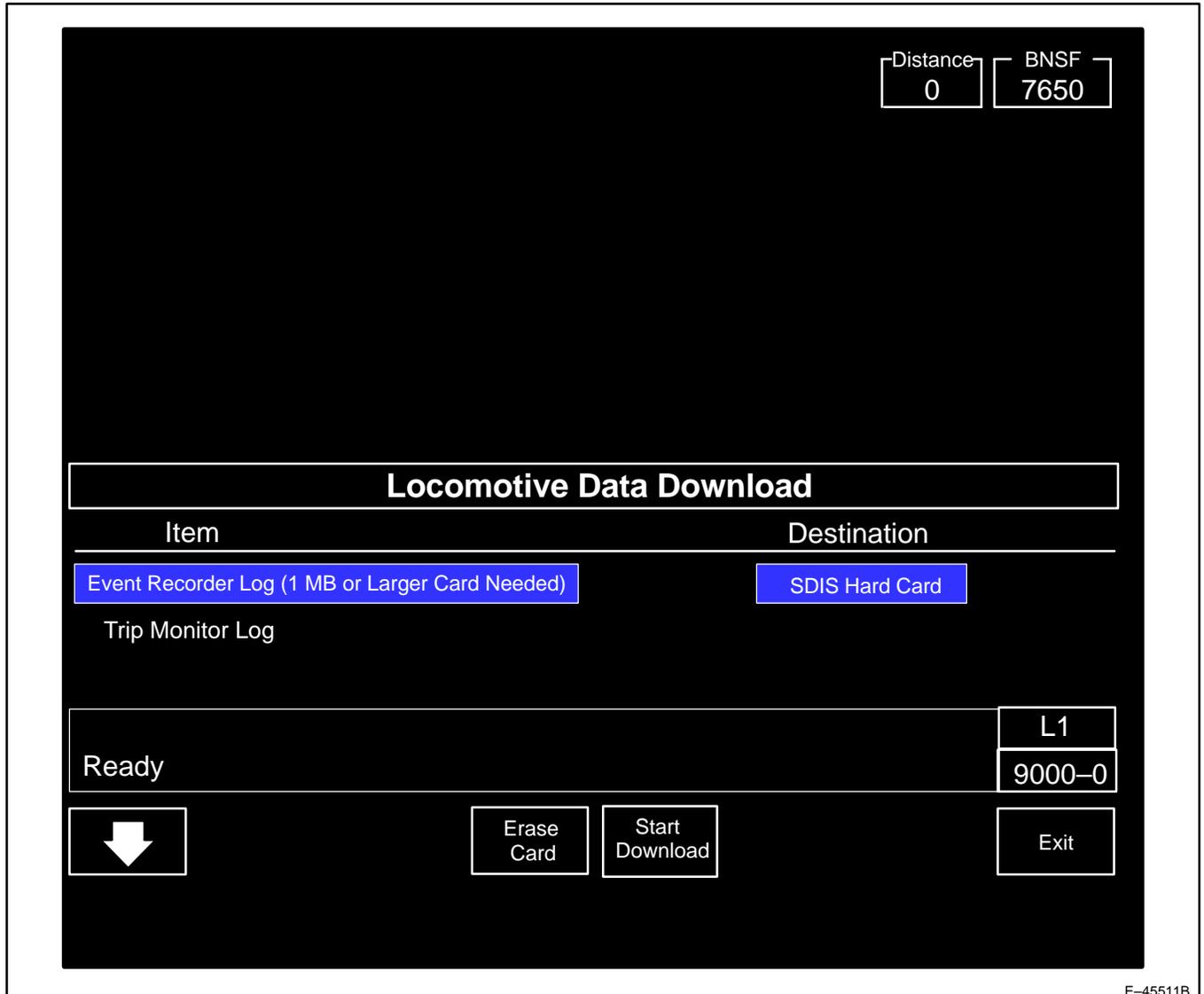
The Data Download screens enable the operator to download the Event Log, Trip Monitor Log, or other information from each SDIS for use by the Maintenance facility.

OPERATION

CAUTION: Do not remove the hard card during a data download. Doing so may cause the SDIS to lock up, requiring a reboot of the locomotive control system computers.

Pressing soft key position F2 (**Data Download**) on the Main Operating Screen...More (Screen 0000-1, Figure 34, 36, or 38) will display screen 9000-0 (Figure 70). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key position F1 ("**Down Arrow**") will scroll down through the log and destination choices. If at the bottom, it will wrap to the top.



E-45511B

Figure 70. Data Download Screen (9000-0), HMI Display.

TRIP MONITOR

INTRODUCTION

The Trip Monitor Screen provides the operator with a trip record of time spent in throttle, idle and dynamic braking (Figure 72).

NOTE: Trip Monitor is available on the HMI display or Auxiliary display and only one Trip Monitor per locomotive can be viewed at any given time.



E-46331

Figure 72. Trip Monitor Screen, HMI Display (4500-0).

OPERATION

Pressing soft key position F6 (**Trip Monitor**) on the Main Operation Screen, More Menu (Screen 0000-1, see Figure 36 or 38) will display screen 4500-0 (Figure 72). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key position F6 (**Start**) initiates the Trip Monitor process. The first two rows of data at the top of the screen are *** unless a previous trip has been recorded. Pressing key position F6 (**Start**) fills in the current time, date, and location, and also changes the F6 soft key to **Stop**. The second row is filled in with ***. All data values in the table are initialized to zero, the message "Trip in Progress" appears, and the trip is started. When **Stop** is pressed, the second row will be filled in with the current date, time and location, and the key will change back to **Start**.
2. The Trip Monitor accumulates time in the appropriate row based on locomotive status until the **Stop** key is pressed. The F6 soft key changes to **Start**, the data stops updating, and the second row is filled in with the current time, date, and location information.
3. Key position F8 (**Exit**) will return the operator to the Main Operation Screen, More Menu (Screen 0000-1). (0000-0). The Trip Monitor will continue until **Stop** is pressed on screen 4500-0.

NOTE: *Trip Monitor data may be downloaded as a Trip Report File from the Data Download screen.*

LOCOMOTIVE MONITOR

INTRODUCTION

The Locomotive Monitoring Screen provides the operator with continually updated information on several parameters regarding overall locomotive performance.

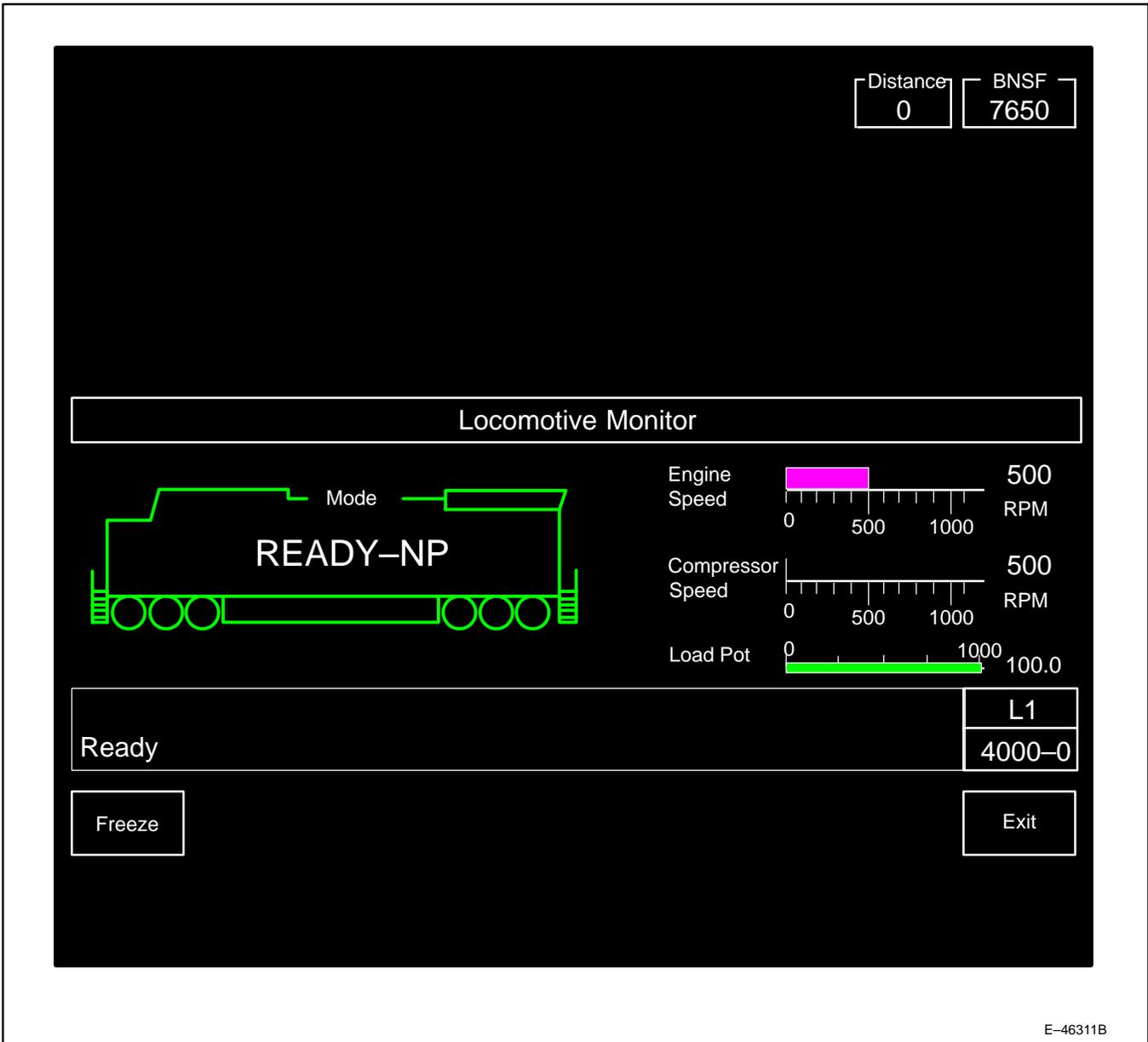
OPERATION

Pressing soft key position F7 (**Loco Monitor**) (Figures 34, 36, or 38), will display screen 4000-0 (Figure 73). Follow *Railroad Operating Procedures* for this operation. The active keys and a brief description of operation are as follows:

1. Pressing key position F1 (**Freeze**) will order the locomotive control system to freeze all data and stop the information updating process on the screen. Key Position F1 will now read **Resume**. Press **Resume** to order the control system to once again update (continually) screen information.

NOTE: *Monitor portion of the gauge data will continue to update.*

2. Key position F8 (**Exit**) will return the operator to the More Menu screen (0000-1).



E-46311B

Figure 73. Locomotive Monitor Screen (4000-0).

ES44DC - Tractive effort to amps converter

Tractive Effort (lbs)	Amps(A)
5000	177
10000	257
15000	326
20000	392
25000	456
30000	515
35000	577
40000	639
45000	700
50000	759

Tractive Effort (lbs)	Amps(A)
55000	816
60000	878
65000	937
70000	993
75000	1051
80000	1107
85000	1162
90000	1215
95000	1269
100000	1320

Tractive Effort (lbs)	Amps(A)
105000	1370
110000	1424
115000	1485
120000	1545
125000	1604
130000	1662
135000	1720
140000	1776



Note: data provided for 42 inch wheels

ES44DC - Braking effort to amps converter

- ◆ Select speed
- ◆ Move down the speed column until you get to the braking effort value displayed on the screen
- ◆ Value indicated at the intersection of speed and braking effort is Amps

		MPH									
		26	30	35	40	45	50	55	60	65	70
Braking Effort - lbs	5000	243	261	282	302	320	337	354	369	384	399
	10000	344	369	399	426	452	477	500	522	544	564
	15000	421	452	489	522	554	584	612	640	666	691
	20000	486	522	564	603	640	674	707	739	769	798
	25000	544	584	631	674	715	754	791	826	860	892
	30000	596	640	691	739	783	826	866	905	920	920
	35000	643	691	746	798	846	892	920	920		
	40000	688	739	798	853	905	920				
	45000	729	783	846	905	920					
	50000	769	826	892	920						
	55000	806	866	920							
	60000	842	905								
	65000	877	920								
	70000	910									



Note: data provided for 42 inch wheels