THE INDUSTRIES AND APPLICATIONS WE SERVE

Oil & Gas
- Oil pipeline pumps
- Natural gas pipeline compressors
- Induced draft fans
- Axial-vane compressors
- Reciprocating compressors
- Centrifugal compressors

Mining & Steel
- Slurry pumps
- Ventilation fans
- Descaling pumps
- Single motor, non-regen conveyors
- Baghouse fans
- Cyclone feed pumps
- Tailings pumps
- Screw pumps

Power Generation
- Feed water pumps
- Induced draft fans
- Forced draft fans
- Baghouse fans

Cement
- Kiln induced draft fans
- Forced draft fans
- Cooler baghouse fans
- Raw mill induced draft fans
- Kiln gas fans
- Cooler exhaust fans
- Baghouse fans

Water / Wastewater
- Raw Sewage Pumps
- Effluent Pumps
- Low Service/Raw Water Pumps
- High Service/Finished Water Pumps
- Booster Pumps
- Flood Control Pumps
- RAS Pumps
- WAS Pumps
- Aeration Blowers

Forest Products
- Fan pumps
- Induced draft fans
- Boiler feed water pumps
- Line shafts
- Slurry pumps

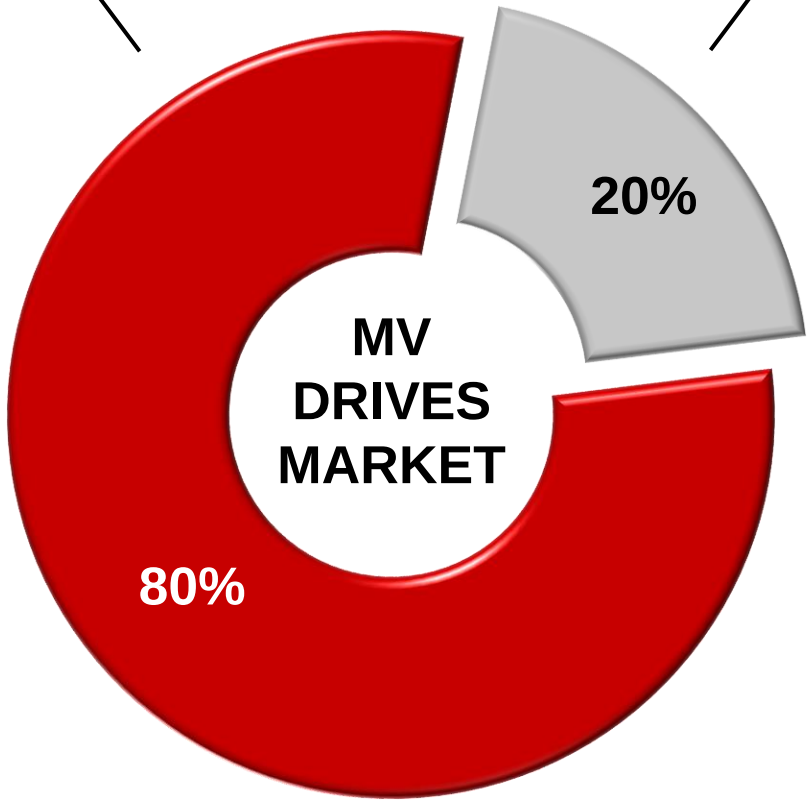
Commercial
- HVAC/OEM Chillers/compressors

Other
- Test stands
- Agitators

Medium Voltage Drive Application Types

GENERAL PURPOSE Applications

- Fans
- Pumps
- Compressors



SPECIAL PURPOSE Applications

- Cranes and Hoists
- Conveyors
- SAG and Ball Mills
- Extruders and Mixers
- Electro-submersible pumps
- Marine
- Subsea

Data Source: 2019 IHS MV Drives Market Study (2018 base year)

Medium Voltage Drive Portfolio - Application Alignment

POWERFLEX 6000

GENERAL PURPOSE DRIVES

Ideally suited for:

- Non-regen applications
- Long motor cable lengths (up to 2 km)

2.3...11 kV (up to 680 A)

POWERFLEX 7000

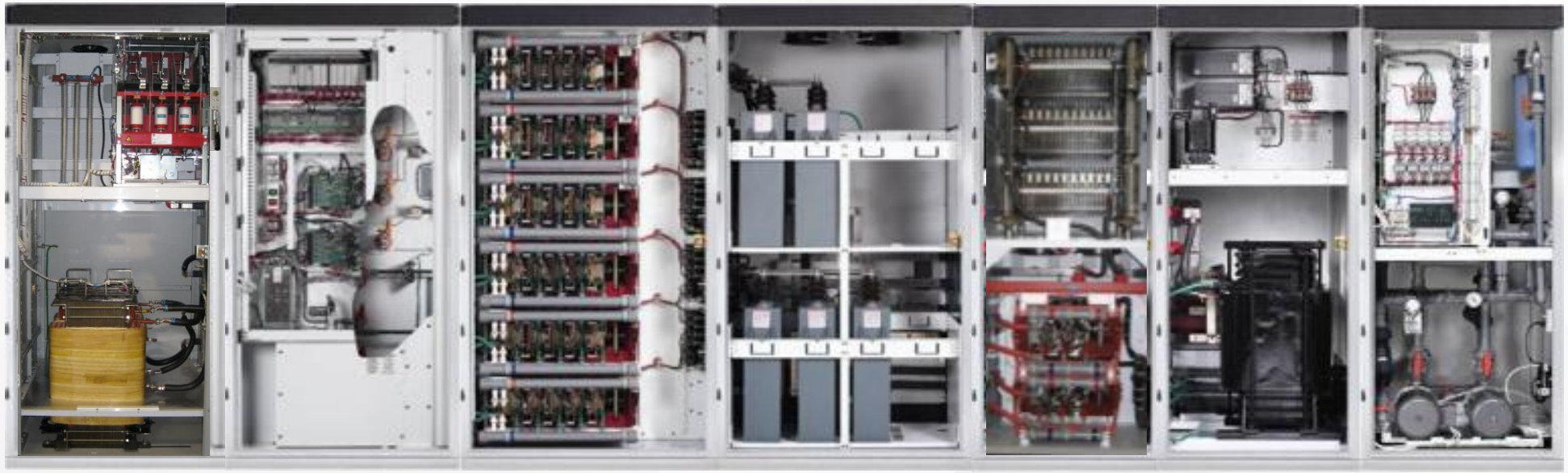
SPECIAL PURPOSE DRIVES

Ideally suited for:

- Regenerative applications
- Extended motor cable lengths (up to 30 km)

2.3...6.6kV (up to 720 A)

PowerFlex 7000



Line Reactor / Output Contactor Cabinet

Control & Cabling Cabinet

Converter Rectifier Cabinet

Capacitor Cabinet

Dynamic Braking & Chopper Cabinet

DC Link Inductor Cabinet

Pump Cabinet

Liquid Cooled & AFE Transformer-less Power Flex 7000 Marine Drive

PowerFlex 6000T Overview

Common control architecture across low voltage and medium voltage drives

Simplify your integration and operating experience

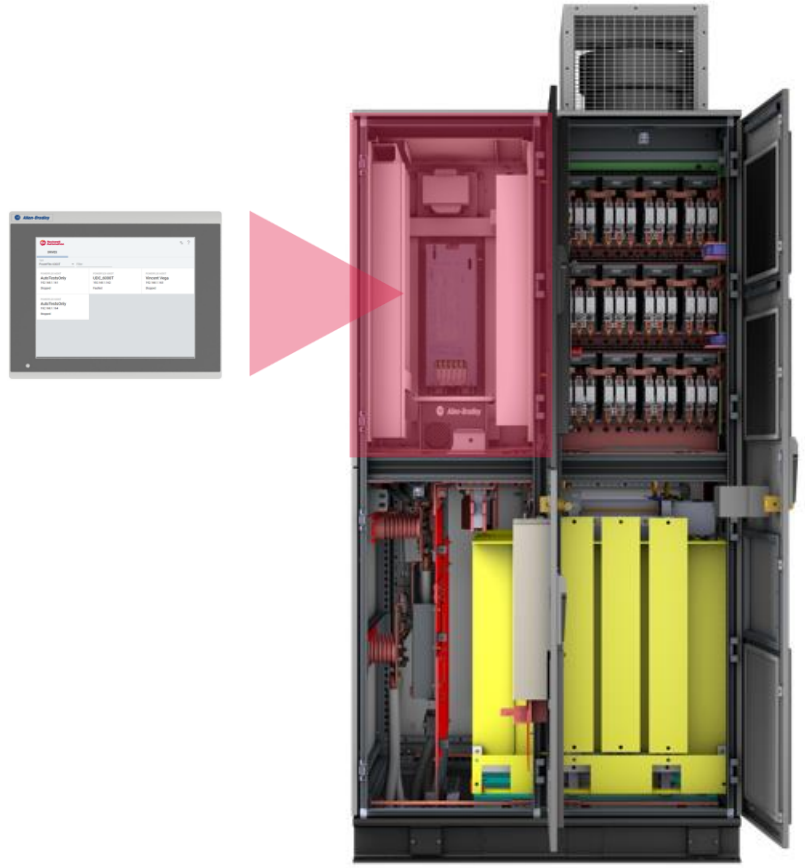
- Common control hardware architecture, firmware, and network interface software with PowerFlex 755T low voltage drives
- Reduce integration, operation, and support costs

PowerFlex 6000T – “A” Frame

PowerFlex 6000T New Features Summary

Key enhancements simplify connecting this smart device to your enterprise, add familiarity and ease of use, and provide additional device and process information

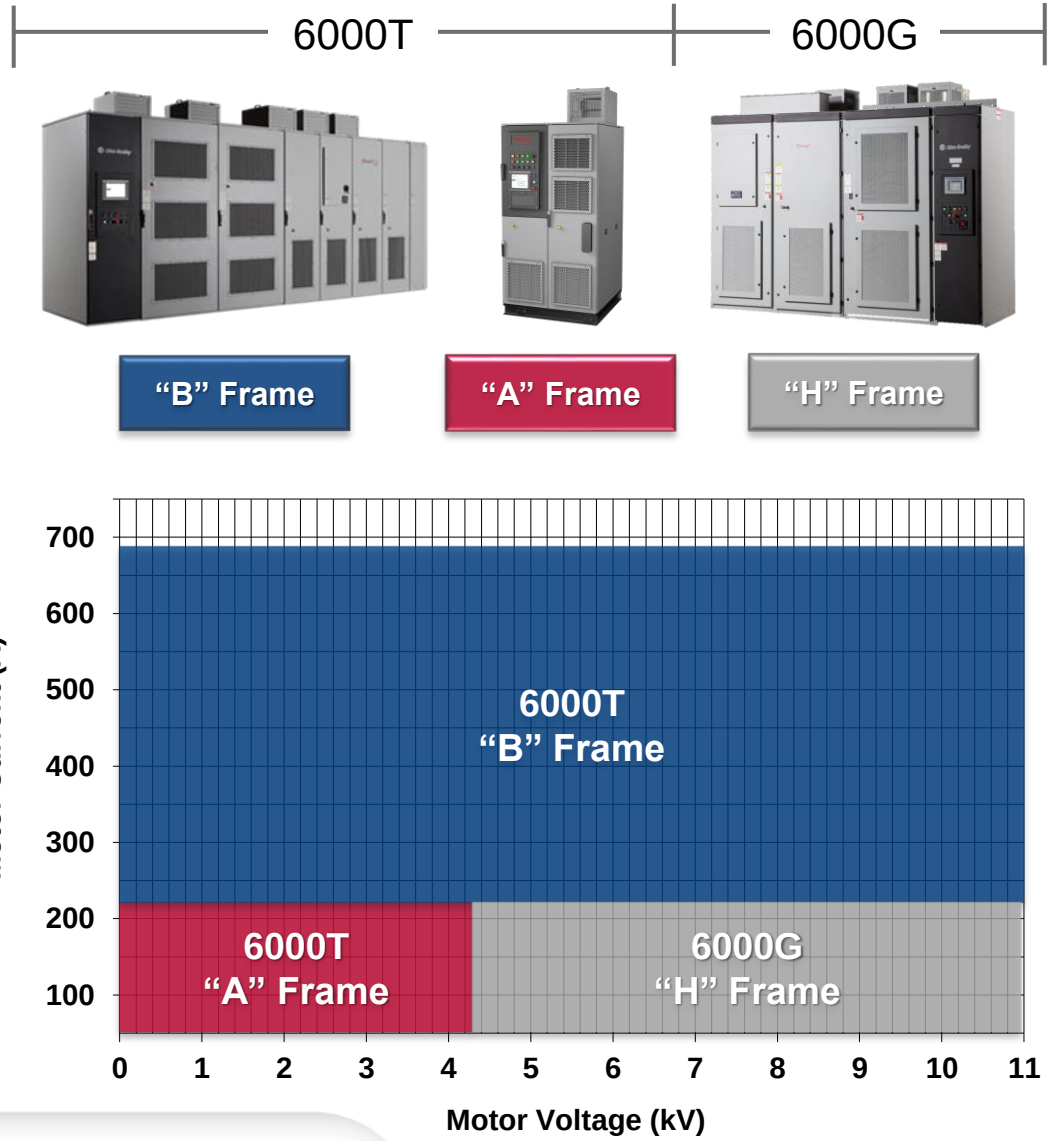
- Common low voltage and medium voltage drives user experience
- Enhanced connectivity
- Enhanced HIM module (eHIM)
- Quick and secure firmware upgrades



Enabled by common control architecture, eHIM, and shared network tools

PowerFlex 6000 Portfolio

- General Purpose Medium Voltage Drive:
  - Fans, pumps, and compressors
  - Ideally suited for non-regen applications
  - Up to 2 km motor cable length
- Global Standards Compliance:
  - IEC (all voltages) / UL - available up to 6.9 kV
- Motor Voltage and Current Scope:
  - 6000T Versions:
    - “A” Frame – 2.4...4.16 kV, 0...215 A
    - “B” Frame - 2.4 kV to 11 kV, 200...680 A
  - 6000G Version:
    - “H” Frame – 6...11 kV, 0...200 A
- Service and support available globally
  - Regional spare part hubs

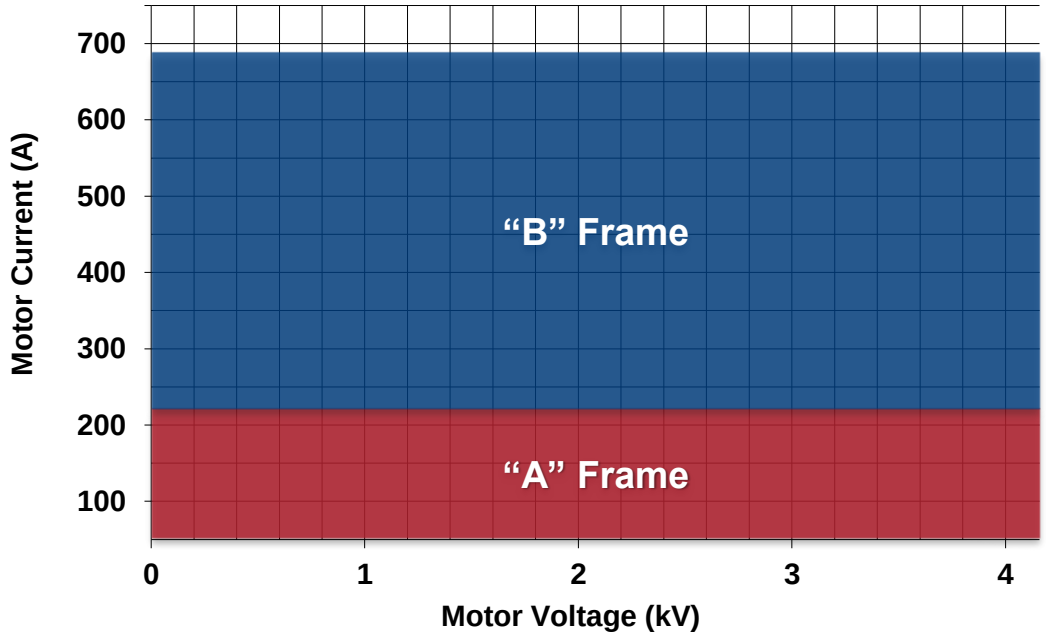


PowerFlex 6000T Product Offering (2.3…4.16 kV Focus)

- General Purpose Medium Voltage Drive:
  - Fans, pumps, and compressors
  - Ideally suited for non-regen applications
  - Up to 2 km motor cable length
- Global Standards Compliance:
  - IEC / UL-CSA
- Configurations:
  - “A” Frame: 0…215 A
  - “B” Frame: 216…680 A
- Service and support available globally
  - Regional spare part hubs

“A” Frame

“B” Frame



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DESIGN

Fast

- Premier Integration
- Software Tools:
  - Add On Profile (AOP) for Studio5000
  - Device Profile for Connected Components Workbench
  - Embedded DeviceLogix™ control

Flexible

- Mix and match option cards for I/O flexibility
- Built-in dual port EtherNet/IP
- Best-in-class footprint to install anywhere

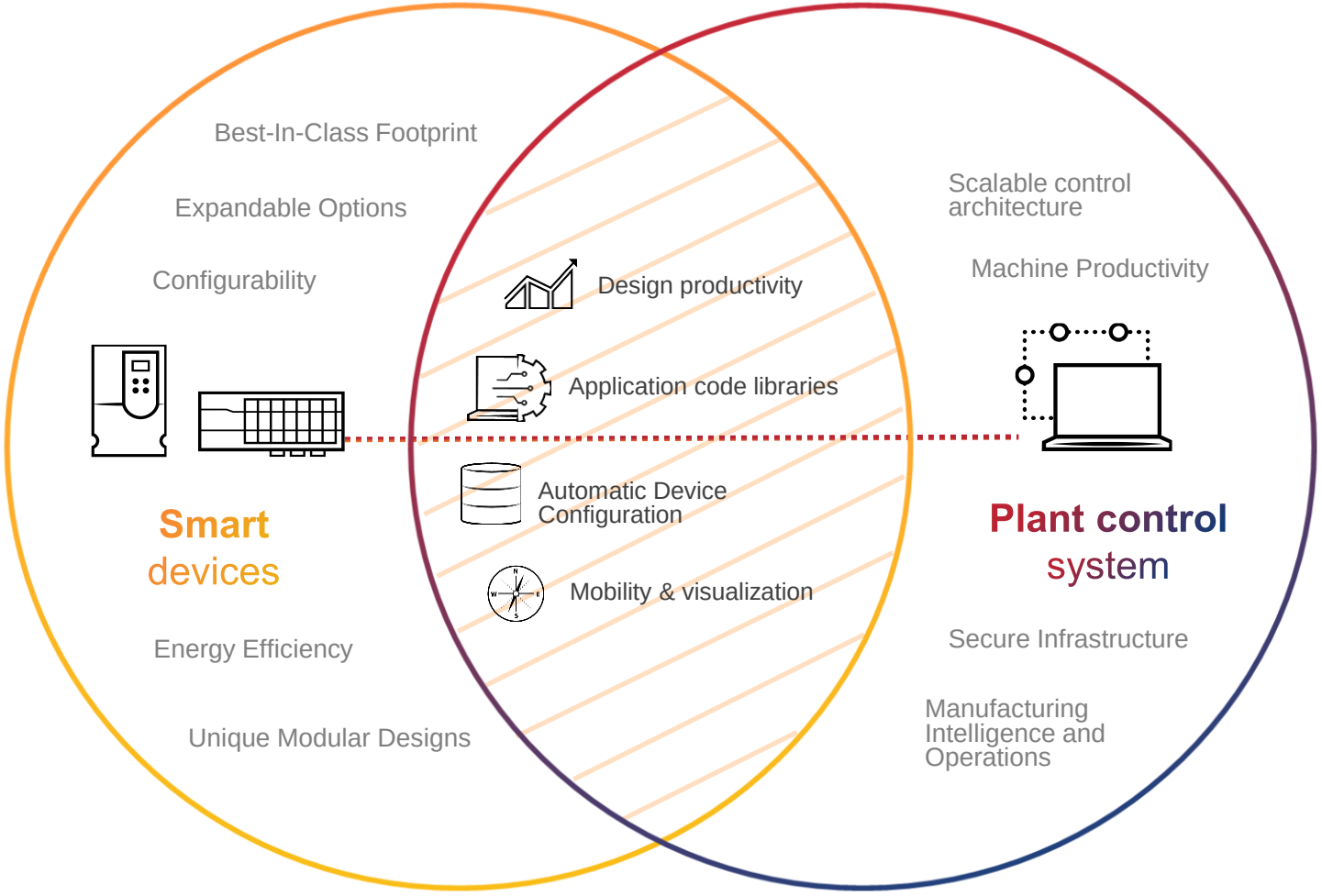
Uniform

- LV-MV common features
- Common spare parts and documentation

Premier Integration

Seamless drive and control system integration improves productivity throughout project lifecycle

Common development environment reduces overall time to program and commission a system

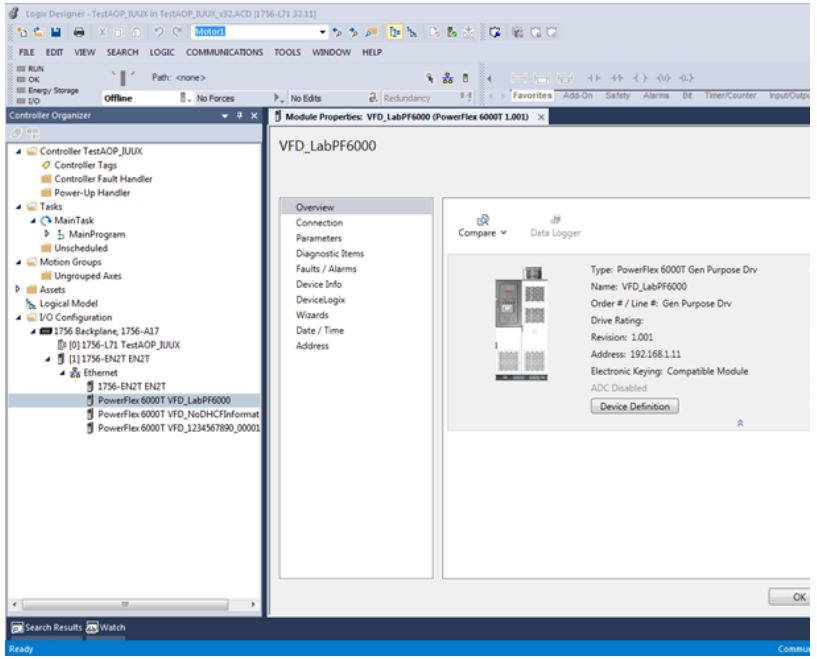


Network Interface Software Tools

Easily configure and program using Studio 5000 Logix Designer

Achieve an unmatched level of integration with Logix Programmable Automation Controllers (PACs)

- Single development environment to configure and program your entire control and device system
- Similar look and feel for low voltage drives and medium voltage drives



PowerFlex 6000T AOP selection in Studio 5000

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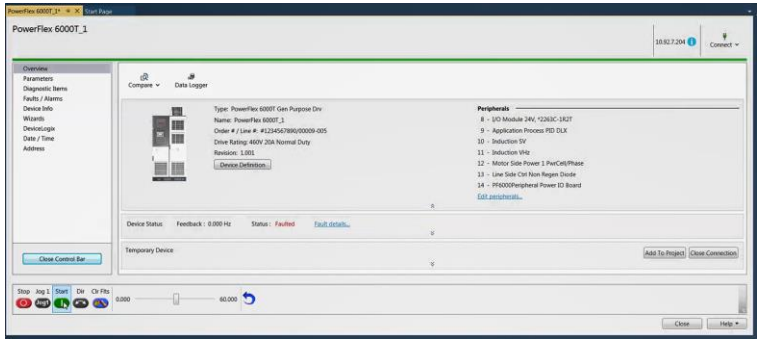
Network Interface Software Tools

Easily configure and program using Connected Components Workbench software

- Free software (standard edition) helps you get your drives up and running with an intuitive interface and configuration wizards
- From the Device Toolbox, insert new devices from the Device Toolbox catalog or discover connected devices
- Provides a similar look and feel for low voltage drives and medium voltage drives



PowerFlex 6000T example screen in Connected Components Workbench software

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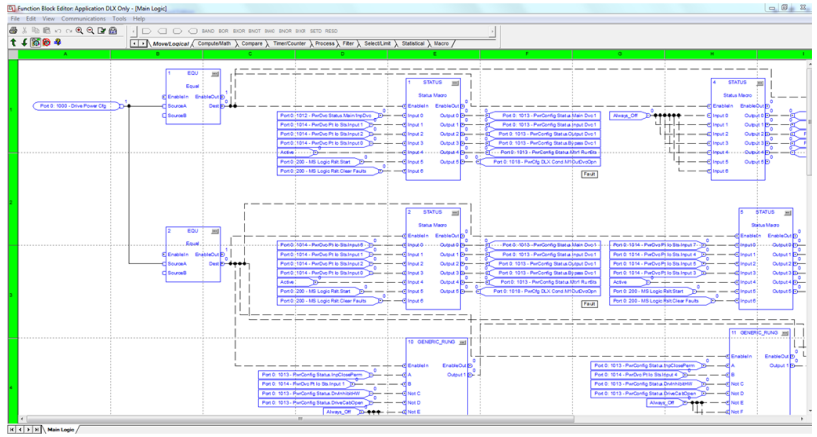
Built-In DeviceLogix

Flexible and cost-effective solution, especially for standalone applications

Process logic locally, either independently or complementary to supervisory control, to reduce demands and dependency on the controller and network throughput, increasing productivity

- Easily configure with Studio 5000 or Connected Components Workbench
- Enhance productivity for standalone applications
- Simple programming tool



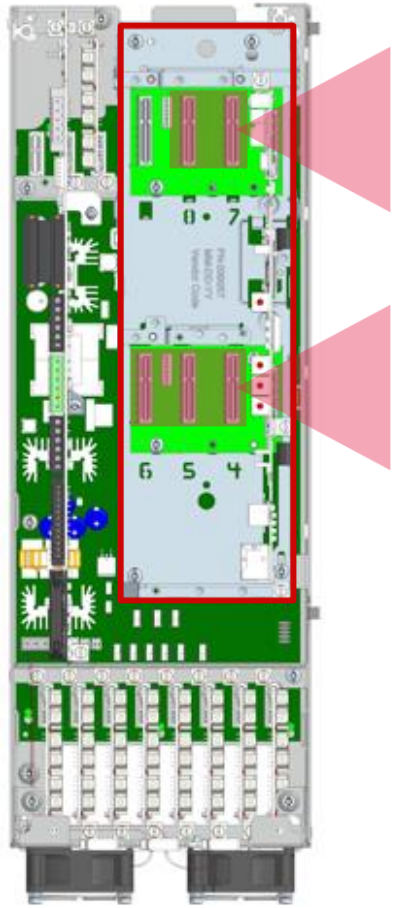
DeviceLogix capabilities are also leveraged to provide added PF6000T functionality

One Common Control Pod

Patented slot-based hardware structure for option cards

Five option slots allow you to easily and quickly add or reconfigure I/O cards - to suit process changes or your evolving needs

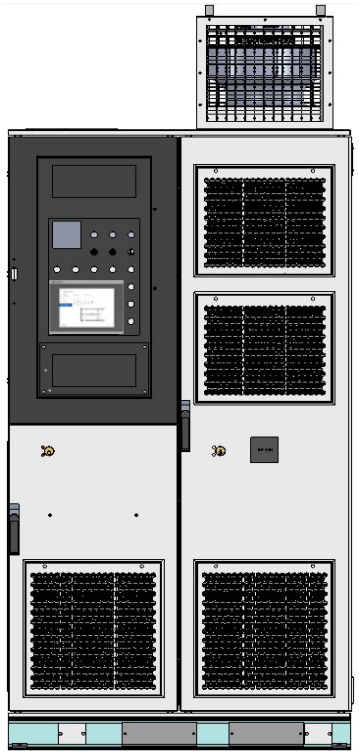
- Same pod for PowerFlex 755T and PowerFlex 6000T drives
- Conformally coated
- Mix and match
- Helps future-proof applications



Control pod – option slots (4-8)

Best in Class Footprint*

"A" Frame Dimensions - Available from 2.4…4.16 kV (up to 215 A)



Frame A1*

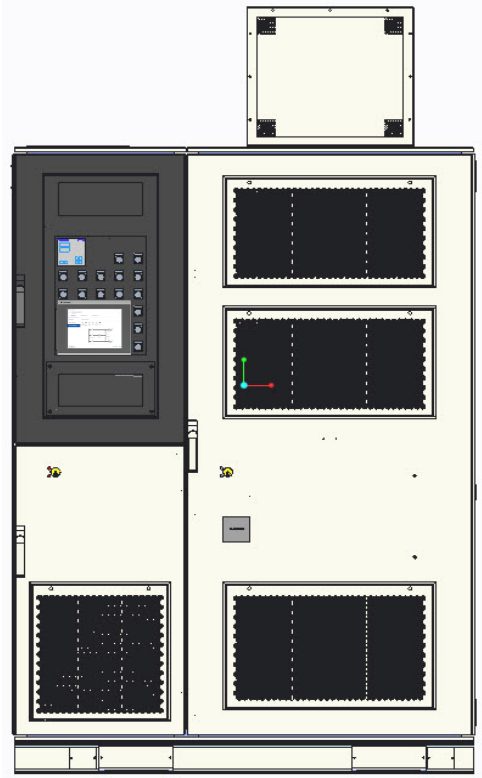
Width:
47.6" (1210 mm)

Depth:
49.2" (1250 mm)

Height with fan:
110.2" (2798 mm)

Height without fan:
91.7" (2328 mm)

0…70 A @ 60 Hz
0…54 A @ 50 Hz



Frame A2

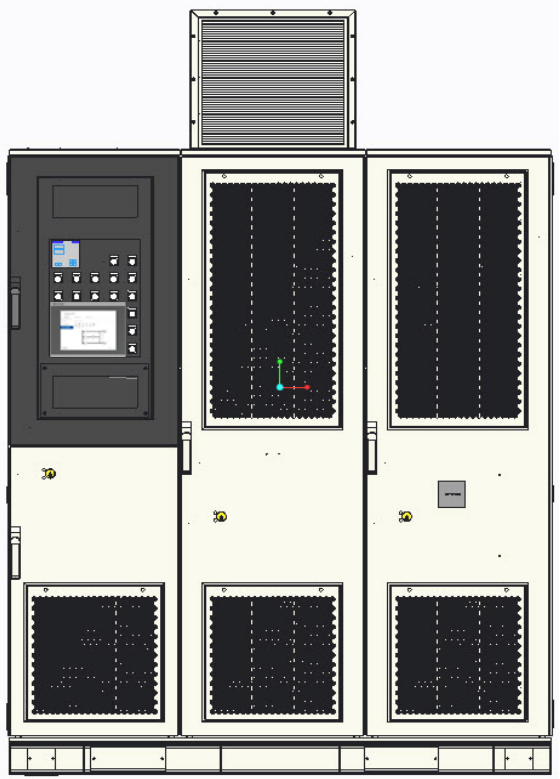
Width:
63.4" (1610 mm)

Depth:
49.2" (1250 mm)

Height with fan:
113.7" (2888 mm)

Height without fan:
91.7" (2328 mm)

71…140 A @ 60 Hz
55…140 A @ 50 Hz



Frame A3

Width:
75.2" (1910 mm)

Depth:
49.2" (1250 mm)

Height with fan:
113.7" (2888 mm)

Height without fan:
91.7" (2328 mm)

141…215 A @ 60 Hz
141…215 A @ 50 Hz

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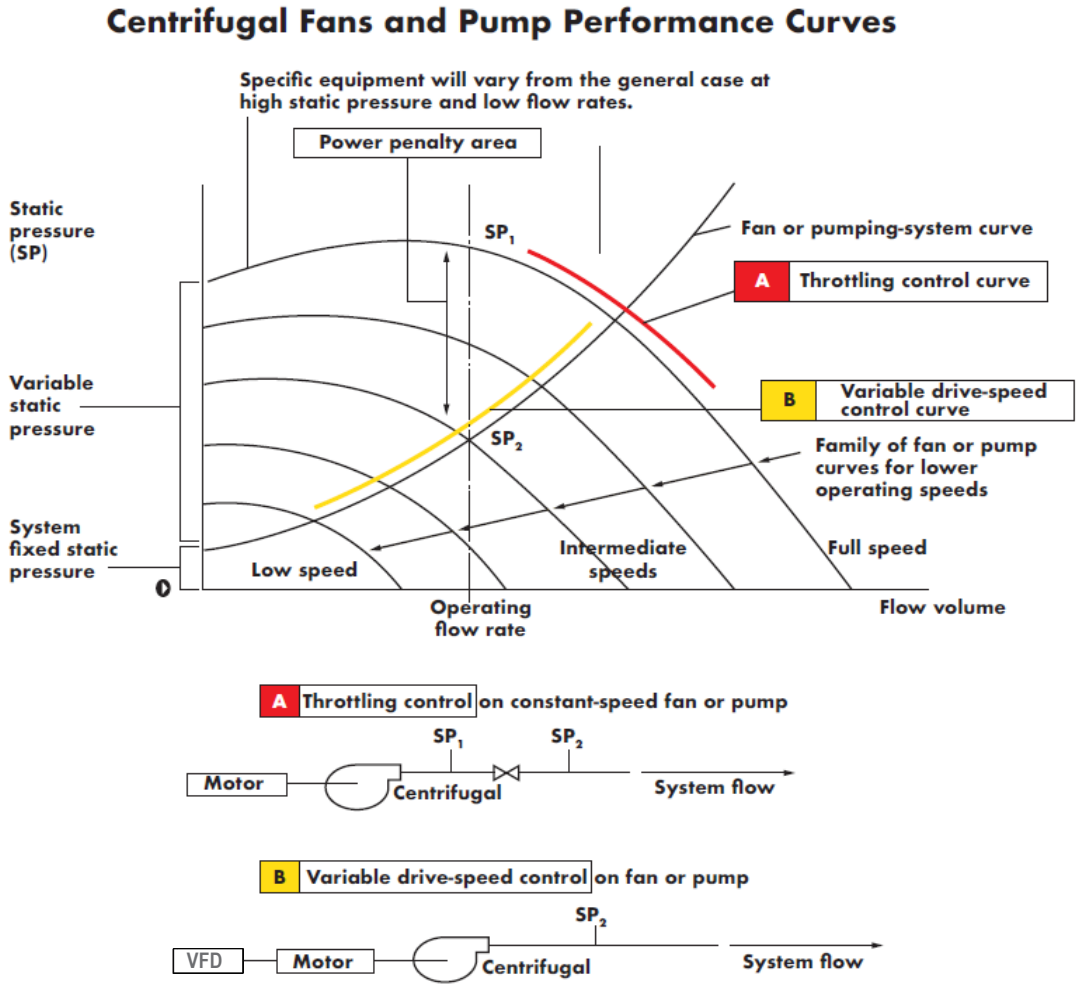
Operational Savings

Higher power motors lead to potentially higher energy savings and quicker return on investment

- MV VFDs provide adjustable speed operation for centrifugal pumps and other variable torque loads
  - eliminate control valves and their maintenance
  - save money through energy savings
- 1000 HP motor running continuously for 20 years will use about $14,000,000 US in electricity
  - Using a VFD typically saves about 25% of that cost - $480 per day ($175K per year)
  - MV VFDs typically pay for themselves in 1-2 years



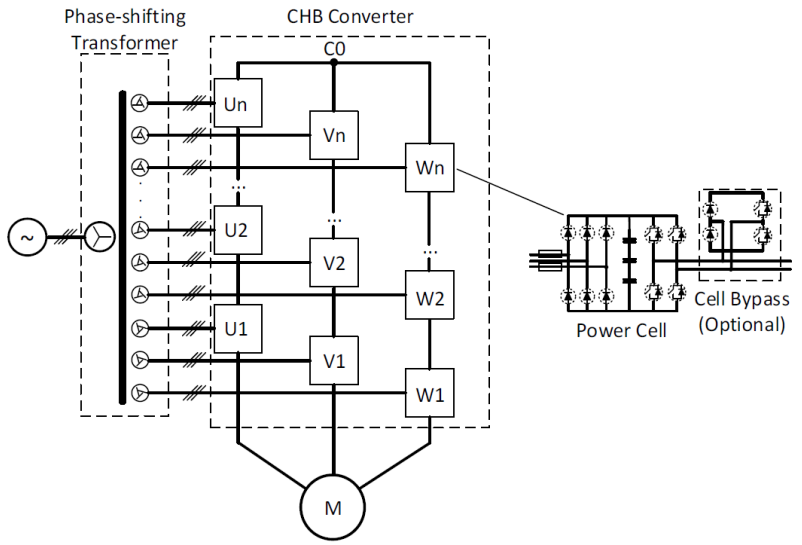
* in most cases

PowerFlex 6000T Low Harmonic Topology

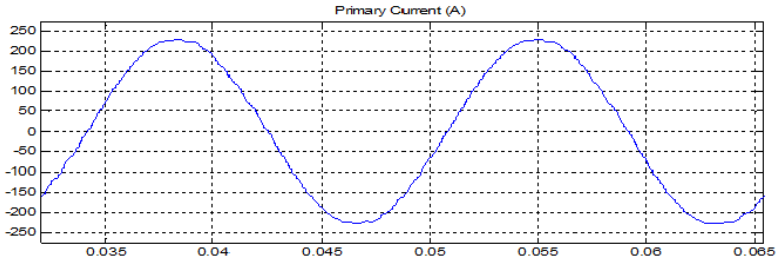
Cascaded “H” Bridge Topology provides inherent harmonic mitigation and high input power factor

The combination of lower line-side harmonics and high input power factor reduces the need to oversize electrical power equipment - to reduce overall system costs and minimize disruption to other devices and processes

- Inherently high input power factor
- Low input harmonics to meet IEEE 519-2014 and other global harmonics standards*



CHB topology - simplified three-line drawing



Typical line-side current waveform (Phase A)

* in most cases

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High Efficiency – Lower Operating Costs

Optimized drive component efficiency

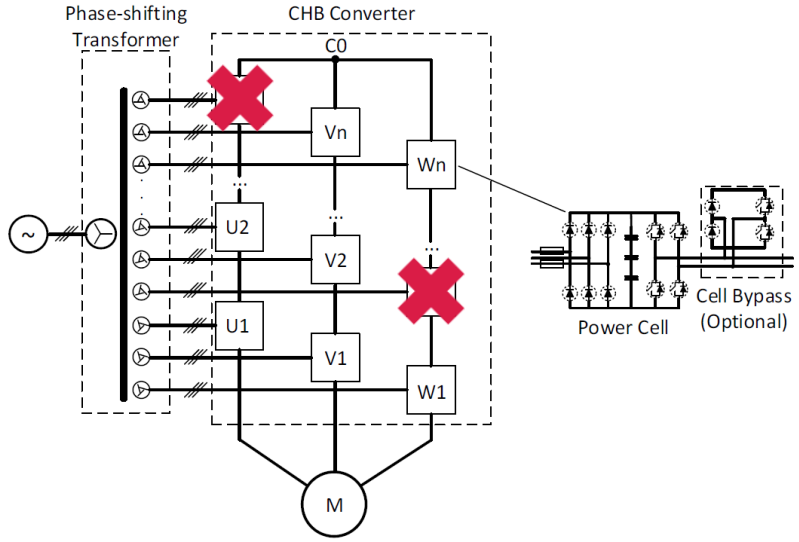
- High efficiency design cooling fans (standard)
- High efficiency design isolation transformer (standard)
- Sensorless Vector Economizer mode (standard)
  - one of 3 standard selectable motor control modes

Avoid Equipment Downtime

Power cell bypass, key component redundancy, and ride through

Optional capabilities deployed individually or together can help to further maximize uptime - enhancing productivity and profitability

- Automatic Power Cell Bypass (Optional)
  - Any power cell in any phase can be bypassed
  - No size penalty
  - Available for all voltage and current configurations



Power Cell Bypass Configuration

Any power cell in any phase can be bypassed

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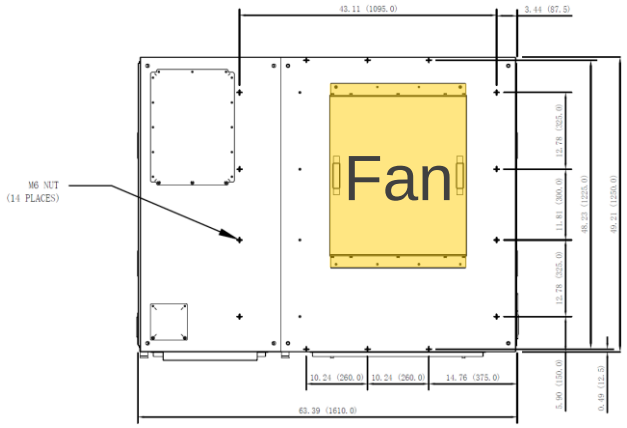
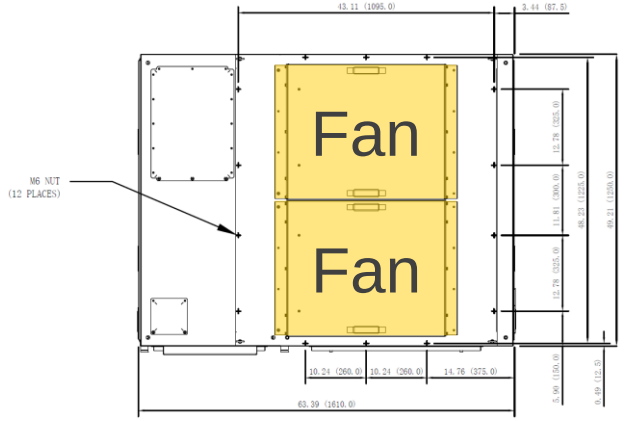
Avoid Equipment Downtime

Power cell bypass, key component redundancy, and ride through

- Redundant Cooling Fans (optional)
  - Every fan is individually monitored with automatic switchover
- Redundant Power Supplies (optional)
  - Each power supply is individually monitored with seamless switchover



Standard Fan Configuration – Top Plate
Frame A2 Example (Top View)

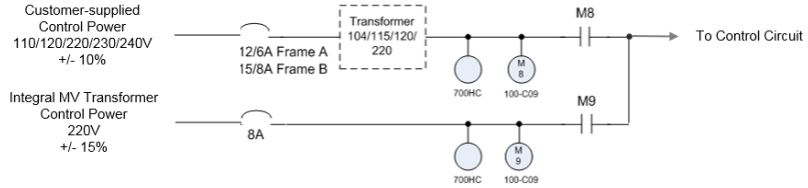


Redundant Fan Configuration – Top Plate
Frame A2 Example (Top View)

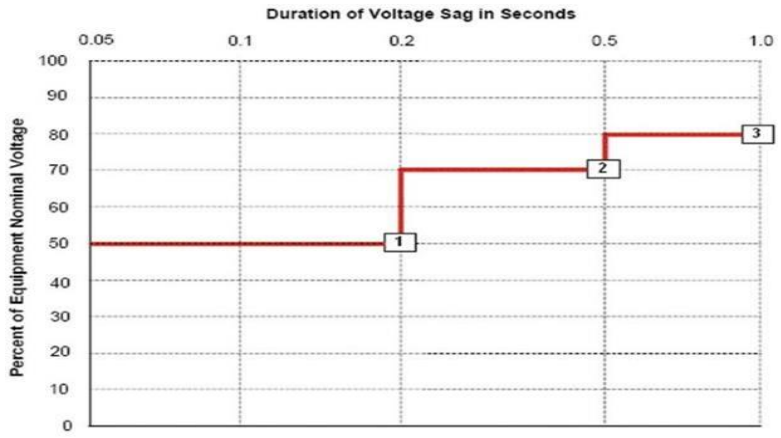
Avoid Equipment Downtime

Power cell bypass, key component redundancy, and ride through

- Automatic control power loss detection and switchover (standard)
  - If customer-supplied control power is lost, the drive will automatically switchover to internal power
- Medium voltage line supply voltage dip ride-through
  - 5 cycle 100% MV power loss ride-though capability is standard
  - With optional UPS:
    - Compliant with IEEE 1566 ride-through requirements
    - Compliant with SEMI F47 ride-through requirements



Automatic switchover control power circuit



SEMI F47 Ride Through Requirements

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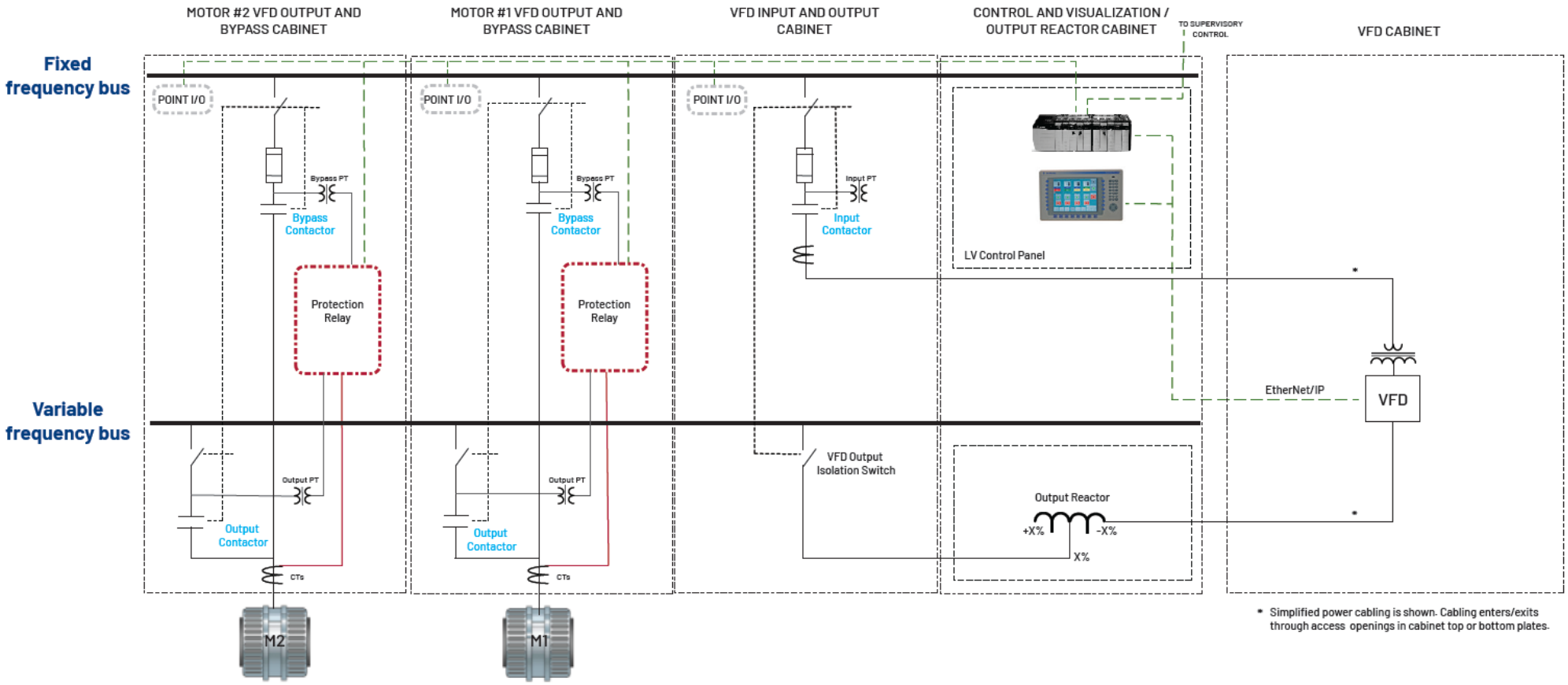
Flexibility – Synchronous Transfer System

Controlled starting and speed control of multiple motors with one drive



Two motor system example - UL/CSA version – single line

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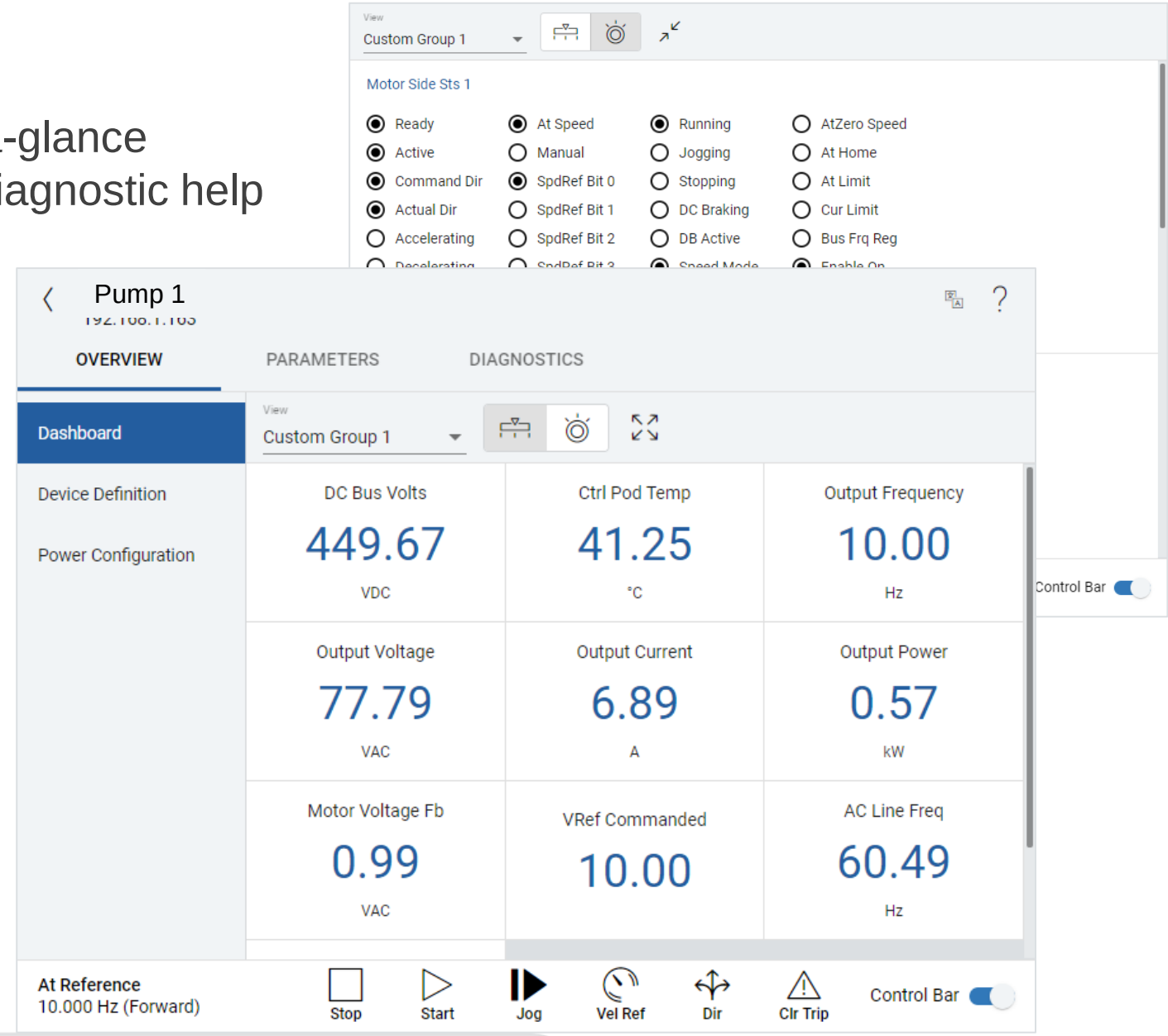
Flexibility – Synchronous Transfer System

Controlled starting and speed control of multiple motors with one drive

Two motor system example - UL/CSA version - with MV Starter units

Enhanced HIM Interface

Delivers a simplified user experience for at-a-glance monitoring, intuitive control, and in-context diagnostic help



Monitor what Matters

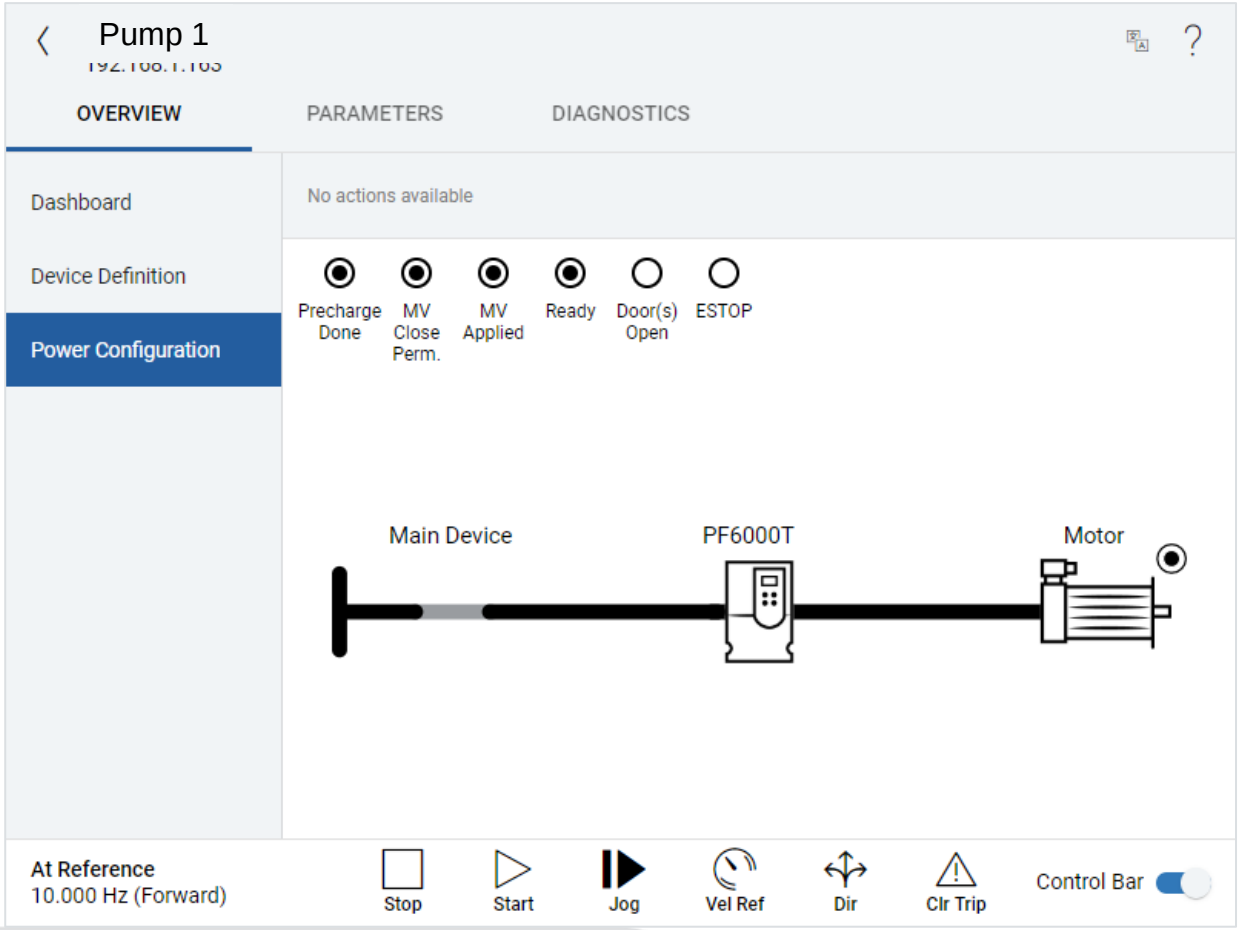
- Get started with a pre-configured **Metering and Status Dashboard**
- Display meaningful data for your system with **Dashboard Customization**
- Navigate anywhere with **Status, Feedback, and Direction** displayed alongside the **Control Bar**

Enhanced HIM Interface

Delivers a simplified user experience for at-a-glance monitoring, intuitive control, and in-context diagnostic help

Watch it Work

- Get a bird's-eye view of the system with **Power Configuration** screens
- Evaluate the readiness of the system with **Status Indicators**

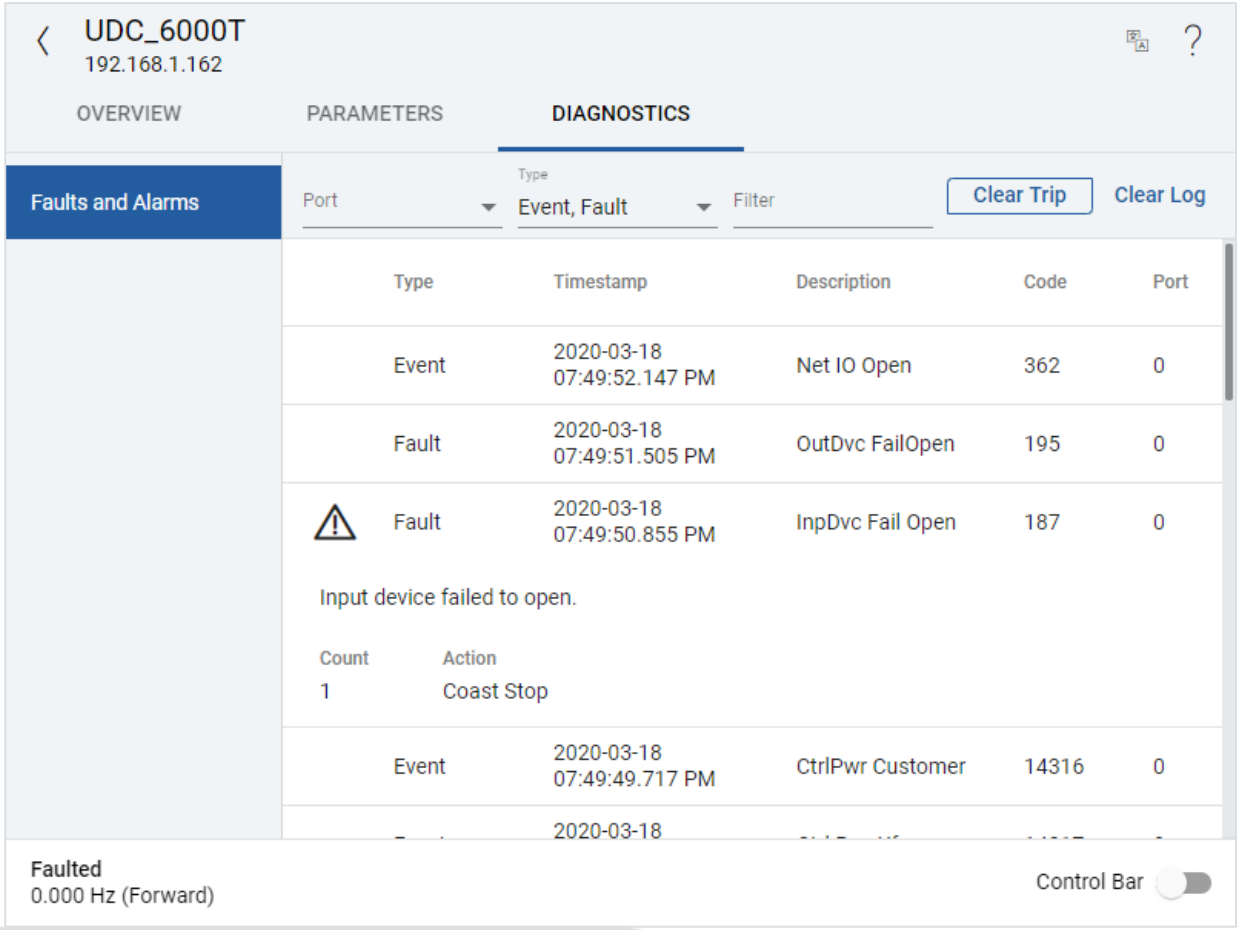


Enhanced HIM Interface

Delivers a simplified user experience for at-a-glance monitoring, intuitive control, and in-context diagnostic help

Root-Cause Analysis Made Easy

- Draw correlations between drive conditions with a **Chronological Event Log**
- Remove the clutter with **Port, Type, and Text Filters**
- Troubleshoot more effectively with **In-Context Help**

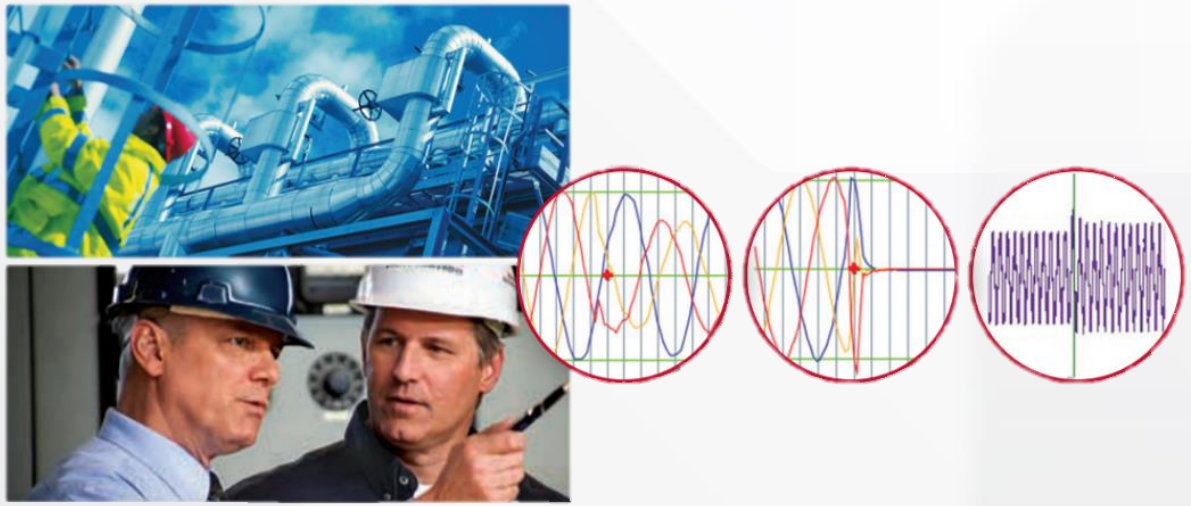


Power Measurement Capability Built-In

Measuring current and voltage, input power information is calculated to help you understand power use and issues in this part of your process and can be incorporated into your overall power management system

Extensive input power monitoring functionality:

- kW
- kVA
- kVAR
- elapsed kWh / MWh
- power factor
- projected demand



PowerFlex 6000T Technical Specifications

Typical Applications	Variable torque and constant torque (non-regenerative)
Drive System Configurations	Standalone or Synchronous Transfer
Drive Cooling Requirements	Air-cooled
Motor Voltage Rating	“A” Frame – up to 4.16 kV, “B” Frame - up to 11 kV
Motor Current Rating	“A” Frame – up to 215 A, “B” Frame - up to 680 A
Output Frequency	1…75Hz
Motor Types	Induction
Regenerative Braking	No (two quadrant operation)
Motor Cable Lengths	Up to 800 m (up to 2 km with additional output dv/dt filter)
Rectifier Pulse #	18…54 pulse diode
Inverter Devices	IGBTs

PowerFlex 6000T Technical Specifications - Continued

Efficiency	• < 373 kW = 96% • 373 kW and above = 96.5%
Input Voltage Tolerance	+/- 10%
Input Voltage Sag	-30% of nominal, up to 60 seconds
Input Power Factor	>.95
VFD Noise Level	• < 215 A = 80 dB(A) • 215…680 A = 85 dB(A)
Speed Regulation	0.5%
Operator Interface	10” Windows 10 IoT Color Touch Screen
Communication Protocols (optional)	EtherNet/IP, Modbus-RTU Slave RS485, Modbus-TCP, Modbus-PLUS Slave RS485, PROFIBUS Slave, PROFINET IO
Enclosure	IP31 (standard), IP42 (optional)
Design MTBF	100,000 hours
Design Standards	NEMA, ANSI, IEEE, UL, CSA, IEC, CE, EEMAC

PowerFlex 6000T Technical Specifications - Continued

Conformal Coating	All main control boards, option cards, power cell control boards
Cable Entry Direction	Top and Bottom: Removable cable access plates for line and load power cabling and control wiring in top plates and floor plates
Rear Access Required?	No. Front access only required for installation and maintenance
Surge Arrestors	Standard for all configurations. No footprint penalty.
Precharge Circuit	• <200 A not offered • 201…407 A, offered if Isc/IL >50 • >408 A always included (adds 1205 mm (40”) wide cabinet – all configurations)
Product Installation	Overhead lifting or forklift handling capability

PowerFlex 6000T

Medium Voltage Drives

First Lastname • Title Goes Here | 02 . 01 . 20

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expanding **human possibility**™

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