INSTALLATION INSTRUCTIONS

Original Issue Date: **3/04**

Model: **Microprocessor, Microprocessor-Plus, Digital, and Digital 550 Generator Set Controllers**

Market: **Industrial**

Subject: **Wireless Monitor Kits GM23409-KP4S, -KP5S, and -KP6S**

Introduction

The wireless monitor kit allows remote monitoring of generator sets equipped with the following controllers:

- Microprocessor
- Microprocessor-Plus
- Digital
- Digital 550

Refer to the generator set controller specification sheet for a list of possible outputs for your system. Figure 1 lists the specification sheet publication numbers.

The wireless monitor can also monitor voltage outputs from other equipment. Refer to the manufacturer's operation instructions for information on equipment outputs.

Generator set status, fault, and shutdown messages are sent to a message center, which posts the messages to a password-protected website and also delivers critical messages to selected recipients via telephone (landline or wireless), pager, e-mail, fax, or other selected methods as configured.

Typical messages might include:

- Overcrank
- Low oil pressure
- Overspeed
- Common fault

Generator run times are reported daily. Models using hardwire inputs accumulate run times over a 24-hour period and report the run times with the last heartbeat message. Models using Modbus® communication (for the 550 controller only) report the total accumulated run time and the total number of starts. Run times for these models are also totaled using the Control Panel function and can be updated upon request.

Read the entire installation procedure and compare the kit parts with the parts list at the end of this publication before beginning installation. Perform the steps in the order shown. This device must be installed in accordance with the National Electrical Code (NFPA 70), local codes, and the authorities having jurisdiction.

See Figure 2 for the wireless monitor illustration.

Controller	Specification Sheet Number
Microprocessor-Plus	M6-30
Digital	M6-34
Digital 550	M6-46

Figure 1 Controller Specification Sheets

Figure 2 Wireless Monitor

Kit Selection

The available kits are listed in Figure 3. Select the kit for your application based on the generator set controller type and the type of inputs used (voltage and dry contact inputs or Modbus® [550 controllers only]).

The 550 controller supports only one connection for Modbus® communication. If the controller's RS-485 or RS-232 connection is already used for Modbus® communication with other equipment, use wireless monitor model GM23409-KP4S or -KP6S with hardwire inputs through a customer connection board for monitoring.

Note: For Modbus® communication with the wireless monitor, the 550 controller must use application program version 2.30 or later. Refer to the 550 controller Operation Manual for instructions to identify the application program version number. See TT-1285, Program Loader, for instructions to update the controller application program, if necessary.

Kit Number	Wireless Monitor Model	Applicable Controllers	Power Requirement	Description
GM23409-KP4S	GM29535	Microprocessor Microprocessor-Plus Digital Digital 550	Selectable, 120 VAC or 12/24 VDC	Includes 7 hardwire inputs: 4 dry contact inputs for connection to the listed generator set controllers and 3 voltage inputs for connection to other customer equipment. Requires a customer connection kit to use with the 550 controller (see GM23409-KP6S). Requires a dry contact when using the common fault/alarm on the Microprocessor or the Microprocessor-Plus controller.
GM23409-KP5S	GM29536	Digital 550 with Modbus® communication	Selectable, 120 VAC or 12/24 VDC	Uses Modbus® communication to interface with the Digital 550 generator set controller. Also includes 8 hardwire inputs (4 dry contact and 4 voltage inputs) for connection to other customer equipment. Includes 14 ft. communication cable with an RJ11 connection on one end and three wires on the other end for RS485 connection at P20 on the 550 controller.
GM23409-KP6S	GM29535	Digital 550	Selectable, 120 VAC or 12/24 VDC	Same inputs as GM23409-KP4S. Also includes a customer connection kit for hardwire connections to the 550 controller.

Figure 3 Kit Descriptions

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Accessories

Figure 4 lists available accessories. Two optional high-gain antennas are available for sites with weak telemetry (cell tower) coverage. (The coverage is weak if the signal strength LED consistently displays 2 or less. See Section 4.) An optional fiberglass antenna is also available for outdoor installation. See Section 3 for more information about optional antennas.

Note: Modbus units (GM29536) shipped after 6/13/05 and hardwire units (GM29535) shipped after 9/1/05 have the 356 mm (14 in.) 3dB antenna provided as standard equipment.

If an input on GM23409-KP4S is used to report a common fault/alarm from a Microprocessor or Microprocessor-Plus controller, a dry contact is required. A single dry contact is available by ordering PA-273912.

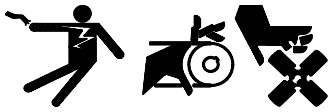
Accessory Kit Number	Description
PA-273912	Single relay dry contact kit. Use to transmit common alarm or common fault signals for Microprocessor and Microprocessor-Plus controllers.
GM23412-KP1 *	Antenna, 356 mm (14 in.), 3 dB, no ground plane required.
GM23412-KP2	Antenna, 686 mm (27 in.), 5 dB, ground plane included.
GM23412-KP3	Antenna, 457 mm (18 in.), 3 dB, fiberglass, with 25-ft. cable (for outdoor applications).
GM23735-KP1	Bracket, 33 mm (1 5/16 in.) pole mount, for fiberglass antenna.
GM23735-KP2	Bracket, 57 mm (2 1/4 in.) wall mount, for fiberglass antenna.
* See Note, above.	

Figure 4 Available Accessories

Safety Precautions

Observe the following safety precautions while installing the kit.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (-) lead first when disconnecting the battery. Reconnect the negative (-) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (-) lead first. Reconnect the negative (-) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

⚠ DANGER

Hazardous voltage.
Will cause severe injury or death.

Disconnect all power sources before opening the enclosure.

NOTICE

Electrostatic discharge damage. Electrostatic discharge (ESD) damages electronic circuit boards. Prevent electrostatic discharge damage by wearing an approved grounding wrist strap when handling electronic circuit boards or integrated circuits. An approved grounding wrist strap provides a high resistance (about 1 megohm), *not a direct short*, to ground.

Installation Procedure

This section covers the installation and test of the wireless monitor. This device must be installed in accordance with the National Electrical Code (NFPA 70), local codes, and the authorities having jurisdiction. Perform the test after the installation, account setup, and message configuration are complete.

The Wireless Monitoring System Operation Manual, MP-6223, explains account setup and message configuration, which must be done on the Internet at the DDC/MTU Power Generation website (ddcmtupowergeneration.com). Either configure the wireless monitor by completing the account setup and message configuration before installation (installation details can be filled in later) or arrange to have someone available at the equipment site to help test the monitor after completing the Internet setup.

1. Tools Required for Installation

- One wireless monitor unit
- Power supply, 85–120 VAC 60 Hz or 12/24 VDC
- Watertight fittings to seal enclosure penetrations (if the monitor unit is installed outdoors)
- Screws to surface-mount the enclosure
- Screwdriver, wire for power supply connection, and 12–18 AWG wire for input connections
- One available dry contact for common fault/alarm annunciation with Microprocessor and Microprocessor-Plus controllers
- One customer connection board for 550 controller hardwire inputs (supplied with GM23409-KP6S; not required with GM23409-KP5S)

2. Cell Service Check

There are some regions where cell coverage is available but DDC/MTU Power Generation service is not. A coverage map is available at the DDC/MTU Power Generation website (ddcmtupowergeneration.com) under Coverage Maps (see MP-6223, Wireless Monitoring System Operation Manual). Simply enter the zip code where you wish to install the wireless monitor to see if monitoring service is available.

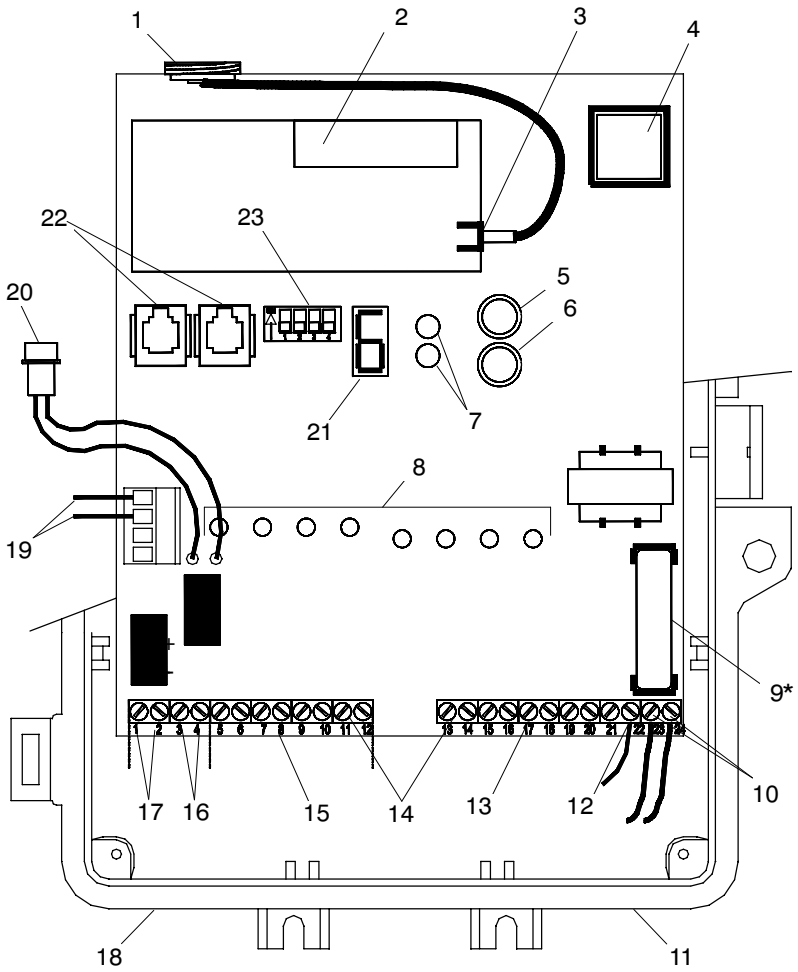
3. Antenna Connection

A standard 76 mm (3 in.) antenna is provided with the monitor. Two optional high gain antennas (kits GM23412-KP1 and GM23412-KP2) can be ordered if the site in question has weak telemetry (cell tower) coverage. See Accessories and contact your distributor/dealer to order optional accessories.

Note: Modbus units (GM29536) shipped after 6/13/05 and hardwire units (GM29535) shipped after 9/1/05 have the 356 mm (14 in.) 3dB antenna provided as standard equipment.

The antenna connection on the enclosure is factory-installed to prevent water from entering the enclosure. DO NOT change the existing connection. Simply screw the antenna to the connector on the top of the wireless monitor enclosure.

An optional outdoor antenna is used for locations where there is a weak signal inside the building structure or where wireless signals may be prohibited (such as hospitals). To connect the outdoor antenna, bring the cable into the monitor enclosure through one of the openings in the bottom of the enclosure. Disconnect the existing antenna cable connection (see Figure 5, item 3) and connect the outdoor antenna cable. To maintain the enclosure's outdoor approved rating, use a watertight fitting in the opening at the bottom of the enclosure and do not remove the unused antenna connector at the top.



1. Antenna connection
2. Radio module
3. Antenna cable connection
4. Processor module (internal)
5. Option button (alarm silence)
6. Service button
7. Status lights
8. Input indication lights
9. Fuse, 1 amp, 250 volt, fast blow, 3 AG *
10. AC Power supply 23, 24 (85–120 VAC, 60 Hz) ‡
11. Use this knockout for Class I leads †
12. Device wiring 22 (earth ground) ‡
13. Voltage inputs 13-20 (24–120 VAC or 5–48 VDC) ‡
14. Terminal blocks (use 12–18 AWG for connections) ‡
15. Dry contact inputs 5-12 (DO NOT apply voltage) ‡
16. Relay inputs 3, 4 (not used)
17. Relay inputs 1, 2 start/stop relay ‡
18. Use this knockout for Class II leads †
19. DC power supply connection (12 or 24 VDC)
20. Battery pack connector (not connected in DC-powered installations)
21. Signal strength (LED) indicator (0–9=signal strength, F=service mode)
22. Modbus® RS-485 RJ11 communication ports or factory test ports
23. DIP switches; see Figure 14

* A blown fuse usually indicates a problem that needs to be corrected. Do not replace the fuse without determining and correcting the cause of the blown fuse.

† Never mix Class I and Class II leads. Install signal leads and AC or DC power conductors in separate raceways, cables, or conduit. Always follow the National Electrical Code (NEC) and applicable local codes.

‡ Refer to the wiring diagrams in Section 17 for connections.

Figure 5 Wireless Monitor Connections and Components (shown with cover removed)

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4. Startup and Location Check

Take the wireless monitor to the area where the equipment to be monitored is located. The wireless monitor can be located either indoors or outside.

The wireless monitor will be able to send messages in locations where analog cell phones will work. If the equipment is in an area where an analog cell phone cannot get a signal, it is likely the wireless monitor will not be able to get a signal either.

Startup and Signal Check Procedure

4.1 Plug the battery pack into the battery pack connector provided on the monitor. See Figure 5, item 20.

4.2 The wireless monitor will begin a startup routine. The startup time will vary but may last up to several minutes as the wireless monitor establishes a connection to a cell site and registers a message.

4.3 During the startup routines, the *Signal Strength Indicator* display segments will rotate. Initially, the middle display segment will not be lit. When the middle segment comes on, the wireless monitor has successfully completed the first half of the startup routines.

4.4 Check the yellow status light. The yellow status light (see Figure 6) flashes once per second and the signal strength is displayed when service is available. See Section 5, Cell Coverage Check.

4.5 Walk around the equipment or the equipment room with the wireless monitor powered by the battery pack.

Note: On battery power, the monitor will display the signal strength for 15 minutes before it goes into a sleep mode and displays a decimal point. Simply unplug the battery pack and then reconnect to continue on battery power to determine final location.

4.6 Place the wireless monitor in several sample mounting locations and check the signal strength by observing the signal strength indicator. The cell signal strength can range from 0 to 9. The higher the signal strength number, the better the signal. See Section 5, Cell Coverage Check.

Note: A signal strength less than 2 will not provide reliable message transmission. A high-gain antenna may be required.

Locate the wireless monitor no more than 12 m (40 ft.) from the generator set or monitored equipment but at least 0.8 m (2.5 ft.) from electronic generator set components to avoid signal interference. Check locations where the antenna rises at least 50 mm (2 in.) above or is directed away from the equipment. Avoid mounting the monitor on vibrating equipment.

4.7 When the mounting location with the strongest (highest number) signal strength is found, disconnect the battery pack connection until the final installation has been completed.

Nuisance alarms are sometimes triggered when the equipment is being tested or serviced. To avoid nuisance alarms, do not connect the power supply or reconnect the battery to the wireless monitor until instructed to do so in Section 10.

5. Cell Coverage Check

After the initial startup routine, the *Signal Strength Indicator* displays the cell signal strength at the wireless monitor location. The cell signal strength can range from 0 to 9. The higher the signal strength number, the better the signal.

The wireless monitor sends out a sample message and then waits for a return signal to determine if DDC/MTU Power Generation service is available at this site. The yellow status light (see Figure 6) will flash once a second and the signal strength will be displayed when service is available. Telemetry system delays may occur in cell coverage areas due to high traffic volume that may result in message delays.

Status Light		
Yellow	**Green**	**Indicates**
Off	Off	Service not available
Flashing once/sec.	Off	Service available, ready to transmit
On	Flashes once or twice	Transmitting message
On	Flashes rapidly for 2 sec.	Successful transmission

Figure 6 Status Lights

A signal strength less than 2 will not provide reliable message transmission. A high-gain antenna may be required.

Note: An optional high gain antenna is available; see the Accessories section.

6. Mounting

Choose a surface that is flat and strong enough to hold the wireless monitor. Avoid mounting the monitor on vibrating equipment. Locate the wireless monitor no more than 12 m (40 ft.) from the generator set or monitored equipment but at least 0.8 m (2.5 ft.) from electronic generator set components to avoid signal interference. The antenna must clear the top of the equipment by 50 mm (2 in.) minimum.

Mount the wireless monitor in a location where the ambient temperature range does not exceed –40° C to 60° C (–40° F to 140° F).

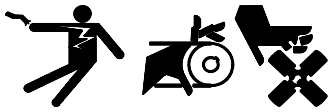
The enclosure has one keyhole mounting tab extending from the top of it and two mounting tabs extending underneath. Use all three tabs to secure the monitor.

Note: This enclosure is UL approved for outdoor use. **DO NOT** drill any holes into or through the enclosure. Use watertight fittings in the precast holes at the bottom of the enclosure for wire entrances.

7. Remove the Generator Set from Service

Before proceeding to wire the power supply and input connections, disable the generator set as instructed in this section to prevent accidental starting.

⚠ WARNING



Accidental starting.
Can cause severe injury or death.

Disconnect the battery cables before working on the generator set. Remove the negative (–) lead first when disconnecting the battery. Reconnect the negative (–) lead last when reconnecting the battery.

Disabling the generator set. Accidental starting can cause severe injury or death. Before working on the generator set or connected equipment, disable the generator set as follows: (1) Move the generator set master switch to the OFF position. (2) Disconnect the power to the battery charger. (3) Remove the battery cables, negative (–) lead first. Reconnect the negative (–) lead last when reconnecting the battery. Follow these precautions to prevent starting of the generator set by an automatic transfer switch, remote start/stop switch, or engine start command from a remote computer.

Procedure to Disable the Generator Set

7.1 Place the generator set master switch in the OFF position.

7.2 Disconnect the power to the battery charger, if equipped.

7.3 Disconnect the generator set engine starting battery(ies), negative (–) lead(s) first.

8. Customer Connection Kits (550 controller)

Kit GM23409-KP6S includes a customer connection kit that must be installed on generator sets with 550 controllers using dry contact inputs to the monitor. The customer connection kit is installed differently on 20–300 kW, 350–400 kW, and 450–2000 kW generator sets. Follow the instructions in this section to install the customer connection kit.

Do not use terminals 42A or N on the controller connection kit terminal strip to supply voltage to customer-provided accessories. The 120 VAC accessories require a customer-supplied voltage source.

Observe applicable local and national electrical codes when installing the wiring system.

Customer Connection Kit Installation Procedure

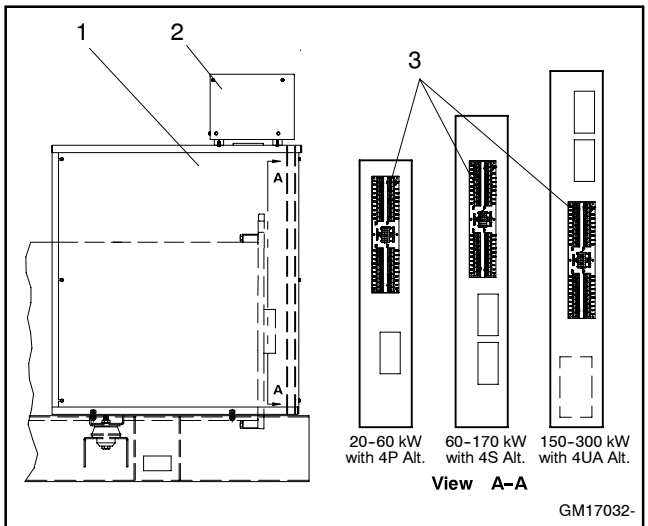
8.1 **20–300 kW Generator Sets**

8.1.1 Remove the junction box rear panel and hardware.

8.1.2 Attach the controller connection assembly (GM13984) to the junction box using six screws (X-51-3), spacers (X-712-9), and nuts (X-6210-4). Place the spacers between the controller connection assembly and the junction box bracket. See Figure 7 for the mounting location.

8.1.3 Plug the wiring connection harness (GM16753) into the controller connection assembly's P25 connector. See Figure 8.

8.1.4 Proceed to step 8.5, Connection.



1. Junction box
2. Generator set controller
3. Controller connection assembly (GM13984)

Figure 7 Controller Connection Assembly Mounting Locations in Junction Box (20–300 kW)

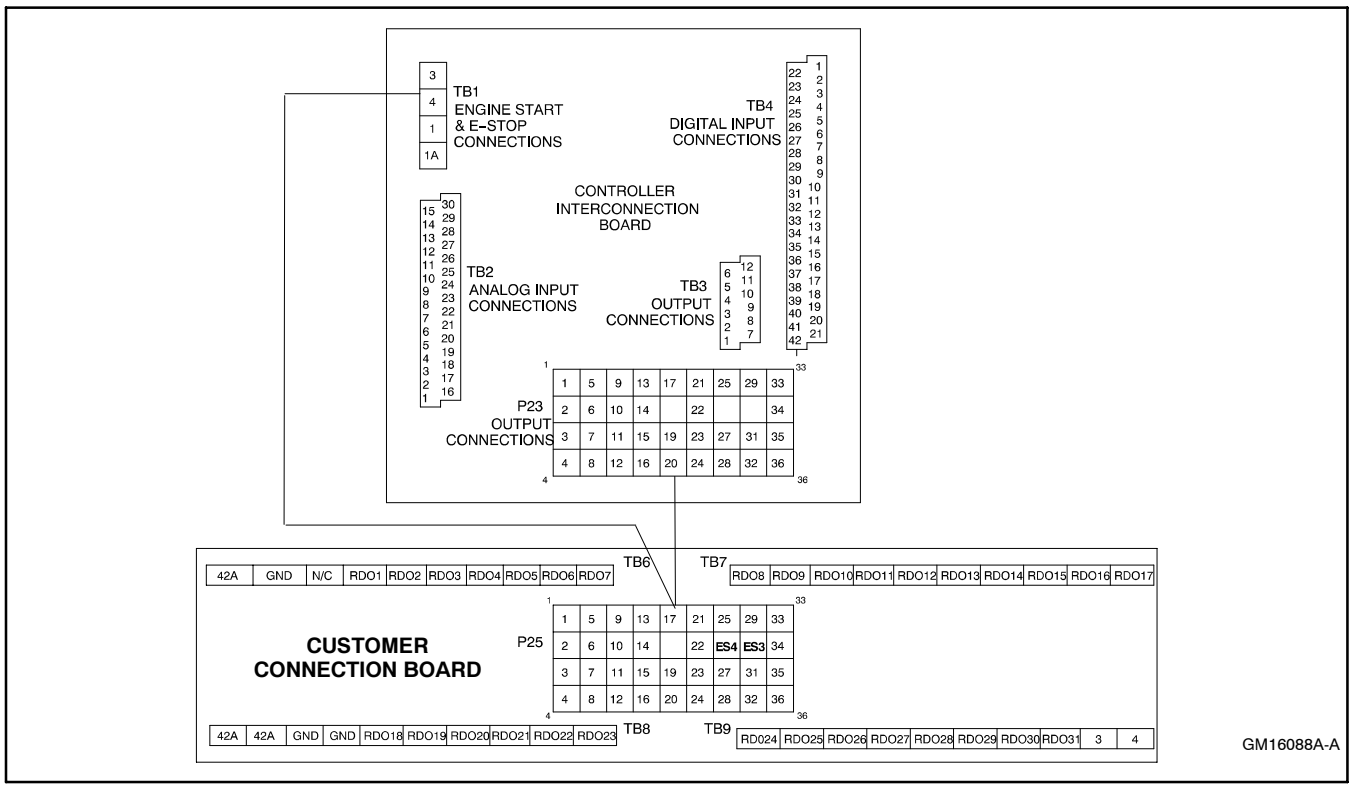


Figure 8 Controller Connection Assembly Kit (GM13984)

8.2 **350/400 kW Generator Sets**

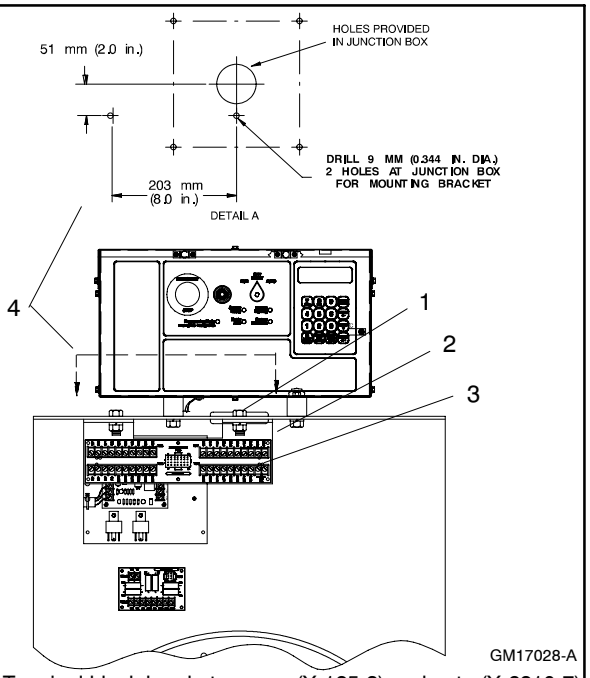
8.2.1 Remove the junction box rear panel and hardware.

8.2.2 Remove the four screws attaching the controller to the junction box. See Figure 9.

8.2.3 Mark the drill hole locations where the controller connection board bracket (347292) mounts to the junction box top panel using the dimensions given in Figure 9.

8.2.4 Move the controller away from the rear of the junction box in order to provide enough clearance to drill two 9 mm (0.344 in.) dia. holes in the top of the junction box.

8.2.5 Remove burrs from the drilled holes and clean up all metal chips in the junction box.



1. Terminal block bracket screws (X-125-3) and nuts (X-6210-7)
2. Terminal block bracket (347292)
3. Controller connection assembly (GM13984)
4. Detail A, mounting hole dimensions (top panel)

Figure 9 Terminal Block Bracket and Controller Connection Assembly Mounting (350/400 kW)

8.2.6 Place the controller connection board bracket (347292) on the underside of the junction box top panel with the bracket mounting holes visible from the rear of the junction box and mount using two screws (X-125-3) and nuts (X-6210-7). See Figure 9.

8.2.7 Reposition the controller over the junction box holes and install the four screws removed in step 8.2.2

8.2.8 Attach the controller connection assembly (GM13984) to the terminal block bracket using six screws (X-51-3), spacers (X-712-9), and nuts (X-70-12). Place the spacers between the controller connection assembly and the mounting bracket.

8.2.9 Plug the wiring connection harness (GM16753) into the controller connection assembly's P25 connector. See Figure 8.

8.2.10 Proceed to step 8.5, Connection.

8.3 450–2000 kW Generator Sets

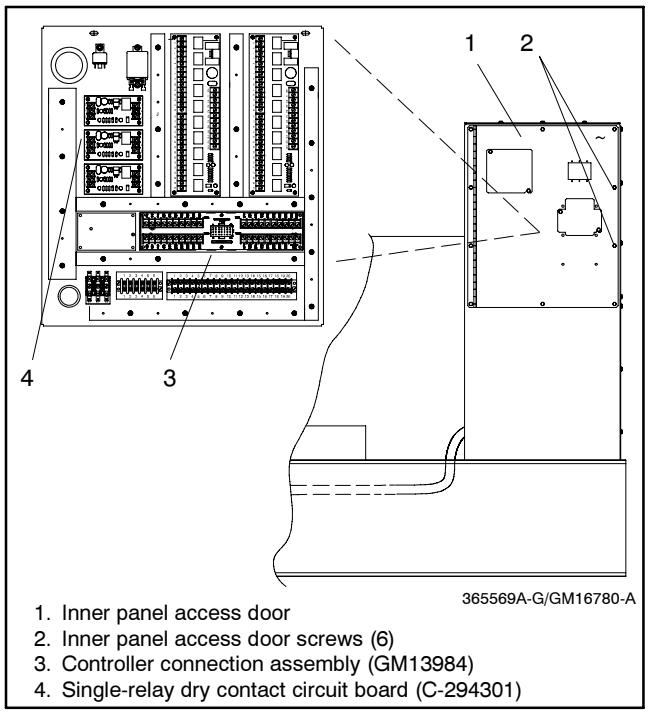
8.3.1 Remove the junction box upper rear panel and hardware.

8.3.2 Remove the inner panel access door screws and swing open the access door.

8.3.3 Attach the controller connection assembly (GM13984) to the junction box bracket studs using six spacers (X-712-9) and nuts (X-70-12). Place the spacers between the controller connection assembly and the mounting bracket. See Figure 10 for the mounting location.

8.3.4 Plug the wiring connection harness (GM16753) into the controller connection assembly's P25 connector. See Figure 8.

8.3.5 Proceed to step 8.5, Connection.



1. Inner panel access door
2. Inner panel access door screws (6)
3. Controller connection assembly (GM13984)
4. Single-relay dry contact circuit board (C-294301)

Figure 10 Connection Assembly Mounting in Junction Box (450–2000 kW)

8.4 2500–2800 kW Generator Sets

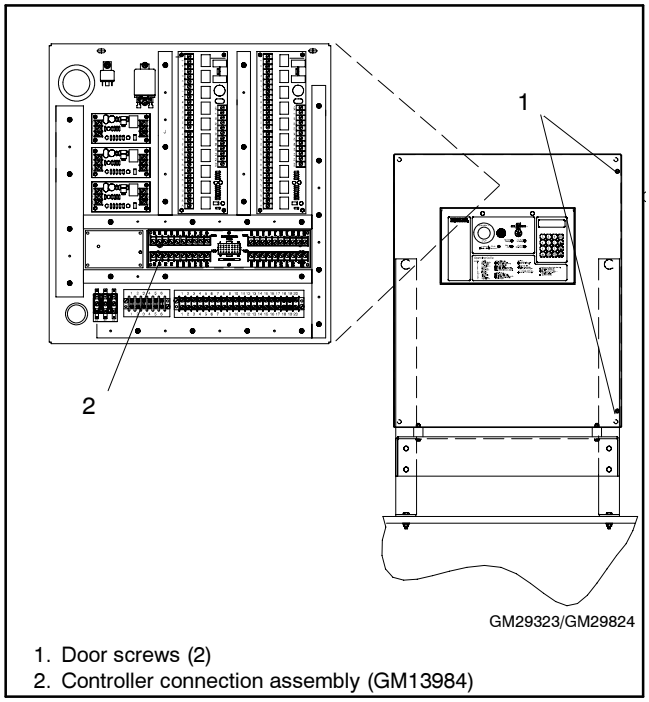
8.4.1 Remove two screws and swing open the junction box front door.

8.4.2 Attach the controller connection assembly (GM13984) to the junction box bracket studs using six spacers (X-712-9) and nuts (X-70-12). Place the spacers between the controller connection assembly and the mounting bracket. See Figure 10 for the mounting location.

8.4.3 Plug the wiring connection harness (GM16753) into the controller connection assembly's P25 connector. See Figure 8.

8.4.4 Swing the junction box door closed and install the screws.

8.4.5 Proceed to step 8.5, Connection.



1. Door screws (2)
2. Controller connection assembly (GM13984)

Figure 11 Connection Assembly Mounting in Junction Box (2500–2800 kW)

8.5 **Connection**

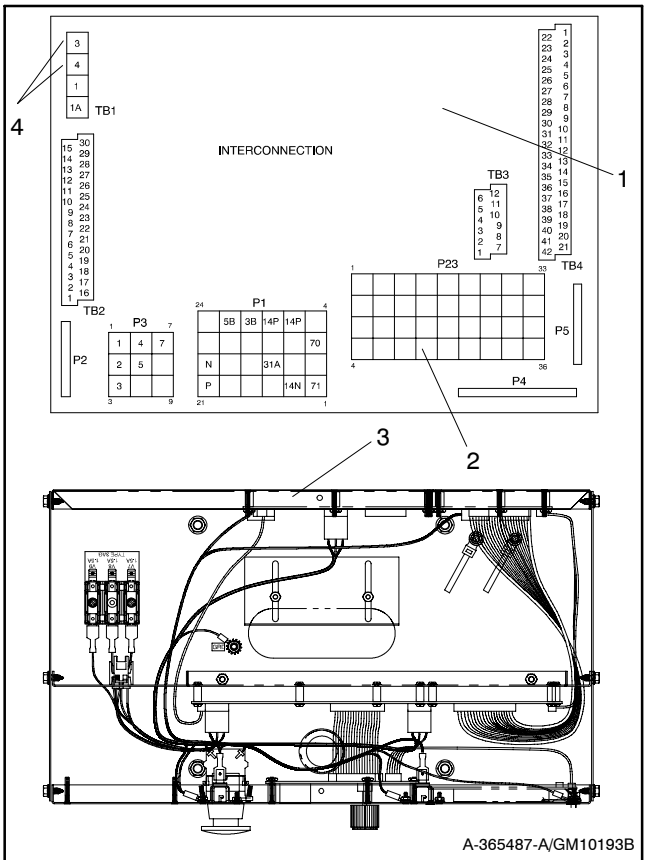
8.5.1 Remove the controller cover and hardware.

8.5.2 Route the other end of the wiring connection harness (GM16753) through the junction box port to the controller interconnection circuit board.

8.5.3 Plug the wiring harness connector into the interconnection circuit board's P23 connector. Connect lead ES3 to TB1 terminal 3 and connect lead ES4 to TB1 terminal 4. See Figure 12. If access to the interconnection circuit board is difficult, remove the two controller panel top screws and center bottom screw and then loosen the bottom screws to swing the rear controller panel down.

8.5.4 Swing the rear controller panel up and replace the screws, if previously removed. Replace the controller cover and hardware. Tighten all controller screws.

8.5.5 Replace the junction box panel and hardware or swing the junction box door closed and replace the screws.



1. Interconnection circuit board (top view)
2. P23 connector
3. Interconnection circuit board mounted on the controller rear panel
4. Connect lead ES3 to TB1 terminal 3 and connect lead ES4 to TB1 terminal 4

Figure 12 Attaching Wiring Connection Harness to Controller Circuit Board

9. Field Wiring

Refer to the wiring diagrams in Section 17 for connections. Open the monitor enclosure and remove the four screws securing the black panel cover to gain access to the input terminals and LEDs (see Figure 5).

The enclosure is equipped with six knockouts. **DO NOT** make any other holes in the enclosure. Bring all Class 1 and Class 2 wiring into the enclosure through separate knockouts. See NFPA 70, National Electric Code, Article 725 for definitions of Class 1 and Class 2 circuits. Install signal leads and AC or DC power conductors in separate raceways, cables, or conduit.

Route all field wiring away from sharp projections, corners, and internal components.

After removing a knockout, seal it with a watertight fitting (not supplied) if the wireless monitor is being mounted outdoors.

Note: Watertight fittings at the knockout openings are *required* in order to maintain the enclosure's UL outdoor approved rating.

9.1 Modbus Communication Connections (GM23409-KP5S)

Model GM23409-KP5S supports Modbus® network communications with the 550 controller. A 14 ft. communication cable is supplied with this model. Connect the phone jack connection to the RJ-11 port on the monitor unit. Wire the other end of the communication cable to the P20 terminal on the 550 controller. See Section 17 for connections.

The 550 controller supports only one connection for Modbus® communication. If the controller's RS-485 or RS-232 connection is already used for Modbus® communication with other equipment, use wireless monitor model GM23409-KP6S with hardwire inputs through a customer connection board for monitoring.

The wireless monitor communicates at 9600 baud. Set the 550 controller to communicate at 9600 baud. Refer to the 550 controller Operation Manual for instructions to check and adjust the baud rate.

For Modbus® communication with the wireless monitor, the 550 controller must use application program version 2.30 or later. Refer to the 550 controller Operation Manual for instructions to identify the application program version number. See TT-1285, Program Loader, for instructions to update the controller application program, if necessary.

9.2 Hardwire Input Connections (GM23409-KP4S and -KP6S)

Each wireless monitor model has four sets of dry contact inputs and the four sets of voltage inputs (see Figure 5). Select wireless monitor model GM23409-KP4S to use the hardwire inputs with controllers that are already equipped with a customer connection board. Model GM23409-KP6S includes a customer connection board if one is not available at the installation for connection to the 550 controller. See Figure 3.

Select any four of the available generator set controller outputs. The wiring diagrams in Section 17 show typical selections; you may select different controller outputs. For the 550 controller, refer to the controller Operation Manual for instructions to identify available outputs and to Figure 8 for wiring the 550 customer connection kit to the monitor inputs.

Note: Digital 550 controller outputs are customer-definable and may be different than the factory settings.

Use #12–18 AWG wire to connect the generator set outputs to the wireless monitor dry contact input terminals. Note the polarity of the connections and follow the wiring diagrams carefully.

Note: Reversed polarity causes a fault.

After connecting the generator set outputs to the wireless monitor input terminals, update the message information on the wireless monitor website. Refer to MP-6223, Wireless Monitoring System Operation Manual for instructions.

9.3 Generator Running Indication

The generator running output is available for the 550 controller connected to a hardwire-input version of the wireless monitor. The generator running output is also available for the Microprocessor-Plus and Digital controllers.

To send a generator running message when the unit starts, connect leads 70R and GND to one set of dry contact input terminals on the wireless monitor. Refer to the wiring diagrams in Section 17.

The generator running output does not send a message when the generator set stops.

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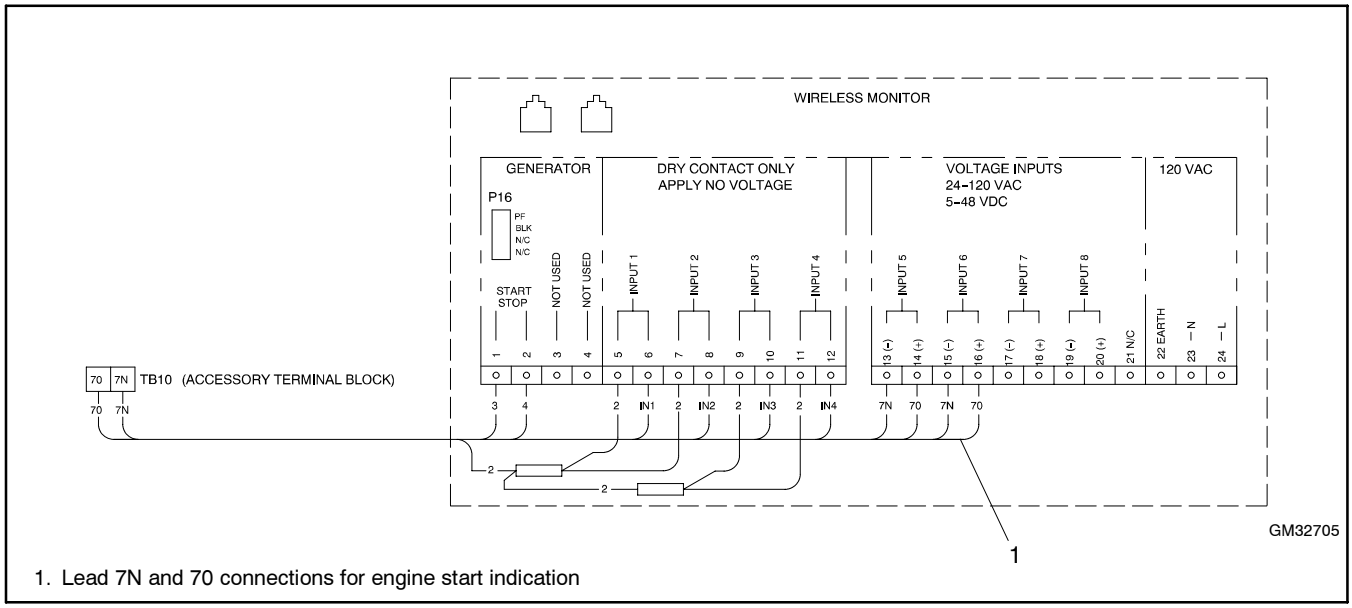
9.4 Engine Start Indication

To send a message each time the generator set attempts to start, connect generator set terminals 70 and 7N on accessory terminal block TB10 in the junction box to wireless monitor voltage input terminals 15 and 16 as shown in Figure 13. Battery voltage is present across terminals 70 and 7N when the engine cranks and runs.

A message will be sent each time a crank cycle is initiated. If the generator set does not start on the first crank attempt, separate messages will be sent for each crank attempt.

9.5 Remote Start/Stop Connections

To allow remote starting and stopping of the generator set through the monitor website, connect the generator set's remote start/stop circuit to monitor terminals 1 and 2 as shown in the appropriate wiring diagram in Section 17. The monitor's remote start/stop DIP switch must also be enabled for remote starting and stopping; see MP-6223, Wireless Monitoring System Operation Manual.



1. Lead 7N and 70 connections for engine start indication

Figure 13 Engine Start Signal Indication Connection

10. Power Connections

Supply either AC (85–120 VAC, 60Hz) or DC (12 or 24 VDC) power to the wireless monitor.

Note: The battery pack mounted inside the monitor enclosure serves a different function than a DC power supply for the monitor. The battery pack is intended for temporary power during equipment setup or AC power loss and connects to a different connector than the DC power supply. The monitor will enter sleep mode after 15 minutes on the battery pack.

10.1 AC-Powered Installations

Refer to Figure 5. Connect the monitor unit battery pack before wiring main power. The battery pack connection is on the left side of the monitor.

For AC-powered installations, provide an AC power supply with a voltage within the range 85–120 VAC. Provide a stepdown transformer for power supply voltages over 120 VAC. Connect the monitor to a receptacle or circuit that is powered by the generator set so that the monitor continues to function if the utility power fails. Connect the AC power supply to terminals 22, 23, and 24 (see Figure 5).

10.2 DC-Powered Installations

Models GM23409-KP4, -KP5, and -KP6 can be powered by 12 or 24 VDC from the generator set's engine starting battery. Use a battery charger to maintain the generator set battery.

For generator battery-powered installations, do not connect the battery pack mounted inside the monitor enclosure. Move DIP switch 4 to the DC position (DIP switch in the ON [up] position). See Figure 5. Connect the external battery harness (provided) to the battery. See Section 17, Wiring Diagrams, for connections. Then plug the harness connector into the battery connection on the wireless monitor.

The monitor does not enter the sleep mode when battery-powered with DIP switch 4 in the DC position.

The harness includes a 5-amp, 250-volt fast-acting ceramic fuse, DDC/MTU Power Generation part number 233298. If the fuse blows, determine and correct the cause of the blown fuse. Replace a blown fuse with an identical part.

11. DIP Switches

The four DIP switches on the wireless monitor are assigned to the functions shown in Figure 14. Set the DIP switches to the appropriate positions for the application. DIP switch positions: on = up, off = down as shown in Figure 5.

Note: The wireless monitor is shipped with all DIP switches in the down position.

DIP Switch	Models	Function	Notes *
1	All	Remote start/stop enable/disable	Set in conjunction with relay input terminals 1 and 2 for remote start/stop operation. On = Enable remote start/stop Off = Disable remote start/stop
2	All	Audible alarm enable/disable	Audible alarm can also be silenced by pushbutton. On = Enable audible alarm Off = Disable audible alarm
3	GM23409-KP4S GM23409-KP6S	Input 4 active on contact open or closed	Applies to dry contact input #4 *only*. On = Active on open Off = Active on closed
	GM23409-KP5S	Inputs 1–4 active on contact open or closed	Applies to all dry contact inputs. On = Active on open Off = Active on closed
4	GM23409-KP4S GM23409-KP5S GM23409-KP6S	AC/DC power supply selection	On = DC power supply Off = AC power supply
* DIP switch positions: on = up, off = down as shown in Figure 5. The wireless monitor is shipped with all DIP switches in the down position.			

Figure 14 DIP Switches

12. Record Equipment Information

Record the following information to use for account setup and message configuration.

- The Device ID number, located on the label inside the monitor. See Figure 15 for the location of the Device ID number on the label.

Note: DO NOT leave the site without recording the Device ID number. Without this number, the device cannot be configured at the website.

- The location name for the piece of equipment being monitored. The exact street address, city, state, and zip code where the wireless monitor is located.

- The local contact phone and name. These should be the phone number and name of the person(s) who would need to be contacted to gain access to this wireless monitor.

- The equipment name for the piece of equipment being monitored. Choose a unique name to identify each piece of equipment, especially if there are multiple pieces of equipment which will have wireless monitors installed at a single site. Keep the names short, since the entire name is used in phone message deliveries.

- The equipment manufacturer, model, and serial number. This information should be sufficient to identify repair or replacement parts before a service person is dispatched to the site.

Use the information collected to set up an account. Connect to the Internet and access www.ddcmtupowergeneration.com. The steps to set up a DDC/MTU Power Generation account are explained in the wireless monitor Operation Manual, MP-6223.

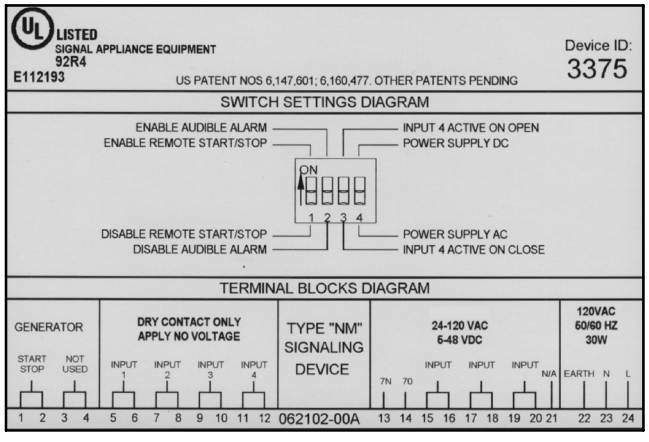


Figure 15 Label with Device ID in Upper Right Corner

13. Restore the Generator Set to Service

13.1 Check that the generator set master switch is in the OFF position.

13.2 Reconnect the generator set engine starting battery(ies), negative (–) lead(s) last.

13.3 Reconnect power to the battery charger, if equipped.

13.4 Move the generator set master switch to AUTO for startup by remote transfer switch or remote start/stop switch.

14. LED Indicators

The red LED light above each input illuminates when the input is on. The LEDs are not visible when the cover panel is in place.

The numerical LED display indicates the cell signal strength during normal operation (See Section 5), displays the letter F when the monitor is in service mode, or displays a decimal point if the power has been disconnected. The numerical LED can also display a code to indicate Modbus® communication; see Section 15.1.

15. Panel Buttons

15.1 Alarm Silence Button

The alarm silence button silences the audible alarm on the monitor unit. The audible alarm occurs when the equipment controller signals a fault/alarm. Select fault assignments on the website. The alarm sounds again five minutes after the button is pressed if the fault is not corrected. The audible alarm can be disabled by a dipswitch selection. The audible alarm is not available for any alarms received via Modbus® connection.

On model GM23409-KP5S only: Press the alarm silence button three times to display a diagnostic code. The LED will display the sequence *— 1 — (dash one dash)* to indicate that the monitor is communicating with the equipment controller. A series of dashes without a number one (1) indicates a loss of communication with the equipment controller.

15.2 Service Button

Pressing the service button sends a message to the website that a technician has arrived on-site. An *F* on the monitor LED display indicates the service mode. The web screen displays *Service Button*. To minimize

nuisance alarm messages, the monitor does not accept alarms from the equipment during servicing.

The technician must press the service button again after service to reset the monitor to receive alarms. The monitor automatically resets 120 minutes after the service button is pressed. A signal strength number (0–9) on the monitor LED display indicates that the monitor has returned to normal operation.

16. Testing

Perform the test in this section after configuring the wireless monitor at the DDC/MTU Power Generation website as instructed in the Wireless Monitoring System Operation Manual, MP-6223. Testing requires a person at the equipment site and someone with access to the web page.

Note that while the following test is recommended, a properly functioning wireless monitor will send out a *Heartbeat* message every night. Therefore, it is possible to check the system operation by simply waiting until the next morning and then checking the website to determine if the wireless monitor sent out a message.

Equipment Site Test Procedure

16.1 Verify that the yellow status light is flashing once per second (see Figure 6). This indicates the wireless monitor registers service, is available and is ready to send. The green status light should be off.

16.2 Press and release the *Service Button.* The green light flashes several times and then flashes quickly for approximately 2 seconds to indicate that the message has been sent. The yellow light should light steadily after the message has been sent.

Note: If green light flashes only twice, the message did not leave the monitor. The monitor will hold the message and retry every 10–15 seconds.

16.3 After the message has been successfully sent, check that the green light turns off and the yellow light flashes every second, showing that the wireless monitor is ready to send another message.

Cell tower traffic can cause occasional delays in message transmission. If the message does not go through after the first few attempts, the yellow light flashes rapidly to indicate that the monitor is holding a message. After about 5 minutes, the monitor will attempt to transmit the message again. The yellow light will light steadily and the green light will again begin to flash, indicating an attempt to transmit. This cycle will continue until the message is sent.

Website Test Procedure

16.4 Access the DDC/MTU Power Generation website and log in to the DataMessenger™ site. See the wireless monitor Operation Manual for instructions to log onto and navigate the website.

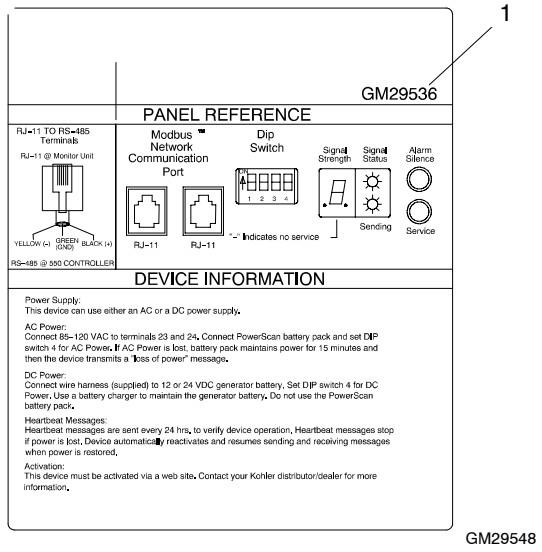
16.5 Confirm that the equipment information is correct including the name, model, make, and address. Confirm the contact information is correct. The correct information is the name and telephone number of the individual(s) who can provide access to the equipment.

16.6 Verify that the *Device Information* screen shows the message that the service button has been pressed.

16.7 Check that all the other appropriate messages were received. Make sure the appropriate individuals were paged, that the appropriate faxes were sent, and the appropriate telephone calls were made.

17. Wiring Diagrams

The wireless monitor model number is shown on the label on the inside of the enclosure's cover. See Figure 16. Refer to Figure 17 to locate the wiring diagram for your application.



1. Model number

Figure 16 Typical Label

Wireless Monitor Kit Number	Wireless Monitor Model	Generator Set Controller	Diagram	
			Drawing Number	Figure
GM23409-KP4S	GM29535	Microprocessor	GM32705C-S-A	Figure 18
		Microprocessor-Plus	GM32705B-S-A	Figure 19
		Digital	GM32705D-S-A	Figure 20
GM23409-KP5S	GM29536	Digital 550 Controller	GM32705A-S-A	Figure 21
GM23409-KP6S	GM29535	Digital 550 Controller	GM32705A-S-A	Figure 21

Figure 17 Wiring Diagrams

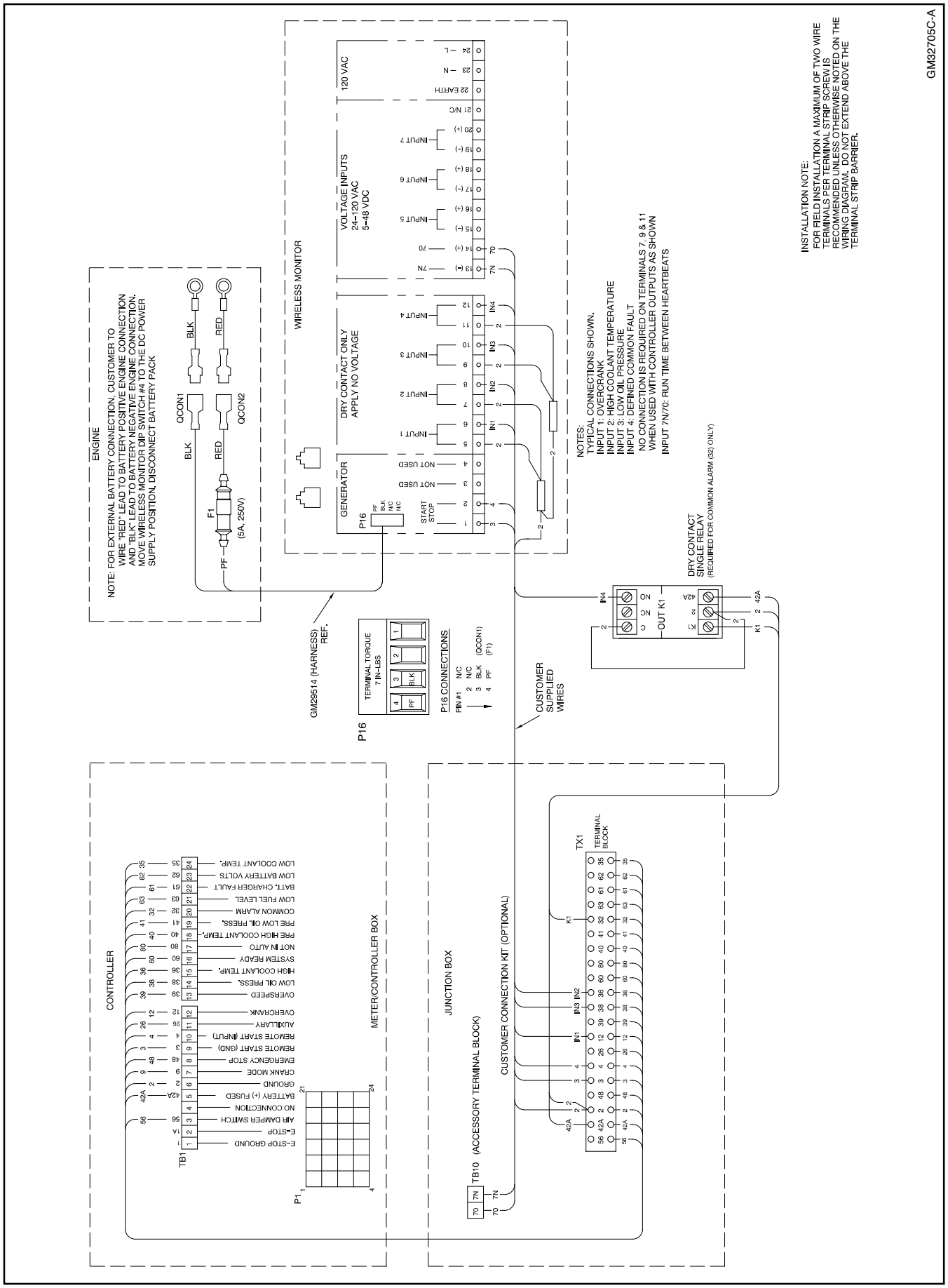


Figure 18 Microprocessor Controller Connections, GM32705C-A-S (kit GM23409-KP4S)

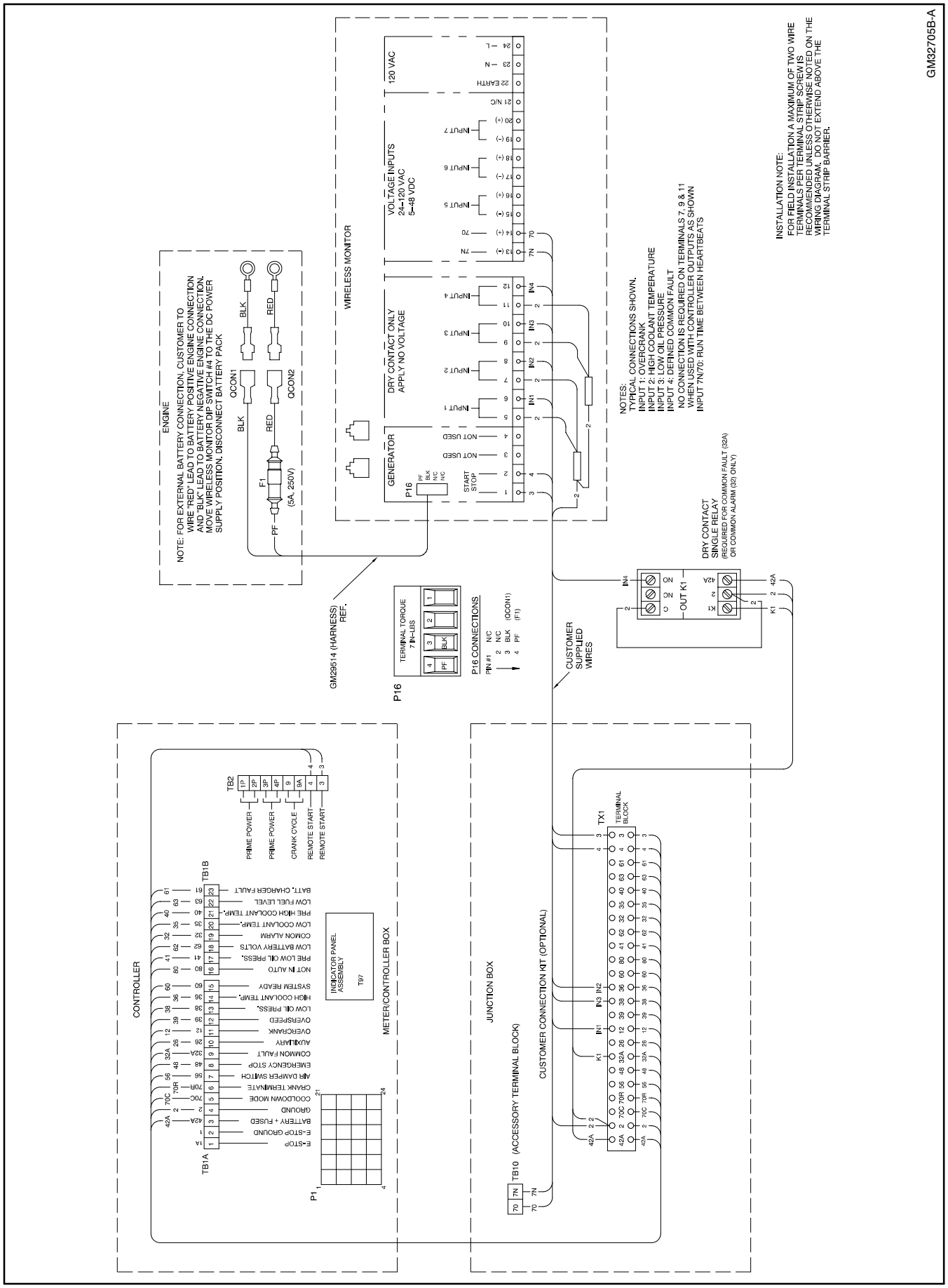


Figure 19 Microprocessor-Plus Controller Connections, GM32705B-A-S (kit GM23409-KP4S)

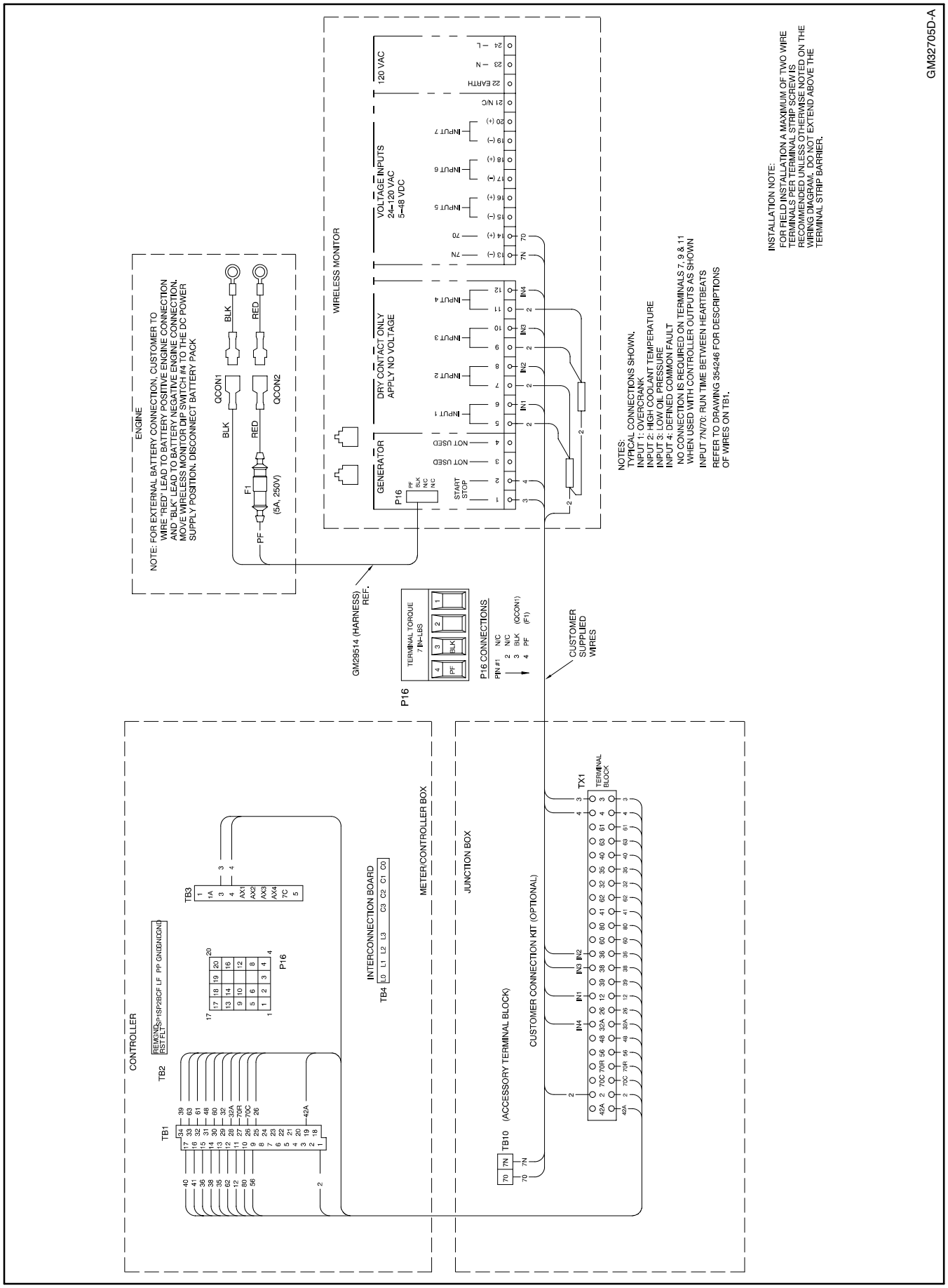


Figure 20 Digital Controller Connections. GM32705D-A-S (kit GM23409-KP4S)

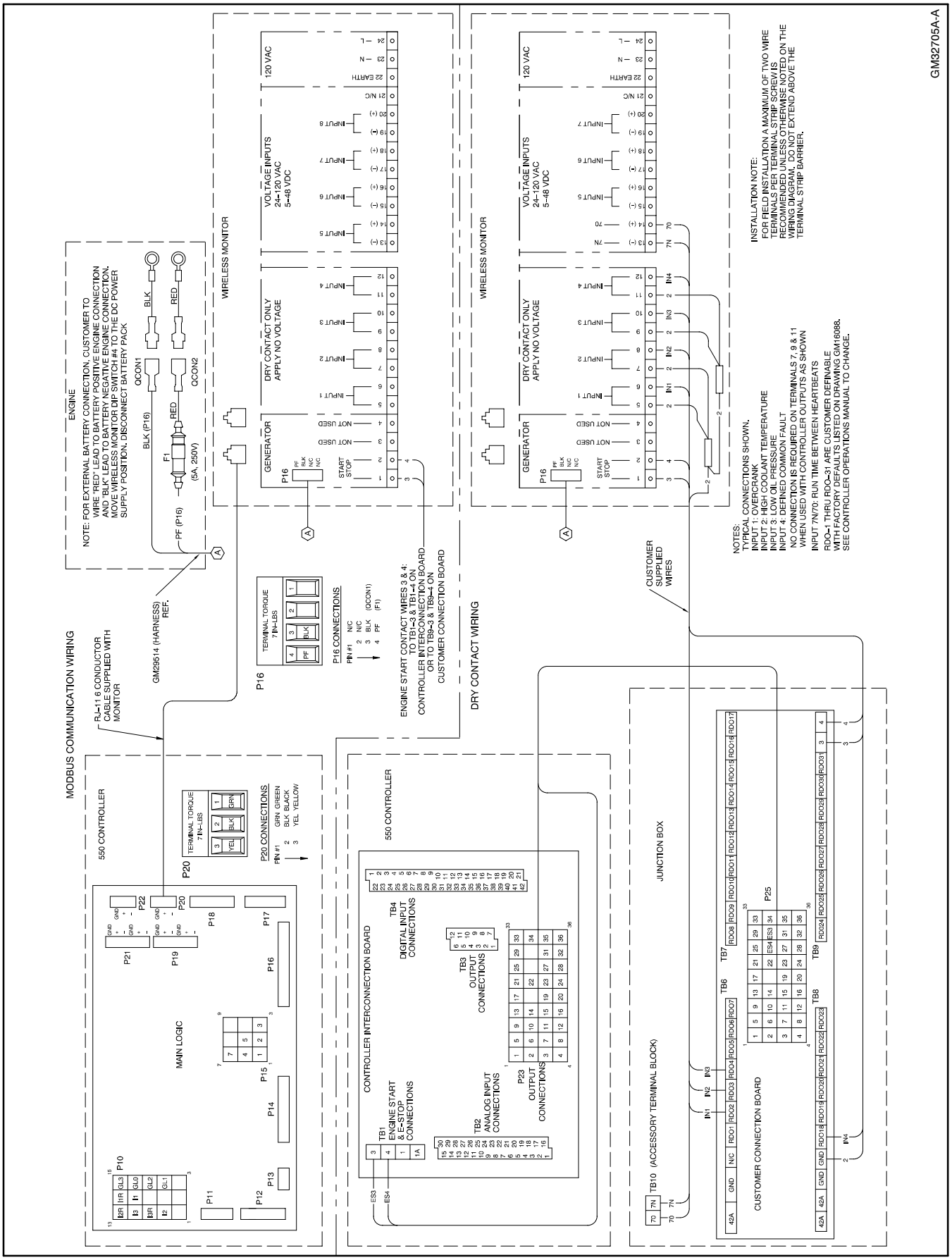


Figure 21 Digital 550 Controller, GM32705A-A-S (kits GM23409-KP5S and GM23409-KP6S)

Noise and Wiring Practices

Electrical noise is an unwanted electrical signal that can cause errors in measurement, loss of control, malfunctions in microprocessor-based control systems, errors in data transfer between systems over communication links, or reductions in system performance.

Good system design and wiring practices can minimize noise levels and the effects of noise.

Noise, because of its random nature, is typically characterized by frequency distribution. Many noise sources are broad-spectrum, that is, they produce many frequencies distributed over a wide range. Broad-spectrum noise is particularly troublesome because it cannot be removed easily by filtering, and because it can affect a variety of systems in unpredictable ways. One common source of broad-spectrum noise is a switch, which can produce voltage and current changes when an electrical circuit is connected and disconnected.

Coupling is the transfer of signals between separate circuits. Signals from one circuit become noise in another. The amount of coupling is cumulative and is a function of the proximity of the circuits, their orientation, exposed area, and length of run. Minimize coupling by the following:

- Isolating circuits from each other by using separate raceways or conduit
- Separating circuits from each other by locating them as far apart as possible
- Enclosing circuits with a grounded metallic shield such as an enclosure, metallic conduit, or cable shield
- Running conductors perpendicular, rather than parallel, to each other
- Running wires loosely and randomly rather than bundling them tightly together
- Twisting a circuit's wires together in pairs

In an industrial environment, there are typically five types of circuits with different noise emission and rejection capabilities. The five types of circuits are as follows:

- **High-Power Distribution.** Circuits to high-power loads such as large electric motors and heaters can emit transient high levels of broad-spectrum noise. Loads on high-power distribution circuits are nearly immune to noise.
- **General Purpose Power Distribution.** Circuits to medium-power loads such as lighting, offices, light-duty equipment, and small motors such as fans and pumps can emit transient, medium levels of broad-spectrum noise. Some electronic equipment, such as computers, emits constant levels of broad-spectrum noise in addition to transient broad-spectrum noise. Loads on general-purpose circuits, except for sensitive electronic equipment, are nearly immune to noise.
- **Control.** Control circuits include DC circuits and 120 VAC maximum AC circuits that operate at a low power level (less than 1 W). Typical circuits include circuits to switches, actuators, and dry-contact relays, including the generator engine-start circuit. Control circuits emit transient low levels of broad-spectrum noise and are fairly immune to noise.
- **Analog.** Analog circuits are low-voltage DC circuits that convey measurement information as relatively small changes in current or voltage. Typical circuits include those connected to the controller's analog inputs. Analog circuits create the lowest noise levels and are the most sensitive to noise.
- **Communication and Signaling.** Communication and signaling circuits are low-voltage circuits that convey information. Typical circuits include RS-232 and RS-485 serial communication lines, telephone lines, and computer network lines. These circuits create noise with frequencies related to the communication signaling rate. These circuits have some level of built-in noise immunity. Typical systems will detect or correct errors caused by noise below certain levels, but with a corresponding reduction in the data transfer rate.

When planning an installation, separate all of these types of circuits as much as possible to minimize the hazards of insulation failure, accidental miswiring, and noise coupling. For best results, install control circuits, analog circuits, and communication and signaling circuits separately. Combining circuit types is unavoidable in the controller's enclosure and some other areas.

Note: It is very important to isolate high- and medium-power circuits in raceways or conduit separate from the other types of circuits.

Parts Lists

Wireless Monitor for Hardwire Inputs, AC/DC

Kit: GM23409-KP4S		
Qty.	**Description**	**Part Number**
1	Dwg, Assy Wireless Monitor	GM23409
1	Harness, External Batt.	GM29514
1	Box, Wireless Monitor	GM29535
1	Decal, DataMessenger Wireless Mon	GM23414
1	Decal, DataMessenger	GM29547
1	Lit Kit, DC Wireless Monitor	MP-6311
2	Terminal, ring, male, 16–14 AWG	X-283-6
1	Terminal, fast-on, female, 14–16 AWG	X-431-30
1	Terminal, fast-on, female, 16–14 AWG	X-431-42

Wireless Monitor for 550 Controllers, Modbus®, AC/DC

Kit: GM23409-KP5S		
Qty.	**Description**	**Part Number**
1	Dwg, Assy Wireless Monitor	GM23409
1	Harness, External Batt. Wireless Moni	GM29514
1	Box, Wireless Monitor	GM29536
1	Decal, DataMessenger Wireless Mon	GM23414
1	Decal, DataMessenger	GM29549
1	Lit Kit, DC Wireless Monitor	MP-6311
2	Terminal, ring, male, 16–14 AWG	X-283-6
1	Terminal, fast-on, female, 14–16 AWG	X-431-30
1	Terminal,fast-on,female,16–14 AWG	X-431-42

Wireless Monitor with Customer Connection Board, AC/DC

Kit: GM23409-KP6S		
Qty.	**Description**	**Part Number**
3	Mount, controller	229353
1	Bracket, terminal block	347292
1	Connection, Assembly, Customer	GM13984
1	Harness, Wiring Dry Contact	GM16753
1	Dwg, Assy Wireless Monitor	GM23409
1	Harness, External Batt. Wireless Moni	GM29514
1	Box, Wireless Monitor	GM29535
1	Decal, DataMessenger Wireless Mon	GM23414
1	Decal, DataMessenger	GM29547
1	Lead	LK-1206-1515
1	Lit Kit, DC Wireless Monitor	MP-6311
6	Washer, lock.262 IDx.743 in.OD	X-22-12
2	Terminal, ring, male, 16–14 AWG	X-283-6
1	Terminal, fast-on, female, 14–16 AWG	X-431-30
1	Terminal,fast-on,female, 16–14 AWG	X-431-42
6	Screw, pan hd. 8-32X1	X-51-3
6	Nut, flange spiralock, 1/4-20	X-6210-2
6	Nut, flange whiz, 8-32	X-6210-4
6	Nut, hex machine screw, 8-32	X-70-12
6	Spacer, .25 OD, .5 in.	X-712-9

Notes