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Solar Powered Stand-Alone Electric AggreGate™

Revision B

8/14/2020



Solar Powered Stand-Alone Electric AggreGate™

Section 1

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Solar Powered Stand-Alone Electric AggreGate™

Section 2

General Information

This manual consists of information, which will be useful in the operation and maintenance of the Miner Solar Powered Stand-Alone Electric AggreGate™ equipped ballast cars. The manual includes operating, maintenance and troubleshooting procedures with illustrations to assist in identifying various components.

Before proceeding with operation or maintenance of the ballast cars, read and understand the SAFETY PRECAUTIONS SECTION of this manual in addition to precautions prescribed by the AAR, FRA and individual handling railroads.

It is expressly understood that issuance of these Miner instructions which were prepared in good faith and are believed to be complete and accurate, shall not be construed to mean that Miner Enterprises, Inc. assumes any liability on account of accidents to persons or property involving the Miner Solar Powered Stand-Alone Electric AggreGate™ .

Miner Enterprises is not responsible for car construction or design, including modifications for gate application.



Solar Powered Stand-Alone Electric AggreGate™

Section 3

Safety Precautions

In addition to safety precautions prescribed by the car owner, loading site, unloading site, repair shop and handling railroad, the following safety precautions must be observed whenever a Miner Solar Powered Stand-Alone Electric AggreGate™ is operated and whenever any maintenance is performed on it.

1. All maintenance, repair, or adjustment must be made on a shop or repair track where the car will not be moved.
2. Protective eye and ear wear and gloves should be used when doors are operated.
3. Read and follow Caution Notes, Remote Gate Operation, and the Emergency Manual Operation decals which are posted on the side of the car.
4. Emergency Manual Operation is only to be used when the doors cannot be operated by the Remote Gate Operation or the Manual Powered Operation. In the event of Emergency Manual Operation, the car must be stopped.
5. If doors do not operate by the Remote Gate Operation or the Manual Powered Operation refer to SECTION 9 Troubleshooting.
6. Never attempt to adjust or repair the system without disconnecting the power using the main power shut-off located in the battery box.
7. After unloading, confirm that all doors are in the completely closed position with no obstructions.
8. Always report an inoperable or damaged gate to a supervisor so that it may be properly repaired or replaced.
9. Do not attempt to force the door system in any way.



Solar Powered Stand-Alone Electric AggreGate™

Section 4

Component Identification

General Description

The Miner Solar Powered Stand-Alone Electric AggreGate™ was designed and built for twin hopper ballast rail cars. The system is actuated by electric drive units, is powered by solar modules that charge special batteries, and is remote controlled by a hand-held transmitter. There are two gates per hopper and each gate is independent of the others, with two electric drive units to discharge inside and outside the rail.

Component Identification

For a complete list of components and descriptions and part numbers, refer to latest revision of the following:

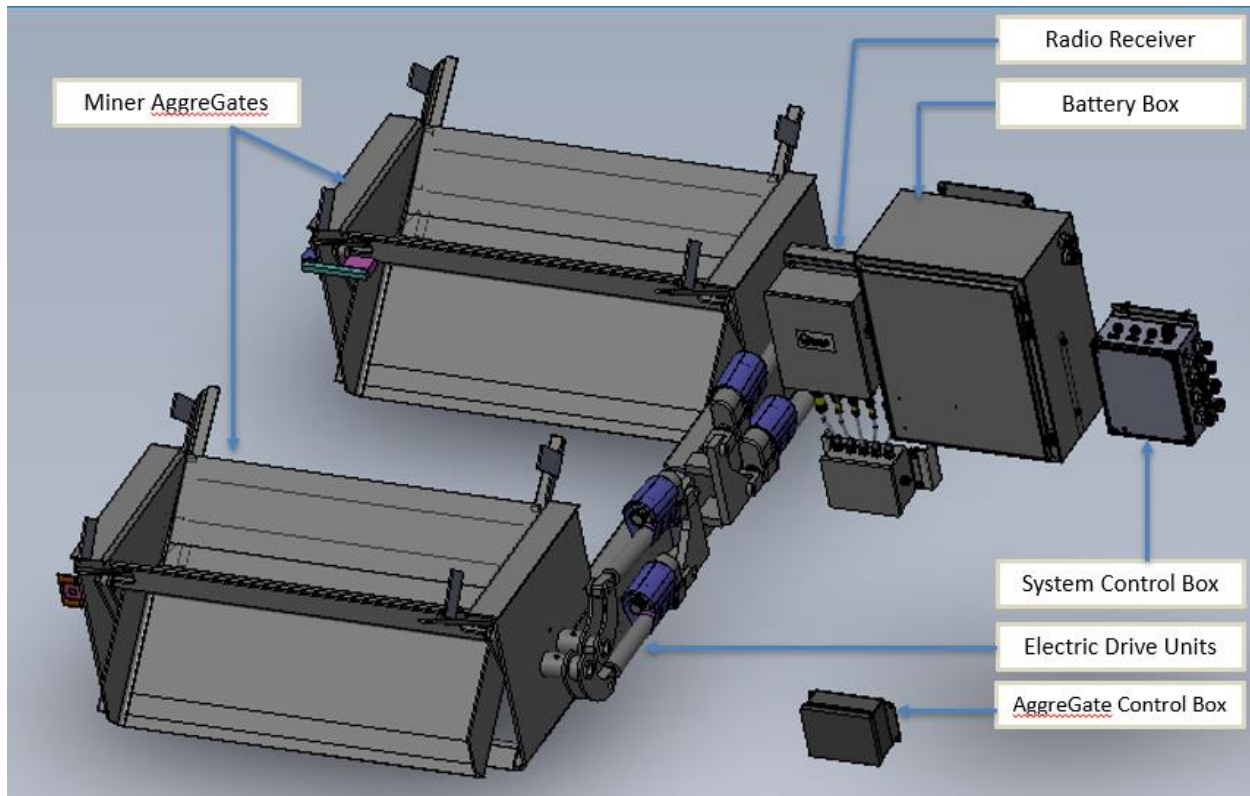
General Arrangement Drawing

Electrical Schematic Drawing

Customer Schedule

For a complete list of Miner part numbers and descriptions refer to the latest revision of the Customer Schedule. Any of these documents can be obtained by contacting Miner Customer Service at (630) 232-3000.

Part Identification



Hand Held Transmitter
and Battery with Charger



Solar Powered Stand-Alone Electric AggreGate™

Section 5

Principle of Operation

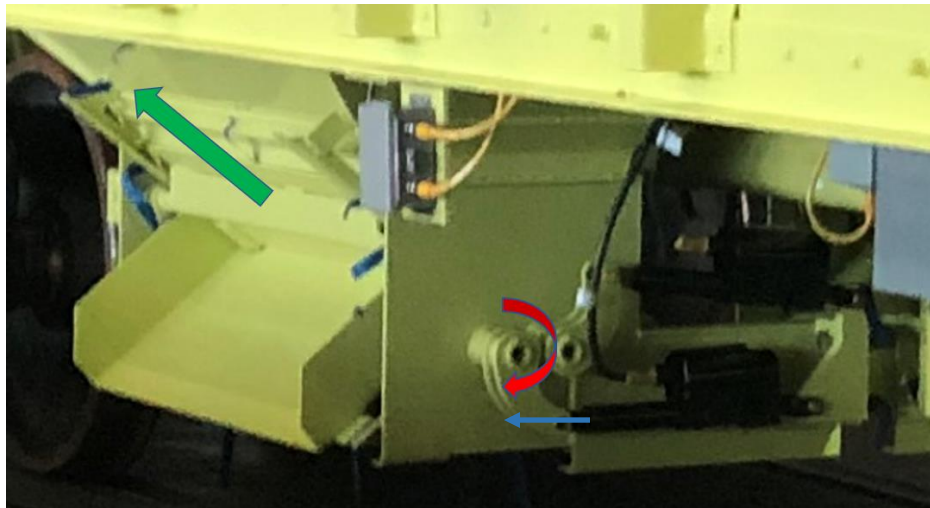
General Description

The Miner Solar Powered Stand-Alone Electric AggreGate™ was designed for twin hopper ballast rail cars. The purpose of the gate is to rapidly discharge ballast from the car to the rail-bed. The primary mode of operation is remote gate operation with hand-held transmitter. In the event remote operation cannot be completed, manual powered operation can be achieved using manual override toggles located in the box assembly on the side of the car. If primary and secondary modes of operation cannot be achieved; the car must be stopped, power cut off in the battery box, and emergency manual door operation can be completed using the provided wrench on the hex nut mounted on the gate shafts.

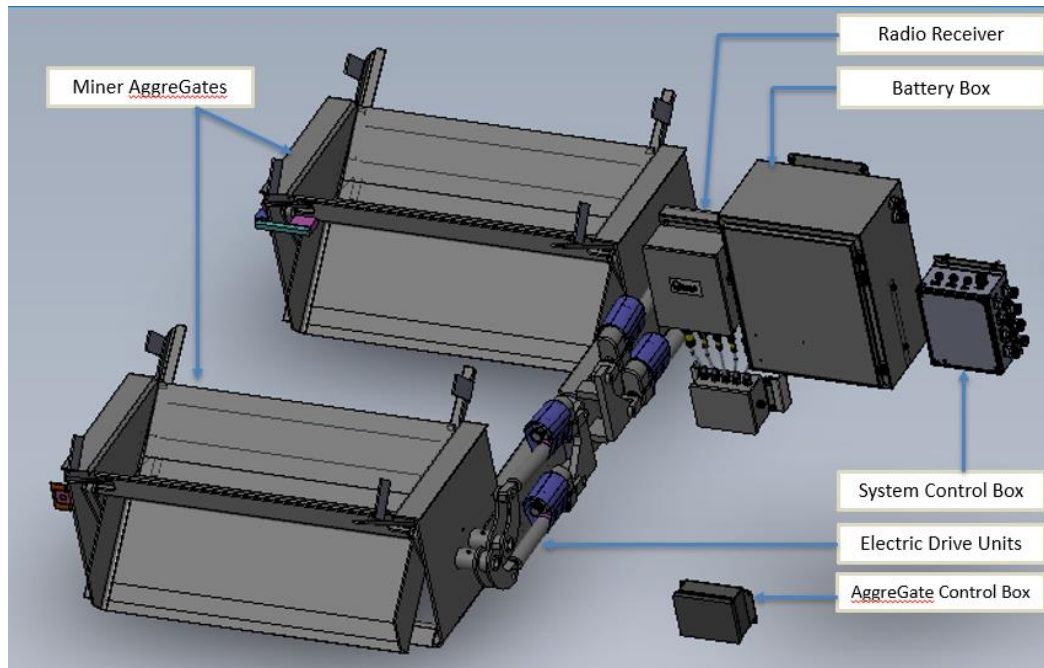
Carefully read and understand the SAFETY PRECAUTIONS SECTION of this manual.

Principle of Operation Electric Aggregate Gate System

Principle of Operation - Gate



Ballast can be unloaded inside or outside of the rail. Power supplied to the drive units results in rotation of the operating shafts which act through linkages to open and close the inner and outer door.



Electricity from two deep cell batteries provides the power to activate the electric drive units on each gate. The electricity is directed to the proper gate by solid state circuitry.

The system is designed for primary operation through digital signal from a radio receiver controlled by an operator using a hand-held radio transmitter. In the event the primary operation cannot be completed, a secondary manual powered operation of the gates can be achieved using toggles located in the gate control box located on the side of the car.

Principle of Operation – Radio Receiver



The receiver can be controlled by two separate transmitters that operate on opposite sides of the car without interfering with each other. Data is transmitted by the radio signal. Up to four transmitters can operate on the same frequency while in proximity. The operating range outdoors is -22°F to 140°F (-30°C to 60°C), RH 0 to 95%

The hand-held transmitter transmits signals to the receiver/decoder using a UHF radio link. The signal is picked up by the antenna and passed on to the receiver. If the signal is the correct frequency and passes all required data tests, the signal is passed on to the decoder.

The decoder compares the base address code of the signal to its own address code. If the signal's base address code does not match the decoder's base address code, it is ignored. If the base address and sub address (ballast car I.D. number) codes are correct, the decoder processes the message and energizes and de-energizes the appropriate output relays.

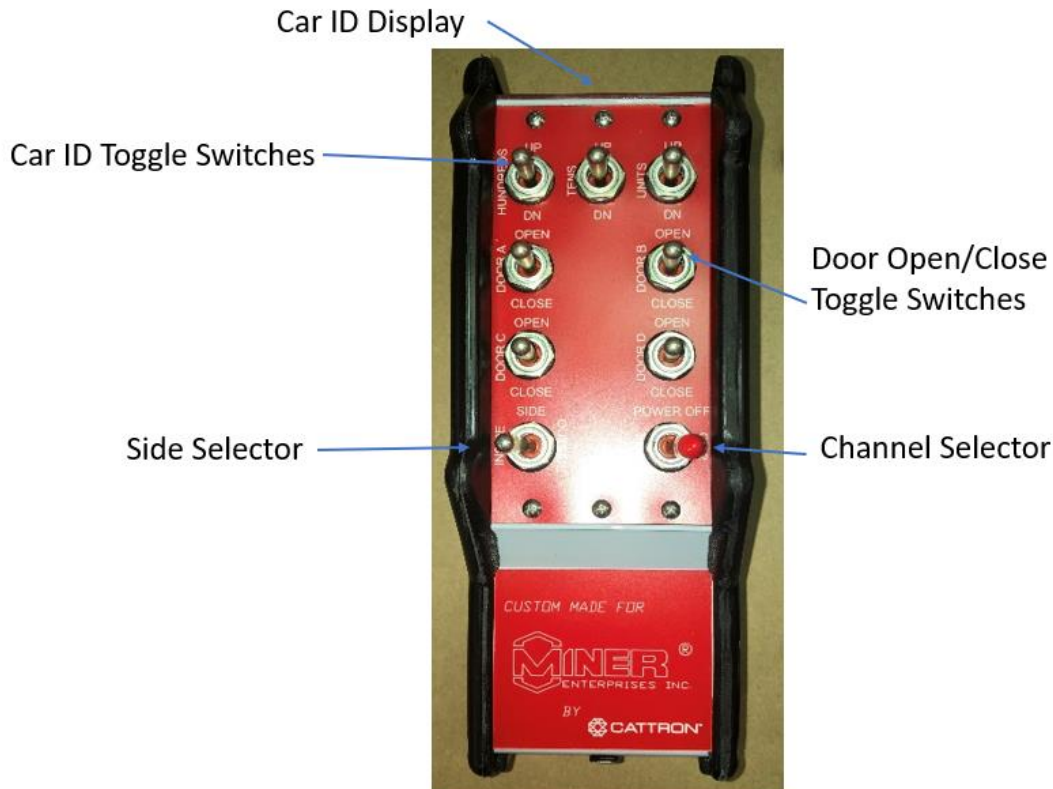


A 20 Amp control fuse is mounted in the common input line of each relay group to provide over-current protection. During operation, the microprocessor on the decoder board resets a watchdog timer circuit whenever valid messages are received and decoded.

The system operates in the specific band, does not require an FCC license, and has a range of 200 feet. The transmitter can operate up to 1000 cars (000-999) individually by using preprogrammed radio receivers mounted on each car which is set up with a unique address. The receiver is turned on by depressing one of the two power toggle switches located in the aggregate control boxes mounted on either side of the car above the side sill.

Note: The receiver will not operate unless both the lids on the aggregate control boxes are latched closed.

Hand-Held Transmitter



The hand-held transmitter has been customized specifically for Ballast Car Operation and contains a highly advanced encoder circuit board using micro-computer digital circuitry.

The hand-held transmitter uses a rechargeable Battery Pack and Charger. The (LED) indicator changes from green to orange when the batteries need replacing.

Note: Transmitters should be maintained at six feet separation from each other during operation.

POWER ON SELF TEST (P.O.S.T.) DIAGNOSTICS - When the operator first turns the power switch on, a sophisticated self-test routine tests the microcomputer and all critical switch inputs to detect unwanted commands in the system. A small speaker beeps twice when the test has been completed satisfactorily.



BATTERY SAVER – If the controller has not been operated for 15 minutes, a battery management system detects this inactivity and puts the controller into a deep sleep' mode. To reset the controller, the ON/OFF SWITCH must be set to 'OFF', and then set to 'ON' again.

CHANNEL SELECTOR – This switch is used to select which side of the ballast car the two operators will be stationed. For example: Operator No. 1 selects controller "CHANNEL 1' and stands trackside with a commanding view of the left hand side of the targeted ballast car. Conversely, Operator No. 2 selects controller 'CHANNEL 2' and stands trackside to view the right hand side of the same ballast car.

CAR ID. TOGGLE SWITCH – These 3-position, spring return-to-center switches are used to set the targeted ballast car identification (I.D.) number. It should be noted that all three toggle switches may only be operated in conjunction with the CAR I.D.

CAR I.D. DISPLAY - This digital display shows the current 3-digit ballast car I.D. number selected on the controller. It may also be used to view the last ballast car I.D. number selected by the operator.

SIDE SELECTOR – This 2-position selector switch is used to select either the INSIDE or OUTSIDE doors.

DOOR OPEN/CLOSE TOGGLE SWITCHES – Four toggle switches are provided, one for each door. The ballast car has four doors denoted A, B, C, and D, with three sides each that allow ballast to be released to inside or outside of the rail as the train moves. These 3-position, spring return-to-center switches are used to OPEN and CLOSE the selected door.

Charging System

The two deep cell batteries producing 24 Volts are kept properly charged by a current from regulated solar panels. The batteries provide power for the radio receiver and the electric drive units. A fully charged system alone has enough storage capacity to provide service for one week of overcast days. When storing the railcar for an extended period, the batteries should be fully charged. The useful service life of the batteries when properly charged and fully functioning charging system should be 3-5 years.

Caution: The electric drive units can be back driven and must be safely secured up and away from anything that may cause them damage when not fully attached to the gate. It is unsafe to use the wrench on the gate when the car is moving.



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Section 6

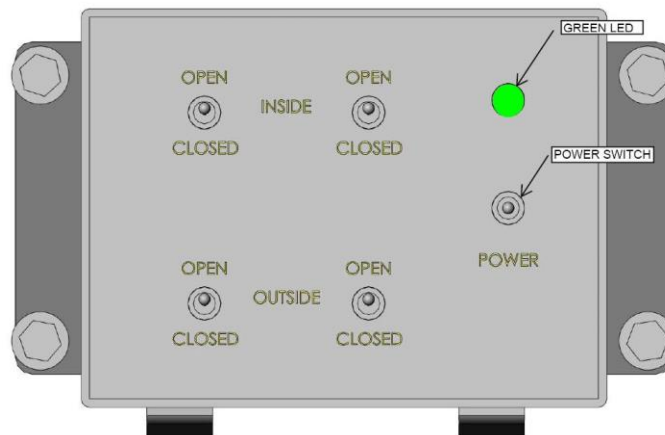
Operating Instructions

General Description

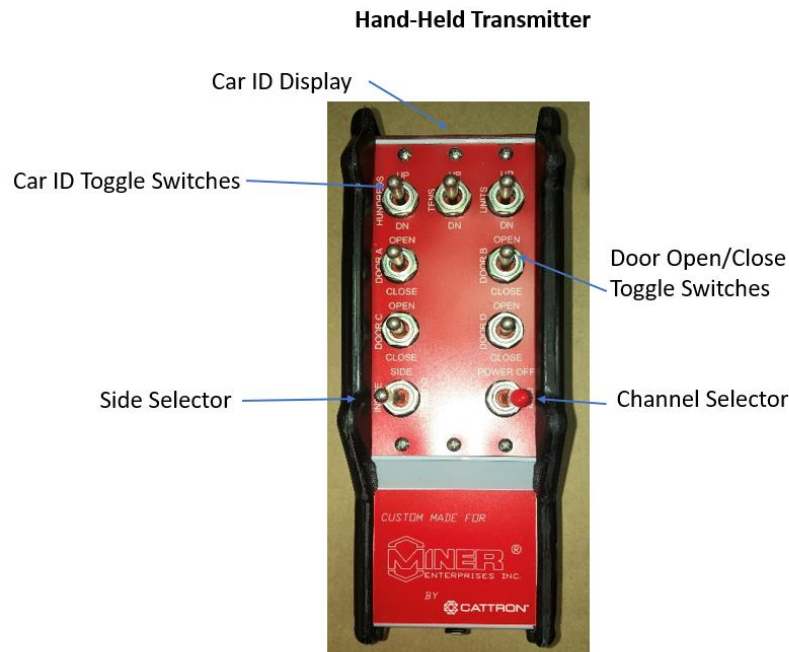
The Miner Solar Powered Stand-Alone Electric AggreGate™ is designed and built for twin hopper ballast rail cars. Read and understand the SAFETY PRECAUTIONS SECTION of this manual in addition to precautions prescribed by the AAR, FRA and individual handling railroads.

The system must be turned on by depressing the power toggle switches located in the gate toggle boxes mounted on either side of the car.

The green LED light will stay on while power is applied to the gate system. Either power toggle switch on the right or left side of the car can be used.

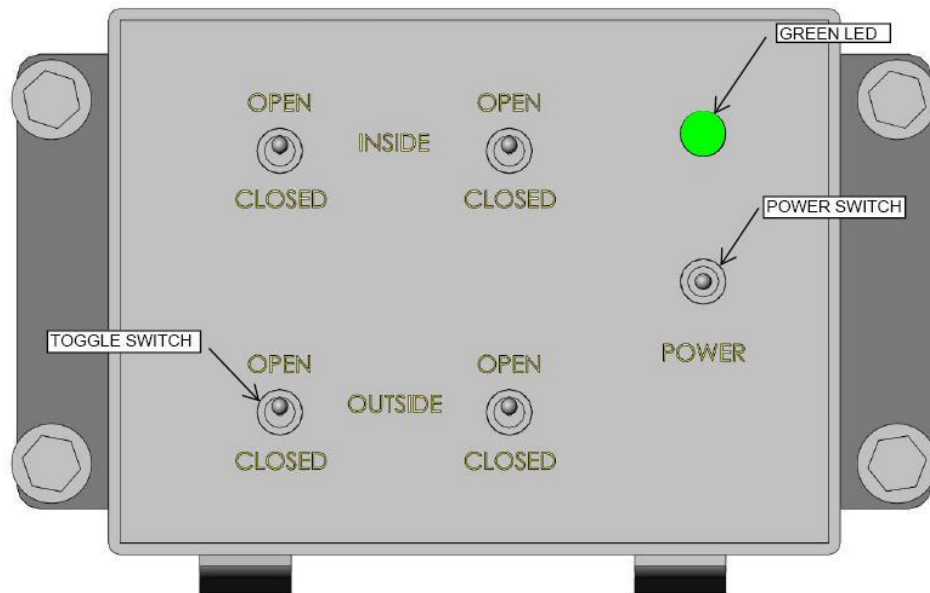


Primary Of Operation – Remote Gate Operation



- 1.) Power up the system inside the gate toggle box.
- 2.) Close and secure the gate toggle box for the hand-held transmitter to function.
- 3.) Power up the hand-held transmitter.
- 4.) When two transmitters are used, set one at channel one and the other at channel two.
- 5.) Dial the last three digits of the car number into the transmitter. Starting with the HUNDREDS switch, pushing upwards increments the first (hundred's) digit of the CAR I.D. DISPLAY. Conversely, pushing the same switch down decrements the first (hundred's) digit of the CAR I.D. DISPLAY. Operation of the TENS and UNITS toggle switches in the same manner will increment or decrement the second and third digits of the CAR I.D. DISPLAY respectively.
- 6.) Set "Inside" or "Outside" of the rail for discharge.
- 7.) Push the toggle to "Open" position for the desired gate (1,2,3,4). The door will continue to open if the toggle is held in the open position and will stop and hold position when the switch is released or when the door is fully open.
- 8.) Close the doors when unloading is complete.
- 9.) Repeat the procedure for each car.
- 10.) Power off the transmitter when unloading is complete.

Secondary Mode Of Operation – Manual Powered Operation

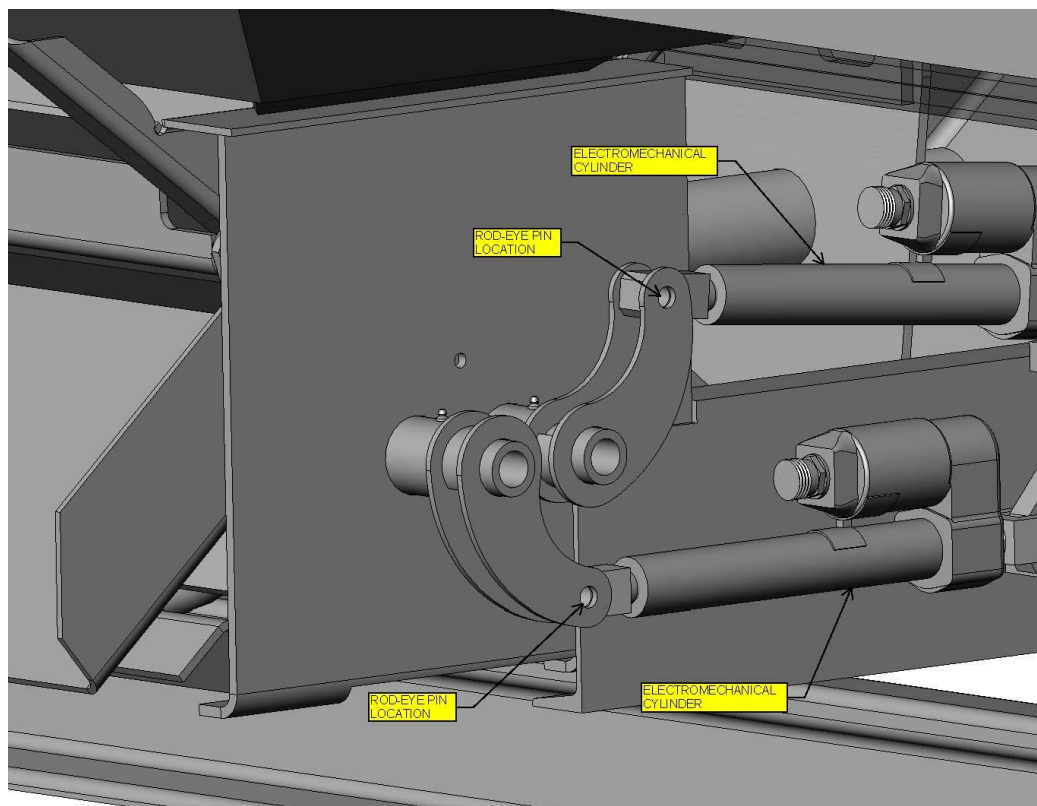


- 1.) Manual powered operation of the gates can be achieved using the manual override toggles located in the box assembly on each side of the car. This procedure is to be used for ballasting only when the remote operation does not function.
- 2.) Use toggle switches to open and close the desired gate.
- 3.) The Toggle Box on the right side of the car can only operate the gates on the right side of the car, and the left only operate the left side. Gates operate while switches are toggled, allowing precision control.

Emergency Manual Gate Operation

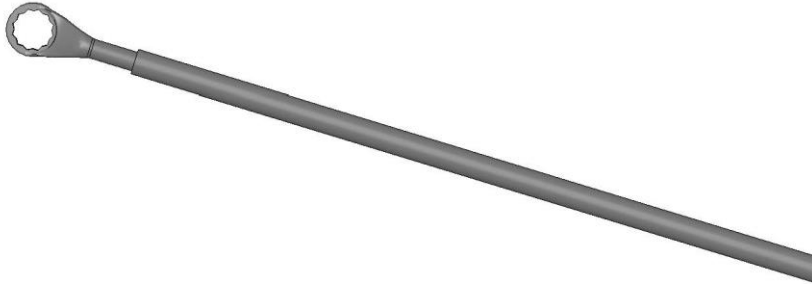
Emergency manual operation should be used only when the doors can not be opened or closed using power. Cars must be stopped, and the system should be powered down before using this procedure.

- 1.) Turn Power Off inside the battery box.
- 2.) Disconnect the cable from the electric drive motor on the non-functioning door position.



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- 3.) Open or close door using box wrench. The wrench is provided and can be found in a secure location under the ballast car. Use wrench to open and close the doors to be operated by placing the head of the wrench on the hex nuts attached to shaft at the end of the gates.



- 4.) Close all the gate doors to complete the process.



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Section 7

Installation Instructions

General Description

The Miner Solar Powered Stand-Alone Electric AggreGate™ was designed and built for twin hopper ballast rail cars. The purpose of the system is to rapidly discharge ballast from the ballast car to the rail-bed. There are two gates per hopper, and each gate is independent of the others.

Carefully read and understand the SAFETY PRECAUTIONS SECTION of this manual.

Required Drawings

For a complete list of components and descriptions and part numbers, refer to latest revision of the following:

General Arrangement Drawing

Electrical Schematic Drawing

Customer Schedule

For a complete list of Miner part numbers and descriptions refer to the latest revision of the Customer Schedule. Any of these documents can be obtained by contacting Miner Customer Service at (630) 232-3000.

Gate Installation Instructions

The Miner Enterprises General Arrangement Drawing and all drawings referenced by said drawings will be necessary to perform gate installation.

Electrical Installation Instructions

The Miner Enterprises General Arrangement Drawing and Electric Schematic Drawing will be necessary to perform electrical installation.



Solar Powered Stand-Alone Electric AggreGate™

Section 8

Inspection Procedures

General Description

The system has three areas that require inspection:

Mechanical System

Electrical System

Charging System

Use the general arrangement drawing, the electrical schematic drawing, and the customer schedule to identify damaged or missing components. Contact Miner Enterprises for assistance in replacing damaged or missing components.

Mechanical System Inspection

Check for damaged welds and components. (*Inspect before each loading and after each unloading.*)

Check for missing or damaged pins, washers or cotter pins. (*Inspect once per year.*)

Check for damaged or missing bolts. (*Inspect once per year.*)

Check for damaged or missing Cable Ties and Cable Tie Brackets. (*Inspect once per year.*)

Check for damaged or missing Cables. (*Inspect once per year.*)

Check for damaged or missing Decals. (*Inspect once per year.*)

Contact Miner Enterprises for assistance in replacing damaged or missing components.



Electrical System Inspection

Check for damaged welds and components. (*Inspect before each loading and after each unloading.*)

Check for damaged or missing or bolts. (*Inspect once per year.*) Replace and repair with like components.

Check Toggle Box Assembly for damage inside or outside and ensure box is functioning properly. If box is not functioning properly, attempt to repair using SECTION 9 TROUBLESHOOTING. (*Inspect once per year.*)

Check Controller Box Assembly for outside damage and ensure box is functioning properly. If box is not functioning properly, attempt to repair using SECTION 9 TROUBLESHOOTING. (*Inspect once per year.*)

Check Radio Receiver Box Assembly for outside damage and ensure box is functioning properly. If box is not functioning properly, attempt to repair using SECTION 9 TROUBLESHOOTING. (*Inspect once per year.*)

Check Radio Receiver Interface Assembly for outside damage and ensure box is functioning properly. If box is not functioning properly the attempt to repair using SECTION 9 TROUBLESHOOTING. (*Inspect once per year.*)

Check Electric Drive Units for outside damage and ensure unit is functioning properly. If unit is not functioning properly, contact Miner Enterprises for assistance in replacing damaged or missing components.

Charging System Inspection

Before proceeding with operation or maintenance of your cars, carefully read and understand the SAFETY PRECAUTIONS SECTION of this manual. Check for damaged or missing bolts. (*Inspect once per year.*) Replace and repair with like components.

Check the battery box for physical damage inside or outside. (*Inspect once per year*)



Check Solar Array Assembly. (*Inspect once per year.*)

Check junction box where solar array cables get connected for physical damage.
Check to make sure cable connections are secure and tight.
Verify the solar array covers are clear. Cloudy panel covers will affect the wattage output of the array and should be replaced.





Solar Powered Stand-Alone Electric AggreGate™

Section 10 Troubleshooting

Before continuing with troubleshooting, carefully read and understand the SAFETY PRECAUTIONS SECTION of this manual.

Use the general arrangement drawing, the electrical schematic drawing, and the customer schedule to identify damaged or missing components. Contact Miner Enterprises for assistance in replacing damaged or missing components.

Mechanical System Troubleshooting

If components are damaged or missing contact Miner Enterprises for assistance in repairing/replacing damaged or missing components.

Electrical System Troubleshooting

If it has been determined that the charge system is functioning properly, and the gates are not functioning then there is a problem with the Electrical System. Follow the steps below to determine what components in the system are not functioning properly.

Check Toggle Box, Control Box, and Electric drive units for damage and ensure they are functioning properly. If components are damaged or missing contact Miner Enterprises for assistance in repairing/replacing damaged or missing components.

1) Does the power LED light on Ballast Toggle Box operate?

Yes - Determine if all toggle switches work.

No - Determine if any toggle switches work, if none work, attempt to replace the box with a box that is known to work.

2) Does the toggle switch work with new box?

Yes - Problem is solved.

No – Determine if the problem is the motor by switching the power cable on the inoperative motor with one that is working. If that does not correct the problem the Ballast Control Box may not work properly.



3) Does the toggle switch operate a different motor?

Yes - The motor is the problem and should be replaced.

No - The cable going from the Ballast Control Box to the gate motor may be damaged. Use a new cable and route it from the proper door # to the corresponding gate motor.

4) Once new cable is connected, does the toggle switch operate the motor?

Yes - The cable is the problem and should be replaced.

No - The problem may be in the Ballast Control Box.

5) If Ballast Control Box is not working properly a new one will need to be ordered.

6) Return all cables to their proper locations.

Check the hand-held Transmitter, Radio Receiver, and Radio Interface for damage and ensure they are functioning properly. If components are not working properly contact Miner Enterprises for assistance in repairing/replacing damaged or missing components.

Charging System Troubleshooting

Two areas to investigate are:

- 1) The Battery Box Assembly and its components.
- 2) The Solar Array Assembly and its components.

Open the battery box and check that the input voltage from the Solar array is 24 volts. Verify the output voltage from the battery box is 24 volts.

If the input voltage is not 24 volts then the problem is in the Solar Array.

If the input voltage is 24 volts but the output voltage is not 24 volts, then the problem is in the Battery Assembly

Check Battery Box. If components are damaged or missing contact Miner Enterprises for assistance in repairing/replacing damaged or missing components.

- 1) Check box for physical damage inside and outside.
- 2) Check to make sure wire connections inside box are secure.
- 3) Check that fuses are functional.
- 4) Check that voltage light on charger is green.
- 5) Check that batteries are securely mounted.
- 6) Check that batteries are not physically damaged.
- 7) Using a voltmeter, check that each battery has 12-18 volts. Check the battery voltage by placing the negative (-) lead to the negative (-) side of the battery and the positive (+) lead to the positive (+) side of the battery. If voltage does not read between 12-18 volts the battery is damaged.
- 8) Check that the voltage from the Solar Array is 24 volts. There are two ways to check this; while the leads from the solar array are still connected to the regulator, take the voltage reading by placing the negative (-) lead to the negative (-) connection of the solar array on the regulator and the positive (+) lead to the positive (+) connection of the solar array on the regulator. The reading should read slightly higher than the sum of the two battery voltages.
- 9) The solar array voltage can also be checked by disconnecting the positive connection of the solar array on the regulator. Take the voltmeter and connect the negative (-) lead to the negative (-) connection of the solar array on the regulator and the positive (+) lead to the positive (+) connection of the solar array that was disconnected. There should be a reading of approximately 40 V, this is the voltage given out by both solar arrays.
- 10) Verify that the array covers are clear.



Check the solar panel assemblies and protective shields. If components are damaged, cloudy, or missing contact Miner Enterprises for assistance in repairing/replacing damaged or missing components.

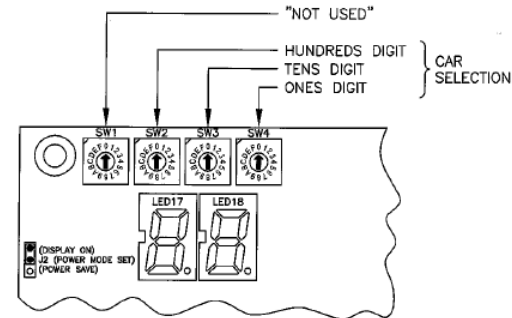
- 1) Check box for physical damage.
- 2) Check to make sure cable connections are secure.



If all other methods have failed to provide a solution, carefully open the Radio Receiver box and review and record the code shown on the LED display. Contact Miner Enterprises for assistance and have the diagnostic code available.



We have included a diagnostic code key to help correlate the code.



- J2 ☐ ENABLES THE DISPLAY (DEFAULT SETTING)
- J2 ☐ ENABLES THE POWERSAVE OPTION
- J2 ☐ DISABLES THE DISPLAY (NO JUMPER INSTALLED)

POWERSAVE OPTION PUTS DECODER INTO A SLEEP MODE AND DISABLES THE DISPLAY. EVERY 5 SECONDS THE DECODER WILL WAKE UP AND LOOK TO SEE IF A CONTROLLER IS ADDRESSING IT. IF A CONTROLLER IS ADDRESSING IT THE DECODER WILL OPERATE AS NORMAL.

STATUS DISPLAY SUMMARY

FOR MORE INFORMATION REFER TO THE MAINTENANCE SECTION IN MANUAL

00 SYSTEM OK DISPLAYED BETWEEN VALID RECEIVED MESSAGES	Fb WATCHDOG TIMER FAILURE--WON'T CYCLE PROPERLY, FAILED TEST
ES BAD SYNC CHARACTER	FC OPR FAILED--MAIN OUTPUT FAILED ON
EA BAD ADDRESS RECEIVED--NOT MATCHED WITH DECODER CODE PLUG	Fd CPU TIMED OUT--DISABLES OUTPUTS AWAITING NEW XMTR MESSAGE
Eb BAD BCH COMPARISON RECEIVED--MESSAGE BCH NOT EQUAL TO THE TRANSMITTED BCH	FE CODE PLUG INVALID MISSING OR NOT PROGRAMMED
EC BAD COMMAND--COMMAND FIELD ERROR	FF PROCESSOR IN RESET
EF FRAMING ERROR--STOP BIT INVALID (SUB ADDRESS DOES NOT MATCH XMTR)	
EE EMERGENCY STOP MESSAGE RECEIVED	

UPON POWER-UP THE DISPLAY WILL SHOW THE FOLLOWING:

- SYSTEM PROGRAMMED ADDRESSES
- CAR ID ☐ & HUNDREDS DIGIT TENS & ONES DIGIT
- Fd AWAITING NEW XMTR MESSAGE

CONTROLLER DESCRIPTION

SWITCHES ON CONTROLLER USED FOR CAR SELECTION
 TOGGLE SWITCH (LEFT) -- HUNDREDS DIGIT OF CAR ID
 TOGGLE SWITCH (CNTR) -- TENS DIGIT OF CAR ID
 TOGGLE SWITCH (RIGHT) -- ONES DIGIT OF CAR ID

INSIDE/OUTSIDE -- SELECTS WHICH GROUP OF DOORS
 DOOR A OPEN/CLOSE -- SENDS OPEN OR CLOSE COMMAND FOR DOOR A
 DOOR B OPEN/CLOSE -- SENDS OPEN OR CLOSE COMMAND FOR DOOR B
 DOOR C OPEN/CLOSE -- SENDS OPEN OR CLOSE COMMAND FOR DOOR C
 DOOR D OPEN/CLOSE -- SENDS OPEN OR CLOSE COMMAND FOR DOOR D

CHANNEL 1/2 -- SELECTS RADIO CHANNEL
 EACH OPERATOR MUST HAVE A DIFFERENT RADIO CHANNEL SELECTED

DECODER DESCRIPTION

"OPERATE" OUTPUT RELAYS REMAINS CLOSED FOR TEN SECONDS AFTER LAST COMMAND IS SENT

ROTARY SWITCHES ON DECODER USED FOR CAR SELECTION
 ASO TEST IS DISABLED ON ALL OUTPUTS

OUTPUT RELAY FUNCTIONALITY

	INSIDE	OUTSIDE
DOOR A OPEN	01	09
DOOR A CLOSE	02	10
DOOR B OPEN	03	11
DOOR B CLOSE	04	12
DOOR C OPEN	05	13
DOOR C CLOSE	06	14
DOOR D OPEN	07	15
DOOR D CLOSE	08	16

Any time a conflicting OPEN/CLOSE command is received for door A, B, C, or D INSIDE or OUTSIDE the decoder will not output any command for that door.

RECEIVER DESCRIPTION

ROTARY SWITCH ON RECEIVER BOARD MAY BE IN ANY POSITION

SEE OPERATIONAL MANUALS FOR FURTHER INFORMATION