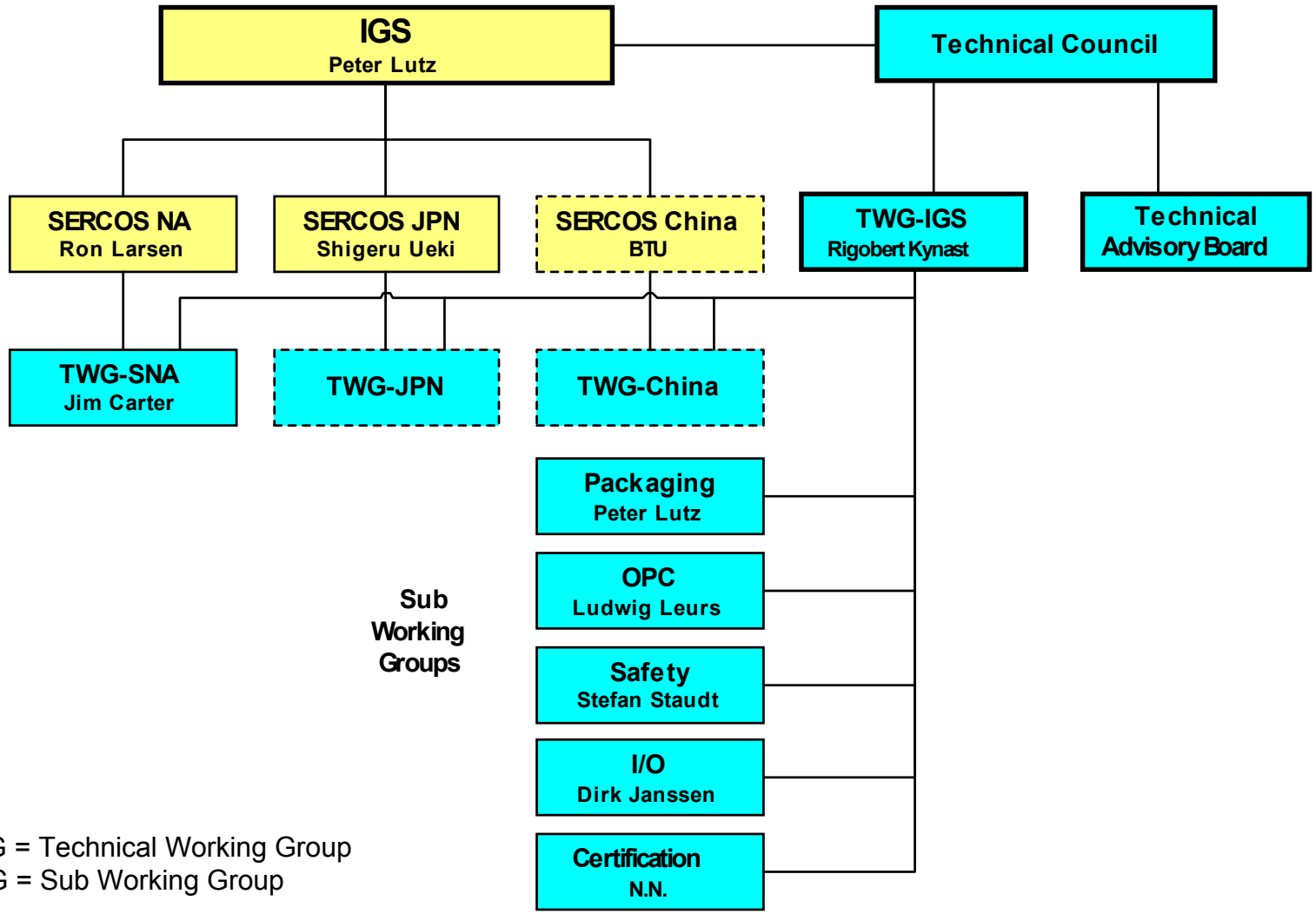
SERCOS interface

presented by

Rigobert Kynast

(Chairman of SERCOS Technical Working Group)

Organization of Technical Working Groups (2002)

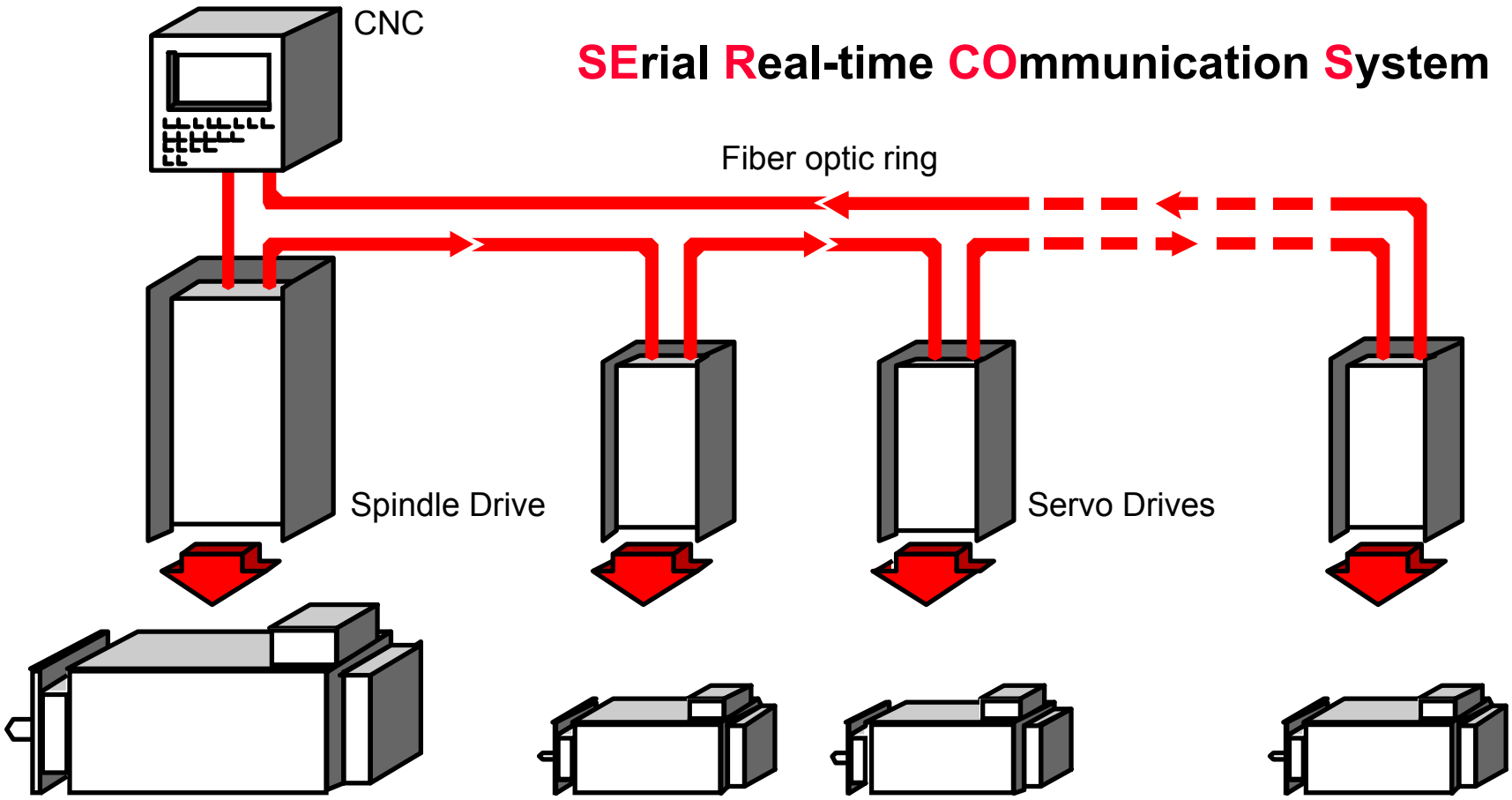


TWG = Technical Working Group
SWG = Sub Working Group

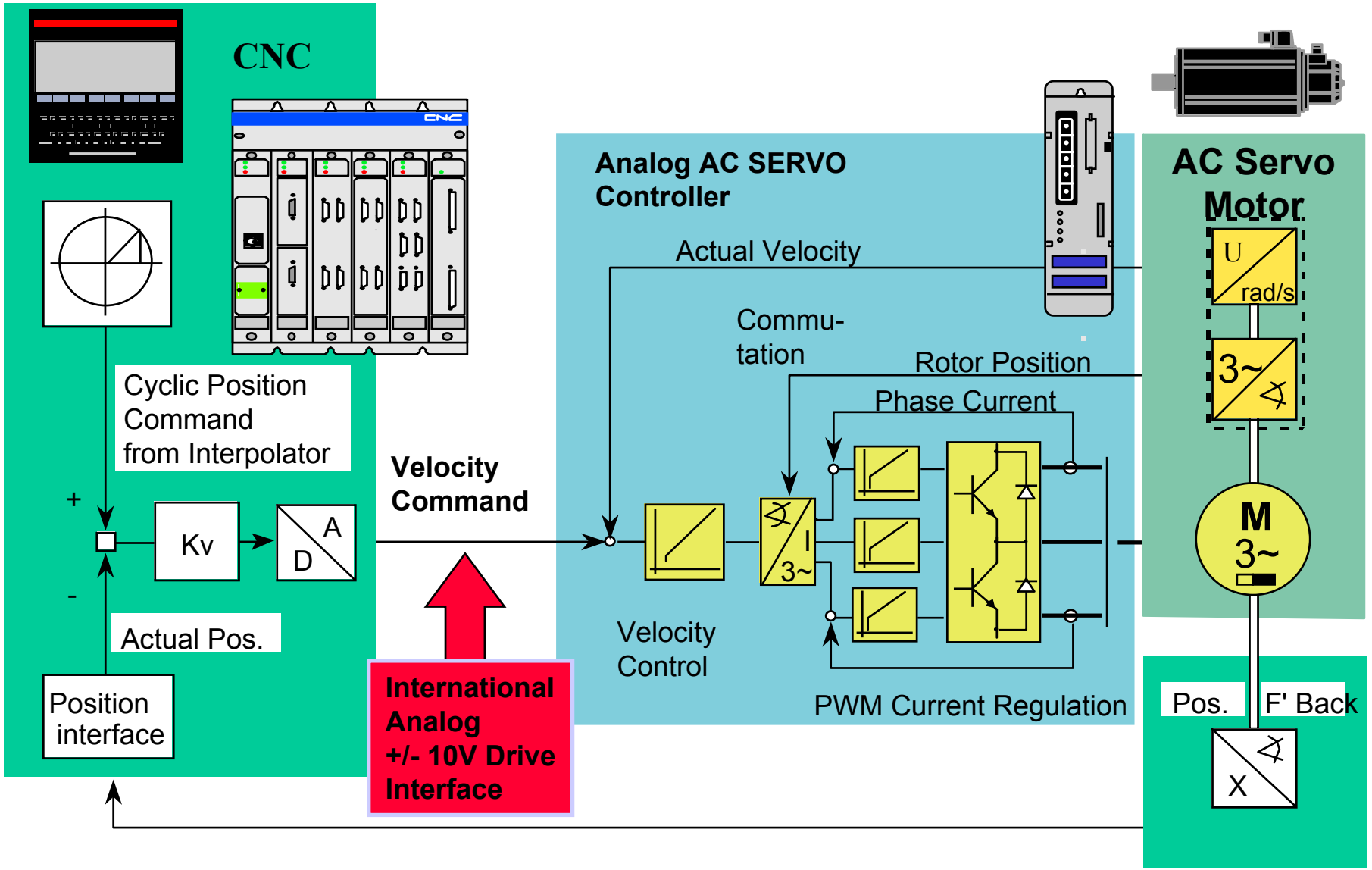
SERCOS Booth - HMI 2002

IEC 61491/ 2nd Edition

Serial data link for real-time communication between controls and drives

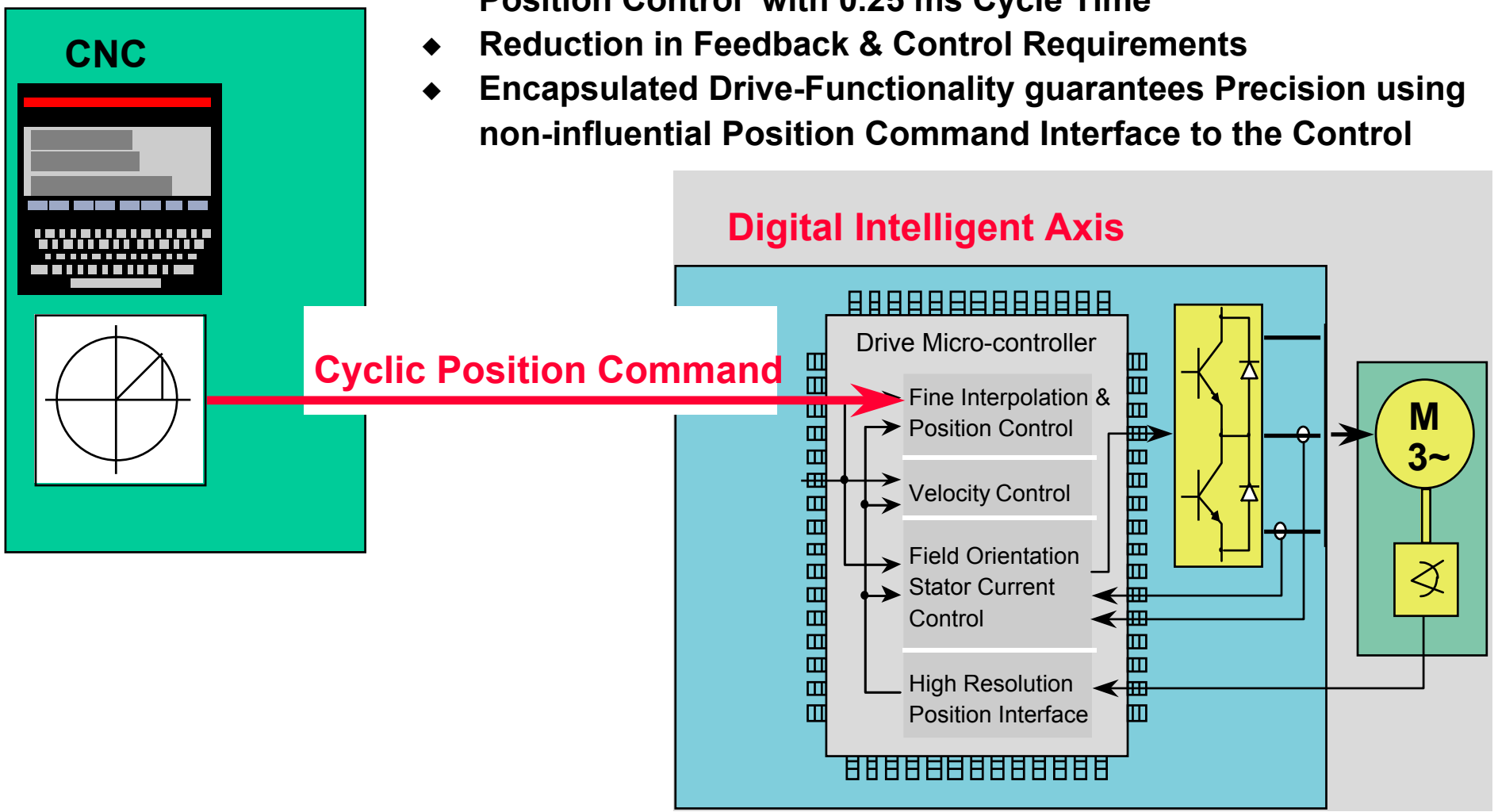


Conventional CNC
with Analog AC SERVO Drive

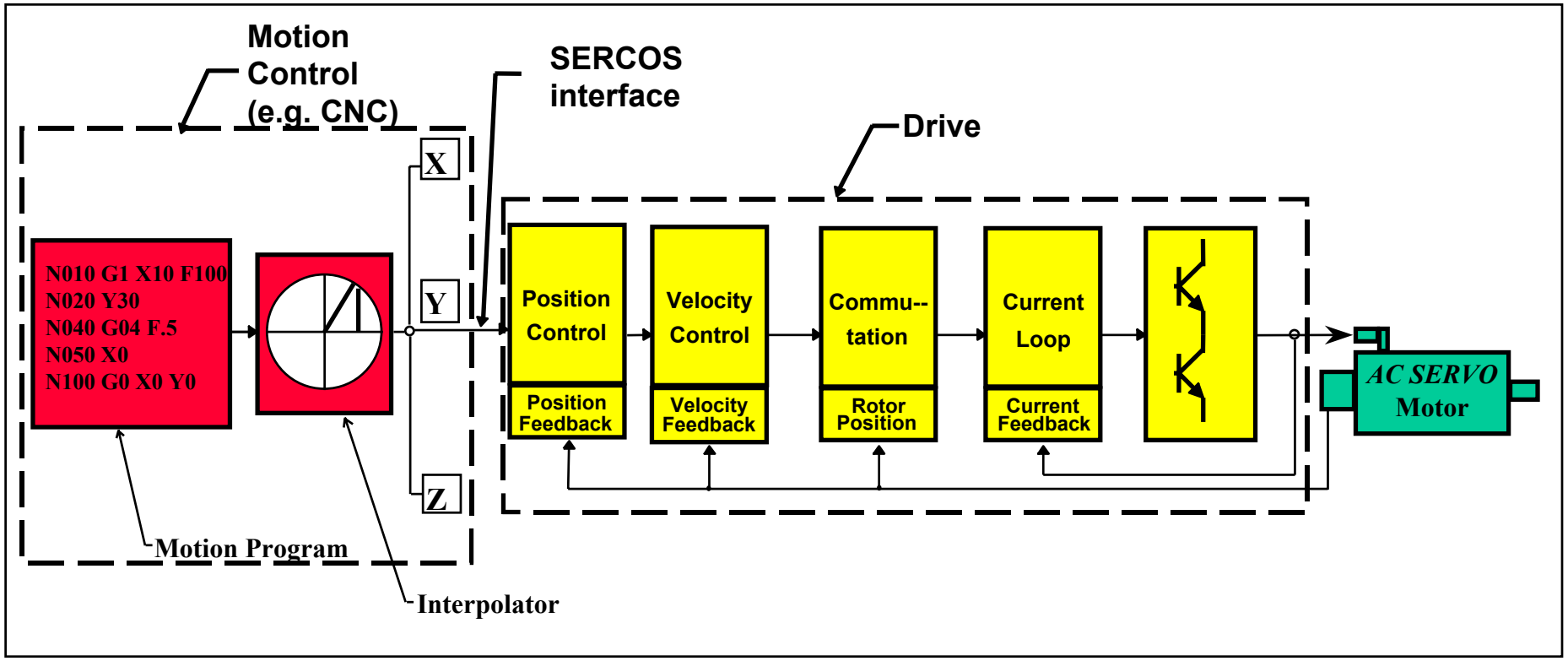


CNC Axis with Digital Intelligent Drive

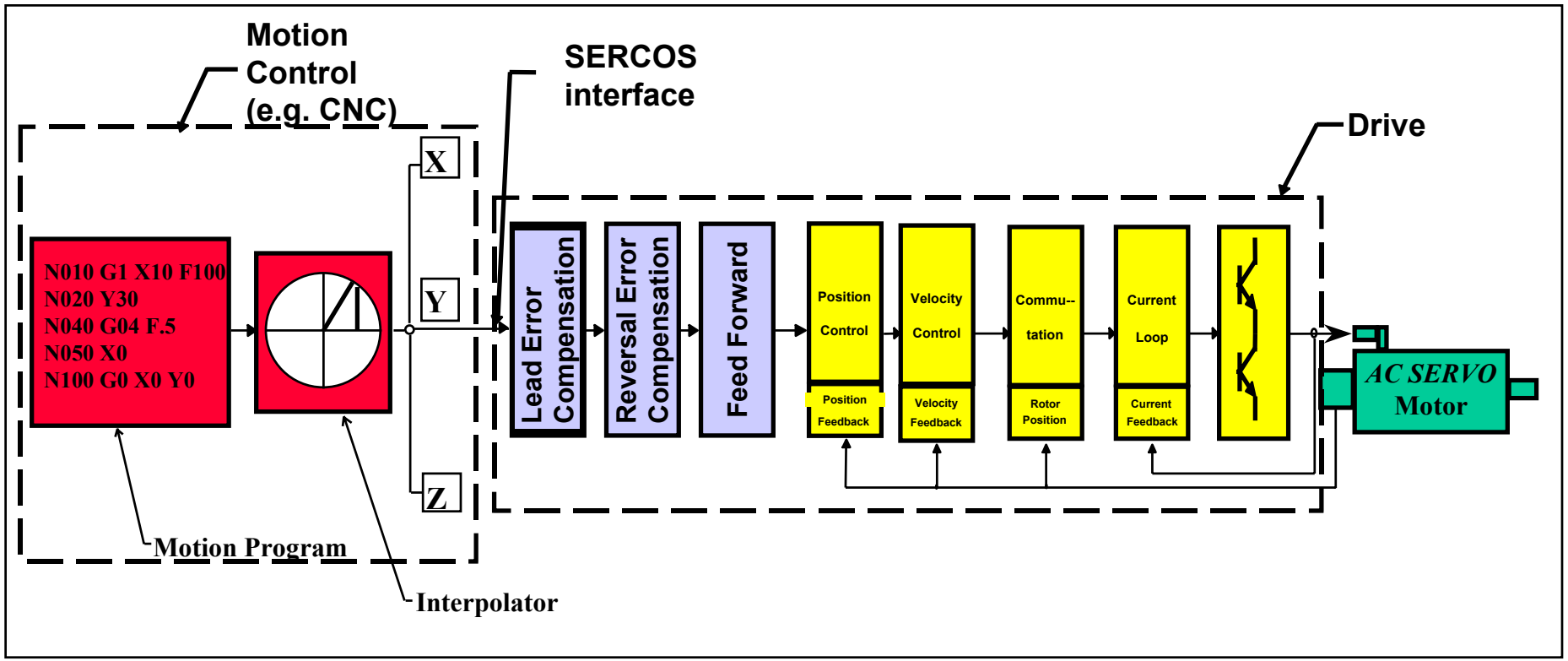
- Complete Drive Control Loop in Fast Micro-controller
- Quantum Leap in Precision and Useable Speed due to Lagless Position Control with 0.25 ms Cycle Time
- Reduction in Feedback & Control Requirements
- Encapsulated Drive-Functionality guarantees Precision using non-influential Position Command Interface to the Control



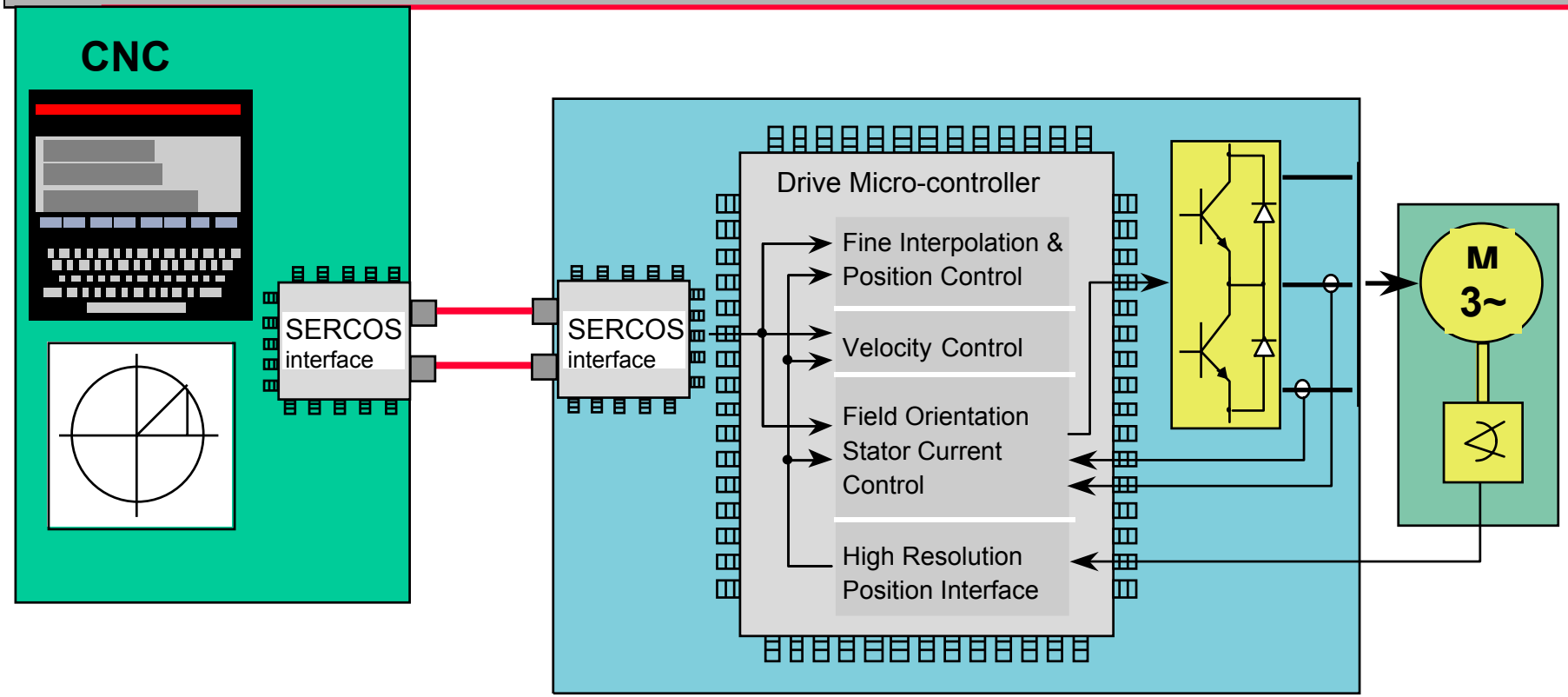
Intelligent SERCOS Drive



Distributed Axis Control

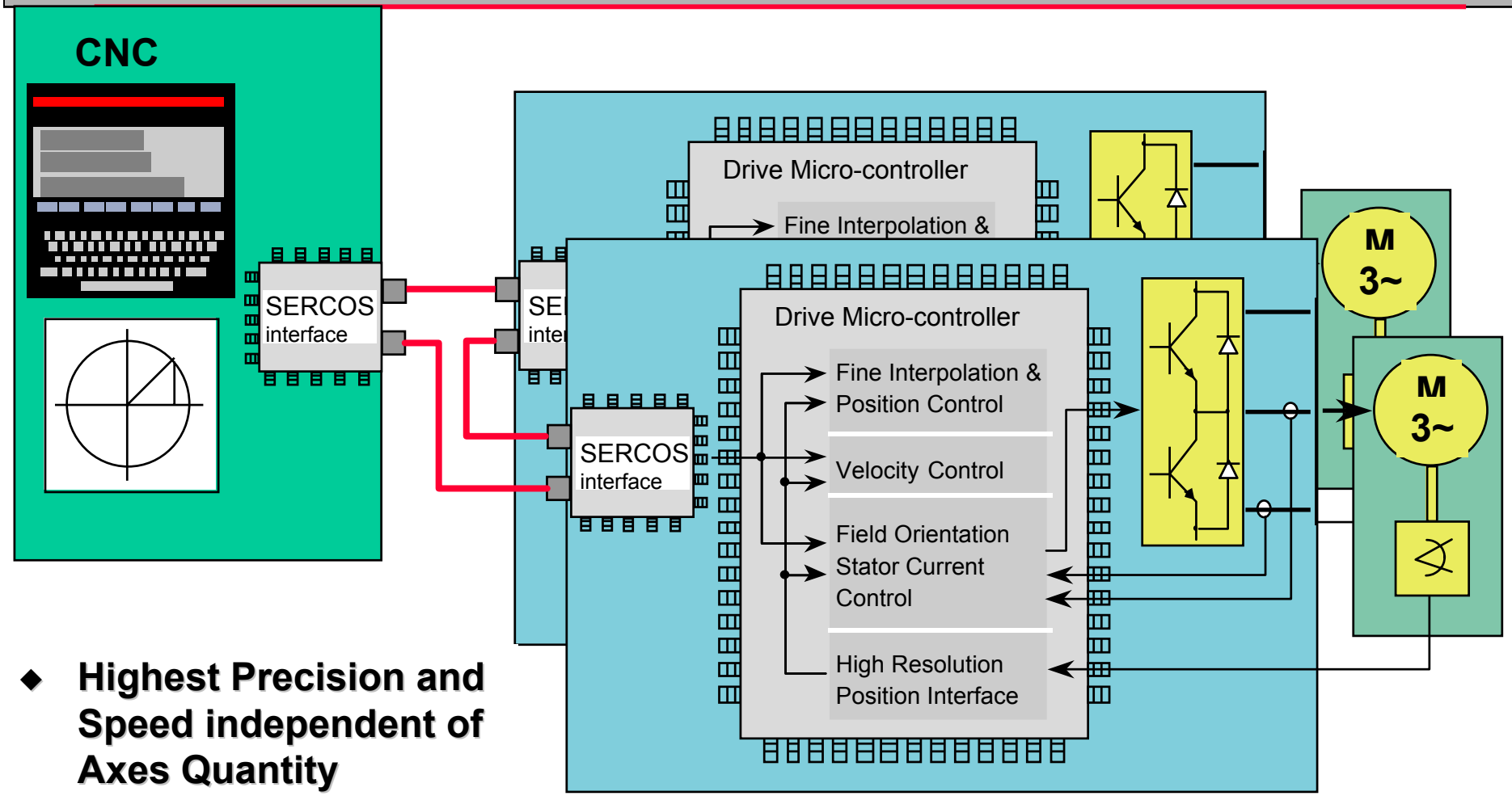


Connection CNC - SERCOS Drive (1)



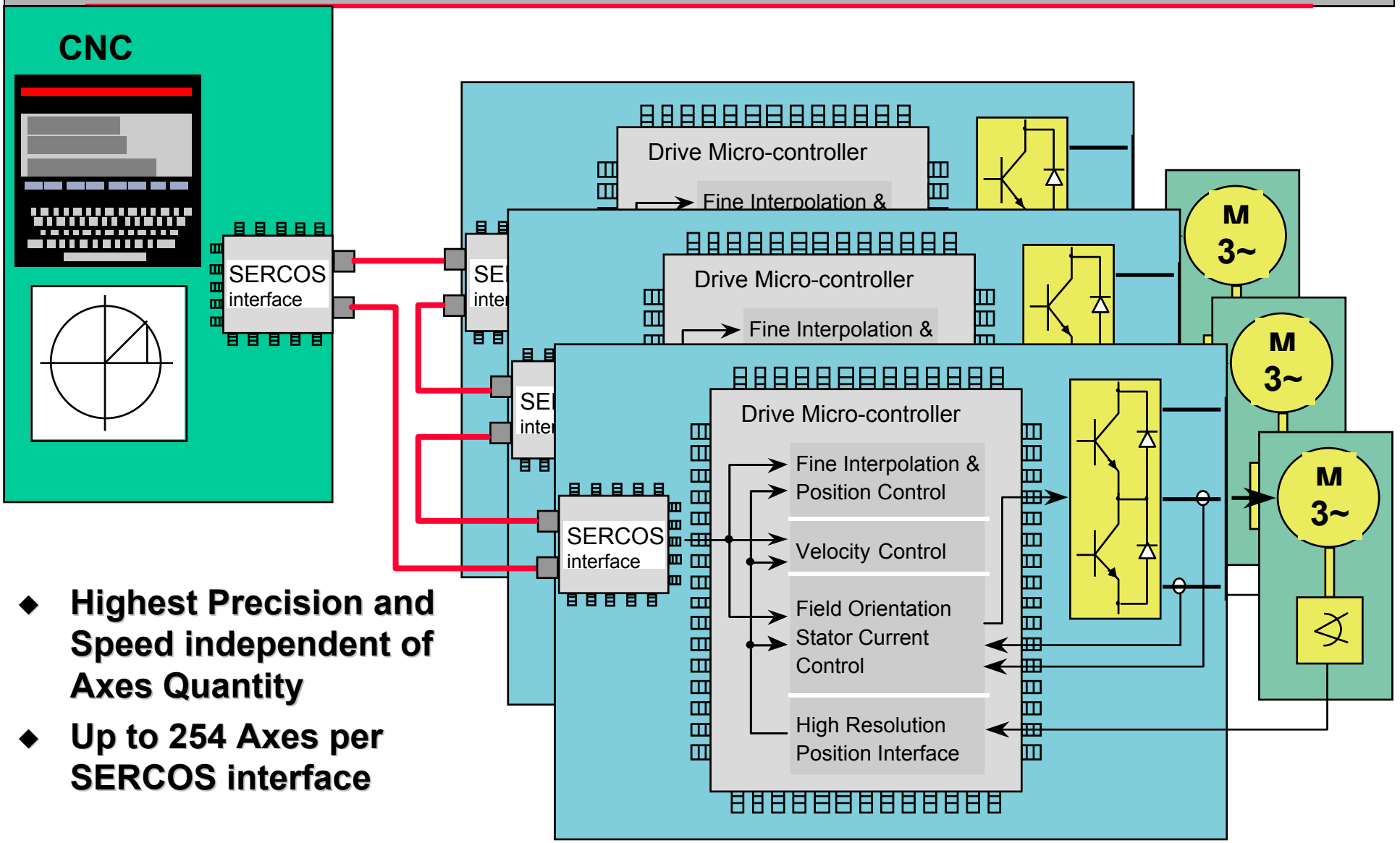
- **Highest Precision and Speed independent of Axes Quantity**

Connection CNC - SERCOS Drive (2)



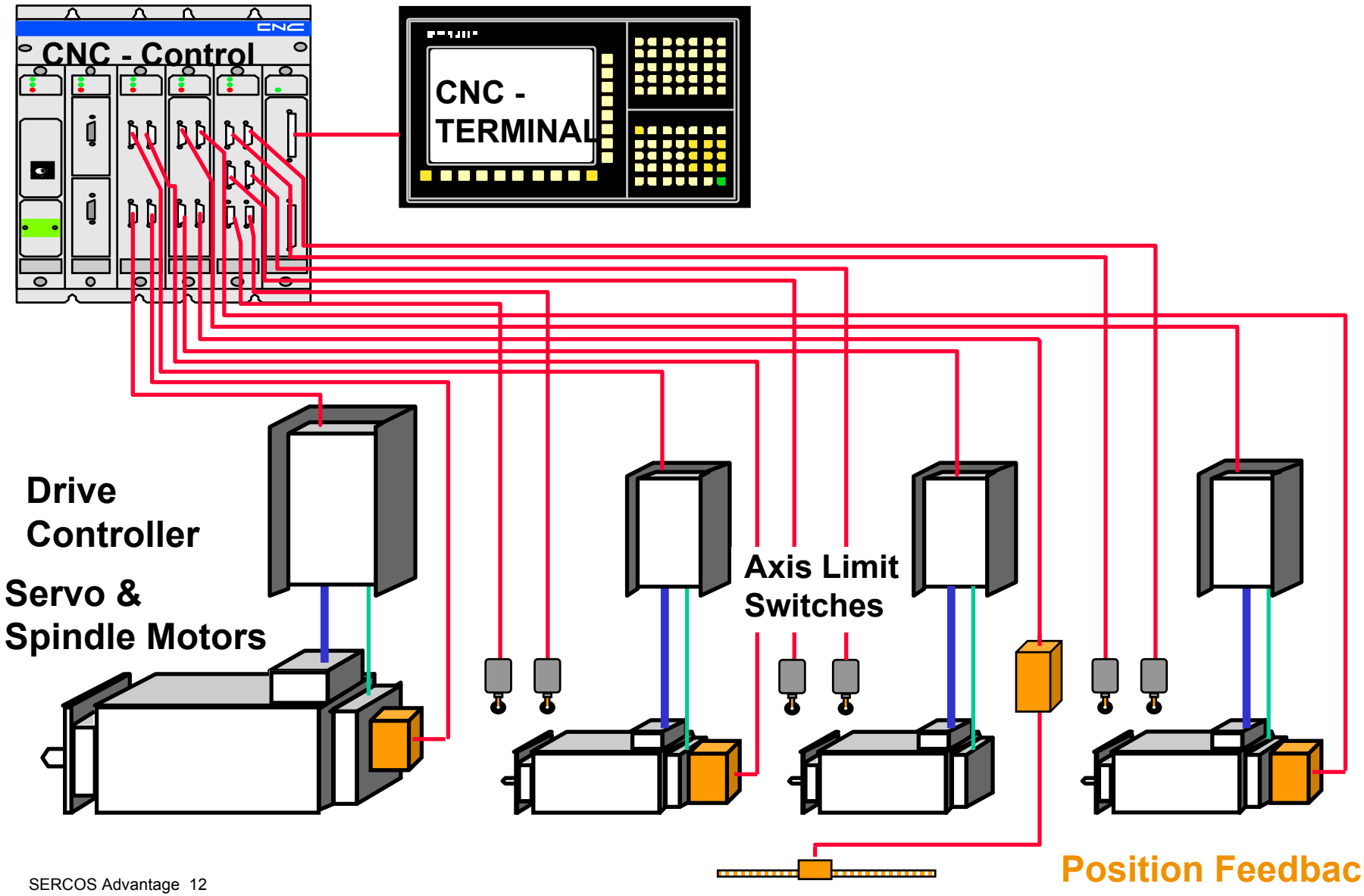
- **Highest Precision and Speed independent of Axes Quantity**
- **Up to 254 Axes per SERCOS interface**

Connection CNC - SERCOS Drive (3...)

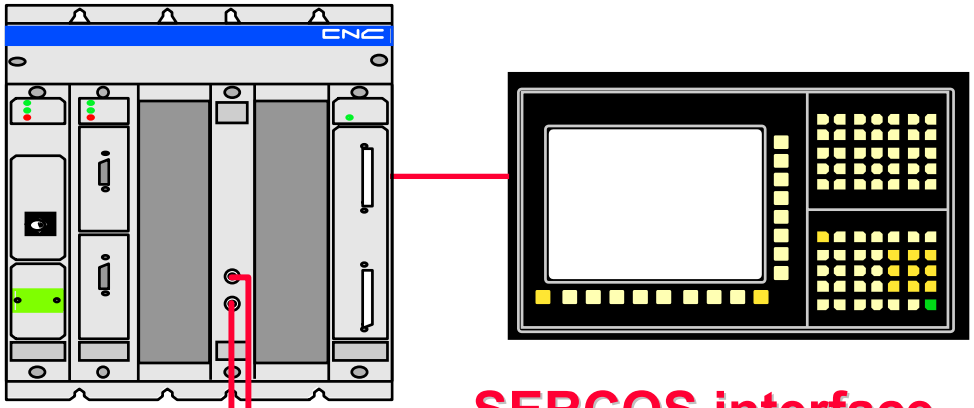


- **Highest Precision and Speed independent of Axes Quantity**
- **Up to 254 Axes per SERCOS interface**

Conventional CNC-Control and Drive Technology



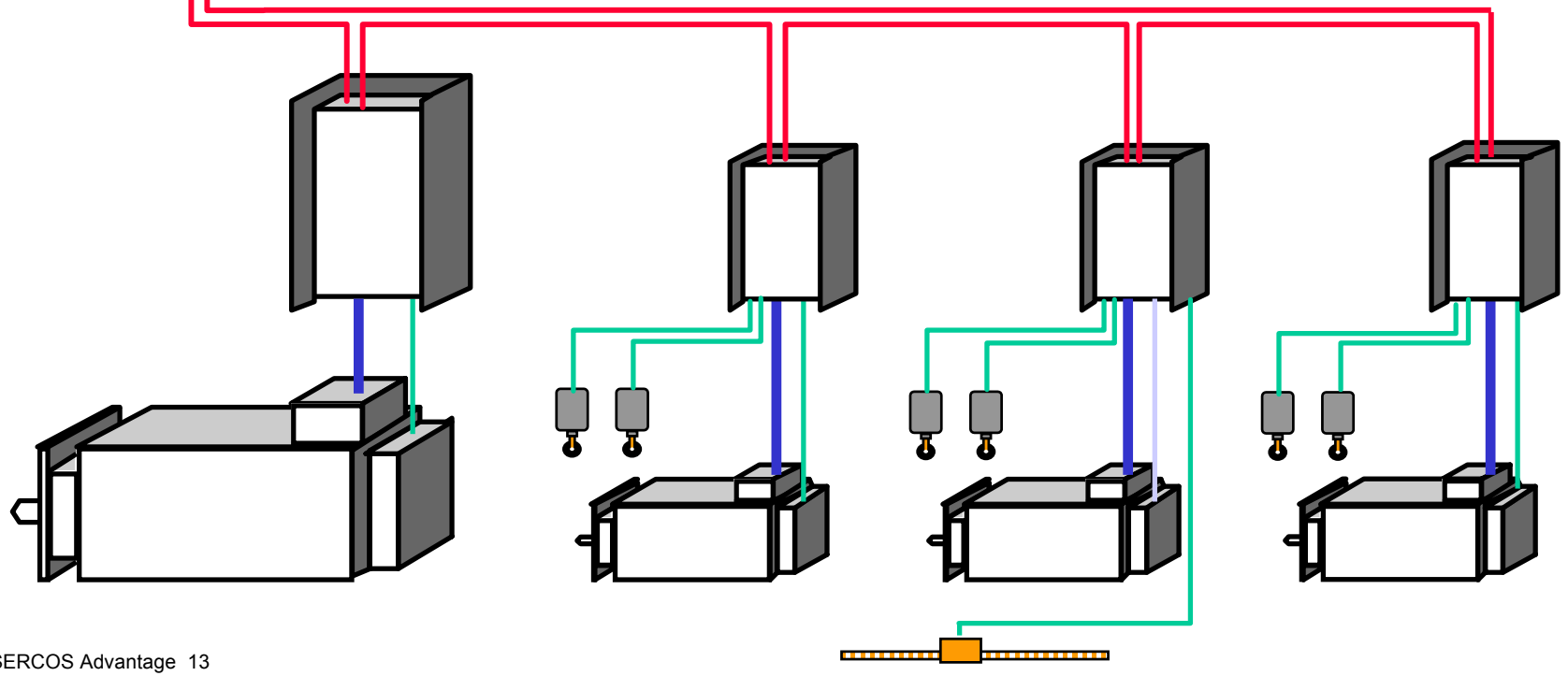
CNC with SERCOS interface



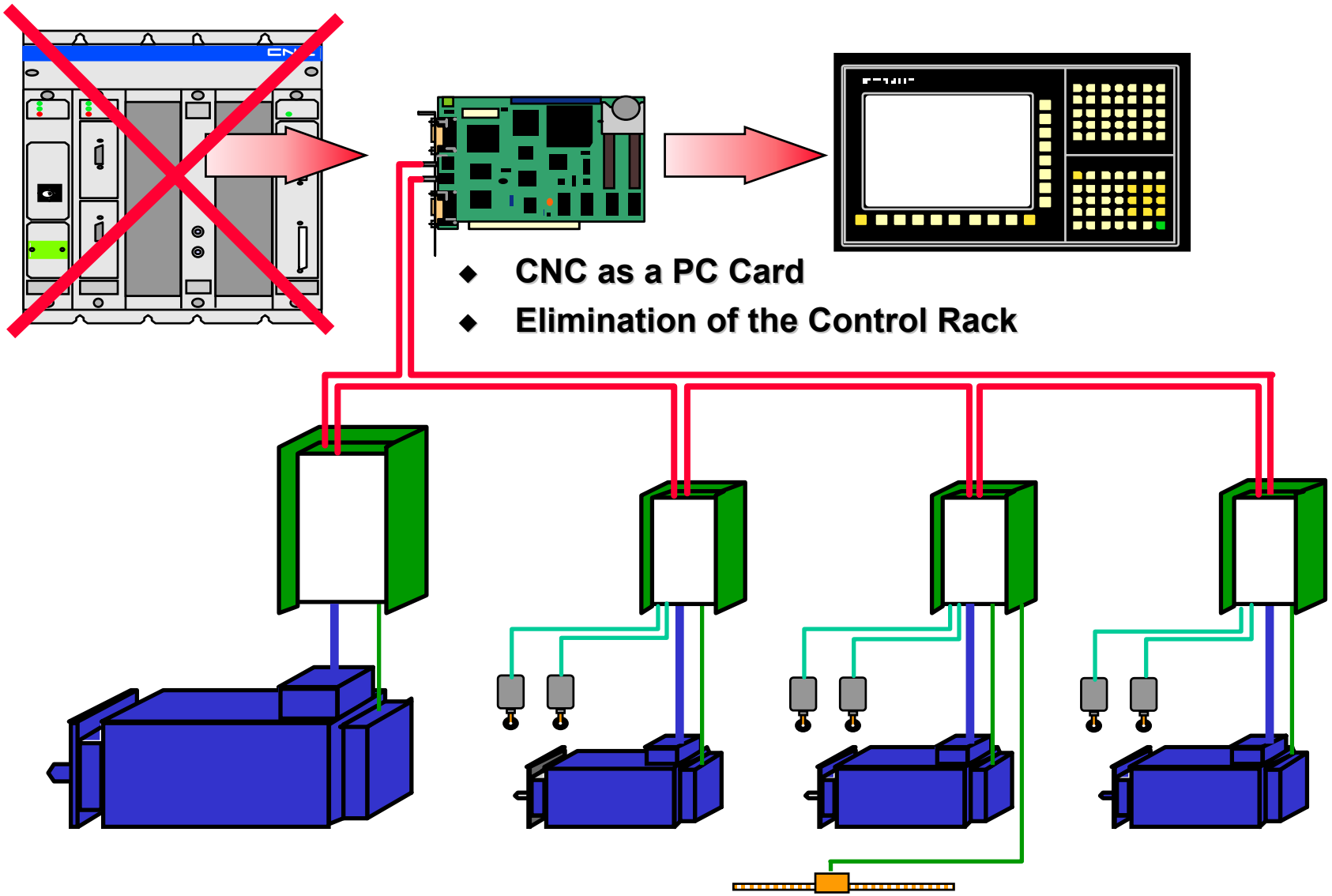
Elimination of:

- **Position Feedback, Cables & Position Interfaces**
- **CNC Axis Cards**
- **Cabling & Terminations**
- **Start-up Requirements**

SERCOS interface

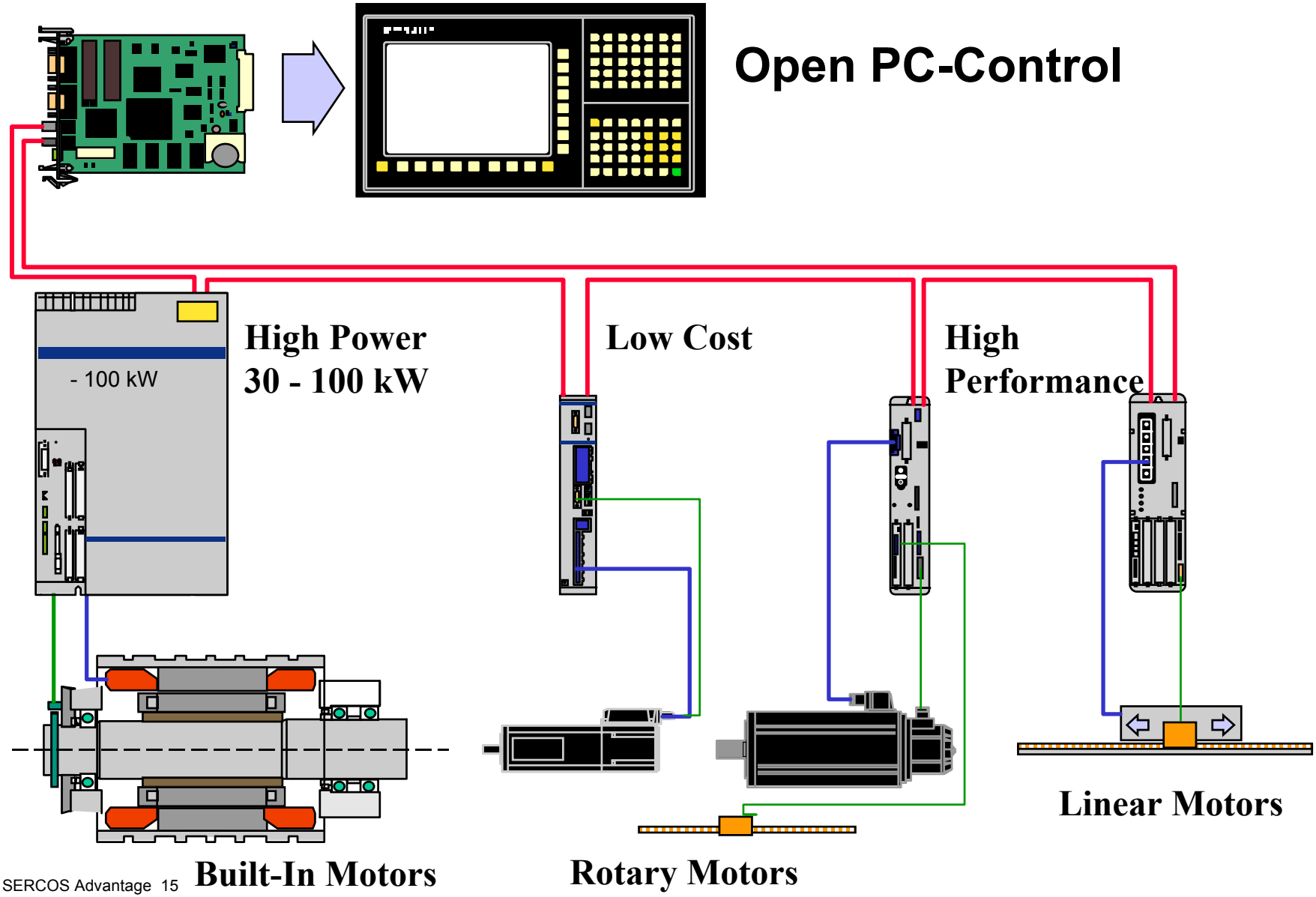


PC-Control with SERCOS interface



- CNC as a PC Card
- Elimination of the Control Rack

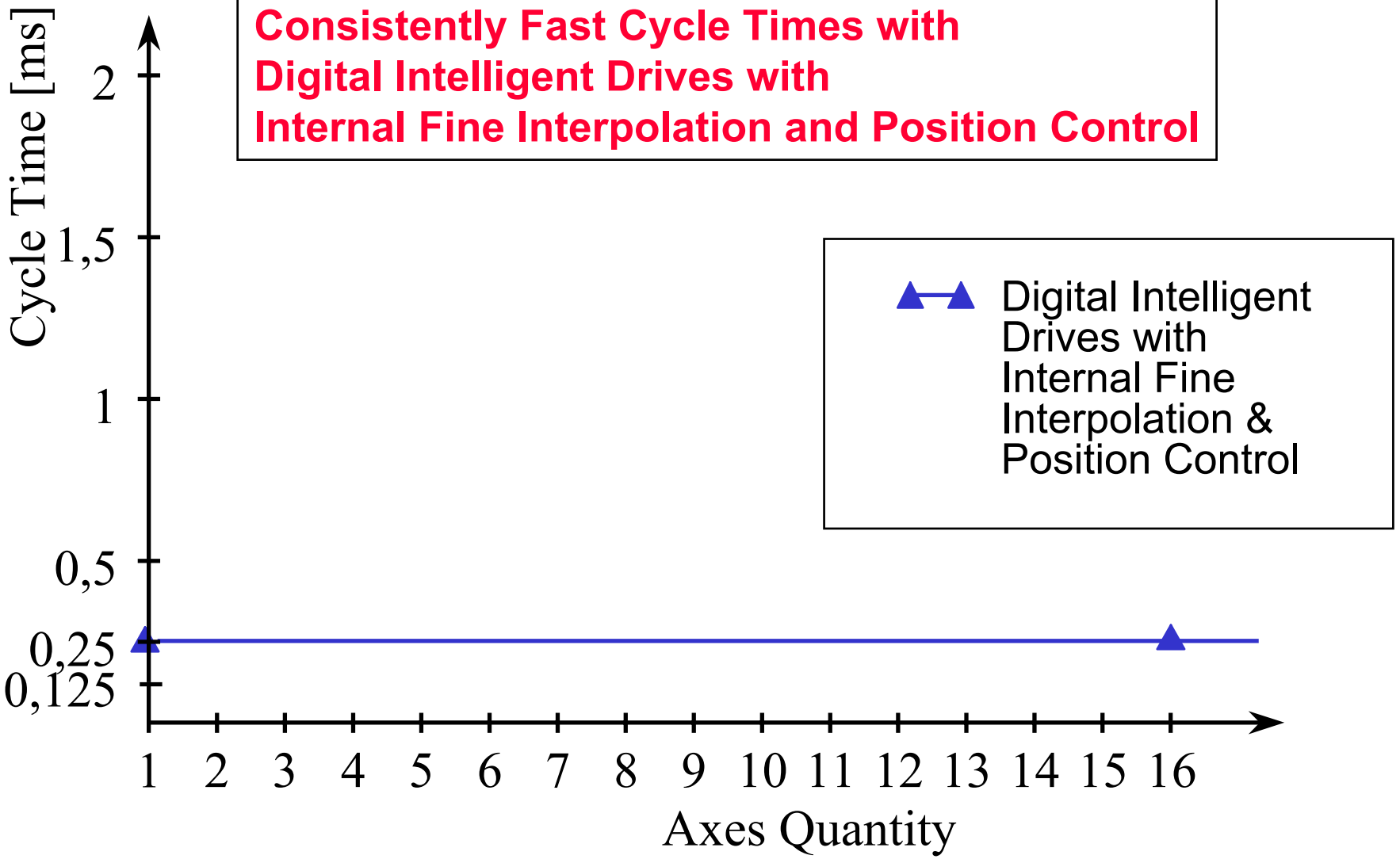
Drive Technology independent



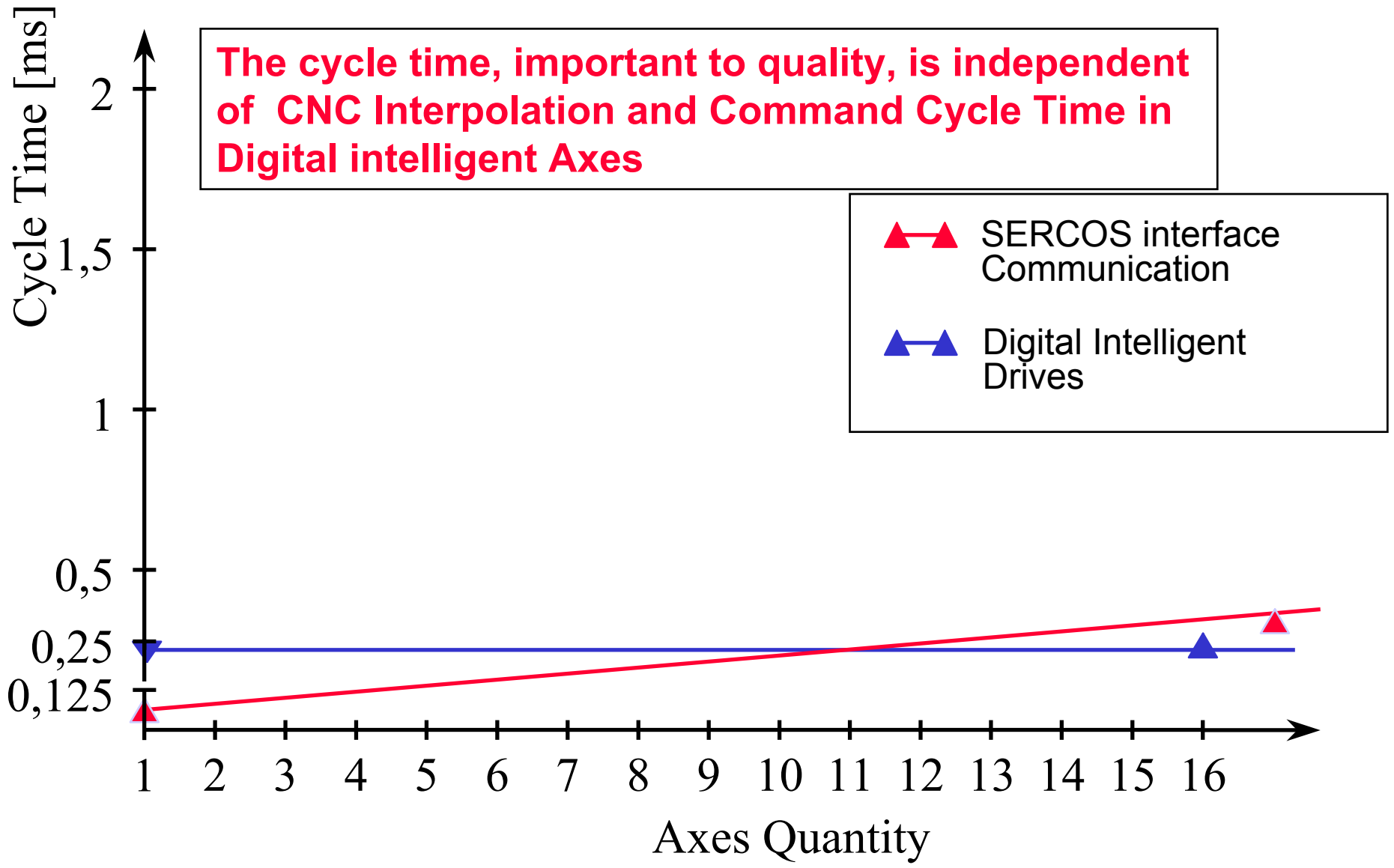
Comparisons

Performance SERCOS interface
Drive with Position Control

Consistently Fast Cycle Times with
Digital Intelligent Drives with
Internal Fine Interpolation and Position Control

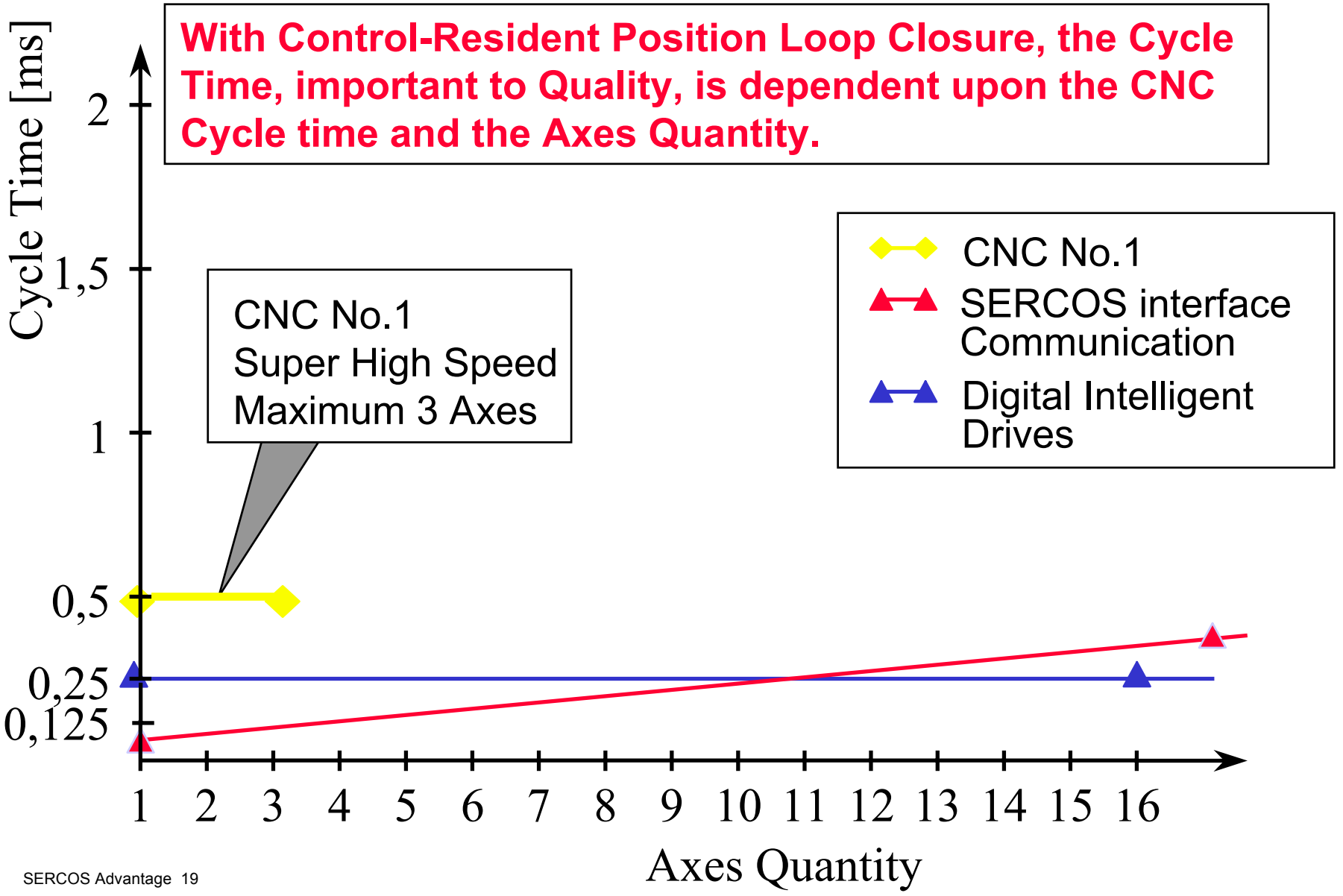


Performance SERCOS interface Communication



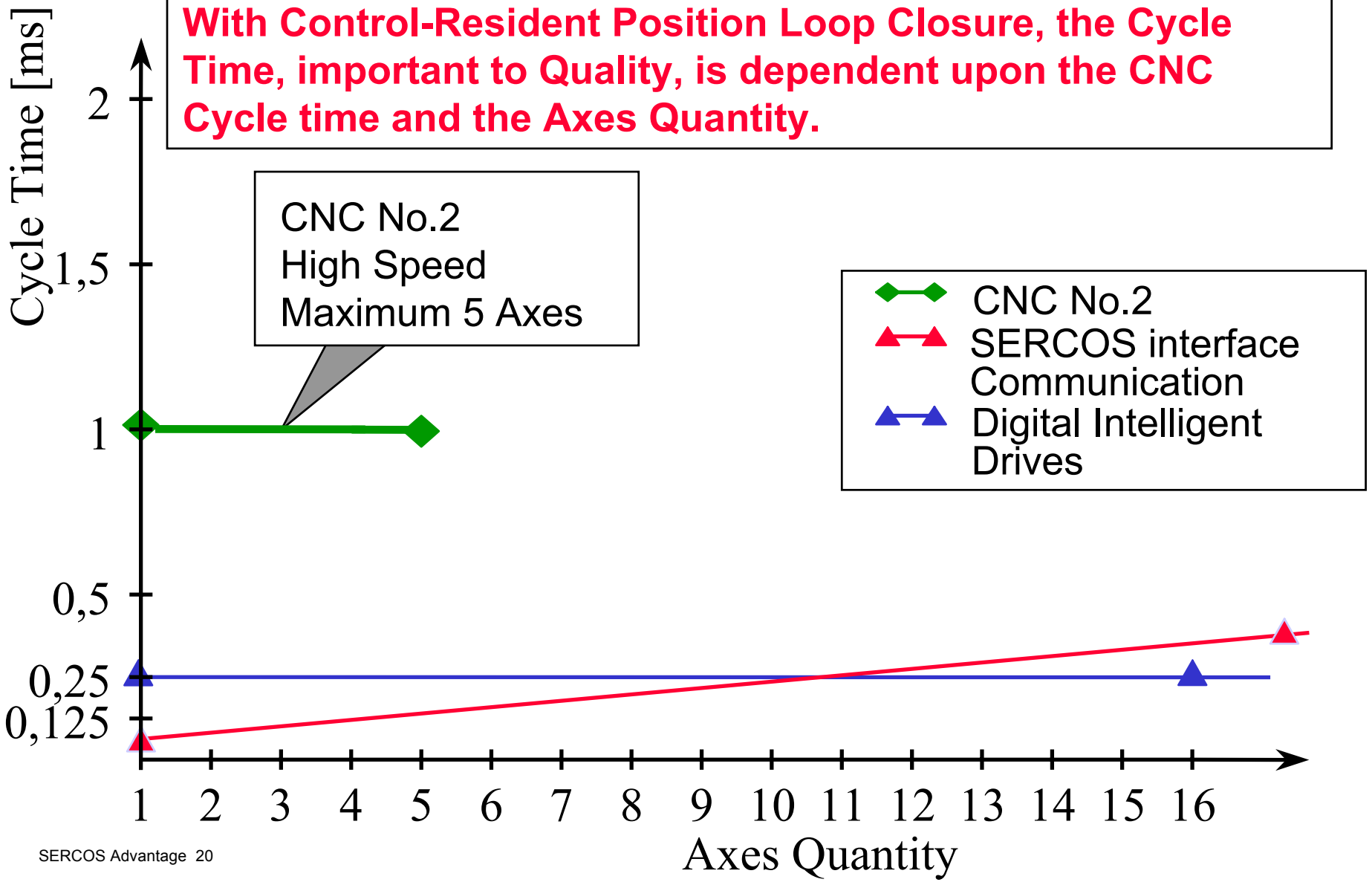
Performance Comparison (CNC No.1)

With Control-Resident Position Loop Closure, the Cycle Time, important to Quality, is dependent upon the CNC Cycle time and the Axes Quantity.

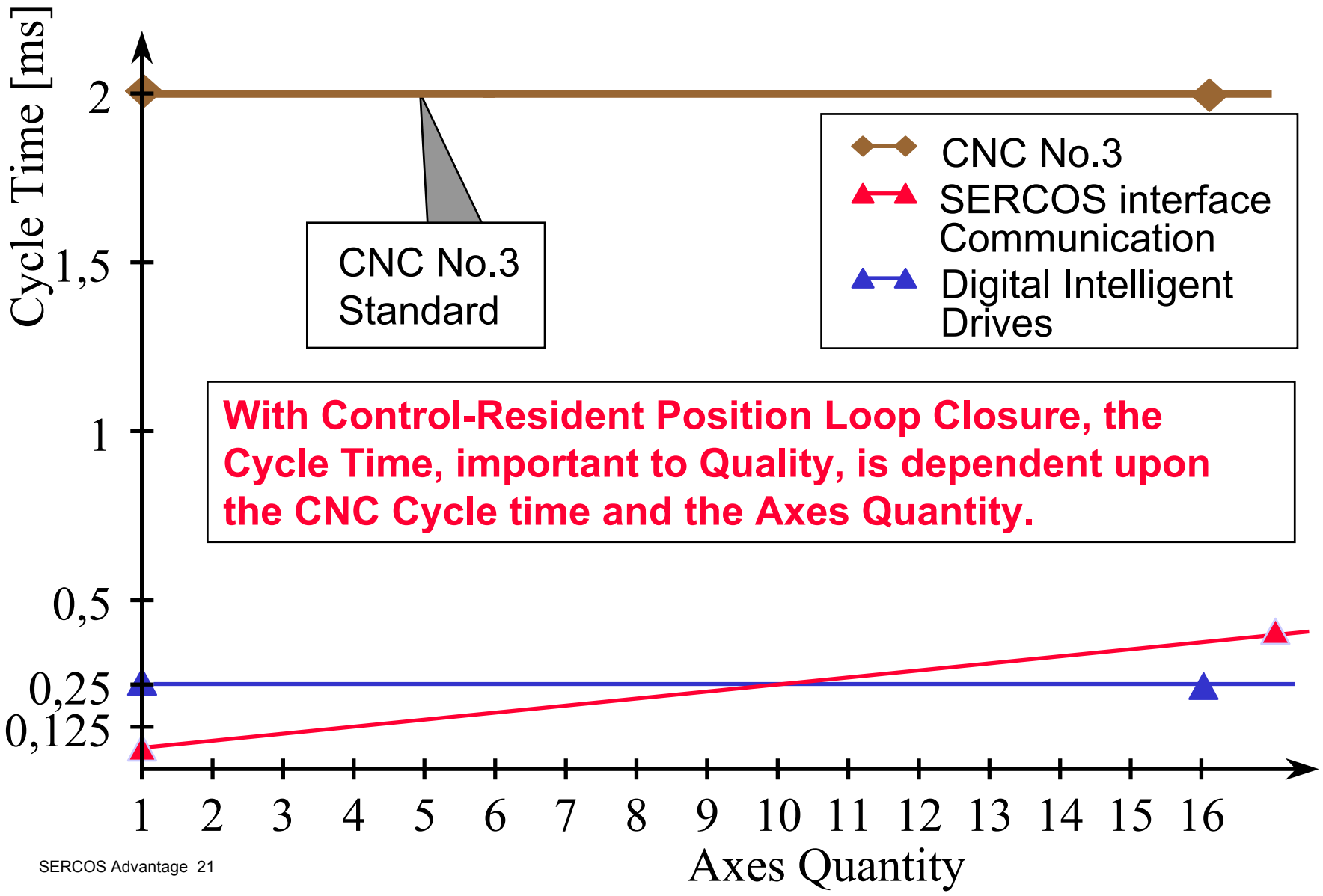


Performance Comparison (CNC No.2)

With Control-Resident Position Loop Closure, the Cycle Time, important to Quality, is dependent upon the CNC Cycle time and the Axes Quantity.

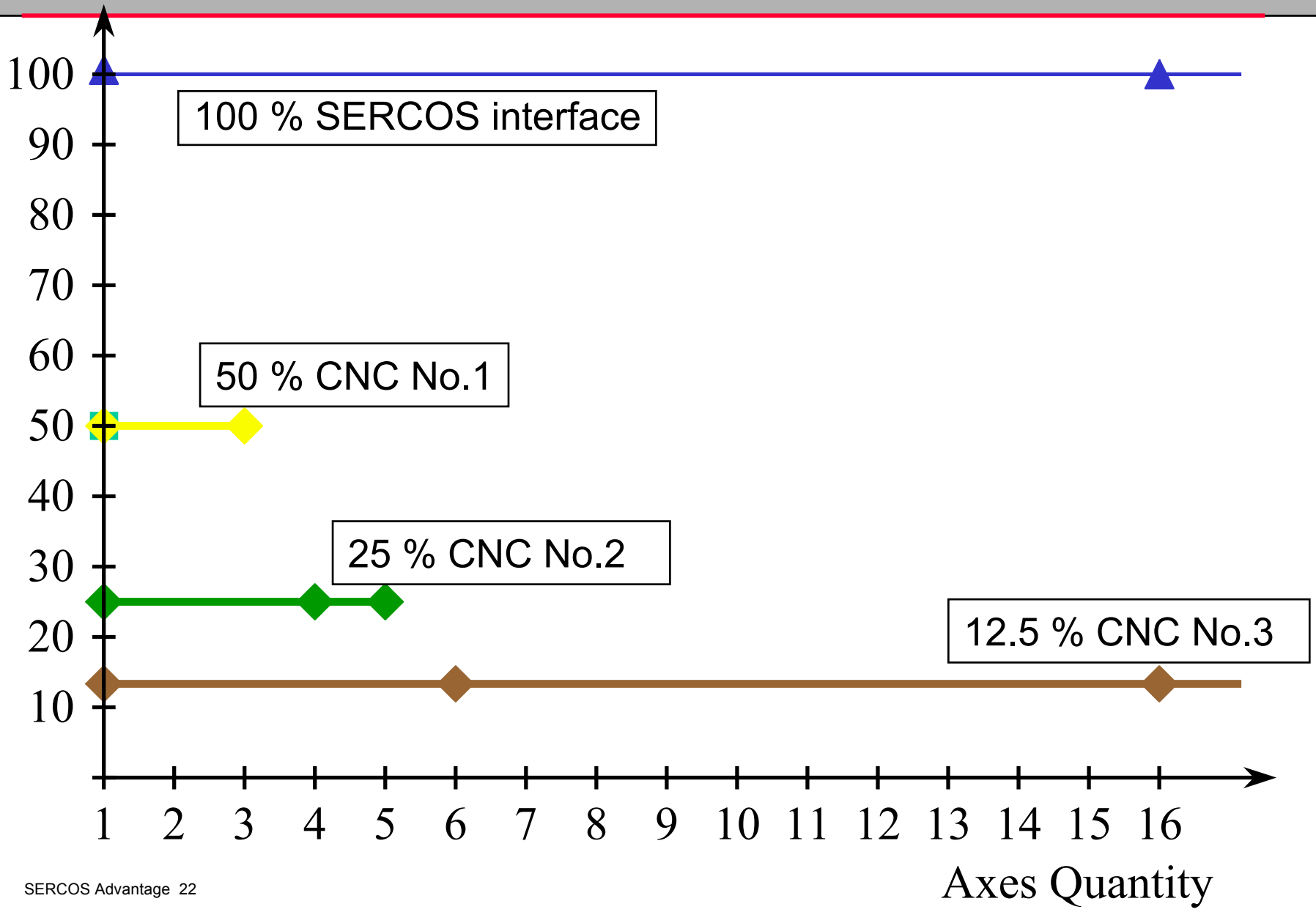


Performance Comparison (CNC No.3)



Performance Capability

[%] (4000 Cycles per Second = 100 %)



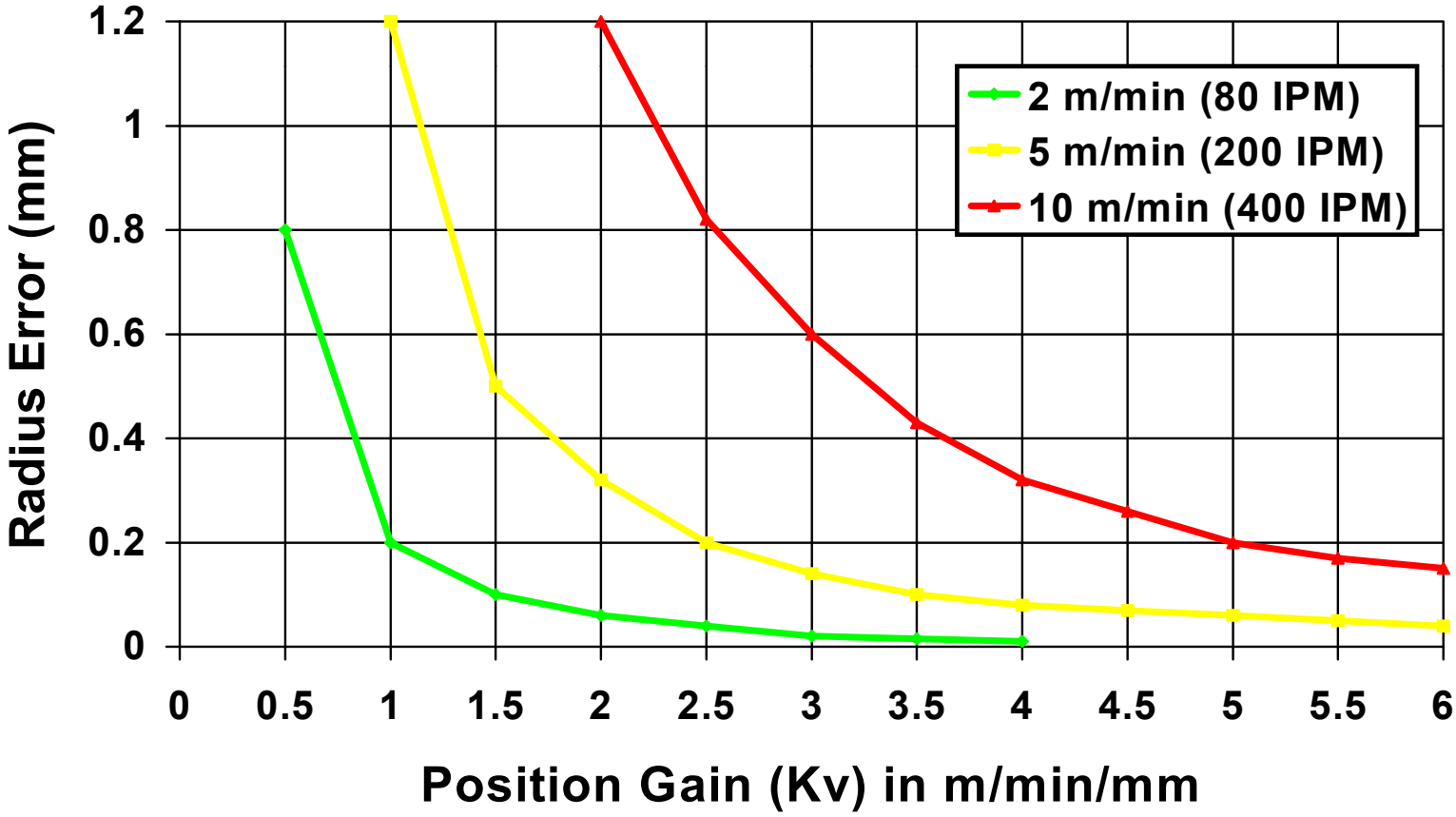
Applications

Maximum Gain as a Function of Position Loop Update Time

Position Loop Update Time	Maximum KV (m/min/mm)
10 ms	2
5 ms	4
2 ms	10
1 ms	20
0.25 ms	80

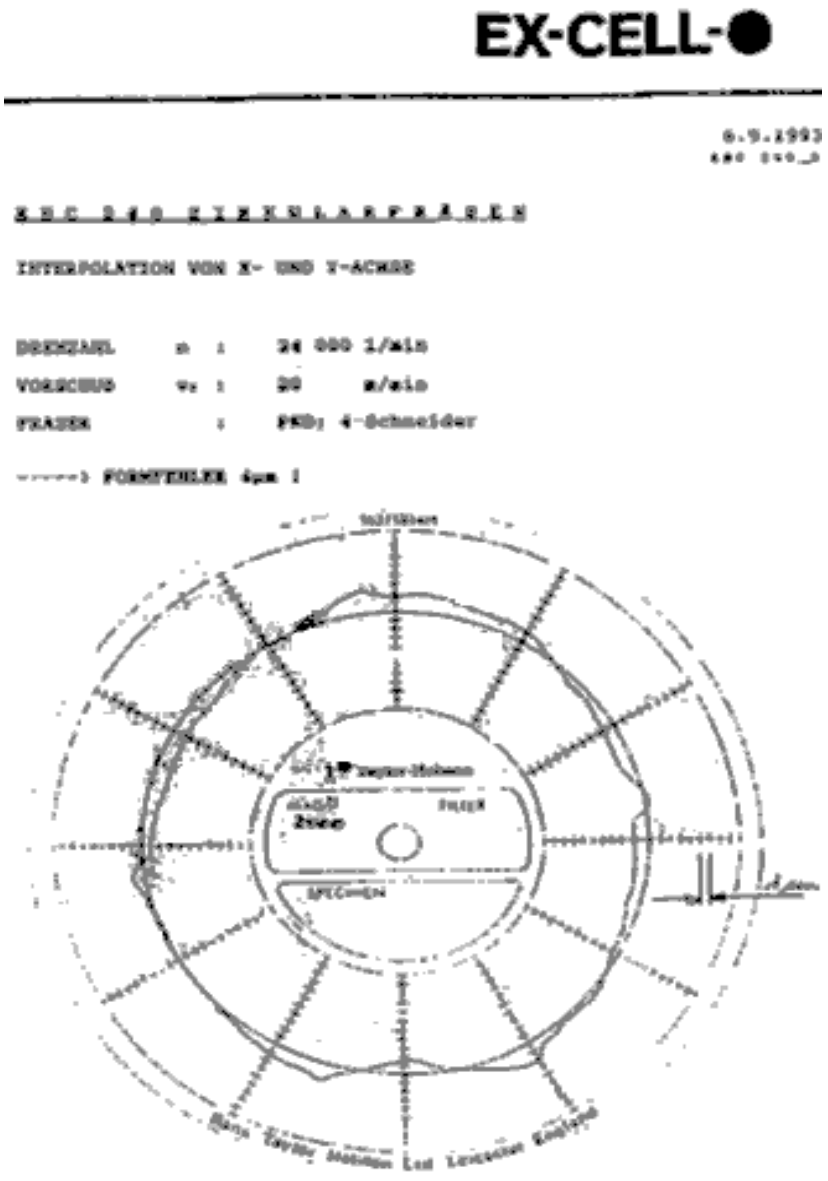
Mechanical Precision
Position Gain & Contour Error

Contour Error as a Function of Position Gain For a Radius of 10 mm (0.4")



Mechanical Precision
Field Example

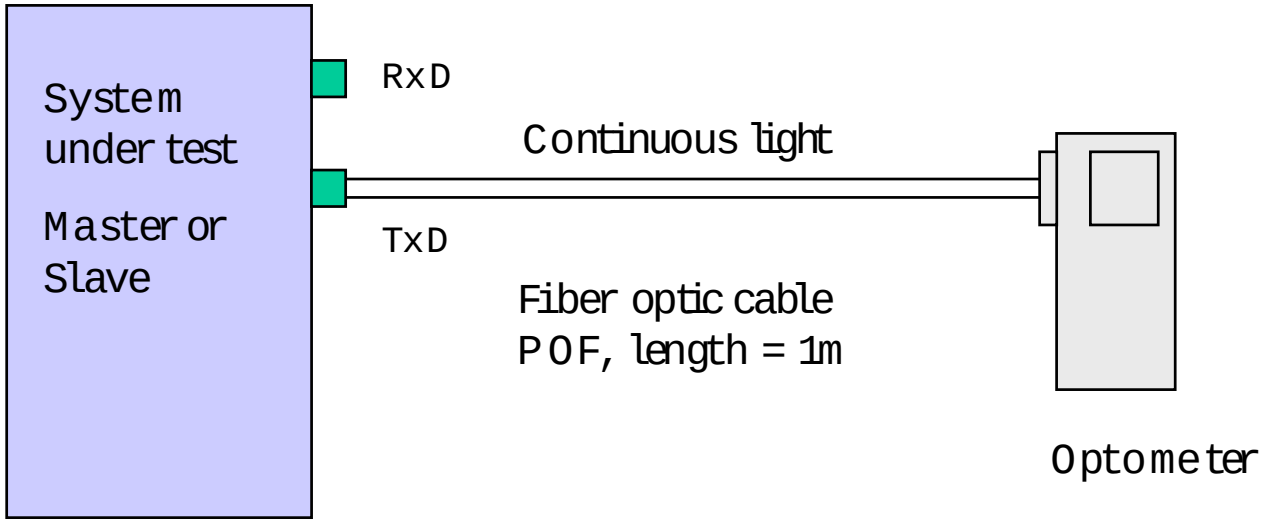
- 20 m/min (800 IPM) path speed
- 16 mm ∅ tool
- XY Circular Interpolation
- 68 mm (2.5”) ∅ circle
- **4 µm (0.00015”) Error**
  as measured on part



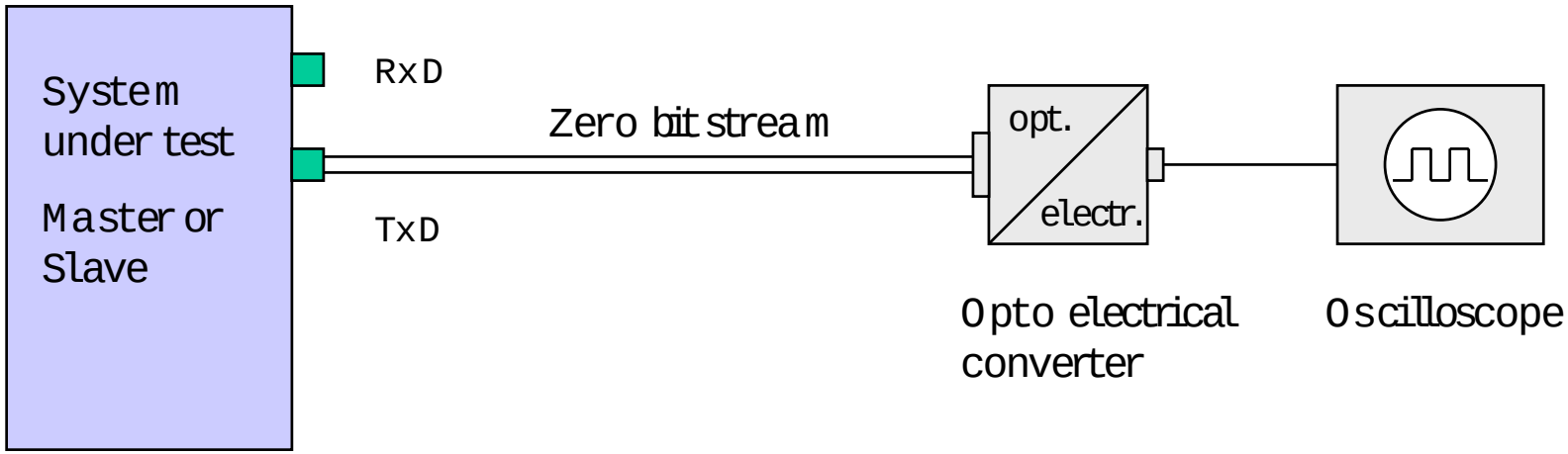
From Low-Cost to High-End
The Intelligent Digital Drive Interface

Certification

Certification
Optical output power

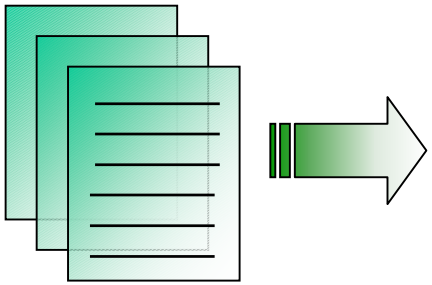


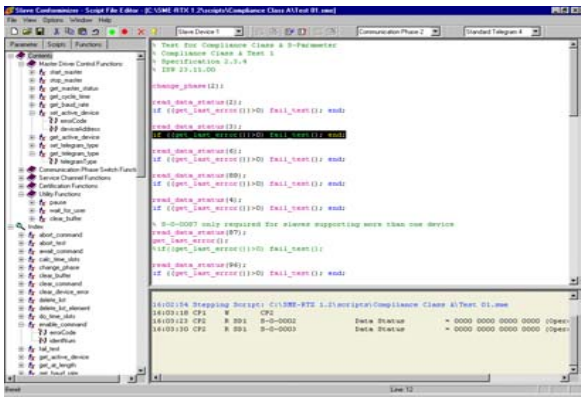
Certification
Optical output signal



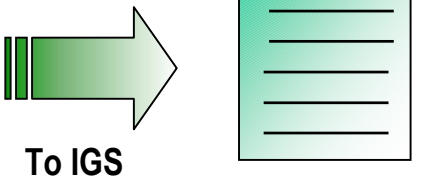
Certification (Conformizer)
Slave Conformance Test

Test Scripts





Test Report (HTML)



To IGS

Test Protocol (RTF)

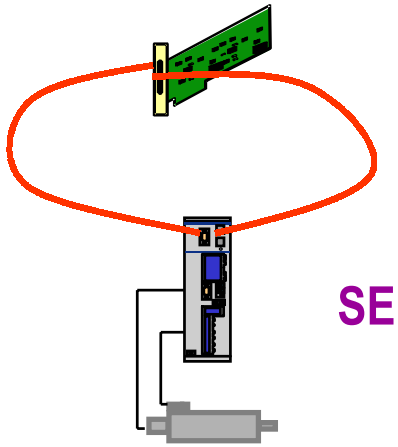
To Manufacturer

Windows NT/2000

RTX 5.0

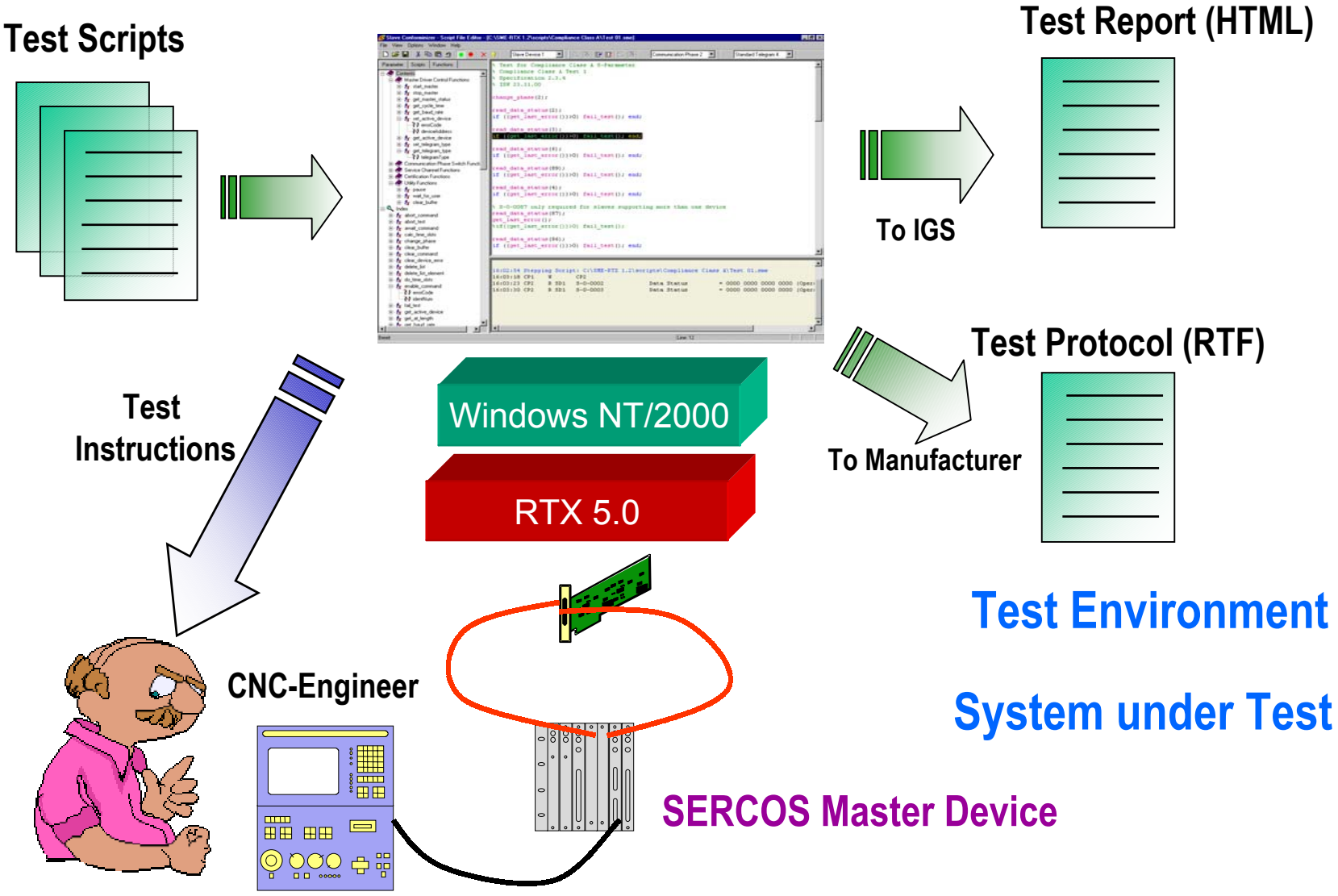
Test Environment

System under Test

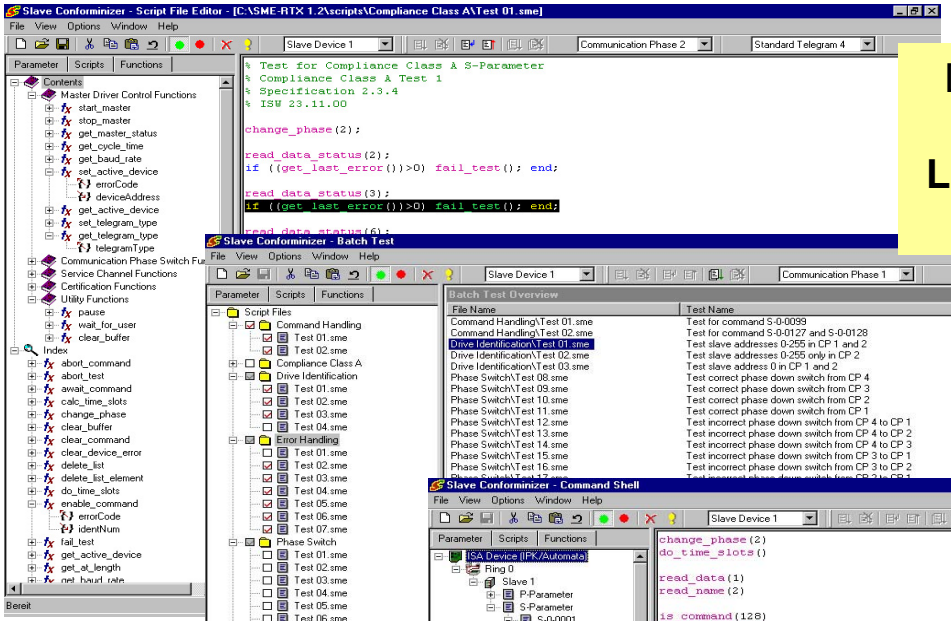


SERCOS Slave Device

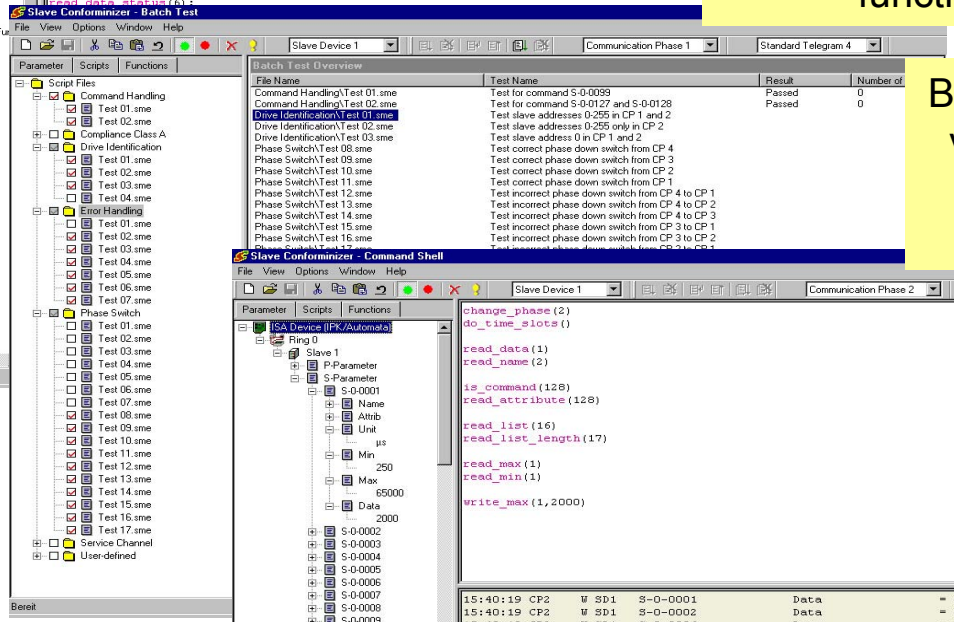
Certification (Conformizer)
Master Conformance Test



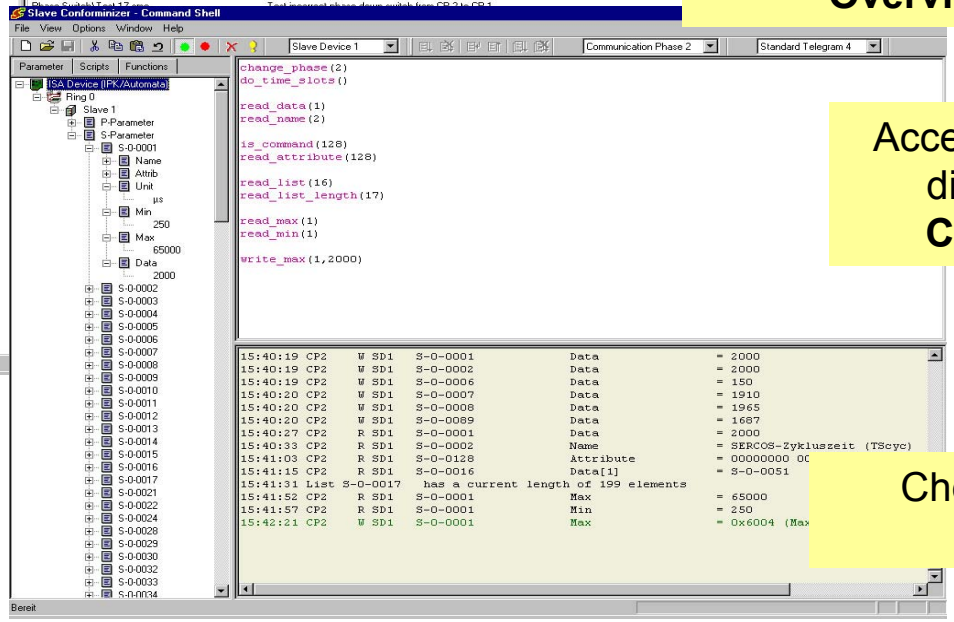
Certification
Master & Slave Conformizer



Describe logical tests using a **Script Language** with over 80 functions



Build test scenarios and view the results using the **Batch Test Overview**



Access script functions directly using the **Command Shell**

Check the detailed **Protocol**

System Requirements

- Windows NT/2000
- RTX 5.0

Capability Characteristics

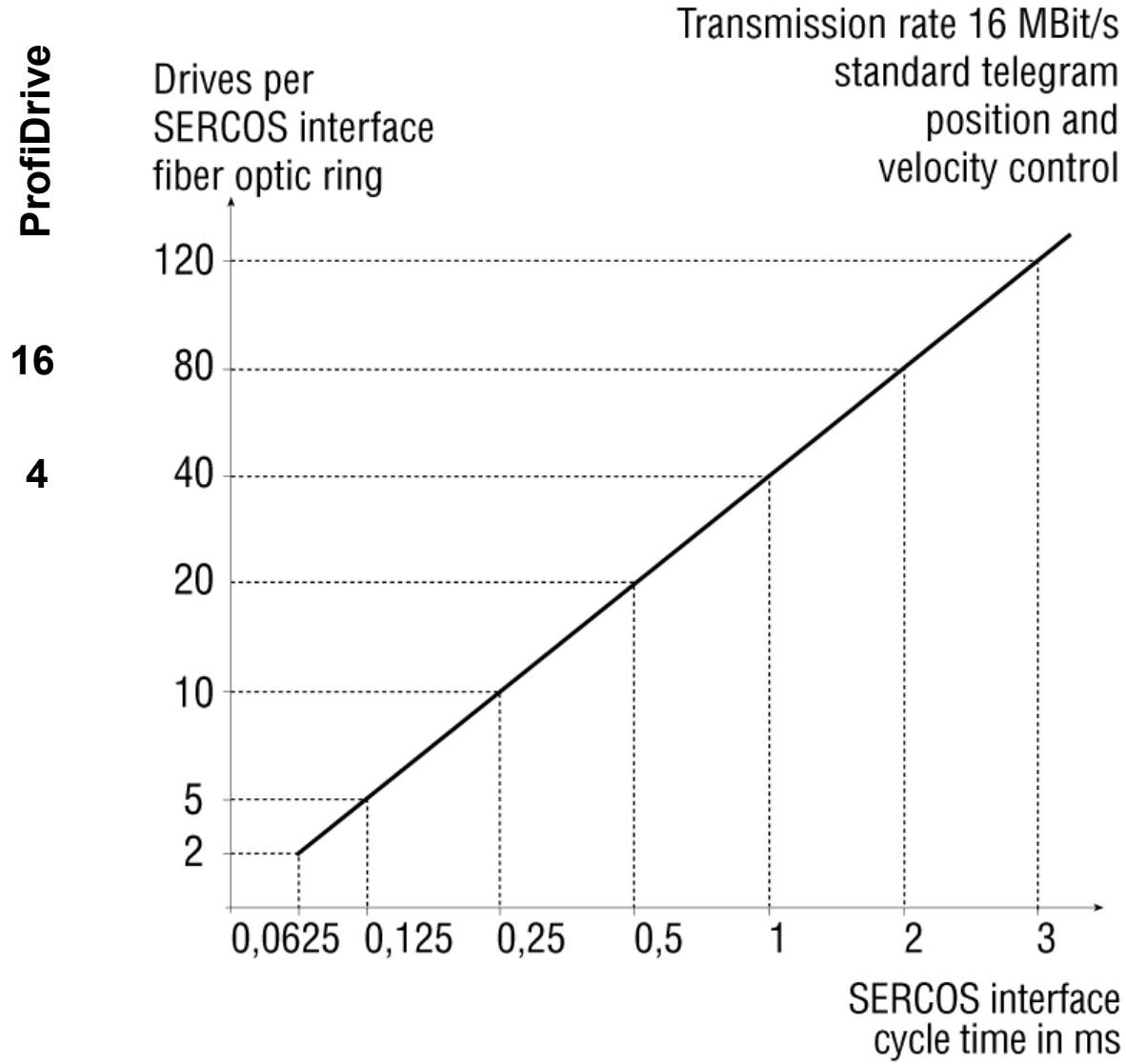
Data Throughput (Examples)

Cycle time	Data per drive (MDT & AT)	Transmission rate	Number of drives	Data rate (non-cyclic data)
1) 2 ms	32 Byte	2 Mbit/s	8	8 kbit/s (2 Byte)
2) 1 ms	32 Byte	4 Mbit/s	8	16 kbit/s (2 Byte)
3) 1 ms	36 Byte	8 Mbit/s	15	32 kbit/s (4 Byte)
4) 0,5 ms	36 Byte	16 Mbit/s	14	128 kbit/s (8 Byte)
5) 2 ms	StandardTelegram 2, 3, 4	16 Mbit/s	120	8 kbit/s (2 Byte)

MST time	MDT time	AT time	Jitter time
1) 30µs	640µs	8 * 100 = 800µs	10 * 14µs = 140µs
2) 15µs	320µs	8 * 50 = 400µs	10 * 14µs = 140µs
3) 8µs	330µs	15 * 28 = 420µs	17 * 2µs = 34µs
4) 4µs	155µs	14 * 14 = 196µs	16 * 2µs = 32µs
5) 4 µs	579µs	120 * 8 = 960µs	122 * 2µs = 244µs

	Telegrams	Safety Time	Spare Time	Bus-Load
❑ **1)**	1470µs	140µs	390µs	73,5%
❑ **2)**	735µs	140µs	125µs	73,5%
❑ **3)**	758µs	34µs	208µs	75,8%
❑ **4)**	355µs	32µs	113µs	71,0%
❑ **5)**	1543µs	244µs	213µs	77,1%

Drives per SERCOS interface fiber optic ring




SERCOS interface
SANYO DENKI CO.,LTD.
Indramat
OPEL
Opel Hungary
MIKRON
promicon SYSTEMS
FAGOR
MITSUBISHI ELECTRIC AUTOMATION, INC.
Motion Engineering, Inc.
BOSCH
Automationstechnik
Ketterer
Maschinenbau GmbH
SGS-THOMSON MICROELECTRONICS
Selca
PACIFIC SCIENTIFIC
AUTOMATION TECHNOLOGY GROUP
andron
kesel
BAUTZ
ALFING
graziano
GM
IEC 61491
EN 61491
SERCOS interface
AUTOMATA
INDUSTRIAL & ROBOTIC CONTROLS
TECHNO PLAN
HESSAPP
SIEMENS
Ford
KOLLMORGEN
Motion Technologies
Thank You for Your Attention
POWERTEC
PRÄZISION
LUTZE
Technik mit System
KAT
NAXOS-UNION
matec
Maschinenbau GmbH
IAM
SSB
LIECHTI & CO. AG
samag
KARL MAYER
DS DROOP & REIN
IPA
HYUNDAI MACHINE TOOLS DIVISION
ABB
AEG
volma
LIEBHERR
DMS Dorsch Mikrosystem GmbH
DMS
Mikrorechnersysteme
WALTER
contraves antriebstechnik