ENGINEERING PUBLICATION
MOTION CONTROL DIVISION

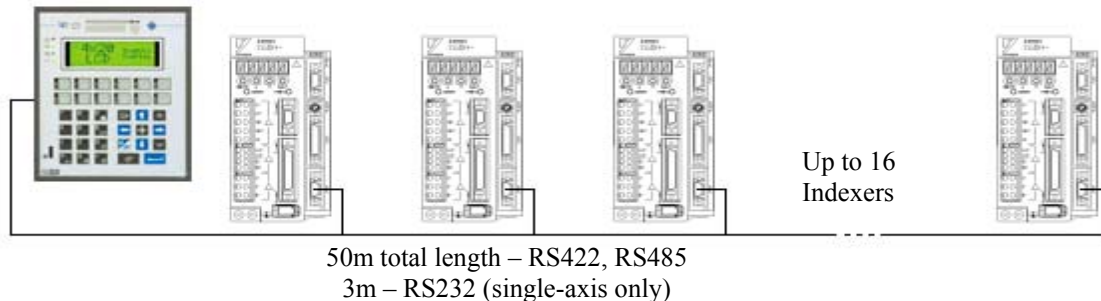## PRODUCT: HMI & JUSP-NS600

SUBJECT: Summary of HMI and Sigma II Indexer Control Systems

CATEGORY: TECH. NOTE

ENGINEER: Paul Zajac   DISTRIBUTION: Sales, MCD

Summary: There have been several requests for directly connecting a Human Machine Interface (HMI) as a master to one or more Yaskawa JUSP-NS600 Sigma II Indexer servo axes for basic configuration and monitoring (see illustration below). This presumes that the serial RS232, 422, or 485 network response times are adequate for the application and that the fieldbus and/or motion networks are too costly or complex for the task at hand.

Up to 16 Indexers

50m total length – RS422, RS485
3m – RS232 (single-axis only)

The benefits of such a system vs. alternative control architectures might include:

BENEFITS:
- Easy to use operator interface for the machine
- Simplicity of control system
- Fewer components to mount and wire
- Lower machine cost

Reference Appendix A: Classification of Servo Networks and/or consult your Yaskawa sales representative for a more complete review of your application requirements and the appropriate servo network.

Purpose:
The Sigma II Indexer is a compact, cost effective solution for the needs of many machine OEMs and end users. This document describes an overview of alternative control system implementations and how various machine control solutions might be addressed depending upon the needs of the application. This document and subsequent references will be most useful during the feasibility stage and early development stages for a machine control solution.

System Introduction:

Two basic machine control solutions are reviewed using an HMI and a serial RS232, 422, or 485 network with the Sigma II Indexer.

HMI Solution #1

One basic machine control solution involves an HMI interface to directly select or edit on-board indexer recipes and servo parameters. In addition, the HMI can be used to perform basic set up and operation commands and monitor servo status. Global commands can also be broadcast to all axes. For example a global start command can be used to simultaneously start all axes on the network. This control solution would rely on the capabilities of the Sigma II Indexer, whereas the HMI would serve only as a tool for editing, monitoring, and basic operational commands. This functionality requires the HMI supplier to provide the necessary driver for the Yaskawa JUSP-NS600 Sigma II Indexer. A driver is available with Yaskawa's HMI and an application example of its use is more fully described in engineering document "Commander (EXOR) HMI Driver for Sigma II Indexer" (pub. # eng/01.051/MCD).

> HMI Driver:
> Most HMI suppliers will need to provide the necessary driver for the Yaskawa Sigma II Indexer and its serial commands listed in Section 6.4 & 6.5 of the Sigma II Indexer Manual (pub. # YEA-SIA-S800-32.11). A driver is available with the Yaskawa HMIs.
>
> There are some cases of HMI suppliers where a driver is not required. For example, Red Lion offers a line of HMIs where a driver for the Indexer is not required. ASCII strings can simply be sent to and received from the Sigma II Indexer. Red Lion also offers one programming environment for screen set up and conditional logic control programming.

HMI Solution #2

A second machine control solution involves the same basic functionality as HMI Solution #1 with the added benefit of non-time critical conditional logic, fault handling, and power-up routines. A typical example might include downloading or activating on-board Indexer recipes for different machine set-ups (widget A, widget B, etc.) and setting and monitoring a batch count for the selected recipes. This requires additional functionality (similar to on-board PLC logic) from the supplier of the HMI. Several HMI suppliers do provide this capability, either integrated into the standard HMI unit or available with an optional add-on module. Engineering documents "Setting up the HMI for Sigma II Indexer Command Demo" (pub. #eng/01.052/MCD) and "Tips on Using an HMI to Command the Sigma II Indexer" (pub. # eng/01.053/MCD) describe the use of the Yaskawa HMI to command the Sigma II Indexer. An add-on module was used to give the control system the required expanded functionality.

Alternative HMI Control Solution

Some application and systems may require more I/O and/or faster control system response than can be achieved with the approaches above. A common solution is to include a micro PLC with the appropriate number of I/O to construct a system as illustrated in Appendix C.

Some HMI suppliers offer a dual driver HMI, which can simply the interface to both the Sigma II Indexer and a PLC. This would also allow for data transfer between the Sigma II Indexer and a PLC. Yaskawa does offer a dual driver HMI. Check with a Yaskawa representative for availability.

Depending on the application requirements, careful consideration should be taken when deciding on an HMI solution. HMI Solution #1 would be adequate for applications where only the functionality of the Sigma II Indexer is required. If additional functionality were needed, such as conditional logic, then HMI Solution #2 (or the alternative control solution) would be required. Check with the HMI supplier for a description of its capabilities.
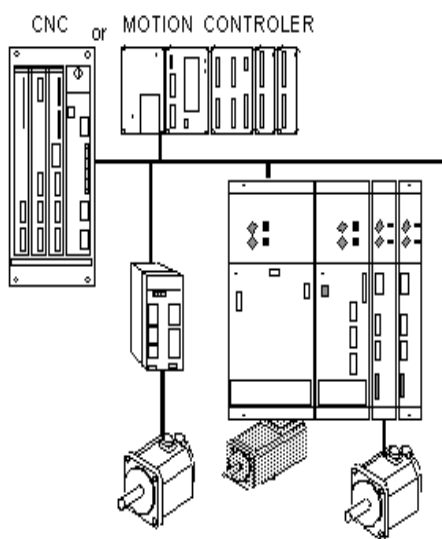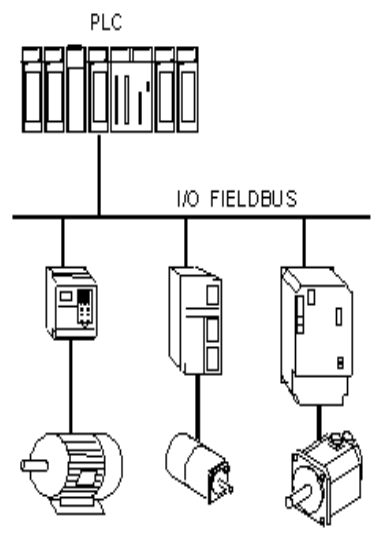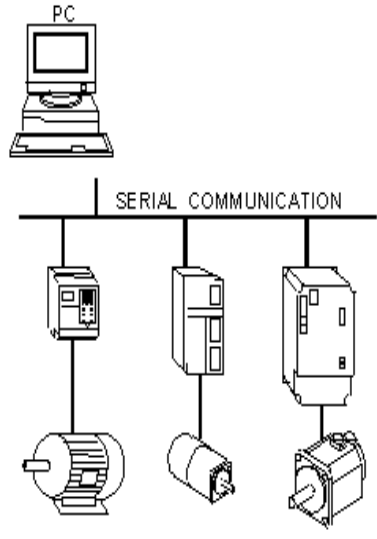
Hardware and Software Alternatives:

Example Bill of Materials (BOM) of the Yaskawa HMI, Sigma II Indexer, and cabling solutions are listed in Appendix B along with the necessary one-time "application development tools" to complete a development project. Appendix B-1 lists a sample BOM for the base level Yaskawa HMI solution #1. Appendix B-2 lists a sample BOM for the base level Yaskawa HMI solution #2. An add-on PLC option is required to expand the capabilities of the HMI. Other HMI panels and options are available. Please consult your Yaskawa representative for more information.

Closing Summary:

This document should only be considered as a guide to components that can provide a total cost effective solution. This document is not intended to replace careful design and thorough system testing prior to commissioning any machine control system.

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Appendix A: Classification of Servo Networks

MOTION NETWORK	I/O FIELDBUS	SERIAL COMMUNICATION
SERCOS,MECHATROLINK	DeviceNet,Profibus-DP	RS232, 422, 485
Positional speed referencing to all axes at fixed interval	Event-driven Command referencing	Event-driven Command referencing
Trajectory control Synchronization control	Positioning	Monitoring & Configuration

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Appendix B-1: HMI Solution #1

HMI (hardware & software components)					
	Part Number	Description	Stock	Qty.	List Price
Typical BOM	HMI-A2X20M-10[1]	Alpha-Numeric 2x20 Display, 2 ports	S	1	$390.00
Application Development Tools	UniWin-CD	Designer Programming Software	S	1	$328.00

Sigma II (hardware & software components)					
	Part Number	Description	Stock	Qty.	List Price
Typical BOM	JUSP-NS600	Sigma II Indexer Application Module	S	n	$460.00
	SGDH-01BE[2]	Sigma II Servo Amplifier, 100W, 100V	S	n	$996.00
	SGMAH-01BAF41[2]	Sigma II Servo Motor, 100W, 100V	S	n	$523.00
Application Development Tools	SigmaWin100	Servo System Monitoring and Set-up Software	S	1	$40.00
	NS600-GUI	IndexWorks Indexer Programming Software	S	1	$40.00

Cabling					
	Part Number	Description	Stock	Qty.	List Price
Typical BOM	HMI-C600-12[3]	HMI to NS600 Communication Cable (use when n=1)	S	1	$91.00
	YSC-1[4]	Sigma II CN6 Serial Communication Connector (use when n>1)	S	n	$35.00
	DA-15SSP[4,5]	HMI D-sub 15-Socket Mating Connector	N/A	1	N/A
	JZSP-CMM00-10(A)[2]	Sigma II Motor Power Cable, 10m	S	n	$70.00
	JZSP-CMP00-10(A)[2]	Sigma II Encoder Cable, 10m	S	n	$92.00
	JZSP-CK101-1(A)[6]	1CN I/O Cable with Pigtail Leads, 1m	S	n	$126.00
	CKI-NS600-01[6]	4CN I/O Cable with Pigtail Leads, 1m	S	n	$110.00
Application Development Tools	HMI-CPROG-20	HMI Programming and Pass through Cable	S	1	$91.00
	YS-12	Sigma II Communication Cable (for use with SigmaWin100 and IndexWorks)	S	1	$40.00

n=number of axes

[1] A full-line of HMIs are available from Yaskawa. This is the base level HMI.

[2] Refer to the Sigma II Servo System Product Catalog Supplement (pub.# G-MI#99001D-SigmaII) for selection of servo system.

[3] For use with single-axis communication.

[4] For use with multi-axis communication. User required to supply and assemble multi-axis cable.

[5] Available from SPC Technology or source locally.

[6] I/O cables may not be necessary depending on the application requirements

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Appendix B-2: HMI Solution #2

HMI (hardware & software components)

	Part Number	Description	Stock	Qty.	List Price
Typical BOM	HMI-A2X20M-10[1]	Alpha-Numeric 2x20 Display, 2 ports	S	1	$390.00
	HMI-OPLC-30	Add-on PLC Module	LS	1	$251.00
Application Development Tools	UniWin-CD	Designer Programming Software	S	1	$328.00
	IsaGRAF	PLC Programming Software	S	1	N/A

Sigma II (hardware & software components)

	Part Number	Description	Stock	Qty.	List Price
Typical BOM	JUSP-NS600	Sigma II Indexer Application Module	S	n	$460.00
	SGDH-01BE[2]	Sigma II Servo Amplifier, 100W, 100V	S	n	$996.00
	SGMAH-01BAF41[2]	Sigma II Servo Motor, 100W, 100V	S	n	$523.00
Application Development Tools	SigmaWin100	Servo System Monitoring and Set-up Software	S	1	$40.00
	NS600-GUI	IndexWorks Indexer Programming Software	S	1	$40.00

Cabling

	Part Number	Description	Stock	Qty.	List Price
Typical BOM	HMI-C600-12[3]	HMI to NS600 Communication Cable (use when n=1)	S	1	$91.00
	YSC-1[4]	Sigma II CN6 Serial Communication Connector (use when n>1)	S	n	$35.00
	DA-15SSP[4,5]	HMI D-sub 15-Socket Mating Connector,	N/A	1	N/A
	JZSP-CMM00-10(A)[2]	Sigma II Motor Power Cable, 10m	S	n	$70.00
	JZSP-CMP00-10(A)[2]	Sigma II Encoder Cable, 10m	S	n	$92.00
	JZSP-CK101-1(A)[6]	1CN I/O Cable with Pigtail Leads, 1m	S	n	$126.00
	CKI-NS600-01[6]	4CN I/O Cable with Pigtail Leads, 1m	S	n	$110.00
Application Development Tools	HMI-CPROG-20	HMI Programming and Pass through Cable	S	1	$91.00
	YS-12	Sigma II Communication Cable (for use with SigmaWin100 and IndexWorks)	S	1	$40.00

n=number of axes

[1] A full-line of HMIs are available from Yaskawa. This is the base level HMI.

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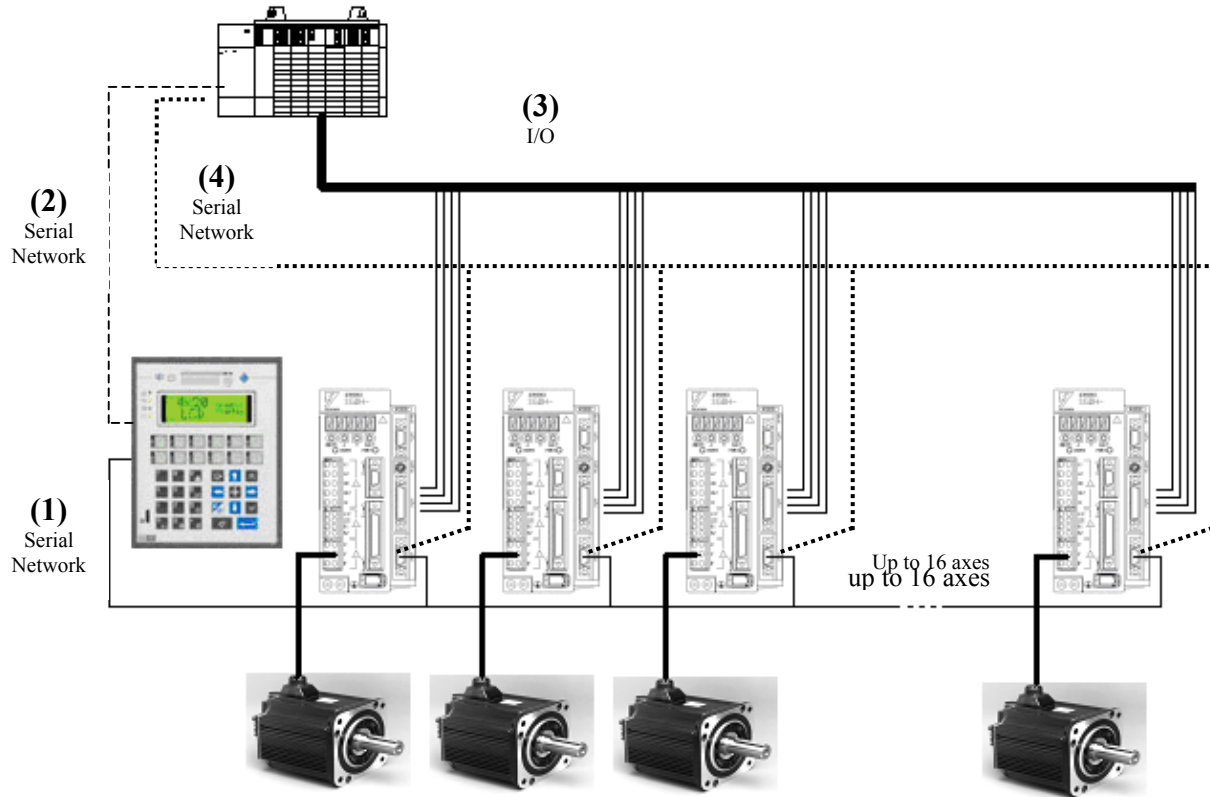
[3] For use with single-axis communication.

[4] For use with multi-axis communication. User required to supply and assemble multi-axis cable.

[5] Available from SPC Technology or source locally.

[6] I/O cables may not be necessary depending on the application requirements

Appendix C: Alternative Control System

(1) HMI serial network to Sigma II Indexers. RS232, RS422, or RS485 serial network (RS232 for single-axis applications only).

(2) HMI serial network to PLC

(3) PLC I/O

(4) PLC serial network to Sigma II Indexers

Control Solutions:

(1)	Control solution #1 or #2. Control solution #2 includes add-on PLC.
(1) & (3)	Alternative control solution incorporating PLC I/O control and HMI.
(1) & (2)	Alternative control solution incorporating dual driver HMI to communicate to PLC and Sigma II Indexers.
(2) & (4)	Alternative control solution incorporating HMI communication with PLC and PLC serial network to Sigma II Indexers.