Telecom DC Power Distribution: Breakers, Load Branches and Expansion

Design telecom DC distribution branches around load current, voltage drop, breaker or fuse ratings, failure isolation, monitoring and future expansion.

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Design each DC branch around its load interface, failure boundary and future state instead of treating an empty breaker position as proven expansion capacity.

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Commissioning An unused breaker way proves only that a panel has an empty position. It does not prove that the DC input, busbars, return path, rectifier plant, battery, conductors, fault protection, cable entries or monitoring can support another load. Telecom DC distribution should therefore be released from a branch schedule, not from a count of blank spaces.

This guide starts at the output boundary of the site DC source and ends at the declared input terminals of each connected load. Rectifier capacity belongs to the telecom rectifier system design ; this page concentrates on how available capacity is divided, protected, isolated and documented downstream.

The design object is one complete branch. Record the source bus, protective device, outgoing and return conductors, terminals, load interface, disconnection group, alarm path and permitted operating state as one traceable circuit.

What does a telecom DC power distribution unit do?

A **telecom power distribution unit** receives power from a defined DC source or bus and divides it into individually protected outgoing circuits for radio, transmission, networking, cooling, monitoring and other site loads. Depending on the project, the PDU may also provide input isolation, separate load groups, trip indication, current measurement, low-voltage disconnection interfaces and spare branch positions.

The boundary matters. A passive rack PDU may contain busbars, breakers or fuses and terminals but no active voltage regulation. An integrated DC distribution section may share a cabinet with rectifiers, batteries and a controller. Neither arrangement should be assumed from the term “PDU”; the released single-line diagram and terminal schedule must show what is inside the supplied assembly.

ETSI TS 102 121 V1.4.1 (2025-02) identifies PSI 2 as the interface between the power supply and distribution system, calls for safe disconnection within the relevant equipment path and ties DC distribution interfaces, cabling and routing to applicable interface and wiring rules. That framework supports a useful procurement question: where is the supply-to-distribution handoff, and which device creates a safe, documented isolation point?

Which data belong in a DC load-branch schedule?

A **DC branch schedule** should contain enough information to reproduce the electrical decision and identify the installed circuit. At minimum, it should connect the load’s operating behavior to the selected bus, conductors, protective device, disconnection policy and acceptance evidence.

Branch record	Design question	Evidence at release
Branch ID and load owner	Which equipment and service depend on this circuit?	Single-line diagram, rack elevation and load list use the same identifier
Input interface	What voltage window, polarity, steady current, peak current and start-up behavior does the load permit?	Approved equipment input specification and measured or declared load profile
Source assignment	Which bus, PDU input or A/B feed supplies the branch?	Source-to-load trace on the single-line diagram
Service state	Is the load critical, shed first, maintenance-only or permitted to restart later?	Operator-approved load priority and disconnection sequence
Protective device	What DC rating, time-current behavior, interrupting capacity and isolation function are required?	Exact breaker or fuse part number, curve and applicable approval data
Feeder path	What are the outgoing and return conductor sizes, lengths, terminals and route conditions?	Cable schedule, terminal data and voltage-drop calculation
Indication and telemetry	How will open, tripped, current or abnormal state be identified?	Alarm matrix, I/O map and controller configuration where fitted
Future state	Is the way installed, reserved, blocked or dependent on an upstream upgrade?	Expansion register with the limiting component named

A missing value is not a zero. If start-up current, minimum input voltage or fault contribution has not been confirmed, keep the branch on technical hold rather than filling the schedule with a convenient assumption. The complete component-interface map can be used to locate the upstream owner of each missing input.

How should a breaker or fuse be selected for a telecom DC branch?

DC breaker selection or fuse selection must be based on the complete circuit, not only the load’s nominal current. The device must be explicitly suitable for the applicable DC voltage and polarity, carry normal and permitted transient current, protect the conductor and terminals, interrupt the available fault current, and provide the required isolation and indication behavior.

IEC 60947-2:2024 covers circuit-breakers for circuits up to 1,500V DC within its stated scope and includes requirements related to ratings and suitability for isolation. A supplier should still provide evidence for the exact offered device, pole arrangement and installation condition. An AC rating printed on a similar-looking breaker is not evidence of its DC interrupting performance.

The choice between a resettable breaker and a replaceable fuse changes the maintenance method as well as the protection method. Review the following points against the project fault study and operator practice:

- available short-circuit current from rectifiers, batteries and any other connected DC source;
- time-current behavior during load start-up, overload and downstream fault;
- DC voltage, pole use, polarity sensitivity and required isolation function;
- conductor and terminal thermal limits, including ambient and grouping conditions;
- selective operation expected between upstream and downstream devices;
- trip indication, auxiliary contact, remote alarm and safe reset or replacement procedure;
- approved spare device or fuse-link availability at the operating location.

This article does not set universal breaker sizes or coordination margins. Final selection requires the actual device curves, source fault contribution, cable data and applicable operator or electrical rules. Two devices with the same current label may have different DC voltage ratings, interrupting capacities and time-current behavior.

How are branch current and feeder voltage drop checked?

Calculate branch current at the limiting load voltage and operating state, then confirm that the entire outgoing-and-return path keeps the equipment terminals inside their permitted voltage window. For a constant-power load, current rises as its terminal voltage falls, so a nominal bus label can understate the current used for a worst-state check.

Constant-power load current: $I = P \div V_{load,min}$
Maximum permitted loop resistance: $R_{loop,max} = \Delta V_{allowed} \div I$
Loop loss at the checked state: $P_{loss} = I^2 \times R_{loop}$

Consider a hypothetical 1.20kW DC load that must receive at least 42.0V in the declared battery-discharge state. If the PDU output is expected to remain at 43.0V in that same state, the initial current check is 1,200W ÷ 42.0V = 28.6A and the available branch drop is 1.0V. The corresponding maximum loop resistance is 1.0V ÷ 28.6A = 0.035Ω before any additional design margin required by the project.

The 0.035Ω is not a cable catalogue value. It is the maximum combined resistance of outgoing conductor, return conductor, breaker or fuse, terminals, joints and any other series connection at the relevant operating temperature. Final **feeder voltage drop** must use released conductor data, route length, installation method, terminal limits and ageing or connection allowances required by the project.

No protective-device rating can be selected from this example alone. The engineer must still check continuous ampacity, start-up current, trip curve, short-circuit withstand, interrupting capacity and the load manufacturer’s input behavior. The actual DC voltage-window guide explains why the minimum equipment-terminal voltage, rather than the nominal label, controls this boundary.

Separate failure domains before assigning breaker ways

A distribution schedule should prevent one branch fault or maintenance action from removing unrelated critical functions. The right separation follows service consequences, not just rack position. Radio units serving different sectors, a backhaul link, the site controller and cabinet cooling can have very different outage effects even when their steady currents are similar.

Use separate branches where independent isolation, fault containment, measurement or maintenance is required. If equipment has true dual DC inputs, trace A and B paths back to their actual upstream sources; two input terminals fed from the same busbar, PDU input or protective device do not create end-to-end diversity. Conversely, splitting every small load without considering space, alarm points and service practice can create an unmanageable panel.

Load-disconnection groups also need an explicit operating sequence. Sites may distinguish critical load, lower-priority load, battery protection, thermal auxiliaries and maintenance outlets, but the labels and order are project decisions. Do not infer a universal LLVD or BLVD arrangement from another operator's drawing, and do not place a load in a shedding group until its restart behavior and service consequence are known.

What counts as real PDU expansion capacity?

PDU expansion capacity exists only when a future branch can be added without exceeding any upstream or downstream limit and without creating an unreviewed failure path. A blank way is useful physical space; it becomes approved capacity only after six linked checks remain open.

1. **Source duty:** rectifier, battery and hybrid-source studies include the future load in normal, backup and recovery states.
2. **Distribution backbone:** PDU input, busbars, return bar, disconnects, terminals and upstream protection have documented spare capacity.
3. **Protection:** prospective fault current, device rating and required selective behavior remain acceptable after the branch is added.
4. **Feeder route:** suitable terminals, conductor path, cable entry, bend space and return connection are physically available.
5. **Environment and access:** added heat, enclosure space, segregation and safe service access remain within the cabinet design.
6. **Operations:** branch identification, alarm input, monitoring channel, spare parts and commissioning records can be extended.

Classify each spare position as "physically vacant," "wired and protected," "capacity verified," or "blocked by named upgrade." That distinction prevents a future crew from energizing a pre-installed breaker whose cable, bus, battery reserve or monitoring path was never approved for service.

Reserved does not mean energized. A fitted spare breaker should remain isolated and controlled under the site's lockout and change-management procedure until its load, conductor, protection, labeling and upstream capacity have been reviewed.

Make every branch identifiable in the cabinet and in the controller

A technician should be able to connect the physical device, the drawing and the remote alarm without interpreting a supplier's private shorthand. Use one durable branch ID across the breaker or fuse position, terminal, outgoing cable, return connection, single-line diagram, cable schedule and alarm matrix. Record the load name and destination separately so equipment can change without breaking the circuit identity.

Monitoring capability is configuration-dependent. Where supported, useful branch evidence may include breaker-trip contact, load current, bus voltage, open-device state and the controller event time. Define alarm polarity and normal state, prove the input mapping and decide whether an open breaker is an alarm, an approved maintenance state or simply unavailable telemetry. A decorative alarm label without a tested signal path adds no operational visibility.

Branch naming should also expose source and service group. A clear record such as “DCA-07 / microwave backhaul / critical” carries more operating meaning than “breaker 7,” but the exact convention should match the operator’s asset and network-management rules.

Commissioning proves the complete branch, not just breaker operation

Branch commissioning should trace the circuit from its PDU source to the intended load and return, first in a safely isolated condition and then under an approved energized test. The procedure, instruments and test levels must match the supplied equipment and site safety rules; inappropriate insulation or polarity tests can damage connected electronics.

1. Confirm the approved drawing, branch ID, load interface, conductor and protective-device part number.
2. Verify isolation, absence of voltage where required, conductor identity, polarity and return path before connection.
3. Inspect terminals, crimping, conductor support, separation, bend radius, torque records and protective covers.
4. Energize through the authorized procedure and record PDU voltage, load-terminal voltage, steady current and any start-up behavior.
5. Confirm voltage drop against the calculation and verify that the load remains inside its permitted input window.
6. Test trip indication, auxiliary contact, controller point and remote alarm where those functions are supplied.
7. Update the as-built single-line diagram, branch schedule, cable record, alarm matrix and remaining expansion register.

Opening a live branch solely to demonstrate interruption may be unacceptable for critical service. Use the project’s approved test method, a safe test load or factory simulation where necessary, and record any function that could not be proven on site.

Engineering boundary. This guide does not prescribe one DC voltage, polarity, breaker technology, fuse class, conductor size, load-shedding sequence or spare-way percentage. Final design requires the connected-load data, source fault contribution, battery and rectifier states, product curves, route conditions, operator rules and applicable electrical requirements.

Send a branch schedule, not only a breaker count

For a configurable Huijue telecom energy cabinet, provide the load list, voltage interfaces, operating and start-up currents, criticality groups, feeder routes, fault information, alarm requirements and future branch plan. The engineering review can then align PDU inputs, busbars, protection, terminals, monitoring and cabinet space with the declared site duty.

Submit the DC distribution inputs

Related engineering resources

Telecom Rectifier System Guide
Telecom Power System Components
Why Telecom Power Commonly Uses −48V DC
Telecom Energy Products and Engineering Services

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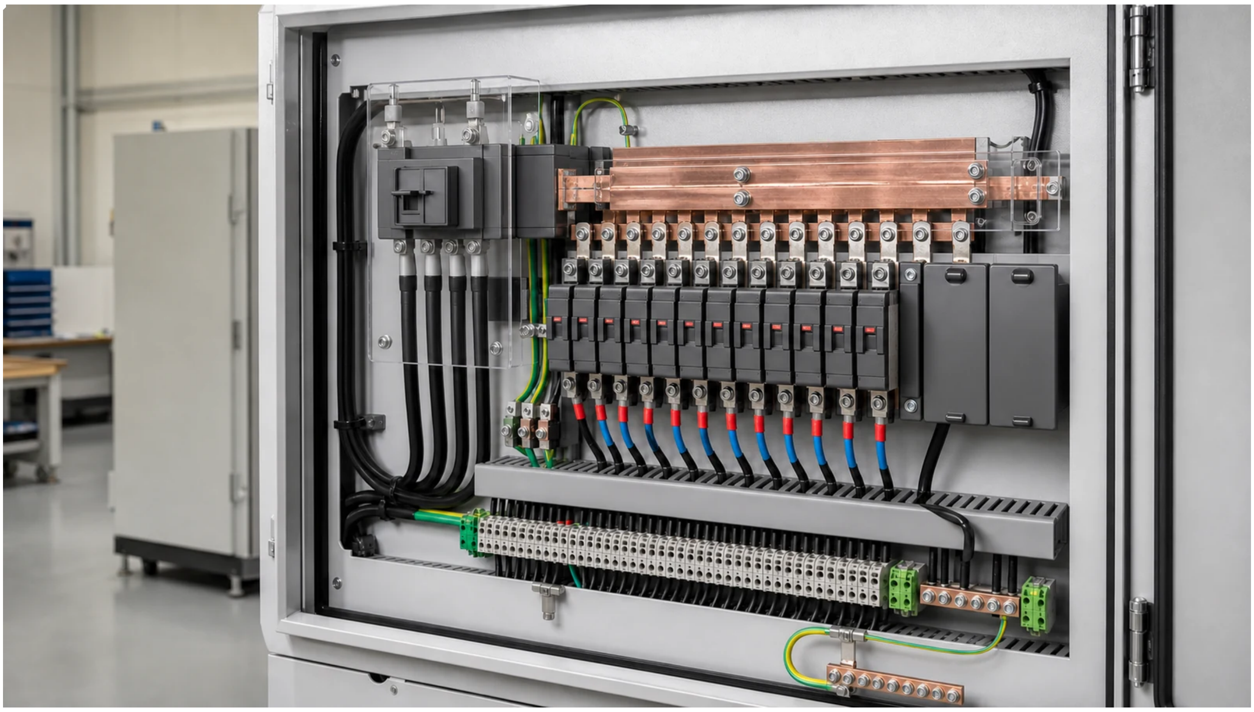

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