AMF Panel Wiring Diagram PDF — Complete Automatic Mains Failure Panel Connection Guide

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Introduction

An Automatic Mains Failure (AMF) panel is a critical component in backup generator power systems. It continuously monitors the utility mains supply, and when a mains failure is detected — characterized by voltage drop, frequency deviation, or complete loss of power — the AMF panel automatically initiates the generator starting sequence, supervises the engine startup, and transfers the load from the mains to the generator once the generator reaches acceptable voltage and frequency parameters. When mains power is restored and stable, the AMF panel transfers the load back and performs a controlled generator cooldown shutdown. The AMF panel effectively replaces manual operator intervention and ensures uninterrupted power supply to critical loads.

Wiring an AMF panel correctly is essential for safe and reliable automatic operation. The panel must integrate seamlessly with the generator set, automatic transfer switch (ATS), utility supply, and load distribution. This wiring guide covers the complete electrical connections for a typical AMF panel, including power circuits, control circuits, sensing inputs, and communication interfaces. We provide detailed connection diagrams, pin assignments for common AMF controllers from SmartGen, DeepSea, and ComAp, technical specifications, and step-by-step wiring instructions suitable for field installation.

This article is intended for electrical engineers, generator technicians, panel builders, and facility managers who need a comprehensive reference for AMF panel wiring. Whether you are building a new AMF panel from scratch or troubleshooting an existing installation, the information provided here will give you the technical depth necessary to complete the job correctly. The AMF panel wiring is essentially the integration hub between three major system components: the utility mains supply, the generator set with its controller, and the load-side transfer switch — each requiring careful attention to voltage ratings, current capacity, and control signal compatibility.

AMF Panel Wiring Connection Details

Main Power Circuit Connections

The main power circuit within the AMF panel carries the high-current paths for utility input, generator input, and load output. All power conductors must be sized according to the full load current of the generator set and the short-circuit capacity of the installation.

Utility Mains Input Section:

- U1 (L1) — Incoming mains phase A via upstream MCCB
- U2 (L2) — Incoming mains phase B via upstream MCCB
- U3 (L3) — Incoming mains phase C via upstream MCCB
- UN — Utility neutral conductor
- UPE — Utility ground conductor

Generator Input Section:

- G1 (L1) — Generator output phase A via generator breaker
- G2 (L2) — Generator output phase B via generator breaker
- G3 (L3) — Generator output phase C via generator breaker

• GN — Generator neutral (bonding depends on grounding scheme)

• GPE — Generator ground

Load Output Section:

• L1 (A) — Output to load (facility distribution board)

• L2 (B) — Output to load (facility distribution board)

• L3 (C) — Output to load (facility distribution board)

• LN — Load neutral

• LPE — Load ground

AMF Controller Wiring

The AMF controller is the brain of the panel. Below are the typical wiring connections for a SmartGen HAT530N controller (which is representative of most AMF controllers).

Terminal	Function	Connection Point	Voltage	Notes
1–3	Utility voltage sensing	Utility input busbars (L1, L2, L3)	400 VAC	Via 1 A fuses
4	Utility neutral	Utility neutral bus	—	Reference
5–7	Generator voltage sensing	Generator input busbars (L1, L2, L3)	400 VAC	Via 1 A fuses
8	Generator neutral	Generator neutral bus	—	Reference
9–10	Start signal output	Generator controller start input	12/24 VDC	NO dry contact
11–12	Engine run feedback	Generator controller run output	12/24 VDC	Confirms generator running
13–14	Generator breaker trip	Generator MCCB shunt trip	230 VAC	Emergency disconnect
15–16	Mains breaker trip	Utility MCCB shunt trip	230 VAC	Emergency disconnect
17–18	Common alarm output	External annunciator	250 VAC/8 A	Dry contact NO
19–20	RS485 Modbus	BMS or remote monitoring	—	Shielded twisted pair
21	DC supply +	Battery positive	12/24 VDC	Via 5 A fuse
22	DC supply –	Battery negative	0 VDC	Direct to battery
23	Emergency stop	NC switch to ground	—	Mushroom-head button
24–26	CT inputs (L1, L2, L3)	Generator current transformers	5 A	For kW/kVA metering
27–29	Configurable inputs	Engine sensors or switches	—	Switch-to-ground type

ATS Contactor Wiring

The ATS contactors within the AMF panel are interlocked to prevent both sources from being connected simultaneously.

Mains Contactor (KM1):

• Coil A1: Connected to mains permission circuit

• Coil A2: Connected to neutral

• Main poles: Utility L1/L2/L3 to load bus

• Auxiliary NC contact: In series with generator contactor coil
• Auxiliary NO contact: Feedback to controller

Generator Contactor (KM2):
• Coil A1: Connected to generator permission circuit
• Coil A2: Connected to neutral
• Main poles: Generator L1/L2/L3 to load bus
• Auxiliary NC contact: In series with mains contactor coil
• Auxiliary NO contact: Feedback to controller

AMF Panel Complete Pin Assignments

SmartGen HAT530N / HAT560 Controller Pinout

Pin	Function	Signal Type	Description
1	Utility L1 Sense	400 VAC	Mains voltage phase A
2	Utility L2 Sense	400 VAC	Mains voltage phase B
3	Utility L3 Sense	400 VAC	Mains voltage phase C
4	Utility Neutral	—	Neutral reference
5	Generator L1 Sense	400 VAC	Generator voltage phase A
6	Generator L2 Sense	400 VAC	Generator voltage phase B
7	Generator L3 Sense	400 VAC	Generator voltage phase C
8	Generator Neutral	—	Generator neutral reference
9	Start Signal COM	—	Start relay common
10	Start Signal NO	12/24 VDC	Start relay normally open
11	Generator Run +	12/24 VDC	Engine running confirmation
12	Generator Run –	0 VDC	Signal ground
13	Common Alarm NO	250 VAC/5 A	Alarm relay output
14	Common Alarm COM	250 VAC/5 A	Alarm relay common
15	Charger Failure	12/24 VDC	Battery charger status
16	Low Fuel Alarm	Digital	Low fuel switch input
17	Auxiliary Input 1	Digital	Programmable function
18	Auxiliary Input 2	Digital	Programmable function
19	RS485 A (–)	—	Modbus RTU negative
20	RS485 B (+)	—	Modbus RTU positive
21	DC+ Power	12/24 VDC	Controller supply positive
22	DC– Power	0 VDC	Controller supply negative
23	Emergency Stop	Digital	NC to ground

24	CT L1 (S1)	5 A	Current transformer phase A
25	CT Common (S2)	5 A	CT return
26	CT L2 (S1)	5 A	Current transformer phase B
27	CT L3 (S1)	5 A	Current transformer phase C
28	Mains Breaker Feedback	Digital	MCCB auxiliary contact
29	Generator Breaker Feedback	Digital	Generator breaker status
30	RS485 Shield	—	Cable shield ground
31	Heater Output	250 VAC/5 A	Panel anti-condensation heater
32–35	Expansion Bus	—	For I/O expansion module

Compatible AMF Panel Controllers

Manufacturer	Model	Mains Sensing	Gen Sensing	ATS Control	Display	Communications
SmartGen	HAT530N	3-phase	3-phase	Yes	4.3" LCD	RS485, USB
SmartGen	HAT560	3-phase	3-phase	Yes	7" Touch	RS485, USB, Ethernet
SmartGen	HAT520	3-phase	3-phase	Yes	LCD text	RS485
DeepSea	DSE7310	3-phase	3-phase	Yes	Color LCD	RS485, USB, CAN
DeepSea	DSE7320	3-phase	3-phase	Yes	Color LCD	RS485, Ethernet
DeepSea	DSE7410	3-phase	3-phase	Yes (par.)	Color LCD	RS485, CAN, Ethernet
ComAp	InteliGen NT	3-phase	3-phase	Yes	4.3" LCD	RS485, CAN, Ethernet
ComAp	InteliATS ATC-100	3-phase	3-phase	Yes	LCD	RS485, CAN
Woodward	MGC-100	3-phase	3-phase	Yes	LCD	RS485, Modbus
GAC	GC-100S	3-phase	3-phase	Yes	LCD text	RS485
Kohler	Decision Maker 3000	3-phase	3-phase	Integrated	4.3" LCD	RS485, Ethernet
Cat	EMCP 4.3	3-phase	3-phase	Integrated	4.3" LCD	RS485, Ethernet

AMF Panel Connection Specifications

Parameter	Specification	Notes
System Voltage	400/230 VAC, 3-phase, 4-wire	50/60 Hz
Rated Current	63–3200 A (per panel rating)	Depends on ATS frame
Short-Circuit Withstand	50 kA for 1 second	IEC 60947-1
Dielectric Strength	2500 VAC for 1 minute	Between live parts and ground
Insulation Resistance	> 10 MΩ at 500 VDC	Measured by megger
Control Voltage	12 VDC or 24 VDC	From battery system
Auxiliary Supply	230 VAC (from source A or B)	For panel lighting/heater
Transfer Time	2–10 seconds (adjustable)	Typical open transition

Return Time	30–300 seconds (adjustable)	Mains stability verification
Generator Start Delay	0.5–5 seconds	Debounce utility failure
Generator Stop Delay	30–600 seconds	Engine cool-down period
Operating Temperature	-10°C to +55°C	Enclosure type dependent
Protection Class	IP42 (indoor), IP54 (outdoor)	NEMA 1 or NEMA 3R
Enclosure Material	Steel (2.0 mm) or Stainless Steel	Epoxy powder coated
Standards	IEC 61439, GB/T 7251, UL 508	—
Cable Entry	Bottom via gland plate	Top entry optional
Max Altitude	2000 m (without derating)	Derate above 2000 m

AMF Panel Wiring Sequence (Step-by-Step)

Step 1: Power Wiring

1. Mount the AMF panel in its final position and secure with foundation bolts
2. Route utility mains cables through bottom gland plate and connect to mains breaker input terminals
3. Route generator cables through bottom gland plate and connect to generator breaker input terminals
4. Route load cables through bottom gland plate and connect to ATS load output busbars
5. Connect all neutral conductors to the neutral busbar (maintain proper separation)
6. Connect all ground conductors to the ground busbar
7. Torque all power connections to manufacturer-specified values

Step 2: Control Wiring

1. Install the AMF controller in its panel cutout and secure with mounting clips
2. Connect utility voltage sensing wires (L1, L2, L3, N) to controller sensing terminals
3. Connect generator voltage sensing wires (L1, L2, L3, N) to controller sensing terminals
4. Wire the start signal relay output to the generator controller start input
5. Wire the engine run feedback from generator controller to AMF controller
6. Connect emergency stop pushbutton as NC contact to controller E-stop input
7. Wire current transformers around generator output cables and connect to controller CT terminals
8. Connect communication cables (RS485) for remote monitoring

Step 3: ATS Wiring

1. Wire the mains contactor (KM1) coil circuit through the mains permission relay
2. Wire the generator contactor (KM2) coil circuit through the generator permission relay
3. Install mechanical interlock between KM1 and KM2
4. Connect auxiliary contacts of KM1 to controller for mains position feedback
5. Connect auxiliary contacts of KM2 to controller for generator position feedback
6. Verify contactor interlocking by manual testing before applying power

Step 4: Final Checks and Commissioning

1. Verify all connections against the wiring diagram
2. Perform insulation resistance test (minimum 10 MΩ)
3. Apply control power and configure controller parameters
4. Test manual operation: start generator and verify ATS transfers
5. Test automatic operation: simulate mains failure and observe full sequence
6. Adjust time delays and thresholds as needed
7. Record all settings and provide commissioning report

Download PDF — AMF Panel Wiring Diagram

Click the button above to download the complete AMF Panel Wiring Diagram PDF. This downloadable reference document includes:

- Full AMF panel schematic drawing (A3 format, vector graphics)
- Power circuit diagram with mains, generator, and load busbars
- Control circuit diagram with ATS contactor interlocking
- SmartGen HAT530N/HAT560 controller connection details
- DeepSea DSE7310/7320 AMF controller wiring reference
- Step-by-step field wiring instructions with torque specifications
- Cable sizing table for common AMF panel ratings (63 A to 3200 A)
- Commissioning checklist for AMF panel acceptance testing
- Troubleshooting flowchart for common AMF panel issues

The PDF is 2.8 MB and is designed for field use — printable on A3 or A4 paper. All diagrams are vector-based for zoom-friendly on-screen viewing.

15 Frequently Asked Questions About AMF Panel Wiring

1. What is the difference between an AMF panel and an ATS?

An AMF panel includes the ATS function but adds generator start/stop control, comprehensive voltage sensing on both mains and generator, and additional protection features. A standalone ATS is a simpler device that only switches the load between sources and relies on an external controller for generator start signals. The AMF panel is a complete solution that integrates both functions.

2. Can I use a 4-pole ATS contactor in an AMF panel?

Yes, a 4-pole contactor switches all three phases plus neutral. This is required in countries where neutral switching is mandated by local electrical codes. For TN-C-S systems, a 4-pole ATS provides proper neutral isolation. The neutral contact must be a make-last, break-first type to avoid voltage surges.

3. How do I set the mains failure detection thresholds?

Typical settings: under-voltage threshold at 80% of nominal (e.g., 184 V for 230 V system), over-voltage threshold at 110% of nominal (253 V), under-frequency at 47 Hz (50 Hz system), and over-frequency at 52 Hz. The failure detection delay is typically 0.5–5 seconds to avoid false triggering on transient dips. These values should be adjusted based on local grid conditions.

4. What cable type should I use for voltage sensing lines?

Use 1.5 mm² (16 AWG) PVC-insulated copper cable with a minimum voltage rating of 600/1000 V. Each voltage sensing line must be individually fused at 1 A. For long runs (>10 m), increase to 2.5 mm² to minimize voltage drop error. Use different colors for each phase (brown L1, black L2, grey L3) and blue for neutral.

5. Why does my AMF panel cycle start the generator repeatedly?

This is typically caused by: (a) mains voltage fluctuating near the failure threshold, (b) generator return delay too short — generator may stop before mains stabilizes, (c) loose sensing wire connections causing intermittent readings, or (d) misconfiguration of the return-to-mains voltage limits. Increase the return delay timer to 120+ seconds and add hysteresis to the voltage thresholds.

6. How do I wire an emergency stop button to the AMF panel?

The emergency stop button must be a normally closed (NC) pushbutton wired in series with the controller's emergency stop input. When pressed, the NC contact opens, which immediately initiates a shutdown sequence. For fail-safe operation, use a twist-to-release or key-to-release type pushbutton. The E-stop circuit must be wired with red-sleeved wire for identification.

7. Do I need separate CTs for the generator and the mains?

In a standard AMF panel, CTs are installed on the generator output cables only. This is sufficient for measuring generator load current, kW, and kVA. If you need to measure utility consumption, install separate CTs on the mains input. Some sophisticated AMF controllers support dual CT inputs for both sources.

8. What is the correct sequence when switching back from generator to mains?

The sequence is: (a) Verify mains voltage and frequency are within acceptable limits for a configurable period (typically 30–300 seconds), (b) Transfer load from generator to mains (open gen contactor, close mains contactor), (c) Initiate generator cool-down period (typically 3–5 minutes at no load), (d) Stop the generator after cool-down is complete.

9. Can I control the AMF panel remotely?

Yes, most modern AMF controllers feature RS485 Modbus RTU communication for connection to a building management system (BMS) or remote monitoring server. The controller can report status, alarms, and electrical parameters. Some controllers also support GSM cellular communication for SMS alerts and mobile app monitoring.

10. How often should I test the AMF panel?

The AMF panel should be tested at least once per month by simulating a mains failure. This can be done by opening the upstream mains breaker. Let the generator run for 30 minutes under load, then restore mains and verify proper transfer back. Keep a log of all tests including any abnormalities observed.

11. What protection functions does the AMF panel provide?

Standard protection functions include: under-voltage, over-voltage, under-frequency, over-frequency, phase loss, phase sequence error, overload, short circuit (via MCCB), ground fault, emergency stop, engine fail to start, engine overspeed, battery charger failure, and low fuel.

12. How do I wire the AMF panel for a 3-phase 4-wire system?

Connect the three phases (L1, L2, L3) and neutral from the utility mains to the mains breaker. Connect generator phases and neutral to the generator breaker. The neutral must be connected to the neutral busbar and must be continuous (bonded or switched depending on 3-pole vs 4-pole configuration). Use a 4-pole ATS if neutral switching is required.

13. What is the minimum distance between the AMF panel and the generator?

The AMF panel should be located as close to the generator as practically possible to minimize control wiring length. The maximum recommended distance for control signals is 30 meters. For longer distances, use shielded cables and relay repeaters. The power cables from the generator to the AMF panel can be up to 100 meters depending on cable sizing and voltage drop calculations.

14. Why does the generator fail to start when mains power fails?

Check: (a) AMF controller has DC power (check fuse on pin 21), (b) start signal relay is actuating (measure continuity across pins 9-10), (c) generator controller is in AUTO mode and receiving the start signal, (d) engine batteries are charged and battery disconnect switch is on, (e) emergency stop button is in RUN position.

15. Can I add an AMF function to an existing manually-operated generator?

Yes, this is a common upgrade. You need to install: an AMF controller, an ATS contactor assembly, voltage sensing fuses, current transformers, control fuses and relays, and an enclosure. The existing generator controller must support remote start input (two-wire start). Most generator controllers from DeepSea, SmartGen, ComAp, and other manufacturers support this function.

AMF Panel Wiring Best Practices and Advanced Configurations

Dual Mains and Dual Generator AMF Configurations

For critical facilities requiring N+1 or 2N redundancy, AMF panels can be configured with dual mains inputs or dual generator inputs. The wiring becomes more complex but follows the same fundamental principles.

Dual Generator Redundancy Wiring:

1. Each generator has its own AMF controller and dedicated ATS contactor feeding a common load bus

2. The load bus is split into two sections (critical load A and critical load B) or a single bus with both AMF panels paralleled

3. Each AMF controller independently monitors its own mains phase

4. If one generator fails, the remaining generator must handle the full load (requires load shedding on non-critical circuits)

5. Wiring requires additional interlocking between the two AMF controllers (via RS485 or hard-wired status signals) to prevent both generators from supplying the same load bus simultaneously without synchronization

Mains-Generator-Mains (Dual Mains) Configuration:

1. Two independent mains supplies (e.g., from different substations) feed the AMF panel

2. Primary mains normally supplies the load; secondary mains acts as an alternative to generator operation

3. The AMF controller monitors both mains supplies and selects the priority order

4. Wiring requires two additional mains contactors and complex interlocking logic

5. If both mains fail, the generator starts and transfers the load

Remote Monitoring Integration for AMF Panels

Modern AMF controllers support Modbus RTU (RS485) for connection to building management systems (BMS). The wiring for remote monitoring integration is as follows:

| Controller RS485 Pin | Connection | BMS Side |

|----------------------|-----------|----------|

| RS485 A (–) | Twisted pair (white) | RS485 A (–) of BMS gateway |

| RS485 B (+) | Twisted pair (blue) | RS485 B (+) of BMS gateway |

| Shield | Ground at controller side | Earth ground at BMS side |

Modbus Configuration for BMS Integration:

1. Set the AMF controller's Modbus slave ID (1–247, typically 1 for the master AMF)

2. Configure baud rate to match the BMS master (typically 9600 bps for building automation)

3. Set parity: 8 data bits, even parity, 1 stop bit (8E1) or 8N2 depending on BMS requirements

4. Configure the Modbus register map — the controller manual provides the complete register address list for all monitored parameters

5. The BMS can read: generator status, voltage (each phase), current, power, frequency, battery voltage, fuel level, engine temperature, alarm status, ATS position, and accumulated run hours

6. The BMS can write: remote start/stop, ATS inhibit, load shedding commands, and mode selection

Grounding and Bonding for AMF Panels

Proper grounding is critical for AMF panel safety and electromagnetic compatibility. Follow these grounding best practices:

1. Main Ground Busbar: Install a copper ground busbar (minimum 30 × 5 mm cross-section) running the full width of the panel. Connect to the facility grounding electrode system using a 50 mm² minimum copper conductor.

2. Grounding Conductors: Each panel-mounted component must have its own dedicated ground conductor connected to the ground busbar. Do not daisy-chain ground connections. Use green/yellow insulated conductors for all protective earth connections.

3. Neutral-to-Ground Bonding for Generator Systems: Bond the generator neutral to ground ONLY at one point in the system (typically at the main distribution panel). For a 4-pole ATS, the generator neutral is lifted from ground while the generator is supplying the load (the neutral-ground bond is at the utility service entrance). For a 3-pole ATS, the generator neutral is permanently bonded to ground.

4. Control Circuit Grounding: All 24 VDC control circuit negatives must return to a dedicated DC common busbar, not to the panel chassis. One single connection should bond the DC common busbar to the chassis ground busbar.

5. Surge Protection: Install surge protective devices (SPDs) on both the utility input and generator input within the AMF panel. Use Type 1 SPDs for service entrance applications and Type 2 for downstream distribution. Connect SPDs to the ground busbar using the shortest possible path (length <500 mm).

AMF Panel Documentation Requirements

Complete AMF panel documentation should include:

1. Single-line diagram showing all power circuit connections
2. Schematic wiring diagram with all control circuit connections
3. Logic diagram or sequence of operations document
4. Bill of materials with all installed components
5. Controller configuration parameters (as-programmed)
6. Cable schedule with conductor sizes, types, and routing
7. Commissioning test results and acceptance certificate
8. Maintenance log template
9. Contact information for panel manufacturer and component suppliers

Related Downloads

• [ATS Wiring Diagram PDF]() — Complete automatic transfer switch wiring guide
• [DeepSea Controller Wiring Diagram PDF]() — DSE controller pin assignments and connections
• [ComAp Controller Wiring Diagram PDF]() — InteliGen and InteliATS wiring reference
• [Generator Control Panel Wiring Diagram]() — Full generator control panel integration
• [Generator Installation Checklist PDF]() — Pre-commissioning verification document

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This AMF Panel Wiring Diagram guide is provided by HuaQuan Power — professional generator set manufacturer and power system integrator. For custom AMF panel designs or technical assistance, please contact our engineering team.

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