



APPLICATION SUMMARY

**SEAR Ii APPLICATION 9VC29-A01C
PREPARED FOR NORFOLK SOUTHERN**

NOVEMBER 2024

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VERSION C

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The equipment covered in this manual has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	Dec 2014		Initial release
B	April 2022	1 to 9	<p>Sec 1, update software number version.</p> <p>Sec 2, update software number version.</p> <p>Sec 3, update software number version, update Table 3-1.</p> <p>Sec 4, update software number version, update Table 4-1.</p> <p>Sec 5, update software number version.</p> <p>Sec 6, update software number version, update Table 6-1.</p> <p>Sec 7, update software number version.</p> <p>Sec 8, update software number version.</p> <p>Sec 9, para 1.</p>
C	Nov 2024	<p>All</p> <p>1.0</p> <p>2.0</p> <p>3.0</p> <p>4.0</p> <p>5.0</p> <p>6.0</p> <p>6.1</p> <p>6.2</p> <p>7.0</p> <p>8.0</p> <p>9.1</p>	<p>Updated software number version from 9VC29-A01B to 9VC29-A01C. General reformatting throughout.</p> <p>Added Glossary and List of Tables</p> <p>Minor text updates for clarity. Added Table 1-1 Reference Documents.</p> <p>Updated text with example and updated Table 2-1: added rows for Low Battery Percentage, Preemption, Prime Used, and Crossing Active Alarm Time.</p> <p>Removed tables 3-1 and 3-2 as they are not configurable in the CDL. Added reference to AG.</p> <p>Updated Table 4-1: all rows, merged with Table 4-2.</p> <p>Entire section updated.</p> <p>Updated and added Table 6-1 for clarity.</p> <p>All content replaced in Table 6-1 and removed rows that are no longer relevant.</p> <p>All content replaced in Table 6-2 and removed rows that are no longer relevant.</p> <p>Content updated.</p> <p>Removed “automated” from section name.</p> <p>Updated User Test Mode subsection – added info about the User Test Mode Disabled message.</p>

		9.2	Updated Activate Inspections subsection, removed non-relevant content.
		10.0	Moved Section “Trouble Light Control” into a subsection of Section 10 “Installation Notes”. Renamed Section “Trouble Light Control” and updated content for clarity.
		10.1	Removed content for battery and lamp calibration as not relevant to this document. Replaced with a reference for locating detailed information.
		11.0	Updated section “Cell Modem Non-critical Feature” and added Table 11-1.
		12.0	Reformatted section “Standard DTMF Activation”.

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:



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.



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.

NOTE

NOTE

Generally used to highlight certain information relating to the topic under discussion.

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

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GLOSSARY

TERM	DESCRIPTION
BATT MON	Battery monitoring input
CDL	<u>Control Description Language</u>
DI	<u>Digital Input</u>
DO	<u>Digital Output</u>
DOT Number	Department of Transportation crossing inventory number assigned to every United States highway-railroad crossing that consists of six numbers with an alpha suffix.
DTMF	<u>Dual-Tone Multi-Frequency</u> – A system where audible tones are used to represent buttons being pressed on a keypad.
EXT ISL	<u>External Island</u>
FRA	<u>Federal Railroad Administration</u> – an agency within the U.S. Department of Transportation concerned with intermodal transportation.
GCP	<u>Grade Crossing Predictor</u> – a train detection device used as part of a highway-railroad grade crossing warning system to provide a relatively uniform warning time.
GD	<u>Gate Down</u> – input energized when gate arm is horizontal.
GFT	<u>Ground Fault Tester</u> – An optional external device that constantly monitors up to two batteries for ground faults and indicates battery status to the SEAR Ili.
GP	<u>Gate Position</u> – Input energized when gate is vertical.
GU	<u>Gate Up</u> – Used in a user defined SEAR Ili application program, (the same as GP).
iLOD	<u>Intelligent Light Out Detector</u> – used for measuring lamp current.
LED	<u>Light-emitting Diode</u> – a semiconductor diode which glows when a voltage is applied.
POK	<u>Power Off Indication</u>
Preemption	The transfer of normal operation of traffic signals to a special control mode.

TERM	DESCRIPTION
PRIME	Primary output for a GCP track circuit. Energized when a track circuit is not in error, island circuit (if used) is energized, and no trains are in the circuit that require crossing activation based on predictor or motion detector logic. PRIME may be de-energized by a track's prime predictor, UAX, advance preempt, and/or island, if zero offset is selected.
RailFusion	An office-based application that communicates with and receives data from specially equipped crossings.
RX	Receive
SEAR II	<u>Siemens Event Analyzer/Recorder II</u> – a non-vital stand-alone system designed to provide continuous real-time general purpose status monitoring and event recording for a wide range of functions associated with railroad wayside and grade crossing installations.
SEAR Ili	<u>Siemens Event Analyzer/Recorder Ili</u> – a SEAR system integrated into a GCP 4000 or GCP 5000 chassis allowing for monitoring of all system inputs and outputs with minimized wiring.
SEAR Ili Application Program	Programming for SEAR Ili that controls alarms.
Sel.	<u>Selection</u>
SSCC	<u>Solid State Crossing Controller</u>
TSS	<u>Track Side Sensor</u>
TX	Transmit
VDH	<u>Vehicle Detection Health</u>
VHF Communicator	Communications device used for remote operations and calibration as well as data communications.
WAMS	<u>Wayside Alarm Management System</u> – this system manages data collected from event recorders supporting railroad operations. Refer to RailFusion.

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1.0 INTRODUCTION

This document supports the installation and maintenance of SEAR Ili units configured with the 9VC29-A01C user program stored in flash memory. This document provides descriptions for, and listings of, the following information unique to this user program:

- Site setup
- LED indications
- Generated messages
- Supported test modes
- Miscellaneous functions

For further information on the SEAR II and SEAR Ili, including configuration of the executive software, refer to the manuals listed in the following table.

Table 1-1 Reference Documents

Manual Name	Document Number
Siemens Event Analyzer Recorder (SEAR II) A80273 Installation & Operation Manual	SIG-00-02-07
SEAR Ili Internal Event Recorder Field Manual	SIG-00-08-13
Grade Crossing Predictor 5000 Instruction & Installation Manual	SIG-00-19-02
Grade Crossing Predictor 5000 Application Guidelines	SIG-00-13-04
Grade Crossing Predictor 4000 Application Guidelines	SIG-00-08-06
Grade Crossing Predictor 5000 Field Manual	SIG-00-13-03
Grade Crossing Predictor 4000 Field Manual	SIG-00-12-68
Grade Crossing Predictor 4000 (Legacy) Field Manual	SIG-00-08-10

NOTE

NOTE

Siemens Mobility, Inc. is not responsible for any misunderstanding or misinterpretation of the federal regulations, or for any changes to the regulations occurring after the release of this document.

2.0 USER MENU ITEMS – SITE SETUP

The following table lists configuration settings unique to 9VC29-A01C. Each row presents an entry in the site setup sequence.

- The 'Question' column shows the text that appears in the SEAR Ili interface function area on the GCP 4000/GCP 5000 display unit.
- The selection (Sel.) columns provide the options or define the range of values that may be entered.
- The 'Condition for Menu Display' column summarizes conditions that determine if that row's step will appear. For example, the 'LOW BATTERY 2 PERCENTAGE?' entry appears only if the entry for 'BATTERY BANKS?' is two or greater.

Table 2-1 User Menu Items – Site Setup

Question	Minimum/ Sel. 1	Maximum/ Sel. 2	Sel. 3	Sel. 4	Sel. 5	Sel. 6	Sel. 7	Sel. 8	Condition for Menu Display
RAILROAD NUMBER?	550	550							
CROSSING CONFIGURATION?	NORMAL	SPLIT GATE	EXTERNAL ENTRANCE GATE CONTROLLER(S)						
AND1 USED AS XR?	NO	YES							
AND2 USED AS XR?	NO	YES							
AND3 USED AS XR?	NO	YES							
AND4 USED AS XR?	NO	YES							
AND5 USED AS XR?	NO	YES							
AND6 USED AS XR?	NO	YES							
AND7 USED AS XR?	NO	YES							
AND8 USED AS XR?	NO	YES							
XR CONTROLLED BY FOREIGN RR?	AND1	AND2	AND3	AND4	AND5	AND6	AND7	AND8	CROSSING CONFIGURATION =SPLIT GATE
ENTRANCE GATES?	0	8							
85% VOLTAGE RELAY OUT?	NO	YES							

Question	Minimum/ Sel. 1	Maximum/ Sel. 2	Sel. 3	Sel. 4	Sel. 5	Sel. 6	Sel. 7	Sel. 8	Condition for Menu Display
BATTERY BANKS?	1	3							
BATT MON USED?	NO	YES							
LOW BATTERY 1 PERCENTAGE?	85	95							
LOW BATTERY 2 PERCENTAGE?	85	95							BATTERY BANKS>1
LOW BATTERY 3 PERCENTAGE?	85	95							BATTERY BANKS>2
LOW BATT MON PERCENTAGE?	85	95							BATT MON USED=YES
PREEMPTION?	NO	NORMAL	ADVANCED						
INTERNAL CROSSING CONTROLLERS?	0	2							
EXTERNAL CROSSING CONTROLLERS?	0	2							
VHF COMMUNICATOR?	YES	NO							
DTMF ACTIVATION?	YES	NO							
ACTIVATION CODE?	1	999							DTMF ACTIVATION=YES
ACTIVATION TIMEOUT (SECONDS)?	30	600							DTMF ACTIVATION=YES
iLOD MODULES?	0	4							
ANY LED BULBS USED?	NO	YES							iLOD MODULES>0
VHF VOICE CHANNEL?	1	8							VHF COMMUNICATOR =YES
VHF DATA CHANNEL?	1	8							VHF COMMUNICATOR =YES
USE CELL MODEM NON-CRITICAL FEATURE?	NO	YES							
PRIME1 USED?	NO	YES							CROSSING CONFIGURATION = SPLIT GATE
PRIME2 USED?	NO	YES							CROSSING CONFIGURATION = SPLIT GATE

Question	Minimum/ Sel. 1	Maximum/ Sel. 2	Sel. 3	Sel. 4	Sel. 5	Sel. 6	Sel. 7	Sel. 8	Condition for Menu Display
PRIME3 USED?	NO	YES							CROSSING CONFIGURATION = SPLIT GATE
PRIME4 USED?	NO	YES							CROSSING CONFIGURATION = SPLIT GATE
PRIME5 USED?	NO	YES							CROSSING CONFIGURATION = SPLIT GATE
PRIME6 USED?	NO	YES							CROSSING CONFIGURATION = SPLIT GATE
CROSSING ACTIVE ALARM TIME (MIN)?	0	60							
POWER OFF ALARM TIME (MIN)?	0	60							

3.0 DIGITAL INPUT STANDARD CONFIGURATION

Digital inputs are configured on the available GCP 4000 / GCP 5000 inputs or the two digital inputs on the SEAR Ili front panel. Refer to the Application Guideline Manual specific to the GCP System MCF that you are using for the digital inputs for 9VC29-A01C, the states and conditions for each input function, and for the physical inputs available for each function. Refer to Table 1-1 for the Application Guideline Manual document numbers.

4.0 USER PROGRAMMABLE LED CONFIGURATION

The following table defines the operation of the tri-color user programmable LEDs for 9VC29-A01C and lists the LED states displayed in various modes of operation.

Table 4-1 LED Configuration and LED States

LED	Alarm Numbers	Designator	LED Color			
			Steady Green	Fast Flash Red	Slow Flash Red	Slow Flash Green
T01	1	WARNING DEVICES	No Alarm	In Alarm	Alarm Stop	
T02	4	XING ACTIVE TOO LONG	No Alarm	In Alarm	Alarm Stop	
T03	5	AC POWER OFF TOO LONG	No Alarm	In Alarm	Alarm Stop	
T04	9	GATE POSITION FAIL	No Alarm	In Alarm	Alarm Stop	
T05	18, 19, 35, 36	BATTERY LOW	No Alarm	In Alarm	Alarm Stop	
T06	22	PREEMPTION FAILURE	No Alarm	In Alarm	Alarm Stop	
T07	7	FOREIGN RAILROAD	No Alarm	In Alarm	Alarm Stop	
T09	None	ONLINE		User Test Mode enabled		User Test Mode disabled

5.0 BATTERY INPUT CONFIGURATION

The following table defines the 9VC29-A01C names, software designators, resolutions, and menu conditions for the SEAR Ili battery inputs on channels 1 through 3 and channel 6.

Table 5-1 Battery Input Channel Assignments

Channel	Name	Designator	Resolution	Menu Condition
Case Power (1)	B12	B12	1 VDC	
SSCC-1 Power (2)	B16	B16	1 VDC	BATTERY BANKS>1
SSCC-2 Power (3)	B16A	B16A	1 VDC	BATTERY BANKS>2
BATT MON (6)	Batt Mon	Batt Mon	1 VDC	BATT MON USED=YES

Notes: SSCC-1 refers to the internal crossing controller in slot 7.

SSCC-2 refers to the internal crossing controller in slot 8.

Batt Mon refers to the circuit connected to the J3 (orange) 12-pin connector on the front of the SEAR Ili module.

6.0 MESSAGES

The tables in the following subsections list all of the messages generated by the 9VC29-A01C application. Messages generated by the SEAR Ili executive are not presented here.

Messages fall into categories defined by message numbers as shown in the following table.

Table 6-1 Message Categories

Message Number	Message Type	Section Reference (if applicable)
0	Internal SEAR Ili Messages	
1-100	Application Alarms	Refer to Table 6-2
101-200	Application Alarm Clears	Refer to Table 6-3
201-230	Reserved (Automatic Inspection Alarms)	
231-250	Reserved (Application Information Messages)	
251-255	Reserved (Automatic Inspection Information)	

6.1 APPLICATION ALARMS

The 9VC29-A01C application generates the alarms shown in the following table.

Table 6-2 Application Alarms

LED	Alarm Code	Name	Description	Sent to Office	Tested
T01	1	CROSSING CONTROLLER FAILURE	Any crossing controller reports a Vital Health error or communications error and POK1 is ON for longer than 30 seconds.	Yes	Always
T02	4	CROSSING ACTIVE FOR XX	Crossing has been active for 0 to 60-minutes or longer. Interval time set by menu question "CROSSING ACTIVE ALARM TIME (MIN)?" XX=Minutes	0 to 60-minute intervals	Always
T03	5	AC POWER OFF FOR XX	POK1 has been off for 0 to 60-minutes or longer. Interval time set by menu question "POWER OFF ALARM TIME (MIN)?" XX=Minutes	0 to 60-minute intervals	Always
T04	9	GATE POSITION FAIL	<ol style="list-style-type: none"> 1. Gate control outputs are energized. 2. Gate position fail time (30-seconds or longer) has elapsed. 3. All entrance gate inputs are not energized. 	Yes	Train Move
T05	18	LOW B12: XX	Battery Channel 1 is less than 85% to 95% of calibrated voltage for longer than 20-seconds. Percentage set by menu question "LOW BATTERY 1 PERCENTAGE?" XX=VDC	Yes	Always

LED	Alarm Code	Name	Description	Sent to Office	Tested
T05	19	LOW B16: XX	Battery Channel 2 is less than 85% to 95% of calibrated voltage for longer than 20-seconds. Percentage set by menu question "LOW BATTERY 2 PERCENTAGE?" XX=VDC	Yes	Always
T05	35	LOW B16A: XX	Battery Channel 3 is less than 85% to 95% of calibrated voltage for longer than 20-seconds. Percentage set by menu question "LOW BATTERY 3 PERCENTAGE?" XX=VDC	Yes	Always
T05	36	LOW BATT MON: XX	Battery Channel 6 is less than 85% to 95% of calibrated voltage for longer than 20-seconds. Percentage set by menu question "LOW BATT MON PERCENTAGE?" XX=VDC	Yes	Always
T06	22	PREEMPTION ALARM	Crossing Active and Preempt Health Input is Energized.	Yes	Train Move
T07	7	**FOREIGN RAILROAD ALARM	"CROSSING CONFIGURATION=SPLIT GATE" Crossing has been active for 0 to 60-minutes due to foreign RR assigned "AND" being de-energized. Interval time set by menu question "CROSSING ACTIVE ALARM TIME (MIN)?"	0 to 60-minute intervals	Always
T09		USER TEST MODE ENABLED	Application alarms will not be generated when enabled.	No	Always

6.2 APPLICATION ALARM CLEARS

The 9VC29-A01C application generates the alarm clears shown in the following table.

Table 6-3 Application Alarm Clears

LED	Alarm Code	Name	Description	Sent to Office	Tested
T01	101	CROSSING CONTROLLER NORMAL	Crossing Controller Failure alarm clears.	Yes	Clears
T02	104	CROSSING NORMAL	Crossing Active Too Long alarm clears.	Yes	Clears
T03	105	AC POWER BACK ON	POK1 back on for 1 minute or longer.	Yes	Clears
T04	109	GATE POSITION FAIL CLEAR	Gate Position Fail alarm clears.	Yes	Clears
T05	118	B12 NORMAL	Low Battery Channel 1 alarm clears for longer than 5 seconds.	Yes	Clears
T05	119	B16 NORMAL	Low Battery Channel 2 alarm clears for longer than 5 seconds.	Yes	Clears
T05	135	B16A NORMAL	Low Battery Channel 3 alarm clears for longer than 5 seconds.	Yes	Clears
T05	136	BATT MON NORMAL	Low Battery Channel 4 alarm clears for longer than 5 seconds.	Yes	Clears

LED	Alarm Code	Name	Description	Sent to Office	Tested
T06	122	PREEMPTION NORMAL	Preemption Fail alarm clears.	Yes	Clears
T07	107	*FOREIGN RAILROAD NORMAL	Foreign railroad alarm clears.	Yes	Clears
T09	24	USER TEST MODE DISABLED	Application alarms will be generated when disabled.	Yes	Clears

7.0 SPECIAL TRAIN MOVE CONDITIONS

The following table provides definitions of train move conditions monitored by the 9VC29-A01C application.

Table 7-1 Definitions of Train Move Conditions

Crossing Active	Any AND that is used as an XR is de-energized.
Island Occupied	Any island is occupied.

8.0 MANUAL INSPECTION RESULTS

The following table presents a listing of test numbers that will appear in SEAR Ili records for 9VC29-A01C.

Table 8-1 Manual Inspection Results

Test Name	Test Description	Recorded Value
Test 251	B12	Voltage read
Test 251	B16	Voltage read
Test 251	B16A	Voltage read
Test 251	Batt Mon	Voltage read

9.0 TEST MODES

Three different test modes may be selected, as described in the following subsections, these are:

- User test mode
- Activate inspections
- Manual tests

Test mode settings can be accessed by pressing the User Test button on the SEAR Ili interface (displayed on the GCP 4000/GCP 5000 display module), or through the 'Tests' option under the main menu of the terminal interface.

9.1 USER TEST MODE

When selected, this mode will cause all application messages numbered 1-250 to be ignored and not processed. These alarms will not be generated in the event buffer nor will they be sent to the office. **USER TEST MODE ENABLED** and **USER TEST MODE DISABLED** messages will be recorded when the modes are entered or exited, respectively. Only the **USER TEST MODE DISABLED** message number (24) will be sent to the office.

The maintainer will have the option of selecting 1, 4, 8, or 12 hour test modes. The local display will show **SKIP ALARMS: XXX MIN.** User test mode will be enabled when a DTMF activation is requested.

9.2 ACTIVATE INSPECTIONS

There are no Automatic Inspections defined in the 9VC29-A01C application.

9.3 MANUAL TESTS

When this mode is selected, the user may enter results for manual tests. If an automated test fails, it will appear in this list. If Auto Inspections = NO then all tests may be entered manually. Corresponding test LEDs will flash green when the user has entered a pass value for a test. On the first of the month, test LEDs will return to solid yellow indicating the next set of manual tests is ready to run.

10.0 INSTALLATION NOTES

10.1 BATTERY AND LAMP CALIBRATION

Upon initial site setup, the user will be prompted to calibrate the batteries and lamps. Refer to the manual specific to the GCP System that you are using for lamp and battery calibration procedures, as follows:

- For GCP 5000: SIG-00-13-04 GCP 5000 Application Guidelines.
- For GCP 4000: SIG-00-12-68 GCP 4000 Field Manual.

Refer to Table 1-1 for additional manual document numbers.

10.2 "MAINT CALL" LED AND OUTPUT FUNCTION

If the "POK1" and "POK2" digital inputs are both assigned in the GCP/SEAR Ili configuration, then the "MAINT CALL" CPU module LED 1, the "MAINT CALL" GCP chassis CPU connector output and any additional "MAINT CALL" outputs defined in the GCP configuration can only be "On" if both "POK1" and "POK2" inputs are "Energized". Otherwise, the "MAINT CALL" LED and output(s) will be "Off".

Refer to the specific GCP manuals for additional information on "MAINT CALL" functionality and troubleshooting information.

11.0 CELL MODEM NON-CRITICAL FEATURE

When a cell modem is selected as the office communication device, the cell modem non-critical feature may be used to reduce the minutes used on the device. Alarms/messages will be sent in when one of the following conditions occur:

- when the health check occurs.
- when the comm queue is full (50 messages/alarms).
- any time a connection is initiated from WAMS.
- when one of the following alarms occurs as shown in the following table.

Table 11-1 Critical Alarms

Alarm/ Message Code	Alarm/Message	Note
1	CROSSING CONTROLLER FAILURE	
4	CROSSING ACTIVE FOR XX	XX=Minutes
5	AC POWER OFF FOR XX	XX=Minutes
18	LOW B12: XX	XX=VDC
19	LOW B16: XX	XX=VDC
24	USER TEST MODE DISABLED	
35	LOW B16A: XX	XX=VDC
36	LOW BATT MON: XX	XX=VDC

To enable this feature, answer “YES” to “Use non-critical feature?” during site setup.

12.0 STANDARD DTMF ACTIVATION

When VHF communicators are utilized, the user may enable DTMF activation during site setup. The “activation code” and “activation timeout (seconds)” questions asked during site setup are related to DTMF activation.

The “activation code” is a three digit code, usually the last three digits of the DOT#, which will be used for activation.

The “activation timeout (seconds)” is the time that the crossing will be allowed to stay active.

The user’s radio must match the frequency that the VHF communicator is set to.

To activate the crossing, complete the following steps:

- enter the activation code
- press #

To deactivate the crossing, complete the following steps:

- enter the activation code
- press *

To activate the lights only, complete the following steps:

- enter the activation code
- press 1
- then press #

To deactivate a lights only activation, complete the following steps:

- enter the activation code
- press 1
- then press *

Timers set in the GCP 4000/GCP 5000 programming can add some delay to the activation/deactivation times.

NOTES

NOTES

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