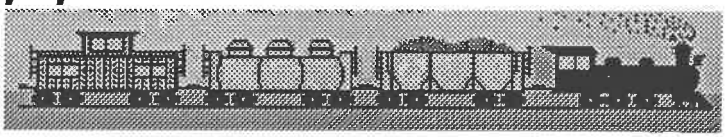
Equipment Defect Detector



For Wide Loads, High Loads and Dragging Equipments

By Devtronics, Inc

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Chapter 1
Specifications

1.0 Hardware

Devtronics will supply a **SCAT** unit consisting of the following:

SCAT1-0746-11	Discrete Input Card	**(1A10)**
SCAT1-0536-11A	Relay Output Card	**(1A9)**
SCAT1-0570-11A	Leased Line Comm Board	**(1A11)**
SCAT1-0534-11E	MicroProcessor Card	**(1A12)**
SCAT1-0539-11C	Motherboard	
SCAT1-0541-11	Short Extender Card	
SCAT1-0538-11	Speech Memory Card	**(1A13)**
SCAT1-0600-11A	Keyboard & LED Display	
SCAT1-0610-11D	Battery Backup Supply	
SCAT1-0542-11	Long Extender Card	

Current Software Version:	**V003R007**
Current Voice Eproms:	**VB3R03 (VB-1 & VB-2)**
Unit Type:	**RTU**
Name:	**Equipment Defect Detector**
Manual Name:	**V3.MAN**

IO Assignments

1A10 Card

1 - Track Circuit
2 - Wheel Gate A
3 - Wheel Gate B
4 - Dragging Equipment
5 - Wide Load Rail 1
6 - Wide Load Rail 2
7 - High Load
8 - Direction Input

1A9 Card

1 - unused
2 - unused
3 - Radio Key
4 - Red Light
5 - White Light

Eprom Label Examples

SCAT	**CSX SCAT**	**CSX SCAT**
V003R007 U-20	**VB3R03 U-8**	**VB3R03 U-9**
1A12 EDD	**1A13 SPEECH**	**1A13 SPEECH**
051993	**031592**	**031592**

Chapter 2
Installation

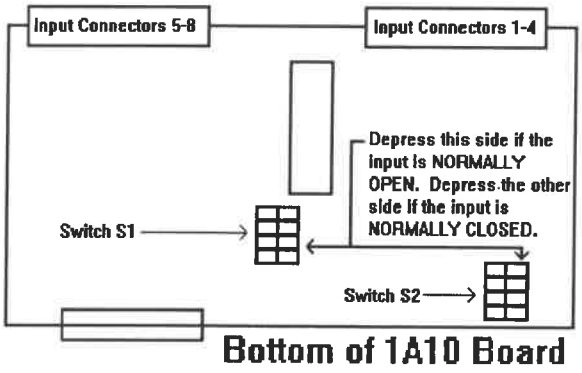
2.0 Installation

Before the unit is operational, certain setup procedures must be adhered to. After correctly wiring the unit (*See Appendix 'B'*), the option switches and input switches must be set.

2.1 Input Switch Settings

Before applying power to the unit, the **1A10** card must have its ***Input Switches*** set to the proper values. Refer to **Figure 1** for the location of these switches. Switch **S2** corresponds to inputs 1-4 and switch **S1** corresponds to inputs 5-8. Chapter 1 of this manual defines each input. Inputs may be defined as *normally-open* or *normally-closed*. A normally-open input is one that provides an open circuit to the unit when in the normal state. A normally-closed input normally provides a closed circuit. To define an input, place the corresponding switch in the **OFF** position for ***normally-open*** and in the **ON** position for ***normally-closed***.

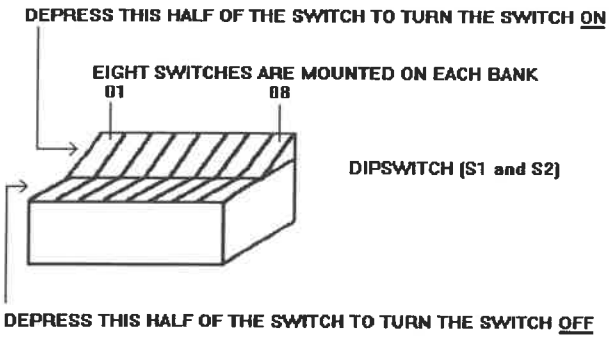
Figure 1 - Input Switches



2.2 Option Switch Settings

The two option switches are located at the top left corner of the Microprocessor Card (1A12). These two **DIP SWITCHES** are used to set the unit's initial configuration. An option switch is in the **ON** position when the top half of its switch is depressed. *(SEE FIGURE 2)*. Switch **S2** is located on the left side of the card. Switch **S1** is located immediately to the right of **S2**. When the unit is first powered on, a list of the option switches and their current settings are printed on the local printer. The following options may be selected by these switches.

Figure 2 -- Option Switches



S1-01 DRAGGING EQUIPMENT INPUT SELECT: When on, the unit will check all trains going in the proper direction for dragging

equipment defects. Otherwise, dragging equipments are ignored.

S1-02 WIDE LOAD RAIL 1 INPUT SELECT: When on, the unit will check all trains going in the proper direction for wide load defects on rail 1. Otherwise, wide loads on rail 1 are ignored.

S1-03 WIDE LOAD RAIL 2 INPUT SELECT: When on, the unit will check all trains going in the proper direction for wide load defects on rail 2. Otherwise, wide loads on rail 2 are ignored.

S1-04 HIGH LOAD INPUT SELECT: When on, the unit will check all trains going in the proper direction for high load defects. Otherwise, high loads are ignored.

S1-05 ALARM INPUT CHECK: When on, if every alarm input to the unit is defective when the train appears at the site, a **DETECTOR MALFUNCTION** message will be enunciated for the greeting message. For example, if the unit is only using the Dragging Equipment input and it is determined to be defective (stuck ON) when the train arrives on site, a **DETECTOR MALFUNCTION** message will be enunciated instead of **DRAGGING EQUIPMENT MALFUNCTION** if this switch is on.

S1-06 DOUBLE TRACK SELECT: When on, the unit is defined as a double track unit. A double track unit is one that shares a common radio with another SCAT unit. A special cable must be used to connect the two units together to provide handshaking capabilities. When one unit wants the radio, it will signal the other unit. This method keeps the units from talking at the same time and producing a garbled message. The messages will be interleaved if a train crosses both detectors at the same time. For instance, if each unit has its message set to repeat twice, after the first message, the talking unit will allow the other unit to speak its first iteration.

S1-07 RESERVED: unused in this version

S1-08 RESERVED: unused in this version

S2-01 DIRECTION INPUT: When on, train direction is determined from the direction input. Otherwise, train direction is determined by the transducer which is activated first. The direction input must be installed if **unidirectional** checking is enabled for any alarm input. The direction input may only be used in conjunction with a Track Circuit.

S2-02 TRACK CIRCUIT: When on, train detection will be accomplished using the track circuit input. Otherwise, processing will begin with the wheel gate transducers. The track circuit input must be present when a greeting message or Direction Circuit is used. Transducers will be ignored if a valid track circuit signal is not present and this switch is ON.

S2-03 / S2-04 PRINTER BAUD RATE: These two switches are used in

conjunction with each other to select the baud rate for the serial printer. The following is a table that shows the valid settings:

S2-03	S2-04	BAUD RATE
off	off	300
on	off	1200
off	on	2400
on	on	9600

S2-05 RAILROAD NAME ENUNCIATION: When on, the railroad name will be added to the beginning of speech messages (***see Chapter 4 for a list of valid messages***). Otherwise, the railroad name will not be enunciated.

S2-06 PRINTER RETURN CODE: When on, at the end of each printed line, the computer will send a Linefeed (**ASCII DECIMAL CODE 10**) and a Carriage Return (**ASCII DECIMAL CODE 13**) to the printer. By turning this switch off, only a Carriage Return code will be sent.

S2-07 USE RED/WHITE LIGHTS: When on, this switch will allow the unit to control the operation of red and white lights as detailed in the **Operations Guides** (***See Chapter 3***). Otherwise, these outputs will not be used.

S2-08 SINGLE TRANSDUCER MODE: When on, the unit operates using a single transducer. In order to mask off alarm checking for one direction with this switch on, a direction circuit must be installed. If no direction circuit is installed, alarm checking must be in both directions. When off, two transducers are used and direction is determined from the transducer inputs or the direction circuit input. **WARNING: if this switch is off, the unit will not function with a single transducer.**

2.3 Menu Settings

When the unit is shipped from the factory, certain user-definable parameters are set to their factory default values. These values are listed in Chapter 5, Menu Systems. If these values are not correct for this particular installation, refer to Chapter 5 for information on how to set the options.

2.3 I/O Definitions

All inputs to the system are wired into the **1A10** board. Dipswitches on this board are used to determine if the input is normally **OPEN** or normally **CLOSED**. Dipswitch **S1** corresponds to inputs **1-4**. Dipswitch **S2** corresponds to inputs **5-8**. The outputs for the system are on the **1A9** board. The following is a list of all inputs and a detailed description of their responsibilities. At the end of each paragraph, the correct ***input sensing switch*** for that input is listed.

Track Circuit (1TB1-3 1TB1-4): The **Track Circuit** input (when installed) is used to determine when a train is approaching the gating transducers. It is also used to determine if a train has stopped on the site. The **Track Circuit** is needed for the greeting

message to be activated. It is also needed if a **Direction Circuit** is being used. Dipswitch **S2-01** on the **1A10** board corresponds to this input.

Direction Circuit (1TB1-1 1TB1-2): The direction circuit input (when installed) is used to determine the direction a train is traveling when it crosses the site. It must be the normal (inactive) state for a train traveling in the **MAIN** direction and activated or ON for a train traveling in the **REVERSE** direction. This input is read when the **Track Circuit** is activated. Dipswitch **S1-04** on the **1A10** board corresponds to this input.

`A' Transducer (1TB1-13 1TB1-14): The **A** transducer is also known as the **MAIN** transducer. This is the transducer that is first activated by the train when it is moving in the normal or main direction. This transducer must be operational for a train to be processed correctly. In single transducer mode (**S2-8 is ON**), this is the transducer to be used. The **B Transducer** is ignored in single transducer mode. Dipswitch **S2-02** on the **1A10** board corresponds to this input.

`B' Transducer (1TB1-15 1TB1-16): The **B** transducer is also known as the **REVERSE** transducer. This is the transducer that is first activated by the train when it is moving in the secondary or reverse direction. This transducer must be operational for a train to be processed correctly. Dipswitch **S2-03** on the **1A10** board corresponds to this input.

DE Sensor (1TB1-5 1TB1-6): The dragging equipment input is one of the alarm inputs and is used to alert the system when a dragging equipment has been detected. This input may be masked off from the system by placing **S1-01** in the OFF position. Checking may be disabled for either direction by changing the Dragging Equipment direction Check parameter in the menu system. (***See Chapter 5, Section 5.3.5***) Dipswitch **S2-04** on the **1A10** board corresponds to this input.

Wide Load Rail 1 Sensor (1TB1-7 1TB1-8): The wide load rail 1 input is one of the alarm inputs and is used to alert the system when a wide load is detected on rail 1. This input may be masked off from the system by placing **S1-02** in the OFF position. Checking may be disabled for either direction by changing the Wide Load direction Check parameter in the menu system. **NOTE: Wide Load Checking is enabled or disabled for both rails only. Directional checking may not be disabled for one rail only.** (***See Chapter 5, Section 5.3.6***) Dipswitch **S1-01** on the **1A10** board corresponds to this input.

Wide Load Rail 2 Sensor (1TB1-9 1TB1-10): The wide load rail 2 input is one of the alarm inputs and is used to alert the system when a wide load is detected on rail 2. This input may be masked off from the system by placing **S1-03** in the OFF position. Checking may be disabled for either direction by changing the Wide Load direction Check parameter in the menu system. **NOTE: Wide Load**

Checking is enabled or disabled for both rails only. Directional checking may not be disabled for one rail only. (***See Chapter 5, Section 5.3.6***) Dipswitch **S1-02** on the **1A10** board corresponds to this input.

High Load Sensor (1TB1-11 1TB1-12): The high load input is one of the alarm inputs and is used to alert the system when a high load has been detected. This input may be masked off from the system by placing **S1-04** in the OFF position. Checking may be disabled for either direction by changing the High Load direction Check parameter in the menu system. (***See Chapter 5, Section 5.3.7***) Dipswitch **S1-03** on the **1A10** board corresponds to this input.

Train On Site Relay: The Train On Site relay is supplied to the customer to use for any purpose he desires. It may be used to turn on alarm sensors, such as Wide Loads lights, etc. This relay is energized when the train is first detected and de-energized after the train has passed the site. **CAUTION: if no Track circuit is being used, this relay will be energized by the first transducer input.** This relay is **Relay 1** on the **1A9** board. The output contact labeled **1** is the center contact of the relay. The output contact labeled **2** is the Normally-Opened contact, while **3** is the Normally-closed. After the Train On Site relay has been energized, the unit will wait 750 milliseconds and then verify that the wide load and high load inputs are functioning correctly, if these inputs are installed. The Dragging Equipment input is also verified at this time.

Chapter 3
Operations Guide

3.0 Operational Limits

The following is a list of the operational parameters that are hard-coded into the software:

Minimum Allowed Axles ---------- 4

3.1 Overview

The **Equipment Defect Detector** will check a train for wide loads, high loads or dragging equipment defects. Defect detection may be activated for either direction or both directions. The railroad name may be appended to the beginning of each message. After the train has been analyzed, a message will be enunciated to the train crew via radio indicating the status of the train. A local printer is provided for hard copy reports. A keypad and display are used to enter any operational parameters. These parameters are stored in nonvolatile **RAM**. A White or Red light output is used to provide visual indications to the train crew. Defect detection for any input may be disabled. The controls for the red and white lights may also be disabled.

3.2 Greeting Message Enunciation

The unit is capable of enunciating a greeting message at the head of the train. In order for the greeting message to be enunciated, certain conditions must be met. The greeting message option must first be turned ON from the main menu. This is **Item 8**. (***See Chapter 5, Section 5.3.8***). The default for this item is OFF. Next, one of the alarm inputs must have checking enabled for the direction the train is traveling. (***See Chapter 5, Sections 5.3.5, 5.3.6 and 5.3.7***). All associated inputs must also be installed and in the correct state for the message to be enunciated. The unit must have a **Track Circuit** (always) and **Direction Circuit** (for unidirectional checking only) installed.

3.3 Screen Display

An 8 character **LED** display is mounted on the front panel of the unit. It is used to provide diagnostic, maintenance and error messages to maintenance personnel. This display is also used for displaying and editing the operational parameters from the menu system. Normally, the screen will display the current system time for 2 seconds, the current system date for 2 seconds, the currently selected safety message for 2 seconds (**if the switches are valid**), the current software version for 2 seconds and the currently selected stored train for 2 seconds (**if no trains are stored, NONE is displayed**). If the internal clock has not been previously set, the time and date will not be displayed. While a train is being processed, the message will be **TRAIN**. If an integrity failure exists within the **SCAT** unit, the following messages will be displayed:

OPT ERR - one or more option switches are set incorrectly. No train processing can occur. Further error messages are printed to the local printer on power-up.

WERR xxx - all the vocabulary could not be found in the speech check or a word could not be found when the unit tried to enunciate a message. **XXX** will be replaced with the word number that caused the error.

NO GATES - the train present input was activated for a minimum time period, no gates occurred on the **A** and **B** transducers and the train present input deactivated. While the train present input is active, the **TP ACTIV** message will be displayed.

DEW1W2HL - one or more of the alarm inputs is stuck in an active condition. The input is represented by a two character designator. If more than one input is faulty, each input will have its designator displayed. The following table details the designators:

W1 - Wide Load Rail 1
W2 - Wide Load Rail 2
DE - Dragging Equipment
HL - High Load

If operation can continue with any of these errors, a train on the site will provide the **TRAIN** message.

3.4 Normal Operation Guide

This section is designed to provide an operational guide for normal train processing. The following are chronological guides based upon various system options.

Track Circuit Installed and Direction Circuit Installed

1) If train is traveling in the REVERSE direction, the direction circuit will activate. Otherwise, it will remain inactive until after the track circuit has activated.
2) Track circuit activates
3) Train direction is determined from direction circuit. **This is the only time the direction circuit will be monitored and this occurs almost instantaneously when the track circuit is activated.**
4) If directional defect detection is enabled and the train is not traveling in the selected direction, no further processing will occur. Once the track circuit deactivates, a report will be sent to the printer.
5) The white light is illuminated
6) The greeting message is enunciated (if selected)
7) Wheel gates occur and the train is analyzed for defects
8) If defects are found, the white light is turned off, the red light is illuminated and a tone is enunciated.

9) Track circuit deactivates
10) The proper message is enunciated
11) All lights are turned off
12) a summary of the train is printed

Track Circuit Installed and No Direction Circuit Installed

1) Track circuit activates
2) The white light is illuminated
3) The greeting message is enunciated (if selected)
4) Wheel gates occur and the train is analyzed for defects
5) If defects are found, the white light is turned off, the red light is illuminated and a tone is enunciated.
6) Track circuit deactivates
7) The proper message is enunciated
8) All lights are turned off
9) a summary of the train is printed

No Track Circuit Installed and No Direction Circuit Installed

1) Wheel gates occur
2) White light is illuminated
3) The train is analyzed for defects
4) If defects are found, the white light is turned off, the red light is illuminated and a tone is enunciated.
6) No gates are detected for at least 10 seconds
7) The proper message is enunciated
8) All lights are turned off
9) a summary of the train is printed

3.5 Abnormal Operation Guide

This section is designed to provide a guide to operations when abnormal conditions exist. It will isolate potential failures and detail the unit's method of managing these conditions.

Less than Four Gates Detected If less than four gates are received from the transducers, no message will be enunciated and no message will be printed.

Track Circuit Input Does Not Activate No train processing occurs if the track circuit is not activated and **S2-02** is ON.

Track Circuit Input Stays Active If the **Track Circuit** input stays active, the unit will assume the train stopped on the site and will not enunciate a message until the track circuit input clears.

No Gates are Detected If a valid **Track Circuit** input is detected and no gating occurs, **NO GATES** will be displayed on the display and a maintenance message will be sent to the local printer. When **Track Circuit** deactivates, a **Detector Malfunction** message will be enunciated.

Alarms Input(s) Always Active If one or more of the alarm inputs are always active, each train will receive a **Malfunction Greeting** message. If the alarms inputs return to a normal operating condition, the unit begin processing trains normally. The alarms must be active at least 2 seconds before the first gate is detected for this error to occur. Otherwise, an alarm at the head of train is assumed.

3.6 Timing Guides

The diagrams on the following page are used to demonstrate the timing relationship between the **Track Circuit, Direction Circuit** and **Wheel Gates.**

Figure 3 -- Main Move

Train is traveling in the main direction

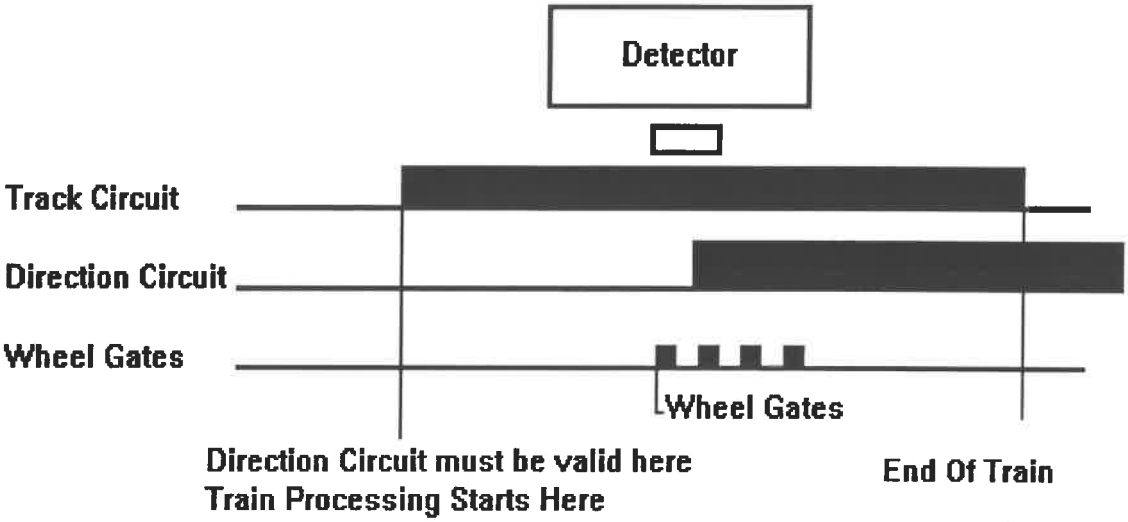
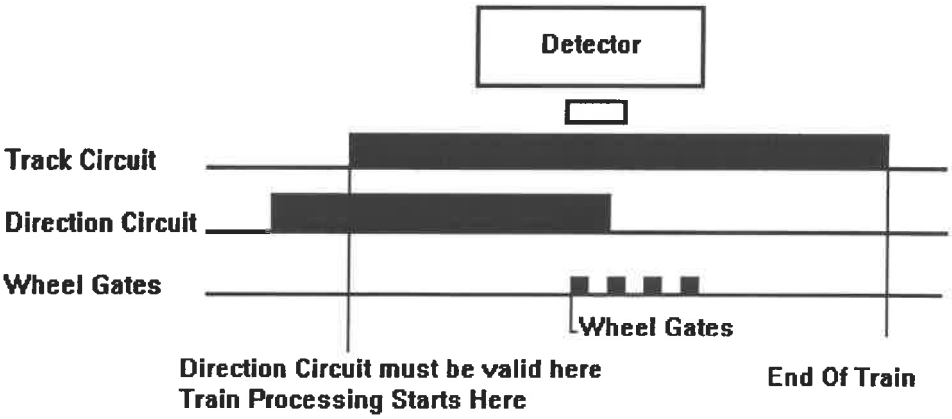


Figure 4 - Reverse Move

Timing Diagram for Track Circuit, Direction Circuit and Wheel Gates

Train is traveling in the reverse direction



Chapter 4
Voice Formats

4.0 Speech Data

Menu options are provided to allow the user to test the vocabulary of the unit. The tone is a 1000hz alarm tone.

4.0.1 Greeting Message

Whenever train arrival is detected by **Track Circuit** and no integrity faults exist, the following message will be enunciated if the Greeting option is activated: <¼ second tone> **CSX** (the railroad name will not be enunciated if SW02-5 is off) **EQUIPMENT DEFECT DETECTOR MILEPOST XXXX.X TRACK NUMBER X** (track number x will not be enunciated if no track is selected in the setup menu).

4.0.2 Malfunction Greeting Message

If, on train arrival, the unit has an integrity failure or an alarm contact is stuck, this message will be enunciated when the train is first detected. No message will be enunciated when the train clears the site. **CSX** (the railroad name will not be enunciated if SW02-5 is off) **EQUIPMENT DEFECT DETECTOR MILEPOST XXXX.X TRACK NUMBER X** (track number x will not be enunciated if no track is selected in the setup menu) **DETECTOR MALFUNCTION** (and/or) **DRAGGING EQUIPMENT MALFUNCTION** (and/or) **HIGH LOAD MALFUNCTION** (and/or) **WIDE LOAD MALFUNCTION** <½ second pause> **END OF TRANSMISSION.** See notes on **S1-05** for the proper message to be enunciated.

4.0.3 Alarm Tones

A two (2) second 1000hz tone will be generated for each defect.

4.0.4 Train Stops On Detector

If a **Track Circuit** is installed and the train stops on the detector, the unit will not enunciate any message to the train crew. When the **Track Circuit** clears, the message will be enunciated.

4.0.5 Alarm Message

If an alarm input is asserted during train time, a 2 second tone will be transmitted. The alarm message will consist of the following: **CSX** (the railroad name will not be enunciated if SW02-5 is off) **EQUIPMENT DEFECT DETECTOR MILEPOST XXXX.X TRACK NUMBER X** (track number x will not be enunciated if no track is selected in the setup menu). ***{ [FIRST / SECOND / ...] WIDE LOAD [[EAST / WEST / NORTH / SOUTH] RAIL] / HIGH LOAD / DRAGGING EQUIPMENT} {NEAR AXLE XXXX [FROM HEAD OF TRAIN / FROM REAR OF TRAIN] TOTAL AXLES XXX / CHECK TRAIN }*** <½ second pause> ***repeat for the number of counts in Defect Repeat Count setting*** <½ second pause> **END OF TRANSMISSION**

4.0.6 Normal Message

If no alarms exist and the train is processed correctly, the following message will be enunciated: **CSX** (the railroad name

will not be enunciated if SW02-5 is off) **EQUIPMENT DEFECT DETECTOR MILEPOST XXXX.X TRACK NUMBER X** (track number x will not be enunciated if no track is selected in the setup menu). **NO DEFECTS TOTAL AXLES XXX** <total axles will not be enunciated if an axle count error exists> <½ second pause> ***repeat for the number of counts in No Defect Repeat Count setting*** <½ second pause> <safety message, if selected> **END OF TRANSMISSION**

4.0.7 Malfunction Message

It is possible, on some types of detector malfunctions, for the unit to be unable to enunciate any message. For example, a defective radio or speech board. If a detector malfunction exists and the unit is capable of enunciating a message, the following message will be enunciated: **CSX** (the railroad name will not be enunciated if SW02-5 is off) **EQUIPMENT DEFECT DETECTOR MILEPOST XXXX.X TRACK NUMBER X** (track number x will not be enunciated if no track is selected in the setup menu). **DETECTOR MALFUNCTION** <½ second pause> ***repeat for the number of counts in Defect Repeat Count setting*** <½ second pause> **END OF TRANSMISSION**

4.0.8 Alarm(s) Exceeded Message

After an alarm limit is exceeded during train time, no more 2 second tones will be transmitted. Only the first defect to occur will be enunciated. The message will consist of the following: **CSX** (the railroad name will not be enunciated if SW02-5 is off) **EQUIPMENT DEFECT DETECTOR MILEPOST XXXX.X TRACK NUMBER X** (track number x will not be enunciated if no track is selected in the setup menu). ***{ FIRST [WIDE LOAD / HIGH LOAD / DRAGGING EQUIPMENT] } {NEAR AXLE XXXX [FROM HEAD OF TRAIN / FROM REAR OF TRAIN] / CHECK TRAIN }*** **MORE DEFECTS CHECK TRAIN TOTAL AXLES XXX** <total axles will not be enunciated if an axle count error exists> <½ second pause> ***repeat for the number of counts in Defect Repeat Count setting*** <½ second pause> **END OF TRANSMISSION**

Chapter 5
Menu System

5.0 Local Speaker

The unit is equipped with a local speaker. The enunciated messages may be heard over this local speaker.

5.1 Keypad Operation

The following is list of the items that are available to the user. They are listed in the same order as listed on the local display. The minimum and maximum settings are listed after each operational parameter. Some options are tests the user may perform to determine if the system is operating properly. There are two main system menus, Test and Setup. Both are operated by the same keys. The **#** key is used to scroll to the next item and to indicate when the user has updated an item. The ***** key is used to exit the menu system and abort any edit or test that is currently is progress. **If no key is pressed for more than 30 seconds and a test is not currently executing, the system will default back to its normal operating mode.**

5.2 Test Options

To enter into the **Test Options** mode, press the '5' key. This will display a list of tests that may be performed to check the integrity of the unit. When the desired test has been reached, press the '0' key and the test will be executed. No test will execute for longer than 2 minutes to prevent the system from *hanging up* if the unit is accidentally left in the test mode. No trains will be processed while the unit is in test mode. If a train approaches the site while tests are being performed, the menu or test may be quickly exited by pressing the ***** key.

5.2.1 Test 1 -- Key Radio and Talk

The radio will be keyed and the entire vocabulary of the unit will be enunciated. The tones that the unit generates will also be enunciated. Once the entire vocabulary has been enunciated, the unit will return to normal mode. The local display will show the word number currently being enunciated while this test is active.

5.2.2 Test 2 -- Beep While Track Circuit is Active

When **Track Circuit** is activated, the local speaker will generate a 1 second tone. The local display will reflect the status of **Track Circuit** by displaying **TP ACTIV** or **TP INACT**. This test is not available if **S2-02** is in the OFF position.

5.2.3 Test 3 -- Display Direction Input Status

The current status of the direction input will be displayed. The two directions displayed are **MAIN** and **REVERSE**. Main is the direction the train is going when it contacts the **A** transducer first. Reverse is when the **B** transducer is contacted first. This test is not available if **S2-02** is in the OFF position.

5.2.4 Test 4 -- Count A and B Gates

The local display will show the following printout when the test is first selected: **000 000**. The transducer that is connected to the MAIN XDUCER input will be displayed on the left side. Each count is independently updated. After the unit has counted 999 axles, the display will wrap back to **000**. If **Single Transducer Mode** is selected by turning switch **S2-08** ON, then the display will read **A - 000**. Only the **MAIN TRANSDUCER** will be shown.

5.2.5 Test 5 -- Illuminate White Light

The white light will be illuminated until the test is exited. The local display will show the current software version number and **WO** (white on). This test is not available if **S2-07** is in the OFF position.

5.2.6 Test 6 -- Illuminate Red Light

The red light will be illuminated until the test is exited. The local display will show the current software version number and **RO** (red on). This test is not available if **S2-07** is in the OFF position.

5.2.7 Test 7 -- Beep on Dragging Equipment

Every dragging equipment detected by the unit will cause a 1 second tone to be generated. The local display will be **DE xx** where **xx** is the count of dragging equipments that the unit has detected.

5.2.8 Test 8 -- Beep on Wide Load (Rail 1)

Every wide load detected on rail 1 by the unit will cause a 1 second tone to be generated. The local display will be **WL1 xx** where **xx** is the count of wide loads that the unit has detected.

5.2.9 Test 9 -- Beep on Wide Load (Rail 2)

Every wide load detected on rail 1 by the unit will cause a 1 second tone to be generated. The local display will be **WL1 xx** where **xx** is the count of wide loads that the unit has detected.

5.2.10 Test 10 -- Beep on High Load

Every high load detected by the unit will cause a 1 second tone to be generated. The local display will be **HL xx** where **xx** is the count of high loads that the unit has detected.

5.2.11 Test 11 -- Beep on Any Alarm

Every alarm detected by the unit will cause a 1 second tone to be generated. The local display will be **ALARM xx** where **xx** is the count of alarms that the unit has detected.

5.2.11 Test 12 -- Display Input Status

The display will show four characters (**x x x x**). Each character will be a **1** or a **0** depending on the current state of each input. The inputs are displayed in the following order: **Dragging Equipment, High Load, Wide Load Rail 1** and **Wide Load Rail 2**. A **1** indicates the input is in alarm status. This is the normal indication for Wide Load and High Load lights when the lights are off.

5.3 Setup Options

To enter into the **Setup Options** mode, press the '**6**' key. This will display a list of operational parameters that must be setup to allow proper unit operation. No trains will be processed while the unit is in setup mode. If a train approaches the site while parameters are being edited or viewed, the menu may be quickly exited by pressing the * key. Any menu items that are not numeric entries may be changed by pressing any number key. These items will scroll to the next valid selection as a number key is pressed. The printer baud option is included in this category. All other entries require the user to type a numeric entry. For example, to set the **maximum wide loads**, the user must enter a valid number (1-10) and then press the # key. But to set the **high load direction check**, the user may press any numeric key and the display will be updated. After the correct entry has scrolled onto the screen, press the # key to save that entry. Each option requiring a number to be entered will be labeled as **NUMERIC** in the following list, All others are labeled **TOGGLE**. If the user enters a **NUMERIC** entry that is out of range, the display will not advance when the # key is pressed and that option's old value will be displayed.

5.3.1 Item 1 - Milepost Setting

The milepost setting is used to identify the unit in all the enunciated messages. Leading zeroes in the milepost setting are ignored. **0069.4** would be enunciated as **MILEPOST SIX NINE POINT FOUR**. If the tenths location is a zero, it will not be enunciated. **0069.0** would be enunciated as **MILEPOST SIX NINE**. **Default:** 0000.0 (no milepost message) **Maximum:** 9999.9 **Minimum:** 0000.0 **Type:** NUMERIC

5.3.2 Item 2 - Maximum Wide Loads

The maximum number of wide loads the unit will process before the **WIDE LOAD LIMIT EXCEEDED** statement is appended to the alarm message. **Default:** 10 **Maximum:** 10 **Minimum:** 1 **Type:** NUMERIC

5.3.3 Item 3 - Maximum High Loads

The maximum number of high loads the unit will process before the **HIGH LOAD LIMIT EXCEEDED** statement is appended to the alarm message. **Default:** 10 **Maximum:** 10 **Minimum:** 1 **Type:** NUMERIC

5.3.4 Item 4 - Maximum Dragging Equipments

The maximum number of dragging equipments the unit will process before the **DRAGGING EQUIPMENT LIMIT EXCEEDED** statement is appended to the alarm message. **Default:** 10 **Maximum:** 10 **Minimum:** 1 **Type:** NUMERIC

5.3.5 Item 5 - Track Circuit Distance

The distance from the first transducer in feet to the **Track Circuit** activation circuit. This distance is used to determine if the transducers and **Track Circuit** is functioning. **Default:** 900 **Maximum:** 900 **Minimum:** 50 **Type:** NUMERIC

5.3.6 Item 6 - Dragging Equipment Direction Check

The directions in which to check for dragging equipments. The selections are **Main**, **Reverse** and **Both**. **Default:** Both **Other:** Main/Reverse **Type:** TOGGLE

5.3.7 Item 7 - Wide Load Direction Check

The directions in which to check for wide loads. The selections are **Main**, **Reverse** and **Both**. **Default:** Both **Other:** Main/Reverse **Type:** TOGGLE

5.3.8 Item 8 - High Load Direction Check

The directions in which to check for high loads. The selections are **Main**, **Reverse** and **Both**. **Default:** Both **Other:** Main/Reverse **Type:** TOGGLE

5.3.9 Item 9 - Railroad Direction

The train directions for this site. This is used when enunciating wide load defects. For instance, if this item is set to **N/S**, a wide load on Rail 1 will be enunciated for the **EAST** rail. A wide load on Rail 2 will be enunciated for the **WEST** rail. If this item is set for **E/W**, a wide load on Rail 1 will be enunciated for the **SOUTH** rail. A wide load for Rail 2 will be enunciated for the **NORTH** rail. **N/S, E/W. Default:** N/S **Type:** TOGGLE

5.3.10 Item 10 - Activate Greeting Message

When activated, the greeting message will be enunciated whenever a valid **Track Circuit** is detected. No greeting message will be enunciated if the unit is operating from the transducers only. **Default:** NO **Other:** YES **Type:** TOGGLE

5.3.11 Item 11 - No Defects Total Axles Message

When activated, the total axles message will be appended to all no defects messages **Default:** YES **Other:** NO **Type:** TOGGLE

5.3.12 Item 12 - Defects Total Axles Message

When activated, the total axles message will be appended to all defects messages that are enunciated. **Default:** YES **Other:** NO **Type:** TOGGLE

5.3.13 Item 13 - Count from Rear or Head

When activated, the axle count given on alarm messages will be from the head of the train. Otherwise, the count will be from the rear of the train. **Default:** HEAD **Other:** REAR **Type:** TOGGLE

5.3.14 Item 14 - No Defects Repeat Count

The number of times to repeat the Normal message. **NOTE: This is the number of times to repeat the message. This is to insure that the message will always get enunciated 1 time. So, if a value of one (1) is entered here, the message will be enunciated twice (repeated once). Default:** 1 **Maximum:** 5 **Minimum:** 0 **Type:** NUMERIC

5.3.15 Item 15 - Defects Repeat Count

The number of times to repeat the Alarm, Malfunction and Alarm(s) Exceeded messages. **NOTE: This is the number of times to repeat the message. This is to insure that the message will always get enunciated 1 time. So, if a value of one (1) is entered here, the message will be enunciated twice (repeated once). Default:** 2 **Maximum:** 5 **Minimum:** 0 **Type:** NUMERIC

5.3.16 Item 16 - Safety Message

Selects the current safety message, if any, to append to the

Normal message. The following are the valid entries and their corresponding messages:

0 ---- No safety message will be appended to the Normal message.
1 ---- Adds safety message #1 to the Normal message. This message is: **HAVE A SAFE DAY**
2 ---- Adds safety message #2 to the Normal message. This message is: **SAFETY FIRST ALWAYS**
3 ---- Adds safety message #3 to the Normal message. This message is: **HAVE A SAFE TRIP**
4 ---- Adds safety message #4 to the Normal message. This message is: **THINK SAFETY**

Default: 0 **Maximum:** 5 **Minimum:** 0 **Type:** NUMERIC

5.3.17 Item 17 - Track Number Selection

If the unit is installed at a multiple track location, this setting is used to allow enunciation of which track the unit is checking. If zero (0) is selected, then the track number message will not be enunciated or printed. **Default:** 0 **Maximum:** 9 **Minimum:** 0 **Type:** NUMERIC

5.3.18 Item 18 - Set Date

Sets the current system date. The system uses this date in conjunction with the time to identify messages sent to the local printer. **Default:** 01-01-90 **Maximum:** 12-31-?? **Minimum:** 01-01-90 **Type:** NUMERIC

5.3.19 Item 19 - Set Time

Sets the current system time. The system uses military time and identifies midnight as 00:00:00 **Default:** 00:00:00 **Maximum:** 23:59:59 **Minimum:** 00:00:00 **Type:** NUMERIC

5.4 Safety Message Selection

When the unit is in its normal operating mode, the safety message may be quickly changed by pressing the numbers **0-4** on the local keypad. If no errors exist in the unit, the selected safety message will be displayed on the local display. Each number represents the safety message to select. The following is a list of the safety messages that correspond to these numbers.

0 ---- No safety message will be appended to the Normal message.
1 ---- Adds safety message #1 to the Normal message. This message is: **HAVE A SAFE DAY**
2 ---- Adds safety message #2 to the Normal message. This message is: **SAFETY FIRST ALWAYS**
3 ---- Adds safety message #3 to the Normal message. This message is: **HAVE A SAFE TRIP**
4 ---- Adds safety message #4 to the Normal message. This message is: **THINK SAFETY**

The local display will show the currently selected safety message for 2 seconds when a new message is selected. The new message will also be enunciated over the local speaker. **The radio will not be keyed.** This allows the user to hear his selection without broadcasting it over the airwaves.

5.5 Stored Train Recall

The unit has the capability to store the last **65** trains past the site in battery-backed **RAM**. The user may retrieve the printouts and enunciated messages from these stored trains. The exact contents of the buffer used to process the train in real-time are copied into the stored buffer. This includes the Operational Parameters used to process the train. If these parameters were subsequently changed, the stored train will still be enunciated and printed based on the values in the unit at the time the train was processed. When the unit is powered up, it will print to the local printer the number of trains currently stored in **RAM**. To access these stored trains, the unit must be in the normal operating mode. Press **'7'** or **'8'** on the numeric keypad to display the next or previous train, respectively. Each time the user presses one of these keys, the display will show the date and time of the next train on the display for 10 seconds. However, you do not need to wait for 10 seconds before pressing another key. The first four digits on the display will be the month and date of the train. The last four digits will be the hours and minutes of the train. To print the selected train, press the **'*'**(***Print Train***) key. After this has been selected, the train will be printed to the local printer and the message will be enunciated over the local speaker. **NOTE: The radio will not be keyed when a stored message is being enunciated. This allows maintenance personnel to leave the radio on during stored train retrieval.** At some point in time, it may be desirable to clear the **Stored Train Memory**. This is accomplished by pressing the **'#'** key five (**5**) times in succession from the normal operating mode. The display will show **NoStored** for 5 seconds after the buffer has been cleared. If any other keys are pressed between the 5 **'#'** keys, the count will be cleared and you must start over.

5.6 Operational Parameters Printout

The current **Operational Parameters** for the unit may be printed to the local printer by pressing the **'9'** key on the numeric keypad. The unit must be in the normal operating mode to accomplish this. The word **PRINTING** will be shown on the LED display while the parameters are being printed.

Chapter 6
Printer Operations

6.0 Power On Message

When the unit is first powered on, the following message will be sent to the local printer: **Equipment Defect Detector (V003R007) Power On at 01-01-91 01:01:01.** The option switch settings will also be listed below this message. Refer to **Chapter 2** for a list of these options.

6.1 Train Messages

Various messages will be printed to the local printer after the train has been processed. These messages will contain different error messages if any errors existed. They will report the time and date the train was processed as well as the status of the train.

6.2 Printer Support

The unit is equipped with a serial port to support a local printer. Any information stored in the database may be printed to this local printer.

6.2.1 Cabling

The following is a description of the pins of the serial port, their function and the gender and type of the connector used.

Connector Type: **DB9 Receptacle (female)**
Pinouts:

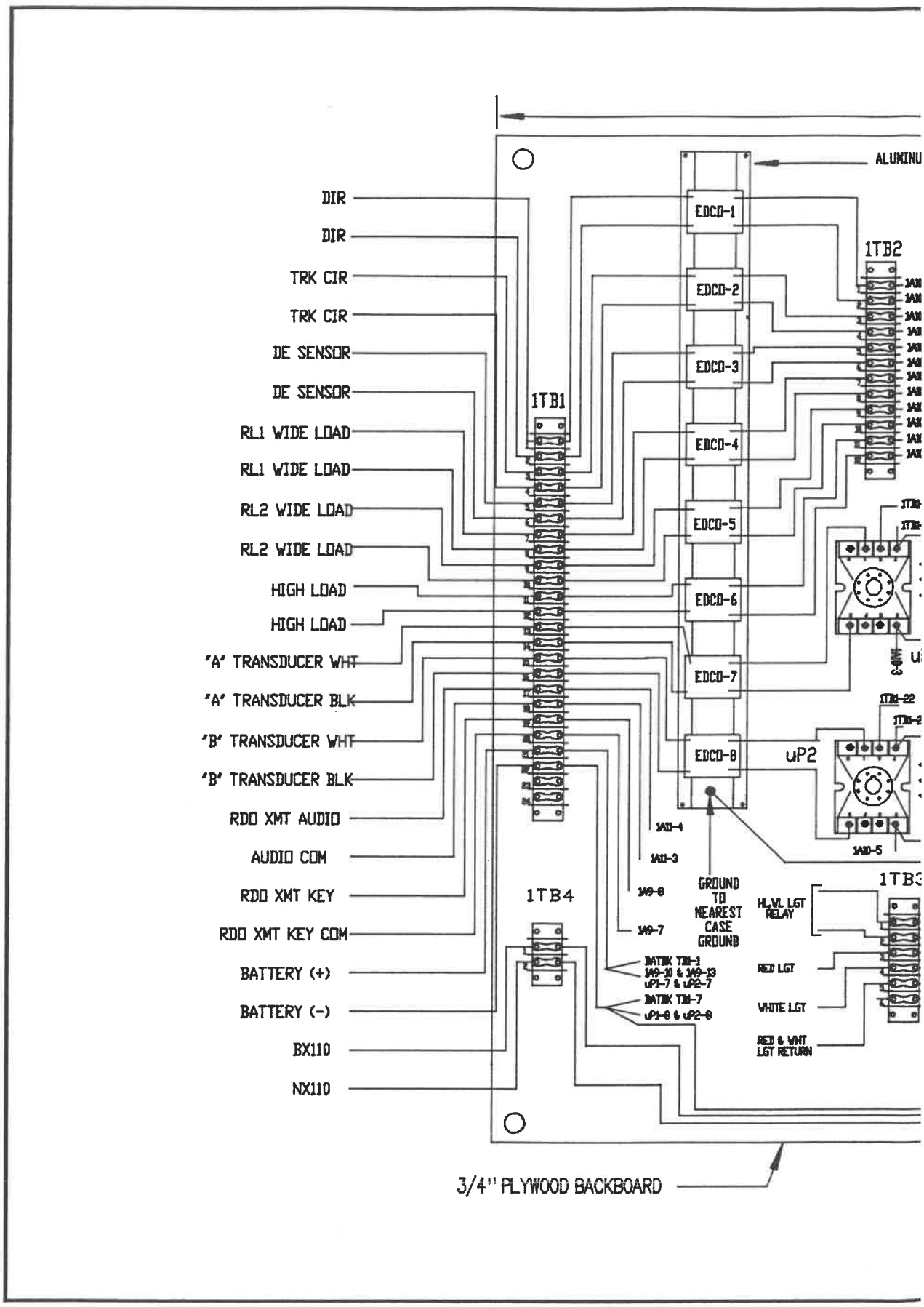
1 -- not connected
2 -- **XMIT** - data sent from the computer to the printer
3 -- not connected
4 -- not connected
5 -- **GROUND**
6 -- not connected
7 -- **CTS** - signal from the printer to the computer that must be asserted before the computer will send data to the printer. Commonly called the **HANDSHAKE** line.
8 -- **RTS** - signal that is asserted when the computer is sending data to the printer
9 -- not connected

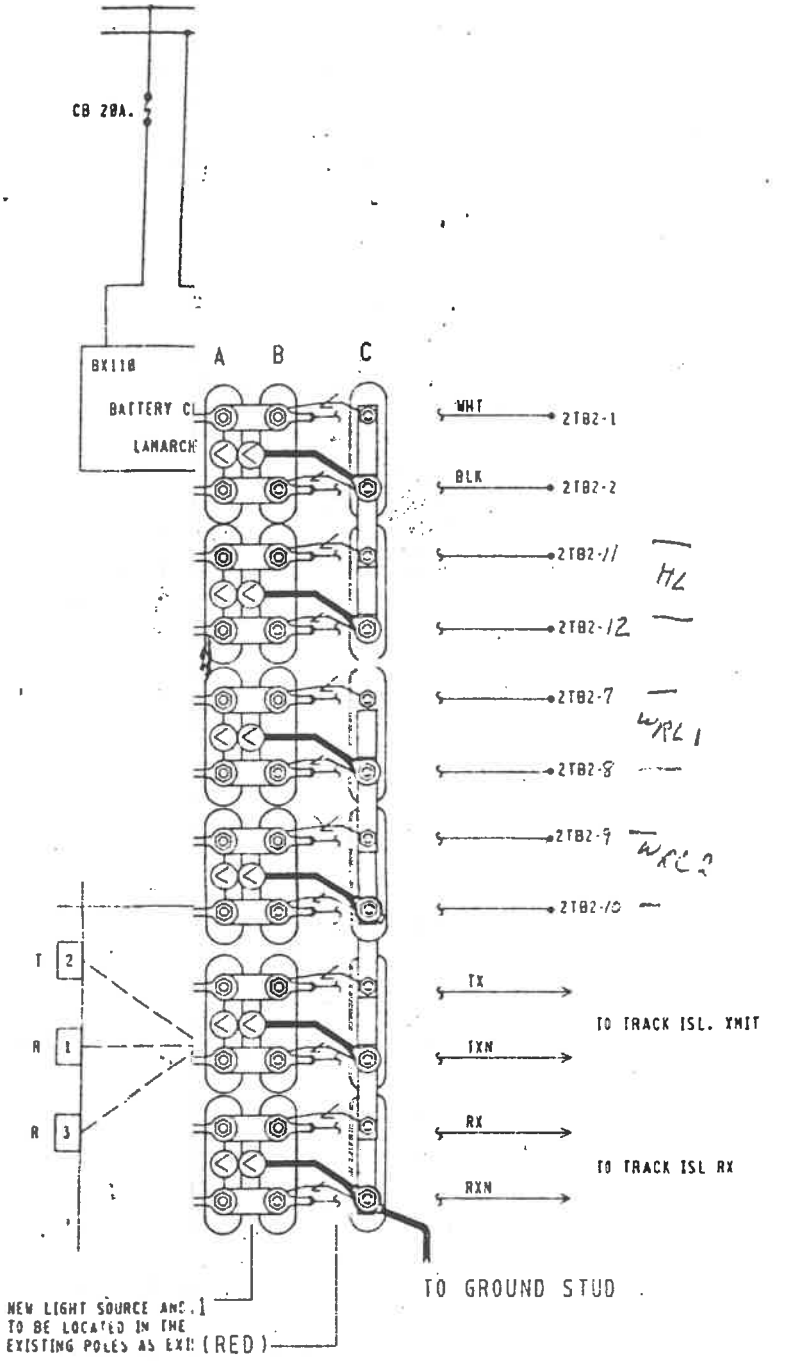
If your printer does not support a **handshake** line, connect pins 7 and 8 on the computer end of the cable.

Appendix A
Vocabulary List

Word	Number	Word	Number
ONE	1	TWO	2
THREE	3	FOUR	4
FIVE	5	SIX	6
SEVEN	7	EIGHT	8
NINE	9	ZERO	10
FIRST	11	SECOND	12
THIRD	13	FOURTH	14
FIFTH	15	SIXTH	16
SEVENTH	17	EIGHTH	18
NINTH	19	TENTH	20
DRAGGING EQUIPMENT	21	NEAR AXLE	22
NO DEFECTS	34	CSX	36
WIDE LOAD	38	FROM REAR OF TRAIN	43
FROM HEAD OF TRAIN	44	MILEPOST	45
DETECTOR	47	SOUTH	48
NORTH	49	WEST	50
EAST	51	RAIL	54
MALFUNCTION	55	HAVE A SAFE DAY	58
THINK SAFETY	60	END OF TRANSMISSION	65
MORE	67	CHECK	68
SAFETY FIRST ALWAYS	69	HAVE A SAFE TRIP	70
POINT	141	TRAIN	165
DEFECTS	182	TOTAL AXLES	185
EQUIPMENT	186	TRACK	187
NUMBER	188	HIGH LOAD	189
DEFECT	190	TONE	-2

Appendix B
Wiring Diagram


DIR
DIR
TRK CIR
TRK CIR
DE SENSOR
DE SENSOR
RL1 WIDE LOAD
RL1 WIDE LOAD
RL2 WIDE LOAD
RL2 WIDE LOAD
HIGH LOAD
HIGH LOAD
'A' TRANSDUCER WHT
'A' TRANSDUCER BLK
'B' TRANSDUCER WHT
'B' TRANSDUCER BLK
RDO XMT AUDIO
AUDIO COM
RDO XMT KEY
RDO XMT KEY COM
BATTERY (+)
BATTERY (-)
BX110
NX110
1TB1
1TB2
1TB3
1TB4
EDCO-1
EDCO-2
EDCO-3
EDCO-4
EDCO-5
EDCO-6
EDCO-7
EDCO-8
uP2
GROUND TO NEAREST CASE GROUND
HL.WL LGT RELAY
RED LGT
WHITE LGT
RED & WHT LGT RETURN
3/4" PLYWOOD BACKBOARD



THIS PLAN SUPERSEDES ALL OTHERS OF PREVIOUS DATE DESTROY OLD PLANS

4' X 6' HOUSE

NOTE:

① K1 SIGNA 42RB-
② K2 POTTER & B
③ (K1 & K2 SOCK
④ BATTERY & CEL
⑤ 20 AMP 250V FU
⑥ AUTOTRAN
⑦ ON/OFF
⑧ WILMORE

CSX TRANSPORTATION
RAIL TRANSPORT GROUP ENGINEERING
COMMUNICATIONS AND SIGNALS

DESIGNED	DIGITIZED	CHECKED	DATE
CPCS	CPCS	CPCS	

NEXT SH	NEXT FILE	NEXT SH	FILE	SHEET
9			WABR00068	C02