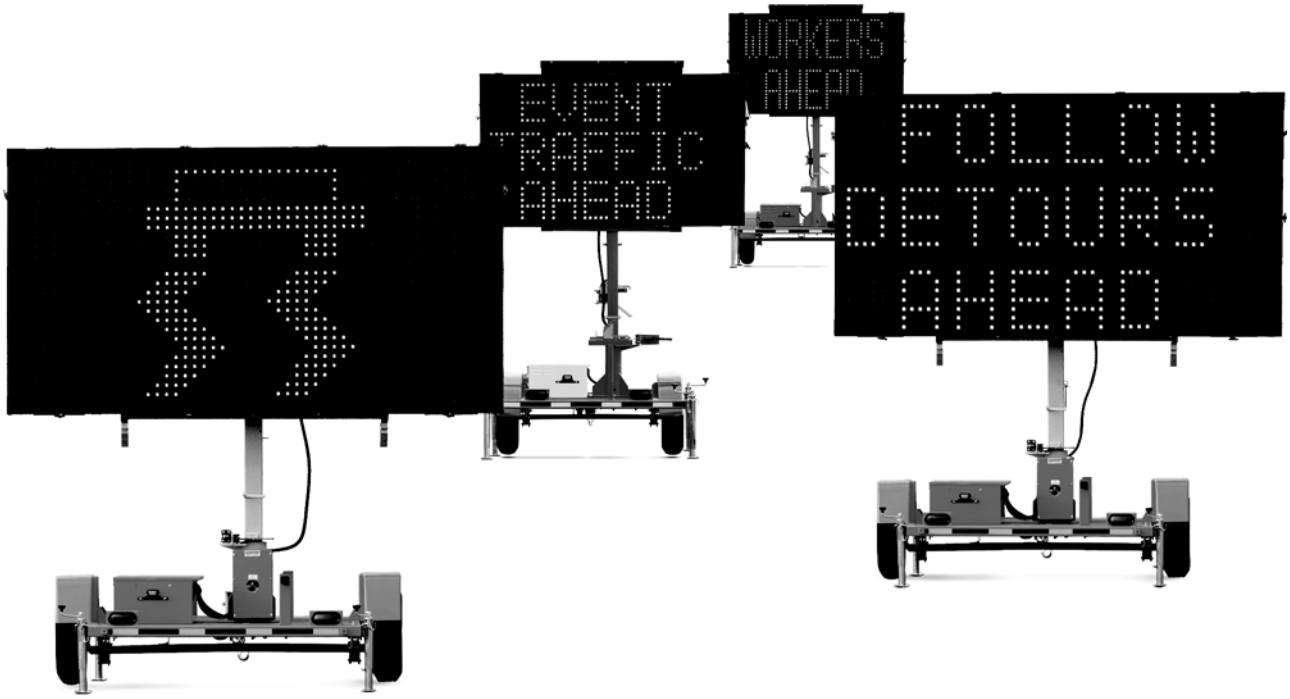
Full-Size & Mini Message Signs

Matrix and Three-Line



Owner's Manual

April 2018

WANCO® The industry leader.

Contents

List of Figures

List of Tables

1 Introduction

1.1 Read before using

This is the owner's manual for Wanco® Full-Size and Mini Message Signs.

For your safety and protection from injury, carefully read, understand, and observe all instructions in this manual. Always read all instructions before performing a procedure.

Keep a copy of this manual with the message sign. Additional and replacement manuals are available from the factory (see Section 1.4, "Where to obtain service," page 2).

Illustrations in this document are representative of common message sign models, but might differ in detail from your message sign.

If you have questions regarding this product, please contact Wanco Service or Sales using the information in Section 1.4.

1.2 Message sign models

Four models of Wanco Message Signs are covered by this instruction manual: two full-size models and two Mini models.

- All four models have either a frame-mounted control box with a keyboard interface or an in-cabinet control box with a touchscreen interface.
- All four models are functionally similar. Differences are listed in Table 1-1.

Table 1-1. Model comparison

Feature	Matrix signs		Three-line signs	
	Full-size	Mini	Full-size	Mini
Sign and trailer size	Large	Medium	Large	Medium
Alphanumeric fonts	12	12	1	1
Displays graphics and symbols	✓	✓		
Displays arrow patterns	✓	✓	✓	✓
Removeable drawbar	see note	✓	see note	✓
Hydraulic lift	Standard	Optional	Standard	Optional
Hand-operated winch	Optional	Standard	Optional	Standard
Meets MUTCD	✓		✓	

Some full-size message signs include a removeable drawbar.

Matrix signs provide the greatest flexibility for displaying any type of message: text messages with a choice of character sizes and weights, graphic messages that show preconfigured or custom graphics and symbols, or a combination of both. To create custom-designed messages that combine text and graphics, use the Wanco Message Graphics program (not included).

Three-line signs are straightfoward: they display up to three lines of text with up to eight characters per line in a single font. Wanco Three-Line Signs can also display arrow-shaped patterns, which are preprogrammed into the sign for easy access.

Full-size signs have a long trailer with a wide footprint that provides excellent stability. Mini signs are about 30 percent smaller, making them highly maneuverable and easy to deploy.

1.3 Applications

Wanco Variable Message Signs feature ultra-bright and highly legible displays for providing messages to motorists. They have a variety of functions for any application. Common applications include:

- Work zones
- Highway construction
- Lane closures
- Parking lots
- Special events

All Wanco message signs include an onboard controller, so no laptop or external controller is needed.

1.4 Where to obtain service

Before calling for service, please have the sign's model number and VIN ready. This information is displayed on the vehicle identification tag (see Figure 1-1).

Contact our service department using the following information:

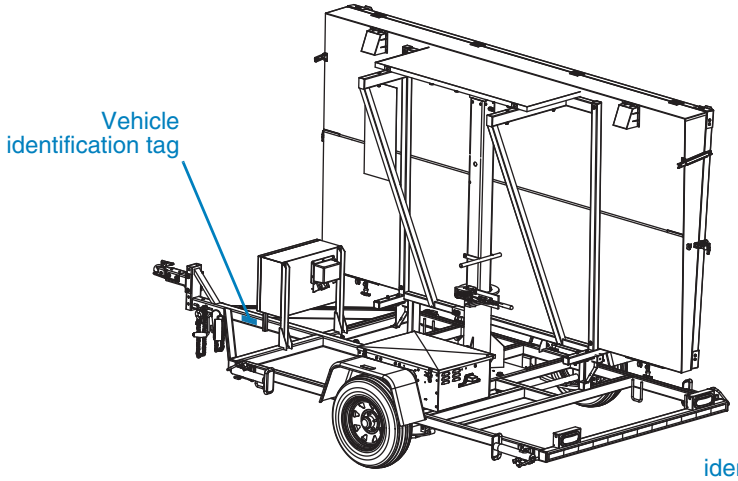
Wanco Inc.
5870 Tennyson Street
Arvada, Colorado 80003 USA

303-427-5700
fax 303-427-5725

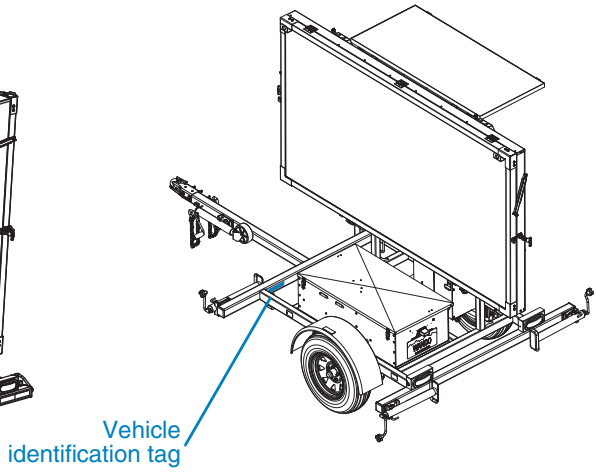
www.wanco.com
info@wanco.com

Figure 1-1. Vehicle identification tag

Full-size sign with A-frame trailer



Sign with removable drawbar



2 Safety

2.1 Safety statements in this manual

This manual contains the following types of callouts, which must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service. Each alert has a specific meaning, as described below:

⚠ The safety alert symbol alerts you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER

Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ WARNING

Indicates an imminently hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

CAUTION

Used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, could result in property damage.

IMPORTANT!

Indicates information that is of particular importance when transporting, operating, or servicing the equipment.

2.2 General safety

⚠ WARNING

Improper use of equipment could cause serious injury or death.

Prior to using this product, carefully read, understand, and observe all instructions in this manual.

⚠ CAUTION

Crush hazard.

When operating or working on the message sign, keep hands and body parts clear of pinch points.

2.3 Operating Safety

2.3.1 Prior to use

- To reduce the risk of personal injury, ensure the surrounding area is in good order and free of debris.
- To reduce the risk of shifting, rolling, or overturning, locate the message sign on a firm, level surface.
- If the message sign has outriggers, ensure there is enough space to deploy outriggers. Outriggers are optional equipment and your sign may not be equipped with them.

⚠ WARNING

Falling equipment could cause severe injury or death.

Before raising display cabinet, stabilize and level the trailer.

- Always stabilize and level the trailer before raising the sign cabinet. To improve stability, deploy outriggers prior to raising the message sign display.
- Ensure the message sign is in good operating condition. Never use any equipment that is damaged or in need of repair.

2.3.2 During operation

⚠ WARNING

Loose equipment can cause severe injury.

Ensure wind does not catch and unexpectedly rotate unlocked display cabinet.

⚠ WARNING

Improper sign display could cause a traffic accident resulting in severe injury or death.

Visually inspect message sign to ensure correct message is displayed.

- When deploying the sign in windy conditions, ensure the sign cabinet rotation is locked to prevent the wind from catching and unexpectedly rotating the cabinet.
- Always visually inspect the message on the sign to ensure the sign is operating as expected. Always replace display modules that are not operating.
- Never collapse the outriggers or move the trailer while the message sign is raised.
- Do not allow water to accumulate around the base of the trailer.
- When the message sign is raised, verify the height-lock pin is engaged.

2.4 Service safety

⚠ WARNING

Fire hazard.

When working with the message sign batteries or hydraulic lift, never allow positive wiring to short to ground.

⚠ CAUTION

During servicing, adverse weather conditions can cause equipment damage and injury.

Whenever possible, perform maintenance indoors or in calm, dry weather.

CAUTION

Voltage surge could damage control circuits.

Before servicing electrical components, disconnect power cable from controller.

- Always take precautions to ensure the safety of service personnel. Whenever possible, perform maintenance indoors, out of the weather and away from traffic.
- Never perform any service unless all electrical components are shut down. Ensure all message sign power circuits are shut off.
- Always disconnect power cable from controller before disconnecting battery cables.
- If disconnecting message sign battery cables, always disconnect the positive (+) cable first.* Do not allow positive power cable to short to ground.
- If the ground under or around the trailer is damp or wet, move the trailer to a dry location and allow it to dry before servicing.
- Do not service the message sign if your clothing or skin is wet.
- Always be aware of traffic when performing roadside maintenance.
- Keep the message sign and all its components clean.

2.5 Labels

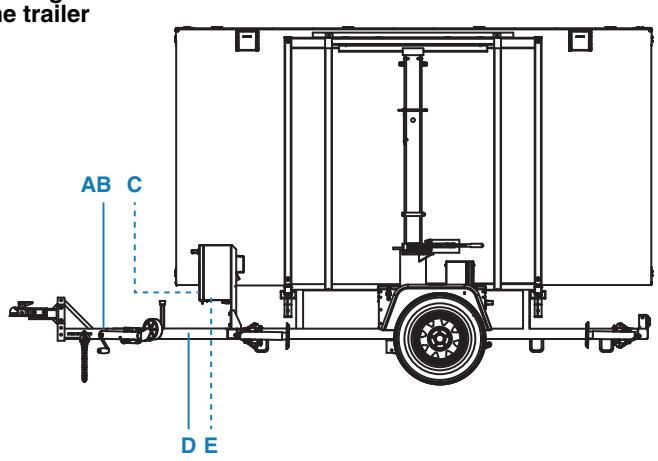
Labels provide instructions and information. They also warn of hazards. For convenience and safety, keep all labels in legible condition, replacing them when they are damaged or missing. Replacement labels are available from the factory.

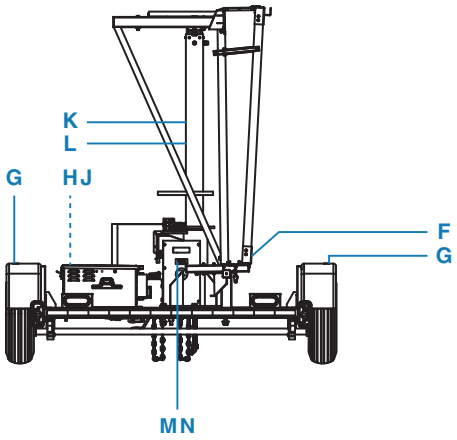
Label locations are indicated in Figure 2-1. Samples of labels and their descriptions are provided in Table 2-1.

**Removing the positive cable first is a requirement for negative-ground systems.*

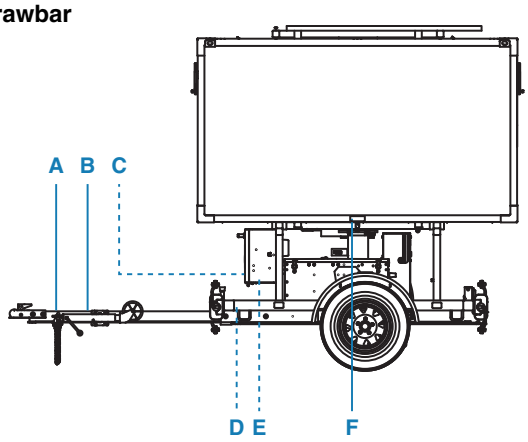
Figure 2-1. Label locations

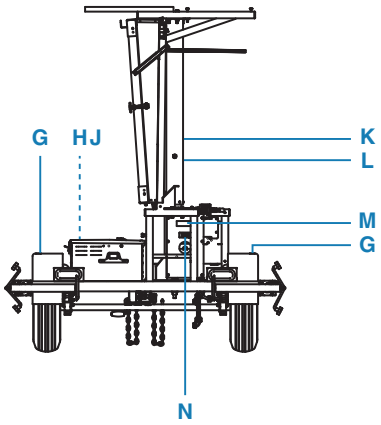
Full-size sign with A-frame trailer



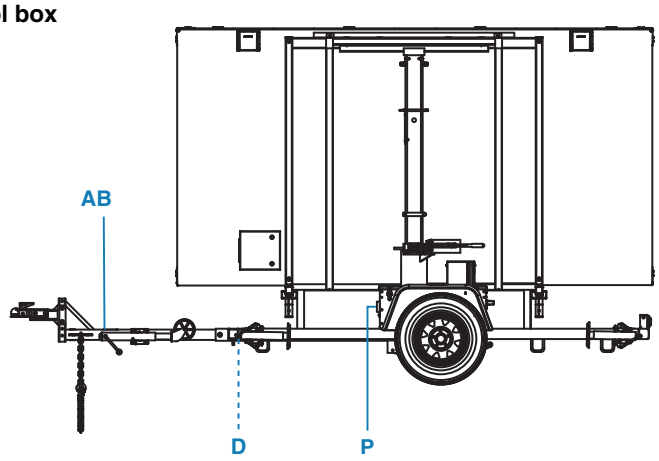


Sign with removable drawbar





Sign with in-cabinet control box



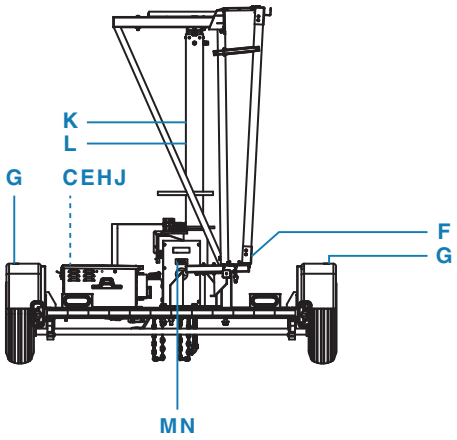
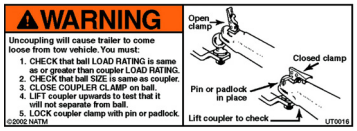
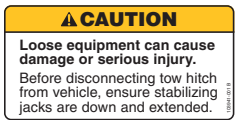
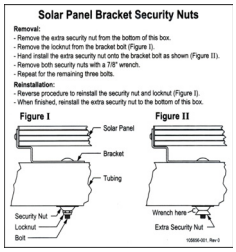
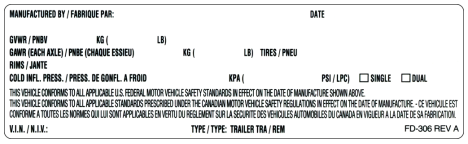
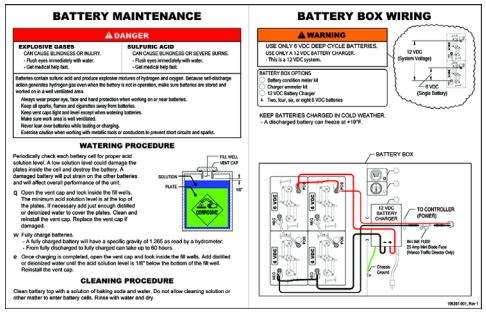
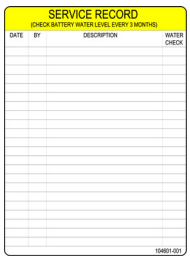


Table 2-1. Label samples and descriptions

Ref.[1]	Label (not to scale)	Description
A		Warning: towing connection
B		Caution: extend stabilizing jack
C		Solar panel bracket security nuts
D		Vehicle identification tag
E		Extra security nut
F		Caution: electronics damage
G		Caution: not a step
H		Danger: battery maintenance Warning: battery voltage
J		Service record

[1]*Reference Figure 2-1 for label location.* [2]*Winch models only.* [3]*Hydraulic models only*

Table 2-1. Label samples and descriptions *continued*

Ref.[1]	Label (not to scale)	Description
K[2]		Warning: stabilize and level trailer before raising sign
L[2]		Release locking pin
M[3]		Caution: not a step
N[3]		Use AW-32 hydraulic fluid only
P[3]		Warning: stabilize and level trailer before raising sign

[1]Reference Figure 2-1 for label location. [2]Winch models only. [3]Hydraulic models only

3 Assembly

Some full-size message signs and all Mini signs have a drawbar that may be removed before shipment from the factory. Before using your Wanco message sign for the first time, it might be necessary to install the drawbar.

To install the drawbar, follow these steps:

1. The drawbar includes wiring for the trailer lights. Before installing the drawbar, ensure the wiring and harness are hanging out of the drawbar, as indicated in Figure 3-1.
2. Refer to Figure 3-2 and install the drawbar and wiring:
   a. Locate the receiving sleeve, centered at the front of the trailer frame.
   b. Carefully insert the wiring and harness into the sleeve, followed by the drawbar.
   c. Align the holes in the sleeve and drawbar.
   d. Attach the drawbar to the trailer with two sets of bolts, washers, and nuts. Tighten the nuts fully.
   e. Connect the wiring harness to the receptacle under the trailer frame. Before towing, ensure the trailer brake lights, taillights, and directional/turn indicators are functioning properly.

Figure 3-1. Wiring and harness

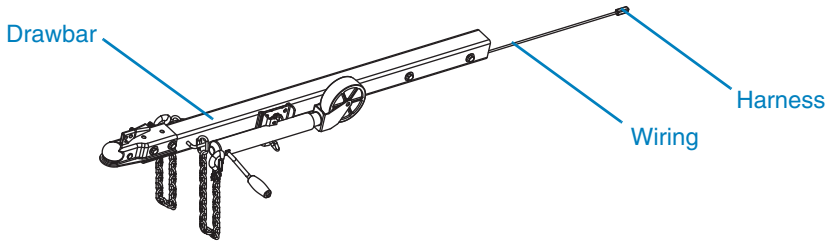
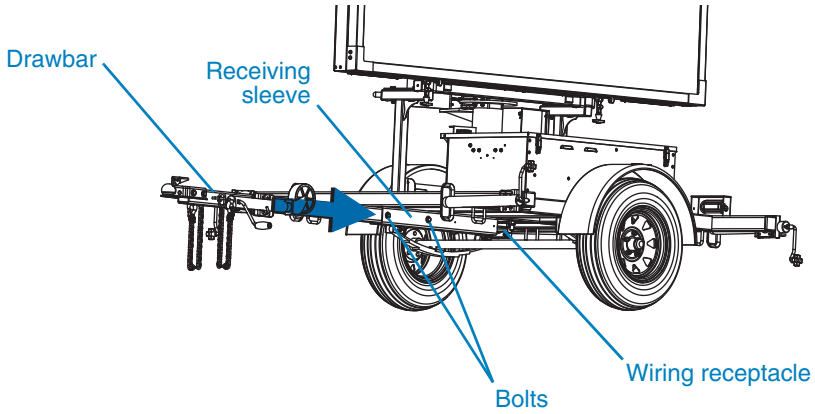


Figure 3-2. Drawbar installation



4 Operation

4.1 Overview

A typical deployment of a Wanco message sign includes the following steps:

1. Towing the trailer to its destination (Section 4.3)
2. Locating and positioning the trailer (Section 4.4.1, page 21)
3. Leveling the trailer (Section 4.4.2, page 22)
4. Raising the display cabinet (Section 4.4.3, page 24)
5. Putting a message on the sign (Section 4.5, page 25)

4.2 Before using the message sign

Before using the Wanco message sign:

- Read and follow all safety instructions (see Section 2, page 5).
- Ensure the message sign batteries are fully charged.
- If the message sign is being returned to service after being in storage, check the cables inside the battery box to ensure they are connected.

CAUTION

Voltage surge could damage control circuits.

Before connecting battery cables, ensure power cable is disconnected from controller.

- Because the message sign power system is a negative-ground system, connect the negative (–) cable to the battery first, then connect the positive (+) cable to the battery.
- AFTER connecting battery cables to the batteries, connect the power cable to the controller.

For additional information:

- Instructions for using the controller in a frame-mounted control box are provided in the Wanco NTCIP Message Sign Software User's Guide.
- Instructions for using the controller in an in-cabinet control box are provided in the touchscreen user's guide.
- Instructions for creating custom messages with text and graphics (for matrix signs only) are provided in the Wanco Message Graphics User's Manual.

4.3 Towing

4.3.1 Before towing

Before towing, refer to Figure 4-1 and prepare the message sign as follows:

1. Lower the mast and display cabinet into the travel position:

   a. If the sign has a hydraulic lift, remove the height locking-pin from the holes in the tower so the display cabinet can be lowered. If the sign has a hand-operated winch, pull and hold the height locking-pin to release the cabinet.

⚠ DANGER

Falling equipment will cause severe injury or death.

If height locking-pin is stuck, removing the pin may cause the display cabinet to fall.

- Do not force pin.
- Contact factory for assistance.

   b. Use the hydraulic-lift switch or the hand-operated winch to lower the cabinet until its bottom edge is within easy reach. Do not lower it all the way yet. For a sign with a winch, release the height-lock pin after you begin lowering the sign.

   c. Pull the rotation-brake handle to release the cabinet so that it can be turned.

⚠ WARNING

Loose equipment can cause severe injury.

Ensure wind does not catch and unexpectedly rotate unlocked display cabinet.

   d. Rotate the cabinet so that the sign support bar is over the travel cradle.

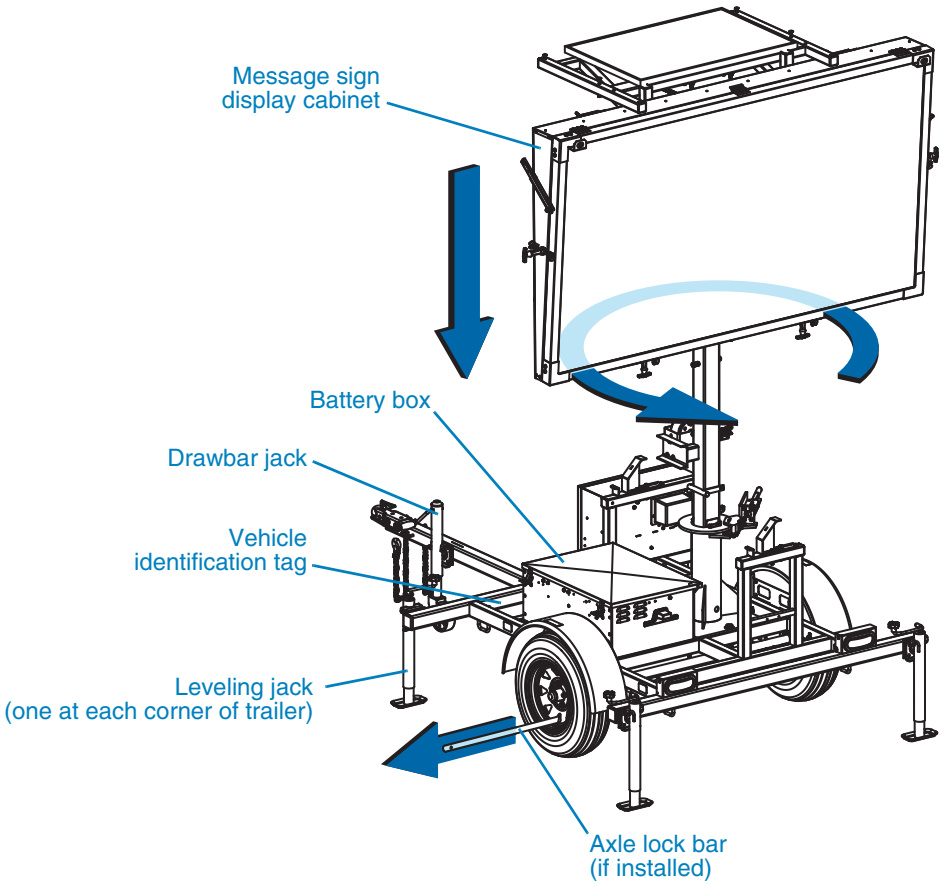
   e. Use the hydraulic-lift switch or the winch to lower the sign support bar into the travel cradle.

   f. Push the rotation-brake handle, locking the cabinet rotation. In the locked position, the brake handle is fully extended.

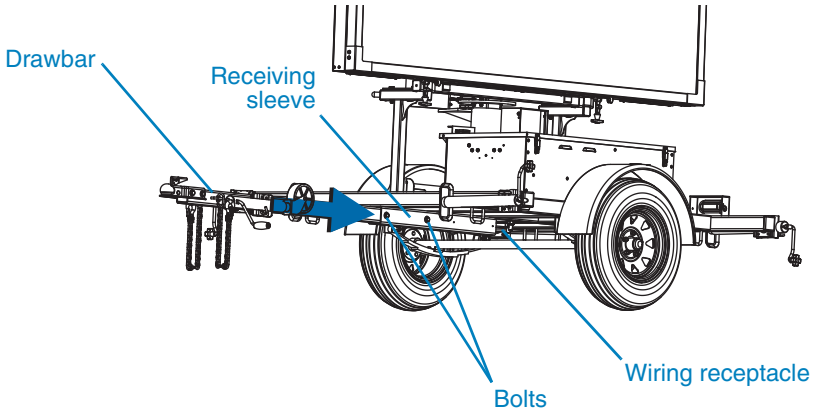
   g. If the sign has a hydraulic lift, secure the height-lock pin in the vertical hole next to where the pin is attached to the tower. If the sign has a winch, the pin engages automatically (when lowered all the way, the spring-loaded pin snaps into place with an audible “click”).

2. Use the controller to “blank” the message sign.
3. Close and latch the control box.
4. Close and latch the battery box.

Figure 4-1. Before towing



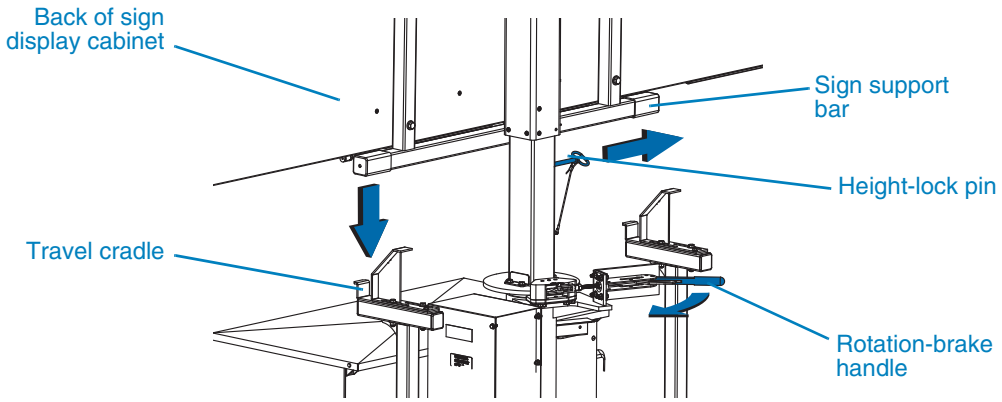
Detail view: removeable drawbar (some models only)



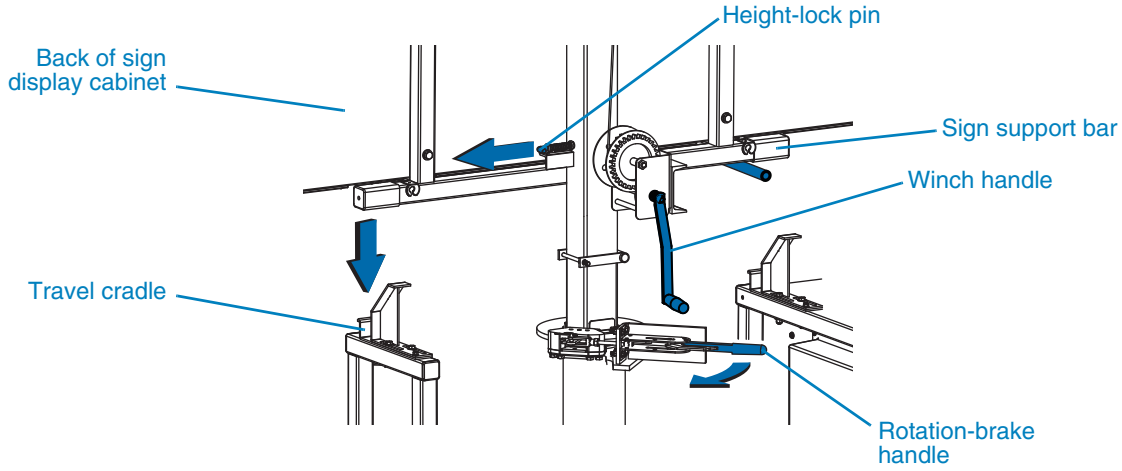
continued on next page

Figure 4-1. Before towing ***continued***

Detail view: hydraulic lift



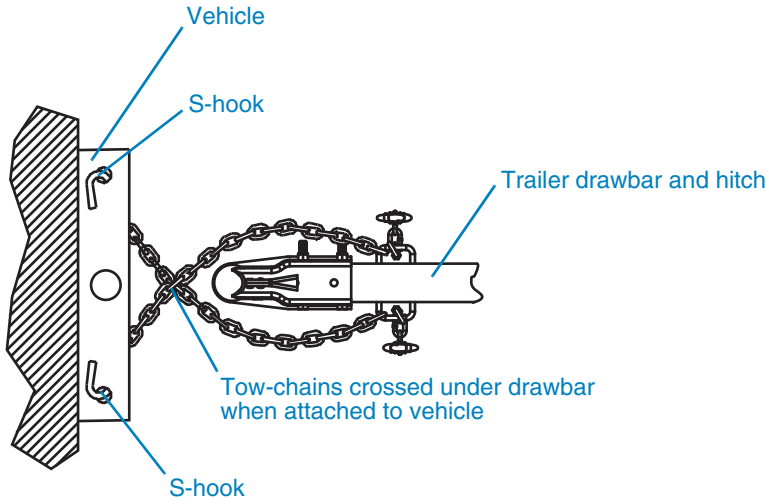
Detail view: manual winch



5. Check tires, wheels, and axle lock:
   a. Check tires for wear. Replace worn tires.
   b. Ensure tires are inflated to the proper pressure.
   c. Verify all wheel lugs are in place and tightened. Do not tow the trailer if a wheel lug is missing.
   d. Remove the axle lock bar, if installed.

6. Check the drawbar, tow hitch, and safety chains:
    a. Ensure the tow hitch on the tow vehicle is rated for weight equal to or greater than the message sign's gross vehicle weight rating (GVWR). The GVWR is listed on the vehicle identification tag.
    b. Ensure the tow hitch on the tow vehicle and the drawbar hitch on the message sign trailer are compatible.
    c. Inspect the tow hitch and drawbar hitch for wear and damage. Replace or repair if necessary.
    d. If the message sign trailer has a removable drawbar, ensure the drawbar is attached securely to the trailer frame with two sets of bolts, washers, and nuts. The bolts should engage the drawbar and the nuts should be tight. (For drawbar installation instructions, see Section 3, page 13.)
    e. Lower the drawbar jack into the down position by pulling the jack locking pin and rotating the jack downward. Release the pin and continue rotating the jack until it is vertical. When the jack is properly set, the locking pin snaps into position with an audible "click." Use the hand-crank on the jack to lower the wheel to the ground.
    f. Verify the trailer's four corner leveling jacks are in the up position and secured with their locking pins. To raise the leveling jacks, use the hand-crank on each jack to raise the jack foot off the ground, then pull the jack locking pin and rotate the jack upward. Release the pin and continue rotating the jack until it is horizontal and the pin reengages with an audible "click."
    g. If the trailer is equipped with outriggers, verify they are retracted. To retract an outrigger, pull the outrigger locking pin on the corner of the trailer frame (not the jack locking pin) and push the outrigger inward, toward the trailer. Release the pin and continue pushing the outrigger inward as far as it will go. When fully retracted, the locking pin snaps into position with an audible "click." Outriggers are optional equipment and may not be included on your message sign.
    h. Use the drawbar jack to raise the front of the trailer and set the drawbar hitch on the tow vehicle hitch. Ensure the coupling is properly engaged and locked.
    i. Raise, rotate, and lock the drawbar jack in the up or horizontal position.
    j. Verify approved safety chains are attached properly to both the trailer and tow vehicle, as illustrated in Figure 4-2. The chains should cross underneath the tow hitch.
7. Ensure the trailer brake lights, taillights, and directional (turn) indicators are connected and functioning properly.
8. Remove blocks or chocks from wheels.
9. Follow the towing requirements in Section 4.3.2.

Figure 4-2. Tow-chain hook-up



4.3.2 During towing

- Do not tow the trailer with any people, parts, supplies, or additional equipment attached to the trailer or loaded onto it.
- Do not tow additional trailers or other equipment in tandem with the message sign trailer.
- The recommended maximum speed for highway towing is 65 mph (105 km/h). For off-road towing, the recommended maximum speed is 15 mph (25 km/h) or less, depending on terrain. Always tow at a safe speed.
- Adhere to applicable transportation department regulations when towing the trailer.

4.3.3 After towing

- After towing, unhook the tow chains from the tow vehicle, then use the drawbar-mounted jack to raise the drawbar and release the drawbar hitch from the tow vehicle. Pull the vehicle away from the message sign trailer when ready.
- Some full-size message signs and all Mini signs have a drawbar that may be removed if desired.
  - ☐ Before removing the drawbar, level the trailer as instructed in Section 4.4.2, page 22.
  - ☐ To remove the drawbar, disconnect the wiring harness from the trailer, loosen and remove the two bolts that connect the drawbar to the trailer, then remove the drawbar by sliding it forward.
  - ☐ To prevent the nuts and bolts from being lost, insert the bolts into the holes in the trailer frame, and secure them and the washers in place with the nuts.

4.4 Deployment

4.4.1 Locating and positioning the trailer

⚠ DANGER

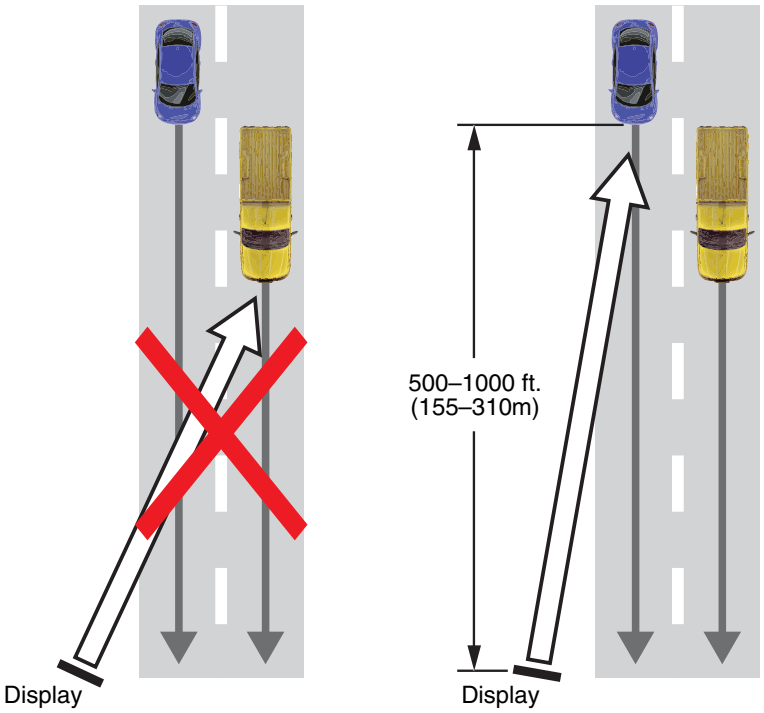
Electric shock hazard.

Contact with overhead electrical power lines will cause serious injury or death.

Do not position message sign under power lines.

- When deployed, the message sign mast rises to nearly 14 feet (4.2 meters). When choosing a location, ensure the area above the trailer is clear of overhead wires and other obstructions.
- To reduce the risk of shifting, rolling, or overturning, locate the message sign on a firm, level surface.
- If the message sign has outriggers, ensure there is enough space to deploy outriggers. Outriggers are optional equipment and your sign may not be equipped with them.
- Depending on vehicle speed, optimal positioning provides a line-of-sight from 500 to 1000 feet (155 to 310 meters), which allows ample time for drivers to read and react to the message on the sign.
- Fog, rain, snow, and blowing dust can reduce the detection distance from drivers to the sign. Allow for possible weather conditions when selecting a location.
- For the message sign's solar charging system to function properly, locate the trailer where it will be exposed to full sunlight during daylight hours.
  - ☐ The solar panel charging capacity is significantly affected by shadows. Avoid locating the trailer where the sun will be obstructed, such as under a tree or in the shadow of a building.
  - ☐ Ensure the solar panels are clean (see Section 6.3.2, page 73).
- Position the trailer so the rear of the trailer faces oncoming traffic.
- Angle the sign display slightly toward the roadway (see Figure 4-3).
  - ❑ Too great an angle creates a short viewing distance, and does not allow drivers enough time to see the speed display.
  - ❑ A slight angle provides a long viewing distance, and gives drivers plenty of time to see the speed display.

Figure 4-3. Positioning the trailer



Incorrect Positioning

Angled too greatly toward the roadway, drivers have a short viewing distance.

Proper Positioning

Angled slightly toward the roadway, drivers have a long viewing distance.

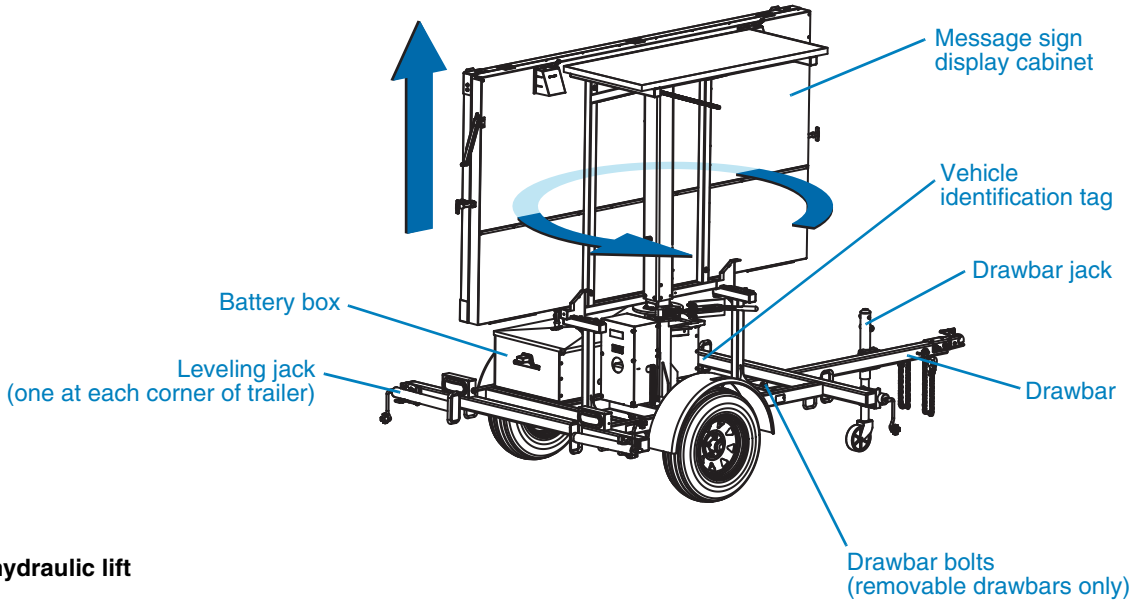
4.4.2 Leveling the trailer

Prior to raising the message sign, the trailer must be level.

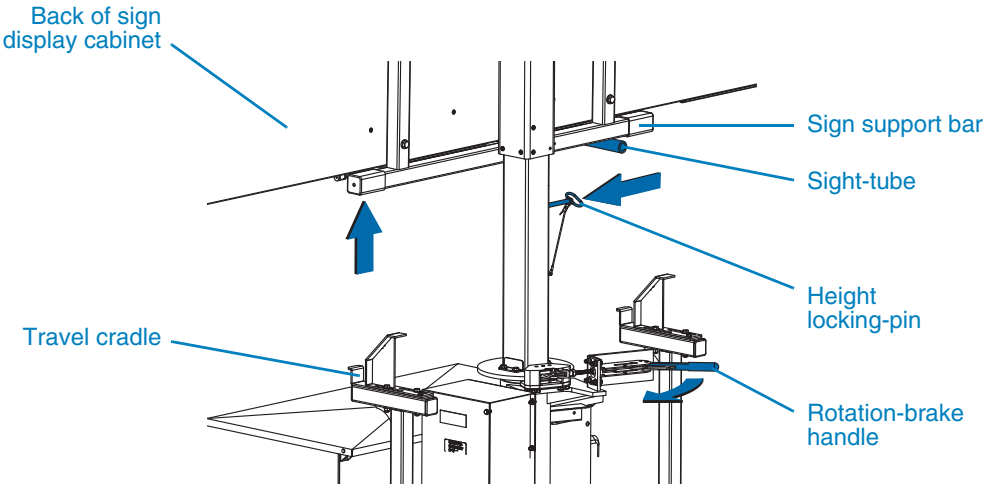
To level the trailer, refer to Figure 4-4 and follow these steps:

1. Block or chock the trailer wheels.
2. If the trailer is equipped with outriggers, extend each of the outriggers at the corners of the trailer. To extend an outrigger, pull the outrigger locking pin on the trailer frame (not the jack locking pin) and pull the outrigger outward, away from the trailer. Release the pin and pull the outrigger outward as far as it will go. When fully extended, the locking pin snaps into position with an audible "click." Outriggers are optional equipment and may not be included on your message sign.
3. For each of the four leveling jacks at the corners of the trailer, pull the jack locking pin and rotate the jack downward. Release the pin and continue rotating the jack until it is vertical. When the jack is properly set, the locking pin snaps into position with an audible "click."
4. Determine which corner of the trailer is highest, and extend the jack foot on that corner downward until it rests firmly on the ground. Then, level the trailer with the remaining three corner jacks.
5. Ensure the drawbar jack is in the up position, so that its wheel is not touching the ground.

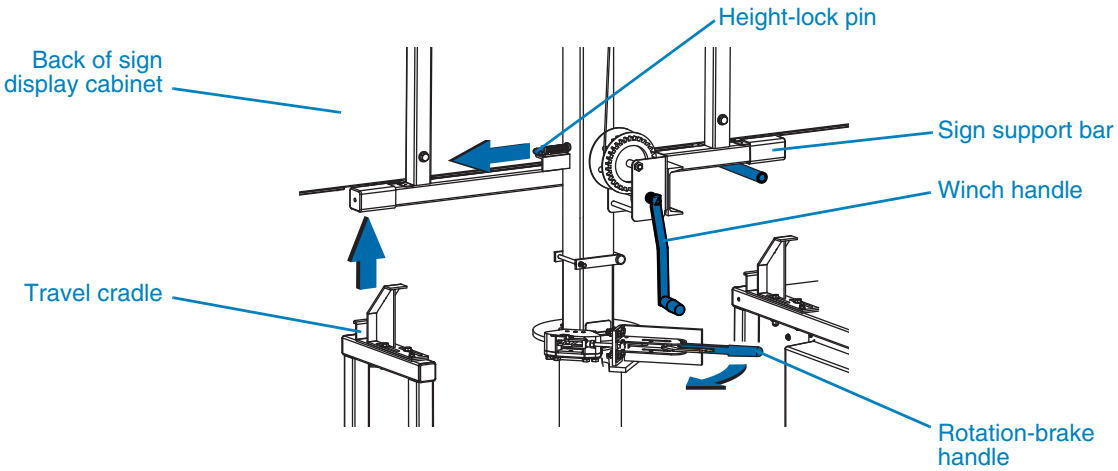
Figure 4-4. Deploying the sign



Detail view: hydraulic lift



Detail view: manual winch



4.4.3 Raising the display and setting a message

After positioning the trailer (Section 4.4.1) and leveling the trailer (Section 4.4.2), set up the message and raise the display cabinet by referring to Figure 4-4 and using the following procedure.

⚠ WARNING

Falling equipment could cause severe injury or death.

Before raising display cabinet, stabilize and level the trailer.

1. Raise the display cabinet until the sign support bar is clear of the travel cradle. Do not raise it all the way yet.
   - If the sign has a hydraulic lift, use the message sign lift switch on the control panel to raise the cabinet.
   - If the sign has a winch, pull the height locking-pin to release the display cabinet so that it can be raised. While holding the pin, use the hand-operated winch to start raising the cabinet. As the cabinet begins to rise, release the pin.
2. Pull the rotation-brake handle to release the mast so the cabinet can be turned.

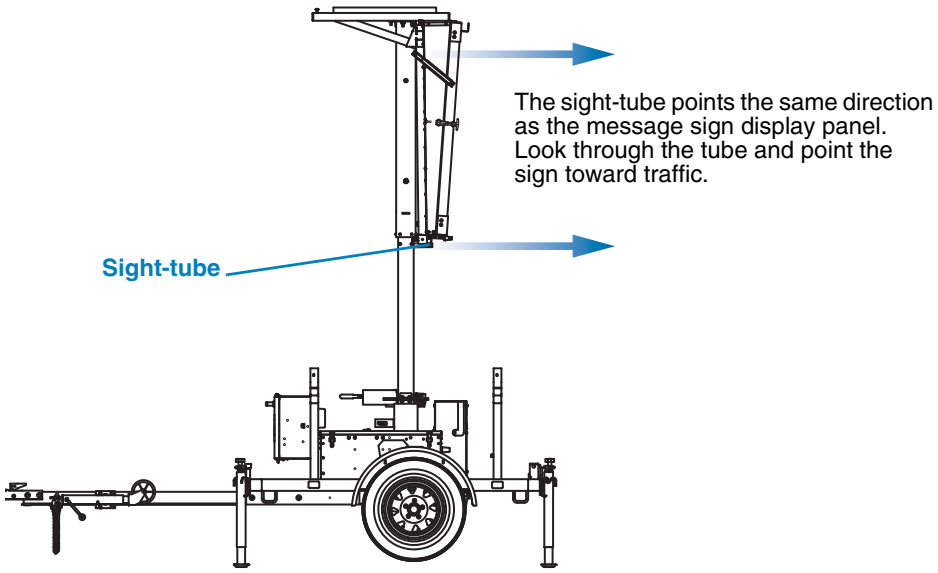
⚠ WARNING

Loose equipment can cause severe injury.

Ensure wind does not catch and unexpectedly rotate unlocked display cabinet.

3. Rotate the cabinet until the front of the sign cabinet faces traffic.
4. Look toward traffic through the sight-tube and angle the sign display appropriately (see Figure 4-5, page 25).
5. Push the rotation-brake handle, locking the cabinet rotation. In the locked position, the brake handle is fully extended.
6. Using the controller, configure the message that will be displayed on the sign (see Section 4.5).
7. Raise the cabinet to its full height.
8. If the sign has a hydraulic lift, insert the height-lock pin through the holes in the tower, so the display cabinet will not fall if the hydraulic lift were to fail. If the sign has a winch, the spring-loaded height-lock pin will engage automatically, snapping into place with an audible “click.”
9. Observe safety precautions (see Section 2, page 5).

Figure 4-5. Sight-tube



4.5 Controller

Your message sign is equipped with an integrated controller that provides access to all sign functions, including configuration and diagnostics. The controller is located inside a weathertight control box.

4.5.1 Controller in a frame-mounted control box

Your message sign may have a control box that is attached to the trailer frame (frame-mounted). The components inside the frame-mounted control box are called out in Figure 4-6 and described below.

Control panel

Use the control panel (Figure 4-7) for setting up and managing the message sign.

Console display

The console display is an LCD screen that provides menus and feedback while you use the controller. Use the keyboard to control what you see on the screen.

To make use of advanced features, such as creating your own messages, you must first log into the system. For login information, see the Wanco NTCIP user's guide.

The display switches off automatically after 20 minutes of inactivity or when the console switch is set to INACTIVE.

Contrast knob

Rotate the contrast adjustment knob to change the contrast on the console display.

Figure 4-6. Inside the frame-mounted control box

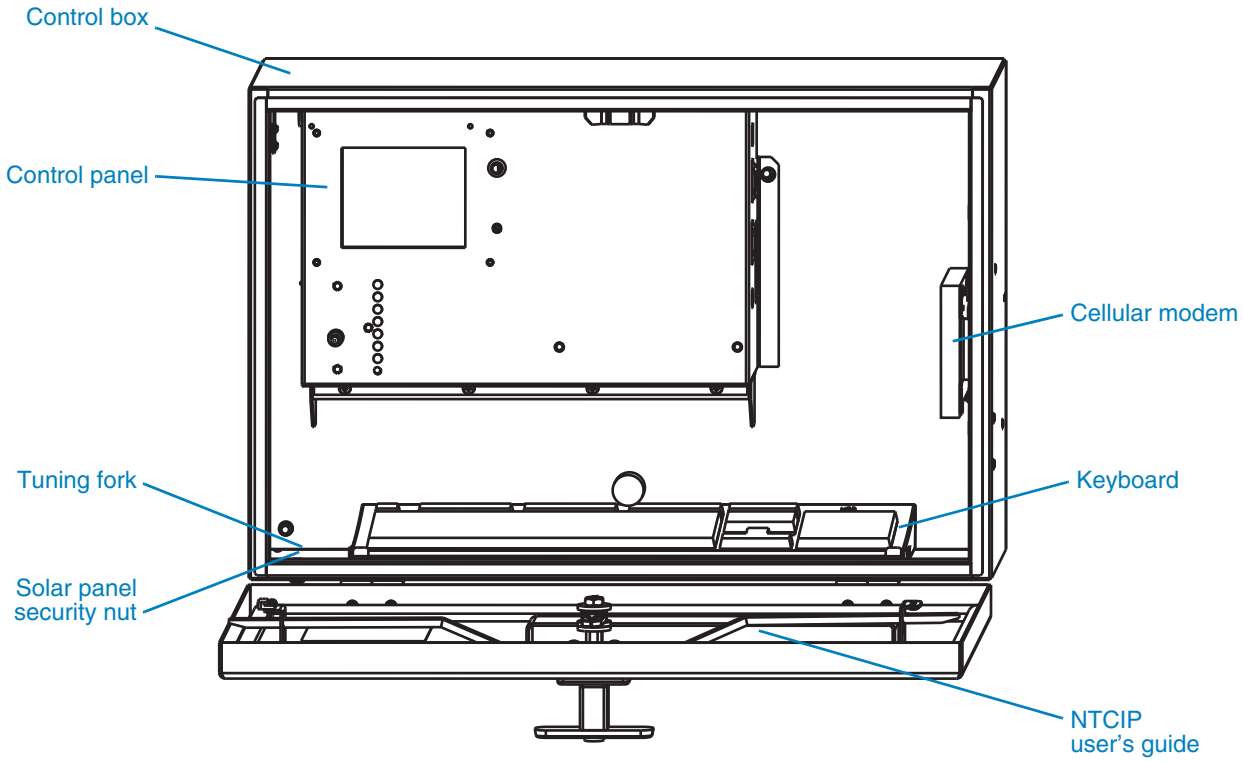
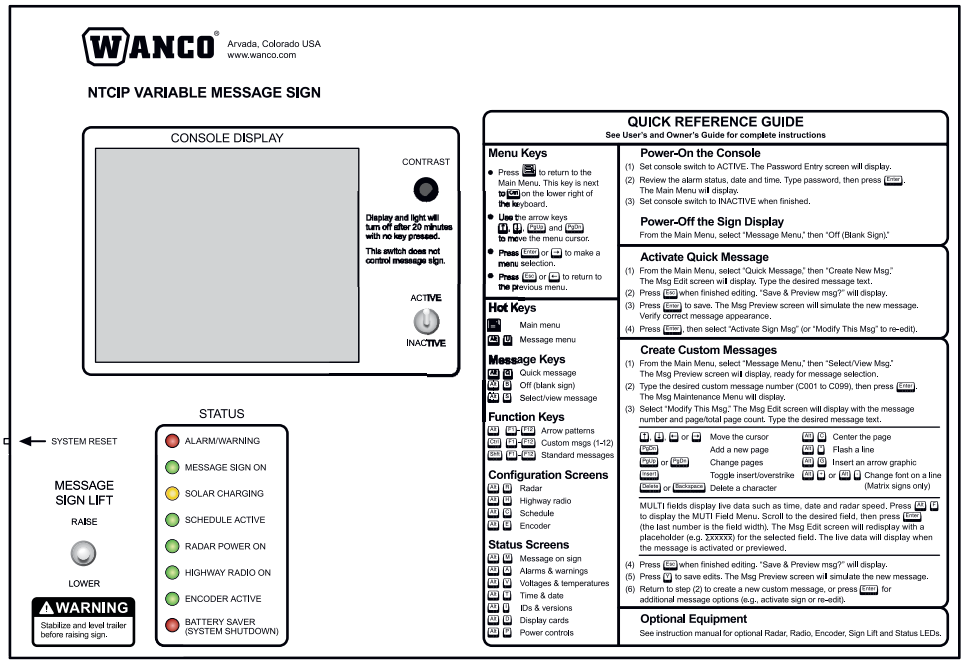


Figure 4-7. Control panel, frame-mounted control box



Console switch

The console switch controls whether the console is on, ready for you to use; or off, essentially in sleep mode.

- To activate the console, toggle the console switch to ACTIVE. If the switch is already set to ACTIVE, toggle it to INACTIVE, wait a few seconds, then toggle it back to ACTIVE.
- To deactivate the control console, toggle the console switch to INACTIVE.

Quick-reference guide

Brief instructions for common tasks are silkscreened on the control panel. For complete operating instructions, see the Wanco NTCIP user's guide.

System reset

The system reset button is sometimes used during troubleshooting and maintenance procedures. DO NOT press the system reset button unless instructed to do so by a qualified Wanco service technician or by a troubleshooting or maintenance procedure (see Section 6.4, page 80).

Message sign lift

If the message sign is equipped with a hydraulic lift, use the message sign lift switch to operate the lift:

- Toggle the switch upward to raise the message sign display cabinet.
- Toggle the switch downward to lower the message sign display cabinet.

Status indicators

Some signs are equipped with status LEDs on the control panel. These LEDs indicate a variety of operating conditions:

Alarm/warning	Indicates one or more active alarms (see Section 5.2, page 35)
Message sign on	Indicates the sign is active and power is on
Solar charging	Indicates the solar charging system is actively charging the message sign batteries
Schedule active	Indicates a programmed schedule is controlling the sign's behavior (see Section 4.5.4, page 32)
Radar power on	Indicates power to the optional radar-based speed detection system is on (see Section 4.7.2, page 33)
Highway radio on	Indicates power to the optional highway radio system is on (see Section 4.7.3, page 34)
Encoder active	The encoder is a legacy device that is no longer available
Battery saver (system shutdown)	Indicates the low-voltage-disconnect circuit has detected low battery voltage and automatically shut down power to the sign (see Section 6.3, page 73)

Status indicators are optional equipment. Your message sign may have one or more indicators, or none at all.

Solar panel security nut

The solar panels are installed on the message sign with security nuts that cannot be removed without the matching security nut inside the control box. Instructions for using the nut are included inside the control box.

Tuning fork

If the message sign is eqiupped with a radar-based speed detection system, a tuning fork is provided for testing the radar. The speed detection system is optional equipment and may not be included with your message sign.

To use the speed detection system when configuring messages, see the Wanco NTCIP guide.

Cellular modem

The cellular modem allows remote communications with the message sign for configuration and monitoring. The cellular modem is optional equipment and may not be included with your message sign.

If the message sign is factory-equipped with a cellular modem, then the modem is configured at the factory and no additional configuration is necessary.

For more information about the cellular modem, see Section 4.7.1, page 33.

Keyboard

A keyboard is required for interacting with the controller.

The keyboard is a standard computer keyboard that is connected to the message sign computer by a USB cable. The cable can be unplugged and the keyboard removed from the control box to heighten security and reduce the risk of unauthorized access to the controller.

User guide

The Wanco NTCIP Message Sign Software User's Guide is shipped from the factory in a weather-resistant binder that is inserted into a bracket inside the control box door.

The binder can be removed from the bracket when you need to use the manual. After you use the manual, Wanco recommends replacing it in the bracket for easy access.

4.5.2 Using the controller in a frame-mounted control box

Use the keyboard and console display to operate the sign.

To use the controller:

1. Open control box door.
2. Set console switch to ACTIVE. If the console display (LCD) indicates an alarm, navigate to the alarms screen and then see Section 5.2, page 35, for troubleshooting instructions.
3. Log in to local console using the keyboard to enter a password.

4. Perform the desired operations using the keyboard and LCD. Refer to the Wanco NTCIP user's guide when necessary.

⚠ WARNING

Improper sign display could cause a traffic accident resulting in severe injury or death.

Visually inspect the message sign to ensure the correct message is displayed.

5. Always visually inspect the message on the sign to ensure the sign is operating as expected. Always replace display modules that are not operating.
6. The LCD turns off automatically after 20 minutes with no keyboard activity. To reactivate, toggle the console switch to INACTIVE and then back to ACTIVE and log in again, or close and reopen the control box door.
7. When you are done using the console, toggle the console switch to INACTIVE, then close and secure the control box door.

4.5.3 Controller in an in-cabinet control box

Your message sign may have a control box that is mounted on back of the message sign display cabinet (in-cabinet). The components inside the in-cabinet control box are called out in Figure 4-8 and described below.

Control panel

The control panel (Figure 4-9) is used for setting up and managing the message sign.

Touchscreen display

The control panel display is a touchscreen controller. Use the touchscreen by tapping lightly with your finger on the "buttons" displayed on the screen.

- The controller display will go blank after 20 minutes of inactivity. The controller is always powered while the message sign has power. To reactivate it, touch the screen.
- To make use of advanced features, such as creating your own messages, you must first log into the system. For login information, see the touchscreen controller user's guide.
- After a system shutdown, the controller turns on automatically when power is reinstated. When the controller finishes its startup sequence, the main screen appears and the touchscreen is ready for you to use.

Figure 4-8. Inside the in-cabinet control box

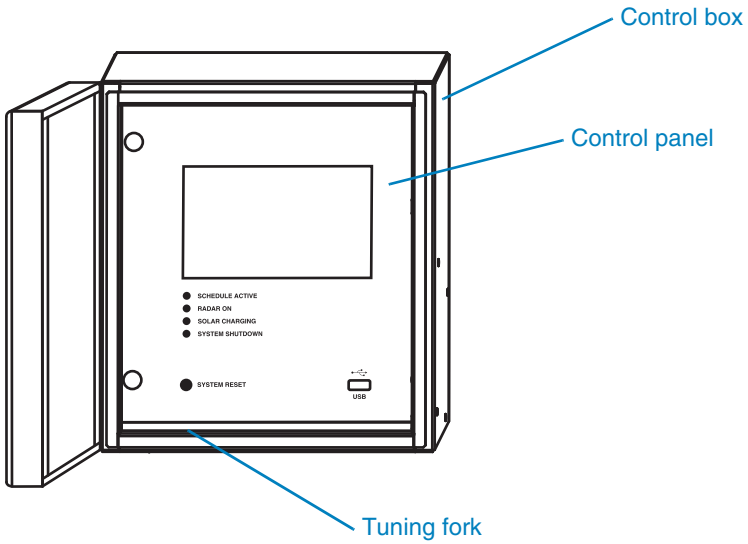
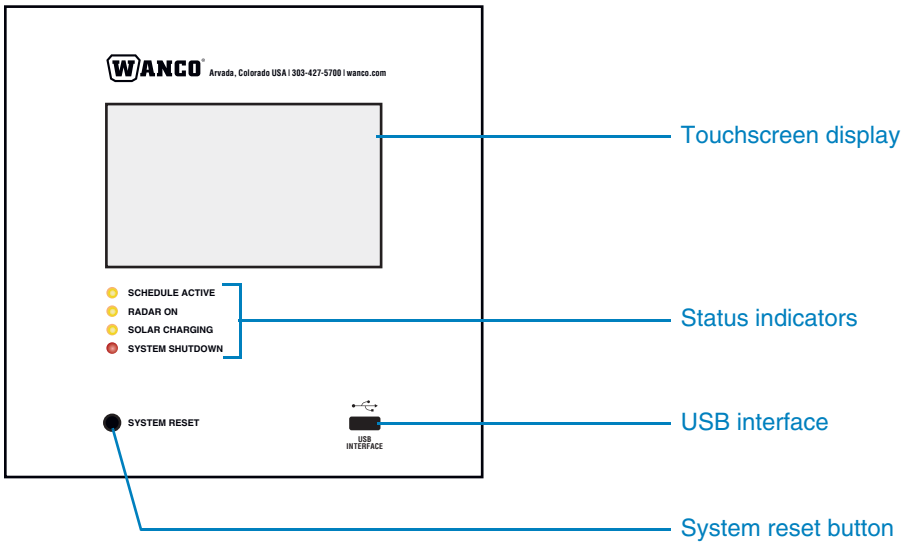


Figure 4-9. Control panel, in-cabinet control box



Status indicators

Status LEDs on the control panel indicate a variety of operating conditions:

Schedule active	Indicates a programmed schedule is controlling the sign's behavior (see Section 4.5.4, page 32)
Radar on	Indicates power to the optional radar-based speed detection system is on (see Section 4.7.2, page 33)
Solar charging	Indicates the solar charging system is actively charging the message sign batteries
System shutdown	Indicates the low-voltage-disconnect circuit has detected low battery voltage and automatically shut down power to the sign (see Section 6.3, page 73)

USB interface

The USB interface serves three functions:

- Use it for connecting an optional, external handheld controller (see Section 4.7.4, page 34). The handheld controller is optional equipment and may not be included with your message sign.
- Use it to update the message sign software when necessary (see Section 6.5, page 81).
- If the message sign is eqiupped with a radar-based speed detection system, use the USB interface for downloading traffic data from the system. The speed detection system is optional equipment and may not be included with your message sign. For data downloading instructions, see the touchscreen controller user's guide.

System reset

The system reset button is sometimes used during troubleshooting and maintenance procedures. DO NOT press the system reset button unless instructed to do so by a qualified Wanco service technician or by a troubleshooting or maintenance procedure (see Section 6.4, page 80).

Tuning fork

If the message sign is eqiupped with a radar-based speed detection system, a tuning fork is provided for testing the radar. The speed detection system is optional equipment and may not be included with your message sign.

To use the speed detection system when configuring messages, see the touchscreen controller user's guide.

4.5.4 Scheduler

The message sign computer has a built-in scheduler that allows you to configure sign functions based on your own program. In addition to other sign functions, you can set specific messages to appear on a specific date and at a specific time. For scheduler instructions, see the touchscreen controller user's guide.

If the control panel on your sign includes a status indicator for the scheduler, the indicator is lit whenever a schedule is controlling the message sign.

IMPORTANT!

If you manually activate a message on the sign, the scheduler is automatically disabled.

If you manually disable the schedule, the sign is immediately blanked.

4.6 Batteries

To ensure battery health, follow these requirements:

- Do not allow batteries to fully discharge.
- Ensure batteries are fully charged before using the message sign.
- Charge batteries after each period of use, before putting the message sign into temporary or long-term storage.
- Power to the message sign is on at all times, and can only be disengaged by disconnecting the batteries. Therefore, it is important to "blank" the message sign when it is not in use. (For instructions on blanking the sign, see the NTCIP or touchscreen controller user's guide.)
- For an overview of the message sign's power system, see Section 6.3.1, page 73.
- For battery charging information, see Section 6.3.3, page 73.

4.7 Optional equipment

4.7.1 Cellular modem

A cellular modem allows you to communicate with the sign from a remote location via the Internet. The modem is installed inside the control box (for a frame-mounted control box) or the display cabinet (for an in-cabinet control box) and is wired to the message sign controller.

If your sign has a modem, you can use Wanco remote control software installed on your computer to perform all the functions from a remote location that you would otherwise perform using the controller and keyboard at the sign. However, the modem does not provide remote control of the message sign hydraulic lift or winch; you can only raise and lower the display cabinet when you are at the sign.

Wanco remote control software can be downloaded from www.wanco.com. Contact Wanco customer service for details (see Section 1.4, page 2).

The cellular modem is optional, auxiliary equipment that may not be included with your message sign.

If you want to add a modem to your sign, it can be installed in the field. Contact Wanco customer service for details (see Section 1.4, page 2).

4.7.2 Radar

When a message sign is equipped with speed-detection radar, the sign can be configured to display messages based on the speed of passing vehicles. The radar head is installed on the bottom of the message sign display cabinet and is wired to the message sign controller.

The message sign is preprogrammed with several messages that use radar-detected speed (such as displaying the motorist's speed), and you can also program your own radar-based messages by inserting a specific "field code" into your message. For instructions, see the NTCIP or touchscreen controller user's guide.

Radar is optional, auxiliary equipment that may not be included with your message sign.

If you want to add radar to your sign, it can be installed in the field. Contact Wanco customer service for details (see Section 1.4, page 2).

4.7.3 Highway radio

A highway radio broadcasts messages to motorists. When a vehicle passes the message sign, the driver is typically instructed by a message on the sign to tune into a specific AM radio frequency.

The message sign is preprogrammed with one message that advises motorists to tune to an AM radio frequency. You program the frequency into the sign using the controller. You can also program your own messages by inserting a specific "field code" into your message. For message sign programming instructions, see the NTCIP or touchscreen controller user's guide.

Wanco does not provide highway radios; they must be owner-supplied. For user instructions, see the radio manufacturer's documentation.

A highway radio is optional, auxiliary equipment that may not be included with your message sign.

If you want to add a highway radio to your sign, it can be installed in the field. Contact Wanco customer service for details (see Section 1.4, page 2).

4.7.4 Handheld controller

The Wanco handheld controller allows you to control the message sign without using the onboard keyboard or touchscreen interface. It connects to an input port on the controller.

The handheld controller is optional, auxiliary equipment that may not be included with your message sign.

If you want to purchase a handheld controller, contact Wanco customer service for details (see Section 1.4, page 2).

5 Troubleshooting

5.1 Before troubleshooting

Before performing any troubleshooting or servicing on the message sign, observe all safety precautions in Section 2.4, page 8.

CAUTION

Voltage surge could damage control circuits.

Before servicing electrical components, disconnect power cable from controller.

When instructed to use the message sign controller for troubleshooting, see the NTCIP or touchscreen controller user's guide if necessary.

IMPORTANT!

You must have advanced- or service-level access to the controller in order to perform service and troubleshooting procedures.

5.2 Alarms

The control panel display may show any of the active alarms listed in Table 5-1, which might indicate issues with the message sign that require attention. Use the controller to access the alarms screen.

Table 5-1. Alarms indicated by the controller

Alarm	Description	Solution
Dsply=!!	One or more sign display modules not responding	see Section 5.2.1
PwrBd=!!	Power control system not responding	see Section 5.2.2, page 37
NTCIP=!!	NTCIP system communications error	see Section 5.2.3, page 39
AuxIO=!!	Communications error between the sign and one or more auxiliary devices	see Section 5.2.4, page 39
VoltWrn=!!	One or more voltages are out of range	see Section 5.2.5, page 40
TempWrn=!!	One or more temperatures are out of range	see Section 5.2.6, page 40
TempCrt=!!	Sign temperature is critically high and the sign display has been blanked	see Section 5.2.6, page 40
PhtoCel=!!	One or more photocell inputs are out of range	see Section 5.2.7, page 42

5.2.1 Display alarm

A display alarm indicates at least one of the sign's display modules is not responding properly. When a display alarm occurs, use the controller to run a diagnostic test on the display modules.

If any module appears to be functioning improperly, or if LEDs fail to light, perform the following steps to determine the cause. If no LEDs on a display module will light (i.e., the module appears not to be working), the cause could be faulty wiring or a loose connection.

IMPORTANT!

If more than one module is malfunctioning, always address "upstream" modules first, working from left to right and top to bottom. When several modules exhibit problems, it may be due to the first module in the sequence.

When a display alarm occurs:

1. Follow the safety requirements in Section 2, page 5.
2. Identify the malfunctioning display module and one that appears to be working properly. Remember their locations.
3. Use the controller to "blank" the message sign.
4. Open the display cabinet door (which is hinged at the top and latched on the sides and the bottom).
5. Before replacing a module, check its wiring connections:
    a. Identify the malfunctioning module and locate the four retaining nuts that hold it in place.
    b. Using the supplied nut wrench or a 5/16-inch nut driver, remove the four nuts.
    c. Carefully pull the display module away from the cabinet to expose the wiring connections on back of the module. The wiring can be damaged if you use too much force.
    d. Check that the wiring connections are secure and properly connected.
6. If the connections are secure, remove two modules and switch their positions:
    a. Being careful to avoid using too much force, first unplug the power connector on back of the malfunctioning display module by pulling the connector straight out, away from the module; then unplug the data input wiring by pushing the locking tab down and pulling the plug sideways, away from the connector. Repeat for the data output wiring. (The bottom-right module does not have output wiring.)
    b. Set the malfunctioning display module aside.
    c. Repeat the process to remove a properly functioning display module.
    d. Reverse the procedure to install the functioning module where the malfunctioning module used to be, then install the malfunctioning module where the properly functioning module used to be.

7. Use the controller to access the display module diagnostics, then initialize the message sign and start a new self-test. After initialization is complete:
   - If the functioning module is not working, then the problem is with the wiring. Contact the factory for assistance (see Section 1.4, "Where to obtain service," page 2).
   - If the malfunctioning module is not working in its new position, the problem is with the module, not the wiring. Replace it as described below.
8. To replace the malfunctioning display module:
   a. Use the controller to "blank" the message sign.
   b. Disconnect the wiring from the malfunctioning display module and remove the module from the display cabinet.
   c. Set the malfunctioning display module aside.
   d. Reverse the procedure to install a new, replacement display module.
9. Use the controller to access the display module diagnostics, then initiate the message sign and start a new self-test.
10. After initialization is complete, use the controller to put a test message on the sign, and ensure the sign is working as expected.
11. When done, close and latch the display cabinet door.

5.2.2 Power board alarm

A power board alarm indicates the sign's computer is not communicating with the power control system. The cause may be a bad connection, or a failed power board or main control board.

When a power board alarm occurs:

1. Follow the safety requirements in Section 2, page 5.
2. Access controller electronics:
   - If the message sign has a frame-mounted control box, see "Accessing controller electronics" on page 50.
   - If the message sign has an in-cabinet control box, see "Accessing controller electronics" on page 54.
3. Check wiring connections to ensure they are proper and secure. If a problem with the connection or cable is obvious, replace the cable; otherwise, unplug each connector and plug it back in.
   - If the message sign has a frame-mounted control box, see Figure 5-1.
   - If the message sign has an in-cabinet control box, see Figure 5-2.
4. Check the controller for alarms or status.
5. If the problem persists, contact the factory (see Section 1.4, "Where to obtain service," page 2).

Figure 5-1. Wiring connections for a sign with frame-mounted control box

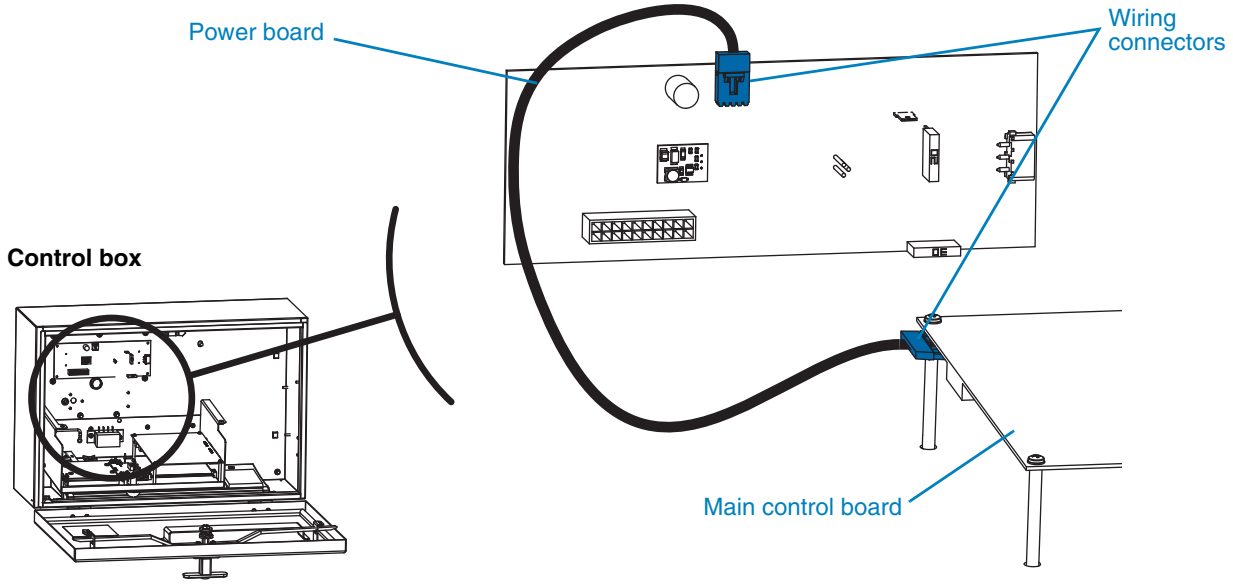
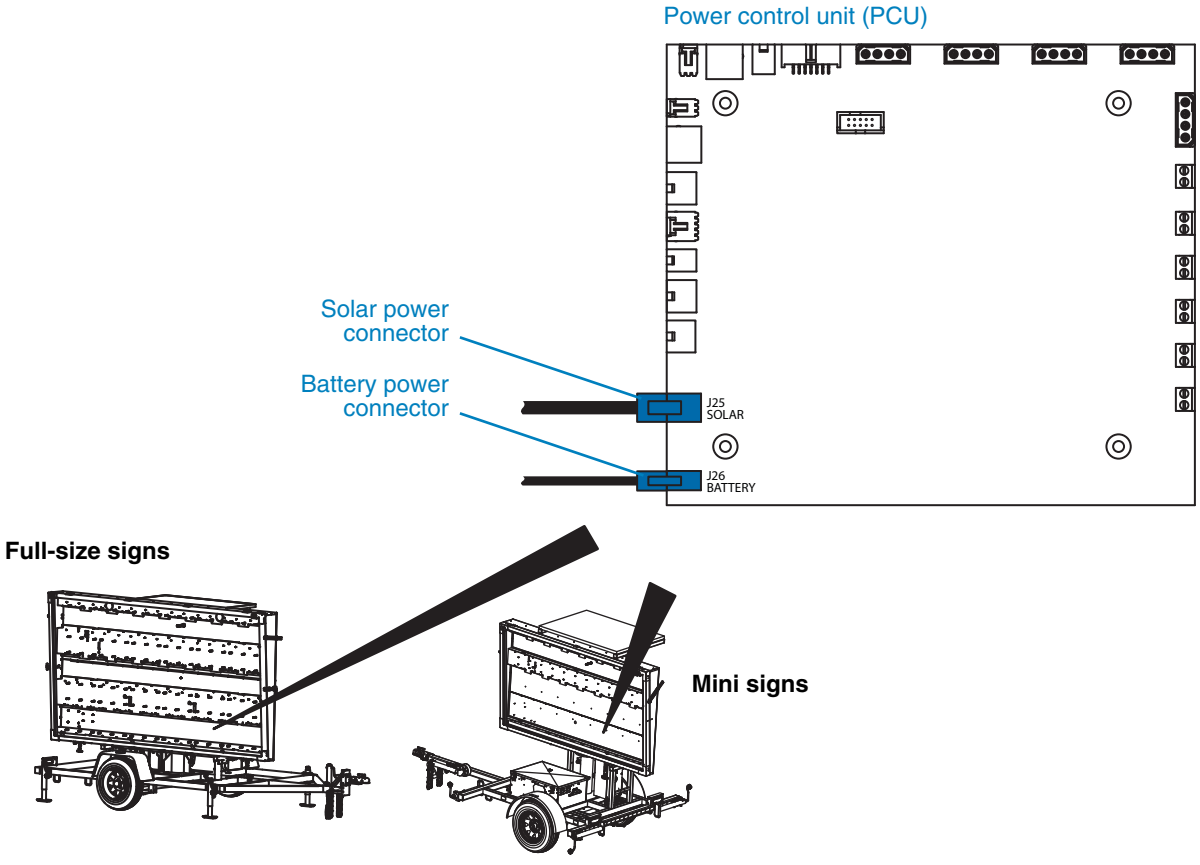


Figure 5-2. Power connections for a sign with in-cabinet control box



5.2.3 NTCIP alarm

An NTCIP alarm indicates an NTCIP communications error. This type of alarm is informational only and does not affect system performance. No troubleshooting is necessary.

5.2.4 AuxIO alarm

An AuxIO (auxiliary input/output) alarm indicates a communications error between the sign and one or more auxiliary devices. An auxiliary device might be a cellular modem installed at the sign, speed-detection radar connected to the sign's controller, or any other auxiliary equipment.

When an AuxIO alarm occurs:

1. Follow the safety requirements in Section 2, page 5.
2. Identify the device that is malfunctioning.
3. Check the wiring connections between the device and the sign, ensuring they are proper and secure. Be sure to check the connections at both ends of the wiring.
4. If the connections are proper and secure, use the controller to determine whether the power circuits to the device are live.
5. If the power circuits are live, the device may be faulty and need to be replaced. Contact the factory (see Section 1.4, "Where to obtain service," page 2).

5.2.5 Voltage alarm

A voltage alarm results when the battery voltage is out of range.

The sign measures voltage and current from the battery and the solar charging circuit. You can use the controller to view the power values listed in Table 5-2.

Table 5-2. Power values

Code	Description
Vs	Sign voltage (battery), in volts
Is	Sign current (battery), in amperes
Vl	Line voltage (solar charger), in volts
Il	Line current (solar charger), in amperes

The out-of-range warning limit for Vs is configurable using the controller.

If a voltage alarm occurs:

1. Follow the safety requirements in Section 2, page 5.
2. Check battery voltage (see "Charging" on page 75).
3. If the voltage is low, charge the batteries. The alarm shuts off when battery voltage increases to 11.9Vdc, but the batteries should be charged to 12.65Vdc.
4. If the batteries do not need charging, check the battery cables and their connections to the batteries. Replace damaged cables and repair bad connections.
5. If the batteries are charged and the cables and cable connections are good, then the alarm may be a result of a power board failure. Contact the factory (see Section 1.4, "Where to obtain service," page 2).

5.2.6 Temperature alarm

A temperature warning alarm results when either of these conditions occur:

- One or more detected temperatures are out of range.
- The temperature inside the display cabinet is critically high.

The sign has several sensors that measure temperature. You can use the controller to view the temperatures listed in Table 5-3.

Table 5-3. Temperature values

Code	Message sign model	Description
Ts	All	Temperature inside message sign display cabinet (ambient plus solar heat)
Tc	Frame-mounted control box	Temperature inside control console
	In-cabinet control box	Same as Ts
Ta	All	Temperature of ambient sensor

Out-of-range warning limits for Ts and Tc are configurable using the controller.

If a temperature alarm occurs, use the information below to troubleshoot the alarm.

High display-cabinet temperature

The temperature inside the display cabinet may be significantly higher than the ambient temperature, due to solar gain.

To troubleshoot high display-cabinet temperature:

1. Follow the safety requirements in Section 2, page 5.
2. Open the display cabinet door and inspect the interior of the cabinet. Vents and filters may be clogged with dust and debris. Clean them if necessary.
3. Use the controller to test the circuits for the circulating fans. If the circuits are live but the fans are not working:
    a. Locate the fans on the back of the display cabinet.
    b. Remove the screws that fasten each fan to the cabinet, then check wiring connections to each fan to ensure they are proper and secure. Check fan filters and clean or replace them if necessary, then reattach both fans to the cabinet.
    c. Use the controller to view the fan temperature settings. If the settings are too high, the fans may not be running often enough. Reset the fan temperature to 165°F.
    d. If all steps fail to solve the problem, the fans may be faulty and need to be replaced.
4. If the fans are working properly, then the temperature sensor, sensor circuit board, or wiring to the sensor may be faulty:
    a. Locate the the photocell board (Figure 5-3, page 42), which also acts as the sensor circuit board.
    b. Check wiring connectors to the sensor circuit board, ensuring they are proper and secure.
    c. Check wiring and wiring connectors for damage, and repair or replace if necessary.
    d. If wiring connections are secure and wiring is undamaged, the sensor circuit board may be loose or damaged. Inspect the sensor board and replace it if necessary (see Section 5.2.7).

High computer-box temperature

If the temperature inside the computer box (Tc) is high, the power board or a component on the board may have failed. In this case, the power board should be replaced. Contact the factory for a replacement power board (see Section 1.4, "Where to obtain service," page 2).

The power board replacement procedure should be performed by an authorized Wanco service technician.

5.2.7 Photocell alarm

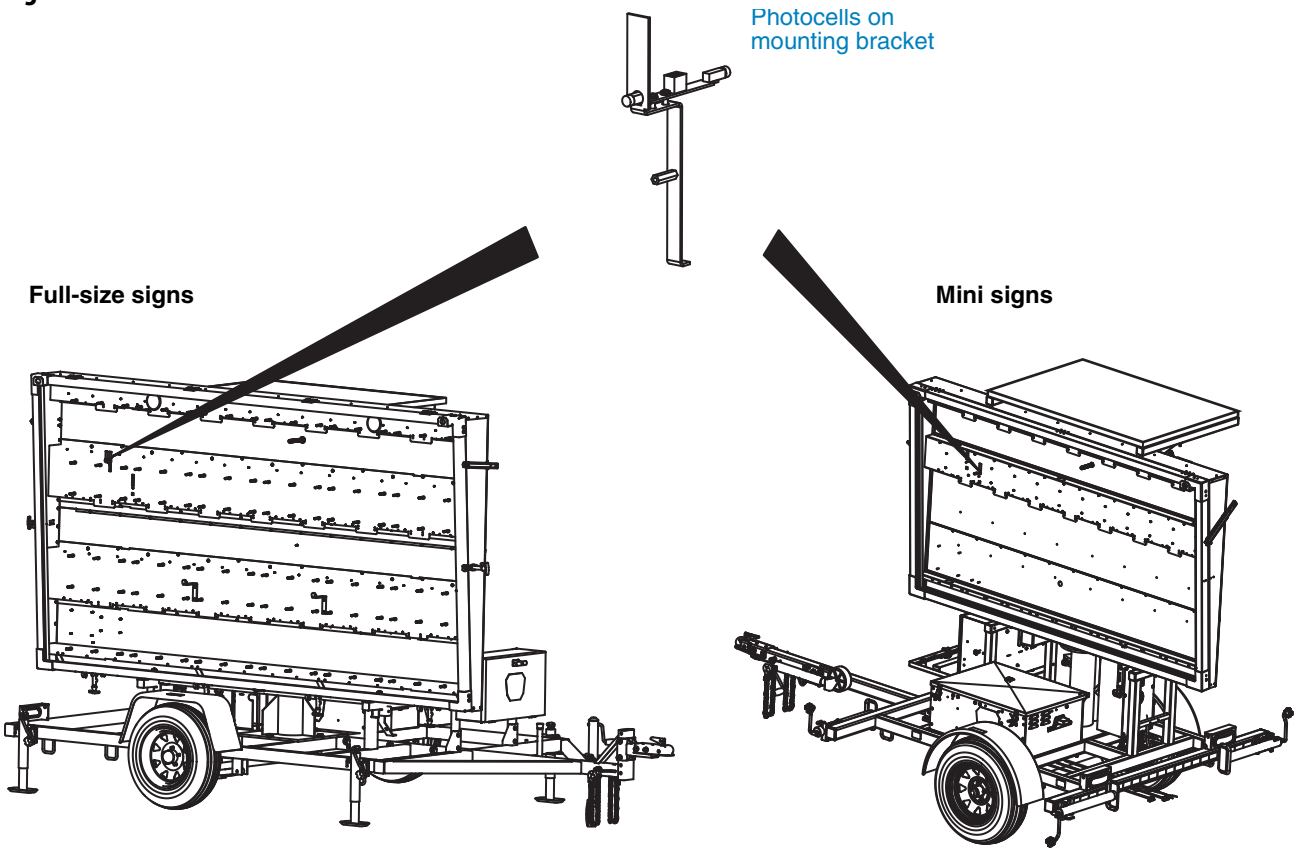
A photocell alarm results when one or more photocell inputs are out of range. The message sign is equipped with two photocells, which are used for controlling the brightness of the display.

- If the display appears to be abnormally dim, one or both photocells may be blocked or defective.
- If the display appears to be abnormally bright, one or both photocells may have short-circuited or become damaged.

If a photocell alarm occurs:

1. Follow the safety requirements in Section 2, page 5.
2. Follow the procedures in Section 5.3, page 44, to access and inspect the main wiring connections inside the display cabinet.
3. Locate the photocells inside the display cabinet (see Figure 5-3).
4. If either the front or rear photocell appears to be dirty or otherwise obstructed, clear it or use a soft, damp cloth to clean the photocell or photocell cover. For the front photocell, clean the display cabinet window if necessary (see Section 6.2.1, page 70).

Figure 5-3. Photocells location



5. Use the controller to view values for P1 and P2 (illumination detected by the photocells).
6. Choose one of the photocells and test it as follows:
    a. While watching the controller screen, block all light from the photocell by holding a thick rag, work gloves, or any opaque object over it. Do not use your hands or a piece of paper to block the light.
    b. With light blocked from reaching the photocell, the value shown for that photocell on the controller screen should be at or near zero (indicating no light and full dimming of the display).
    c. While watching the controller screen, shine a flashlight at the photocell.
    d. With light shining directly into the photocell, the value shown for that photocell on the controller screen should be at or near 100 (indicating bright light and full brightness of the display).
7. Repeat Step 6 for the other photocell.
8. If, when performing the previous steps, the values shown on the controller screen do not indicate full dimming and full brightness, then the photocell may be damaged or defective. To replace the photocells:
    a. Use the controller to "blank" the message sign.
    b. With the display cabinet door open, access the circuit board on which the photocells are mounted.
    c. A locking tab on the front of the photocell wiring connector keeps the connector attached to the circuit board. Remove the connector from the board by pushing the locking tab toward the connector, then pulling the plug sideways, away from the board.
    d. Remove the screws that hold the circuit board in place, then remove the board and set it aside.
    e. Insert the replacement photocell circuit board into place, attach it with the screws, and connect the photocell wiring by installing the wiring connector to the board.
9. Repeat Step 6 for the both photocells, then:
    a. If the photocell values on the controller screen change as expected, the new photocells are correctly installed.
    b. If the values do not change as expected, check the wiring connection at the photocell circuit board.
    c. If all wiring connections are secure and the photocells do not appear to be working correctly, contact the factory (see Section 1.4, "Where to obtain service," page 2).
10. When done, close and latch the display cabinet door.

5.3 Main wiring connections

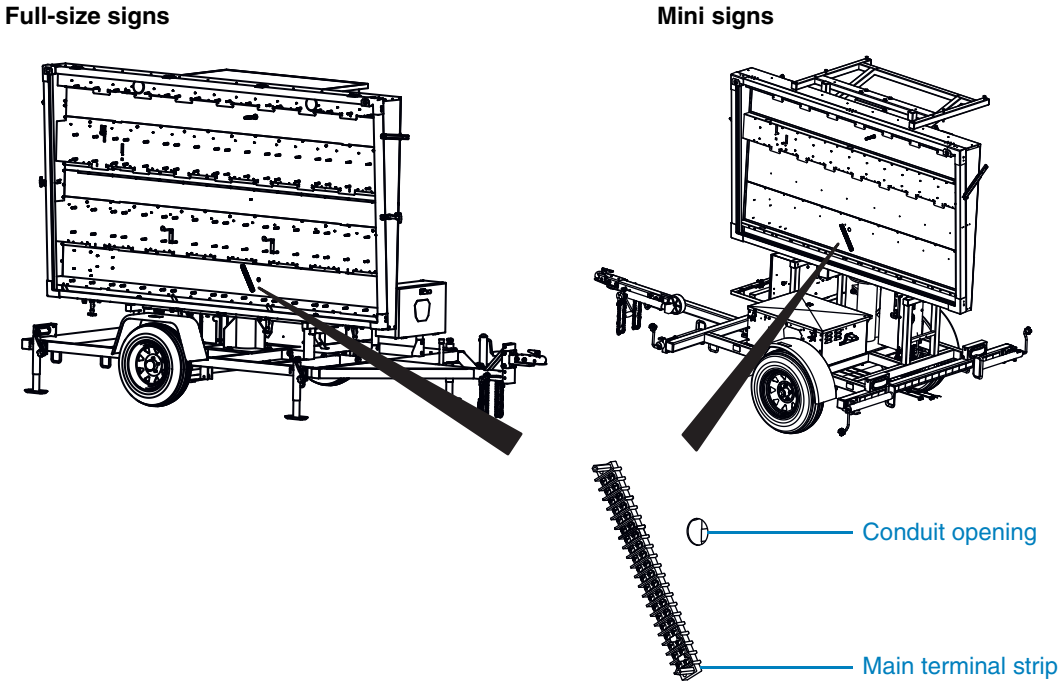
5.3.1 Frame-mounted control box

For a message sign with a frame-mounted control box, the main wiring connections are located at the main terminal strip inside the display cabinet. If these wiring connections are loose or damaged, the message sign will not function properly.

When instructed to access the main terminal strip by a Wanco service technician or by a troubleshooting procedure, refer to Figure 5-4 and follow these steps:

1. You must remove a display module to access the terminal strip. To determine which display module you need to remove:
   a. Locate the wiring conduit entry point on the back of the cabinet. The conduit runs from the control box to the cabinet.
   b. When facing the front of the display, the main terminal strip is located immediately to the left of the conduit opening.
   c. Follow the procedures in Section 6.2.3, page 72, to remove the appropriate display module in front of the terminal strip.
2. Examine all wiring connections at the terminal strip. If any wiring connections are loose or damaged, repair if able or contact the factory for assistance (see Section 1.4, "Where to obtain service," page 2).

Figure 5-4. Main terminal strip location



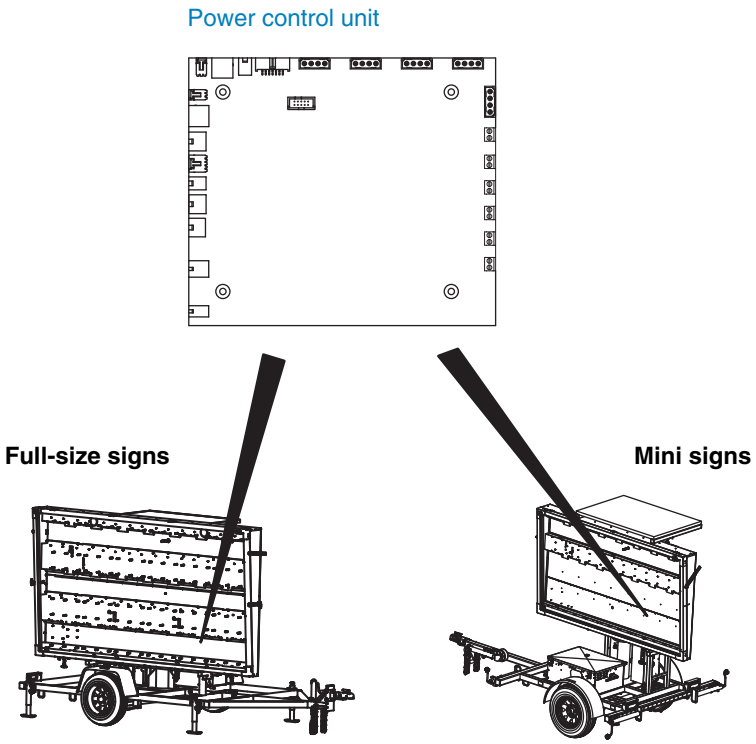
5.3.2 In-cabinet control box

For a message sign with an in-cabinet control box, the main wiring connections are located at the power control unit (PCU) inside the display cabinet. If these wiring connections are loose or damaged, the message sign will not function properly.

When instructed to access the PCU by a Wanco service technician or a troubleshooting procedure, refer to Figure 5-5 and follow these steps:

1. You must remove the appropriate display modules to access the PCU. Determine which display modules you need to remove:
   a. Locate the control box on the back of the cabinet. The PCU is located inside the cabinet, directly behind the control box.
   b. Follow the procedures in Section 6.2.3, page 72, to remove the appropriate display modules in front of the PCU.
2. Examine all wiring connections at the PCU. If any wiring connections are loose or damaged, repair if able or contact the factory for assistance (see Section 1.4, "Where to obtain service," page 2).

Figure 5-5. Power control unit (PCU) location



5.4 Message display

Before troubleshooting display problems, use the controller to check for alarms. If you resolve the issue that caused an alarm, you may also resolve problems with the display.

To troubleshoot alarms, see Section 5.2, page 35. After troubleshooting alarms, use the following tables to troubleshoot the display.

- Table 5-4, "Troubleshooting a blank display"
- Table 5-5, "Troubleshooting messages that appear or disappear unexpectedly"
- Table 5-6, "Troubleshooting partial messages and duplicate characters"
- Table 5-7, "Troubleshooting stuck LEDs"
- Table 5-8, "Troubleshooting LED brightness"

Table 5-4. Troubleshooting a blank display

Possible cause	Description	Solution
Program schedule	A programmed schedule may have "blanked" the display	Use the controller to determine whether a schedule is active or has recently ended; deactivate the schedule if appropriate
User control	A user may have directly or remotely "blanked" the display	Use the controller to put a message on the sign
Spaces in message	Displayed message may be all spaces	Use the controller to replace the current message
Bad cables or connections	Display cable connections may be loose, damaged, or corroded	Check cable connections at the control box (see page 50 for a frame-mounted control box or page 54 for an in-cabinet control box) to ensure they are proper and secure. Check cables for wear and damage. Replace cables if necessary. Check the main terminals inside the display cabinet (see Section 5.3, page 44) to ensure they are proper and secure. Check wiring for wear and damage. Replace wiring if necessary.
Periodic self-test is running	Sign may be performing a periodic self-test	Message should reactivate automatically within a few minutes

Table 5-5. Troubleshooting messages that appear or disappear unexpectedly

Possible cause	Description	Solution
Control by auxiliary device	Message may be controlled by radar or other auxiliary device	Use the controller to access the auxiliary equipment configuration and turn off the device, then check whether the message sign behaves as expected
Program schedule	A programmed schedule may have "blanked" the display	Use the controller to determine whether a schedule is active or has recently ended; deactivate the schedule if appropriate
Remote-control by user	Message may be controller by remote-control software	Determine whether a remote user is controlling the sign; if necessary, disconnect message sign modem
Periodic self-test is running	Sign may be performing a periodic self-test	Message should reactivate automatically within a few minutes

Table 5-6. Troubleshooting partial messages and duplicate characters

Possible cause	Description	Solution
Bad cables or connections	Display module power or data cable connections may be loose or broken	Test and, if necessary, replace defective cables or display modules (see Section 5.2.1, page 36)
Faulty display modules	One or more display modules may be faulty	Test and, if necessary, replace defective display modules (see Section 5.2.1, page 36)

Table 5-7. Troubleshooting stuck LEDs

Possible cause	Description	Solution
Short circuit	LED or pixel driver may be shorted	Examine display module for damage, debris, moisture, or contact with metal on front or back of module (to remove module from display, see Section 5.2.1, page 36)
Defective LED or driver	LED or pixel driver may be faulty	Test display module by swapping it with a properly functioning module (see Section 5.2.1, page 36)

Table 5-8. Troubleshooting LED brightness

Possible cause	Description	Solution
Transparent window is dirty	The polycarbonate window that protects the display may be dirty	Clean the window (see Section 6.2.1, page 70)
Display position	Apparent brightness can be affected by the display position relative to traffic	Ensure the message sign is properly located and oriented (Section 4.4.1, page 21), and the trailer is level (see Section 4.4.2, page 22)
Brightness settings	Brightness settings control how bright the display appears	Use the controller to check brightness settings; change or restore defaults if necessary
Illumination control settings	Illumination settings control dimming of the display	Use the controller to check illumination control settings; change or restore defaults if necessary

5.5 Controller

5.5.1 Frame-mounted control box

Troubleshooting

If the system-shutdown status indicator is lit, or power to the sign appears to be off, then the power system has shut down (see Section 5.6, page 56). To troubleshoot other controller issues, use the following tables:

- Table 5-9, "Troubleshooting the console display (LCD)"
- Table 5-10, "Troubleshooting the keyboard"
- Table 5-11, "Troubleshooting status indicators (LEDs)"

Table 5-9. Troubleshooting the console display (LCD)

Symptom	Possible cause	Solution
LCD screen is off	Timeout due to inactivity	Toggle the console switch to INACTIVE, wait a few seconds, then toggle it back to ACTIVE
LCD screen is very dark or very bright	Contrast out of adjustment	Use contrast knob to adjust LCD contrast
	Cable or wiring connections	Test and, if necessary, replace defective cables or connections between LCD and control board (see "Accessing controller electronics" on page 50)
	Faulty LCD	Replace the LCD assembly (see Section 5.5.3, page 56)
LCD screen will not activate	Temperature too low	The LCD may not operate if ambient temperature falls below –4°F (–20°C)
	Humidity too high	The LCD may not operate when relative humidity is above 95%
	Faulty switch	Replace console (active/inactive) switch
	Cable or wiring connections	Test and, if necessary, replace defective cables or connections between LCD and control board (see "Accessing controller electronics" on page 50)
	Faulty LCD	Replace the LCD assembly (see "Accessing controller electronics" on page 50)
LCD screen is slow to respond to keystrokes	Overloaded processor	Some sign functions can temporarily slow the main processor (such as a cellular modem or radar, flashing and multi-page messages, sign initialization and self-test). Temporarily blank the message sign display and turn off any optional accessories that are running.
LCD screen does not respond to keystrokes		See Table 5-10

Table 5-10. Troubleshooting the keyboard

Symptom	Possible cause	Solution
Keyboard error when activating LCD	Keyboard disconnected	Ensure the keyboard cable is plugged into the USB port on the right side of the control console, then verify the Caps and Num Lock lights on the keyboard go on when activating the console
	Communications failure	Toggle the console switch to INACTIVE, wait a few seconds, then toggle it back to ACTIVE
	Bootup failure	See "System reset" on page 80 and check and the charge the batteries if necessary; then, press the system reset button and wait for the sign to restart*
	Faulty keyboard	Replace the keyboard (use any standard computer keyboard with a USB connector)
	Faulty USB port	Replace control board
LCD does not respond to keystrokes	Same as above	

**DO NOT press the system reset button without first checking the batteries.*

Table 5-11. Troubleshooting status indicators (LEDs)*

Symptom	Possible cause	Solution
No LEDs are lit	All systems are OK	No action necessary
	Timeout due to inactivity	Toggle the console switch to INACTIVE, wait a few seconds, then toggle it back to ACTIVE
	Cable or wiring connections	Test and, if necessary, replace defective cables or connections between LED/switch board and control board (see "Accessing controller electronics" on page 50)
	Blown fuse	Replace fuse on LED/switch board (see Section 5.5.3, page 56)
	Power failure	See Section 5.6, page 56
	LED/switch board failure	Replace LED/switch board (see Section 5.5.3, page 56)
One or more LEDs are not lit	Status is as indicated	If some LEDs are lit and others are not, then the status being indicated by each LED is probably correct (see "Status indicators" on page 27)
	LED failure	Test the LED by activating or deactivating (depending on what the LED indicates) the system that makes the LED light up. If the LED fails to light, then it may have failed, which means the LED/switch board must be replaced.

**Status indicators are optional equipment. Your message sign may have one or more indicators, or none at all.*

Accessing controller electronics

The control box houses electronics for the message sign controller. If necessary, you can access the electronics as follows.

1. Locate the cable cover on the back of the control box (see Figure 5-6).
2. Remove the five screws that hold the cover in place, and remove the cover.
3. Disconnect cables from back of control box:
   a. Unscrew the power cable connector from the control box.
   b. Pull the power cable loose so that it is no longer connected to the control box.
   c. If you will be replacing the power board, then you should also remove the message board cable connector; otherwise, it is not necessary to detach this connector.
4. Disconnect cables from control console:
   a. Open the control box door.
   b. View the right side of the control console (see Figure 5-7) and note where each cable comes from. Mark the cables if necessary.
   c. Unplug all cables from the right side of the console.
5. Remove retention screws:
   a. On the back of the control box, locate the two console retention screws indicated in Figure 5-6.
   b. Support the underside of the control console, inside the control box, to prevent it from falling open when the screws are removed.
   c. Unscrew and remove the two retaining screws.
   d. Gently lower the console, which is hinged at the bottom, until it lies open inside the control box.

CAUTION

Static electricity can damage electrical components.

Before touching electronic components, touch grounded metal to discharge static electricity.

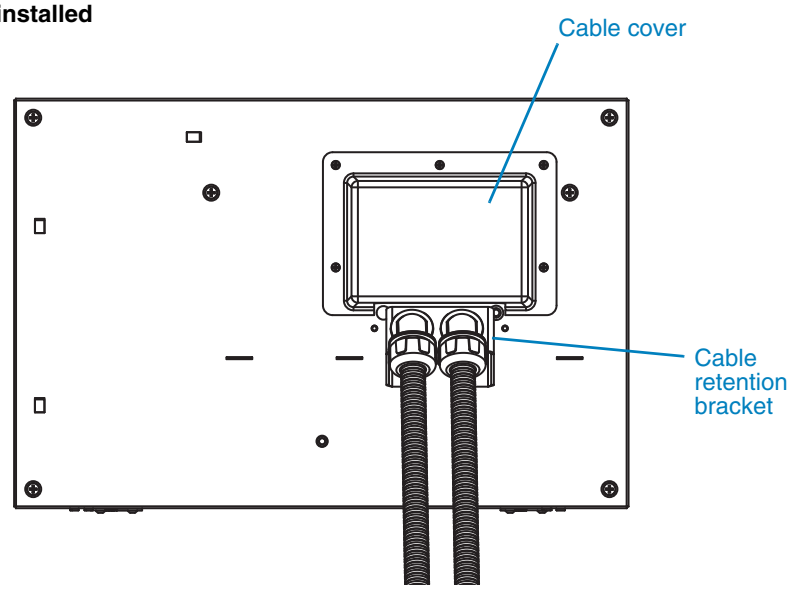
6. Before touching any component inside the console, be sure to touch grounded metal, to discharge static electricity.

- Components are called out in Figure 5-8.
- To replace a component, see Section 5.5.3, page 56.

7. When you are ready, reverse this procedure to close the console, reconnect the cables, and reinstall the cable cover.

Figure 5-6. Cable connections on back of frame-mounted control box

Cable cover installed



Cable cover removed

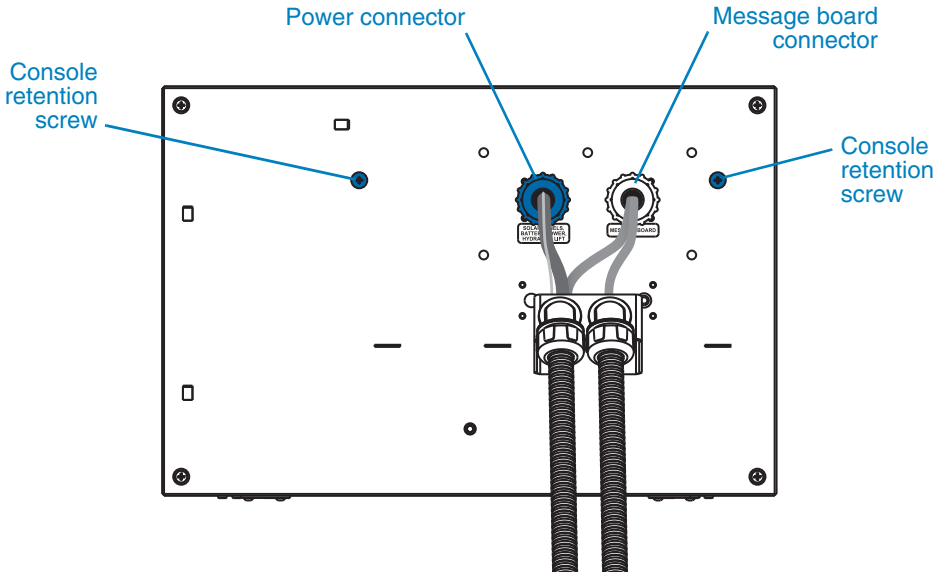


Figure 5-7. Control console cable connections

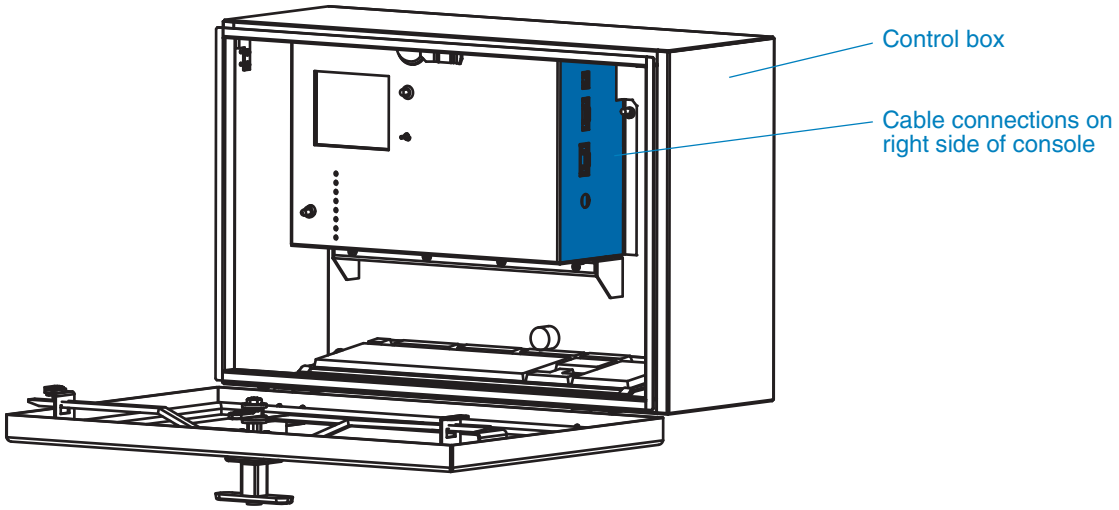
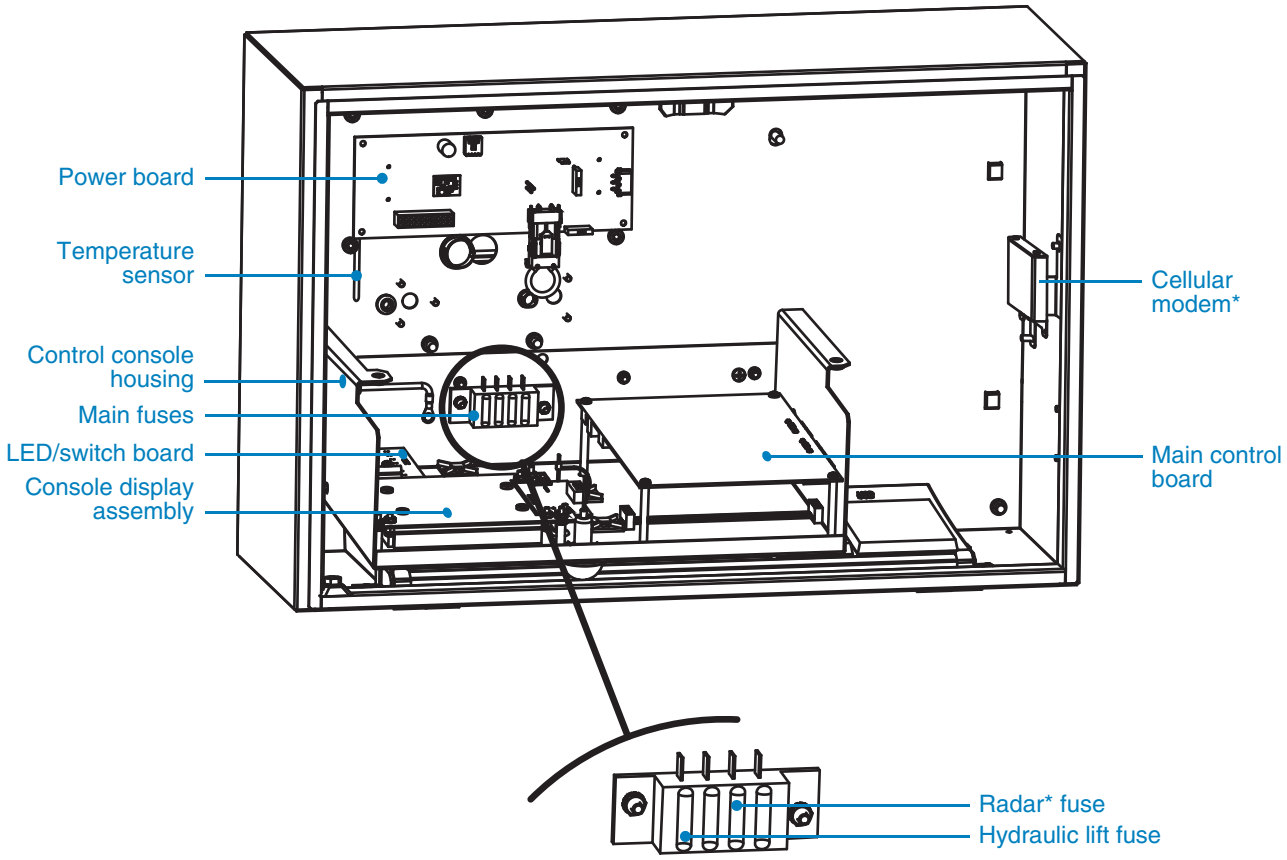


Figure 5-8. Components inside the control console



**Optional equipment; may not be installed on your message sign.*

5.5.2 In-cabinet control box

Troubleshooting

If the system-shutdown status indicator is lit, or power to the sign appears to be off, then the power system has shut down (see Section 5.6, page 56). To troubleshoot other controller issues, use the following tables:

- Table 5-12, "Troubleshooting the touchscreen display"
- Table 5-13, "Troubleshooting status indicators (LEDs)"

Table 5-12. Troubleshooting the touchscreen display

Symptom	Possible cause	Solution
Touchscreen is off	Timeout due to inactivity	Touch the touchscreen to activate it
Touchscreen will not activate	Faulty display control unit	Replace the DCU (see Section 5.5.3, page 56)
Touchscreen is very dark or bright	Glare or washout	Block direct sunlight or bright light from the touchscreen by shading it with your hand or an opaque object
	Temperature too high	Touchscreen may not operate properly if the temperature inside the control box rises above 170°F (77°C)
	Contrast out of adjustment	Contact the factory (see Section 1.4, page 2)
	Faulty display control unit	Replace the DCU (see Section 5.5.3, page 56)
Touchscreen is slow to respond	Temperature too low	Touchscreen may not operate properly if ambient falls below –4°F (–20°C)
	Overloaded processor	Some sign functions can temporarily slow the main processor (such as a cellular modem or radar, flashing and multi-page messages, sign initialization and self-test). Temporarily blank the message sign display and turn off any optional accessories that are running.
Touchscreen responds abnormally	Software error	See "System reset" on page 31 and check and the charge the batteries if necessary; then, press the system reset button and wait for the sign to restart*

**DO NOT press the system reset button without first checking the batteries.*

Table 5-13. Troubleshooting status indicators (LEDs)

Symptom	Possible cause	Solution
No LEDs are lit	All systems are OK	No action necessary
	Timeout due to inactivity	Touch the touchscreen to activate it
	Power failure	See Section 5.6, page 56
	Faulty power control unit	Replace PCU (see Section 5.5.3, page 56)
One or more LEDs are not lit	Status is as indicated	If some LEDs are lit and others are not, then the status being indicated by each LED is probably correct (see "Status indicators" on page 27)
	LED failure	Test the LED by activating or deactivating (depending on what the LED indicates) the system that makes the LED light up. If the LED fails to light, then it may have failed, which means the LED/switch board must be replaced.

Accessing controller electronics

Electronics for the message sign power and controller are located inside the control box and inside the display cabinet. If necessary, you can access the electronics as follows.

CAUTION

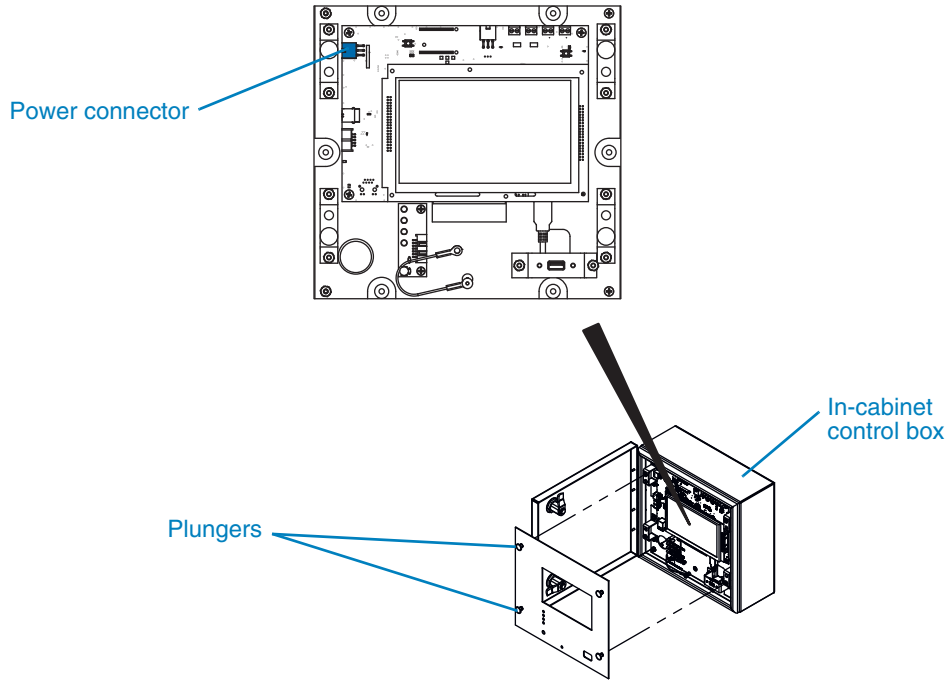
Static electricity can damage electrical components.

Before touching electronic components, touch grounded metal to discharge static electricity.

Before touching any electrical component, be sure to touch grounded metal, to discharge static electricity.

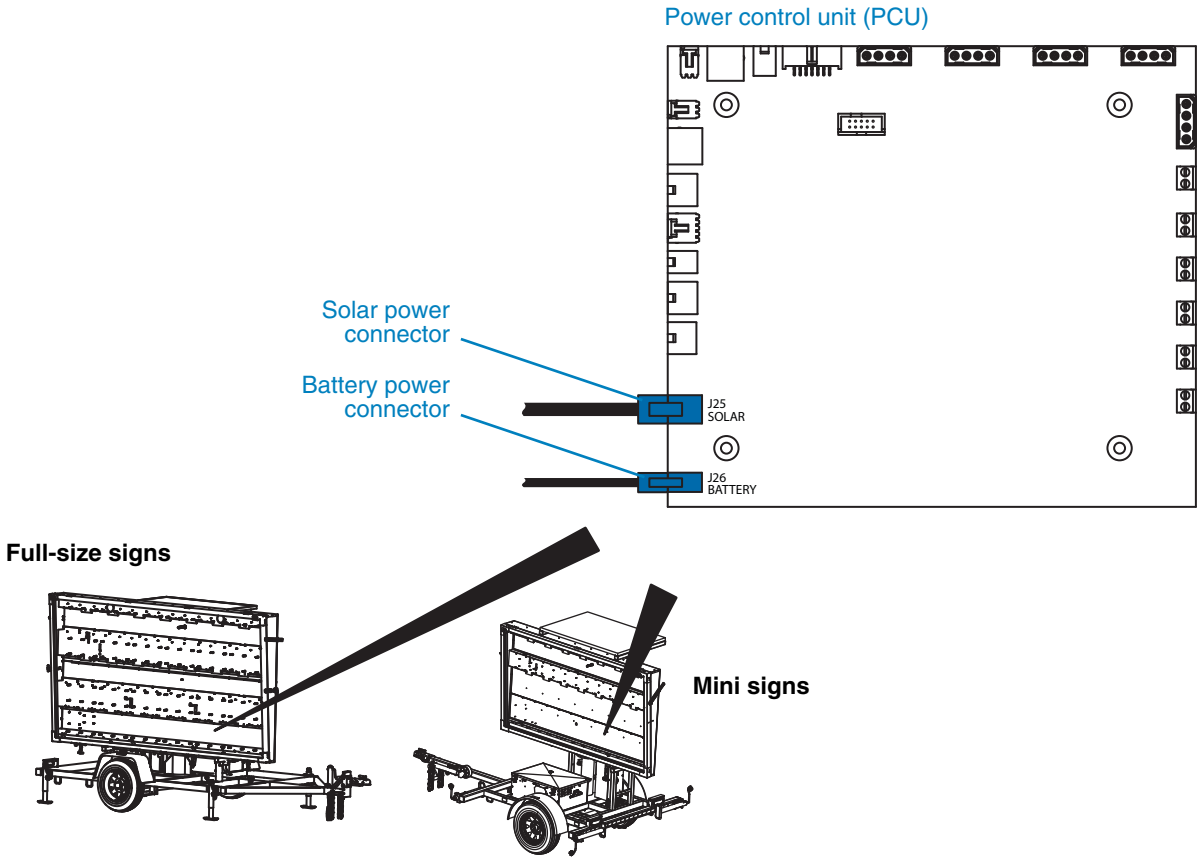
1. Access the display control unit (DCU) inside the control box:
   a. Open the control box.
   b. Pull each the four plungers that hold the control panel in place (see Figure 5-9).
   c. Using care not to damage any components, remove the control panel from the control box: first move the panel to the left, then bring the right side of the panel toward you to pivot the panel out of the control box.
   d. A lanyard ties the control panel to the control box to prevent the panel from falling. Using care not damage the panel, allow it to hang from the control box.

Figure 5-9. Display control unit (DCU) location



2. Disconnect the power connector from the DCU:
   a. Release the power connector by pulling the right end of the tab gently toward you.
   b. While pulling the tab, slide the cable side of the connector to the left to disconnect it from the DCU.
3. Access the power control unit (PCU) inside the display cabinet (see Figure 5-10):
   a. Open the cabinet door.
   b. Remove the display modules that are directly behind the control box. (For instructions on removing a module, see Section 6.2.3, page 72.)
4. Disconnect the power cables from the PCU (see Figure 5-10):
   a. Release the battery power connector by pressing the tab on the cable side of the connector.
   b. While pressing the tab, slide the cable side of connector to the left to disconnect it from the PCU.
   c. Repeat the above procedure for the solar power connector.
5. To replace a component, see Section 5.5.3, page 56.
6. When you are ready, reverse these procedures to reconnect cables, reinstall the display modules, and close the display cabinet and control box doors.

Figure 5-10. Power cable connections on power control unit (PCU)



5.5.3 Replacing controller electronics

CAUTION

Static electricity can damage electrical components.

Before touching electronic components, touch grounded metal to discharge static electricity.

Some controller components can be removed and replaced if necessary. Before touching any component inside the console, be sure to touch grounded metal, to discharge static electricity.

To remove components:

- Access components using the following procedure:
  - ☐ For a frame-mounted control box, see page 50.
  - ☐ For an in-cabinet control box, see page 54.
- Circuit boards are held in place with screws, and may be connected to other components with wires or cables. Before removing connectors, make note of where each cable is connected. Disconnect the cable connectors from the board that you are removing.
- Other control system components are held in place with screws or hold-down brackets. When removing any component, use care not to damage it or any other component.

5.6 Power failure

If the message sign display is blank and the controller cannot be activated, or if the system-shutdown status indicator is lit, then the power system has shut down.

- If the power system was shut down intentionally (a common reason is when the sign is put into storage), the solution may be as simple as reconnecting a battery cable or exposing the solar panels to sunlight so they can charge the batteries. Before proceding with troubleshooting, check battery connections and the fuse in the battery box, then check the batteries to see whether they need to be charged (see “Charging” on page 75).
- If power was shut down automatically by the sign’s control system, see Table 5-14.
- Other power problems and solutions include those listed in Table 5-15.
- After solving the problem, allow the solar charging system to charge the batteries, or use the AC-powered charger to charge the batteries. Always charge batteries fully before using the message sign (see “Charging” on page 75).

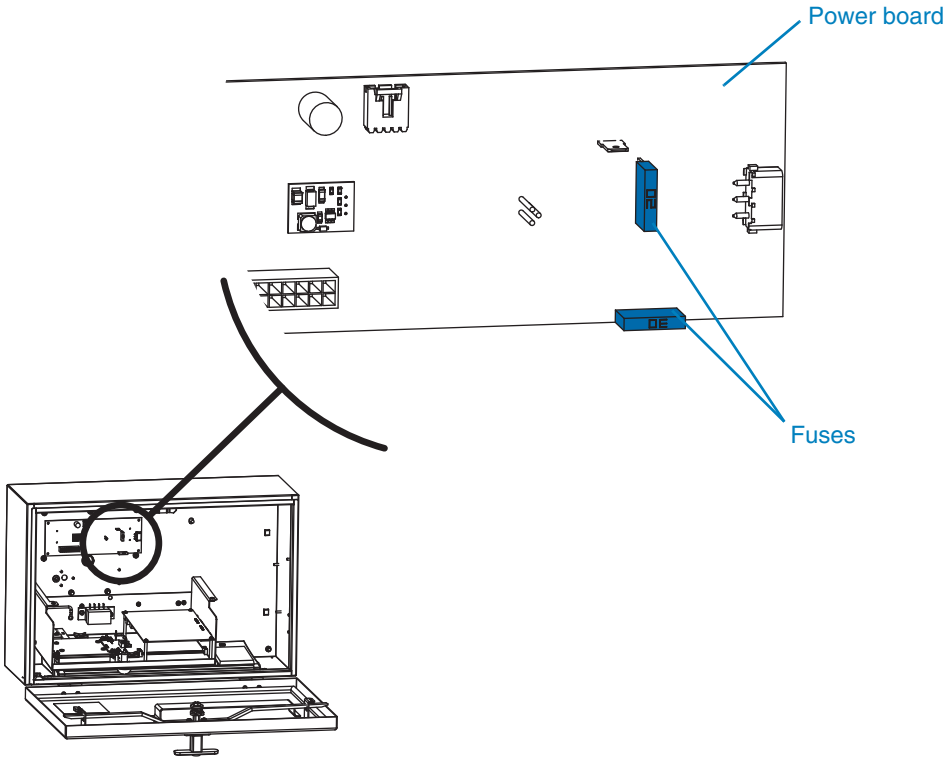
Table 5-14. Troubleshooting automatic shutdown

Possible cause	Description	Solution
Solar panels covered	Solar panels may be partially or completely covered by dust or dirt, or snow	Clean the solar panels as instructed in Section 6.3.2, page 73
Solar panels obstructed	Solar panels may be obstructed by shadows	Clear obstruction or move the sign to avoid shadows from trees, buildings, and other tall objects
Solar panels damaged	Solar panels may be damaged from weather or vandalism, or altogether missing	Replace damaged or missing panels
Insufficient sunlight	Solar panels may be receiving insufficient sunlight due to weather or the season	Charge the batteries manually using the AC-powered charger (see "Charging" on page 75)
Faulty batteries	One or more batteries may be faulty or have reached their end of life	Test and charge batteries (see "Charging" on page 75); if one or more batteries will not hold a charge, replace them
Bad cables or connections	Solar power cables may be loose or damaged	Check cable connections to ensure they are proper and secure. Check cable for wear and damage. Replace cable if necessary.
Fans running too often	Temperature settings for the display cabinet fans may be low and the fans are running too often	Use the controller to view and, if necessary, reset the fan temperature settings to 165°F
Display cabinet too hot	Temperature settings for the display cabinet fans may be too low and the fans are not running often enough	Use the controller to view and, if necessary, reset the fan temperature settings to 165°F
	Fan vents or filters may be clogged with dust or debris	Detach fans from back of display cabinet, then clean or replace the fan filters if they are dirty
	Wiring to fans may be loose or damaged	Check wiring connections to ensure they are proper and secure. Check wiring for wear and damage. Replace wiring if necessary.
	Fans may not be running because they are broken or faulty	Replace fans

Table 5-15. Troubleshooting power problems

Possible cause	Description	Solution
Dead batteries	One or more batteries may need recharging or replacing	Test and charge batteries (see "Charging" on page 75); replace any batteries that will not hold a charge
Bad cables or connections	Power, display, or battery cable may be loose, damaged, or corroded	Check cable connections to ensure they are proper and secure. Check cables for wear and damage. Replace cables if necessary.
Blown fuse	A fuse on the power board may have blown	For a frame-mounted control box, check fuses on the power board (see Figure 5-11) and replace if necessary.
	The fuse in the battery box may have blown	Contact the factory (see Section 1.4, page 2)
Faulty power board	Power board may be faulty	Contact the factory (see Section 1.4, page 2)

Figure 5-11. Fuses on the power board



5.7 Hydraulic lift

5.7.1 Overview

The display cabinet rises on a telescoping tower, using either an electically operated hydraulic lift or a manual hand-operated winch. If the sign uses a winch to raise the display cabinet, then this section does not apply.

For a sign with a hydraulic lift, a power unit pressurizes a hydraulic cylinder to raise the cabinet; the cabinet is lowered by controlled gravity return.

- For a message sign with a frame-mounted control box, the control switch for the hydraulic lift is located on the control console.
- For a message sign with an in-cabinet control box, the control switch for the hydraulic lift is located on the outside of the battery box.

If you cannot raise or lower the display, or if the hydraulic lift operates inefficiently or does not operate at all, use the following information for troubleshooting:

- Section 5.7.2, “Lift switch has no effect,” page 59
- Section 5.7.3, “Slow or rough operation, or pump noise,” page 60
- Section 5.7.4, “Cannot raise display cabinet or keep it raised,” page 61
- Section 5.7.5, “Cannot lower display cabinet,” page 61
- Section 5.7.6, “Leaking hydraulic fluid,” page 62

5.7.2 Lift switch has no effect

If the hydraulic lift switch does not operate, see Table 5-16

⚠ WARNING

Fire hazard.

When working with the hydraulic lift, never allow positive wiring to short to ground.

Table 5-16. Troubleshooting inoperable hydraulic lift switch

Possible cause	Description	Solution
Power system shutdown	The message display is blank and the controller does not turn on	See Section 5.6, page 56
Hydraulic fluid low, dry, or dirty	When the display is lowered, the hydraulic fluid reservoir should be full. New fluid should be nearly clear, while old or contaminated fluid could be yellow or brown.	Check hydraulic fluid quality and level; replace or refill if necessary (see Section 5.7.7, page 64)
Damaged pump or motor	A damaged hydraulic pump or motor can operate roughly or not at all	Check pump and motor for damage and smooth operation; repair or replace as necessary
Loose or damaged parts	Over time, hydraulic system components can come loose or be damaged	Check hydraulic system parts and assemblies to ensure they are tight and in good condition; repair or replace as necessary
Loose or damaged wiring	Worn or damaged wiring or a loose connection will prevent the switch from functioning	Check power cable and lift switch wiring connections to ensure they are proper and secure. Check cables and wiring for wear and damage. Replace if necessary.
Insufficient pressure	With insufficient pressure, the hydraulic system cannot raise the display cabinet	To adjust the hydraulic pressure, contact the factory (see Section 1.4, page 2)
Insufficient power	With insufficient voltage, the pump may lack the power necessary to raise the display cabinet	Test and charge batteries (see “Charging” on page 75); replace any batteries that will not hold a charge
Faulty switch	If the switch is broken, it will not function	Inspect switch for damage and replace if necessary

5.7.3 Slow or rough operation, or pump noise

If the hydraulic lift operation is slow or rough, or if the pump makes a loud noise, a grinding noise, or a high-pitched whine, see Table 5-17.

⚠ DANGER

Falling equipment will cause severe injury or death.

Hydraulic failure may cause display cabinet to fall.

- If height-lock pin is stuck, do not force it loose. Contact factory for assistance.
- Never drain hydraulic fluid while display cabinet is raised.

⚠ WARNING

Fire hazard.

When working with the hydraulic lift, never allow positive wiring to short to ground.

Table 5-17. Troubleshooting slow, rough, or noisy hydraulic lift

Possible cause	Description	Solution
Drain plug is open	The drain plug lets you drain hydraulic fluid from the reservoir	Check the drain plug and close it if it is open (for drain plug location, see Figure 5-14, page 65)
Hydraulic fluid low, dry, or dirty	When the display is lowered, the hydraulic fluid reservoir should be full. New fluid should be nearly clear, while old or contaminated fluid could be yellow or brown.	Check hydraulic fluid quality and level; replace or refill if necessary (see Section 5.7.7, page 64)
Damaged pump or motor	A damaged hydraulic pump or motor can operate roughly or not at all	Check pump and motor for damage and smooth operation; repair or replace as necessary
Loose or damaged parts	Over time, hydraulic system components can come loose or be damaged	Check hydraulic system parts and assemblies to ensure they are tight and in good condition; repair or replace as necessary
Insufficient pressure	With insufficient pressure, the hydraulic system cannot raise the display cabinet	To adjust the hydraulic pressure, contact the factory (see Section 1.4, page 2)
Insufficient power	With insufficient voltage, the pump may lack the power necessary to raise the display cabinet	Test and charge batteries (see “Charging” on page 75); replace any batteries that will not hold a charge
Air pockets in hydraulic fluid	Air pockets in the hydraulic fluid will cause the display cabinet to lower roughly	Raise the sign to its full height and ensure height-lock pin is engaged, then contact factory for assistance (Section 1.4, page 2)

5.7.4 Cannot raise display cabinet or keep it raised

If the hydraulic lift appears to be working but the display cabinet will not rise, or if the lift raises the cabinet but the cabinet will not stay raised, the hydraulic system may have insufficient pressure to hold the sign in place.

To troubleshoot problems raising the display or keeping it raised, follow these steps:

1. Lower the cabinet into the travel position.
2. Check the drain plug and close it if it is open (for drain plug location, see Figure 5-14, page 65).
3. Check the hydraulic fluid level and refill if necessary (see Section 5.7.7, page 64).
4. Check the hydraulic system for evidence of leaking hydraulic fluid. If leaking from the vent cap into the swivel base, the reservoir may have been overfilled; otherwise, a component, washer, or seal may have failed. See Section 5.7.6, page 62, or contact the factory for assistance (see Section 1.4, "Where to obtain service," page 2).

5.7.5 Cannot lower display cabinet

If the hydraulic cylinder loses pressure while the sign is deployed (i.e., the display cabinet is raised), then a serious hazard exists:

⚠ DANGER

Falling equipment will cause severe injury or death.

Hydraulic failure may cause display cabinet to fall.

- If height-lock pin is stuck, do not force it loose. Contact factory for assistance.
- Never drain hydraulic fluid while display cabinet is raised.

⚠ WARNING

Fire hazard.

When working with the hydraulic lift, never allow positive wiring to short to ground.

To troubleshoot problems lowering the display, see Table 5-18.

Table 5-18. Troubleshooting problems lowering the sign with the hydraulic lift

Possible cause	Description	Solution
Height-lock pin engaged	The height-lock pin prevents the display cabinet from falling if the hydraulics fail, but also prevents the cabinet from being lowered	Remove the height-lock pin from the tower, then try lowering the sign. If the pin is stuck, DO NOT FORCE IT; contact the factory for assistance (see Section 1.4, page 2).
Display cabinet obstructed	Because the display cabinet rotates, it can be in a position that is obstructed when it is lowered	Look for obstructions, such as other parts of the sign or objects in the area of the sign. Remove the obstruction and continue lowering cabinet.
Loose or damaged wiring	Worn or damaged wiring or a loose connection will prevent the lift switch from functioning	Check power cable and lift switch wiring connections to ensure they are proper and secure. Check cables and wiring for wear and damage. Replace if necessary.

5.7.6 Leaking hydraulic fluid

Leaking at vent cap

If hydraulic fluid is leaking from the vent cap into the swivel base, the reservoir may have been overfilled; otherwise, a component, washer, or seal may have failed.

- If the display cabinet is in the travel position (fully lowered), repair if able or contact the factory for assistance.
- If the display cabinet is in the deployed position (raised at any height), do not attempt to repair. Instead, contact the factory.

  To contact the factory, see Section 1.4, “Where to obtain service,” page 2.

Leaking at bleed screw

If hydraulic fluid is leaking from the bleed screw, use Figure 5-12 and the procedure below to troubleshoot the leak.

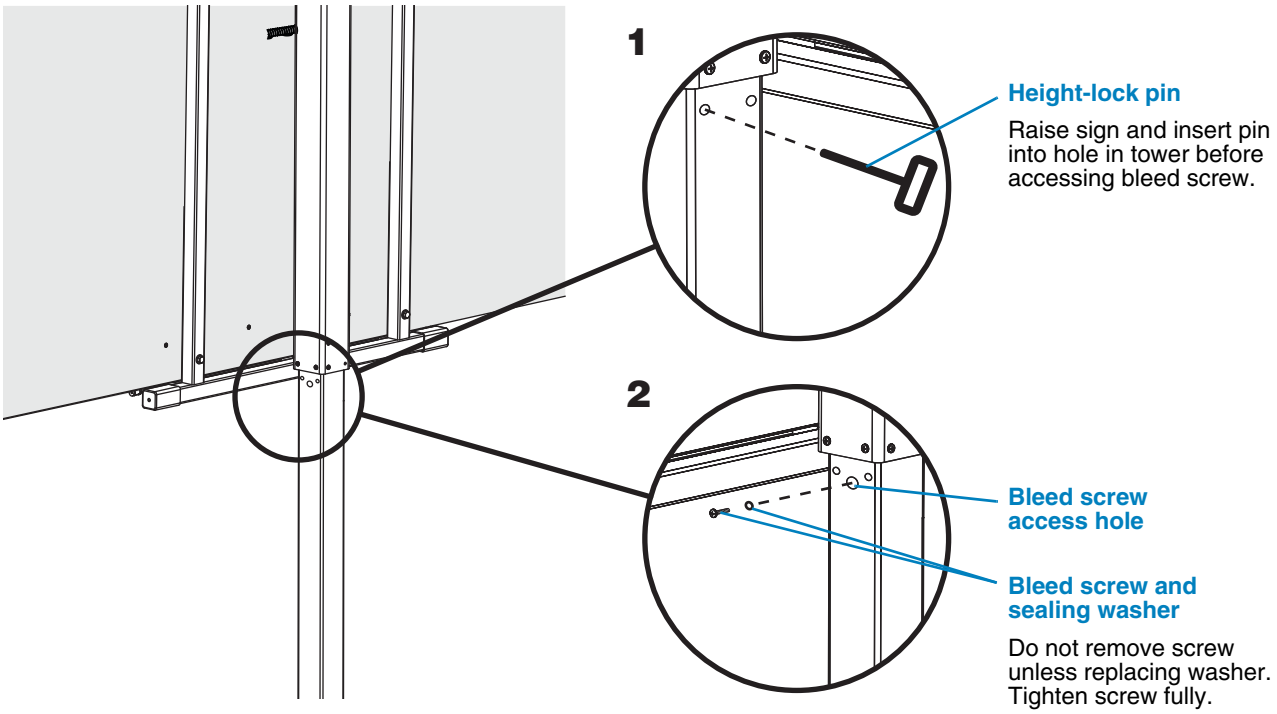
⚠ WARNING

Falling equipment could cause severe injury or death.

Ensure height-lock pin is fully engaged before accessing bleed screw.

1. Raise the display cabinet as high as it will go.
2. Insert the height-lock pin to prevent the cabinet from falling.
3. Locate the hole in the tower where the bleed screw is located.
4. Check the sealing washer:
   a. Verify the sealing washer is installed; it is often lost during maintenance.
   b. Verify the sealing washer is not damaged.

Figure 5-12. Bleed screw and sealing washer



5. If the sealing washer is missing or damaged:

IMPORTANT!

When you remove the bleed screw, hydraulic fluid will leak out.

Before removing the screw, be prepared to reinstall the screw with the replacement washer quickly, to minimize the amount of escaping fluid.

   a. Remove the bleed screw.

   b. Install a new washer on the screw and tighten the screw in the tower all the way.

6. If the bleed screw is loose, tighten it.

7. Wipe away excess hydraulic fluid from the tower and screw.

8. Remove the height-lock pin if desired to lower the display cabinet. If the pin is stuck, try raising the display cabinet slightly and then remove the pin. DO NOT force the pin if it is stuck. Contact the factory for assistance (see Section 1.4, page 2).

⚠ DANGER

Falling equipment will cause severe injury or death.

If height-lock pin is stuck, removing the pin may cause the display cabinet to fall.

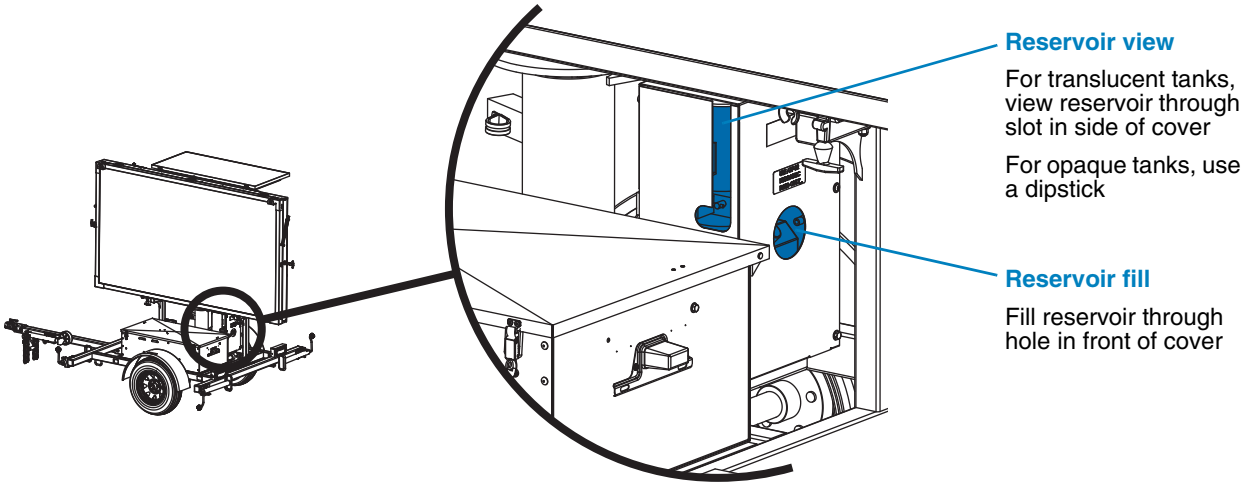
- Do not force pin.
- Contact factory for assistance.

5.7.7 Checking hydraulic fluid level

When the sign is in the travel position, you can check the fluid level by looking at the reservoir if the fluid tank is translucent (see Figure 5-13), or by using a dipstick.

When the sign is deployed (i.e., the display cabinet is raised), you cannot check the fluid level because the fluid is not in the reservoir; it is inside the cylinder.

Figure 5-13. Checking hydraulic fluid level



5.7.8 Manually raising the sign

If the hydraulic lift will not operate and the message sign has a hand-operated pump, you can raise the display cabinet manually. The hand-operated pump is optional equipment that may not be included with your message sign.

To raise the sign with the hand-operated pump:

1. Retrieve the pump handle from inside the battery box.
2. Ensure the drain plug is closed (see Figure 5-14).
3. Insert the handle onto the receiving sleeve on the hydraulic pump (see Figure 5-15). Pump the handle to raise the display cabinet. Do not raise it all the way yet.
4. Pull the rotation-brake handle to release the cabinet so that it can be turned.

⚠ WARNING

Loose equipment can cause severe injury.

Ensure wind does not catch and unexpectedly rotate unlocked display cabinet.

5. Rotate the cabinet counterclockwise, so that the front of the sign cabinet faces traffic.
6. Look toward traffic through the sight-tube and angle the sign display appropriately (see Section 4.4.1).

7. Push the rotation-brake handle, locking the cabinet rotation. In the locked position, the brake handle is fully extended.
8. Use the hand-operated pump to raise the cabinet to its full height.
9. Insert the height-lock pin through the holes in the tower, so the display cabinet will not fall if hydraulic pressure were to fail.
10. Use the controller to configure the message that will appear on the sign. (For information about the controller, see Section 4.5, page 25.)

Figure 5-14. Hydraulic reservoir drain plug

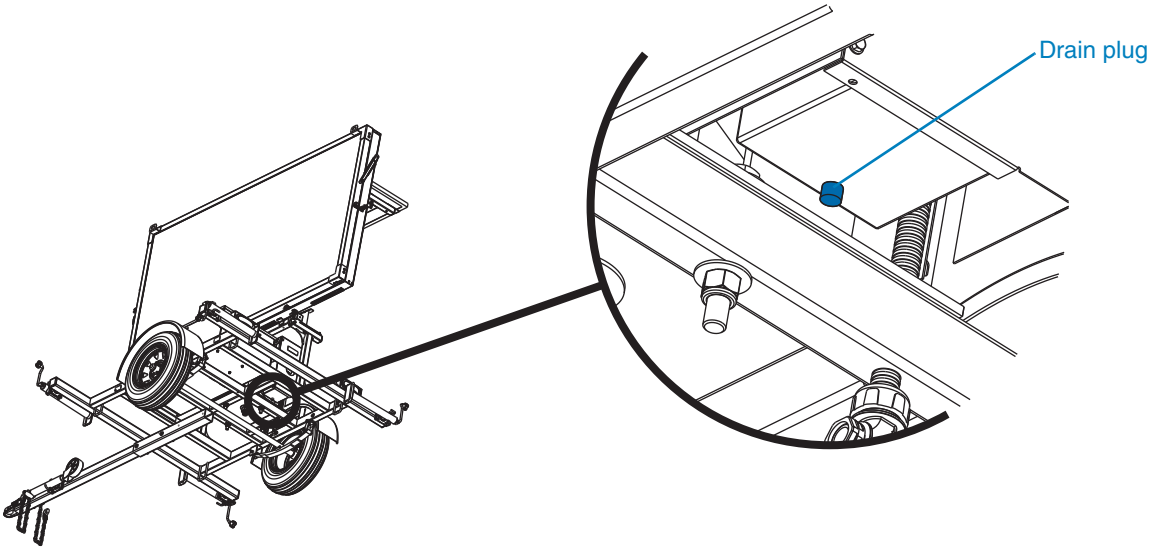
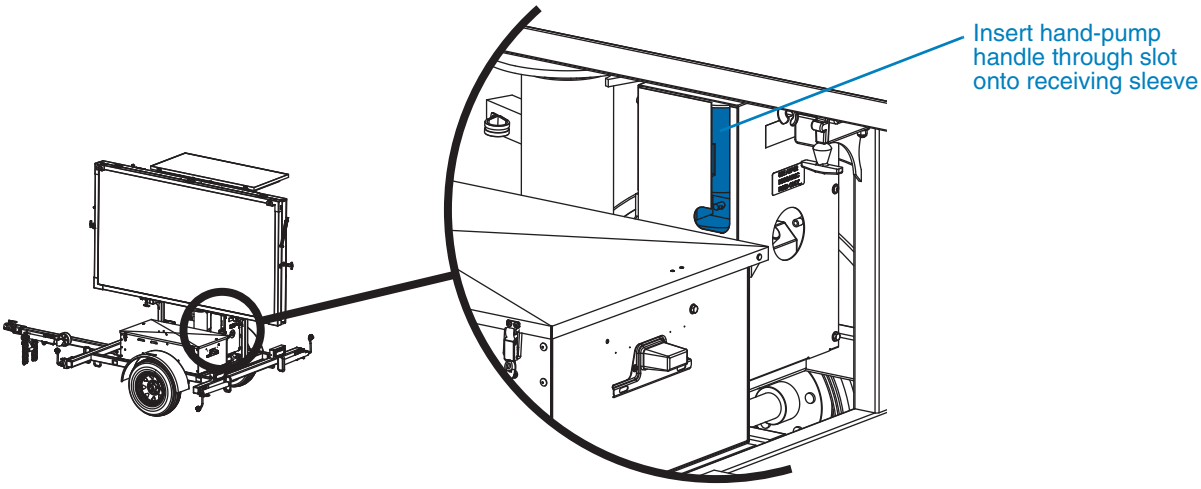


Figure 5-15. Hand-operated pump



5.8 Radar

5.8.1 Before troubleshooting radar

Radar is powered by the message sign power system and controlled by the message sign computer.

- If the message sign power is off and all the status LEDs on the front of the control panel are off, see Section 5.6, page 56, for troubleshooting.
- If the message sign is operating properly and some status LEDs are on, but the radar LED is off and the radar is not functioning, see Section 5.8.2.

Radar is optional, auxiliary equipment that may not be included with your message sign (see Section 4.7.2, page 33).

5.8.2 Radar troubleshooting procedure

IMPORTANT!

After each step in the following procedure, check the radar status LED on the front of the control panel. When the LED is on or blinking, the radar is functioning properly.

To troubleshoot radar:

1. Use the controller to access the radar configuration screen and ensure radar power mode is set to an active mode (i.e., not "OFF"). Verify other radar settings are as expected.
2. Ensure the cable connections and wiring are proper, secure, and undamaged:
   - If the message sign has a frame-mounted control box, check connections and wiring at the LED/switch board (see Figure 5-16). Repair or replace if necessary. (To access the LED/switch board , see "Accessing controller electronics" on page 50.)
   - If the message sign has an in-cabinet control box, check connections and wiring at the power control unit or PCU (see Figure 5-17). Repair or replace if necessary. (To access the PCU, see "Accessing controller electronics" on page 54.)
3. If the message sign has a frame-mounted control box, check the radar power and ground fuses (see Figure 5-16). Replace fuses if necessary.
4. If the message sign has a frame-mounted control box, check wiring connections at the radar terminal strip inside the display cabinet (see Figure 5-18). Ensure they are proper, secure, and undamaged. Repair if necessary.
   - To access the radar terminal strip, remove the bottom left display module.
   - For instructions on removing a display module, see Section 6.2.3, page 72.
5. If all other steps failed to solve the problem, the radar head may have failed. Contact the factory (see Section 1.4, page 2).

Figure 5-16. Radar wiring connections and fuses inside frame-mounted control box

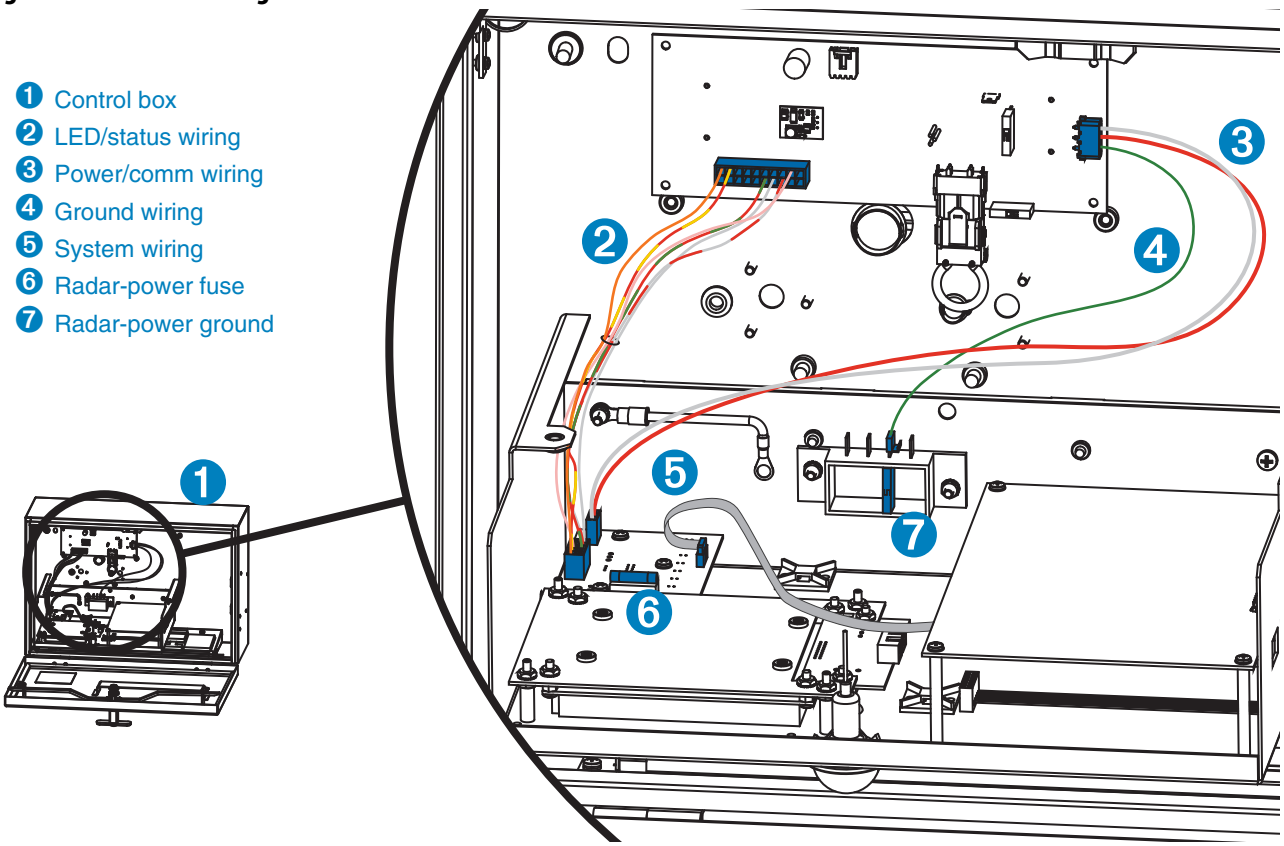


Figure 5-17. Radar wiring connections for a sign with in-cabinet control box

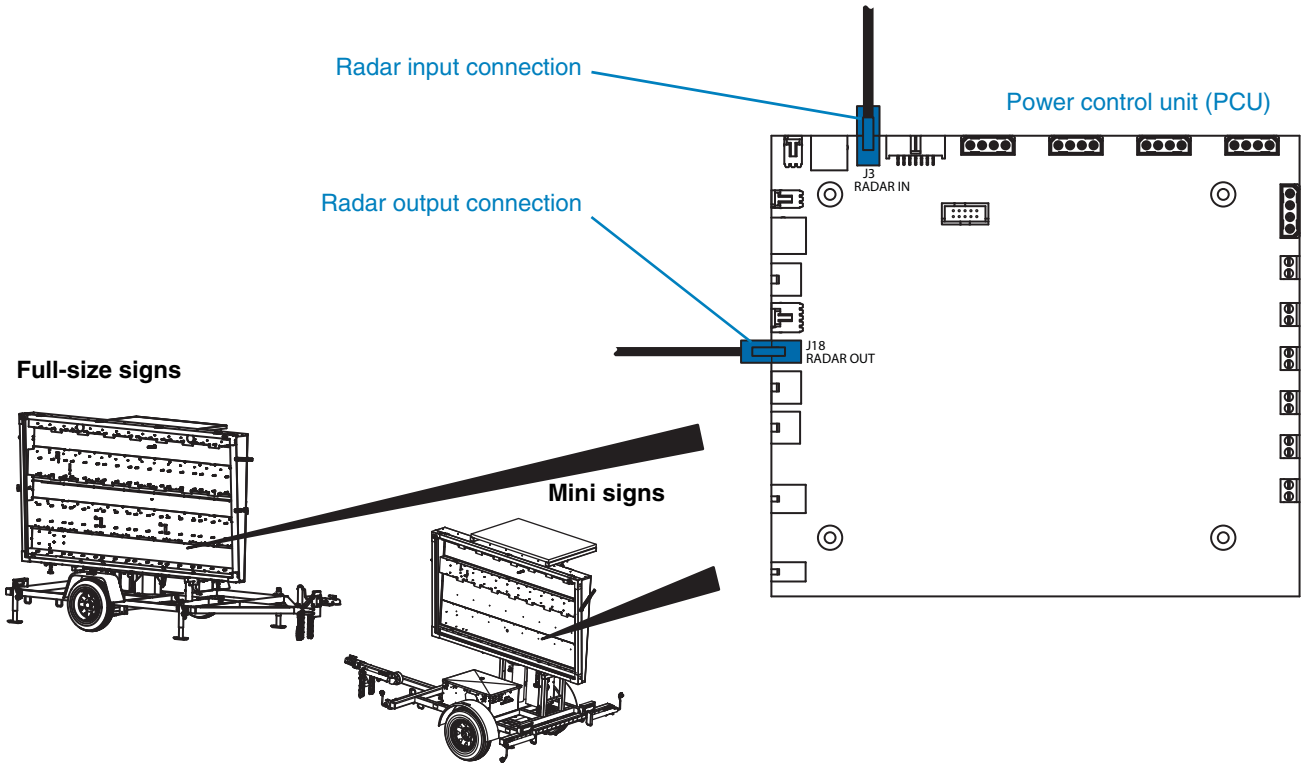
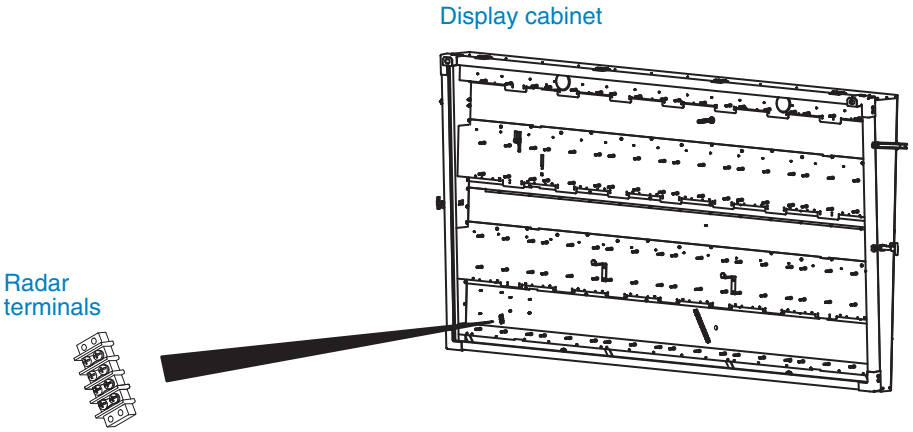


Figure 5-18. Radar wiring terminals for a sign with frame-mounted control box



6 Maintenance

6.1 Periodic maintenance

When performing any maintenance on the system, follow the safety requirements in Section 2, page 5.

Repair or replace worn and damaged components immediately. Never use any equipment that is damaged or in need of repair..

⚠ CAUTION

During maintenance, adverse weather conditions can cause equipment damage and injury.

Whenever possible, perform maintenance indoors or in calm, dry weather.

CAUTION

Voltage surge could damage control circuits.

Before servicing electrical components, disconnect power cable from controller.

Perform the following maintenance regularly:

- The sign's display comprises a matrix of display modules with sets of LEDs that light up to display messages on the sign.

⚠ WARNING

If the message sign is not working properly, a traffic accident could occur, resulting in serious injury or death.

Verify all display modules are functioning properly.

- ☐ Before using the sign, ALWAYS check the display modules for proper operation.
- ☐ Replacement modules are available from the factory (Section 1.4, "Where to obtain service," page 2).

- At least once a week, check the display cabinet window for cleanliness and cracks. Clean or replace window when necessary.
- At least once a month, check cooling-fan air filters for cleanliness. Clean or replace filters when necessary.
- All components in the battery box will operate more efficiently and have a longer lifespan if they are free of dirt and dust. Keep the interior of the battery box and components inside the battery box clean. Observe battery safety requirements when working on or around batteries (see "Safety" on page 74).

6.2 Display cabinet

The display cabinet protects the LED display modules and other electronics inside the cabinet. The display-cabinet door is hinged at the top and latched on the sides and bottom. The door props open for servicing.

- The door frame holds a clear, polycarbonate-resin thermoplastic window. During use, the window will become dirty and require cleaning (see Section 6.2.1).
- The gasket between the door frame and the display cabinet can become worn over time. The gasket is important for sealing the cabinet against the weather, and should be replaced if worn or damaged.
- Ensure the cabinet door is closed and latched when the message sign is not being serviced.

6.2.1 Polycarbonate window

To clean the window:

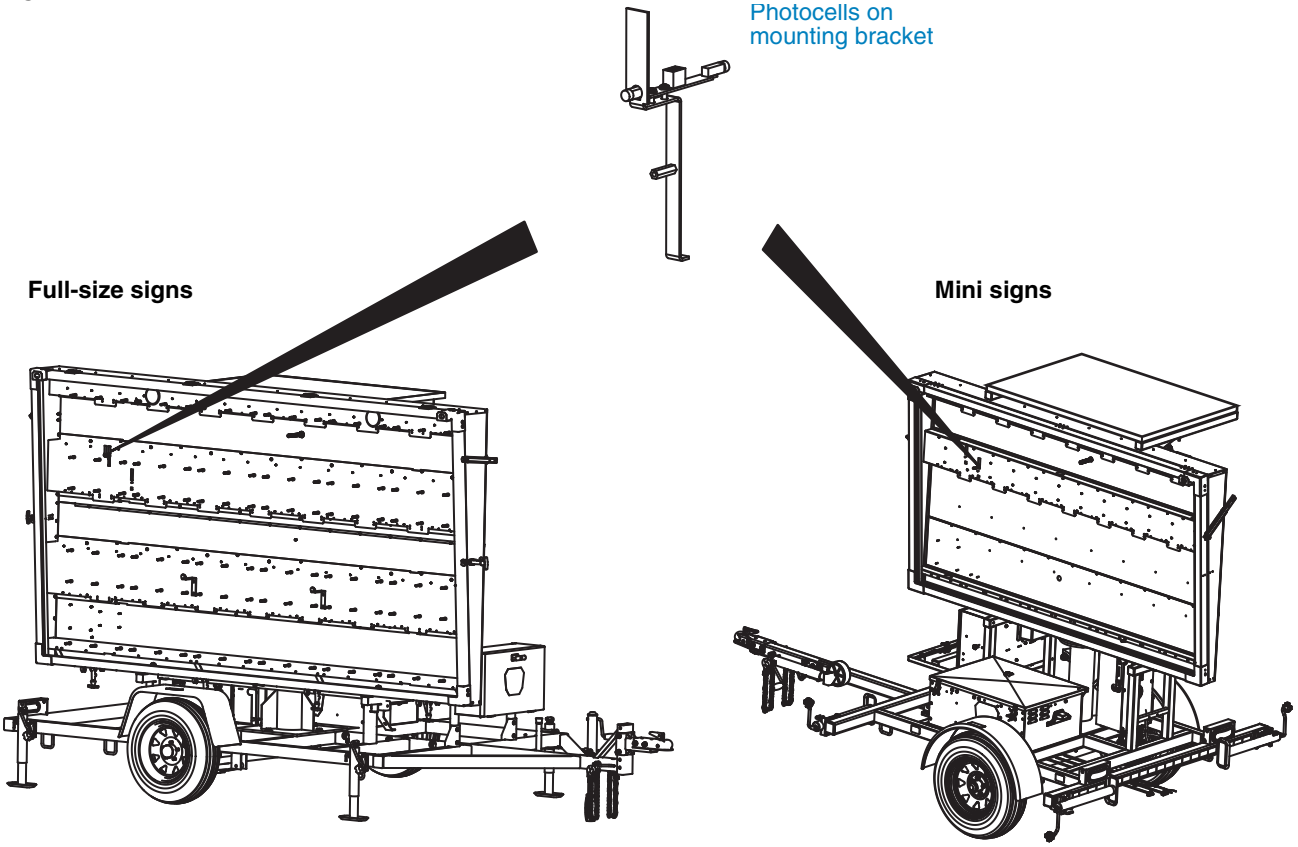
1. Follow the safety requirements in Section 2, page 5.
2. Open the display cabinet door.
3. Follow these guidelines:
   - Use a cleaning solution of mild soap and warm water. If necessary, commercial cleaning solutions, such as Formula 409®, are acceptable. Do not use chemical or industrial cleaning solutions.
   - Use a sponge or soft cloth and clean the window gently, using care not to scratch the surface. Do not use a brush or squeegee.
   - To prevent spotting or streaking, dry the surface with a soft cloth or moist sponge.
4. When done, close and latch the display cabinet door.

6.2.2 Photocells

To clean the photocells:

1. Follow the safety requirements in Section 2, page 5.
2. Locate and inspect the photocells (see Figure 6-1).
3. If either the front or rear photocell appears to be dirty or otherwise obstructed, clear or clean it using a soft, damp cloth on the photocell or its cover. For the front photocell, clean the window if necessary (see Section 6.2.1).
4. When done, close and latch the display cabinet door.

Figure 6-1. Photocells location



6.2.3 Display modules

The display modules can be replaced when damaged or if LEDs fail to light.

Each module has an address, which marks its designated location in the display. All modules are interchangeable, and their addresses are assigned by initialization. Therefore, after replacing modules in the cabinet, initialization is required to ensure messages are displayed correctly.

IMPORTANT!

Initialization is a maintenance action and should be performed only by Wanco service personnel and advanced users. If improperly used, initialization can disable the sign.

To replace a display module:

1. Follow the safety requirements in Section 2, page 5.
2. Identify the display module to be replaced, and remember its location.
3. Use the controller to "blank" the message sign.
4. Open the display cabinet door (which is hinged at the top and latched on the sides and the bottom).
5. Remove the display module:
   a. Identify the module and locate the four retaining nuts that hold it in place.
   b. Using the supplied nut wrench or a 5/16-inch nut driver, remove the four nuts.
   c. Carefully pull the display module away from the cabinet to expose the wiring connections on back of the module. The wiring can be damaged if you use too much force.
   d. Being careful to avoid using too much force, first unplug the power connector on back of the malfunctioning display module by pulling the connector straight out, away from the module, then unplugging the data input wiring by pushing the locking tab down and pulling the plug sideways, away from the connector. Repeat for the data output wiring. (The lower-right module does not have output wiring.)
   e. Set the module aside.
6. Install and initialize the new module:
   a. Reverse the procedure to install the replacement module in place of the one you removed.
   b. Use the controller to access the display module diagnostics, then initiate the message sign and start a new self-test.
   c. After initialization is complete, use the controller to put a test message on the sign, and ensure the sign is working as expected.
7. When done, close and latch the display cabinet door.

6.3 Power system

6.3.1 Overview

The message sign is powered by 6-volt batteries wired in series and parallel for a 12-volt power supply, or by optional 12-volt batteries. Solar panels are used for charging the batteries.

The charging system runs continuously, keeping the batteries charged. The system automatically detects when batteries are fully charged and will not overcharge them.

Under optimal conditions, the batteries will remain charged and the message sign can be used without having to charge the batteries using an external charger. If you use the message sign continuously and the solar panels are not exposed to full sunlight all day, the solar charging system may not keep the batteries charged sufficiently.

If there is not enough sunlight to keep the batteries fully charged, you will need to charge the batteries using the external AC-powered charger, which is located inside the battery box (see "Charging" on page 75).

A low-voltage-disconnect circuit detects when the battery charge falls below 11.2 volts DC, and shuts down power to the message sign. If a shutdown occurs, the message sign will not function; the batteries must be fully charged.

6.3.2 Solar panels

For the solar charging system to function properly, the solar panels must be exposed to full sunlight during daylight hours. If the location where the message sign will be used is not a sunny location, the batteries must be charged using the external AC-powered charger, which is located inside the battery box.

The solar panels must be kept clean and completely unobstructed:

- When necessary, clean the solar panels with a squeegee, soft cloth, or sponge and a cleaning solution of mild detergent and warm water.
- If a shadow or any obstruction blocks even a portion of any of the solar panels, charging will be negatively affected and a significantly longer charge time will be necessary.

6.3.3 Batteries

Although the automated charging system helps maintain battery health by keeping batteries fully charged when there is sun, and by shutting down power before full discharge, regular maintenance is necessary for the batteries to function properly and for long battery life.

- When working on or around the batteries, always observe battery safety precautions.
- Routinely inspect batteries and cables, clean surfaces and terminals, and check fluid levels and battery charge.

See the following pages for battery safety and care instructions.

Safety

⚠ DANGER

Explosive gases can cause blindness and severe injury.

When working on or near batteries:

- Wear eye protection
- Prevent sparks and open flames
- No smoking anywhere in the vicinity
- Keep children clear of the area

⚠ DANGER

Sulfuric acid can cause blindness and severe burns.

- Use caution when working on or near batteries
- Avoid contact with skin, face, and eyes
- Upon contact, seek medical help immediately
- Keep out of reach of children

CAUTION

Voltage surge could damage control circuits.

Before working with batteries, disconnect power cable from controller.

- Even when the batteries are not in operation, self-discharge generates hydrogen gas that can explode. Always store and work on batteries in a well ventilated area.
- Always wear proper eye, face, and hand protection when working on or near batteries.
- Keep all sparks, flames, and cigarettes away from batteries at all times.
- Never lean over batteries when testing or charging.
- Keep battery vent caps tight and level, except when watering batteries.
- To prevent short circuits and sparks, exercise caution when working with metallic tools or conductors near batteries.
- To reduce the risk of sparks, ensure connectors make good contact with battery terminals.
- Replace cables that you suspect might be worn or damaged. Replace cables that have visible fraying, cracks, or bare wires.
- Always disconnect power cable from controller before disconnecting battery cables.
  - ☐ For a frame-mounted control box, disconnect power cable from back of control box (see “Accessing controller electronics” on page 50).
  - ☐ For an in-cabinet control box, disconnect power connector from display control unit, behind the control panel (see “Accessing controller electronics” on page 54).

- If disconnecting message sign battery cables, always disconnect positive (+) cable first.* Do not allow positive power cable to short to ground.
- At least once a month, coat cable connections with a protective spray, non-metallic grease, or petroleum jelly (such as Vaseline® brand) to prevent corrosion. Keep battery hold-downs painted.
- To lengthen battery life and prevent freezing, always keep batteries fully charged and keep cable connections clean and tight.
- Visually inspect batteries for physical damage, including cracks and leaking. Always replace damaged batteries immediately. Dispose of old batteries in accordance with local regulatory codes.
- Keep the battery box lid closed and latched unless you are performing maintenance or charging the batteries.

Charging

Battery voltage should be checked once a week to ensure the charging system is keeping the batteries charged. In northern locales during winter, when sunlight is less intense, battery voltage should be checked more often. For an overview of the charging system, see Section 6.3.1, page 73.

If the battery voltage is low because the charging system is not able to fully charge the batteries, use the external AC-powered charger when the batteries need charging (see "External AC-powered charger" on page 77).

After charging flooded (non-sealed) batteries, check battery fluid levels (see "Watering flooded batteries" on page 78).

If the sign has a voltage meter in the battery box, use it for checking voltage levels. To determine charge requirements, perform a specific-gravity or voltage test as described below.

Specific-gravity testing procedure

A specific-gravity test is the preferred testing method for flooded (non-sealed) batteries, because it is possible for batteries to exhibit a valid voltage (surface charge) yet have no capacity to drive a load.

For regular maintenance, perform specific-gravity testing on two or more cells on different batteries. Normal readings should be between 1.250 and 1.280. If readings are low, check all other cells and batteries to determine whether batteries are near the end of their operating life.

1. Observe battery safety precautions (see "Safety" on page 74).
2. Turn off all electrical loads and halt battery charging from both the solar panels and external AC charger.
3. Open vent cap and inspect fluid level.
4. Add distilled water until the plates are covered.

**Removing the positive cable first is a requirement for negative-ground systems.*

5. Fill and then drain a battery hydrometer. Repeat two to four times.
6. Using the hydrometer, pull out a sample. There should be enough sample fluid (electrolyte) to support the float.
7. Record the hydrometer reading.
8. Return the fluid to the battery cell.
9. Close and tighten the battery vent cap.
10. Repeat for the other cells of the battery.
11. Clean any spilled electrolyte.
12. Correct the hydrometer readings to 80°F (27°C) using ambient air temperature:
    - Add 0.004 for every 10°F above 80°F (5.6°C above 27°C).
    - Subtract 0.004 for every 10°F below 80°F (5.6°C below 27°C).
13. Refer to Table 6-1 to determine the battery charge requirements based on the corrected specific gravity.

Voltage testing

Before performing a voltage test on flooded (non-sealed) batteries, consider a specific-gravity test (a more accurate indicator of battery charge) instead. For sealed batteries, the voltage test is the only testing method.

1. Observe battery safety precautions (see "Safety" on page 74).
2. Turn off all electrical loads and halt battery charging from both the solar panels and the external AC charger in the battery box.
3. Ensure battery cables are disconnected and terminals are clean.
4. For accurate voltage readings, wait at least one hour to allow the battery voltage to stabilize.
5. Using a DC voltmeter or multimeter, measure and record the DC voltage across the positive and negative terminals of each battery.
6. If the voltage varies between batteries, recharge the batteries and perform the test again, or obtain appropriate test equipment from the battery manufacturer and follow the manufacturer's instructions.
7. Correct the voltage readings to 80°F (27°C). Using ambient air temperature:
    - Add 28 mV (0.028 volts) per cell for every 10°F above 80°F (5.6°C above 27°C)
    - Subtract 28 mV (0.028 volts) per cell for every 10°F below 80°F (5.6°C below 27°C).
    - Each 6-volt battery has three 2-volt cells.
8. Refer to Table 6-1 to determine the battery charge requirements based on the corrected voltage.

Table 6-1. Battery charge requirements

Charge level, %	Specific gravity @ 80°F (27°C)	Open-circuit voltage, volts		Approx. required charge time, hrs.		
		6V batt.	12V batt.	5A	10A	20A
100	1.277	6.37	12.73	0	0	0
95	1.268	6.34	12.68	3	1	1
90	1.258	6.31	12.62	5	2	1
85	1.248	6.28	12.56	8	4	2
80	1.238	6.25	12.50	10	5	3
75	1.227	6.22	12.44	13	6	3
70	1.217	6.19	12.37	16	8	4
65	1.206	6.16	12.31	18	9	4
60	1.195	6.12	12.24	21	10	5
55	1.184	6.09	12.17	23	12	6
50	1.172	6.05	12.10	26	13	6
45	1.277	6.37	12.03	28	14	7
40	1.268	6.34	11.96	31	16	8
35	1.137	5.95	11.89	34	17	8
30	1.124	5.91	11.81	36	18	9
25	1.111	5.87	11.74	39	19	10
20	1.098	5.83	11.66	41	21	10
15	1.087	5.79	11.59	44	22	11
10	1.079	5.75	11.51	47	23	12
5	1.037	—	—	—	—	—
0	1.000	—	—	—	—	—

Notes

1. Determine the battery charge level from the specific-gravity or voltage test readings.
2. If charge level is above 70%, no charging is required. If charge level is below 10%, the battery may need replacing. Otherwise, determine the required charge time from the table.

External AC-powered charger

To charge the batteries with the external AC-powered charger, located inside the battery box:

1. Observe battery safety precautions (see “Safety” on page 74).
2. Observe the following charging requirements:
   - Avoid charging batteries at temperatures above 120°F (49°C).
   - Never charge a frozen battery. Thaw batteries completely before charging.
   - Always charge batteries fully. Undercharging causes stratification and may result in the message sign shutting down unexpectedly.

3. Connect the charger to a standard 120-volt or 240-volt commercial power outlet.
   - If the charger appears not to be working, the fuse on the charger may be blown, or the power outlet may not be switched on.
   - The charger will not overcharge the batteries, even if left unattended for an extended period.
4. Charge the batteries until they reach 12.65 volts DC.
5. After charging is complete, disconnect the charger from the power outlet and stow the power cord inside the battery box.
6. Close and latch the battery box.

Watering flooded batteries

This section applies only to flooded (non-sealed) batteries. If your message sign uses sealed batteries, you do not need to water the batteries.

CAUTION

Low battery acid can damage batteries.

Periodically check fluid level in each battery cell.

For proper and optimal functioning of the message sign, battery fluid levels must be maintained. Check fluid levels regularly and refill when necessary using the following guidelines:

- Observe battery safety precautions (see "Safety" on page 74).
- Use only distilled or deionized water. Water with mineral content can cause the plates to corrode. Never add acid or additives to batteries.
- Open battery vent caps and inspect the fluid well for each cell. If necessary, add just enough distilled water to cover the plates. More water may be required after charging.
- Do not overfill batteries. Overfilling will result in overflowing of battery acid during use.
- Watering guns and automatic watering systems are acceptable for watering batteries. Do not use a common garden hose for watering.
- When finished, ensure all vent caps are tight and level.
- Charge batteries after refilling, then check again for proper fluid levels.
- When checking battery fluid levels, overfull batteries can be an indication of overcharging, operation at high temperature, or the battery nearing its end of life.
- Battery maintenance instructions are shown on a label attached to the inside of the battery box lid.

Cleaning

- Observe battery safety precautions (see "Safety" on page 74).
- Keep batteries clean to avoid accumulation of dust, dirt, and grime.
- To clean batteries, use a solution of 50% baking soda and 50% water. Do not allow cleaning solution or other material to enter battery cells. After cleaning, rinse batteries with clean water and allow to dry thoroughly.
- Clean battery terminals, particularly if they are warm, hot, or corroded. Scour the terminals and the inside of the cable clamps using a battery post or clamp cleaner, or a wire brush, until they have a bright metallic shine.
- At least once a year, visually inspect terminals and cables for signs of corrosion, especially in hot temperatures.

Replacing

To replace a battery, follow these steps:

1. Observe battery safety precautions (see "Safety" on page 74).
2. Disconnect power cable from controller:
   - For a frame-mounted control box, disconnect power cable from back of control box (see "Accessing controller electronics" on page 50).
   - For an in-cabinet control box, disconnect power connector from display control unit, inside the display cabinet (see "Accessing controller electronics" on page 54).
3. Disconnect the positive (+) cable from the battery.*
4. Disconnect the negative (–) cable from the battery.
5. Remove the hold-down brackets that keep the battery in place.
6. Taking care to prevent injury, lift the battery out of the battery box. A battery is heavy, and you may need assistance to lift it.
7. Inspect the bottom of the battery box for corrosion and other damage. Clean the bottom of the box and any other components in the battery box that need cleaning.
8. Inspect the battery cables for corrosion and damage. Clean or replace the cables as necessary for ensuring a good connection.
9. Install the new battery and secure it with the hold-down brackets. Replace the old battery with a new battery of the same type.
10. Reconnect wiring (see Figure 6-11, page 95), taking care not to over-tighten the cable clamps:
    a. Connect the negative (–) cable to the replacement battery.
    b. Connect the positive (+) cable to the replacement battery.
11. Reconnect power cable to controller.

**Removing the positive cable first is a requirement for negative-ground systems.*

Storing

- Observe battery safety precautions (see "Safety" on page 74).
- Before storing the message sign or batteries:
  - ☐ See Section 6.6, "Storing the message sign," page 83.
  - ☐ Clean the batteries as described in "Cleaning" on page 79.
  - ☐ Check fluid levels as described in "Watering flooded batteries" on page 78.
  - ☐ To prevent freezing, ensure all batteries are fully charged (see "Charging" on page 75).
- Store batteries in a cool, dry, well-ventilated location. The storage temperature should remain as low as possible without dropping below 32°F (0°C), and should not exceed 80°F (27°C).
- Store batteries safely out of reach of children and pets.
- Check fluid levels and state of charge every week.
- Charge stored batteries every 30 days.

6.4 System reset

The system reset button is sometimes used during troubleshooting and maintenance procedures. Pressing it causes the message sign computer to shut down and restart. DO NOT press the system reset button unless instructed to do so by a qualified Wanco service technician or by a troubleshooting or maintenance procedure.

IMPORTANT!

If the message sign has a frame-mounted control box, and the battery charge is below 12.10 volts, DO NOT press the system reset button.

When the battery charge is low and you press the system reset button, the message sign computer will shut down and will not restart until the batteries are fully charged.

ALWAYS check the battery charge before pressing the system reset button.

6.5 Software update

It may sometimes be necessary to update the software on your message sign's computer. This should only be done when recommended by a Wanco service technician. The update procedure takes 20 to 30 minutes to complete.

To update the message sign software:

1. Obtain the software update as instructed by the Wanco service agent, and save it to an empty USB flash drive.
2. Configure the sign to show a message. Choose any message. This is so you can see when the sign restarts later in the procedure.
3. Initiate a system reset:
   a. See important information in Section 6.4, page 80.
   b. Check the batteries and charge them if necessary.
   c. Press the system reset button on the control panel (see Figure 6-2 or Figure 6-3). DO NOT press the button without first checking the batteries.
4. After the sign restarts and the message you chose appears on the display, unplug the keyboard if necessary, then insert the flash drive into the USB port on the control panel (see Figure 6-2 or or Figure 6-3). This initiates the software update.
5. It can take up to 20 minutes for the computer to run the update process. When the update is complete, the system reboots and the sign returns to normal operation.
6. After the sign restarts and the message you chose appears on the display, the controller will update its software automatically. If the controller does not respond when you activate it, wait 10 minutes for it to complete its update process.
7. After the update is complete, you can confirm the update:
   a. Remove the flash drive from the USB port on the control panel.
   b. If the sign has a frame-mounted control box, reconnect the keyboard cable to the USB port.
   c. Use the controller to access the message sign ID information.

Figure 6-2. Reset button and USB port on control console in frame-mounted control box

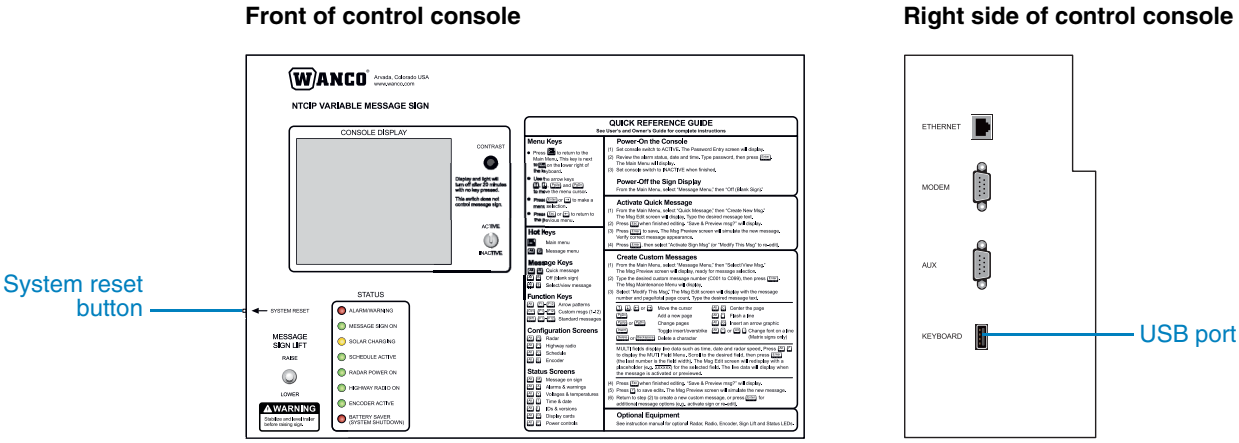
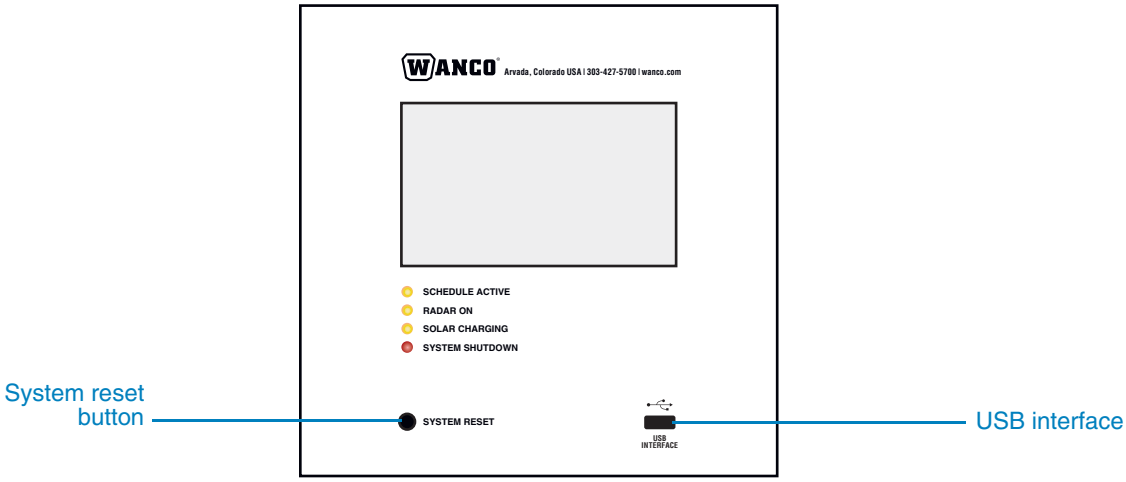


Figure 6-3. Reset button and USB port on control panel in-cabinet control box



6.6 Storing the message sign

Before storing the message sign, take the following steps to prevent damage to electrical components:

1. Observe battery safety precautions (see “Safety” on page 74).
2. Disconnect power from controller:
   - For a frame-mounted control box, disconnect power cable from back of control box (see “Accessing controller electronics” on page 50).
   - For an in-cabinet control box, disconnect power cable from PCU inside the display cabinet (see “Accessing controller electronics” on page 54).
3. Disconnect message board from controller:
   - For a frame-mounted control box, disconnect message board cable from back of control box (see “Accessing controller electronics” on page 50).
   - For an in-cabinet control box, disconnect main board cable from PCU inside the display cabinet (see “Accessing controller electronics” on page 54).
4. If storing for more than a month without active solar charging, disconnect the cable from the positive (+) battery terminal.*

CAUTION

Voltage surge could damage control circuits.

Before disconnecting battery cable, ensure power cable is disconnected from controller.

6.7 Winch cable replacement

If the message sign has a winch, it may sometimes be necessary to replace the winch cable. Under normal use, the cable will last the life of the message sign. If the cable is damaged, it must be replaced.

The cable replacement procedure requires removing the old cable and running a new one through the tower, connecting it to the cable pin at the bottom and the winch at the top. Instructions are provided with the cable replacement kit.

If the winch cable broke due to stress of having the mast hitch pin engaged while operating the winch, then it is likely the cable pin is also damaged. Using a flashlight, inspect the cable pin, which is located at the bottom of the mast under the trailer. If the pin is bent or in poor condition, it must be replaced. On a full-size message sign, the pin replacement procedure requires a Wanco service technician.

To order a cable replacement kit, contact the Wanco service department (see Section 1.4, “Where to obtain service,” page 2).

**Removing the positive cable is a requirement for negative-ground systems.*

6.8 Wiring

Before performing any type of service or maintenance, read and observe all service safety instructions. See Section 2, page 5.

For wiring, see the following diagrams.

- Figure 6-4, “Wiring diagram: Full-size trailer,” on page 85
- Figure 6-5, “Wiring diagram: Mini trailer,” on page 85
- Figure 6-6, “Wiring diagram: Display cabinet, matrix sign with frame-mounted control box,” on page 86
- Figure 6-8, “Wiring diagram: Display cabinet, three-line sign with frame-mounted control box,” on page 90
- Figure 6-10, “Wiring diagram: Frame-mounted control box,” on page 94
- Figure 6-11, “Wiring diagram: Battery box for sign with frame-mounted control box,” on page 95

6.9 Replacement parts

Before performing any type of service or maintenance, read and observe all service safety instructions. See Section 2, page 5.

For replacement parts, see the diagrams and parts lists starting on page 97, or contact the Wanco Service Department (see Section 1.4, “Where to obtain service,” page 2).

Figure 6-4. Wiring diagram: Full-size trailer

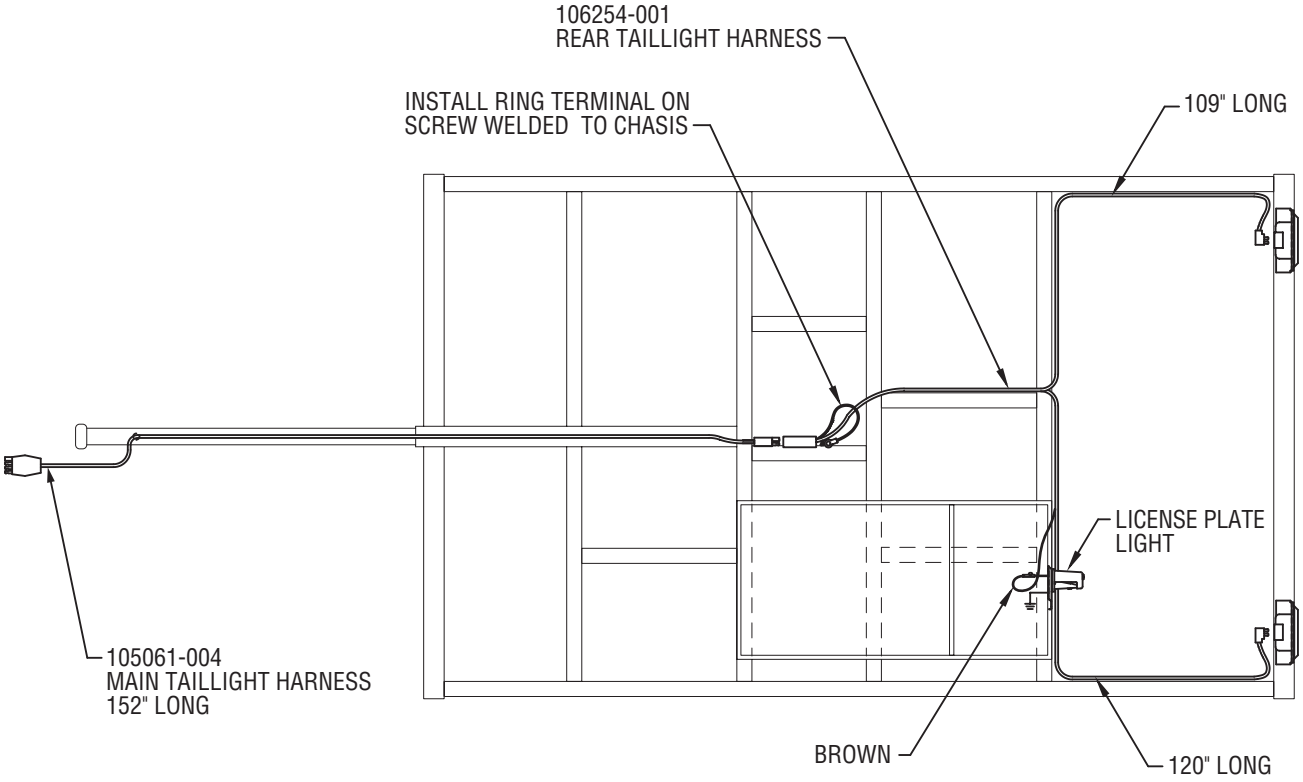


Figure 6-5. Wiring diagram: Mini trailer

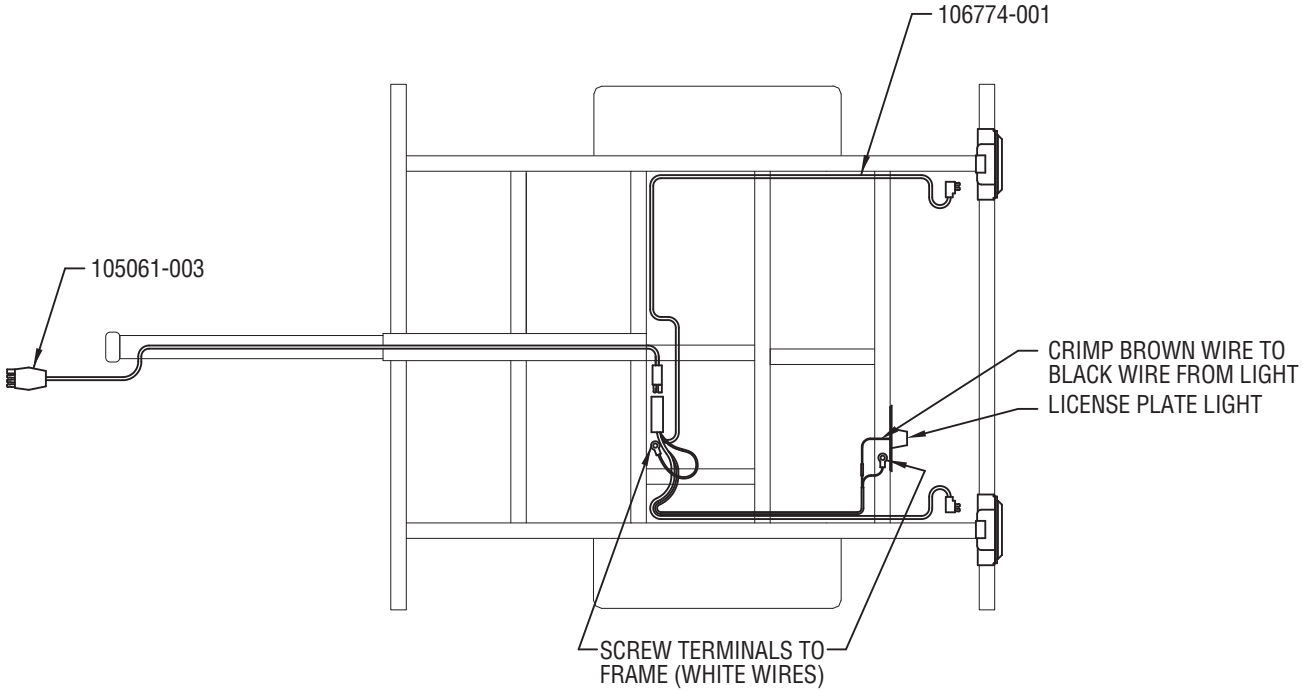
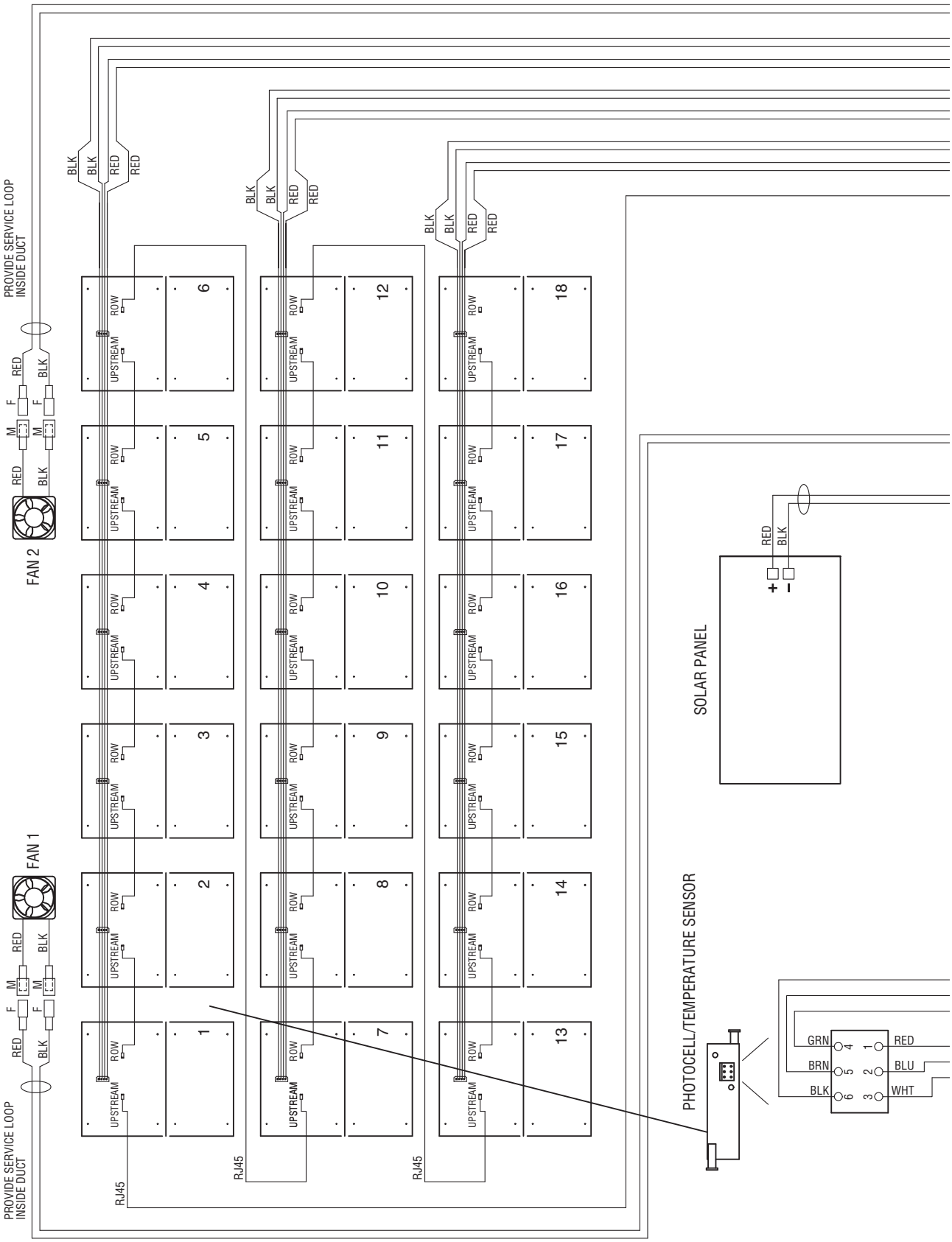
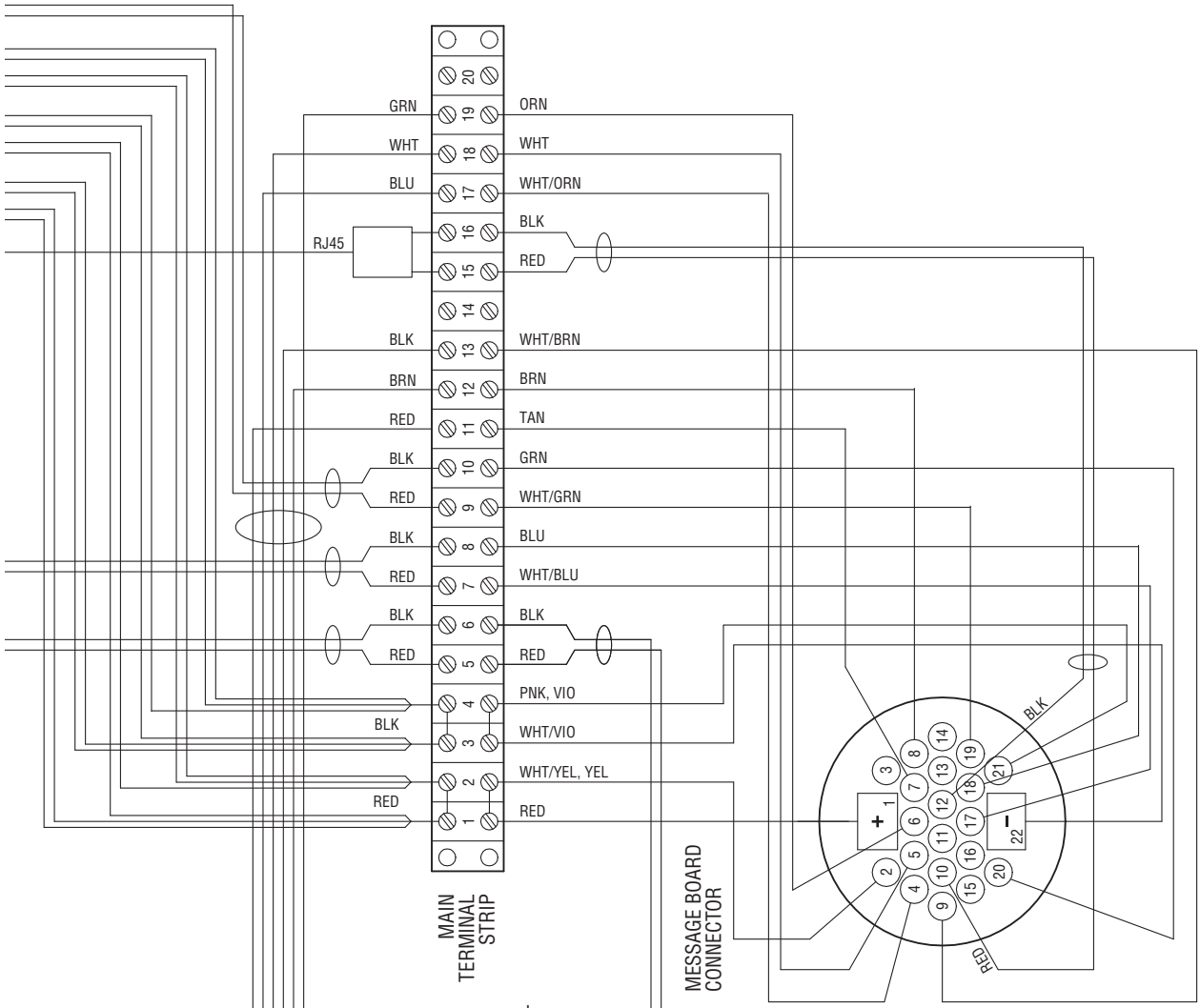


Figure 6-6. Wiring diagram: Display cabinet, matrix sign with frame-mounted control box





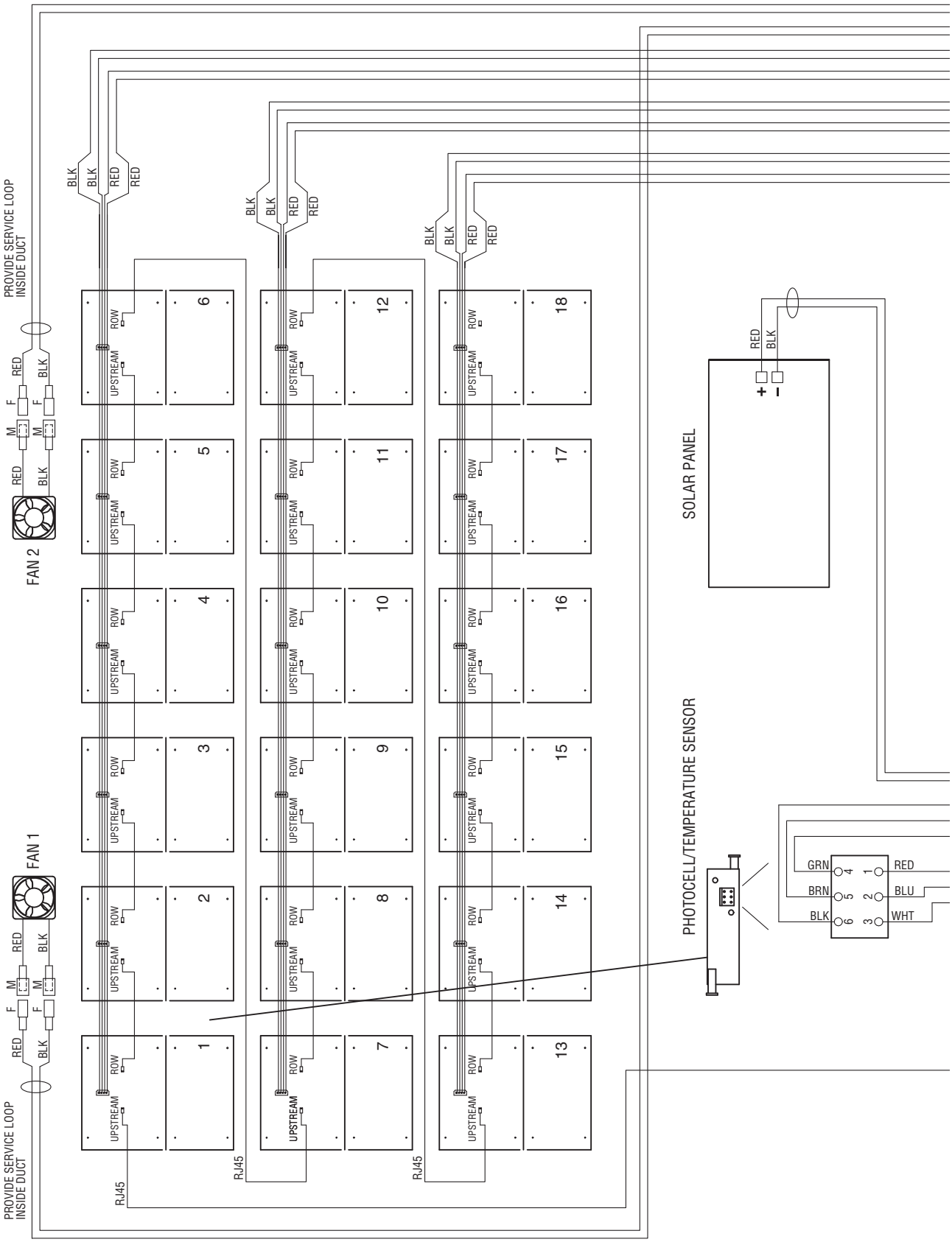
BATTERY & SOLAR PANEL INPUT CONNECTOR PIN OUT

PIN	COLOR	PURPOSE	GA	TERM BLK #
7	RED	SOLAR POWER +	12	5
15	BLK	SOLAR POWER –	12	6

MESSAGE BOARD CONNECTOR PIN OUT

PIN	COLOR	PURPOSE	GA	TERM BLK #
1	RED	BATTERY +	14	1
2	WHT/YEL, YEL	BATTERY +	18, 18	2
3	NOT USED			
4	ORN	PHOTOCELL 2	18	19
5	WHT	PHOTOCELL 1	18	18
6	WHT/ORN	PHOTOCELL POWER	18	17
7	TAN	TEMP SENSOR POWER	18	11
8	BRN	TEMP SENSOR INPUT	18	12
9	WHT/BRN	TEMP SENSOR GROUND	18	13
10	RED	DATA CABLE RED	22	15
11	NOT USED			
12	BLK	DATA CABLE BLACK	22	16
13	NOT USED			
14	NOT USED			
15	NOT USED			
16	NOT USED			
17	WHT/BLU	FAN 1 +	18	7
18	BLU	FAN 1 RETURN –	18	8
19	WHT/GRN	FAN 2 +	18	9
20	GRN	FAN 2 RETURN –	18	10
21	PNK, VIO	BATTERY –	18, 18	4
22	WHT/ VIO	BATTERY –	14	3

Figure 6-7. Wiring diagram: Display cabinet, matrix sign with in-cabinet control box



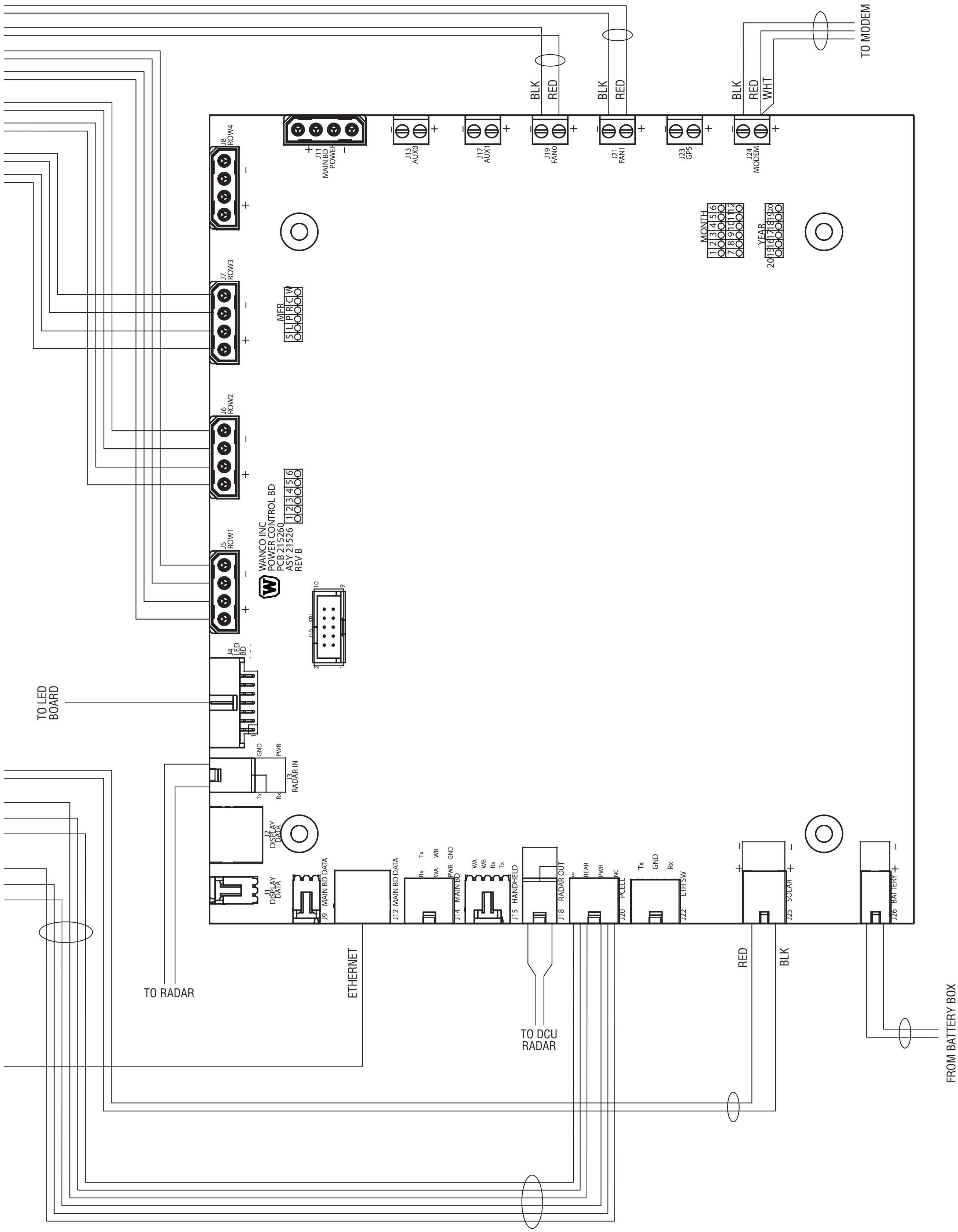
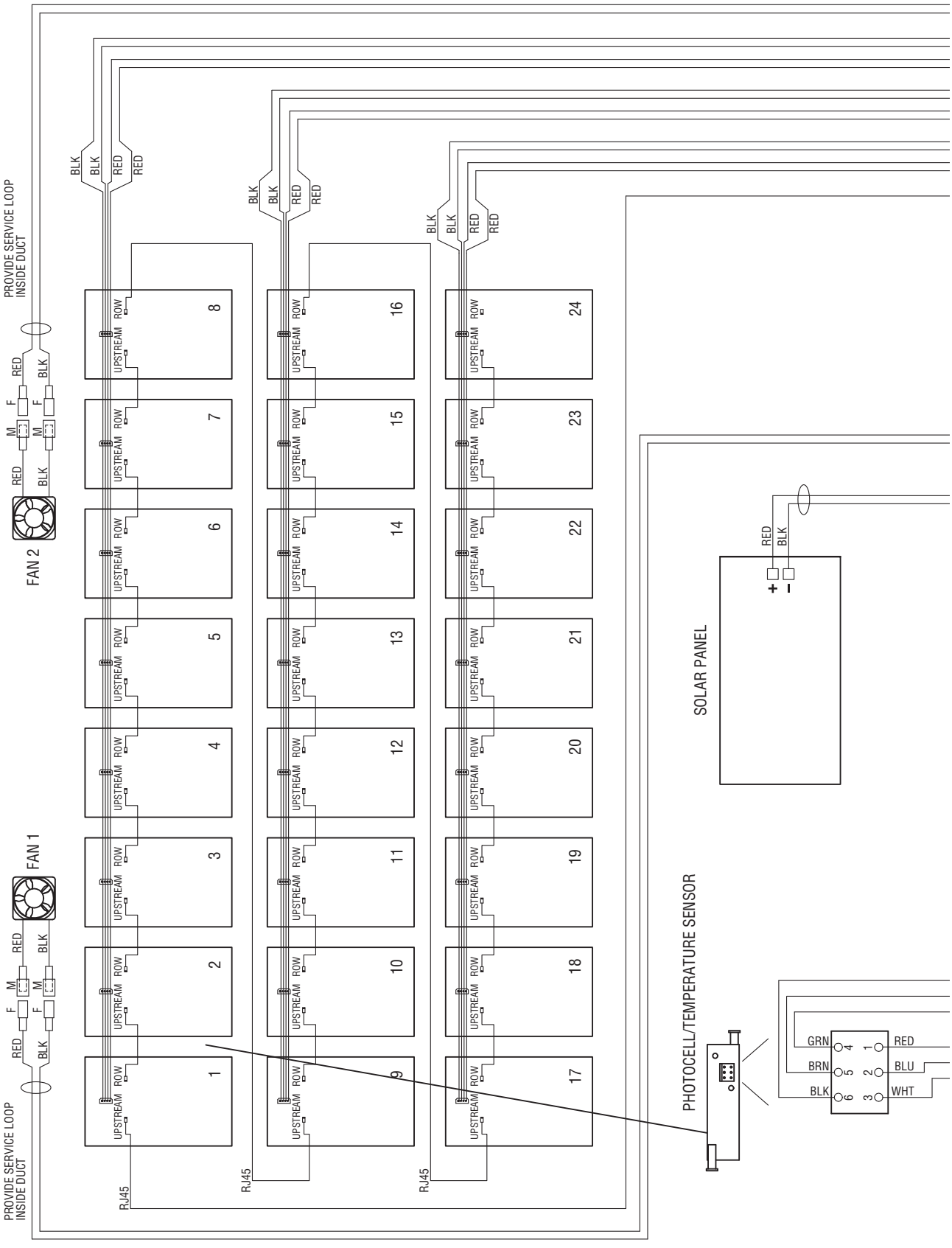
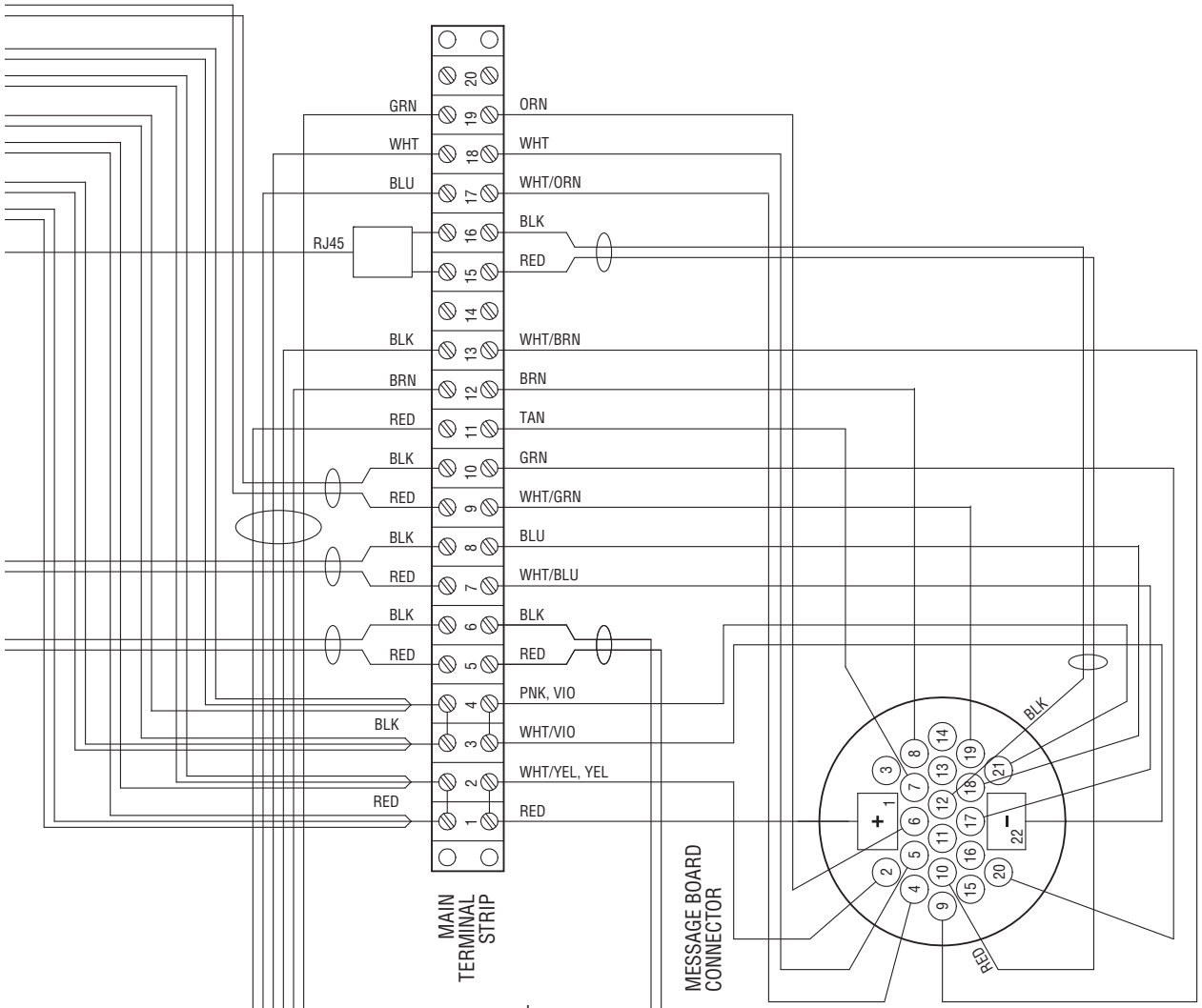

TO MODEM
BLK
RED
WHT
BLK
RED
BLK
RED
J11 MAIN BD POWER
J13 AUX0
J17 AUX1
J19 FAN0
J21 FAN1
J23 GPS
J24 MODEM
J8 ROW4
J7 ROW3
J6 ROW2
J5 ROW1
J4 LED BD
MONTH
YEAR
WANCO INC
POWER CONTROL BD
PCB 215260
ASY 21526
REV B
TO LED BOARD
J3 RADAR IN
J2 DISPLAY DATA
J1 DISPLAY DATA
J9 MAIN BD DATA
J12 MAIN BD DATA
J14 MAIN BD
J15 HANDHELD
J18 RADAR OUT
J20 PCELL
J22 ETH SW
J25 SOLAR
J26 BATTERY
TO RADAR
ETHERNET
TO DCU RADAR
RED
BLK
FROM BATTERY BOX

Figure 6-8. Wiring diagram: Display cabinet, three-line sign with frame-mounted control box





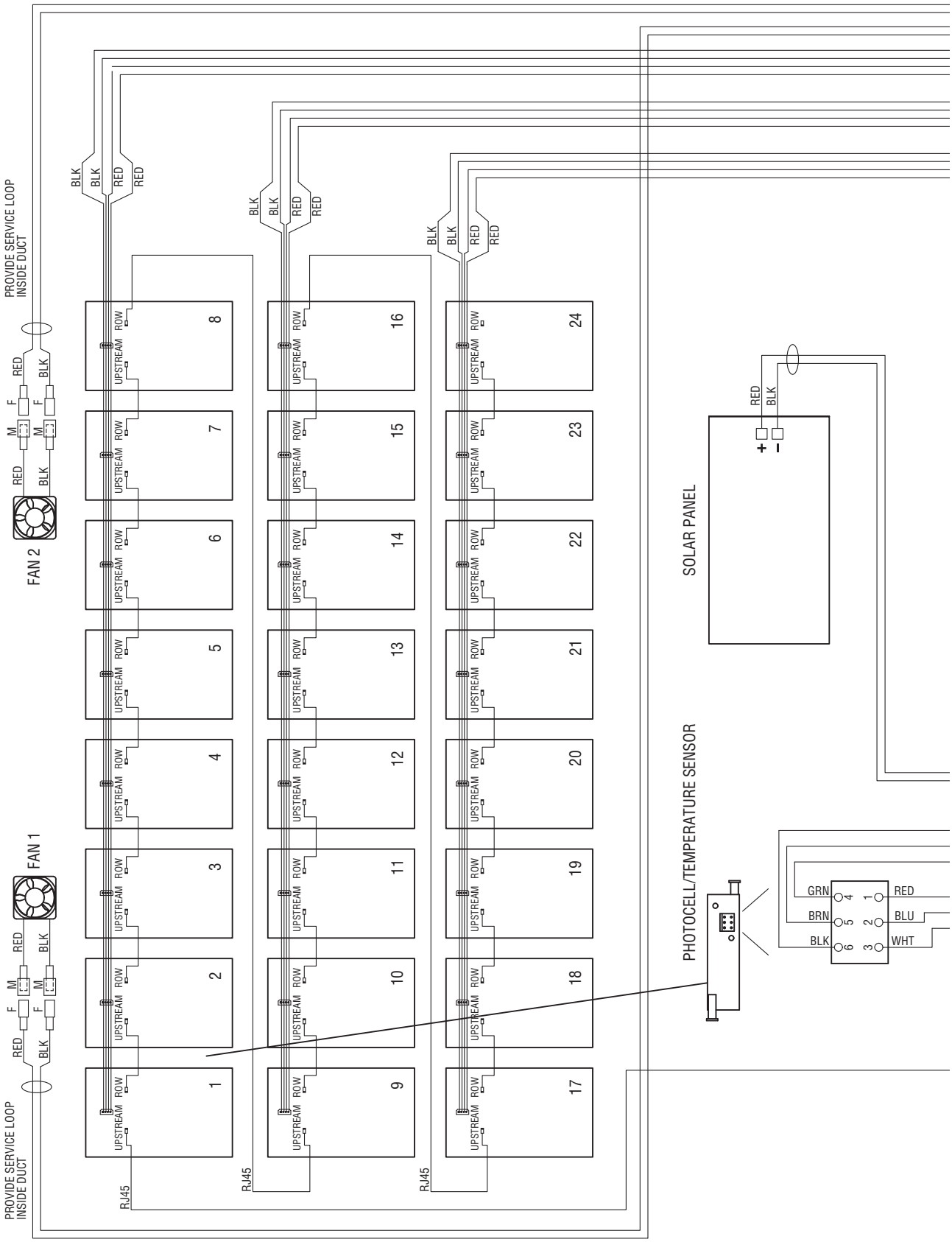
BATTERY & SOLAR PANEL INPUT CONNECTOR PIN OUT

PIN	COLOR	PURPOSE	GA	TERM BLK #
7	RED	SOLAR POWER +	12	5
15	BLK	SOLAR POWER –	12	6

MESSAGE BOARD CONNECTOR PIN OUT

PIN	COLOR	PURPOSE	GA	TERM BLK #
1	RED	BATTERY +	14	1
2	WHT/YEL, YEL	BATTERY +	18, 18	2
3	NOT USED			
4	ORN	PHOTOCELL 2	18	19
5	WHT	PHOTOCELL 1	18	18
6	WHT/ORN	PHOTOCELL POWER	18	17
7	TAN	TEMP SENSOR POWER	18	11
8	BRN	TEMP SENSOR INPUT	18	12
9	WHT/BRN	TEMP SENSOR GROUND	18	13
10	RED	DATA CABLE RED	22	15
11	NOT USED			
12	BLK	DATA CABLE BLACK	22	16
13	NOT USED			
14	NOT USED			
15	NOT USED			
16	NOT USED			
17	WHT/BLU	FAN 1 +	18	7
18	BLU	FAN 1 RETURN –	18	8
19	WHT/GRN	FAN 2 +	18	9
20	GRN	FAN 2 RETURN –	18	10
21	PNK, VIO	BATTERY –	18, 18	4
22	WHT/ VIO	BATTERY –	14	3

Figure 6-9. Wiring diagram: Display cabinet, three-line sign with in-cabinet control box



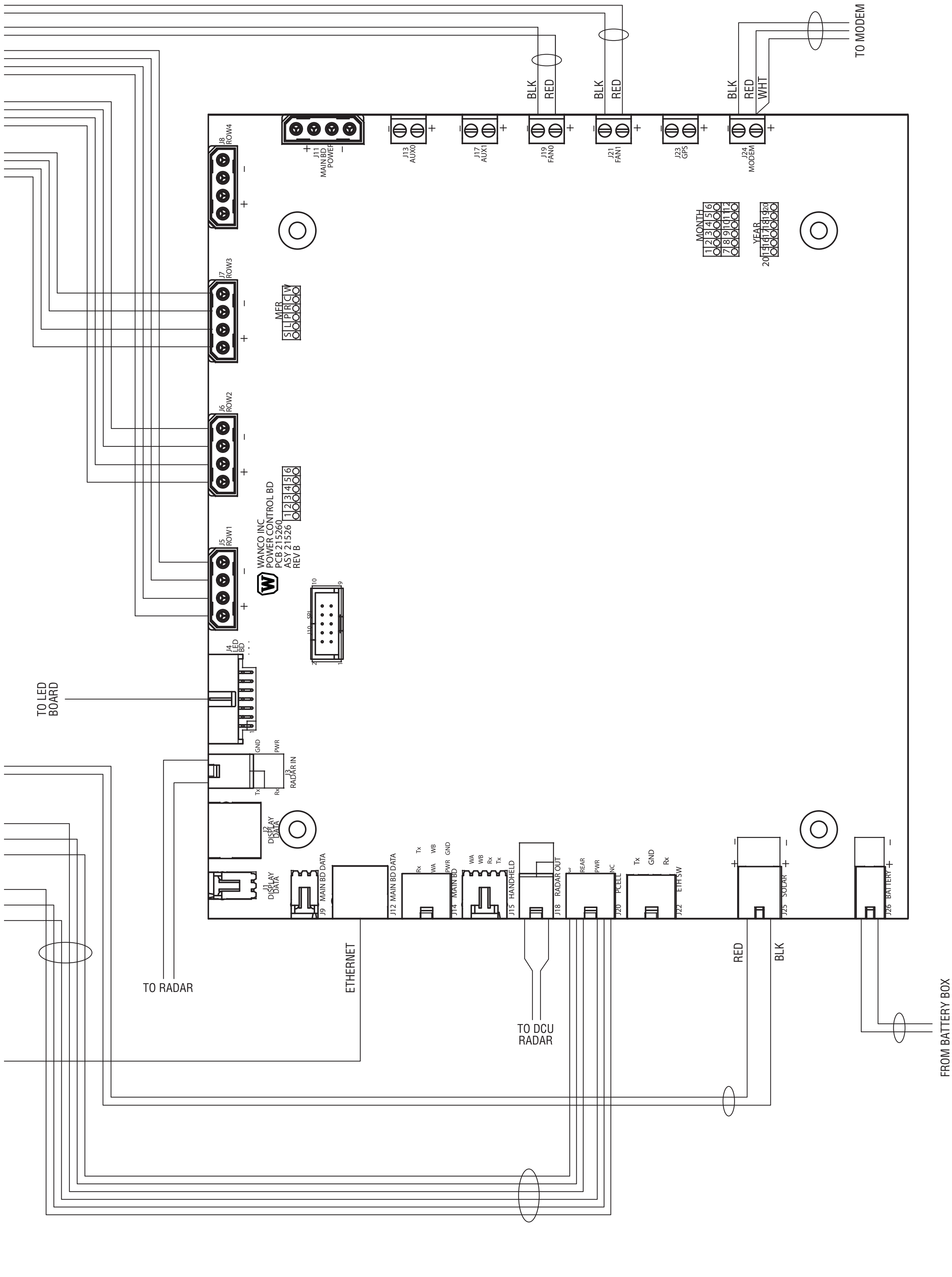

TO MODEM
BLK
RED
WHT
BLK
RED
BLK
RED
J8 ROW4
J7 ROW3
J6 ROW2
J5 ROW1
J11 MAIN BD POWER
J13 AUX0
J17 AUX1
J19 FAN0
J21 FAN1
J23 GPS
J24 MODEM
MONTH
YEAR
MER
WANCO INC
POWER CONTROL BD
PCB 215260
ASY 21526
REV B
J4 LED BD
TO LED BOARD
J3 RADAR IN
J2 DISPLAY DATA
J1 DISPLAY DATA
J9 MAIN BD DATA
J12 MAIN BD DATA
J14 MAIN BD
J15 HANDHELD
J18 RADAR OUT
J20 PCELL
J22 ETH SW
J25 SOLAR
J26 BATTERY
TO RADAR
ETHERNET
TO DCU RADAR
RED
BLK
FROM BATTERY BOX

Figure 6-10. Wiring diagram: Frame-mounted control box

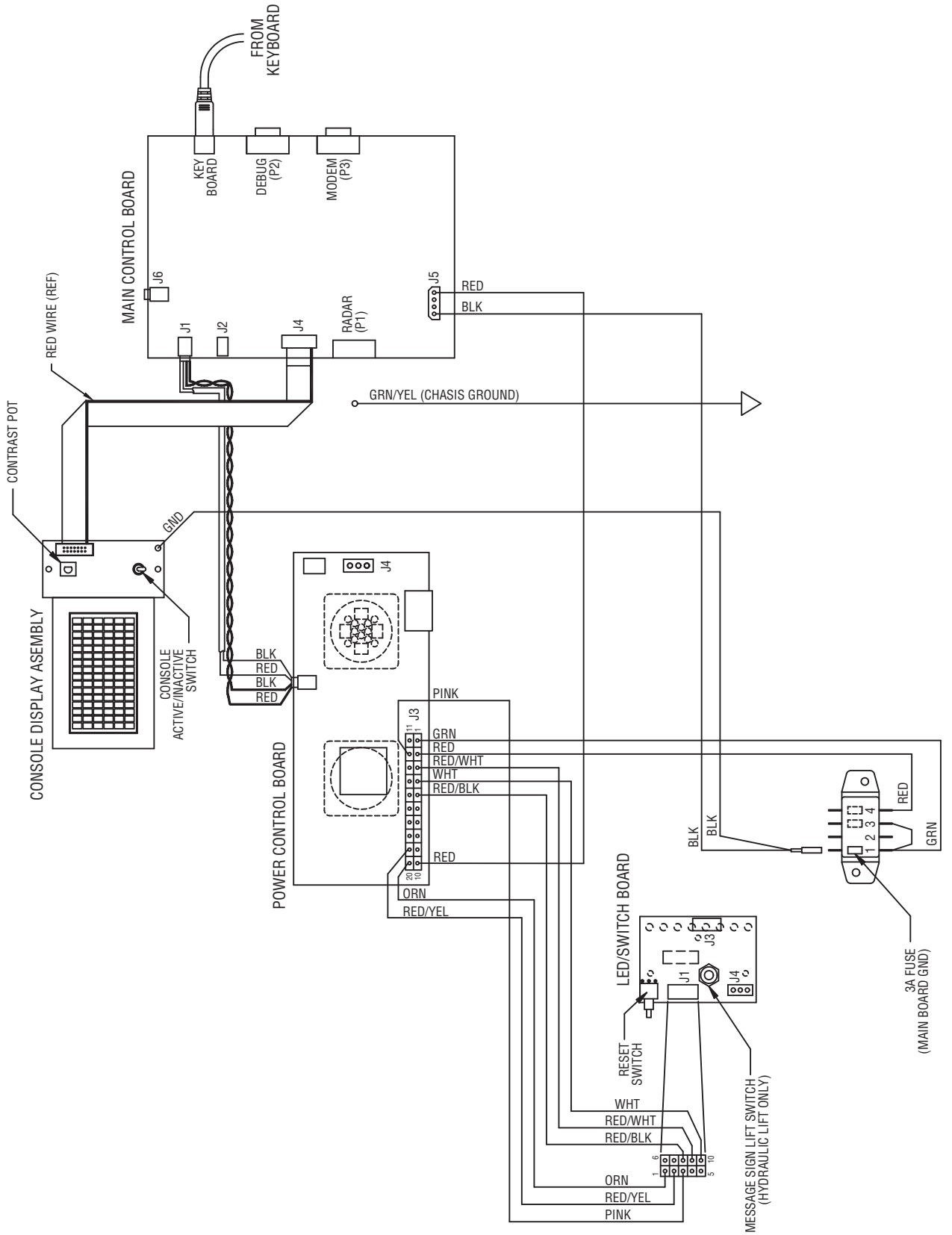


Figure 6-11. Wiring diagram: Battery box for sign with frame-mounted control box

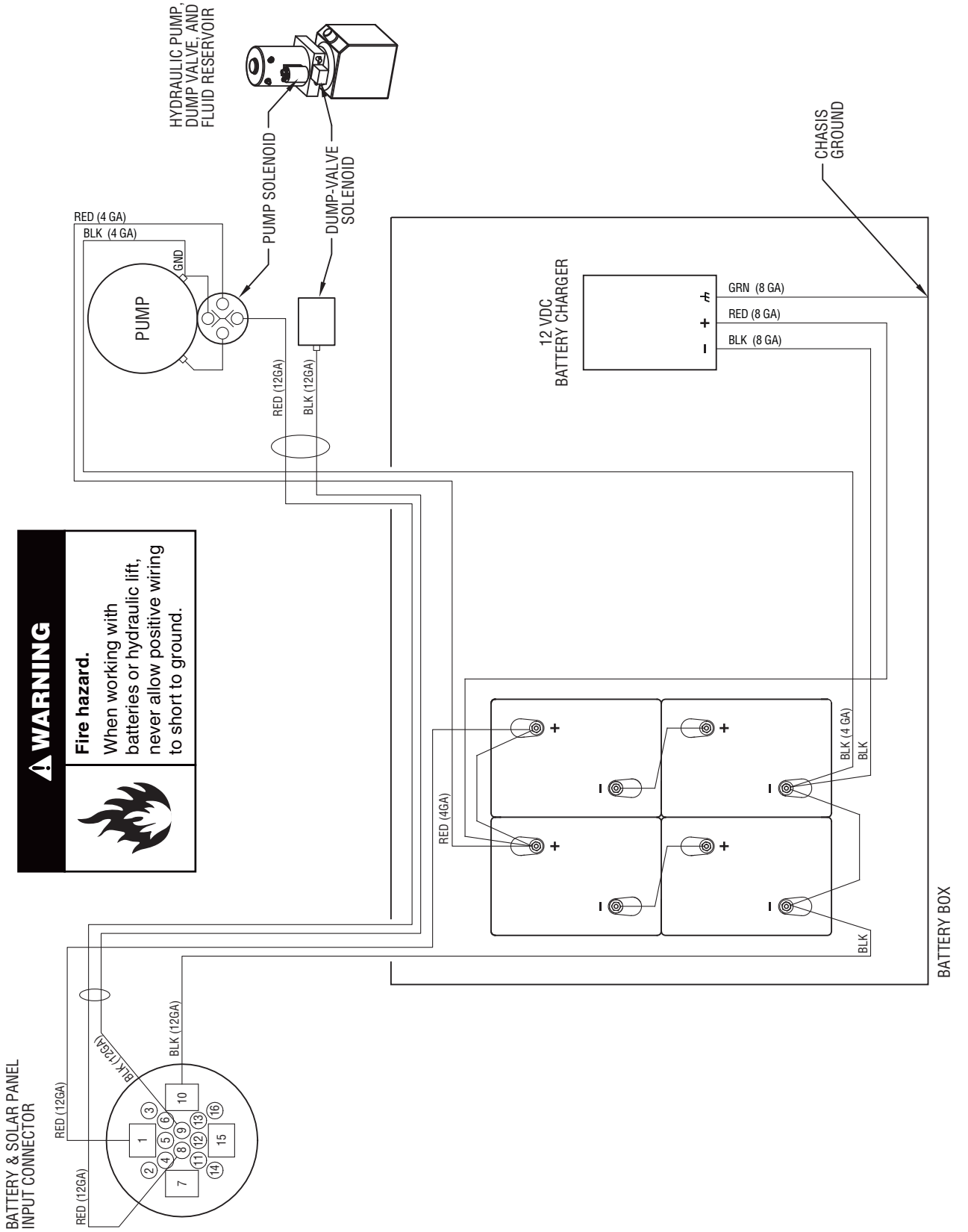


Figure 6-12. Wiring diagram: Battery box for sign with in-cabinet control box

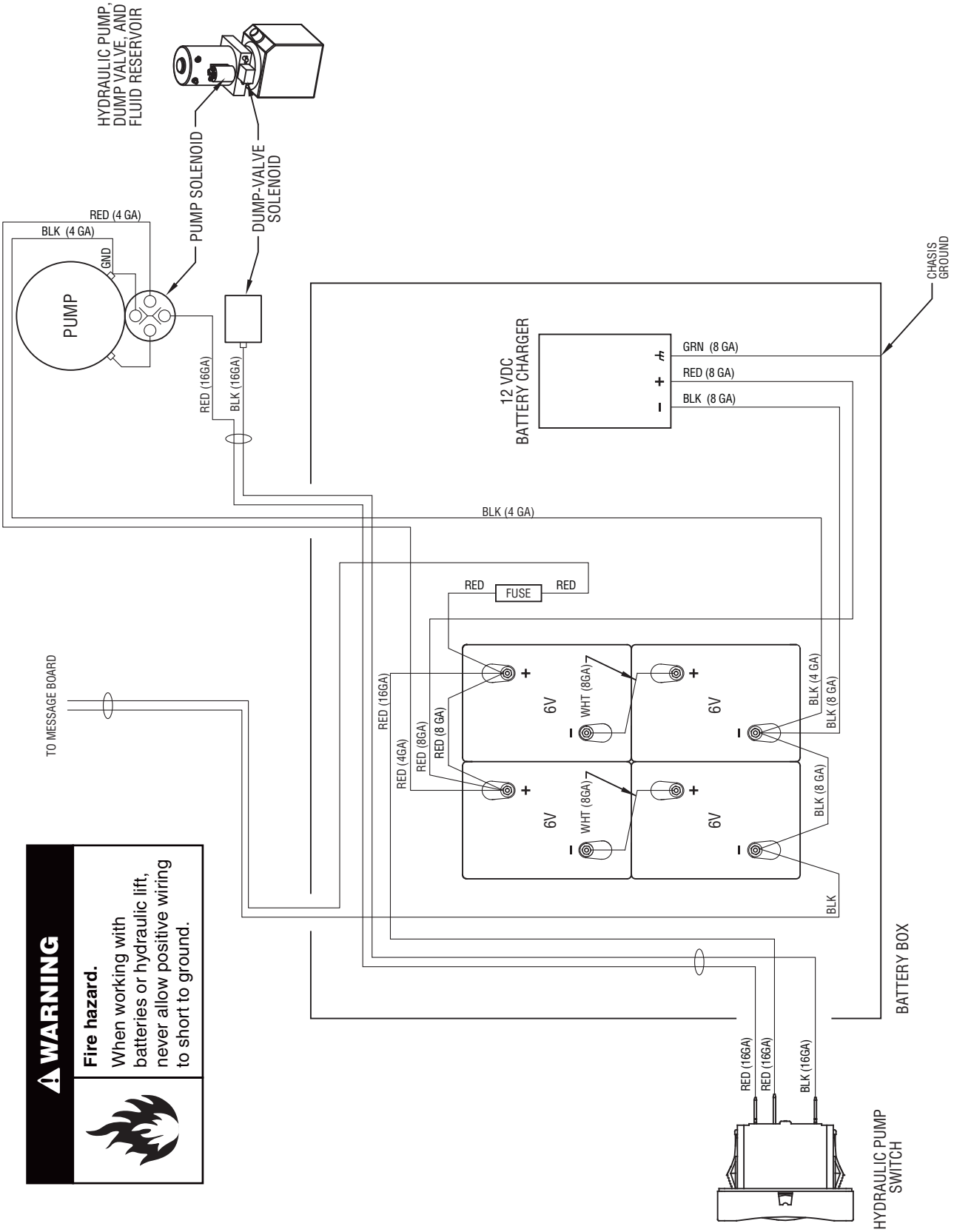


Figure 6-13. Parts drawing: Full-size trailer assembly

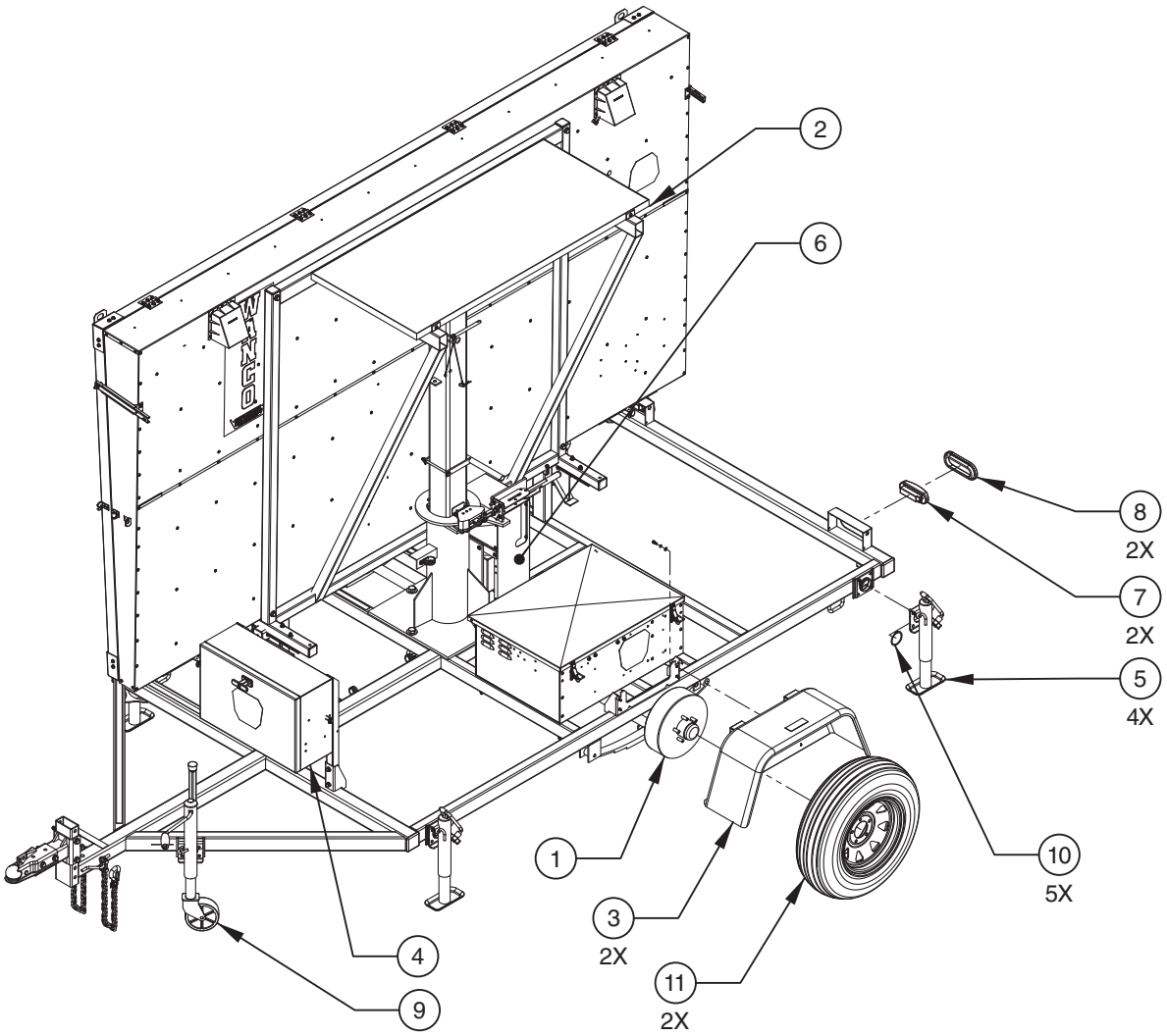


Table 6-2. Parts list: Full-size trailer assembly

Item No.	Part No.	Description	Qty.
1	202169	Axle assembly, 3500-lb. cap. 88" track	1
2	202493	Solar panel assembly, 130 watts	1
3	202614-P1	Fender	2
4	202872	Frame-mounted control box assembly for matrix sign	1
	107186-003	Frame-mounted control box assembly for 3-line sign	1
5	100943-001	Top-wind swivel jack with foot, 2000-lb cap.	4
6	101645-004	Hydraulic pump	1
7	102409-002	Combination stop/turn/taillight	2
8	102409-003	Taillight grommet	2
9	102919-002	Side-wind swivel jack with wheel	1
10	102919-003	Swivel jack snap ring, 2 1/2"	5
11	104591-003	Trailer tire with wheel, ST205/75D-15	2

Figure 6-14. Parts drawing: Full-size tower assembly with hydraulic lift

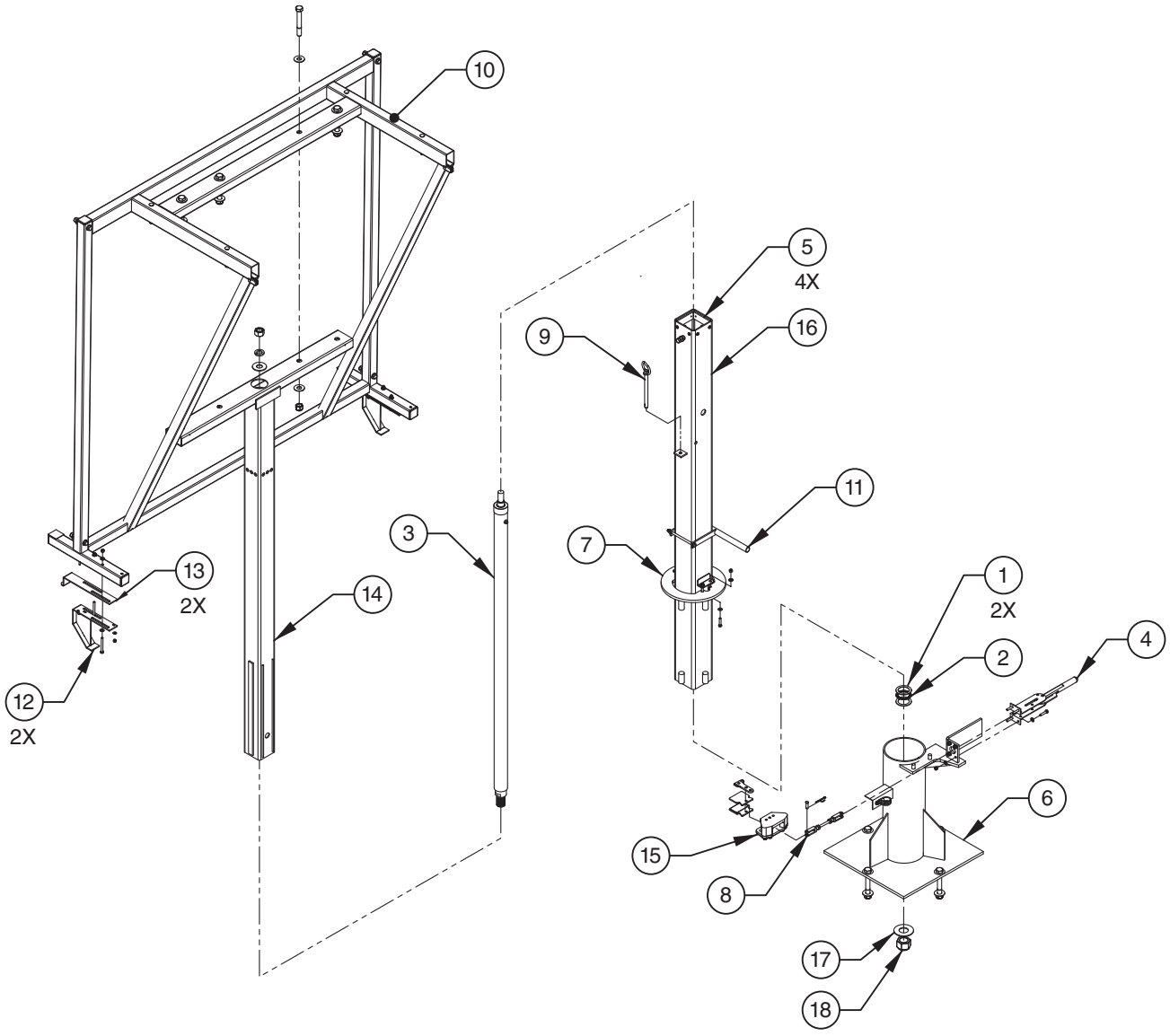


Table 6-3. Parts list: Full-size tower assembly with hydraulic lift

Item No.	Part No.	Description	Qty.
1	101197-001	Thrust washer, 2"	2
2	101198-001	Thrust bearing, 2"	1
3	101644-001F	Hydraulic cylinder	1
4	102316-002F	Rotation brake lever	1
5	102425-003F	Nylon guide block, 4"	4
6	103267-002G1	Swivel base	1
7	103419-001	Brake plate	1
8	103501-001	Brake yoke	1
9	103830-001	Vertical-lock pin assembly	1
10	108777-000P1	Display cabinet mounting frame	1
11	103478-001	Sight tube	1
12	106053-001	Short guide bracket	2
13	106394-001	Long guide bracket	2
14	202660	Top tower section	1
15	206237	Brake caliper assembly	1
16	202657-G1	Bottom tower section	1
17	101508-001	Fender washer, 1 1/2" × 3 1/2" × 0.203"	1
18	103521-001	Hex nut, nylon insert lock 1 1/2-6	1

Figure 6-15. Parts drawing: Full-size tower assembly with winch

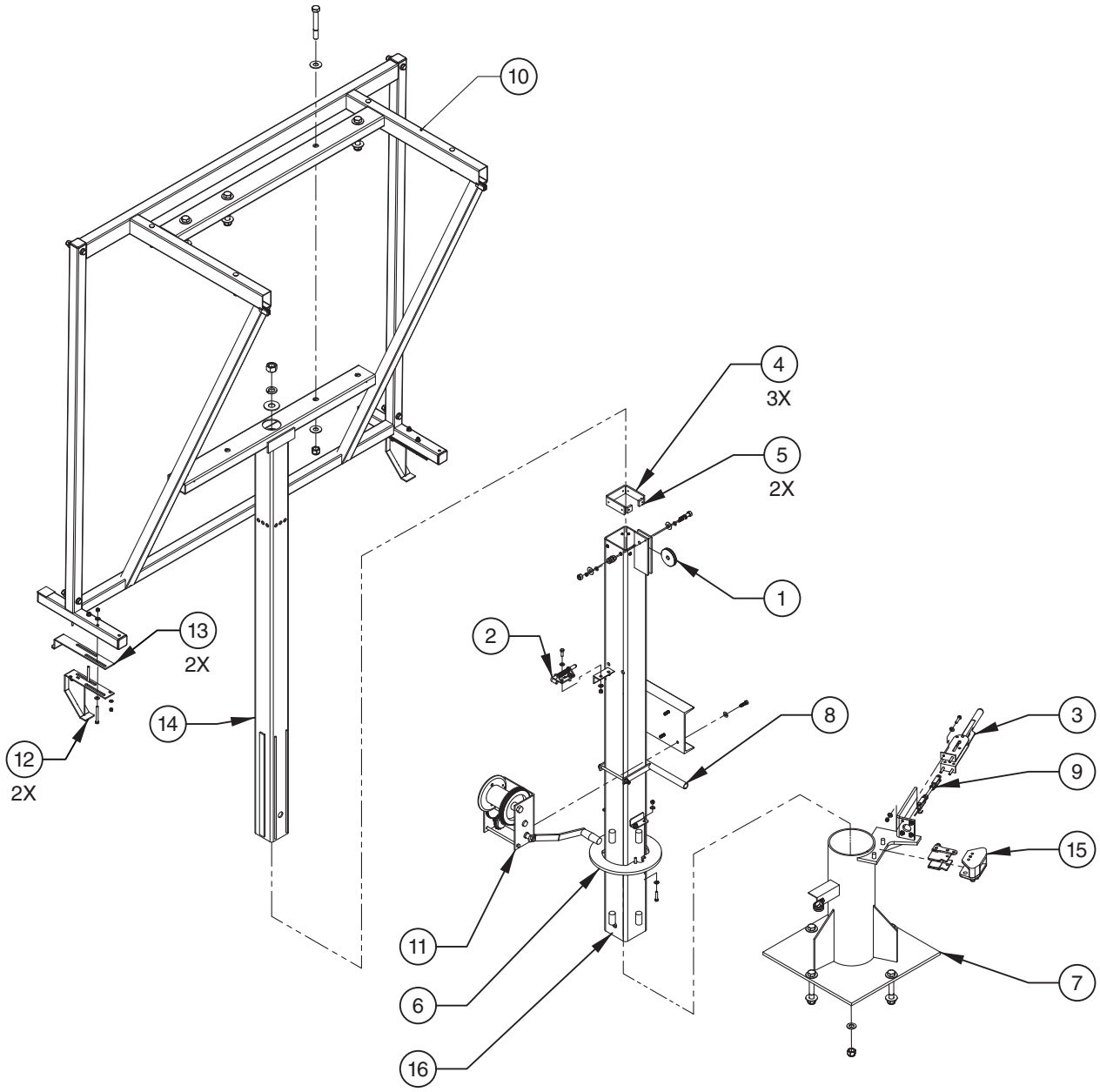


Table 6-4. Parts list: Full-size tower assembly with winch

Item No.	Part No.	Description	Qty.
1	100166-001	Single-groove pulley, 3"	1
2	100394-003	Spring-latch	1
3	102316-002F	Rotation brake lever	1
4	102425-003F	Nylon guide block, 4"	3
5	106015-001F	Nylon guide block, 1"	2
6	103419-001	Brake plate	1
7	103421-001P1	Swivel base	1
8	103478-001	Sight tube	1
9	103501-001	Brake yoke	1
10	108777-000P1	Display cabinet mounting frame	1
11	103416-001	Hand-operated winch, 2500-lb. cap.	1
12	106053-001	Short guide bracket	2
13	106394-001	Long guide bracket	2
14	202651	Top tower section	1
15	206237	Brake caliper assembly	1
16	202648-P1	Bottom tower section	1

Figure 6-16. Parts drawing: Full-size display cabinet assembly

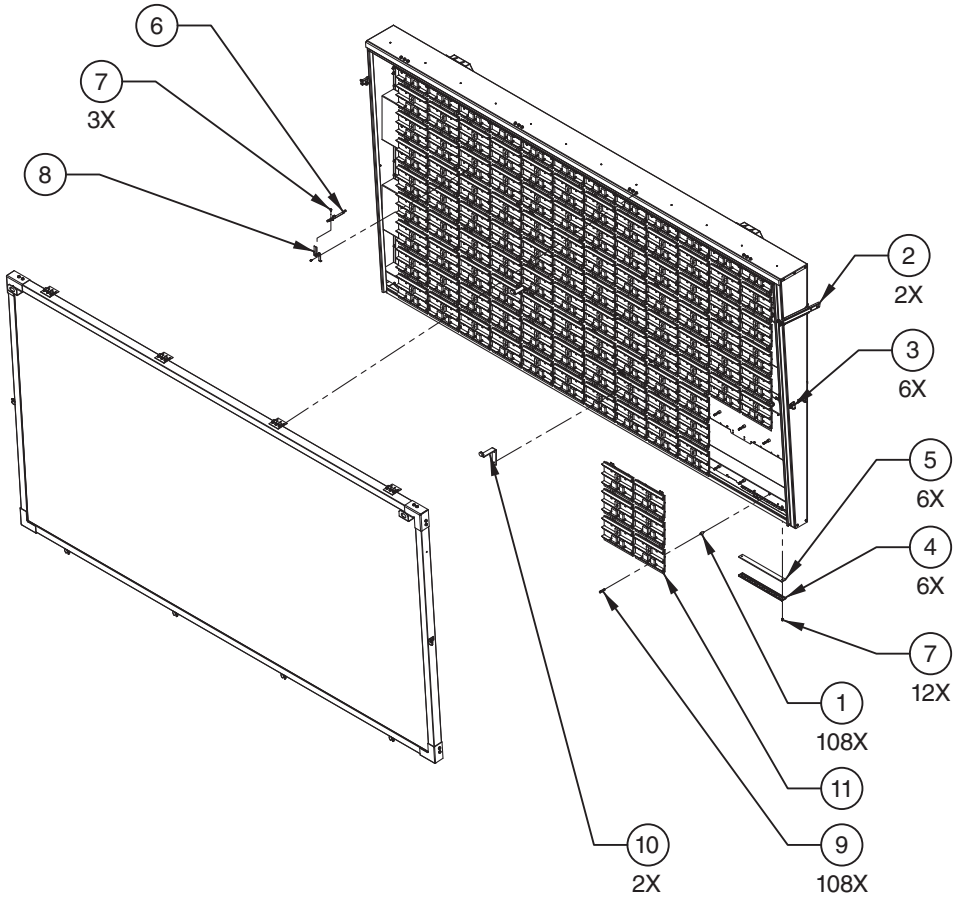


Table 6-5. Parts list: Full-size display cabinet assembly

Item No.	Part No.	Description	Qty.
1	102314-001	Vibration mount	108
2	102406-002	Telescoping door holder	2
3	105421-001	Rubber draw-latch	6
4	105964-001P2	Vent panel	6
5	105965-001F	Vent filter	6
6	106081-001	Photocell assembly	1
7	106363-001	Pan-head sems screw, #8-32 UNC × 1/2"	15
8	107794-001P2	Photocell bracket	1
9	107557-001	Hex nut, #8-32	108
10	200127	Bumper for display window	2
11	211678	LED display module for matrix sign	18
	211485	LED display module for three-line sign	24

Figure 6-17. Parts drawing: Removable drawbar assembly for full-size sign

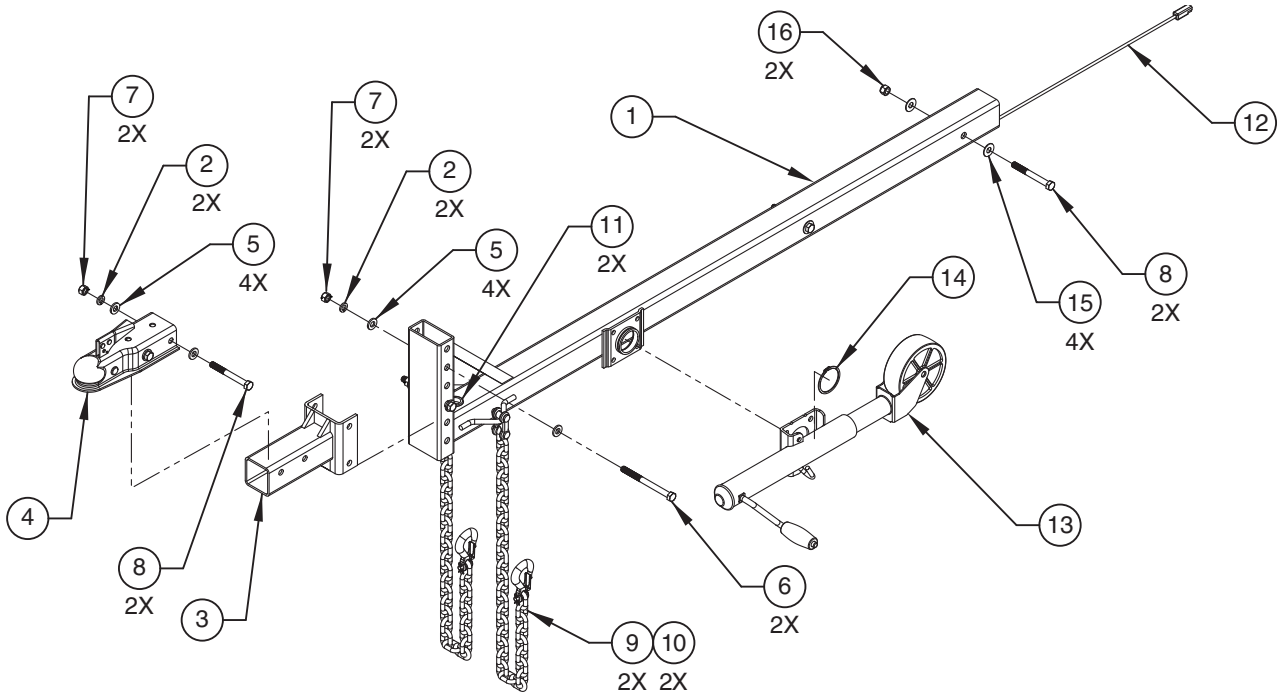


Table 6-6. Parts list: Removable drawbar assembly for full-size sign

Item No.	Part No.	Description	Qty.
1	216228-P	Full-size message sign drawbar	1
2	100713-001	Split lockwasher, 1/2"	4
3	103633-001P	Adjustable hitch bracket for 2" ball coupler	1
4	101677-002	Tow hitch, 2" ball	1
5	108622-001	Flat washer, 3/8"	8
6	100216-019	Hex screw, 1/2-13 × 6"	2
7	100652-001	Hex nut, 1/2-13	4
8	100216-016	Hex screw, 1/2-13 × 4 1/2"	4
9	104889-001	Tow chain with hook	2
10	108046-001	Mid-link for tow chain, 6000-lb. load limit	2
11	209317	Rubber grommet	2
12	105061-003	Taillight cable with flat-four plug	1
13	102919-002	Side-wind swivel jack with wheel	1
14	102919-003	Swivel jack snap ring, 2 1/2"	1
15	100233-001	Flat washer, 1/2"	4
16	100217-001	Hex nut, nylon insert lock 1/2-13	2

Figure 6-18. Parts drawing: Mini trailer assembly

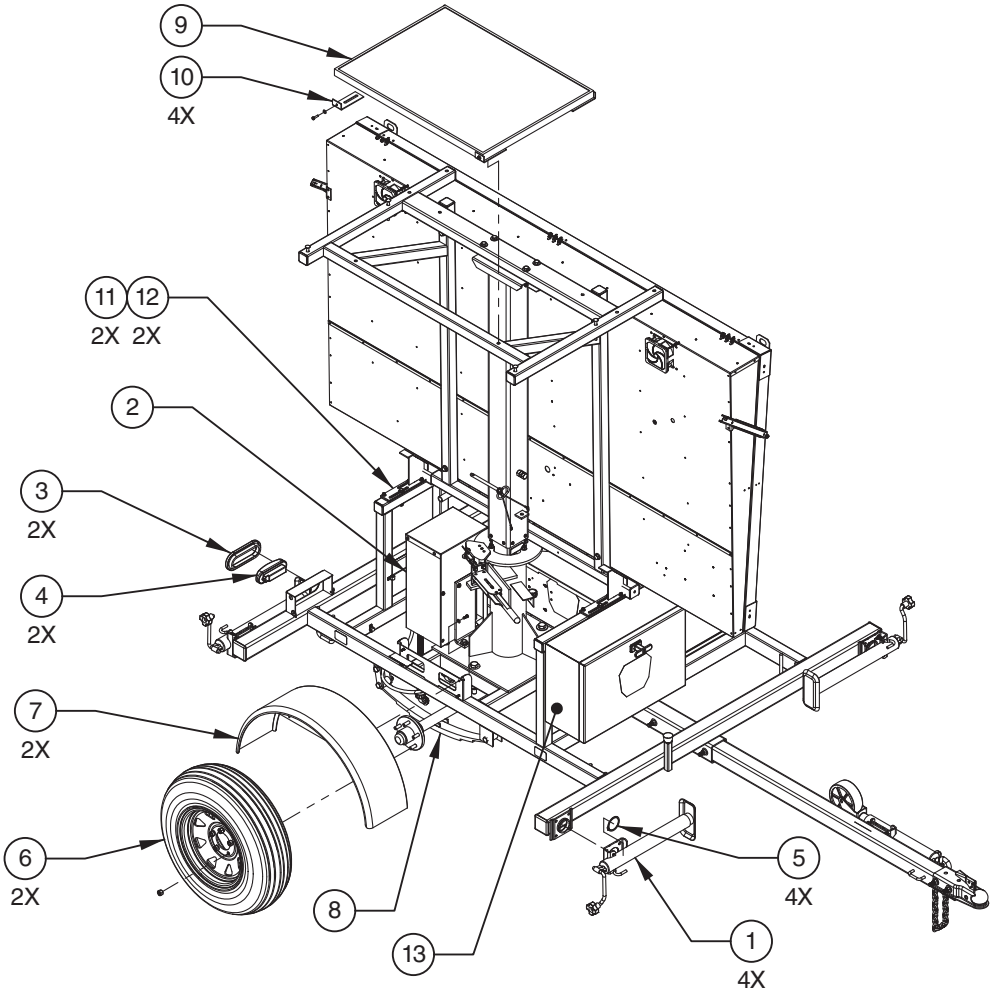


Table 6-7. Parts list: Mini trailer assembly

Item No.	Part No.	Description	Qty.
1	100143-001	Top-wind swivel jack with foot, 2000-lb. cap.	4
2	101645-004	Hydraulic pump	1
3	102409-002	Combination stop/turn/taillight	2
4	102409-003	Taillight grommet	2
5	102919-003	Swivel jack snap ring, 2 1/2"	4
6	104591-003	Trailer tire with wheel, ST205/75D-15	2
7	108420-200P1	Fender	2
8	201839	Axle assembly, 2000-lb. cap. 60" track	1
9	202485	Solar panel assembly, 85 watts	1
10	206892-P2	Solar panel bracket	4
11	106053-001	Short guide bracket	2
12	106394-001	Long guide bracket	2
13	202872	Frame-mounted control box assembly for matrix sign	1
	107186-003	Frame-mounted control box assembly for 3-line sign	1

Figure 6-19. Parts drawing: Mini tower assembly with hydraulic lift

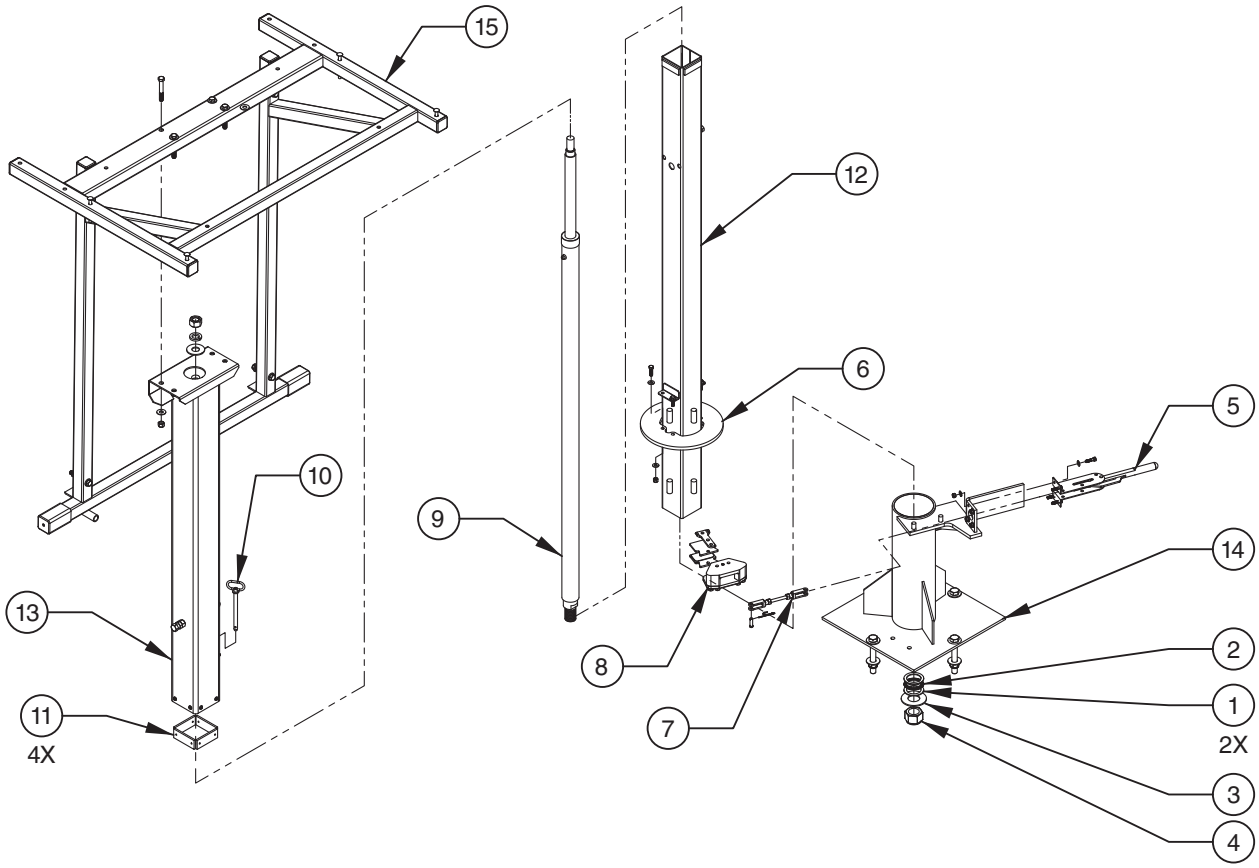


Table 6-8. Parts list: Mini tower assembly with hydraulic lift

Item No.	Part No.	Description	Qty.
1	101197-001	Thrust washer, 2"	2
2	101198-001	Thrust bearing, 2"	1
3	101508-001	Fender washer, 1 1/2" × 3 1/2" × 0.203"	1
4	103521-001	Hex nut, nylon insert lock 1 1/2-6	1
5	102316-002F	Rotation brake lever	1
6	103228-001	Brake plate	1
7	103501-001	Brake yoke	1
8	206237	Brake caliper assembly	1
9	101644-001F	Hydraulic cylinder	1
10	103830-001	Vertical-lock pin assembly	1
11	102425-003F	Nylon guide block, 4"	4
12	202755	Bottom tower section	1
13	202751-P1	Top tower section	1
14	202776-P1	Swivel base	1
15	202745-P1	Display cabinet mounting frame	1

Figure 6-20. Parts drawing: Mini tower assembly with winch

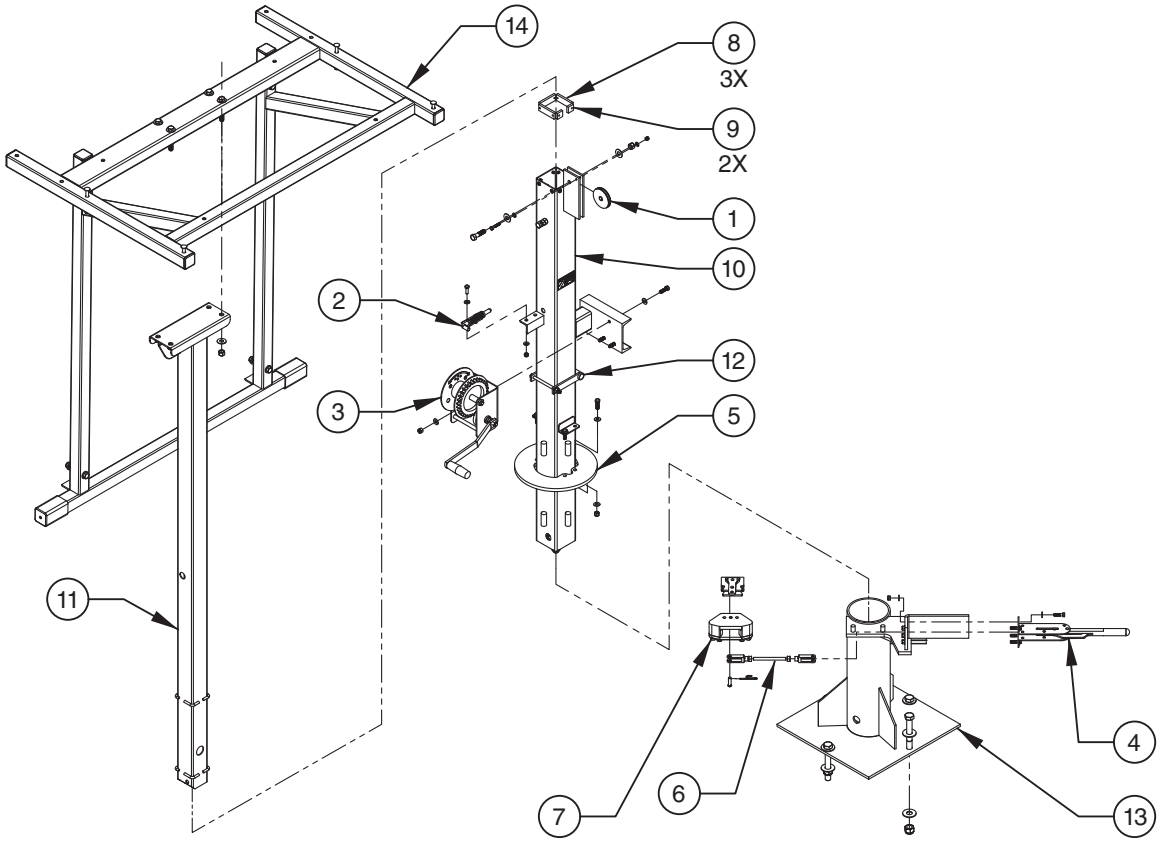


Table 6-9. Parts list: Mini tower assembly with winch

Item No.	Part No.	Description	Qty.
1	100166-001	Single-groove pulley, 3"	1
2	100394-001	Spring-latch	1
3	101007-002	Hand-operated winch, 1500-lb. cap.	1
4	102316-001	Rotation brake lever	1
5	103228-001	Brake plate	1
6	103501-001	Brake yoke	1
7	206237	Brake caliper assembly	1
8	105811-001F	Nylon guide block, 3"	3
9	106015-001F	Nylon guide block, 1"	2
10	109036-000P	Bottom tower section	1
11	108565-001	Top tower section	1
12	103825-001	Sight tube	1
13	109037-000P1	Swivel base	1
14	202745-P1	Display cabinet mounting frame	1

Figure 6-21. Parts drawing: Mini display cabinet

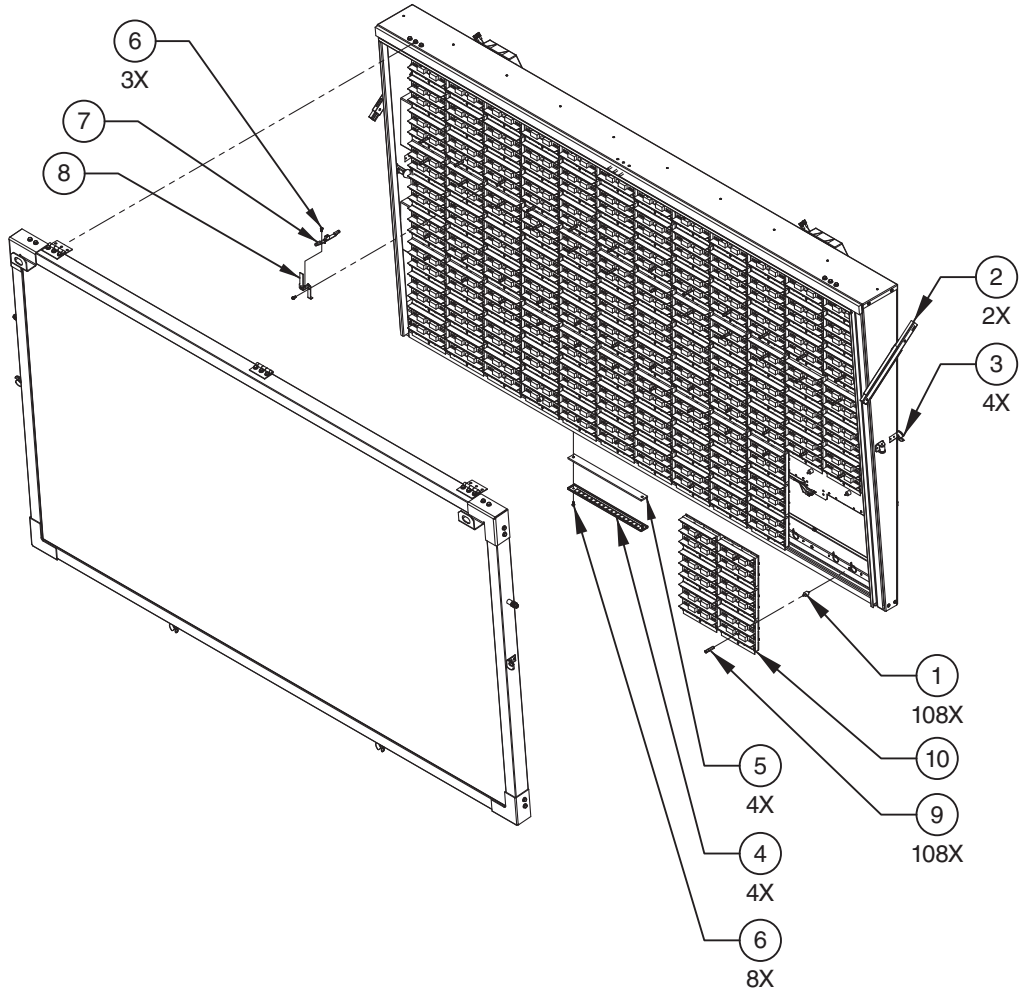


Table 6-10. Parts list: Mini display cabinet

Item No.	Part No.	Description	Qty.
1	102314-001	Vibration mount	108
2	102406-002	Telescoping door holder	2
3	105421-001	Rubber draw-latch	4
4	105964-001P2	Vent panel	4
5	105965-001F	Vent filter	4
6	106363-001	Pan-head sems screw, #8-32 UNC × 1/2"	11
7	106850-001	Photocell assembly	1
8	107794-001P2	Photocell bracket	1
9	107557-001	Hex nut, #8-32	108
10	211789	LED display module for matrix sign	18
	211772	LED display module for three-line sign	24

Figure 6-22. Parts drawing: Mini drawbar assembly

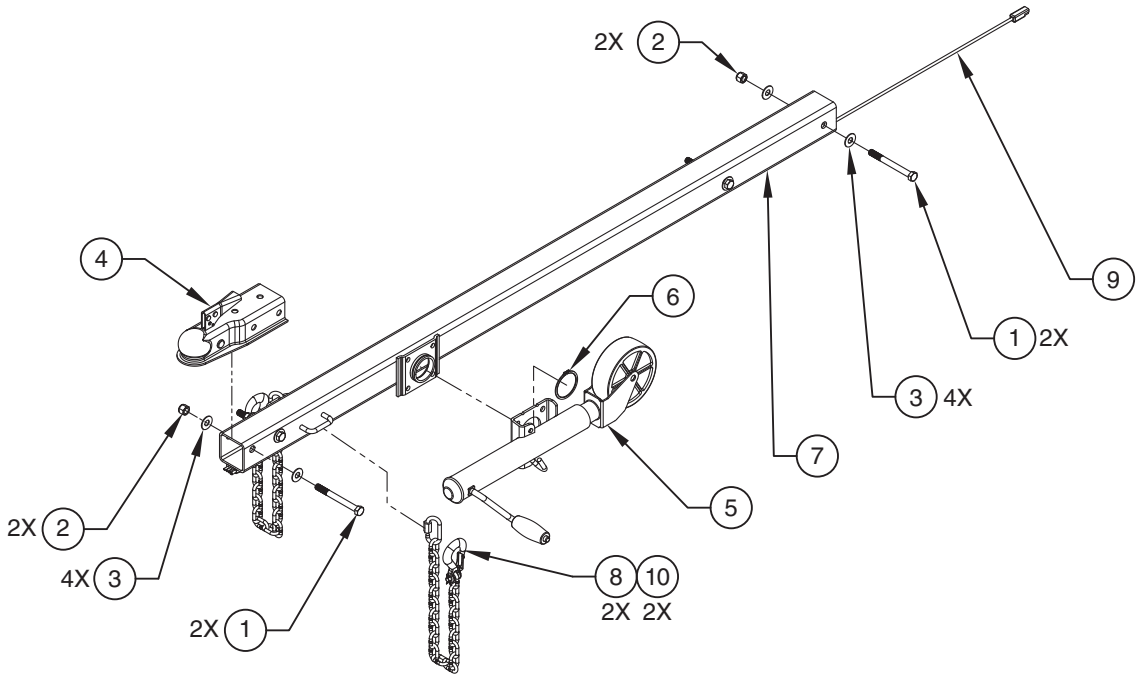


Table 6-11. Parts list: Mini drawbar assembly

Item No.	Part No.	Description	Qty.
1	100216-017	Hex screw, 1/2-13 × 5"	4
2	100217-001	Hex nut, nylon insert lock 1/2-13	4
3	100233-001	Flat washer, 1/2"	8
4	101677-002	Tow hitch, 2" ball	1
5	102919-002	Side-wind swivel jack with wheel	1
6	102919-003	Swivel jack snap ring, 2 1/2"	1
7	103409-001P1	Mini message sign drawbar	1
8	104859-001	Tow chain with hook	2
9	105061-003	Taillight cable with flat-four plug	1
10	201432	Quick-link for tow chain	2

Figure 6-23. Parts drawing: Frame-mounted control box

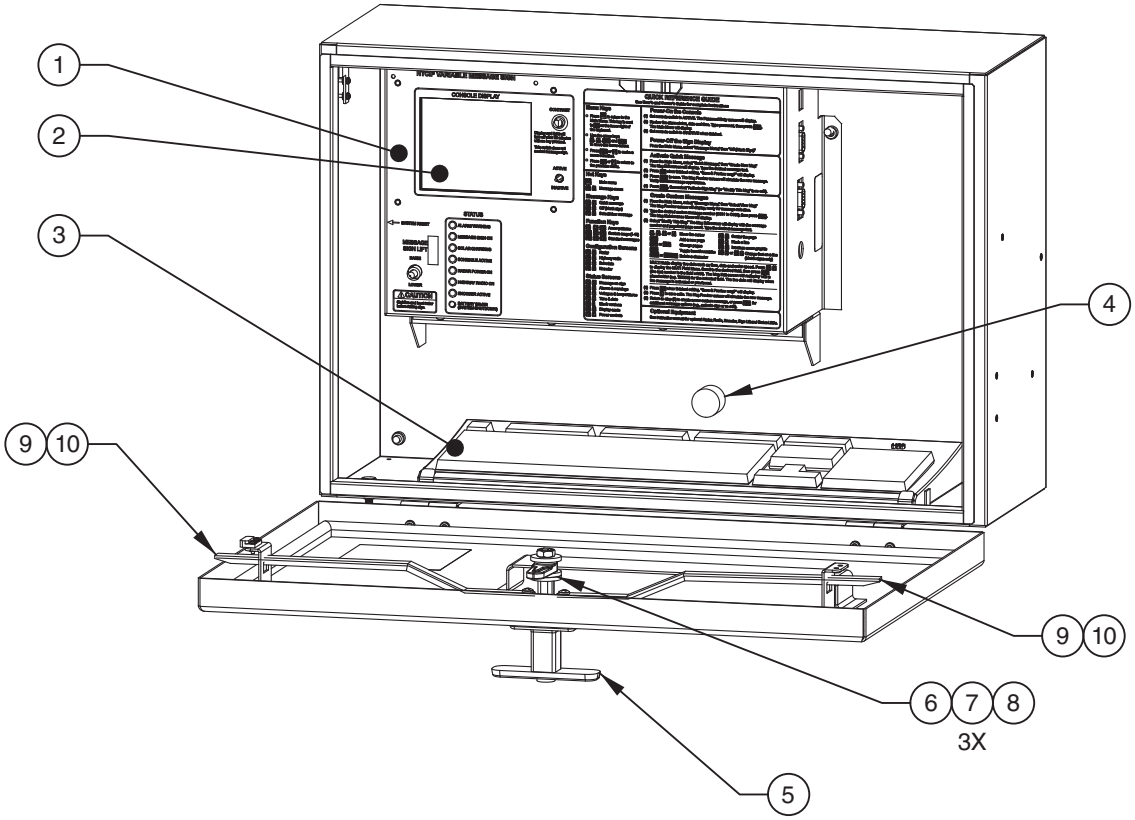


Table 6-12. Parts list: Frame-mounted control box

Item No.	Part No.	Description	Qty.
1	106116-001	Control panel, English	1
2	108639-001	Control panel display for matrix sign	1
	106400-001	Control panel display for three-line sign	1
3	202873	Keyboard	1
4	202301	Rubber bumper	1
5	105720-001	Locking T-handle	1
6	103708-003	Cam latch	1
7	108622-001	Flat washer, 3/8"	3
8	107225-001	Hex nut, 3/8"	1
9	103707-001	Locking arm	2
10	108017-001	Screw, #10-32 UNC × 3/8"	2

Figure 6-24. Parts drawing: Frame-mounted control console

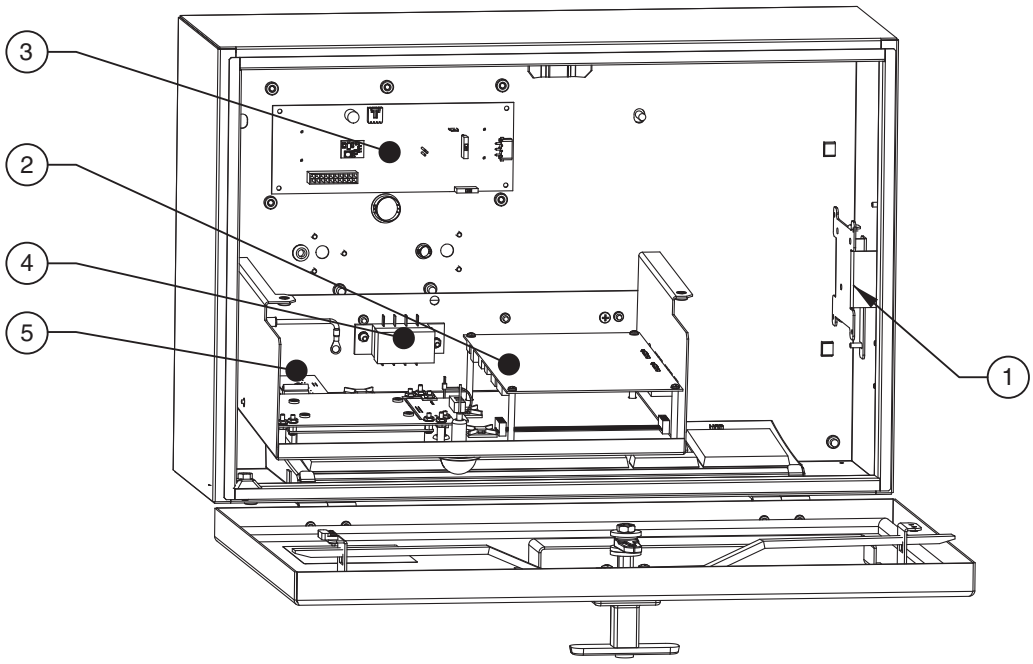


Table 6-13. Parts list: Frame-mounted control-box console

Item No.	Part No.	Description	Qty.
1	200340-P3	Modem mounting bracket	1
2	204981	PCB, Linux board	1
3	105074-001	PCB, power board	1
4	106310-001	Fuse block	1
5	200449	PCB, LED/swtch board for sign with hydraulic lift	1
	200450	PCB, LED/swtch board for sign with manual winch	1

Figure 6-25. Parts drawing: In-cabinet control box

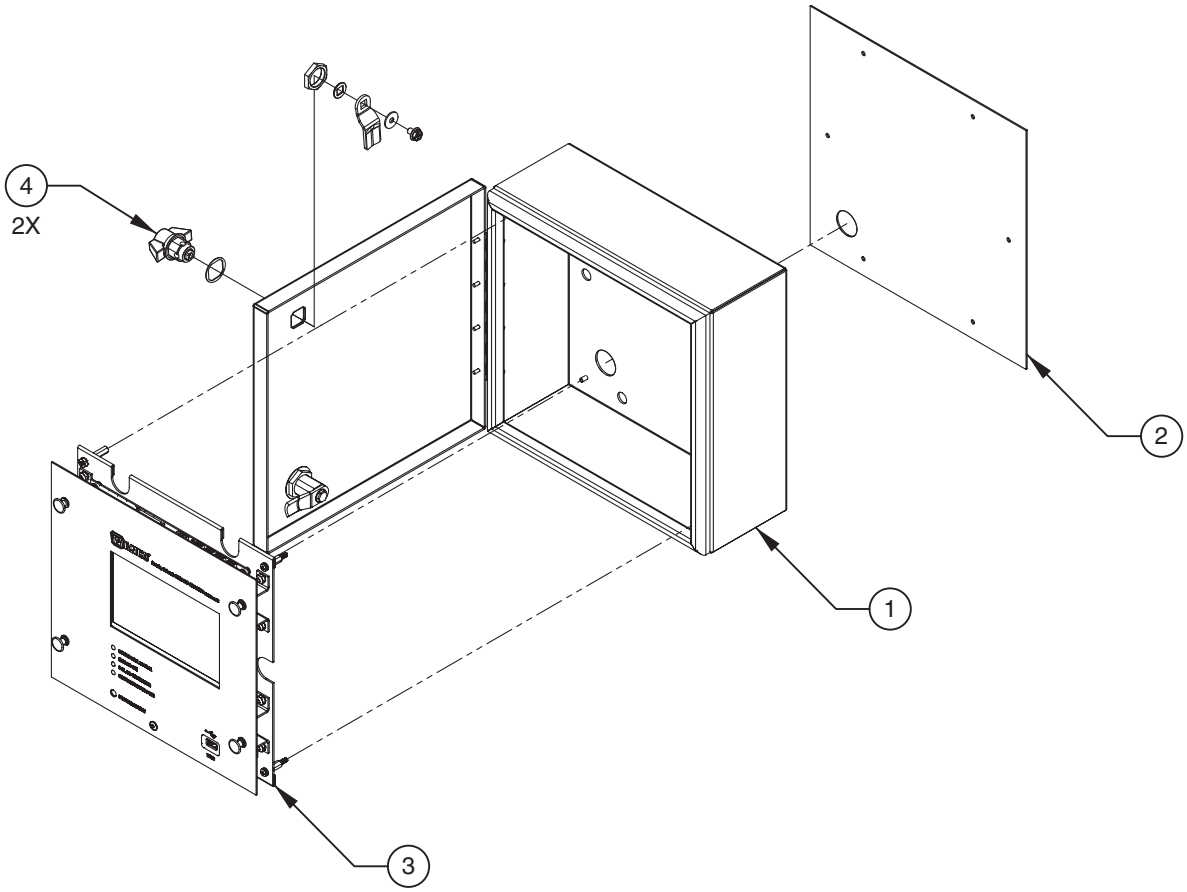


Table 6-14. Parts list: In-cabinet control box

Item No.	Part No.	Description	Qty.
1	218529-C	Control box	1
2	203053	Gasket	1
3	216671-C	Control panel assembly with display control unit (DCU)	1
4	218437	Cam-latch assembly with lock and key	2

Figure 6-26. Parts drawing: Display control unit (DCU) for in-cabinet control box

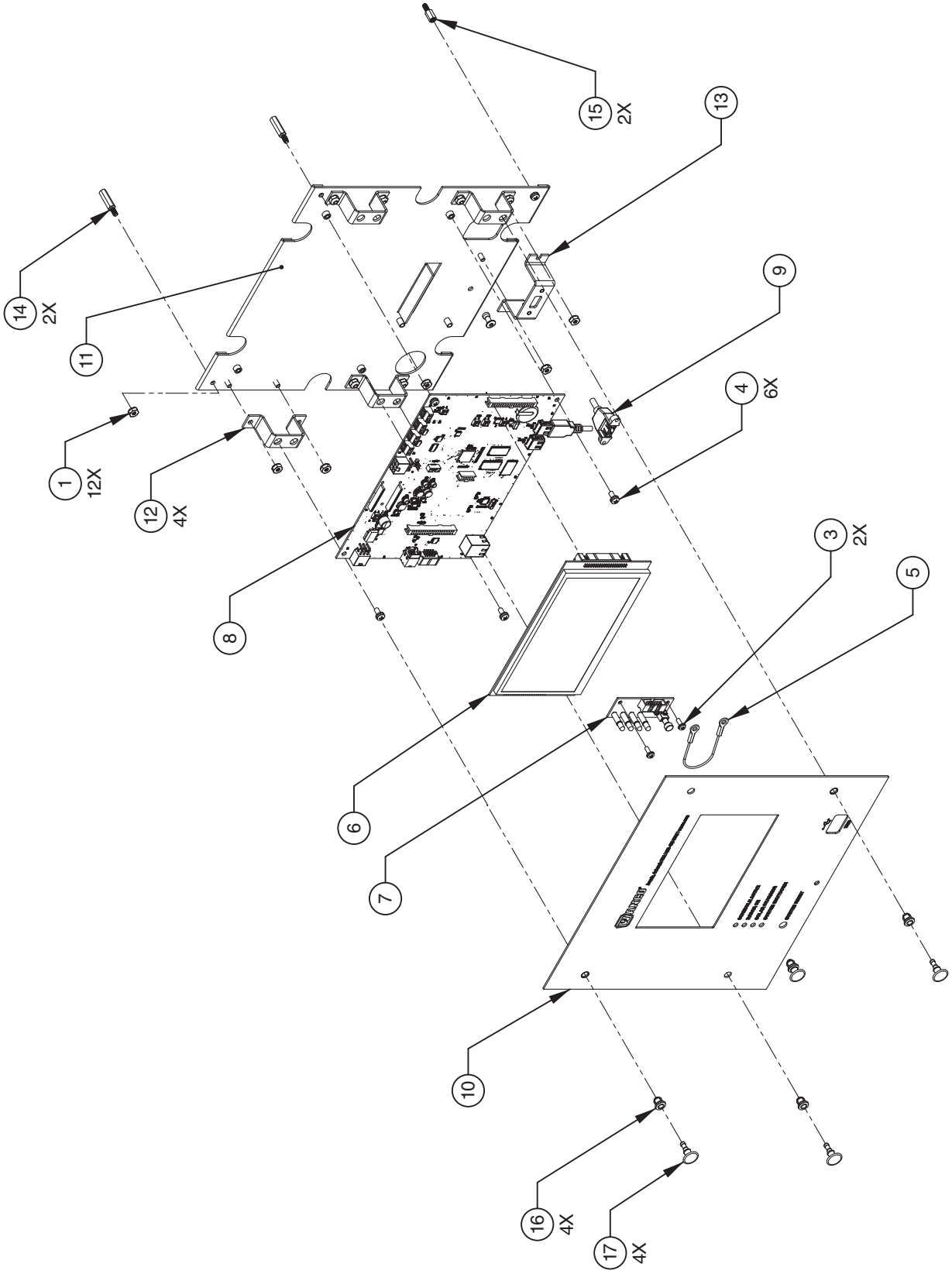


Table 6-15. Parts list: Display control unit (DCU)

Item No.	Part No.	Description	Qty.
1	103534-001	Keps hext nut, #8-32	12
3	105686-001	Pan-head screw, #6-32 × 3/8"	2
4	105688-001	Pan-head screw, #8-32 UNC × 3/8"	6
5	205454	Lanyard	1
6	217071	Touchscreen	1
7	210261	PCB, indicator lights	1
8	215571	PCB, display control unit	1
9	216452	USB port extender	1
10	216603	Control panel	1
11	216604-P	DCU mounting panel	1
12	216605-P	Mounting bracket, DCU	4
13	216606-P	Mounting bracket, USB extender	1
14	216607	Standoff, #8-32 7/8"	2
15	216608	Standoff, #8-32 0.438"	2
16	216610	Grommet, 0.313 dia.	4
17	216611	Plunger fastener, 0.313 dia.	4

Figure 6-27. Parts drawing: Battery box

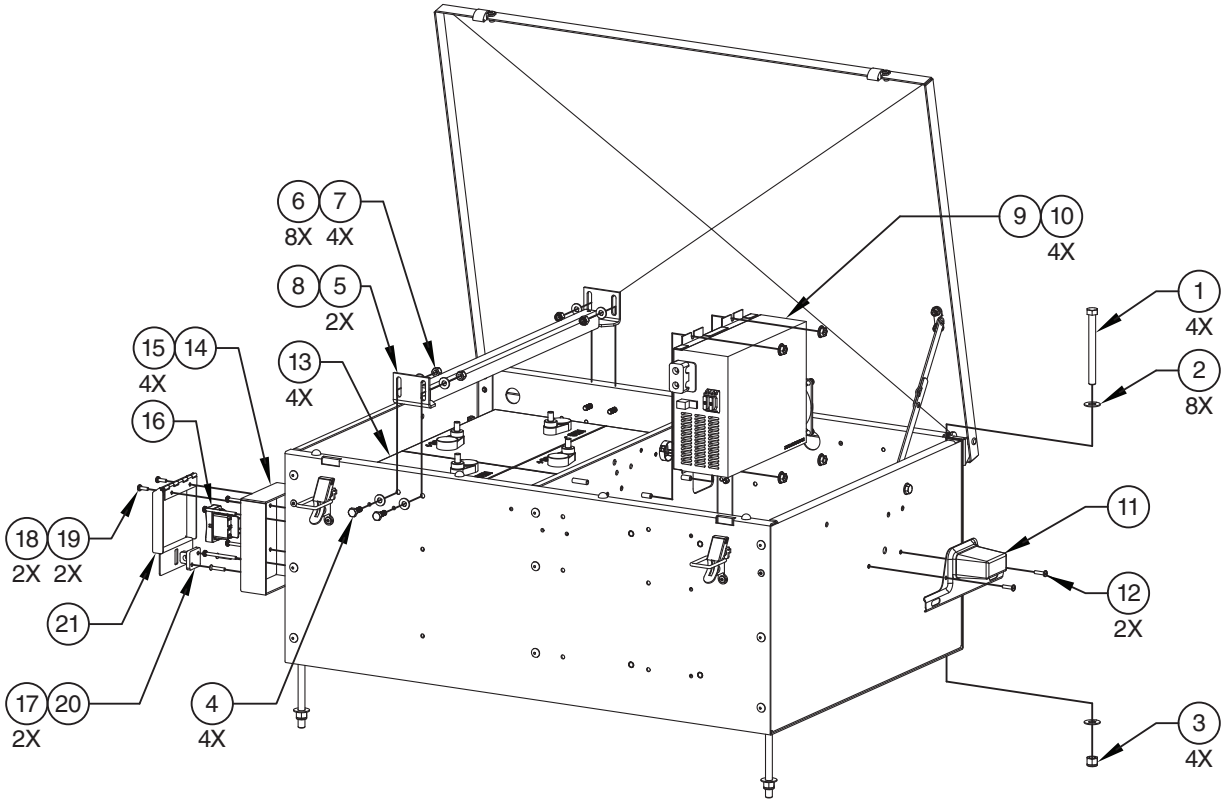


Table 6-16. Parts list: Battery box

Item No.	Part No.	Description	Qty.
1	104177-005	Hex screw, 3/8-16 × 4"	4
2	100234-001	Flat washer, 3/8"	8
3	100073-001	Hex nut, nylon insert lock 3/8-16	4
4	100207-002	Hex screw, 1/4-20 × 3/4"	4
5	104577-001P	Bracket for hold-down bar	2
6	100236-001	Washer, 1/4"	8
7	100238-001	Hex nut, nylon insert lock 1/4-20	4
8	200913	Battery hold-down bar	1
9	210268	Battery charger, 15A 60Hz 105/135VAC 12VDC	1
10	105280-001	Hex flange nut, 1/4-20	4
11	100783-001	License plate holder with light	1
12	101806-028	Pan-head screw, #8-32 UNC × 5/8"	2
13	104131-001	Battery, 6V deep-cycle 225Ah	4
14	218289-P	Housing for hydraulic-lift switch	1
15	218495	Pan-head sems screw, #8-32 × 2"	4
16	216619	Rocker switch for hydraulic lift	1
17	201251	Flat-head screw, #8-32 UNC × 7/8"	2
18	104129-001	Split lockwasher, #8	2
19	101806-001	Pan-head screw, #8-32 UNC × 1/2"	2
20	102275-005	Padlock hasp	1
21	216617-P	Cover for hydraulic-lift-switch housing	1

WANCO INC.
5870 Tennyson Street
Arvada, Colorado 80003
800-972-0755
303-427-5700
303-427-5725 fax
www.wanco.com