



INTELLIGENT ELECTRICAL CONTRACTING SYSTEM

Integrated Power Distribution, Emergency Supply, Metering and EMS/BMS
Supervision

SYSTEM CONCEPT & EQUIPMENT SCHEDULE

Prepared by Scorpions Services

Purpose of this document

A complete, project-ready concept for electrical contracting and intelligent supervision. Final ratings, quantities, fault levels, discrimination, cable sizes and statutory requirements shall be confirmed from the approved project design and site conditions.

Design • Supply • Installation • Testing • Commissioning • Handover • Maintenance

Executive Overview

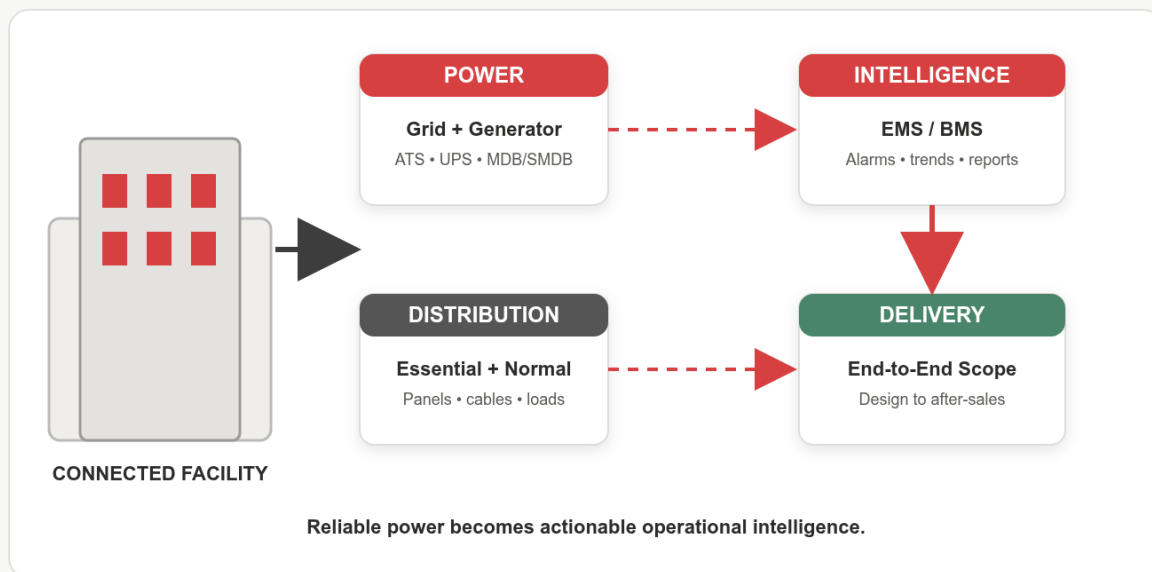


Illustrative intelligent-building and facility-operations environment.

INTELLIGENT ELECTRICAL SYSTEM

A coordinated power, resilience, metering and smart-building solution

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Integrated power, distribution, intelligence and delivery concept.

Scorpions Services proposes an end-to-end electrical contracting system that combines reliable normal power, resilient emergency power, safe distribution, granular metering and centralized operational intelligence. The architecture links the utility supply, MV intake, transformers, MDBs, SMDBs, ESMDB/EMDB panels, final DBs, generators, ATS/AMF, UPS systems, KWH/power-quality meters, MCC/VFD panels, renewable sources and major loads into one coordinated installation.

The EMS/BMS layer provides real-time visibility, alarms, trends, demand analysis and reporting while certified electrical protection remains local to the switchgear and equipment. This separation preserves electrical safety and allows approved supervisory commands only through documented interlocks.

Scorpions Services value proposition

Practical engineering, intelligent integration and complete project delivery—from concept and shop drawings through installation, programming, commissioning, training and after-sales support.

Key outcomes

- Safe and selective electrical distribution from source to final circuit.
- Automatic restoration of essential services following utility failure.
- No-break continuity for designated critical loads through UPS systems.
- Metered consumption by source, building, floor, tenant, department, plant or major load.
- Fast fault response using alarm, event and breaker/source-status visualization.
- Peak-demand, power-factor, load-profile, cost and sustainability reporting.
- Scalable architecture for future panels, meters, generation and renewable energy.

Design principles

Principle	Application
Safety first	Protection, earthing, segregation, arc-risk controls, interlocks and local emergency operation.
Resilience	Utility/generator transfer, essential distribution, UPS autonomy and optional redundancy.
Selective operation	Coordinated protection and load priorities to limit the impact of a fault.
Open integration	Modbus, BACnet, SNMP, hardwired contacts and vendor gateways where approved.
Maintainability	Clear labeling, spare capacity, accessible panels, test points and complete as-builts.
Energy intelligence	Meters, trends, demand KPIs, alarms and scheduled reports.

System Intelligence Architecture

Architecture description. The intelligent electrical architecture coordinates normal, emergency, essential and no-break power from the utility intake through MV switchgear, transformers, MDBs, SMDBs, ESMDB/EMDB panels, final DBs and connected loads. Generators, ATS/AMF systems and UPS equipment maintain continuity for approved critical services, while KWH and power-quality meters provide detailed visibility at source, main-bus, sub-distribution and major-load levels. Approved gateways connect equipment data to the EMS/BMS for centralized dashboards, alarms, event history, trends, demand analysis and scheduled reporting. Electrical protection, safety interlocks and certified equipment controls remain local and autonomous.

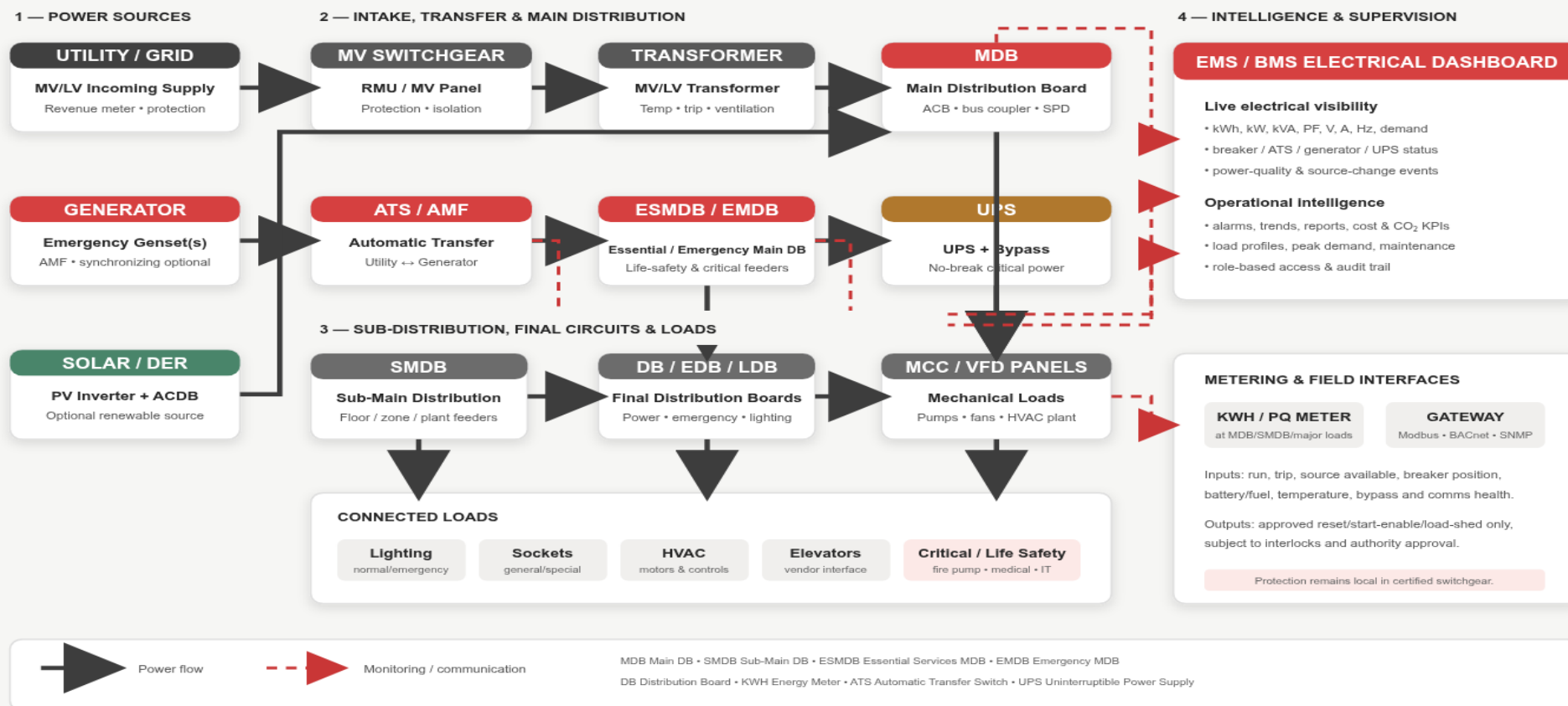


Illustrative intelligent electrical operations environment linking switchgear, metering and EMS/BMS supervision.

INTELLIGENT ELECTRICAL CONTRACTING SYSTEM

Power distribution • emergency resilience • metering • EMS/BMS intelligence

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Conceptual architecture—not a construction single-line diagram. Final topology, ratings, redundancy and protection shall follow approved engineering calculations and authority requirements.

Electrical Equipment & Connected Systems



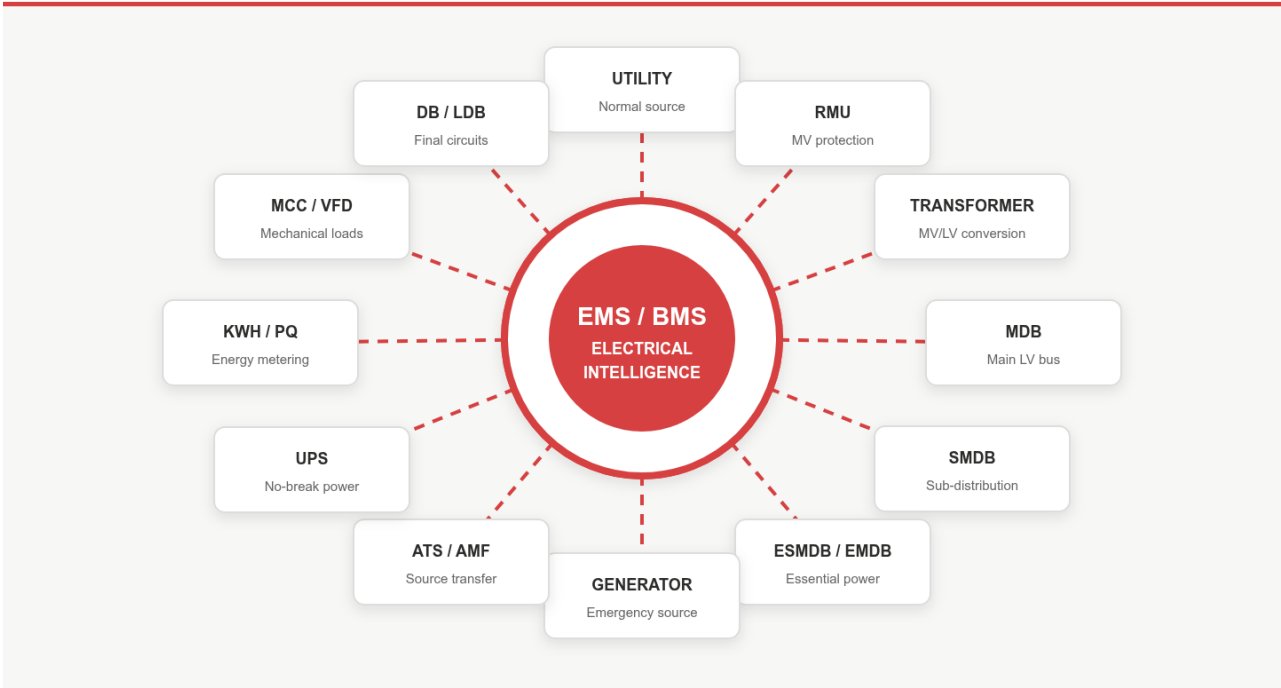
Illustrative integrated electrical equipment room with intelligent metering.

ELECTRICAL EQUIPMENT ECOSYSTEM

All major assets connected through power paths and approved monitoring interfaces

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Electrical equipment ecosystem and intelligent monitoring interfaces.

Equipment	Electrical function	Typical intelligent points
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Equipment	Electrical function	Typical intelligent points
Utility / Grid Incomer	Normal source; revenue metering; service protection; incoming breaker.	Availability, V/A/Hz/kW/kWh/PF, demand, power quality, breaker status.
RMU / MV Switchgear	MV isolation, switching and protection upstream of transformers.	Breaker/isolator position, relay trip, earth fault, SF6/health where available.
MV/LV Transformer	Steps MV down to LV; dry/oil type per design.	Winding/core temperature, fan status, trip/alarm, load and ventilation.
MDB	Main LV distribution board; incomers, bus sections, coupler and major feeders.	ACB status/trip, V/A/kW/kWh/PF/Hz, demand, bus temperature optional.
SMDB	Sub-main distribution by floor, zone, tenant or plant.	MCCB status where motorized/auxiliary; energy and demand by feeder.
ESMDB	Essential Services Main Distribution Board for priority and life-safety services.	Source, breaker, load, energy, alarms, load-shed state and transfer history.
EMDB / Emergency MDB	Emergency distribution supplied through ATS/generator arrangement.	Source and breaker status, electrical values, outage and restoration events.
DB / PDB	Final power distribution board for sockets and small power.	Optional incomer energy meter, breaker trip summary and SPD status.
LDB / ELDB	Normal and emergency lighting final distribution.	Energy, schedule/contactors state and emergency supply status.
MCC / VFD Panel	Motors for pumps, fans and HVAC/mechanical plant.	Run, trip, local/remote, speed, current, runtime, bypass and fault code.
Generator Set	Standby or prime emergency source with local controller.	Available/run/fault, V/A/Hz/kW/kWh/PF, fuel, battery, coolant, oil, runtime.
ATS / AMF	Automatic source selection and transfer between normal and emergency supplies.	Source healthy, switch position, auto/manual, transfer failure and event log.
Synchronizing Panel	Optional multi-generator or utility parallel operation.	Generator availability, synchronization, load share, breaker and alarm status.
UPS + Bypass	No-break supply for IT, controls, medical or other critical loads.	Input/output/bypass, battery, load %, autonomy, alarms and temperature.
KWH / Multifunction Meter	Sub-metering and power-quality measurement.	kWh, kvarh, kW, kVA, PF, V, A, Hz, demand, harmonics where supported.
Capacitor Bank / APFC	Automatic power-factor correction.	PF, stage status, kvar, controller alarm, capacitor temperature optional.
Active Harmonic Filter	Optional harmonic mitigation for nonlinear loads.	THD, compensation current, loading and alarms.
Solar PV Inverter + ACDB	Optional distributed generation connected under approved protection scheme.	Generation kWh/kW, inverter status, alarms, grid condition and availability.

Equipment	Electrical function	Typical intelligent points
Earthing & Lightning Protection	Protective, functional and lightning earthing; bonding and surge protection.	SPD remote alarm; optional earth-leakage/insulation monitoring.
EMS/BMS Server & Gateway	Central dashboard, history, alarming, analytics and reporting.	Modbus TCP/RTU, BACnet/IP, SNMP, API or hardwired I/O interfaces.

Distribution Hierarchy & Naming

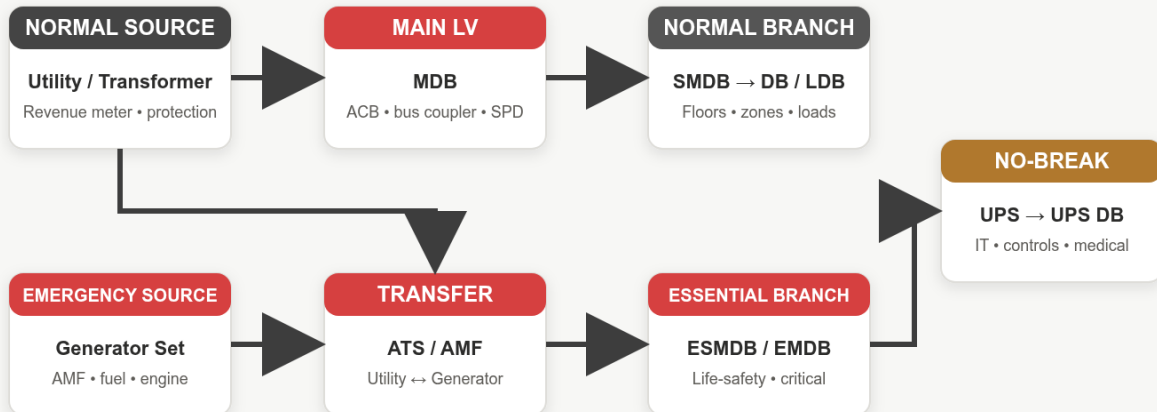


Illustrative modern LV distribution switchgear installation.

DISTRIBUTION HIERARCHY

Normal, emergency, essential and no-break power paths

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Selective protection • source segregation • essential-load priority • future expansion

Normal, emergency, essential and no-break distribution hierarchy.

Abbreviation	Meaning	Typical position / purpose
MDB	Main Distribution Board	Primary LV board downstream of transformer or LV source.
SMDB	Sub-Main Distribution Board	Distributes power to floors, zones, departments or plant groups.
ESMDB	Essential Services Main Distribution Board	Feeds essential services intended to remain or become available during an outage.
EMDB	Emergency Main Distribution Board	Main emergency board supplied from emergency source/ATS.
DB / PDB	Distribution Board / Power DB	Final circuits for small power and dedicated equipment.
LDB / ELDB	Lighting DB / Emergency Lighting DB	Normal and emergency lighting circuits.
MCC	Motor Control Center	Starters, protection and controls for motors.
ATS / AMF	Automatic Transfer Switch / Auto Mains Failure	Detects normal-source failure and performs approved transfer sequence.
KWH / PQ	Energy / Power-Quality Meter	Measures consumption and electrical characteristics.
UPS	Uninterruptible Power Supply	Maintains no-break supply to selected critical loads.

Terminology note

“EMBD” is commonly intended to mean EMDB (Emergency Main Distribution Board). Final panel abbreviations should match the consultant’s approved legend and project specifications.

Typical source-to-load paths

- Normal power: Utility → RMU/MV switchgear → Transformer → MDB → SMDB → DB → final loads.
- Emergency power: Generator → generator breaker/control → ATS/AMF → EMDB/ESMDB → emergency/essential SMDB/DB → priority loads.
- No-break power: EMDB/ESMDB → UPS input/bypass → UPS DB → critical IT, controls, medical or security loads.
- Renewable power (optional): PV array/inverter → ACDB/protection → approved MDB connection point → building loads/grid interface.
- Intelligence: KWH/PQ meters, protection relays and equipment controllers → gateway/network → EMS/BMS server → dashboards, alarms and reports.

Operating Philosophy

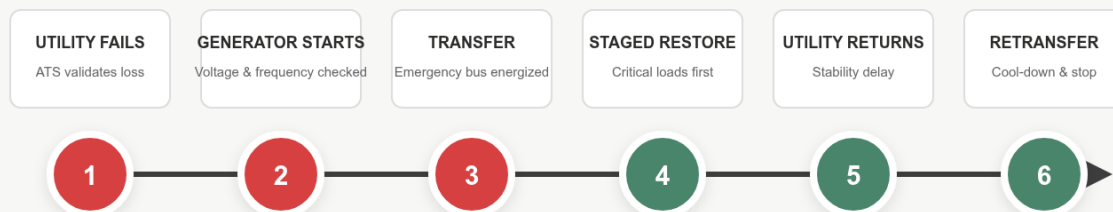


Illustrative generator, ATS and emergency-power plant arrangement.

EMERGENCY OPERATING SEQUENCE

Automatic restoration with engineered delays, interlocks and load priorities

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All events are time-stamped in the EMS/BMS.

Primary protection and transfer interlocks remain local in certified equipment.

Typical emergency source-transfer and restoration sequence.

Normal operation

- Utility supply feeds the transformer and MDB; normal and essential buses operate from the normal source.
- Meters record source, main bus, sub-main and major-load consumption.

- EMS/BMS trends demand, power factor, voltage/current balance, frequency, energy and configured power-quality indicators.
- Operators receive alarm notification for abnormal voltage, overload, breaker trip, communication loss or meter threshold breach.

Utility failure and emergency restoration

- ATS/AMF confirms normal-source failure after the engineered time delay.
- Generator receives an automatic start request; its controller validates speed, voltage and frequency.
- ATS transfers the essential/emergency bus only after the emergency source is healthy and all interlocks are satisfied.
- Priority loads are restored in engineered steps to limit generator inrush and preserve capacity.
- Noncritical feeders may remain disconnected or be shed according to the approved load-priority schedule.
- On utility return, ATS confirms source stability, retransfers after delay, and allows generator cool-down before stopping.
- Every source change, failed start, transfer failure and breaker event is time-stamped in the EMS/BMS where interfaces are available.

UPS operation

- UPS supports designated no-break loads during transfer and short interruptions.
- Static/manual bypass arrangements permit maintenance subject to approved procedures.
- Battery autonomy is calculated from real critical load, growth allowance, battery technology, temperature and end-of-life capacity.
- Low autonomy, battery fault, overload, bypass and general alarm points are supervised centrally.

Control boundary

The EMS/BMS is supervisory. Short-circuit, earth-fault, overload, differential, reverse-power, under/over-voltage and other primary protections must remain in certified relays, breakers and equipment controllers. Remote commands require approved cause-and-effect logic, access rights and hardwired/software interlocks.

Energy Metering & Intelligence



Illustrative EMS/BMS energy-management control room.

ENERGY METERING & ANALYTICS

Turning KWH and power-quality data into cost, demand and sustainability intelligence

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LIVE ENERGY DASHBOARD

CURRENT DEMAND

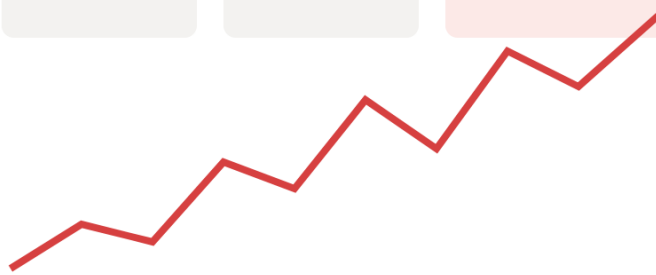
742 kW

POWER FACTOR

0.97

TODAY'S ENERGY

8.4 MWh



24-hour load profile and peak-demand visibility

METERING LEVEL 1

Source & Main Bus

Utility • generator • MDB

METERING LEVEL 2

Sub-Distribution

SMDB • floor • department

METERING LEVEL 3

Major Loads

HVAC • lifts • IT • tenants

Multi-level metering and energy-performance dashboard concept.

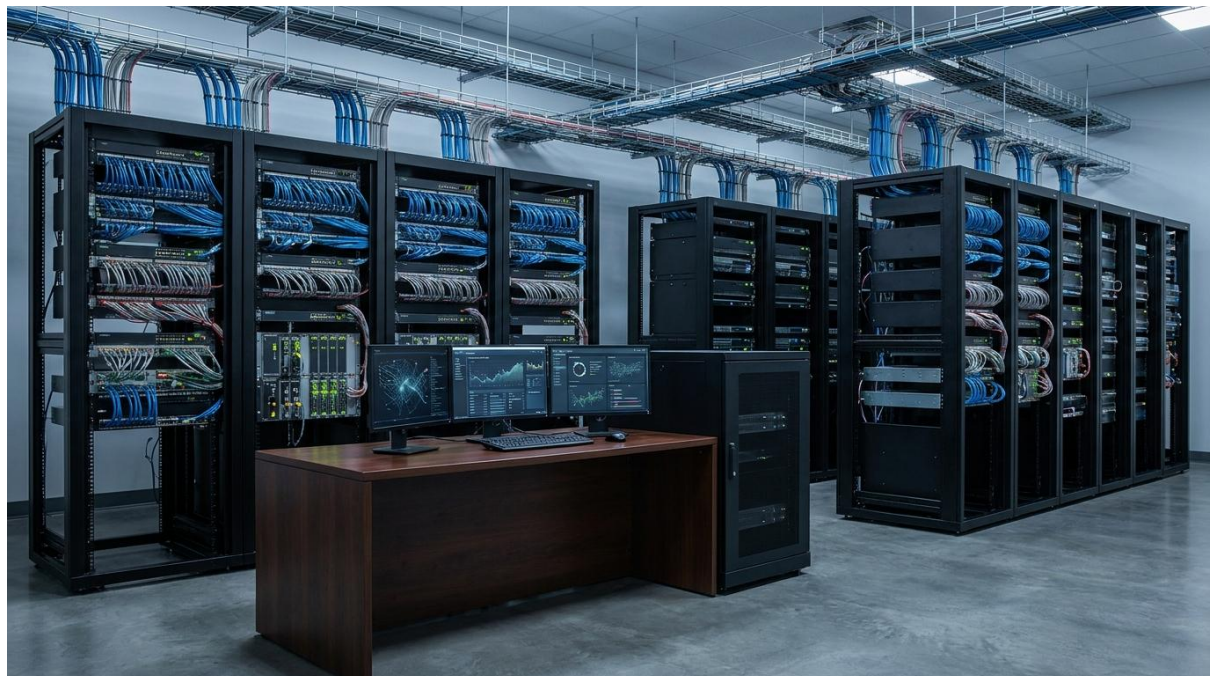
Recommended metering levels

Level	Recommended measurement
Source	Utility import/export and each generator; renewable generation where applicable.
Main distribution	Each MDB incomer, bus section and major outgoing feeder.
Essential/emergency	ESMDB/EMDB incomers and critical feeder groups.
Sub-distribution	SMDB by floor, department, tenant, zone or major plant.
Major loads	Chillers, large AHUs, pumps, lifts, data rooms, kitchens and other high-consumption loads.
Final/tenant	DB or tenant meter when accountability, billing or detailed benchmarking is required.

Typical dashboard KPIs

- Real-time kW, kVA, kvar, PF, V, A and frequency.
- Daily/monthly/annual kWh and comparison against baseline or budget.
- Maximum demand, peak time and load-factor profile.
- Phase imbalance, voltage deviation and harmonic values where supported.
- Utility vs generator vs renewable contribution.
- Consumption by building, floor, department, tenant, system or equipment.
- Cost and CO₂ calculations using approved tariff and emissions factors.
- Meter communication health, data gaps and abnormal-consumption alarms.

Integration Matrix

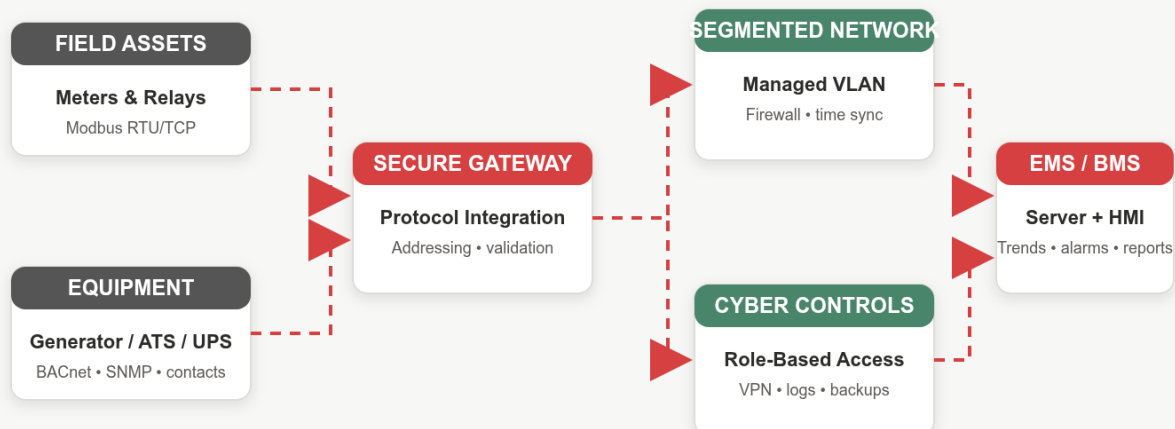


Illustrative secure server, gateway and building-systems network environment.

INTEGRATION & CYBERSECURITY

Open protocols with controlled access, auditability and resilient local operation

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Protection remains autonomous when the server or network is unavailable.

Secure integration architecture from field assets to the EMS/BMS.

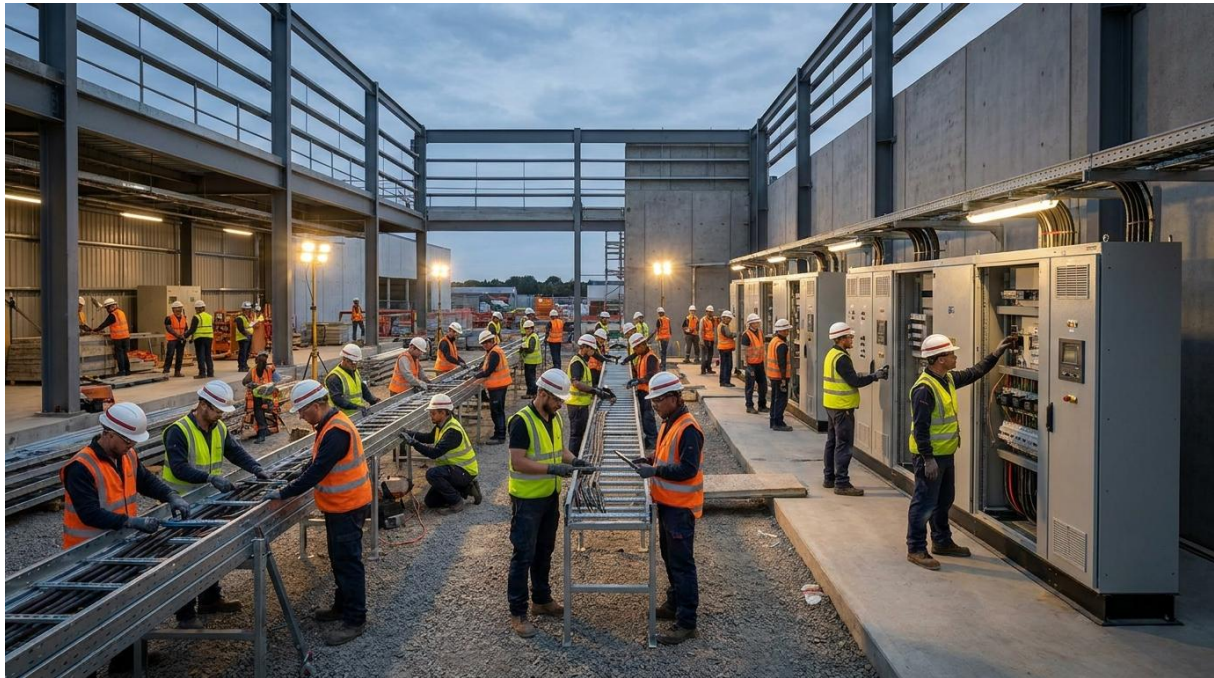
Asset	Interface	Monitor	Permitted supervisory control*
KWH/PQ meter	Modbus RTU/TCP	Electrical values, demand, energy, alarms	None
MDB/SMDB breaker	Auxiliary contacts / relay / gateway	Open/closed/trip, spring, local/remote	Motorized open/close only if approved
Generator controller	Modbus / BACnet gateway / contacts	Available, run, fault, electrical/engine data	Start-enable/reset only if approved
ATS/AMF	Modbus / contacts	Sources, position, auto/manual, fault, events	Test/transfer only under approved procedure
UPS	SNMP / Modbus / dry contacts	Input/output, bypass, battery, load, alarms	Usually monitoring only
APFC / harmonic filter	Modbus / contacts	PF, stages, kvar, THD, alarm	Enable/reset if approved
MCC/VFD	BACnet/Modbus / hardwired I/O	Run, fault, speed, current, mode	Start/stop/speed subject to process interlocks
PV inverter	Modbus / vendor API/gateway	Generation, status, alarms	Curtailment/reset only if authority/vendor approved
Protection relay	IEC/Modbus/vendor gateway	Trips, measurements, event codes	Protection settings excluded from BMS

* Final commands depend on the approved control philosophy, authority requirements, vendor warranty, cybersecurity review and equipment interlocks.

Network and cybersecurity

- Dedicated, segmented EMS/BMS network using managed switches and approved VLAN/firewall rules.
- Unique accounts, role-based permissions and least-privilege access.
- Secure remote access through the client-approved VPN or equivalent controlled method.
- Time synchronization for meters, relays, controllers and servers.
- Configuration, graphics, database and program backups with tested restore procedure.
- Protocol gateways limited to required services and documented data flows.
- Audit logs for user logins, commands, setpoint changes and alarm actions.
- Controller and protection operation remains autonomous during server/network interruption.

Electrical Contracting Scope of Work

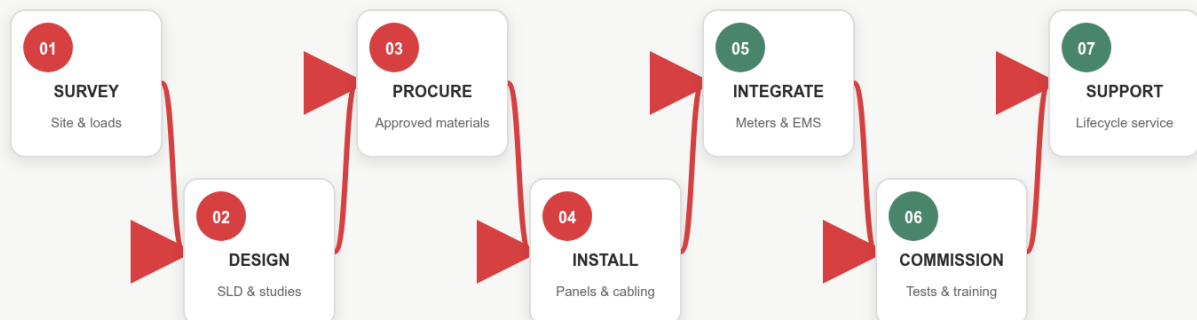


Illustrative electrical installation and site-execution activities.

END-TO-END ELECTRICAL CONTRACTING

Engineering, installation, intelligence and lifecycle support

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One accountable delivery path—from concept to long-term performance.

End-to-end delivery stages from survey through lifecycle support.

Stage	Scorpions Services activities
Survey & verification	Review utility data, loads, existing panels, generators, earthing, routes, interfaces and site constraints.
Concept & calculations	Load schedule, maximum demand, diversity, source sizing, transformer/generator/UPS concept and metering strategy.
Detailed engineering	SLD, schematics, layouts, panel schedules, cable schedule, discrimination/short-circuit/voltage-drop/earthing calculations.
Procurement	Approved switchgear, panels, meters, breakers, ATS, generator/UPS interfaces, cables, containment and accessories.
Installation	Panels, cabling, busduct, trays, conduits, glands, terminations, identification, earthing and field interfaces.
Programming & integration	Meter addressing, gateways, dashboards, alarms, trends, reports, event logs and user roles.
Testing & commissioning	Inspection, electrical tests, point-to-point checks, functional sequences, transfer/load tests and integrated system tests.
Handover	As-built drawings, calculations, settings, reports, O&M manuals, training, backups, warranties and spare-parts list.
After-sales	Preventive/corrective maintenance, emergency support, thermography coordination, firmware review and system expansion.

Engineering, Installation & QA/QC Requirements

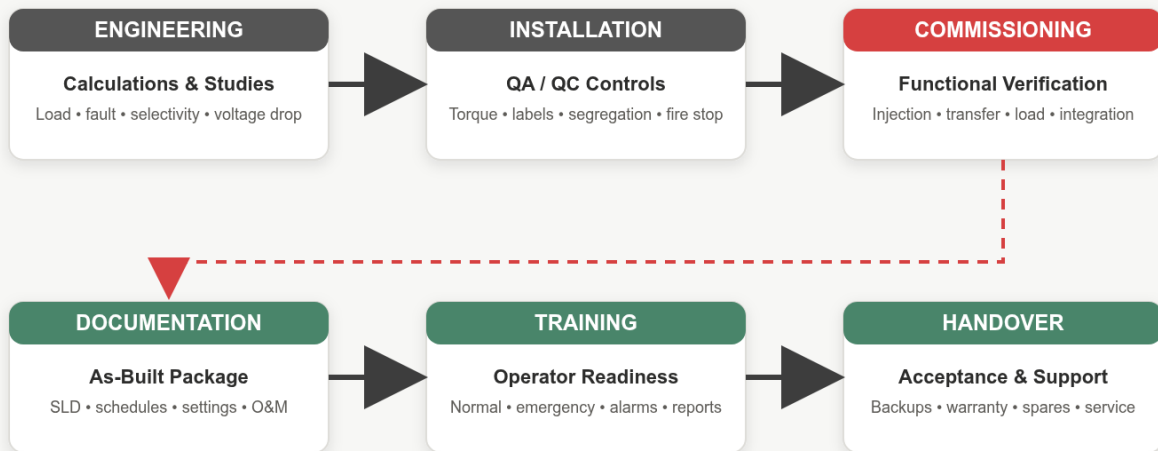


Illustrative electrical testing, commissioning and QA/QC activities.

ENGINEERING, QA/QC & HANDOVER

A traceable path from calculation to tested, documented operation

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Measured evidence at every stage—not just installation completion.

Traceable engineering, quality, commissioning and handover workflow.

Required engineering studies

- Connected-load and maximum-demand schedule with diversity assumptions.
- Short-circuit and equipment-duty verification at each relevant bus.
- Protection coordination/selectivity and approved relay/breaker settings.

- Cable ampacity, derating, voltage-drop and short-circuit withstand calculations.
- Transformer, generator and UPS sizing, including starting/inrush and future capacity.
- Earthing and bonding design; lightning and surge-protection assessment.
- Arc-flash assessment and labeling where required by the governing standard/client.
- Generator step-load, load-shedding and recovery sequence.
- Metering schedule, CT ratios/classes, communication topology and addressing.

Installation quality controls

- Panels installed plumb, accessible, ventilated and with required working clearances.
- Power/control/communication segregation maintained throughout containment and panels.
- Correct glands, lugs, ferrules, torque settings, phase identification and cable labels.
- Neutral and protective-earth conductors sized and terminated per approved design.
- CT polarity, ratio and shorting arrangements verified before energization.
- Fire stopping applied at penetrations; environmental/IP ratings maintained.
- Spare ways, space and bus capacity provided as specified for future expansion.
- Approved samples, material inspections and installation checklists maintained.

Testing and commissioning schedule

Test	Minimum verification
Visual / mechanical	Nameplates, ratings, clearances, interlocks, torque, barriers, labels and workmanship.
Cables	Continuity, insulation resistance, phasing and termination checks.
Earthing	Protective-conductor continuity and earth-system tests per approved method.
Switchgear	Primary/secondary injection as applicable, breaker operation, trip tests and settings verification.
Meters / CTs	Polarity, ratio, phase mapping, scaling, readings and communication.
Generator	Auto/manual start, alarms, load test, step loading, fuel/battery/engine parameters and cool-down.
ATS/AMF	Source failure, start, transfer, retransfer, delays, interlocks and failure modes.
UPS	Normal, battery, bypass, alarm and autonomy/load test per approved procedure.
EMS/BMS	Point-to-point, alarm priority, timestamps, trends, reports, user rights and communication-loss alarms.
Integrated test	Utility outage through full emergency restoration and return-to-normal sequence.

Deliverables



Illustrative project documentation and operational handover.

PROJECT DELIVERABLES

The complete engineering, commissioning and handover record

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SLD & DRAWINGS  Single-line, layouts, schematics	CALCULATIONS  Load, fault, selectivity, cables	SETTINGS REGISTER  Breakers, relays and protection	METERING PACKAGE  Points, CTs, addresses, topology
EMS / BMS FILES  Graphics, alarms, trends, reports	TEST RECORDS  FAT, SAT and integrated tests	O&M MANUALS  As-builts, backups and warranties	TRAINING & SPARES  Readiness and lifecycle support

A complete, traceable package for operation, maintenance and future expansion.

Complete engineering, commissioning and handover deliverable package.

- Approved single-line diagrams, layouts, schematics and panel schedules.
- Load schedule, cable schedule and calculation package.
- Protection coordination study and final settings register.
- Metering and communication architecture with device/address schedule.
- Panel general arrangements, wiring diagrams and bill of materials.

- Cause-and-effect, operating philosophy and load-shedding matrix.
- EMS/BMS point list, alarm matrix, trend schedule and report templates.
- Inspection and test plans, factory/site test records and commissioning reports.
- As-built documents, software/configuration backups and O&M manuals.
- Operator/maintenance training, warranties and recommended spare-parts list.

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Project-Specific Information Required



Illustrative multidisciplinary engineering coordination meeting.

PROJECT-SPECIFIC INFORMATION

Inputs required to finalize ratings, quantities, protection and commercial scope

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TECHNICAL INPUTS

- ✓ Utility characteristics & fault level
- ✓ Approved loads and criticality
- ✓ Generator / UPS autonomy
- ✓ Panel ratings and spare capacity
- ✓ Metering and reporting granularity

PROJECT & GOVERNANCE INPUTS

- ✓ Applicable standards & authority
- ✓ Existing asset and interface details
- ✓ IT and cybersecurity requirements
- ✓ Approved makes and specifications
- ✓ Programme, phasing and access

Verified inputs convert the concept into a safe construction design.

Inputs required to convert the concept into a project-specific construction design.

- Project type, location, occupancy, operating hours and applicable authority/standards.
- Utility supply characteristics, available fault level, tariff and service constraints.
- Architectural/MEP drawings, equipment schedules and final connected loads.
- Critical, essential and nonessential load classification with required restoration times.
- Generator quantity/rating, fuel autonomy, synchronizing and redundancy requirements.

- UPS load, required autonomy, redundancy and battery-room/environment criteria.
- Existing panel, cable, earthing, generator, ATS, UPS and meter information.
- Required meter granularity, cost allocation, tenant billing and sustainability KPIs.
- Approved makes, form of separation, IP rating, spare capacity and expansion allowance.
- IT/cybersecurity, remote access, data retention and reporting requirements.

Important clarification

This document defines a comprehensive system concept and typical connected equipment. It does not replace the project's approved electrical design, utility conditions, local authority requirements, manufacturer instructions or site-specific risk assessment.