

Electrical Fuse Schedule (Implementation - Lynx Topology)

As-of date: 2026-02-23

Purpose: define each required fuse by circuit, protected conductor/device, holder/housing method, physical placement, and linked wire gauge assumptions for the approved Phase 1 Lynx architecture with a battery-backed 12V bus.

Related docs:

- Canonical electrical/system baseline: [docs/SYSTEMS.md](#)
- Implementation topology and conductor map: [docs/ELECTRICAL_overview_diagram.md](#)
- Battery and trunk recalculation record: [docs/ELECTRICAL_battery_fuse_wire_recalc_2026-02-18.md](#)
- Decisions/open items tracker: [docs/TRACKING.md](#)
- BOM source of truth: [bom/bom_estimated_items.csv](#)

Sweep Findings (2026-02-12)

Finding ID	Finding	Impact	Resolution status
FS-001	BB1248120 was modeled in planning docs as 120A on the 48V output.	Alternator-recovery math was materially overstated.	Corrected in bom/bom_estimated_items.csv row 18 and docs/SYSTEMS.md (~1500W, about 26A at 57.6V).
FS-002	Fuse schedule listed fuse values but not a complete housing/holder definition for every fuse family.	Install path and procurement freeze were ambiguous.	Resolved below with explicit holder/housing method and location per fuse ID.
FS-003	Fuse schedule did not tie each fuse to a conductor gauge plan.	Hard to verify "fuse protects conductor" rule at install time.	Resolved below with gauge mapping and assumptions.

Design Basis

- Topology: Victron Lynx Distributor M10 (LYN060102010) with 4 fused 48V branches.
- Battery bank assumption: 3x 48V 100Ah batteries in parallel (3 separate battery-positive conductors leaving batteries).
- 12V distribution assumption: 12V fuse block used as the shared junction device (main + stud = source combine, integrated negative bus/main - = return), fed by Orion-Tr Smart 48/12-30 charger and a 12V 100Ah LiFePO4 buffer battery branch.
- Parallel-bank safety rule: use one Class T fuse per battery-positive conductor leaving the battery. A single shared "bank fuse" does not protect the individual battery leads and does not prevent cross-feed faults between parallel batteries.
- Branch devices on Lynx:

1. MultiPlus-II 48/3000
2. SmartSolar 150/45
3. Sterling BB1248120 output
4. Orion-Tr 48/12-30 input

- 12V buffer battery protection and switching baseline: F-11 (100A class) on battery positive within ~7" of source, then SW-12V-BATT manual disconnect for service isolation.
- Phase 1 complexity lock: no automatic low-voltage disconnect (LVD) layer in this revision.
- SmartShunt control/power lead note: retain the Victron-supplied fused positive sense/power lead assembly (small-current harness), and avoid substituting lower-voltage automotive fuse components on the 48V system.
- Sterling rating basis used for this revision: BB1248120 output ceiling about 1500W (~26A at 57.6V), with 150A input fuse and 40A output fuse guidance.

Manufacturer References Used

- Victron MultiPlus-II 120V installation page (recommends 125A DC fuse for 48/3000 ; cable table includes AWG 1 to AWG 2/0 by length): https://www.victronenergy.com/media/pg/MultiPlus-II_120V/en/installation.html
- Victron SmartSolar MPPT 150/45 installation/spec pages (50A-63A battery fuse range, terminal limit 16 mm2 / AWG 6): https://www.victronenergy.com/media/pg/Manual_SmartSolar_MPPT_150-35__150-45/en/installation.html and https://www.victronenergy.com/media/pg/Manual_SmartSolar_MPPT_150-35__150-45/en/technical-specifications.html
- Victron Orion-Tr Smart isolated DC-DC charger product page, manual, and datasheet (48V models require external input fuse per manual; 48/12-30 output rating and terminal limits per datasheet): <https://www.victronenergy.com/dc-dc-converters/orion-tr-dc-dc-converters-isolated>
- Victron Lynx Distributor manual (MEGA fuse carrier format): https://www.victronenergy.com/media/pg/Lynx_Distributor/en/installation.html
- Victron Orion-Tr Smart isolated DC-DC installation page (external input fuse guidance): https://www.victronenergy.com/media/pg/Orion-Tr_Smart_DC-DC_Charger_-Isolated/en/installation.html
- Victron fuse datasheet (for 48V systems use 58V -class fuses): <https://www.victronenergy.com/upload/documents/Datasheet-Fuses-EN.pdf>
- Sterling BB12V->48V charger references (model list includes BB1248120 , fuse/cable guidance): <https://sterling-power.com/products/battery-to-battery-chargers-12v-to-48v>
- Sterling BB12V->48V charger installation manual PDF (fuse/cable guidance): https://sterling-power.com/cdn/shop/files/bb1230_1240_1260_12120_122430_241230_241240_241260_241280_242430_124810_1248120_241280_242430_b2b_installation_manual.pdf

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- Blue Sea Systems guidance (fuse close to source): <https://www.bluesea.com/resources/1437>
- Blue Sea Class T holder-family compatibility (110A-200A vs 225A-400A):
https://www.bluesea.com/support/articles/Fuse_Blocks/1438>Selecting_Class_T_Fuses

Battery Branch Re-Baseline (2026-02-18)

- This schedule now uses a gated battery-branch baseline of 200A Class T per battery (F-01A/B/C) as a provisional default.
- Re-baseline method and calculations are documented in `docs/ELECTRICAL_battery_fuse_wire_recalc_2026-02-18.md`.
- Final lock gate for F-01A/B/C : capture a true 51.2V battery datasheet/manual with validated current and terminal limits before permanent fuse lock.
- Holder-family constraint: battery branch values below 225A require the 110A-200A Class T holder family. Do not pair <225A fuse targets with 225A-400A holder-only hardware.
- If validated battery or terminal limits are lower than current provisional assumptions, move F-01A/B/C to 175A and update BOM row 7 accordingly.

Required Fuse Map (Start-to-Finish, With Housing)

Fuse ID	Circuit (source -> load)	Protected wire/device	Fuse type and voltage class	Amperage	Holder or housing method	Physical location	Planned conductor gauge
F-01A	Battery A + -> bank positive combine/disconnect input	Battery A positive cable leaving battery	Class T (>=125VDC)	200A provisional	Blue Sea Class T fuse block (covered stud mount, 110A-200A family)	Battery compartment, within ~7" of Battery A positive post	2/0 AWG
F-01B	Battery B + -> bank positive combine/disconnect input	Battery B positive cable leaving battery	Class T (>=125VDC)	200A provisional	Blue Sea Class T fuse block (covered stud mount, 110A-200A family)	Battery compartment, within ~7" of Battery B positive post	2/0 AWG
F-01C	Battery C + -> bank positive combine/disconnect input	Battery C positive cable leaving battery	Class T (>=125VDC)	200A provisional	Blue Sea Class T fuse block (covered stud mount, 110A-200A family)	Battery compartment, within ~7" of Battery C positive post	2/0 AWG
F-02	Lynx Slot 1 -> MultiPlus DC+	Main inverter positive feeder	MEGA, 58V or 80V	125A	Integrated Lynx Distributor fuse slot	Lynx Distributor, Slot 1	2/0 AWG planned (AWG 1 minimum on short run)
F-03	Lynx Slot 2 -> SmartSolar BAT+	MPPT battery-side positive feeder	MEGA, 58V or 80V	60A	Integrated Lynx Distributor fuse slot	Lynx Distributor, Slot 2	6 AWG
F-04	Lynx Slot 3 -> Sterling BB1248120 output +	Sterling output feeder to house 48V bus	MEGA, 58V or 80V	40A	Integrated Lynx Distributor fuse slot	Lynx Distributor, Slot 3	6 AWG planned (10 AWG minimum per Sterling table)
F-05	Lynx Slot 4 -> 48v auxiliary feeder (Orion branch)	Aux feeder from Lynx to Orion-branch fuse point	MEGA, 58V or 80V	40A	Integrated Lynx Distributor fuse slot	Lynx Distributor, Slot 4	6 AWG
F-06	48v aux feeder -> Orion 48v input +	Orion input lead (device protection)	Inline MIDI family rated >=58VDC	30A (58V MIDI, lock)	Littelfuse 049809216XMS sealed inline MIDI holder on backplate	Electrical cabinet, mounted at source end of Orion input lead	6 AWG planned (8 AWG minimum per Orion cable table)
F-07	Orion 12v output + -> 12V fuse block main + stud	Main 12v feeder from Orion into shared source-combine point	MEGA, 58V or 80V	60A	Victron MEGA fuse holder (external, non-Lynx)	Electrical cabinet, within ~7" of Orion 12V output stud	6 AWG planned (8 AWG minimum per Orion cable table)
F-08	Starter battery + -> Sterling BB1248120 input +	Vehicle-side charger input cable	MEGA/ANL equivalent rated >=32VDC	150A	Sealed engine-bay fuse holder with high-temp cover	Engine bay, within ~7" of starter battery positive post	2/0 AWG planned (2 AWG minimum per Sterling table)

F-09A/B/C	PV string + leads -> MPPT PV combiner	Each solar string positive conductor and reverse-current path	gPV string fuse (>=150VDC)	15A each (provisional)	10x38 touch-safe PV fuse holders in weatherproof combiner enclosure	Roof-entry combiner near gland/pass-through	10 AWG PV wire
F-10	12v fuse block branch circuits -> each 12v load	Individual 12v branch conductors and load circuits	ATO/ATC blade fuses (32v class)	Per-circuit	Integrated sockets in generic marine 12v fuse block	12v fuse block in electrical cabinet	Per branch (table below)
F-11	12V buffer battery + -> 12V fuse block main + stud via SW-12V-BATT	Buffer battery source cable and downstream junction fault exposure	Inline MIDI/AMI/ANL family rated >=32VDC	100A class baseline	Sealed inline holder mounted close to battery positive	Within ~'7" of 12V buffer battery positive post	4 AWG planned
OEM-SHUNT	Lynx positive tap -> SmartShunt positive sense/power lead	SmartShunt electronics lead	Victron OEM inline low-current fuse (factory harness)	OEM value (small-current harness fuse)	Integrated inline holder in supplied harness	Electrical cabinet near Lynx positive tap	OEM harness lead

Notes:

- Victron Orion fuse table is keyed by side voltage (`input` or `output`). For `48/12-30` : `F-06` tracks the `48V` input side (project lock now `30A` `58V` MIDI based on available holder/fuse family), and `F-07` tracks the `12V` output side (`60A`).

12V Buffer Battery Switching Requirement

- `SW-12V-BATT` is a manual service disconnect in the 12V buffer battery positive path, installed downstream of `F-11` .
- Operational default:
 1. `SW-12V-BATT` closed (`NORMAL`) for battery-backed shared-junction operation.
 2. `SW-12V-BATT` open (`SERVICE`) for battery isolation or Orion-only validation mode.
- Service-path note: the Orion `12V` output remains connected to the fuse-block main + stud through `F-07` even when `SW-12V-BATT` is open.
- Maintenance-path note: when `SW-12V-BATT` is closed, Orion output can maintain/charge the buffer battery through the shared fuse-block main + stud path.
- Do not solder-splice high-current source conductors; use crimped lugs on rated studs/junction hardware.
- Keep always-on safety branch (`12V-05`) unswitched at branch level; isolation is handled at source path controls.

12V Branch Fuse + Gauge Assignments (Initial Build)

Circuit	Planned load	Fuse	Planned wire gauge	Notes
12V-01	Starlink DC power supply	10A	14 AWG duplex	Remote-work load path
12V-02	Fridge (35-50qt)	15A	14 AWG duplex	Current estimate pass flags this as a voltage-drop warning at ~12 ft; hold <=8 ft or move to 12 AWG
12V-03	Diesel heater electrical	15A	14 AWG duplex	Startup surge expected; estimate pass flags tight margin at ~8 ft
12V-04	Water pump	10A	14 AWG duplex	Intermittent duty
12V-05	CO + propane detector	3A	18/2	Always-on safety load
12V-06	LED strips	5A	18/2	Estimate pass flags voltage-drop warning at ~8 ft; shorten run/load or upsize
12V-07	Cerbo GX power feed (assumed via 12V panel)	3A	18/2	Assumption until final harness lock
12V-08	USB PD station branch (office zone)	20A	12 AWG duplex	Keep <=5 ft (estimate-pass assumption) or upsize
12V-09	USB PD station branch (galley zone)	15A	14 AWG duplex	Current estimate pass assumes ~8 ft and ~8A expected load; move to 12 AWG if sustained current rises

F-11 Validation (2026-02-22)

- Scope validated: `C-19A` (12V buffer battery positive path), including `F-11` , `SW-12V-BATT` , and planned `4 AWG` conductor.
- Documented branch-fuse envelope from `12V-01` through `12V-09` : `96A` theoretical simultaneous maximum (`10+15+15+10+3+5+3+20+15`).
- Modeled practical load envelope from `bom/load_model_wh.csv` is materially lower (~300W average, about `25A @ 12V`), but branch-level surge/transient overlap remains possible.
- Conductor check for `4 AWG` , `2.5 ft` one-way (`5 ft` loop) using this doc resistance basis (`0.0002485 ohm/ft`):

1. 50A -> 0.062V drop (0.52% @ 12V)
2. 80A -> 0.099V drop (0.83% @ 12V)
3. 100A -> 0.124V drop (1.04% @ 12V)

- Validation result: keep F-11 at 100A class for the current architecture. This preserves margin above the modeled 50A design basis and near/at the branch-fuse aggregate envelope while staying aligned with the 4 AWG short-run drop target.
- Hard lock conditions for this 100A choice:
 1. Buffer-battery positive path remains 4 AWG and approximately 2.5 ft one-way as documented.
 2. SW-12V-BATT continuous DC rating is >=100A at the installed system voltage class.
 3. The selected 12V 100Ah battery/BMS continuous discharge rating is >=100A .
- Down-select gate: if final battery/BMS continuous rating is below 100A , reduce F-11 to the nearest compliant class (typically 80A) and synchronize spare stock row 105 .

Length-Validation Sync (2026-02-18)

- docs/ELECTRICAL_overview_diagram.md now carries one-way estimated lengths and voltage-drop screening for C-01 through C-35 .
- Lynx Orion-feeder branch fuse (F-05) is locked to 40A MEGA for BOM sync in this pass.
- USB branch baseline is synchronized across docs/BOM: office branch 12 AWG (C-34), galley branch 14 AWG (C-35).

Holder Ecosystem Standard (Procurement Guidance)

Fuse family	Preferred holder style	Why
Class T (F-01A/B/C)	Covered stud-mounted marine block (110A-200A family for current baseline)	High interrupt capacity and robust battery-compartment mounting; holder family must match chosen Class T range
MEGA (58v/80v) in Lynx (F-02 to F-05)	Lynx integrated holders only	Eliminates separate branch fuse block and keeps topology locked
Inline 48v Orion input (F-06)	Littelfuse 04980921GXMS sealed inline MIDI holder on interior backplate	Keeps source-end protection near branch takeoff with confirmed 58v holder availability
Orion output (F-07) 60A MEGA	Victron external MEGA holder at Orion output	Standardizes 60A spare pool with MPPT fuse family
12V buffer battery main (F-11)	Sealed MIDI/AMI/ANL holder near battery	Protects shared 12V source-junction path from battery fault current
12V battery disconnect (SW-12V-BATT)	Sealed rotary DC switch near distribution cabinet access	Provides simple service isolation without adding LVD complexity
Engine-bay Sterling input (F-08)	Sealed MEGA/ANL holder, high-temp/engine-bay suitable	Environmental robustness and source-proximate protection
PV string fuses (F-09)	DIN-rail 10x38 gPV holders in weatherproof combiner	Proper PV-voltage insulation and serviceable string isolation
12V branches (F-10)	Integrated blade sockets in marine fuse block	Fast field service and clear branch labeling
SmartShunt positive lead (factory harness)	Keep Victron-supplied inline fused lead assembly	Preserves vendor-qualified low-current protection path for shunt electronics

Spare Fuse Inventory

Fuse type	Installed qty	Spare qty to carry	Notes
Class T 200A (provisional installed)	3	3	One spare per installed battery fuse while 200A baseline is active
Class T 175A (alternate pending final battery datasheet lock)	0	3 optional	Optional non-regret alternate set if budget allows; install only if final lock gate requires lower value
MEGA 125A (58V/80V)	1	4	MultiPlus branch; BOM lock is x5 total
MEGA 60A (58V/80V)	2	4	Shared pool for MPPT (F-03) + Orion output (F-07); target 6 total
MEGA 40A (58V/80V)	2	4	Shared Sterling (F-04) + Orion feeder (F-05) family; BOM lock is x6 total
Orion input fuse (30A MIDI, 58v)	1	3	BOM row 133 lock is x4 total (1 installed + 3 spares)
12V buffer battery main fuse (100A class)	1	3	Spare pack basis is BOM row 105 (BOJACK 100A ANL 3-count)
Sterling input fuse 150A (32v+)	1	1	Vehicle-side charger input
PV string fuse 15A gPV	3	3	One spare per string

SmartShunt OEM harness fuse	1	1	Keep OEM-equivalent spare if the fuse is field-replaceable on final harness
ATO/ATC branch fuses	variable	2 each used value	Keep mixed kit onboard

BOM Row Mapping

Fuse scope	BOM row(s)
Main battery Class T protection (F-01A/F-01B/F-01C) + Class T spares	bom/bom_estimated_items.csv row 7
Lynx branch MEGA fuses (F-02 to F-05) installed + spare set	bom/bom_estimated_items.csv row 10
Orion/Sterling installed fuse-holder hardware (F-06, F-07, F-08)	bom/bom_estimated_items.csv row 11
Orion input fuses (F-06)	bom/bom_estimated_items.csv row 133
12V buffer battery (B12)	bom/bom_estimated_items.csv row 21
12V buffer battery main fuse + holder (F-11)	bom/bom_estimated_items.csv row 125
12V battery disconnect (SW-12V-BATT)	bom/bom_estimated_items.csv row 124
12V branch panel and blade fuses (F-10)	bom/bom_estimated_items.csv row 16
SmartShunt OEM fused lead (OEM-SHUNT)	bom/bom_estimated_items.csv row 23 (included with SmartShunt kit)
High-current spare fuse kit (non-Lynx spares, if retained)	bom/bom_estimated_items.csv row 105
PV string fuses + holder (F-09A/B/C) and spares	bom/bom_estimated_items.csv row 106

Lynx MEGA Procurement Lock (BOM Sync)

- Updated row 10 fuse-family lock: 125A x5 , 60A x6 (shared F-03 + F-07 pool), 40A x6 (shared F-04 + F-05 pool).
- Updated row 10 estimate should be kept synchronized with the final 40A x6 cart quantity.

Assumptions and Open Items

1. Wire sizing above assumes copper conductors, enclosed vehicle routing, and the one-way run-length estimate set in [docs/ELECTRICAL_overview_diagram.md](#) (2026-02-18 pass).
2. F-09A/B/C remains provisional at 15A pending final solar module datasheet max-series-fuse confirmation.
3. Final SKU lock is still required for inline holders used by F-08 and F-11 , plus the external Victron MEGA holder for F-07 and SW-12V-BATT .
4. If Orion run lengths exceed the short/medium assumption, keep F-06 / F-07 and upsize conductors before energizing.
5. Do not use 32V automotive MEGA fuses on 48V house circuits; use 58V / 80V DC-rated fuses only.
6. Keep the SmartShunt fused lead as an OEM harness item unless an equivalent voltage-rated replacement is fully validated.
7. SW-12V-BATT is manual-only in Phase 1; no automatic LVD behavior is assumed in this schedule.
8. Battery listing data (<=200A current limit) is currently treated as provisional because the provided screenshot includes 14.6V/14.2V values that are not a 51.2V profile; final lock requires validated 51.2V battery documentation.
9. If final battery current or terminal limits are lower than current assumptions, down-select F-01A/B/C to 175A and keep fuse-to-conductor coordination synchronized with [docs/ELECTRICAL_overview_diagram.md](#) and [bom/bom_estimated_items.csv](#) .
10. Orion fuse selection is side-voltage based per Victron table (input or output), not just converter model number. Keep F-06 and F-07 aligned to 48V input / 12V output sides.
11. Final lock for F-11 requires explicit 12V buffer battery/BMS continuous discharge-current confirmation; if <100A , down-select F-11 and SW-12V-BATT /holder family accordingly.