



INSTRUCTION and OPERATIONS MANUAL

for

CAB SIGNAL MASTER

MODEL NUMBER 15100-00

CAUTION

Be sure to read and become thoroughly familiar with the entire contents of this manual before attempting to operate the **"CAB SIGNAL MASTER."**

DOCUMENT NO. 15100-99 Rev D

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GENERAL DESCRIPTION

The CAB SIGNAL MASTER is a self contained microprocessor based test system designed to test cab signal equipment in the railroad locomotives and cars. It generates signals to drive the on-board signal receivers and speed detection equipment in order to test for proper receiver operation. It has front panel controls and a display to allow the operator to setup and operate the system. The RS232 serial communications port provides for an interface with PC's or other digital serial devices. The portable enclosure is suitable for rugged use.

IMPORTANT: *The “DC POWER IN” connector and the “OUTPUT TO LOOP” connector uses a Quick-Lock with Securing Lever. Insert and twist connector clockwise to lock in place. To remove, pull up on release lever and then twist counterclockwise to unlock. Failure to unlock the connector will damage the locking mechanism. Connector damage may prevent reliable electrical connection.*

System Components

1. CAB Signal Master (15100-00)
2. Loop Output Cable Connector (part #16012-02 supplied w/15100-00)
3. One (1) Speed Output Cable Assembly (part #16111-00 supplied w/15100-00)
4. DC Power Input Cable – Black (part #16013-01 supplied w/15100-00)
5. Optional AC Adapter (part # 16063-00)

Note: Customer supplies DVM cable and additional Speed output cable.

OPERATION

The basic function of the CAB SIGNAL MASTER is to generate CAB and SPEED signals as required to test the functionality and sensitivity of the on-board receiver equipment.

MODES OF OPERATION

Basic Cab Signal Mode of Operation (BASIC)

The BASIC mode of operation is intended to provide the operator a basic tool to perform departure signal operational verification testing. The BASIC mode limits the adjustable parameters to loop current, code rates, and selection of carrier frequencies as per customer requirement. Carrier Frequency and Code Rate may be saved as a power-on User Default. (Note: To restore original setting, use Restore Customer Defaults)

Four Aspect Cab Signal Operation (CABSIG4)

The CABSIG4 mode of operation provides for four aspect signaling. All parameters may be adjusted by the operator and user defined parameters may be stored in the system for repetitive testing. Will be saved as a User Default. (Note: To restore to previous User Default setting, use Restore User Defaults. To restore to the original setting, use Restore Customer Defaults).

Nine Aspect Cab Signal Operation (CABSIG9)

The CABSIG9 mode of operation provides for different carrier frequencies to be used during each half cycle of the coding period. When two carrier frequencies are used, the first period initially defaults to 100Hz and the second period initially defaults to 100Hz. All parameters may be adjusted by the operator and user defined parameters may be stored in the system for repetitive testing. Will be saved as a User Default. (Note: To restore to previous User Default setting, use Restore User Defaults. To restore to the original setting, use Restore Customer Defaults).

Speed Signal Generator

The SPEED mode provides the simulated speed signal for the ATC system on board the train. Selection of SPEED 1 or SPEED 2 from the main menu determines the output port and available output levels. All parameters may be adjusted by the operator and user defined parameters may be stored in the system for repetitive testing. Will be saved as a User Default. (Note: To restore to previous User Default setting, use Restore User Defaults. To restore to the original setting, use Restore Customer Defaults).

FRONT PANEL CONTROLS

INPUTS:

DC POWER IN

INPUT A

INPUT B

Power input connector (supplied). Quick-Lock connector.

Voltage measurement input. Connection is banana plug.

Voltage measurement input. Connection is banana plug.

WARNING: INPUT A AND INPUT B ARE ELECTRICALLY THE SAME CONNECTION. DO NOT CONNECT BOTH INPUTS TO DIFFERENT POTENTIALS.

SENSE

Connection for the output of a cab signal receiver. Unit detects pulse when the receiver picks up. Connection is a standard ¼" phone jack.

OUTPUTS:

OUTPUT TO LOOP

Code rate loop output connector (supplied). Quick-Lock connector.

SPEED SIGNAL 1

20 to 15K Hz, 5Vrms into 50 ohms. BNC connector.

SPEED SIGNAL 2

20 to 15K Hz, 17.675 Vrms (50Vp-p) into 600 ohms. BNC connector.

INPUT/OUTPUT:

RS232

Serial data port. 9 pin "D" connector.

AUXILIARY

General purpose input/output (I/O). 25 pin "D" connector.

SWITCHES AND CONTROLS:

ON/OFF Controls the ON and OFF state of the CAB Signal Master. Pressing the ON/OFF button toggles between the ON and OFF.

NOTE: The following buttons are available and functional *ONLY* when it's associated front panel light is on.

Function Buttons:

F1 Applies to ALL function buttons (F1-F5).
F2 Selects the parameter displayed directly above
F3 function button (bottom line of display).
F4 Subsequent presses of the button may toggle through
F5 user default settings depending on the selected Mode of operation.

Parameter Buttons:

AMPS Selects the Amps Menu. Press the function button (F1-F5) to select the Loop Output Current. After a selection is made, you can still adjust this parameter by using the UP, DOWN, or KNOB. Then press START/STOP button.

RATE Selects the Code Rate Menu. Press the function button (F1-F5) to select the Code Rate of the loop output. After a selection is made, you can still adjust this parameter by using the UP, DOWN, or KNOB. Then press START/STOP button.

FREQ Selects the Frequency Menu. Press the function button (F1-F3 for CabSig4 OR F1, F2, F4, F5 for CabSig9) to select the Carrier Frequency of the loop output. After a selection is made, you can still adjust this parameter by using the UP, DOWN, or KNOB. Then press START/STOP button.

DUTY Selects the Duty Cycle Menu. Press the function button (F1-F5) to select the Duty Cycle of the loop output. After a selection is made, you can still adjust this parameter by using the UP, DOWN, or KNOB. Then press START/STOP button.

Menu Buttons:

MENU Selects the Menu screen. **Pressing the Menu button returns to the previous screen.** Can be pressed repetitively to bring you back to the main Menu screen.

SPEED Selects the Speed screen. Allows user to choose:
F1: OFF (turns Speed outputs off)
F2: ON (turns Speed outputs on)
F3: MPH (use UP, DOWN or KNOB to adjust)

| | |
|-------------------------|--|
| RAMP | F5: Setup (selects Speed Setup screen) Selects the Ramp screen. Ramp is not available in BASIC mode. This screen is associated with the highlighted parameter. Select the Start, Stop, and Time that is required by your test. Then press the START/STOP button to initiate the Ramp. |
| INPUT/OUTPUT | Pressing this button when the associated light is lit will bring you to the DVM screen. To go back to the previous screen, simply press the MENU button. |
| DEFAULT | Allows the user to save parameter values as the default start-up values for that screen. Normally, once you have completed the Default section for your application, you may rarely have to complete this again. Pressing for the first time since a power-on brings you to a "Enter Passcode" screen. Enter the Passcode. A Passcode is only required to be entered once during any one power-up. If you had previously entered the Passcode, it will bring you to a "Save current values as user defaults?" screen. To save the parameter defaults, press YES. The PAGE button is also available at this time. Press it to go to the "Restore User Defaults" (which restores previous User Default) or by pressing the PAGE button again it will bring you to the "Restore Customer Defaults" screen (which restores to the original settings). To return to parameter screens, simply press the MENU button. |
| HELP | Press and hold down. Activates a help screen. If the help message is greater than two lines, the PAGE button light will go ON. While holding down the HELP button, press the PAGE button and the display will show the next 2 lines, 2 lines at a time. Once the full HELP screen is completed, it will repeat. Releasing the HELP button returns the display to the screen from which help was invoked. |
| Control Buttons: | |
| START/STOP | Starts a ramp from the Ramp screen OR changes the output state to the currently selected value if pressed from a parameter screen. |
| PAGE | Associated with the HELP button. Displays the next 2 lines if the current screen has more than one page. |
| UP | Increments the highlighted parameter UP in value (coarse adjust). |
| DOWN | Increments the highlighted parameter DOWN in value (coarse adjust). |
| KNOB | Is a rotary encoder used to adjust output/parameter up or down (fine adjust). |

BASIC MODE

Connect the test loop to the OUTPUT TO LOOP connector on the CAB Signal Master. When the CAB Signal Master is first powered ON, it will display several screens and the loop resistance that is connected to it. It then comes up in the BASIC MODE.

Press **F1** to toggle and select Carrier Frequency. First press selects Freq parameter and the following presses toggle through the Carrier Frequencies.

Press **F2** to toggle and select Code Rates. First press selects the Rate parameter and the following presses toggle through the Code Rates.

Use the **UP** and **DOWN** buttons and/or the **KNOB** to adjust output current in Amps. Note that the lights are ON for these buttons as well as for the knob.

Run test to sense Pickup. Press F3.

Run test to sense Drop Away. Press F3.

Press F3 once more to display Pickup, Drop Away, and Noise.

Press F3 to return to BASIC parameter screen.

CabSig4

Once the CAB Signal Master is powered up and in the BASIC MODE, press the MENU button once to go to the MODE SELECT MENU screen. If you are already powered ON and in any screen, simply press the MENU button repeatedly to get to the MODE SELECT MENU.

Press **F2** to go to the CabSig4 screen.

Once in the CabSig4 screen:

Press **F1** to select Frequency. Adjust using UP button, DOWN button, or KNOB.

Press **F2** to select Code Rate. Adjust using UP button, DOWN button, or KNOB.

Press **F3** to select Amps (output current). Adjust using UP button, DOWN button, or KNOB.

F4 is only available if Speed 1 and/or Speed 2 are enabled. Enabling the Speed outputs is done in the Speed Menu Screen. If Enabled, it allows for Speed change as well as toggling between Speed 1 and Speed 2 outputs if both outputs are enabled.

Press **F5** to select Duty Cycle of loop output. Adjust using UP button, DOWN button, or KNOB.

NOTE: While in the above screens, a number of buttons are lit making them available to use.

CabSig9

Once the CAB Signal Master is powered up and in the BASIC MODE, press the MENU button once to go to the MODE SELECT MENU screen. If you are already powered ON and in any screen, simply press the MENU button repeatedly to get to the MODE SELECT MENU.

Press **F3** to go to the CabSig9 screen.

Once in the CabSig9 screen:

Press **F1** to select or adjust Frequency. Can only adjust one Freq at this point. If you press the FREQ button it brings you to Freq1/Freq2 Setup screen. Press either F1 or F2 for the first frequency to select associated Frequency and then you can adjust the Frequency by using UP, DOWN, or KNOB. Press either F4 or F5 for the second frequency to select associated Frequency and then you can adjust the Frequency by using UP, DOWN, or KNOB.

Press START/STOP button to initiate this change and bring you back to the CabSig9 screen.

Press **F2** to select or adjust Code Rate.

Press **F3** to select or adjust Amps (output current).

F4 is only available if Speed 1 and/or Speed 2 are enabled. Enabling the Speed outputs is done in the Speed Menu Screen. If Enabled, it allows for Speed change as well as toggling between Speed 1 and Speed 2 outputs if both outputs are enabled.

Press **F5** to select or adjust Duty Cycle of loop output.

NOTE: While in the above screens, a number of buttons are lit making them available to use.

Speed

Once the CAB Signal Master is powered up and in the BASIC MODE, press the MENU button once to go to the MODE SELECT MENU screen. If you are already powered ON and in any screen, simply press the MENU button repeatedly to get to the MODE SELECT MENU or select the SPEED button if lit.

Press **F4** to go to the Speed Menu screen.

Once in the Speed screen:

Press F1 to turn Speed outputs OFF.

Press F2 to turn Speed outputs ON.

Press F3 to select MPH. Use UP, DOWN, or KNOB to make adjustments.

Press F5 to bring you to the Speed Setup Screen.

Press F1 to select Speed 1. Brings you to Speed 1 setup screen.

Press F1 to select Disable Speed 1 output.

Press F2 to select Enable Speed 1 output.

Press F3 to select Voltage. Adjust output Voltage by using the KNOB.

Press F4 to select PPR (Pulses Per Revolution). Brings you to Speed 1 PPR screen. Select and or adjust per your requirement.

Press F5 to select Wheel Diameter. Brings you to Speed 1 Wheel Diameter screen. Select and or adjust per your requirement.

Press F2 to select Speed 2. Brings you to Speed 2 setup screen.

Press F1 to select Disable Speed 2 output.

Press F2 to select Enable Speed 2 output.

Press F3 to select Voltage. Adjust output Voltage by using the KNOB.

Press F4 to select PPR (Pulses Per Revolution). Brings you to Speed 2 PPR screen. Select and or adjust per your requirement.

Press F5 to select Wheel Diameter. Brings you to Speed 2 Wheel Diameter screen. Select and or adjust per your requirement.

Press F3 to select Slaved and use UP or DOWN button to make selection of Slaved (both Speed 1 and Speed 2 track with each other and can be set in MPH or KPH) or Independent (Speed 1 and Speed 2 totally separate and only set by Frequency).

Press F4 to select MPH and use UP or DOWN button to make selection of MPH, KPH, or Freq (Independent only).

Specifications

Physical

| | | | |
|---------|---------|---------|-----------|
| Depth: | 6.0" | Width: | 11.75" |
| Length: | 13.375" | Weight: | 10.5 lbs. |

Electrical

Power Input: 30 to 90 VDC, 1.5 Amps maximum (45 Watts max)

Note: The CAB Signal Master has a circuit breaker designed to trip at 2 amps. If an over current condition occurs, the circuit breaker will trip.

OUTPUT TO LOOP Connector (CAB Signal):

| | |
|--------------------------------|---|
| Output Current: | 4 Amps into a .200 Ohm Loop 1.5 +/- .1 Amps into a 1.00 Ohm Loop |
| Carrier Frequency (Hz): | 55 to 550 *Higher Carrier Frequencies available. Call factory |
| Code Rate (pulses per minute): | Steady to 700 |
| Duty Cycle (%): | 10% to 100% |

SPEED SIGNAL1 Connector:

| | |
|-------------------|----------------------|
| Output Voltage: | 5 Vrms into 50 Ohms. |
| Output Frequency: | 20 to 15K Hz |

SPEED SIGNAL 2 Connector:

| | |
|-------------------|-------------------------------------|
| Output Voltage: | 50 Vp-p (17.675 Vrms) into 600 Ohms |
| Output Frequency: | 20 to 15K Hz |

INPUT A & B MEASUREMENT

| | |
|---------------|------------------------------------|
| DC VOLTS: | Auto-Ranging (Maximum of 600 Vdc) |
| AC VOLTS rms: | Auto-Ranging (Maximum of 600 Vrms) |

Environmental

| | |
|------------------------|----------------------|
| Operating Temperature: | -20 to +60 degrees C |
| Relative Humidity: | 0 to 80% |
| Storage Temperature: | -40 to 70 degrees C |
| Relative Humidity: | 0 to 95% |

APPENDIX A

QUICK START GUIDE

POWER CONNECTIONS

Connect the blue connector on the power cable to the DC POWER input connector on the Cab Signal Master.

Connect the other end of the power cable using the alligator clips to 30-90Vdc (RED is positive).

NOTE: Press and Hold the HELP button for F1 through F5 button explanations. Front Panel buttons are only available for use when they are lit.

BASIC MODE

CAB SIGNAL LOOP TESTING:

Connect your test loop to the "OUTPUT TO LOOP" socket using the gray connector.

Press the ON/OFF button to turn unit ON.

Unit will display Software Version then Loop Resistance and will go into BASIC MODE ready for LOOP testing.

Press F1 repeatedly to toggle and select desired Carrier FREQ (Hz).

Press F2 repeatedly to toggle and select desired Code RATE (PPM).

Adjust displayed output current (AMPS) by using the coarse (UP and DOWN) keys and/or FINE ADJUST knob.

Complete your specific Cab Signal receiver tests.

PICKUP, DROP OUT AND NOISE LEVEL MEASUREMENTS

Press F3 to record the Maximum Value

Press F3 again to record the Maximum Drop Out Value

Press F3 again to record Minimum Value

Tester will then display Pick Up above F1, Drop Out above F3 and Noise above F5

Press F3 again to return tester to BASIC MODE.

SPEED 1 OUTPUT:

After power-up or after the above test, press the MENU button until the MODE SELECT MENU is displayed (the MENU button always returns you to the last screen).

Press F4 to select SPEED.

Press F2 to turn output ON.

Press F3 once to adjust SPEED 1 FREQ.

Adjust displayed output FREQ (Hz) by using the coarse (UP and DOWN) buttons and/or FINE ADJUST knob.

Press F5 to enter SPEED SETUP SCREEN for SPEED 1.

Press F1 for SPEED 1.

Press F3 once for VOLTAGE (adjustment).

Adjust displayed output voltage by using the FINE ADJUST knob.

Press F2 to ENABLE SPEED 1 OUTPUT at the SPEED SIGNAL 1 jack.

Complete your specific SPEED test.

SPEED 2 OUTPUT:

After power-up or after the above test, press the MENU button until the MODE SELECT MENU is displayed (the MENU button always returns you to the last screen).

Press F4 to select SPEED.

Press F2 to turn output ON.

Press F4 once to adjust SPEED 2 FREQ.

Adjust displayed output FREQ (Hz) by using the coarse (UP and DOWN) buttons and/or FINE ADJUST knob.

Press F5 to enter SPEED SETUP SCREEN for SPEED 2.

Press F2 for SPEED 2.

Press F3 once for VOLTAGE (adjustment).

Adjust displayed output voltage by using the FINE ADJUST knob.

Press F2 to ENABLE SPEED 2 OUTPUT at the SPEED SIGNAL 2 jack.

Complete your specific SPEED test.

CabSig4 MODE

Verify test loop is connected to the "OUTPUT TO LOOP" socket.

Press MENU button until MODE SELECT MENU is displayed.

Press F2 for CabSig4 Mode.

Press F3 to select AMPS

Adjust the output current using the UP and DOWN buttons or use the FINE ADJUST knob. Press F3 again to re-enable the FINE ADJUST knob after having used the UP/DOWN buttons.

Press the START/STOP button to enter selected settings.

NOTE 1 for CabSig4: To Select and Change Default Settings:

Select Carrier FREQ, Code RATE, AMPS, or DUTY Cycle by pressing F1, F2, F3 or F5 and adjust using the UP and DOWN buttons and/or FINE ADJUST knob OR Press the FREQ, Code RATE, AMPS, or DUTY button to select from factory presets followed by Pressing the START/STOP button to enter the change.

NOTE 2 for CabSig4:

SPEED 1 and SPEED 2 can be selected as INDEPENDENT or SLAVED outputs.

Digital Volt Meter

To use the DVM, use INPUT A ONLY. Press INPUT/OUTPUT button when lit, then Press F2 for AC or F3 for DC reading. When done with DVM, Press F1 to OFF. Then Press the MENU button to return to previous screen. The MENU button always returns you to the last screen.

END OF QUICK START GUIDE

APPENDIX B

PROCEDURE FOR DEFAULT SETTINGS

Basic Mode:

In **Basic Mode** Menu, default values can only be selected from the pre-defined lists for Carrier and Rate.

Steps:

1. Toggle **F1** button to select **Freq.** from pre-defined list.
2. Toggle **F2** button to select **Rate** from pre-defined list.
3. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

4. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
5. Press **F5** (NO) not to save current settings. (Will return to previous menu)

CabSig4/9 Mode:

In **CabSig4/9 Mode** Menu, default vales can be saved for Freq., Rate, Amps and Duty-cycle.

Note: Speed parameters are saved from the Speed Menu.

Main Screen Defaults:

1. Press **F1** button to select **Freq.** using the **UP** and **DOWN** buttons select from a pre-defined list or use **FINE ADJUST** knob for non-defined frequency.
(In CS9 Mode, F1 also toggles between FREQ1 and FREQ2 to adjust).
2. Press **F2** button to select **Rate** using the **UP** and **DOWN** buttons select from a pre-defined list or use **FINE ADJUST** knob for non-defined Rate.
3. Press **F3** button to select **Amps** using the **UP** and **DOWN** buttons select from a pre-defined list or use **FINE ADJUST** knob for non-defined current.

4. Press **F5** button to select **Duty** using the **UP** and **DOWN** buttons select from a pre-defined list or use **FINE ADJUST** knob for non-defined duty cycle.
 5. Press & Release **DFLT** button.
- Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)
6. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
 7. Press **F5** (NO) not to save current settings. (Will return to previous menu)

Defaults Parameter Lists:

AMPS, RATE, FREQ and **DUTY** buttons allow the setting of the pre-defined lists mentioned above.

Note: Speed parameters are saved from the Speed Menu.

STEPS in Editing a list:

1. Select one of the four buttons above.
2. Select a value using the available **F1-F5** buttons.
(For multiple pages use **PAGE** button)
3. Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
4. Repeat steps 2 & 3 until list is complete.
5. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

6. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
7. Press **F5** (NO) not to save current settings. (Will return to previous menu)

SPEED Defaults:

SPEED MAIN MENU - Defaults allow you to save speed1 and speed2 outputs in selected format.

Note: If selected format is incorrect, go to SPEED SETUP SCREEN to select proper format before Saving Defaults.

Steps:

1. Press **SPEED** button.
2. Select **Freq1** (F3) / **Freq2** (F4) or **MPH/KPH** (F3) - (defined in Speed Setup Menu)
3. Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
4. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

5. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
6. Press **F5** (NO) not to save current settings. (Will return to previous menu)

SPEED SETUP SCREEN - Defaults allow you to save output Metric, Standard or Hz.

Steps: (Start In Speed Setup Screen)

1. Press F4, Use UP & DOWN buttons to select Freq, MPH or KPH.

Note: MPH/KPH = Slaved Output
Freq. = Independent Output

2. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

3. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
4. Press **F5** (NO) not to save current settings. (Will return to previous menu)

SPEED1 PPR and Wheel Diameter Pre-defined Lists:

PPR and **Wheel Diameter** buttons allow the setting of the pre-defined lists.

STEPS: Editing a list:

1. Start in Speed Setup Screen.
2. Press **F1** button for SPEED1.
3. Select one of the two buttons above.
4. Select a value using the available **F1-F5** buttons.
(For multiple pages use **PAGE** button)
5. Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
6. Repeat steps 2 & 3 until list is complete.
7. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

8. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
9. Press **F5** (NO) not to save current settings. (Will return to previous menu)

SPEED 1 SCREEN :

Defaults allow you to save Output 1 enabled or Disabled, Voltage, PPR, Wheel Dia.

Steps: (Start In Speed Setup Screen)

1. Press **F1** button for SPEED1.
2. Press **F1** or **F2** button to Enable or Disable Speed 1.
3. Press **F3** button to select voltage. Use **FINE ADJUST** (Knob) to enter desired value.
4. Press **F4** button to enter **PPR MENU**. Select a value using the available **F1-F5** buttons. (For multiple pages use **PAGE** button)
Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.

Press **START/STOP** button to use selected PPR value.

5. Press **F5** button to enter **Wheel Dia. MENU**. Select a value using the available **F1-F5** buttons. (For multiple pages use **PAGE** button)
Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
Press **START/STOP** button to use selected Wheel Dia. value.

5. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

6. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.

7. Press **F5** (NO) not to save current settings. (Will return to previous menu)

SPEED2 PPR and Wheel Diameter Pre-defined Lists:

PPR and **Wheel Diameter** buttons allow the setting of the pre-defined lists.

STEPS: Editing a list:

1. Start in Speed Setup Screen.
2. Press **F2** button for SPEED2.
3. Select one of the two buttons above.
4. Select a value using the available **F1-F5** buttons.
(For multiple pages use **PAGE** button)
5. Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
6. Repeat steps 2 & 3 until list is complete.
7. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

8. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.

9. Press **F5** (NO) not to save current settings. (Will return to previous menu)

SPEED 2 SCREEN

Defaults allow you to save Output 2 enabled or Disabled, Voltage, PPR, Wheel Dia.

Steps: (Start In Speed Setup Screen)

1. Press **F2** button for SPEED2.
2. Press **F1** or **F2** button to Enable or Disable Speed 2.
3. Press **F3** button to select voltage. Use **FINE ADJUST** (Knob) to enter desired value.
4. Press **F4** button to enter **PPR MENU**. Select a value using the available **F1-F5** buttons. (For multiple pages use **PAGE** button)
Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
Press **START/STOP** button to use selected PPR value.
5. Press **F5** button to enter **Wheel Dia. MENU**. Select a value using the available **F1-F5** buttons. (For multiple pages use **PAGE** button)
Use Coarse adjust (**UP & DOWN** Buttons) or **FINE ADJUST** (Knob) to enter desired value.
Press **START/STOP** button to use selected Wheel Dia. value.
5. Press & Release **DFLT** button.

Note: If pass code has been enabled enter 5-digit code with F1 thru F5 buttons.
(It only needs to be entered once per power-on)

6. Press **F1** (YES) to save current settings as power-on defaults for basic mode.
If **F1** were pressed, the screen will display "WAIT" then "SAVED".
Press **MENU** to return to previous menu.
7. Press **F5** (NO) not to save current settings. (Will return to previous menu)

WARRANTY

Ultra-Tech Enterprises, Inc. (the "Company"), will repair or replace, at the Company's option, its products free of charge if such products are found to be defective in material or workmanship, for the period of one year from the date of purchase, except as follows:

Transportation charges to the Company's designated repair station for defective and replacement parts or service are the responsibility of the purchaser. This warranty does not apply, if: (i) the product has been damaged by improper connection or disconnection with any electrical device; (ii) the product has been damaged in shipping; (iv) the product has been damaged due to an act of God, accident, misuse, abuse, negligence or any other use than the product's intended use as set forth in the specifications; or (v) the device has suffered damage from an external blow or trauma. This warranty does not cover cosmetic damage and may not be transferred to any person or entity. The Company will provide warranty service as provided herein as soon, as is commercially reasonable.

THE SOLE REMEDY UNDER THIS WARRANTY IS THE REPAIR OR REPLACEMENT OF THE PRODUCT AS PROVIDED HEREIN. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY INCIDENTAL, INDIRECT, OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESS OR IMPLIED WARRANTY ON THIS PRODUCT. IN ANY EVENT, IF DAMAGES ARE AWARDED, THEY WILL BE LIMITED TO THE COST OF THIS PRODUCT.

EXCEPT TO THE EXTENT PROHIBITED BY ANY APPLICABLE STATE OF FEDERAL LAW, ALL IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED.

Some states do not allow the exclusion or limitation of incidental, indirect, or consequential damages, or allow limitations to the length of an implied warranty, in which case the foregoing warranty shall be extended to conform to the minimum requirement of such applicable law.

To obtain service under this warranty, it is necessary to obtain a Return Merchandise Authorization (RMA) from the Company prior to returning equipment for service. RMA numbers must be clearly marked on the outside of the shipping package in which the merchandise is returned. Failure to follow the Company's RMA procedure may result in delays in obtaining requested service and or refusal of the Company to accept packages not marked clearly with the appropriate RMA number.