QuickCMC Test Guide — All 20 Protection Functions

How to carry out each test using OMICRON QuickCMC specifically (CMC 256plus/353/356). Builds on the Test Universe methodology and secondary injection theory discussed earlier.

QuickCMC — What It Actually Gives You

QuickCMC is the manual, steady-state injection module. Each output channel (voltage and current) is set independently by magnitude, phase angle and frequency, then switched ON and left running until you change it — there is no automatic sequencing or ramping. What it does have, which is enough for most pickup and timing checks: live binary input (BI) status indicators that change colour the instant a contact operates, a built-in trigger/timer that can measure elapsed time from output-ON (or a manual trigger) to a BI change, manual binary output (BO) forcing for simulating an initiating contact, and — on most vector views — the option to enter values directly as symmetrical components (I1/I2/I0) instead of per-phase ABC values. What it does NOT do: automatic ramping (step it yourself), multi-state sequencing with timed transitions, or superimposing a harmonic on top of a fundamental on the same channel. Where a function genuinely needs one of those, it's flagged below with the fallback module.

General QuickCMC Workflow (applies to every function)

1. Wire the CMC outputs to the relay's CT/VT secondary inputs and its trip contact(s) to a CMC binary input.
2. Enter the relay's actual setting value (pickup, ratio, angle, etc.) so you know what to test around.
3. Set a starting value comfortably below pickup, switch outputs ON, confirm the BI shows healthy/non-operated.
4. Step the value up in fixed increments (fine steps near the expected pickup) until the BI changes state — that value is the measured pickup.
5. For timing: set a value clearly past pickup, arm the trigger (output-ON or manual trigger as start event, BI change as stop event), switch ON, read the elapsed time.
6. Switch OFF between every step to let the relay reset before the next injection.

1. Generator Differential (87G)

Needs two independent current channels (terminal CT + neutral CT) — a 6-current-channel CMC (356) or two synced sets. Set equal, balanced currents on both channels, switch ON, confirm the BI stays non-operated (restraint). Then manually increase one channel's magnitude in steps to build up a differential current above the bias slope; note the value at which the BI trips. Repeat the whole test at 2–3 different base (restraint) current levels to hand-plot points against the relay's slope characteristic.

> *Limitation: No automatic slope sweep in QuickCMC — record each point manually; a proper continuous slope trace needs Advanced Differential.*

2. Generator Stator Earth Fault (59N / 100% stator EF)

95% element: put the neutral VT voltage on one channel, step it up from zero in small increments, watch the BI for pickup, then repeat at a value past pickup with the trigger timer running to capture the delay. 100% element (3rd-harmonic ratio scheme): this needs a fundamental and a harmonic voltage present on the same channel at the same time, which plain QuickCMC channels generally cannot superimpose.

> *Limitation: Use State Sequencer's harmonic content field for the 100% element — QuickCMC alone only covers the 95% part.*

3. Overcurrent (50/51)

Set the current channel to a value above pickup for 50 (instantaneous) and switch ON — confirm trip with no intentional delay via the trigger timer (start = output-ON, stop = BI trip). For 51, repeat at 2x, 5x and 10x Is as separate manual injections, reading the trigger timer at each multiple, and compare each operate time to the IEC/IEEE curve tolerance (±5% typical).

> *Limitation: Each current multiple is its own manual test — QuickCMC won't auto-step through them like Ramping would.*

4. Negative Sequence (46)

If the vector view offers symmetrical-component entry, set I1=0, I0=0 and step I2 up directly. Otherwise create physical unbalance by switching one phase channel off (or reversing its angle 180°) and stepping the remaining current magnitude. Watch the BI for pickup, then use the trigger timer at a value past pickup for the inverse-time curve if the element has one.

5/6. Over/Undervoltage (59/27) & Over/Underfrequency (81O/81U)

There's no ramp function in QuickCMC, so approximate one manually: step the voltage (or frequency) value toward the setpoint in fixed increments, finer as you approach it, checking the BI at each step. Once you've bracketed pickup, set a value clearly past it and read the operate/reset time on the trigger timer.

7/8. Reverse Power (32R) / Over Power (32O)

Set V and I magnitude plus the angle between them manually. For reverse power, set the V-I angle beyond 90° (simulating motoring/import) and step the power magnitude up into the operate region. For overpower, keep the angle near 0° and step forward real power up until pickup. Confirm with the trigger timer.

9. Loss of Excitation (40)

Impedance-based (offset mho) — there's no live trajectory plot in QuickCMC, so pick a handful of test points around the expected circle boundary (e.g. 0°, 45°, 90°, 180° from the offset), calculate the V and I magnitude/angle for each point in advance, inject each one as a separate static test, and confirm operate/no-operate matches the expected side of the boundary at every point.

> *Limitation: A continuous impedance trajectory sweep needs Advanced Distance — QuickCMC only gives you discrete points.*

10. Overfluxing / V/Hz (24)

Set V and frequency independently on the same channel and step them together to hit a specific V/Hz ratio; increase the ratio in steps, watching the BI, to find pickup. Repeat at a value past pickup for the inverse-time curve.

11/12. Generator-Transformer Differential (87GT) / Transformer Differential (87T)

Same manual restraint/trip method as function 1 (balanced through-current with no trip, then unbalance to trip), with vector group and CT ratio compensation applied per channel. Through-fault stability and basic internal-fault tripping are both fine on QuickCMC.

> *Limitation: 2nd-harmonic inrush restraint and 5th-harmonic overexcitation restraint both need a harmonic superimposed on the fundamental — not possible on a plain QuickCMC channel; use State Sequencer for those two sub-tests.*

13. Restricted Earth Fault (64REF)

Drive the phase CT channels and the separate neutral CT channel independently. Set them so current appears to flow straight through (in = out, balanced) to confirm restraint on an external fault, then unbalance the neutral vs. summed-phase currents to confirm trip on an internal fault. For high-impedance REF, step the injected current up while watching the stabilizing resistor voltage to verify the setting.

14. Transformer Earth Fault (51N / SBEF)

Identical procedure to function 3, injected on the neutral/earth CT channel instead of a phase channel — pickup step-search plus trigger-timer readings at 2x/5x/10x for the IDMT curve.

15. Busbar Differential (87B)

Needs one current channel per feeder in the protected zone, which usually means a CMC356 or several synced CMC sets. Set all feeder channels to a common balanced through-current first and confirm no trip (this is the critical stability test under heavy through-fault current), then change one feeder's channel to create an imbalance and confirm trip. Repeat per zone/bus section for multi-zone schemes.

> *Limitation: Every feeder channel is set and changed by hand in QuickCMC — there's no automated multi-channel sequencing; for a large zone this is slow but still doable.*

16. Breaker Failure (50BF)

Use a QuickCMC binary output to manually force the 'initiating trip' contact (start event for the trigger timer), inject current above the BF current-detector level on the relevant phase channel, and hold it beyond the BF timer setting — the trigger timer (BO force → backup/lockout BI operate) gives you the measured BF time. Separately, repeat with the current dropping below the detector level before the timer would expire, and confirm the backup trip is blocked.

17. Synchronism Check (25)

Needs two independently controllable voltage sources (bus side and line/generator side) — only available on CMC models with dual voltage channel groups (e.g. 356). Set the magnitude difference, phase angle difference and slip frequency between the two sources manually, step each parameter in and out of the configured windows, and watch the permissive-close BI to confirm it only asserts inside the ΔV/Δangle/Δf limits.

18. Trip Circuit Supervision (74TCS)

Pure binary test, no analog injection at all. Use QuickCMC's binary output/input page to open the forced output that emulates the trip circuit continuity loop (broken wire / blown fuse / breaker auxiliary contact mismatch), confirm the supervision alarm asserts after its debounce delay (read via the trigger timer), then reconnect and confirm the alarm clears.

19. Lockout Relay (86)

Also binary-only. Force the relevant protection trip binary(s) via QuickCMC's BO page, confirm the 86 lockout output picks up and latches, confirm it stays latched even after you release the initiating force, then verify both reset methods (manual pushbutton and electrical reset input) actually clear it.

20. Field / Rotor Earth Fault (64F/64R)

Outside QuickCMC's normal scope — these schemes inject AC or DC bias onto the rotor circuit itself, which needs a dedicated rotor earth-fault test box, not a CT/VT secondary injection set.

> *Limitation: Use the relay's own self-test/simulation mode to exercise the alarm/trip logic and output contacts instead; QuickCMC can still verify the downstream binary output wiring once that simulated fault is raised.*

Quick Reference — Functions Needing More Than Plain QuickCMC

Function	Extra module/hardware needed	Why
2 (100% stator EF)	State Sequencer	harmonic + fundamental on same channel
9 (LOE)	Advanced Distance (optional)	continuous impedance trajectory vs. discrete points
11/12 (harmonic restraint)	State Sequencer	2nd/5th harmonic superimposed on fundamental
15 (Busbar diff)	CMC356 or multiple synced sets	one current channel per feeder
17 (Sync check)	Dual voltage-source CMC (356)	two independent, phase-related sources
20 (Rotor EF)	Dedicated rotor EF test box	not a CT/VT secondary signal at all