Control Category: Closed Loop Position Control

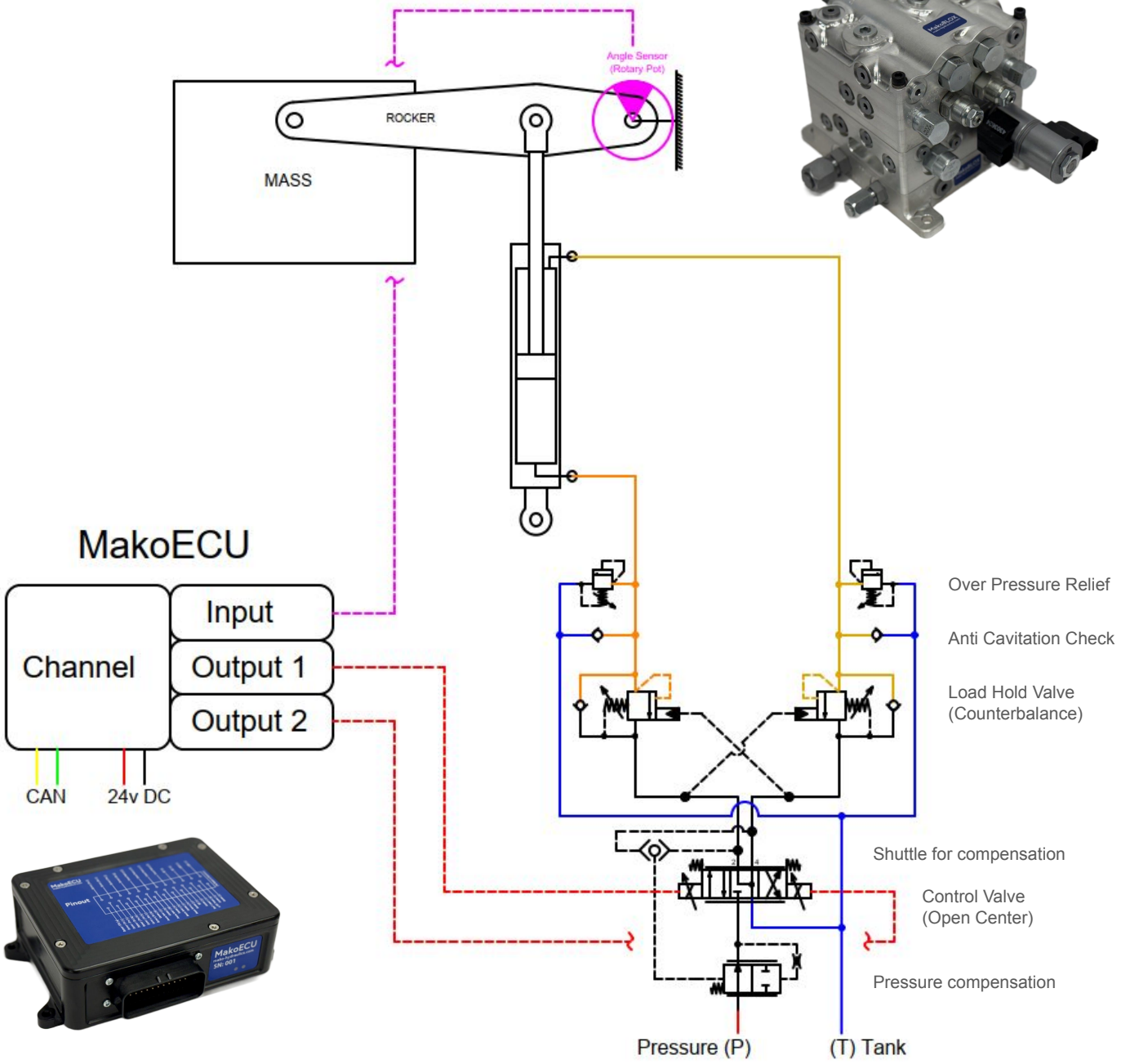
Functional requirements: Load hold with over-running load, over-pressure protection from external forces, anti-cavitation valve to compensate for volume changes from relief movement/ flow

Control valve: 4-way, 3-position cartridge valve with pressure compensating circuit to passively minimize control error with varying load.

Mako ECU Channel Mode: 1 - Position control

Mako BLOX Config: Appendix 1

Potential Applications: Agricultural robotics, Defense, Off-Highway, Forklifts, Boom Lifts, Test stands, Material handling, Hydraulic Presses, Injection molding



Control Category: Closed Loop Velocity Control

Functional requirements: High inertial loads where stopping quickly can cause damage from shock, anti-cavitation valve to compensate for volume changes from relief movement/ flow, neutral (free spin)

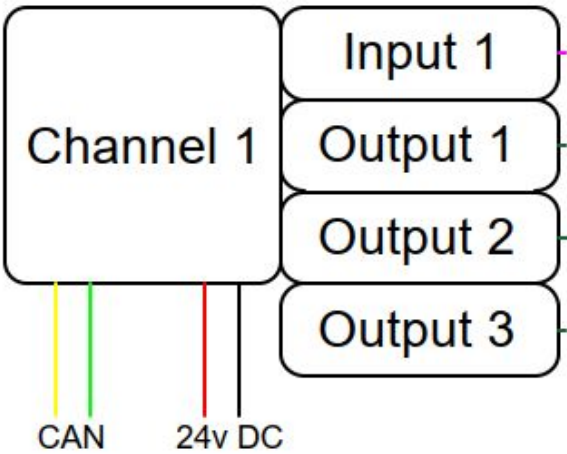
Control valve: Dual 3 Way flow control valves

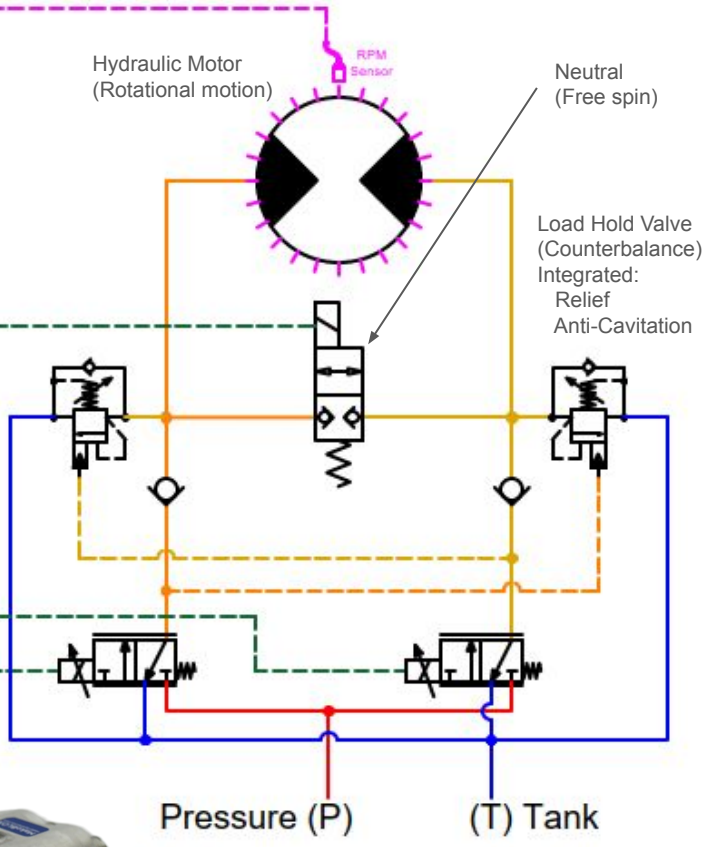
Mako ECU Channel Mode: 2 - Velocity control

Mako BLOX Config: Appendix 2

Potential Applications: Drive motors, Off-Highway, Pinion drive gears, torque vectoring, Agricultural robotics, Defense, Test stands

MakoECU





Dual control valves to create a 4 way motion control circuit

Control Category: Closed Loop Position Control (Highly Dynamic Functions, Linear Motor Direct Drive)

Functional requirements: Load hold, over-pressure protection from external forces, anti-cavitation valve to compensate for volume changes from relief movement/ flow

Control valve: Direct Drive 4-way, 3-position Valve provides the durability and reliability of of a proportional valve with the performance of a servo valve.

Mako ECU Channel Mode: 1 - Position control, utilizing full bridge for +/- current control

Mako BLOX Config: Appendix 3

Potential Applications: Flight control surfaces, Agricultural robotics, Defense, Off-Highway, Test stands, Simulators

MakoECU

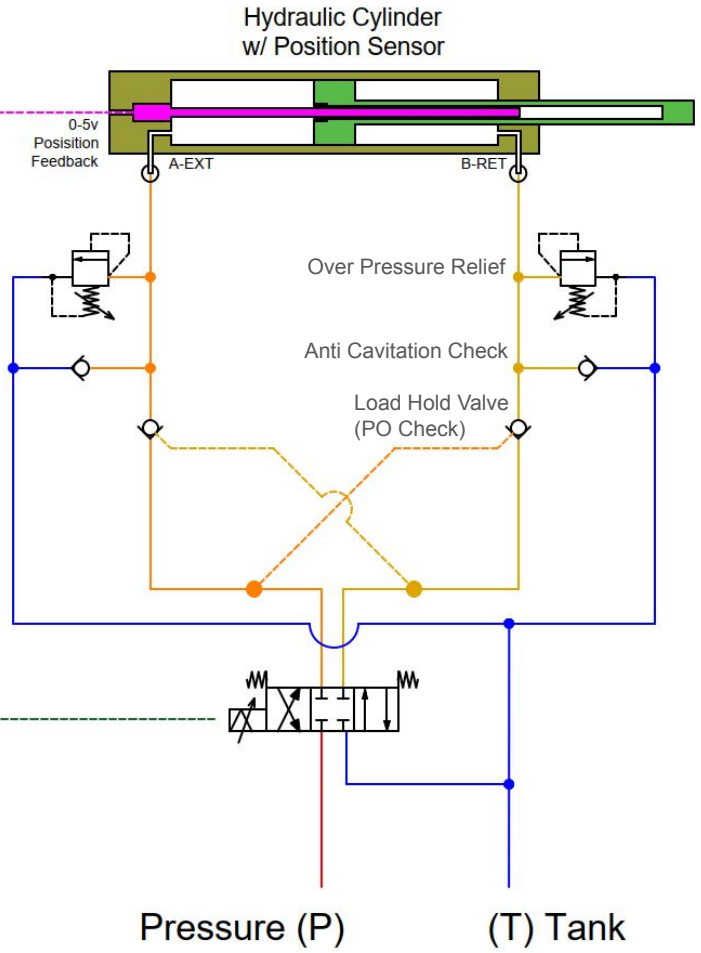
Channel

Input

Output 1

CAN

24v DC



*up to 4x direct drive (linear motor) valves per Mako ECU

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Control Category: Open Loop Control, double acting

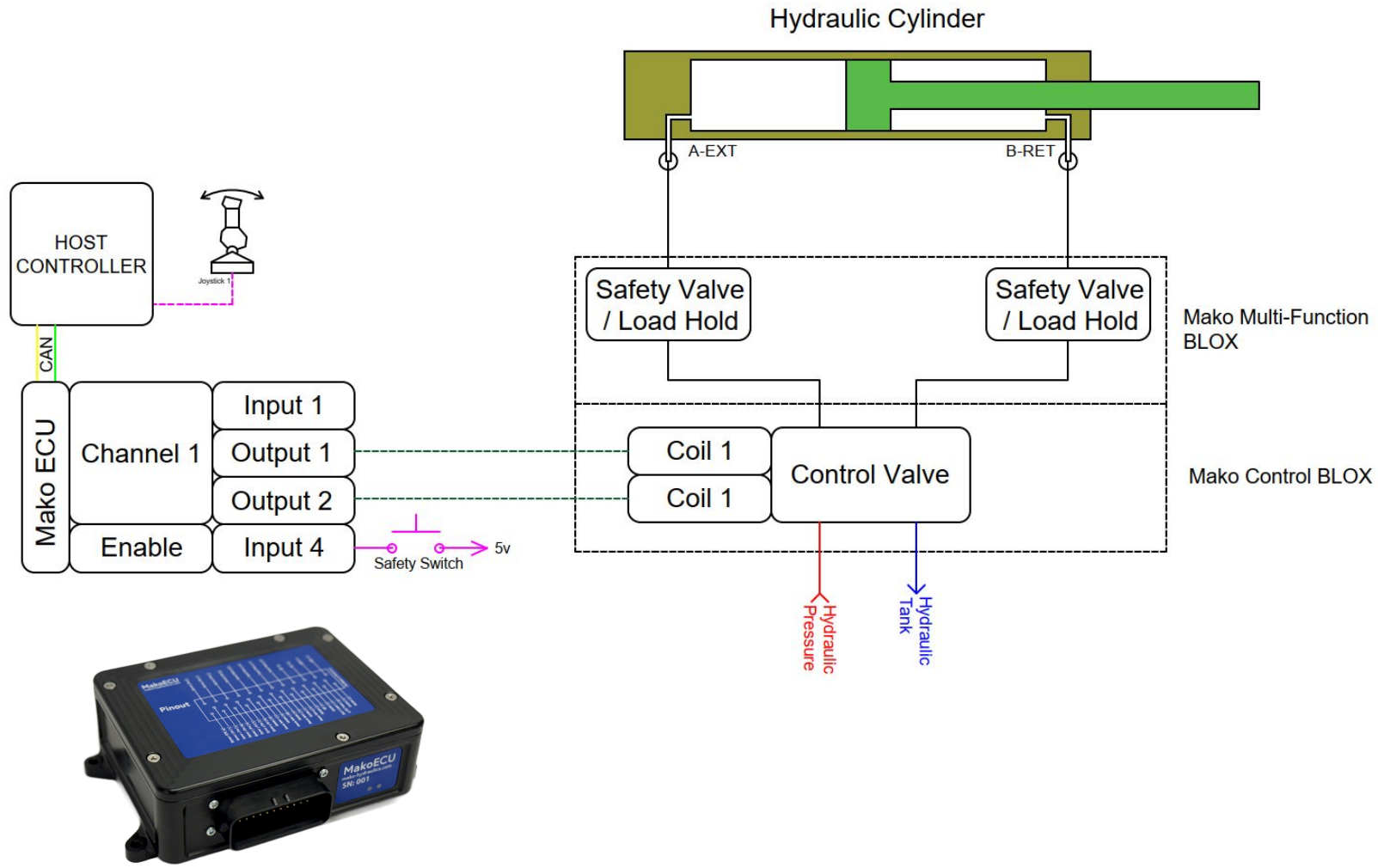
Functional requirements: Safety/ Load hold valve

Control valve: 2 coil proportional control, can be either 3 position 4 way, or Dual 3 way valves

Mako ECU Channel Mode: 3 - Proportional Current Control

Mako BLOX Config: Appendix 1 or 2

Potential Applications: Mobile robotics, Defense, Off-Highway, Heavy equipment, Outriggers, Stabilizers, Tilt mechanisms



Control Category: Open Loop Velocity Control, single acting (up to 2 functions per Multi-Function BLOX)

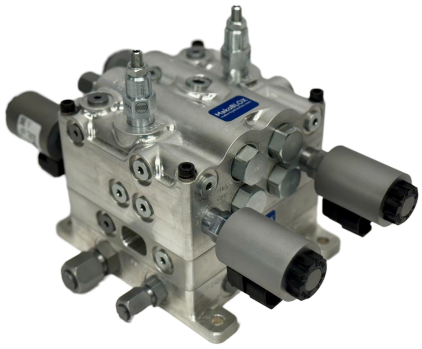
Functional requirements: Zero leakage, relief for overpressure protection

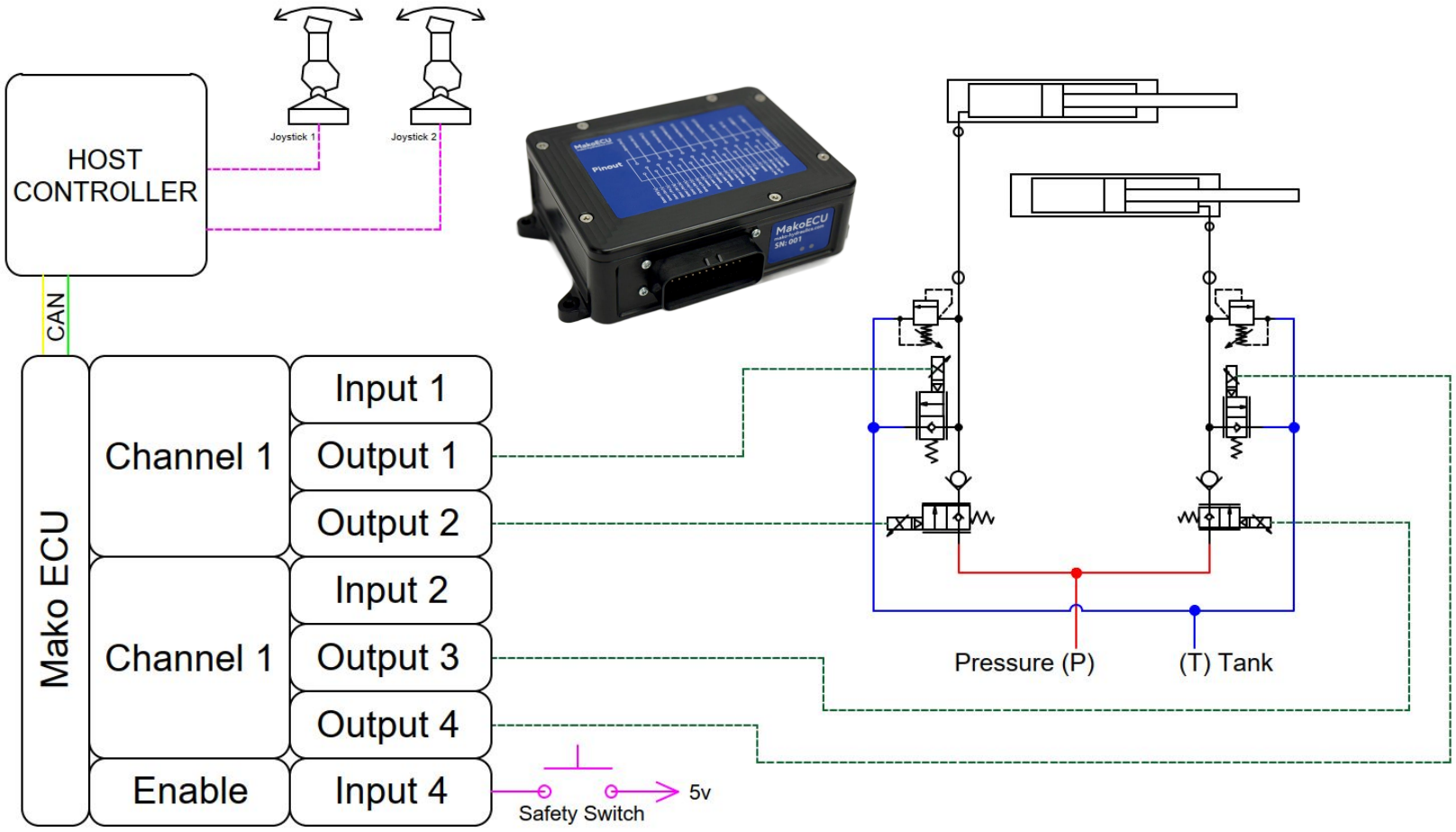
Control valve: Meter in and meter out valves, poppet style for 0 leakage, Gravity lowering (high efficiency)

Mako ECU Channel Mode: 3 - Proportional Current Control

Mako BLOX Config: Appendix 4

Potential Applications: Electrification, Off-Highway, Marine, Mobile robotics, Defense, Heavy equipment, Outriggers, Stabilizers, Tilt mechanisms





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Control Category: Pump Safety and Distribution circuit with accumulator isolation

Functional requirements: Prevent backflow to pump, normally open safety circuit (power loss safety), accumulator isolation (charge and discharge) with safety relief when isolated

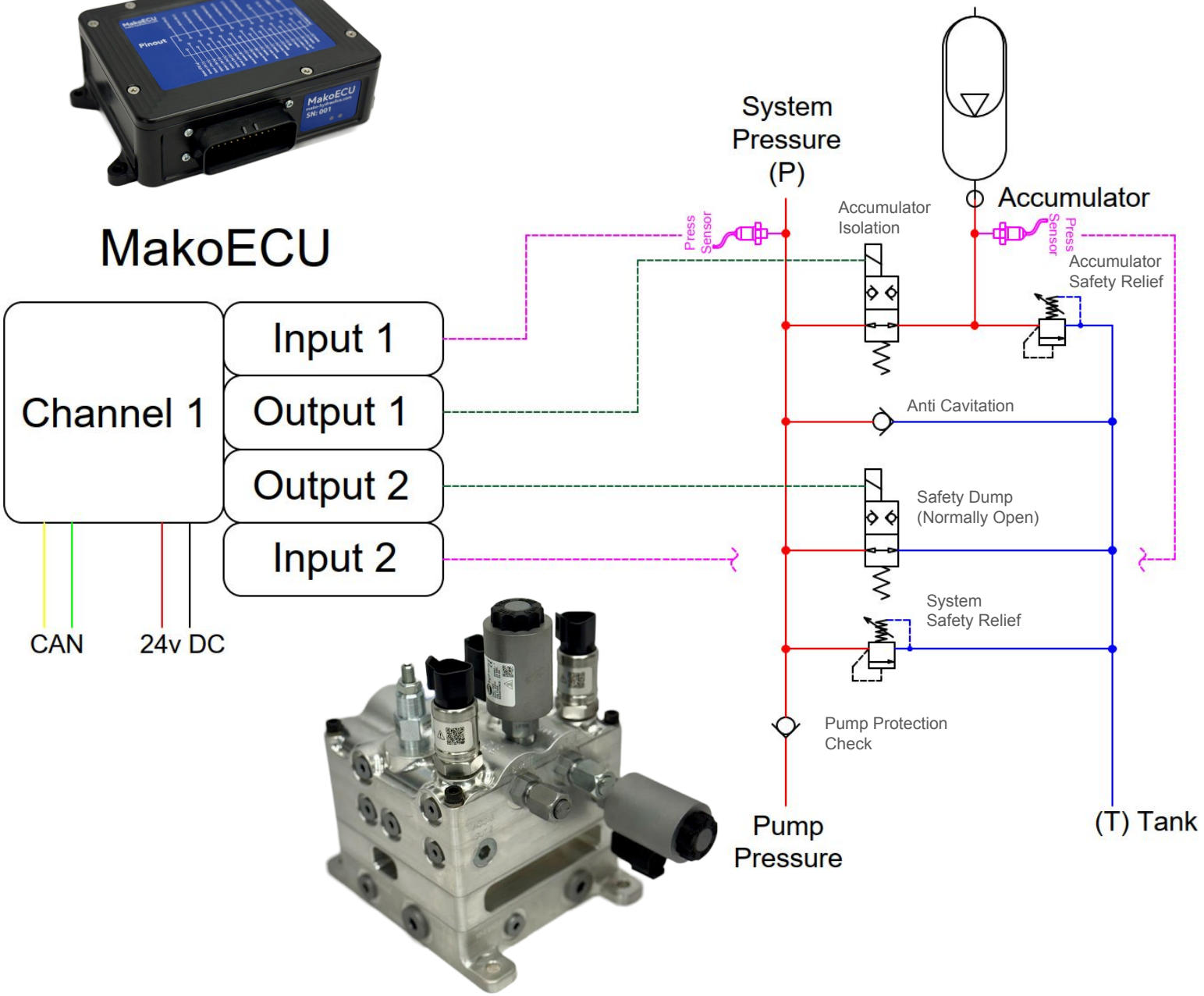
Control valve: On/ Off poppet valves (0 leakage when energized)

Mako ECU Channel Mode: 4 - Digital Current Control

Mako BLOX Config: Appendix 5

Potential Applications: Mobile robotics, Defense, Heavy equipment, Test Rigs

MakoECU



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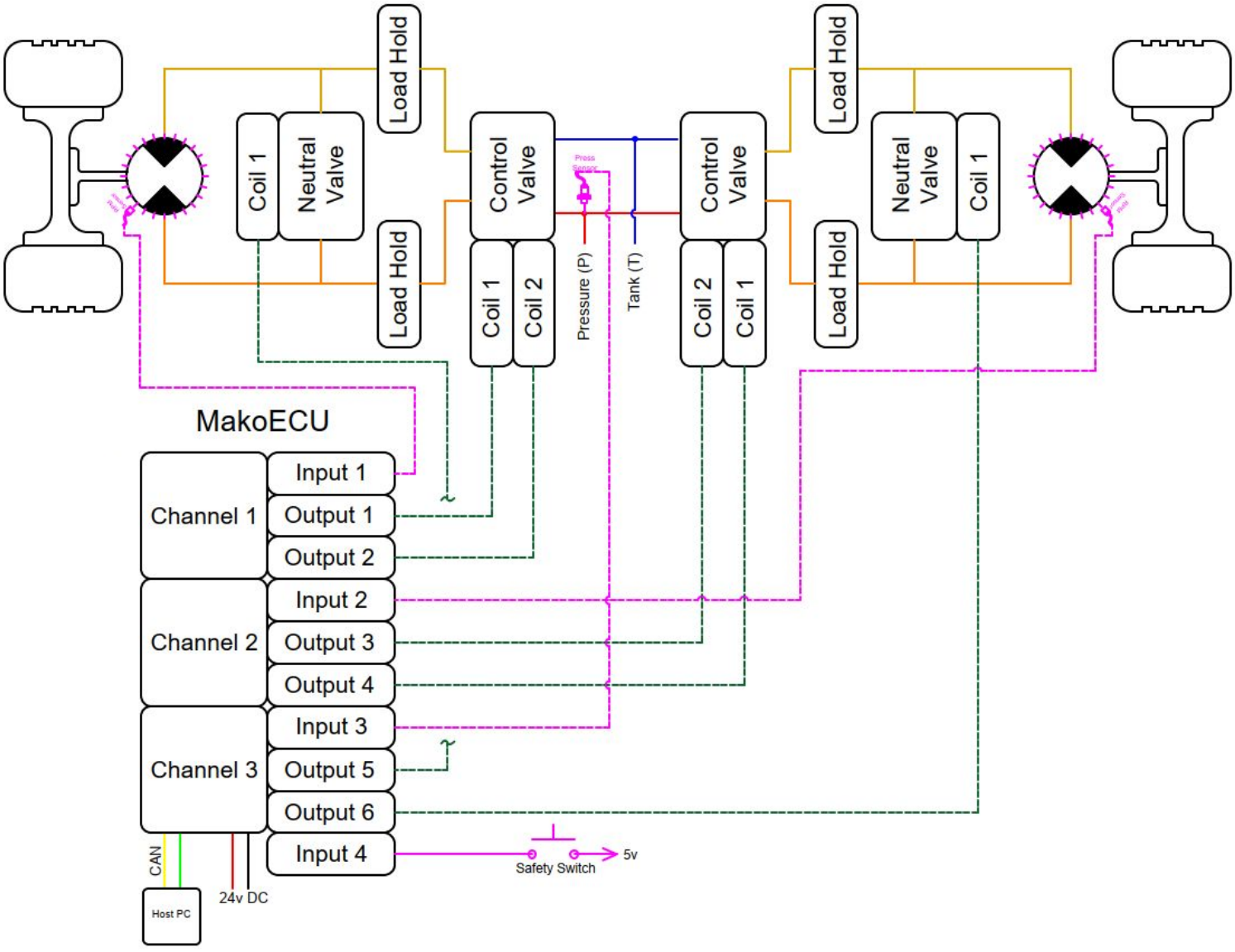
System Example: 2WD Platform, capable of torque vectoring and neutral mode

Mako ECU Channel Mode: 3 - Proportional Current Control and 4 - Digital Current Control

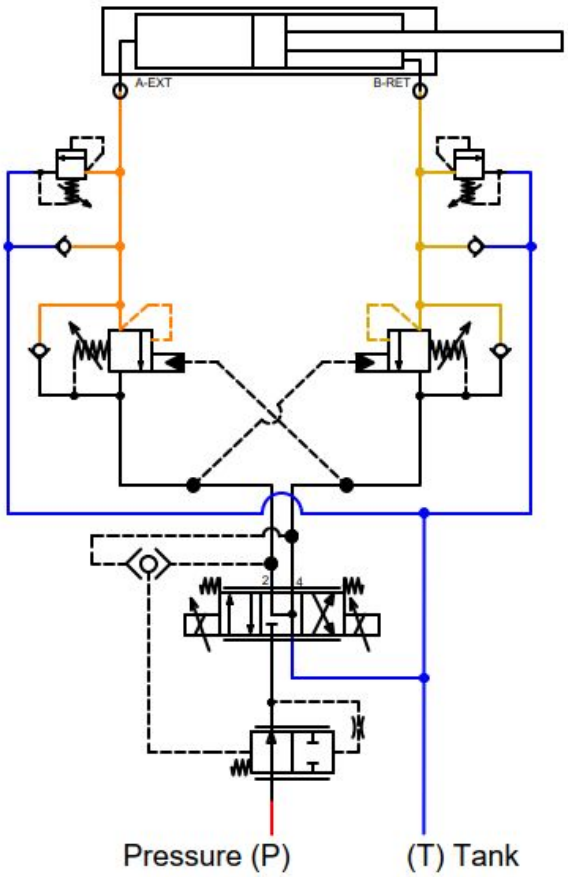
Mako BLOX Config: Appendix 1 or 2

Potential Applications: Mobile robotics, 0 radius turn platforms, tracked vehicles

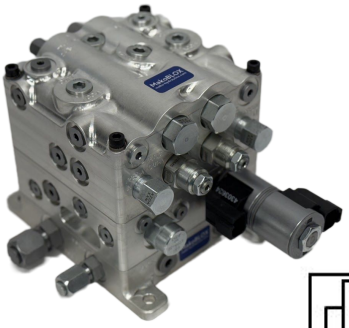


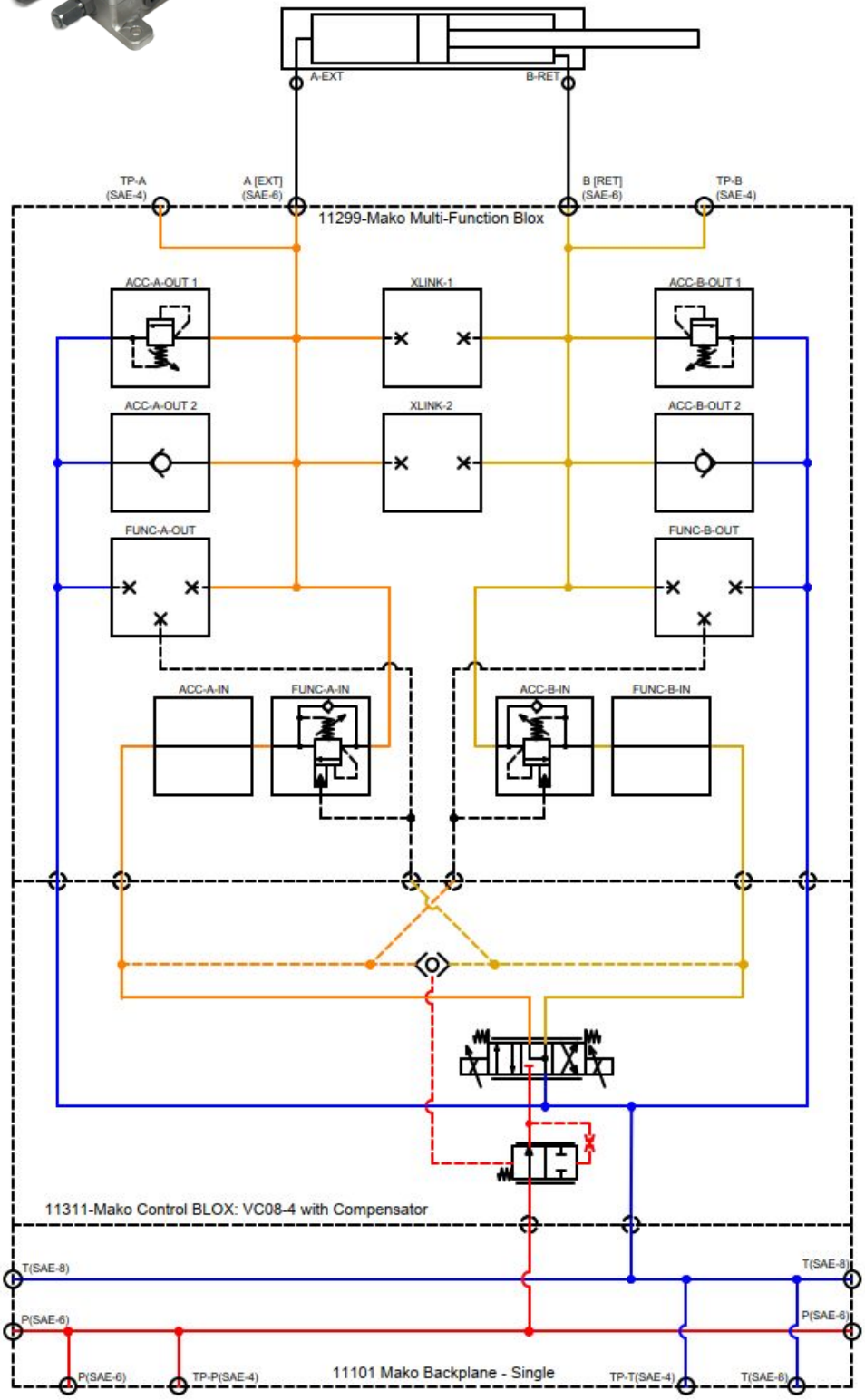
Mako BLOX Config: Appendix 1

Simplified Circuit



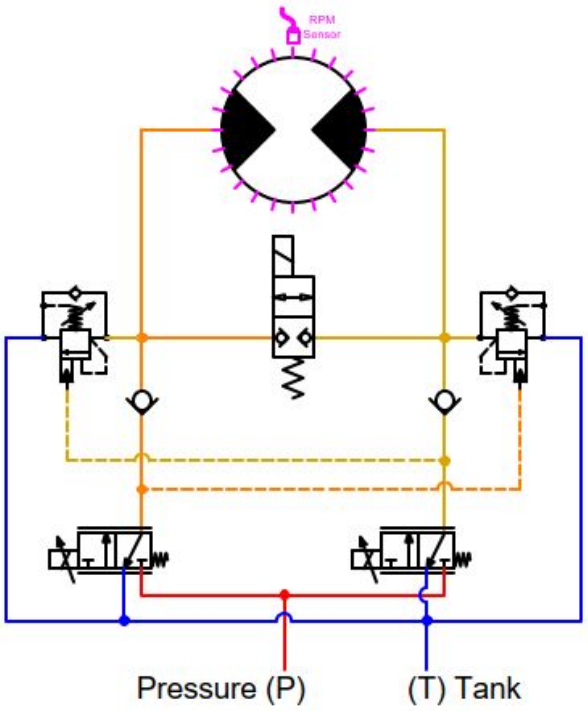
MakoBLOX Config



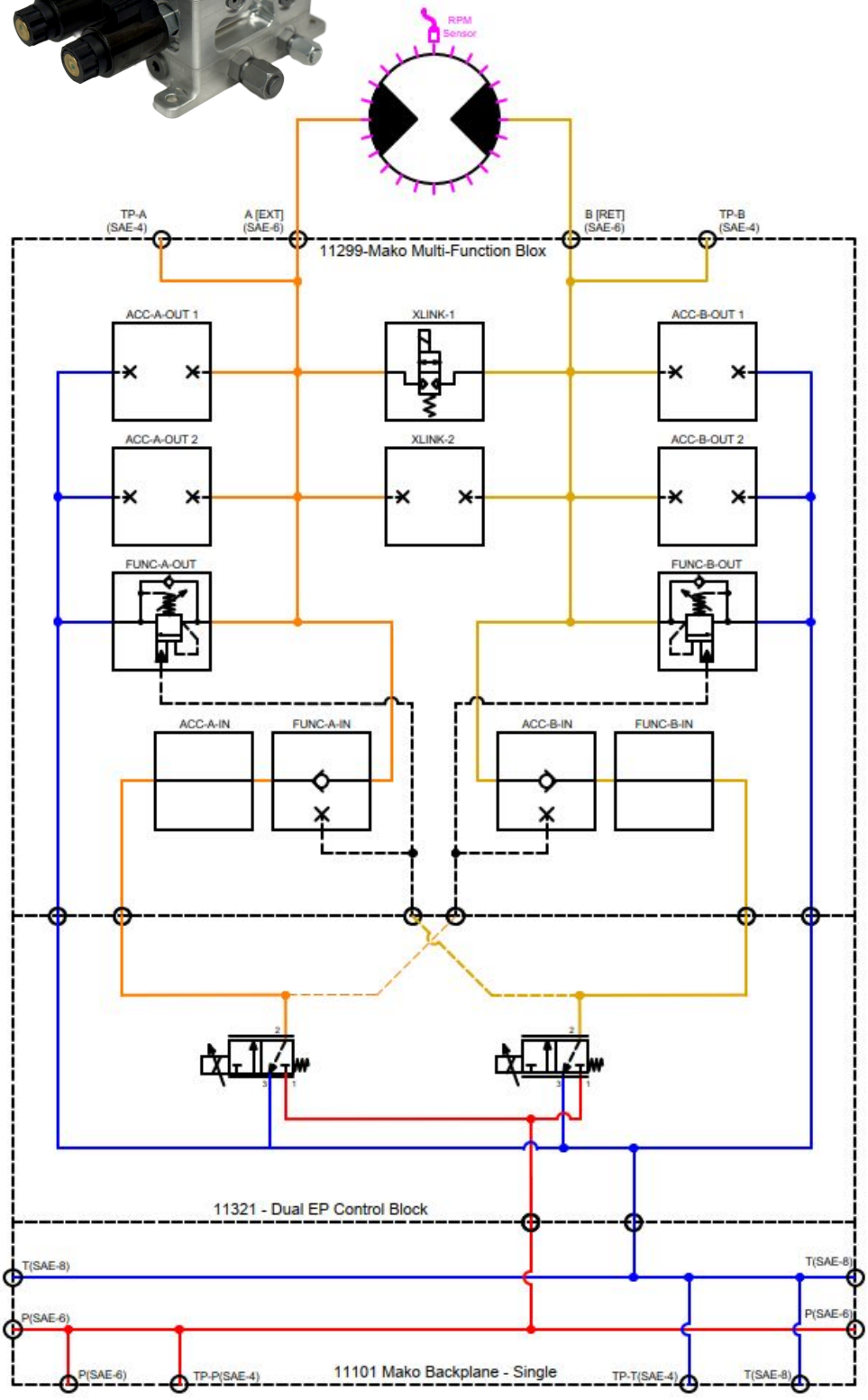


Mako BLOX Config: Appendix 2

Simplified Circuit

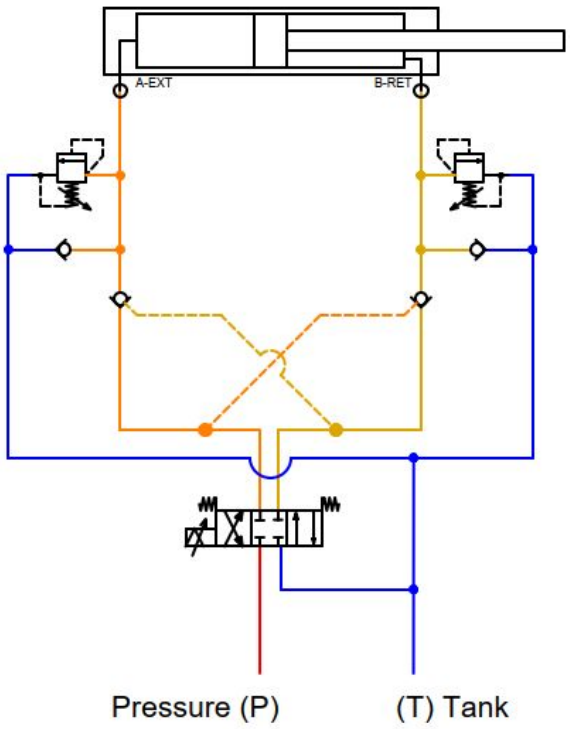


MakoBLOX Config

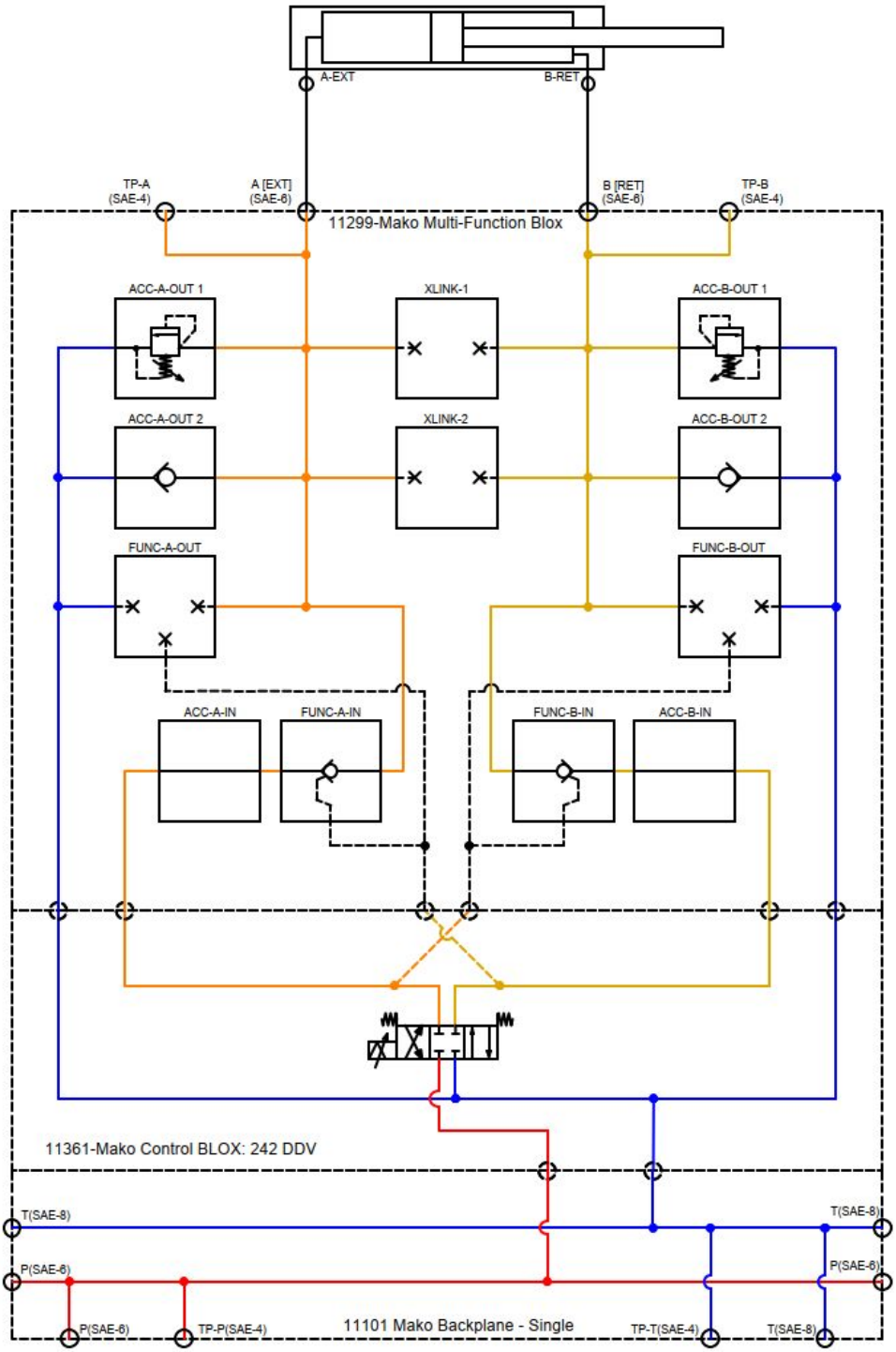


Mako BLOX Config: Appendix 3

Simplified Circuit

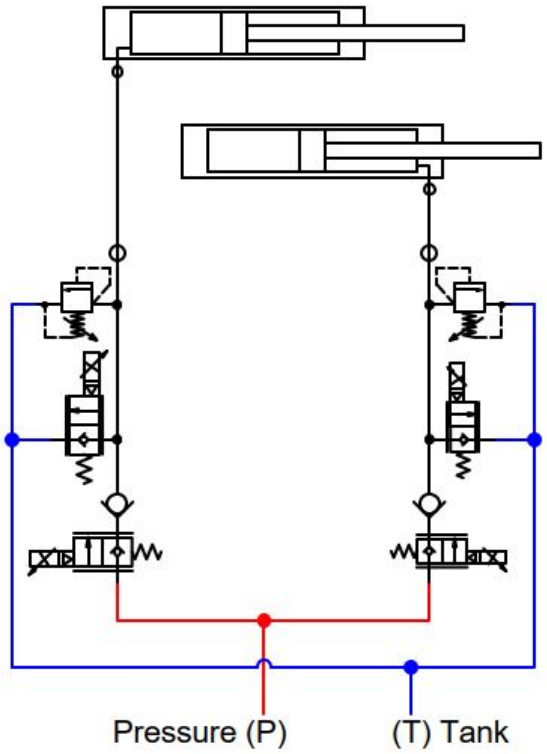


MakoBLOX Config

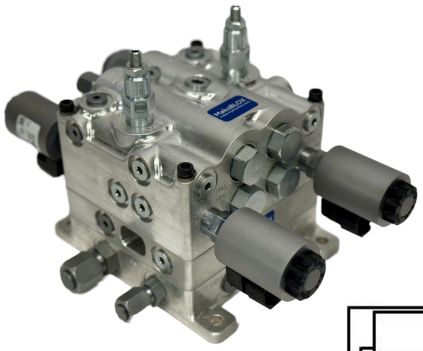


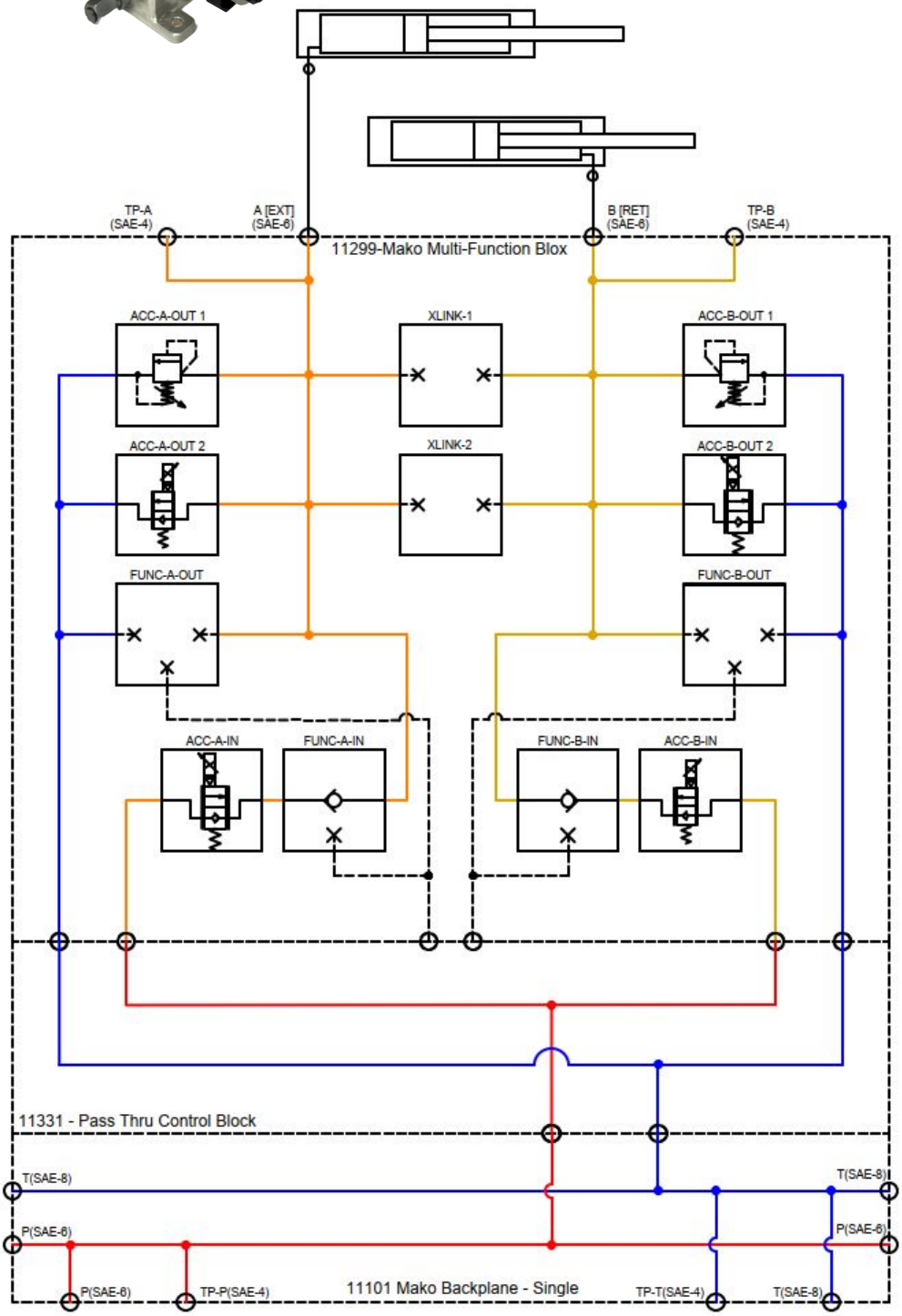
Mako BLOX Config: Appendix 4

Simplified Circuit



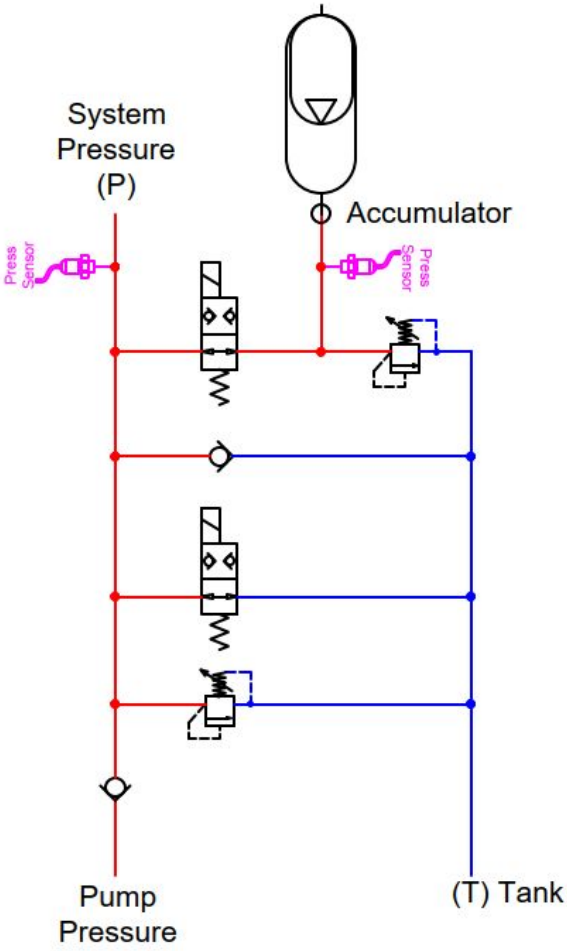
MakoBLOX Config





Mako BLOX Config: Appendix 5

Simplified Circuit



MakoBLOX Config