

LISTEN.
THINK.
SOLVE.

Summer Days 2018

Kinetix Platform Overview

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Integrated Architecture® Portfolio

Design Software



Studio 5000® Design Software, Connected Components Workbench™, Arena® Software

Distributed Control System



PlantPAX® Distributed Control System

Visualization & Information Software



FactoryTalk® Software
ThinManager® Software

Programmable Automation Controllers



CompactLogix™, ControlLogix®, GuardLogix®, and Armor™ GuardLogix® Controllers

Industrial Network Infrastructure & Media



Stratix® Switches

Operator Interfaces & Industrial Computers



PanelView™ and MobileView™ Graphic Terminals

Smart Sensing Devices



RightSight™, VisiSight™, RFID Pressure

Input / Output Devices



Compact I/O™, FLEX™ I/O, POINT I/O™, ArmorBlock®, and ArmorPOINT® Input/Output Devices

Motor Control Devices



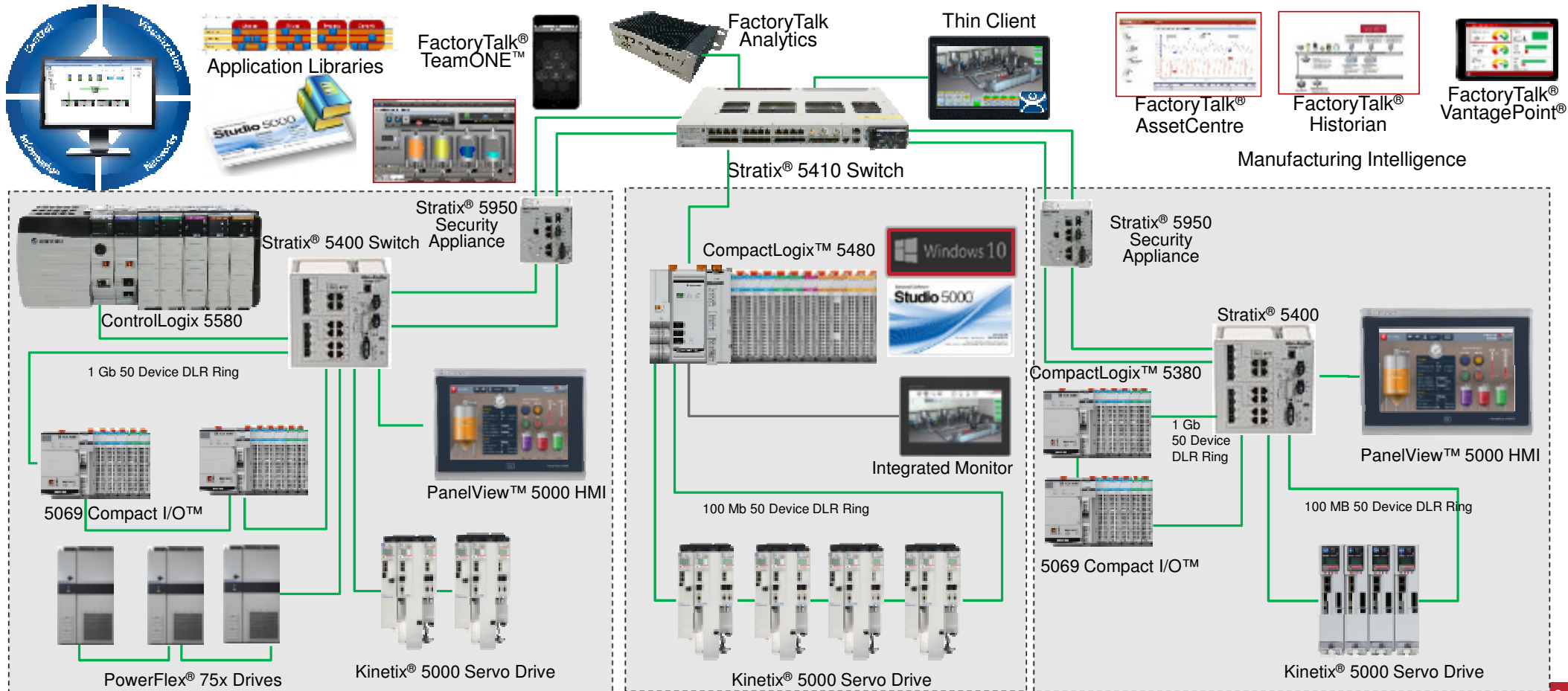
PowerFlex® drives and IntelliCENTER® MCCs

Motion Control



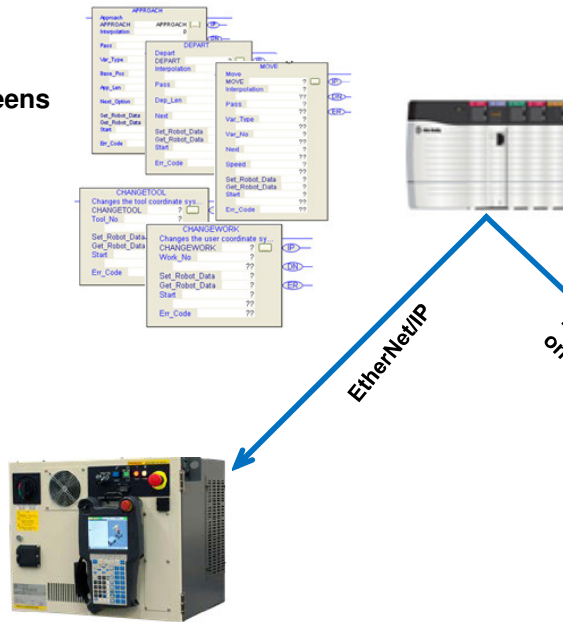
Kinetix® drives, iTRAK® and MagneMotion® Independent Cart Technology

This Is The Integrated Architecture



Logix Robot Interface Options

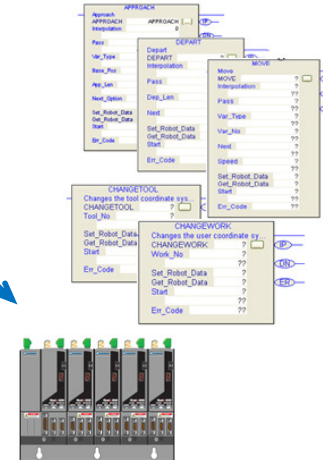
Studio 5000® AOP, AOI, EOI screens



EtherNet/IP Connected

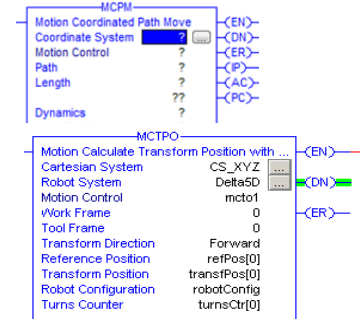
- Robot vendor's controller
 - Kinematics
 - Programming/local program
 - Joint axis drives & motors
 - Handheld/EOI
- Various Logix integration features

Studio 5000® Kinematics, Motion Instructions AOP, AOI, EOI Screens



Logix Kinematics, Kinetix® Drives

- Robot controller eliminated
- Integrated motion on EtherNet/IP joint axis drives (Kinetix)
- Logix management of the kinematics/trajectory planning



Logix EtherNet/IP Connected

Encompass Product	Manufacturer	Robot Type	Configuration Profile			AOI Library	HMI FacePlates	No Teach Pendant Required	Device Level Ring	CIP Safety Slave	SSA Capable
			Generic	EDS Profile	Custom AOP						
N	ABB	Articulated Arm	✓							✓	
		Delta	✓								
		Palletizing	✓								
N	Adept Technology Omron	Articulated Arm	✓					✓			
		SCARA	✓					✓			
		Delta	✓					✓			
N	Comau	Articulated Arm	✓								
		Palletizer	✓								
		Cartesian	✓					✓			
Y	DENSO robotics	Articulated Arm (Up to 6 axis)	✓			✓	✓	✓			
		SCARA (4 axis)	✓			✓	✓	✓			
N	Epson Robots	Articulated Arm	✓								
		SCARA	✓								
Y	FANUC Robotics	Articulated Arm			✓	✓	✓			✓	✓
		Delta			✓	✓	✓			✓	✓
		SCARA			✓	✓	✓			✓	✓
		Palletizing			✓	✓	✓			✓	✓
N	Kawasaki Heavy Ind.	Articulated Arm	✓							✓	
		Delta	✓							✓	
		Palletizing	✓							✓	
Y	KUKA Robotics	Articulated Arm			✓	✓		✓		✓	
		Palletizer			✓	✓		✓		✓	
		Cartesian/Gantry			✓	✓		✓		✓	
N	Nachi Robotic Sys.	Articulated Arm	✓							✓	
		SCARA	✓							✓	
N	Staubli	Articulated Arm	✓								
		SCARA	✓								
N	Yamaha	SCARA	✓			✓	✓	✓	✓		
		Cartesian	✓			✓	✓	✓	✓		
Y	Yaskawa-Motoman	MLX200 Controller Articulated/Pallet/Delta	✓			✓	✓	✓			
		DX200 Controller Articulated/Palletizer		✓						✓	

Delta Robot Geometry Examples

- New Kinematics features/Instructions for support of up to 6 axis robot geometries.
 - Delta 3,4,5 axis supported in the first release
 - SCARA, Articulated, Custom geometries in a future release

Codian – 4 Axis Delta



autonox24 - 4 Axis Delta



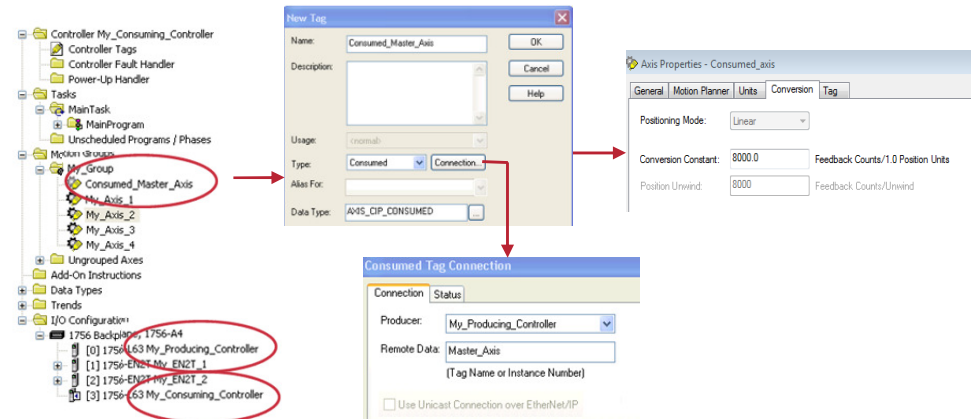
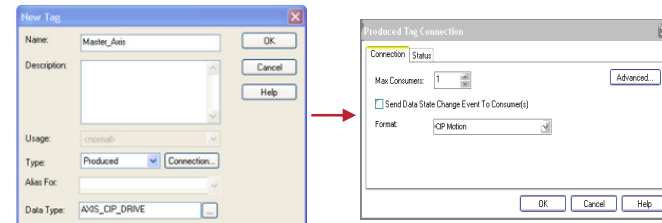
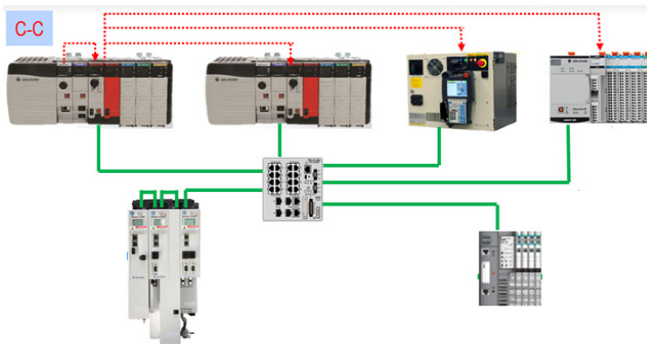
Codian - 5 Axis Delta



autonox24 - 5 Axis Delta

EtherNet/IP Produced/Consumed Axis

- Produced/consumed axis between controllers in a 1756 chassis or on EtherNet/IP
- CompactLogix™ and ControlLogix® 5570, 5580, 5380, 5480 controllers
- Synchronized motion functions across multiple controllers
 - PCAM
 - GEAR
 - MDSC movers
 - Scheduled outputs
 - Registration events
 - Position based interlocks/handshaking



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Motion Drive/Motor/Actuator Portfolio



Rotary Motors & Actuators VP and MP-series

- Designed to meet the unique needs of many industries including wash down applications
- Single or dual cable motor options available
- SIL 2/PIID encoder options



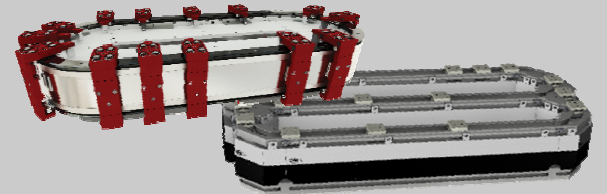
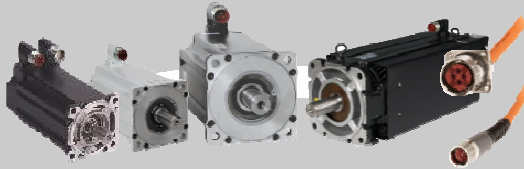
Servo Drives Kinetix®

- Broad range of drives from low power indexing drives to high power, multi-axes drives
- Integrated motion on EtherNet/IP
- Integrated safety on EtherNet/IP



Intelligent Track Systems iTRAK®- MagneMotion®

- Modular, scalable linear motor system that allows independent control of multiple movers
- Ideal for packaging, automotive, life sciences, logistics industries



Kinetix 5700 Servo System

200 A common DC bus
for shared energy usage
and savings



Multiple motor types
supported, including DSL
single cable technology

Power dense design
saves cabinet space



DC Bus
Supplies



Single-axis
Servos



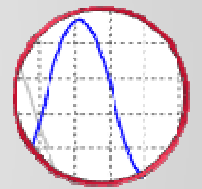
Dual-axis
Servos



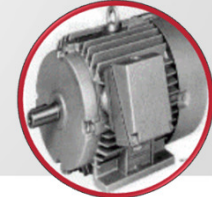
Combined safety technology.
Integrated or hardwired Safety
- Safe Torque Off SIL3/PLe



Advanced tuning
technologies that
help improve
performance and
reduce tuning



Advanced motor
control technology



Kinetix 5700 Safe Monitoring Servos

new



Kinetix VP motors with SIL2/PLd rated encoders



MP motors with Hiperface sin/cos encoders



Support for 842HR sin/cos encoders



“ERS4” Single-axis Modules

“ERS4” Dual-axis Modules

Seamless and inherently safe communications



Ability to safety monitor speed, direction, and position



Emergency safety stop functions and zero speed monitoring





SIL 2 Rated Kinetix[®] VP Motors:

Supports advanced safety functions via Kinetix[®] 5700 “ERS4 Advanced Safety” Safe Speed Monitoring drives



9-12 bit safety channel feedback on “W” or “Q” encoder option when used within integrated safety systems



23-bit primary channel feedback on “Q” encoder option provides application flexibility (Frame 100 - Frame 165)

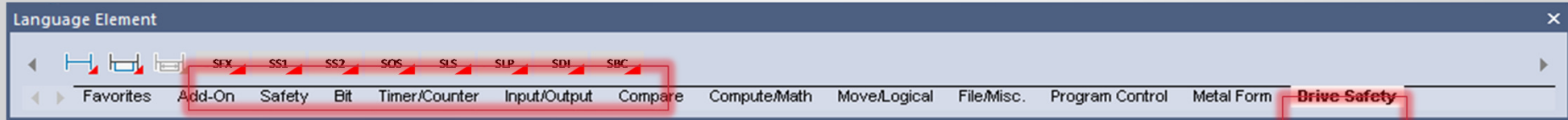


SIL 2 TÜV Certification on optical encoder



Current “C, P” encoder options remain active for ease of ordering

Drive Advanced Safety Instructions in V31



- Advanced drive safety for Kinetix® 5700 and PowerFlex® 755/755T
- Suite of drive safety instructions for use in the 5580 and 5380 GuardLogix® safety task
 - SFX (Safe Feedback Scaling)
 - SS1 (Safe Stop 1)
 - SS2 (Safe Stop 2)
 - SOS (Safe Operating Stop)
 - SLS (Safely-limited Speed)
 - SLP (Safely-limited Position)
 - SDI (Safe Direction)
 - SBC (Safe Brake Control - external brake)

SFX Safety Feedback Interface		
Safety Control	?	(O1)
Time Unit	?	
Position Scaling	?	(FP)
Feedback Resolution	??	(SFH)
Unwind	?	
Home Position	?	
Feedback Position	??	
Feedback Velocity	?	
Feedback Valid	??	
Connection Faulted	?	
Homing Trigger	?	
Reset	?	
Safe Feedback Homed	?	
SFX Fault	?	
Actual Position	??	
Actual Cycles	??	
Actual Speed	??	
Fault Type	??	
Diagnostic Code	??	

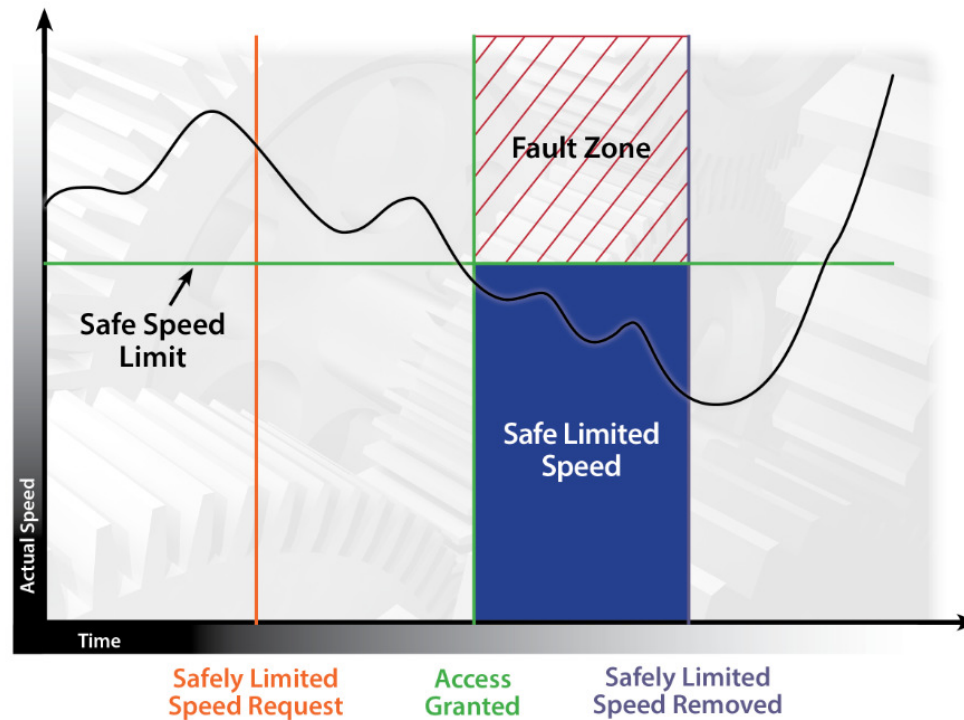
SLS Safely-Limited Speed		
Safety Control	?	(O1)
Restart Type	?	
Cold Start Type	?	(RR)
Check Delay	?	
Active Limit	??	(FP)
Feedback SFX Request	?	
Reset	?	
SLS Active	?	
SLS Limit	?	
SLS Fault	?	
Fault Type	??	
Diagnostic Code	??	

SLP Safely-Limited Position		
Safety Control	?	(O1)
Restart Type	?	
Cold Start Type	?	(RR)
Check Delay	?	
Positive Travel Limit	??	(FP)
Negative Travel Limit	?	
Feedback SFX Request	?	
Reset	?	
SLP Active	?	
SLP Limit	?	
SLP Fault	?	
Fault Type	??	
Diagnostic Code	??	

Safely Limited Speed (SLS)

- SLS instruction initiates and monitors the motor speed to verify it does not exceed the specified “active speed” limit
- “Active speed” limit is dynamically changeable
- If the specified speed limit is exceeded, the SLS Limit output is signaled
- The output is used to initiate a user defined Safe Stop Function (STO, SS1, SS2 or SOS).

Safely Limited Speed



SLS	
Safe Limited Speed - Safety ...	(O1)
SLS	?
RestartType	?
ColdStartType	?? (RR)
CheckDelay	?
ActiveLimit	?
FeedbackSFX Request	?? (FP)
Reset	?
SLSActive	??
SLSLimit	??
SLSFault	??
FaultType	??
DiagnosticCode	??

Kinetix 5700 AFE (Active Front End)

Mounting Flexibility

Mount inverters to right and left of the regenerative bus supply



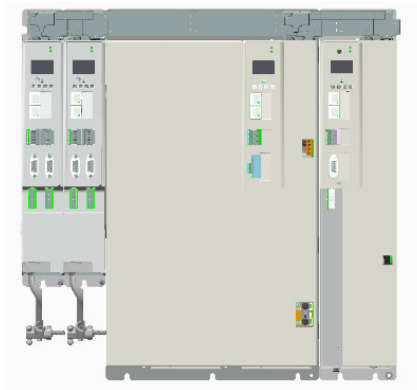
Right Sized

Wide power range in bookshelf zero stack format



Reduced Footprint

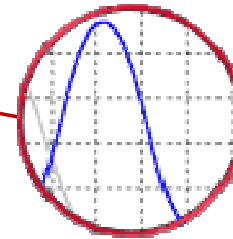
Power dense design supporting Kinetix® 5700 in complex machine space



Three frame sizes:
Frame 7, 9, and 12:
4 ratings:
(35 – 207A)

Studio 5000

Consistent UX
Studio 5000® integration and configuration



Global Performance
DC bus regulation across wide input voltage and low harmonic operation

Easier Installation

Reduced wiring and less components required for complete solution



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Kinetix 5700 Large Frame Inverter

Kinetix® 5700 Common Bus Capability
Leverage Kinetix® 5700 AFE and DFE



Common Format
Bookshelf zero stack format



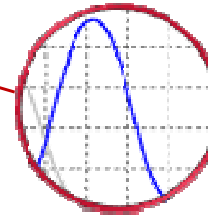
Reduced Footprint
Power dense design supporting Kinetix 5700 in complex machine space



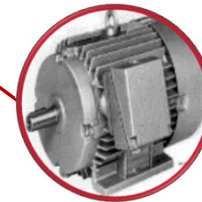
1 frame size:
Frame 8:
2 ratings:
150 A and 192 A



Advanced Safety Capable
Leverage SSM control hardware



Advanced Tuning
Improve performance and eliminate tuning



Use Kinetix 5700 Motor Control Core
Native application capabilities for converting, print, and web

Q4
CY2018

Kinetix 5700 Large Frame Inverter

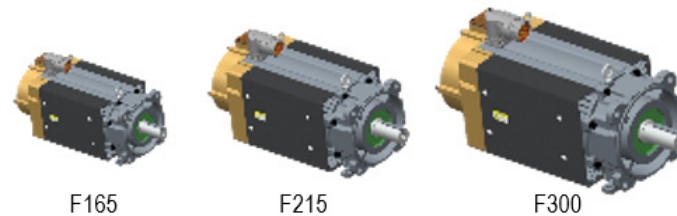
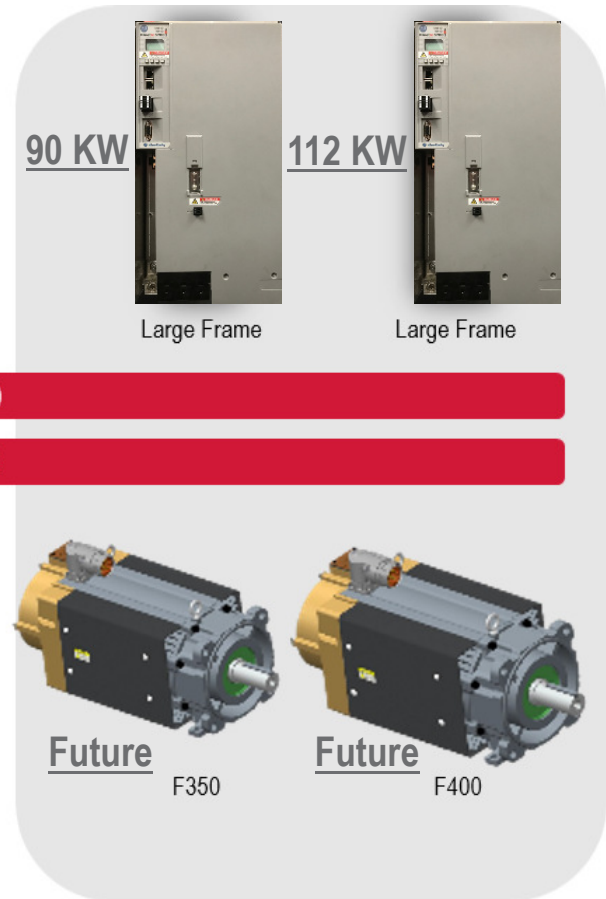
Overview

Product Highlights:

- Single-axis inverter : two models: (263A, 312A peak)
- Basic (ERS3) and advanced (ERS4) safety options
- Advanced tuning and Kinetix® 5700 family feature set
- Feedback and motor control identical to Kinetix 5700



1.6kW – 60kW



F165

F215

F300

3.7kW – 37kW
(20 base offerings)

2198-ABQE Encoder Output Module



Simplified Installation

Eliminates need to mount external encoders on the machine



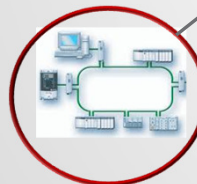
Ease of use

Configure with Studio 5000 Logix Designer® Programming interface with Logix Add On Instruction



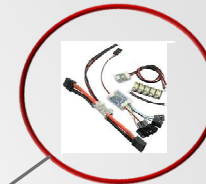
EtherNet/IP DLR

Supports standard network topologies



Reduce wiring

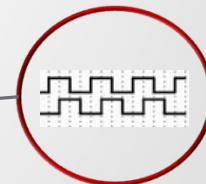
Eliminate the need to split encoder signals between the motor and drive



Flexibility Synchronize two axes of motion within the system



Configurable Outputs
AQB or Pulse Train



Synchronize 3rd party devices to your integrated motion system

2198-AQBE System Configuration

Fully programmable using AOI instructions, link to CIP Motion or Virtual axes,

```

Dvc_2198ABQE_2CH
2198-ABQE - Dual Channel Encoder Output
Dvc_2198ABQE_2CH Wrk_EncoderOutputM1
Ref_MotionGroup      MG01
Ref_AxisCh00         Axis_Ch00
Ref_AxisCh01         Axis_Ch01
Ref_Module           EncoderOutM1
Inp_Module_I        EncoderOutM1:I
Out_Module_O        EncoderOutM1:O
Cmd_Reset            0
Cmd_Ch00POE         0
Cmd_Ch00POD         0
Cmd_Ch00Reset       0
Cmd_Ch01POE         0
Cmd_Ch01POD         0
Cmd_Ch01Reset       0
    
```

Logix Controller



2198-AQBE

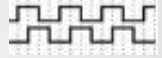


Printers



Glue Dispensers

Vision Systems



Robots



Print Registration Systems

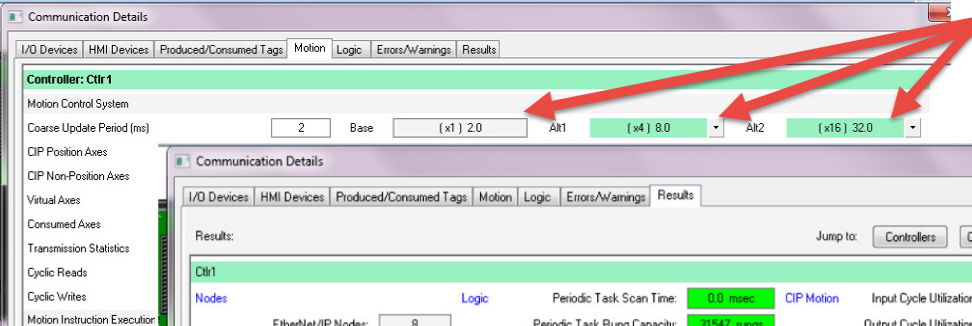
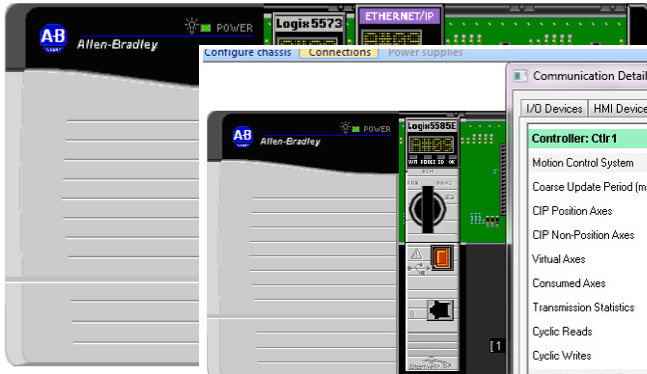
Kinetix Drives



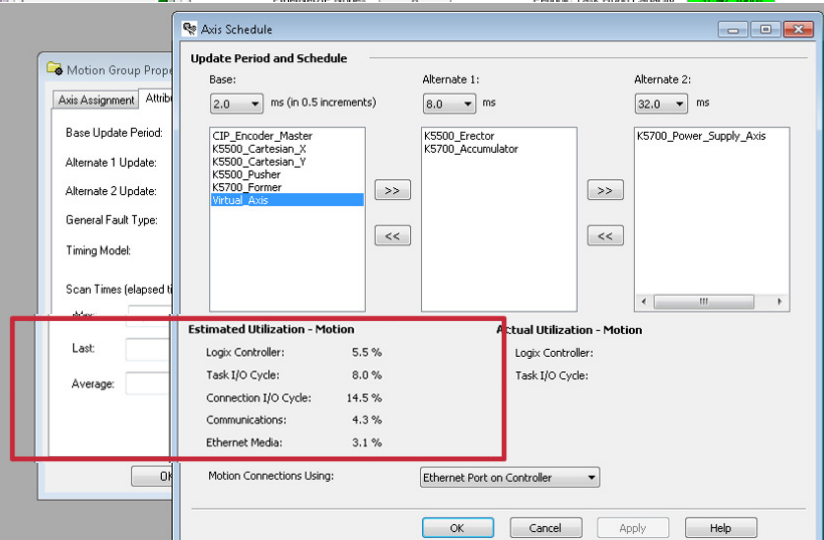
PowerFlex Drives



IAB and Studio 5000 Design Tools



IAB Advance Performance Motion Usage Calculator (Multiplexing shown)



IAB Motion Performance Results & Summary

Studio Application Motion Utilization (Estimated and Actual)

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

Objective:

- Compare three systems to show the improvement in Motion Performance
 - System 1: 5570 processor + EN3TR + 26 axes motion
 - System 2: 5580 processor + EN3TR + 26 axes motion
 - System 3: 5580 processor + Gb port + 26 axes motion

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

System 1: ControlLogix® 5570 processor + EN3TR + 26 axes motion

The screenshot displays the IAB software interface for a ControlLogix 5570 processor. On the left, a system architecture diagram shows a 'Kinetix003 (Copy 1)' connected to a 'Linear001' system, which is further connected to 'Kinetix5500_002' and 'Kinetix5500_kine'. The main window, titled 'CLogix001', shows various system parameters and performance metrics.

Controller: Ctr1

- Motion Control System
- Coarse Update Period (ms)
- CIP Position Axes
- CIP Non-Position Axes
- Virtual Axes
- Consumed Axes
- Transmission Statistics
- Cyclic Reads
- Cyclic Writes
- Motion Instruction Execution
- Active MAM
- Active MAJ
- Active MAG
- Active PCAM
- Active TCAM
- Active MADC
- Coordinate Systems
- Active MCLM
- Active MCCM

Communication Details

Results:

Jump to: **Controllers** | Communication Modules | Networks

Controllers

Ctr1

Connections	I/O: 26	Logic	Periodic Task Scan Time: 0.0 msec	CIP Motion	Input Cycle Utilization (Drive to Controller): 54.7%
	HMI: 0		Periodic Task Rung Capacity: 1893 rungs		Output Cycle Utilization (Controller to Drive): 61.6%
	Remaining: 474		Continuous Task Scan Time: 0.0 msec		Motion Task I/O Cycle Utilization: 91.6%
					Logix Controller Utilization: 44.1%
					Logix System Minimum Time Slice: 8.9%

Memory

Used: 207 KB	Connection/Memory Details
Available: 8.0 MB	
Remaining: 7.8 MB	

Communication Modules

Comm1 (connected to network: EtherNet/IP001)

Motion Packets per Second (PPS): 13000	Utilization: 49.4%	Motion Capacity Used: 49.4%
I/O Packets per Second (PPS): 0	CIP Connections: 26 (230 rem)	I/O Capacity Used: 0.0%
HMI Packets per Second (PPS): 0	TCP Connections: 26 (102 rem)	HMI Capacity Used: 0.0%
	CIP Motion Pos Axes: 26 (max 128)	
	CIP Motion Non-Pos Axes: 0 (max 128)	
	Total Axes: 26 (max 128)	

Adapters

* The results shown in this estimation tool have been tested for accuracy, however actual results may vary. Estimates for controller memory do not include...

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

System 2: ControlLogix® 5580 processor + EN3TR + 26 axes motion

System Configuration:

- Kinetix003 (Copy 1)
- Linear001
- Kinetix5500_002
- Kinetix5500_Kine
- CLogix001

Communication Details - Results:

Category	Item	Value	Limit/Utilization
Nodes	EtherNet/IP Nodes	26	74 Remaining
	Periodic Task Scan Time	0.0 msec	
	Periodic Task Rung Capacity	29486 rungs	
	Continuous Task Scan Time	0.0 msec	
Memory	Used	207 KB	
	Available	9.8 MB	
	Remaining	9.6 MB	
CIP Motion	CIP Motion Pos Axes	25	max 256
	CIP Motion Non-Pos Axes	1	max 256
Total Axes	Total Axes	26	max 256
	Total Axes	26	max 128
Communication Modules	Motion Packets per Second (PPS)	13000	Utilization: 49.4%
	I/O Packets per Second (PPS)	0	CIP Connections: 26 (230 rem)
	HMI Packets per Second (PPS)	0	TCP Connections: 26 (102 rem)
Capacity	Motion Capacity Used	49.4%	
	I/O Capacity Used	0.0%	
	HMI Capacity Used	0.0%	

* The results shown in this estimation tool have been tested for accuracy, however actual results may vary. Estimates for controller memory do not include application code. IAB users must independently verify the configuration and bill of material. (click HELP for more information)

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

System 3: ControlLogix® 5580 processor + Gb port + 26 axes motion

The screenshot displays the IAB software interface. On the left, a system architecture diagram shows a 'Kinetix003 (Copy 1)' connected to a 'Linear001' system, which is further connected to two 'Kinetix5500' units. The main window is titled 'Communication Details' and shows performance metrics for 'Controller: Ctr1'.

Controller: Ctr1 Performance Metrics:

Category	Value	Limit/Max
Nodes	26	74
Memory Used	207 KB	9.8 MB
Memory Remaining	9.6 MB	
Periodic Task Scan Time	0.0 msec	
Periodic Task Rung Capacity	29486 rungs	
Continuous Task Scan Time	0.0 msec	
CIP Motion Pos Axes	25	max 256
CIP Motion Non-Pos Axes	1	max 256
Total Axes	26	max 256
Input Cycle Utilization (Drive to Controller)	22.2%	
Output Cycle Utilization (Controller to Drive)	21.2%	
Motion Task I/O Cycle Utilization	14.6%	
Logic Controller Utilization	10.7%	

Communication Modules:

Module	Value	Utilization	Capacity Used
Motion Packets per Second (PPS)	13000	10.2%	10.2%
I/O Packets per Second (PPS)	0		0.0%
HMI Packets per Second (PPS)	0		0.0%

Adapters:

- Ctr1 (embedded) (connected to network: EtherNet/IP001)

* The results shown in this estimation tool have been tested for accuracy, however actual results may vary. Estimates for controller memory do not include application code. IAB users must independently verify the configuration and bill of material. (click HELP for more information)

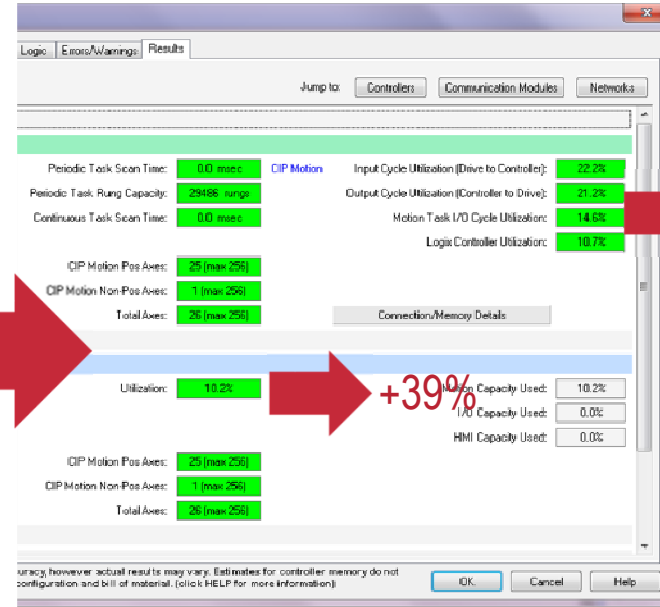
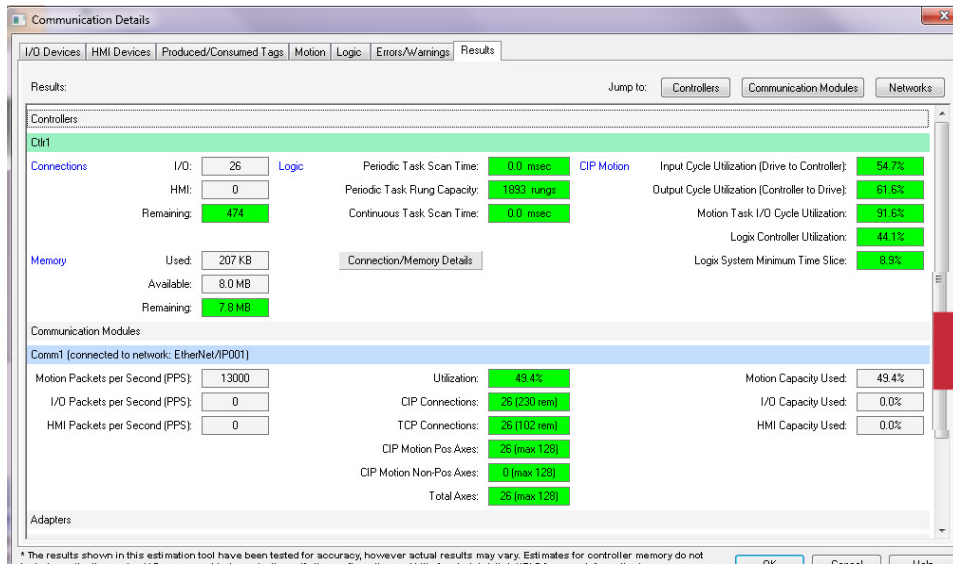
IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

Results:

System 1 (5570 w/EN3TR):

System 3 (5580 w/embedded 1 Gb):



+33%
+40%
+77%
+33%

+39%

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

Example 1: ControlLogix® 5580 with 50 CIP axes at 3ms:

The screenshot displays the IAB software interface. On the left, a tree view shows 'Motion Groups' with a sub-group 'MotionGroup' containing 23 axes (K5700_Axis1 to K5700_Axis23). Below this is a table with the following data:

Type	MOTION_GROUP Periodic
Description	
Coarse Update Period	3.0 ms
Timing Model	Two Cycle
Group Status	
Group Fault	
Axis Fault	

The main window is titled 'Axis Schedule' and shows 'Update Period and Schedule' settings. The 'Base' update period is set to 3.0 ms. The 'Alternate 1' update period is 12.0 ms, and the 'Alternate 2' update period is 24.0 ms. The 'Estimated Utilization - Motion' table is highlighted with a red box:

Estimated Utilization - Motion	
Logix Controller:	46.4 %
Task I/O Cycle:	64.9 %
Connection I/O Cycle:	35.6 %
Communications:	21.7 %
Ethernet Media:	15.5 %

The 'Actual Utilization - Motion' table is also visible:

Actual Utilization - Motion	
Logix Controller:	
Task I/O Cycle:	

The 'Motion Connections Using:' dropdown is set to 'Ethernet Port on Controller'.



- (50) CIP axes with mux
- (10) Virtual axes
- (100) cyclic reads
- (50) cyclic writes

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

Example 2: ControlLogix® 5580 with **50 mixed** CIP and analog/SERCOS axes at 3ms:

Update Period and Schedule

Base: 3.0 ms (in 0.5 increments)

Alternate 1: 12.0 ms

Alternate 2: 24.0 ms

Estimated Utilization - Motion

Category	Value
Logix Controller:	40.2 %
Task I/O Cycle:	85.1 %
Connection I/O Cycle:	44.8 %
Communications:	17.6 %
Ethernet Media:	12.5 %

Estimated Utilization - Motion

Category	Value
Logix Controller:	46.4 %
Task I/O Cycle:	64.9 %
Connection I/O Cycle:	35.6 %
Communications:	21.7 %
Ethernet Media:	15.5 %

30% change compared to pure CIP



- (42) CIP axes with mux
- (8) SERCOS axes
- (10) Virtual axes
- (100) cyclic reads
- (50) cyclic writes

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance

CompactLogix™ 5380 with **32 axes in 1 ms:**

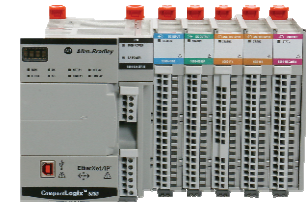
The screenshot displays the IAB software interface. On the left, a tree view shows a 'Motion Groups' folder containing 32 axes (K5700_Axis1 to K5700_Axis25). Below this is a table with the following data:

Type	MOTION_GROUP Perio.
Description	
Coarse Update Period	1.0 ms
Timing Model	Two Cycle
Group Status	
Group Fault	
Axis Fault	

The main window is titled 'Axis Schedule' and shows 'Update Period and Schedule' settings. It includes three columns for 'Base', 'Alternate 1', and 'Alternate 2' update periods (1.0 ms, 4.0 ms, and 8.0 ms respectively) and lists of axes assigned to each. A red box highlights the 'Estimated Utilization - Motion' section, which contains the following data:

Estimated Utilization - Motion	
Logix Controller:	68.4 %
Task I/O Cycle:	95.6 %
Connection I/O Cycle:	66.5 %
Communications:	35.9 %
Ethernet Media:	25.6 %

The 'Actual Utilization - Motion' section is also visible but empty.



- (32) CIP axes with mux
- (2) Virtual axes / MCT
- (64) cyclic reads
- (32) cyclic writes

IAB – Integrated Architecture Builder

Predict and Refine Controller Performance (FUTURE IAB/LD Updates)

CompactLogix™ 5480 with **150 axes in 1 ms:**

Motion Control System		
Logix Controller	5480	family
Base Update Period	1	msec
Timing Model	2	cycles
CIP Drive Axes	150	axes
Cyclic Reads	450	attributes
Cyclic Writes	200	attributes
Motion Planner		
	Basic	
Active MAM	0	axes
Active MAJ	0	axes
Active MAG	0	axes
Active PCAM	150	axes
Active TCAM	0	axes
Active MAOC	0	instances
Coordinate Systems	0	instances
Active MCLM	0	instances
Active MCCM	0	instances
Active MCT (Articulated)	0	instances
Active MCT (Cartesian)	0	instances
Motion Task Avg Scan Time	426	usec

Estimated Utilization - Motion	
Logix Controller:	42.6%
Task I/O Cycle:	66.4%
Connection I/O Cycle:	93.8%
Communications:	75.0%
Ethernet Media:	18.3%



- (150) CIP axes no mux
- (150) PCAMs
- (450) cyclic reads
- (200) cyclic writes

LISTEN.
THINK.
SOLVE.

Otázky?

Děkuji Vám za pozornost

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