

VIBS 2019

PYS Presentation

Inverter Selection & Installation Tips

By Jeff Cote

Pacific Yacht Systems Inc.

design • installation • service • support

Passion for Boating



- Systems Design Engineer
- Owner/operator of Pacific Yacht Systems
- NMEA & ABYC certifications
- Published monthly columns
 - Pacific Yachting Magazine: Tech Talk
 - Northwest Yachting Magazine: Hot Wire
- Proud Owner: 36' Sailboat
- Favorite BC cruising grounds are Barkley Sound and the Broughton Archipelago

About Pacific Yacht Systems Inc.



- Specialize in marine electrical and electronics
- Servicing the British Columbia and Western Canada
- Worldwide electrical design / consultation
- 2018 Recap:
 - Completed over 1000 boat projects
 - Designed / consulted on over 100 electrical projects
- Over 150 “How To” PYS Videos on YouTube
- www.pysystems.ca for schematics, design info, published articles, etc...

Inverter Requirements



- Large battery bank to sustain large amp draw from inverter:
 - Microwave draws 50-100 amps
 - Coffee machine 90-140 amps
- Minimum Battery bank size
 - 200 AHr (2 Golf Cart in series, 2 Group 31s in parallel, 1 8D)
- Battery Bank Voltage 12VDC or 24VDC

Inverter - Purchasing Tips

Wattage Size?



- What's inverter intended purpose?
 - Microwave, computer charging, TV, blender, etc...
 - Look at wattage specification of AC appliances
- Advice: Get a slightly larger inverter than you need
- EXAMPLES
 - Inverter: 300W – 600W
 - TV, computer charging, portable power tool battery charging
 - Inverter: 1000W
 - Small microwave, blender, etc...
 - Inverter: 2000W
 - Coffee/espresso machine, hairdryer, etc...

Inverter - Purchasing Tips

True Sine vs Modified



- What loads will you be running off Inverter
 - Resistive Loads: Toaster, hairdryer, etc..
 - Inductive Loads: Microwave, fridge, etc...
- PYS Recommendation: true sine wave inverter
 - Provides flexibility
 - More efficient at conversion



Inverter - Purchasing Tips With or Without Charger



- Many inverters come with a built-in charger
 - 1000W Inverter & 50A Charger
 - 2000W Inverter & 80 - 100A Charger
 - 3000W Inverter & 125 – 150A Charger
- Convenient way to get large battery charger to recharge large battery banks
 - Recall: minimum charge rate is 10% of battery capacity
- Cost effective way to get large charge rate
 - Standalone 100 amp 12 VDC smart charger is about \$2K

Inverter/Charger Example

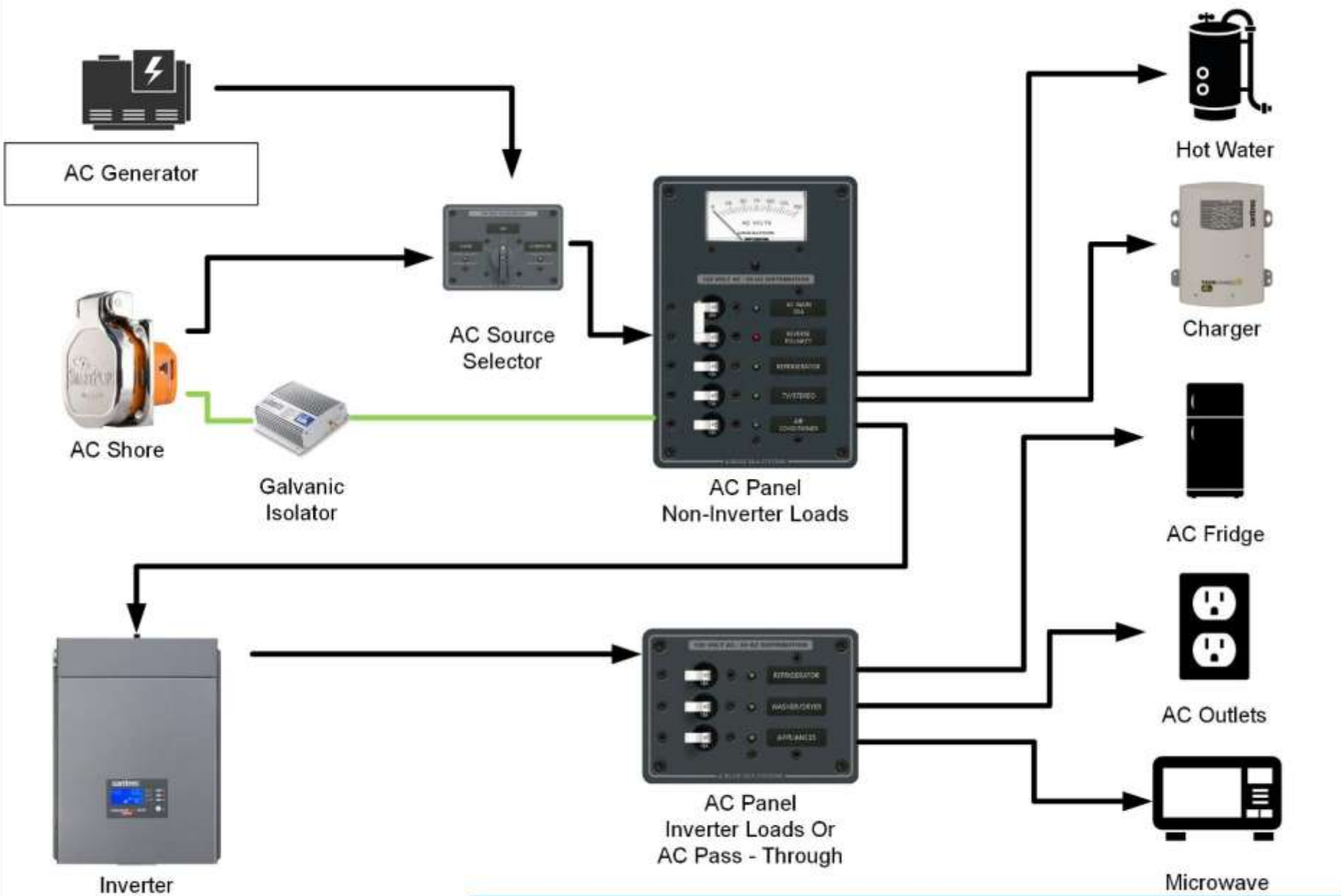


Inverter - Purchasing Tips

Interesting Features



- Marine certified
- Low idle power draw (i.e. stand-by mode)
- High efficiency
 - DC to AC conversion
- Power assist mode
- Remote control
 - Disable inverter, power draw, battery voltage
- Built-in charger
 - Custom charge profile e.g. AGM
- Automatic generator start module



Inverter – Installation Tips

AC Loads to Select



- What AC loads on AC panel will run off inverter
 - AC outlets
 - Microwave
 - Ice maker
 - Etc...
- Examples of AC loads NOT to connect to inverter (typical install)
 - Hot water heater
 - Air conditioning
 - Battery charger for boat batteries

Inverter - Installation Tips

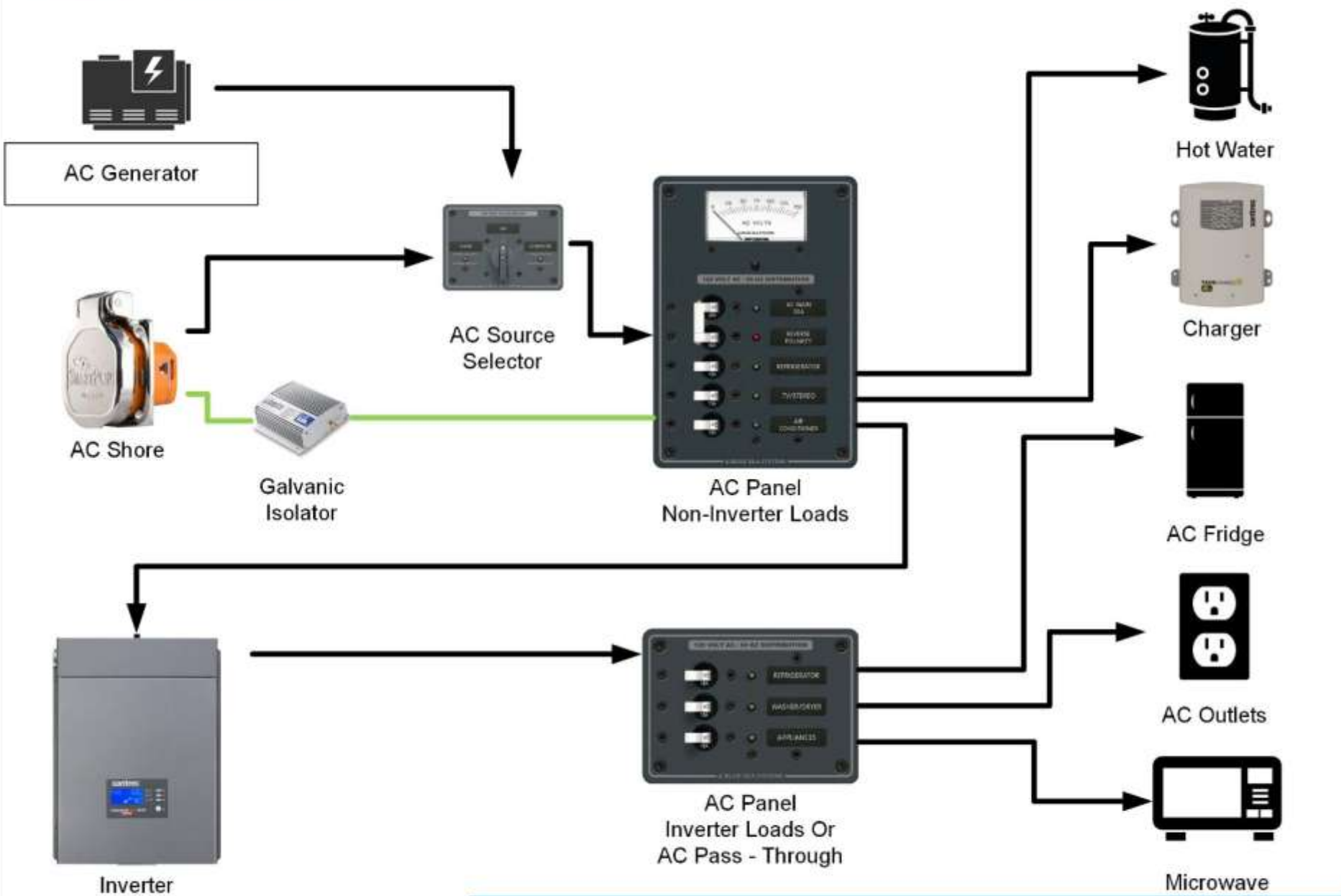
AC Wiring



- Dedicated inverter/charger AC circuit breaker at AC panel is required
- Marine grade AC wiring
- Inverter-only neutral bus is required
 - i.e. all inverter loads need their own AC neutral bus
- NEVER connect inverter/charger between AC shorepower receptacle and AC panel without circuit protection

Marine AC Wiring



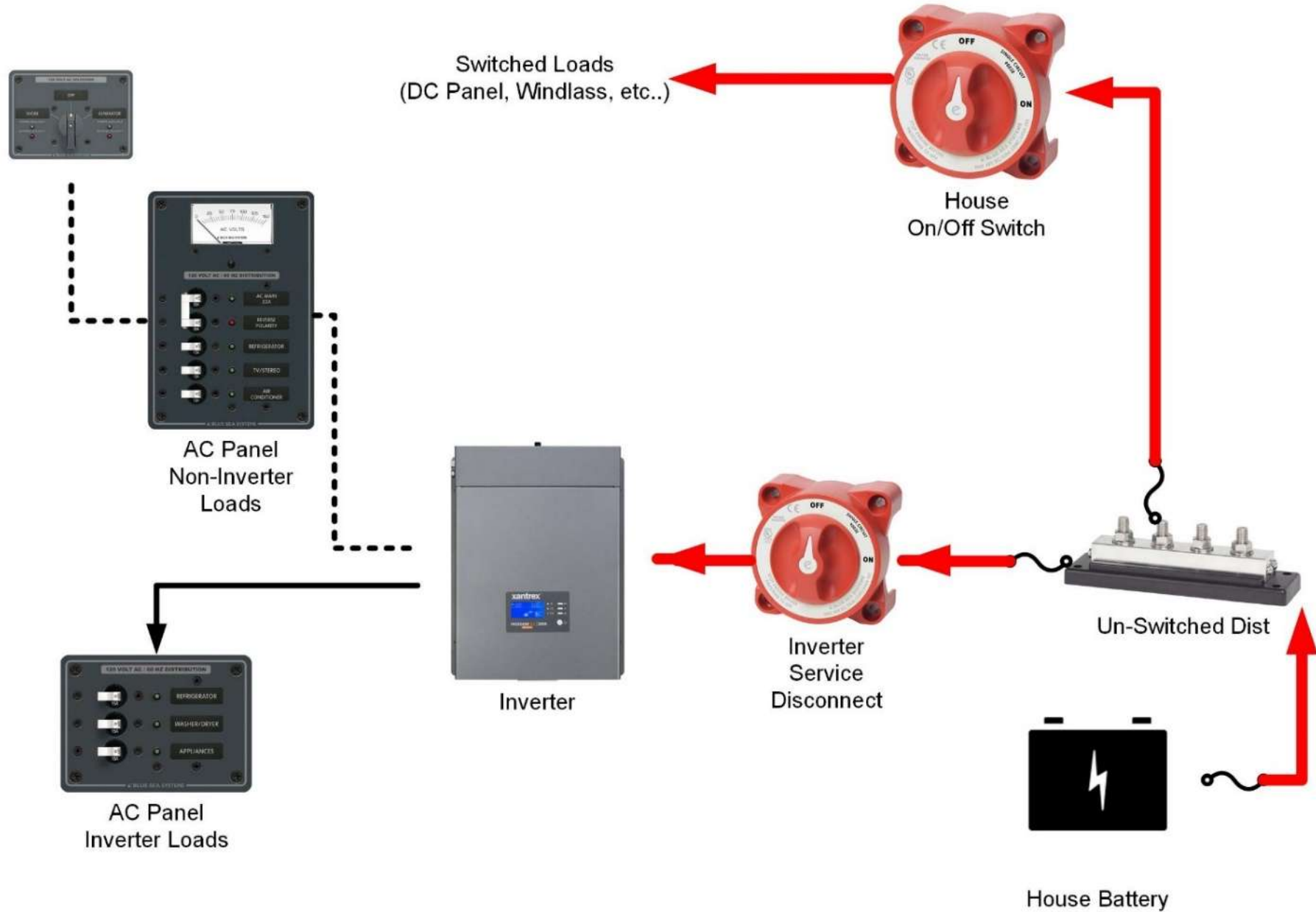


Inverter - Installation Tips

Inverter Location



- Inverters are NOT ignition protected and cannot be installed in gasoline engine room
- Mount in dry location
 - AWAY from potential engine water spray
 - AWAY from rainwater
- Location with good ventilation
- NOT above flooded lead acid batteries
 - Corrosive gassing of batteries while charging



Inverter Mounting Example



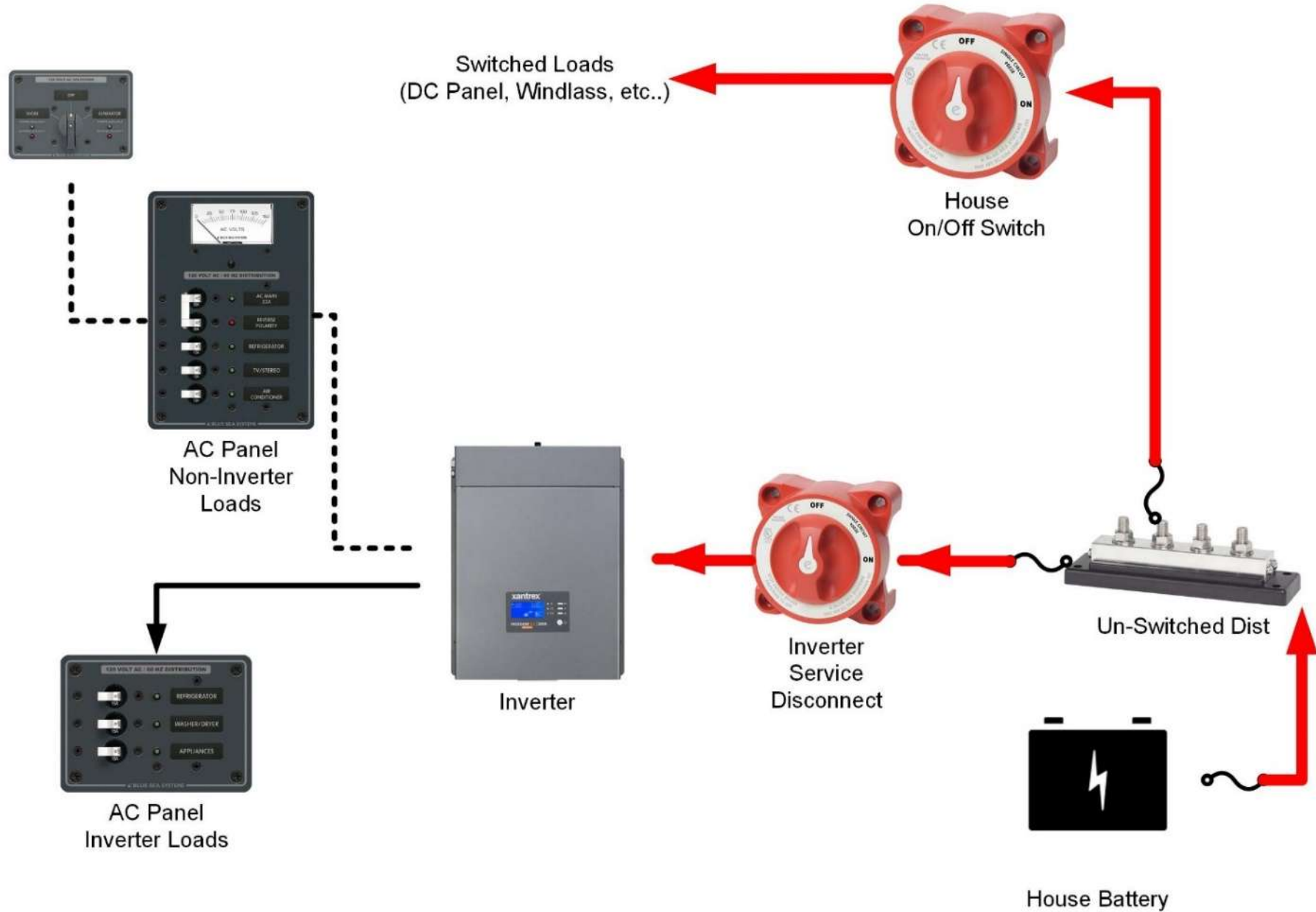
Inverter - Installation Tips

Fusing



- Choose correct type of fuse (preferred Class T)
- Correct amp rating
- Location of fuse near the battery
- Class T fuse is NOT ignition protected
 - DO NOT install in gasoline engine room
- Fuse to protect inverter and wire inverter
- Carry a spare inverter fuse
 - Hard to find when cruising





Inverter Fuse Re-invented???



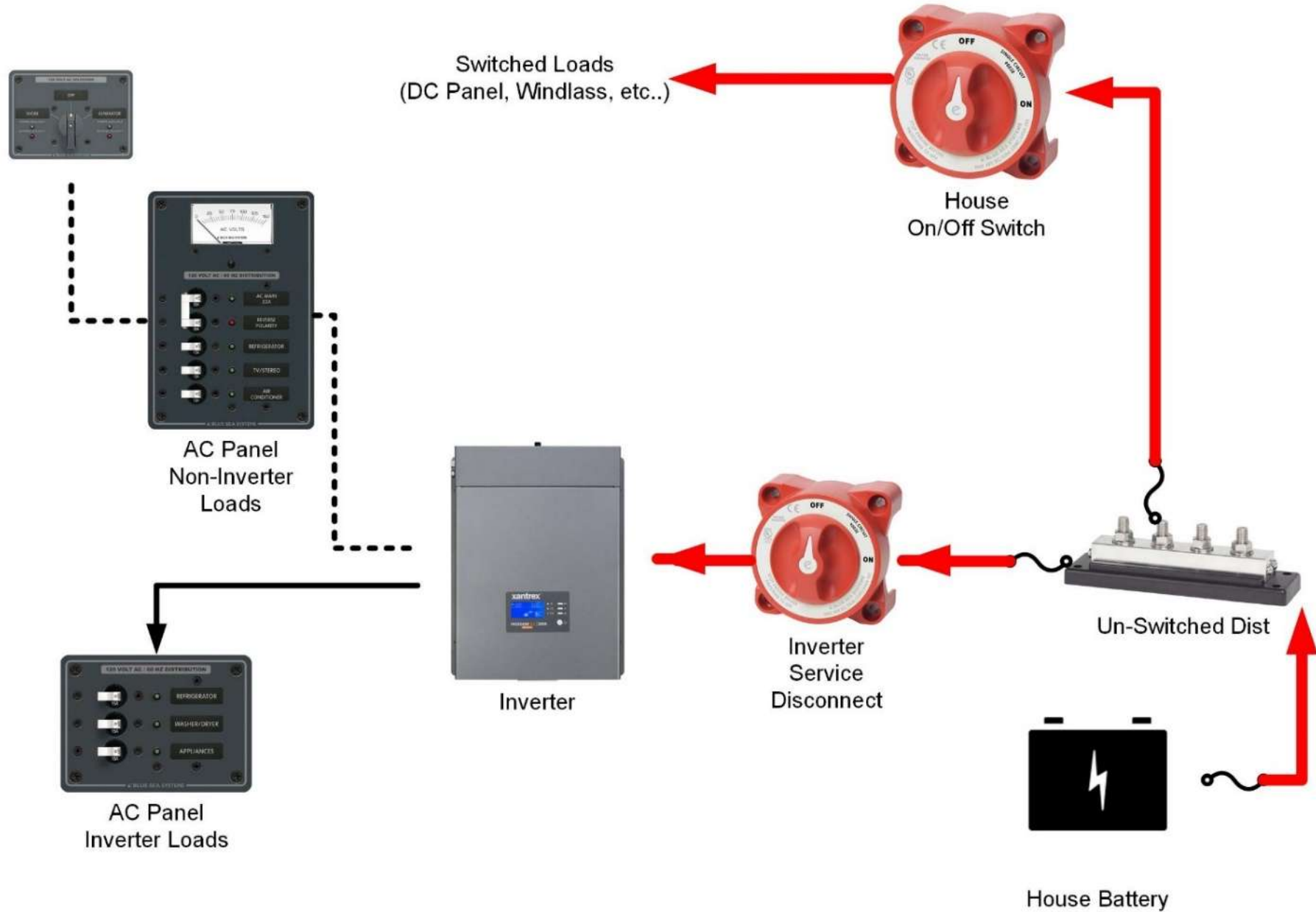
Inverter - Installation Tips

Master Disconnect



- On/off master DC disconnect
 - Turn power OFF to inverter for servicing AC or troubles with inverter
- Installed in convenient location for easy access
- Installed after the inverter fuse
- Inverter/charger switch
 - Bypass house switch
 - Direct at battery via fuse





Inverter - Installation Tips

DC Wiring



- Wire size is a function of amperage and voltage drop
 - Consider the whole length of DC positive and negative cable
- Use ABYC color wiring red for positive and yellow for negative
- High amperage connection requires perfect crimp of lug unto inverter battery cable
- Chassis ground cable
 - Needs to be only 1 size smaller than large DC cable size
 - Terminated to DC common bus

Marine Grade Cabling



2/0^{AWG}



Inverter/Charger Operation Guidelines



- When connected to shorepower and leaving vessel unattended (for long periods)
 - Turn inverter function off (using inverter button)
 - Especially when large AC loads like a heater are connected to inverter outlets
 - NEVER turn inverter/charger circuit breaker OFF
 - Charger will NOT work without AC input
- Charger function
 - Some models will allow the adjustment of charger output for smaller battery banks and limited AC power use

Old Inverter/Charger Considerations



- An inverter/charger is a cornerstone of many boat AC and DC electrical systems:
 - Charger is essential to recharge batteries while connected to shorepower or running AC generator
 - Many critical AC loads run off inverter: refrigeration, all AC outlets, microwave
 - Pass-through feature is convenient until inverter/charger fails
 - Lost of ALL AC loads even with shorepower or generator
- Inverter/charger rarely fail at the dock charging
 - They fail while doing heavy use

Inverter/Charger Remote Monitoring



- Newer models allow ability to remote login
 - Loss of AC shorepower
 - Capacity of batteries
 - Inverter status





Questions?

Connect with PYS



- PYS Electrical Orientation for your boat
 - 90 mins: Batteries, DC distribution, charger, alternator, inverter
- PYS Design Services for DIYers
 - Electrical system designed by PYS (collaborative and to marine code)
 - Installed by yourself or other outfit
- Pacific Yachting magazine - Monthly Tech Talk Column
- Northwest Yachting – Monthly Hot Wire
- YouTube – 500K Views
- www.pysystems.ca 1000s of articles
- Monthly email newsletter



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p | 604-284-5171 w | www.pysystems.ca

a | 1641 Powell Street, Vancouver, BC V5L 1H5