SIEMENS

QUICK START GUIDE

S-80 SMART GATE™ MECHANISM

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

DOCUMENT HISTORY

Version	Release Date	Sections Changed	Details of Change
A	NOV 2021	N/A	Initial Release
A.1	FEB 2022	4.2.2	Addition of Table 4-2, “Horizontal Torque Values”, and note to page 4-10.

Table of Contents

NOTES, CAUTIONS, AND WARNINGS

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

WARNING

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

CAUTION

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

NOTE

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

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

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS

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

- 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.).
- Cover workbench surfaces used for repair of electronic equipment with static dissipative workbench matting.
- Utilize only anti-static cushioning material in equipment shipping and storage containers.

SECTION 1 **INTRODUCTION**

This manual provides general information to allow users to get started with the S-80 Smart Gate™ mechanism (S-80), including instructions for installation, maintenance, operation, and troubleshooting of the unit. This information is essential to ensure proper system operation and problem diagnosis. It is recommended that each system operator and maintainer become familiar with the information provided herein before attempting to program, calibrate, or troubleshoot the S-80.

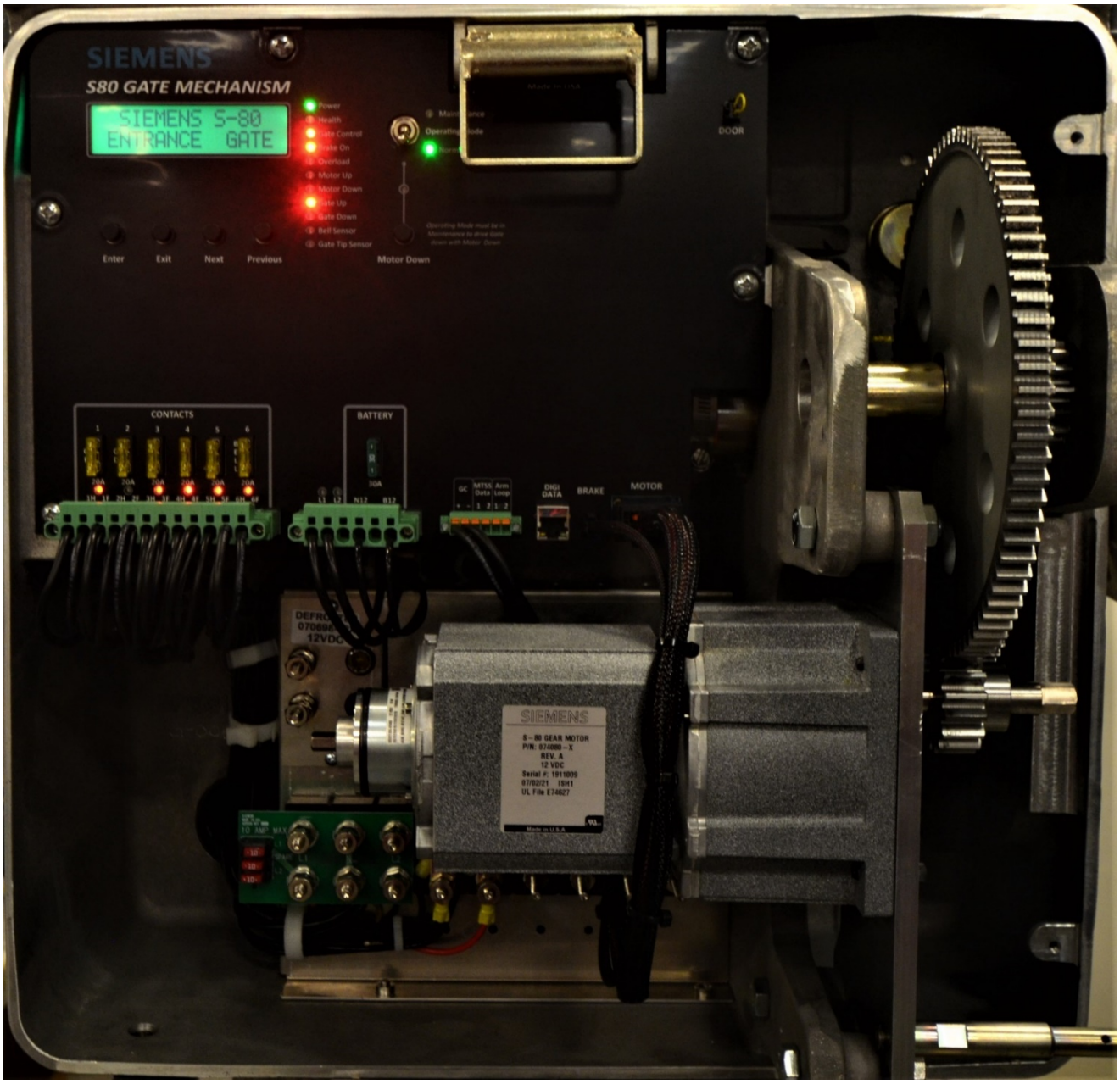


Figure 1-1 S-80 Smart Gate Mechanism

1.1 STANDARD FEATURES AND OPTIONS

The following figure provides an overview of the standard features and options of the S-80 Smart Gate™ mechanism.

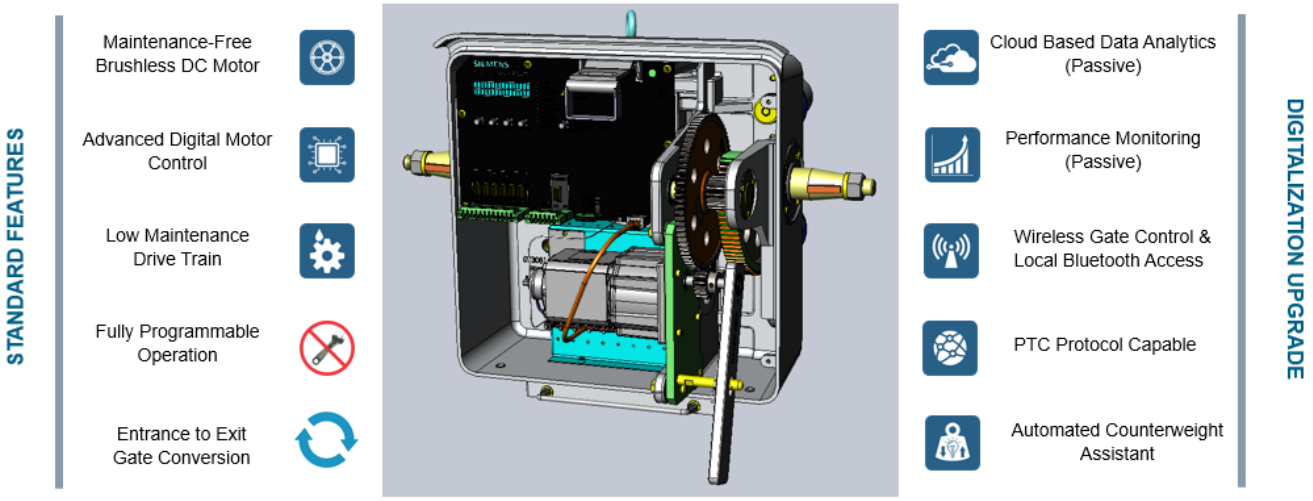


Figure 1-2 S-80 Smart Gate™ Mechanism Product Features Overview

1.1.1 Maintenance-Free Brushless DC Motor

The S-80 incorporates advanced control and performance monitoring (Hall sensor feedback) and has no brushes to maintain. This allows for a longer motor life expectancy.

1.1.2 Advanced Digital Motor Technology

The S-80 uses a brushless DC motor with advanced motor control that provides smoother gate operation. The advanced motor control in the S-80 controls the gate arm movement with a soft start and soft stop, eliminating the recoil shock to the gate's drive train from the "whipping" action of the gate arm. This dramatically reduces the wear on the bearings, gears, motor, and electric brake. Also, the reduced whipping action of the arm reduces wear on the affiliated gate arm hardware and breakaway gate arm protection devices. This significantly improves the overall life expectancy of the mechanism.

The gate arm is fully powered throughout the ascend and descend cycles and only snubbed when descending under a loss of power condition. The S-80 has an Arm Retention feature that can be enabled during the programming sequence. When enabled, it eliminates the possibility of pedestrians manually lifting the gate arm, from the lowered position.

1.1.3 Low Maintenance Drive Train

The low maintenance drive train includes forged and hardened drive train gears with a service life of one million operations with periodic lubrication. Refer to Section 6.2 for periodic gear lubrication recommendations.

1.1.4 Fully Programmable Operation via LCD Display

The S-80 is fully programmable and incorporates a backlit 2 x 16 character display allowing the user to configure:

- The vertical gate position (88-degree maximum vertical limit).
- Gate arm ascent and descent times (limited to AREMA recommended ranges)
- Six contact settings to be open or closed in the horizontal position and at what degree the contact is to change state (for example the gate down (GD) contact would be programmed to be closed in the horizontal position (0 degrees) and then programmed to open at 5 degrees).
- Gate arm retention (enabled or disabled).
- Gate arm length (required for diagnostic capability).

1.1.5 Automated Counterweight Assistant

The automated counterweight assistant (available as part of the Digitalization Package upgrade) helps to prevent improper adjustment and installation on gates. Once the gate arm length is entered (programmed) into the gate control board and the preliminary install is complete, the gate is run through a calibration sequence. This provides step-by-step instructions on how to adjust counterweights, which ensures optimum adjustment of horizontal and vertical torques.

⚠ WARNING

WARNING

NO GATE SHOULD EVER BE INSTALLED AND NOT PROPERLY ADJUSTED.

SIEMENS ASSUMES NO LIABILITY FOR IMPROPER INSTALLATION, MAINTENANCE, OR OPERATION.

1.2 ADVANCEMENTS

1.2.1 Fully programmable Digital Contacts

There are provisions for six (6) digital contacts that can be used for bell operation, gate position detection (GP), traffic preemption interfaces, etc. These can be configured to be open or closed in the horizontal position and programmed to change state, from 1 to 88 degrees, in 1-degree increments.

1.2.2 Operating Mode Switch

This replaces the Gold Nut test link configuration used in previous models. The toggle switch enables the gate to be put into Maintenance mode, to manually power down the gate in the event of a broken gate arm, using the Motor Down push button.

1.2.3 Gate Arm Loop Detection System

The Gate Arm Loop Detection system employs a thin gauge wire loop running down the length of the gate arm. The controller monitors the gate arm loop wire as a series circuit. The series loop will break when a gate arm is broken, providing indication of a malfunctioning system. Alarms can be sent via the serial link to notify maintenance personnel remotely.

1.2.4 Door Switch

The Door Switch connection has been designed for future enhanced features and currently has a jumper on the connector to close the door switch circuit. Removing the jumper will turn off the display backlight and some of the LED indications. Removing the jumper will not have any adverse effect on the normal operation of the mechanism.

1.3 PC CONTROL BOARD OVERVIEW

The S-80 PC Control Board is plug coupled to minimize wire disarrangement when replacing components. The control board has an array of diagnostic LEDs to monitor the condition of the mechanism, minimizing the need for a multi-meter when troubleshooting.

In addition, the Mini Track Side Sensor (MTSS) technology is built into the S-80 control board so there is no need for an additional MTSS daughter card to enable this functionality.

The S-80 is designed to run on both 12 and 24 Volt DC systems and therefore operates over a wide voltage range from 9 to 36 VDC. There is no longer a need for an additional DC-to-DC converter to apply the gate to 24 VDC systems.

The control board is detailed in the following figure.

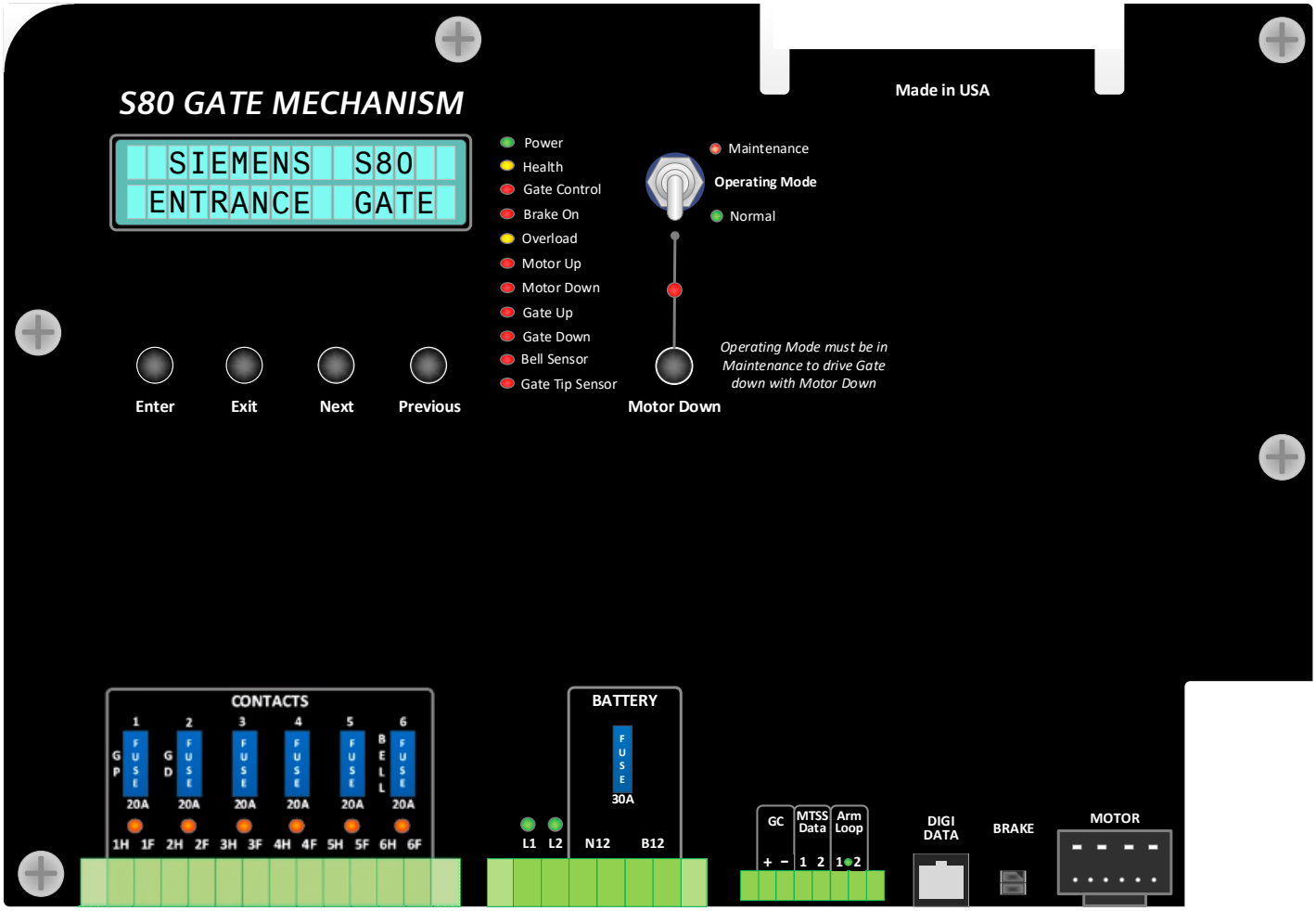


Figure 1-3 S-80 Front Panel

1.3.1 Backlit 2 x 16 LCD display

The display includes the following buttons to allow for programming: Enter, Exit, Next, and Previous. The programming functionality is similar to Siemens' Solid-State Crossing Controller (SSCC) logic.

1.3.2 Fully Programmable Operation

The user can program the gate arm ascend and descend times, define the vertical gate arm position (from 70 to 88 degrees), program the functionality of the six (6) digital contacts and enable/disable the Gate Arm Retention feature.

1.3.3 LED Diagnostics

The Control Board includes status LED's for all major gate functions:

- Power
- Health
- Gate Control
- Brake On
- Overload
- Motor Up
- Motor Down
- Gate Up
- Gate Down
- Bell Sensor
- Gate Tip Sensor

1.4 ENTRANCE GATE SPECIFICATIONS

Component	Specification
Housing and Cover	Cast Aluminum
Gear Train	33:1 Reduction (Gear motor output to main shaft)
Bearings	Maintenance-Free Sealed – both main and gear shafts
Gearmotor	Maintenance-Free 12 Volt Brushless DC
Gate Control (GC) Current in Vertical Position	615 mA @ 12 VDC
Operating Voltage	12 and 24 VDC Nominal (9 to 36 VDC at the mechanism)
Operating Current	6 to 15 A @ 12 VDC (current varies with gate arm length)
Battery Current in Vertical Position	775 mA @ 12 VDC
Weight	110 pounds (mechanism only)

SECTION 2 **ENTRANCE GATE**

2.1 ENTRANCE GATE COMPONENTS

The following figure displays the components of the Entrance Gate mechanism.

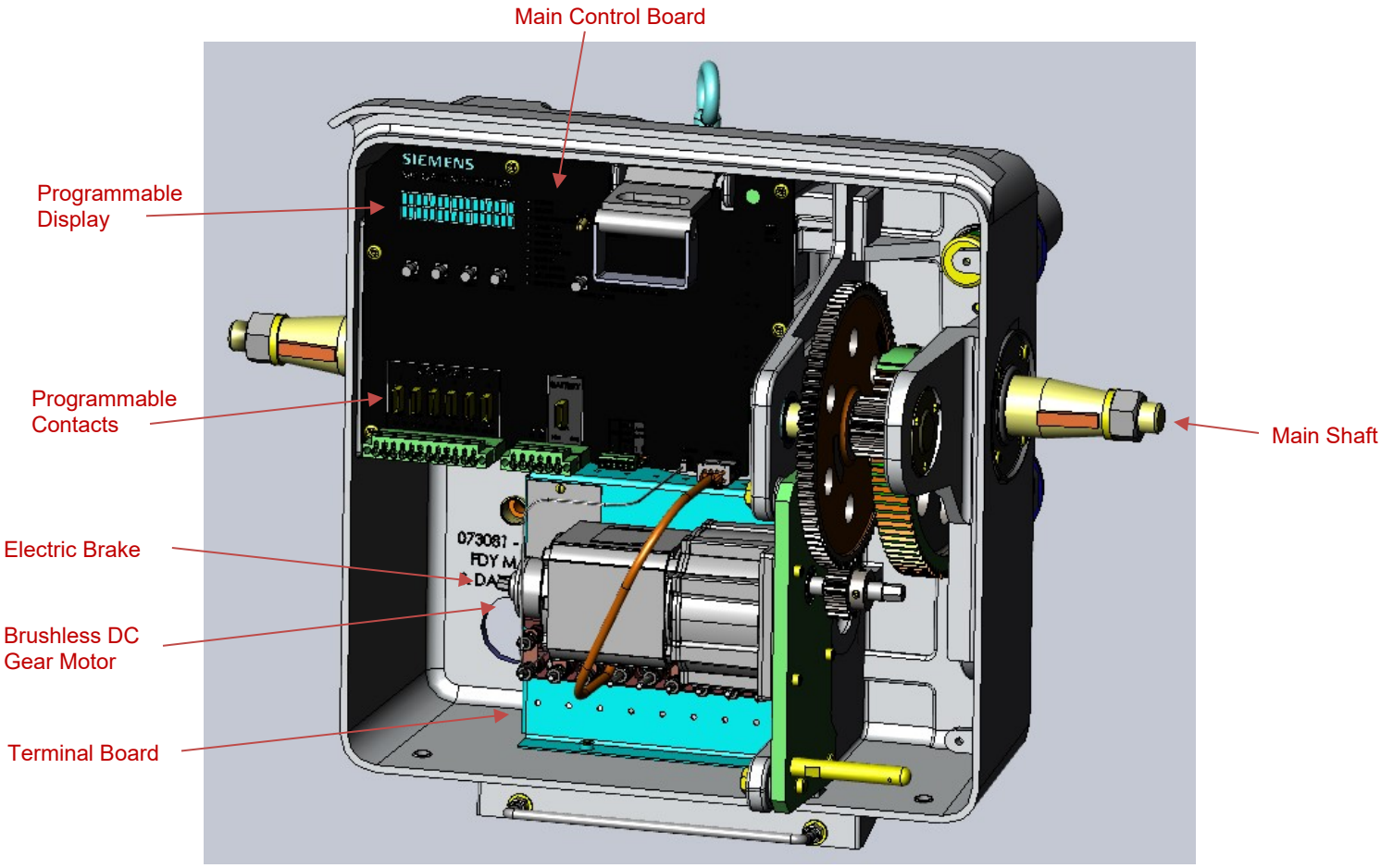


Figure 2-1 S-80 Entrance Gate Mechanism Components

2.2 BASIC OPERATION

Battery power is continuously applied to supply power to the motor and PC board. An independent "Gate Control" (GC) input is used to operate the gate arm. External switching of the GC input is required by the user. When the GC input is energized, the gate arm rises from the horizontal to the vertical position and is then held in the clear position by the electric brake. When the GC input is deenergized, the electric brake releases and then the arm is driven from the vertical to the horizontal position. Unlike previous S-type gates, the S-80 drives the gate arm down from the full vertical to the full horizontal position. Snubbing is only used to control the gate arm descent in the event of a power loss. A Motor Down pushbutton is provided to use in

conjunction with the Operating Mode switch, for powering down then mechanism when the gate arm is broken.

The ascend and descend times are fully programmable. The vertical or clear position of the gate arm is also programmable and can be set between 70 and 88 degrees. The maximum vertical limit of 88 degrees is intentional to prevent the gate arm from interfering with high wind guards and to the prevent the gate arm lights from hitting the main mast. The horizonal or “zero degree” position is automatically set via the S-80 software once the gate arm is installed and the horizontal buffer is adjusted to set the gate arm height at the necessary distance above the roadway and then power is applied to the mechanism.

⚠ CAUTION

CAUTION

DO NOT APPLY POWER TO THE S-80 UNTIL AFTER THE GATE ARM HAS BEEN INSTALLED, AND THE HORIZONTAL BUFFER HAS BEEN ADJUSTED, SO THAT THE GATE ARM IS LEVEL AND SET TO THE PROPER VERTICAL DISTANCE ABOVE THE ROADWAY.

DOING SO WILL INCORRECTLY SET THE HORIZONTAL (ZERO DEGREE) REFERENCE POSITION.

The positive and negative battery and GC inputs on the PCB are reverse polarity protected. Improper application of polarity will not damage the unit.

2.3 GEAR MOTOR

The gear motor in the S-80 mechanism is a factory sealed, line replaceable unit. No lubrication of the internal gear mechanism is required.

The gear motor has a plug coupled harness so there is no disarrangement of wires required to replace the unit. Because the S-80 gear motor is a brushless DC type, no periodic maintenance is required throughout the lifetime of the gear motor.

⚠ WARNING

WARNING

DO NOT UNPLUG THE MOTOR CONNECTOR FROM THE PCB WITH THE GATE IN THE VERTICAL POSITION UNLESS THE LOCK BAR IS IN PLACE TO RESTRICT DOWNWARD MOVEMENT.

WITHOUT THE LOCK BAR IN PLACE, THE GATE ARM WILL FALL IN AN UNCONTROLLED MANNER IF GC IS REMOVED OR THE BRAKE CONNECTOR IS UNPLUGGED.

2.4 ELECTRIC BRAKE

The electric brake is a two-piece unit consisting of an Armature Plate assembly and a Brake Housing. The Brake Housing is mounted directly to the motor end bell and the Armature Plate assembly is fastened to the motor shaft via a set screw in the assembly collar. An air gap of 0.015” minimum, 0.020” maximum must be maintained, between the Armature Plate Assembly and the Brake Housing, to ensure proper operation of the brake. The air gap is factory set to 0.015” and will very gradually increase as the brake wears. The brake should be inspected periodically to ensure the air gap is maintained. If an air gap adjustment is necessary, remove the set screw using a 2.5 mm Allen wrench and apply a single drop of Loctite® 243 to the threads and reinsert it loosely into the collar. Set the air gap to between 0.015” and 0.020”, using Siemens’ brake adjustment shims (part number NYK:074070-C and NYK:074070-D) or two automotive feeler gauges (one on either side of the motor shaft) and fully tighten the set screw in the collar. Refer to the following figure.

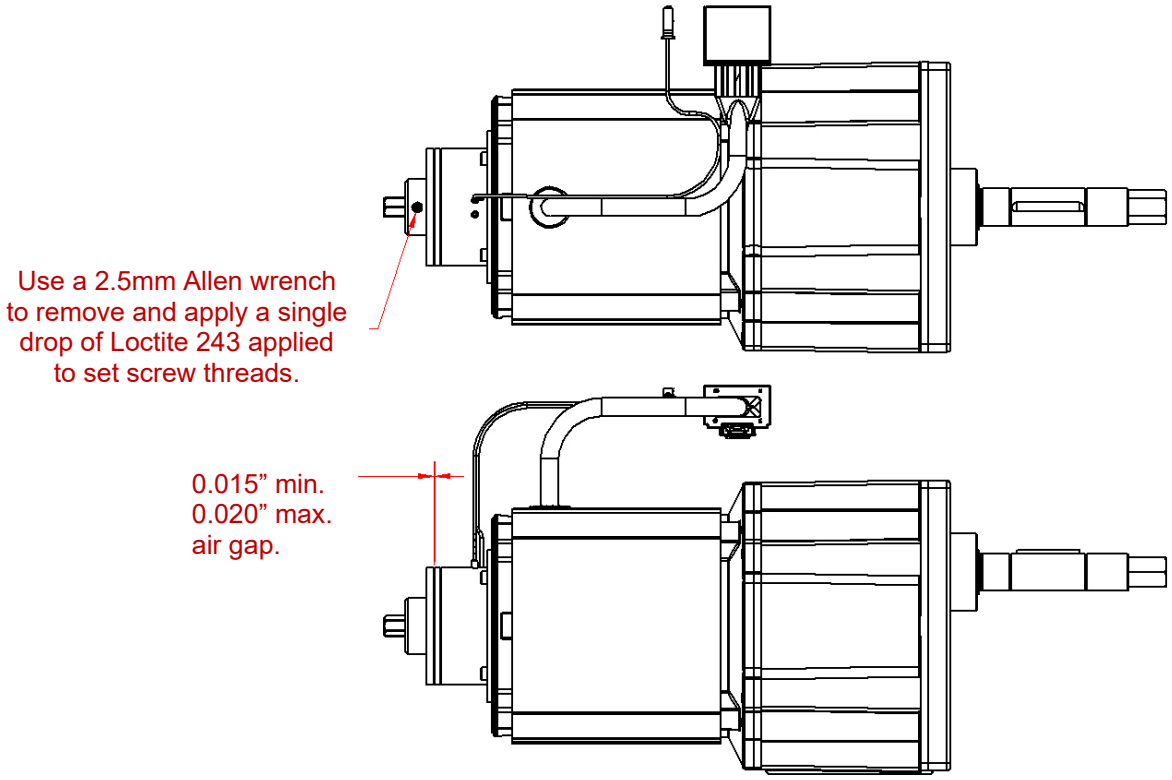


Figure 2-2 Electric Brake Detail

⚠ WARNING

WARNING

ALWAYS ENSURE A MINIMUM BRAKE AIR GAP OF 0.015".

IF ADJUSTMENT OF THE BRAKE AIR GAP IS REQUIRED, ENSURE THAT LOCTITE® 243 IS REAPPLIED TO THE BRAKE COLLAR SET SCREW.

REMOVE THE SET SCREW AND ONLY APPLY A SINGLE DROP OF LOCTITE® 243 DIRECTLY ONTO THE SET SCREW THREADS.

DO NOT POUR LOCTITE® IN THE SET SCREW THREADED HOLES.

DO NOT ALLOW ANY LOCTITE® OR ANY OTHER TYPE OF CONTAMINANTS (SOLVENTS, LUBRICANTS, ETC.) TO COME IN CONTACT WITH THE FRICTION SURFACES OF THE BRAKE.

2.5 ADVANCED ELECTRONIC MOTOR PROTECTION

The advanced motor controls of the S-80 are designed to protect both the motor and the PC board in a stalled motor condition. This is achieved using the following procedure:

- During gate arm movements, when maximum motor torque is applied and the expected corresponding gate arm movement is not detected, the S-80 automatically reduces the driving torque on the motor and returns to the previous position.
- After a 10 second wait period, the S-80 attempts to drive the arm to the position indicated by the Gate Control.
- If the obstruction persists, the 10 second wait period is repeated for a second and third time.
- If the obstruction persists on the fourth attempt to move the gate arm, the wait period is extended to one minute intervals, and attempts to move the gate arm to the position indicated by the Gate Control will continue until the obstruction is removed.

2.6 BI-DIRECTIONAL LOCK BAR (US PATENT NUMBER 7,690,702)

The S-80 is equipped with a Bi-Directional Lock Bar used to lock the mechanism at any angle, in either direction, for maintenance purposes.

⚠ WARNING

WARNING

DUE TO DRIVE TRAIN CHANGES IN THE S-80, THE S-80 LOCK BAR IS LONGER THAN THE S-60 LOCK BAR AND DESIGNED TO HOLD HIGHER DRIVE TRAIN TORQUE LEVELS.

DO NOT USE THE LOCK BAR PROVIDED WITH THE S-60 ON S-80 MECHANISMS.

The bar is placed over the Reaction Pin on the Motor Adapter Plate and the Hex portion of the Motor Pinion Gear Shaft. Proper orientation of the bar is required to restrict upward or

downward movement of the mechanism. The cover cannot be closed with the lock bar in place due to the length of the handle.

⚠ CAUTION

CAUTION

THE LOCK BAR IS MARKED WITH A “KEEP UP” DESIGNATION ON ONE SIDE AND A “KEEP DOWN” DESIGNATION ON THE OPPOSITE SIDE.

TO ACHIEVE THE DESIRED FUNCTIONALITY, MAKE SURE THE KEEP UP OR KEEP DOWN MARKINGS ARE FACING TOWARD THE MOTOR WHEN BEING INSTALLED AND NOT TOWARD THE EXTERIOR OF THE GATE MECHANISM.

Under certain conditions, it may be difficult to remove the lock bar if it is under pressure.

It may be necessary to use a 5/16” wrench on the brake end of the motor hex to relieve the pressure of the lock bar against the reaction pin.

⚠ CAUTION

CAUTION

APPLY MINIMAL FORCE IN THE PROPER DIRECTION TO AVOID DAMAGE TO THE DRIVE TRAIN.

Refer to the following illustrations.

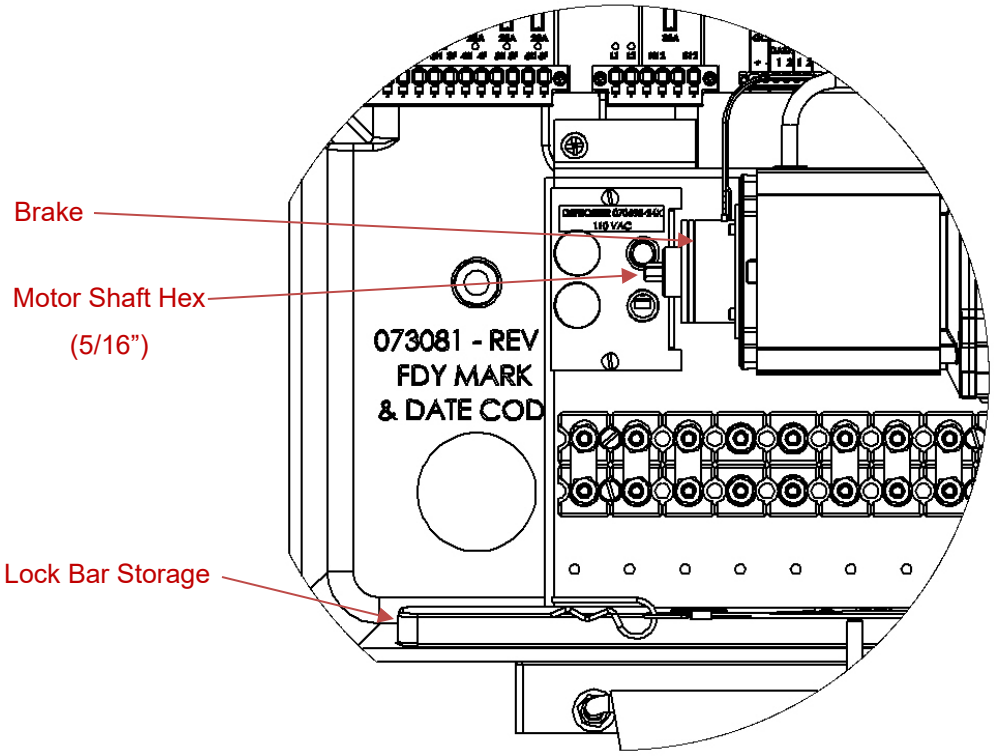


Figure 2-3 Bi-Directional Lock Bar Storage

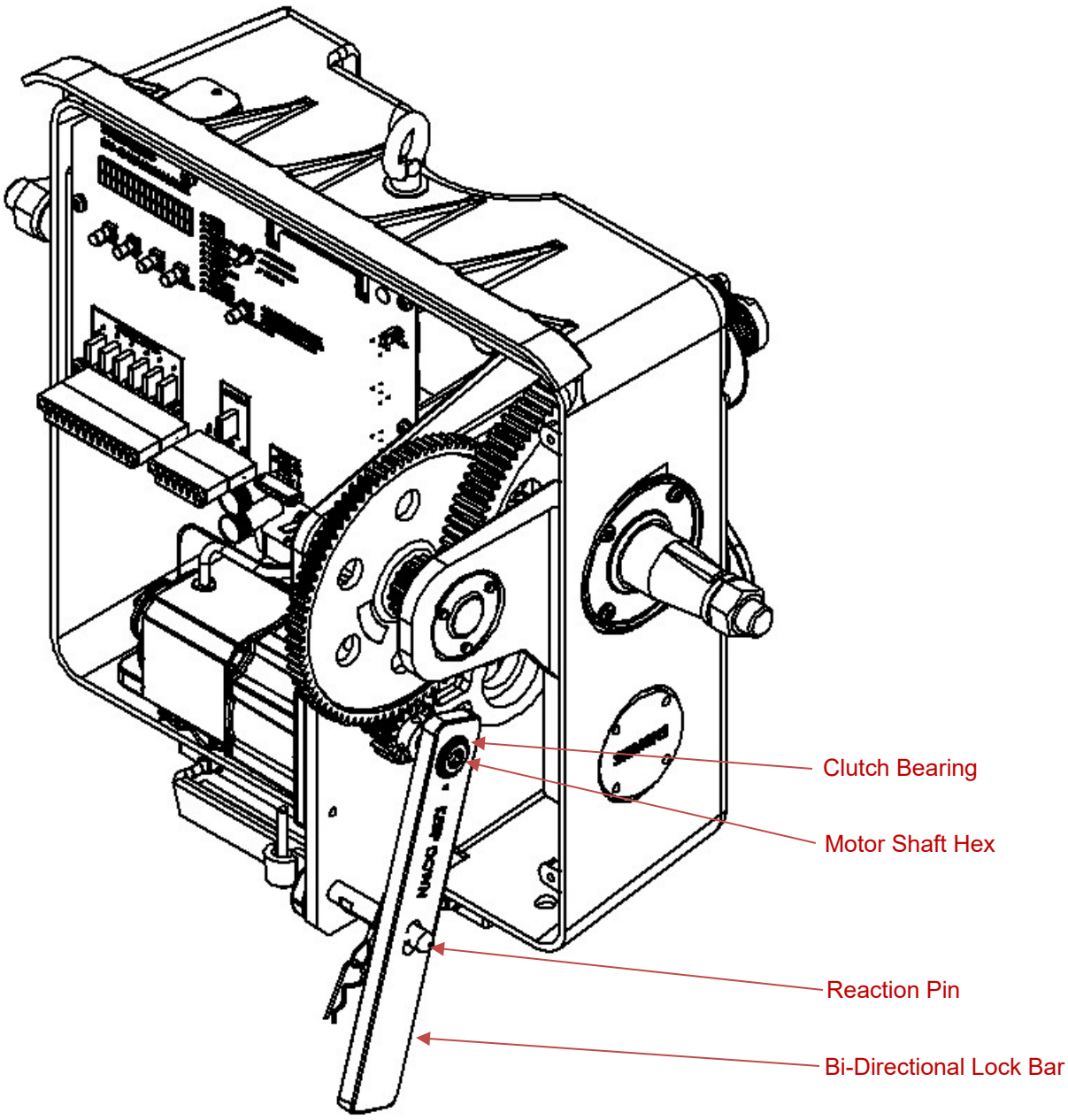


Figure 2-4 Bi-Directional Lock Bar – Right Side View

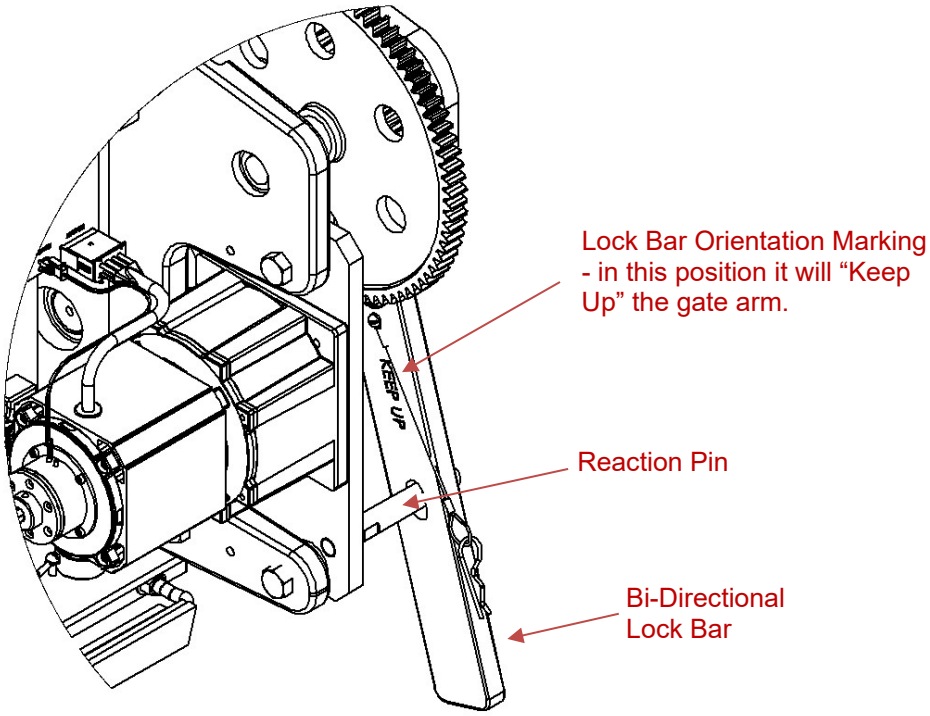


Figure 2-5 Bi-Directional Lock Bar Illustration – Left Side View

⚠ WARNING

WARNING

IMPROPER ORIENTATION OF THE LOCK BAR IN THE “KEEP UP” OR “KEEP DOWN” POSITION DURING MAINTENANCE ACTIVITIES COULD RESULT IN PERSONAL INJURY AND/OR CAUSE DAMAGE TO THE MECHANISM.

REFER TO FIGURE 2-5 TO DETERMINE THE PROPER ORIENTATION OF THE LOCK BAR TO HOLD THE GATE IN THE DESIRED POSITION.

2.7 OPERATING MODE SWITCH

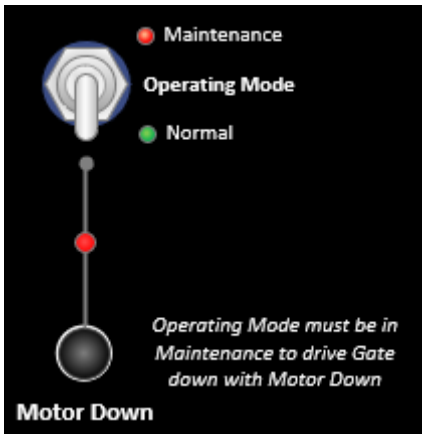


Figure 2-6 Operating Mode Switch

The Operating Mode switch is located in the upper center of the control board and is used to drive the gate mechanism from the vertical to the horizontal position so that a damaged gate arm can be repaired. By switching the Operating Mode switch from the lower Normal position to the upper Maintenance position, the Motor Down pushbutton can now be activated to power down the mechanism. The S-80 is designed to drive a mechanism with seven (7) 58 pound counterweights, fully extended, to the horizontal position. The Bi-Directional Lock Bar must be installed to hold the mechanism in the horizontal position once it has been powered down using the Motor Down pushbutton. See Figure 2-5.

⚠ WARNING

WARNING

THE LOCK BAR SHOULD NOT BE INSTALLED UNTIL AFTER THE GATE ARM IS IN THE HORIZONTAL POSITION, AFTER BEING LOWERED WITH THE MOTOR DOWN PUSHBUTTON.

THE MOTOR DOWN PUSHBUTTON SHOULD NEVER BE USED WITH THE LOCK BAR INSTALLED OR DAMAGE TO THE MECHANISM CAN OCCUR.

⚠ WARNING

WARNING

ENSURE THAT ALL PRECAUTIONS ARE IN PLACE TO PROTECT THE CROSSING WHILE USING THE OPERATING MODE SWITCH.

WHEN THE OPERATING MODE SWITCH IS IN THE "MAINTENANCE" POSITION, THE GATE MECHANISM WILL NOT DESCEND AS NORMAL WHEN GATE CONTROL (GC) IS REMOVED FROM THE WAYSIDE CONTROL.

⚠ WARNING

WARNING

NEVER LEAVE THE OPERATING MODE SWITCH IN THE "MAINTENANCE" POSITION AFTER A GATE ARM REPAIR HAS BEEN COMPLETED.

CONTROL OF THE MECHANISM VIA THE CROSSING CONTROL SYSTEM WILL NOT FUNCTION AS INTENDED WHEN THIS FEATURE IS LEFT IN THE MAINTENANCE POSITION.

2.8 OVER SPEED CIRCUIT

The over-speed snubbing circuit is always in place directly across the motor. It provides robust dynamic braking if the motor RPM goes too high, driven by a gate arm with no counterweights, or a broken gate arm. It provides snubbing protection in both motor directions.

SECTION 3 INSTALLATION AND CONFIGURATION

3.1 INTERNAL WIRING

The following figure details the S-80 Entrance Gate interior wiring.

NOTE

Siemens recommends the use of a double-break Positive (+) and Negative (-) Gate Control (GC) circuit.

If single-wire GC is desired, connect positive GC from the wayside to the GC+ (GC positive) terminal on the control board. In addition, run a jumper between the GC- (GC negative) terminal and the BATTERY N12 terminal on the control board.

The maximum wire size for the jumper is #12 AWG, solid or stranded wire.

NOTE

Gate application design (mechanical and electrical) should be done in accordance with Part 8 (Traffic Controls for Highway Rail Grade Crossings) of the MUTCD Manual, latest revision. This includes installation of gate mechanism foundations to achieve the required gate arm vertical height above the roadway, and horizontal clearance to the edge of the roadway.

NOTE

The digital contacts emulate the mechanical contacts supplied on previous gate mechanisms. They do not supply an output power source to energize external devices. They are single pole contacts that are used to open and close series circuits.

The digital contacts are isolated from the gates main Battery source and Gate Control (GC) circuitry.

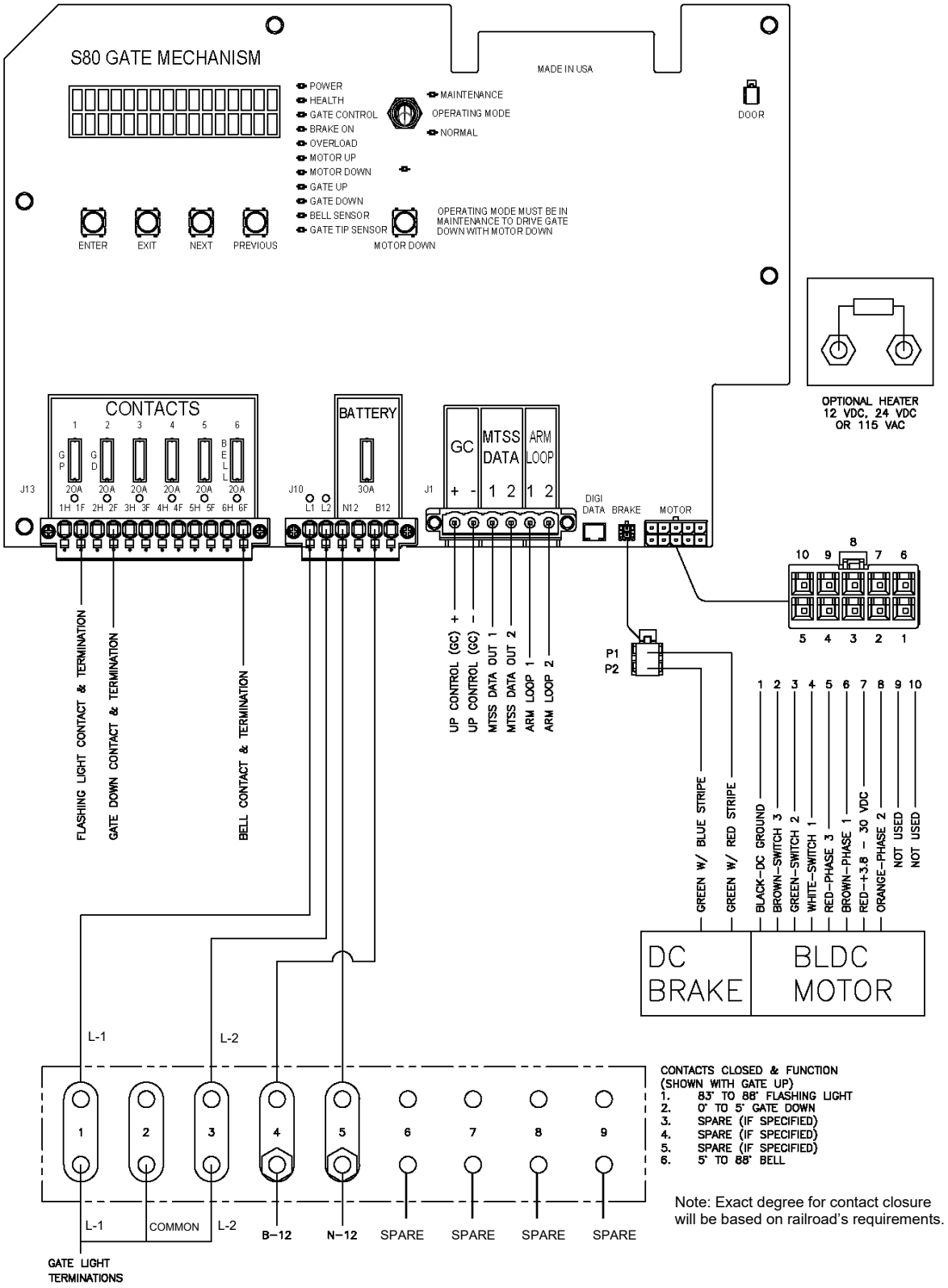


Figure 3-1 S-80 Internal Wiring Diagram

SECTION 4 ENTRANCE GATE INSTALLATION AND SETUP

The following section details the installation and setup of the S-80 Entrance Gate Crossing.

4.1 RECOMMENDED WIRE SIZE REQUIREMENTS

Sizes of wire used for the motor circuit should be calculated so that there will be not more than 0.1 ohm resistance between the battery and mechanism terminals.

Wire sizes are recommended in the following table.

Table 4-1 Recommended Wire Sizes for Battery Supply to the Mechanism

Distance from Battery Terminals to Mechanism Terminals	Size of Copper Wire to Use
Up to 60 feet (120 total feet of wire)	No. 9 AWG
From 60 to 120 feet (240 total feet of wire)	No. 6 AWG

4.2 INSTALLATION PROCEDURE

WARNING

SEVERE PINCH POINT HAZARD - ALWAYS KEEP FINGERS, AND ANY OTHER MATERIAL, CLEAR OF THE GEAR TEETH ANY TIME THAT POWER IS APPLIED TO THE MECHANISM.

CAUTION

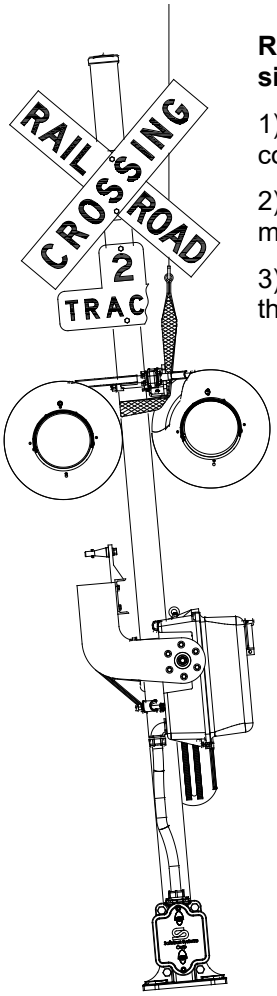
DO NOT APPLY POWER TO THE S-80 **UNTIL AFTER** THE GATE ARM HAS BEEN INSTALLED AND THE HORIZONTAL BUFFER HAS BEEN ADJUSTED SO THAT THE GATE ARM IS LEVEL AND SET TO THE PROPER VERTICAL DISTANCE ABOVE THE ROADWAY.

DOING SO WILL INCORRECTLY SET THE HORIZONTAL (ZERO DEGREE) REFERENCE POSITION.

WHENEVER A HORIZONTAL GATE ARM ADJUSTMENT IS MADE, POWER MUST BE CYCLED TO THE BOARD, TO RE-ESTABLISH ZERO OR HORIZONTAL POSITION.

1. **Mount the support clamp onto the mast.** The support clamp NYK:070786-5X mounts on a 5-inch diameter mast with the casting portion facing 45 degrees from the field side (toward the track).
2. **Prepare the mechanism.** Thread 90-degree flex conduit coupling into the back of the gate cabinet and insert the four ¾” diameter square head machine bolts into the slots on the back of the cabinet.

Weight (as shown) = 461 lbs.

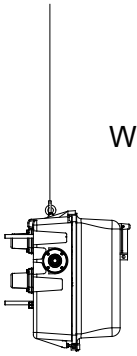


Recommendations for lifting pre-assembled signals with gate mechanism:

1) Signal assembly must be without arm and counterweights.

2) Lift point should be a minimum of 15” above gate mechanism.

3) Lifting sling can be used around mast and under the junction box crossarm for lights as shown.



Weight = 110 lbs.

Mechanism can only be lifted into place using the lifting eye provided.

Figure 4-1 Lifting Gate Assembly Recommendation

⚠ WARNING

WARNING

DO NOT LIFT COMPLETE GATE ASSEMBLY WITH LIFTING EYE IN TOP OF MECHANISM HOUSING. DOING SO MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE MECHANISM.

3. **Clamp the mechanism in place.** Lift the mechanism and set it on top of the support clamp. Secure the mechanism to the mast with the four, square head machine bolts, two saddles, nuts and washers. Use a 1-1/8” wrench or socket to tighten the nuts to a torque range of 95 to 105 ft-lbs.

CAUTION

DO NOT TIGHTEN THE MECHANISM MOUNTING HARDWARE MORE THAN THE RECOMMENDED 105 FT-LBS OR DAMAGE TO THE CAST SADDLES MAY OCCUR.

⚠ CAUTION

4. **Install conduit into the junction box base.** The S-80 housing is shorter than previous S-style gates (by 4 inches), so longer conduit may be required.
5. **Install the counterweight support arms.** Remove the nuts and washers from each side of the main shaft. Ensure the woodruff keys are in place and install the counterweight support arms securing them with the six bolts. Install the main shaft nuts and washers but **do not fully tighten** any hardware until after installing the conversion bracket.
6. **Install the conversion bracket or gate saving device.** Bolt to the counterweight support arms and now **fully tighten** the main shaft nuts and all of the remaining hardware,
7. **Ensure the gate conversion bracket is in the horizontal position so the gate arm can be installed.**
8. **Install the gate arm and gate arm lights per the manufacturer's recommendations**. If the gate arm weight is fully compressing the vertical buffer, it may be necessary to add a few counterweights to relieve some of the pressure on the buffer so the horizontal position on the gate arm can be properly adjusted. Refer to the following steps, 9 and 10. This is typically needed when heavier gate saving devices are being used.
9. **Install the counterweight stud plates.** Be sure the roller spacers are over the studs and in the arm support slot before mounting clamp bar and locking piece.
10. **Install counterweights.** Install the gate arm supports and counterweights with the gate arm in the up position. The number of counterweights required is shown in Table 4-2. Weights are based on the use of AREMA compliant gate arms and may vary slightly between different manufacturer's gate arm types. Use of a gate saving device may change the number of counterweights required.
11. Torque the gate arm per Section 4.2.2.
12. **Adjust the horizontal buffer per the instructions below to ensure the arm is level and at the proper vertical height above the roadway per railroad and/or MUTCD requirements.**

    Spring Buffer Adjustment: The S-80 Entrance gate mechanism is equipped with an external, adjustable spring buffer for horizontal gate arm positioning. This is the upper buffer on the mechanism's housing. The vertical (lower) buffer is a fixed synthetic bumper that does not require field adjustment. The horizontal buffer controls the height of the gate arm above the roadway. To adjust the horizontal position:

    a) With the arm horizontal, remove the buffer cap from the top buffer.
    b) Loosen the locking ring using Siemens Buffer Nut Wrench P/N NYK:070903-5 (pictured below), and thread the buffer into the gate housing to raise the gate arm.
    c) Adjust the buffer so that the gate arm is level (as close to zero degrees as possible) and ensure the gate arm height above the crown of the roadway is adjusted in accordance with railroad and/or local DOT standards.
    d) Once the horizontal buffer is properly set, resecure the locking ring using the Buffer Nut Wrench (shown below) and replace the buffer cap.

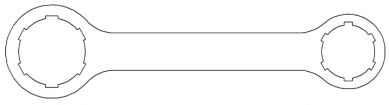
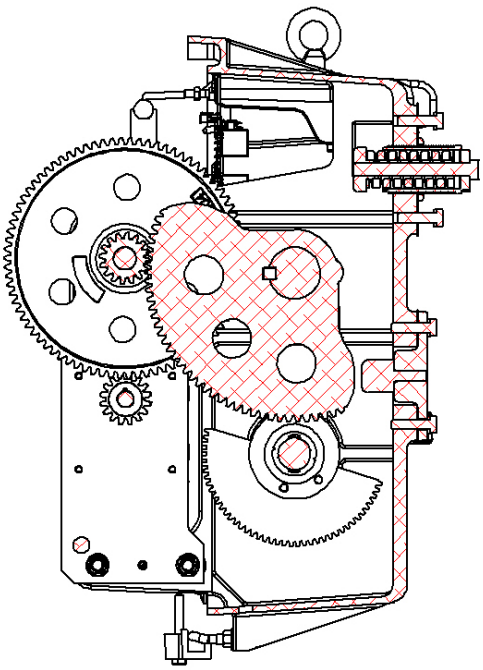


Figure 4-2 Buffer Nut Wrench

(1)



(2)

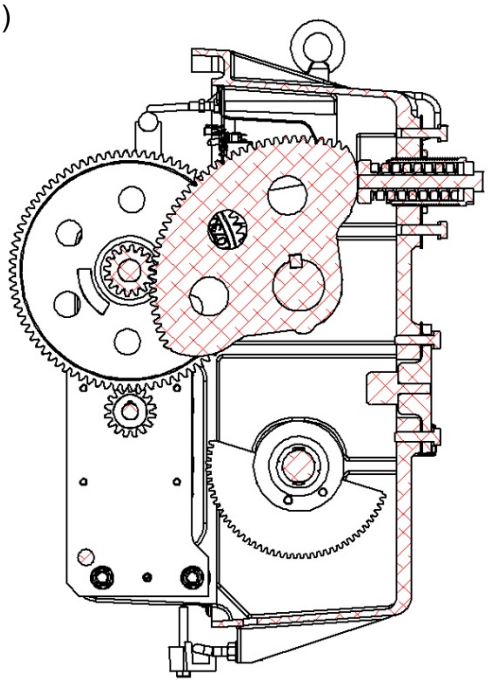


Figure 4-3 Spring Buffer Adjustment –(1) Vertical Position and (2) Horizontal Position

13. **Mount flashing lights, bell and signs.** The GP contact (#1) is provided for the position of the gate and is typically used for flashing light control. Typically lights are turned off when the gate is at 83 degrees or higher, however this angle is fully programmable. The BELL contact (#6) is provided to turn off the bell when the gate arm is in the horizontal position. The angle at which this occurs is fully programmable.

NOTE

NOTE

Strip Gate Control wires back before inserting into the GC+ and GC- terminals on the control board. Maximum wire size for this connector is 12 AWG.

If wire ferrules are being used, the barrel size of the ferrule must not exceed the outside diameter of #12 AWG wire

It may be necessary during change out from older style gate mechanisms to replace the existing 10 AWG wire that runs from the junction box base to the gate with 12 AWG wire.

14. **Apply power to the mechanism** (ensure connections are made with the proper polarity). This will automatically set the horizontal position of the gate arm to zero degrees in the control board. There is an accelerometer mounted to the main shaft that compensates for the gate arm angle zero-degree position if the gate arm is not perfectly level to the ground.

4.2.1 Hand Cranking of Gate Mechanism

⚠ WARNING

WARNING

DISCONNECT POWER BY OPENING THE BATTERY TEST LINKS (AREMA TERMINALS 4 AND 5) TO GATE MECHANISM BEFORE INSERTING TOOLS FOR HAND CRANKING.

⚠ WARNING

WARNING

NEVER USE A CORDLESS DRILL IN PLACE OF A RACHET WRENCH.

DOING SO MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE MECHANISM.

⚠ WARNING

WARNING

DO NOT USE THE RACHET WRENCH TO ROTATE THE MOTOR IN THE OPPOSITE DIRECTION OF THE LOCKBAR.

DOING SO MAY RESULT IN PERSONAL INJURY AND/OR DAMAGE TO THE MECHANISM.

The gate mechanism hand crank feature may be used either to crank the gate arm up, or in cases where the arm has been sheared off, to crank the gate arm to the horizontal position.

Tools required are a ratchet wrench, 5/16-inch socket, and the Bi-directional Lock Bar.

Hand Cranking Procedure:

1. Disconnect power from the mechanism by opening up the test links on terminals 4 and 5.
2. Place ratchet wrench with 5/16-inch socket over the hexagon shaft (brake side). The ratchet should be set in the direction to prevent its rotation backwards (direction depends on whether you are raising or lowering the mechanism; the motor shaft rotates in the opposite direction as the main shaft of the gate), This is required to retain your progress as you use the Lock Bar to crank the mechanism.
3. Place the Lock Bar on the motor output shaft in the proper orientation (“Keep Up” or “Keep Down” position). Do not engage the Lock Bar with the Reaction Pin. Rotate the Lock Bar to raise or lower the gate. Once the gate is in the desired position, slide the Lock Bar over the Reaction Pin and secure in place using the Cotter Pin.

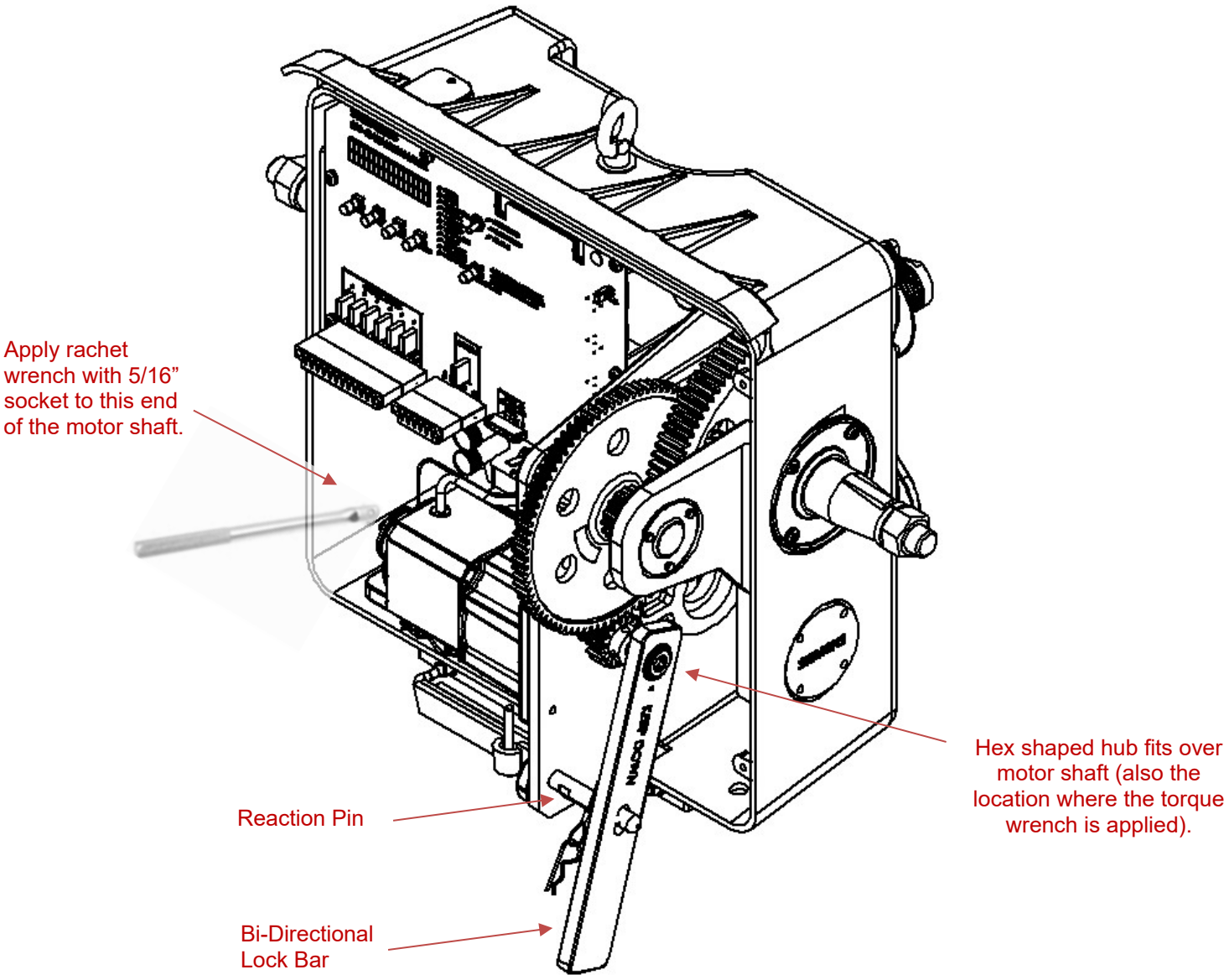


Figure 4-4 Hand Cranking Gate Mechanism

4.2.2 Horizontal and Vertical Torque Adjustment, and Counterweight Guidelines

NOTE

This procedure requires the use of the following tools:

- a torque wrench with a range of 20 to 250 inch-pounds, that has a digital readout with a tracking mode.
- a ½" socket for the torque wrench.
- a 5/16" wrench or a ratchet with a 5/16" socket (for application to the brake end of the gearmotor).

Prerequisites

- Gate assembly fully installed.
- Gate arm and arm lights installed.
- Gate arm in horizontal position.
- Counterweights installed per Table 4-3.
- Optional: 12 VDC connected to battery input terminals.

A. Set Horizontal Torque (no power is applied to the mechanism)

1. Install the torque wrench onto the ½" hex of the gearmotor output shaft (see Figure 4.4). This is the same location as where the lock bar is applied.
2. Turn the torque wrench clockwise (when viewed from the gearmotor) until the segment gear is no longer resting on the horizontal buffer.
3. Hold the torque wrench stationary and ensure the gate arm is not bouncing. Read the torque value indicated on the torque wrench.
4. ***Slowly*** release tension on the torque wrench and allow the segment gear to rest on the horizontal buffer.
5. Repeat Steps 2 – 4 a total of three times to obtain an accurate, average reading for the horizontal torque.
6. Compare the value from Step 5 to Table 4-2:
    a. If the horizontal torque measured is lower than indicated in the table, move the counterweights closer to the main shaft.
    b. If the horizontal torque measured is higher than indicated in the table, move the counterweights further from the main shaft.
    c. If the horizontal torque measured is within the range indicated in the table, tighten the adjustment nuts on the counterweights, tighten the counterweight stud plate nuts on the opposite side from the counterweights, and proceed to set the vertical torque.

Table 4-2 Horizontal Torque Values

	Gear Motor Output Shaft Torque (inch-pounds)	Main Shaft Torque (foot-pounds)
With Conversion Bracket Only	73±7	200±20
With Gate Saver	Max 92	Max 250

NOTE

NOTE

When using a gate arm protection device, it may be necessary to set the horizontal torque higher (250 ft-lbs. max.) to ensure proper operation (restoration) of the device. Vertical torque should be set based on gate arm length recommendations, as detailed in the following Section B, and listed in Table 4-3.

B. Set Vertical Torque (power can be applied to the mechanism but it is not required)

1. Raise the gate arm to the vertical position either manually or automatically:

    a. Manually (no power to the mechanism):
        i. With the gate arm in the horizontal position, install the lock bar onto the ½" hex of the gearmotor output shaft (see Figure 4.4).
        ii. Open the test links on Battery Terminals 4 and 5 to remove power to the mechanism.
        iii. Using the lock bar, hand crank the mechanism to the vertical position per Section 4.2.1 of this manual.
        iv. Once the gate is in the vertical position, engage the slot in the lock bar with the reaction pin (see Figure 4.4).

    b. Automatically (power is applied to the mechanism):
        i. Apply 12 VDC to the battery input to terminals 4 and 5.
        ii. Apply 12 VDC to the Gate Control terminals. The gate arm will raise to a vertical position.
        iii. Install the lock bar onto the ½" hex of the gearmotor output shaft, ensuring that the slot in the lock bar is engaged with the reaction pin (see Figure 4.4).
        iv. Open the test links on Battery Terminals 4 and 5 to remove power to the mechanism.

2. Apply a 5/16" wrench to the brake end of the gearmotor to relieve pressure from the lock bar.
3. Remove the lock bar and use the 5/16" wrench to keep the gearmotor stationary.

4. Install the torque wrench onto the ½” hex of the gearmotor output shaft (Figure 4.4).
5. Gradually release pressure from the 5/16” wrench until full gate arm torque is held by the torque wrench.
6. Hold the torque wrench stationary and ensure the gate arm is not bouncing. Read the torque value indicated on the torque wrench.
7. Use the 5/16” wrench to hold the gearmotor stationary and release pressure on the torque wrench.
8. Repeat Steps 5 – 7 a total of three times to obtain an accurate, average reading for the vertical torque.
9. Install the lock bar onto the ½” hex of the gearmotor output shaft and engage the slot in the lock bar with the reaction pin (Figure 4.4).
10. Use the 5/16” wrench to release drive train pressure until full gate arm torque is held by the lock bar.
11. Compare the value from Step 8 to Table 4-3:
    a. If the vertical torque measured is lower than indicated in the table, move the counterweights closer to the mast.
    b. If the vertical torque measured is higher than indicated in the table, move the counterweights further from the mast.
    c. If the vertical torque measured is within the range indicated in the table, tighten the adjustment nuts on the counterweights.
12. To safely lower the gate arm:
    a. Ensure the motor plug is connected to the main board.
    b. With the main board still powered off, apply the 5/16” wrench to the gearmotor to keep it stationary.
    c. Remove the lock bar from the ½” hex of the gearmotor output shaft (use the 5/16” wrench to rotate the brake end of the motor as necessary, to relieve pressure from the lock bar).
    d. Release the motor brake by removing the 5/16” inch wrench. The Gate arm will descend to the horizontal position in a controlled manner.
    e. Reapply power to the gate mechanism by closing the test links on Terminals 4 and 5 (if previously removed).

The following table provides counterweight and torque guidelines for fiberglass/aluminum gate arms.

Table 4-3 Fiberglass/Aluminum Gate Arm Counterweights and Vertical Torque

	Gate Arm Length (ft)	Counterweights Required		Stud Plate NYK: 070757		Gear Motor Output Shaft Torque (inch-pounds)		Main Shaft Torque (foot-pounds)	
		Std.	Short	Std.	Short	Min	Max	Min	Max
Counterweights mounted on one Support Arm	12’ – 15’	1	3	-26X	-30X	64	75	175	205
	16’ – 20’	2	5	-26X	-30X	64	77	175	210
	21’ – 22’	3	7	-26X	-30X	64	77	175	210
	23’ – 27’	4	10	-26X	-30X	70	84	190	230
	28’ – 32’	5	10	-26X	-30X	86	96	235	260
Counterweights mounted on two Support Arms	33’ – 36’	6	13	-26X(2)	-30X(2)	96	110	260	300
	37’ – 40’	7	17	-26X(2)	-30X(2)	110	129	300	350

NOTE

NOTE

The values listed in the table above are approximate as there are differences between various gate arm manufacturers.

NOTE

NOTE

Due to variations in gate arm cross sections, arm material, gate arm lights, and gate arm adapters, torque must be checked. Table 4-3 is a rough approximation when using a conversion bracket.

4.2.3 S-80 Installation Overview

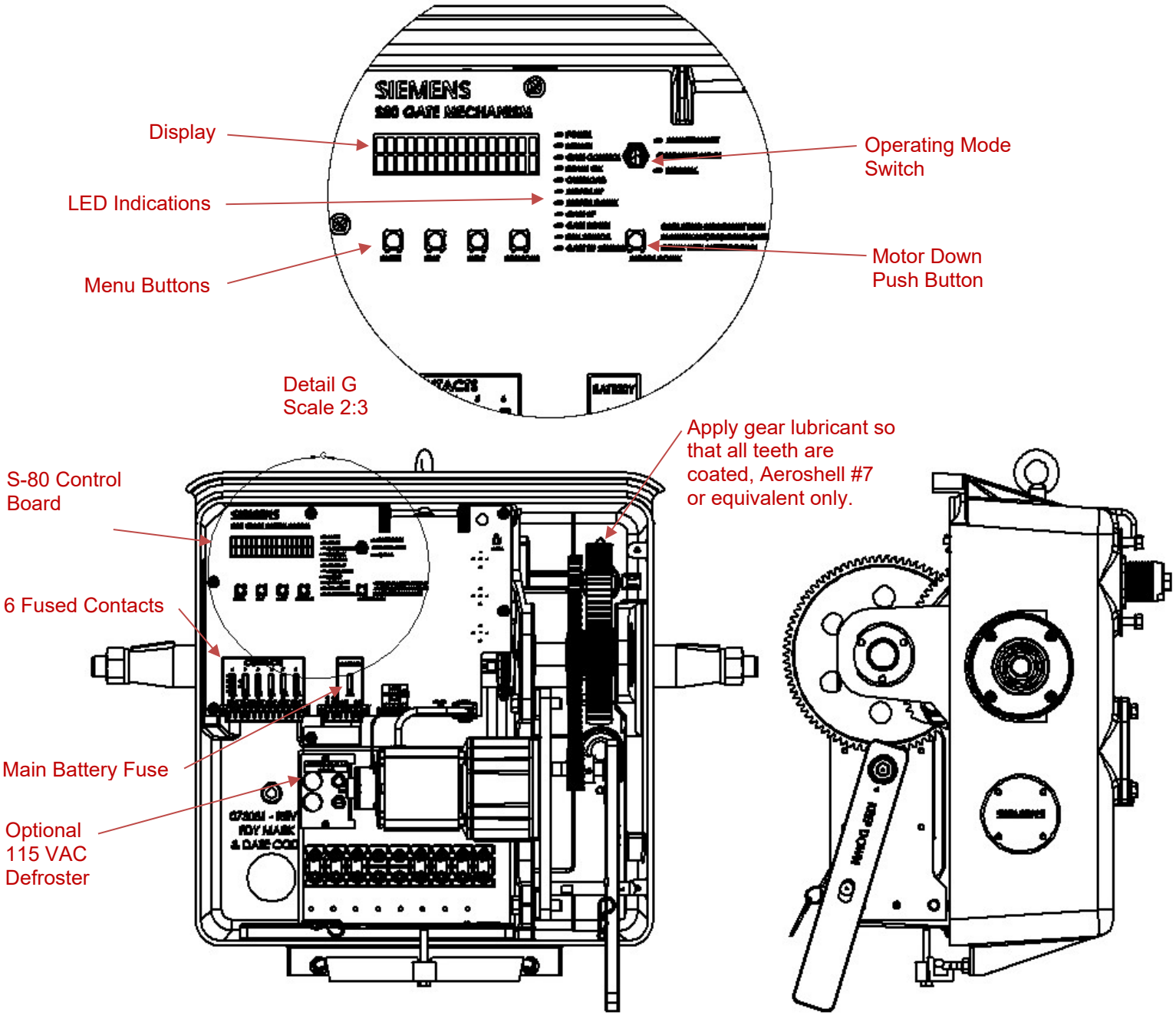


Figure 4-5 S-80 Installation Overview

4.2.4 Contact Assignments

The S-80 is equipped with 6 “digital” contacts. All contacts can be programmed to be either open or closed in the horizontal position and then programmed to any angular degree where the contact changes state (from 1 to 88 degrees). The contacts are dedicated as follows:

- Contact #1 (GP or Gate Position) is dedicated for the position of the gate. This is typically used for the control of the flashing lights and/or to indicate that the gate arm is in the vertical position.
- Contact #2 (GD or Gate Down) is dedicated for determining that the gate arm is in the down position.
- Contacts #3, #4, and #5 are spare contacts. These can be used for traffic-preemption, etc.
- Contact #6 (Bell) is dedicated for control of the bell.

Refer to Section 5 for detailed programming instructions of the contacts. Refer to Section 7 to troubleshoot the contacts.

Table 4-4 S-80 Digital Contacts Default Functions

Contact Number	Function of Contact	Default Contact State in Horizontal Position	Default Contact State Change Angle
1 GP	Gate Position (GP)	Open	Closes at 83°
2 GD	Gate Down (GD)	Closed	Opens at 5°
3	Spare	Open	Closes at 5°
4	Spare	Open	Closes at 5°
5	Spare	Open	Closes at 5°
6	Bell	Open	Closes at 5°

4.2.5 Final Inspection

A. **Voltage at terminal posts 4 and 5**- should be no less than 9 volts DC and no more than 36 volts DC.

B. **Check for possible grounds.**

C. **Check voltage and current during operation.**

The voltage on terminals 4 & 5 should **never drop below 11 volts** during the gate up cycle.

The gate up current at the mechanism should be 6-15 amps (longer arms require more current).

Power down current should be 6-15 amps.

D. **Check ascending and descending times.**

Validate ascend and descend times with the values that were programmed during the installation. Measured times should be within 1 second of the programmed times. This can be verified by using a stop-watch or the timer on a mobile device.

E. **Brake air gap -** using Air Gap Tools (part numbers NYK:074070-C and NYK:074070-D), verify air gap is no less than 0.015”, and no more than 0.020”.

⚠ WARNING

WARNING

WHEN PLACING THE GATE IN SERVICE, OBSERVE PROPER OPERATION WITH TRAIN ACTIVATION OF THE CROSSING AND PERFORM ANY ADDITIONAL TESTS IN ACCORDANCE WITH RAILROAD PROCEDURES.

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SECTION 5 **PROGRAMMING**

5.1 DESCRIPTION OF USER INTERFACE

The user interface on the front panel of the control board allows the user to ascertain system status and program the unit. The LCD display is a 2 x 16 character display with a backlight. The display provides information about various menu items, described in this section, as directed by using the pushbutton menu selections.

Refer to Figure 1-3 and the following figure for detailed pictures of the user interface. The table below lists the buttons that are available for the user to interact with the unit.

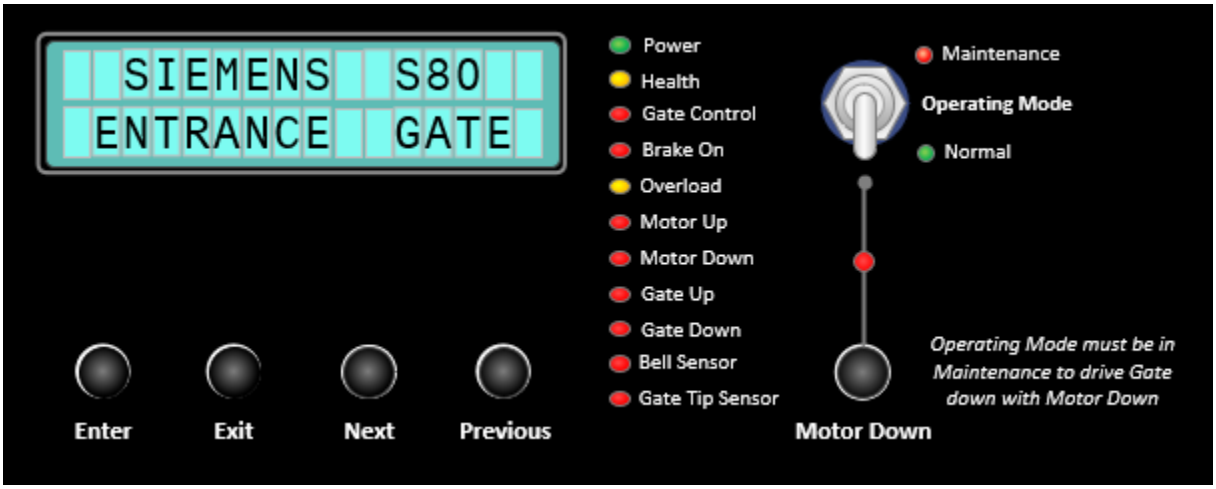

Figure 5-1 S-80 Front Panel User Interface (Enlarged View)

Table 5-1 User Interface Buttons/Switches

Pushbutton/Switch Label	Function
Enter	Enter menu item
Exit	Exit menu item
Next	Next menu item
Previous	Previous menu item
Motor Down	Drive the gate arm down when the Operating Mode switch is in the Maintenance position.
Operating Mode Switch	Can be toggled to Maintenance or Normal mode.
Maintenance position of the Operating Mode Switch	Enter Maintenance mode to disable the GC input.
Normal position of the Operating Mode Switch	Enter normal mode to enable the GC input.

5.2 MENU SYSTEM PROGRAM

The following figure shows the menu system for the S-80 Gate Mechanism. The main menu follows the following sequence.

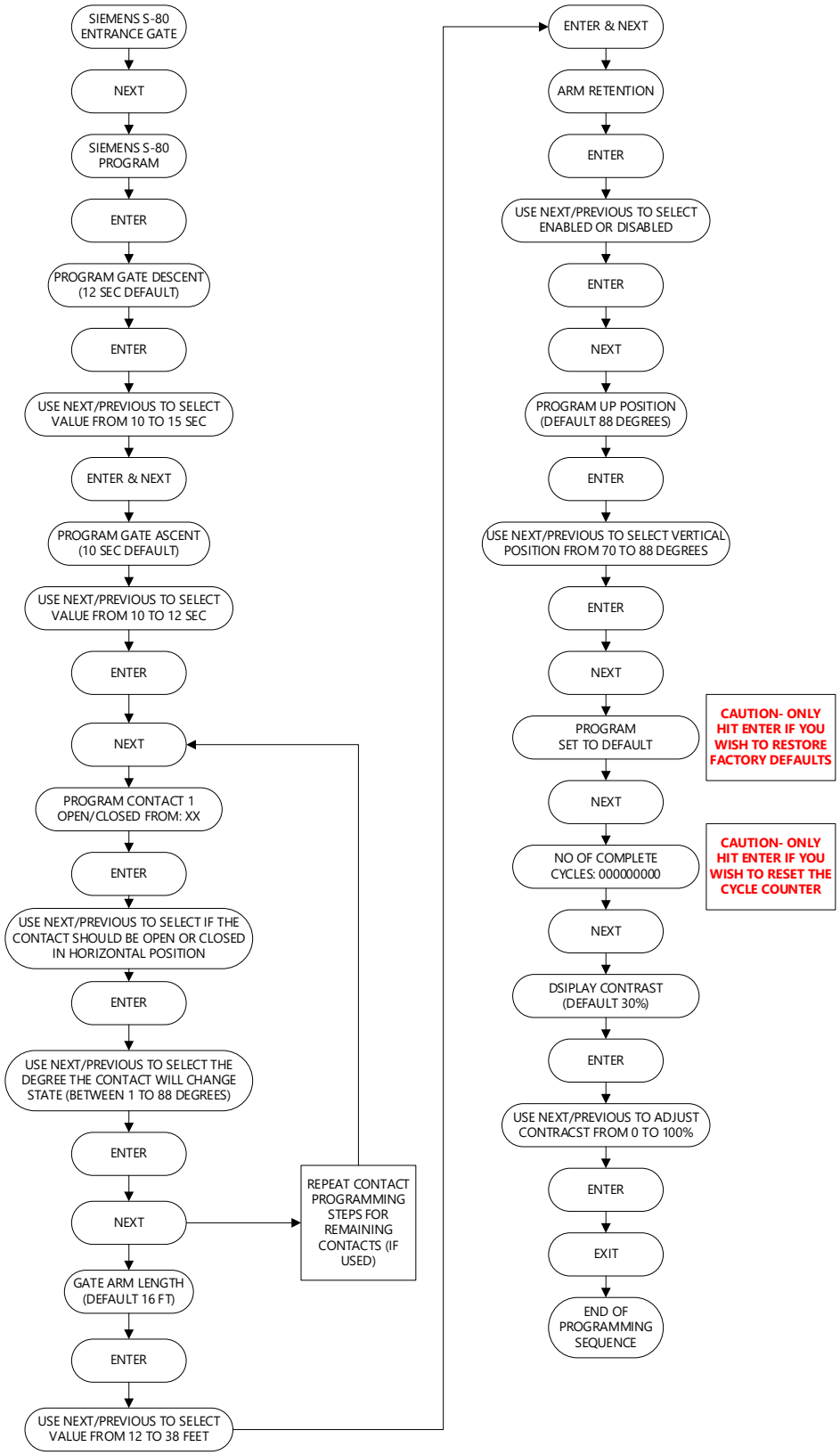

Figure 5-2 User Interface Menu System

The following table shows the menu names and their details. The default values are used to set the default menu.

Table 5-2 Menu Names and Default Values

Menu names/ Program Label	Definition	Default
Program	Allows viewing and modification of Program submenus.	-
Program Gate Descent Time	View/Program Gate Descent time in seconds.	12 (10 to 15 second range)
Program Gate Ascent Time	View/Program Gate Ascent time in seconds.	10 (10 to 12 second range)
Program Contact 1 (GP)	View/Program Relay 1. Determines open or closed in horizontal position and angular degree of state change.	Open in Horiz. (83 degree state change)
Program Contact 2 (GD)	View/Program Relay 2. Determines open or closed in horizontal position and angular degree of state change.	Closed in Horiz. (5 degree state change).
Program Contact 3	View/Program Relay 3. Determines open or closed in horizontal position and angular degree of state change.	Open in Horiz. (5 degree state change)
Program Contact 4	View/Program Relay 4. Determines open or closed in horizontal position and angular degree of state change.	Open in Horiz. (5 degree state change)
Program Contact 5	View/Program Relay 5. Determines open or closed in horizontal position and angular degree of state change.	Open in Horiz. (5 degree state change)
Program Contact 6 (Bell)	View/Program Relay 6. Determines open or closed in horizontal position and angular degree of state change.	Open in Horiz. (5 degree state change)

Menu names/ Program Label	Definition	Default
Gate Arm Length	View/Program Gate Arm Length in increments of 2 feet. Used as part of the counterweight calculations in the Status menu Counterweight Vertical and Horizontal.	16 (12’ to 38’ range)
Arm Retention	Enable/Disable Gate Arm Retention. Enabled: maintain Gate Arm in the down position actively. Disabled: Do not actively maintain the Gate Arm in the down position.	Enabled
Program Up Position	Program the Gate Arm Vertical position in degrees.	88º (70 to 88 degree range)
Program Set to Default	Program set to default parameters.	-
Activations	Resettable activation count.	-

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SECTION 6 **ENTRANCE GATE MAINTENANCE**

This section provides maintenance requirements and procedures.

6.1 TOOLS

The following is a list of tools included with every gate mechanism:

a. 2.5 mm Allen wrench for brake armature set screw
b. 0.015” Brake Adjusting Shim (Siemens’ part number NYK:074070-C)
c. 0.020” Brake Adjusting Shim (Siemens’ part number NYK:074070-D)
d. S-80 Lock Bar part number NYK:074035-X40

The following is a list of tools, recommended but not provided, with the gate mechanism:

- 1-1/2” wrench (main shaft to hub nuts)
- 1-1/8” wrench (counterweight support studs and saddle plate nuts)
- ¾” wrench (motor adaptor plate to housing bolts / nuts, conversion bracket)
- #3 Phillips head screwdriver (PCB to housing, terminal board assy. to housing)
- Thin blade screwdriver for wire connectors
- AREMA terminal wrench (Siemens part number NYK:032619-9X)
- 9/16” and ½” wrenches (gate arm)
- Loctite® 243 Threadlocker

6.2 PERIODIC LUBRICATION

The S-80 Gate Mechanism has sealed bearings on the main shaft, on the idler gear shafts, and on the auxiliary sidewalk arm shaft, if so equipped. No bearing lubrication is required. Gearmotor bearings are sealed with all temperature grease and no lubrication is required.

Gears should be coated with a thin film of all temperature grease such as Aeroshell® 7. The grease is applied at the factory, so no initial lubrication is required during installation. **Siemens requires that the gears be thoroughly cleaned and have grease reapplied annually. For gates used in extremely high-volume applications, in excess of 100,000 operations per year, Siemens recommends that grease be reapplied every 6 months or when signs of gear wear become evident.**

⚠ CAUTION

CAUTION

USING THE IMPROPER LUBRICANT ON THE GEARS MAY CAUSE THE GATE OPERATION SPEED TO DECREASE IN EXTREME COLD CONDITIONS.

6.3 PERIODIC INSPECTION

Ensure that air vents are kept unobstructed and flexible conduit between gate mechanism and the junction box base is kept sealed.

6.4 PLACING CROSSING IN SERVICE

Prior to placing the Crossing in service, testing must be performed to verify proper operation. Ensure the Operating Mode switch is in the Normal position. Perform all tests as specified by Railroad procedures.

WARNING

WHEN PLACING THE GATE IN SERVICE, OBSERVE PROPER OPERATION WITH TRAIN ACTIVATION OF THE CROSSING AND PERFORM ANY ADDITIONAL TESTS IN ACCORDANCE WITH RAILROAD PROCEDURES.

SECTION 7 **TROUBLESHOOTING**

Table 7-1 provides service assistance information for the S-80 Smart Gate Mechanism. Contact Siemens Mobility, Inc. Customer Service if additional assistance is required.

Table 7-1 Entrance Gate Troubleshooting

Trouble	Cause	Action	Correction
Gate does not ascend	No battery power available	Ensure green "Power" LED is illuminated.	1) Ensure a minimum of 11 VDC is present on terminals B12 and N12 and ensure the polarity is correct. 2) Ensure the B12 (Battery +) and N12 (Battery -) polarity is correct.
	40 amp automotive fuse is blown.	Check the 40 Amp fuse located just above the B12 and N12 terminals.	Replace the fuse as required.
	⚠ WARNING	**WARNING** **NEVER REPLACE THE FUSE WITH A HIGHER AMPERE RATING THAN THE CURRENT VALUE IDENTIFIED ON THE FACE OF THE CONTROL BOARD.**	
	No gate control (GC) power is available.	Ensure the red Gate Control LED is lit.	1) Ensure 12 VDC nominal voltage is present on terminals GC + and GC - and ensure the polarity is correct. 2) Ensure the GC+ (Battery +) and GC- (Battery -) polarity is correct. 3) Ensure the Operating Mode toggle switch is in the Normal mode and the green LED is illuminated.
	No motor power.	Ensure the red Motor Up LED is lit.	Ensure motor plug connector is properly inserted in the plug connector on the control board.

Trouble	Cause	Action	Correction
Gate ascends but "pumps" (will not lock) in the vertical position.	Motor overload is tripped.	Verify yellow Overload LED is illuminated.	Clear gate of any obstructions and ensure the drive train rotates freely.
	Control board is not operating properly.	Verify yellow Health light is flashing at 1 Hz.	1) If Health light is on steady or dark, cycle the control board power. 2) If it does not recover, replace the control board.
	Electric brake is not engaging properly.	Ensure the electric brake air gap is between 0.015" and 0.020" and ensure the motor shaft rotates freely.	Adjust the brake air gap.
		Ensure a minimum of 11 VDC is present on the control board's brake terminals.	Validate that Gate Control GC power is available and that both the Gate Control and Brake On red LED's are illuminated.
	Segment (main shaft) gear is hitting the vertical buffer and tripping the Motor Overload.	Improper horizontal position setting	Lower the gate arm to ensure the horizontal position of the arm is correct and then cycle power to the mechanism to reestablish the zero-degree position
Gate does not descend	Electric brake is not properly releasing.	Check the brake air gap.	1) Ensure a minimum 0.015" air gap between the brake armature and the housing. 2) Check the brake functionality by switching the Maintenance Mode toggle switch to the Maintenance mode. The brake should release. 3) Replace the electric brake.
	⚠ CAUTION	**CAUTION** WHEN CHANGING BRAKE WITH THE GATE IN THE VERTICAL POSITION, DO NOT REMOVE LOCK BAR.	

Trouble	Cause	Action	Correction
	External obstruction	Verify the yellow Overload LED is illuminated.	1) Remove any obstructions. 2) Ensure the wind guard is parallel to the gate arm and not binding.
	Internal obstruction	Ensure drive train rotates freely.	Ensure internal reduction gearing rotates freely without binding or drag.
	Gear motor obstruction or drag	Ensure motor rotates freely when turning the motor shaft by hand from the brake end.	1) Secure gate position with the Lock Bar in the “Keep Up” position. Unplug and unbolt the gear motor and remove the pinion gear from the reduction gear to check the free rotation of the gear motor independently. 2) If drag or binding is present, replace gear motor.
	Incorrect horizontal torque	Verify correct counterweighting.	Adjust as necessary to achieve proper horizontal torque.
Gate drops uncontrollably	Poor motor wire connections	Motor connector not properly installed/seated.	Ensure motor connector is fully inserted into the control board. Replace the Control Board
Gate rises too slowly	Low battery voltage	Measure battery voltage on B12 and N12 terminals.	Ensure a minimum of 11 VDC is sustained at all times on terminals B12 and N12 while the gate is ascending.
	Incorrect counterweight settings	Verify correct counterweighting.	Adjust as necessary to achieve proper horizontal and vertical torque values.
	Gate ascent time is not set to the desired speed.	Verify gate ascent time is programmed a higher value than intended.	Refer to the programming section of this manual and reprogram the Gate Ascent time to the desired rise time.
Gate drops too slowly	Incorrect counterweight settings	Verify correct counterweighting.	Adjust as necessary to achieve proper horizontal and vertical torque values.
	Gate descent time is not set to the desired speed.	Verify gate descent time is programmed a higher value than intended.	Refer to the programming section of this manual and reprogram the gate descent time to the desired fall time.

Trouble	Cause	Action	Correction
Gate drops too quickly	Incorrect counterweight settings	Verify correct counterweighting.	Adjust as necessary to achieve proper horizontal and vertical torque values
	Gate Descent time is not set to the desired speed.	Verify gate descent time is programmed a lower value than intended.	Refer to the programming section of this manual and reprogram the Gate descent time to the desired fall time.
Gate raises partially then falls	Motor overload is tripped	Determine if yellow Motor Overload LED is illuminating during operation.	Clear gate of any obstructions and ensure the drive train rotates freely.
		Verify correct counterweighting.	Adjust as necessary to achieve proper horizontal and vertical torque values.
	Low battery voltage	Verify battery voltage is dropping below the 11 VDC minimum during operation.	Ensure a minimum of 11 VDC is sustained at all times on terminals B12 and N12 while the gate is ascending.
Gate arm does not rise to the desired vertical position	Gate Up position improperly programmed.	Verify Gate Up position is not programmed to the desired vertical angle (position).	Refer to the programming section of this manual and reprogram the Gate Up position to the desired vertical angle as defined by the site-specific conditions. (*Note- the Gate Up position can only be set to a vertical angle ranging from 70 to 88 degrees).
Gate arm rests above or below the desired horizontal position	Incorrect horizontal buffer setting	Check the horizontal buffer setting.	Adjust the horizontal buffer so the gate arm is resting in the level position and the gate arm height is properly set in reference to the crown of the roadway. It may be necessary to raise or lower the mechanism on the mast to achieve the proper gate height above the roadway and to ensure the gate arm is level.
Digital Contacts not operating as intended	Contact Open/Closed in the horizontal position functionality is reversed.	Verify contact programming setting.	In the programming sequence toggle from the Open in the Horizontal position to Closed in the Horizontal position (or vice versa) state for the respective contact.

<table>
<tr><th>Trouble</th><th>Cause</th><th>Action</th><th>Correction</th></tr>
<tr><td rowspan="4"></td><td>Contacts not changing state at the proper gate arm angle.</td><td>Verify contact programming setting.</td><td>Program each contact to the desired degree it needs to change state (*note the degree it changes state is always with reference to the horizontal and not the vertical gate arm position).</td></tr>
<tr><td rowspan="2">Digital Contacts not functioning as intended</td><td>Verify the red Contact LED's are not lit for the corresponding contact in question.</td><td>Verify contact programming setting as stated above.</td></tr>
<tr><td>Check 20 amp automotive fuse.</td><td>Replace fuse.</td></tr>
<tr><td colspan="3">⚠ WARNING
WARNING
NEVER REPLACE THE FUSE WITH A HIGHER AMPERE RATING THAN THE CURRENT VALUE IDENTIFIED ON THE FACE OF THE CONTROL BOARD.</td></tr>
<tr><td>MTSS features are not functioning properly</td><td>No gate indication</td><td>Verify the Red Gate Position LED is not illuminated.</td><td>Ensure the gate arm is within 5 degrees of the horizontal position.</td></tr>
</table>

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SECTION 8 **HARDWARE TORQUE GUIDELINES**

The following chart details the recommended hardware torque.

Table 8-1 Recommended Hardware Torque Guidelines

Thread Size	Hex Nut Size	Torque
4-40	3/32” Allen	6 in. lbs.
10-32	-	32 in. lbs.
14-24	7/16	6 ft. lbs.
¼-20	7/16	6 ft. lbs.
5/16 - 18	½	15 ft. lbs.
3/8 - 16	9/16	25 ft. lbs.
½ - 13	¾	55 ft. lbs.
5/8 - 11	15/16	90 ft. lbs.
¾ - 10	1 - 1/8	105 ft. lbs.
1” - 8	1 - 1/2	140 ft. lbs.

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