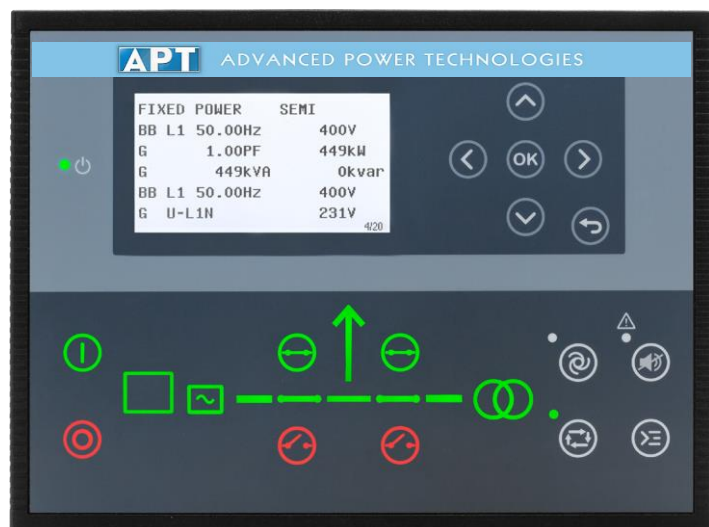


Advanced Generator Set Control ACM 5150

Control System Module



Main features

Automatic Generator Set Control

- Automatic synchronizing control.
- Automatic Load Sharing and Load Demand control of multiple generator sets.
- Monitoring of all electrical parameters of generators and bus.
- Comprehensive generator electrical protection.
- Automatic control of generator active and reactive power when operating in parallel with the utility grid.
- Optional Engine Start/Stop cranking control when not provided by the generator set local control panel.
- Optional Electronically Controlled Engine interface via CAN J1939 connection.
- Optional Engine speed, oil pressure and coolant temperature monitoring, when required and not provided by engine local control panel.

Open Architecture interface

Equipped with Ethernet and RS-485 ports with industry standard Modbus TCP/IP and Modbus RTU interface for easy interface with customer's plant SCADA and DCS control systems.

Advanced design - Easy to mount

Adaptive mimic, with easy switching between applications. Compact package makes it suitable for most applications.

Guided experience

Only buttons relevant for a function are visible to the user.

User levels in settings

Configurable user levels with a password for each level: Configure appropriate parameters for a user level, and only the parameters relevant for the user are displayed.

Shortcut menu

Configurable shortcuts give the user easy access to frequently used functions.

PLC functions

Programmable project specific logic.

Alarm and Event logging

View historical alarms and events on the display (up to 500 alarms and 500 events).

Graphical Display

View important genset and/or system information on the easy-to-read graphical display, shown as text, symbols, numbers, and even a graphical synchroscope.

Built-in analog Generator AVR and Engine Governor control

Isolated DC Voltage and PWM outputs to control Generator Voltage and Frequency.

General description

The ACM 5150 is an easy-to-use control unit containing all necessary functions for protection and control of a genset.

It can be used as a single unit for one genset, or it can be connected in a complete power management system with up to 32 controllers for automatic paralleling of multiple generators to the generator bus or the utility grid. Integrated power management system controls the load sharing between gensets and the load-dependent start and stop.

ACM 5150 contains all necessary 3-phase sensing circuits, and all values and alarms are presented on the sun proof LCD display.

Applications

The ACM 5150 is an integrated control module designed for the following applications:

Mode of operation	Description/Application
Isolated Operation Of Multiple Generators	Automatic synchronizing and control of generators operating isolated from utility grid for Prime Power or Emergency Standby use.
Automatic Load Transfer	Critical power/emergency standby generators, black start generators.
Base Load	Generators are automatically soft loaded to an adjustable kW and kVAR/PF setpoints.
Peak shaving	Applications where generators supply peak load demand while paralleled to the grid.
Bumpless (Soft) Load Transfer	Applications where load is soft transferred from the utility to generators and/or from generators to utility in a controlled manner without an outage.
Import/Export	Automatic control of the amount of power imported from or exported to the utility grid

Functions and features

Key functions and features

- Engine start/stop control
- Engine and generator protection
- Communication with engine ECM via CANbus
- Control of engine starting motor magnetic switch and fuel solenoid control when used with electro-mechanical controlled engines
- Diesel and gas genset support
- 3-phase generator and bus sensing
- Phase compensation for D/Y transformers
- Four current sensing inputs
- Integrated governor and AVR control outputs
- State-of-the-art synchronizing and load sharing
- Integrated synchroscope and sync check
- Digital voltage regulation support for different DVR
- Voltage and frequency matching
- Support of multiple synchronizing methods to suite various applications.
- 12 digital outputs (configurable)
- 12 digital inputs (configurable)
- Two analog outputs (-10 to 10 V)
- Four configurable inputs:
 - Resistor, 0 to 4000 Ω
 - Voltage, 0 to 10 V
 - Current, 4 to 20 mA
 - Digital input
- Dead bus sensing
- Multifunction generator protection
- Optional Engine protection when required or not included in the engine local control panel
- Automatic standby operation for single generator set (ATS)
- Analog load sharing with external module
- 128 genset support via digital load sharing (CAN bus)
- ROCOF and Vector shift protection
- Optional fuel usage monitoring
- Optional maintenance alarms

System Control

- A power management system can include up to 40 controllers
(32 genset or utility circuit breakers and 8 bus tie circuit breakers). Larger number of controllers can be used with APT Master Control.
- Analog Load Sharing support for compatibility with legacy paralleling control systems
- Droop mode support

Easy view

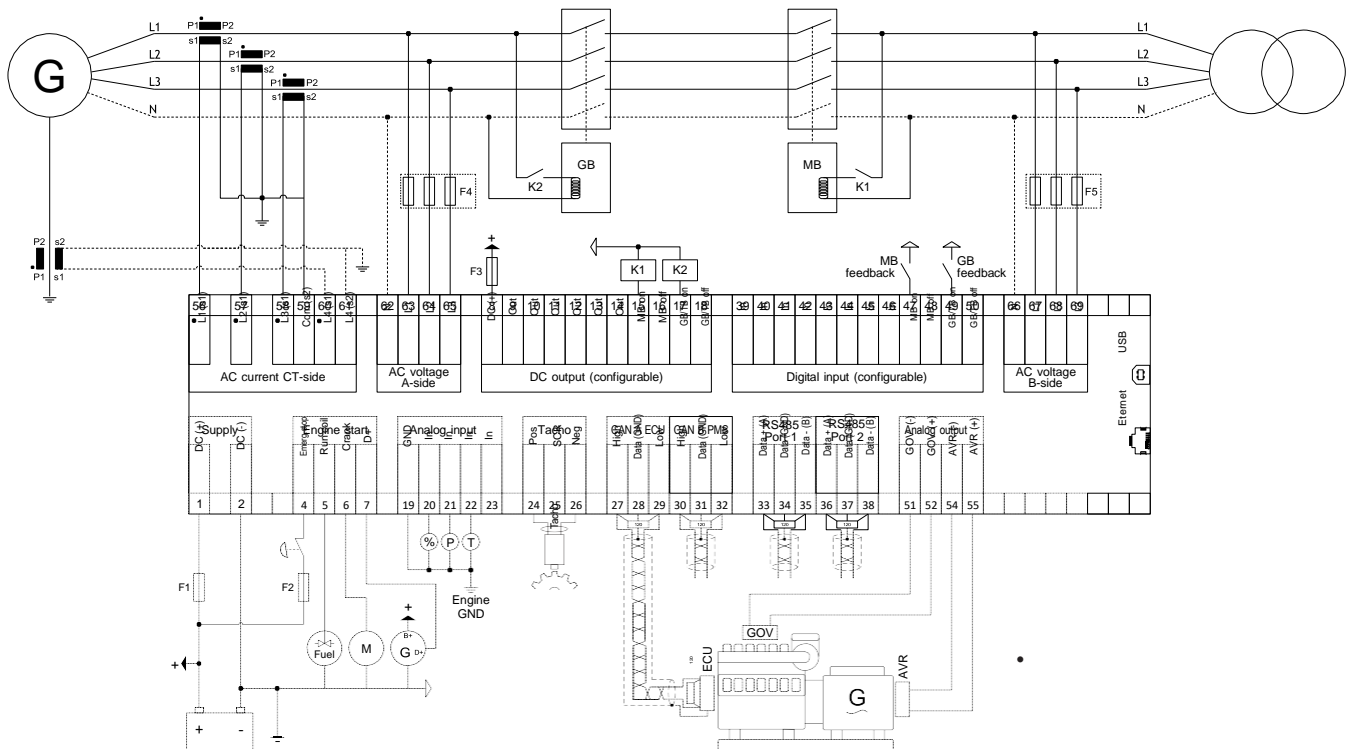
- Display of Generator electrical metering parameters
- Optional display of Engine parameters
- Generator set alarms in clear text on the display
- Graphical display:
 - LCD, back-lit
 - High resolution, 240 x 120 pixels
 - Six lines
 - Operating temperature from -40 to +70 °C (-40 to +158 °F)
- Five-key navigation menu
- Event log with 500 entries (can be exported to a CSV file)
- Alarm log with 500 entries (can be exported to a CSV file)

Highly configurable

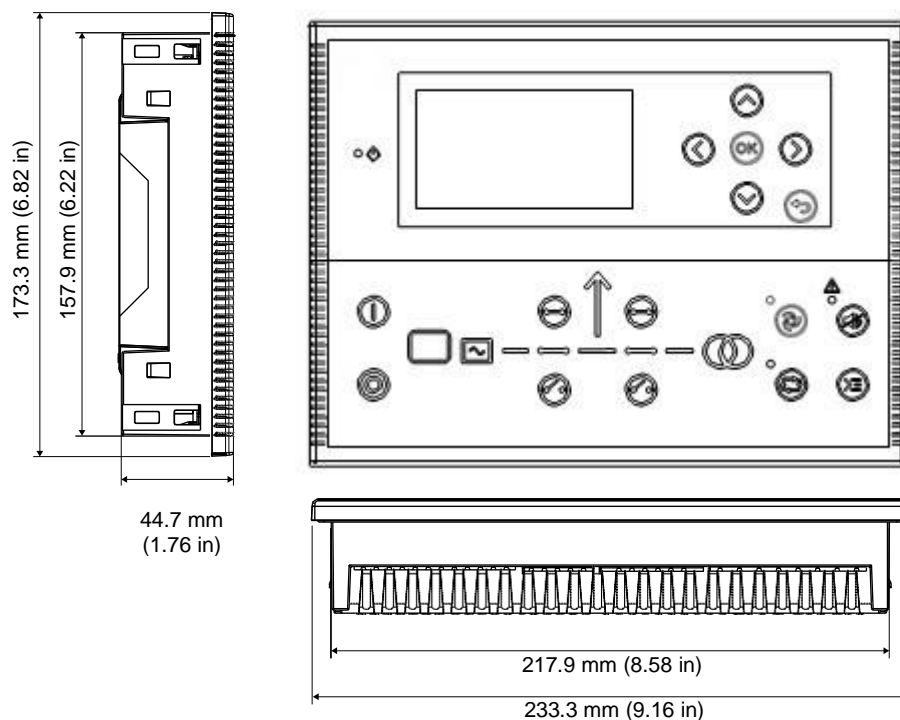
- Controller configuration from the front panel (PIN code protected)
- 20 configurable views
- Four fully configurable PID controllers
- CAN flags between controllers
- CANbus based extension module for Inputs/Outputs
- Real time clock
- User configurable logic (lite PLC)
- Ethernet communication for PLC, SCADA or BMS
- Multi-language support (incl. Chinese, Russian and other languages)

Wiring and Dimensions

Typical wiring



Dimensions



Technical Specifications

Power supply

- Nominal voltage: 12/24 V DC
- Operating range: 6.5 to 35 V DC
- Load dump protection (ISO16750-2)
- Measuring range: 0 to 50 V DC (35 V DC continuously)

Operating conditions

- Operating temperature: -40 to +70 °C (-40 to +158 °F)
- Storage temperature: -40 to +85 °C (-40 to +185 °F)

Environment

- Altitude: 0 to 4000 m
- Humidity: 20/55 °C at 95 % RH
- Protection degree: IP65 in panel, IP20 on terminals
- Pollution degree 2
- Self-extinguishing plastic

Measuring

- Voltage range: 100 to 690 V, phase-to-phase
- Max. measured voltage: 10 to 135 % of nominal
- Voltage accuracy: ± 1 % of nominal
- Current range: 1 A and 5 A, 2 to 300 %
- Max. measured current: 3/15 A overload
- Current accuracy: ± 1 % of nominal
- Frequency range: 3.5 to 75 Hz
- Power accuracy: ± 1 % of nominal

Inputs/Outputs

- Digital inputs: 12 (max. +50 V, min. -24 V)
- Digital outputs: 2 (15 A inrush / 3 A continuously)
10 (2 A inrush / 0.5 A continuously)
- Digital common: 12/24 V DC
- Analog inputs: 4
- Analog outputs: 2
- CANbus 1 and 2
- RS-485 1 and 2
- RJ-45 Ethernet
- USB (service-port)

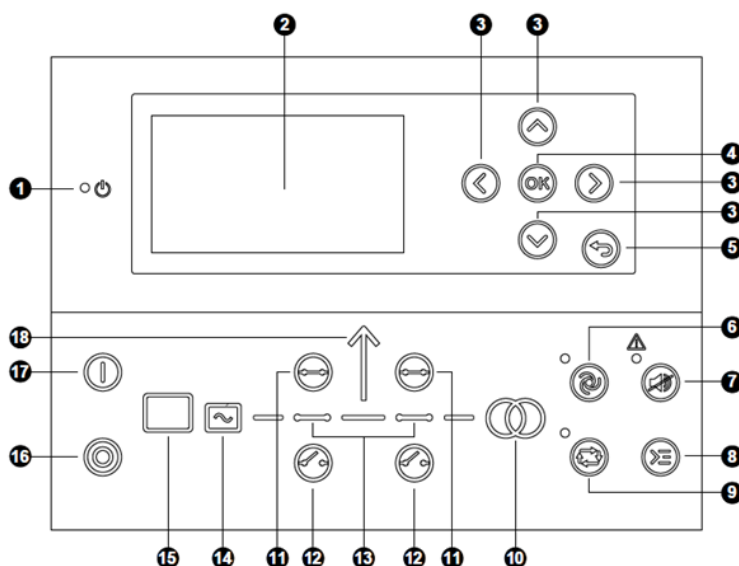
Compliance

- cULus Listed to UL508 Industrial control equipment
- cULus recognized to UL6200 controls for stationary engine gensets
- CE

Protections

2 x Reverse power	ANSI 32R
2 x Short circuit (limited functionality)	ANSI 50P
4 x Over-current	ANSI 51
1 x Voltage-dependent over-current	ANSI 51V
2 x Over-voltage	ANSI 59P
3 x Under-voltage	ANSI 27P
3 x Over-frequency	ANSI 81O
3 x Under-frequency	ANSI 81U
1 x Unbalanced voltage	ANSI 47
1 x Unbalanced current	ANSI 46
1 x Under-excitation or var import	ANSI 32RV
1 x Over-excitation or var export	ANSI 32FV
5 x Overload	ANSI 32F
1 x Ground current	ANSI 51G
1 x Neutral current	ANSI 51N
3 x Bus/Utility over-voltage	ANSI 59P
4 x Bus/Utility under-voltage	ANSI 27P
3 x Bus/Utility over-frequency	ANSI 81O
3 x Bus/Utility under-frequency	ANSI 81U
1 x Emergency stop	ANSI 1
2 x Overspeed	ANSI 12
1 x Low auxiliary supply	ANSI 27DC
1 x High auxiliary supply	ANSI 59DC
1 x Generator breaker external trip	ANSI 5
1 x Tie/mains breaker external trip	ANSI 5
Sync failure alarms	ANSI 25
Breaker open failure	ANSI 52BF
Breaker close failure	ANSI 52BF
Breaker position failure	ANSI 52BF
1 x Close before excitation failure	ANSI 48
1 x Phase sequence error	ANSI 47
1 x De-load error	ANSI 34
1 x Crank failure	ANSI 48
1 x Running feedback error	ANSI 34
1 x MPU wire break	
1 x Start failure	ANSI 48
1 x Hz/V failure	ANSI 53
1 x Stop failure	ANSI 48
1 x Stop coil, wire break alarm	ANSI 5
1 x Engine heater	ANSI 26
2 x Max. ventilation/radiator fan	
1 x Not in Auto	ANSI 34
1 x Fuel fill check	
1 x Vector shift	ANSI 78
1 x df/dt (ROCOF)	ANSI 81R
2 x Under-voltage and reactive power, U and Q	
1 x Positive sequence (mains) voltage low	ANSI 27
2 x Directional over-current	ANSI 67
1 x Negative sequence voltage high	ANSI 47
1 x Negative sequence current high	ANSI 46
1 x Zero sequence voltage high	ANSI 59G
1 x Zero sequence current high	ANSI 50G
1 x Reactive Power-based loss of excitation	ANSI 40
1 x IEEE/IEC inverse time over-current	ANSI 51

Control Front Panel Overview




No.	Name	Function
1	Power ON	Green: The controller power is ON. OFF: The controller power is OFF.
2	Display screen	Resolution: 240 x 128 px. Viewing area: 88.50 x 51.40 mm. Six lines, each with 25 characters.
3	Navigation	Move the selector up, down, left, and right on the screen.
4	OK	Enter the Menu system. Confirm the selection on the screen.
5	Back	Go to the previous page.
6	AUTO mode	The controller automatically starts and stops gensets according to the system settings. No operator actions are needed.
7	Silence horn	Turns off an alarm horn (if configured) and enters the Alarm menu.
8	Shortcut menu	Gives access to: Jump menu, Mode selection, Test, Lamp test, Hybrid (PV semi start and stop).
9	MANUAL Init	The controller cannot automatically start, stop, connect, or disconnect the genset. The operator can start, stop, connect, or disconnect the genset. The controller automatically synchronizes before closing a breaker, and automatically unloads before opening a breaker.
10*	Utility symbol	Red: Utility voltage and frequency are OK. The controller can synchronize close the breaker. Green: Utility failure.
11	Close breaker	Press to close the breaker.
12	Open breaker	Press to open the breaker.
13	Breaker symbol	Red: Breaker is Closed. Red flashing: Synchronizing or unloading. Green: Breaker Open.
14	Generator	Red: Generator voltage and frequency are OK. The controller can synchronize and close the breaker. Red flashing: The generator voltage and frequency are OK, but the V&Hz OK timer is still running. The controller cannot close the breaker. Green: The generator voltage is too low to measure.
15	Engine	Red: There is running feedback. Green flashing: The engine is getting ready. Green: The engine is not running, or there is no running feedback.
16	Stop	Stops the genset if MANUAL Init is selected.
17	Start	Starts the genset if MANUAL Init is selected.
18*	Load symbol	OFF: Power management application. Red: The supply voltage and frequency are OK. Green: Supply voltage/frequency failure.

*Not present in all applications






Typical Sequence of Operation

Full Automatic Mode

1. Press the AUTOMATIC button 
2. The controller will respond to a utility outage by initiating a generator set start, and automatically close the generator circuit breaker when the generator reaches proper voltage and frequency. In multiple generator applications generators will automatically synchronize to the generator bus.
3. The utility breaker will open, and generator bus tie breakers will close in a coordinated fashion to apply generator power to the site load.
4. Upon return of the utility source the generator(s) will synchronize to the utility and the utility breaker will close.
5. The generator will be unloaded, the generator circuit breaker will open, and the engine will cooldown/shutdown.
6. Tie circuit breakers will return to their normal position.

MANUAL Initiated Mode

This mode allows for manually initiation of automatic sequences, including engine start/stop, automatic generator synchronizing and breaker closing and generator unloading and breaker opening. This mode is used for testing and operational purposes. Genset synchronizing to the bus is automatic and breaker operations are supervised by the controller once initiated by the operator. Automatic loading controls operate as appropriate for the system status.

1. Press the MANUAL Init button 
2. To start the engine, press the Start button 
Once the engine is started and reaches voltage and frequency the generator circuit breaker closing can be manually initiated by the operator.
3. Press the Close Gen Breaker button 
The generator circuit breaker will close to a dead generator bus or the genset will synchronize to a live bus and the breaker will close when synchronized. The genset will enter the appropriate mode of operation (island, load sharing, or base load).
4. To open the generator circuit breaker, press the Open Gen Breaker button 
The generator circuit breaker will open (The generator will be soft unloaded first, if possible, based on the mode of operation.)
5. To stop the engine, press the Stop button 
The engine will cooldown and shutdown. If the generator circuit breaker is closed when the Stop button is pressed the controller will first unload the generator and open the circuit breaker before stopping the engine.