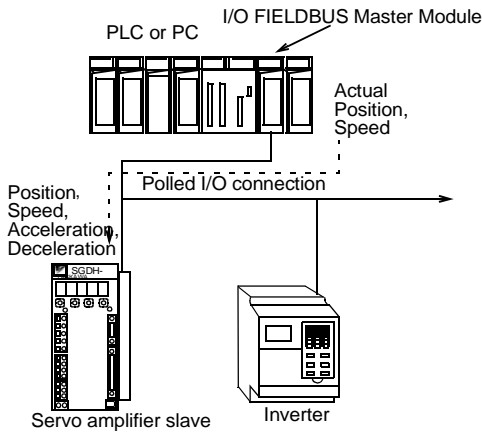


Sigma II DeviceNet Communication

The Sigma II Indexer is a compact, cost-effective solution for the needs of both the machine OEM and the end user. All servo loops and positioning functions are included in a self-contained servo amplifier/indexer package. Machine controller to servo axis interfacing simplifies to DeviceNet™ communications and wiring.

Control System Architecture

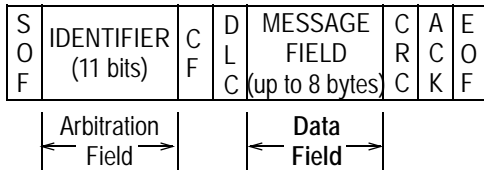


DeviceNet Protocol

- By general industry agreement, the ODVA DeviceNet specification established a **Predefined Master/Slave Connection Set**.
- Polled I/O command/response communication messages are suitable for time-critical, control-oriented data.
- The Sigma II messages are eight bytes long, embedded within the data field of the DeviceNet™ **Data Frame**.

DeviceNet™ Data Frame Overview and Protocol

DeviceNet™ Data Frame Overview



Where:
 SOF = Start of frame
 CRC = Cyclic redundancy code
 CF = Control field
 ACK = Acknowledgment
 DLC = Data length code
 EOF = End of field

Using the Eight-Byte Data Field

- Sigma II with DeviceNet™ accepts two types of polled I/O messages in the **Data Field** for positioning applications:
 - Move commands (monitor and control)
 - Set/Read commands (setup and troubleshooting)
- Also supports explicit messaging and EDS file transfer

Sigma II Move Commands

Command Message Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	0	ALRST	ESTP	0	0	SVON	C_STRT
1	Response type				Command code			
2	HOME	PTBL	STN	STEP	FEED	0	HOLD	CANCEL
3	0	0	0	0	0	0	DIR	INC
4	Command data							
5								
6								
7								

Refer to the DeviceNet™ Interface Unit User's Manual (SIE-C718-6) for a detailed description of the command bits.

Using move command messages

- Initiate positioning or speed control moves
- Communicate positioning move variables
- Activate point tables of index moves
- Activate homing, alarm reset, emergency stop, feed hold, and servo amplifier functions

Example of Command Execution:

- Set the positioning command code and data
- Change the Command Start(C-Start), byte 0, bit 0, from 0 to 1

Positioning Command Codes	Operation
0000	No operation
0001	Simple positioning
0010	External positioning
0011	Positioning with notch signal outputs
0100	Multi-speed positioning

Sigma II Responses to Move Commands

Response Messages

- Reports the status of the current positioning move , i.e., in position, near position, home, overtravel,, alarm, etc.
- Move data can be collected in the response. See the response type table at the right.
- The data requirements in the response message are specified in the command message, byte 1, bits 4 through 7, (as shown on the Command Message Format table on the previous page).
- Response codes are returned in the response message (byte 1, bits 4 through 7) along with the data.

Response Message Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	Response type				Command code			
2	HOME_R	PTBL_R	STN_R	STEP_R	FEED_R	0	HOLD_R	PRGS
3	POT	NOT	INPOS	WEAR	HOME_P	0	DIR_R	INC_R
4	Response data							
5								
6								
7								

Response Type	Response Data Reference Units (RU)
0000	Command position (RU)
0001	Current position (RU)
0010	Following error (RU)
0011	Command speed (1000RU/min)
0100	Current speed (1000RU/min)
0101	Torque (%)
1010	Station number
1011	Point table number

Refer to the DeviceNet™ Interface Unit User's Manual (SIE-C718-6) for a detailed description of the status bits.

Sigma II Set/Read Commands and Command Codes

Set/Read messages enable user friendly network routines that can reconfigure machine positioning variables, initialize setup routines, enable auto-tuning, source alarm and warning data, etc. These functions are available to any master on the network.

Uses of Set/Read Messages

- Set up and configuration data
- Edit parameters
- Set/edit preprogrammed point tables of index moves
- Report alarm codes
- Used with polled I/O messaging

Defining Set/Read Messages (versus move command messages)

- Set by byte 0, bit 7 = 1
- It is not necessary to specify response type for Set/Read commands

Command Codes

- Set "No Operation" to prevent execution of commands.
- Out-of-range parameters generate a setting error (WARN bit)

Command Message Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	ALRST	ESTP	0	0	SVON	C_STRT
1	0				Command code			
2	Command number							
3	Command message							
4								
5								
6								
7								

Command Code	Operation
0000	No operation
1000	Read parameter
1001	Write parameter
1010	Set current position
1011	Set zero point
1100	Read alarm
1110	Reset Unit

Response Message Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	READY	PWRON	ESTP_R	ALRM	WARN	SVON_R	C_STRT_R
1	0				Command code			
2	Command number							
3	response data							
4								
5								
6								
7								

Sigma II DeviceNet™ Functional Features and Capabilities

Sigma II DeviceNet™ acts as a servo position or velocity controller slave to a master controller. For application flexibility, use polled I/O messages from the applications software to dynamically load incremental or absolute point-to-point positioning data. For these applications use:

- Simple positioning
- Simple positioning with notch outputs
- External input positioning
- Multistage velocity positioning

For precise velocity control only, use Feed operation. For applications where the parameters of the positioning moves can be preset, use:

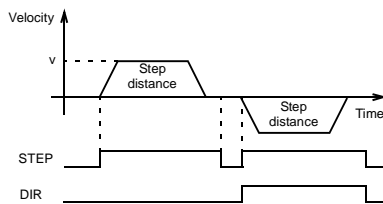
- Stepping operation
- Point-table positioning
- Station number positioning (rotary table operation)

Note: Establish or change parameters of a preset move with an EDS file configuration, Yaskawa's Windows NSXXX software utility, or a dynamic Sigma II polled I/O Set/Read Commands. For more permanent settings, recycle the power or issue a unit reset command (to move the parameters into non-volatile memory).

Stepping Operation

How it works:

- When the STEP bit turns ON, the axis moves in the specified direction (DIR bit).
- Use command data to select one of four preset parameters that define the step distance. Moves can be incremental or absolute.
- When the STEP bit turns OFF during movement, step movement is cancelled.
- Additional parameters to help define the stepping operation are preset to determine:
 - Approach velocity (v) and acceleration/deceleration type (eight types are available, including S-curve)
 - Acceleration/deceleration values



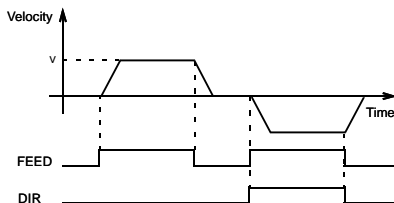
STEP bit: Refer to the Move Command message format, byte 2, bit 4.

DIR bit: Refer to the Move Command message format, byte 3, bit 1.

Feed Operation

How it works:

- While the FEED bit is ON, the axis jogs in the direction specified.
- Use command data during movement to set or override the preset velocity feed.
- Parameters are preset to determine:
 - Feed velocity (v)
 - Acceleration/deceleration type
 - Acceleration/deceleration rate



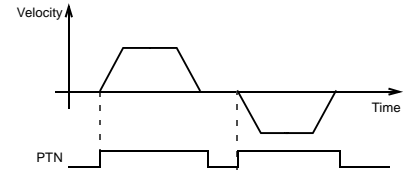
FEED bit: Refer to the Move Command message format, byte 3, bit 3.

Point Table Positioning

How it works:

- Use command data to select point table number and then the PTN bit to initiate positioning.
- Fifty positioning points are available.
- Point table parameters are preset to determine:
 - Target position
 - Positioning velocity

PRESET INDEX MOVES		
POINT TABLE NUMBER	TARGET POSITION	POSITIONING VELOCITY
1	X1	V1
:	—	—
50	X50	V50

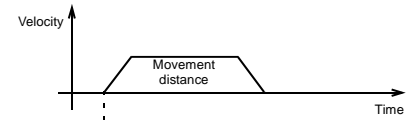


PTN bit: Refer to the Move Command message format, byte 2, bit 6.

Simple Positioning

How it works:

- Use simple positioning to receive target position data from a DeviceNet™ master controller's application software.
- When the C_STRT bit turns ON, the system moves from the current position to the target position.
- Communicate target positions with a move command message* using the positioning command code (set to 0001) and command data set with the target position.
- Velocity, acceleration type, and acceleration rate work the same way as in stepping operation.



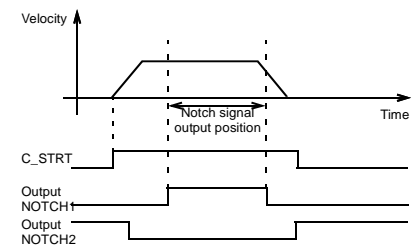
C-STRT bit: Refer to the Move Command message format, byte 0, bit 0.

* Refer to the Move Command Message Format on page 22.

Positioning with Notch/Zone (PLS) Outputs

How it works:

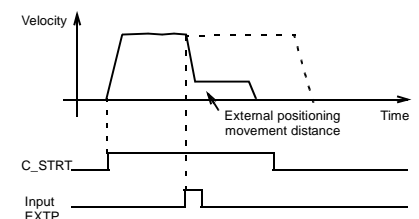
- Use the same procedure as simple positioning, except the positioning command code is to 0011.
- Two settable notch signal outputs are available.
- Notch signal output ON and OFF positions can be incremental or absolute.



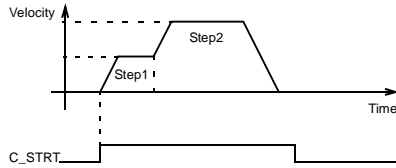
External Input Positioning

How it works:

- Use the same procedure as simple positioning, except the positioning command code is 0010.
- When the EXTP (external input signal) is activated during a move, the system will perform the final positioning.
- Parameters determine:
 - External positioning distance
 - External positioning velocity



Multi-Stage Velocity Positioning

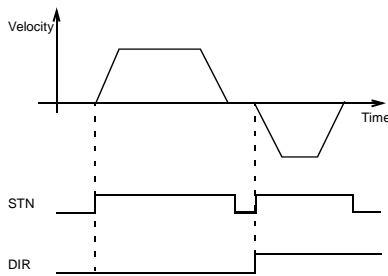
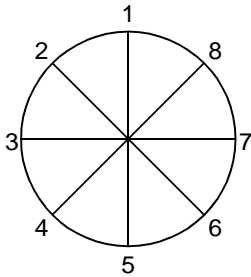


C_STRT bit: Refer to the Move Command message format, byte 0, bit 0.

How it works:

- Use the same procedure as simple positioning, except the positioning command code is 0100.
- During axis movement, after reaching the parameter's initial target position, the axis switches to the next speed and moves to the position specified in the next step.
- A maximum of 16 steps are available.
- Parameters set:
 - The number of steps
 - Reference velocity
 - Acceleration/deceleration

Station Number Positioning

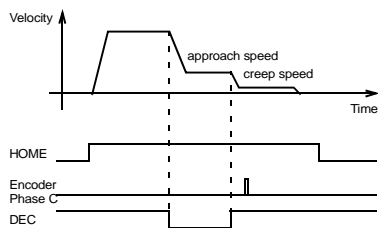


STN bit: Refer to the Move Command message format, byte 2, bit 5.

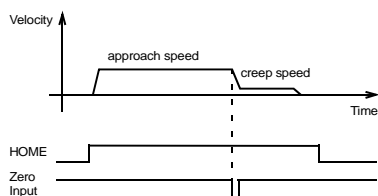
How it works:

- The system will index to the prescribed station number when the STN command bit is turned ON. The target station is defined with command data in the move command message (refer to page 22).
- Define (by parameter) up to 32,767 equidistant stations per rotation.
- Set the direction of rotation with the DIR bit or set the system (by a parameter) to automatically select the shortest distance.
- Set acceleration and deceleration with parameters.
- Accommodate rotary systems with gearing or belt ratios with parameters for electronic gear ratios.

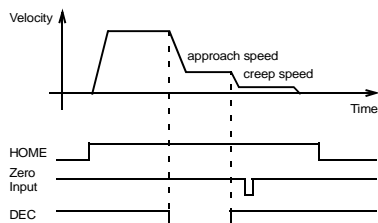
Homing type 0



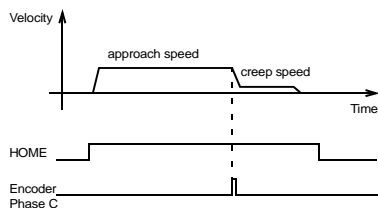
Homing type 1



Homing type 2



Homing type 3



How it works:

When the HOME bit turns ON, the system returns to the home position at the programmed speed and direction. After reaching home, the position of the Sigma II DeviceNet™ resets to zero.

- If the HOME bit turns OFF during the procedure, the rest of the homing operation is cancelled.
- Homing methods:
 - Type 0: DEC and Encoder Phase C
 - Type 1: Zero Input
 - Type 2: DEC and Zero Input
 - Type 3: Encoder Phase C
- Use parameters to set:
 - Homing direction
 - Homing approach and creep speed
 - Acceleration/deceleration velocity
 - Acceleration/deceleration type
 - Home offset (zero-point return final travel distance).