Section 12:
Cyberscan 2000 with ACS/Pyro Scanners
(Work Procedure 9)

Work Procedure 9

System Configuration

Troubleshooting

Work Procedure
Number 9

Chapter Overview

Purpose

This chapter provides maintenance procedures as outlined in Rule 27.0 for the Cyberscan 2000 with ACS/Pyro scanners.

Scope

Topics covered in this chapter include these maintenance procedures:

- Weekly
- Monthly
- Quarterly

Weekly

Tools Needed

The following equipment is needed to perform weekly maintenance:

- Fluke 27, 87, or equivalent
- Soldering iron
- Torque wrench
- Data inquiry unit
- Function simulator
- Appropriate hand tools

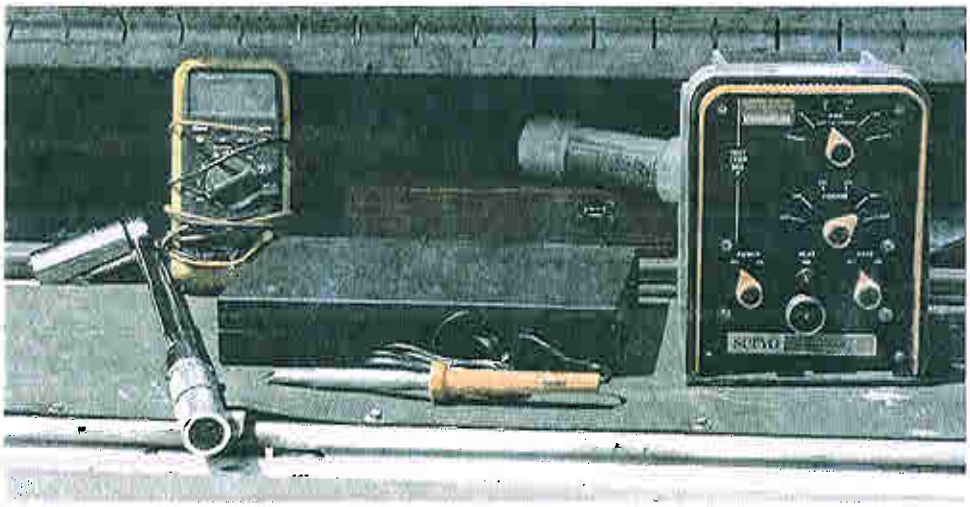


Figure 12-1 Fluke meter, Soldering iron, Torque wrench, Data inquiry unit, Function simulator.

Weekly, *continued*

Visual Inspection

Follow these inspection steps during weekly maintenance:

Step	Action
1	Inspect; then, if necessary, tighten, and/or replace any loose bolts and broken parts on the: • transducers • scanner bases • deflector blocks • dragger • junction boxes
2	Inspect all ground rods and connections; then, if necessary, replace or repair them. (Refer to the *Train Control System Reference* manual.)
3	Inspect and replace any badly damaged paddles on the dragger.
4	Remove debris or obstructions from the dragger.
5	Inspect the dragger switch gaskets to ensure that water is not getting into the switch contact.

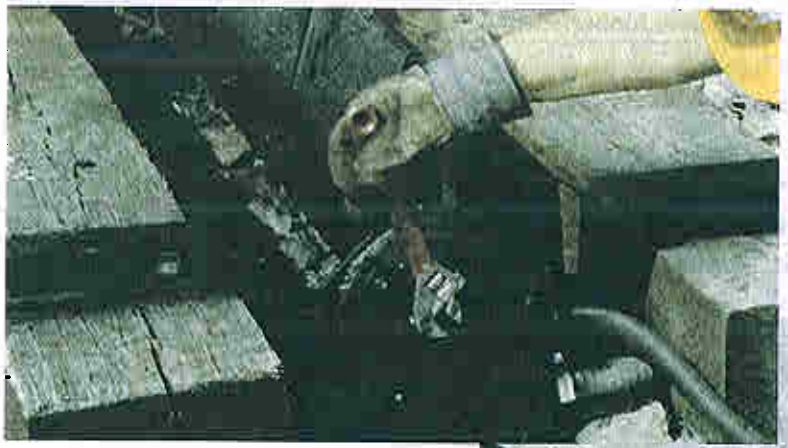


Figure 12-2 Inspecting the dragger switch gasket.

Figure 12-3 Inspecting ground rod.

Weekly, continued

Scanner Maintenance

You'll need the following materials to complete scanner maintenance:

- Soft bristle brush
- Spray bottle with clean water
- Soft cloth
- Rain-X™
- Cleaning solution
- Aluminum spray paint

Do the following to complete weekly scanner maintenance:

Step	Action
1	Remove the scanner cover and clean out the inside of the scanner base using a soft brush.
2	Clean the scanner lens and mirror by carefully washing off any dirt and grime using a spray bottle with clean water. Finish cleaning them with a soft cloth. (Do **NOT** clean lens with an ammonia-based product because it will damage them.)
3	Apply Rain-X™ to the mirror only.
4	Check to ensure that the scanner cover heaters and the shutter mechanisms operate properly.
5	Check the tightness of the scanner cable connector.
6	Check the tightness of the setscrew. **WARNING!** Do not touch the 110VAC terminals.
7	Replace the scanner cover and clean it with a cleaning solution.
8	Paint dingy or dull scanner covers aluminum to help reflect heat away from the scanner.

Figure 12-4 Spray painting scanner cover.

Weekly, continued

Printer Maintenance

Materials needed for printer maintenance include:

- Replacement ribbon
- Paper

Each week, complete printer maintenance by doing the following:

Step	Action
1	Press and release the RESET button on the D board to check printer operation.
2	Replace the ribbon, if necessary.
3	Check the paper supply.

Voltage Checks

Each week check and record Cyberscan 2000 voltages by doing the following:

- Check battery and AC power input voltages on the arrestor panel with a multi-meter.
- TypeV at the local prompt on the DIU; then press ENTER to check the following voltages.
  - battery - (12-14 VDC is an acceptable range)
  - + 12 VDC
  - - 12 VDC
  - + 5 VDC

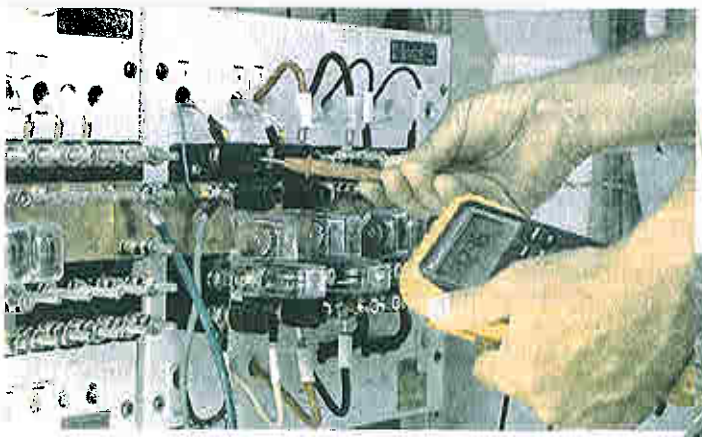


Figure 12-5 Checking voltage on arrestor panel.

Figure 12-6 Data Inquiry Unit (DIU)

Weekly, continued

Operational Check

Do an Enhanced Function Simulation (EFS) test to verify the Cyberscan 2000 operational capabilities by following these steps:

Step	Action
1	Plug the male end of the function simulator cable into connector FS located on the D board. Connect the female end to the function simulator.
2	Type EFS at the local prompt on the DIU; then press ENTER. (Make sure the printer is turned on.)
3	Turn the function simulator power switch to the ON position. Then, set the temperature to the lowest setting and follow system instructions.
4	Fire rail one using a heated soldering iron; then activate the rail one side of the dragger in both directions.
5	Turn off the gate on the function simulator. Result: The detector must announce and print the correct locations of all defects. **Note:** Be sure the correct side is announced for the alarms.
6	Repeat steps 2-5 for rail two.
7	Inspect the header information to be sure that it is correct, including the alarm locations. Date and initial the printouts and keep them for 30 days.
8	Activate the A or B transducer four times using a metal object and listen to the voice transmission in the vehicle or hand-held radio to be sure it is clear (not distorted) and has proper amplitude (volume). **Note:** If a train passes over a site during the EFS test, it automatically terminates the test. If termination occurs, the system must be re-initialized and the test started again.
9	Before leaving the location: • verify that the radio and system transmit switch is on. • turn off the DIU. • turn off the printer. • cleanup the location. • lock the location.

Monthly

Equipment Needed

The monthly maintenance requires this additional equipment:

- Saddle
- Thermometer

Figure 12-7 Saddle and thermometer

Beginning Monthly Maintenance

To begin the monthly maintenance, complete all the actions required during the weekly test.

Figure 12-8 Function simulator placed in the shade.

Monthly, continued

Preparing to Calibrate the Function Simulator

After completing the required weekly test, continue monthly maintenance by preparing the function simulator following these steps:

Step	Action
1	Determine the ambient temperature using a thermometer placed in the shade near the bungalow.
2	Place the function simulator outside in the shade for about 15 minutes. The reference chopper wheel should be at ambient temperature before going to the next step.
3	At the DIU local prompt, type DP; then press ENTER. Compare the values of A10 (rail 1 gain) and A11 (rail 2 gain) with the logbook entries from last month.
4	Press ESC (Escape); type CALIB; then press ENTER.
5	Compare the temperature from the thermometer with the Cyberscan. If the temperature is: • not within 5 degrees, go to step 6. • within 5 degrees, go to step 7.
6	Type N to reject the Cyberscan temperature; then type the thermometer temperature, press ENTER, and follow instructions displayed on the DIU.
7	Type Y to accept the temperature from the Cyberscan and follow the calibration instructions displayed on the DIU.
8	Wait 5 minutes while the simulator stabilizes. Result: The simulator light should go out. **Note:** You now have 15 minutes to complete the calibration. If the calibration takes longer than 15 minutes, turn the simulator off, place it in the shade and allow it to cool for at least 15 minutes before using it again.

Monthly, *continued*

Calibrating the Cyberscan

Follow these steps to finish calibration of the Cyberscan 2000:

Step	Action
1	Place the function simulator on the scanner cover saddle rail 1 or rail 2.
2	Turn the gate switch on; then follow the instructions displayed on the DIU. Typical calibration range is 30 to 55. If calibration is not within tolerance, refer to the troubleshooting procedures.
3	Repeat calibrations on the rail until two calibration values are equal, plus or minus five. Example: first reading 32, second reading 45, third reading 37. In this case accept the 37 reading since it is equal, plus or minus five, to 32.
4	Move the simulator to the opposite rail and follow the instructions displayed on the DIU.
5	Type DP (display parameters) on the DIU and record the values for A10 and A11 in the logbook.
6	Compare old and new rail gain values from the previous month's maintenance. Reading for each rail should not be more than ten points higher than the previous month's reading.

Figure 12-9 Placing function simulator on rail.

Monthly, continued

Securing the Location

Before leaving the location, do the following:

- Verify that the radio and system transmit switch is on.
- Turn off the printer.
- Turn off the DIU.
- Cleanup the location.
- Lock the location.

Figure 12-10 Cleaning up location.

Quarterly

Equipment Needed

The quarterly maintenance requires this additional equipment:

- Tape line
- Alignment fixture
- Mirror cap
- Appropriate hand tools
- Hardwire shunt

Figure 12-11 Tapeline, Alignment fixture, Mirror cap, Hardwire shunt, Appropriate hand tools.

Beginning Quarterly Maintenance

To begin quarterly maintenance, complete the weekly and monthly tests.

Figure 12-12 Coal train approaching DD checking track circuit.

Quarterly, continued

Verifying Scanner Alignment

Using a triangulation procedure, check to be sure that the scanners are located squarely across from each other. To triangulate, do the following:

Step	Action
1	Place a small nail at the exact center of the track in a tie approximately 15 feet from the scanners.
2	Using a metal tape-line, measure the distance from the nail to the middle of the scanner aperture installed on the same rail as the transducers. Note this distance.
3	Measure the distance from the nail to the center of the other scanner aperture. It should be the same (within 1/2 inch) as the distance measured in step 2. If not, move the scanner until it is.

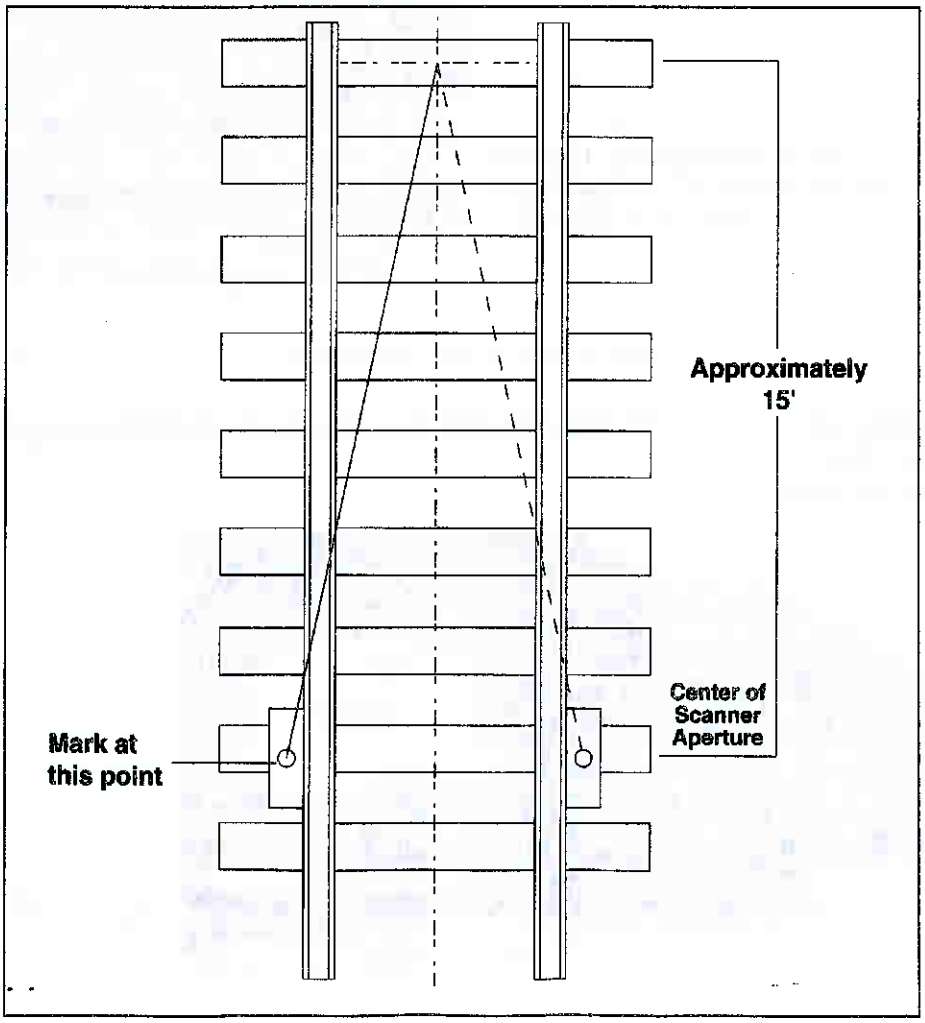


Figure 12-13 Diagram of triangulation

Quarterly, continued

Checking the Optical Alignment

Check the optical alignment of the scanner by doing the following:

Step	Action
1	Place the alignment fixture across the rails, approximately centered between the A and B transducers. **Note:** Be sure the alignment fixture is square with the rails.
2	Remove the scanner cover and place a mirror cap on the scanner lens. **Note:** Be sure that the cap is squarely seated against the end of the lens barrel. A small error here can cause a large alignment error.
3	Look through the peep hole in the target plate toward the scanner. The red dot should be centered in the circle. • To lower the dot, move the fixture closer to the scanner. • To raise the dot, move the fixture away from the scanner. • To align the dot horizontally, move the upright post left or right on the fixture bar.

Continued on the next page

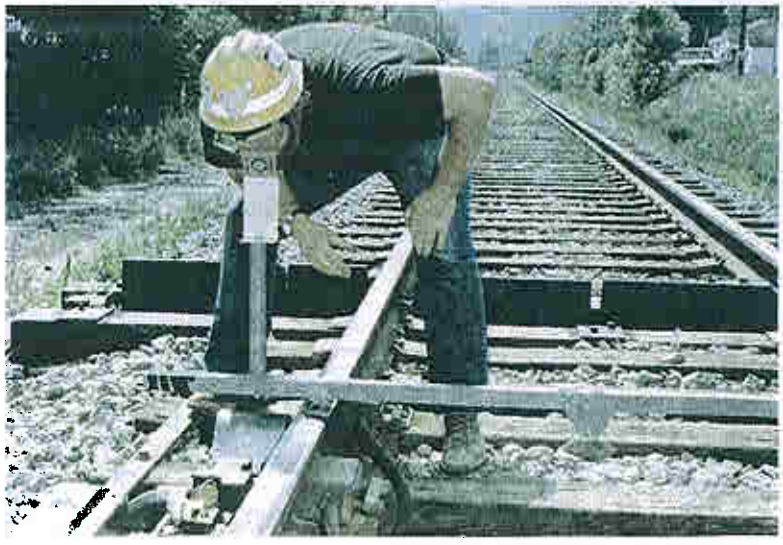


Figure 12-14 Checking the scanner optical alignment.

Quarterly, continued

Checking the Optical Alignment *(continued)*

4	Observe the index mark on the upright post. This dimension should be 7 inches plus or minus ¼ inch. Adjust the scanner cant nuts, if necessary, to achieve this dimension. **Note:** To increase the distance from gauge, use a lower cant nut position. Both cant nut position numbers must be the same. Torque the scanner mounting bolts to 60 foot pounds. **WARNING!** Do not exceed 60 foot pounds or the bolts will bend. Result: When you are finished, the fixture should be at the center of the A and B transducers, plus or minus 1 inch. Reposition the scanner, as necessary to achieve this tolerance.
5	Remove the mirror cap from the scanner lens when you are finished.
6	Replace cover, being careful not to pinch any cables.

Figure 12-15 Replacing scanner covers.

Quarterly, *continued*

Aligning the Opposite Rail

Locate the optical alignment point on the opposite rail by doing the following:

Step	Action
1	Verify that the alignment fixture is perpendicular using a triangulation method. Mark its position on both rails.
2	Reverse the alignment fixture and remove the scanner cover.
3	Place a mirror cap on the scanner lens. **Note:** Be sure that the cap is squarely seated against the end of the lens barrel.
4	Look through the peep hole in the target plate toward the scanner. The red dot should be centered in the circle. • To lower the dot, move the fixture closer to the scanner. • To raise the dot, move the fixture away from the scanner. • To align the dot horizontally, move the upright post left or right on the fixture bar.
5	Observe the index mark on the upright post. This dimension should be 7 inches plus or minus ¼ inch. Adjust the scanner cant nuts, if necessary, to achieve this dimension. **Note:** To increase the distance from gauge, use a lower cant nut position. Both cant nut position numbers must be the same. Torque the scanner mounting bolts to 60 foot pounds. **WARNING!** Do not exceed 60 foot pounds or the bolts will bend. Result: When you are finished, the fixture should be at the center of the A and B transducers, plus or minus 1 inch. Reposition the scanner to achieve this tolerance. Remove the mirror cap from the scanner lens when you are finished.
6	Remove the mirror cap from the scanner lens.
7	Replace cover being careful not to pinch any cables.

Quarterly, *continued*

Checking the Track Circuit

Check the EPIC III track circuits by placing a hardwire shunt 100 feet from the track connections.

Result: The Cyberscan 2000 K801 track circuit relay should energize. If the track circuit does not energize, readjust the EPIC III unit.

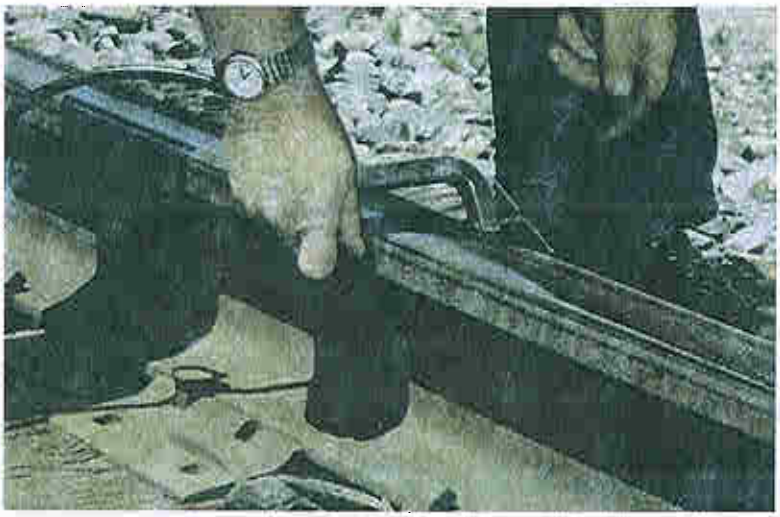


Figure 12-16 Connecting a hardwire shunt on the rail.

Verifying the Track Gauge

Measure the track gauge.

Note: Correct gauge should be 56 ¼ inches.

Check the track surface by observing a passing train. Notify the proper authority if the track condition does not meet the CSXT standard.

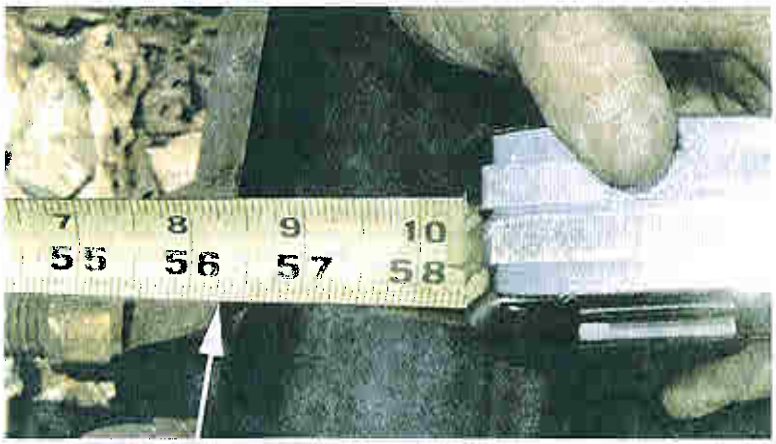


Figure 12-17 Verifying that the track gauge is still 56 ¼ inches.

System Configuration

Chapter Overview

Purpose

This chapter describes the Cyberscan 2000 with ACS/Pyro scanners. It provides a detailed description of the system, including hardware.

Scope

Topics covered in this chapter include:

- System Overview
- Components
- Advanced Concept Scanner

System Overview

System Description

The Cyberscan 2000 is a highly accurate train surveillance system that contains a microprocessor-based data processing unit (DPU). The DPU receives trackside analog heat signal information, analyzes it, and determines bearing, wheel, and other defects as a train passes over the detector site at speeds between 3 and120 miles-per-hour. If defects exist, the system can report them to:

- train crews
- dispatchers
- other designated personnel

The Cyberscan 2000 is capable of storing multiple train data in its memory, recalling it, and repeating it as required.

Four printed circuit boards enable the system to perform the following operations:

- input/output for auxiliary equipment
- analog-to-digital conversions
- site specific information, i.e., milepost, site name, axle count
- voice generation for message outputs
- alarm level selection
- processor/controller
- time and date

Functional Description

Components of the Cyberscan perform these functions:

- Wheel-sensing transducer and heat-sensing scanner analog signals are sent to the D board.
- Transducer signals are sent from the terminal block in the junction box (JB) to the D board, where they are conditioned and passed to the A processor.
- Scanner signals are amplified, filtered, and then sent to the A processor board, where they are converted to digital signals for further processing. The track circuit input detects train presence and is passed to the D board.
- Auxiliary alarm inputs are detected by the D board and sent to the A processor.

System Overview, continued

Configuration

The Cyberscan 2000 is comprised of the following:

- trackside equipment relay input/output panel
- input power
- printer
- data inquiry unit
- modem
- radio
- trackside devices:
  - transducers
  - dragging equipment detector
  - track circuit
  - scanners
  - scanner cables
- data processing unit
  - processors
  - printer circuit boards

Components

Trackside Equipment RelayInput/ Output Panel

The trackside equipment contains the following relays.

Relay	Part	Description
K801	R10-T2Z3-J1.0K	track circuit
K802	KRP14DG 12V	dragging equipment
K803	KRP14DG 12V	slid load 2 (wide load)
K804	KRP14DG 12V	slid load 1 (wide load)
K805	KRP14DG 12V	high load
K806	KRP14DG 12V	radio transmit key

Input Power

Input power to the D board AAR terminals provides the following voltages:

- BX and NX provide 115VAC unregulated
- B12 and N12 provide 12VDC battery power

Printer

The printer provides the following print options:

- parameters (site or system)
- train directory
- calibration information
- individual trains, cars or axles
- events
- on-line help

Data Inquiry Unit

The DIU is used for the following functions:

- configuration
- calibration
- evaluation
- documentation

Components, continued

Modem

The modem provides interface between the Cyberscan and telecommunication lines. It performs the following functions:

- converts Cyberscan digital information into phone-line compatible tonesfor transmission to a remote location.
- receives phone-line tones from a remote location and converts them to digital for Cyberscan use.

Radio

The Cyberscan 2000 communicates to the train crew using a VHF radio.

Data Processing Unit

The Data Processing Unit (DPU) consists of an electronics cabinet that houses:

- Processor A
- Processor B
- C assembly board

It receives pulses and heat signals from the transducers and scanners. The DPU uses transducer pulses to control DPU operation and accurately identify the location (by axle number and train side) of each bearing. The DPU processes the real-time analog heat signals it receives from the hot box infrared scanners at trackside. It records this data while performing the following functions:

- analyzes heat signals to determine whether the heat level meets alarming criteria.
- calculates axle speed and spacing.
- correlates the data with axle numbers.
- computes train length and ambient temperature.
- stores results in memory.

Components, continued

Processors

The Cyberscan contains two processors that do the following functions:

Part	Function
A Processor	• controls the shutters, cover heaters and integrity heaters in the scanners. • processes transducer/SOTC signals. • provides wheel gate and train present signals. • conducts all automatic testing of the trackside equipment. • processes contact closure A inputs. • monitors the internal temperature of each bearing scanner. • processes Function Simulator heat inputs FS-A and FS-B. • sends data to Processor B; then is ready to receive the next train and any commands from Processor B.
B Processor	• receives and organizes data generated by the A Processor after a train leaves a site. • completes all required operations on the raw data and then stores the data in its memory. • monitors the ambient temperature probe input. • completes all required operations on the raw data and then stores the data in its memory. • provides all RS-232 communications. • processes Contact Closure B inputs. • provides the relay drives for the digital outputs associated with the transducers. • provides the transmitter audio and transmit key outputs. • provides local audio output (speaker drive) to the speaker on the D board.

Components, continued

Boards

The Cyberscan 2000 uses two boards to perform the following functions:

Part	Function
C Board	The C board provides an interface path between the: • D board and the processor boards • RS-232 devices and processors
D Board	The D board provides: • interface between the C board assembly and all trackside equipment, signals, and power • DC/DC conversion • filtered plus and minus 5VDC, plus and minus 12VDC, and minus 14VDC (Power supplies located on this board are not field replaceable.) • local audio output • an input path to the Processor A when conducting a scanner function simulator test • opto-isolated contact closure input circuits for both processors

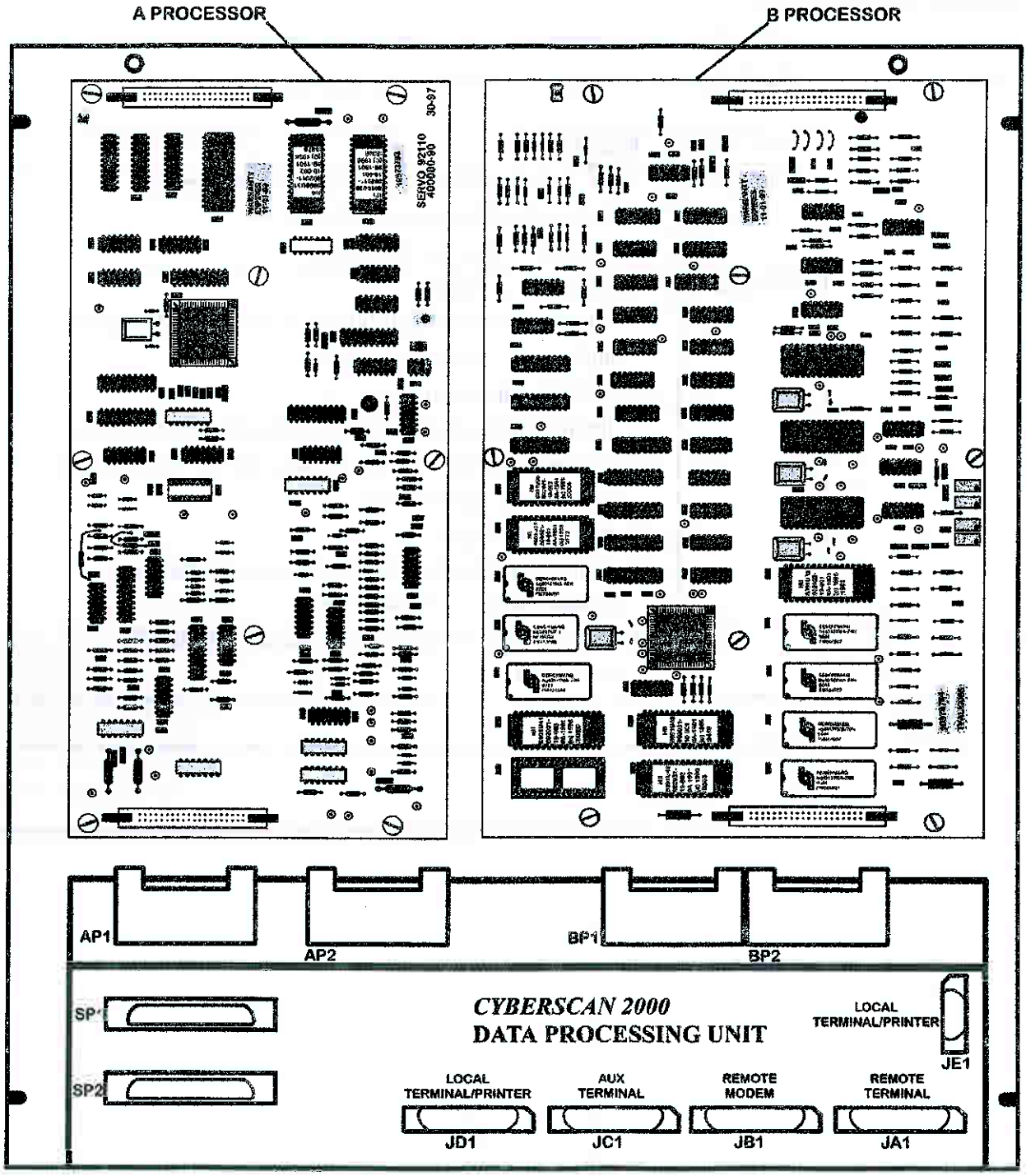


Figure 12-18 A and B processors and C board on the data processing unit.

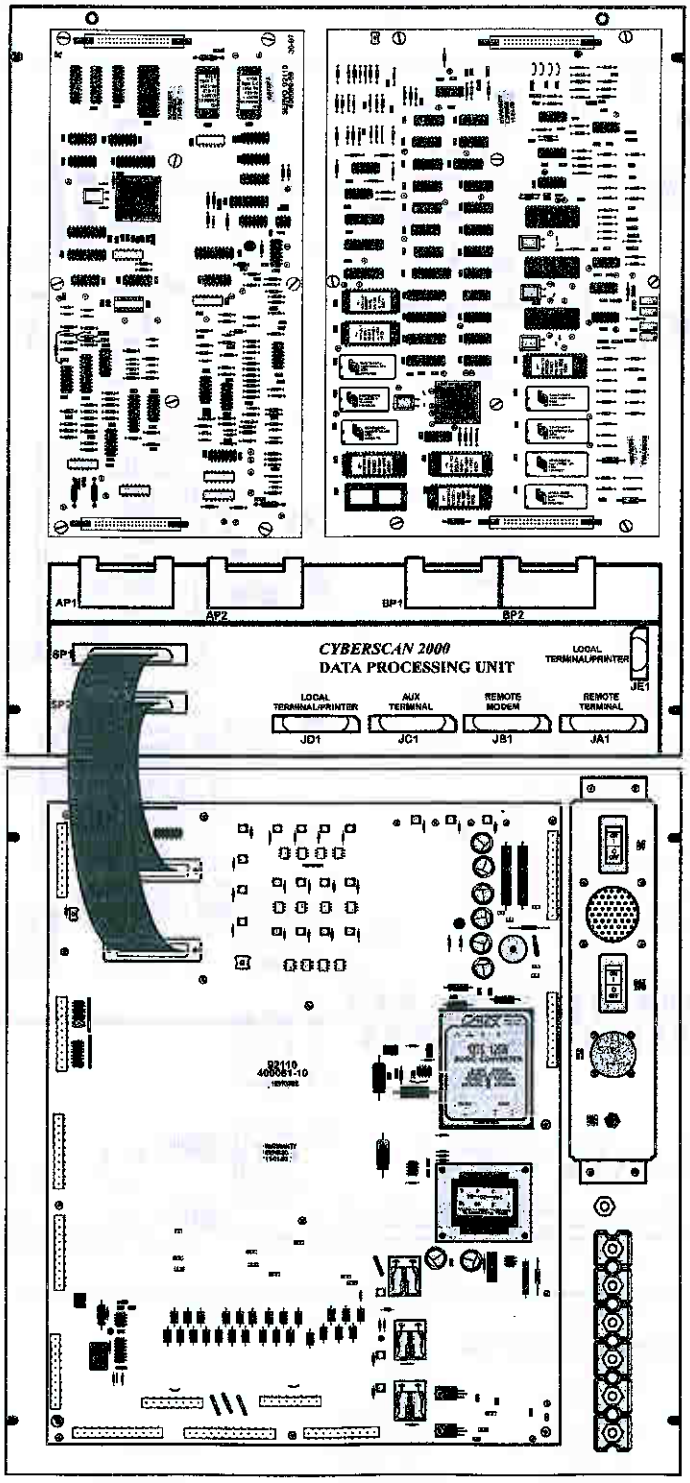


Figure 12-19 Front view of the Cyberscan 2000.

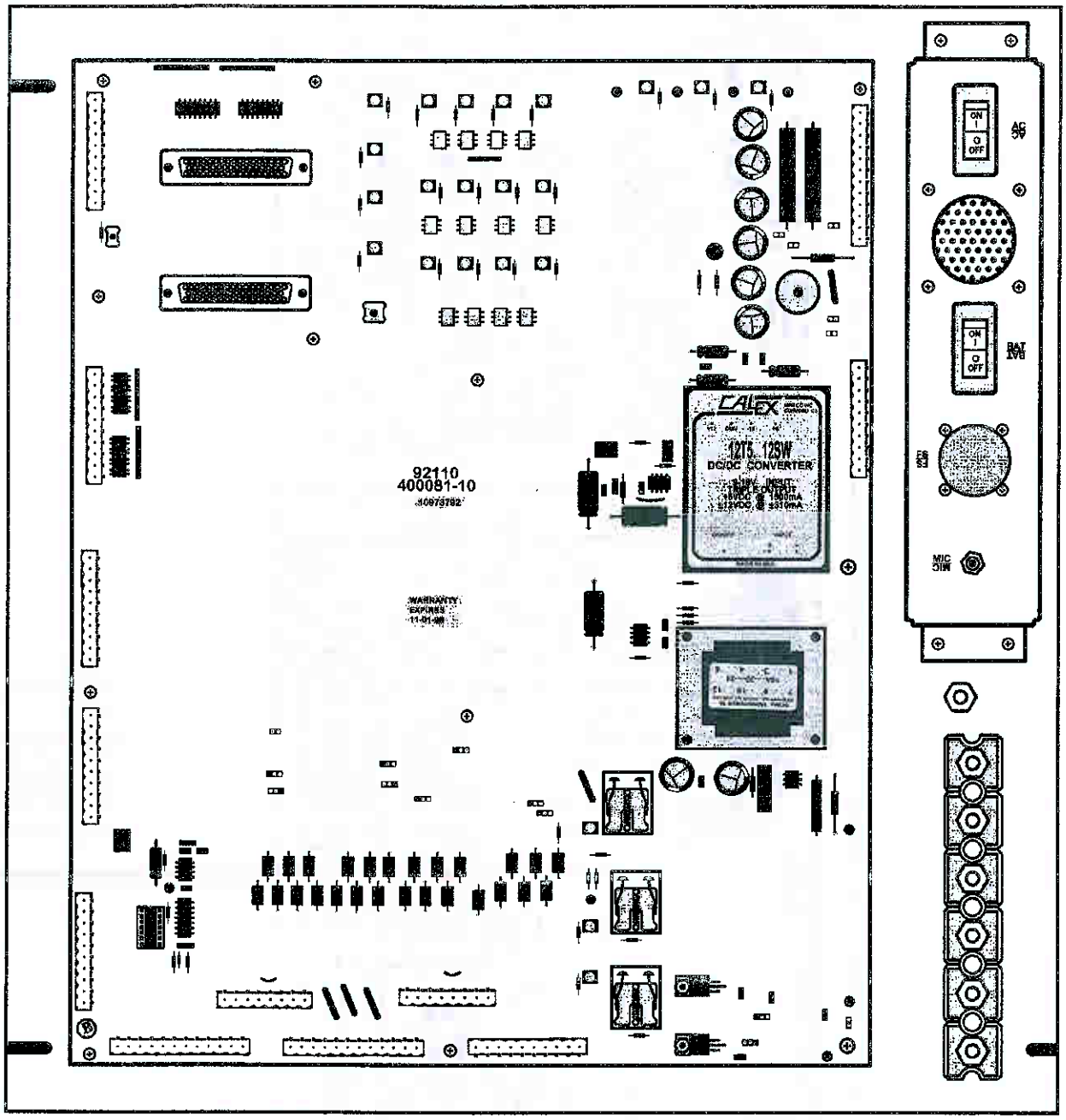


Figure 12-20 D board on the data processing unit.

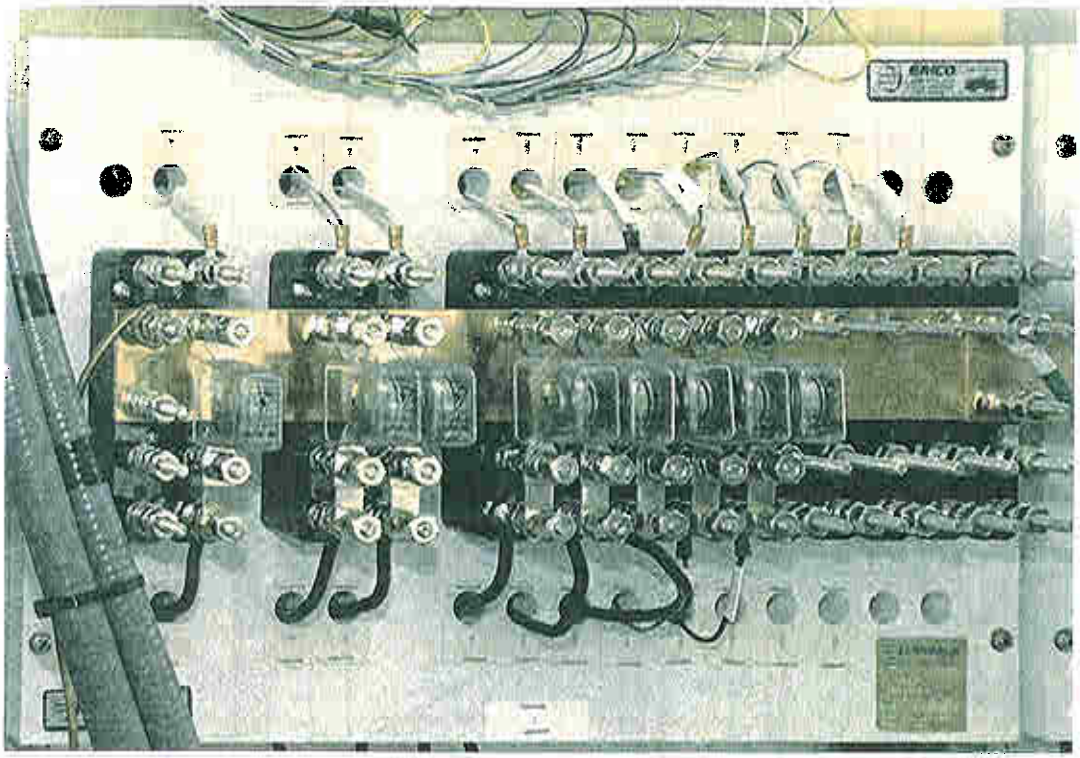


Figure 12-21 Close-up of arrestor panel connections.

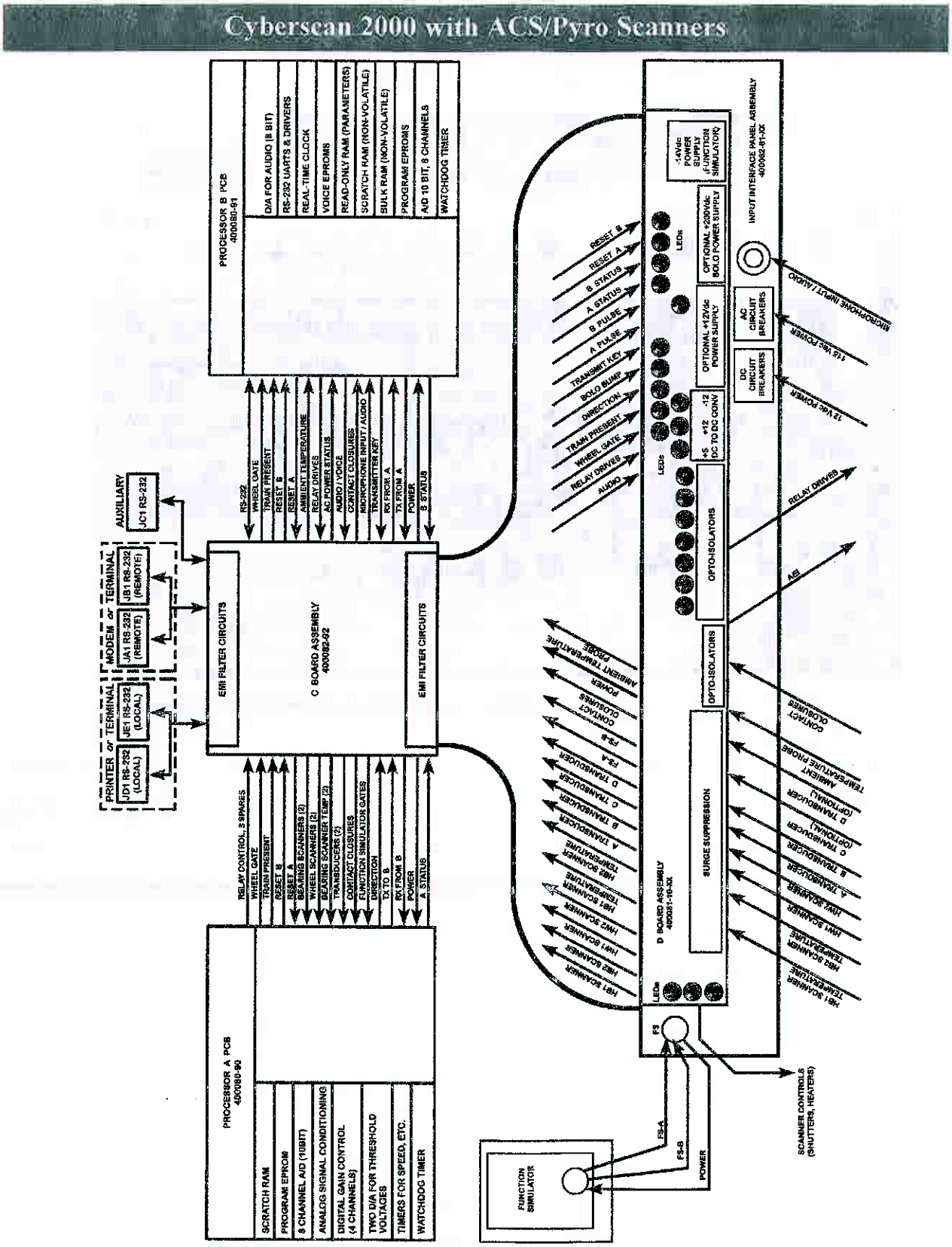


Figure 12-22 Cyberscan 2000 block diagram.

Components, *continued*

Trackside Devices

The following trackside devices are used by the Cyberscan 2000:

- two transducers for wheel gating
- two pyrometer-based scanners for sensing bearing temperature
- dragging equipment assembly
- track circuit

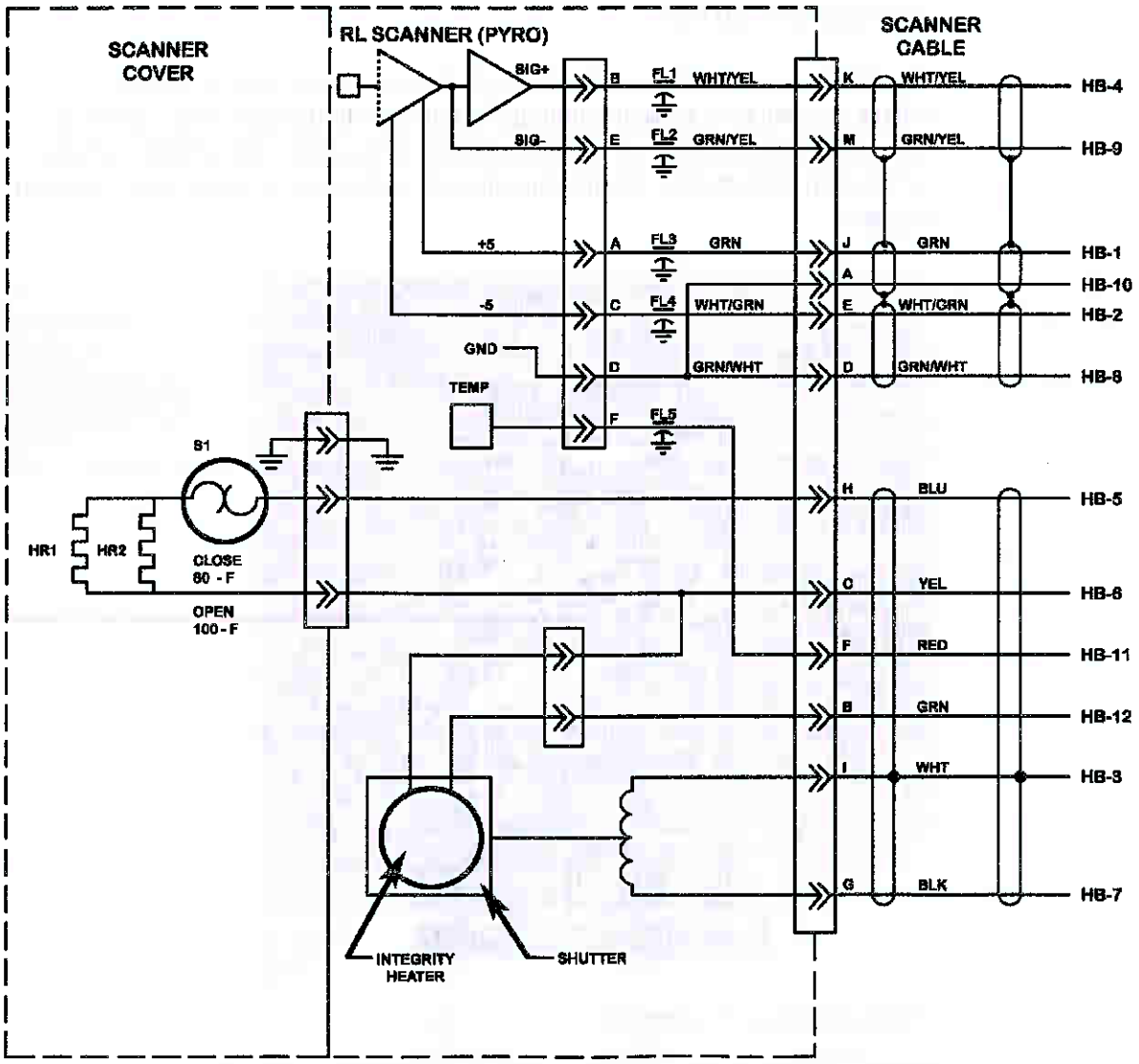


Figure 12-23 Diagram of the pyrometer-based scanners.

Components, continued

Track Circuit

The EPIC III™ is an audio frequency, two-wire series type overlay track circuit. Any train present or other shunt is detectable within an adjustable zone of 30 to 500 feet. It is designed to operate a normally de-energized relay (250-2000 ohms).

The EPIC III™ assembly contains a transceiver factory tuned to operate at a given frequency from 8.2 kHz to 20.0 kHz. The equipment is designed to be powered from a nominal 10 or 12 volt case battery and will normally draw approximately 250 mA.

The EPIC transmitter is coupled through the rails to the receiver section whenever a shunt is present within the shunt zone of the unit. The positive and negative track wires are connected to the transmitter and receiver sections of the unit, respectively. Connection to each rail should be made with minimum stagger.

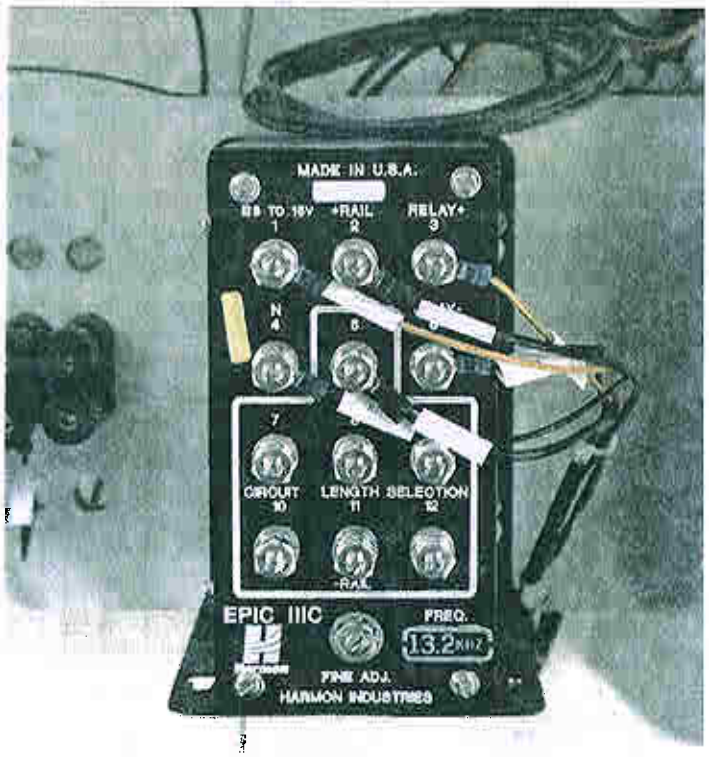


Figure 12-24 Epic III transmitter.

Components, *continued*

Adjusting the Track Circuit

Follow these steps to adjust the EPIC III:

Step	Action
1	Turn the FINE ADJ on the front panel fully clockwise.
2	Place a shunt at the desired end of the shunt zone.
3	Connect the negative rail wire to terminal 5. **Note:** If the relay fails to energize, disconnect the wire and reconnect it successively to terminals 7 through 12 until the relay energizes.
4	Turn the FINE ADJ slowly counterclockwise until the relay becomes de-energized.
5	Move the shut inward 5 feet; the relay should energize. **Note:** Once this adjustment is made, the initial shunt point will normally vary no more than 10% of the desired shunt zone length due to ballast changes. No further adjustments are required.

EPIC III Specs

The table below lists the system specifications:

	Specifications
Operating Voltage	Nominal: 10 or 12 volt battery Range: 8 to 15VDC
Operating current	250 mA
Transmitter output	.39 V into 1 ohm (approximate)
Frequencies available	8.2 kHz (do not use with Electro Code) 10.0 kHz 11.5 kHz 13.2 kHz 15.0 kHz 17.5 kHz 20.0 kHz
Relay output voltage	12VDC (500 ohm load)
External relay or mechanism	Coil resistance: 250-2000 ohms
Temperature range Weight	-40°F (-40°C) to +160°F (+71°C) 3 ½ pounds

Components, continued

D Board Controls and Indicators

The following controls and indicators are located on the D board:

Item	Part	Function
1	R63	Variable resistor for adjusting the bias offset for hot wheel detector number 2 when a bolometer is in use.
2	R56	Variable resistor for adjusting the bias offset for hot wheel detector number 1 when a bolometer is in use.
3	R49	Variable resistor for adjusting the bias offset for hot wheel detector number 2 when a bolometer is in use.
4	R41	Variable resistor for adjusting the bias offset for hot wheel detector number 1 when a bolometer is in use.
5	R7	Variable resistor for adjusting the output of power supply PS2 (+12VDC).
6	DS8, A2	LED lights **yellow** when the A spare relay drive number 2 is energized.
7	DS11, A3	LED lights **yellow** when the A spare relay drive number 3 is energized.
8	DS7, A1	LED lights **yellow** when the A spare relay drive number 1 is energized.
9	DS15, B4	LED lights **yellow** when the B spare relay drive number 4 is energized.
10	DS16, B3	LED lights **yellow** when the B spare relay drive number 3 is energized.
11	DS17, B2	LED lights **yellow** when the B spare relay drive number 2 is energized.
12	DS14, B1	LED lights **yellow** when the B spare relay drive number 1 is energized.
13	DS12	Led lights **green** when power is applied to the scanner shutters.
14	DS10	LED lights **green** when power is applied to the integrity heaters.
15	DS9, BOLO BUMP	LED flashes **green** when any bolometer-equipped scanner is being tested.

continued on next page

Components, continued

D Board Controls and Indicators, *continued*

Item	Part	Function
16	DS20, TP	LED lights **green** when the system detects a train present at the site.
17	DS21, WG	LED flashes **green** when wheel gate is on.
18	DS13, DIR	LED lights **green** when the train currently passing the site is traveling in the normal direction.
19	DS5, XMIT	LED lights **green** when the transmitter key is energized.
20	DS22, RESET B	LED flashes **red** when processor A is resetting processor B.
21	DS19, STAT B	LED flashes **red** when processor B is operating in its program.
22	DS18, STAT A	LED flashes **red** when processor A is operating in its program.
23	DS23, RESET A	LED flashes **red** when processor B is resetting processor A.
24	DS2, +5V	LED lights **red** when +5VDC is available.
25	DS1, -12V	LED lights **red** when –12VDC is available.
26	DS3, +12V	LED lights **red** when +12VDC is available.
27	DS4, +24V	LED lights **red** when +24VDC is available.
28	DS6	LED lights **red** when power is applied to the scanner case heaters
29	CB1	Circuit breaker protects AC circuits.
30	CB2	Circuit breaker protects DC circuits.
31	S1, RESET	Momentary push-button switch. Pressing S1 applies a reset signal to both processors.
32	S2 (EVENT)	Momentary push-button switch. Pressing S2 inputs information to processor B (to be determined by software).
33	R70	Volume control for speaker LS1.

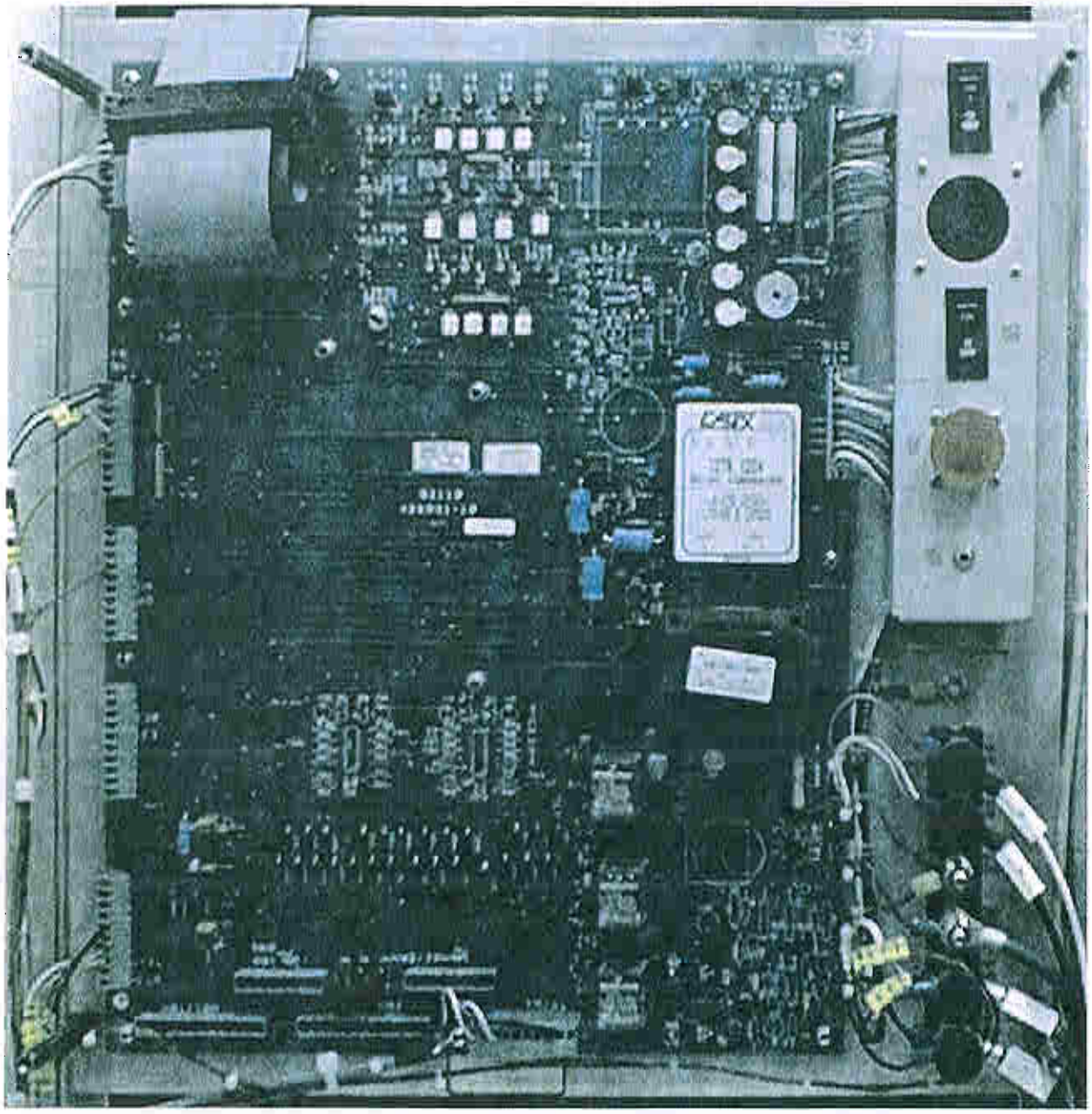


Figure 12-25 Cyberscan D Board.

Advanced Concept Scanner (ACS/Pyro)

Scanner

The Advanced Concept Scanner (ACS) is capable of viewing a variety of roller bearing assemblies. It is secured to the rail using a ISO-clamp shock and vibration assembly. Mounting the scanner closer to the rail improves scanning performance. The ACS/Pyro Scanner operates at plus and minus 5VDC.

WARNING! Do not interchange pyrometer pre-amps with bolometer pre-amps.

The ACS has the following features:

- cant cam clamp
- removable scanner cable with positive locking connector
- optic system with rotary lens focusing
- aperture shutter mechanism
- replaceable cover heaters

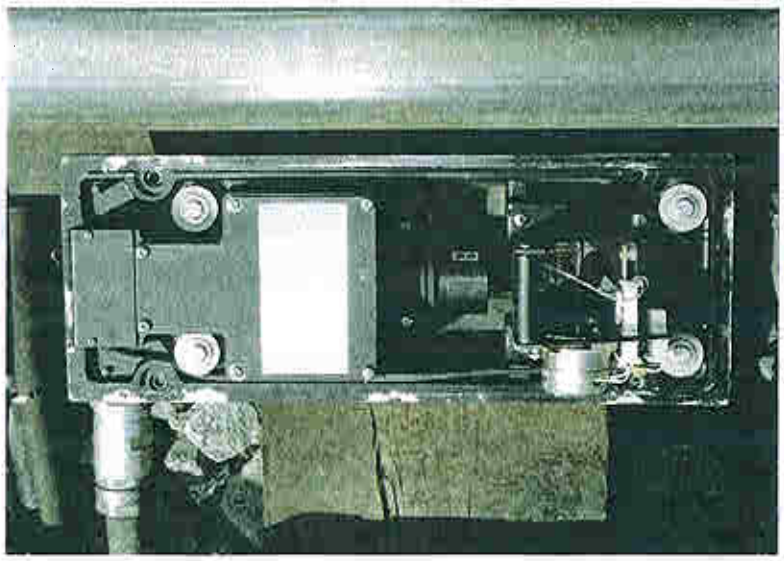


Figure 12-26 Top view of the ACS/Pyro scanner.

Troubleshooting

Chapter Overview

Purpose

This chapter provides guidelines for troubleshooting defect detector equipment.

Scope

This chapter covers the following topics:

- Standard Troubleshooting Procedure
- Troubleshooting
- Transducer Troubleshooting
- Train Movement

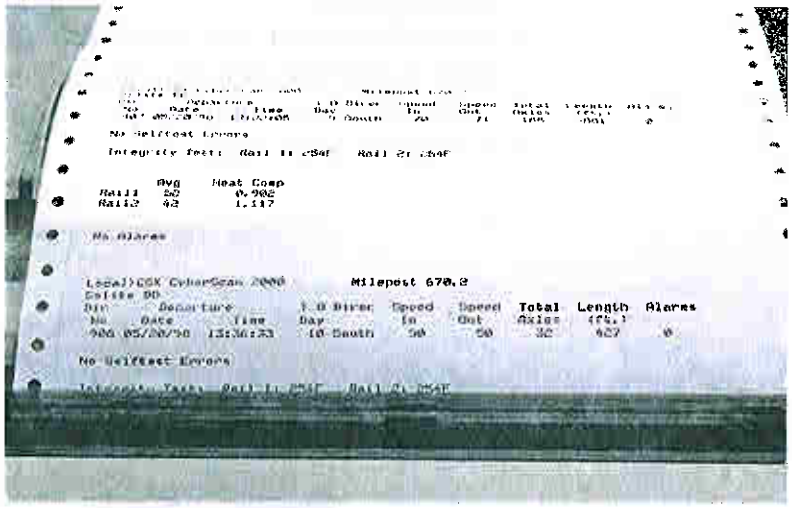


Figure 12-27 Maintainer train data.

Standard Troubleshooting Procedure

Introduction

CSXT's Quality Action Council has adopted a standard troubleshooting procedure to ensure a systematic approach to all problems relating to defect detector equipment.

Standard Procedure

The standard troubleshooting procedure is listed below:

Step	Action
1	Identify the trouble symptom. a) Get as much information as possible from the train crew or dispatcher. b) Perform a visual inspection.
2	Sectionalize the problem. a) Look at the rail or trackside equipment related to signal input. b) Check the Cyberscan system units related to signal outputs. c) Check the train directory for Warnings & Failures Directory on the DIU. d) Review the event log for error/event codes.
3	Localize the problem. a) Check input and system voltages. b) Refer to the logbook for previous voltage readings. c) Run Sim train and Ramp test.
4	Isolate the problem to locate the faulty circuit by: • checking multimeter readings. • doing a thorough visual inspection. • swapping boards.
5	Repair the problem.
6	Perform an operational check. Do not assume that finding one fault repairs the equipment.

Troubleshooting

System Help

System Help is available on the DIU by typing H at the local prompt then pressing ENTER.

Result: Help screen will display.

Self Test

The Cyberscan 2000 performs a post-train self-test. This test can also be performed manually. Additionally, the DPU is capable of testing the entire system under software program control. If the system is equipped with a printer, self test results for a previous train or trains can be seen on the printed output. On the Data Inquiry Unit request a print by typing: SE, space, and the train number at the local prompt. Example: SE 520

Directory of Alarming Trains

The DIU is used in troubleshooting to display a directory (list) of trains with alarms. Follow these steps to display the directory:

Step	Action
1	Type: DIR (*space*) A Example: DIR A
2	Press ENTER.

Example

The table below shows what the Directory of Alarming Trains inquiry looks like.

```
Local>dir A
Directory of Alarming Trains

Trn     Departure        T O  Dir  Axle    In    Train R11 R12 Ch Slf Alm
ID      Date      Time   Day                Spd Lngth Avg Avg St Tst Cnt
3     04/10/XX 2:58:48     5 Rev    220    60    5048 32  30  6  P   1*
2     04/09/XX 1:15:00     2 Norm   256    59    5785 70  62  6  P   1*
1     04/09/XX 12:38:36    1 Norm   258    40    3975 45  39  6  P   1*
```

Troubleshooting, continued

Processor B System Events/ Errors & Causes

Test results that show system failures are as follows:

Event	Data	Description	
20		BAD_EVENT_ID	
21		ALM_MSG_RECEIVED	
22		COMPLETED_ALM_MSG	
23		SELFTEST_COMPLETE	
24		FAILED_SELFTEST	
	0	POST_TRAIN_TEST	
26		FORGET ISSUED	
27		PROCB_SHUTDOWN	
28		PROCB_INIT	
29		PARAMS_INITIALIZED	
2A		PERIODIC_TEST	
	0	PT_START	
	1	PT_COMPLETE	
	2	PT_A_SAID_BUSY	
	3	PT_TP_ON	
2B		RECEIVED_TRAIN_DATA	
	0	RCVD_SUMMARY	
	1	RCVD_END_OF_TRN	
2C		REQUEST TO REPEAT POST TRAIN DATA	
2D		MESSAGE DURING TP	

continued on next page

Troubleshooting, continued

Processor B System Events/Errors & Causes, *continued*

Event	Data	Description	
30		XMISSION_RESET	
31		RECEIVE_RESET	
32		INTERFACE_TEST_FAILED	
	0	GOT_NOK	
	1	MISMATCH	
	2	IF_TIMEOUT	
33		PARAMS_NOT_ACCEPTED	
34		INAPPROPRIATE_RESPONSE_FROM_A	message probably out of sync
35		WAITING_TO_XMIT	
	0	RESPONSE_WAITING	
	1xxxx	MSG_WAITING	
	xxxx	ID of Waiting Message	
36		B_RESET_A	
	0	RESET_A_NOKS	
	1	RESET_A_BUSY_NO_TRAIN	Proc A sent back incorrect BUSY msg
	2	RESET_A_BAD_MSGS	Processors out of sync
	3	RESET_A_NO_RESPONSE	No response, reset Processor A
	4	RESET_A_TP_TOO_LONG	Train Preset too long, reset Proc A

continued on next page

Troubleshooting, continued

Processor B System Events/Errors & Causes, *continued*

Event	Data	Description	
	5	TP_TOO_LONG_DUR_INITTP	too long, comm. never established
	6	RESET_COMMAND	deliberate reset via keyboard
	7	DAILY_RESET	deliberate daily reset
	8	PROCA_FAILURE_POST_TRNA	reset after failing post train test
	9	FAILED_INTERFACE_TEST	no response to 1 min interface test
37		B_RESET_B	
	0	RESET_B_NOKS	
	1	RESET_B_BUSY_NO_TRAIN	Proc B sent back incorrect BUSY msg
	2	RESET_B_BAD_MSGS	Processors out of sync
	3	RESET_B_NO_RESPONSE	No response, reset Processor B
	4	RESET_B_TP_TOO_LONG	Train Preset too long, reset Proc B
	5	TP_TOO_LONG_DUR_INITTP	too long, comm. never established
	6	RESET_COMMAND	deliberate reset via keyboard
	7	DAILY_RESET	deliberate daily reset
	8	PROCA_FAILURE_POST_TRNB	reset after failing post train test
	9	FAILED_INTERFACE_TEST	no response to 1 min interface test

continued on next page

Troubleshooting, *continued*

Processor B System Events/Errors & Causes, *continued*

Event	Data	Description	
39		INPUT_BUFFER_OUT_OF_SYNC (correction made)	
3A	UART#	UART_HANGUP 1=Remote, 2=Local, 3=Aux	
3B		PASSWORD_DENIED	
	1	PASS1	
	2	PASS2	
3C		CHANGED_TEXT	
3D		CHANGED_BYTE	
	xxxx0	xxxx=byte address, yy=new value	
	0yy		
3E		CHANGED_WORD	
	xxxxy yyy	xxxx=byte address, yyyy=new value	
3F		CHANGED PARAMETER	
	xxyyz zzz	xx=param group (ASCII), yy=param id, zzzz=new value	
40		LOST_AC_POWER	
41		AC POWER OK FOR FULL MINUTE	
42		PARAMETER_CORRUPTION	
	1	BACKUP_BAD	
	2	RECOVERED_FROM_BACKUP	
	3	DEFAULTS_WRITTEN	

continued on next page

Troubleshooting, continued

Processor B System Events/Errors & Causes, *continued*

Event	Data	Description	
44		INCORRECT_TALKER_OP_NUM	
45		RESET_DURING_POST_TRAIN_TALKER	
46		NO_POST_TRAIN_TALKER_MESSAGE	
	0	MEMORY_FAILURE	
	2	MEMORY OK	
	3	SAID INTEGRITY FAILURE	
47		NO POST TRAINANALYSIS	
	0	MEMORY_FAILURE	
	1	HEAT_COMP_OVER_LIMIT	
	2	TOO_SHORT_FOR_HEAT_COMP	
48		ALARM_DIRECTORY_STORAGE_FAILURE	
49		RETRIEVAL_ERROR	
	FF	AUTOSUMMARY_FAILURE	
4C		MODEM EVENT	
	xxxxy	yy=which try, zz=response	
	yzz		
4D		MODEM INITIALIZATION	
	xxxxy	yy=which try, zz=response	
	yzz		

continued on next page

Troubleshooting, continued

Processor A System Events/Errors & Causes

Event	Data	Description	
50		AUX WENT HIGH TO LOW	
			the data field provides the affected bit
58		AUX WENT LOW TO HIGH	
			the data field provides the affected bit
60		CLEAR_EVENT=SYS_EVENTS	
61		BLANK_EVENT	
62		SY_UNDEFINED_OPCODE	
63		SY_TRAP	
64		SY_EXTINT	
65		SY_SLEEP66STACK_OF67A2D_OFF	
68		TRAIN_AQUISITION_DISABLED	
69		IP_BAUD_CHECK	
6A		IP_BAUD_CONNECT	
6B		IP_BAUD_CHANGE	
6C		RX_NOK_FROM_B	
6D		RX_RESPONSE_TIMEOUT	
6E		RX_RETRY_FAIL	
6F		RX_NON_RESPONSE	
70		RX_2ND_NON_RESPONSE	
71		RX_INVALID_MSG	
72		RX_CHECKSUM_FAIL	

continued on next page

Troubleshooting, continued

Processor A System Events/Errors & Causes, *continued*

Event	Data	Description	
73		HELLO_B	
74		MSG_FROM_A	
75		REQUEST_FROM_B	
76		INVALID_PARAM_TYPE	
77		A_RESET_B	
78		A_COLD_START	
79		A_WARM_START	
7A		A_PARAM_FAIL	
7B		SELFTEST_DENIED	
7C		STATUS_ABORTED	3 Train Present
7D		A_CALIBRATE_ON	
7E		A_CALIBRATE_OFF	
7F		MINIMUM_CALIB_FAIL	
80		EFS_ON	
81		TRACK_CIRCUIT_TRIP	1Engage
			2 Disengage
82		NEW_TRAIN	0 Normal
			1 Reverse
			2 Unknown (TC)
83		TIMEOUT_120FT	
84		TIMEOUT_AUX_STOP	
85		TRAIN_STOPPED	
86		RESET_UNDER_TRAIN	
87		TRAIN_OVER	

continued on the next page

Troubleshooting, continued

Processor A System Events/Errors & Causes, *continued*

Event	Data	Description	
88		XDCR_EVENT	0 Second CD Timeout
			1 First AB Timeout
			2 Close Timeout
			3 Zero A
		xxxx	B Count
			4 Zero B
		xxxx	A Count
89		MINIMUM_AXLE_FAIL	
8A		RAMP_TRAIN	
8B		SIM_TEST_TRAIN	
8C		DATA_OVERFLOW	
8D		REJECTED_SPEED_ESTIMATES	

Troubleshooting, continued

Troubleshooting Chart

The chart below lists typical problems encountered by the Cyberscan along with possible causes and actions:

Problem	Possible Cause and/or Action
Rail 1 integrity failure	Cause: shutter heater inoperative. Action: Check the shutter assembly.
Rail 2 integrity failure	Cause: shutter heater inoperative. Action: Check the shutter assembly.
Rail 1 & 2 integrity failure	Actions: Check the following: • AC input to D board • K2 relay and DS12 LED • K4 relay and DS10 LED
No dragging equipment	Actions: Check the following: • dragger switch • cabling • K802 on the Relay Panel
Milepost information incorrect	Action: Check parameter D4 on the DIU and adjust accordingly.
Unstable calibration	Causes include: • faulty simulator • improper use of the simulator • faulty scanner or cabling • pre-amp • D board • A processor

continued on the next page

Troubleshooting, continued

Troubleshooting Chart, *continued*

Cover heaters off	Actions: Check the following: • faulty thermostat • CB1 circuit breaker, DS6 LED, and K3 relay located on D board • constant train presence (check LED DS20) • faulty heater
Erratic heat signal, one scanner only	Actions: Check the following: • scanner alignment • scanner loose • loose wires • bad pre-amp • foreign material in the scanner or pre-amp housing • feed-through capacitor in scanner • spikes, tie plates, rail anchors, or other metallic object in contact with scanner
Heat level high - one side	Causes include: • defective scanner • faulty calibration • improper alignment
Heat level high - both sides	Cause: faulty plus or minus 5 volt power supply.
False alarms relative to heat *(false firing)	Causes include: • scanner cap and wiring (check all pertinent wiring) • improper calibration • loose cable connectors (check pertinent connectors) • power supply noise

continued on the next page

Troubleshooting, continued

Troubleshooting Chart, *continued*

No heat, one scanner only during train	Actions: Check the following: • alignment • missing plus or minus 5VDC • alignment mirror cap on lens • broken lens or mirror assembly • shutter inoperative • foreign material in scanner or pre-amp housing • feed through capacitor in scanner • scanner cable, D board, or A processor board
No heat signal or erratic heat signal, both rails	Actions: Check the following: • voltages of plus or minus 5VDC • shutter drive relay K2 and indicator LED DS12 • transducers
Missing or excessive wheel counts, erratic train presence, erratic heat on both rails, all zero heats, or bad transducer message	Action: Check the following: • A and B transducers • A processor board • D board
Incorrect or missing data on DIU or printer	Actions: Check the following: • baud rate on applicable communication port on the C board • defective B processor • defective DIU or printer • defective cable

Transducer Troubleshooting

Transducer Problems To check the transducer, follow these steps:

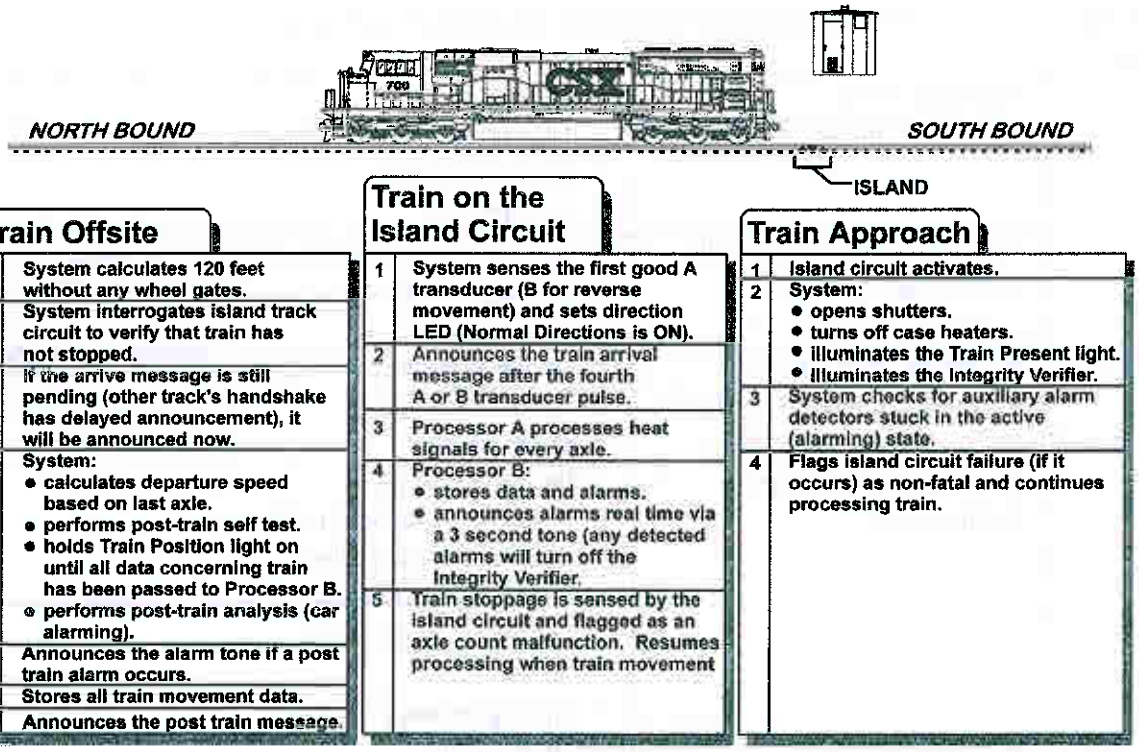
Step	Action
1	Connect a voltmeter across the transducer terminals in the junction box and/or arrestor panel.
2	Attach the positive lead to the black wire and the negative lead to the white wire.
3	Set the voltmeter on the low DC voltage scale.
4	Insert a metal object into the transducer's magnetic field. Result: Insertion of the metal object should result in a positive meter movement. (Retraction of the object should result in a negative deflection.)
5	If no meter movement is indicated in the above test, check for an open transducer coil using an ohmmeter. The transducer should read approximately 600 ohm.

Train Movement

Process

The following illustrates how the Cyberscan 2000 processes a train during these three stages as a train:

- approaches
- occupies the island circuit
- moves offsite



Train Movement, *continued*

Arrival Message

The table below lists arrival messages:

Message Name	Announcements
Train arrival	• ¼ second tone • header message

Post Train Messages

The Cyberscan 2000 post train messages are as follows.

Message Name	Announcements
No alarms and self test passes	• header message "no defects" • closing message • tail message
No alarms and self test fails (after train)	• header message "hot box detector malfunction." • closing message • tail message
No alarms with equal heat test and integrity test fails	• header message "hot box detector malfunction" • closing message • tail message
No alarms and multiple malfunctions	• header messages: • dragging equipment malfunction • high load malfunction • wide load malfunction • hot wheel malfunction • no defects • closing message • tail message
Alarms present and self test passes	• header message • alarms message • closing message • tail message
Alarms and integrity heater test fails	• header message • alarms message "more defects, check train" • closing message • tail message

continued on next page

Train Movement, continued

Post Train Messages *(continued)*

Alarms and axle count malfunction	• header message • alarms message "axle count malfunction, check train" • tail message
Alarms and train stopped on detector	• header message • alarms message "axle count malfunction, check train • tail message
Excessive alarms	• header message • alarms message "more defects, check train" • closing message • tail message

Other Messages

The table below lists other messages:

Message Type	Announcement
Header message	• CSX Equipment Defect Detector • Milepost xxx Point x [NSEW] Track
Alarms message	• 1 - 10 Hot Box Axle xxx [NSEW} Rail • 1 - 10 Dragging Equipment Near Axle xxx • 1 - 10 Hot Wheel Near Axle xxx • 1 - 10 Wide Load Near Axle xxx [NSEW} Rail
Closing messages (parameter selectable)	• Length of Train xxxx • Speed xxx • Total Axles xxx
Tail message	• End of Transmission