SIEMENS

INSTRUCTION & INSTALLATION

MICROPROCESSOR BASED SIMPLE GRADE CROSSING PREDICTOR 4000 / MOTION SENSOR 4000 (SGCP4000 / MS4000), P/N A80490 & P/N A80495

DECEMBER 2011, REVISED FEBRUARY 2016

DOCUMENT NO. SIG-00-11-02
VERSION A.3

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PRINTED IN U.S.A.

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DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
1	01/15/11		Initial draft
A	12/02/2011		Initial Release per inspection MS4-F28
A.1	06/11//2014	all	Rebrand for Siemens and reformat
A.2	07/20/2015	All	Product renamed per PLM email 06/23/15 0831
A.3	02/09/2016	Sec 7	Add Section 7.3.9 Island Test for EZ and Z Levels

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

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

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 Industry Inc., Rail Automation 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 Industry, Inc., Rail Automation 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:

- Ground yourself before touching card cages, assemblies, modules, or components.
- 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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MOTION SENSOR 4000 (SGCP4000 / MS4000) OVERVIEW

1.1 INTRODUCTION

Figure 1-1:
Simple Grade Crossing Predictor 4000 / Motion Sensor 4000 (SGCP4000 / MS4000), Redundant Single Track System (P/N A80490) and Single Track System (P/N A80495)

The Simple Grade Crossing Predictor 4000 / Motion Sensor 4000 (SGCP4000 / MS4000) 0is a modular microprocessor-controlled motion detector system that is designed to reliably detect the motion of an approaching train and to activate the crossing warning equipment when the speed of the train exceeds the minimum motion sensitivity. In addition to motion sensor functionality, the system also provides simple predictor functionality. The SGCP4000 / MS4000 is available as a Redundant Single Track System (A80490) or a Single Track System (A80495) unit.

1.2 DESCRIPTION

Operation of the SGCP4000 / MS4000 is based on the maximum impedance of an unoccupied track circuit. This is determined by the location of the termination shunts and the rate of change in the impedance resulting from the physical location of a train as it moves within the track circuit. The SGCP4000 / MS4000, applies a constant current AC signal to the track and measures the level of the resulting voltage. The level varies with approach track impedance, which also varies with the distance of the train from the crossing. The rate of change is sensed

by the SGCP4000 / MS4000, which then activates the crossing warning equipment provided the approaching train exceeds the minimum motion sensitivity.

A shunt is connected across the rails to terminate the SGCP4000 / MS4000 approach circuit. This device presents a low impedance at the SGCP4000 / MS4000 operating frequency and may consist of a wire connected between the rails (hardwire shunt) when no other signals (AC or DC) are present on the rails, or when non-coded DC track circuits only are present, a wideband shunt may be used. A narrow-band shunt is used when other AC signals are present. Insulated joints in DC coded track can be coupled using Tunable Insulated Joint Bypass Couplers, 62785-f.

The SGCP4000 / MS4000 will respond to the approaching motion of a train and cause the crossing warning equipment to operate within approximately 5 seconds. When the train has cleared the crossing, the SGCP4000 / MS4000 no longer senses approaching motion and the crossing warning signal system recovers.

When a train stops before reaching the crossing, or reverses direction and backs away from the crossing, the SGCP4000 / MS4000 system will recover after a short (programmable) pickup delay as approaching motion is no longer detected. When the train resumes forward motion toward the crossing, the SGCP4000 / MS4000 system is activated and remains in operation until the train has cleared the crossing.

The required track length becomes an integral part of the SGCP4000 / MS4000 system and is a function of maximum train speed, warning time desired, plus an additional 5-second system response time. The 5-second interval enables the crossing warning signal equipment to activate and ensures adequate warning time when a maximum speed train enters the SGCP4000 / MS4000 approach. At this point, the track circuit is terminated by a shunt across the rails. The track distance from the feed point to the shunt is the approach distance. Under normal conditions, the impedance of this section of track is a constant value. However, a train entering the approach shunts the track and reduces the impedance and, therefore, the effective length of the track circuit. This, in turn, causes a voltage reduction in the track signal.

The SGCP4000 / MS4000 receiver circuits are also transformer-coupled to the track through wires connected to the rails usually on the opposite side of the crossing from the transmitter feed points. The length of track between the two sets of feed points defines the island circuit. The receiver senses the voltage level across the track impedance and the level changes as the effective impedance of the track changes with the position of the train in the approach.

When a train approaches near the crossing at 1 mile-per-hour (approximately 2 km/h) or faster, the processor module detects the train movement and activates the crossing warning signal equipment. Self-check modulation occurs every few seconds and verifies proper operation of the motion-processing circuits.

The crossing warning signal equipment recovers when the receiver circuits sense any of the following conditions:

- A zero rate of change indicating an unoccupied track or a train stopped within the approach but not yet within the island circuit
- An increasing rate of change caused by a train moving away from the crossing

Operating parameters are programmable via buttons on the CPU2+ card. Self check circuits in the SGCP4000 / MS4000 test the unit at specific intervals, ensuring safe operation. Module

status LED indicators plus diagnostic messages, which are displayed on the 4-Character display, combine to permit rapid troubleshooting.

The SGCP4000 / MS4000 island circuit is established and controlled by a high frequency island module that contains separate transmitter and receiver circuits. The length of the island circuit is established by the location of the track connections on either side of the crossing. A train located at any point within the island circuit will activate the SGCP4000 / MS4000. The island frequency may be selected from a number of available frequencies ranging from 2.14 kHz to 20.2 kHz.

1.3 MOTION SENSOR OPERATIONAL PARAMETERS

The SGCP4000 / MS4000 supports Unidirectional track circuits, Bidirectional track circuits, and Bidirectionally Wired track circuits. The Bidirectionally Wired track circuit is one where the direction of travel may be determined by the configuration of the 6-wire track wire connections.

The SGCP4000 / MS4000, detects the motion of an approaching train when its speed exceeds a set (programmed) motion detection threshold and activates crossing-warning devices at time of train detection.

The SGCP4000 / MS4000, communicates with other ATCS devices via Echelon® LAN. These other devices may include the Safetran® Event Analyzer/Recorder II (SEAR2), HD/LINK, a VHF Communicator, an iLOD, SSCC IV, and/or a second SGCP4000 / MS4000.

1.4 TRAIN DETECTION

The SGCP4000 / MS4000, applies a constant current audio frequency (AF) signal to the track and measures the level of the resulting voltage. The approach track signal magnitude (EZ) varies with approach track impedance. The approach track impedance corresponds to the distance of the train from the crossing. When unoccupied the approach circuit has maximum impedance. When a train enters the approach and moves towards the crossing, the track circuit impedance continually decreases due to the low resistance shunt created by the train's wheels. When a train reaches the crossing, the approach circuit is reduced to minimum impedance. As a train moves away from the crossing, the track impedance continually increases. When the train exits the approach the circuit again has maximum impedance.

The EZ is proportional to the relative distance the train is from the crossing. When no train is on a calibrated approach, the EZ is approximately 100 (see Figure 1-2). The EZ value rate of change is proportional to the speed of the train. The rate of change is sensed by the SGCP4000 / MS4000 and used predict when to activate the crossing warning devices.

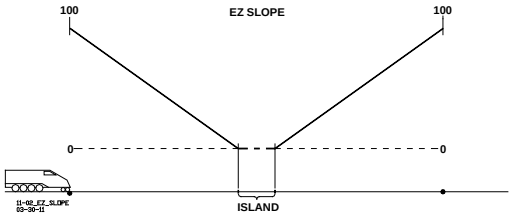


Figure 1-2:
Diagram of EZ Level Compared to Train Shunt Location

1.4.1 Track Ballast Condition

The EX value is a numerical indication of track ballast conditions. The EX corresponds to electrical leakage through track ballast. An EX value of 100 represents optimum track ballast conditions. The standard low EX operating threshold for the SGCP4000 / MS4000 is 39. EX is nominally between 70 and 100.

1.4.2 Track Ballast Changes

The EX value can be affected by the presence of water, mud, salt or other contaminates deposited in the track ballast. High concentrations of these contaminates at a crossing can cause excessive leakage (lump loading). The SGCP4000 / MS4000 provides automatic compensation of EZ for a wide range of lump loading conditions.

1.4.3 SGCP4000 / MS4000 Signal Frequencies

The constant current audio frequency (AF) signal for each track can be programmed for any of 56 frequencies:

Table 1-1: SGCP4000 / MS4000 Approach Frequencies

86	114	156	211	285	348	430	525
645	790	970	44	45	46	151	250
267	326	392	452	522	560	630	686
753	816	881	979	999	85.5	86.5	87
113	113.5	114.5	115	155	115.5	156.5	157
210	212	284	286	347	349	429	431
523	527	643	647	788	792	968	972

1.5 SYSTEM SPECIFICATIONS

Table 1-2:
Input Power Specifications

PARAMETER	RANGE OF VALUES
Battery Voltage	
On CPU Connector:	9.0-16.5 VDC
On Track Card Connector:	9.0-16.5 VDC
Maximum Ripple:	1.0V p-p

Table 1-3:
SGCP4000 / MS4000 Input Current Requirements

Table 1-3: SGCP4000 / MS4000 Input Current Requirements			
COMPONENT	**CPU BATTERY CONNECTOR @10V**	**CPU BATTERY CONNECTOR @13.2 V**	**CPU BATTERY CONNECTOR @16.5V**
CPU2+:	0.4 A	0.5 A	0.6 A
Track:	1.7 A @ medium transmit power 1.90 A @ high transmit power Current increases by 200 mA when one 250 ohm relay output is energized and increases by 450 mA when two outputs are energized	1.05 A @ medium transmit power 1.15 A @ high transmit power Current increases by 80 mA when one 250 ohm relay output is energized and increases by 150 mA when two outputs are energized	800 mA @ medium transmit power 850 mA @ high transmit output Current increases by 60 mA when one 250 ohm relay output is energized and increases by 130 mA when two outputs are energized
80490 Chassis	2.258 A (medium transmit power) 2.288 A (high transmit power)	1.685 A (medium transmit power) 1.707 A (high transmit power)	1.392 A (medium transmit power) 1.412 A (high transmit power)
80495 Chassis	2.022 A (medium transmit power) 2.055 A (high transmit power)	1.445 A (medium transmit power) 1.465 A (high transmit power)	1.158 A (medium transmit power) 1.183 A (high transmit power)

Table 1-4:
SGCP4000 / MS4000 General Parameters

PARAMETER	VALUES
MS Response Time	5 seconds
Relay Drive Outputs (VO):	400 to 1000-ohm load
Minimum Output Current @ medium transmit power:	200 mA
Minimum Output Current @ high transmit power:	400 mA
Surge Protection:	Built-in secondary surge protection for all connections. Requires external arresters and equalizers on track wires as primary surge protection. Surge panels or their electrical equivalent are required. Refer to paragraph 2.16 for battery and external cable surge protection.
Typical Monitoring and Storage:	CPU2+
IO State Changes:	3000 minimum
Train Moves:	100 minimum
Mounting:	All SGCP4000 / MS4000 chassis can be wall, rack, or shelf mounted
Temperature Range:	-40 °F to +160 °F (-40 °C to 70 °C)

Table 1-5:
Physical Dimension Data

PARAMETER	VALUES	
CHASSIS DIMENSIONS:		
	Redundant Single Track (A80490)	Single Track (A80495)
Width:	10.16 In. (25.806 cm)	5.94 in. (15.088 cm)
Depth:	10.86 In. (27.584 cm)	12.38 in. (31.446 cm)
Height:	14.25 In. (36.195 cm)	19.09 in. (48.489 cm)
CHASSIS WEIGHTS:		
	Empty	Full Module Complement
Redundant Single Track (A80490)	11.80 lb. (5.352 kg)	17.5 lb. (7.938 kg)
Single Track (A80495)	8.25 lb. (3.742 kg)	10.5 lb. (4.762 kg)
MODULE WEIGHTS:		
CPU2+ (A80403)	1.25 lbs (0.567 kg)	
Track (A80418)	1.00 lbs (0.454 kg)	
Transfer (A80406) .A90490 only)	0.83 lbs (0.567 kg)	

SECTION 2 –
GENERAL SGCP4000 / MS4000 APPLICATION INFORMATION

2.1 SGCP4000 / MS4000 TRACK SIGNALS

The SGCP4000 / MS4000, applies a constant current audio frequency (AF) signal to the track.

2.1.1 Frequency Selection

Approach distance and track ballast resistance generally determines SGCP4000 / MS4000 signal frequency selection. Track circuit types, track configurations, and other factors must also be taken into consideration when determining frequency. If difficulties are encountered when setting up track circuits, the generic application may not be correct for that particular site and further investigation and mitigation may be required.

2.1.2 SGCP4000 / MS4000 Frequency Range

The SGCP4000 / MS4000 application program utilizes frequencies between 44 and 999 Hz.

2.1.3 SGCP4000 / MS4000 Signal Attenuation

SGCP4000 / MS4000 transmitted frequencies are attenuated by track ballast resistance: the higher the frequency, the greater the attenuation. The useful approach distance tends to be inversely proportional to the signal frequency.

2.2 SGCP4000 / MS4000 APPROACH FREQUENCIES

The SGCP4000 / MS4000 can operate using one of 56 separate frequencies. The specific frequency chosen is dependent on approach distance requirements and track ballast conditions.

Table 2-1:
SGCP4000 / MS4000 Approach Frequencies

86	114	156	211	285	348	430	525
645	790	970	44	45	46	151	250
267	326	392	452	521.2	560	630	686
753	816	881	979	999	85.5	86.5	87
113	113.5	114.5	115	155	115.5	156.5	157
210	212	284	286	347	349	429	431
523	527	643	647	788	792	967.7	972

2.3 SGCP4000 / MS4000 FREQUENCY VERSES OPERATING DISTANCE

SGCP4000 / MS4000 frequency versus the operating distance at 2, 4, and 6 Ohms per 1000 ft. (304.80 meters) of ballast resistance is provided in Table 2-2 (Bidirectional and Directionally-wired) and Table 2-3 (Unidirectional). The minimum distances provided are based on use of hardwire or wideband shunts.

Table 2-2:
Ballast Resistance vs. Approach Distance by Frequency,
Bidirectional and Directionally-wired Applications

SGCP4000 / MS4000 OPERATING FREQUENCY (HZ)	BIDIRECTIONAL APPROACH DISTANCE					
	2 OHMS/1,000‘ (304.8M) DISTRIBUTED BALLAST IN FEET (METERS)		4 OHMS/1,000‘ (304.8M) DISTRIBUTED BALLAST IN FEET (METERS)		6 OHMS/1,000‘ (304.8M) DISTRIBUTED BALLAST IN FEET (METERS)	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
86	1,000 (304.8)	5,350 (1,630.7)	1,000 (304.8)	7,950 (2,423.2)	1,000 (304.8)	9,280 (2,362.2)
114	750 (228.6)	4,525 (1,379.2)	750 (228.6)	6,450 (1,966.0)	750 (228.6)	7,448 (2,270.2)
156	600 (182.9)	3,925 (1,196.3)	600 (182.9)	5,550 (1,691.6)	600 (182.9)	6,349 (1,935.2)
211	475 (144.8)	3,350 (1,021.1)	475 (144.8)	4,800 (1,463.0)	475 (144.8)	5,494 (1,674.6)
285	400 (121.9)	2,950 (899.2)	400 (121.9)	4,225 (1,287.8)	400 (121.9)	4,762 (1,451.5)
348	400 (121.9)	2,625 (800.1)	400 (121.9)	3,675 (1,120.1)	400 (121.9)	4,151 (1,265.2)
430	400 (121.9)	2,300 (701.0)	400 (121.9)	3,350 (1,021.1)	400 (121.9)	3,785 (1,153.7)
525	400 (121.9)	2,150 (655.3)	400 (121.9)	3,150 (960.1)	400 (121.9)	3,541 (1,179.3)
645	400 (121.9)	1,950 (594.4)	400 (121.9)	2,800 (853.4)	400 (121.9)	3,175 (967.7)
790	400 (121.9)	1,725 (525.8))	400 (121.9)	2,475 (753.4)	400 (121.9)	2,807 (855.9)
970	400 (121.9)	1,550 (472.4)	400 (121.9)	2,175 (662.9)	400 (121.9)	2,472 (753.5)

Table 2-3:
Ballast Resistance vs. Approach Distance by Frequency,
Unidirectional Applications

SGCP4000 / MS4000 OPERATING FREQUENCY (HZ)	UNIDIRECTIONAL APPROACH DISTANCE					
	2 OHMS/1,000‘ (304.8M) DISTRIBUTED BALLAST		4 OHMS/1,000‘ (304.8M) DISTRIBUTED BALLAST		6 OHMS/1,000‘ (304.8M) DISTRIBUTED BALLAST	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
86	700 (213.4)	4,375 (1,333.5)	700 (213.4)	6,175 (1,882.1)	700 (213.4)	7,080 (2,158.0)
114	525 (160.0)	3,850 (1,173.5)	525 (160.0)	5,550 (1,691.6)	525 (160.0)	6,360 (1,938.5)
156	420 (128.0)	3,325 (1,013.5)	420 (128.0)	4,875 (1,485.9)	420 (128.0)	5,520 (1,682.5)
211	400 (121.9)	2,750 (838.2)	400 (121.9)	4,100 (1,249.7)	400 (121.9)	4,680 (1,426.5)
285	400 (121.9)	2,250 (686.8)	400 (121.9)	3,500 (1,066.8)	400 (121.9)	3,960 (1,207.0)
348	400 (121.9)	1,925 (586.7)	400 (121.9)	3,025 (922.0)	400 (121.9)	3,420 (1,042.4)
430	400 (121.9)	1,725 (525.8)	400 (121.9)	2,650 (807.7)	400 (121.9)	3,000 (914.4)
525	400 (121.9)	1,500 (457.2)	400 (121.9)	2,275 (693.4)	400 (121.9)	2,580 (786.4)
645	400 (121.9)	1,300 (396.2)	400 (121.9)	1,950 (594.4)	400 (121.9)	2,220 (676.7)
790	400 (121.9)	1,125 (342.9)	400 (121.9)	1,650 (502.9)	400 (121.9)	1,860 (566.9)
970	400 (121.9)	1,050 (320.0)	400 (121.9)	1,550 (472.4)	400 (121.9)	1,710 (521.2)

Lumped loads in the SGCP4000 / MS4000 approach can affect the linearity (slope) of EZ over the length of the approach.

2.4 TRACK CIRCUIT OPERATING FREQUENCY RESTRICTIONS

The following track circuits are subject to the specified operating frequency restrictions:

NOTE

NOTE

Refer to Paragraph 2.14, Track Circuit Isolation Devices, for applicable battery isolation and AC filter requirements. Contact Siemens Rail Automation for assistance as required at (800) 793-7233.

2.4.1 Relay Coded DC Track Circuits

⚠ WARNING

WARNING

THE SINGLE POLARITY DC CODED TRACK CIRCUIT MUST BE CAREFULLY REVIEWED TO ENSURE THAT ALL TRANSMIT AND RECEIVE CODES ARE OF THE SAME POLARITY PRIOR TO INSTALLING ANY 6A342-1 UNIT.

IF THE POLARITY IS IN DOUBT, INSTALL TWO 6A342-3 ISOLATION UNITS AT EACH END OF THE TRACK CIRCUIT USING THE SAME INSTALLATION AS THE DUAL POLARITY CODED TRACK CIRCUIT.

CONTACT SIEMENS RAIL AUTOMATION TECHNICAL SUPPORT AT (800) 793-7233 FOR DETAILS.

In Relay Coded DC track circuits, select frequencies of 86 Hz or higher. When using frequencies between 86 Hz and 211 Hz use maximum transmit level

2.4.2 Electronic Coded DC Track Circuits

In Electric Coded DC track Circuits, select frequencies of 86 Hz or higher. When using frequencies between 86 Hz and 211 Hz use maximum transmit level

2.4.3 100 Hz Non-coded Cab Signal Circuits

In 100 Hz Non-coded Cab Signal Circuits, select frequencies of 156 Hz or higher. Use maximum transmit level

2.4.4 60 Hz AC Coded Track or Coded Cab Signal Circuits

In 60 Hz AC Coded Track or Coded Cab Signal Circuits, select 86 Hz or higher. Use maximum transmit level

2.4.5 100 Hz AC Coded Track or Coded Cab Signal Circuits

In 100 Hz AC Coded Track or Coded Cab Signal Circuits, select 211 Hz or higher. Use maximum transmit level

2.5 TRACK CIRCUIT FREQUENCY SELECTION

Siemens Rail Automation equipment is compatible with most motion sensing and constant warning time units supplied by other manufacturers, provided audio frequency separation and compatibility are maintained.

⚠ WARNING

WARNING

WHEN SELECTING THE SGCP4000 / MS4000 TRACK FREQUENCY, ACCOUNT FOR ANY EXISTING AUDIO FREQUENCY TRACK CIRCUIT SIGNALS.

2.5.1 Frequency Selection Restrictions

Before selecting the SGCP4000 / MS4000 frequency, determine if any high-level audio frequency (AF) is present on the track. Avoid using any SGCP4000 / MS4000 Frequency that is within fifteen percent of any AF signal present. For additional restrictions on the use of overlapping SGCP4000 / MS4000 frequencies, see paragraph 2.8.

2.6 SGCP4000 / MS4000 APPROACH DISTANCE CALCULATIONS

The approach is defined by the location of the termination shunts.

2.6.1 Approach Distance Calculations

⚠ WARNING

WARNING

THE SGCP4000 / MS4000 APPROACH DISTANCE CALCULATIONS ARE BASED ON WARNING TIME REQUIREMENTS OF TRACK SPEED TRAINS PLUS THE SYSTEM RESPONSE TIME OF APPROXIMATELY FIVE (5) SECONDS. IN AREAS WHERE POOR SHUNTING IS EXPECTED ADD FIVE (5) SECONDS OF ADDITIONAL APPROACH DISTANCE.

IN APPLICATIONS WITH SHORT APPROACHES, VERIFY THAT THE ISLAND LENGTH (MINIMUM 120 FT / 36.6 M) DOES NOT EXCEED 30 PERCENT (30%) OF THE LONGEST SGCP4000 / MS4000 APPROACH. IF GREATER THAN 30%, INCREASE THE LENGTH. WHERE NOT POSSIBLE (E.G. INSULATED JOINTS) INCREASE THE APPROACH LENGTH WITH A DUMMY LOAD IN SERIES WITH THE TERMINATION SHUNT. ENSURE THAT THE RESULTING TOTAL LENGTH MEETS THE LENGTH VERSUS FREQUENCY REQUIREMENTS.

Table 2-4:
Warning Time vs. Maximum Speed Distance Table (Imperial {MPH-FT/S})

MAXIMUM SPEED																
MPH		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
ft/s		7.3	14.7	22.0	29.3	36.7	44.0	51.3	58.7	66.0	73.3	80.7	88.0	95.3	102.7	110.0
DISTANCE TRAVELED IN FEET																
TOTAL WARNING TIME IN SECONDS	1	7	15	22	29	37	44	51	59	66	73	81	88	95	103	110
	2	15	29	44	59	73	88	103	117	132	147	161	176	191	205	220
	3	22	44	66	88	110	132	154	176	198	220	242	264	286	308	330
	4	29	59	88	117	147	176	205	235	264	293	323	352	381	411	440
	5	37	73	110	147	183	220	257	293	330	367	403	440	477	513	550
	10	73	147	220	293	367	440	513	587	660	733	807	880	953	1027	1100
	15	110	220	330	440	550	660	770	880	990	1100	1210	1320	1430	1540	1650
	20	147	293	440	587	733	880	1027	1173	1320	1467	1613	1760	1907	2053	2200
	25	183	367	550	733	917	1100	1283	1467	1650	1833	2017	2200	2383	2567	2750
	30	220	440	660	880	1100	1320	1540	1760	1980	2200	2420	2640	2860	3080	3300
	35	257	513	770	1027	1283	1540	1797	2053	2310	2567	2823	3080	3337	3593	3850
	40	293	587	880	1173	1467	1760	2053	2347	2640	2933	3227	3520	3813	4107	4400
	45	330	660	990	1320	1650	1980	2310	2640	2970	3300	3630	3960	4290	4620	4950
	50	367	733	1100	1467	1833	2200	2567	2933	3300	3667	4033	4400	4767	5133	5500
	55	403	807	1210	1613	2017	2420	2823	3227	3630	4033	4437	4840	5243	5647	6050
	60	440	880	1320	1760	2200	2640	3080	3520	3960	4400	4840	5280	5720	6160	6600
	65	477	953	1430	1907	2383	2860	3337	3813	4290	4767	5243	5720	6197	6673	7150
	70	513	1027	1540	2053	2567	3080	3593	4107	4620	5133	5647	6160	6673	7187	7700
	75	550	1100	1650	2200	2750	3300	3850	4400	4950	5500	6050	6600	7150	7700	8250
	80	587	1173	1760	2347	2933	3520	4107	4693	5280	5867	6453	7040	7627	8213	8800
	85	623	1247	1870	2493	3117	3740	4363	4987	5610	6233	6857	7480	8103	8727	9350
	90	660	1320	1980	2640	3300	3960	4620	5280	5940	6600	7260	7920	8580	9240	9900
	95	697	1393	2090	2787	3483	4180	4877	5573	6270	6967	7663	8360	9057	9753	10450
	100	733	1467	2200	2933	3667	4400	5133	5867	6600	7333	8067	8800	9533	10267	11000
	105	770	1540	2310	3080	3850	4620	5390	6160	6930	7700	8470	9240	10010	10780	11550
	110	807	1613	2420	3227	4033	4840	5647	6453	7260	8067	8873	9680	10487	11293	12100
	115	843	1687	2530	3373	4217	5060	5903	6747	7590	8433	9277	10120	10963	11807	12650
	120	880	1760	2640	3520	4400	5280	6160	7040	7920	8800	9680	10560	11440	12320	13200

Note: Where the length of the track is known, the Total Warning Time In Seconds can be determined by dividing the length in feet by the "Feet/Sec" at the train speed selected.

Table 2-5:
Warning Time vs. Maximum Speed Distance Table (Metric {KPH-M/S})

MAXIMUM SPEED																
KPH		5	10	15	20	25	30	40	50	60	70	80	90	100	110	120
m/s		1.388	2.77	4.166	5.6	6.9	8.3	11.1	13.9	16.7	19.4	22.2	25.0	27.8	30.6	33.3
DISTANCE TRAVELED IN METERS																
TOTAL WARNING TIME IN SECONDS	1	1	3	4	6	7	8	11	14	17	19	22	25	28	31	33
	2	3	6	8	11	14	17	22	28	33	39	44	50	56	61	67
	3	4	8	13	17	21	25	33	42	50	58	67	75	83	92	100
	4	6	11	17	22	28	33	44	56	67	78	89	100	111	122	133
	5	7	14	21	28	35	42	56	69	83	97	111	125	139	153	167
	10	14	28	42	56	69	83	111	139	167	194	222	250	278	306	333
	15	21	42	63	83	104	125	167	208	250	292	333	375	417	458	500
	20	28	56	83	111	139	167	222	278	333	389	444	500	556	611	667
	25	35	69	104	139	174	208	278	347	417	486	556	625	694	764	833
	30	42	83	125	167	208	250	333	417	500	583	667	750	833	917	1000
	35	49	97	146	194	243	292	389	486	583	681	778	875	972	1069	1167
	40	56	111	167	222	278	333	444	556	667	778	889	1000	1111	1222	1333
	45	63	125	188	250	313	375	500	625	750	875	1000	1125	1250	1375	1500
	50	69	139	208	278	347	417	556	694	833	972	1111	1250	1389	1528	1667
	55	76	153	229	306	382	458	611	764	917	1069	1222	1375	1528	1681	1833
	60	83	167	250	333	417	500	667	833	1000	1167	1333	1500	1667	1833	2000
	65	90	181	271	361	451	542	722	903	1083	1264	1444	1625	1806	1986	2167
	70	97	194	292	389	486	583	778	972	1167	1361	1556	1750	1944	2139	2333
	75	104	208	313	417	521	625	833	1042	1250	1458	1667	1875	2083	2292	2500
	80	111	222	333	444	556	667	889	1111	1333	1556	1778	2000	2222	2444	2667
	85	118	236	354	472	590	708	944	1181	1417	1653	1889	2125	2361	2597	2833
	90	125	250	375	500	625	750	1000	1250	1500	1750	2000	2250	2500	2750	3000
	95	132	264	396	528	660	792	1056	1319	1583	1847	2111	2375	2639	2903	3167
	100	139	278	417	556	694	833	1111	1389	1667	1944	2222	2500	2778	3056	3333
	105	146	292	438	583	729	875	1167	1458	1750	2042	2333	2625	2917	3208	3500
	110	153	306	458	611	764	917	1222	1528	1833	2139	2444	2750	3056	3361	3667
	115	160	319	479	639	799	958	1278	1597	1917	2236	2556	2875	3194	3514	3833
	120	167	333	500	667	833	1000	1333	1667	2000	2333	2667	3000	3333	3667	4000

Note: Where the length of the track is known, the Total Warning Time In Seconds can be determined by dividing the length in meters by the "Meters/Sec" at the train speed selected.

NOTE

NOTE

System response time is approximately 5 seconds.

The approach distance for a SGCP4000 / MS4000 installation with or without an island circuit is the distance from the SGCP4000 / MS4000 track wire connections on the rail to the termination shunt connections. Figure 2-1 provides a depiction of approach distances. The required approach distance is calculated using the following factors:

- Maximum speed of trains through the approach in feet per second/meters per second

- Highest crossing warning time requirement in seconds. This is based on maximum train speed as well as the SGCP4000 / MS4000 response time in seconds

2.6.2 Approach Distance Calculation Example

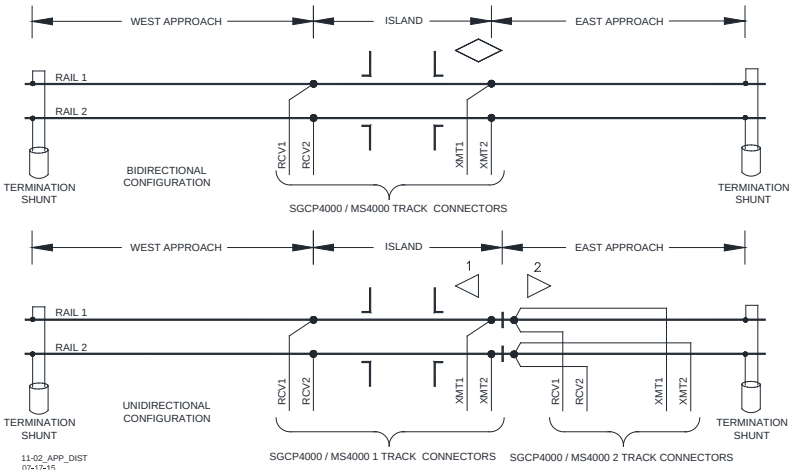


Figure 2-1:
Approach Distance

Given:

- Speed Conversion Factor:
  - 1 mile per hour (MPH) = 1.47 feet per second (ft/s)
  - 1 kilometer per hour (KPH) = 0.28 meters per second (m/s)
- Maximum train speed = 50 MPH or 80 KPH
- Typical SGCP4000 / MS4000 response time = 5 seconds
- Total warning time = 30 seconds

Conversion Formulas:

- Maximum train speed:
  - Measured in ft/s = speed in MPH multiplied by 1.47
  - Measured in m/s = speed in KPH multiplied by 0.28
- Total approach time = Typical SGCP4000 / MS4000 response time plus (+) Total warning time
- Total approach distance = maximum train speed in ft/s multiplied by total approach time

Calculations:

- Maximum train speed:
  - 50 MPH X 1.47 = 73.3 ft/sec
  - 80 KPH X 0.28 = 22.2 m/s
- Total approach time = 5 seconds + 30 seconds = 35 seconds
- Required approach distance:
  - 73.3 ft/sec X 35 seconds = 2566.9 feet
  - 22.2 m/s X 35 seconds = 778 meters

NOTE

NOTE

The required approach distance is the distance from the island track wires to the termination shunt. Refer to the above figure for further information.

2.7 USING NARROW-BAND SHUNTS AND OVERLAPPING APPROACHES

When crossings are close together, it may be necessary to overlap the SGCP4000 / MS4000 approaches as well as use adjacent SGCP4000 / MS4000 frequencies. Restrictions on the use of adjacent SGCP4000 / MS4000 frequencies and the type of termination shunt used are covered in the following paragraphs.

2.7.1 Using Narrow-Band Termination Shunts

A narrow-band shunt must be used to terminate each overlapping approach as shown in Figure 2-2.

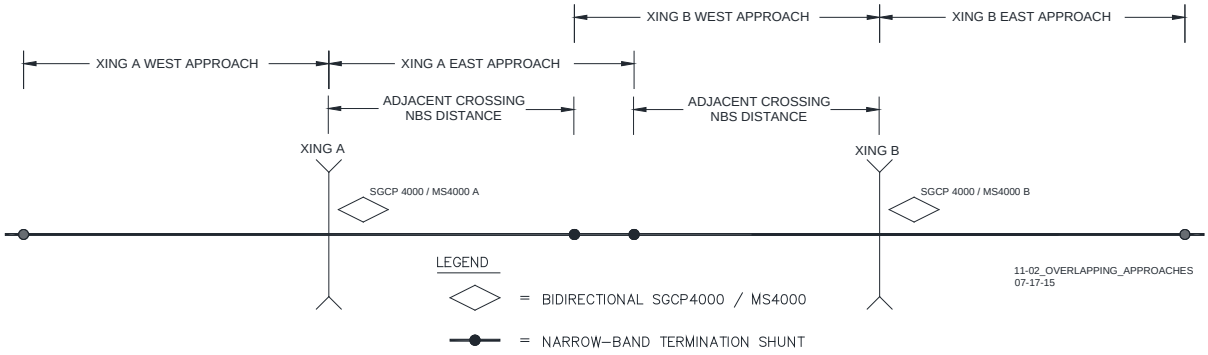


Figure 2-2:
Overlapping Approaches

2.7.2 Types of Narrow-Band Shunts

The following sections detail the types of narrow-band shunts can be used with the SGCP4000 / MS4000.

2.7.2.1 62775 Single Frequency Narrow-Band Shunt

Primary termination shunt for both bidirectional and unidirectional applications. The 62775-f Single Frequency Narrow Band Shunt is available in the following termination frequencies:

Table 2-6:
62775-f Single Frequency Narrow Band Shunt Available Frequencies

86	156	267	392	525	686	881
100	172	285	430	560	753	970
114	210	326	452	630	790	979
151	211	348	521.2	645	816	
Siemens Rail Automation Standard SGCP4000 / MS4000 frequencies are shown in **bold**.						

⚠ WARNING

WARNING

THE 62775 NARROW-BAND SHUNT CANNOT BE USED IF A SGCP4000 / MS4000 APPROACH OVERLAPS A MODEL 300 OR MODEL 400 SGCP4000 / MS4000 APPROACH. USE THE 62780 SHUNT INSTEAD.

2.7.2.2 62775 Multi-frequency Narrow-Band Shunt

The 62775 Multi-frequency Narrow Band Shunt is the primary multi-frequency termination shunt for both bidirectional and unidirectional applications. The shunts are available in the termination frequencies shown in Table 2-7.

Table 2-7:
Multi-frequency Narrow-band Shunt, 62775

SHUNT PART NUMBER	FREQUENCY (HZ)	SHUNT PART NUMBER	FREQUENCY (HZ)
62775-8621	86	62775-2152	211
	114		285
	156		348
	211		430
			525
62775-1543	156	62775-3497	348
	211		430
	285		525
	348		645
	430		790
			970

2.7.2.3 62780-f Narrow-band Shunt

The 62780-f Narrow-band Shunt is used in overlapping areas where adjacent frequency narrow-band shunts produce excessive loading when used with the 62775 shunt. It produces less loading effect on adjacent frequencies than 62775-f narrow-band shunt, but does not terminate as well as 62775-f narrow-band shunt. The 62780-f Narrow-band Shunt is used in installations with overlapping Model 300 and Model 400 SGCP4000 / MS4000 approaches and is available in the frequencies listed for the 62775-f narrow-band shunt except 172 Hz.

2.7.3 Adjacent Frequency Use In Overlapping Bidirectional Or Directionally-wired Approaches

When overlapping two or more adjacent SGCP4000 / MS4000 frequencies in bidirectional and directionally-wired applications the frequency of the overlapping narrow-band termination shunt must be selected to ensure optimum SGCP4000 / MS4000 operation. The acceptable adjacent narrow-band shunt frequency is determined by the length of the approach, the track frequency of the approach, and the location of the overlapping termination shunts in their respective approaches.

Charts using these factors are provided to determine if the selected adjacent frequency narrow-band shunt locations are allowed for use in your application.

- Charts for 62775-f narrow-band shunt are shown in Figure 2-3, Figure 2-4, and Figure 2-5.
- Charts for 62780-f narrow-band shunt are shown in Figure 2-6, Figure 2-7, and Figure 2-8.
- A chart is provided for each SGCP4000 / MS4000 crossing frequency with its adjacent frequency acceptance information.
- Each chart relates approach distance with the distance from the track wires to the adjacent approach narrow-band shunt
- Shading indicates the distance area near the SGCP4000 / MS4000 track wires that adjacent frequency narrow-band shunt distances should not be used.

2.7.4 Adjacent Frequency Narrow-Band Shunt Distance Example

As an example, a crossing SGCP4000 / MS4000 is operating at 114 Hz with bidirectional approaches set at 4000 feet (121.90 meters). The overlapping approach narrow-band frequency is 86 Hz. (The 62775-f Narrow Band Shunt chart for 114 Hz with adjacent frequencies of 86 and 156 Hz is shown in Figure 2-3, sheet 1).

The 114 Hz chart shows that 62775-f Narrow-band Shunts for 86 Hz should be located no closer than 1,000 feet (304.8 meters) to the 114 Hz SGCP4000 / MS4000 track wires.

If a 62780 shunt is used at 86 Hz (see Figure 2-6) the chart shows the 62780 shunt should be located no closer than 300 feet (91.4 meters) to the 114 Hz SGCP4000 / MS4000 track wires.

2.7.5 Adjacent Frequency Use with Unidirectional Applications

When adjacent SGCP4000 / MS4000 operating frequencies are used for overlapping unidirectional approaches, narrow-band shunts can be used in accordance with the following:

- Adjacent frequency shunts 62775 should only be located in the outer 50% of a unidirectional approach.

- When closer than 50%, change the unidirectional application to directionally-wired operation and use Figure 2-3 to determine the allowable shunt location.

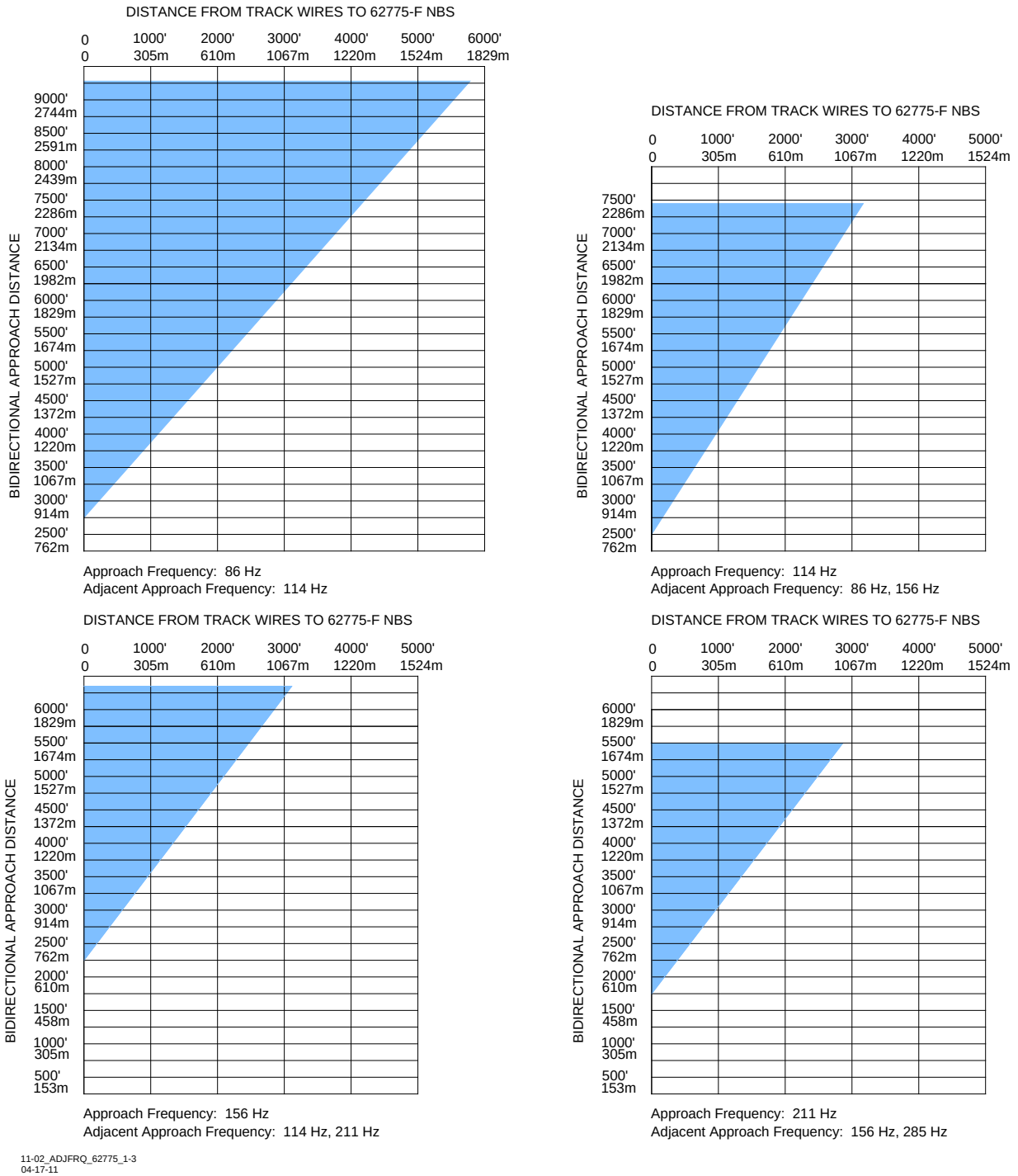


Figure 2-3:
Adjacent Frequency 62775-f Narrow-band Shunt Placement Charts, Bidirectional and Directionally-Wired Application (Sheet 1 of 3)

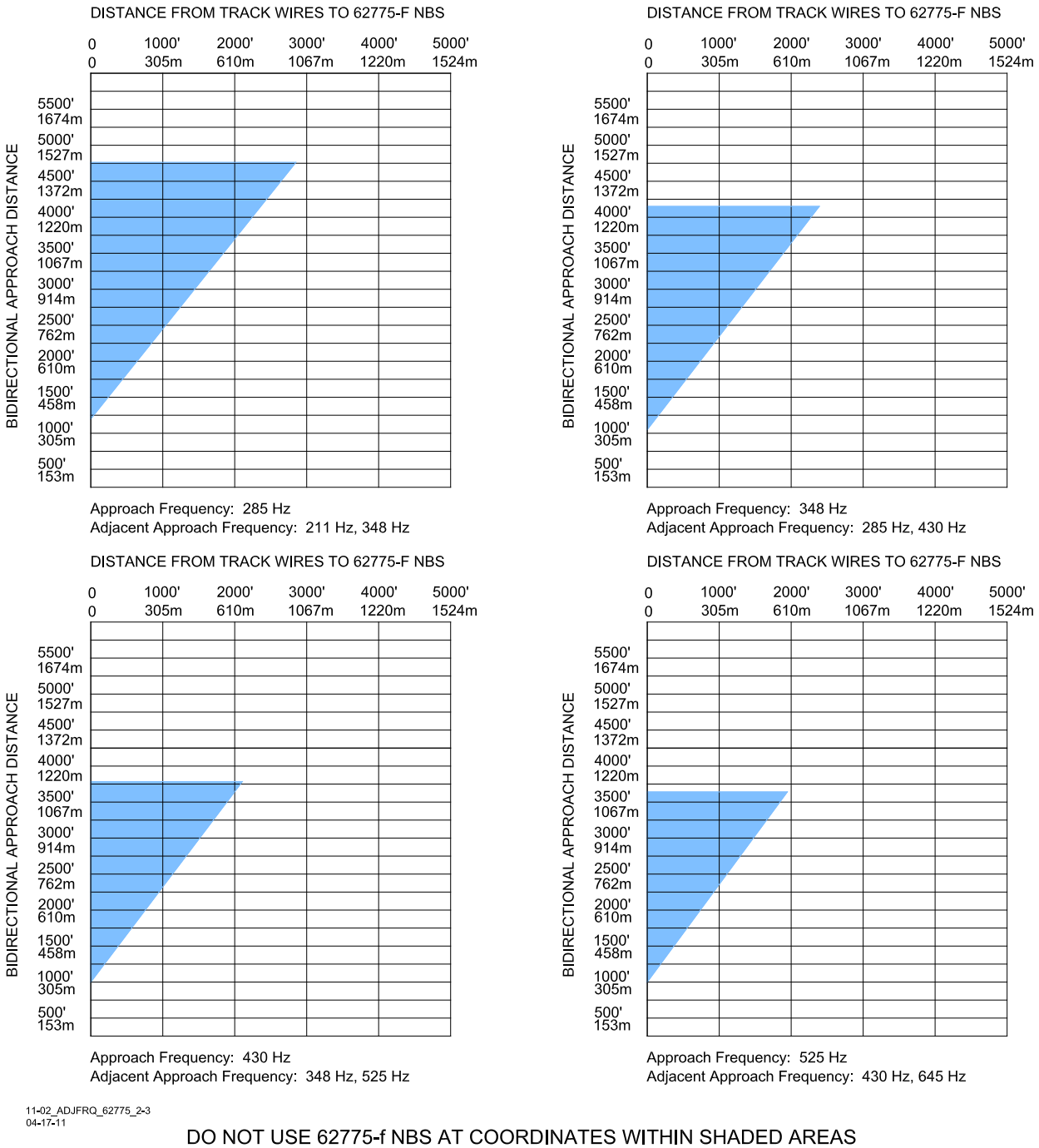


Figure 2-4:
Adjacent Frequency 62775-f Narrow-band Shunt Placement Charts, Bidirectional and Directionally-Wired Application (Sheet 2 of 3)

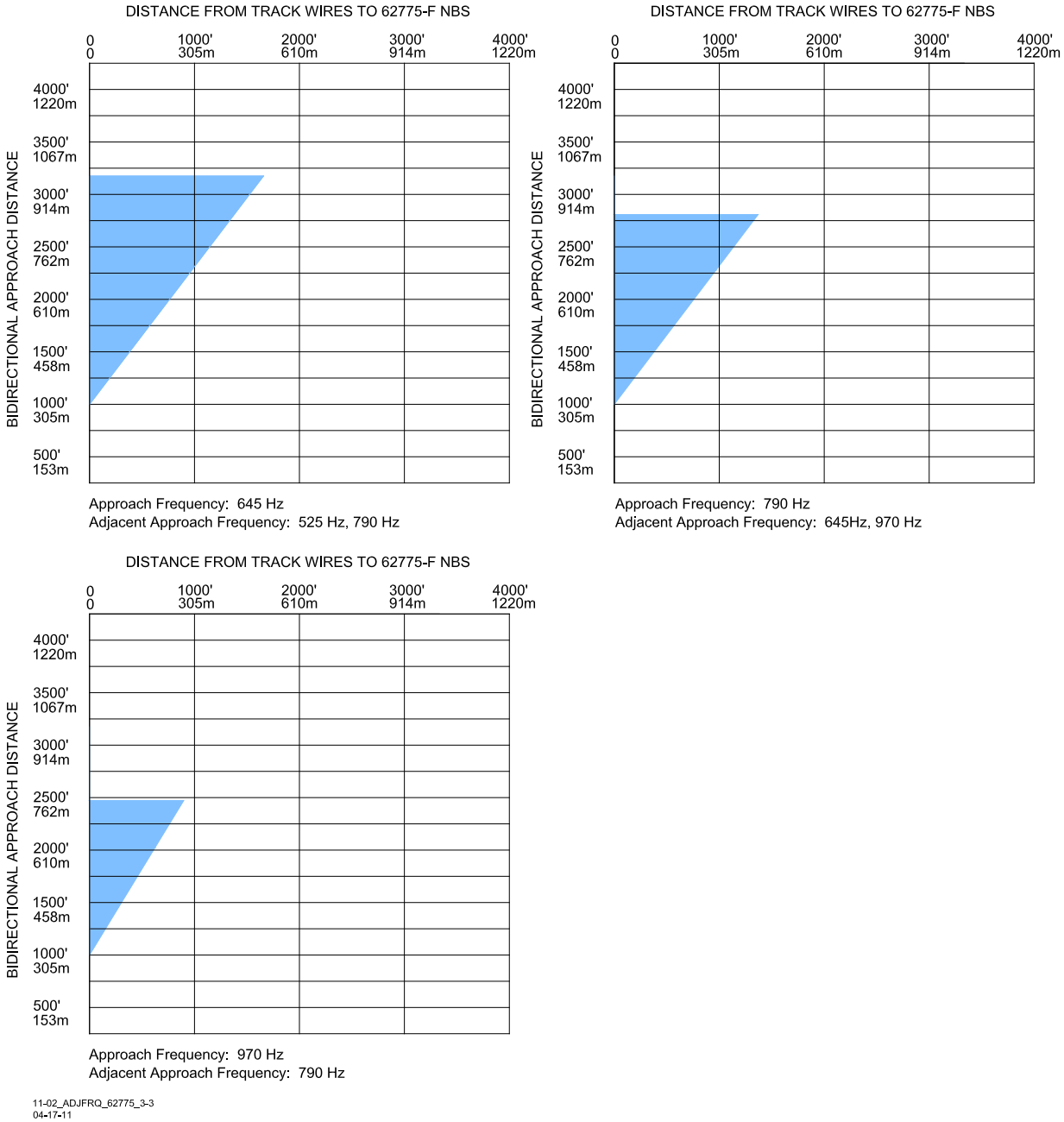
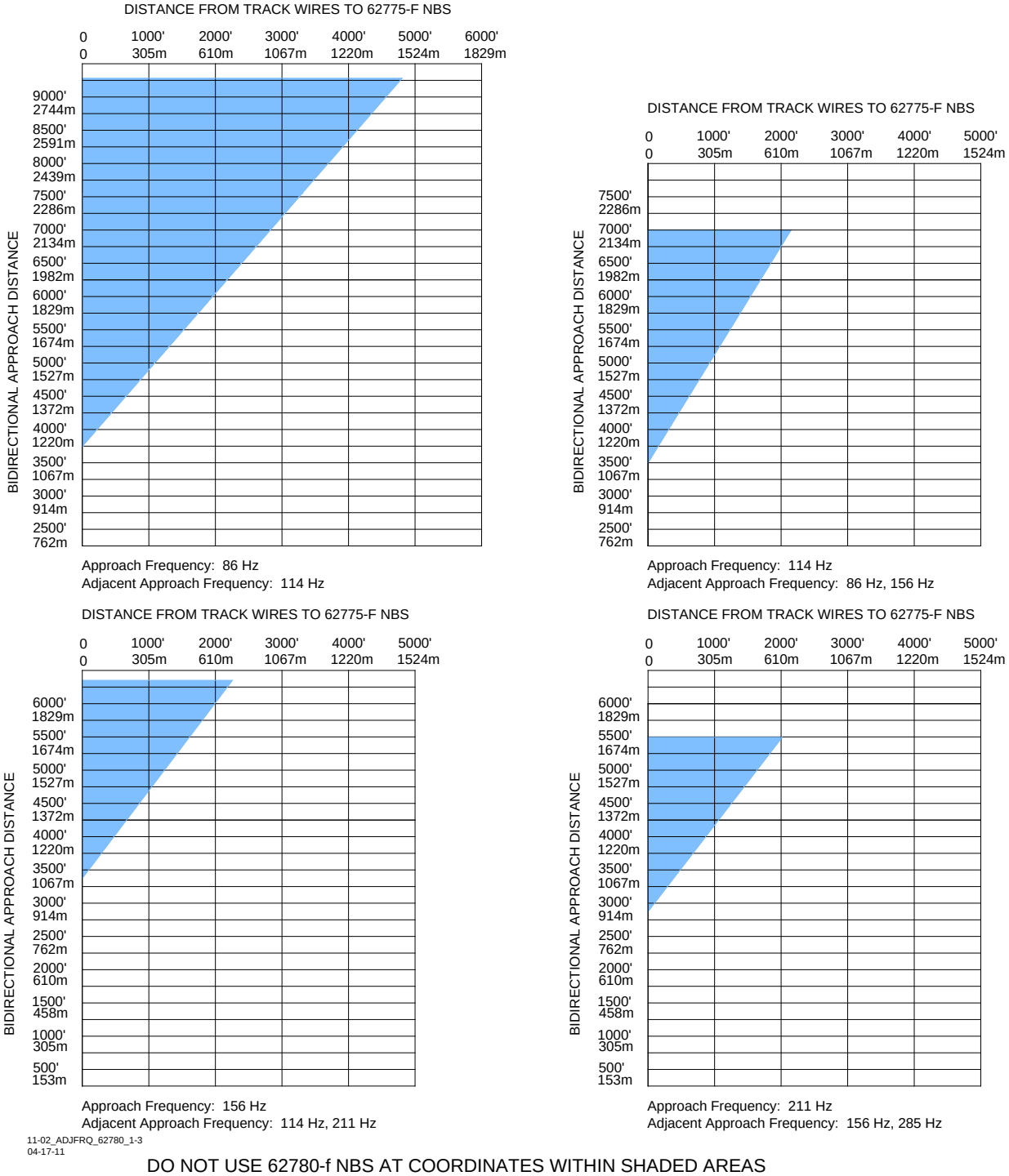


Figure 2-5:
Adjacent Frequency 62775-f Narrow-band Shunt Placement Charts, Bidirectional and Directionally-Wired Application (Sheet 3 of 3)



DO NOT USE 62780-f NBS AT COORDINATES WITHIN SHADED AREAS

Figure 2-6:
Adjacent Frequency 62780-f Narrow-band Shunt Placement Charts, Bidirectional and Directionally-Wired Application (Sheet 1 of 3)

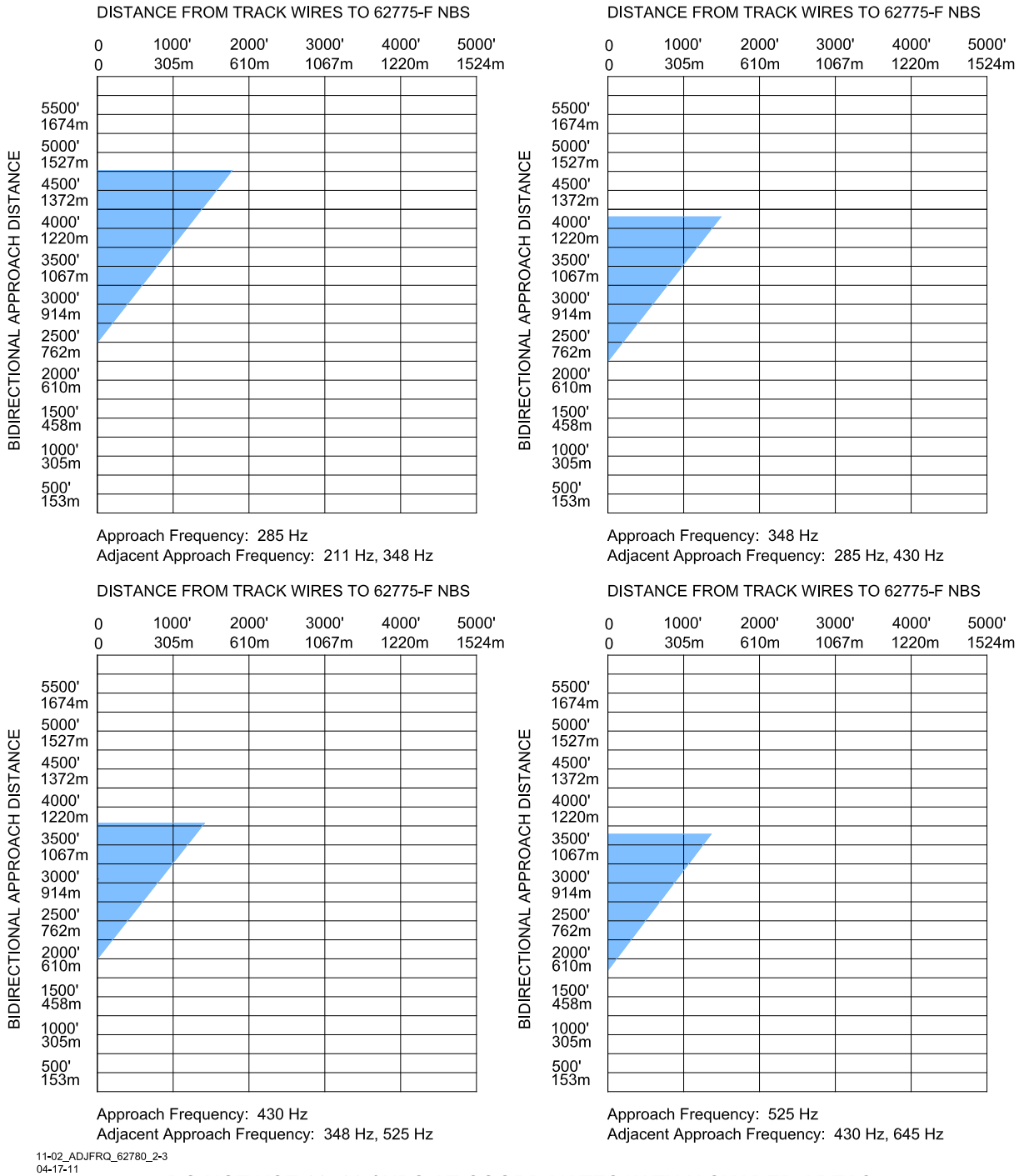


Figure 2-7:
Adjacent Frequency 62780-f Narrow-band Shunt Placement Charts, Bidirectional and Directionally-Wired Application (Sheet 2 of 3)

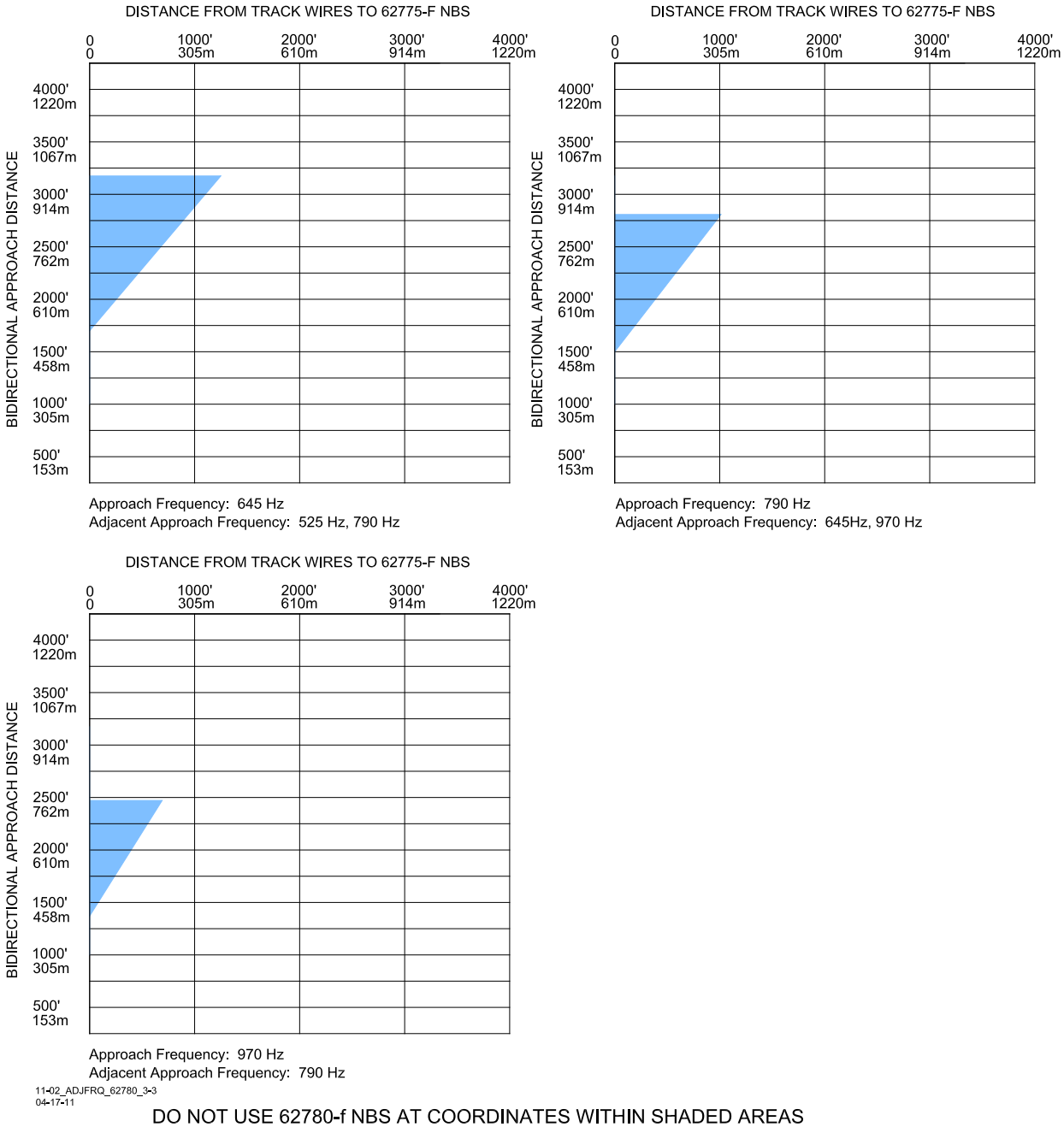


Figure 2-8:
Adjacent Frequency 62780-f Narrow-band Shunt Placement Charts, Bidirectional and Directionally-Wired Application (Sheet 3 of 3)

2.8 REPEATING SGCP4000 / MS4000 OPERATING FREQUENCIES

2.8.1 Insulated Joints Requirements

In general, do not operate two SGCP4000 / MS4000s at the same frequency on a common track unless the units are separated by insulated joints. If necessary, frequencies can be repeated without insulated joints, provided the SGCP4000 / MS4000 approaches do not overlap and the minimum separation distances specified in Table 2-8 exist between termination shunts, and/or one of the SGCP4000 / MS4000s uses an offset frequency. In some cases of extremely high ballast conditions, it may not be possible to repeat the frequencies without insulated joints.

NOTE

NOTE

The distances specified in Table 2-8 vary according to frequency and type of terminating shunt.

Use greater distances between shunts where possible. When repeating frequencies in the same block section where the approaches do not overlap, set one SGCP4000 / MS4000 track frequency as normal and the other to the lower offset frequency.

Example: When a frequency of 285 Hz is selected, set one SGCP4000 / MS4000 to 285 Hz and the other to 284 Hz.

Table 2-8:
Minimum Distance Between Termination Shunts When Repeating SGCP4000 / MS4000 Operating Frequencies

STANDARD SGCP4000 / MS4000 FREQUENCY (HZ)	SEPARATION DISTANCE IN FEET (METERS) 62775-F & 62780-F NBS / 8A076A WIDEBAND SHUNTS
86	5200/1200 (1585.0/365.8)
114	4500/1000 (1371.6/304.8)
156	3500/750 (1066.8/228.6)
211	3000/450 (914.4/137.2)
285	2000/225 (609.6/68.6)
348	500/150 (152.4/45.7)
430	400/100 (121.9/30.5)
525	350/75 (106.7/22.9)
645	300/50 (91.4/15.2)
790	250/25 (76.2/7.6)
970	250/25 (76.2/7.6)

2.9 TERMINATION SHUNTS

Termination shunts are required for all SGCP4000 / MS4000 installations. They must be connected across the rails at sufficient distances from the SGCP4000 / MS4000 track wire connection points to provide full crossing warning system operating time (see paragraph 2.6).

⚠ WARNING

WARNING

WHEN ADDING OR REPLACING TERMINATION SHUNTS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE TERMINATION SHUNT DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.

2.9.1 Hard-Wire Shunt

Use a hard-wire shunt only when no other signals (AC or DC) are present on the rails.

2.9.2 Wideband Shunt

Use the Wideband shunt only with steady energy DC track circuits and no other AC signals present on the rails. The Siemens Rail Automation Part Number for the Wideband Shunt is 8A076A

NOTE

NOTE

The use of dual wideband couplers, part number 8A077, is not required for SGCP4000 / MS4000 4000 applications.

2.9.3 Narrow-Band Shunts

Use a Narrow-band Shunt when other AC signals or coded AC or DC is present on the rails.

2.9.3.1 62775 Single-Frequency Narrow-Band Shunt

The 62775 Single-Frequency Narrow-band Shunt is the primary termination shunt for both bidirectional and unidirectional applications, and is available in the following fixed termination frequencies:

Table 2-9:
Narrow-band Shunt, 62775, Fixed Termination Frequencies

86	151	210	285	392	521.2	630	753	881
100	156	211	326	430	525	645	790	970
114	172	267	348	452	560	686	816	979

Siemens Rail Automation Standard SGCP4000 / MS4000 frequencies are shown in **bold**.

2.9.3.2 62775 Multi-frequency Narrow-Band Shunt

The 62775 Multi-frequency Narrow-band Shunt is available in four multi-frequency versions (see Table 2-10). The frequency is selected by means of seven standard AREMA terminals. The Siemens Rail Automation Part Number is 62775-XXXX.

Table 2-10:
Multi-frequency Narrow-band Shunt, 62775

SHUNT PART NUMBER	FREQUENCY (HZ)	SHUNT PART NUMBER	FREQUENCY (HZ)
62775-8621	86	62775-2152	211
	114		285
	156		348
	211		430
			525
62775-1543	156	62775-3497	348
	211		430
	285		525
	348		645
	430		790
			970

2.9.3.3 62780-f Narrow-Band Shunt

The 62780-f Narrow-Band Shunt is used in territories where overlapping adjacent frequency 62775-f Narrow-Band Shunts produce too much loading effect. The 62780-f NBS must be used when overlapping into Model 300 and Model 400 SGCP4000 / MS4000 approaches. The 62780-f NBS produces less loading effect on adjacent frequencies than the 62775-f Shunt does.

The 62780-f Narrow-band Shunt is available in the following fixed termination frequencies:

Table 2-11:
62780-f Narrow-band Shunt Fixed Termination Frequencies

86	151	211	326	430	525	645	790	970
100	156	267	348	452	560	686	816	979
114	210	285	392	521.2	630	753	881	

Siemens Rail Automation Standard SGCP4000 / MS4000 frequencies are shown in **bold**.

2.9.3.4 62780 Multi-frequency Narrow-Band Shunt

⚠ WARNING

WARNING

THE 62780 NBS MUST BE USED WHEN OVERLAPPING INTO MODEL 300 AND MODEL 400 SGCP4000 / MS4000 APPROACHES.

The 62780 Multi-frequency Narrow-band Shunt is used in territories where overlapping adjacent frequency 62775 Narrow-band Shunts provide too much loading effect. It is available in three multi-frequency versions, as depicted in Table 2-12. The frequency is selected by means of seven standard AREMA terminals.

Table 2-12:
62780 Multi-frequency Narrow-band Shunt,

SHUNT PART NUMBER	FREQUENCY (HZ)	SHUNT PART NUMBER	FREQUENCY (HZ)
62780-8621	86	62780-1543	156
	114		211
	156		285
	211		348
62780-5297	525		430
	645		
	790		
	970		

2.9.4 Termination Shunt Installation

On open track locate termination shunts near the rail with leads as short as practical. Where not at insulated joints avoid wire runs of over 25 feet (7.62 meters). Shunt wires should be 6 AWG.

To afford maximum protection from physical damage, place Wideband and Narrow-band Shunts in a protective enclosure or buried at an appropriate depth, but it is not necessary to bury shunt below the frost line. At insulated joints the termination shunt may be located within the house or signal enclosure.

NOTE

NOTE

The A62776 MS/SGCP4000 / MS4000 Termination Shunt Burial Kit protects shunts while they are buried.
For additional information on Siemens Rail Automation Shunts and the A62776 Burial Kit, refer to the Section 5, Auxiliary Equipment.

2.10 COUPLING AROUND INSULATED JOINTS

Track separated by insulated joints can be coupled only under the specific conditions described in the following paragraphs.

⚠ WARNING

WARNING

THE FEEDPOINT INSULATED JOINTS OF A UNIDIRECTIONAL OR A DIRECTIONALLY-WIRED APPROACH MUST NOT BE BYPASSED WITH ANY COUPLING DEVICE.

USE ONLY INSULATED JOINT BYPASS COUPLER, 62785 F WITH THE SGCP4000 / MS4000.

WHEN AC TRACK CIRCUITS OR CAB SIGNALS ARE PRESENT, DO NOT COUPLE AROUND THE INSULATED JOINTS WITH ANY TYPE OF COUPLER.

LEAD WIRE LENGTH SHOULD NOT EXCEED 10 FEET (3.05 METERS) AND SHOULD NOT BE SMALLER THAN 6 AWG.

WHEN ADDING OR REPLACING INSULATED JOINT COUPLERS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE INSULATED JOINT COUPLER DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.

2.10.1 Bypassing Insulated Joints Using Wideband Shunt

The 8A076A Wideband Shunt presents low impedance to all SGCP4000 / MS4000 frequencies and any other audio signals present. It is only for use with steady energy DC track circuits

⚠ WARNING

WARNING

THE 8A076A WIDEBAND SHUNT MUST NOT BE USED TO BYPASS INSULATED JOINTS IN DC CODED TRACK CIRCUITS, AC TRACK CIRCUITS, AND/OR CODED AC TRACK CIRCUITS.

NOTE

NOTE

The use of dual wideband couplers, part number 8A077, is not required for SGCP4000 / MS4000 applications.

A total of five sets of insulated joints can be bypassed in an approach using a wideband shunt.

When insulated joints are located very near the crossing and are bypassed with wideband shunts, if possible, place the SGCP4000 / MS4000 island circuit track wire connections to the rails beyond the insulated joints.

This includes the wideband shunts in the actual island circuit.

2.10.2 Tunable Insulated Joint Bypass Coupler

The 62785-f Tunable Insulated Joint Bypass Coupler Is available in the standard Siemens Rail Automation operating frequencies of 156 Hz through 970 Hz. The coupler must be located within 10 feet (3.0 meters) of the insulated joints that it is coupling. It can be used in SGCP4000 / MS4000 applications that require using an insulated joint bypass coupler as long as:

- No CAB signals, AC, or coded AC track circuits are present.
- In DC coded track circuits, the insulated joints within an approach can be bypassed using the 62785-f coupler, provided the minimum distances specified in Table 2-13 are observed.
- As a general rule, a maximum of two sets of insulated joints in each approach can be bypassed using the 62785-f.
- The 62785-f coupler must be field adjusted to pass the SGCP4000 / MS4000 operating frequency around the insulated joints, as field tuning enables precise frequency adjustment for proper SGCP4000 / MS4000 operation.
- The 62785-f couplers must be adjusted in conjunction with SGCP4000 / MS4000 calibration.
- In motion sensor applications only, you can use the 62785-f coupler when insulated joints are located in general anywhere within the approach. When used in a motion sensor application, the 62785-f couplers must be adjusted in conjunction with SGCP4000 / MS4000 calibration

⚠ WARNING

WARNING

THE MINIMUM DISTANCES TO THE INSULATED JOINTS SPECIFIED IN TABLE 2 13 APPLY ONLY TO SIEMENS RAIL AUTOMATION SGCP4000 / MS4000'S.

WHEN THE SGCP4000 / MS4000 IS PROGRAMMED AS A PREDICTOR, APPLICATION RULES FOR THE 62785-F ARE SPECIFIED IN THE TABLE 2 13. WHEN APPROACH LENGTHS ARE SHORTER THAN THOSE SPECIFIED IN TABLE 2 13, THE 62785-F COUPLER MUST NOT BE LOCATED WITHIN THE INNER TWO-THIRDS OF THAT APPROACH.

USE ONLY THE INSULATED JOINT BYPASS COUPLER, 62785 F WITH THE SGCP4000 / MS4000.

TUNED COUPLERS CANNOT BE USED TO BYPASS INSULATED JOINTS IN CAB SIGNAL OR AC TRACK CIRCUITS.

Table 2-13:
Minimum Distance to Insulated
Joints Bypassed With The 62785-f Coupler

FREQUENCY (HZ)	MINIMUM DISTANCE TO 1ST SET OF INSULATED JOINTS IN FEET (METERS)*	MINIMUM DISTANCE TO 2ND SET OF INSULATED JOINTS IN FEET (METERS)*
151 to 211	1500 (457.2)	2200 (670.6)
212 to 348	1000 (304.8)	1400 (426.7)
349 to 560	700 (213.4)	1000 (304.8)
561 to 790	500 (152.4)	800 (243.8)
791 to 979	400 (121.9)	700 (213.4)

* Distance applies to insulated joints located on the same side of the crossing.

NOTE: Frequencies of 86 and 114 Hz are not normally used with the 62785-f coupler. Contact Siemens Rail Automation Technical Support at 1-800-793-7233 for these applications.

2.11 INSTALLING BYPASS SHUNTS AND COUPLERS

When installing wide band shunts and tuned couplers to bypass insulated joints, connect the devices directly to the rails with leads as short as practical and encase the devices in a protective enclosure or buried at an appropriate depth as shown in Figure 2-9.

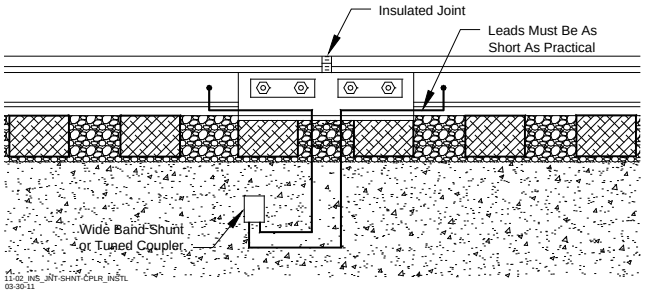


Figure 2-9:
Insulated Joint, Shunt, or Coupler Installation

NOTE

NOTE

The A62776 MS/SGCP4000 / MS4000 Termination Shunt Burial Kit is designed to protect shunts while they are buried. For additional information, refer to Section 5, Auxiliary Equipment.

2.12 ISLAND CIRCUITS

The SGCP4000 / MS4000 provides a high frequency island track circuit with excellent cutoff and shunting characteristics under varying ballast conditions.

2.12.1 Island Circuit Approach Length

Siemens Rail Automation recommends that the minimum length of an island track circuit should be 120 feet (36.6 meters) between track connections, or longer if required to ensure island circuit shunting for the operating car fleet and to comply with the operating practices of the railroad. To ensure proper SGCP4000 / MS4000 operation, the maximum island length (measured between the track wire connections on either side of the crossing) should be 350 feet (106.7 meters) and must not exceed 30 percent of the longest SGCP4000 / MS4000 approach. The 30 percent figure applies to approach circuits that are 1,000 feet (304.8 meters) or shorter.

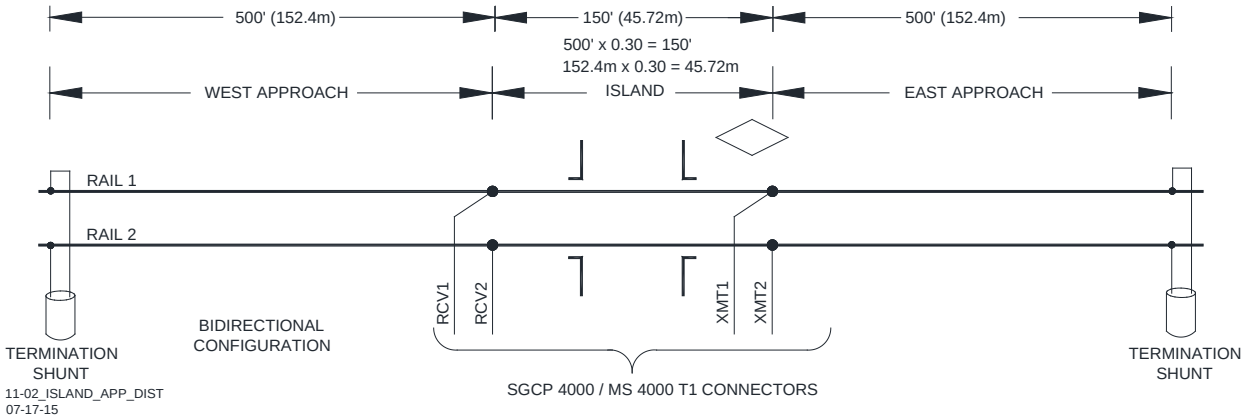


Figure 2-10:
Determining Island Approach Length

For SGCP4000 / MS4000 track approaches utilizing an internal island and with track approaches that are less than 800 feet (243.8m), it is permissible to connect the RX and RX CHK wires to the same pair of track wires from the crossing house. This activity will provide a similar benefit to making a six-wire connection for remote applications.

In applications that cannot meet either of the above guidelines, either:

- Use a standard six-wire connection where the SGCP4000 / MS4000 RX CHK wires are connected to the TX wires adjacent to the track side connections, or
- Extend or lengthen the approach(es) to a length that meets the 30% rule. This may be accomplished either by extending the approaches or adding dummy loads in series with the termination shunts.

2.12.2 Track Circuit Compatibility

The SGCP4000 / MS4000 Island is compatible with most track circuits, including DC and AC coded track.

2.12.3 Island Frequencies

Table 2-14:
SGCP4000 / MS4000 Island Frequencies (kHz)

2.14	3.24	4.90	7.10	10.00	13.20	17.50
2.63	4.00	5.90	8.30	11.50	15.20	20.20

⚠ WARNING

WARNING

AT MULTIPLE TRACK INSTALLATIONS, USE DIFFERENT FREQUENCIES FOR EACH ISLAND CIRCUIT.

IN THE SAME TRACK SECTION, DO NOT REPEAT ISLAND FREQUENCIES WITHIN 5000 FEET (1524.0 METERS), UNLESS SEPARATED BY INSULATED JOINTS.

ON ADJACENT TRACKS, DO NOT REPEAT ISLAND FREQUENCIES WITHIN 1500 FEET (457.2 meters).

NOTE

NOTE

Use frequencies of 10.0 kHz and lower when required island length is over 200 feet (61.0 meters), or lumped ballast loading at the street is anticipated.

2.12.4 Island Shunting Sensitivity

The island can be calibrated to respond to a shunting sensitivity of 0.12, 0.3, 0.4 or 0.5 ohms. A hardwire shunt is used for calibration.

NOTE

NOTE

The island circuit shunting sensitivity adjustment procedure is in the Section 7.3.8, Calibrating the SGCP4000 / MS4000.

Island track circuit calibration is generally performed using 0.12 ohm shunting sensitivity. In an area where poor shunting is experienced or anticipated, a minimum of 0.3-ohm shunting sensitivity is recommended.

In areas of passenger operation, a minimum of 0.3-ohm shunting sensitivity is recommended.

2.12.5 Island Circuit Wiring

Use #6 AWG for track wires. Use twisted pair wires with at least two turns per foot for connections between the track and the SGCP4000 / MS4000 bungalow. Provide as much separation between transmit and receive wire pairs as practical. Total wire length from the bungalow to transmit wire rail connections and bungalow to receive wire connections should not exceed 600 ft. (182.9m).

⚠ CAUTION

CAUTION

USE PROPER PRIMARY SURGE PROTECTION ON THE TRACK WIRES, SGCP4000 / MS4000 BATTERY WIRES, AND ALL SGCP4000 / MS4000 LINE CIRCUITS.

2.13 TRACK CONNECTIONS

Track wire (lead) connection requirements are based on the track circuit configuration and the distance between the SGCP4000 / MS4000 bungalow and the transmitter lead connections at the track.

⚠ WARNING

WARNING

WHEN ANY EXTERNAL TRACK CIRCUIT EQUIPMENT OR AUXILIARY TRACK CIRCUIT EQUIPMENT SHARES TRACK WIRES WITH A SGCP4000 / MS4000/MS TRACK CIRCUIT THAT DOES NOT HAVE AN ACTIVE INTERNAL ISLAND FOR THAT TRACK CIRCUIT OR OUTPUT, SUCH AS A DAX OR PRIME PREDICTION OFFSET, THEN THE TRACK CIRCUIT EQUIPMENT MUST BE CONNECTED IN ACCORDANCE WITH PARAGRAPH 2.13.7.

2.13.1 Four-Wire Connections For Bidirectional Applications

In most installations where a SGCP4000 / MS4000 is operating at a crossing, four track leads (wires) connect the SGCP4000 / MS4000 to the track. Two transmitter leads are connected on the side of the crossing nearest the instrument bungalow. The transmitter leads must be as short as possible and not exceed the maximum lengths specified in Table 2-15. Two receiver leads are connected to the rails on the opposite side of the crossing. Two check channel receiver leads are routed to the surge panel where they are connected to the corresponding transmitter leads as shown in Figure 2-11.

⚠ CAUTION

CAUTION

THE MAXIMUM TRANSMITTER LEAD LENGTHS SPECIFIED IN Table 2 15 ARE FOR THE TRANSMITTER PAIR OF WIRES MEASURED BETWEEN THE BUNGALOW AND THE RAILS CONNECTIONS. FAILURE TO DO SO MAY RESULT IN CHECK RECEIVER ERRORS AND FALSE ACTIVATION.

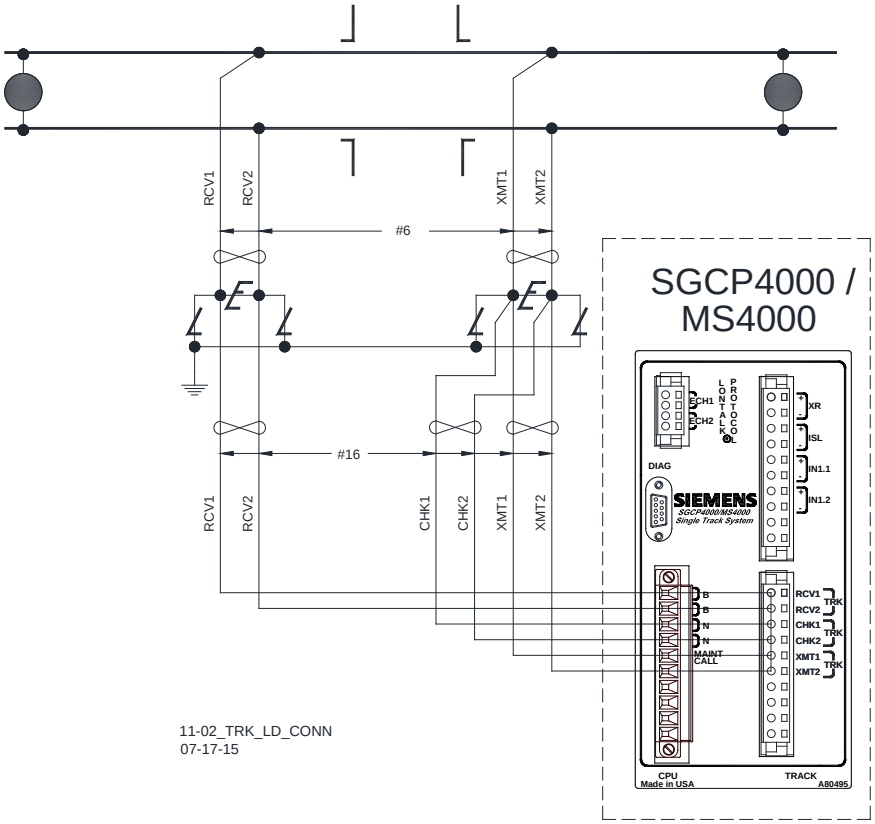


Figure 2-11:
Track Lead Connections

Table 2-15:
Maximum Transmitter Track Wire Length For 4-Wire Applications

STANDARD SIEMENS RAIL AUTOMATION SGCP4000 / MS4000 FREQUENCY (HZ)	MAXIMUM TRANSMIT LEAD LENGTH IN FEET (METERS)
86	100 (30.5)
114	125 (38.1)
156	150 (45.7)
211	200 (61.0)
285-970	250 (76.2)

2.13.2 Four Track Wire Unidirectional and Directionally-wired Applications Rail Connections

In unidirectional or directionally-wired installations, locate the transmitter leads adjacent to the insulated joints wherever possible.

2.13.3 Track Lead Routing

Track wires are routed between the SGCP4000 / MS4000 track connectors on the 4000 front panel and the Surge Panel and between the Surge Panel and the rails as shown in Figure 2-11. The leads between the SGCP4000 / MS4000 and the Surge Panel use number 16 AWG to 12 AWG wire. The transmitter and receiver leads between the Surge Panel and the rails must be twisted and have a minimum wire size of number 6 AWG

NOTE

NOTE

When using an island circuit, physically separate the SGCP4000 / MS4000 transmitter pair as far as practical from the receiver pair, both below ground and within the bungalow. When splicing track wire connections, use a crimped or welded splice.

2.13.4 Track Lead Length

In general, limit the total track lead length to 600 feet (182.9 meters), where possible. This includes the actual length of the transmitter and the receiver twisted pairs added together. Twist each pair of wires at least two turns per foot. Track lead length is measured from the bungalow to the rail connections.

2.13.5 Six-Wire Connections

When the transmit leads must exceed the maximum lengths specified in Table 2-15, a six-wire track hookup must be used. In a six-wire hookup, the maximum wire length allowed is 3500 feet (1066.8 meters).

2.13.6 Six-Wire Transmitter and Check Receiver Track Connection Requirements

In a six-wire application there must be a six-wire to four- wire conversion near the rail connection so that only two transmitter wires and two receive wires are actually connected to the track. Each of the two Check wires must be connected to the corresponding Transmitter wire:

- Within 25 feet (7.62 meters) of the rail connections.
- Outside the ballast line or area damaged by track machinery.
- Both transmitter/check pairs are connected to the rail by single wires.
- A typical SGCP4000 / MS4000 six-wire to four-wire conversion operating in unidirectional mode is shown in Figure 2-12.

⚠ WARNING

WARNING

IN A SIX-WIRE APPLICATION, TWO CHECK WIRES ARE CONNECTED TO THE CORRESPONDING TRANSMITTER TRACK WIRES IN THE UNDERGROUND TO PROVIDE REMOTE SENSING OF THE TRANSMIT SIGNAL. THE CONNECTION IS MADE WITHIN 25 FEET (7.62 METERS) OF THE TRANSMITTER FEED POINTS BUT NOT AT THE RAIL CONNECTIONS AND NOT WHERE THE CONNECTION CAN BE DAMAGED BY TRACK MACHINERY OR DRAGGING EQUIPMENT.

THE CORRESPONDING XMT AND CHK WIRES MUST BE CONNECTED TOGETHER AS SHOWN IN FIGURE 2 12.

ENSURE THAT THE CORRESPONDING XMT AND RCV WIRES ARE NOT CONNECTED TOGETHER OR OPEN TRACK WIRE DETECTION WILL NOT OPERATE CORRECTLY.

THE LOCATION OF THE TRANSMITTER/CHECK CONNECTION SHOULD

BE LOCATED AWAY FROM THE TRACK AND IN A MANNER THAT MINIMIZES THE RISK OF THE CHECK AND RECEIVE WIRES BEING DAMAGED SIMULTANEOUSLY BY TRACK MACHINERY OR DRAGGING EQUIPMENT.

WHEN ANY EXTERNAL TRACK CIRCUIT EQUIPMENT OR AUXILIARY TRACK CIRCUIT EQUIPMENT SHARES TRACK WIRES WITH A SGCP4000 / MS4000/MS TRACK CIRCUIT THAT DOES NOT HAVE AN ACTIVE INTERNAL ISLAND FOR THAT TRACK CIRCUIT OR OUTPUT, SUCH AS A DAX OR PRIME PREDICTION OFFSET, THEN THE TRACK CIRCUIT EQUIPMENT MUST BE CONNECTED IN ACCORDANCE WITH PARAGRAPH 2.13.7.

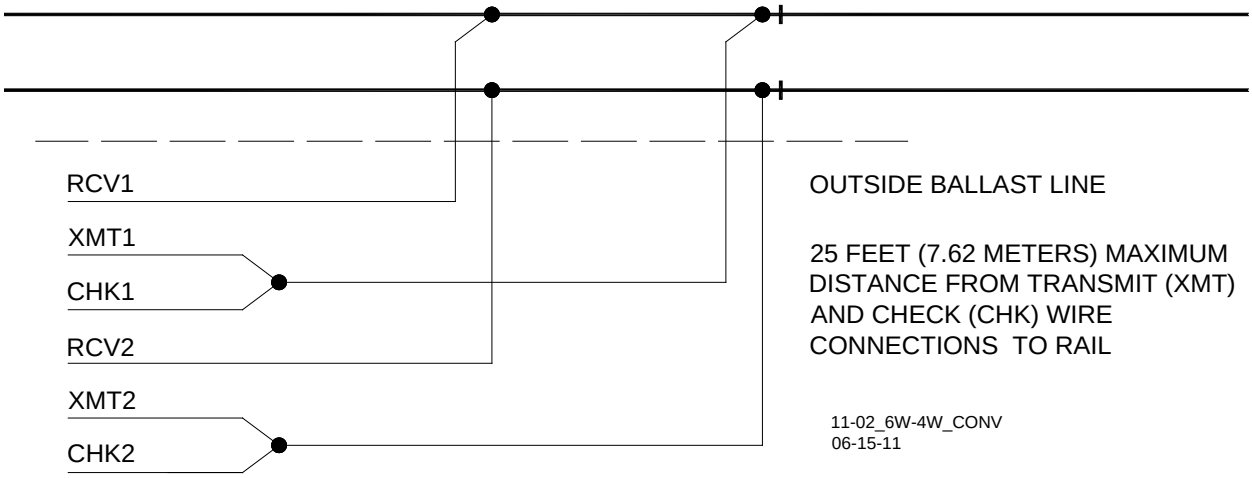


Figure 2-12:
Six-Wire To Four-Wire Conversion

2.13.7 Sharing Track Wires with External Track Circuit Equipment

When any external track circuit equipment or auxiliary track circuit equipment shares track wires with a SGCP4000 / MS4000/MS track circuit that does not have an active internal island for that track circuit or output, such as a UAX or External Island, then the track circuit equipment must be connected in one of two ways:

The external track circuit equipment or auxiliary track circuit equipment may be connected across the receiver wires directly, or

When connected to the Transmitter/Check Receiver wires the external track circuit equipment or auxiliary track circuit equipment must be connected as identified in paragraphs 2.13.7.1 and 2.13.7.2.

2.13.7.1 Six-Wire Connections

The external equipment must be connected to the Check Receiver wires only (refer to Figure 2-14, SGCP4000 / MS4000 #2).

⚠ WARNING

WARNING

FOR 6 WIRE CONNECTIONS, DO NOT CONNECT ANY EXTERNAL TRACK CIRCUIT EQUIPMENT ACROSS THE TRANSMITTER WIRES.

2.13.7.2 Four-Wire Connections

The Check Channel Receiver wires may connect either to the Transmitter wires at the same point or prior to connecting to the other track circuit equipment (refer to Figure 2-13), or

The Check Channel Receiver wires may connect to the external track circuit equipment prior to connecting to the transmitter track wires (refer to Figure 2-14, SGCP4000 / MS4000 #1)

⚠ WARNING

WARNING

DO NOT CONNECT ANY EXTERNAL TRACK CIRCUIT EQUIPMENT ACROSS THE TRANSMITTER PRIOR TO CONNECTING IT TO THE CHECK CHANNEL RECEIVER WIRES.

CONNECTIONS MUST BE ARRANGED SO THAT AN OPEN WIRE OR OPEN CONNECTION WILL NOT RESULT IN THE TRANSMITTER WIRES BEING CONNECTED TO THE AUXILIARY TRACK CIRCUIT EQUIPMENT UNLESS THE CHECK RECEIVER IS ALSO CONNECTED (REFER TO Figure 2 13).

NOTE

NOTE

External track circuit equipment includes, but is not limited to, 80049 DC Exciter Panels, Electronic Coded Track, AFO Track circuits, Track batteries or relays, surge suppressors (not including air gap arresters) or Bidirectional Simulation Couplers.

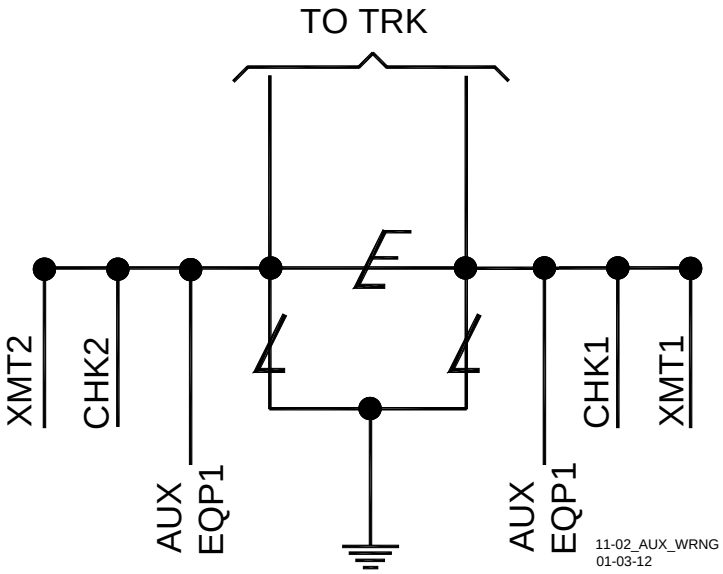


Figure 2-13:
Proper Connections of Track Wires

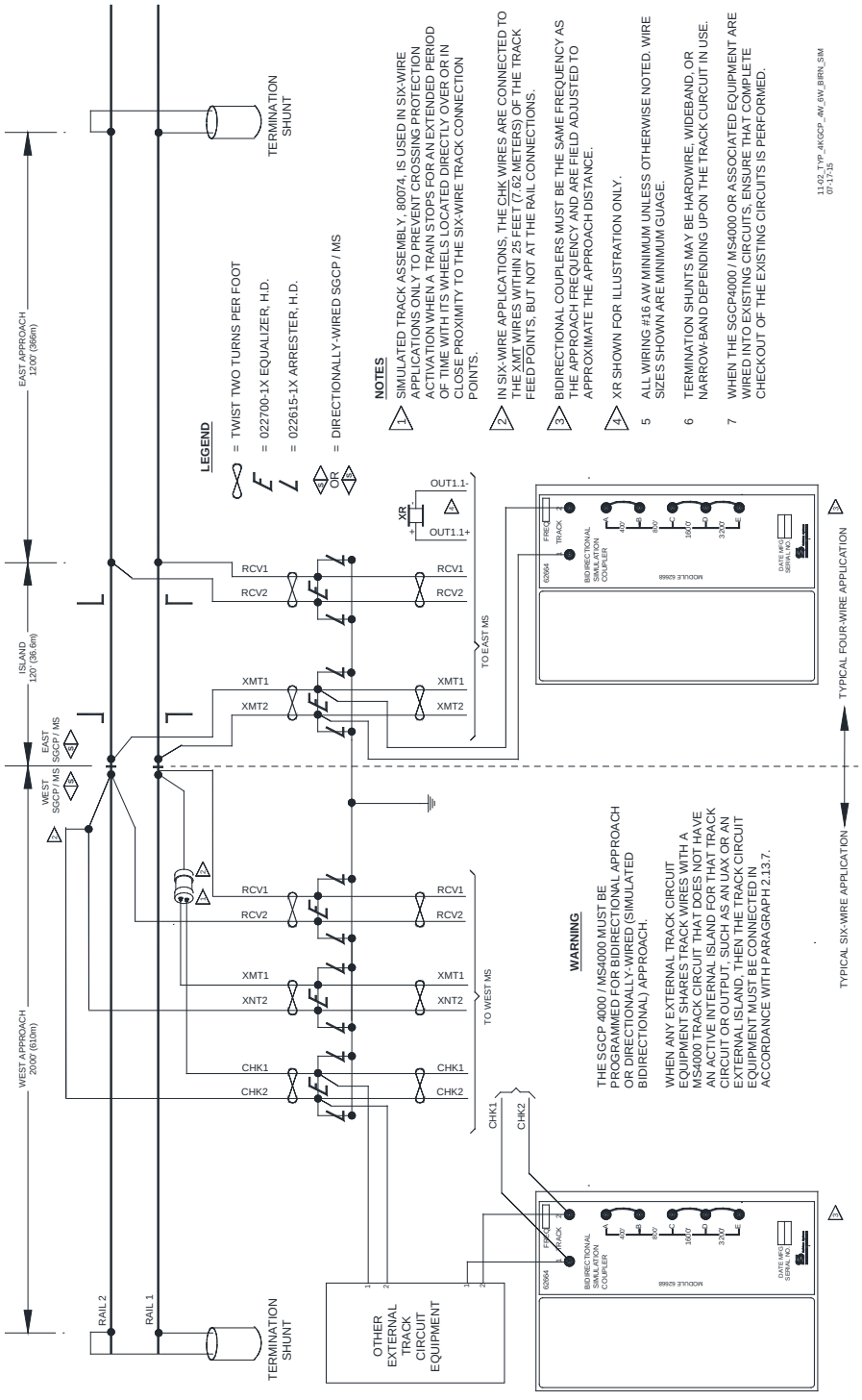


Figure 2-14:
Proper 4-Wire & 6-Wire Connections When Using Auxiliary Track Circuit Equipment

NOTE

NOTE

Customer Service Bulletin 4-94, dated 3-8-94, concerned multiple track wire failures and it recommended connecting the transmitter and check receiver track wires "at or near the bootleg connection and then running a single wire to the rails. The single wire was limited to a maximum of 50 feet (15.2 meters).

Customer Service Bulletin 3-06B.01, dated 12-8-06, amended 12/19/06, indicates in Figures 2 and 3 that "the CHK wires are connected to the XMT wires within 25 feet (7.62 meters) of the track feed points, but not at the rail connections."

Current practice is to connect the CHK and XMT wires within 25 feet (7.62 meters) of the track feed points, which further reduces the potential for check receiver errors. Existing locations that are between 25 and 50 feet (7.62 – 15.24 meters) and do not experience check receiver errors may remain at their location.

2.14 TRACK CIRCUIT ISOLATION DEVICES

Several types of track circuit isolation devices are available for both DC and AC coded track applications. The following discussions are grouped by non-coded and coded track circuit type.

NOTE

NOTE

The recommendations listed in the following paragraphs are general in nature and no attempt is made to cover all applications.

Battery chokes and code isolation devices described here are designed for mounting inside a weatherproof enclosure.

If there are any questions concerning these recommendations or applications, contact Siemens Rail Automation Technical Support for assistance.

2.14.1 Steady Energy DC Track Circuits

A DC track circuit should be equipped with a battery choke when its battery is located within the SGCP4000 / MS4000 approach or it is less than 1,000 feet (304.8 meters) beyond the approach termination.

NOTE

NOTE

If the track connections for the DC track circuit are 1,000 feet or (304.8 meters) more beyond the SGCP4000 / MS4000 approach termination shunt, a battery choke is not required (see Section 5, Auxiliary Equipment).

2.14.1.1 Battery Chokes

⚠ WARNING

WARNING

IN APPLICATIONS WHERE THE CHOKE IS LOCATED WITHIN AN ADJACENT MODEL 300 OR MODEL 400 GCP APPROACH, THE 8A065A BATTERY CHOKE MUST BE USED.

WHEN PLACING THE WIDEBAND SHUNT, 8A076A, AS SHOWN IN FIGURE 2 16 ENSURE THAT THE SHUNT IS PLACED ON THE BATTERY SIDE OF THE INDUCTOR.

⚠ CAUTION

CAUTION

IN LONG DC TRACK CIRCUITS, THE DC RESISTANCE OF THE 8A065A BATTERY CHOKE CAN ADVERSELY AFFECT TRACK CIRCUIT OPERATION AT LOW BALLAST. USE THE 62648 BATTERY CHOKE IN THIS TYPE OF CIRCUIT.

WHEN USING A SGCP4000 / MS4000 OPERATING FREQUENCY OF 114 HZ IN A DC TRACK CIRCUIT WITH A RECTIFIED 60 HZ SOURCE, USE A 8A076A WIDEBAND SHUNT WITH THE BATTERY CHOKE TO ELIMINATE THE 120-HZ RIPPLE PRODUCED (SEE Figure 2 16).

NOTE

NOTE

For additional information on Siemens Rail Automation Battery Chokes, refer to the Section 5, Auxiliary Equipment.

Two Siemens Rail Automation Battery Chokes can be used in DC track circuits. The part number and DC resistance for each choke is listed below:

Table 2-16:
Siemens Rail Automation Battery Chokes

PART NUMBER	DC RESISTANCE
62648	0.10 ohm
8A065A	0.40 ohm

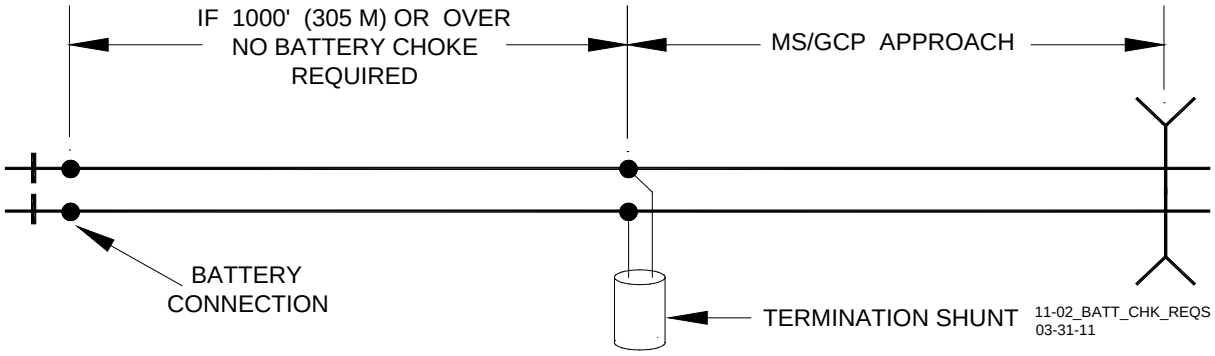


Figure 2-15:
Battery Choke Requirements

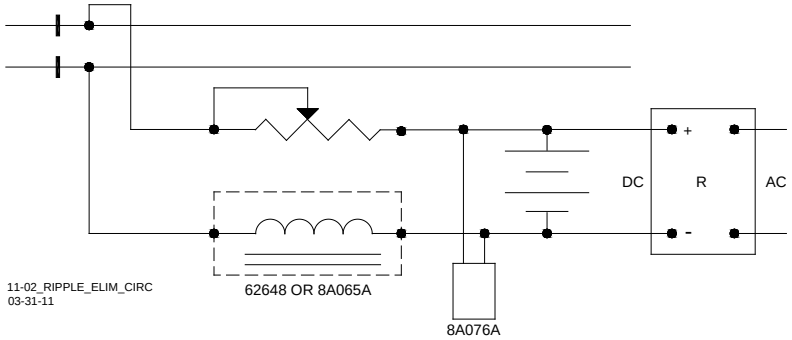


Figure 2-16:
Ripple Elimination Circuit

2.14.2 Siemens Rail Automation GEO Coded DC Track Circuit

Standard SGCP4000 / MS4000 frequencies of 86 Hz and higher are compatible with GEO. Isolation circuits are not required in the GEO transmitter rail connections.

Frequencies of 86, 114, 156, and 211 Hz require using maximum track drive, and installation of GEO Track Noise Suppression Filter, A53232. The GEO Filter must be installed at the signal location for the above mentioned frequencies.

2.14.3 Electronic Coded DC Track Circuit

Standard SGCP4000 / MS4000 frequencies of 86 Hz and above can normally be used with electronic DC coded track systems; e.g., ElectroCode, GenraKode™, MicroTrax®, and E-Code. All frequencies of 211 Hz and lower require using maximum SGCP4000 / MS4000 track drive.

When signals from other equipment are present on the track, SGCP4000 / MS4000 transmit level should be set to maximum.

NOTE

NOTE

Under some circumstances, an external track filter may be required when electronic coded track is located within the SGCP4000 / MS4000 approach.

As with any coded track system, the lower the transmit level, the less interference to SGCP4000 / MS4000 units.

2.14.4 Relay Coded DC Track Circuit

⚠ WARNING

WARNING

THE SINGLE POLARITY RELAY DC CODED TRACK CIRCUIT MUST BE CAREFULLY REVIEWED TO ENSURE THAT ALL TRANSMIT AND RECEIVE CODES ARE OF THE SAME POLARITY PRIOR TO INSTALLING ANY 6A341-1 UNIT. IF THE POLARITY IS IN DOUBT, INSTALL TWO 6A342 3 ISOLATION UNITS AT EACH END OF THE TRACK CIRCUIT

SAME INSTALLATIONS AS THE DUAL POLARITY CODED TRACK CIRCUIT.

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

CONTACT SIEMENS RAIL AUTOMATION TECHNICAL SUPPORT AT 1-800-793-7233 FOR MORE DETAILS.

Most relay coded DC track installations require DC Code Isolation units. A code isolation unit is a special battery choke that aids in preventing coded track battery and track relays from causing high interference with the SGCP4000 / MS4000. The Siemens Rail Automation 6A342-1 DC Code Isolation unit is used in most single polarity code systems. The Siemens Rail Automation 6A342-1 DC Code Isolation unit is also used in GRS Trakode (dual polarity) relay systems, as long as the GRS TD relay is also used.

2.14.4.1 Single (Fixed) Polarity Systems

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

NOTE

NOTE

To limit current losses to the track relay during low track ballast conditions, use number 6 AWG wires to terminals 1 and 2 on the Isolation units.

A fixed polarity code system must have the same received and transmitted polarities to use the 6A342-1 DC Code Isolation unit. 75, 120, 180-ppm rate code systems are generally fixed polarity systems. A typical fixed polarity code system using the 6A342-1 Code Isolation unit is shown in Figure 2-17.

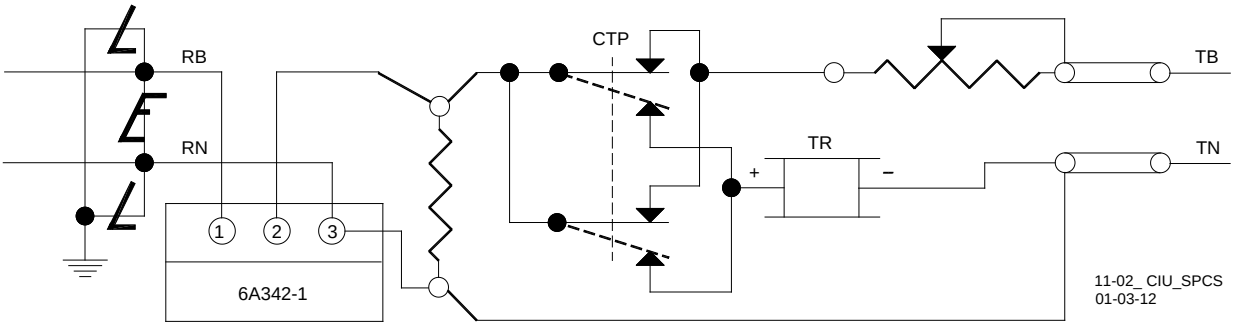


Figure 2-17:
Code Isolation Unit in a Single Polarity Code System

2.14.4.2 GRS Trakode (Dual Polarity) Systems:

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

TO INSTALL THE UNIT AS SHOWN IN FIGURE 2 18, A TRANSFER DELAY (TD) RELAY MUST BE USED.

DO NOT INSTALL ANY CODE ISOLATION CIRCUIT IN GRS TRAKODE WITHOUT USING THE TD RELAY.

NOTE

NOTE

To limit current losses to the track relay during low track ballast conditions, use #6 AWG wires to terminals 1 and 2 on the Isolation units.

The GRS Trakode (dual polarity) system is the only dual polarity system that can use the 6A342-1 code isolation unit as installed. This application requires that a GRS TD relay also be used when installing a 6A342-1 unit. Figure 2-18 shows the 6A342-1 Code Isolation unit installed in a GRS Trakode system.

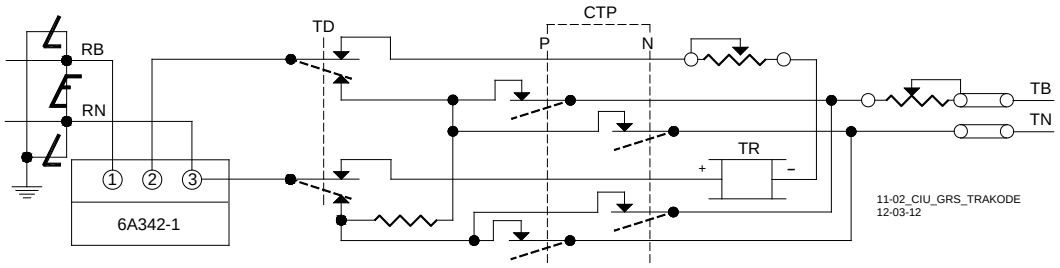


Figure 2-18:
Code Isolation Unit Installation In GRS Trakode System

2.14.4.3 Dual Polarity (Polar) Coded Track Systems Other Than GRS Trakode

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

NOTE

For additional information on Siemens Rail Automation DC Code Isolation units, refer to Section 7, Auxiliary Equipment.

Contact Siemens Rail Automation Technical Support for at 1-800-793-7233 for assistance in dual polarity code systems.

A dual polarity system is one in which the received code polarity is opposite to that of the transmitted code.

When used in a dual polarity system, two 6A342-3 Code Isolation units must be placed at each end of the circuit for proper filtering. The application depends upon the track circuit configuration.

2.14.5 AC Code Isolation Units

CAB signal track circuit installations require an AC Code Isolation unit. AC Code Isolation units are designed to minimize harmonic frequencies from being applied to the track and provide a higher impedance to SGCP4000 / MS4000 frequencies. The part number and isolation frequency for each Siemens Rail Automation AC Code Isolation unit is listed below:

Table 2-17:
Siemens Rail Automation AC Code Isolation Units

PART NUMBER	ISOLATION FREQUENCY
8A466-3	60 Hz
8A470-100	100 Hz

2.14.5.1 CAB Signal AC:

WARNING

ALWAYS VERIFY PROPER CAB SIGNAL OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

Application of SGCP4000 / MS4000 systems in cab territory using the 8A466-3, 60 Hz AC Code Isolation Unit or the 8A470-100, 100 Hz Isolation Unit is shown in Figure 2-19.

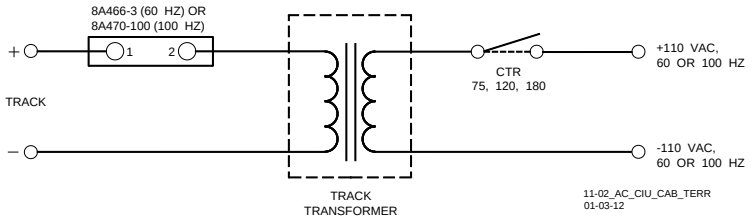


Figure 2-19:
AC Code Isolation Unit Used in CAB Territory

2.15 APPROACH CONFIGURATIONS

2.15.1 Bidirectional Configuration

The bidirectional configuration is the simplest of the approach applications. This configuration allows:

- a single SGCP4000 / MS4000 track module to monitor train movement in both approaches to a crossing
- longest approach distance for each operating frequency
- bidirectional approach distances are less affected by low ballast resistance than unidirectional applications

A typical bidirectional application consists of an island and two approaches (see Figure 2-2). The Island is defined by the location of the rail connections. The approach length is defined by the location of the termination shunt rail connections.

2.15.2 Bidirectional Approach Length Balancing

Bidirectional approach length must be balanced within ±10 percent. Where approach distances differ by more than 10 percent, due to the presence of un-bypassed insulated joints in one of the approaches, simulated track must be added in series with the termination shunt of the shorter approach to bring it within 10% of the longer approach.

2.15.3 Simulated Track

Simulated track can consist of either of the following:

- 8V617 Simulated Track Inductor of the proper value, which is normally installed within the Multifrequency Narrow-band Shunt
- 8A398-6 Adjustable Inductor

2.15.4 Unidirectional Installations

⚠ WARNING

WARNING

DO NOT BYPASS THE FEEDPOINT INSULATED JOINTS OF A UNIDIRECTIONAL OR A DIRECTIONALLY-WIRED APPROACH WITH ANY COUPLING DEVICE.

When configured for unidirectional operation:

- A Track module monitors train movements in a single approach due to insulated joints being present
- When insulated joints are at a crossing, two Track modules are required to monitor both approaches
- Insulated joints are sometimes used to separate crossing approaches (see Figure 2-20).
- Using insulated joints permits SGCP4000 / MS4000 frequencies to be repeated in adjacent approaches.
- Locate insulated joints opposite each other, as close as practical.

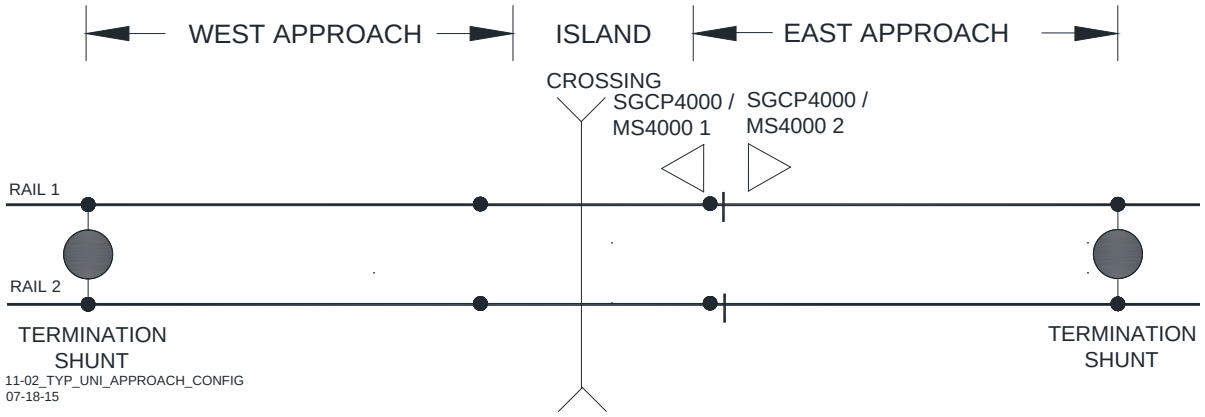


Figure 2-20:
Typical Unidirectional Approach Configuration

Unidirectional installations are generally used:

- When the signal system dictates them
- when closely following trains are expected
- at crossings where standing cars or trains can occupy opposite approach circuits
- with remote SGCP4000 / MS4000s in coded track and cab signal territory to extend crossing approaches beyond existing track circuit limits.

2.15.5 Directionally-wired Installations

⚠ WARNING

WARNING

FOR DIRECTIONALLY-WIRED OPERATION, THE SGCP4000 / MS4000 MUST BE PROGRAMMED FOR DIRECTIONALLY-WIRED OPERATION.

NOTE

NOTE

In general, where unidirectional SGCP4000 / MS4000 approaches longer than 2,000 feet (609.6 meters) are required, use the directionally-wired application. This ensures optimum SGCP4000 / MS4000 operation over varying ballast conditions.

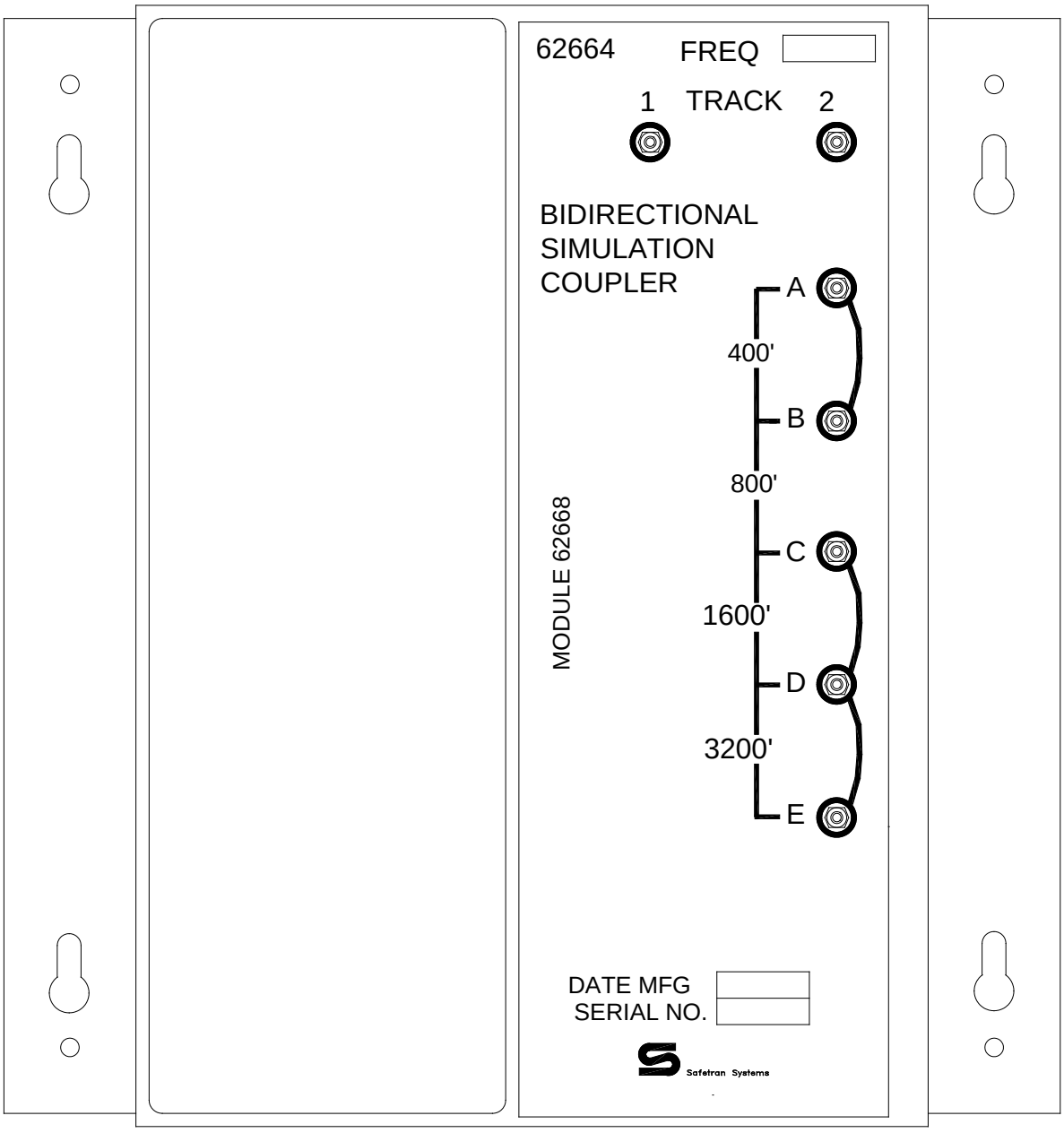
The directionally-wired configuration is applied to a unidirectional installation to obtain the low ballast and adjacent frequency overlap operating benefits of a bidirectional application. Bidirectional applications are less affected by low ballast (EX) than unidirectional applications. In the directionally-wired configuration, a narrow-band shunt is connected in series with an adjustable inductor.

This combination is generally connected in parallel across the track connections in the bungalow and is adjusted to be electrically equal in distance to that of the actual track approach circuit. Both approach circuits appear equal in length to the SGCP4000 / MS4000.

2.15.6 Simulated Approach

A directionally-wired approach can consist of any of the following:

- 62664-f Bidirectional Simulation Coupler adjusted to the proper distance (Figure 2-21).
- 8V617 Simulated Track Inductor in series with a Multi-frequency Narrow-band Shunt. The inductor distance must be equal within 10% to that of the track approach.
- 8A398-6 Simulated Track Inductor in series with a Narrow-band Shunt.



11-02_BIRDN_SIM_CPLR
12-22-11 (Revised 5-29-2014)

Figure 2-21:
Bidirectional Simulation Coupler

The 62664-mf Bidirectional Simulation Coupler contains a Narrow-band Shunt at the SGCP4000 / MS4000 termination frequency and an adjustable simulated track inductor that simulates a specific track length and is tapped and connected to front panel terminals.

The front panel terminals allow simulated approach distances to be selected that closely match the actual track approach. Approach distances ranging from 400 to 6,000 feet (121.9 – 1829 meters) in 400 foot (121.9 meter) increments can be selected using terminal shorting straps adjustable within ± 200 feet (61.0 meters) of the SGCP4000 / MS4000 approach

⚠ WARNING

WARNING

IN STANDARD FOUR-WIRE DIRECTIONALLY-WIRED INSTALLATIONS, THE BIDIRECTIONAL SIMULATION COUPLER (62664-MF) MUST BE CONNECTED TO THE TWO TRANSMITTER (XMT) TRACK LEADS AS SHOWN FOR T1 IN Figure 2 22. DO NOT USE THIS COUPLER AS A STANDARD TERMINATION SHUNT ON THE TRACK.

NOTE

NOTE

For additional information on the 62664-mf Bidirectional Simulation Coupler, refer to Section 5 , Auxiliary Equipment.

2.15.7 Six-Wire Directionally-wired Applications Connections

When a unidirectional SGCP4000 / MS4000 is connected in a six-wire directionally-wired configuration (see paragraph 2.15.5) the bidirectional simulation coupler must be connected to the check (CHK) wires as shown in Figure 2-22.

⚠ WARNING

WARNING

IN A STANDARD SIX-WIRE BIDIRECTIONAL CONFIGURATION THE BIDIRECTIONAL SIMULATION COUPLER (62664-MF) MUST BE CONNECTED TO THE TWO CHECK (CHK) TRACK LEADS AS SHOWN FOR T2 IN FIGURE 2 22 AND NOT BE CONNECTED TO THE TRANSMIT (XMT) TRACK LEADS.

IF THE COUPLER IS INCORRECTLY CONNECTED TO THE TRANSMIT (XMT) WIRES OF THIS CONFIGURATION, AN OPEN TRANSMITTER TRACK WIRE MAY NOT BE DETECTED. THIS CAN ADVERSELY AFFECT SGCP4000 / MS4000 OPERATION.

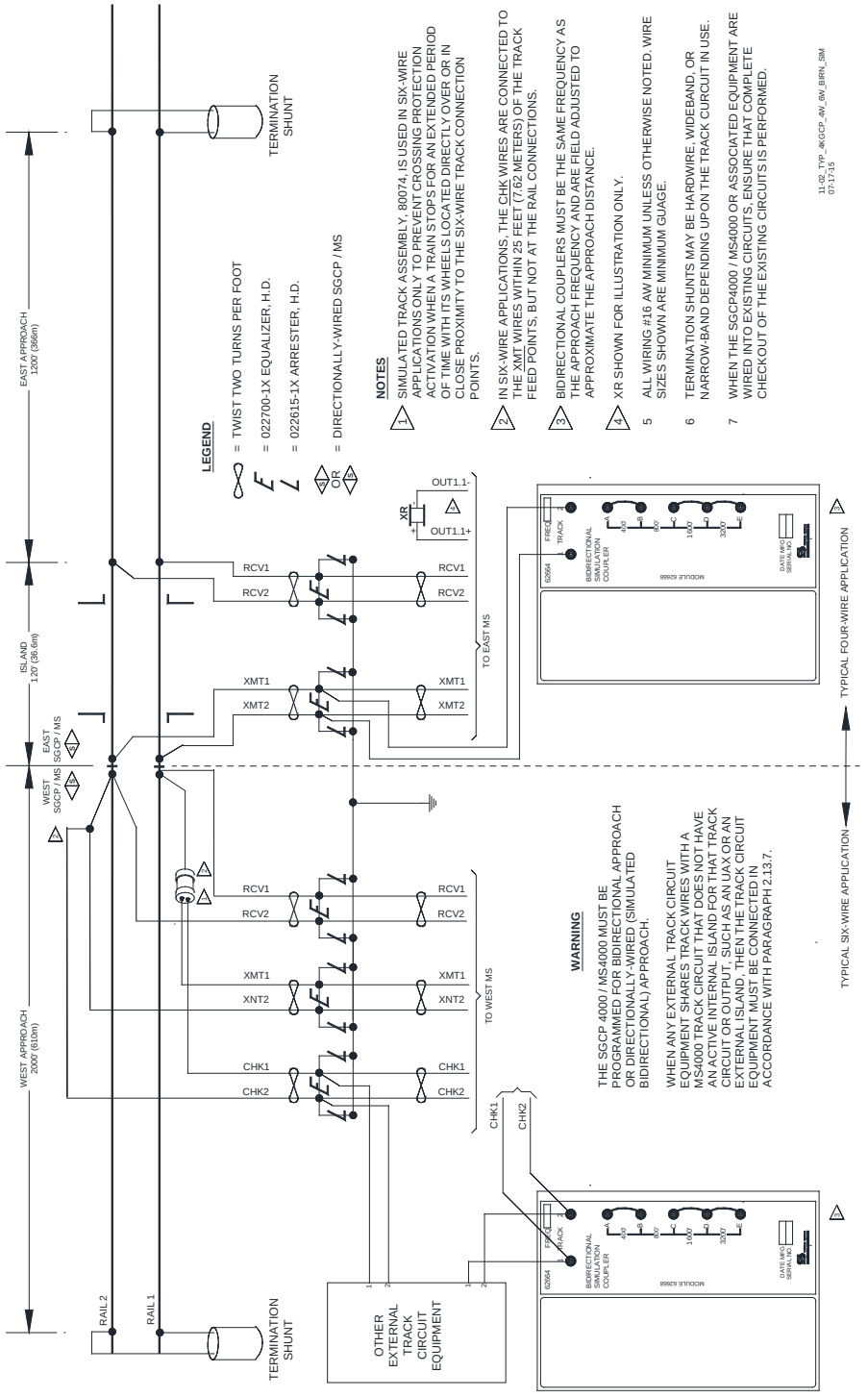


Figure 2-22:
4 and 6-Wire Directionally-wired Applications

2.16 SURGE PROTECTION

2.16.1 Primary Surge Protection for Track and I/O Wiring Between Bungalows

All 4000 track wires, output and input line or cable circuit wires that leave or enter the bungalow must have primary surge protection provided. Primary surge protection for 4 and 6 track wires requires arrestors and equalizer as shown in Figure 2-27. Primary surge protection for all I/O wiring between bungalows is shown in Figure 2-28.

2.16.2 Battery Surge Protection and Power Wiring

Primary battery surge protection for the SGCP4000 / MS4000 requires careful power wiring from the charger to battery, from battery to surge arrestors and from surge arrestors to 4000 equipment. Primary arrestors, equalizers and power wiring are shown in Figure 2-29.

2.17 TYPICAL APPLICATION DRAWINGS

This section provides drawings to show each of the following SGCP4000 / MS4000 applications:

- Single Track, Unidirectional (Figure 2-23)
- Single Track, Bidirectional (Figure 2-24)
- Single Track, Back-to-Back, Unidirectional, In Directionally-wired Operation (Figure 2-25)
- Single Track, Two Overlapping Crossings, Using 80049-1 DC Shunting Enhancer Panels (Figure 2-26)
- Typical Track Wire Surge Protection for 4 and 6 Wire Track Connections Figure 2-27)
- Typical Surge Protection Requirements When Cabling Between Remote UAX Unit and SGCP4000 / MS4000 (Figure 2-28)
- Recommended Battery Surge Protection Wiring for SGCP4000 / MS4000 (Figure 2-29)

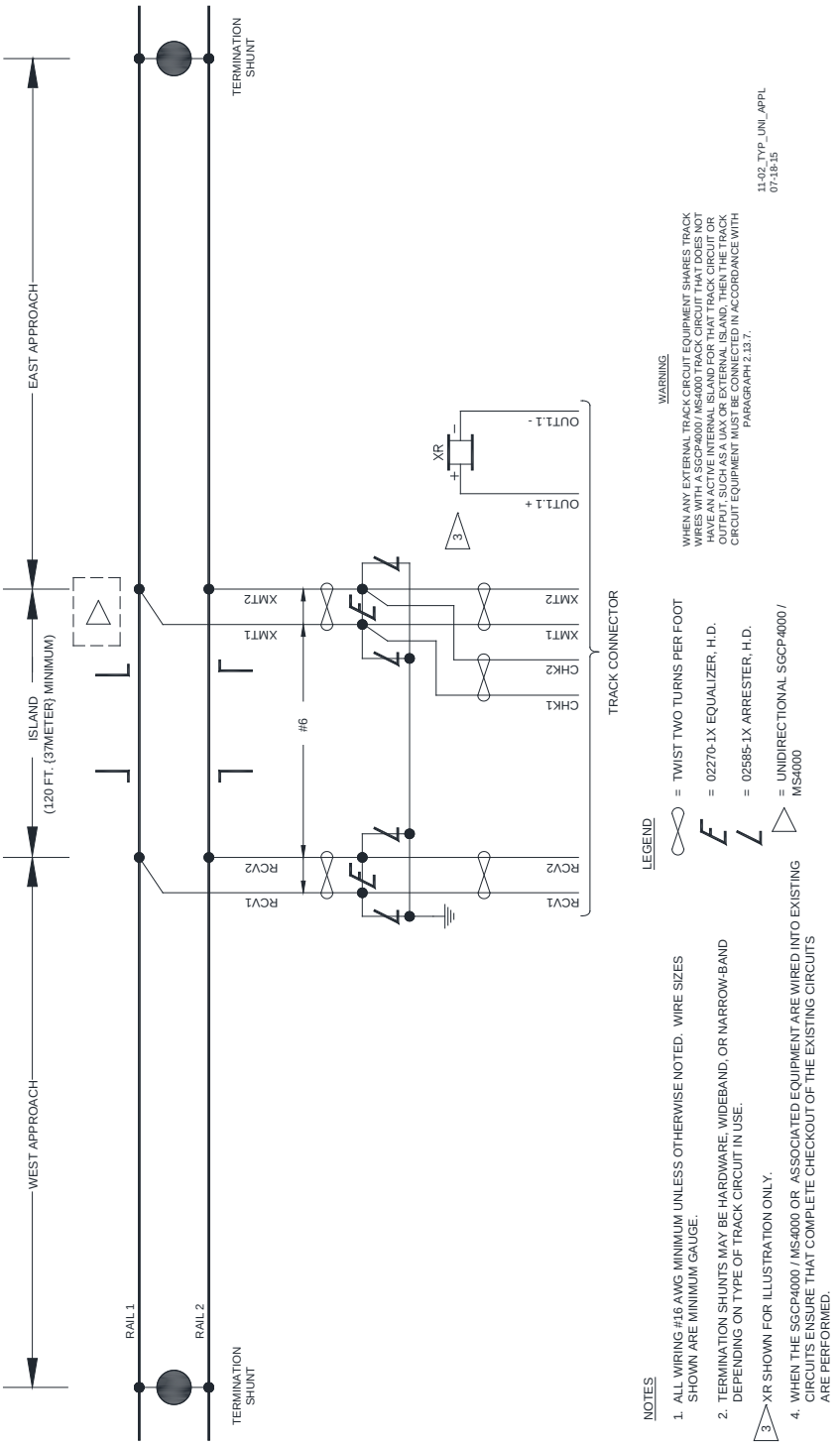


Figure 2-23:
Typical Unidirectional Application

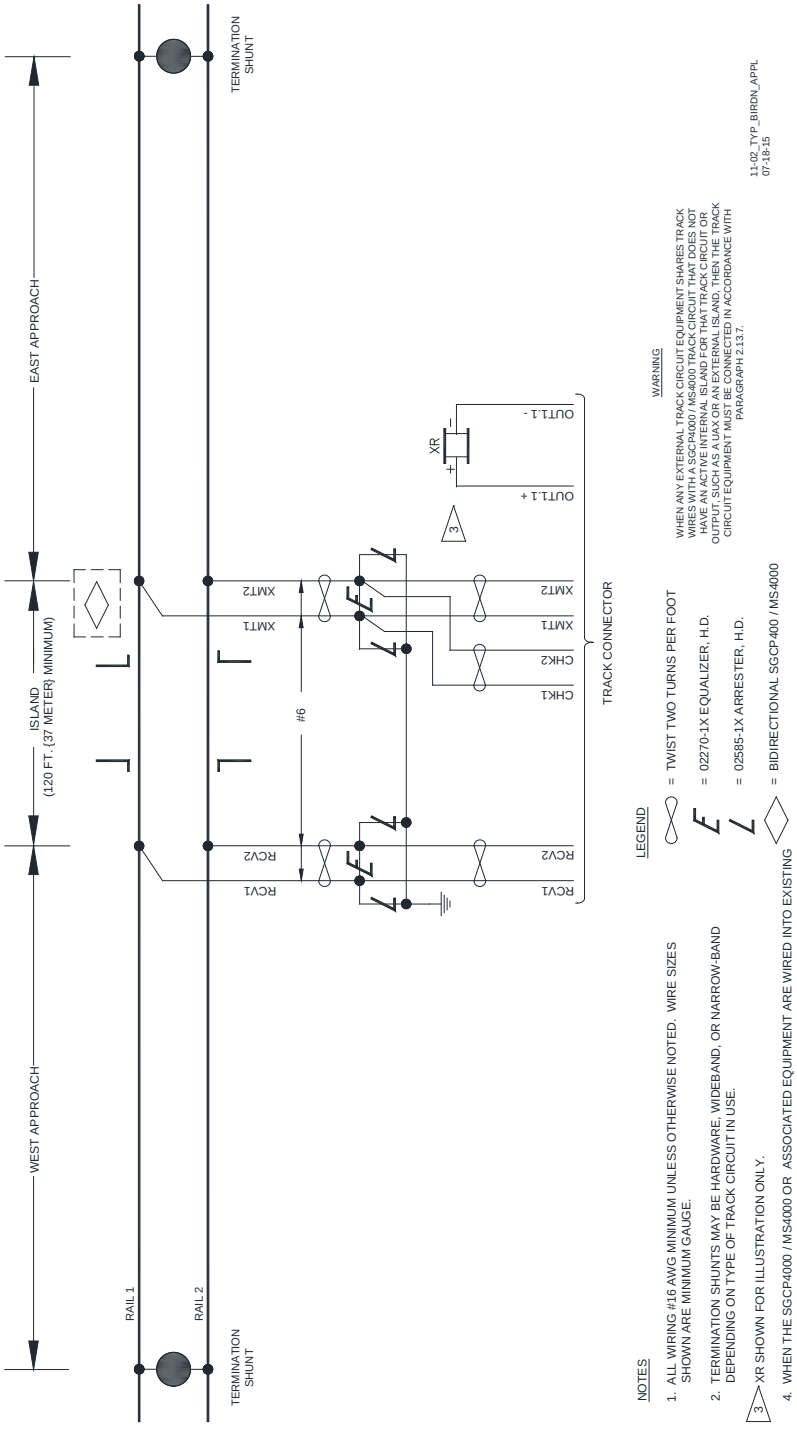


Figure 2-24:
Typical Bidirectional Application

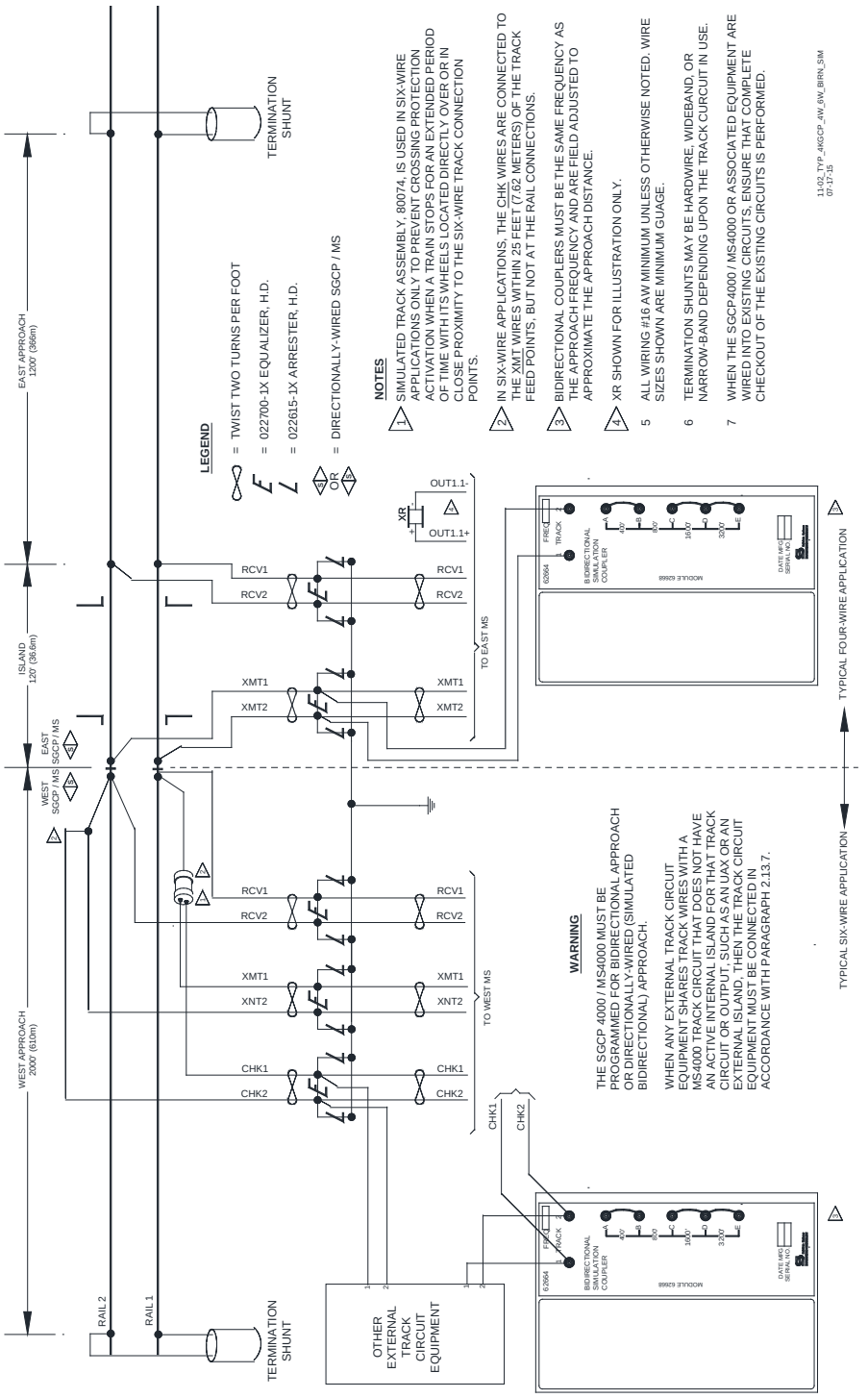


Figure 2-25:
Two Back-to-Back Unidirectional Units In Directionally-Wired (Simulated Bidirectional) Application

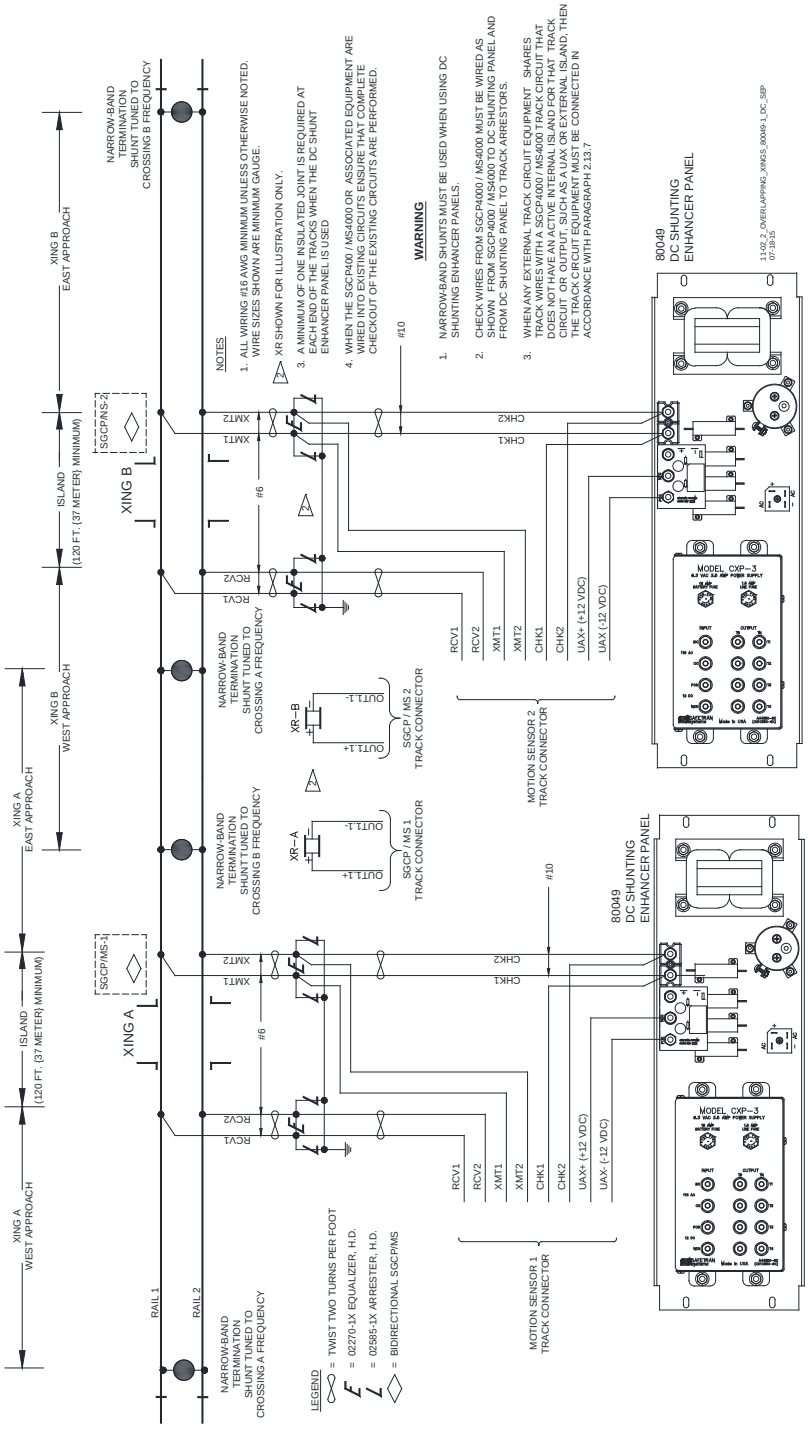


Figure 2-26:
Two Overlapping Crossings, Using 80049-1
DC Shunting Enhancer Panels

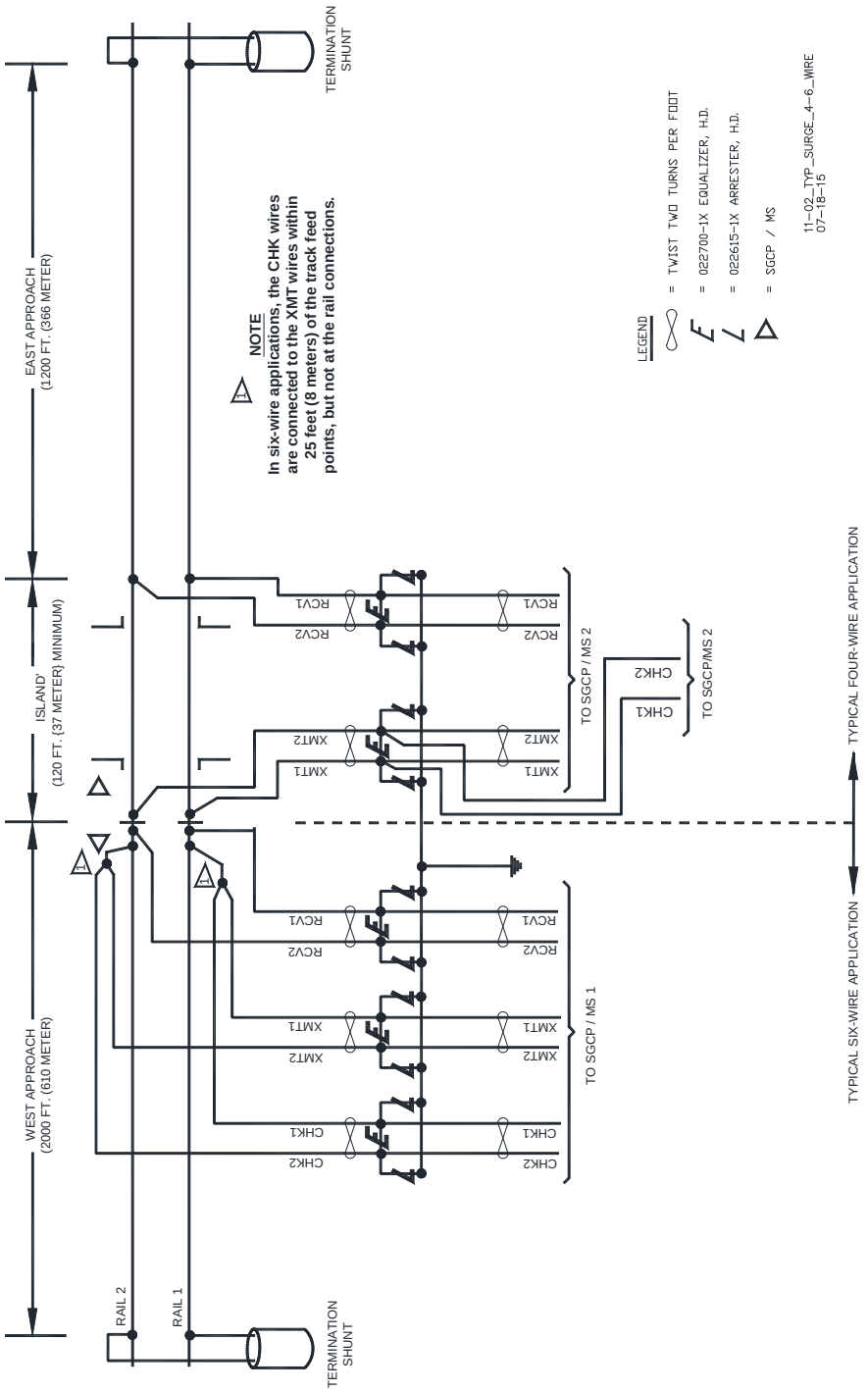
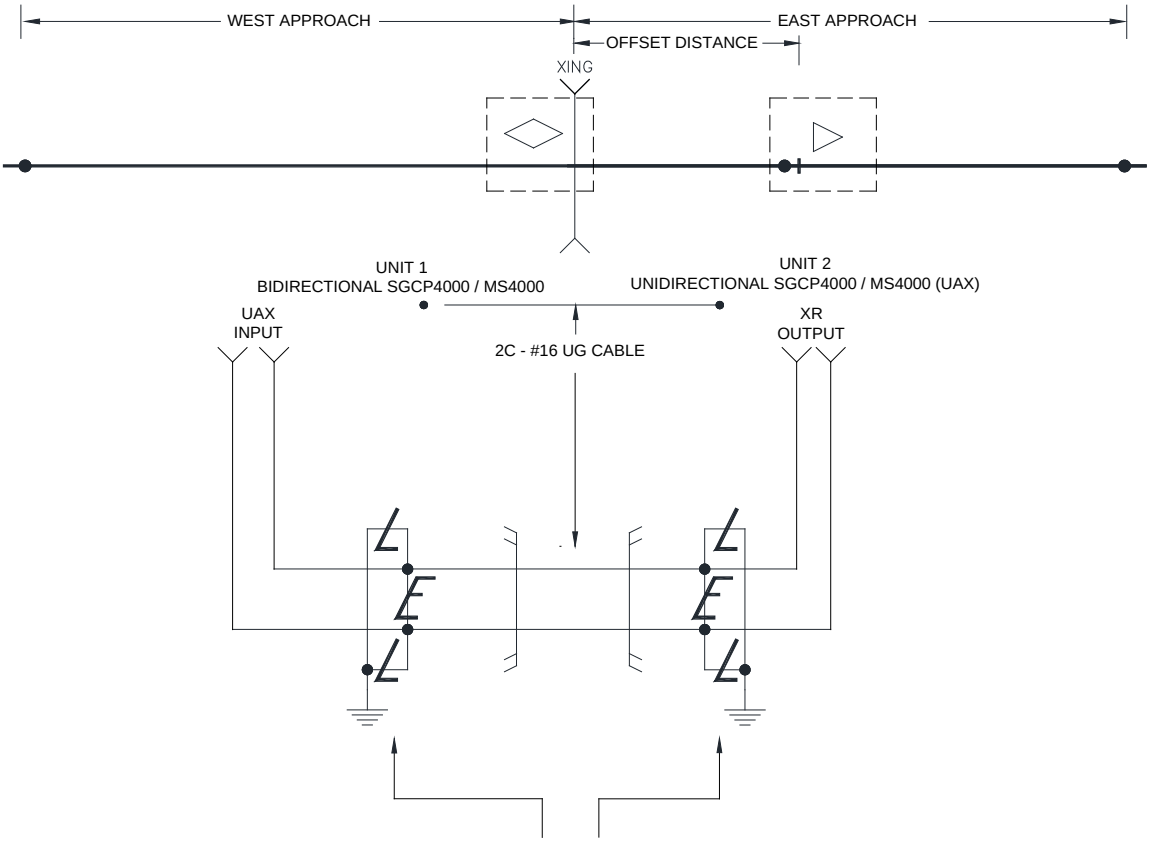


Figure 2-27:
Typical Track Wire Surge Protection for 4 and 6 Wire Track Connections



Required Surge Protection

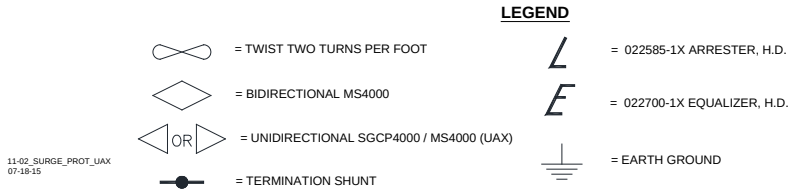


Figure 2-28:
Typical Surge Protection Requirements When Cabling Between UAX Unit and SGCP4000 / MS4000

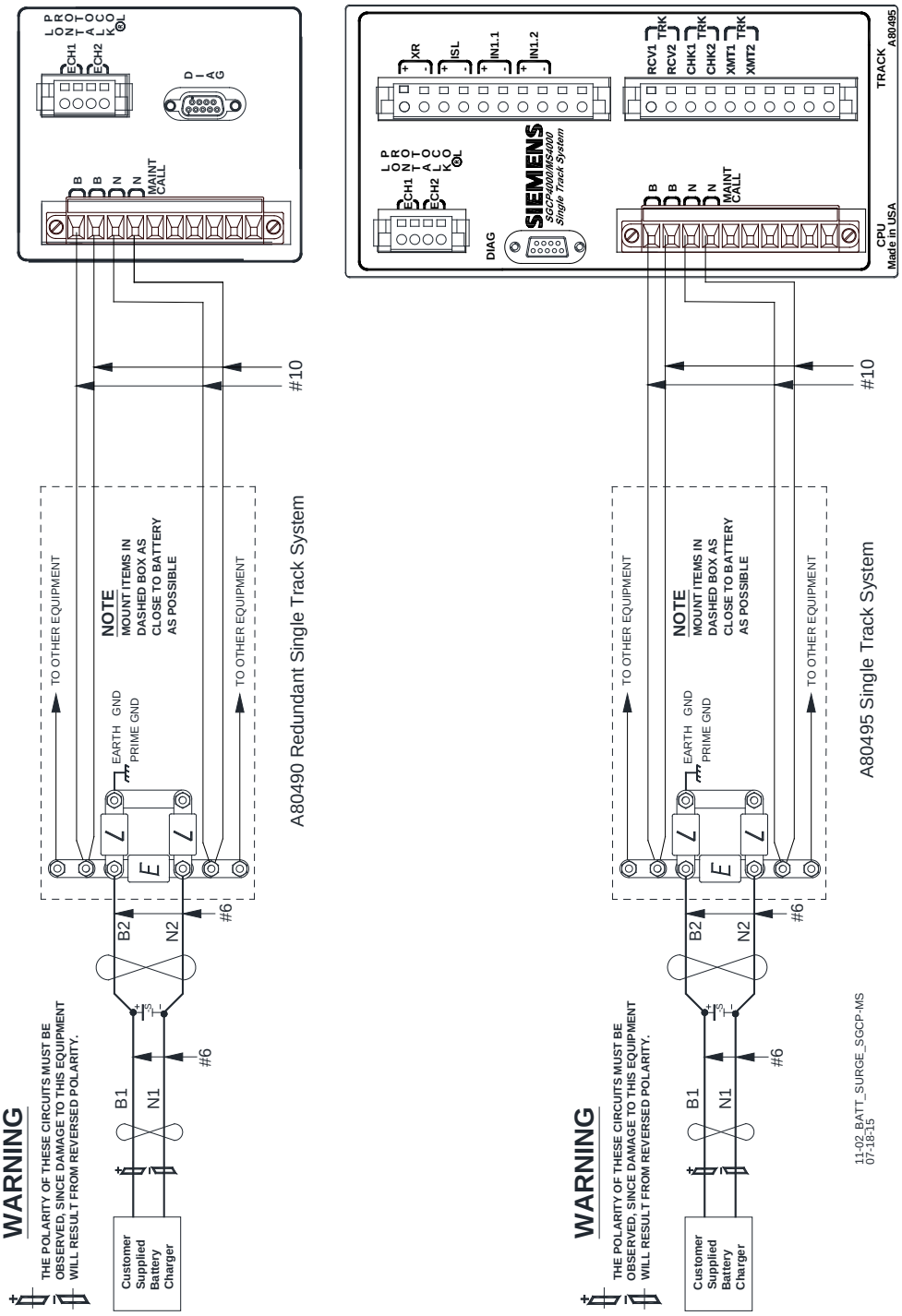


Figure 2-29:
Recommended Battery Surge
Protection Wiring for SGCP4000 / MS4000

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SECTION 3 –
SGCP4000 / MS4000 SYSTEM PROGRAMMING

3.1 GENERAL

The SGCP4000 / MS4000 differs from earlier Motion Sensor versions (MS 2000, 660, 500-550, or 350 Motion Sensors) in that its operation is completely software driven. There are only a few physical connections made within the Wayside Signal Shelter. No jumpers connected to the unit, nor are there any straps used to enable high power operation. The units come with the software pre-loaded, ready for field installation; requiring only individual unit software configuration following the railroad's approved wiring diagram to place the unit into operation.

3.2 MENU SYSTEM OVERVIEW

The menu system allows users to implement changes without requiring laptop computers to interface with the Unit. The SGCP4000 / MS4000 has a menu system of main menus, sub-menus, parameters, and individual values. All controls and indicators used to program the SGCP4000 / MS4000 are found on the CPUII+ card. No programming is performed using the Track Card.

3.2.1 Controls and Indicators Used in Manu Navigation

3.2.1.1 Four Character Alphanumeric Display

The Four Character Alphanumeric Display is located directly below the Unit Information written on the top of the faceplate. It displays letters, numbers, and limited symbols. Once the unit has completed the startup process, a message scrolls across the display stating SGCP4000 / MS4000.

3.2.1.2 SEL Button

The SEL (Select) Button is located immediately below the 4 Character Display. The major use of this button is to select the desired menu, parameter value, calibration, diagnostics, etc.

3.2.1.3 NAV Button

The NAV (Navigate) Button is located immediately below the SEL Button. There are two major uses of this button. The first is to scroll (move from one menu item to the next) through the menus, parameter values, etc. Each time the NAV button is momentarily pressed, the next menu item is displayed. The second use is to go up one level in the menu by pressing and holding the NAV button for a few seconds.

3.2.2 SGCP4000 / MS4000 Main Menu

The SGCP4000 / MS4000 has the following main menus:

- Program (PROG)
- Calibration (CAL)
- Out of Service (OOS) (when enabled)
- Version Data (VERS)
- Warning Time Data (TRWT) (from last train movement)
- Display Test (TEST)

Each of the unit main menus is discussed in Section 3.2.6. Submenu groupings and individual parameters are also discussed throughout Section 3.2.6.

3.2.3 Navigating the Menus

Each CPU II+ Card has two buttons on its face: Select (SEL) and Navigate (NAV).

In general, the pushbuttons are used to navigate the menus as shown in Table 3-1:

Table 3-1:
General Menu Navigation and Selection Using The Pushbuttons

OPTION DESIRED	ACTION TAKEN
Move to the next item at the same menu level (e.g., if in the main menu level such as PROG, move to the next main menu item such as CAL)	Press NAV momentarily
Go down a main menu level (e.g., if at the top level (SGCP4000 / MS4000 scrolls across display), move to the MENU level (PROG, CAL, etc.) or move from the ADVD menu to the Sub-Menu PSTR, which is the first submenu of the ADVD Menu)	Press SEL momentarily
Move to the next PARAMETER value	Press NAV momentarily
To modify a PARAMETER value	Hold SEL until currently set PARAMETER appears, press NAV multiple times until desired PARAMETER value appears, then hold SEL until the set parameter message (e.g., SET DIRN=UNI?) appears. Press and hold SEL button until WAIT appears. Release the SET button. Once the parameter is saved, DONE appears, and then the menu item just saved appears (e.g., DIRN=UNI) appears in the 4-Character Display
To scroll down through PARAMETER items	Each time NAV is pressed a new PARAMETER item appears
To SAVE CHANGES to modified PARAMETER values	Hold SEL until DONE appears
Go up one level (e.g., if in the AFRQ MENU editing frequency parameters, select to return to AFRQ at MAIN Menu level)	Hold NAV until BACK appears

3.2.4 Program Menu Processes

The Program (PROG) Menu is used to edit parameter values. To edit an individual parameter, refer to Section 7.3.7, Configure the SGCP4000 / MS4000.

3.2.5 Calibration Menu Process

Calibration is used to set signal threshold levels for the Motion Sensor Receiver and Island Receiver. To calibrate an item, refer to Section 7.3.8, Calibrate the SGCP4000 / MS4000.

3.2.6 Out of Service (OOS) Menu Processes

The purpose of the Out of Service (OOS) is to take the motion sensor OOS regarding either the approach or the crossing (approach and island). To take a motion sensor OOS, refer to Section 4.4, Taking Tracks "Out of Service."

3.3 SGCP4000 / MS4000 MAIN MENUS

Each of the Unit Menus differs from the others. While many values are common across the Units, care must be taken so that proper selections are made. Default entries are shown in **bold** type. The following menu systems are depicted:

- Program Menu
- Calibration Menu
- Out of Service (OOS)

3.3.1 SGCP4000 / MS4000 Program Menu Parameter Definitions and Values

The following sections provide information regarding the purpose and values of each parameter in the PROG (Program) Menu.

3.3.1.1 Approach Frequency (AFRQ)

The AFRQ menu provides a listing of all approach frequencies that may be used by the SGCP4000 / MS4000, whether the frequency is a Siemens Rail Automation standard frequency, a frequency used by other vendors, or an offset frequency. There are a total of 56 different frequencies available and those frequencies are depicted in Table 3-2.

Table 3-2:
SGCP4000 / MS4000 Approach Frequency Selections

Not Set	86	114	156	211	285	348	430	525	645
790	970	44	45	46	151	250	267	326	392
452	522	560	630	686	753	816	881	979	999
85.5	86.5	87	113	113.5	114.5	115	155	155.5	156.5
157	210	212	284	286	347	349	429	431	523
527	643	647	788	792	968	972			

3.3.1.2 Approach Directionality (DIRN)

The Approach Directionality (DIRN) menu parameter determines whether the approach is Unidirectional (UNI), Bidirectional (BI), or Bidirectionally-Wired (BIWD). The default is UNI.

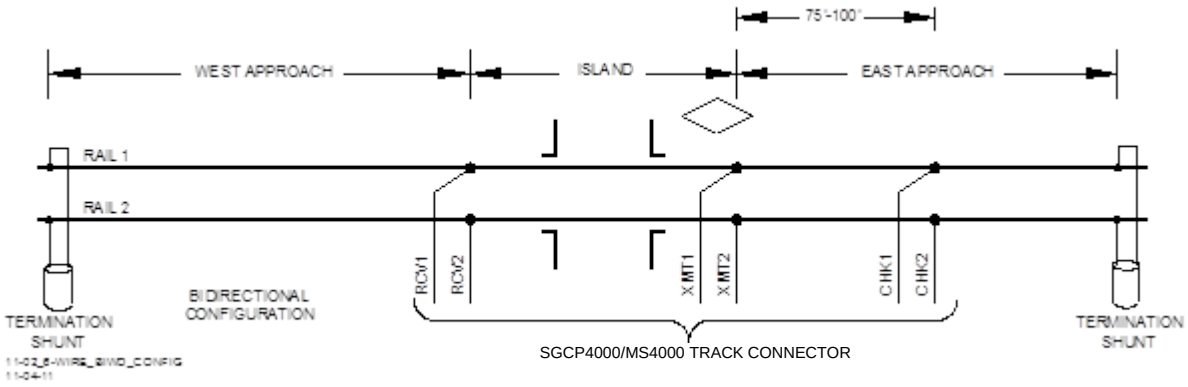

Figure 3-1:
Bidirectionally Wired Approaches

In this configuration, a six wire connection, one where the Check wires are physically separated from the Transmit wires, is required in order to allow the system to determine train direction. The wires are separated by between 75 – 100 feet (see Figure 3-1). The orientation of the wiring is specified in the Railroad's or Agency's approved wiring diagram.

The parameter value "Bidirectionally-Wired" that appears on the menu enables the system to determine train direction. As an example, as the train passes through the crossing, it crosses the Receive wire, then the Transmit wire followed by the Check wire. The system notes this as the train direction.

3.3.1.3 Transmit Level (TLVL)

The Transmit Level (TLVL) parameter range of values are Medium and High. The default setting is Medium.

3.3.1.4 Approach Pickup Delay (APKU)

The Approach Pickup Delay (APKU) is the length of time from the point at which motion ceases in the approach until the gates pickup. The range is 8 – 99 seconds, and the default is 15 seconds.

3.3.1.5 Upstream Adjacent Crossing Used (UAX)

The Upstream Adjacent Crossing (UAX) parameter is used when the SGCP4000 / MS4000 receives an input from another unit (another motion sensor, a GCP, a PSO, etc.) and the pickup delay set for that input. The default setting is Not Used with no chassis input enabled. The UAX is enabled when:

- A non-zero time value is set,
- An input is set to UAX
- The input is energized.

The UAX activates when the input de-energizes.

The range of values is from 0 – 99 seconds. The value entered is the length of time from when the UAX input energizes until the system will allow the XR to be energized (assuming no other detection/error is keeping the XR down). The default value is Not Set.

3.3.1.6 Island Used (ISL)

The SGCP4000 / MS4000 may be configured to use an internal island or an external island. When a frequency value is selected, the internal island is enabled. When the parameter value EXT (external) is selected, the external island is enabled and an external input is used in lieu of the internal island.

The SGCP4000 / MS4000 will not allow the XR output to recover if the island is not used.

The Island Used parameter values depicted in Table 3-3 are available on the SGCP4000 / MS4000.

Table 3-3:
SGCP4000 / MS4000 Island Frequency Selection Values

External (EXT)	Not Used	4.9kHz	11.5kHz
2.14kHz	5.9kHz	13.2kHz	2.63kHz
7.1kHz	15.2kHz	3.24kHz	8.3kHz
17.5kHz	4.0kHz	10.0kHz	20.2kHz

3.3.1.7 Island Pickup Delay (IPKU)

The Island Pickup Delay (IPKU) is the time from the island energizing to the system recognizing the island is up (island pickup delay). When the Internal Island is enabled, the range of values is 0 – 6 seconds, and the default setting is 0 seconds. When the External Island is enabled, the range of values is 0 – 99 seconds, and the default is 1 second.

3.3.1.8 Input 1 (IN1)

The IN1 parameter is used to set the type of function activated when the input is activated. The options are None, Out of Service (OOS), UAX (if UAX has a time selected), and ISL (if the External Island is selected). The default setting is Not Used.

3.3.1.9 Input 2 (IN2)

The IN1 parameter is used to set the type of function activated when the input is activated. The options are Not Used, Out of Service (OOS), UAX (if UAX has a time selected), and ISL (if the External Island is selected). The default setting is Not Used.

3.3.1.10 Advanced Menu Settings (ADVD)

The Advanced Menu parameter contains the sub-menus that pertain to the SGCP4000 / MS4000.

3.3.1.10.1 Positive Start Level (PSTR)

When enabled, the Positive Start level immediately activates the crossing when EZ is less than the programmed Positive Start EZ Level. There is no 5-second reaction delay time. Once Positive Start occurs, the crossing is continuously activated until either the train clears the island circuit, the EZ value rises to a number 5 greater than the programmed positive start EZ level, or the Positive Start timer has exceeded the programmed timer delay of 1 to 99 minutes. A new Positive Start sequence may be initiated once EZ exceeds the programmed Positive Start EZ level by 5. The range of values is 1 – 80, the default is OFF

3.3.1.10.2 Positive Start Timer (PTIM)

The Positive Start Timer parameter value allows a continuous positive start to either not time out (PTIM=0) or to timeout after the programmed delay. Range of values is 0 – 99 minutes. The default value is NONE. This parameter is only visible when PSTR is enabled.

3.3.1.10.3 Sudden Shunt Detection (SHNT)

This parameter is used when a signal is located close to a crossing, Sudden Shunt can activate the crossing immediately when the first wheels of the train pass the remote UAX insulated joints into the crossing approach. The range of values is OFF, 5 – 75. The default setting is OFF.

3.3.1.10.4 Low EZ Detection Used (LWEZ)

Low EZ Detection is used to detect a significant reduction of EZ. The valid range of settings are OFF, 50 – 80. The default value is Off.

3.3.1.10.5 Low EX Adjustment Level (LWEX)

The Low EX Adjustment Level (LWEX) enables the SGCP4000 / MS4000 to operate at EX levels as low as 34. The range of values is 34 – 39. The default setting is 39.

3.3.1.10.6 Compensation Level (COMP)

The compensation value is a correction factor used to fine tune the system for unusual ballast conditions. The range of values is 1000 – 2000. The default setting is 1300.

3.3.1.10.7 SGCP4000 / MS4000 Predictor (PRED)

The SGCP4000 / MS4000 Predictor provides simple prediction functionality when programmed. The range of values is No or Yes. The default value is No.

3.3.1.10.8 Warning Time (WTIM)

The warning time value is the amount of warning time desired for the crossing measured in seconds. The default values is 23 – 99 seconds. The default setting is 35 seconds.

3.3.2 Program Menu

The SGCP4000 / MS4000 has four top level menus, one sub-menu, and one data report:

- PROG – Top level menu used to program the SGCP4000 / MS4000
  - ADVD – The Advanced parameter is a programming sub-menu of the PROG main menu
- CAL – Top level menu used to calibrate the SGCP4000 / MS4000
- OOS – Top level menu used to place the SGCP4000 / MS4000 in Out of Service (OOS) status
- VERS – Top level menu that depicts software and hardware information of the SGCP4000 / MS4000
- TRWT – Top level data report that depicts information regarding most recent train movement
- TEST – Top level menu used to run the Display Test on the SGCP4000 / MS4000.

The menu for the SGCP4000 / MS4000 is as depicted in Table 3-4 below.

Table 3-4: SGCP4000 / MS4000 Program Menu

ITEM	VALUE
PROG	Top Level Program Menu
AFRQ	**NOT SET**, 86, 114, 156, 211, 285, 348, 430, 525, 645, 790, 970, 44, 45, 46, 151, 250, 267, 326, 392, 452, 522, 560, 630, 686, 753, 816, 881, 979, 999, 85.5, 86.5, 87, 113, 113.5, 114.5, 115, 155, 115.5, 156.5, 157, 210, 212, 284, 286, 347, 349, 429, 431, 523, 527, 643, 647, 788, 792, 968, 972 Hz
DIRN	**UNI**, BI, BIWD
TLVL	**MED**, HI
APKU	8 – 99 SEC (DEFAULT = **15**)
UAX	**NOT USED**, 0-99 SEC (UAX + UAX Pickup Delay)
ISL	**NOT USED**, EXT, 2.14, 2.63, 3.24, 4.0, 4.9, 5.9, 7.1, 8.3, 10.0, 11.5, 13.2, 15.2, 17.5, 20.2 kHz
IPKU	**0**-6 SEC (Internal) 0 – 99 SEC (External)
IN1	**NOT USED**, OOS, UAX (if time is programmed), EXT (if External Island is selected)
IN2	**NOT USED**, OOS, UAX (if time is programmed), EXT (if External Island is selected)
ADVD	Sub-menu Program Label
PSTR	**OFF**, 1-80
PTIM	**0**-99 MIN
SHNT	**OFF**, 5 – 75
LWEZ	**OFF**, 50 – 80
LTIM	**2** – 99 MIN
LWEX	34-**39**
COMP	1000 – 2000 (DEFAULT = **1300**)
PRED	**No**, Yes
WTIM	23 – 99 SEC (DEFAULT = **35**)
OOS	Out of Service (OOS) Menu
APPR	Take Approaches only OOS
XNG	Take Approaches and Island OOS
CAL	Calibration Menu
MCAL	Approach Calibration
ICAL	Island Calibration
ACAL	Approach Distance Calibration
LCAL	Linearization Calibration
VERS	Software and Hardware Information
TRWT	Warning Time of previous train
TEST	SGCP4000 / MS4000 Display Test

On Table 3, Main Menu titles are underlined. **Default values** are in **BOLD** text

When the Set Default parameter is selected, the values in Table 3-5 are set.

Table 3-5: SGCP4000 / MS4000 MENU DEFAULT SETTINGS

PARAMETER	VALUE
Track Frequency (AFRQ)	NOT SET
Directionality, to include directionality of wiring (DIRN)	UNI
Transmit Level (TLVL)	MED
Pickup Delay (APKU)	15 SEC
Upstream Adjacent Crossing (UAX) Time	NOT USED
Island Frequency (ISL)	NOT USED
Island Pickup Delay (IPKU) (Internal Island selected)	0 SEC
Island Pickup Delay (IPKU) (External Island selected)	1 SEC
IN1	NOT USED
IN2	NOT USED
Positive Start EZ Value (PSTR)	OFF
Positive Start Time (PTIM)	0 MIN
Sudden Shunt Level (SHNT)	OFF
Low EZ Level (LWEZ)	OFF
Low EZ Time (LTIM)	2 MIN
Low EX Level (LWEX)	39
Compensation Value (COMP)	1300
Predictor Used (PRED)	No
Warning Time (WTIM)	30 SEC

3.3.3 Calibration Menu

Table 3-6: Calibration Menu Options

MENU ITEM	DESCRIPTION
MCAL	Depicts approach calibration when unit is in Motion Sensor Mode
ICAL	Depicts island calibration
ACAL	Depicts approach distance calibration when unit is in Predictor Mode
LCAL	Depicts linearization calibration when unit is in Predictor Mode

3.3.4 Out of Service Menu

Table 3-7: Out of Service (OOS) Menu Options

MENU ITEM	DESCRIPTION
OOS TIME	The amount of time in hours (1-23) that the unit shall remain OOS once activated
APPR	Takes the approaches OOS but leaves the Island in service.
XNG	Takes the motion sensor (approaches and island) OOS

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SECTION 4 –
SGCP4000 / MS4000 APPLICATION GUIDELINES

4.1 INTRODUCTION AND OVERVIEW

The Simple Grade Crossing Predictor 4000 / Motion Sensor 4000 (SGCP4000 / MS4000) allows many application functions to be configured in software, reducing the equipment and wiring needed to install and maintain a crossing. Extensive reduction in the number of relays utilized by crossings is achieved through the use of various software routines.

4.2 APPLICATION PROGRAMMING GUIDELINES

4.2.1 External Islands

NOTE

NOTE

There are only two inputs available on the SGCP4000 / MS4000. If an application plan specifies both OOS and UAX inputs, there is no input available for assignment as an External Island. Planners must keep this fact in mind when creating SGCP4000 / MS4000 applications.

When an input is required from an island circuit external to the SGCP4000 / MS4000, such as a DC island as shown in Figure 4-1, the LOS pickup delay for an external island is set using the IPKU.

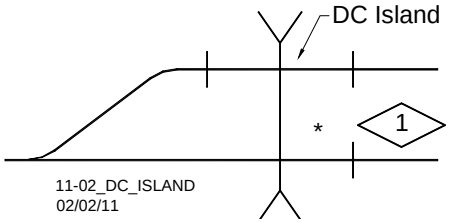


Figure 4-1:
External Island Example

4.2.2 Programming For Trains That Stop In The Approach

When trains have a normal stop in a MS/GCP approach such as a station stop or at a signal location, it is important to consider the following:

- How close to the crossing does the stop occur
- Will trains accelerate fast enough from the stop to affect warning time

Station stops are generally for short commuter trains that have brief stops at a station and when leaving, accelerate fast. Station stops unlike stops at signal (near track wires), may be located anywhere within a SGCP4000 / MS4000 approach.

When a station stop is located in the crossing or remote approach, it may be desirable to maintain the crossing activated during the stop. Motion sensing provides the fastest train detection possible when trains begin accelerating from a station stop toward the crossing.

4.2.3 Positive Start (Maintains the Crossing Activated)

If the station stop is very close to a crossing, (generally less than 1000 feet {305 meters}), it may be desirable to maintain the crossing activated. This may be implemented by means of the Positive Start feature. Positive Start holds the XR relay in the de-energized state when EZ is less than the programmed value. Positive start recovers when the:

- Train passes the island circuit
- Train backs up 5 points higher than the EZ Positive Start level value.
- Positive Start timed mode is selected and the timer exceeds its programmed value

The Positive Start function depends on the operating mode selected (ON or TIMED).

When in the ON (non-timed) mode:

- The XR Relay deenergizes when EZ drops below its configured level without any reaction time delay
- If the train stops, XR Relay stays deenergized as long as EZ is below its configured level
- The XR Relay recovers when train passes the island circuit or EZ rises 5 points above its configured level and the programmed pickup time expires.

When in the timed mode:

- the XR Relay deenergizes when EZ drops below its configured level
- the positive start timer starts when EZ drops to a value that is less than its configured level
- the XR Relay recovers when train passes the island circuit or both the programmed Positive Start timer and the prime Pickup delay timer have elapsed, provided no other prediction processes are in process

A Positive Start timer value of 1 to 99 minutes may be specified.

NOTE

NOTE

When Positive Start is used, slow trains may cause a long warning time if the Positive Start EZ level activation point is located well out in the approach.
If bidirectional approaches are used, Positive Start is active for both directions of train traffic
If movement through a trailing switch causes EZ to be below the Positive Start threshold, crossing activation will result.

4.2.4 Sudden Shunt detection

When a signal is located close to a crossing, Sudden Shunt can activate the crossing immediately when the first wheels of the train pass the remote UAX insulated joints into the crossing approach. See the application in Figure 4-2. Sudden Shunt will activate the crossing on all inbound trains (slow or fast) that pass the signal location so care should be taken in the application of this option.

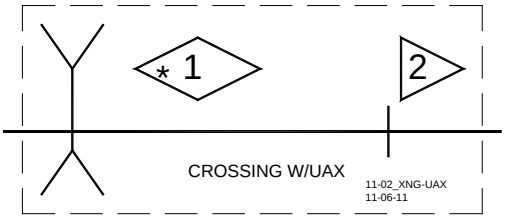


Figure 4-2:
Track application

The sudden shunt option allows the user to configure the crossing unit so that the XR relay de-energizes when a sudden shunt is detected. Sudden Shunt when enabled operates as follows:

- Sudden Shunt is detected when EZ drops instantaneously from above 80 to below a configured Sudden Shunt EZ level
- EZ drops due to the termination shunt having simulated track in series with it to balance or extend the approach distance
- Once Sudden Shunt has activated the crossing, if the train stops short of the island, any active timers will run their programmed pickup delays and the crossing will then recover
- When the crossing is unidirectional and has Sudden shunt enabled, a reverse move train although providing the Sudden Shunt detection conditions will not trigger Sudden Shunt operation

4.2.4.1 Track 1, Sudden Shunt Det Level

To determine the Sudden Shunt Detector EZ Level value:

- A hardwire shunt is placed on the track on the crossing side of the remote UAX insulated joints and the EZ value noted.
- The Sudden Shunt Det Level should be set 5 EZ point higher than the EZ value noted with the hardwire shunt
- The EZ value noted with the hardwire shunt must not be less than 5 for Sudden Shunt to be detected.
- The detector EZ level configuration setting is from an EZ of 5 to 75

NOTE

NOTE

When Sudden Shunt is used, ensure there are no trailing switches that are close enough on either side of the crossing (if bidirectional) to cause EZ to drop below the programmed Sudden Shunt EZ level. If so, this would cause a crossing activation each time a train comes out of the trailing switch.

4.2.5 Low EZ Detection

Low EZ Detection is used to detect a significant reduction of EZ. The valid range of settings are No and Yes. The default value is No.

- The EZ signal may decrease for various reasons including a false shunt

- Low EZ detection occurs when the EZ level drops below the programmed EZ level threshold (default is 70) for a period of time exceeding the low EZ detection timer value.
- Once low EZ detection occurs and depending on user selection, the crossing is continuously activated until EZ rises 5 points above the EZ level threshold.

When Low EZ Detection Used is set to Yes, it provides two submenus:

- Low EZ Detection Level – Valid range is an EZ between 50 and 80. Default setting is 70.
- Low EZ Detection Time – Valid range is between 2 and 99 minutes. Default setting is 10 minutes.

4.2.5.1 Low EZ Detection Level

- This sets the threshold level for low EZ detection. It is generally set at the default level of 70 for most applications.

4.2.5.2 Low EZ Detection Time

- The valid range of entry is between 2 and 99 minutes. The default is 10 minutes.
- The low EZ detection timer is generally programmed for a time interval longer than trains would normally remain in the approach.

4.2.6 Compensation Value

⚠ WARNING

WARNING

THE COMPENSATION VALUE IS AUTOMATICALLY SELECTED BY THE SYSTEM WHENEVER THE FREQUENCY IS CHANGED. THE COMPENSATION VALUE CAN BE CHANGED MANUALLY VIA THIS MENU ITEM; HOWEVER, THE COMPENSATION VALUE SHOULD NOT BE CHANGED UNLESS SPECIFICALLY INSTRUCTED BY SIEMENS APPLICATION ENGINEERING TO DO SO. CALIBRATE THE CROSSING IF THE COMPENSATION VALUE IS CHANGED.

The compensation value is a correction factor used to fine tune the system for unusual ballast loads on the track. This value is selected automatically to maintain a stable EZ value over changing ballast conditions. The EZ value can be monitored using the Status Mode (see Section IV, Diagnostics). The valid range of entries is 1000 to 2000; however, 1300 is generally used.

4.2.7 SGCP4000 / MS4000 Simple Predictor

⚠ CAUTION

CAUTION

THE SGCP4000 / MS4000 IS NOT A MODEL 4000 GCP! WHILE IT CAN RECEIVE UAX INPUT, IT CANNOT DAX NOR CAN IT PERFORM TRAFFIC PREEMPTION OR ANY OTHER ADVANCED PROGRAMMING OPTIONS (ANDING, ADVANCED APPROACH PREDICTION, WRAP CIRCUITS, APPROACH OVERRIDES, ETC.) DESCRIBED IN SECTION 6 OF SIEMENS'S MICROPROCESSOR BASED MODEL 4000 GRADE CROSSING PREDICTOR FAMILY APPLICATION GUIDELINES, SIG-00-08-06.

The SGCP4000 / MS4000 provides a simple predictor to allow users to set up crossing applications with programmable warning times. When programmed to PRED=YES (or *Prime MS/GCP Mode=Pred on the DT), the SGCP4000 / MS4000 will perform as a very simple predictor, activating the crossing in accordance with its programmed warning time. The predictor

is not capable of performing any advanced programming actions (DAXing, ANDing, Traffic Preemption, etc.) as described in Section 6 of the Model 4000 GCP Application Guidelines Manual.

4.3 MAINTENANCE CALL OUTPUT

The maintenance call output may be controlled by the SGCP4000 / MS4000, an external SSCC, or other equipment at the crossing connected via ECHELON LAN.

4.3.1 Internal Deactivation

When equipped with an external SEAR, the maintenance call output is deactivated if:

- The CPU detects a low battery condition
- The SEAR detects that POK (power off indicator) is low
- Communication with the external SEAR is lost
- Unit is taken Out-of-Service (OOS)
- During any transfers from MAIN to STBY or STBY to MAIN, until the active side is fully recovered.

4.4 TAKING TRACKS "OUT OF SERVICE"

⚠ WARNING

WARNING

THE RAILROAD PROCEDURES GOVERNING HOW TO TAKE A TRACK CIRCUIT OUT OF SERVICE (OOS) SHALL BE FOLLOWED. THE INSTRUCTIONS IN THIS SECTION MAY BE FOLLOWED ONLY IF ALLOWED BY THE RAILROAD.
OUT OF SERVICE TRACKS WILL NOT RESPOND TO TRAIN OPERATION. TAKE ALTERNATE MEANS TO WARN VEHICULAR TRAFFIC, PEDESTRIANS, AND EMPLOYEES.
REQUIRED OPERATIONAL TESTS SHOULD BE PERFORMED IN ACCORDANCE WITH RAILROAD PROCEDURES WHEN RESTORING TRACKS TO SERVICE.
DO NOT USE TEST TERMINALS OR SWITCHES THAT CAN VIBRATE CLOSED TO ENERGIZE OOS INPUTS. .

NOTE

NOTE

There are only two inputs available on the SGCP4000 / MS4000. If an application plan specifies both External Island and UAX inputs, there is no input available for assignment as an OOS. Planners must keep this fact in mind when creating SGCP4000 / MS4000 applications.

When an approach is out of service, the message "APPR OOS" OR "XNG OOS" scrolls across the 4-Character Display and if a Diagnostic Terminal (DT) is connected, its display will remain ON and not go into the sleep mode. The track module outputs remain energized (no crossing activation). Module motion and island LEDs remain ON during train movements. External inputs are ignored (UAX and External Island). Most OOS Track module failures and all corresponding rail failures are ignored. Failure types and causes can be reviewed by selecting the DIAG button. The Island is ignored when the approach and the island are selected OOS. Maintenance call light is turned off when the input is energized, and lights when the input is de-energized. Status log shows OOS EZ changes and EX on train moves but XR Relay does not de-energize nor are warning times displayed.

If the SGCP4000 / MS4000 switches over between MAIN and STANDBY modules, OOS tracks will be placed in-service and will remain in-service until user selects tracks OOS again.

4.4.1 OOS Options

NOTE

NOTE

If the approaches (APPR) or the approaches and the island together (XNG) are Out of Service and one of the following occurs, the component is put back In Service:

- The Out of Service Timer expires
- Transfer occurs
- The user puts the component back into service using the user interface
- The Unit reboots
- The Unit detects a health error (not including Island or motion sensor component errors).

The approaches (APPR), or the approaches and the island together (XNG) may be taken out of service. When the Out of Service option XNG is activated, the unit does not command the crossing to activate and only logs the train activity.

NOTE

NOTE

The Maintenance Call light is de-energized whenever the OOS input is energized. Ensure that the input is only energized only when the unit is to be taken OOS.

To enable Out of Service on the SGCP4000 / MS4000:

Scroll down the main menu to PROG, and select either IN1.1 or IN1.2.

1. When IN1.X=XXXX appears, press and hold the SEL button until NONE appears.
2. Press the NAV button until OOS appears.
3. Press and hold the SEL button until SET IN1.X=OOS?
4. Press and hold the SEL button until DONE appears. IN1.X=OOS appears.
5. Verify IN1.X. is de-energized

4.4.1.1 Take Approach OOS via 4-Character Display

To take only the approaches Out of Service:

Scroll down the main menu to OOS, and select OOS.

1. Energize IN1.X.
2. When SET OOS TIME appears, either select NONE (for permanent OOS) or the length of time required, set in hourly increments (01 – 23 hours, in 1 hour increments).
3. Press and hold the SEL button until DONE appears. OOS TIME=XXHR (e.g., OOS TIME=4HR) appears.
4. When APPR appears, press the Select button for approximately 2 seconds.
5. Select “TAKE APPR OOS?” as it appears in the window.
6. The 4-Character Display scrolls APPR OOS REM TIME XX:XX (e.g., APPR OOS REM TIME 03:59). This message scrolls as the top level description until the timer expires.

4.4.1.2 Take Crossing (Approaches and Island) OOS via 4-Character Display

To take the Crossing (XNG), Out of Service:

Scroll down the main menu to OOS, and select OOS.

1. Energize IN1.X.
2. When SET OOS TIME appears, either select NONE (for permanent OOS) or the length of time required, set in hourly increments (01 – 23 hours, in 1 hour increments).
3. Press and hold the SEL button until DONE appears. OOS TIME=XXHR (e.g., OOS TIME=4HR) appears.
4. When APPR appears, the NAV button until XNG appears in the 4-Character Display
5. Press the Select button for approximately 2 seconds.
6. Select “TAKE XNG OOS?” as it appears in the window.
7. The 4-Character Display scrolls XNG OOS REM TIME XX:XX (e.g., XNG OOS REM TIME 03:59). This message scrolls as the top level description until the timer expires.

4.4.1.3 Take Approach OOS via DT

To take only the approaches Out of Service:

Scroll down the main menu to OOS, and select OOS.

1. Energize IN1.X.
2. Right click the DT and select OOS
3. If required, select the EDIT button by the upper OOS Timeout and select YES if the approach is to be OOS for a set number of hours (01 – 23) or NO if OOS is to be permanent.
4. If required and the OOS Timeout value is set to YES, select the EDIT button by the lower OOS Timeout and set the timer to the desired period (01 – 23 hours).
5. Select the TAKE GCP OUT OF SERVICE button.
6. Select Yes when the message “Are you sure you want to take GCP Out Of Service?”

4.4.1.4 Take Crossing (Approaches and Island) OOS via DT

To take the Crossing (XNG) (both Approaches and the Island) Out of Service:

Scroll down the main menu to OOS, and select OOS.

1. Energize IN1.X.
2. Right click the DT and select OOS
3. If required, select the EDIT button by the upper OOS Timeout and select YES if the approach is to be OOS for a set number of hours (01 – 23) or NO if OOS is to be permanent.
4. If required and the OOS Timeout value is set to YES, select the EDIT button by the lower OOS Timeout and set the timer to the desired period (01 – 23 hours).
5. Select the TAKE ISL OUT OF SERVICE button.
6. Select Yes when the message “Are you sure you want to take GCP Out Of Service?”

4.4.1.5 Returning an OOS Function to Service

Deenergizing the OOS input causes the approach or crossing to be returned to service. Another method to return an OOS approach or crossing is as follows:

Scroll down the main menu to OOS, and select OOS.

1. When PUT APPR IN SERV? Or PUT XNG IN SERV? appears, press and hold the SEL button until DONE appears.
2. OOS TIME=00:00 appears, then the menu scrolls SGCP4000 / MS4000 (e.g., OOS TIME=4HR) appears

When returned to service, the 4-digit display returns to normal configuration, (e.g., SGCP4000 / MS4000). Ensure the Input is de-energized when the OOS period is complete.

On the DT, simply select either Put GCP Back in Service to return the entire unit to service, or select Put ISL Back in Service to leave the approaches Out Of Service.

SECTION 5 –
AUXILIARY EQUIPMENT

5.1 GENERAL

The equipment described in this section can be used with the SGCP4000 / MS4000. Where applicable, installation and adjustment information is provided. The following equipment is covered:

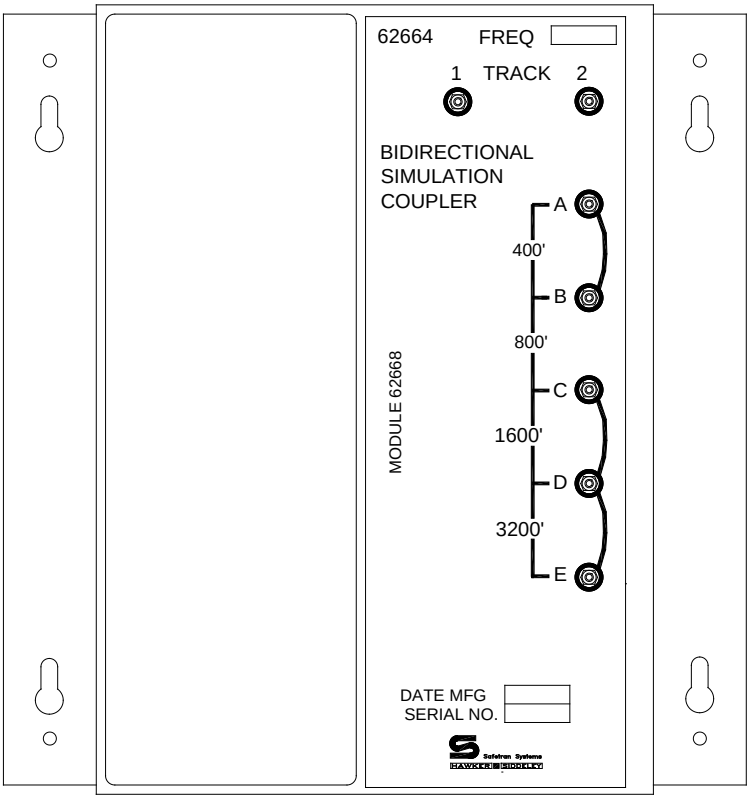
5.2 BIDIRECTIONAL SIMULATION COUPLER, 62664-MF

⚠ WARNING

WARNING

WHEN A SGCP4000 / MS4000 IS CONNECTED IN A SIX-WIRE CONFIGURATION (TWO RECEIVER WIRES, TWO TRANSMIT WIRES, AND TWO CHECK WIRES) AS SHOWN IN Figure 5-2, THE BIDIRECTIONAL SIMULATION COUPLER MUST BE CONNECTED TO THE CHECK (CHK) WIRES, NOT TO THE TRANSMIT (XMT) WIRES. IF THE COUPLER IS CONNECTED TO THE TRANSMIT WIRES, AN OPEN TRANSMITTER TRACK WIRE CANNOT BE DETECTED AND CAN, THEREFORE, ADVERSELY AFFECT MOTION SENSOR OPERATION. HOWEVER, IN STANDARD FOUR-WIRE BIDIRECTIONALLY-WIRED (SIMULATED BIDIRECTIONAL) INSTALLATIONS; IT IS PERMISSIBLE TO CONNECT THE COUPLER

**TO THE TWO TRANSMITTER TRACK LEADS AS SHOWN.
THIS CONDITION EXISTS FOR SIX-WIRE APPLICATIONS USING BIDIRECTIONAL SIMULATION EQUIPMENT WHICH IS LOCATED IN THE CASE/BUNGALOW (NOT AT THE TRACKS) REGARDLESS OF WHICH OF THE FOLLOWING TYPES OF SIMULATED TRACK LOAD IS USED:
(1) BIDIRECTIONAL SIMULATION COUPLER (62664-MF),
(2) SINGLE-FREQUENCY NARROWBAND SHUNT (62775-MF) USED IN CONJUNCTION WITH ADJUSTABLE INDUCTOR (8A398-6), OR
(3) MULTI-FREQUENCY NARROW-BAND SHUNT (62775 OR 62780) EQUIPPED WITH SIMULATED TRACK INDUCTOR (8V617-DISTANCE).
IN STANDARD FOUR TRACK WIRE BIDIRECTIONALLY-WIRED (SIMULATED BIDIRECTIONAL) INSTALLATIONS, IT IS PERMISSIBLE TO CONNECT THE SIMULATED BIDIRECTIONAL LOAD TO THE TWO TRANSMITTER TRACK LEADS IN THE BUNGALOW AS SHOWN IN Figure 5-2.**



11-02_BIRDN_SIM_CPLR
12-22-11

Figure 5-1:
Bidirectional Simulation Coupler, 62664-Mf

Low ballast resistance effectively reduces approach distances to a greater degree in unidirectional SGCP4000 / MS4000 installations than in bidirectional installations.

⚠ WARNING

WARNING

THE 62664 BIDIRECTIONAL SIMULATION COUPLER MUST NOT BE USED AS A TERMINATION SHUNT.
THE 62664 PLUG-IN MODULE FREQUENCY MUST BE THE SAME AS THE MOTION SENSOR FREQUENCY.

In a simulated bidirectional configuration, a narrow-band shunt is connected in series with an adjustable inductor. This combination is:

- Connected in parallel across the track connections.
- Electrically equal to that of the actual track approach circuit.

Both approach circuits appear equal in length to the SGCP4000 / MS4000, even though one of the circuits consists of the shunt and inductor located in the instrument housing/bungalow.

The 62664 Bidirectional Simulation Coupler (Figure 5-1) is a convenient, compact, shelf- or backboard-mounted unit containing:

- A narrow-band Shunt of the same frequency as the MOTION SENSOR

- An adjustable inductor (simulated track).

The Bidirectional Simulation Coupler is housed in a brushed aluminum case and consists of:

- A single plug-in-type printed circuit board that is available in 12 fixed frequencies (Hz)
- Four series-connected, toroid-wound inductors. Each inductor simulates a specific track length and is tapped and connected to the front panel terminals.

The front panel terminals allow simulated approach distances to be selected that closely match the actual track approach:

- Approach distances ranging from 400 to 6,000 feet (122 – 1829 meters) may be selected using terminal shorting straps.
- The available simulated approach distances and the corresponding shorting strap terminal positions for the 62664 are shown in Table 5-1.

Table 5-1:
Approach Distance Selection Strapping For
Bidirectional Simulation Coupler, 62664-Mf

DISTANCE FEET/METERS	STRAP TERMINALS	DISTANCE FEET/METERS	STRAP TERMINALS
400/122	B-C, C-D, D-E	3,600/1098	B-C, C-D
800/244	A-B, C-D, D-E	4,000/1220	A-B, C-D
1,200/366	C-D, D-E	4,400/1342	C-D
1,600/488	A-B, B-C, D-E	4,800/1464	A-B, B-C
2,000/610	B-C, D-E	5,200/1585	B-C
2,400/732	A-B, D-E	5,600/1707	A-B
2,800/854	D-E	6,000/1829	No Straps
3,200/976	A-B, B-C, C-D		

When a SGCP4000 / MS4000 is connected in a six-wire configuration the bidirectional simulation coupler must be connected to the check (CHK) wires as shown in Figure 5-2.

When a SGCP4000 / MS4000 is connected in a standard four-wire configuration, the bidirectional simulation coupler is connected to the two transmit leads as shown in Figure 5-2.

Mounting dimensions for the bidirectional simulation coupler are provided in Figure 5-3. Specifications for the bidirectional simulation coupler are as depicted in Table 5-2:

Table 5-2:
Bidirectional Simulation Coupler, 62664-Mf

PARAMETER	VALUE
Environmental	-40°F to +160°F (-40°C to +71°C)
Dimensions	8.75 inches (22.225 centimeters) high 8.50 inches (21.590 centimeters) wide 9.25 inches (23.495 centimeters) deep
Weight	5 pounds (2.27 kilograms) (approximate)
Adjustment Range	400 to 6,000 feet (122 – 1829 meters)
Loading Effect	Loading effects of the internal narrow-band Shunt are equivalent to that of the 62775 narrow-band Shunt.

NOTE

NOTE

The adjustment range must be within ±10% of actual approach distance.

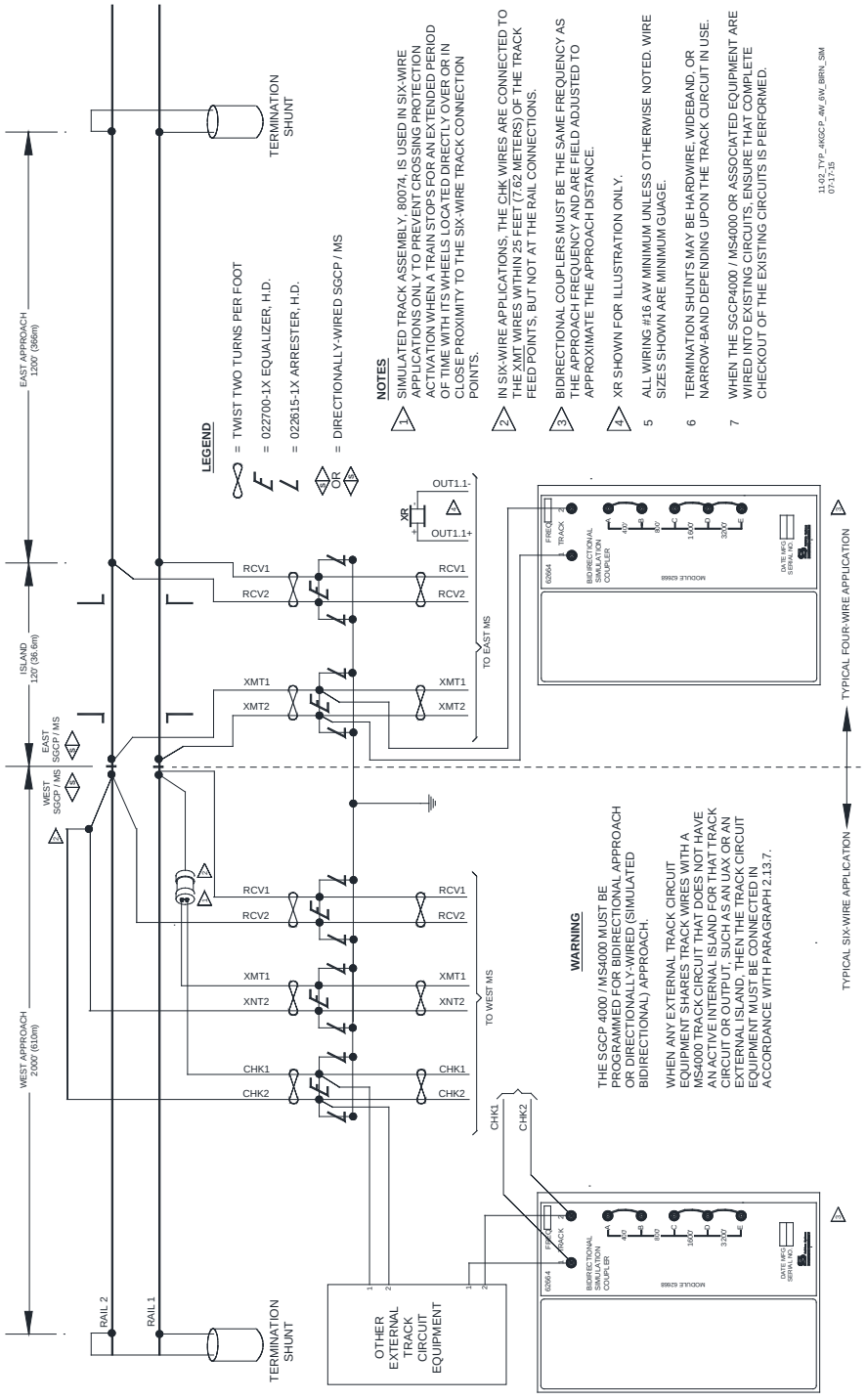


Figure 5-2:
Proper SGCP4000 / MS4000 Four-wire and Six-wire

Connections Using Bidirectional Simulation Coupler on SGCP4000 / MS4000 Operating in the Bidirectional Simulation Mode

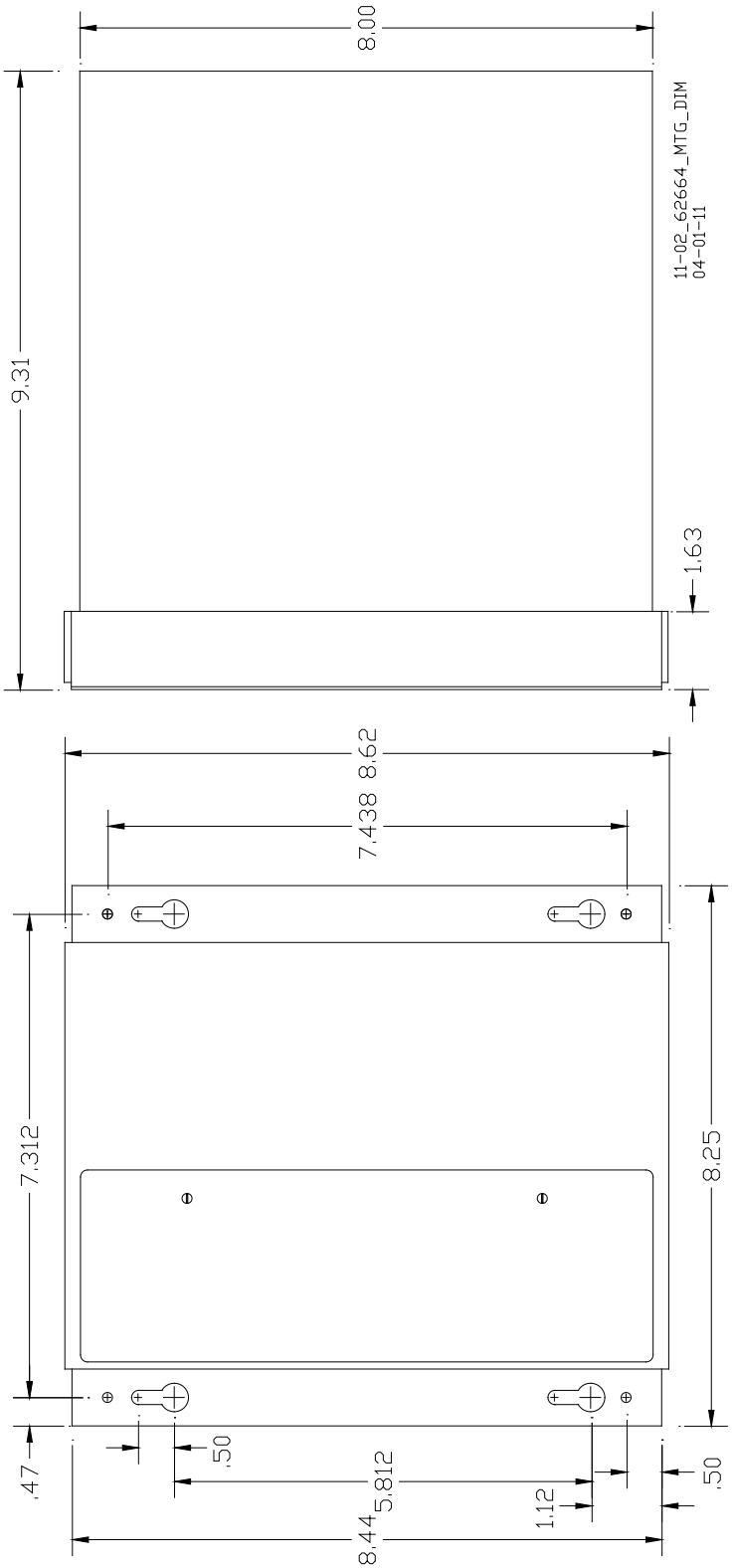


Figure 5-3:
Bidirectional Simulation Coupler Assembly Mounting Dimensions

5.3 DC SHUNTING ENHANCER PANEL, 80049

Intermittent poor shunting can result just about anywhere due to numerous causes, but generally occurs due to:

- infrequent track usage
- lightly weighted cars
- passenger and transit operation
- spillage from rail cars
- rail contamination

Lack of any shunting generally occurs in dark territory where no DC or AC track circuits exist and few trains run. Track shunting in dark territory can be easily improved using methods similar to those employed in style-C track circuits (but without the need for so many insulated joints). This involves the use of one insulated joint at the far end of each approach and the application of a DC voltage to the track at the crossing.

These measures improve shunting, thus allowing the SGCP4000 / MS4000 Enhanced Detection software to function optimally.

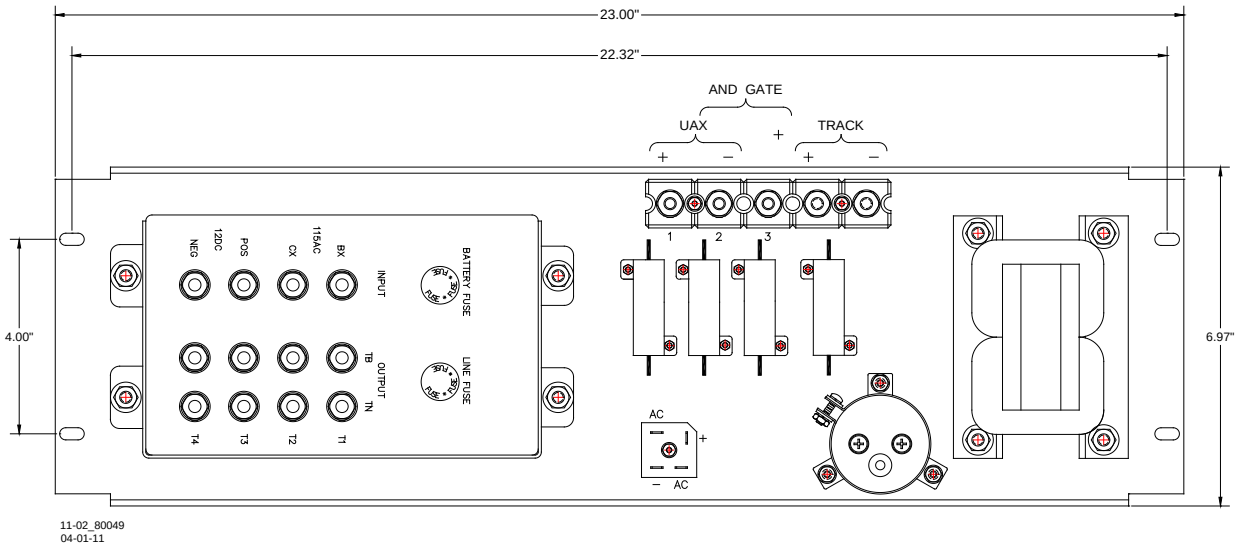


Figure 5-4:
DC Shunting Enhancer Panel, 80049

5.3.1 Track Output Voltage

The Siemens 80049 DC Shunting Enhancer Panel, Figure 5-4, applies a nominal 6 volts DC to the track at the crossing to break down any insulating film that may develop on the rails. This DC voltage is isolated from battery and is generated from a 110 volt AC step-down transformer when AC is present or utilizes battery powered DC-to-DC converter when AC is off. The panel switches automatically to the DC-to-DC converter output if AC fails.

5.3.2 Monitor Output Voltage

The Monitor Output voltage is applied to a SGCP4000 / MS4000 vital input programmed as AND 1 XR Enable. Loss of the Monitor Output voltage will activate the crossing. The AND 1 XR enable must be programmed with a minimum of 5 second pickup delay.

5.3.3 Track Requirements

Installation of the Siemens 80049 DC Shunting Enhancer Panel requires the placement of at least one joint at the far end of each approach. The insulated joints are required to confine the DC track voltage to the crossing. The insulated joints can be located beyond the approach narrow-band shunt termination as desired.

The 80049 panel can be rack, wall, or shelf mounted. See Figure 5-4 for mounting dimensions.

⚠ WARNING

WARNING

THE TERMINATION SHUNTS MUST BE 62775-F OR 62780-F NARROW-BAND SHUNTS. SOME FAILURE MODES CANNOT BE DETECTED IF HARDWIRE OR WIDEBAND SHUNTS ARE USED. MOTION SENSOR TRANSMIT WIRES MUST FIRST BE ROUTED TO THE ENHANCER PANEL TRACK CONNECTIONS AND THEN ON TO THE TRACK; IF NOT, SOME FAILURES CANNOT BE DETECTED BY THE SYSTEM. (SEE Figure 5-7)

⚠ CAUTION

CAUTION

WHEN TWO OR MORE DARK TERRITORY CROSSINGS OVERLAP, ENSURE THAT EACH MODEL SGCP4000 / MS4000 CROSSING HAS AN 80049 PANEL IN OPERATION AND THAT THE POLARITY OF THE TRACK VOLTAGE TO THE RAIL FROM ALL 80049 PANELS IS THE SAME AT EACH CROSSING.

NOTE

NOTE

The DC Shunting Enhancer Panel can be used with applications involving overlapping approaches from two or more crossings without the use of additional insulated joints.
A typical DC Shunting Enhancer Panel application drawing for a two track application is provided in Figure 5-7 and for two overlapping crossings is provided in Figure 5-8.

5.3.4 Interface Terminal Connections

The DC Shunting Enhancer Panel is equipped with eight user interface terminals. These terminals are connected as shown in Figure 5-5.

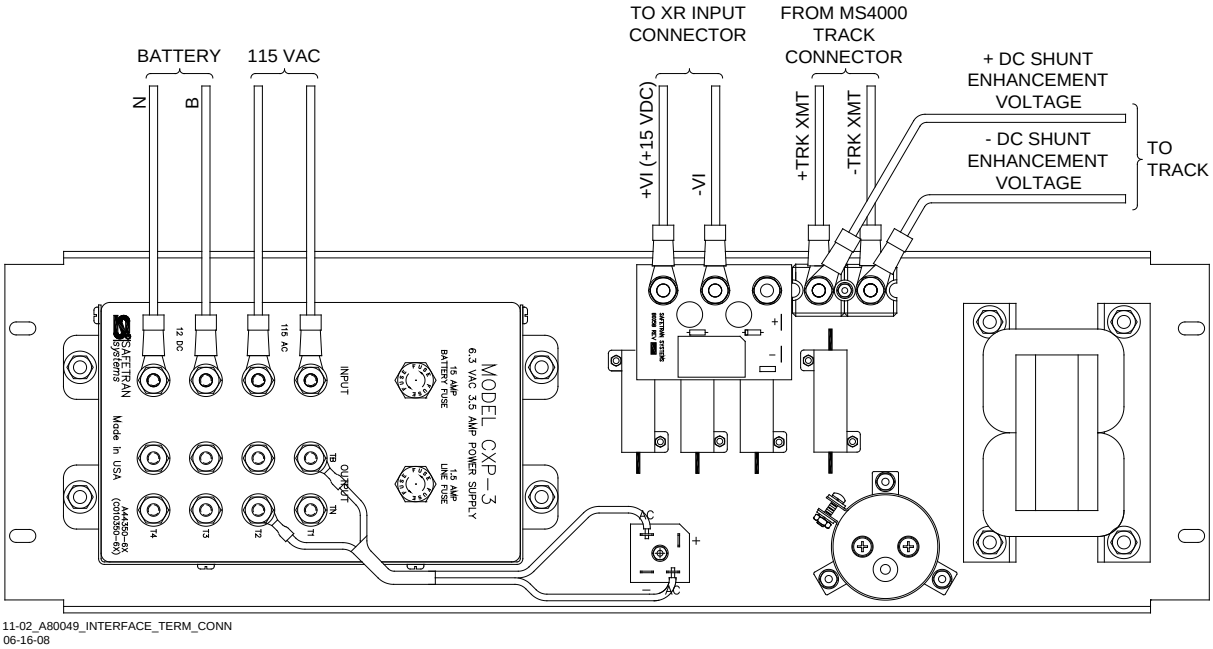


Figure 5-5:
DC Shunting Enhancer Panel, 80049, Interface Terminal Connections

5.3.5 DC Shunting Enhancer Panel Specifications

Table 5-3:
DC Shunting Enhancer Panel Specifications

PARAMETER	VALUES
Input Power:	
AC Voltage:	95 to 130 VAC
DC Voltage:	11 to 16 VDC
DC Current (AC present):	0 amps
DC Current (AC not present):	0.25 amps with no train and high ballast resistance 2.5 amps with train shunting track
Environmental Temperature Range:	-40 °F to +160 °F (-40 °C to +71 °C)
UAX Output:	+15.0 ± 0.2 VDC
Surge Protec8tion:	Primary protection required for AC input and battery Secondary protection provided internally
Humidity:	95%, non-condensing

Continued on next page

Table 5-3, Continued

PARAMETER	VALUES
Dimensions:	
-1 unit:	6.97 inches (17.704 centimeters) high 23.0 inches (58.420 centimeters) wide 10.75 inches (27.305 centimeters) deep
-5 unit:	6.97 inches (17.704 centimeters) high 23.0 inches (58.420 centimeters) wide 5.75 inches (14.605 centimeters) deep
Weight:	-1 unit: 32 pounds (14.4 kilograms) (approximate) -5 unit: 17 pounds (7.65 kilograms) (approximately)
Mounting Dimensions	The DC Shunting Enhancer Panel can be rack, wall, or shelf mounted. The Panel mounting dimensions are provided in Figure 5-6.

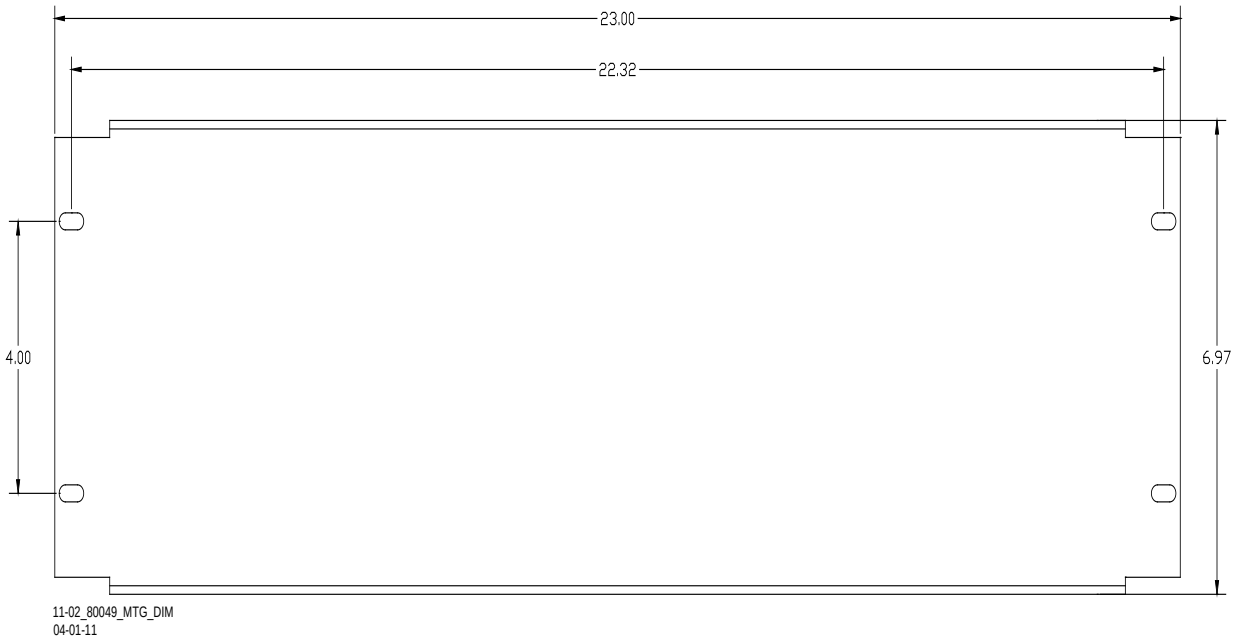


Figure 5-6:
DC Shunting Enhancer Panel Mounting Dimensions

5.3.6 DC Shunting Enhancer Panel Configuration Options

Two DC Shunting Enhancer Panel configuration options are available. These configurations are described in Table 5-4.

Table 5-4:
DC Shunting Enhancer Panel Configuration Options

PART NUMBER	OPTION DESCRIPTION
8000-80049-0001	Panel with CXP-3 DC-to-AC Inverter
8000-80049-0005	Panel without CXP-3 DC-to-AC Inverter Used in two track applications

5.3.7 Two Track and Overlapping Crossing Applications

When two 80049 Panels are required with applications involving two tracks at a crossing, the first panel is an 80049-0001and the second panel may be an 80049-0001 or 80049-0005.

NOTE

NOTE

When the –5 panel is used, it must be connected to the isolated 6.3 VAC inverter output of the first panel as shown in Figure 5-7.

When there are two crossings that have overlapping approaches, this application may be implemented as shown in Figure 5-8.

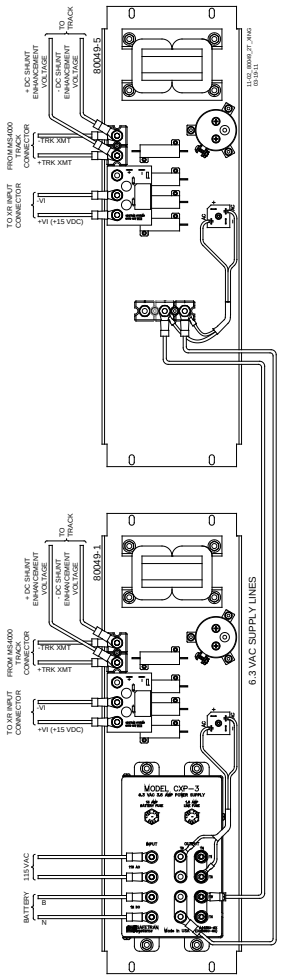


Figure 5-7:
DC Shunting Enhancer Panels for Two Track Crossing

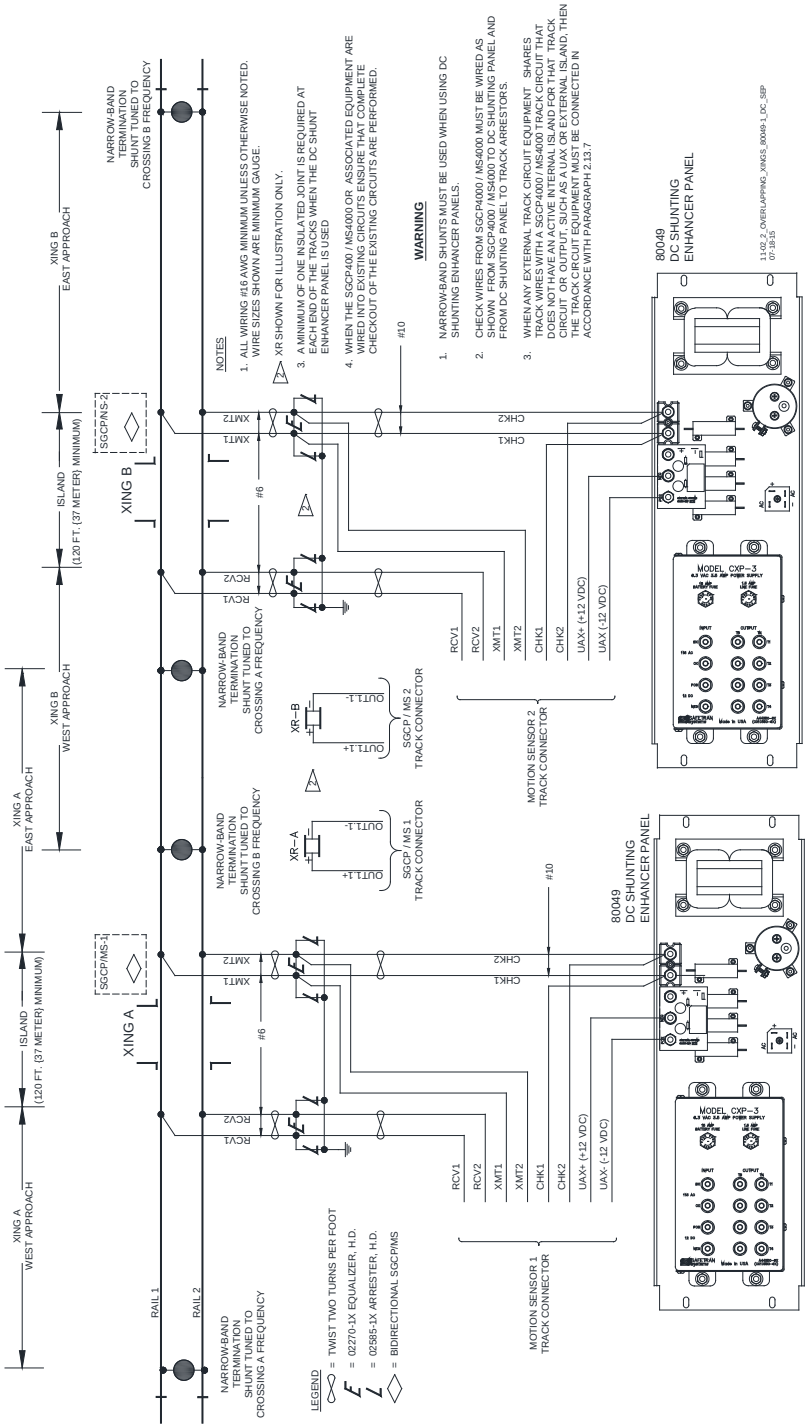


Figure 5-8:
DC Shunting Enhancer Panels for Overlapping Crossings

5.4 NARROW-BAND SHUNT, 62775-F

⚠ CAUTION

CAUTION

WHEN ADDING OR REPLACING TERMINATION SHUNTS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE TERMINATION SHUNT DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.
THE SHUNT SHOULD BE CONNECTED AS CLOSE AS PRACTICABLE TO THE RAILS (WITHIN THE #6 AWG WIRE LEAD LENGTH OF 25 FEET {7.62 METERS},) AND, TO AFFORD MAXIMUM PROTECTION FROM PHYSICAL DAMAGE, BE ENCASED IN A PROTECTIVE ENCLOSURE OR BURIED (EITHER VERTICALLY OR HORIZONTALLY) AT AN APPROPRIATE DEPTH (SEE PARAGRAPH 5.13). IT IS NOT NECESSARY TO BURY THE SHUNT BELOW THE FROST LINE.

The 62775-f Narrow-band Shunt (Figure 5-9) is intended for use in areas where other AC frequencies or DC coded track circuits are present, but where only the SGCP4000 / MS4000 frequency should be terminated.

The Shunt requires no special tuning and is generally preferred for most applications.

The 62775-f Narrow-band Shunt is housed in a hermetically sealed, cylindrical case with a pair of 10-foot leads extending from one end.

The Shunt is available in any fixed frequency (Hz) listed in the chart below (Siemens frequencies are shown in **boldface** type).

Table 5-5:
Frequencies Available with Narrow Band Shunt, 62775-f

86	151	285	522	753
100	156	326	525	790
114	172	348	560	816
134	210	392	630	881
141	211	430	645	970
149	267	452	686	979

5.4.1 Narrow-band Shunt, 62775-F Specifications

Dimensions	16 inches (40.640 centimeters) long 5 inches (12.700 centimeters) in diameter
Weight	10 pounds (4.54 kilograms) (approximate)
Frequencies	See Table 5-5 above.
Leads	10 feet (3.047meters); number 6 AWG, stranded, black PVC

5.5 NARROW-BAND SHUNT, 62780-F

⚠ CAUTION

CAUTION

WHEN ADDING OR REPLACING TERMINATION SHUNTS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE TERMINATION SHUNT DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.
THE SHUNT SHOULD BE CONNECTED AS CLOSE AS PRACTICABLE TO THE RAILS (WITHIN THE #6 AWG WIRE LEAD LENGTH OF 25 FEET {7.62 METERS},) AND, TO AFFORD MAXIMUM PROTECTION FROM PHYSICAL DAMAGE, BE ENCASED IN A PROTECTIVE ENCLOSURE OR BURIED (EITHER VERTICALLY OR HORIZONTALLY) AT AN APPROPRIATE DEPTH (SEE PARAGRAPH 5.13). IT IS NOT NECESSARY TO BURY THE SHUNT BELOW THE FROST LINE.

The Narrow-band Shunt, 62780-f (Figure 5-9) is intended for use in areas where other AC frequencies or DC coded track circuits are present, but where only the SGCP4000 / MS4000 frequency should be terminated.

- Similar to the Narrow-band Termination Shunt, 62775 (paragraph 5.4).
- The 62780 Shunt produces less loading effect on adjacent frequencies (10 ohms reactance) than the 62775 Shunt:
- This shunt can be used in territories with overlapping Model 300 and Model 400 GCP approaches.
- The 62780 Narrow-band Shunt is compatible with all Siemens Motion Sensors and GCP's.

This shunt is available in any one of 26 frequencies ranging from 86 Hz to 979 Hz as shown in the following chart (Siemens frequencies are shown in **boldface** type).

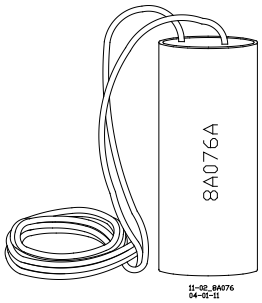
Table 5-6:
Frequencies Available with Narrow Band Shunt, 62780-f

86	151	**211**	326	**430**	**525**	**645**	**790**	**970**
100	**156**	267	**348**	452	560	686	816	979
114	210	**285**	392	522	630	753	881	

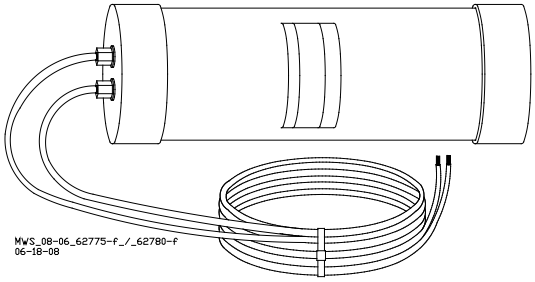
The Narrow-band Shunt, 62780 is housed in a hermetically sealed, cylindrical case with a pair of 10-foot leads extending from one end.

5.5.1 Narrow-band Shunt, 62780-f Specifications

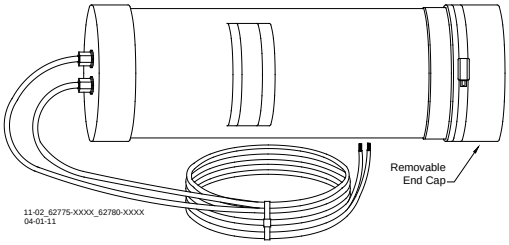
Dimensions	14.125 inches (35.9 centimeters) long 4.125 inches (10.5 centimeters) in diameter
Weight	7 pounds (3.18 kilograms) (approximate)
Frequencies	See Table 5-6 above.
Leads	10 feet (3.048 meters); number 6 AWG, stranded, black PVC



Wideband Shunt, 8A076A



Narrow-band Shunt, 62775-f/62780-f



Multifrequency, Narrow-band Shunt, 62775-XXXX/62780-XXXX

Figure 5-9:
Siemens Narrow-band and Wide-band Termination Shunts

5.6 MULTI-FREQUENCY NARROW-BAND SHUNT, 62775-XXXX

⚠ WARNING

WARNING

THE 62775-XXXX MULTI-FREQUENCY NARROW-BAND SHUNT MUST NOT BE USED ANYWHERE WITHIN A MODEL 300 OR 400 GCP APPROACH; NARROW-BAND SHUNT 62780-XXXX IS RECOMMENDED FOR THESE APPLICATIONS.

CAREFULLY TIGHTEN ALL NUTS ON ALL FREQUENCY JUMPERS, AND THEN INSTALL A SECOND NUT TO SECURELY LOCK THE ASSEMBLY.

⚠ CAUTION

CAUTION

WHEN ADDING OR REPLACING TERMINATION SHUNTS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE TERMINATION SHUNT DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.

THE SHUNT SHOULD BE CONNECTED AS CLOSE AS PRACTICABLE TO THE RAILS (WITHIN THE #6 AWG WIRE LEAD LENGTH OF 25 FEET {7.62 METERS}) AND, TO AFFORD MAXIMUM PROTECTION FROM PHYSICAL DAMAGE, BE ENCASED IN A PROTECTIVE ENCLOSURE OR BURIED (EITHER VERTICALLY OR HORIZONTALLY) AT AN APPROPRIATE DEPTH (SEE PARAGRAPH 5.13). IT IS NOT NECESSARY TO BURY THE SHUNT BELOW THE FROST LINE.

NOTE

NOTE

The Shunt is shipped with no factory jumpers installed and is, therefore, electrically open and does not load any frequency on the track. Install jumpers for the desired frequency before placing the unit in service..

The Multi-frequency Narrow-band Shunt, 62775-XXXX, like its single single-frequency counterpart (paragraph 5.4), is designed to terminate specific track frequencies in areas where other audio frequencies or DC coded track circuits are present.

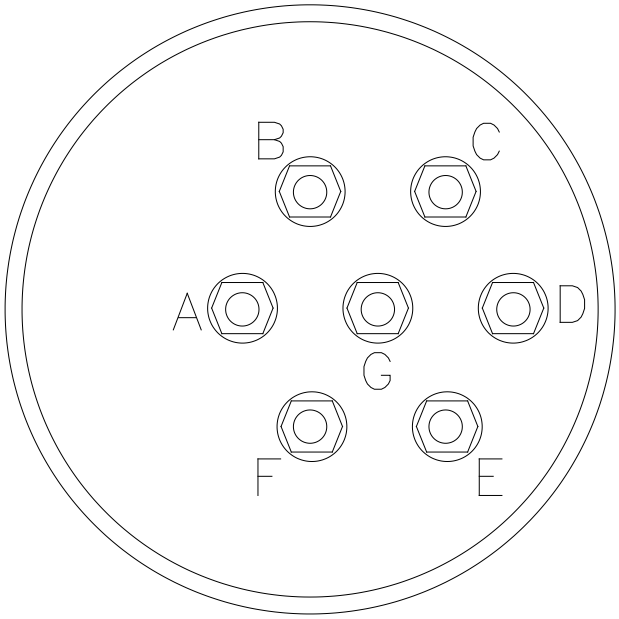
5.6.1 Physical Description

The Multi-frequency Narrow-band Shunt, 62775-XXXX, (Figure 5-10) is slightly longer than its single-frequency counterpart (Section 5.4), but exhibits the same electrical characteristics as the basic single-frequency unit.

5.6.2 Frequency Selection

The Multi-frequency Narrow-band Shunt is available in eight frequency ranges.

- The Shunt is housed in a hermetically sealed, cylindrical case with a pair of 10-foot (3.048 meter) leads extending from one end and seven standard AREMA terminals extending from the other.
- The terminals are labeled A through G and are jumpered to select the desired shunting frequency (Table 5-7).



11-02_MLTIFRQ_NBS_AREMA_BP
04-01-11

Figure 5-10:
Multi-frequency Narrow-band Shunt, 62775-XXXX/62780-XXXX AREMA Binding Posts

NOTE

NOTE

Terminal jumper hardware is supplied with each Shunt. The Shunt is shipped with no factory jumpers installed and is therefore electrically open and does not load any frequency on the track. Install jumpers for the desired frequency before placing the unit into service. A label located inside the removable end cap identifies the terminal jumpering for each frequency.

The pliable end cap covering the terminal end of the Shunt is secured in place by a sturdy stainless steel clamp for protection against moisture.

5.6.3 Multi-frequency Narrow-band Shunt, 62775-XXXX Specifications

Dimensions	22 inches (55.880 centimeters) long 5 inches (12.700 centimeters) in diameter
Weight	10 pounds (4.54 kilograms) (approximate)
Frequencies	See Table 5-7
Leads	10 feet (3.048 meters); number 6 AWG, stranded, black PVC

Table 5-7:
Multi-frequency Narrow-band Shunt, 62775-XXXX Frequency Selection Jumpers

SHUNT PART NUMBER	FREQUENCY (HZ)	JUMPER SHUNT TERMINALS
62775-8621	86	A-F, G-D, D-E, E-F
	114	B-G, G-D, D-E
	156	C-D, D-G
	211	C-D
62775-1543	156	A-F, G-C, C-D, D-E, E-F
	211	A-G, G-C, C-D, D-E
	285	B-C, C-D, D-G,
	348	B-C, C-D
	430	B-C
62775-2132*	211	A-F, G-C, C-D, D-E, E-F
	267	B-G, G-C, C-D, D-E
	285	B-C, C-D, D-G
	313	B-C, C-D
	326	B-C
62775-2152	211	A-F, G-C, C-D, D-E, E-F
	285	B-C, C-D, D-E, E-G
	348	B-C, C-D, D-G
	430	B-C, C-D
	525	B-C
62775-3448*	348	A-B, B-C, C-D, D-E, E-F, F-G
	389	A-B, B-C, C-D, D-E, E-F
	392	A-B, B-C, C-D, D-E
	430	A-B, B-C, C-D
	452	A-B, B-C
	483.5	A-B
62775-3497	348	A-B, B-C, C-D, D-E, E-F, F-G
	430	A-B, B-C, C-D, D-E, E-F
	525	A-B, B-C, C-D, D-E
	645	A-B, B-C, C-D
	790	A-B, B-C
	970	A-B
62775-5274*	522	A-B, B-C, C-D, D-E, E-F, F-G
	525	A-B, B-C, C-D, D-E, E-F
	560	A-B, B-C, C-D, D-E
	645	A-B, B-C, C-D
	669.9	A-B, B-C
	746.8	A-B
62775-7910*	790	A-B, B-C, C-D, D-E, E-F, F-G
	816	A-B, B-C, C-D, D-E, E-F
	832.5	A-B, B-C, C-D, D-E
	970	A-B, B-C, C-D
	979	A-B, B-C
	1034	A-B

*Available for special applications only

5.7 MULTI-FREQUENCY NARROW-BAND SHUNT, 62780-XXXX

⚠ WARNING

WARNING

CAREFULLY TIGHTEN ALL NUTS ON ALL FREQUENCY JUMPERS, AND THEN INSTALL A SECOND NUT TO SECURELY LOCK THE ASSEMBLY.

⚠ CAUTION

CAUTION

WHEN ADDING OR REPLACING TERMINATION SHUNTS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE TERMINATION SHUNT DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.

THE SHUNT SHOULD BE CONNECTED AS CLOSE AS PRACTICABLE TO THE RAILS (WITHIN THE #6 AWG WIRE LEAD LENGTH OF 25 FEET {7.62 METERS}) AND, TO AFFORD MAXIMUM PROTECTION FROM PHYSICAL DAMAGE, BE ENCASED IN A PROTECTIVE ENCLOSURE OR BURIED (EITHER VERTICALLY OR HORIZONTALLY) AT AN APPROPRIATE DEPTH (SEE PARAGRAPH 5.13). IT IS NOT NECESSARY TO BURY THE SHUNT BELOW THE FROST LINE.

NOTE

NOTE

The Multi-frequency Narrow-band Shunt is shipped with no factory jumpers installed and is, therefore, electrically open and does not load any frequency on the track. Install jumpers for the desired frequency before placing the unit in service.

The Multi-frequency Narrow-band Shunt, 62780-XXXX Figure 5-10, can be used in territories with overlapping Model 300 and Model 400 GCP approaches.

This shunt:

- Produces less loading effect on adjacent frequencies (10 ohms reactance) than the 62775-xxxx Shunt (paragraph 5.7)
- Is compatible with all Siemens GCP's and Motion Sensors.
- Is available in four Multi-frequency versions (see Table 5-8).
- Is housed in a hermetically-sealed, cylindrical case:

A pair of 10-foot leads extends from one end of the case. Seven standard AREMA terminals extend from the opposite end of the case.

- AREMA terminals use jumpers to select the desired shunt frequency.
- AREMA terminals are labeled A through G

- Terminal jumper hardware is supplied with each Multi-frequency Shunt:
- A label located inside the removable end cap identifies the terminal jumpers required for each frequency.

The pliable end cap covers the terminal end of the Shunt is secured in place by a sturdy stainless steel clamp for protection against moisture.

Table 5-8:
Multi-frequency Narrow-band Shunt,
62780 Frequency Selection Jumpers

SHUNT PART NUMBER	FREQUENCY (HZ)	JUMPER SHUNT TERMINALS
62780-8621	86	A-F, G-D, D-E, E-F
	114	B-G, G-D, D-E
	156	C-D, D-G
	211	C-D
62780-1543	156	A-F, G-C, C-D, D-E, E-F
	211	A-G, G-C, C-D, D-E
	285	B-C, D-G, C-D
	348	B-C, C-D
	430	B-C
62780-2152*	211	A-F, G-C, C-D, D-E, E-F
	285	B-C, C-D, D-E, C-G
	348	B-C, C-D, D-G
	430	B-C, C-D
	525	B-C
62780-5297	525	A-B, B-C, C-D, D-E
	645	A-B, B-C, C-D
	790	A-B, B-C
	970	A-B

*Available for special applications only

5.7.1 Multi-frequency Narrow-band Shunt, 62780-XXXX Specifications

Dimensions	22 inches (55.880 centimeters) long 5 inches (12.700 centimeters) in diameter
Weight	10 pounds (4.54 kilograms) (approximate)
Frequencies	See Table 5-8 above
Leads	10 feet (3.048 meters); number 6 AWG, stranded, black PVC

5.8 WIDEBAND SHUNT, 8A076A

⚠ WARNING

WARNING

THE 8A076A OR 8A077 WIDEBAND SHUNTS MUST NOT BE USED TO BYPASS INSULATED JOINTS IN DC CODED TRACK CIRCUITS OR WHERE AC OR CODED AC CIRCUITS EXIST.

⚠ CAUTION

CAUTION

WHEN ADDING OR REPLACING TERMINATION SHUNTS, APPROPRIATE TESTS MUSTS BE MADE TO DETERMINE THAT THE TERMINATION SHUNT DID NOT ADVERSELY AFFECT OTHER HIGHWAY CROSSING WARNING SYSTEM OR WAYSIDE SIGNAL SYSTEM TRACK CIRCUITS.

THE SHUNT SHOULD BE CONNECTED AS CLOSE AS PRACTICABLE TO THE RAILS (WITHIN THE #6 AWG WIRE LEAD LENGTH OF 25 FEET {7.62 METERS}) AND, TO AFFORD MAXIMUM PROTECTION FROM PHYSICAL DAMAGE, BE ENCASED IN A PROTECTIVE ENCLOSURE OR BURIED (EITHER VERTICALLY OR HORIZONTALLY) AT AN APPROPRIATE DEPTH (SEE PARAGRAPH 5.13). IT IS NOT NECESSARY TO BURY THE SHUNT BELOW THE FROST LINE.

NOTE

NOTE

The use of dual wideband couplers, part number 8A077, is not recommended for SGCP4000 / MS4000 applications.

NOTE

The use of dual wideband couplers, part number 8A077, is not recommended for SGCP4000 / MS4000 applications.

The Wideband Shunt, 8A076A (Figure 5-9) provides an effective short circuit to AC but presents an open circuit to DC. This shunt may be used as a termination shunt where no other frequencies (other than the motion sensor) are present or to bypass existing insulated joints required for DC signaling purposes within the track circuit.

The Wideband Shunt is housed in a hermetically sealed, cylindrical case with a pair of 10-foot leads extending from one end.

5.8.1 Wideband Shunt Specifications

Dimensions	7.5 inches (19.050centimeters) long 3.35 inches (8.509 centimeters) in diameter
Weight	7 pounds (3.18 kilograms) (approximate)
Leads	10 feet (3.048 meters); number 6 AWG, stranded, black PVC

5.9 SIMULATED TRACK INDUCTOR, 8V617 (USED WITH MULTI-FREQUENCY SHUNTS)

The Simulated Track Inductor, 8V617 (Figure 5-11) is intended for use with Siemens's Multi-frequency Narrow-band Shunts (62775/62780).

In bidirectional motion sensor and grade crossing predictor installations, insulated joints located in one approach frequently prevent both termination shunts from being installed at equal distances from the MS/GCP feed point as required.

The 8V617 Simulated Track Inductor is used with the Shunt in the shorter approach to compensate for the reduced distance (Figure 5-12).

Each Inductor:

- Consists of an insulated, toroid-wound coil with a pair of 4-inch number 18 AWG stranded wire leads with 1/4-inch ring terminals attached.
- Is supplied in 21 configurations to simulate track lengths ranging from 200 to 4,000 feet (61 – 1220 meters) in 200-foot (61 meter) increments plus 4,400 feet (1342 meters.
- Is identified with the basic part number followed by a dash number indicating the simulated distance in feet as listed in Table 5-9.

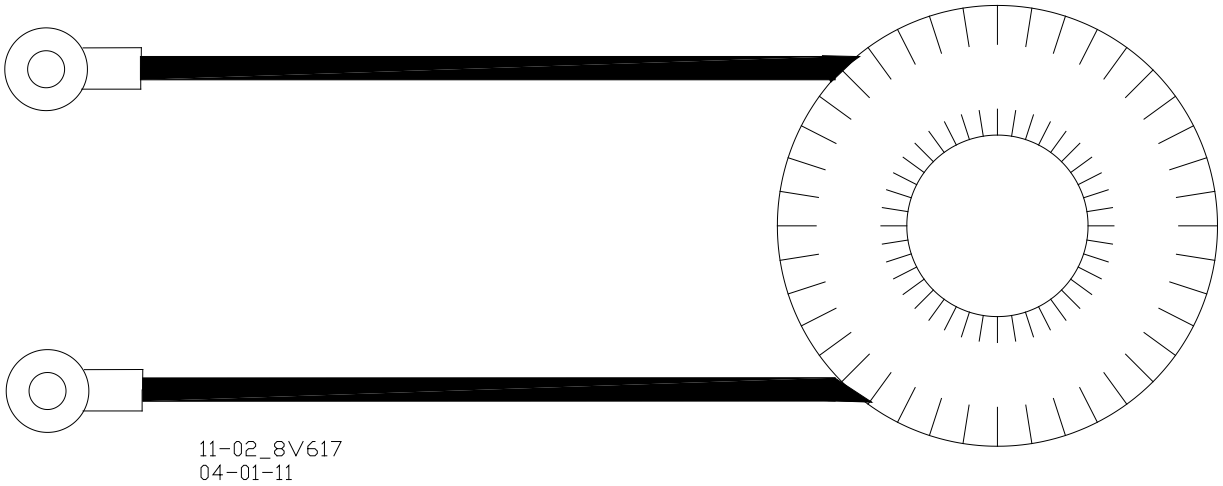


Figure 5-11:
Simulated Track Inductor, 8V617

Table 5-9:
Simulated Track Inductor Part Number Listing

BASIC PART NO.	DASH NUMBER = DISTANCE IN FEET (METERS)		
8V617	-0200 (61) -0400 (122) -0600 (183) -0800 (244) -1000 ((309) -1200 (366) -1400 (427)	-1600 (488) -1800 (549) -2000 (610) -2200 (671) -2400 (732) -2600 (793) -2800 (854)	-3000 (450) -3200 (976) -3400 (1037) -3600 (1098) -3800 (1159) -4000 (1220) -4400 (1342)

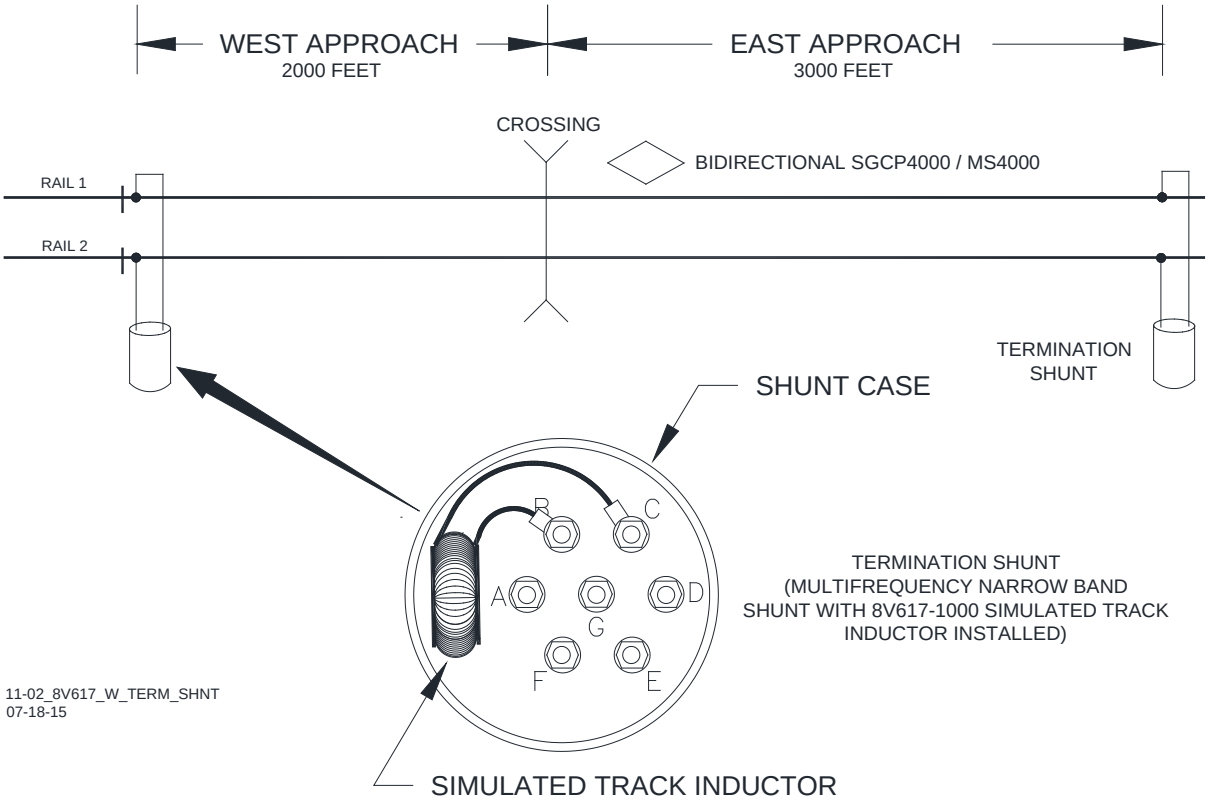


Figure 5-12:
Simulated Track Inductor Used With Termination Shunt

5.9.1 Simulated Track Inductor Installation

⚠ WARNING

WARNING

BEFORE INSTALLING, VERIFY THAT THE 8V617 INDUCTOR IS THE CORRECT DISTANCE VALUE FOR THE APPLICATION.

ALWAYS WRAP THE INDUCTOR IN THE FOAM INSULATION (INCLUDED WITH THE INDUCTOR) THAT PROVIDES INSULATION FROM THE TERMINAL POSTS (AS SHOWN IN FIGURE 5-13).

NOTE

NOTE

Refer to the small chart inside the end cap for terminal strapping information. If the chart is missing or illegible, refer to Table 5-7 (62775) or Table 5-8 (62780) in this manual.

Position the inductor with the leads extending horizontally toward the side (not upward) to prevent interference with the Shunt end cap.

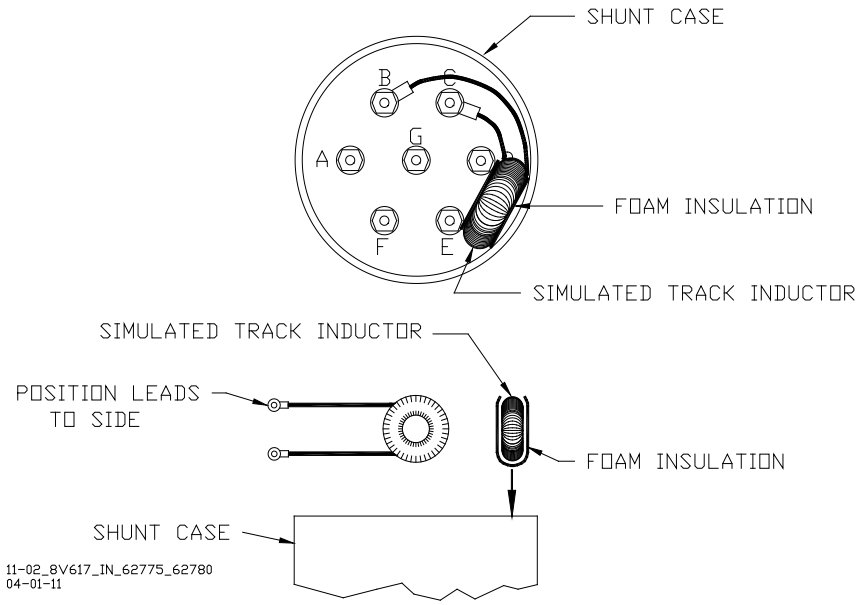


Figure 5-13:
Typical Installation of 8V617 in 62775/62780 Shunt

Step 1: Determine the Shunt frequency and compensating distance required.

Step 2: Loosen the clamp and remove the end cap from the Shunt to gain access to the frequency-selection terminals.

Step 3: Refer to Table 5-10 and note the inductor mounting terminals for the applicable shunt and frequency.

Step 4: Remove the nuts, washers, and shorting link from the shunt terminals indicated. Discard the shorting link.

Step 5: Install the inductor in its place by connecting the inductor leads to the two terminals. Install the washers and nuts and tighten securely.

Step 6: Wrap the inductor in the foam insulation (included with the inductor) as shown in Figure 5-13 and carefully insert into the Shunt housing between the terminals and case at the approximate location shown.

Step 7: Return the end cap to its original position on the Shunt and tighten the clamp securely.

5.9.2 8V617 Simulated Track Inductor Specifications

Diameter	1.875 inches (4.763 centimeters)
Thickness	0.875 inches (2.223 centimeters)
Weight	5 ounces (141.75 grams)

Table 5-10:
Simulated Track Inductor, 8V617, Mounting Terminals

NARROW-BAND SHUNT PART NO.	FREQUENCY (HZ)	REMOVE SHORTING LINK AND CONNECT INDUCTOR LEADS BETWEEN SHUNT TERMINALS
62775/62780-8621	86	A and F
	114	B and G
	156	C and D
	211	C and D
62775/62780-1543	156	A and F
	211	A and G
	285	B and C
	348	B and C
	430	B and C
62775-2132*	211	A and F
	267	B and G
	285	B and C
	313	B and C
	326	B and C
62775/62780-2152*	211	A and F
	285	B and C
	348	B and C
	430	B and C
	525	B and C
62775-3448*	348	A and B
	389	A and B
	392	A and B
	430	A and B
	452	A and B
	483.5	A and B
62775-2132*	211	A and F
	267	B and G
	285	B and C
	313	B and C
	326	B and C

Continued on next page

Table 5-10: Concluded

NARROW-BAND SHUNT PART NO.	FREQUENCY (HZ)	REMOVE SHORTING LINK AND CONNECT INDUCTOR LEADS BETWEEN SHUNT TERMINALS
62775/62780-2152*	211	A and F
	285	B and C
	348	B and C
	430	B and C
	525	B and C
62775-3448*	348	A and B
	389	A and B
	392	A and B
	430	A and B
	452	A and B
	483.5	A and B
62775-3497	348	A and B
	430	A and B
	525	A and B
	645	A and B
	790	A and B
	970	A and B
62775-7910*	790	A and B
	816	A and B
	832.5	A and B
	970	A and B
	979	A and B
	1034	A and B
62775-5274*	522	A and B
	525	A and B
	560	A and B
	645	A and B
	669.9	A and B
	746.8	A and B
62780-5297	525	A and B
	645	A and B
	790	A and B
	970	A and B

*Available for special applications only

5.10 ADJUSTABLE INDUCTOR ASSEMBLY, 8A398-6

The Adjustable Inductor Assembly, 8A398 is intended for use with Siemens's Single-frequency Narrow-band Shunts (62775-f/62780-f) to balance the approaches of a bidirectional application when the approaches differ by more than 10%. Insulated joints located in one approach frequently prevent both termination shunts from being installed at approximately equal distances from the SGCP4000 / MS4000 feed point as required.

- Adjustable Inductor Assembly, 8A398-6 (Figure 5-14), may be used along with the Shunt in the shorter approach to compensate for the reduced distance as shown in Figure 5-15.
- The Adjustable Inductor Assembly consists of a 3-inch diameter ABS plastic enclosure with mounting brackets at the base and seven AREMA terminals extend from the top of the assembly.
- Terminals accommodate connections to six inductors that are connected in series and housed within the sealed unit.

NOTE

NOTE

When configuring the 8A398-6 Adjustable Inductor, simulated track length is selectable in 50 foot (15.2 meter) increments ranging from 50 to 3150 feet (15.2 – 960.1 meters).

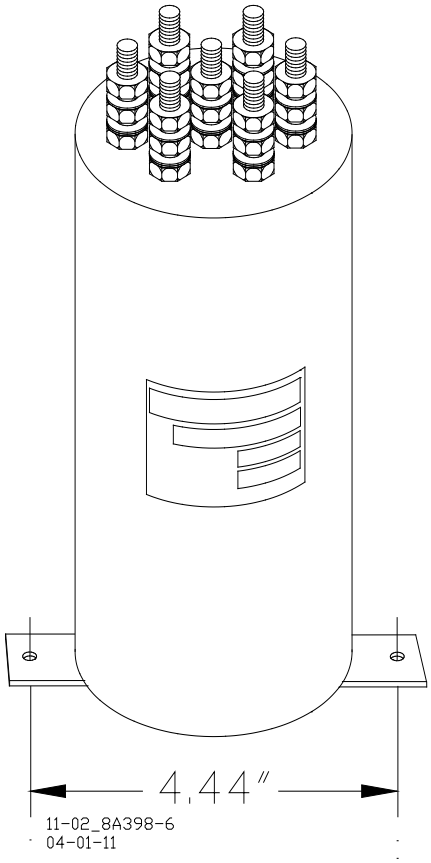


Figure 5-14:
Adjustable Inductor Assembly, 8A398-6

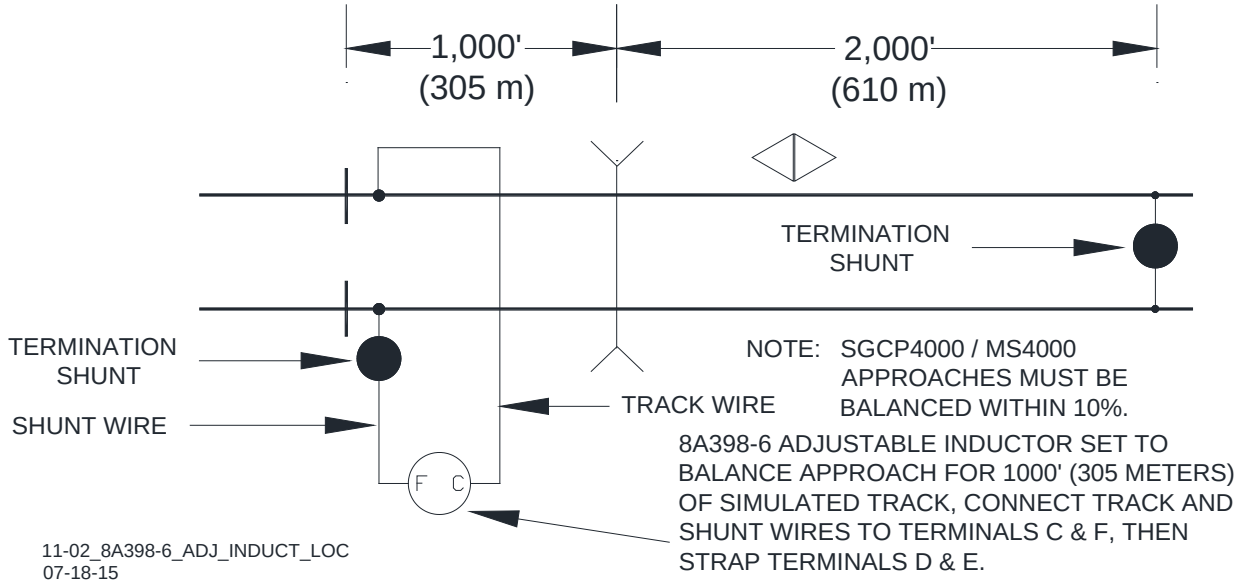


Figure 5-15:
Adjustable Inductor Used With Termination Shunt

5.10.1 Adjustable Inductor Configuration

Step 1: Refer to Table 5-11 and locate the desired simulated track length (column 1).

Step 2: Read across the table to determine which inductors (indicated by terminal pairs in column 2) are required to simulate that length (i.e., for a simulated track length of 1,000 feet, terminals C and F are indicated).

Step 3: Connect the track wire and the shunt wire (see Figure 5-15) to the two terminals indicated in column 2.

Step 4: Install a strap between the terminal pairs indicated in column 3. [This shorts the inductor(s) located between the track and shunt wire connecting terminals (Figure 5-16) which are not required for the desired length. To continue the example given in Step 2, when the track and shunt wires are connected to terminals C and F, a simulated track length of 1400 feet (800 + 400 + 200) is selected. Placing a strap between terminals D and E shorts the 400-foot inductor, removing it from the series circuit].

Table 5-11:
Terminal Connections For Adjustable Inductor Assembly, 8A398-6

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 1	COLUMN 2	COLUMN 3
SIMULATED TRACK LENGTH FEET/ METERS	SET TRACK & SHUNT WIRES TO TERMINALS	CONNECT SHORTING STRAP(S) TO THESE TERMINALS	SIMULATED TRACK LENGTH FEET/ METERS	CONNECT TRACK AND SHUNT WIRES TO TERMINALS	CONNECT SHORTING STRAP(S) BETWEEN THESE TERMINALS
50/16	A-B		1650/503	A-G	B-C, C-D, D-E, E-F
100/31	B-C				
150/46	A-C		1700/519	B-G	C-D, D-E, E-F
200/61	C-D		1750/134	A-G	C-D, D-E, E-F
250/77	A-D	B-C	1800/549	C-G	D-E, E-F
300/92	B-D		1850/564	A-G	B-C, D-E, E-F
350/107	A-D		1900/580	B-G	D-E, E-F
400/122	D-E		1950/595	A-G	D-E, E-F
450/137	A-E	B-C, C-D	2000/610	D-G	E-F
500/153	B-E	C-D	2050/625	A-G	B-C, C-D, E-F
550/168	A-E	C-D	2100/640	B-G	C-D, E-F
600/183	C-E		2150/656	A-G	C-D, E-F
650/199	A-E	B-C	2200/671	C-G	E-F
700/214	B-E		2250/686	A-G	B-C, E-F
750/229	A-E		2300/701	B-G	E-F
800/244	E-F		2350/717	A-G	E-F
850/259	A-F	B-C, C-D, D-E	2400/732	E-G	
900/275	B-F	C-D, D-E	2450/747	A-G	B-C, C-D, D-E
950/282	A-F	C-D, D-E	2500/762	B-G	C-D, D-E
1000/305	C-F	D-E	2550/778	A-G	C-D, D-E
1050/320	A-F	B-C, D-E	2600/793	C-G	D-E
1100/336	B-F	D-E	2650/808	A-G	B-C, D-E
1150/351	A-F	D-E	2700/823	B-G	D-E
1200/366	D-F		2750/839	A-G	D-E
1250/381	A-F	B-C, C-D	2800/854	D-G	
1300/397	B-F	C-D	2850/869	A-G	B-C, C-D, D-E
1350/412	A-F	C-D	2900/884	B-G	C-D
1400/427	C-F		2950/899	A-G	C-D
1450/442	A-F	B-C	3000/914	C-G	
1500/458	B-F		3050/930	A-G	B-C
1550/473	A-F		3100/945	B-G	
1600/488	F-G		3150/961	A-G	

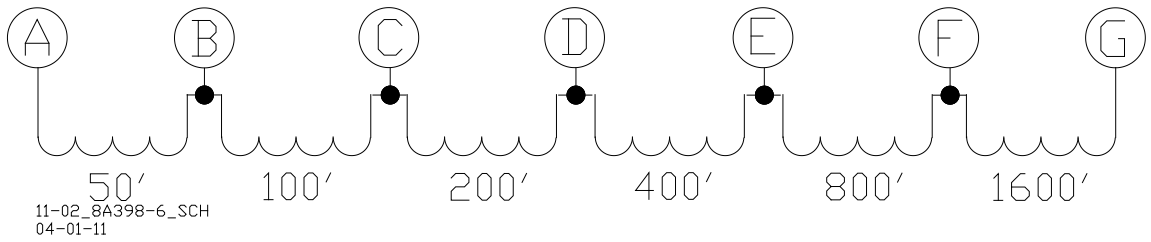


Figure 5-16:
Adjustable Inductor, 8A398-6 Schematic

5.10.2 8A398-6 Adjustable Inductor Assembly Specifications

Diameter	3.375 inches (8.573 centimeters)
Height	9 inches (22.860 centimeters) (to top of AREMA terminals)
Weight	5 pounds, 12 ounces (2.59 kilograms)

5.11 TRACK CIRCUIT ISOLATION DEVICES

Several types of track circuit isolation devices are available for both DC and AC coded track applications. The following discussions are grouped by coded track circuit type.

NOTE

NOTE

The recommendations presented in the following paragraphs are general in nature and no attempt has been made to cover all applications.

Battery chokes and code isolation devices described here are designed for mounting inside a weatherproof enclosure.

If there are any questions concerning these recommendations or applications, contact Siemens Technical Support for assistance.

5.11.1 Steady Energy DC Track Circuits

NOTE

NOTE

If the track connections for the DC track circuit are 2,000 feet (610 meters) or more beyond the approach termination shunt, a battery choke is not required (see Figure 5-17).

A DC track circuit should be equipped with a battery choke when its battery is located:

- Within the Model 3000 GCP/Model 4000 GCP/MS 2000/SGCP4000/MS4000 approach
- Less than 1,000 feet (305 meters) beyond the approach termination.

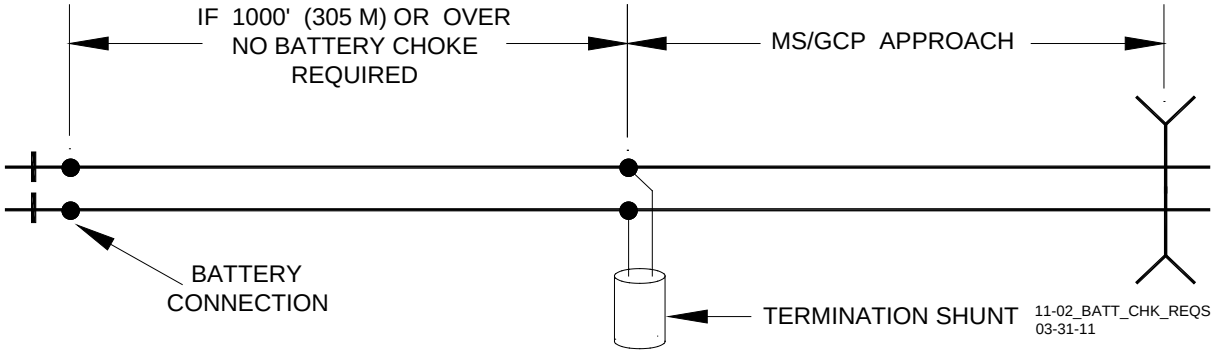


Figure 5-17:
Battery Choke Requirements

Either of the following Battery Chokes may be used: (see limitations in the following paragraphs):

- Part number 8A065A
- Part number 62648.

The use of battery chokes is subject to the following limitations:

- Operation of long DC track circuits with very low ballast conditions may be affected by the DC resistance (DCR) of the 8A065A Battery Choke (DCR of 8A065A is 0.40 ohm). Such track circuits should use the 62648 Battery Choke, which has a DCR of 0.10 ohm.
- In applications where the Choke is located within a Model 300 or Model 400 GCP approach, the 8A065A Battery Choke must be used.
- When a rectified track circuit is used and the motion sensor is operating at 114 Hz, an 8A076A Wideband Shunt (paragraph 5.8) should be used together with the Battery Choke to eliminate 120 Hz ripple. This application is illustrated in Figure 5-18.

The 62648 and 8A065A Battery Chokes each consist of a large inductance coil with two top-mounted AREMA terminals and a mounting base (see Figure 5-19).

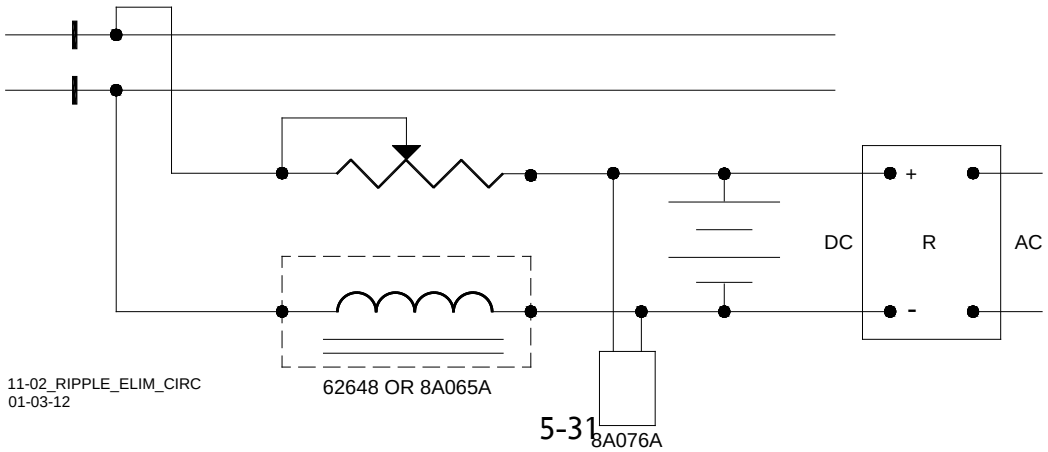


Figure 5-18:
Ripple Elimination Circuit

5.11.1.1 62648 and 8A065A Battery Chokes Specifications

Dimensions	4.5 inches (11.430 centimeters) wide 5.0 inches (12.700 centimeters) deep 8.5 inches (21.590 centimeters) high (to top of terminal studs)
Weight	17 pounds (7.72 kilograms) (approximate)

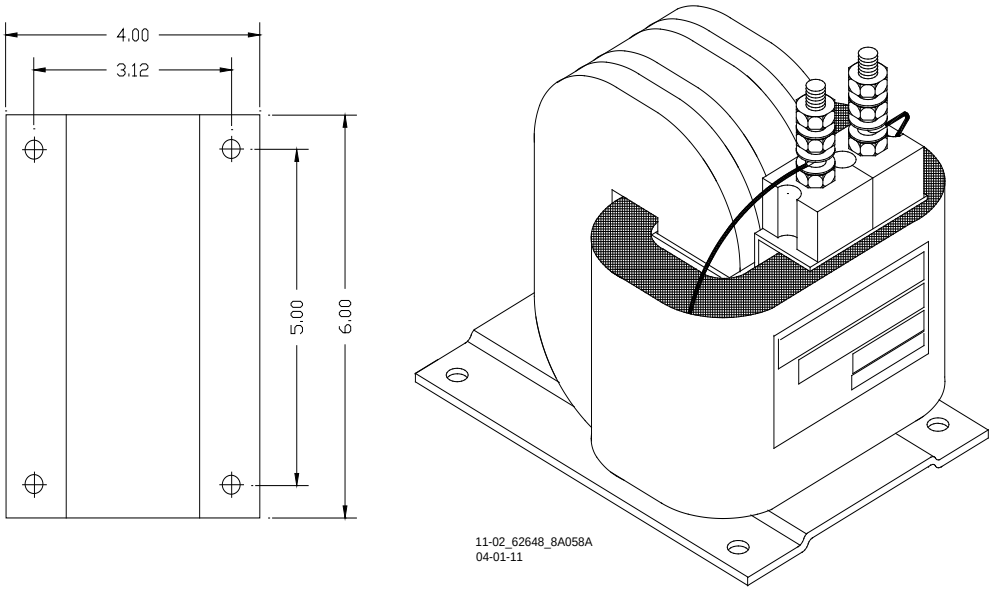


Figure 5-19:
62648/8A065A Battery Choke With Mounting Dimensions

5.11.2 Siemens GEO Electronic DC Coded System

The standard Siemens SGCP4000 / MS4000 frequencies of 86 Hz and above are compatible with GEO. Isolation circuits are generally not required in the GEO transmitter rail connections. Frequencies of 86, 114, 156, and 211 Hz require use of maximum current, track devices, and the GEO Track Noise Suppression Filter, A53252. The GEO Filter must be installed at the signal location for the above mentioned frequencies.

5.11.3 ElectroCode Electronic Coded System

SGCP4000 / MS4000 frequencies of 86 Hz and above can normally be used with Electro Code.

- All frequencies of 211 Hz and lower require use of maximum current track drive.
- In certain instances, 285 Hz may also require maximum current.
- For frequencies of 211 Hz and lower, an Electro Code track filter (TF-freq) may be required when the Electro Code transmitter is located within the SGCP4000 / MS4000 approach.

5.11.4 Genrakode Electronic Coded System

SGCP4000 / MS4000 frequencies of 86 Hz and above can normally be used with Genrakode when used in conjunction with a 6A342-5 DC Code Isolation Unit.

- All frequencies of 211 Hz and lower require use of maximum current track drive.
- In certain instances, 285 Hz may also require maximum current.
- For frequencies of 211 Hz and lower, a 6A342-5 DC Code Isolation Unit may be required when the Genrakode transmitter is located within the SGCP4000 / MS4000 approach.

NOTE

NOTE

Under some circumstances, an external track filter may be required when electronic coded track is located within the SGCP4000 / MS4000 approach. As with any coded track system, the lower the transmit level, the less interference to motion sensor units.

5.11.5 Relay Coded DC Track

Most relay coded DC track installations require use of DC Code Isolation units. A code isolation unit is a special battery choke that aids in preventing coded track battery and track relays from causing high interference with the SGCP4000 / MS4000. There are two Siemens DC Code Isolation units: the 6A342-1 DC Code Isolation Unit, used in single polarity systems and the 6A342-3 DC Code Isolation Unit, which is used in dual polarity systems.

5.11.5.1 DC Code Isolation Unit, 6A342-X (6A342-1, 6A342-3, & 6A342-5)

There are three versions of the DC Code Isolation Unit, 6A342-X: the 6A342-1, the 6A342-3, and the 6A342-5 (see Figure 5-20). The 6A342-1 is used in most single polarity code systems. The 6A342-1 unit consists of filter components (L1, C1, R1, and CR1) and three AREMA binding posts on a mounting base. The 6A342-3 DC Code Isolation Unit is used in GRS Trakode (dual polarity) relay systems. The 6A342-3 unit consists of filter components (L1, C1, and R1) and three AREMA binding posts on a mounting base. The 6A342-5 DC Code Isolation Unit is used in GRS Genrakode (dual polarity) relay systems. The 6A342-5 unit consists of filter components (L1 and C1) and three AREMA binding posts on a mounting base.

⚠ WARNING

WARNING

THE SINGLE POLARITY CODED TRACK CIRCUIT MUST BE CAREFULLY REVIEWED TO ENSURE THAT ALL TRANSMIT AND RECEIVE CODES ARE OF THE SAME POLARITY PRIOR TO INSTALLING ANY 6A341-1 UNIT. IF THE POLARITY IS IN DOUBT, INSTALL TWO 6A342-3 ISOLATION UNITS AT EACH END OF THE TRACK CIRCUIT. SAME INSTALLATION AS THE DUAL POLARITY CODED TRACK CIRCUIT.

CONTACT SIEMENS TECHNICAL SUPPORT AT 800-793-7233 FOR DETAILS.

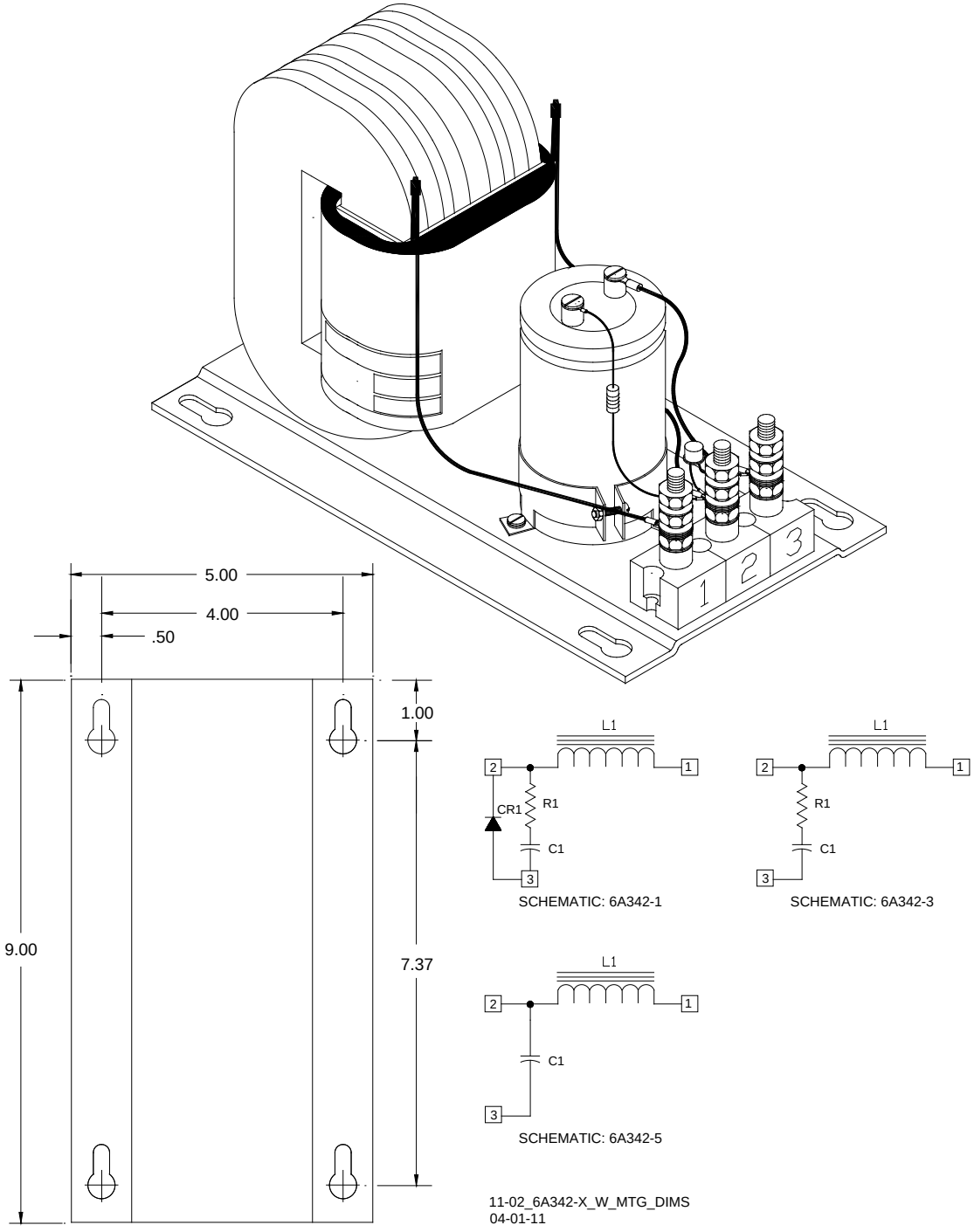


Figure 5-20:
DC Code Isolation Unit, 6A342-X, With Mounting Dimensions and Schematics

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF THE ISOLATION UNIT.

NOTE

NOTE

All wiring to terminals 1 and 2 on the Isolation units should be number 6 AWG. This significantly reduces current losses to the track relay during low track ballast conditions. Frequencies below 211 Hz require maximum track drive current.

5.11.5.2 DC Code Isolation Unit, 6A342-1 Specifications

Dimensions	5.0 inches (12.700 centimeters) wide 9.0 inches (22.860 centimeters) deep 5.75 inches (14.605 centimeters) high
Weight	15 pounds (6.81 kilograms) (approximate)

5.11.5.3 DC Code Isolation Unit, 6A342-1 Applications

Three applications for the 6A342-1 DC Code Isolation Units are discussed in the following paragraphs.

5.11.5.4 Single Polarity Systems (Fixed Polarity)

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF THE ISOLATION UNIT.

NOTE

NOTE

To limit current losses to the track relay during low track ballast conditions, use number 6 AWG wires to terminals 1 and 2 on the isolation units.

The 6A342-1 Code Isolation unit can be used in most single (fixed) polarity code systems. A single polarity code system must have the same received and transmitted polarities to use this Code Isolation unit. Most rate code systems (75, 120, 180 ppm) are of this type. Figure 5-21 illustrates a typical 6A342-1 Code Isolation unit installation in a single polarity code system.

The 6A342-5 Code Isolation unit can be used in Genrakode single (fixed) polarity code systems. A single polarity code system must have the same received and transmitted polarities to use this Code Isolation unit. Most rate code systems (75, 120, 180 ppm) are of this type.

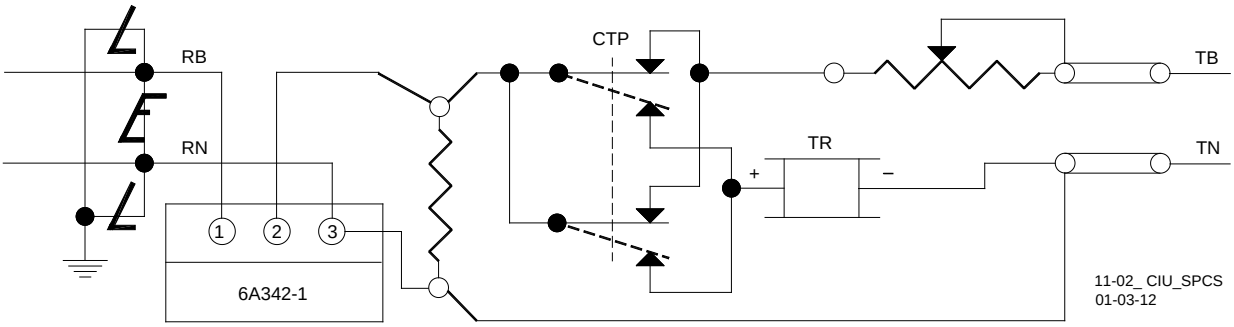


Figure 5-21:
Code Isolation Unit In a Single Polarity Code System

5.11.5.5 GRS Trakode (Dual Polarity) Systems

⚠ WARNING

WARNING

TO INSTALL THE UNIT AS SHOWN, A TRANSFER DELAY (TD) RELAY MUST BE USED. DO NOT INSTALL ANY CODE ISOLATION CIRCUIT IN GRS TRAKODE WITHOUT USE OF THE TD RELAY.

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

NOTE

NOTE

To limit current losses to the track relay during low track ballast conditions, use number 6 AWG wires to terminals 1 and 2 on the isolation units.

Figure 5-22 illustrates the 6A342-1 Code Isolation unit installed in a GRS Trakode system.

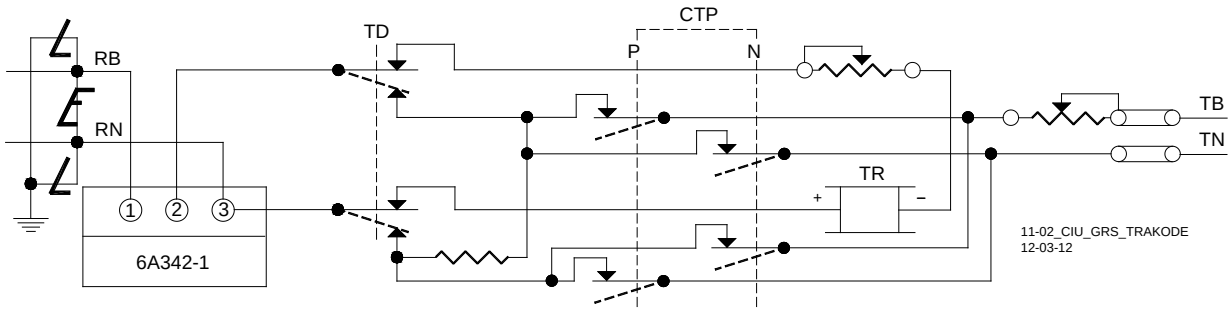


Figure 5-22:
Code Isolation Unit Installation In a GRS Trackode System

5.11.5.6 Dual Polarity (Polar) Coded Track Systems Other Than GRS Trakode

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

A dual polarity system is one in which the received code polarity is opposite to that of the transmitted code.

The 6A342-3 Code Isolation unit can be used in a dual polarity system; however, two 6A342-3 units must be specifically placed at each end of the circuit for proper filtering. The application will depend upon the track circuit configuration. Contact Siemens Technical Support for assistance in dual polarity code systems.

5.11.6 AC Code Isolation Units

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF AN ISOLATION UNIT.

CAB signal and style C track circuit installations require the use of an AC Code Isolation unit such as the 8A466-3 (Figure 5-23) or the 8A470-100 (Figure 5-24). Both of these units should be used only with frequencies of 790 Hz and higher in style C track circuit installations. Contact Siemens Technical Support for specific information.

5.11.6.1 AC Code Isolation Unit, 8A466-3

The 8A466-3 AC Code isolation unit is used in 60 Hz CAB signal track circuit installations to reduce 60 Hz harmonics from being applied to the track. It is used with frequencies 156 Hz and higher. It is housed in a steel case with top mounted AREMA binding posts provided for track connections.

5.11.6.2 AC Code Isolation Unit, 8A466-3 Specifications

Dimensions	10.15 inches (25.781 centimeters) wide 11.78 inches (29.921 centimeters) deep 7.62 inches (19.355 centimeters) high
Weight	26 pounds (11.8 kilograms) (approximate)

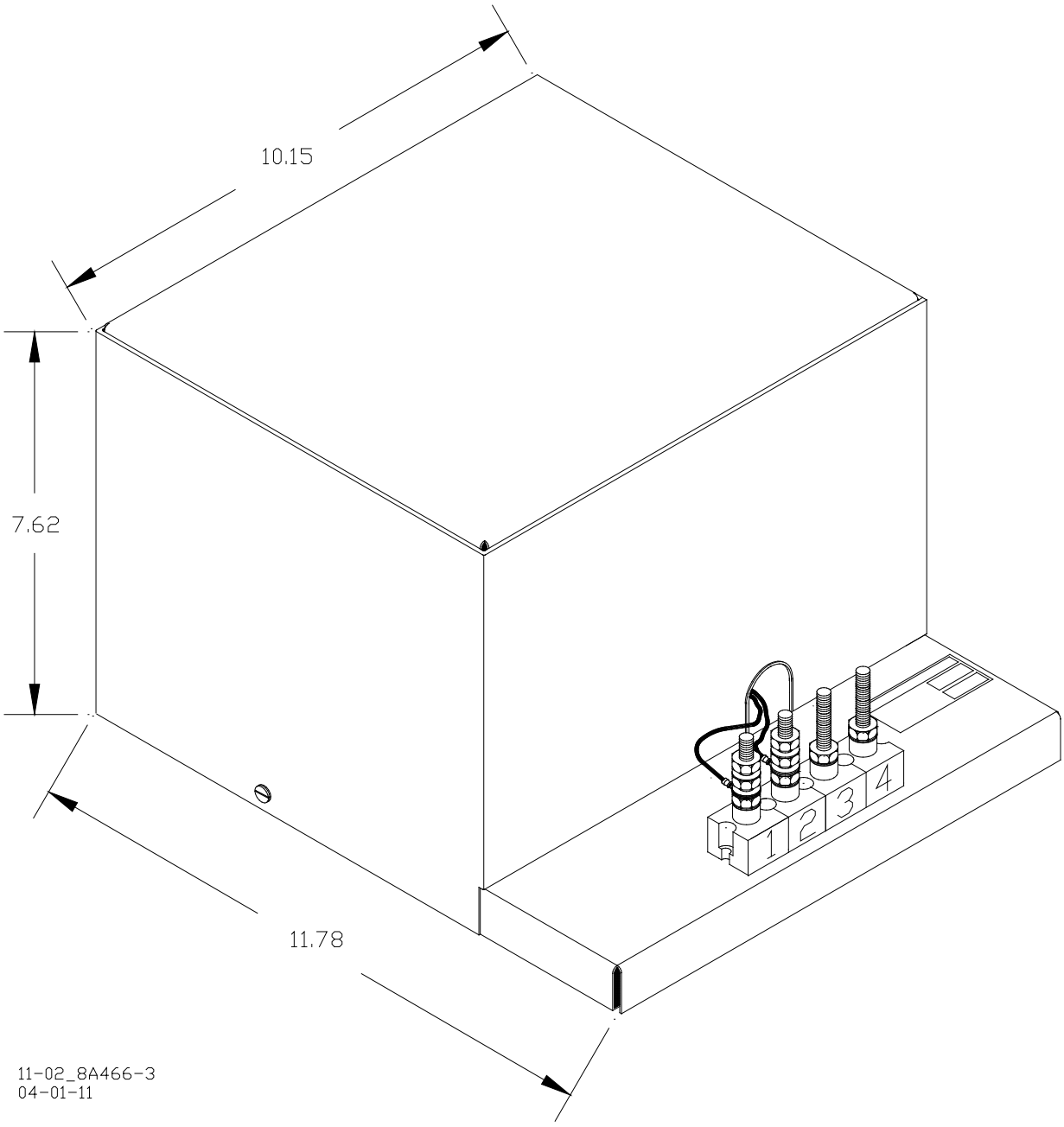


Figure 5-23:
AC Code Isolation Unit, 8A466-3

5.11.6.3 AC Code Isolation Unit, 8A470-100

The 8A470-100 AC Code isolation unit is used in 100 Hz CAB signal track circuit installations to reduce 100 Hz harmonics from being applied to the track. It is used on with frequencies 211 Hz and higher. It is mounted on an aluminum case with two top mounted AREMA binding posts provided for track connections.

5.11.6.4 Code Isolation Unit, 8A470-100 AC Specifications

Dimensions	5.0 inches (12.700 centimeters) wide 9.4 inches (23.876 centimeters) deep 9.0 inches (22.860 centimeters) high
Weight	5 pounds (2.27 kilograms) (approximate)

5.11.6.5 Cab Signal AC

⚠ WARNING

WARNING

ALWAYS VERIFY PROPER CODE SYSTEM OPERATION FOLLOWING INSTALLATION OF A CAB SIGNAL UNIT.

Application of SGCP4000 / MS4000 systems in cab territory using the 8A466-3, 60 Hz AC Code Isolation Unit or the 8A470-100, 100 Hz Isolation Unit is shown in Figure 5-25.

For other installations, contact Siemens Technical Support for assistance.

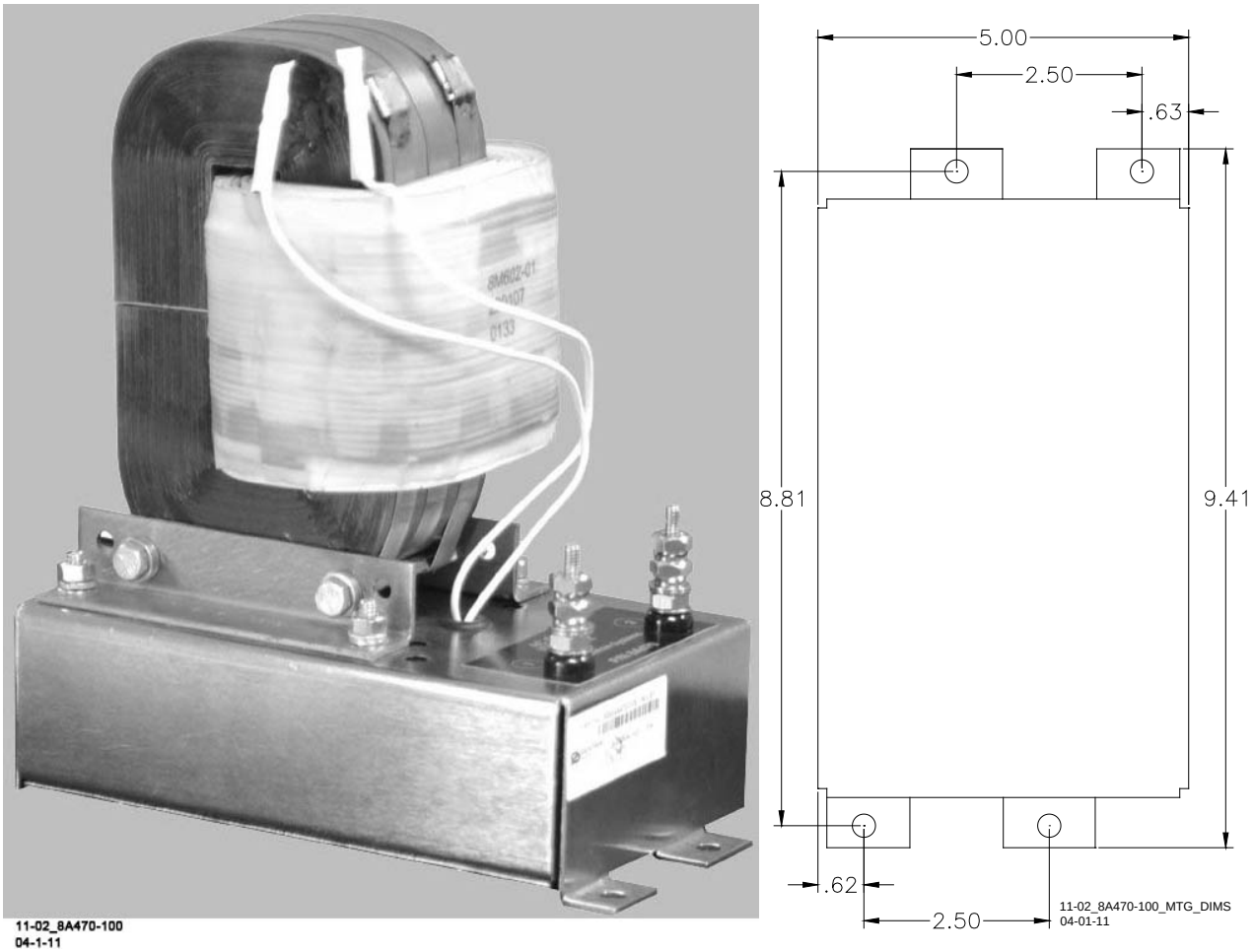


Figure 5-24:
AC Code Unit, 8A470-100, With Mounting Dimensions

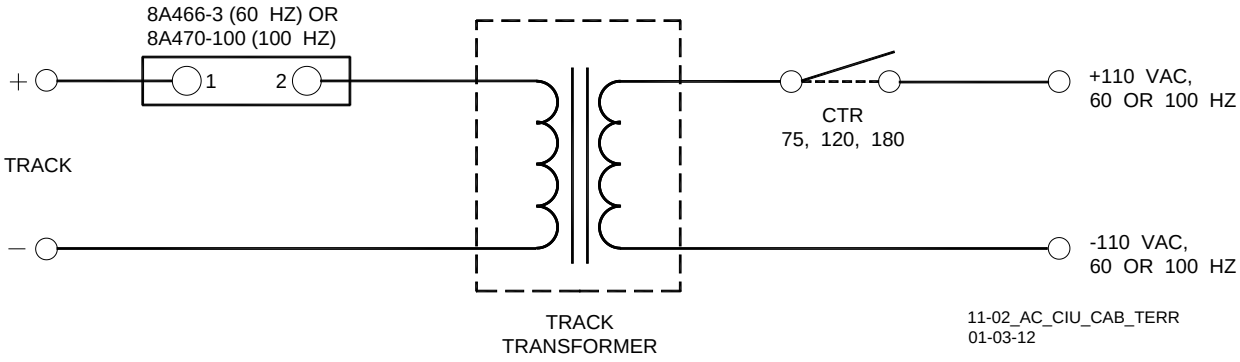


Figure 5-25:
AC Code Isolation Unit Used In CAB Territory

5.11.6.6 Style C Track Circuits

The 60 Hz AC Code Isolation unit (8A466-3) is used with style C track circuits as shown in Figure 5-26.

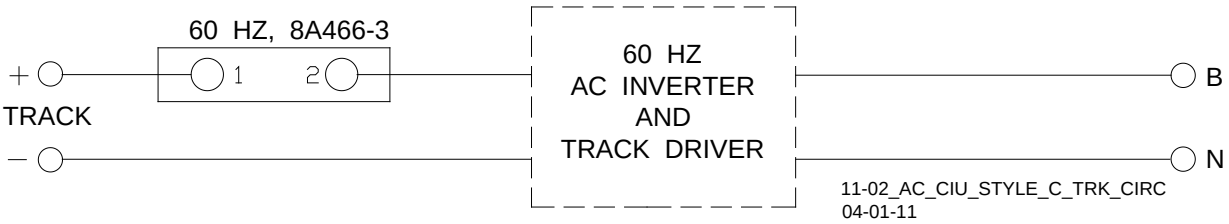


Figure 5-26:
AC Code Isolation Unit Used in Style C Track Circuits

5.11.6.7 AC Code Isolation Unit, 8A471-180

For special applications, 180 Hz AC Code Isolation Unit (8A471-180) is also available. Contact Siemens Technical Support for specific information.

5.12 TUNABLE INSULATED JOINT BYPASS COUPLER, 62785-F

The Tunable Insulated Joint Bypass Coupler, 62785-f is the only tuned bypass coupler to be used with the SGCP4000 / MS4000 for bypassing insulated joints in DC coded track.

- The 62785-f Bypass Coupler is used in all SGCP4000 / MS4000 applications requiring the use of an insulated joint bypass coupler.
- The 62785-f Coupler is available in standard Siemens frequencies of 114 Hz through 970 Hz.

⚠ WARNING

WARNING

INSULATED JOINT BYPASS COUPLERS, 62531-F AND 62631-F, MUST NOT BE USED WITH THE SGCP4000 / MS4000.

THE MINIMUM DISTANCES TO THE INSULATED JOINTS SPECIFIED IN TABLE 5-12 APPLY TO THE SGCP4000 / MS4000 ONLY.

62785-F TUNED BYPASS COUPLERS MUST ONLY BE USED TO BYPASS INSULATED JOINTS IN CODED DC TRACK CIRCUITS.

The application guidelines for Tunable Insulated Joint Bypass Coupler, 62785-f when used only with the SGCP4000 / MS4000 have been expanded as follows:

In DC coded track circuits, the insulated joints within an approach may be bypassed using the Siemens 62785-f Tunable Insulated Joint Bypass Coupler, provided the minimum distances specified in Table 5-12 are observed.

- The 62785-f Coupler must be field tuned to pass the SGCP4000 / MS4000 operating frequency (f) around insulated joints in DC or coded DC track circuits.
- Field tuning of the Coupler enables precise frequency adjustment for track and joint parameters.
- The Coupler must be located within 10 feet (3 meters) of the insulated joints that it is coupling.
- The minimum distance to the insulated joints is generally a function of the SGCP4000 / MS4000 operating frequency; i.e., the lower the operating frequency, the longer the minimum distance.

Two sets of insulated joints may be coupled in any single approach, provided the minimum operating distances specified in Table 5-12 are observed. Table 5-12 indicates the minimum operating distances (in feet/meters) to the first and second set of insulated joints that are coupled with 62785-f couplers for SGCP4000 / MS4000 operation.

Table 5-12:
Minimum Distance to Insulated Joints When Coupled
With Tunable Insulated Joint Bypass Coupler, 62785-f

FREQUENCY (HZ)	MINIMUM DISTANCE TO FIRST SET OF INSULATED JOINTS (FEET/METERS)*	MINIMUM DISTANCE TO SECOND SET OF INSULATED JOINTS (FEET/METERS)*
86	N/A	N/A
114	2000/610	3000/914
151 – 211	1500/458	2200/671
212 – 348	1000/305	1400/427
349 – 560	700/214	1000/305
561 – 790	500/153	800/244
791 – 979	400/122	700/214

*Distance applies to insulated joints located on the same side of the crossing.

The Coupler is housed in a hermetically sealed, 6-inch (15.240 cm) diameter case

- A pair of 10-foot (3.048 meter), number 6 AWG leads extend from one end
- Nine AREMA terminals extend from the other end (see Figure 5-27).
- Five of the terminals (labeled A through E) are equipped with special gold test nuts that are used to tune the Coupler.

⚠ WARNING

WARNING

AT THE COMPLETION OF FIELD TUNING THE 62785-F BYPASS COUPLERS ENSURE THAT A STANDARD AREMA NUT IS TIGHTENED SECURELY AGAINST EACH GOLD NUT ON TERMINALS A THROUGH E, INCLUDING THE TERMINALS THAT ARE NOT TIGHTENED DOWN.

NOTE

NOTE

While field tuning the 62785-f Bypass Coupler, tightening the nut on terminal E produces maximum change in EZ value. Tightening the nut on terminal A produces minimum change.

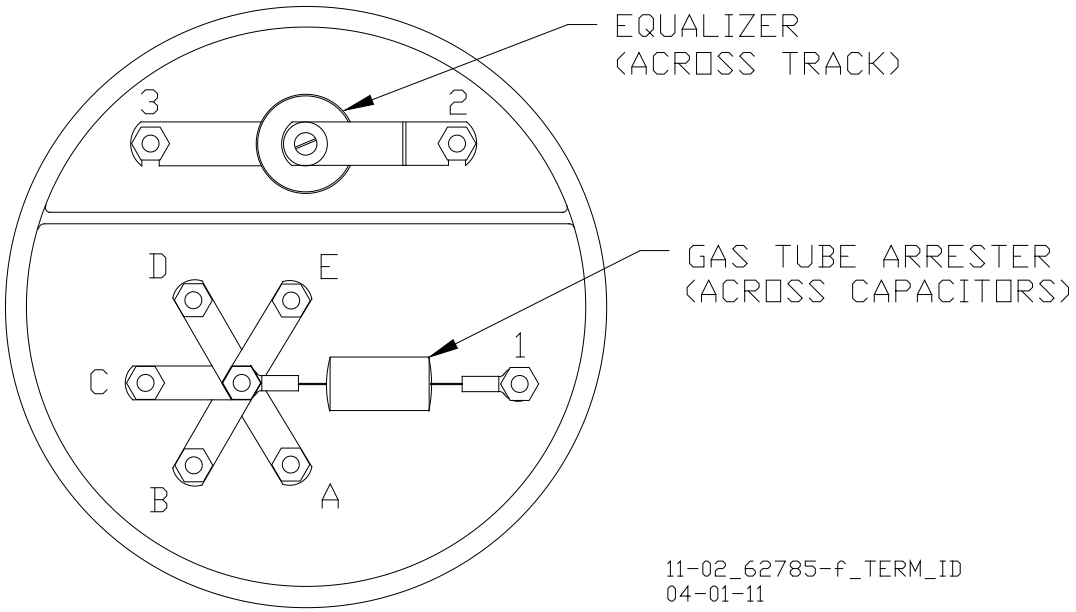


Figure 5-27:
Terminal Identification, 62785-f
Tunable Insulated Joint Coupler

The Coupler is tuned in the following sequence:

- The gold nut on terminal E is tightened first.
- Calibrate the SGCP4000 / MS4000 so that the EZ value is 100.
- Next, a hardwire shunt is placed across the tracks, first on one side of the coupler and then on the other, tightening one or more of the remaining nuts in sequence to obtain the minimum change in EZ value across the joint.

NOTE

NOTE

Tightening the nut on terminal E produces maximum change in EZ value and tightening the nut on terminal A produces minimum change.

- When the adjustment is complete, a second (standard) AREMA nut is tightened on each of the terminals to lock the gold adjusting nuts firmly in position.
- Next, an equalizer and a gas tube for capacitor protection are connected to the remaining AREMA terminals to provide complete surge protection.
- Finally, a pliable end cap is secured in place over the terminal end of the coupler by a sturdy stainless steel clamp to provide protection against moisture and dust.

There are two different tuning procedures to tune the Tunable Insulated Joint Bypass Coupler depending on where the coupler(s) is/are located in the approach. Use the procedure outlined in paragraph 0 primarily. Use the procedure outlined in paragraph 5.12.2 as an alternate. Refer to Figure 5-28 when performing either of the following tuning procedures.

⚠ CAUTION

CAUTION

THE COUPLER SHOULD BE CONNECTED WITHIN 10 FEET (3.048 METERS) OF THE RAILS. TO AFFORD MAXIMUM PROTECTION FROM PHYSICAL DAMAGE, IT SHOULD BE ENCASED IN A PROTECTIVE ENCLOSURE OR BURIED (EITHER VERTICALLY OR HORIZONTALLY) AT AN APPROPRIATE DEPTH (SEE PARAGRAPH 5.13). IT IS NOT NECESSARY TO BURY THE COUPLER BELOW THE FROST LINE.

NOTE

NOTE

Multiple couplers often require the procedures in paragraph 5.12.2 for proper setup.

Tightening the nut on terminal E produces maximum change in EZ value and tightening the nut on terminal A produces minimum change.

5.12.1 Field Tuning Procedure #1

Refer to the appropriate installation diagram Figure 5-28 for the following tuning procedure.

Step 1: Tighten the gold nut securely on terminal E of each coupler.

Step 2: Calibrate the SGCP4000 / MS4000 so that the EZ value is 100.

Step 3: Place a hardwire test shunt across the track at location A (refer to Figure 5-28.

Step 4: **Make note of the EZ value** appearing on the SGCP4000 / MS4000 display.

Step 5: Move the test shunt to location B.

Step 6: Tune the Tunable Insulated Joint Bypass Coupler #1 to the same EZ value noted in Step 4.

- Tighten the gold nut on the Coupler **#1** terminals labeled D, C, B, and A, in sequence beginning with terminal D.
- If tightening a nut results in an EZ value that is lower than the value recorded in step 4, loosen the nut and tighten the next nut in sequence.
- If, after tightening a nut, the EZ value remains higher than the value recorded in step 4, leave the nut tightened and tighten the next nut in sequence.
- Continue to tighten nuts D through A as necessary to obtain an EZ value that is approximately the same as that recorded in step 4.

Step 7: Move the test shunt to location C.

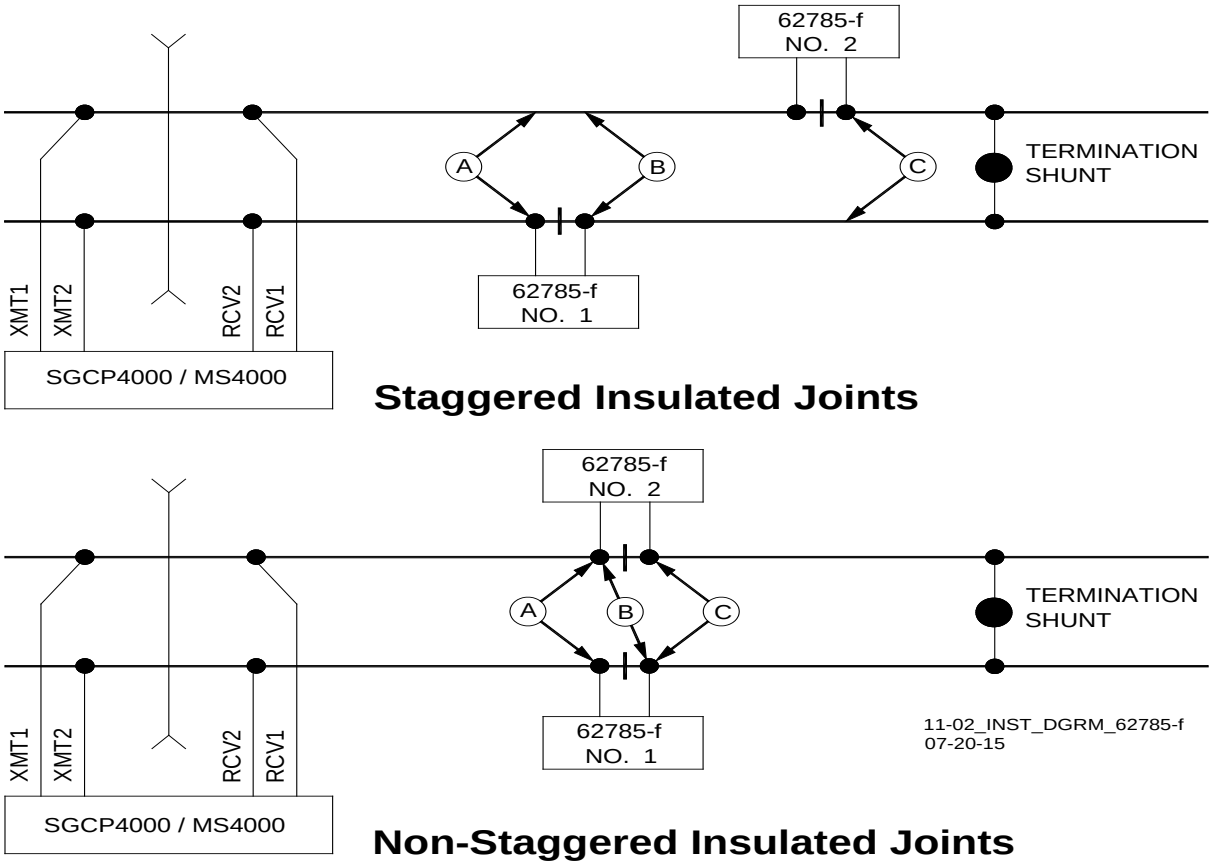


Figure 5-28:
Typical Installation Diagrams Using the 62785-f Coupler

Step 8: Tune the No. 2 Tunable Insulated Joint Bypass Coupler to the EZ value noted in step 4.

- Tighten the gold nut on the Coupler #1 terminals labeled D, C, B, and A, in sequence beginning with terminal D.
- If tightening a nut results in an EZ value that is lower than the value recorded in step 4, loosen the nut and tighten the next nut in sequence.
- If, after tightening a nut, the EZ value remains higher than the value recorded in step 4, leave the nut tightened and tighten the next nut in sequence. Continue to tighten nuts D through A as necessary to obtain an EZ value that is approximately the same as that recorded in step 4.

Step 9: Remove the test shunt and tighten a standard AREMA nut against each gold nut to ensure all nuts are securely locked in position.

⚠ WARNING

WARNING

ENSURE THAT A STANDARD AREMA NUT IS TIGHTENED SECURELY AGAINST EACH GOLD NUT ON TERMINALS A THROUGH E, INCLUDING THE TERMINALS THAT ARE NOT TIGHTENED DOWN.

Step 10: Completely recalibrate the SGCP4000 / MS4000 and perform all operational checks while observing the smooth change in the EZ value across the couplers during a train move.

5.12.2 Field Tuning Procedure #2 for Couplers

Step 1: Tighten the gold nut securely on terminal E of each coupler.

Step 2: Calibrate the SGCP4000 / MS4000 EZ value to 100.

Step 3: Place a hardwire test shunt across the track at location A (refer to Figure 5-28).

Step 4: Make a note of the EZ and EX values on the SGCP4000 / MS4000 display.

Step 5: Move the test shunt to location B.

Step 6: Tune the Tunable Insulated Joint Bypass Coupler **#1 EX** value to above 75. The **EZ** value may be as much as 8 points above the value noted in Step 4.

Step 7: Move the test shunt to location C.

Step 8: Tune the Tunable Insulated Joint Bypass Coupler **#2** so the **EX** value stays above 75. The **EZ** value may be as much as 16 points above the value note in Step 4.

Step 9: Remove the test shunt and tighten a standard AREMA nut against each gold nut to ensure all nuts are securely locked in position.

⚠ WARNING

WARNING

ENSURE THAT A STANDARD AREMA NUT IS TIGHTENED SECURELY AGAINST EACH GOLD NUT ON TERMINALS A THROUGH E. TERMINALS THAT ARE NOT USED FOR TUNING THE COUPLER MUST HAVE THEIR GOLD NUTS REMOVED.

Step 10: Completely recalibrate the SGCP4000 / MS4000 and perform all the operational checks while observing the relatively smooth change in the EZ value across the couplers during a train move.

5.12.3 Tunable Insulated Joint Bypass Coupler, 62785-f Specifications

Dimensions	18 inches (45.720 centimeters) long 6 inches (15.240 centimeters) in diameter
Weight	12 pounds (5.45 kilograms) (approximate)
Leads	10 feet (3.048 meters); #6 AWG, stranded, black PVC
Surge Suppresser Part Numbers	Equalizer, 022700-21X, Siemens No. Z803-00052-0001 Gas Tube Arrester, Siemens No. Z803-00053-0001

5.13 MS/GCP TERMINATION SHUNT BURIAL KIT, 62776

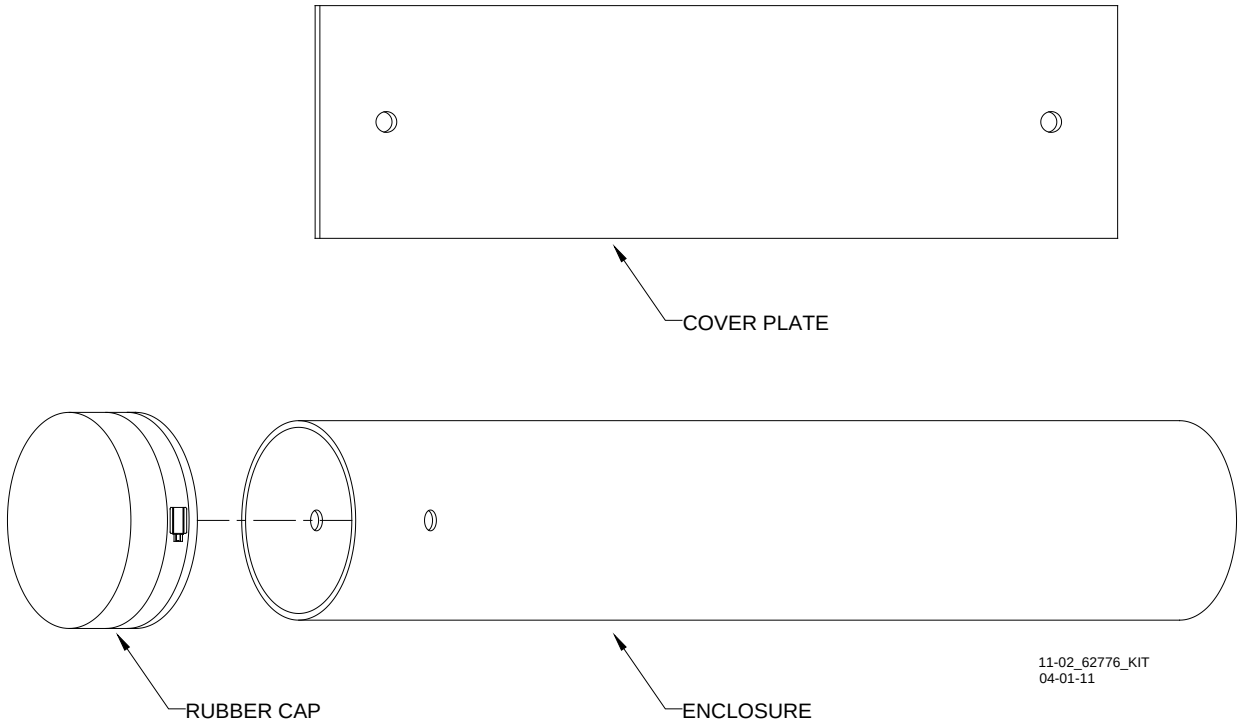


Figure 5-29:
MS/GCP Termination Shunt Burial Kit, 62776

The MS/GCP Termination Shunt Burial Kit, 62776, is designed to protect Narrow-band Termination Shunts while they are buried in the space between adjacent railroad ties.

5.13.1 Kit Contents

The MS/GCP Termination Shunt Burial Kit, 62776, consists of a 26-inch (66 cm) length enclosure of 6-inch (15.2 cm) diameter black PVC tubing, a 7x24-inch (17.8 X 61cm), a 1/4-inch (6.4 mm) thick steel plate, a pliable rubber cap with an adjustable stainless steel clamp, and two 1/4 X 3-inch (7 X 77mm) lag bolts (not shown).

One end of the tubing is fitted with a pliable rubber cap that is secured in place by an adjustable stainless steel clamp. Two 5/8-inch (16 mm) diameter holes located near the capped end of the tube accommodate the shunt leads.

5.13.2 Kit Use

The enclosure is normally buried in a vertical position between the ties.

- The Termination Shunt is lowered into the enclosure and the two leads routed through the holes in the enclosure wall and connected to the rails using standard procedures.
- The cap is then secured over the top of the enclosure using the stainless steel clamp.
- The steel plate is centered over the buried enclosure/shunt and securely fastened to each tie using the two 1/4 X 3-inch lag bolts provided.

5.13.3 Shunt Kit Assemblies Specifications

Dimensions:		
	Enclosure (PVC)	24 inches (60.960 centimeters) long (w/o end cap) 6 inches (15.240 centimeters) in diameter (inside)
	Cover Plate (Steel)	24 inches (60.960 centimeters) long 7 inches (17.780 centimeters) wide 0.25 inch (0.635 centimeters) thick
Weight:		
	Enclosure	5 pounds (2.27 kilograms)
	Cover Plate	12 pounds (5.44 kilograms)

5.14 SURGE PANELS, 80026-XX

The 80026-XX Surge Panels are available in a combination of equalizers and arresters to provide protection for battery and/or track circuits.

⚠ WARNING

WARNING

ANY ALTERNATIVE SURGE PROTECTION DEVICE MUST BE ANALYZED TO INSURE THAT FAILURE MODES OF DEVICE DO NOT COMPROMISE SAFETY OF SGCP4000 / MS4000 SYSTEM. FOR EXAMPLE, BUT NOT LIMITED TO, UNINTENTIONAL EARTH GROUNDS ON CONTROL CIRCUITS OR SHORTS ON TRACK CIRCUITS.

5.14.1 Surge Panel Configurations

Surge Panel units are provided in a variety of configurations to meet specific customer requirements. Wall mounted Surge Panel applications are listed in Table 5-13. Rack mount Surge Panel applications are in Table 5-14.

NOTE

NOTE

For surge protection requirements not listed or for custom designed Surge Panels, contact Siemens Technical Support.

5.14.2 Surge Panel Nomenclature and Mounting Dimensions

Surge panel nomenclature and mounting dimensions are provided on the figures identified in Table 5-13 and Table 5-14.

5.14.3 Surge Panel Arresters

⚠ WARNING

WARNING

DO NOT MOUNT ARRESTER WITH ELECTRODES POINTED IN THE DOWN POSITION TO MINIMIZE THE POTENTIAL OF SHORT CIRCUIT.

A typical Surge Panel arrester is shown in Figure 5-30.

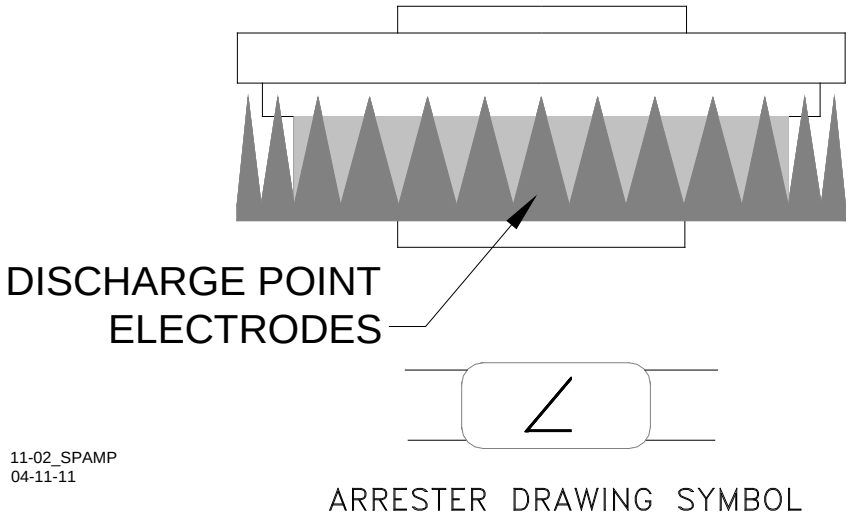


Figure 5-30:
Typical 80026 Surge Panel Arrester Mounting Position

Table 5-13:
Wall Mount Surge Panels

PART NO.	FIG.	DESCRIPTION	DIMENSIONS	WEIGHT
80026-01	3-35	Protects 1 battery and 1 track circuit.	Height: 13.5 in (34.290 cm) Width: 5.69 in (14.453 cm) Depth: 3.625 in (9.208 cm)	6.00 lb. (2.72 kg) (approximate)
80026-02	3-35	Protects 1 track circuit. • Use with –1 panel for subsequent track protection.	Height: 8.75 in (22.23 cm) Width: 5.69 in (14.453 cm) Depth: 3.625 in (9.208 cm)	4.00 lb. (1.82 kg) (approximate)
80026-22	3-35	• Protects 1 track circuit. Use for six-wire applications.	Height: 5.44 in (13.82 cm) Width: 5.69 in (14.453 cm) Depth: 3.625 in (9.208 cm)	3.00 lb. (1.36 kg) (approximate)

Table 5-14:
Rack Mount Surge Panels

PART NO.	FIG.	DESCRIPTION	DIMENSIONS	WEIGHT
80026-31	3-36	Protects 1 track and 1 battery circuit.	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	5.00 lb. (2.26 kg) (approximate)
80026-32	3-36	Protects 1 track and 1 battery circuit. • Use with –31 panel for subsequent track and battery circuit protection.	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	6.00 lb. (2.72 kg) (approximate)
80026-33	3-37	Protects 1 battery circuit. • Use with –31 panel for subsequent battery circuit protection.	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	7.00 lb. (3.18 kg) (approximate)
80026-34	3-37	Protects 1 track circuit. • Use with –31 panel for subsequent track circuit protection.	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	6.00 lb. (2.72 kg) (approximate)
80026-35	3-38	Protects 2 track circuits.	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	7.00 lb. (3.18 kg) (approximate)
80026-36	3-38	Protects 1 track circuit. • Use with –31 panel for subsequent track circuit protection. • Used with six-wire applications for transmit, receive, and check receive lead protection	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	6.00 lb. (2.72 kg) (approximate)
80026-37	3-39	Protects 1 battery circuit.	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	6.00 lb. (2.72 kg) (approximate)
80026-38	3-39	Protects 2 track circuits. • Used in applications with six wires on one track and four on the other	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	8.00 lb. (3.64 kg) (approximate)
80026-39	3-40	Protects 4 battery circuits. • Battery input/output line protection for two DAX start or two UAX circuits. • Normally used with second battery when line circuit protection is required	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	6.00 lb. (2.72 kg) (approximate)

Concluded on next page

Table 5-17: Concluded

PART NO.	FIG.	DESCRIPTION	DIMENSIONS	WEIGHT
80026-41	3-40	Protects 110 VAC circuits. • Used when 20-ampere solid-state crossing controller (91070A) is used in conjunction with SGCP4000 / MS4000 • Includes four 15-ampere resettable circuit breakers and one 15-ampere GFCI duplex outlet	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	9.00 lb. (4.09 kg) (approximate)
80026-41A	3-40	Protects 110 VAC circuits. • Used when 40-ampere solid-state crossing controller (91075A) is used in conjunction with SGCP4000 / MS4000 • Includes three 15-ampere and one 25-ampere resetta-ble circuit breakers and one 15-ampere GFCI duplex outlet	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	9.00 lb. (4.09 kg) (approximate)
80026-47	3-41	Protects 2 battery circuits and 1 track circuit. • Used with motion sensor battery and second battery	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	7.00 lb. (3.18 kg) (approximate)
80026-50	3-41	Protects 4 vital Input/output circuits • Generally used for UAX inputs or DAX start outputs	Height: 4.96 in (12.598 cm) Width: 23.00 in (58.420 cm) Depth: 4.535 in (11.519 cm)	7.00 lb. (3.18 kg) (approximate)

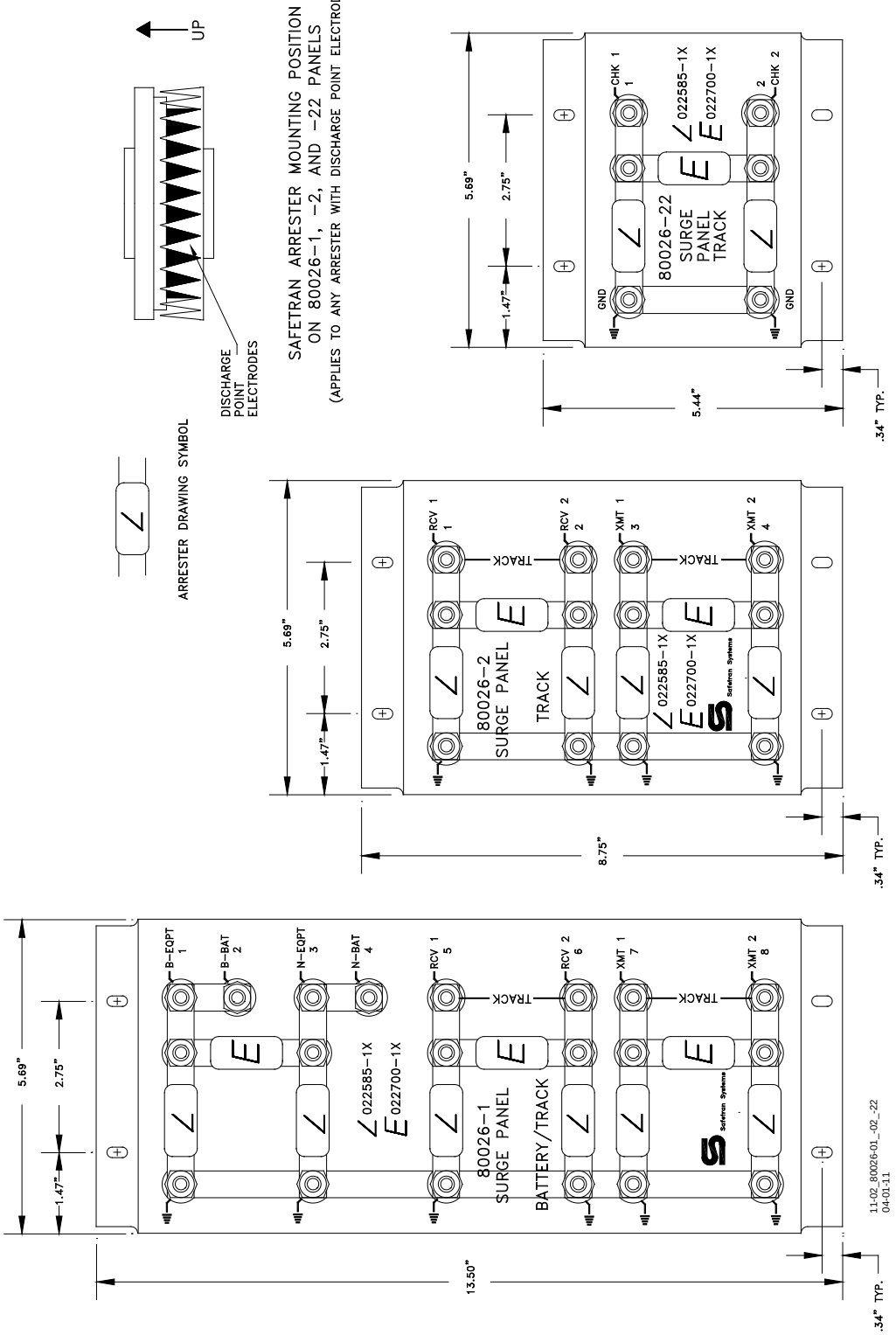


Figure 5-31:
Wall Mount Surge panels, 80026-01, -02, and -22

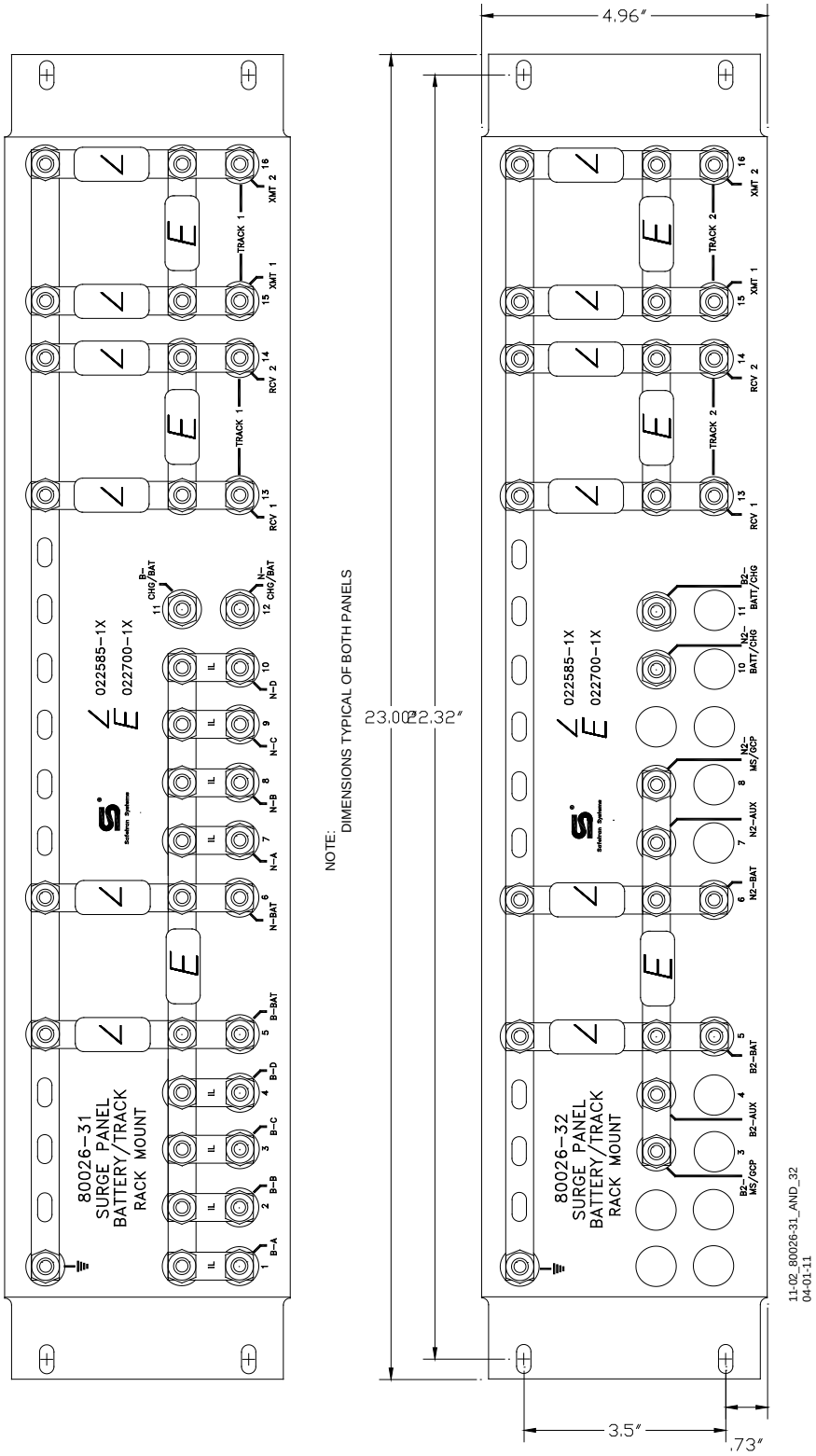


Figure 5-32:
Rack Mounted Surge Panels, 80026-31 and -32

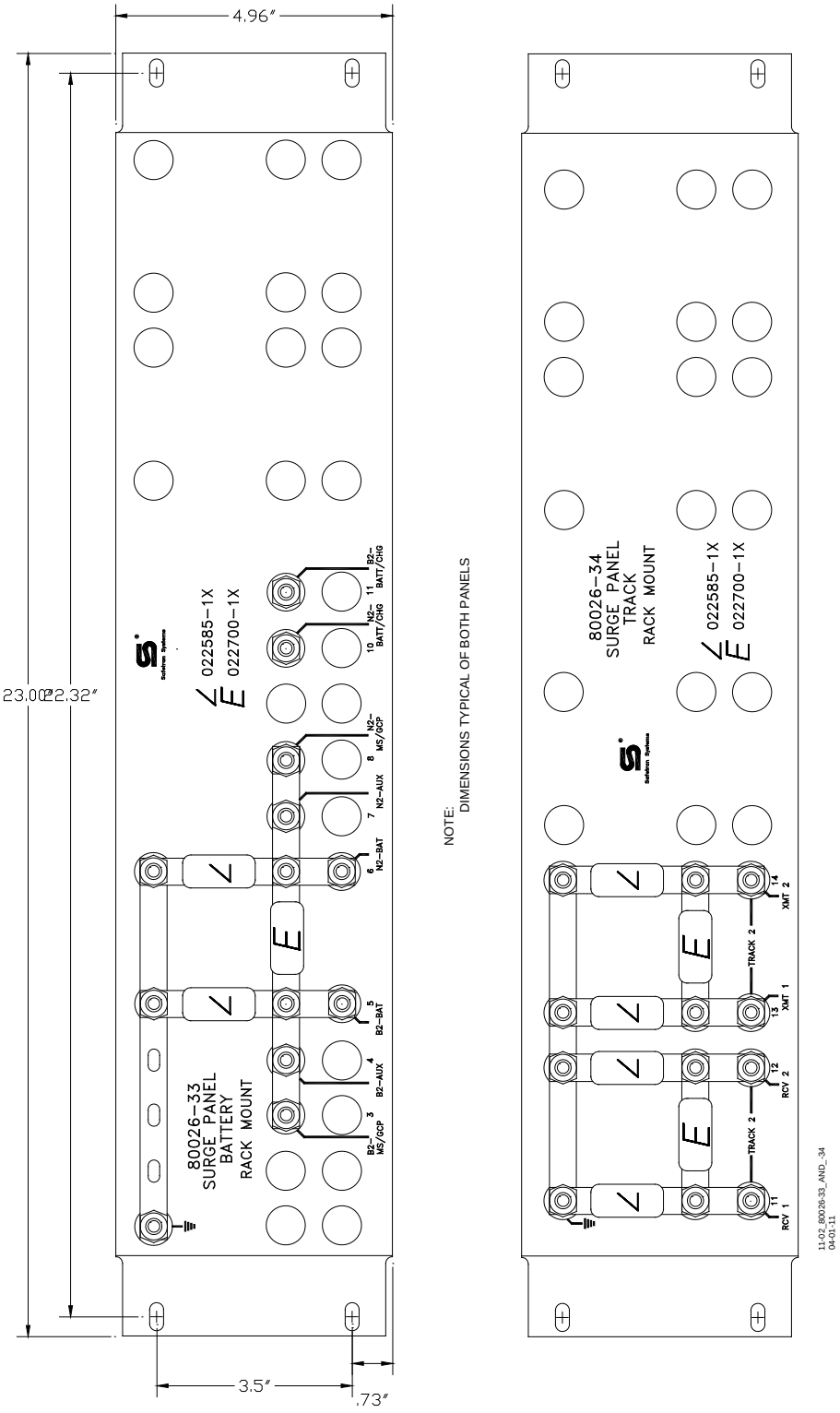


Figure 5-33:
Rack Mounted Surge Panels, 80026-33 And -34

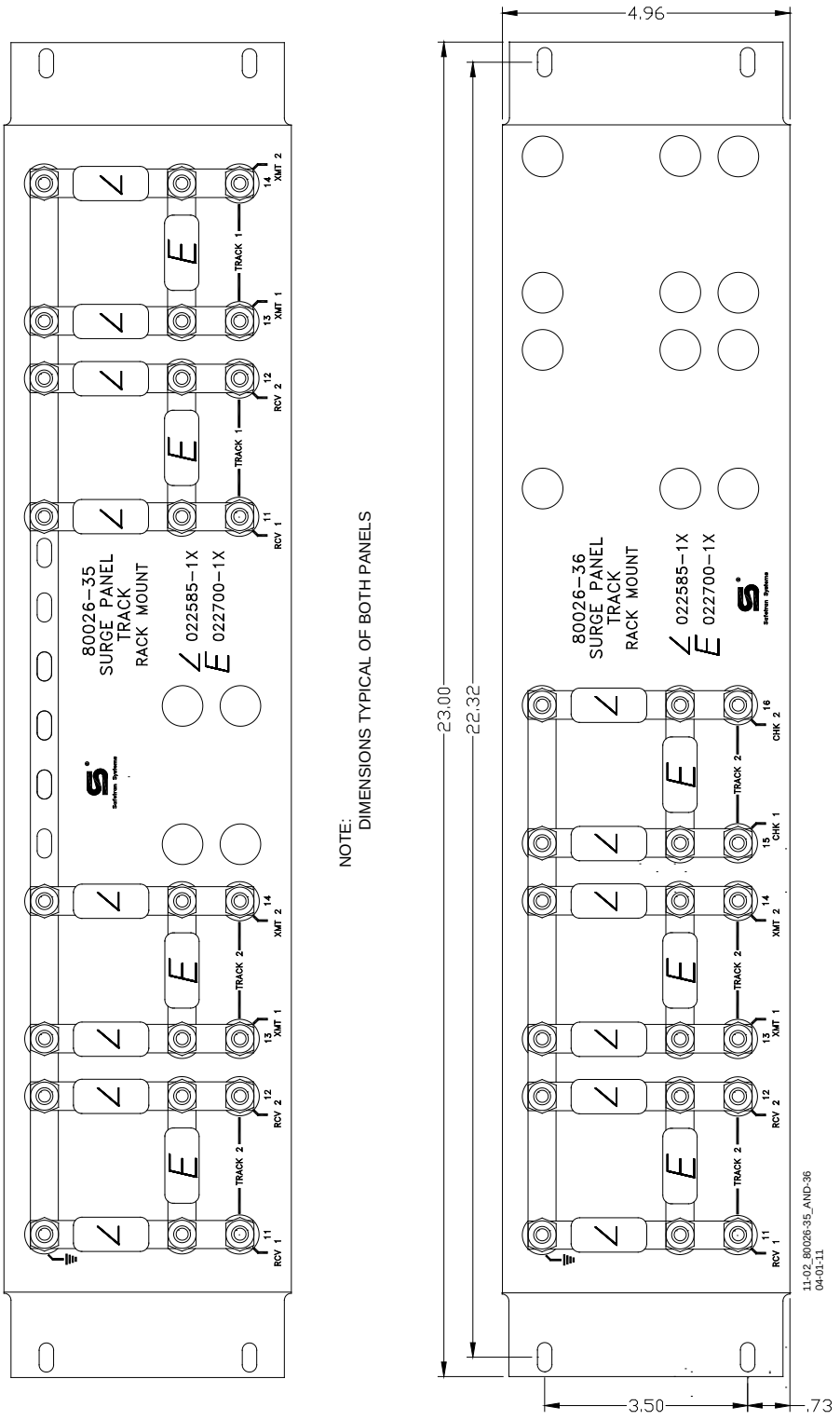


Figure 5-34:
Rack Mounted Surge Panels, 80026-35 and -36

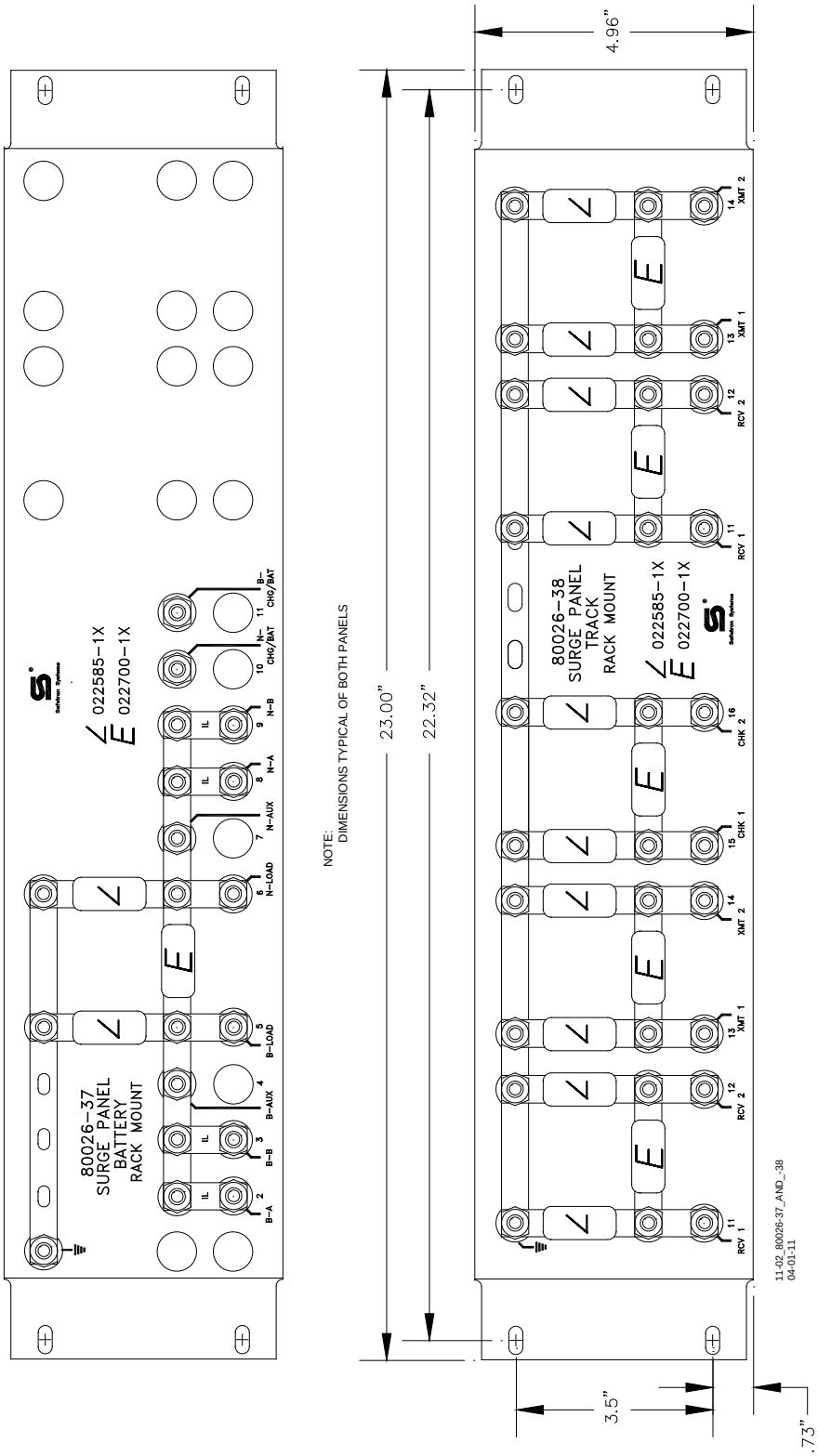


Figure 5-35:
Rack Mounted Surge Panels, 80026-37 And -38

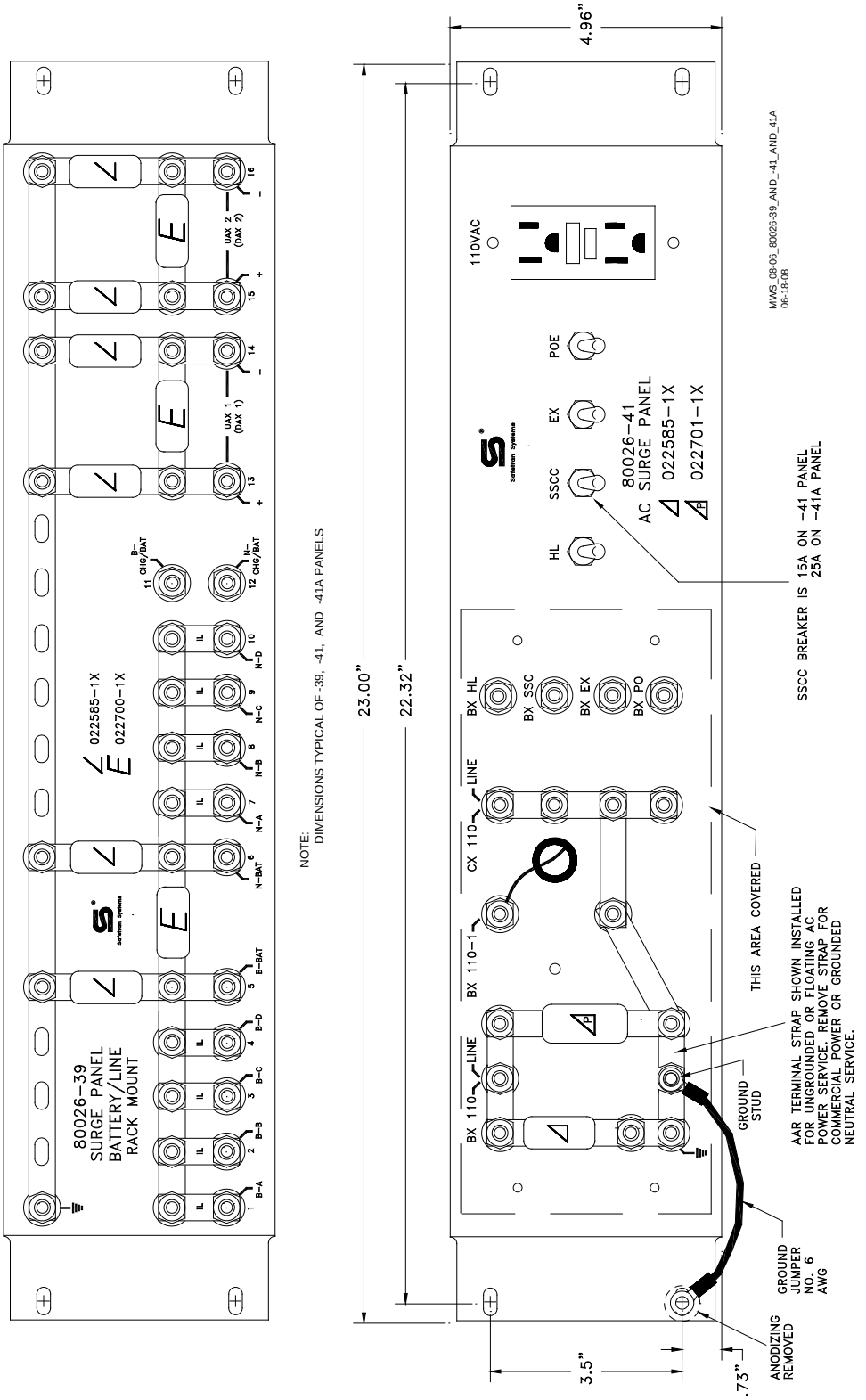


Figure 5-36:
Rack Mounted Surge Panels. 80026-39, -41 and -41A

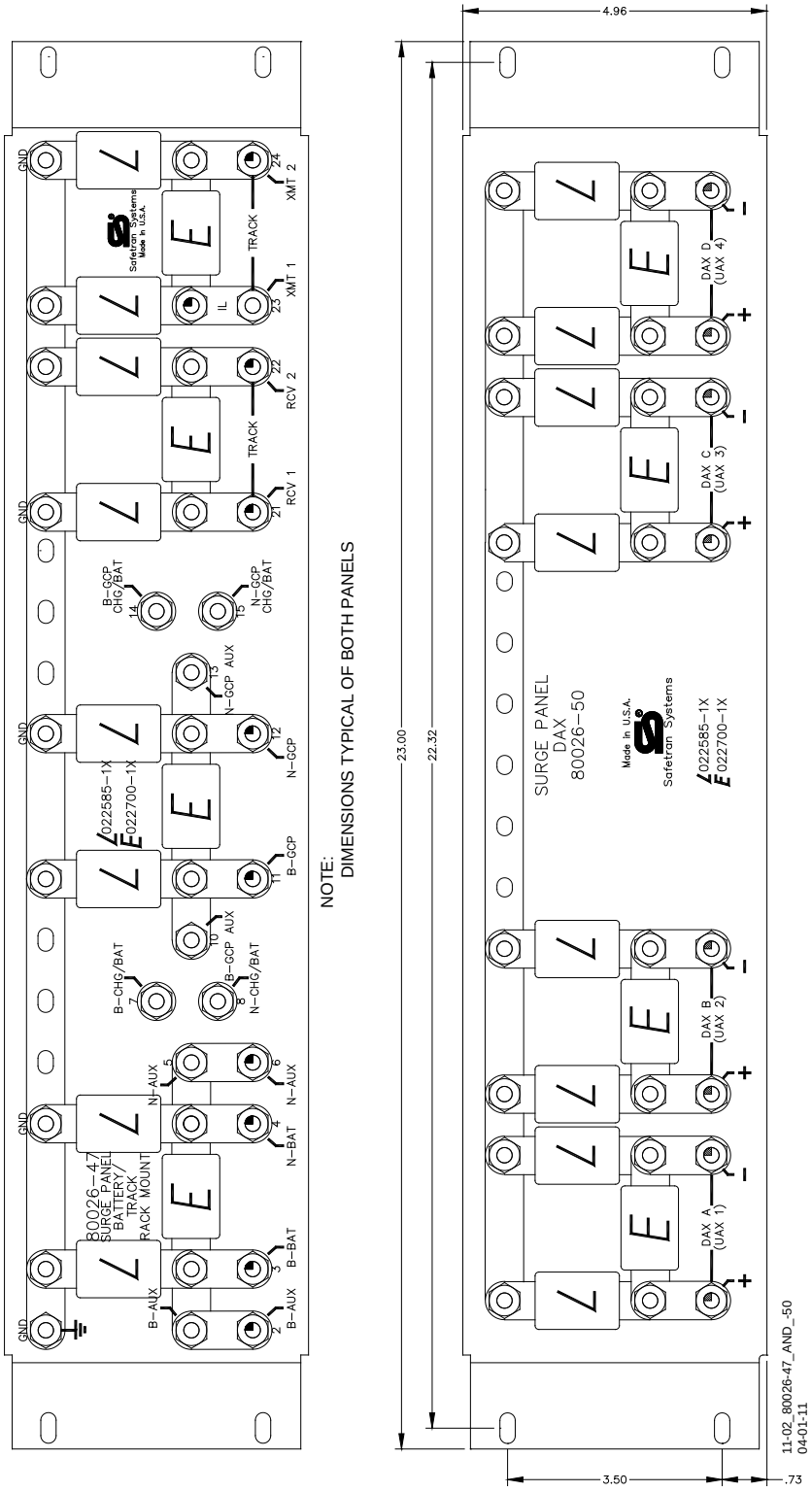


Figure 5-37:
Rack Mounted Surge Panels 80026-47 and 80026-50

5.15 RECTIFIER PANEL ASSEMBLY, 80033

The 80033 Rectifier Panel Assembly is equipped with equalizers and arresters to provide surge protection on the B (+) and N (-) connections to the battery and the motion sensor. Mounting holes are provided for a battery charger, as required.

5.15.1 Rectifier Panel Assembly Nomenclature and Mounting Dimensions-

Rectifier Panel Assembly, 80033 nomenclature and mounting dimensions are provided on Figure 5-38.

Table 5-15:
Rectifier Panel Assembly, 80033 Specifications

PARAMETER	VALUE
Height	10.46 in. (26.568 cm)
Width	23.00 in. (58.420 cm)
Depth	2.75 in. (6.985cm)
Weight	7 pounds (3.18 kg) (approximate)

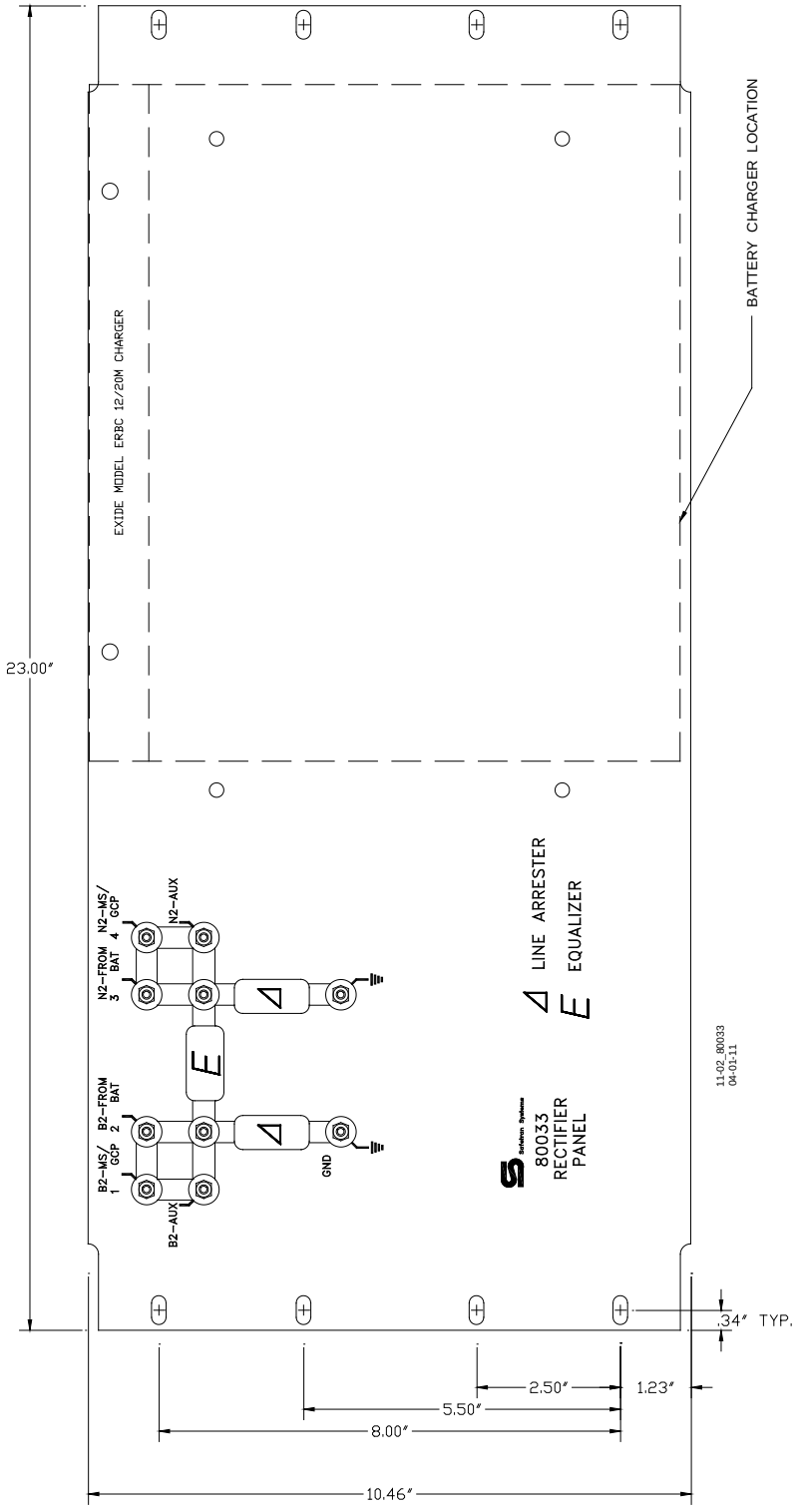


Figure 5-38:
Rectifier Panel assembly, 80033

5.16 CABLE TERMINATION PANEL ASSEMBLY, 91042

The Cable Termination Panel Assembly, 91042 is a universal-mounting panel that can be ordered with from 1 to 19 pairs of strapped AREMA binding posts.

Cable Termination Panel Assembly Mounting Dimensions**-**91042 Cable Termination Panel Assembly mounting dimensions are provided on Figure 5-39.

Table 5-16:
Cable Termination Panel Assembly, 91042 Specifications

PARAMETER	VALUE
Height	3.96 in. (10.058 cm)
Width	23.00 in. (58.420 cm)
Depth	2.25 in. (5.715cm)
Weight	7 pounds (3.18 kg) (approximate)

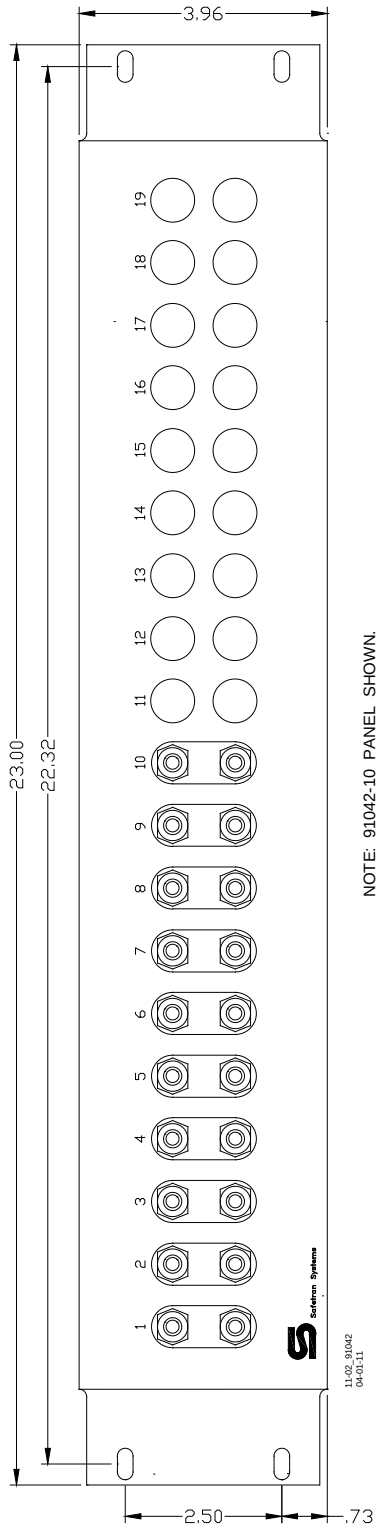


Figure 5-39:
Cable Termination Panel Assembly, 91042

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SECTION 6 –
DETAILED CASE AND MODULE DESCRIPTION

6.1 GENERAL PHYSICAL DESCRIPTION

Each SGCP4000 / MS4000 consists of a case assembly, a motherboard, and plug-in circuit modules that come equipped with plug-in external wiring connectors.

6.1.1 Chassis

Each chassis consists of a powder-coated steel case with a backplane-mounted motherboard.

6.1.2 Motherboard

The Motherboard for each assembly provides:

- SGCP4000 / MS4000 unit wiring
- Circuit module connectors
- External Configuration Device Connector(s)
- Chassis Identification Chip socket(s)
- DIAG (diagnostic) port connector
- Interface connectors for external wiring connectors
- Echelon LONTALK® PROTOCOL LAN connector (See Safetran's Echelon Configuration Handbook, COM-00-07-09).

6.1.3 Plug-In Circuit Modules

Each SGCP4000 / MS4000 plug-in circuit module is equipped with:

- A dual 43-pin connector on one edge which plugs into a corresponding edge connector on the motherboard.
- Locking ejector levers at the top and bottom of each module to facilitate removal from the case.

6.2 SIMPLE GRADE CROSSING PREDICTOR 4000 / MOTION SENSOR 4000 (SGCP4000 / MS4000) ASSEMBLIES

The SGCP4000 / MS4000 is available in two configurations:

- Redundant Single Track System (A80490)
- Single Track System (A80495)

NOTE

NOTE

The module slot allocations shown below the module connectors are assigned for discussion purposes only and do not appear on the actual case assembly.

6.2.1 Redundant Single Track System, A80490

6.2.1.1 Interface Connectors

The A80495 case is shown in Figure 6-1. The relationships between the Single Case modules and the interface connectors are described in Table 6-1.

Table 6-1:
Dual Single Track Case, A80490 Module to Interface Connector Relationship

MODULE	SLOT POSITION	INTERFACE CONNECTOR
A80403	M1	CPU II+
A80418	M2	TRACK
A80406	M3	TRANSFER
A80403	M4	CPU II+
A80418	M2	TRACK

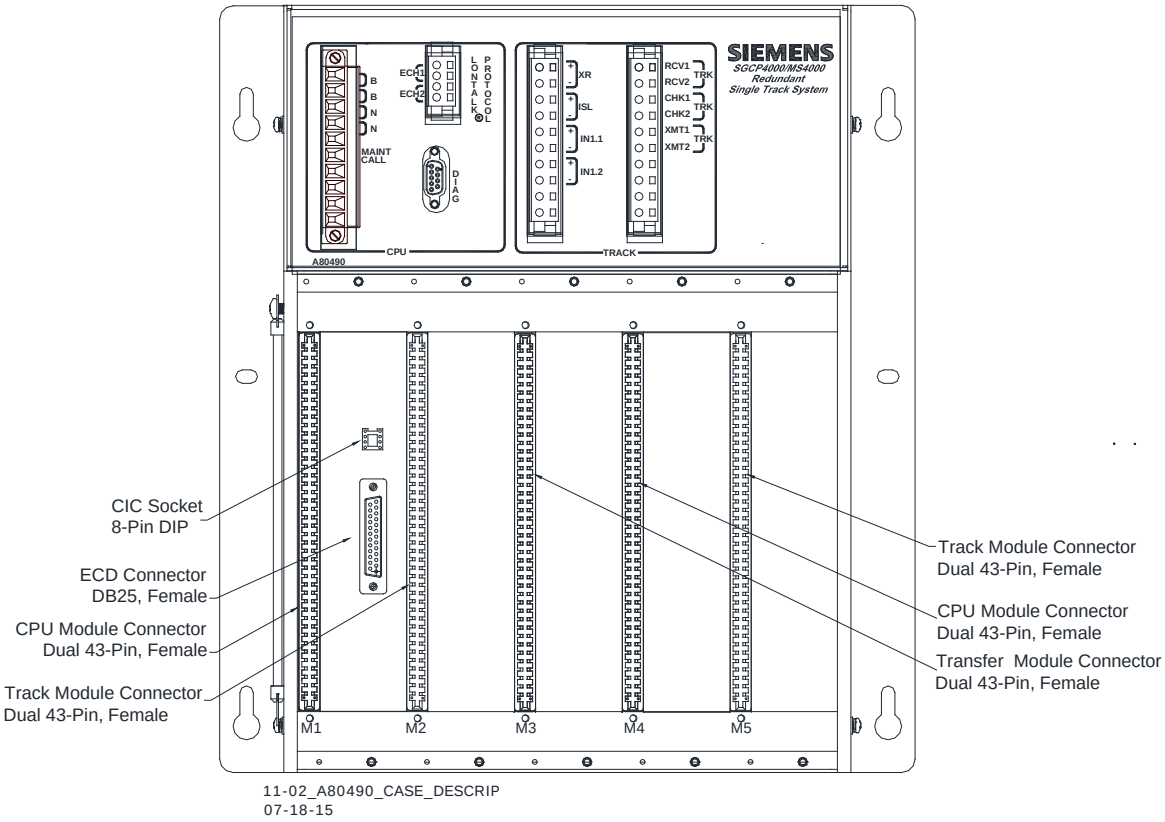


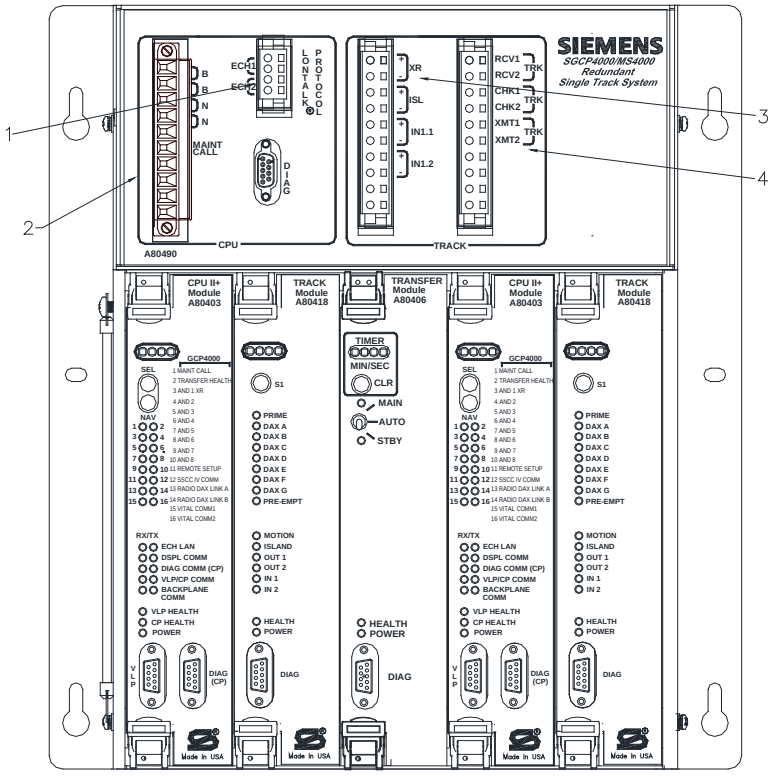
Figure 6-1:
SGCP4000 / MS4000, A80490 Connectors

6.2.1.2 Modules and External Wiring Connectors

The SGCP4000 / MS4000, A80495 with modules and external wiring connectors installed is shown in Figure 6-2. The case contains FIVE modules:

- Two Central Processor Units, A80403 (CPU II+) module in slot positions M1 and M4.
- Two Track Modules, A80418 in slot positions M2 and M5.
- Transfer Module, A80406 in slot position M3.

The SGCP4000 / MS4000 Case, A80495 has four external wiring connectors (see Table 6-2).



11-02_A80490_CASE_W-MODULES
07-18-15

Figure 6-2:
SGCP4000 / MS4000 Case, A80490 With Modules and External Wiring Connectors Installed

Table 6-2:
SGCP4000 / MS4000 Case External Wiring Connectors

REF. NO.	CONNECTOR DESCRIPTION	CONNECTOR DESIGNATION	SIEMENS PART NUMBER
1	4-pin cage clamp, female	LONTALK® PROTOCOL	Z715-09099-0000
2	10-pin screw lock, female	CPU	Z715-02101-0007
3	Keyed 10-pin cage clamp, female	INPUT/OUTPUT	Z715-02101-0001
4		TRACK	Z715-02101-0008

6.2.2 Single Track System, A80495

6.2.2.1 Interface Connectors

The A80495 case is shown in Figure 6-3. The relationships between the Single Case modules and the interface connectors are described in Table 6-1.

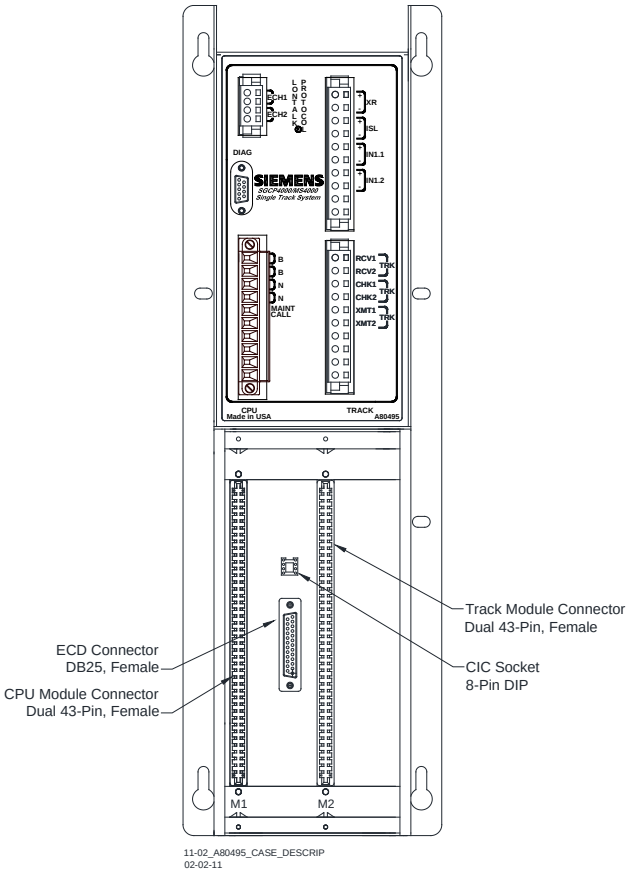


Figure 6-3:
A80495 Connectors

Table 6-3:
Single Track Case, A80495 Module to Interface Connector Relationship

MODULE	SLOT POSITION	INTERFACE CONNECTOR
A80403	M1	CPU
A80418	M2	TRACK

6.2.2.2 Modules and External Wiring Connectors

The SGCP4000 / MS4000, A80495 with modules and external wiring connectors installed is shown in Figure 6-4. The case contains two modules:

- Central Processor Unit, A80403 (CPU2+) module in slot position M1.
- Track Module, A80418 in slot position M2

The SGCP4000 / MS4000 Case, A80495 has four external wiring connectors (see Table 6-2).

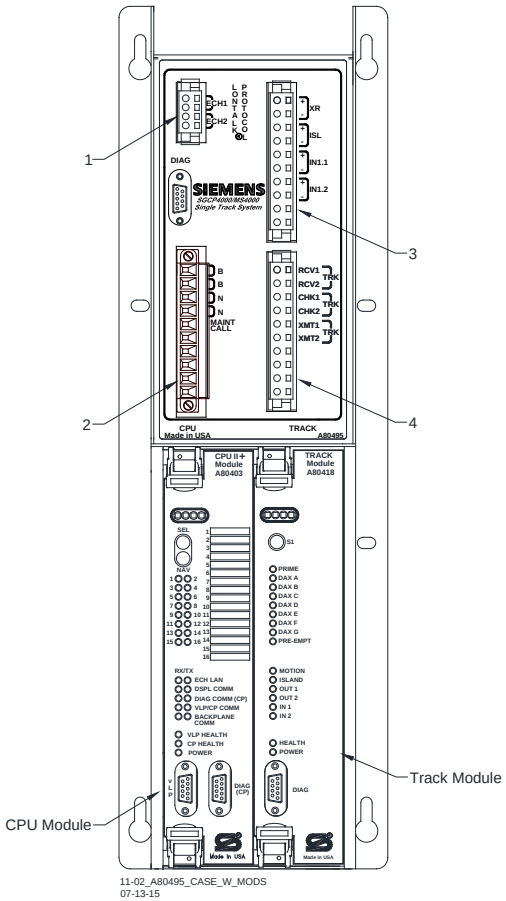


Figure 6-4:
SGCP4000 / MS4000 Case, A80495 With Modules and External Wiring Connectors Installed

Table 6-4:
SGCP4000 / MS4000 Case External Wiring Connectors

REF. NO.	CONNECTOR DESCRIPTION	CONNECTOR DESIGNATION	SIEMENS PART NUMBER
1	4-pin cage clamp, female	LONTALK® PROTOCOL	Z715-09099-0000
2	10-pin screw lock, female	CPU	Z715-02101-0007
3	Keyed 10-pin cage clamp, female	INPUT/OUTPUT	Z715-02101-0001
4		TRACK	Z715-02101-0008

6.3 DIAGVIEW DISPLAY UNIT, A80500

The DiagView Display Unit Case, A80500 is shown in Figure 6-5.

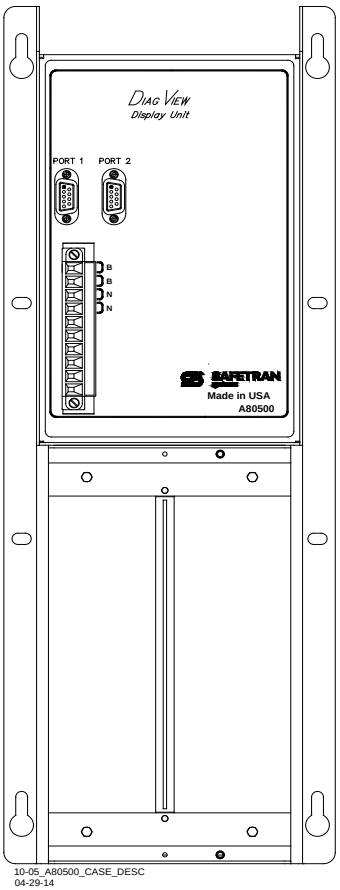


Figure 6-5:
DiagView Display Unit Case, A80500

6.3.1 DiagView Display Unit Case, A80500 Modules

The DiagView Display Unit Case along with the Display II Panel, A80407-03, installed is shown in Figure 6-6.

Table 6-5:
DiagView Display Unit Case External Wiring Connectors

REF. NO.	DESCRIPTION	DESIGNATION	SIEMENS PART NUMBER
1	DB9 connector	Port 1	Z715-09099-0000
2	DB9 connector	Port 2	Z715-02101-0007
3	10-pin screw clamp connector, female	Power	Z715-02101-0007

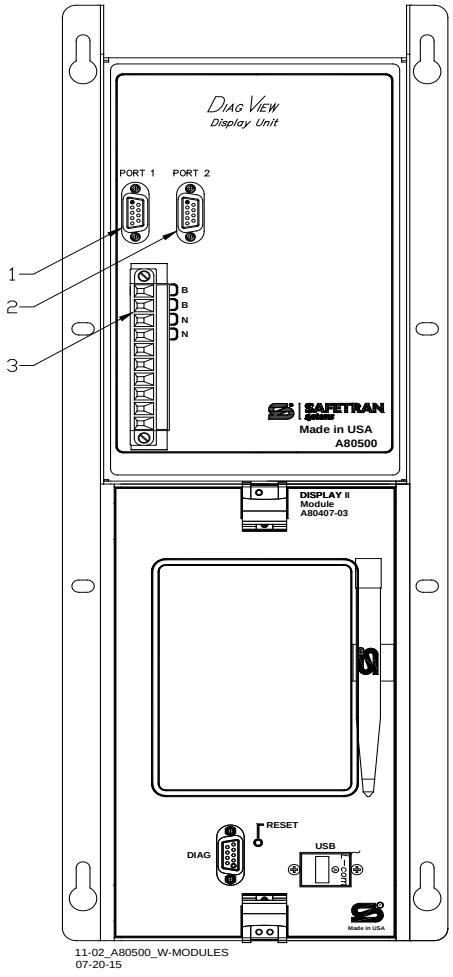


Figure 6-6:
DiagView Display Unit, A80500

The DiagView Display Unit is used with either SGCP4000 / MS4000 Case, A80490 or A80495, to provide the user with a visual cue of track status as well as a Display Terminal.

The DiagView Display Unit is connected to the Single Track Case through the use of Serial Cable, P/N Z706-00280-0000. This cable has a male DB9 connector on each end of the cable. The cable is connected between the Diag Port located on the upper portion of the Single Track Case between the Echelon LAN connector and the power connector and Port 1 on the DiagView Display Unit case.

6.4 PLUG-IN MODULES AND SUBASSEMBLIES

6.4.1 CPU2+ Module, A80403

The A80403 CPU2+ Module is a central processing unit that provides all vital logic processing functions for all SGCP4000 / MS4000 chassis, controls ECHELON LAN, and vital and non-vital serial communications interfaces with front panel CPU connectors.

6.4.1.1 CPU2+ Module, A80403 User Interface

The CPU2+ front panel is shown in Figure 6-7. The CPU2+ user interface is described in Table 6-6.

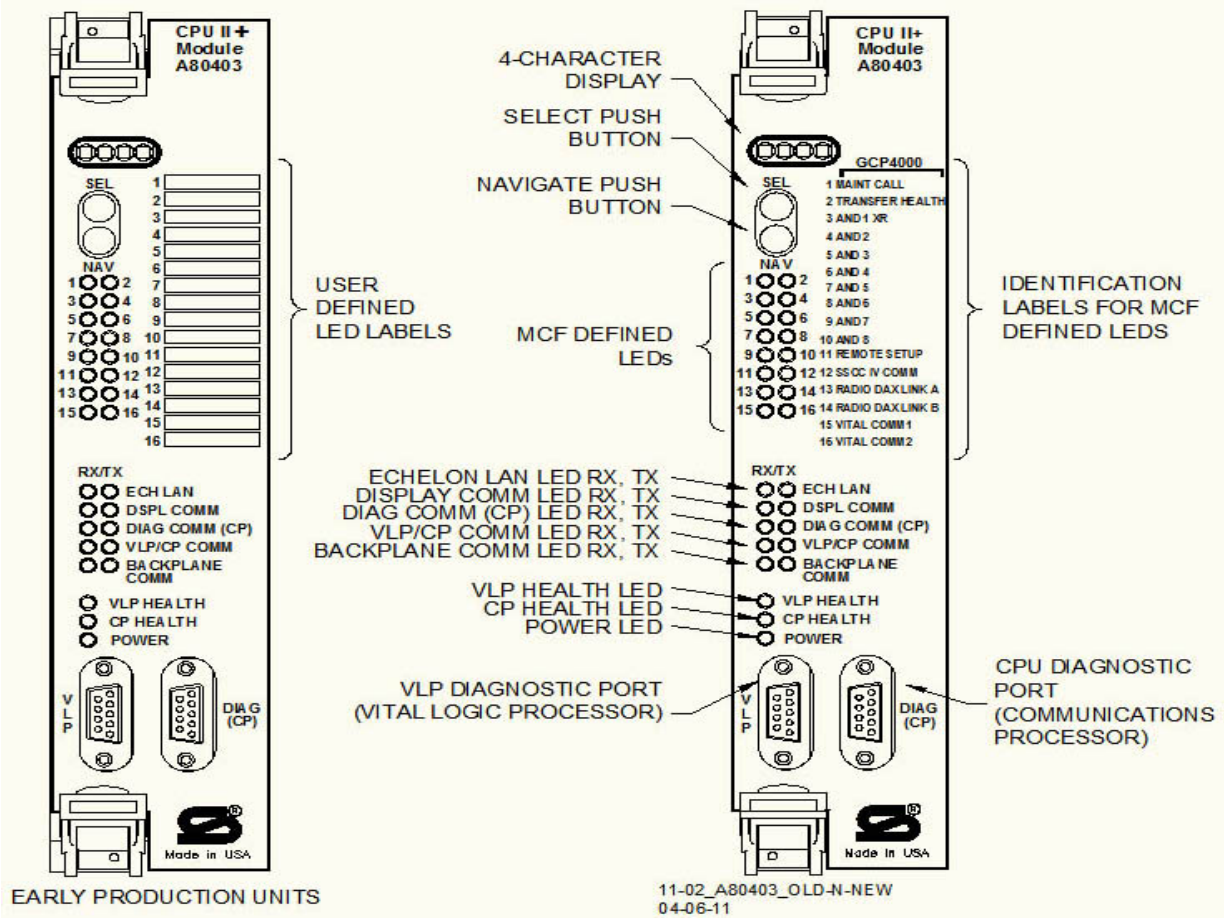


Figure 6-7:
CPU2+ Module, A80403 Front Panel

Table 6-6:
CPU2+ Module, A80403 User Interface

COMPONENT	FUNCTION		
4-Character Display	Displays alphanumeric representation of currently selected function menu item. (Refer to Model SGCP4000 / MS4000 Field Manual for diagnostic messages.)		
Select Push Button (SEL)	Used to select menu item displayed on 4-Character Display.		
Navigate Push Button (NAV)	Used to select an available function menu.		
16 MCF DEFINED LEDS	**COLOR**	**FUNCTION**	**INDICATION**
1 (MAINT CALL)	Red	Maintenance Call see maintenance call logic section	On – maintenance call output on Off – maintenance call output off
2 (TRANSFER HEALTH)	Red	Transfer Output see transfer output section	On – transfer signal is being generated transfer card should not be counting down Off – transfer signal is not being generated If transfer card is in AUTO it should be counting down
3 (XR RELAY)	Red	XR Relay	On – XR Relay is energized Off – XR Relay is Deenergized
4 (AND 2)*	Red	AND 2	Not Used in this application
5 (AND 3)*	Red	AND 3	Not Used in this application
6 (AND 4)*	Red	AND 4	Not Used in this application
7 (AND 5)*	Red	AND 5	Not Used in this application
8 (AND 6)*	Red	AND 6	Not Used in this application
9 (AND 7)*	Red	AND 7	Not Used in this application
10 (AND 8)*	Red	AND 8	Not Used in this application
11 (REMOTE SETUP)*	Red	Remote Setup Session	On – the SGCP4000 / MS4000 has been primed for a remote one person setupsee section 6-10. Off – No remote setup is in progress
12 (SSCC IV COMM)	Red	SSCC IV Communication link	Not Used in this application
13 (RADIO DAX LINK A)*	Red	Radio DAX Link A	Not Used in this application
14 (RADIO DAX LINK B)*	Red	Radio DAX Link B	Not Used in this application
15 (VITAL COMM1)*	Red	Vital Comm 1	Not Used in this application
16 (VITAL COMM2)*	Red	Vital Comm 2	Not Used in this application

Continued on next page

Table 6-4, Concluded

COMPONENT	FUNCTION
ECH LAN LEDs	TX flashes red when the CPU2+ is transmitting an ATCS message via the LONTALK® LAN.
	RX flashes green when the CPU2+ is receiving an ATCS message via the LONTALK® LAN.
DSPL COMM LEDs	TX flashes red when the CPU2+ is transmitting data to the Display Panel.
	RX flashes green when the CPU2+ is receiving data from the Display Panel.
DIAG COMM (CP) LEDs	TX flashes red when the CPU2+ is transmitting data on the communications processor diagnostic (DIAG CP) serial port.
	RX flashes green when the CPU2+ is receiving data from the communications processor diagnostic (DIAG CP) serial port.
VLP/CP COMM LEDs	TX flashes red when the Vital Logic Processor (VLP) is transmitting data to the Communications Processor (CP).
	RX flashes green when the Vital Logic Processor (VLP) is receiving data from the Communications Processor (CP).
BACKPLANE COMM LEDs	TX flashes red when the Vital Logic Processor (VLP) is sending data onto the serial bus.
	RX flashes green when the Vital Logic Processor (VLP) is receiving data from the serial bus.
BACKPLANE COMM LEDs	TX flashes red when the Vital Logic Processor (VLP) is sending data onto the serial bus.
	RX flashes green when the Vital Logic Processor (VLP) is receiving data from the serial bus.
VLP HEALTH LED	Flashes yellow to indicate that the Vital Logic Processor is functioning normally.
CP HEALTH LED	Flashes yellow to indicate that the Communications Processor is functioning normally.
POWER LED	Lights green to indicate that power is applied to the CPU2+ module.
VLP Serial Port	9-pin diagnostic serial port for Vital Logic Processor.
DIAG (CP) Serial Port	9-pin diagnostic serial port for Communications Processor.

* LED not used in Motion Sensor application

6.4.2 Track Module, A80418

The Track Module, A80418 performs the predictor and island train detection functions. The Vital I/O functions found on the Track Module, A80418 are:

- 2 isolated vital inputs
- 2 isolated vital outputs

6.4.2.1 Track Module, A80418 Front Panel

The Track module front panel is shown in Figure 6-8. The PRIME LED depicts the XR Relay. The DAX LEDs are not used on the SGCP4000 / MS4000 application. The user interface is described in Table 6-7.

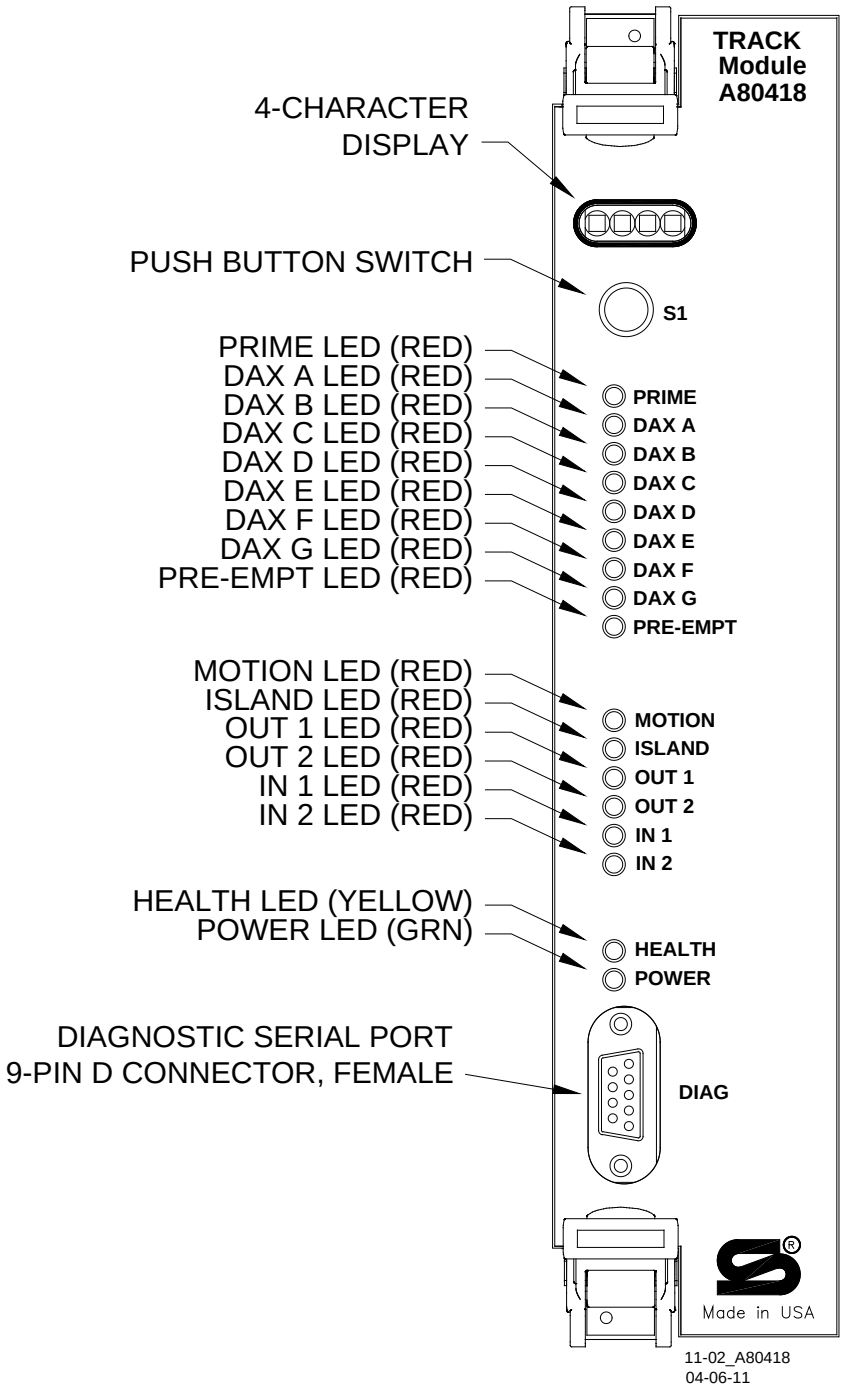


Figure 6-8:
Track Module, A80418 Front Panel

Table 6-7:
Track Module, A80418 User Interface

COMPONENT	FUNCTION
4-Character Display	Displays module and track status and diagnostic messages. Refer to Section 7, Troubleshooting, for diagnostic message information.
S1 Push Button Switch	For future applications.
PRIME LED {XR Relay} (red)	On – XR Relay is energized Off – XR Relay is de-energized or not used Flashing – XR Relay is running the programmed pickup delay
DAX A – DAX G LEDS (red)	Not Used in SGCP4000 / MS4000 application
PRE-EMPT LED (red)	Not Used in SGCP4000 / MS4000 application
MOTION LED (red)	On – Motion Sensor has not detected motion Off – Motion Sensor has detected motion
ISLAND LED (red)	On – Island is unoccupied Off – Island is occupied Flashing – Island is running its pickup delay
OUT 1 LED (red)	On – output energized Off – output de-energized or not used
OUT 2 LED (red)	On – output energized Off – output de-energized or not used
IN 1 LED (red)	On – input energized Off – input de-energized or not used
IN 2 LED (red)	On – input energized Off – input de-energized or not used
HEALTH LED (yellow)	Slow (1Hz) – module is healthy and communicating with CPU Fast (2Hz) – module is healthy but not communicating with CPU Very Fast (4Hz) – module is unhealthy and communicating with CPU
POWER LED (green)	LED is on steady when power is applied to the module
DIAG Serial Port	9-pin diagnostic serial port for Track module.

6.4.3 A80435 External Configuration Device (ECD)

The ECD is a factory installed plug-in device on the SGCP4000 / MS4000 backplane (see Figure 6-9). The ECD stores the module configuration file (MCF) and the application program for the SGCP4000 / MS4000. Both the Main and the Standby CPU Modules copy the MCF from the ECD, as it is used for vital system operation.

⚠ WARNING

WARNING

IF AN ECD IS REPLACED WITH AN ECD CONTAINING A DIFFERENT MCF, THE SGCP4000 / MS4000 WILL COPY THE NEW MCF INTO THE FLASH ON THE CPU MODULES AND SET THE SYSTEM BACK TO DEFAULT VALUES.

6.4.4 Chassis Identification Chip (CIC)

The CIC is a non-volatile memory chip that is installed adjacent to the ECD on the SGCP4000 / MS4000 backplane (see Figure 6-9). Each CIC stores site specific information for both Main and Standby vital operations.

⚠ WARNING

WARNING

IF THE CIC IS REPLACED, THE USER MUST SET THE SYSTEM BACK TO DEFAULTS AND REPROGRAM THE SYSTEM. FAILURE TO DO THIS COULD RESULT IN THE SYSTEM RUNNING WITH THE WRONG CONFIGURATION FOR THE SITE.

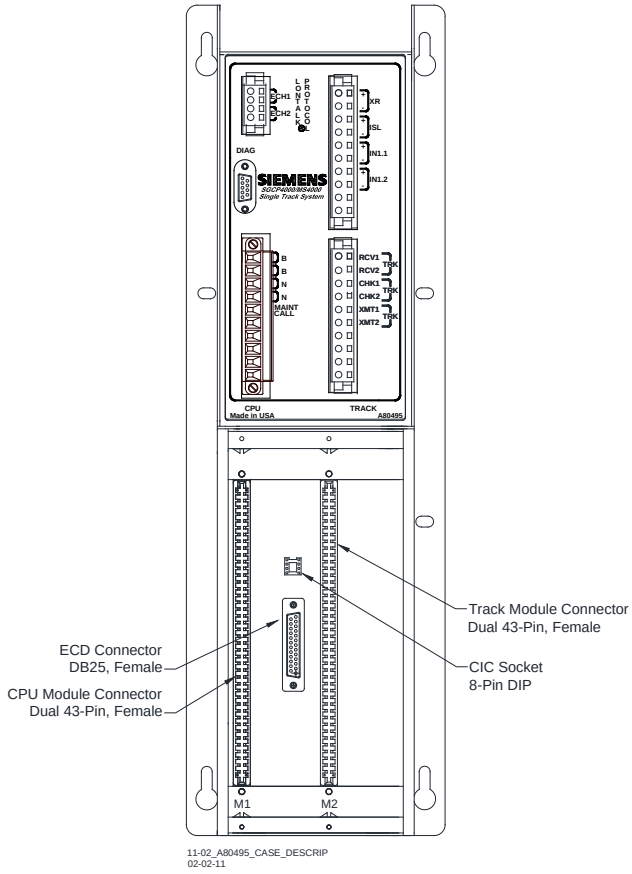


Figure 6-9:
Typical ECD & CIC Locations On Backplane

6.4.5 Interface Connector Functions

The SGCP4000 / MS4000 CPU interface connector functions are illustrated in Figure 6-10 and are described in Table 6-8; the SGCP4000 / MS4000 Track Connector interface functions s are illustrated in Figure 6-11 and are described in Table 6-9.

6.4.5.1 CPU Connectors

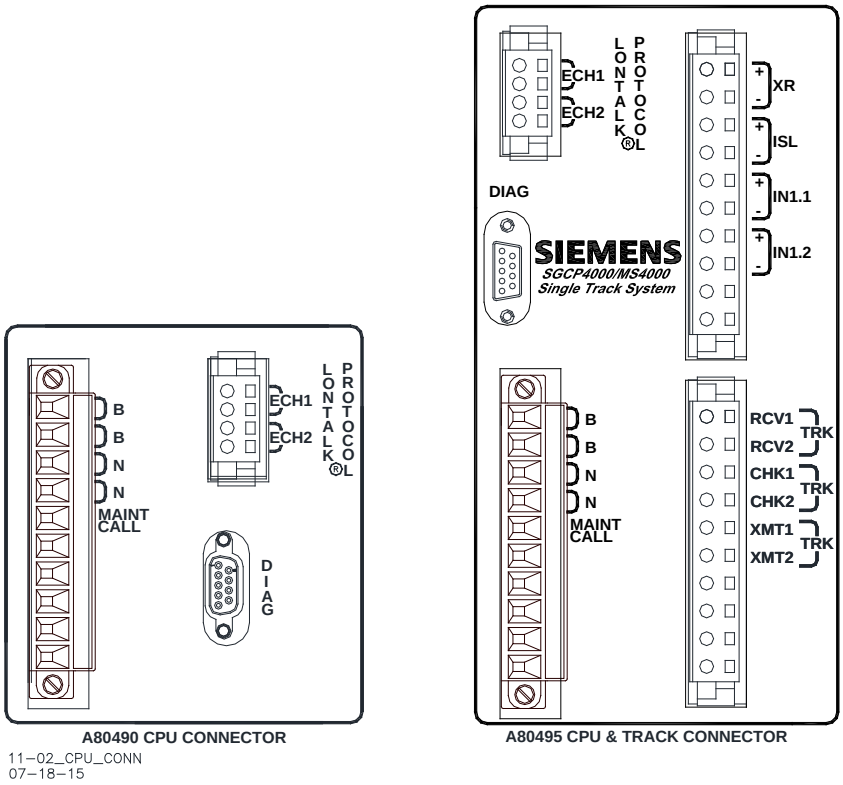


Figure 6-10:
A80490 & A80495 CPU Connectors

Table 6-8:
CPU Connectors

CONNECTOR	PINOUT	FUNCTION
LONTALK® PROTOCOL	ECH1	LAN Twisted pair
	ECH2	LAN Twisted pair
DIAG	2	DT_TX
	3	DT_RX
	4	GROUND
CPU	B	Battery B input to SGCP4000 / MS4000
	N	Battery N input to SGCP4000 / MS4000
	MAINT CALL	Battery power to Maint Call Light

6.4.5.2 Track Connector

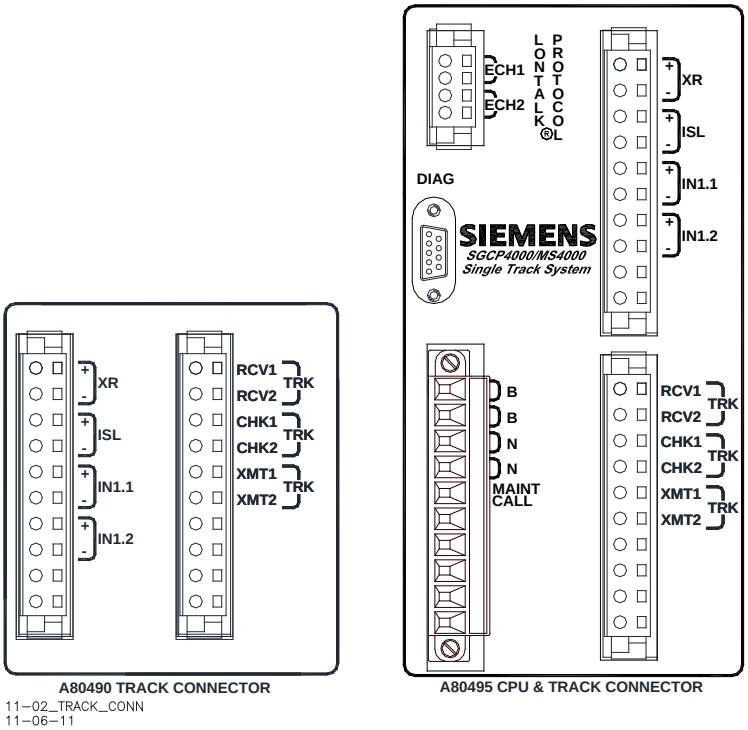


Figure 6-11:
A80490 and A80495 Track Connectors

Table 6-9:
Track Connectors

CONNECTOR	PINOUT*		FUNCTION
TRACK	+	XR	Vital output to crossing relay (XR)
	-		
	+	ISL	Vital output to island relay (ISL RLY)
	-		
	+	IN1.1	Vital input 1
	-		
	+	IN1.2	Vital input 2
	-		
	TRK RCV1		Receiver input from track
	TRK RVC2		
	TRK CHK1		Check input from track
	TRK CHK2		
	TRK XMT1		Transmit output to track
	TRK XMT2		

6.5 LAN COMMUNICATIONS

⚠ CAUTION

CAUTION

BECAUSE THE ECHELON® INTERFACE IS NOT SURGE PROTECTED, NETWORK CONNECTIONS MUST BE RESTRICTED TO THE EQUIPMENT CONTAINED INSIDE A SIGNAL CASE OR BUNGALOW.

NOTE

NOTE

For additional information concerning the Echelon® LAN, contact Siemens Technical Support.

Each SGCP4000 / MS4000 may communicate with other Siemens equipment via LONTALK® LAN (Echelon®) For further information, see Safetran's Echelon Configuration Handbook, COM-00-07-09.

6.5.1 ATCS Vital Protocol

Vital ATCS serial protocol data may be incorporated with the LONTALK® protocol to facilitate:

- Crossing control functions
- Vital communications with other Siemens vital controllers

SECTION 7 –
INSTALL, PROGRAM, CALIBRATE AND CHECKOUT
SGCP4000 / MS4000

7.1 GENERAL REQUIREMENTS

It is recommended that the following wiring and installation requirements be read before the starting installation.

⚠ WARNING

WARNING

VERIFY THAT THE SGCP4000 / MS4000 SOFTWARE, AND PROGRAMMING DATA ARE AS SPECIFIED BY THE RAILROAD'S OR AGENCY'S APPROVED DESIGN. FAILURE TO DO SO MAY LEAD TO INCORRECT OR UNSAFE OPERATION OF THE WARNING DEVICES.

FAILURE TO FOLLOW THE RAILROAD'S OR AGENCY'S APPROVED DESIGN REGARDING MOTION SENSOR SETTINGS AND CALIBRATION MAY LEAD TO POSSIBLE UNSAFE OPERATION OF THE WARNING DEVICES.

FOLLOWING INSTALLATION OR AFTER ANY MENU CHANGES HAVE BEEN MADE, RECALIBRATE THE MOTION SENSOR AND TEST FOR PROPER OPERATION PER THE REQUIREMENTS SPECIFIED IN TABLES 8-1 THRU TABLE 8-3 OF SIG-00-11-02, SGCP4000 / MS4000 INSTRUCTION & INSTALLATION MANUAL.

⚠ CAUTION

CAUTION

IF ANY MOTION SENSOR IS CALIBRATED IN POOR BALLAST CONDITIONS, IT MUST BE RE-CALIBRATED WHEN BALLAST CONDITIONS IMPROVE.

7.2 WIRING REQUIREMENTS

7.2.1 Battery Wiring

Battery wiring to the SGCP4000 / MS4000 equipment should be #16 AWG stranded minimum and twisted in pair. The wires are connected to at the shelter battery surge suppression panel. For proper battery surge protection, the battery surge suppression panel should be wired as shown in Figure 2-29.

7.2.2 Case Wiring

Case wiring to the SGCP4000 / MS4000 equipment should be #16 AWG stranded. See individual application drawings in Section 2 for additional information.

7.2.3 Track Wiring

Equipment connections to the rails should be as short as practical (preferably less than a 100-foot {30.5 meter} pair) and should be #9 AWG or #6 AWG.

7.2.4 External Wiring Connectors & Wire Size

All external wiring to a SGCP4000 / MS4000 Assembly is by means of plug-in connectors. The orange cage-clamp connectors for the signal circuits should use 16 to 12 AWG wire. The orange cage-clamp connector for the Echelon Lon Talk should use communication grade

twisted wires of at least 20. The green Screw-Lock connectors for the CPU and the SSCC should use 10 AWG wire.

NOTE

NOTE

Generic spare connectors that are not keyed for specific modules may be ordered. Refer to the catalog for ordering information.

7.2.5 Wire Preparation

Strip insulation from the end of the wire as follows:

Table 7-1:
Wire Preparation Standards

CONNECTOR TYPE	STRIP LENGTH
Screw terminal	0.28” (7 mm)
Cage clamp	0.32” – 0.35” (8 – 9 mm)

NOTE

NOTE

Use a stripping tool to accurately set the strip length. The addition of ferrules is not required.

7.2.6 Screw-terminal Connector Wire Insertion

Wires are secured to the screw-terminal connector as follows:

- Insert the stripped end of a wire into the wire receptor of the connector until it stops
- Tighten the screw to a torque of 4.5 inch pounds (0.508 Newton meters)

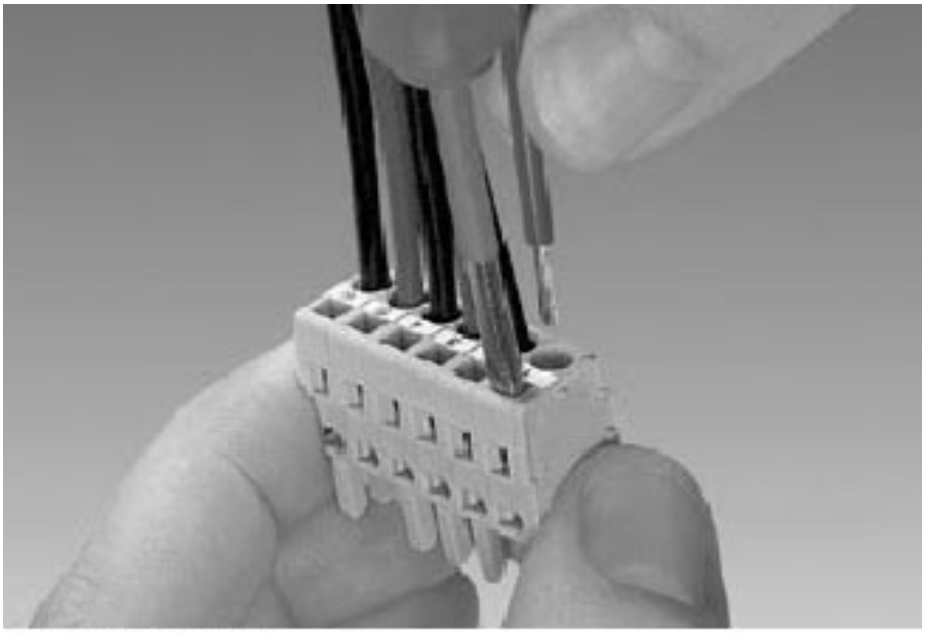


Figure 7-1:
Insertion of Wire into Cage-clamp Connector

7.2.7 Cage-clamp Connector Wire Insertion

Wires are secured to the cage-clamp connector as follows:

- Place a flat bladed screwdriver in the rectangular slot in the connector next to the wire receptor (see Figure 7-1).
- Use a screwdriver blade 0.10 in. wide and 0.020 in. thick (2.5mm x 0.5mm)
- Lever the wire cage clamp open by pressing straight down on the screwdriver
- Insert the stripped end of a wire into the fully-open wire receptor until it stops
- Hold the wire in place and release the screwdriver blade pressure
- The wire receptor closes on the stripped end of the wire

7.3 SYSTEM CUTOVER

The cutover test procedure should be used when initially installing, modifying, or after disarrangement of a SGCP4000 / MS4000 system.

NOTE

NOTE

This procedure does not supersede procedures of the maintaining railroad. This procedure is designed to supplement railroad procedures. In case of conflicts between procedures, the most restrictive procedure should govern.

Results of the tests may be documented on the SGCP4000 / MS4000 System Cutover Test Form, which is found in Appendix D of this document.
Unless otherwise noted, the term ‘activate crossing’ means activating the flashing light signals and gates by de-energizing an AND 1 XR Enable input.

7.3.1 Equipment Needed:

- Hardwire test shunt
- Test shunt
- Stop watch
- PC with Diagnostic Terminal, DT, software.
- Volt meter – Either a Agilent U1252A or equivalent with a True RMS AC + DC scale or a conventional volt-meter.

NOTE

NOTE

It is not necessary to remove power from the motion sensor case before installing or removing modules.

7.3.2 Equipment and Site Preparation

⚠ WARNING

WARNING

IF ISLAND STATUS IS CHANGED FROM EXTERNAL TO INTERNAL, ISLAND RECALIBRATION IS REQUIRED.

NOTE

NOTE

If the CPU module MCF or the Track Module are changed, requisite programming and recalibration will be required.

7.3.3 Recalibration & Reprogramming Requirements Due To Module Replacement

The recalibration requirements due to the replacement of a module are shown in the following table.

Table 7-2:
Recalibration and Reprogramming Requirements Due to Module/Chassis Replacements

PART NUMBER	MODULE	INTERNAL ISLAND CALIBRATION APPROACH CALIBRATION	INTERNAL ISLAND CALIBRATION ISLAND CALIBRATION	EXTERNAL ISLAND CALIBRATION APPROACH CALIBRATION	COMPLETE CHASSIS REPROGRAMMING REQUIRED
A80403	CPU	No	No	No	No
A40418	Track	Yes[1]	Yes	Yes[1]	No
A80406	Transfer	No	No	No	No
A80550	Display Unit	No	No	No	No
A80438-2	ECD[1]	No	No	No	Yes
A80495	Chassis	Yes	Yes	Yes	Yes
1 – Plug-in located on chassis behind CPU Module. Requires same MCF as previously in use.					

7.3.4 Recalibration Requirements Due To Program Changes

The program changes that require track recalibration are indicated in the following table.

Table 7-3:
Recalibration Requirements Due to Program Changes

PROGRAM CHANGES	INTERNAL ISLAND CALIBRATION APPROACH CALIBRATION	INTERNAL ISLAND CALIBRATION ISLAND CALIBRATION	EXTERNAL ISLAND CALIBRATION APPROACH CALIBRATION	COMPLETE CHASSIS REPROGRAMMING REQUIRED
Approach Frequency Change	Yes	No	Yes	No
Island Frequency Change	No	Yes	No	No
Directionality changed: UNI to BI/BIWD, or BI/BIWD to UNI	Yes	No	Yes	No
Transmit Level Changed	Yes	No	Yes	No
Ballast Compensation Value Changed	Yes	No	Yes	No
Application changed: EXT to Internal or Internal to EXT	Yes[1]	Yes[2]	Yes[2]	No
Template Set to Default selected	Yes	Yes	Yes	Yes
New Software Installed	Yes	Yes	Yes	Yes
1 If EZ varies by more than 2			2. If changed to Internal	

7.3.5 Recalibration Requirements Due To Track Equipment Changes

Changes made to the existing track equipment that require track recalibration are shown in the following table.

Table 7-4:
Recalibration Requirements Due to Track Equipment Changes

TRACK EQUIPMENT CHANGES	INTERNAL ISLAND CALIBRATION APPROACH CALIBRATION	INTERNAL ISLAND CALIBRATION ISLAND CALIBRATION	EXTERNAL ISLAND CALIBRATION APPROACH CALIBRATION
Termination Shunts Changed	Yes	No	Yes
Termination Shunts Moved to New Location	Yes	No	Yes
Change of shunt or frequency in overlapping territory	Yes	No	Yes
Termination Shunts of Other Frequencies Added, Removed From, or Moved Within the SGCP4000 / MS4000 Approaches)	Yes	No	Yes
Wide band Insulated Joint Couplers (8A076 or 8A077) Replaced in SGCP4000 / MS4000Approaches	Yes	No	Yes
Tuned Insulated Joint Couplers (62785-f) Replaced in SGCP4000 / MS4000 Approaches)	Yes	No	Yes
SGCP4000 / MS4000 Track Wire(s) Replaced, Disarranged, and/or Modified	Yes	Yes	Yes
Change of Insulate Joint Bypass Coupler (Tuned) 7A422-f	Yes	No	Yes

7.3.6 Install SGCP4000 / MS4000

1. Install and connect all SGCP4000 / MS4000 equipment per the railroad's or agency's approved design.
2. Connect all required wiring per the railroad's or agency's approved design.

7.3.7 Configure SGCP4000 / MS4000:

1. Observe the face of the CPU Card. SGCP4000 / MS4000 scrolls in the 4-Character Display (Figure 7-3).
    - Press and release the SEL button. PROG appears in the 4-Character Display.
    - Press and release the SEL button. AFRQ appears in the 4-Character Display. If the desired parameter value is displayed, proceed to step 6. Otherwise, press and hold the SEL until the currently programmed value flashes on the display.
    - To move down the menu, press and release the NAV button to scroll through the menu until the desired frequency value appears. To move back up the menu, press and release the SEL button until the desired frequency value appears.

NOTE

NOTE

Typically, the SEL button is used to select desired parameter values. However, when setting parameters in the AFRQ (approach frequency) and ISL (island frequency) portions of the menu, pressing the SEL button moves the parameter value back up the value list, eliminating the need to scroll all the way through the menu if a mistake in made in parameter value selection.

- Press and hold the SEL button until SET TFRQ = XXXX? (e.g., SET TFRQ=4000?) appears in the 4-Character Display. Press and hold the SEL until WAIT appears. Release the SEL button. After the parameter value is saved, TFRQ=XXXX (e.g., TFRQ=4000 HZ) appears.
- Continue programming the values per the railroad's or agency's approved design until all main menu items have been programmed. If no values from the Advanced (ADVD) menu require programming, proceed to step 8.
- Press and release the SEL value when the ADVD sub-menu appears, and begin programming with the Positive Start EZ Value (PSTR) and program per the railroad's or agency's approved design until all sub-menu items have been programmed.

8. Once all required parameters have been programmed, proceed to Section 7.3.8, Calibrate the SGCP4000 / MS4000.

7.3.8 Calibrate the SGCP4000 / MS4000

The MS 4000 may operate using an internal island (ISL frequency is set) or an external island (EXT is set). The calibration process differs depending upon whether the internal or external island is selected.

1. Observe face of Track Card. The display scrolls GCAL, ICAL, the EZ value, the EX value and the Island value (e.g., I250). On the CPU card, LED 3 is unlit.
2. Observe face of the CPU Card. To calibrate the approach (GCAL):
   - Navigate to the CAL menu. Press and release the SEL button. MCAL appears in the display.
   - Press and hold the SEL Button. Release the SEL Button when *CAL appears, as *CAL alternating with MCAL signifies that the calibration process has begun.
   - PASS or FAIL appears for twenty (20) seconds when calibration is complete.

⚠ WARNING

WARNING

IF "FAIL" APPEARS ON THE DISPLAY AND CPU CARD LEDS DO NOT LIGHT, THE CALIBRATION PROCESS DID NOT COMPLETE. SHOULD THIS HAPPEN, CYCLE THE UNIT POWER AND THEN REPEAT THE APPROPRIATE STEP. IF THE UNIT FAILS TO COMPLETE THE CALIBRATION PROCESS, FURTHER TROUBLESHOOTING IS REQUIRED. REFER TO THE SECTION 8, TROUBLESHOOTING, THIS MANUAL.

   - If FAIL appears, perform the measures directed in the WARNING immediately above. If Pass appears, proceed to Step 3.

The island can be calibrated to respond to a shunting sensitivity of 0.12, 0.3, 0.4, or 0.5 ohms. A hardwire shunt is used for calibration.

NOTE

NOTE

Island track circuit calibration is generally performed using 0.12 ohm shunting sensitivity. In an area where poor shunting is experienced or anticipated, a minimum of 0.3 ohm shunting sensitivity is recommended.

In areas of passenger operation, a minimum of 0.3 ohm shunting sensitivity is recommended.

In areas of passenger operation, a minimum of 0.3 ohm shunting sensitivity is recommended.

3. If the internal island is enabled, proceed to Step 4. If the external island is enabled, proceed to Step 6.

Table 7-5:
Island Shunt Distance in Feet/Meters

ISLAND FREQUENCY	0.12 OHM SENSITIVITY	0.3 OHM SENSITIVITY	0.4 OHM SENSITIVITY	0.5 OHM SENSITIVITY
2.14	20/6.10	50/15.24	67/20.42	84/25.60
2.63	17/5.18	43/13.11	58/17.68	72/21.95
3.24	13/3.96	33/10.06	44/13.41	55/16.76
4.0	10.5/3.20	27/8.23	36/10.97	45/13.72
4.9	9.0/2.74	23/7.01	31/9.45	39/11.89
5.9	7.5/2.29	19/5.79	26/7.92	32/9.75
7.1	6.5/1.98	17/5.18	23/7.01	29/8.84
8.3	6.0/1.82	15/4.57	20/6.10	25/7.62
10.0	5.0/1.50	13/3.96	18/5.49	22/6.71
11.5	4.5/1.37	12/3.66	16/4.88	20/6.10
13.2	4.0/1.22	10/3.20	14/4.27	17/5.18
15.2	3.5/1.07	9/2.74	12/3.66	15/4.57
17.5	3.0/0.91	8/2.44	11/3.35	14/4.27
20.2	3.0/0.91	8/2.44	11/3.35	14/4.27

4. Observe face of the CPU Card. To calibrate the island:
   - Connect a hardwire shunt at the distance beyond the receiver track connections specified in Table 7-5 for the desired sensitivity. Verify solid connections of the shunt to each rail.
   - ICAL appears in the display. Press the SEL Button until *CAL appears alternating with ICAL. Release the SEL Button. The calibration process begins.
   - *CAL and ICAL alternately flash during the calibration process.
   - PASS or FAIL appears for twenty (20) seconds when calibration is complete. When PASS appears, continue to Step 5. If FAIL appears, the CPU card LEDs do not light; refer to the WARNING above.
5. Remove the test shunt.
6. LEDs #2 & #3 on the CPU card should light following calibration. If the LEDs do not light, proceed to the Section 8 – Troubleshooting this manual.

7. If the unit is programmed as a motion sensor (PRED=NO / *Prime MS/GCP Mode=NO), proceed to Step 13. If the unit is programmed as a simple predictor (PRED=YES / *Prime MS/GCP Mode=YES), proceed to Step 8.
8. Observe the face of the CPU Card. To calibrate the approach distance (ACAL):
   - Press and release the NAV button. ACAL appears in the display.
   - Press and hold the SEL Button. Release the SEL Button when *CAL appears, as *CAL alternating with ACAL signifies that the calibration process has begun.
   - PASS or FAIL appears for twenty (20) seconds when calibration is complete.
   - If PASS appears, proceed to Step 6. If FAIL appears, proceed to Step 5 to manually enter the approach EZ.
9. Press and release the NAV button until APPEZ=100 appears.
   - Press and hold the SEL Button. Use the NAV to increase the numerical value depicted on the 4-Character Display and the SEL button to navigate between the columns on the display.
   - When the desired EZ value is displayed, press and hold the SEL button until SET APPEZ= XXX? (e.g., SET APPEZ=100?) appears in the 4-Character Display. Press and hold the SEL until WAIT appears. Release the SEL button. After the parameter value is saved, APPEZ=XXXX (e.g., APPEZ=100) appears.
10. Accurately (within 1%) locate the midpoint of the approach and move the hardwire shunt to that point on the rails.
11. Navigate down the menu until LCAL appears.
    - Press and release the NAV button. LCAL appears in the display.
    - Press and hold the SEL Button. Release the SEL Button when *CAL appears, as *CAL alternating with LCAL signifies that the calibration process has begun.
    - PASS or FAIL appears for twenty (20) seconds when calibration is complete.
    - If PASS appears, calibration is complete. If FAIL appears, proceed to Step 12 to manually enter the linearization steps.
12. Press and release the NAV button until LIN=100 appears. .
    - Press and hold the SEL Button until the “100” begins to flash. Use the NAV to increase the numerical value depicted on the 4-Character Display and the SEL button to navigate between the columns on the display or hold the SEL button to bypass LIN.
    - When complete “SET LIN=XXX” (e.g., SET LIN=100) appears. Bypass is now complete.
13. Press and hold the SEL button until DONE appears.
14. Press and hold the NAV button until “SGCP4000 / MS4000” appears in the display.

7.3.9 Track Module (A80418) Response Test

After calibration check the Track Module response using the following procedure:

1. Observe face of Track Card. The display scrolls GCAL, ICAL, the EZ value, the EX value and the Island value (e.g., I250). On the CPU card, LED 3 is unlit.
2. Following railroad policies concerning the use of jumpers, place a jumper wire across the RCV1 and RCV2 receiver wires at the main terminal board and verify the EZ value is less than or equal to 5. If the EZ value is greater than 5 and the jumper is confirmed to be securely connected, use additional jumper wires in parallel until an EZ less than or equal to 5 is achieved. Note the Island Z value (e.g. I020) and verify the value is less than or equal to 40.

3. Remove the jumpers and allow the unit to recover.
4. Following railroad policies concerning the use of jumpers, place a jumper wire across the XMT1 and XMT2 receiver wires at the main terminal board and verify the EZ value is less than or equal to 5. If the EZ value is greater than 5 and the jumper is confirmed to be securely connected, use additional jumper wires in parallel until an EZ less than or equal to 5 is achieved. Note the Island Z value (e.g. I020) and verify the value is less than or equal to 40.
5. Remove the jumpers and allow the unit to recover.
6. If either the Island Z value is greater than 40, perform a full island calibration as detailed in Section 7.3.8 and repeat the Response Test in Section 7.3.9.

15. If after performing the Response Test and Recalibration the Island value remains greater than 40, remove the Track Module from service and contact Siemens Rail Automation Technical Support at (800) 793-7233, Option 1, inform the operator you have a Track Module that failed the functional checks as described in this procedure and CSB 3-15D. Be prepared to provide the following:

1. Your Contact Information
2. Part Number
3. Serial Number
4. The EZ and Z values recorded during the test

7.3.10 Auxiliary Equipment Calibration Procedures

⚠ WARNING

WARNING

TRACKS MUST BE VERIFIED TO BE FREE OF ANY AND ALL TRACK RELATED ISSUES PRIOR TO BEING PLACED IN SERVICE. ANY TRACK RELATED ISSUES THAT ARE IDENTIFIED MUST BE CORRECTED AND VERIFIED TO BE CORRECT PRIOR TO FINAL CALIBRATION AND LINEARIZATION.

NOTE

NOTE

If the outlined procedures fail, they should be repeated once. If the error repeats, refer to the Troubleshooting section.

SGCP4000 / MS4000 calibration is divided into the following procedures:

- Tuning the Tuned Joint Coupler (TJC)
- Approach Calibration (MCAL)
- Island Calibration (ICAL)

⚠ WARNING

WARNING

PERFORM THE FOLLOWING TUNING PROCEDURES ON THE TUNED JOINT COUPLER PRIOR TO BEGINNING THE CALIBRATION PROCESS.

7.3.11 Tuning the 62785-f Tuned Joint Coupler

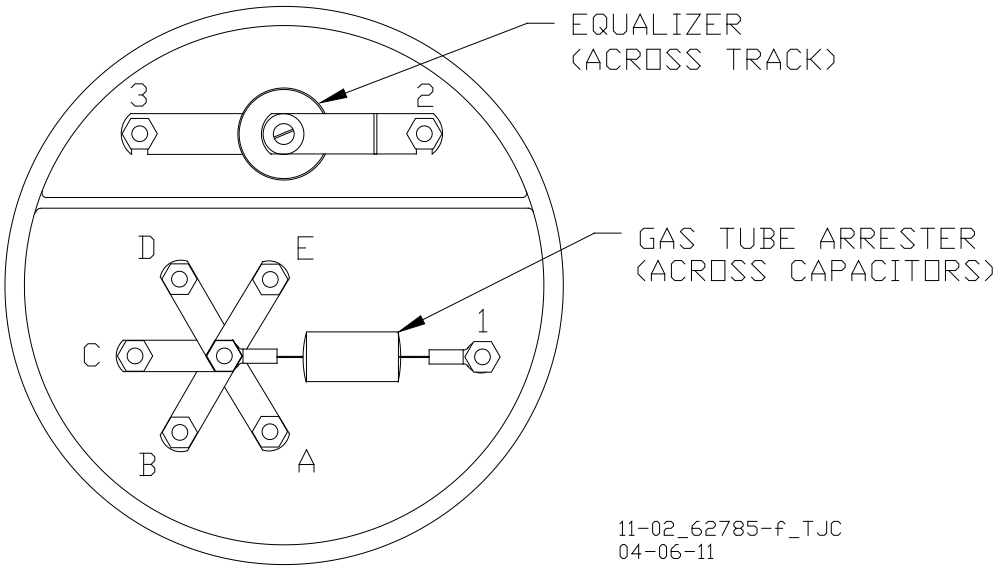


Figure 7-2:
Tuned Joint Coupler, 62785-f

The Tunable Insulated Joint Bypass Coupler, 62785-f is the only tuned bypass coupler to be used with the SGCP4000 / MS4000 for bypassing insulated joints in DC coded track.

- The 62785-f Bypass Coupler is used in all SGCP4000 / MS4000 applications requiring the use of a tuned insulated joint bypass coupler.
- The 62785-f Coupler is available in standard Safetran frequencies of 114 Hz through 970 Hz.

The application guidelines for Tunable Insulated Joint Bypass Coupler, 62785-f when used only with the SGCP4000 / MS4000 have been expanded as follows:

- In DC coded track circuits, the insulated joints within an approach may be bypassed using the Safetran 62785-f Tunable Insulated Joint Bypass Coupler, provided the minimum distances specified in Table 7-6 are observed.
- The 62785-f Coupler must be field tuned to pass the SGCP4000 / MS4000 operating frequency (f) around insulated joints in DC or coded DC track circuits.
- Field tuning of the Coupler enables precise frequency adjustment for track and joint parameters.
- The Coupler must be located within 10 feet (3.048 meters) of the insulated joints that it is coupling.
- The minimum distance to the insulated joints is generally a function of the SGCP4000 / MS4000 operating frequency; i.e., the lower the operating frequency, the longer the minimum distance.

Two sets of insulated joints may be coupled in any single approach, provided the minimum operating distances specified in Table 7-6 are observed.

- Table 7-6 indicates the minimum operating distances (in feet & meters) to the first and second set of insulated joints that are coupled with 62785-f couplers for SGCP4000 / MS4000 operation.

Table 7-6:
Tuned Joint Coupler, 62785-f Minimum Distances

FREQUENCY (HZ)	MINIMUM DISTANCE TO 1ST SET OF INSULATED JOINTS (FEET/METERS)*	MINIMUM DISTANCE TO 2ND SET OF INSULATED JOINTS (FEET/METERS)*
151 to 211	1500/458	2200/671
212 to 348	1000/305	1400/427
349 to 560	700/214	1000/305
561 to 790	500/153	800/244
791 to 979	400/122	700/214

* Distance applies to insulated joints located on the same side of the crossing.

NOTE: Frequencies of 86 and 114 Hz are not normally used with the 62785-f coupler. Contact Siemens Technical Support (1-800-793-7233) for these applications.

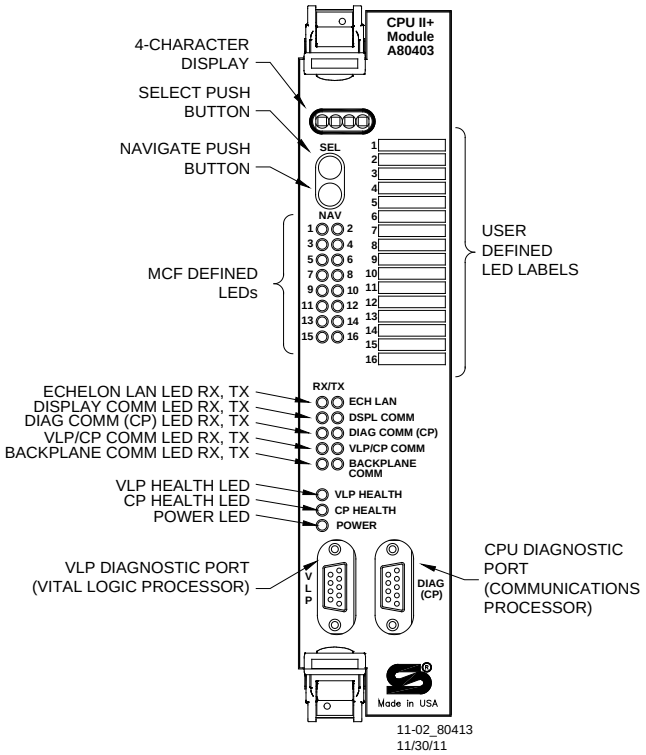


Figure 7-3:
CPU Card, A80403

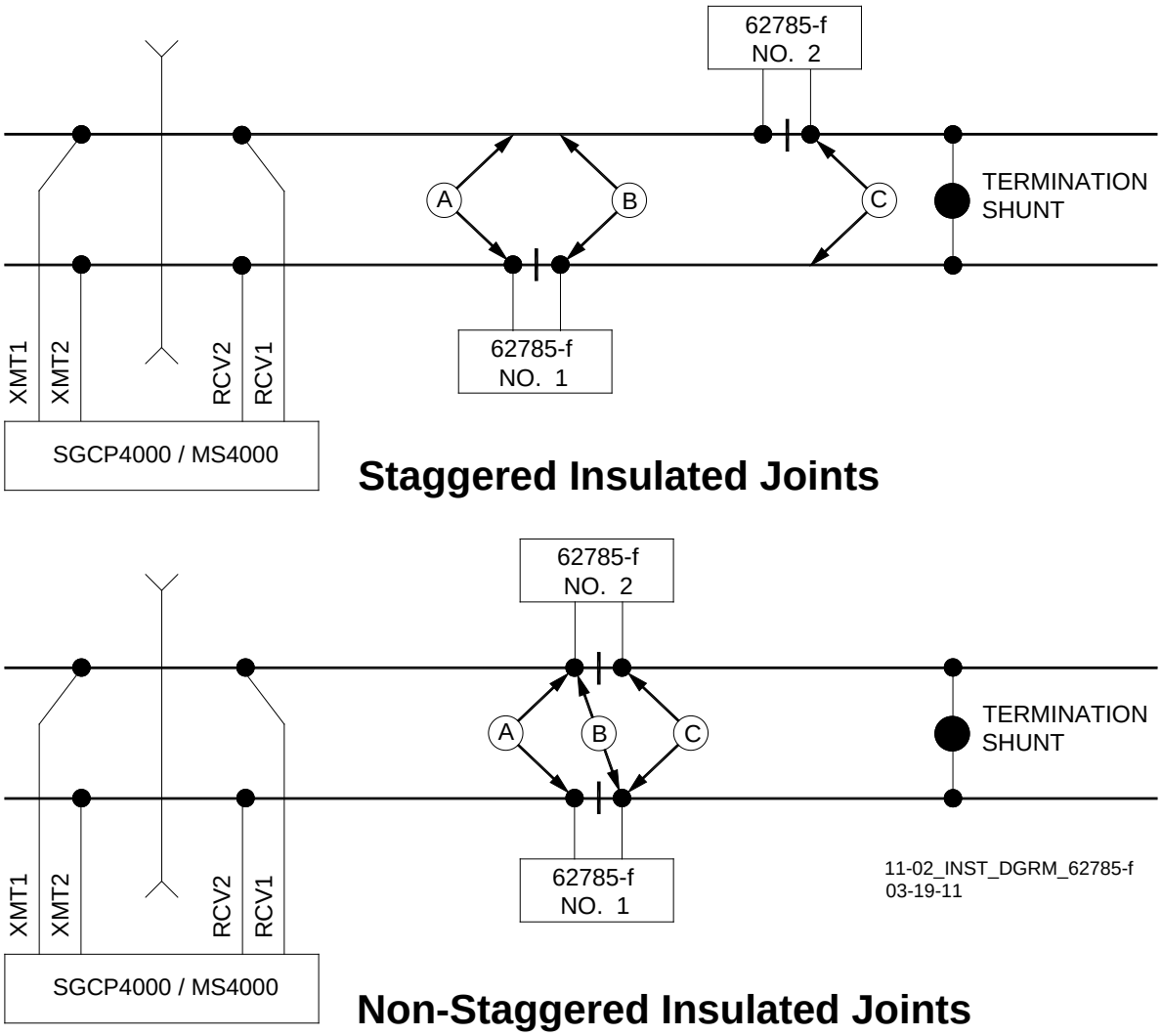


Figure 7-4:
Shunt Placement For 62785f Bypass Coupler

WARNING

WARNING

AT THE COMPLETION OF FIELD TUNING THE 62785-F BYPASS COUPLERS ENSURE THAT A STANDARD AREMA NUT IS TIGHTENED SECURELY AGAINST EACH GOLD NUT ON TERMINALS A THROUGH E, INCLUDING THE TERMINALS THAT ARE NOT TIGHTENED DOWN.

NOTE

NOTE

While field tuning the 62785-f Bypass Coupler, tightening the nut on terminal E produces maximum change in EZ value. Tightening the nut on terminal A produces minimum change. The 62785-f Coupler is tuned by means of five standard AREMA binding posts.

- AREMA binding posts are labeled A through E (see Figure 7-2)
- AREMA binding posts are equipped with special gold AREMA adjustment nuts

Table 7-7:
Method 1 for Tuning the 62785-f Tuned Joint Coupler (Refer to Figure 7-4 for Locations)

Step 1	Tighten the gold nut securely on terminal E of each coupler.
Step 2	Calibrate the SGCP4000 / MS4000, setting the EZ value to 100.
Step 3	Place a hardwire test shunt across the track at location A.
Step 4	Note the EZ value appearing on the SGCP4000 / MS4000 display.
Step 5	Move the test shunt to location B.
Step 6	Tune the Tunable Insulated Joint Bypass Coupler #1 to the same EZ value noted in Step 4. • Tighten the gold nut on the Coupler #1 terminals labeled D, C, B, and A, in sequence beginning with terminal D. • If tightening a nut results in an EZ value that is lower than the value recorded in step 4, loosen the nut and tighten the next nut in sequence. • If, after tightening a nut, the EZ value remains higher than the value recorded in step 4, leave the nut tightened and tighten the next nut in sequence. • Continue to tighten nuts D through A as necessary to obtain an EZ value that is approximately the same as that recorded in step 4.
Step 7	Move the test shunt to location C.
Step 8	Tune the No. 2 Tunable Insulated Joint Bypass Coupler to the EZ value noted in step 4. • Tighten the gold nut on the Coupler #2 terminals labeled D, C, B, and A, in sequence beginning with terminal D. • If tightening a nut results in an EZ value that is lower than the value recorded in step 4, loosen the nut and tighten the next nut in sequence. • If, after tightening a nut, the EZ value remains higher than the value recorded in step 4, leave the nut tightened and tighten the next nut in sequence. • Continue to tighten nuts D through A as necessary to obtain an EZ value that is approximately the same as that recorded in step 4.
Step 9	Remove the test shunt.
Step 10	Tighten a standard AREMA nut against each gold nut of both couplers to ensure all nuts are securely locked in position.
Step 11	Secure the end caps over the terminal end of both couplers.
Step 12	Completely recalibrate the SGCP4000 / MS4000 and perform all operational checks.
Step 13	Verify that a smooth change in the EZ value occurs across the couplers during a train move.

Table 7-8:
Method 2 for Tuning the 62785-f Tuned Joint Coupler (Refer to Figure 8-2 for Locations)

Step 1	Tighten the gold nut securely on terminal E of each coupler.
Step 2	Calibrate the SGCP4000 / MS4000, setting the EZ value to 100.
Step 3	Place a hardwire test shunt across the track at location A.
Step 4	Note the EZ and EX values appearing on the SGCP4000 / MS4000 display.
Step 5	Move the test shunt to location B.
Step 6	Tune the Tunable Insulated Joint Bypass Coupler #1 **EX** value to above 75. The **EZ** value may be as much as 8 points above the value noted in Step 4.
Step 7	Move the test shunt to location C.
Step 8	Tune the Tunable Insulated Joint Bypass Coupler #2 **EX** value to above 75. The **EZ** value may be as much as 16 points above the value noted in Step 4.
Step 9	Remove the test shunt.
Step 10	Tighten a standard AREMA nut against each gold nut of both couplers to ensure all nuts are securely locked in position.
Step 11	Secure the end caps over the terminal end of both couplers.
Step 12	Completely recalibrate the SGCP4000 / MS4000 and perform all operational checks.
Step 13	Verify that a smooth change in the EZ value occurs across the couplers during a train move.

⚠ WARNING

WARNING

AT THE COMPLETION OF FIELD TUNING THE 62785-F BYPASS COUPLERS ENSURE THAT A STANDARD AREMA NUT IS TIGHTENED SECURELY AGAINST EACH GOLD NUT ON TERMINALS A THROUGH E. TERMINALS THAT ARE NOT USED FOR TUNING THE COUPLER MUST HAVE THEIR GOLD NUTS REMOVED.

7.4 SGCP4000 / MS4000 OPERATIONAL TESTS

Prior to placing a system in service, tests must be performed to verify proper system operation and I/O wiring. Proceed to next step if a feature is not used.

⚠ WARNING

WARNING

AFTER INITIAL PROGRAMMING OR PROGRAMMING, MODULE, TRACK, OR WIRING CHANGES, TESTS MUST BE PERFORMED TO VERIFY PROPER OPERATION OF THE MOTION SENSOR PRIOR TO PLACING A SYSTEM IN SERVICE.

IF A RAPID CHANGE OCCURS IN THE VALUE OF EZ AT ANY TIME THE TRAIN IS MOVING WITHIN THE TERMINATION SHUNTS, TRACK DISCONTINUITY CAUSED BY A HIGH RESISTANCE BOND OR A DEFECTIVE COUPLER IS INDICATED. LOCATE AND CORRECT THE PROBLEM IMMEDIATELY.

THE RAILROAD PROCEDURES GOVERNING HOW TO TAKE A TRACK CIRCUIT OUT OF SERVICE SHALL BE FOLLOWED. THE INSTRUCTIONS IN THIS SECTION MAY BE FOLLOWED ONLY IF ALLOWED BY THE RAILROAD.

Table 7-9:
SGCP4000 / MS4000 Operational Tests

Step 1	Check tracks for: • Open transmit wire • Crossing activates • EZ = 0 Or • Open receive wire • Crossing activates • EZ = 0
Step 2	UAX, if used: Crossing activates when each remote line circuit that controls a UAX is de-energized or opened from the far end of the circuit. Pickup Delay time is correct when input closes.
Step 3	Out of Service, OOS, if this feature is used: 4-Character Display reflects time remaining in OOS
Step 5	If Positive Start, and/or Sudden Shunt Detection are used: • Shunt at the appropriate point • Take the required measurements • Reprogram EZ threshold levels as required
Step 6	If the predictor is used: • Perform Approach Calibration • Edit the Comp Dist, if required • Determine the 50% approach distance • Shunt at the appropriate point • Perform Linearization Calibration • Edit the Lin Steps, as required

Finishing Step 6 completes the SGCP4000 / MS4000 operational checks / tests. Now verify proper Train Detection, Warning Time, and Crossing Activation.

Table 7-10:
Train Detection, Warning Times, and Crossing Operation

Step 1	EZ continuity check on train moves: • Crossing devices activate and EZ value decreases smoothly (without rapid change) for an approaching train. • Crossing devices turn off when island recovers after train move and the EZ rises smoothly (without rapid change) as the train recedes.
Step 2	Check warning times for inbound train moves on each approach including UAX operation.
Step 3	Check for proper gate / flasher / bell operation on all train moves.

7.5 VIEW SGCP4000 / MS4000 HARDWARE & SOFTWARE VERSION DATA:

To view SGCP4000 / MS4000 Hardware and Software Data:

1. Observe the face of the CPU Card. SGCP4000 / MS4000 scrolls in the 4-Character Display (Figure 7-3).
2. Press and release the SEL button. PROG appears in the 4-Character Display.
3. Press the NAV button to scroll down the menu until VERS appears.

4. Press and release the SEL button. Press the NAV button to scroll to the desired sub-menu (CP, VLP, TRK, or CFG).
5. On the desired sub-menu (e.g., CP), press and release the SEL button. The first parameter appears.
6. Review the parameter values by pressing the NAV to scroll through each value.
7. Move back up the menu by pressing and holding the NAV button for approximately 2 sec.

7.6 VIEW WARNING TIME OF THE PREVIOUS TRAIN

To view the Warning Time (measured in seconds) of the previous train:

1. Observe the face of the CPU Card. SGCP4000 / MS4000 scrolls in the 4-Character Display (Figure 7-3).
2. Press and release the SEL button. PROG appears in the 4-Character Display.
3. Press the NAV button to scroll down the menu until TRWT appears.
4. Press and release the SEL button. The Warning Time appears in the 4-Character Display.

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SECTION 8 – TROUBLESHOOTING

8.1 ERROR CODES

⚠ WARNING

WARNING

IF APPROACH LENGTH IS REDUCED, MAXIMUM TRAIN SPEED MUST ALSO BE CORRESPONDINGLY REDUCED.

NOTE

NOTE

Throughout Table 8-1, any reference to GCP includes the Simple Grade Crossing Predictor 4000 / Motion Sensor 4000 (SGCP4000 / MS4000).

Disp. Code refers to the codes being displayed in the 4-Character Display on the CPU Card or Track Card.

The following table provides a listing of the error codes used with the SGCP4000 / MS4000:

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag1000	RECV	Track	GCP Recovering	The GCP runs a 30s recovery timeout after an error has cleared	None
Diag1001	GSTB	Track	GCP Stabilizing	On startup GCP is output stabilizes for 20s before normal operation	None
Diag1002	HIEZ	Track	High EZ	A High EZ is caused by: a) high resistance bond b) broken rail c) defective termination shunt d) high resistance connection to termination shunt e) defective insulated joint coupler f) ballast has increased since calibration	a) check for high resistance bond b) check for broken rail c) check for defective termination shunt d) check for high resistance connection to termination shunt e) check for defective insulated joint coupler f) recalibrate the GCP only after verifying that none of the other causes above exist
Diag1003	LWEX	Track	Low EX	Low EX is caused by low ballast resistance possibly due to: a) salted crossing b) poor drainage at the crossing c) mud between rails	If above signs of poor ballast are present, consider: a) using a lower GCP frequency b) temporarily shortening the approach c) check if low EX Adjust is applicable as directed in the manual

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag1004	LWEZ	Track	Low EZ Detected	a) A train sitting on the approach for longer than the configured Low EZ detection timer b) A false shunt on the track c) Broken receive track wire	a) If the cause is a train sitting on the approach, turn off the low EZ detection temporarily until the train has left b) Check for false shunts on the track, and ensure EZ has gone back to it normal value after the shunt is removed. c) if the above shunts are not found, see other diagnostics messages for broken receive wire
Diag1005	RXEX	Track	Receive Wire EX Error	Generally occurs at cutover, and means that the receive wires and transmit wires are misphased.	Check the receive wires for proper phasing
Diag1006	CKEX	Track	Check Wire EX Error	Generally occurs at cutover with 6 wire installations, and means that the check wires and transmit wires are misphased.	Check the check wires for proper phasing
Diag1007	CHK2	Track	Gain Check - Check Wire Error	The error generally occurs when there is a high resistance or open connection in the check wire	Check for high resistance or open connection in check wire
Diag1008	CHK1	Track	Gain Check - Receive Wire Error	The Gain Check Receive Error is caused when the receiver wires have a low reading and the check wires have a high reading	Check the receive and check wires
Diag1009	CHK3	Track	Gain Check Island Error	The Gain Check Island Error is caused when the receiver and check wires have a low reading indicating that the train is at EZ zero, but the island has not become occupied. Note: this check is only done when the GCP and island share the same pair of transmit wires.	a) Check the receive and check wires b) check the island shunting and calibration
Diag1010	CHCK4	Track	Gain Check Error	The Gain Check Error is caused when the receiver and check wires have a reading that differs by a significant amount. This could be due to: a) High resistance or open connection (if no train is present) b) high resistance in transmitter (if a train is present)	a) Check for high resistance or open connections in check and receive wires b) check for high resistance in transmitter

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag1011	GMAX	Track	GCP Transmitter	The GCP Transmitter Error is caused when the card detects either: a) high resistance or open track wire or track wire rail connection or b) Unidirectional installation: open termination; open coupler; or open bond,	a) Check that transmit wires are connected properly b) Check for open termination, open coupler, open bond,
Diag1012	GFRQ	Track	No GCP frequency	This message indicates that Ms/GCP Operation has been requested but no GCP frequency has been selected	Select a GCP frequency from the Program menu
Diag1013	GIPS	Track	IPS Mode	IPS Mode is shown when the card has been configured with the Enhanced Detection option On and the card has detected in bound poor shunting.	None.
Diag1014	GRCV	Track	Receiver Error 1	Receiver Error 1 is caused by an unacceptable difference between the redundant receivers on the module	Replace the track module
Diag1015	GRCV	Track	Receiver Error 2	Receiver Error 2 is caused by an unacceptable difference between the redundant receivers on the module	Replace the module
Diag1016	GEXP	Track	EX Process Prediction	An EX Process Prediction is possibly caused by: a) poor shunting b) a high resistance bond or c) coupler	Check that no high resistance bonds are present
Diag1017	UCFG	Track	No Communications	No Communications indicates that the track card is not communicating with the CPU	a) Check that there is a module in the appropriate slot, b) Check to see if the module is continuously rebooting (Boot shows on the 4 character display every minute or so), if it is replace the module. c) If the module is not continuously rebooting, then check to see if the module says UCFG on its display. If only this module is shows UCFG, then replace it, if all Track modules show UCFG then replace the CPU
Diag1018	GLCK	Track	Power Up Lockout Error	This occurs when the EZ or check EZ values are below three after a power up. This could be caused by a) a train shunting the tracks or b) open receive or check wires	a) Check to see if a train is present, if it is the lockout can be cleared using the diagnostic terminal b) if no trains are present verify that the check and receive wires are connected properly

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag1019	GHWR	Track	Track Hardware Error	This occurs when the track card detects that its hardware is not operating correctly	Replace the hardware
Diag1020	GCAL	Track	GCP Calibration Required	The GCP requires calibration if the: a) module was replaced b) MCF was changed c) the program was set to defaults or if one of following has changed: i) frequency ii) approach distance iii)compensation value iv) transmit level v) bi/uni directional	Check that the module is programmed correctly then go to the Setup Track GCP Calibration screen, and calibrate the GCP as described in the manual
Diag1021	GAPP	Track	GCP Approach Calibration Required	The GCP requires approach calibration if the: a) GCP calibration was performed b) module was replaced c) program was set to defaults d) programmed approach distance has changed e) MCF was changed	Go to the Setup Track Approach Calibration screen. If the computed approach distance is correct, hit the bypass button. If the computed approach distance is known for this track from a previous calibration, enter the correct value by hitting the edit button. If the computed approach distance is incorrect and not known, perform an approach calibration as described in the manual.
Diag1022	GLIN	Track	GCP Linearization Required	The GCP requires linearization if the: a) GCP calibration was performed b) GCP approach calibration was performed c) module was replaced d) program was set to defaults e) programmed approach distance has changed f) MCF was changed	Go to the Setup Track Linearization Screen. If the linearization value is correct, hit the bypass button. If the linearization value is known for this track from a previous calibration, enter the correct value by hitting the edit button. If the linearization value is incorrect and not known, perform a linearization as described in the manual.
Diag1200	VOER OUT	Track	OUT Correspondence Check Error	OUT Correspondence Check Error is caused by the module detecting a state on its output that is not in correspondence with the commanded state of the OUT.	a) check that the output is not shorted b) replace the module
Diag1201	GSWR	Track	Software Compatibility Error	The software (MEF) in the track module is incompatible with the MCF running in the CPU	a) install the latest track module MEF b) install the latest MCF
Diag1202	GMAX	Track	GCP Transmit Level	This version of GCP module does not support the MAX transmit level	a) set transmit level to Medium or High b) change A80418 module to rev newer than rev D

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag1202	GPRM	Track	Prime Offset Error	The track module is configured to expect an island and the prime has a non-zero offset value	a) set the prime to zero offset if applicable b) if island is used at remote location, use a DAX not the prime c) set the Island Connection to No Islands if no island is intended
Diag1203	ICON	Track	Island Connect Error	The GCP Island Connection indicates an island is connected, but no island is turned on	a) turn the island on, if applicable b) set the island connection to No Islands if no island is intended
Diag1300	IFRQ	Track	No Island Frequency Selected	This message indicates that Island Operation has been requested but no island frequency has been selected	Select an island frequency from the Program menu
Diag1301	ISTB	Track	Island Stabilizing	On startup the island output stabilizes for about 10s	None
Diag1302	ITST	Track	Island Self Test Error	Island Self Test Error is caused when an interfering signal causes large variations in the Island receive signal.	a) Check for interfering signals on the track b) Change IPI frequencies c) Replace the module
Diag1303	RECV	Track	Island Recovering	The Island runs a 30s recovery timeout after an error has cleared	None
Diag1304	IXMT	Track	Island Transmitter Error	The Island Transmitter Error is caused when the card detects either: a) high resistance or open track wire or track wire rail connection b) Unidirectional installation: open termination, open coupler, open bond	a) Check that transmit wires are connected properly b) Check for open termination, open coupler, open bond,
Diag1305	ICAL	Track	Island Calibration Required	The Island requires calibration if the: a) module was replaced b) MCF was changed c) the program was set to defaults or if the frequency has changed	Check that the module is programmed correctly then go to the Setup Track Island Calibration screen and calibrate the island as described in the manual
Diag3001	DFT	CPU	Operating Parameters set to default	New MCF has been loaded	Set the operating parameters to the required values
Diag3002	DFT	CPU	Vital Cfg Params set to default	New MCF has been loaded or UCN changed	Set the vital CFG parameters to the required values
Diag3003	CRPT	CPU	MCF checksum incorrect	MCF is corrupt	Reload the MCF
Diag3004	CRC	CPU	MCF CRC incorrect	a) incorrect MCF CRC has been entered for this MCF b) the MCF is corrupt	a) reload MCF CRC b) reload MCF
Diag3005	MCF	CPU	MCF Checks failed	the MCF is invalid	obtain and load a valid MCF
Diag3006	MOD	CPU	Module type error	The MEF is incompatible with this hardware	Reload a valid MEF for this hardware

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag3007	VERS	CPU	Hardware compatibility error	The software (MEF) is incompatible with this revision of hardware	a) reload compatible software b) obtain later compatible release of hardware
Diag3008	VERS	CPU	MCF Compatibility incorrect	The MCF is incompatible with the software (MEF)	Obtain compatible MCF or software (MEF)
Diag3009	SIN	CPU	SIN Error	The ATCS address of System is incorrect, due to: a) address not set b) address has an illegal value	Set SIN to valid value using ATCS Site ID Menu
Diag3010	UCN	CPU	UCN Error	The UCN has not been entered correctly or is not the correct one for this location	a) Obtain and enter the correct UCN or b) check that the UCN is for this location and check that the vital options and ATCS address are set correctly
Diag3013	MCF	CPU	MCF Compatibility incorrect	The MCF is incompatible with the software(MEF)	Obtain compatible MCF or software (MEF)
Diag3014	CRC	CPU	MEF CRC incorrect	The software (MEF) is corrupt	Reload the MEF
Diag3015	ADR	CPU	ATCS Session address invalid	The ATCS address of the session is invalid	Reenter the SIN for this location
Diag3016	CAP	CPU	MCF Capability Error	The CPU is not capable of running this MCF	a) Purchase a CPU with a higher capability or b) Obtain and MCF requiring lower a capability CPU
Diag3017	DFT	CPU	Configuration Set to Default	The configuration parameters have been setback to defaults due to either: a) an MCF change b) a template change c) user setting default	Wait. This message will clear after the defaults have been set.
Diag3018	UCFG	CPU	VLP Unconfigured	The VLP is unconfigured, as thus does not communicate with any I/O modules. This is usually due to UCN, MCF CRC, SIN errors.	Check other diagnostic message for the exact cause of the VLP being unconfigured
Diag3019	UCFG	CPU	Configuration Invalid	The VLP has found that the configuration is either corrupt or invalid for this MCF or MTF.	If a new MCF loaded or MTF selected, do a Set To Default. Otherwise repower the CPU, if this does not fix the problem, do a Set To Default and reprogram the unit.
Diag3020	INIT	CPU	No VLP Comms	The VLP is rebooting or is in its Initial State and performing its initial checks. This may occur after a VLP reset, or after changing templates.	Wait for a minute for the VLP to power up. If the VLP does not power up, check to see if it is continuously rebooting by checking the VLP Health LED.
Diag3021	CCN	CPU	CCN Incorrect	After loading a configuration file the CCN is incorrect	Reload the configuration file, and repower the CPU card. If you still get a CCN error, do a Set to Default and reprogram the unit.

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag3021	N/A	SEAR	SEAR Health	SEAR not in session	1. Verify that Power light on SEAR is lit. Verify that the first 10 digits (7.RRR.LLL.GGG) of the ATCS address match between the MS/GCP and the SEAR.
Diag3022	CIC	CPU	CIC Access Error	The CPU cannot access the configuration data stored in the CIC.	1. If CIC access error is on the Main CPU: a) remove the Standby card, and repower the Main CPU, b) if CIC error clears then the Standby CPU card is faulty, replace the Standby CPU with a good CPU. c) if error does not clear, remove the Main CPU and insert the original Standby CPU, and switch to Standby, d) if the error clears, the Main CPU is faulty, replace with a good CPU module e) if the error does not clear, the CIC chip is likely to be the problem, replace the chassis. 2. If CIC access error is on the Standby CPU: a) remove the Main card, and repower the Standby CPU, b) if CIC error clears then the Main CPU card is faulty, replace the Main CPU with a new module. c) if error does not clear, remove the Standby CPU and insert the original Main CPU, and switch to Main, d) if the error clears, the Standby CPU is faulty, replace with a good CPU module e) if the error does not clear, the CIC chip is likely to be the problem, replace the chassis.
Diag3023	UCFG	CPU	CP Unconfigured	The CP is unconfigured.	The probable cause of this is failure to the read the CIC, see other diagnostic messages for more information.
Diag3024	UCFG	CPU	Unconfigured due to	The CPU is unconfigured to a due request to upload a configuration file.	Reset the VLP2, or repower the CPU card.

Table 8-1:
SGCP4000 / MS4000 Error Codes

Diag Code	Disp. Code	Card	Error Name	Cause	Remedies
Diag4017	UCFG	CPU	No Communications (Remote SSCC)	No Communications indicates that the GCP4000 is not communicating with the remote SSCCIV	a) Check that ATCS addresses are set correctly for the local and remote unit b) Check that echelon transmit is blinking every second or so c) Check that echelon receive light is blinking every second or so, if it is not check the comms link and radio system is configured properly d) Check the CP status log for misrouted ATCS messages e) Check the VLP2 status log for illegal ATCS messages

8.2 TESTING TRACKSIDE EQUIPMENT

8.2.1 Testing Insulated Joint Couplers, Rail Bonds, and Termination Shunts

Table 8-2:
Insulated Joint Coupler Test

Step 1	Connect a hardwire shunt on the crossing side of the joint coupler.
Step 2	Note the EZ value: _____
Step 3	Move the hardwire shunt to the termination side of the joint coupler.
Step 4	Note the EZ value: _____
Step 5	Remove the hardwire shunt.
Step 6	Note the difference in EZ values in steps 2 and 4. • Wideband shunt coupler - if the difference in EZ is more than 2, the wideband shunt is defective. • Tuned Insulated Joint Coupler, TIJC - (located in the outer half of the approach), if the EZ difference is more than 3, the TIJC is mistuned or defective.

Table 8-3:
Rail Bond Test

Step 1	Note the EX value with no shunt _____
Step 2	Place a hardwire shunt at the 50% point of the approach.
Step 3	Note the EX value: _____
Step 4	Note the difference in EX values in steps 1 and 3. • An EX value **always** increases as a shunt is placed closer to the crossing. • If the EX value recorded in step 3 is greater than the EX value in step 1, the bad bond is between the hardwire shunt and the termination. • If the EX value recorded in step 3 is lower than the EX value in step 1, the bad bond is between the hardwire shunt and the crossing.
Step 5	Continue placing the hardwire shunt closer or further away from the starting point, based on the value in step 3. When the EX value increases, the last bond passed is the bad bond.

EZ must be greater than 15 for this test to work.

Table 8-4:
Termination Shunt Test

Step 1	Note the EZ value _____
Step 2	Install a hardwire shunt across the termination.
Step 3	Note the change in EZ: _____ • If termination is hardwire, no EZ change occurs. • If termination is wideband, an EZ change of no more than ± 2 occurs. • If termination is NBS, EZ can decrease up to 30. Lower frequencies and shorter approaches produce a greater change. • If termination is NBS and an increase in EZ is noted, then the NBS is defective.

8.2.2 Troubleshooting A De-energized Motion Sensor

This subsection describes the method of troubleshooting a problem in a system that has previously been in service.

The first step in troubleshooting a problem is to determine whether the track circuit continuity and components of a SGCP4000 / MS4000 system are healthy.

When the SGCP4000 / MS4000 system is healthy it shows the following:

- Power LEDs on all modules are on and steady

Table 8-5:
Troubleshooting a De-energized Motion Sensor

REASON	HOW
The track module senses that EZ is decreasing at a rate that is fast enough to trigger the motion sensor.	An approaching train.
Positive Start is enabled and the EZ level is below the programmed Positive Start EZ Level	Positive start is de-energizing the motion sensor. Enabled in the menu. Predictor remains de-energized while the EZ is less than the positive state level plus 5. The current Track Module EZ is shown on the module's 4-character display.
An UAX input is deenergized	A UAX input is programmed for the Track Module and the input is not energized or is running UAX Pickup delay.
Interference is causing large EZ fluctuations which appear to be an approaching train	The rapid fluctuation of the displayed track EZ level by 5 to 10 points (or more) indicates the presence of interference.

8.2.3 Troubleshooting A Physical SGCP4000 / MS4000 Input

After it is determined that a problem is caused by a de-energized physical input, use the following procedure to isolate the cause.

Table 8-6:
Troubleshooting Inputs

Step 1	Determine the connections to the physical inputs by referring to the circuit plans for the location. These inputs may include: • a UAX circuit from a remote site • an external island • other external inputs
Step 2	If the input is connected to other equipment that is not in this bungalow, go to step 5.
Step 3	Verify that the output of the other equipment is energized using either the indications from that equipment or a meter.
Step 4	If the output of the other equipment is energized but the motion sensor input is not, check the wiring between the equipment and the motion sensor.
Step 5	Using a meter, check the remote connection input at the point it enters the bungalow. • If the input is energized, go to the remote site and check the output. • If the input is de-energized, check the wiring from this point through to the motion sensor terminals.

8.2.4 Track Circuit Problems

When a failure occurs in a bi-directional track circuit, the EZ and CHECK EZ on the Detailed Status View will generally change in relationship to the normal range and possibly to each other as follows:

If EZ and Check EZ move higher or lower than normal, but remain relatively equal to each other, the track circuit problem lies on the transmitter side of the crossing.

If EZ and Check EZ move higher or lower than normal, but their values differ by more than 5, the track circuit problem most likely lies on the receiver side of the crossing.

8.2.5 Nuisance Activation – Rail Phase Check

In situations where EZ shifting between 5 to 20 points concurrently with EX is shifting from 2 to 5 points, checking the rail to ground voltage is required. From within the enclosure, measure the AC voltage from RCV1 to ground, and then measure the AC voltage from RCV2 to ground. The ideal measurement is identical. If V_{RCV1} differs from V_{RCV2} by approximately 0.75V or higher, nuisance activations may occur. Typically, the cause of this problem is a failing insulating joint or arrestor in the signal block.

⚠ WARNING

WARNING

DO NOT USE A NARROW BAND SHUNT TO REPLACE A DEFECTIVE COUPLER.

⚠ CAUTION

CAUTION

FOLLOWING INSTALLATION OF DUAL COUPLERS OR DUAL SHUNTS AROUND INSULATED JOINTS, VERIFY PROPER OPERATION OF THE TRACK CIRCUIT PRIOR TO PLACING IT INTO OPERATION.

8.3 UPGRADING SOFTWARE

As software upgrades are issued, the procedures for updating the software will be distributed with the upgrade. Install CD with software upgrade to be installed into a laptop and follow the instructions found on the CD.

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APPENDIX A – INTERFERENCE

A.1 CHARACTERISTICS

In general terms there are two basic types of interference, which are characterized by voltage amplitude. The first and usually the most common is 'Low Voltage' amplitude and the second is 'High Voltage' amplitude.

Symptoms for the first case include a moving EZ and EX. Typically this is only a few points at a time (less than 10). This movement can happen in either jumps (step changes) or a slow drift over time (30 secs to several minutes). In many situations the changes in EZ and EX can result in occasional false activations or nuisance operations.

The High Voltage symptoms include both EZ and EX changing great amounts over time. This change may include frequent errors such as Hi EZ, Frequency, and Self Check.

Many times the system will not operate normally for any extended time; having almost constant false activations.

A.2 MEASUREMENTS AND IDENTIFICATION

In order to address the interference issue the actual problem needs to be identified. Use of a Spectrum Analyzer (Velleman or Equivalent) can often be an extremely valuable tool in this effort of identifying interfering fundamental and harmonic frequencies.

A.2.1 Measure The Track Voltage.

This is a rail to rail measurement for AC voltage with the SGCP4000 / MS4000 and island turned off. If the problem is present and the AC value is 2.5 VRMS or smaller the interference falls into the low voltage category. If the value is greater than 5VRMS with the problem present it falls into the High Voltage category.

If the spectrum analyzer is available take a sample of frequencies within 100 HZ of the SGCP4000 / MS4000 frequency being analyzed. If any frequencies are found to be within 1 channel of the SGCP4000 / MS4000 in question or within 20 dBm, they could be a potential concern.

NOTE

NOTE

In High Voltage situations frequencies may be much higher in value than the frequency set by the SGCP4000 / MS4000.

When looking for low voltage problems check other AC track circuits. Especially look for other SGCP4000 / MS4000's of the same frequency. Overlay Track circuits can also be a source.

The investigation should also include adjacent tracks, particularly when switches are in the area. When conducting these checks think in terms of Signal Blocks not just Approaches. Sources are often found outside of the in question approach limits.

The Power Company can also be a source. Check the area for load balancing capacitors mounted on poles. These can be a source of problems for higher frequencies (generally 348Hz and above).

Other problems can result from improper or failed equipment, such as Isolation/filter units, Surge protection, battery chokes, or other track appliances.

High Voltage problems are typically some what easier to identify since any mitigation results in large observable changes. Sources typically include cab signal/ AC track circuits and power company related sources.

⚠ WARNING

WARNING

BE VERY CAREFUL WHEN INVESTIGATING POWER COMPANY ISSUES. IN SOME AREAS VOLTAGES CAN BE OVER 50VRMS WITH SIGNIFICANT CURRENT. THIS CAN BE A HAZARD TO BOTH PERSONNEL AND EQUIPMENT.

The power company issues usually will involve transmission line situations. Typically a power line or large industry is in or near the crossing. There may also be substations and/or power plants as well. The history of the location can be important. The local personnel probably know an area which has always had a power related issue.

Another major cause can be related to bad insulated joints. A shorted joint can cause a major electrical imbalance which can result in conduction of power company signals and their harmonics on to the track.

As stated above, other items can come into play, such as Isolation/filter units, Surge protection, battery chokes, or other track appliances. In this situation be especially watchful for damage due to surge protection issues.

A.3 MITIGATION

Generally two basic approaches are followed to mitigate interference problems. One is to minimize the interference effects by changing the SGCP4000 / MS4000 frequency. The other, which is typically more difficult, is to identify the source of the interference and reduce or eliminate it.

The simple approach is most often used in ‘Low voltage’ situations. Looking at the simple approach a rule of thumb applies: find a frequency for the SGCP4000 / MS4000 that is 15% or more from that of the interference. The Spectrum Analyzer is a real aide in identifying the new frequency. Conversely one could change the frequency of the interfering unit.

NOTE

NOTE

If two SGCP4000 / MS4000 systems are operating at the same frequency and a slow drift of EZ is observed, a shift of one of the two SGCP4000 / MS4000 frequencies (using a SGCP4000 / MS4000 offset frequency) could be accomplished rather than changing to a new frequency

Throughout Table 8-1, any reference to GCP includes the Simple Grade Crossing Predictor 4000 / Motion Sensor 4000 (SGCP4000 / MS4000).

Disp. Code refers to the codes being displayed in the 4-Character Display on the CPU Card or Track Card.

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Disp. Code refers to the codes being displayed in the 4-Character Display on the CPU Card or Track Card.

For 'High Voltage' situations where elimination or reduction of the voltage is attempted try the following. Repair or replace insulated joints, surge protection as necessary. Look for bad grounds and also note the phasing of local power lines.

If these initial steps do not reduce the interference to workable levels (less than 5 volts RMS), then working on identifying and minimizing the voltage must be attempted. There are two categories- Cab Signal Environment and Power related environment.

A.3.1 Cab Signal Environment

In the Cab Signal Environment of course there is little flexibility to reduce amplitudes. One needs to consider the following options:

A. Change the SGCP4000 / MS4000 Frequency.
B. For Frequencies 211 Hz and lower use 62770 Shunts with Max SGCP4000 / MS4000 transmit current.
C. For Frequencies above 211Hz use 62780 Shunts.
D. Insure that the appropriate cab signal filters are being used (if required) in the cab signal feeds to the track.

A.3.2 Power Related Environment

In the Power related environment:

- When the option exists to reduce amplitudes of 60 and 180 Hz harmonics typically a shunt is used. In addition to reducing amplitude this often balances the track circuit which can also improve conditions.
- Use a 62780-60 or 62780-180 Hz shunts for filtering of lower track current interference situations.
- For those where more than 2 amps are suspected use a 62765 for 60 or 180 Hz.
- For severe situations use a 62760 for 60 hertz applications.

Start with using these shunts rail to rail within the approach of interest as close to the crossing as possible. If this does not help, check rail to rail at the next set of joints. At times two or more of these shunts may be required. Some situations may require these shunts to be applied across the joints. There is no magic combination here- use whatever combination works out best for your situation.

After determining the amplitude remaining after using one of the above shunts and the problem still persists, options A through C from above will still need to be accomplished. Again the spectrum analyzer can be a good tool to use.

Again remember flexibility is key. It may take a combination of actions to arrive at a solution. Due to the variability of these issues solutions for one location may not work at a different location.

Table A-1:
Devices Specially Designed for Interference Mitigation:

PART NUMBER	RATING	APPLICATION
62780	Low Current	60 Hz and 180 Hz Shunt
62770	Medium and High Currents	86Hz – 211Hz Termination shunts
62765	Medium and Higher Currents- 3 amps	60Hz and 180 Hz Shunts
62760	High Currents- 10 amps	60 Hz Shunt
8A470-100	High Cab 100 Hz filter	100 Hz Cab Signal
8A466-3	Low Cab 60 Hz filter	60 Hz cab signal

APPENDIX B – GLOSSARY

AF	Audio Frequency
AFO	Audio Frequency Overlay
AND 1 XR:	The AND function that controls the local crossing. Is equivalent to the XR relay.
AREMA	American Railway Engineering and Maintenance-of-way Association
ATCS:	Advanced Train Control System – An industry standard used in the SGCP4000 / MS4000 for communications.
CCN:	Configuration Check Number – The 32 bit CRC of the configuration data.
CDL:	Control Descriptor Language – The programming language used by application engineers to customize the operation, settings, and behavior of a SEAR II/IIi.
CHK:	CHECK receiver on a track module connected to transmit wires that perform track wire integrity checks.
CHK EZ:	Check EZ is a signal value compared to main receiver EZ that is useful in troubleshooting.
CIC:	Chassis Identification Chip – A non-volatile memory chip that is installed adjacent to the ECD on the SGCP4000 / MS4000 backplane. Stores site specific information for both Main and Standby operations.
Computed Approach Distance:	The track approach length calculated by the MS. The calculated distance between the wire connections on the rail and the termination shunt connections.
CP:	Communications Processor – One of two microprocessors on the CPUII+ module, processes external communications for the SGCP4000 / MS4000.
CRC:	Cyclical Redundancy Check - Used to determine that data has not been corrupted.
CRTU:	Cellular Remote Telemetry Unit
DAX:	Acronym for Downstream Adjacent Crossing (Xing). DAX outputs are used to send prediction information from an upstream SGCP4000 / MS4000 to a downstream SGCP4000 / MS4000 when insulated joints are in the approach circuit.
dB	Decibels
DIAG:	Diagnostic
Directionally Wired	Setting used to enable a bidirectional SGCP4000 / MS4000 to determine train direction.
Directional Stick Logic	The logic function used to determine direction of train movement. The output of this function is used to activate/deactivate associated signal systems.
DOT Number:	Department Of Transportation crossing inventory number assigned to every highway-railroad crossing that consists of six numbers with an alpha suffix.

DT:	Diagnostic Terminal – The Diagnostic Terminal (DT) is an Siemens developed Windows® based software that can run on the Display Module or on a PC, which allows the user to perform programming, calibration, and troubleshooting.
DTMF:	Dual Tone Multi-Frequency - The tones on a telephone or radio keypad.
ECD:	External Configuration Device – The non-volatile memory device on the SGCP4000 / MS4000 backplane used for storing the module configuration file.
Echelon:	A Local Area Network, LAN, used by the SGCP4000 / MS4000.
Enhanced Detection:	User selectable process that detects nonlinear fluctuations in track signal due to poor shunting and temporarily switches the track module from predictor to motion sensor.
EX:	The EX value is a numerical indication of track ballast conditions relative to the leakage resistance between the rails. A value of 100 represents nominal good ballast. A value of 39 represents very poor ballast.
EZ:	The track signal value that varies with approach track impedance that indicates the relative train position within an approach. 100 represents nominal value with no train in the approach, 0 represents nominal value for a train occupying the island.
Field Password	The password set that allows field maintenance personnel access to field editable parameters.
Flash Memory	A type of non-volatile memory that can be reprogrammed in-circuit via software.
FLASH SYNC:	The two wire circuit that synchronizes the alternating flash of an external crossing controller with the internal crossing controller, SSCC3i or the external crossing controller, SSCCIV.
GCP:	Grade Crossing Predictor – A train detection device used as part of a highway-railroad grade crossing warning system to provide a relatively uniform warning time.
APP:	SGCP4000 / MS4000 Approach length calibration into a hardwire shunt located at the termination shunt.
CAL:	SGCP4000 / MS4000 Calibration into a termination shunt.
LIN:	Approach Linearization calibration into a hardwire shunt located at the 50% point on the approach.
GFT:	Ground Fault Tester – An optional external device connected to the Echelon LAN that constantly monitors up to two batteries for ground faults and indicates battery status to the SEAR2i.
Highway-Railroad Grade Crossing Advance Warning Sign:	A traffic control sign (round yellow sign with RR and a black X) placed by the highway agency in advance of many highway-railroad grade crossings

Healthy:	The SGCP4000 / MS4000 system, modules and track circuit are operating as intended. Health is generally indicated by a yellow LED flashing at 1 Hz (approximately the same flash rate as the FLASH SYNC on a controller or a flashing light signal). Unhealthy conditions are indicated by faster flash rates (2 Hz and 4 Hz) or a dark Health LED.
Hz:	Hertz – Common reference for cycles per second or flashes per second.
Interconnection:	The electrical connection between the railroad active warning system and the traffic signal controller for the purpose of preemption.
IO or I/O:	Input/Output
ISL:	Island
ISL CAL:	Island calibration
kHz:	Kilohertz – 1000 Hz or 1000 cycles per second.
LAN:	Local Area Network – A limited network where the data transfer medium is generally wires or cable.
Linearization:	The linearization procedure compensates for lumped loads in the SGCP4000 / MS4000 approach that affects the linearity (slope) of EZ over the length of the approach.
Linearization Steps:	A calibration value that allows the SGCP4000 / MS4000 to compensate for non-linear EZ values within the approach circuit.
LOS:	Loss of Shunt – Commonly due to rust and / or rail contamination. LOS timers provide a pick up delay function.
Lumped Load:	A section of track that has a lower ballast resistance than the rest of the approach because of switches, crossings, contamination, etc.
MAIN:	The primary SGCP4000 / MS4000 Modules (CPU, Track, and RIO Modules) that are in a dual SGCP4000 / MS4000 chassis.
MBT	Abbreviation for Master Boot file.
MCF:	Module Configuration File – The SGCP4000 / MS4000 application logic file.
MEF:	Module Executable File – The SGCP4000 / MS4000 executive software program.
Module	Physical package including PCBs and input/output terminals for connecting to external devices and equipment.
MS:	Motion Sensor – A train detection device used as part of a highway-railroad grade crossing warning system to provide a detection of a train approach.
NVRAM	Non-Volatile Random Access Memory
OCCN:	Office Configuration Check Number – The 32 bit CRC of the configuration data, excluding items that are protected by the Field Password.
OCE:	Office Configuration Editor – The PC version of the DT that can be used to create configuration package files (Pac files) for the SGCP4000 / MS4000 system.

Offset Distance:	The distance between the track circuit connections of the remote GCP (sending DAX information) to the island track connections of the UAX GCP (receiving the information).
Out Of Service:	The process for taking one or more SGCP4000 / MS4000 approach circuits and / or approach and island circuits out of service.
Pac File:	A SGCP4000 / MS4000 configuration Package File that can either be created in the office using the OCE, or downloaded from a SGCP4000 / MS4000 system via the CP.
PCB	Printed Circuit Board
Pick Up Delay:	An internal delay time between when an input receives the signal to pickup and when it actually responds.
POK:	Power Off Indication
Positive Start:	Activate crossing devices when EZ level is less than a programmed value.
PRIME:	PRIME may be de-energized by a Track's prime predictor, UAX, advance preempt, and/or island, if zero offset is selected.
PSO	Phased Shift Overlay Module
PSO II, PSO III, PSO 4000, PSOPlus	Different models of Siemens's Phase Shift Overlay – a track circuit (transmitter at one location and receiver at another location) that supplies track occupancy information for crossing warning devices and other train or vehicle detection systems.
RIO:	Relay Input Output Module
RS232:	Industry standard serial port.
RTU:	Remote Telemetry Unit
RX:	Receive
SEAR2i Application Program:	Programming for SEAR2i that controls alarms.
SIN:	Site (Subnode) Identification Number - A twelve-digit ATCS address representing the module as a subnode on the network.
Spread Spectrum:	A method of radio transmission in which the transmitted energy is evenly spread over the complete bandwidth of the radio, resulting in a low RF profile.
SSCC:	Solid State Crossing Controller
SSR:	Spread Spectrum Radio – A radio that utilizes spread spectrum transmission.
Standby:	The SGCP4000 / MS4000 Backup Modules (e.g., CPU, Track, and RIO modules) that are in a dual SGCP4000 / MS4000 chassis.
Supervisor Password	The password set that allows application design personnel access to office editable parameters.
TCN	Track Check Number (TCN) is used to track changes due to re-calibration and adjustments made to key Track Modules specific setup variables.

Track Speed Train	A train that proceeds through the approach at the maximum authorized speed.
True RMS AC+DC:	A scale on a multimeter that measures the effective combined AC and DC portions of the total voltage. Used to measure the pulsed output of a crossing controller. Measured as VRMS.
TX:	Transmit
TX Wire Side Connection	Used in multiple BIDAX operation. This setting enables the system to transmit DAX signals to the Transmit Wire side of the crossing.
UAX:	Acronym for Upstream Adjacent Crossing (Xing). UAX inputs are used to receive prediction information from an upstream SGCP4000 / MS4000 as inputs to a downstream SGCP4000 / MS4000 when insulated joints are in the approach circuit.
USB Port:	Universal Serial Bus Port
USB Drive:	Types of memory devices that plug into a USB port. These devices are commonly called flash drives or memory sticks.
VHF Communicator:	Communications device used for remote operations and calibration as well as data communications.
VLP:	Vital Logic Processor – One of two microprocessors on the CPUII+ module, processes SGCP4000 / MS4000 vital system logic.
VRMS	Volt Root Mean Square – See True RMS AC + DC above.
WAMS:	Wayside Alarm Management System – An office based application that communicates with and receives data from specially equipped crossings.
Z Level:	An Island calibration value. A calibrated island will have a nominal Z Level of approximately 250. The Z Level approaches 0 when shunted.

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APPENDIX C –
REMOTE CALIBRATION

C.1 CHARACTERISTICS

Optional remote MS/GCP calibration may be used as needed. The remote calibration is the same as the other procedures, except that the person doing the adjustment or calibration communicates directly with the MS/GCP via VHF radio and that a Display Terminal (either a A80500 DiagView unit or a laptop based DT) is required to generate a password. The MS/GCP sends voice options and the person performing the operation replies via a DTMF keypad on a VHF radio.

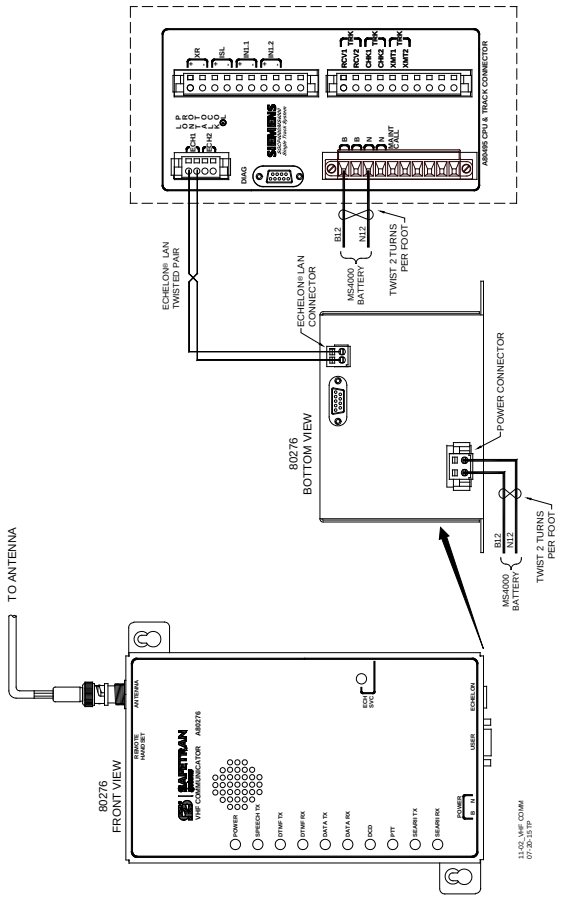

Figure C-1:
Connecting the VHF Communicator, A80276

To perform remote calibration and/or lamp adjustment the following are required:

1. Siemens VHF Communicator (A80276) programmed and connected to the MS/GCP Echelon LAN.

- VHF Communicator is a VHF Radio interface to the MS/GCP that sends setup and calibration options to remote radio.
- VHF Communicator set to a railroad VHF frequency.

- Hand-held VHF radio with DTMF keypad.
- Person doing remote calibration responds to options and sends commands to MS/GCP.
- Set to same frequency as VHF communicator.
- Hardwire test shunt for calibration and appropriate voltmeter for lamp adjustments.
- Obtain a one-time password from the MS/GCP for remote operation.
- Password expires in 60 minutes unless another setting is selected by user.

Previously during the programming stage, the DOT Crossing Number must be entered in the Location Information on the SITE INFO screen. During remote calibration, the DOT number is used to identify that the proper location is being calibrated.

This section includes flow charts for the commands and choices used in setup and calibration:

- Remote calibration setup
- Remote MS/GCP calibration
- Remote approach calibration (Not Applicable in Motion Sensor application)
- Remote linearization calibration (Not Applicable in Motion Sensor application)
- Remote crossing lamp voltage adjustment (Not Applicable in Motion Sensor application)
- Remote calibration termination

NOTE

NOTE

The MS/GCP sends and receives commands via the VHF Communicator which includes a half-duplex radio. The radio cannot receive a reply until it is finished transmitting. DO NOT send back responses until the message is completed.

Figure C-2:
Remote Setup Window

Table C-1:
Remote Calibration Setup

Step 1	Select the **Setup** button from the DT Buttons at the top of the status Screen.
Step 2	From the menu that appears, select **REMOTE SETUP**. The **Remote Setup** dialog box displays.
Step 3	Select the **GET PASS** button. A **Push button** message appears in the message box at the bottom of the window.
Step 4	Press the **SEL** pushbutton on the front panel of the CPU module: • The **Remote Setup** dialog box changes. • A four-digit password appears in the **Remote Password** value field (see Figure XXXX). • Check boxes for each used track module and the SSCC appear below the **Remote Password** value field.
Step 5	Record the four-digit password.
Step 6	If the default 60-minute timeout is not long enough, select the **EDIT TIMER** button. The Set Timer dialog box displays.
Step 7	Using the keypad numbers, enter the required Setup Timeout value (range 1 – 120 minutes) into the **New Value** field.
Step 8	Select the **Update** button. The dialog box closes and the **Remote Setup** dialog box appears. The new Remote Setup Timeout value displays.
Step 9	Individually select each field of the Track to be calibrated. A check appears in the check box of each selected field.
Step 10	Select the **CLOSE** button. The Status Screen displays.
Step 11	To perform an Island Calibration, go to the Island Calibration screen and record the shunt placement distance for shunting sensitivity.

⚠ WARNING

WARNING

AFTER PERFORMING REMOTE MS/GCP CALIBRATION USING THE VHF COMMUNICATOR, RETURN TO THE SGCP4000 / MS4000 AND VERIFY THAT EACH CALIBRATION IS PROPERLY IMPLEMENTED. REVIEW THE MAINTENANCE LOG OR THE CPU STATUS LOG AS PART OF THE VERIFICATION PROCESS.

Table C-2:
Island Shunt Distance in Feet/Meters

ISLAND FREQUENCY	0.12 OHM SENSITIVITY	0.3 OHM SENSITIVITY	0.4 OHM SENSITIVITY	0.5 OHM SENSITIVITY
2.14	20/6.10	50/15.24	67/20.42	84/25.60
2.63	17/5.18	43/13.11	58/17.68	72/21.95
3.24	13/3.96	33/10.06	44/13.41	55/16.76
4.0	10.5/3.20	27/8.23	36/10.97	45/13.72
4.9	9.0/2.74	23/7.01	31/9.45	39/11.89
5.9	7.5/2.29	19/5.79	26/7.92	32/9.75
7.1	6.5/1.98	17/5.18	23/7.01	29/8.84
8.3	6.0/1.82	15/4.57	20/6.10	25/7.62
10.0	5.0/1.50	13/3.96	18/5.49	22/6.71
11.5	4.5/1.37	12/3.66	16/4.88	20/6.10
13.2	4.0/1.22	10/3.20	14/4.27	17/5.18
15.2	3.5/1.07	9/2.74	12/3.66	15/4.57
17.5	3.0/0.91	8/2.44	11/3.35	14/4.27
20.2	3.0/0.91	8/2.44	11/3.35	14/4.27

Table C-3:
Remote Calibration

Step 1	Press and Hold the Transmit button of the hand-held VHF radio.
Step 2	Enter ***#** followed by the password recorded in step 5 of Table C-1.
Step 3	Release the Transmit button of the hand-held VHF radio: An assigned Department Of Transportation (DOT) number (**XXX**) is verbally announced. The Root menu options are announced: • "For location press 1" • "For MS/GCP press 2" • "For SSCC press 3" • "For Help press 4"
Step 4	Press and Hold the Transmit button then Press **2**. MS/GCP is selected.
Step 5	Release the Transmit button. An "Enter track number" message is announced
Step 6	Press and Hold the Transmit button. Enter the number 1 (one) to calibrate the motion sensor track.
Step 7	Release the Transmit button. The Track Menu options are announced: • "For MS/GCP calibration press 1" • "For island calibration press 4" • "To monitor EZ EX press 5" • "To monitor island press 6"

Table C-4:
Remote Approach Calibration

Step 1	To perform the MS/GCP Calibration: • Press and Hold the Transmit button then press **3**. • MS/GCP calibration is selected.
Step 2	Release the Transmit button. The Calibration Menu options are announced: • "To start track N MS/GCP calibration press 1" • "To monitor EZ EX press 2"
Step 3	Press and Hold the Transmit button then Press **1**.
Step 4	Release the Transmit button. "Enter password for DOT XXX" is announced.
Step 5	Press and Hold the Transmit button then enter the password recorded in step 5 Table C-1.
Step 6	Release the Transmit button. The following information messages are sequentially announced: • "Initiating track N MS/GCP calibration" • "Track N MS/GCP calibration in progress" If MS/GCP calibration passes the information messages are concluded with: • "Track N MS/GCP calibration passed" • "EZ is ___" • "EX is ___" If MS/GCP calibration fails: • The information messages conclude with: • "Track N MS/GCP calibration failed" • The calibration menu of step 2 is repeated. • Refer to Section 8 for troubleshooting procedures. When the cause of the failure is corrected, repeat this procedure starting at step 3. If the Remote Setup Timeout selected in 5 Table C-1. step 6 expires, start again from Step 1 of Table C-1.

Table C-5:
Remote Island Calibration

Step 1	Temporarily install a hardwire shunt beyond the island receiver rail connections. Place the shunt at the distance recorded in Table C-2, step 11.
Step 2	Press and Hold the Transmit button then press 6. Island calibration is selected.
Step 3	Release the Transmit button. The Calibration Menu options are announced: • "To start track N island calibration press 1" • "To monitor island signal level press 2"
Step 4	Press and Hold the Transmit button then press 1.
Step 5	Release the Transmit button. An "Enter password for DOT ___" message is announced
Step 6	Press and Hold the Transmit button and enter the password recorded in step 5 of 5 Table C-1..
Step 7	Release the Transmit button. The following information messages are sequentially announced: • "Initiating track N island calibration" • "Track N island calibration in progress" If island calibration passes: • The information messages conclude with: • "Track N island calibration passed" • "Island signal level n" (where n is around 100). If island calibration fails: • The information messages conclude with: • "Track N island calibration failed" • Release the Transmit button. • The calibration menu from step 3 is repeated. Refer to the Maintenance and Troubleshooting section for troubleshooting procedures. When the failure is corrected, repeat the procedure starting at step 2.
Step 8	Remove the hardwire shunt.

Table C-6:
Completing Remote Calibration

Step 1	Repeat all remote procedures for each track module selected in the Remote Calibration steps.
Step 2	To terminate the remote session, press and hold the Transmit button then press *##.
Step 3	Release the Transmit button. The remote setup is finished
Step 4	Return to the bungalow and check the Status log to ensure that the tracks were correctly calibrated. To access the Status Log, press the History Button on the display, then select Status Log.

APPENDIX D:
SGCP4000 / MS4000 SYSTEM CUTOVER TEST FORM

Case Serial Number: _____ **CPU Card Serial Number:** _____
Track Module Serial Number: _____ **External SEAR Serial Number:** _____
Crossing Name: _____ **Date:** _____-_____-_____
DOT Number: __ __ __-__ __ __-__ **Milepost:** _____
ATCS Number: __ __ __ __ __ __ __ __ __ __ __ __ **Signed:** _____
Crossing Controller Type: _____ **Crossing Controller Serial Number:** _____
Type & Number of each type of Warning Devices: Gates_____ , Pairs of FLS _____, Bell _____

Use the SGCP4000 / MS4000 Instruction and Installation Manual (SIG-00-11-02) to perform the Cutover Test.

Place a check in the appropriate space when the procedure has been checked, verified, or completed. Write n/a if procedure is not applicable. Verify wiring and programming in accordance with the approved installation diagram. Verify polarity and voltage with a meter. If as-built wiring or programming is different from the circuit plans, explain in remarks area.

Do not connect power to SGCP4000 / MS4000 or chassis outputs to warning devices until instructed to do so.

Test Procedure
10.1.2 Preliminary

___ SGCP4000/MS4000 modules in correct slots and inserted properly
___ CPU battery voltage and polarity
___ SGCP4000 / MS4000 programming
___ ATCS SIN
___Wiring to SGCP4000 / MS4000 & Surge equipment
___Wiring to Track
___Wiring to Warning Devices
___Wiring to other cables
___Connect remainder of connections on SGCP4000 / MS4000 system
___Connect other equipment to battery buss

10.2 Procedure 10-1 Approach Calibration

___ Approach Calibration

10.3 Procedure 10-2 Island Calibration

___ Island Cal.
___ Shunt Island

10.4 Procedure 10-3 GCP Operational Tests

___ Open Transmit. wire
___ Open Receive wire
___ Open UAX circuits
___ UAX pickup time
___ Open External Island Input **10.4 GCP**

Train Detection M=Main S=Standby

Observe train move(s) Track Circuit (circle)
___ EZ decrease without rapid changes
___ EZ increase without rapid changes
___ Proper Warning Time
___ Island Operation
___ Crossing Recovery
___ Out of Service

10.5 Maintenance Call (MC) Light
___ Maint. Call light output on
___ Maint Call light output turns off

Remarks:

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APPENDIX E:
SGCP4000 / MS4000 APPLICATION HISTORY CARD

Case Serial Number: _____
Track Module Serial Number: _____
Crossing Name: _____
DOT Number: __ __ __-__ __ __-__
ATCS Number: __ __ __ __ __ __ __ __ __ __ __ __
Crossing Controller Type: _____
Type & Number of each type of Warning Devices:

CPU Card Serial Number: _____
External SEAR Serial Number: _____
Date: _____-_____-_____
Milepost: _____
Signed: _____
Crossing Controller Serial Number: _____
Gates_____ **, Pairs of FLS** _____**, Bell** _____

Use the approved Railroad or Agency Installation Diagram to program SGCP4000 / MS4000 system.

PARAMETER	VALUE INITIAL SETUP	VALUE REPROGRAM 1 DATE: _____	VALUE REPROGRAM 2 DATE: _____
AFRQ			
DIRN			
TLVL			
APKU			
UAX			
ISL			
IPKU			
ADVANCED (ADVD) MENU			
PSTR			
PTIM			
SHNT			
LWEZ			
LTIM			
LWEX			
COMP			
PRED			
WTIM			

SOFTWARE DATA	SOFTWARE VERSION INITIAL SETUP	SOFTWARE VERSION REPROGRAM 1	SOFTWARE VERSION REPROGRAM 2
MOTION SENSOR MCF			
CPU MEF			
VLP MEF			
TRACK MODULE MEF			

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