SIEMENS

SERVICE MANUAL

NS BACKHAUL FOR ARGUS AND SEAR II/IIi

MAY 2021

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VERSION A

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DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	05/11/2021	N/A	Initial Release

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NOTES, CAUTIONS, AND WARNINGS

Throughout this manual, notes, cautions, and warnings are frequently used to direct the reader's attention to specific information. Use of the three terms is defined as follows:

<table>
<tr><td>⚠ WARNING</td><td>**WARNING**

INDICATES A POTENTIALLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY. WARNINGS ALWAYS TAKE PRECEDENCE OVER NOTES, CAUTIONS, AND ALL OTHER INFORMATION.</td></tr>
</table>

<table>
<tr><td>⚠ CAUTION</td><td>**CAUTION**

REFERS TO PROPER PROCEDURES OR PRACTICES WHICH IF NOT STRICTLY OBSERVED, COULD RESULT IN A POTENTIALLY HAZARDOUS SITUATION AND/OR POSSIBLE DAMAGE TO EQUIPMENT. CAUTIONS TAKE PRECEDENCE OVER NOTES AND ALL OTHER INFORMATION, EXCEPT WARNINGS.</td></tr>
</table>

<table>
<tr><td>NOTE</td><td>**NOTE**

Generally used to highlight certain information relating to the topic under discussion.</td></tr>
</table>

If there are any questions, contact Siemens Mobility, Inc. Application Engineering

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

Static electricity can damage electronic circuitry, particularly low voltage components such as the integrated circuits commonly used throughout the electronics industry. Therefore, procedures have been adopted industry-wide which make it possible to avoid the sometimes invisible damage caused by electrostatic discharge (ESD) during the handling, shipping, and storage of electronic modules and components. Siemens Mobility, Inc. has instituted these practices at its manufacturing facility and encourages its customers to adopt them as well to lessen the likelihood of equipment damage in the field due to ESD. Some of the basic protective practices include the following:

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- Remove power from card cages and assemblies before removing or installing modules.
- Remove circuit boards (modules) from card cages by the ejector lever only. If an ejector lever is not provided, grasp the edge of the circuit board but avoid touching circuit traces or components.
- Handle circuit boards by the edges only.
- Never physically touch circuit board or connector contact fingers or allow these fingers to come in contact with an insulator (e.g., plastic, rubber, etc.).
- When not in use, place circuit boards in approved static-shielding bags, contact fingers first. Remove circuit boards from static-shielding bags by grasping the ejector lever or the edge of the board only. Each bag should include a caution label on the outside indicating static-sensitive contents.
- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.
- Use integrated circuit extractor/inserter tools designed to remove and install electrostatic-sensitive integrated circuit devices such as PROM's (OK Industries, Inc., Model EX-2 Extractor and Model MOS-40 Inserter (or equivalent) are highly recommended).
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

For information concerning ESD material applications, please contact the Technical Support Staff at 1-800-793-7233. ESD Awareness Classes and additional ESD product information are also available through the Technical Support Staff.

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GLOSSARY

TERM	DESCRIPTION
ATCS	<u>Advanced Train Control System</u> – A set of standards compiled by the AAR for controlling all aspects of train operation.
CDL	<u>Control Description Language</u> - CDL is the language used to generate application programs for the SEAR II/IIi and the Argus.
IP	<u>Internet Protocol</u> - Usually tied with TCP.
NS	<u>Norfolk Southern Railway</u>
SIN	<u>Site Identification Number</u> – The 12-digit ATCS address for the SIN has the form 7.RRR.LLL.GGG.SS stored in binary coded decimal, with each digit in one nibble. The digit 0 is represented by "A" and 0 is used as a null byte.
TCP	<u>Transmission Control Protocol</u> - Usually tied with IP. The internet protocol used to connect a world-wide inter-network of universities, research laboratories, military installations, organizations, and corporations. The TCP/IP includes standards for how computers communicate and conventions for connecting network and routing traffic.
UDP	<u>User Datagram Protocol</u> - A transport protocol used primarily for the transmission of network management information. Not as reliable as TCP.
VHF	<u>Very High Frequency</u> – radio wave range.
WAMS	<u>Wayside Alarm Management System</u> - Siemens application software that runs in the office environment to manage alarms and other data generated in the field by Event Recorders.

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SECTION 1 **INTRODUCTION**

1.0 PURPOSE

This manual provides installation information and operating instructions for the A80311 Argus, A80273 SEAR II, and the A80410 SEAR IIi event recorders when used in the NS VHF backhaul system. The information is essential to proper system operation and problem diagnosis. It is strongly recommended that each system operator/maintainer become familiar with the information provided herein before attempting to program, calibrate, or troubleshoot these systems.

1.1   APPLICABLE DOCUMENTS

The following documentation is associated with these products and may be used for reference purposes.

Table 1-1   Reference Documents

Component	Manual Title	Document Number
SEAR II Event Analyzer Recorder, A80273	Installation and Operation Manual	SIG 00-02-07
Argus Event Recorder, A80311	Installation and Operation Manual	SIG-00-06-05
GCP 5000 SEAR IIi Internal Event Recorder, A80410	Field Manual	SIG 00-19-03
Event Recorders: • A80273 SEAR II • A80311 Argus • A80410 SEAR IIi	NS Backhaul Service Manual	SIG-00-20-06

1.2   SCOPE

The event recorders implement a VHF radio protocol compatible with the existing NS VHF backhaul system, which is designed to efficiently manage access to the shared VHF channel. The protocol includes a retry mechanism to re-deliver lost or corrupted packets, a multi-packet transfer mechanism to efficiently deliver higher volumes of data, and an automatic mute mechanism to reduce packet collisions.

The event recorders use the VHF radio communication system to transport ATCS messages. The Argus can also transport the same ATCS messages over a network using UDP. Network connectivity of the Argus is not covered in this manual.

The following figure shows an overview of the VHF communication system.
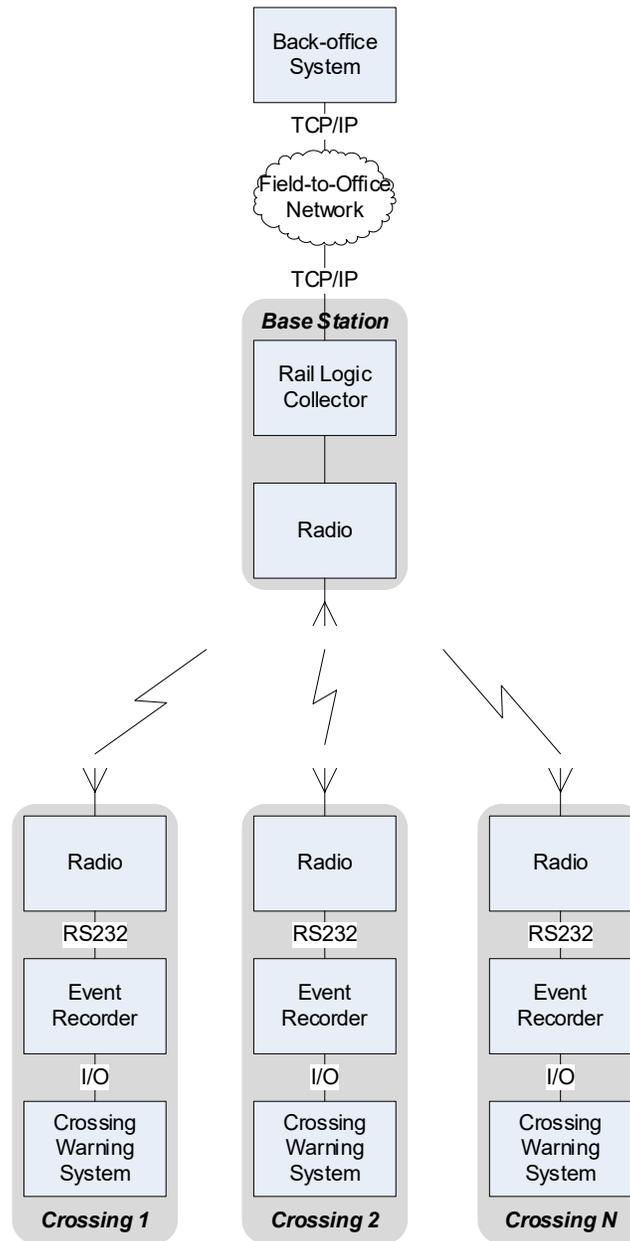
Figure 1-1   Rail Logic Communication Overview

The event recorders report the following information to the back-office:

- Alarm conditions
- Event log entries (when requested)
- Health status
- Configuration settings
- Echelon® devices version information (when requested)
- I/O status (when requested)

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In addition, the back-office system may send the following to the event recorders:

- System time
- New configuration settings
- Reset request
- Event log request
- I/O status request
- Echelon® device software version request
- New CDL file/Remove CDL file
- CDL Q&A answers
- CDL compile request

For details on the available messages, message formats, and the WAMS ATCS protocol, refer to the **WAMS protocol specification, document number 21S0065**.

1.3   INSTALLATION AND WIRING

1.3.1   SEAR II and SEAR IIi

The AUX port of the SEAR II and the SEAR IIi is connected to the Kenwood NX-700 radio using the 26778 cable. The schematic diagram of the 26778 cable is shown in the following figure.
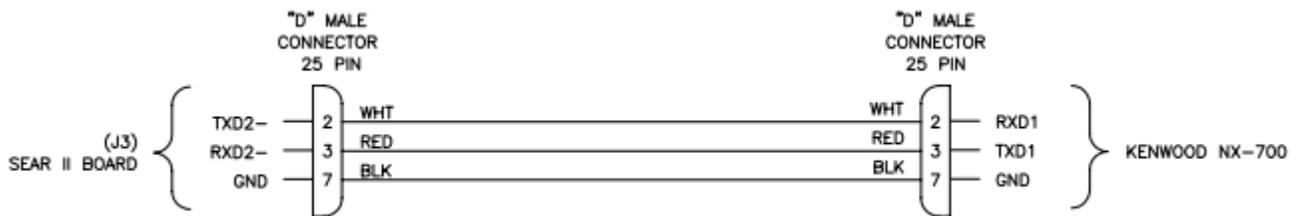

Figure 1-2   26778 Cable

1.3.2   Argus

The Laptop serial port of the Argus is connected to the Kenwood NX-700 radio using the 26782. The schematic diagram of the 26782 cable is shown in the following figure.
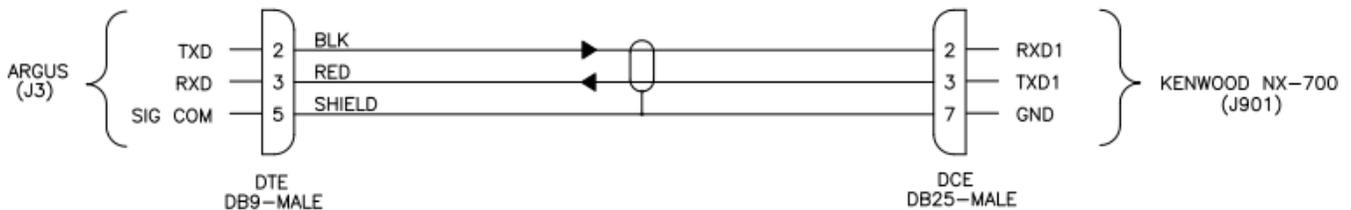

Figure 1-3   26782 Cable

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NOTE

The event recorder must be connected to the Kenwood NX700 radio while the radio is powered off. Once the radio is connected to the event recorder, the radio can be turned on. That is necessary for the radio to enable transparent data mode, which is the mode used for this system.

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SECTION 2   **SEAR II/IIi**

2.0 SEAR II AND SEAR IIi PRODUCTS

The information in this section applies to both the SEAR II and SEAR IIi products. They will be referred to as the SEAR in this section.

2.1   SEAR RAIL LOGIC COMMUNICATION SETTINGS

The user edits the communication settings on the Communication screen (CTRL+L > Main Menu > Configuration > Communication).

To enable VHF backhaul communication, the user must set the "Site type" setting to "Collector" and the "Office device" setting to "Rail Logic" as shown in the following figure.
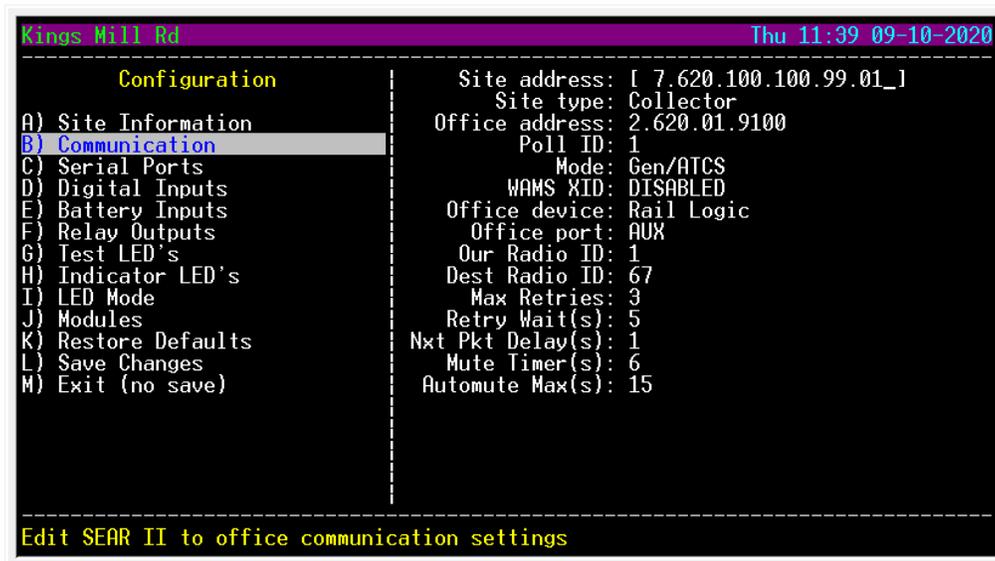

Figure 2-1   Rail Logic Communication Configuration Screen

The user may also edit the communication settings from the front panel keypad and display of the SEAR by pressing the COMM SETUP button and walking through the presented settings. The SEAR will also present the Rail Logic communication parameters during the SITE SETUP sequence.

The following table describes each setting on the Communication screen.

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Table 2-1 Communication Screen Settings

Setting	Default Value	Value for VHF Backhaul	Description
Site address	7.620.100.100.99.01	Railroad assigned	Each location must have a unique ATCS address. The ATCS address is assigned by the railroad. The SEAR will set the source ATCS address of all generated messages to this address. The SEAR will only respond to messages with a destination ATCS address that matches this address.
Site type	No Communication	Collector	The Site type must be set to Collector to enable VHF backhaul communication.
Office address	2.620.00.0000	Railroad assigned	The address of the back-office is assigned by the railroad. The SEAR will set the destination ATCS address of all generated messages to this address.
Poll ID	1	1	The Poll ID setting is not used for VHF backhaul communication. Leave it set to the default value.
Mode	Gen/ATCS	Gen/ATCS	The Mode setting is not used for VHF backhaul communication. Leave it set to the default value.
WAMS XID	DISABLED	DISABLED	The WAMS XID is a legacy message that is no longer used. The user should set this value to DISABLED.
Office device	Direct (RS232)	Rail Logic	The user must set the Office device setting to Rail Logic to enable VHF backhaul communication.
Office port	AUX	AUX	The Office port selects the physical serial port connected to the VHF radio.
Our Radio ID	1	Railroad assigned	Our Radio ID is the VHF protocol ID to assign to the SEAR. Each SEAR reporting to the same Rail Logic collector requires a unique ID, as assigned by the railroad. All VHF packets generated by the SEAR will use this value as the source ID of the packet. The SEAR will ignore all received packets with a different destination ID (unless they are broadcast packets).

Setting	Default Value	Value for VHF Backhaul	Description
Dest Radio ID	2	Railroad assigned	Dest Radio ID is the VHF protocol ID of the Rail Logic collector device the SEAR reports through. The ID of the Rail Logic collector is assigned by the railroad. All VHF packets generated by the SEAR will use this value as the destination ID of the packet.
Max Retries	3	5	When the SEAR transmits a VHF packet and it does not receive an ack, the SEAR will retry the packet. This setting selects the maximum number of times the SEAR will try the packet before discarding it.
Retry Wait(s)	5	7	When the SEAR transmits a VHF packet and it does not receive an ack, the SEAR will retry the packet. This setting selects the number of seconds the SEAR will wait before trying again.
Nxt Pkt Delay(s)	1	3	When the SEAR starts a multi-packet session with the Rail Logic collector, it will send multiple packets in a row before waiting for an ack. This setting selects how long to wait between consecutive packets in a multi-packet session. This setting also determines how long to wait after sending a single packet before sending the next packet.
Mute Timer(s)	6	6 (typically)	When the SEAR hears a VHF packet from another location, the SEAR automatically mutes for this many seconds, which allows other locations to finish transmission and receive an ack. If the SEAR receives another packet for an adjacent site while muted, it will restart the mute time. Typically, this setting can be left to the default.
Automute Max(s)	15	15 (typically)	When the SEAR automatically mutes and restarts the mute timer for packets being heard for other sites, it will only stay muted for a maximum amount of time. This setting selects the maximum amount of time the SEAR will stay muted before forcing a transmission. Typically, this setting can be left to the default.

2.2 ALARM INTERVAL RETRY

When the SEAR sends an alarm, it will wait for an acknowledgement for that alarm from the back-office. If an acknowledgement does not arrive before the Alarm Retry Interval (seconds) expires, the SEAR will send the alarm again. The SEAR will retry alarms forever. The SEAR stores alarms in battery-backed RAM so alarms are not lost across reboots.

The Alarm Retry Interval needs to be set to a large enough value to allow the lower-level transport protocols to perform the low-level retries before the application attempts the alarm again. The Alarm Retry Interval currently defaults to 3600 seconds (1 hour) but can be adjusted to customer needs.

The user edits the Alarm Retry Interval on the Site Information screen (CTRL+L > Main Menu > Configuration > Site Information) as shown in the following figure.

Figure 2-2   Rail Logic Communication Configuration, Site Information Screen

The user may also edit the Alarm Retry Interval from the front panel of the SEAR by pressing the MENU key, selecting CONFIGURATION, selecting SITE INFO, and walking through the configuration parameters. The SEAR will also present the Alarm Retry Interval during the SITE SETUP sequence.

2.3 HEALTH PERIOD (HEARTBEAT)

The SEAR sends a health message to the back-office on a configurable interval. This message is also sometimes referred to as the heartbeat message. The user may change the interval for the heartbeat message using the HyperTerminal interface. The heartbeat period may also be changed from a back-office message.

The screen to change the heartbeat interval is in the password protected menu system of the SEAR. The default password is "ssc" but may be changed by the user. To navigate to the screen, type CTRL+G > *password* > Office Debug > Heartbeat as shown in the following figure.

There are two types of heartbeat interval: Offset and Actual (time-of-day).

If the heartbeat interval type is Offset, the SEAR will send the heartbeat message once every configured interval. For example, if the time is configured as 6 hours, the SEAR will send the heartbeat message every 6 hours. The SEAR sends the first one after the user changes the heartbeat interval and shortly after startup. The SEAR adds up the configured Hours, Minutes, and Seconds for the interval.

If the heartbeat period type is Actual, the SEAR will send the heartbeat message at that specific time of day, each day. The SEAR will send the heartbeat message when the time matches the configured Hour, Minute, and Second. The SEAR will also send the heartbeat message when the user changes the heartbeat interval.

Figure 2-3   HyperTerminal Interface

2.4 TROUBLESHOOTING SEAR COMMUNICATION

If there are problems with VHF Backhaul Communication, the user can view the messages sent and received by the SEAR on the "Data Analyzer" and the "Trace Frames" screens.

2.4.1 Data Analyzer

The ATCS protocol layer packets can be viewed on the Data Analyzer screen. The user may trigger test messages, view the alarm list, and perform other troubleshooting steps on the Data Analyzer screen.

The Data Analyzer screen is in the password protected menu system of the SEAR. The default password is "ssc" but may be changed by the user. To navigate to the screen, type CTRL+G > *password* > Office Debug > Data Analyzer.

The screen will show "Enable text capturing then hit any key". If you want to capture the session to a file, now is the time to enable that in your terminal emulator. Then, press any key to start the session.

The following figure shows an example test packet and test ack from the back-office system.

```
========================================================================
10:46:51.87 SENDING (OFFICE)
            Q: 0, D: 0, Type: Inf, Priority: 7, RfAckDis: 1
        Source: 7.620.100.100.99.01   Dest: 2.620.01.9100
        Number: 68  Part: 1 of 1  Label: 788B  Len: 25
            Type: 241 (TEST PKT)

2F 00 6E 00 EA 26 2A A1 91 AA 76 2A 1A A1 AA 99  /.n..&*...v*....
A1 00 88 02 02 78 8B 04 F1                        .....x...
========================================================================


========================================================================
10:46:52.68 RECEIVED (OFFICE)
            Q: 0, D: 0, Type: Inf, Priority: 4, RfAckDis: 1
        Source: 2.620.01.9100         Dest: 7.620.100.100.99.01
        Number: 4  Part: 1 of 1  Label: 784B  Len: 25
            Type: 242 (TEST ACK)
            Route: PROCESSING

29 00 06 00 AE 76 2A 1A A1 AA 99 A1 26 2A A1 91  )....v*.....&*..
AA 00 08 02 02 78 4B 01 F2                        .....xK..
========================================================================
```

Figure 2-4   Data Analyzer Screen

The Data Analyzer breaks down some of the ATCS packet fields of the packet as well as shows the raw data for the ATCS packet. The Data Analyzer does not show the lower VHF protocol layer details. In order to see the lower-level VHF protocol layer, you must use the "Trace Frames" screen.

2.4.2 Trace Frames

The "Trace Frames" screen is in the password protected menu system of the SEAR. The default password is "ssc" but may be changed by the user. To navigate to the screen, type CTRL+G > *password* > Office Debug > Trace frames

The screen will ask if you want to "Show Polls and Acks?". For the VHF protocol, you can answer "NO" to this question.

The screen will show "Enable text capturing then hit any key". If you want to capture the trace to a file, now is the time to enable that in your terminal emulator. Then, press any key to start the trace.

The following figure shows an example trace. Typically, the data needs to be captured and sent to Siemens Mobility personnel to analyze the data to interpret what is happening in the system.

Figure 2-5   Trace Frames Screen

The Trace Frames screen shows the raw data transmitted and received over the serial port connected to the VHF radio.

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SECTION 3 **ARGUS**

3.0 ARGUS PRODUCT

The information in this section applies to the Argus product.

NOTE

NOTE	**NOTE** The Argus HyperTerminal menus can only be accessed via Telnet when the VHF protocol is enabled. The menu navigation instructions are identical for the HyperTerminal interface and the Argus front panel menu system.

3.1 ARGUS RAIL LOGIC COMMUNICATION SETTINGS

The user edits the VHF protocol settings on the Rail Logic screen (MAIN MENU > CHANGE SETTINGS > RAIL LOGIC).

To enable VHF protocol, the user must set the "ENABLE" field to ENABLED as shown in the following figure. The user may also edit the Rail Logic Configuration parameters using the front panel keypad and display.

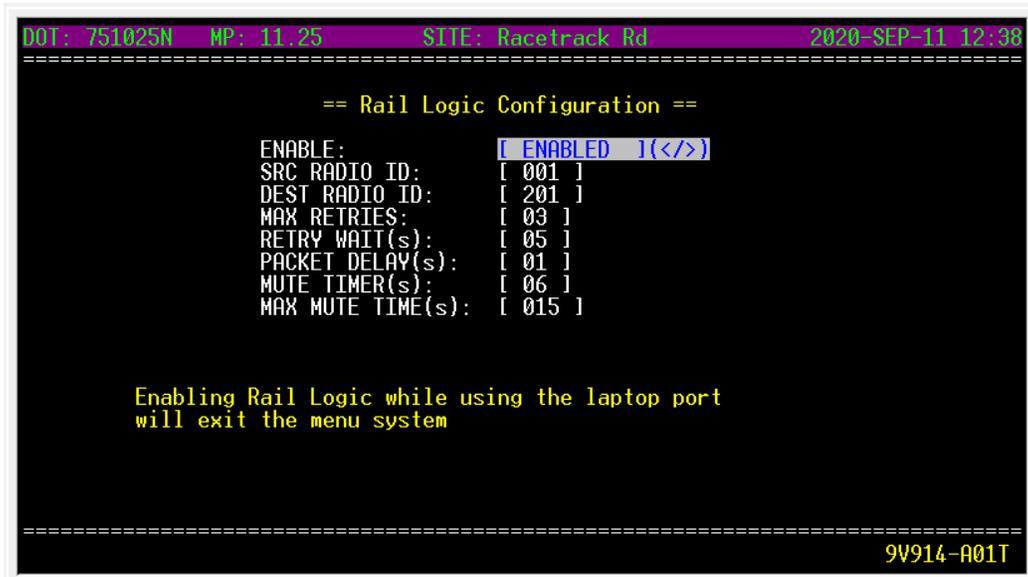|	
NOTE	**NOTE** Once enabled and saved, the user will not be able to access the HyperTerminal menu system on the Laptop serial port. The user will need to access these menus via Telnet, which the HyperTerminal program also supports. The user can also access the configuration from the Argus front panel user interface.

Figure 3-1 Rail Logic Configuration Screen

3-1

The following table describes each setting on the Rail Logic screen.

Table 3-1   Rail Logic Screen Settings

Setting	Default Value	Value for Rail-Logic Comms	Description
ENABLE	DISABLED	ENABLED	This setting enables VHF protocol on the Laptop serial port of the Argus.
SRC RADIO ID	1	Railroad assigned	SRC RADIO ID is the VHF protocol ID to assign to the Argus. Each Argus reporting to the same Rail Logic collector requires a unique ID, as assigned by the railroad. All VHF packets generated by the Argus will use this value as the source ID of the packet. The Argus will ignore all received packets with a different destination ID (unless they are broadcast packets).
DEST RADIO ID	201	Railroad assigned	DEST RADIO ID is the VHF protocol ID of the Rail Logic collector device the Argus reports through. The ID of the Rail Logic collector is assigned by the railroad. All VHF packets generated by the Argus will use this value as the destination ID of the packet.
MAX TRIES	3	5	When the Argus transmits a VHF packet and it does not receive an ack, the Argus will retry the packet. This setting selects the maximum number of times the Argus will try the packet before discarding it.
RETRY WAIT(s)	5	7	When the Argus transmits a VHF packet and it does not receive an ack, the Argus will retry the packet. This setting selects the number of seconds the Argus will wait before trying again.
PACKET DELAY(s)	1	3	When the Argus starts a multi-packet session with the Rail Logic collector, it will send multiple packets in a row before waiting for an ack. This setting selects how long to wait between consecutive packets. This setting also determines how long to wait after sending a single packet before sending the next packet.
MUTE TIMER(s)	6	6 (typically)	When the Argus receives a VHF packet from another location, the Argus automatically mutes for this many seconds, which allows the other locations to finish transmission and receive an ack. If the Argus receives another packet for another site while muted, it will restart the mute time. Typically, this setting can be left to the default.

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Setting	Default Value	Value for Rail-Logic Comms	Description
MAX MUTE TIME(s)	15	15 (typically)	When the Argus automatically mutes and restarts the mute timer for packets being received for other sites, it will only stay muted for a maximum amount of time. This setting selects the maximum amount of time the Argus will stay muted before forcing a transmission. Typically, this setting can be left to the default.

3.2   HEARTBEAT, ALARM RETRY, AND BACK-OFFICE ATCS ADDRESS

The heartbeat and alarms work the same in the Argus as in the SEAR, except that the Argus does not store pending alarms in battery-backed RAM (the Argus does not use internal batteries). The Argus will lose pending alarms if it is reset before the Argus successfully delivers the alarms.

The menu system is organized differently in the Argus from the SEAR II/IIi. The Heartbeat and Alarm Retry Interval are set on the WAMS SETTINGS screen (MAIN MENU > CHANGE SETTINGS > WAMS) along with the back-office ATCS address as shown in the following figure. The user may also edit WAMS settings from the front panel keypad.

The WAMS ATCS address, the alarm retry interval, and the heartbeat interval all function the same as they do in the SEAR II/IIi as explained in section 2.

Figure 3-2   WAMS Settings Screen

3-3

3.3   ARGUS ATCS ADDRESS

The Argus ATCS address is located on the Site Information screen (MAIN MENU > CHANGE SETTINGS > SITE INFO) as shown in the following figure.
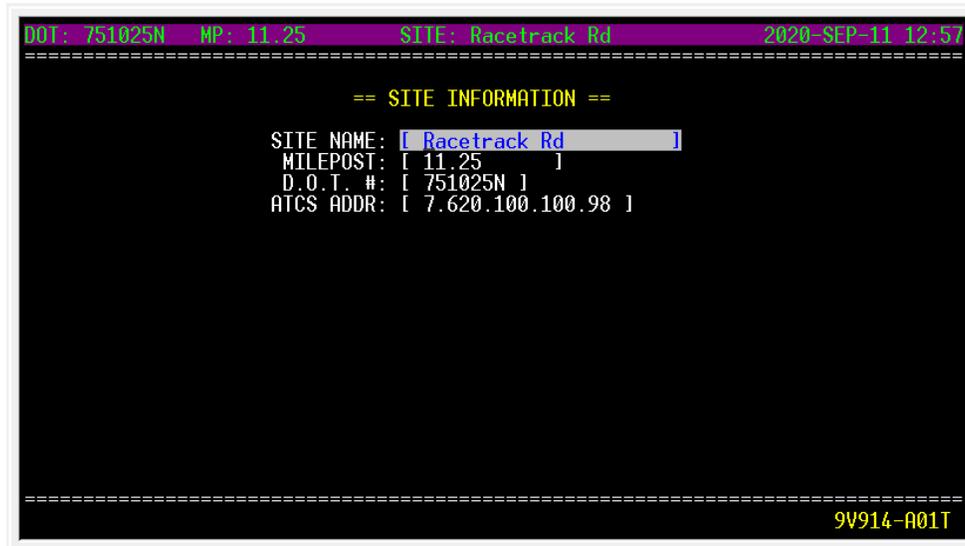

Figure 3-3   Site Information Screen

3.4   TROUBLESHOOTING ARGUS RAIL LOGIC COMMUNICATION

If there are problems with communication, the user can view the messages sent and received by the Argus on the Rail Logic Monitor screen (MAIN MENU > MONITOR I/O > RAIL LOGIC TRACE).

The screen will show "Enable text capturing then hit any key. (Press CTRL_T to send WAMS test message)". If you want to capture the session to a file, now is the time to enable that in your terminal emulator. Then, press any key to start the session.

The following figure shows an example test packet and response.


```
Waiting for events...
13:10:59.89: Sending single packet
13:10:59.91: Send Single Packet(IDLE): size:191
----------------------------
55 AA 01 43 00 BF 00 0B 0B 00 B1 75 00 00 00 00   U..C.......u....
00 31 2E 31 34 00 00 00 00 08 0B 0D 0A 3B 01 19   .1.14........;..
2F 46 0A 00 EA 26 2A AA AA AA 76 2A 1A A1 AA 98   /F...&*...v*....
A1 00 0A 02 02 78 8C 04 F1 00 00 00 00 00 00 00   .....x..........
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
00 00 00 00 00 00 00 00 00 00 F9 54 53 89 FE      ..........TS..
13:11:00.40: State changed from IDLE to WAIT_FOR_ACK
13:11:00.67: Process Receive(WAIT_FOR_ACK): size:19
----------------------------
55 AA 43 01 00 13 00 01 00 00 0D 0A 2E 09 0B 14   U..C............
48 78 FE                                          Hx.
13:11:00.78: Received ACK packet.  Code: 0, packet number 0
13:11:00.81: State changed from WAIT_FOR_ACK to IDLE
_
```

Figure 3-4   Example Test Packet and Response

The Trace Frames screen shows the raw data transmitted and received over the Laptop serial port connected to the VHF radio.

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