

# 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 LiFeP04 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:
  - MultiPlus-II 48/3000
  - SmartSolar 150/45
  - Sterling BB1248120 output
  - 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](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](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](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](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](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?](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.blueseas.com/resources/1437>
  - Blue Sea Class T holder-family compatibility ( 110A-200A vs 225A-400A ): [https://www.blueseas.com/support/articles/Fuse\\_Blocks/1438/Selecting\\_Class\\_T\\_Fuses](https://www.blueseas.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 04980921GXM5 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\_1\_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 049809216XM5 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

- 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).
- F-09A/B/C remains provisional at 15A pending final solar module datasheet max-series-fuse confirmation.
- 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 .
- If Orion run lengths exceed the short/medium assumption, keep F-06 / F-07 and upsize conductors before energizing.
- Do not use 32V automotive MEGA fuses on 48V house circuits; use 58V / 80V DC-rated fuses only.
- Keep the SmartShunt fused lead as an OEM harness item unless an equivalent voltage-rated replacement is fully validated.
- SW-12V-BATT is manual-only in Phase 1; no automatic LVD behavior is assumed in this schedule.
- 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.
- 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 .
- 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.
- 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.