

The onboard Micro Cabmatic III signaling system will be comprised of three subsystems:

- Cab Signal: This system vitally receives the wayside signaling information from the rails and provides it to the ATC and ATO for safe train operation.
- Automatic Train Control (ATC): This system compares the train speed with the authorized speed to determine if the train is overspeed. The ATC system will take appropriate action based on the overspeed conditions and operator's actions determining when to request a penalty brake or an emergency brake application.
- Automatic Train Operation (ATO): This system will maintain vehicle speed based on information received from the cab signal system and Train Number ID system. Safety of the system will always be governed by the ATC system.

The signal system transmits one of five coded signals, which are received by the car-mounted cab signal system. These correspond to 65 mph, 40 mph, 30 mph, 20 mph, and stop commands. Loss of a signal or shutting the code off produces a fail-safe emergency stop indication.

The ATO equipment receives a speed command from the cab signal and compares this with actual train speed from the speed sensors, then calls for power or braking to comply with the ordered speed.

1-2. FUNCTIONAL DESCRIPTION (CONT)

1-2.4 Automatic Train Operation (ATO) / Automatic Train Control (ATC) (Cont)

In order to make sure that cab signal and ATO are functioning properly, an ATC system is provided. The ATC system is an automatic train stop device, which monitors the cab signals, train speed, and power or brake command from the ATO. Should the ATO lose a train speed signal, receive a confusing input such as two cab signal speed commands, or fail to respond to a more restrictive signal within four seconds, the ATC will apply maximum brakes. If train speed exceeds the allowed speed by more than 3 mph, the ATC will apply maximum brakes. The ATC system provides three basic protections:

- prevents overspeed
- prevents signal violation
- maintains train separation

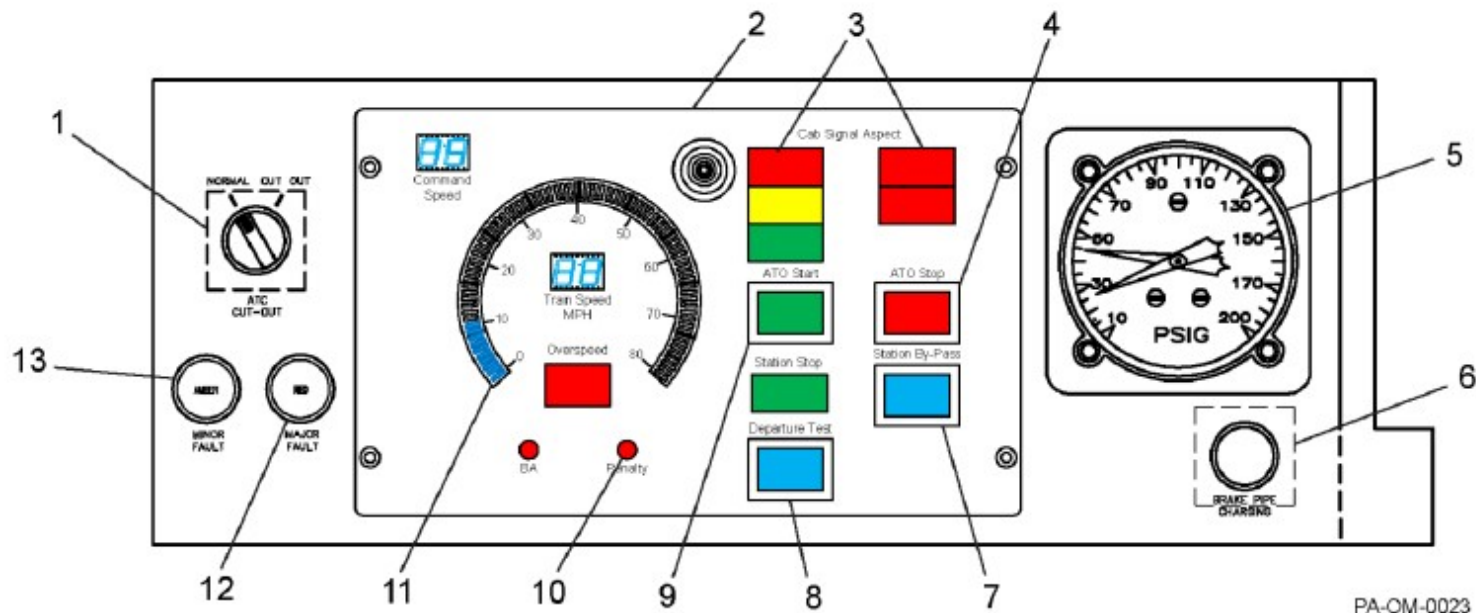
The station stop system provides track side signal markers located at fixed distances from each station, which are detected by the car-mounted control unit. The ATO then brakes at a predetermined rate required to stop at the platform with a tolerance of 20 feet.

Manual control governed by cab signals will be possible if the ATO system fails or some other unusual cause arises.

Manual operation not governed by cab signals will be the manner of control in the yards. A special dead slow speed control feature allowing 2.5 mph to 3 mph is provided for movement through the car wash.

Cab Console Controls:

2-3. CAB CONSOLE ARRANGEMENT (CONT)



PA-OM-0023

Figure 2-4. Right Side Console Switch Panel

Table 2-3. Right Side Console Switch Panel Controls and Indicators

| Index Number | Nomenclature | Type | Function |
|---------------------|---------------------------|-----------------------------|---|
| 1 | ATC CUT-OUT | Blue 2-Position Switch | Indicates whether Automatic Train Control (ATC) is in use for train operation (NORMAL - CUT-OUT). No train supervision by ATC when switch is in CUT-OUT position. |
| 2 | ASPECT DISPLAY UNIT (ADU) | Panel with Multiple Buttons | Indicates status of various ATC systems including current train speed and overspeed conditions. |
| 3 | Cab Signal Aspect | Five Lenses | Indicates command speed with illumination of 3 red lenses, 1 yellow lens, and 1 green lens. Located on ADU. |
| 4 | ATO Stop | Red Pushbutton | Places train in full service braking when in Automatic Train Operation (ATO) mode. Located on ADU. |

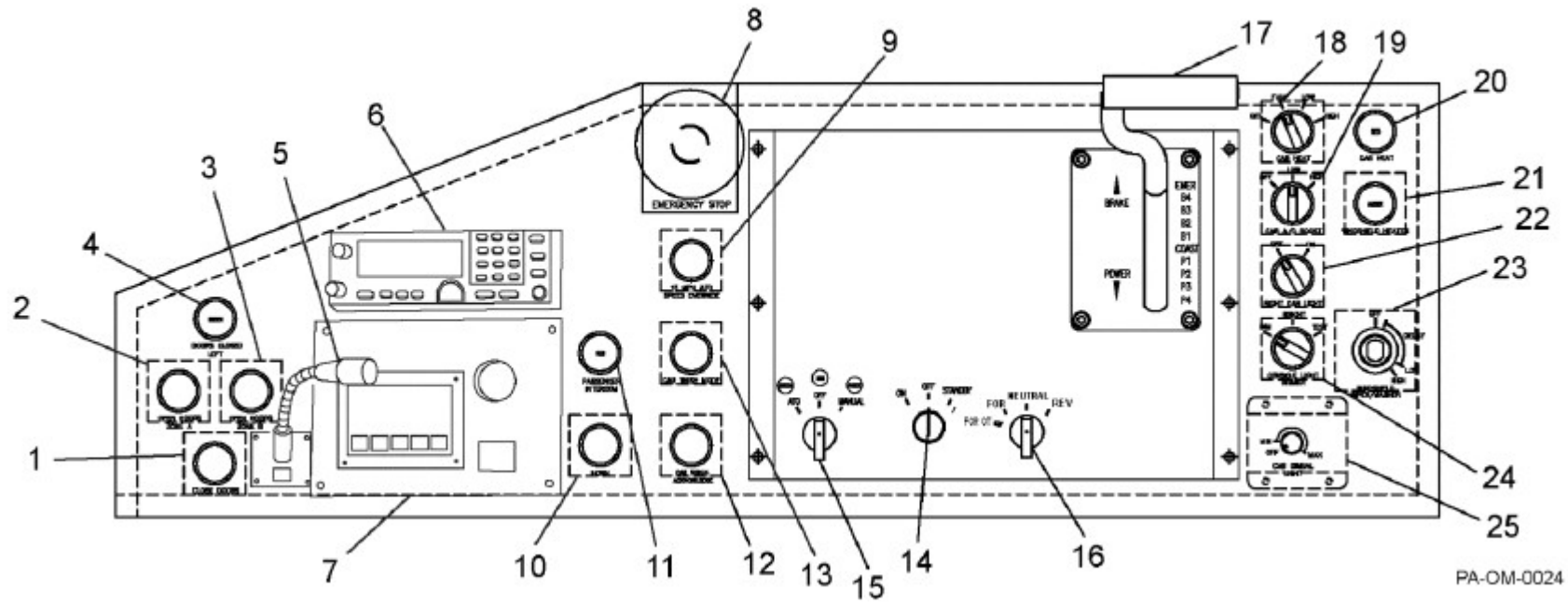
Table 2-3. Right Side Console Switch Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|---------------------|----------------------------|------------------|--|
| 5 | AIR GAUGE | 2-Pointer Gauge | Gauge is calibrated from 0 to 200 psi. Indicates trainline brake pipe pressure on white needle and brake cylinder pressure on red needle. NOTE 1: The red needle only indicates the brake cylinder pressure on that truck. NOTE 2: If brake pipe pressure falls below 120 psi when in a non-braking mode, the Dispatcher must be notified. |
| 6 | BRAKE PIPE CHARGING | Black Pushbutton | Recharges brake pipe 32 seconds after emergency brake application. |
| 7 | Station By-Pass | Blue Pushbutton | Permits train to bypass programmed station stop upon orders or as scheduled. Automatically resets to standard ATO operation after each station bypass is accomplished. Located on ADU. |

Table 2-3. Right Side Console Switch Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|---------------------|-----------------------|---------------------------------|---|
| 8 | Departure Test | Blue Pushbutton | Used to test ATC system before commissioning train service. Train must be at zero speed to initiate test. Located on ADU. |
| 9 | ATO Start | Green Pushbutton | Starts train in ATO mode. Located on ADU. |
| 10 | Penalty | Red Indicator Light | When illuminated, indicates that ATC is applying full service brake application. Located on ADU. |
| 11 | SPEEDOMETER | Blue Digital and Analog Display | Shows train speed. Calibrated in 3 mph increments from 0 to 80 mph. Illuminated when cab is keyed. Located on ADU. |
| 12 | MAJOR FAULT | Red Indicator Light | Indicates at least one major fault is logged on train. |
| 13 | MINOR FAULT | Amber Indicator Light | Indicates at least one minor fault is logged on train. |

2-3. CAB CONSOLE ARRANGEMENT (CONT)



PA-OM-0024

Table 2-4. Operator's Control Panel Controls and Indicators

| Index Number | Nomenclature | Type | Function |
|---------------------|---|--|--|
| 1 | CLOSE DOORS | Green Pushbutton | Closes passenger doors on left side of train. |
| 2 | OPEN DOORS ZONE A | Red Pushbutton | Opens Zone A passenger doors on left side of the cars of the consist. |
| 3 | OPEN DOORS ZONE B | Red Pushbutton | Opens Zone B passenger doors on left side of the cars of the consist. |
| 4 | DOORS CLOSED LEFT | Green Indicator Light | Indicates that all passenger doors are closed and movement of the train is permitted. |
| 5 | GOOSENECK MICROPHONE | Push-To-Talk | Used to communicate with passengers and wayside. |
| 6 | RADIO CONTROL HEAD | Panel with Buttons and Display Screen | Contains PA/Trainphone selector switch and paging speaker volume control. Used for radio communication. |
| 7 | COMMUNICATION CONTROL HEAD - LEFT | Panel with Display Screen and Buttons | Touch screen module with soft keys used for public address, passenger emergency intercom, radio communication, cab-to-cab intercom, and automatic announcement system. |

2-3. CAB CONSOLE ARRANGEMENT (CONT)

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|--------------|----------------------------------|---------------------|---|
| 8 | EMERGENCY STOP | Red Mushroom Switch | Mechanically vents emergency pipes to provide emergency braking. |
| 9 | 15 MPH ATO SPEED OVERRIDE | Black Pushbutton | Used in ATO where operating rules require. When switch is depressed, train will maintain 15 mph. When released, train will resume speed under cab signal control. NOTE: This must not be used to operate at Restricted Speed. |
| 10 | HORN | Black Pushbutton | Activates pneumatic horn when depressed. |
| 11 | PASSENGER INTERCOM | Red Indicator Light | Alerts train operator with light and audible alarm that passenger needs to communicate with operator. |

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|--------------|---------------------------------|---|--|
| 12 | CAB SIGNAL ACKNOWLEDGE | Amber Pushbutton | Used in Manual/ATC Manual operation. When cab signal system indicates a downward speed change, the operator must acknowledge by pressing the button. This button only silences alarm. |
| 13 | CAR WASH MODE | Black Pushbutton | Sets up a low speed of 2.5 to 3.0 mph for movement through the car washer. When button is released, car will coast. Console must be set for manual operation and the master controller set in COAST position. |
| 14 | KEY SWITCH | 3-Position Switch | Allows train operator or maintainer to use key to place switch in ON - OFF- STANDBY positions. |
| 15 | MASTER CONTROLLER (MODE SWITCH) | 3-Position Switch with Indicator Lights | Allows train operator to control operation mode. Switch can be placed at ATO (green light), OFF (red light), or MANUAL (amber light). |

2-3. CAB CONSOLE ARRANGEMENT (CONT)

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|--------------|--------------|-------------------|---|
| 16 | REVERSER | 4-Position Switch | <p>Allows train operator to select direction of train movement. Switch can be placed at FWD (forward), NEU (neutral), or REV (reverse). Reverser is locked in FWD or REV unless the master controller is in B4 position. Reverser must be in NEU and master controller in non-op to remove the key.</p> <p>FOR-OT is a toggle position used to switch between MANUAL and ATO while train is in motion, avoiding emergency application. FOR-OT bridges the contacts for the emergency switch in master controller.</p> |

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|--------------|-------------------|---------------------------|--|
| 17 | DRIVE/BRAKE LEVER | Black Single Lever Handle | <p>Used to control operation in Manual/ATC-Manual. Pushing handle forward applies braking; pulling lever backwards applies power.</p> <p>A. Power Positions:</p> <ul style="list-style-type: none"> Power 1 (P1) Low acceleration rate; approximately 30 mph. Power 2 (P2) Medium acceleration rate; approximately 60 mph. Power 3 (P3) High acceleration rate; approximately 75 mph. Power 4 (P4) High acceleration rate; maximum speed capability. <p>B. COAST Position</p> |

2-3. CAB CONSOLE ARRANGEMENT (CONT)

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|--------------|-----------------------------|-------------------------|---|
| 17 (Cont) | DRIVE/BRAKE LEVER (Cont) | | <p>C. Brake Positions: Brake 1 (B1) Minimum brake rate. Brake 2 (B2) Medium brake rate. Brake 3 (B3) Normal service brake rate. Brake 4 (B4) Maximum service brake rate. Brake 5 (EMER) Emergency brake. Electrically vents brake pipe.</p> <p>Approx. 32 seconds are required before the system can be recharged.</p> <p>D. Non-Op</p> |
| 18 | CAB HEAT | Black 4-Position Switch | Permits train operator to select level of heat for the operator's cab (OFF - FAN - LOW - HIGH). |

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|---------------------|--------------------------------|--|--|
| 19 | CAB A/C BOOST | Black 3-Position Switch | Permits train operator to select level of air conditioning for the operator's cab (OFF - LOW - HIGH). |
| 20 | CAB HEAT | Red Indicator Light | Indicates when cab heaters are operational. |
| 21 | WINDSHIELD HEATER | Amber Pushbutton | Allows heat to be applied to windshield in inclement weather. |
| 22 | RIGHT CAB LIGHT | Black 2-Position Switch | Allows end door light and right side cab light to be turned ON or OFF . |
| 23 | WINDSHIELD WIPER/WASHER | 2-Position Switch with Delay Option | Allows windshield wipers to be used in inclement weather. Switch selections are OFF and HIGH with delay for low speed. Pushbutton in center of switch permits spray of windshield fluid cleaner. |
| 24 | CONSOLE LIGHT DIMMER | Black 3-Position Switch with Spring Return | Controls brightness of console and air gauge lighting with DIM or BRIGHT settings. TEST setting is also available. |

2-3. CAB CONSOLE ARRANGEMENT (CONT)

Table 2-4. Operator's Control Panel Controls and Indicators (Cont)

| Index Number | Nomenclature | Type | Function |
|---------------------|-------------------------|-------------------------|---|
| 25 | CAB GIMBEL LIGHT | White Adjustable Switch | Controls use and brightness of cab gimbel light with OFF position and variable brightness from MIN to MAX . Turn to operate. |

Emergency braking: T/O used option #2 to activate emergency braking.

6-5. **EMERGENCY BRAKING**

1. The **EMERGENCY STOP** button (red mushroom) is the primary way to apply emergency braking to a train because it is a deliberate mechanical action by the Operator which is available in any mode of operation.
2. The Master controller - **EMER** position (B5 notch) is an electrical means of placing a train into emergency and is only available while operating in ATC-Manual and Manual control.
3. Release of Deadman is an electrical means of placing a train into emergency and is only available while operating in ATC-Manual and Manual control.
4. Fail safes:
 - a. Failure of ATC - maximum service brakes will apply.
 - b. Loss of cab signal - ATC takes action, causing maximum service brakes to apply.
 - c. Loss of both speed sensors - ATC takes action, causing maximum service brakes to apply.
 - d. Coupler release - Upon separation, train with non-active cab will go into emergency.
 - e. Low air pressure - Brake pipe less than 90 psi will cause maximum service brake application and inability to take power.

Matthew & Michael,

Attached is an analysis of the logs from 1092. This analysis is based on the same log file I provided Mr. Thompson on USB flash drive this morning.

I am gathering the remaining documentation per Mr. Thompson's request. I'll send them over shortly via email.

Please let me know if you require additional information or have question regarding the attached.

Best regards,
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