



TC00891A

Description

The Harmony Input/Output (I/O) System utilizes a variety of input and output blocks to interface process signals to the Symphony[™] Enterprise Management and Control System. Control input/output (CIO) blocks interface field inputs and outputs used in control loop applications. The control I/O block along with other types of blocks for analog and digital I/O interface and remote I/O communication combine to create a complete I/O system (Fig. 1). Refer to the *Harmony Input/Output System* overview for a complete system description.

The CIO-100 block supports the following control inputs and outputs:

- Four analog inputs.
- Two analog outputs.
- Four digital inputs.
- Four digital outputs.

The CIO-100 block provides two station connectors to support connection of up to eight IISAC01 Analog Control Stations.

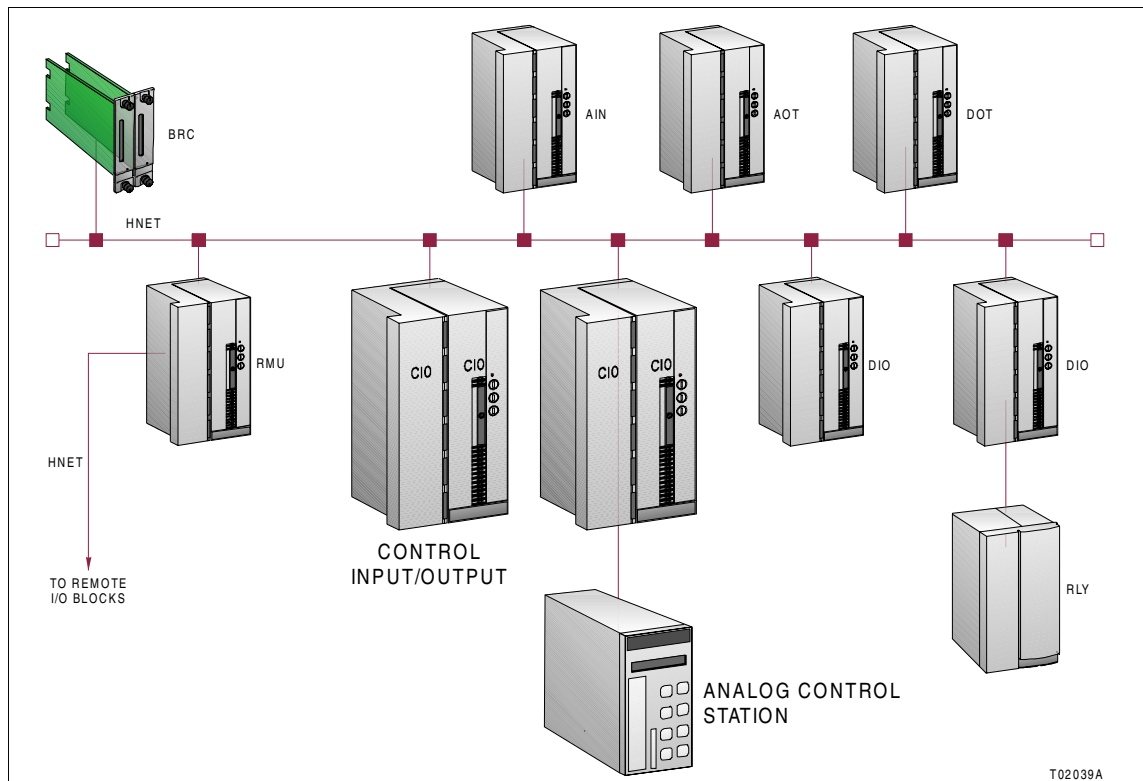


Figure 1. Harmony I/O System

Operation

The CIO-100 block has an onboard microprocessor which controls and performs the following functions for the block:

- Hnet communication.
- Analog and digital input/output processing.
- Station link communication.
- Block diagnostics.
- Status reporting.

Along with these functions, the microprocessor is also responsible for executing the I/O block portion of the control configuration. The complete control configuration made up of linked function codes resides and is retained in the Harmony controller at all times. The controller only off loads a portion of the configuration to be executed by the individual I/O blocks. Function codes are predefined, fixed function algorithms.

The controller uses the following function codes to interface to a control I/O block:

- I/O device definition (FC 221).
- Analog input/channel (FC 222).
- Analog output/channel (FC 223).
- Digital in/channel (FC 224).
- Digital out/channel (FC 225).

Specifications are set on a per channel basis rather than on an I/O group basis. The function codes provide addressing, and start-up, execute (i.e., run time), override, simulation, and failure mode operation specifications. The I/O channel function codes are exception reporting function codes.

Input/Output

The CIO-100 block supports the following control inputs and outputs:

- Four high level analog inputs at 4 to 20 milliamperes or 1 to 5 VDC.
- Two high level analog outputs at 4 to 20 milliamperes or 1 to 5 VDC.
- Four digital inputs individually selectable for 24, 48, and 125 VDC, and 120 and 240 VAC.
- Four 24 VDC open-collector (NPN) digital outputs with a maximum load current of 250 milliamperes.

The analog input and output channels are individually hardware configurable for voltage or current mode. Digital input channels are individually hardware configurable for input voltage. The analog output channels have readback ability.

Analog Control Station Interface

The CIO-100 block provides two station connectors to support connection of up to eight IISAC01 Analog Control Stations. Up to four analog control stations (SAC) can be daisy-chained from each connector. As shown in Figure 2, the first station connected can be configured as a bypass control station while the remaining three daisy-chained from the first station operate as indicator stations (i.e., no bypass capability). The CIO-100 block does not support redundant I/O electronics. Instead, the IISAC01 station can be used with the CIO block to provide automatic or manual backup.

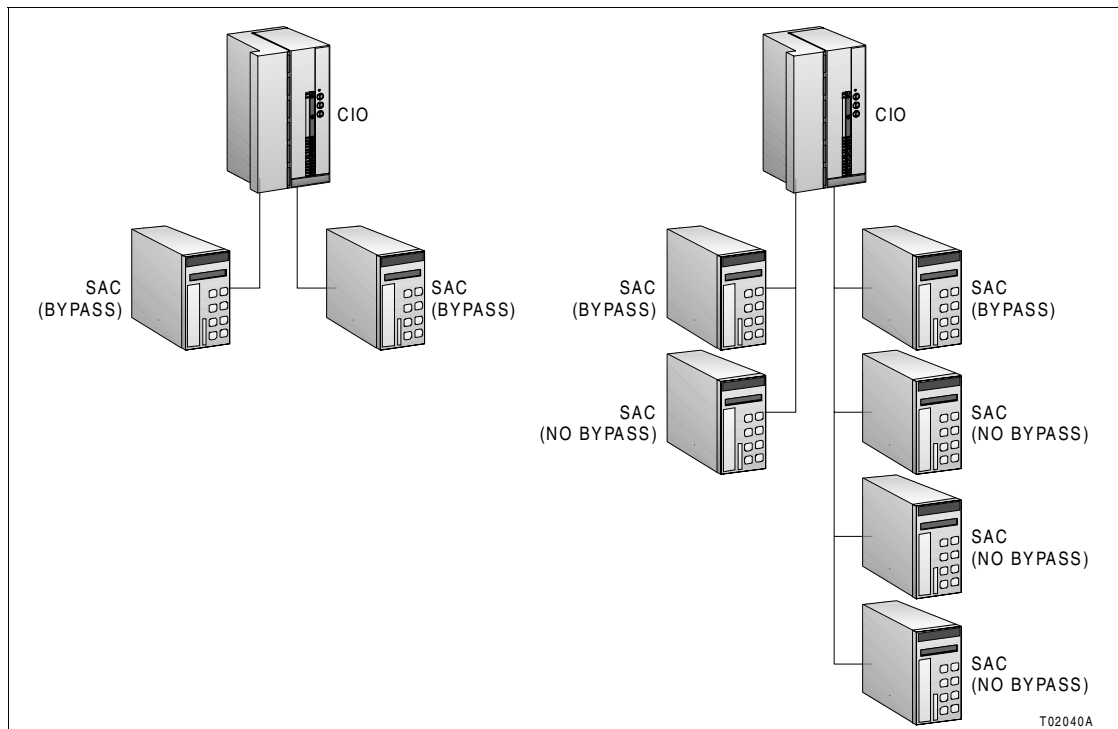


Figure 2. Analog Control Station Interface

The SAC station receives and sends information from and to the controller through the CIO-100 block. The CIO-100 block communicates with the SAC station over an RS-485 serial link.

A bypass station can be set up as a current bypass station or an electric drive/pulse positioner bypass station (Fig. 3). A current bypass station connects directly to the CIO-100 block. In this configuration, an NKCS03 adapter cable connects the IISAC01 station. An electric drive/pulse positioner bypass station requires a CIO-100 and CIO-110 block pair for connection. The CIO-110 block provides the terminal strip positions necessary for proper connection. In this configuration, the CIO-100 block cable connects to the CIO-110 block using an NKCS04 cable, and an NKCS05 adapter cable connects the IISAC01 station to the CIO-110 block.

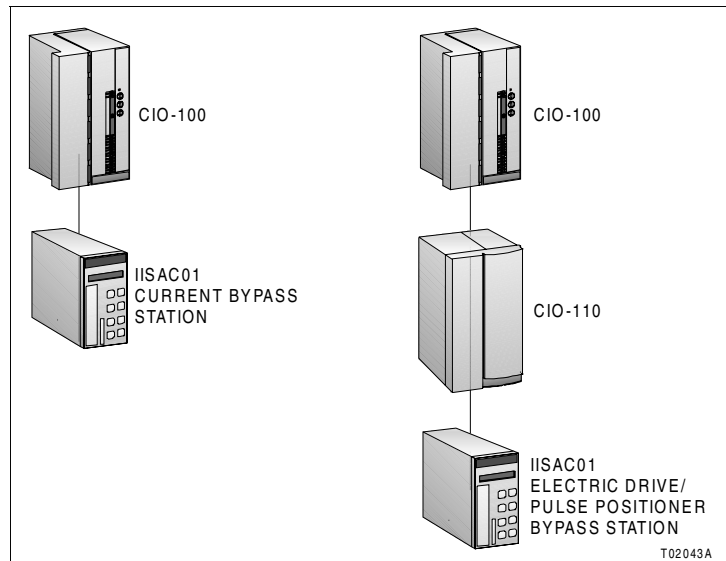


Figure 3. Bypass Station Connection

A control strategy using IISAC01 stations is accomplished by using function codes configured within a Harmony controller. The station provides the ability to monitor and control the process variable (PV), set point (SP), and control output (CO) of a control loop. The process variable, set point, and control output display on the SAC station faceplate. The control station function code (FC 80) defined in the Harmony controller provides the station interface ability. It determines the type of station as either basic, cascade, or ratio and defines other operating parameters.

CIO/Station Control

Normally, the controller and CIO-100 block drive the control output (i.e., analog output). The CIO-100 block provides digitized analog signals representing the process variable to the controller. The operator selects a set point using the set point pushbuttons on the station faceplate. The SAC station sends the set point value to the controller for algorithm processing. The controller generates a control output value based on its algorithm processing. The control output value is sent to the CIO-100 block where it becomes a control output value to a field device.

The station can drive the output signal during one of the following conditions:

- The controller directs the SAC station to enter bypass mode.
- Communication with the controller is lost and the auto bypass option for the station is enabled. This forces the station into bypass mode.
- The operator forces the station into manual override mode of operation.

In manual mode, the operator can set the control output value via raise/lower pushbuttons on the SAC station. This mode essentially disables the controller and CIO-100 block. For electric drive control applications, the SAC station provides a specific manual operating mode. It asserts a manual/auto select signal when the electric drive option is enabled that forces the electric drive to respond only to contact inputs from the SAC station. Raise/lower contacts are provided to change the position of the electric drive. In electric drive mode, the four to 20-milliampere output signal is disabled. The operator directly controls the drive in manual mode using the stations raise/lower pushbuttons. The output raise/lower pushbuttons on the faceplate energize the drive raise or lower relay contact outputs.

Power Options

The CIO-100 block uses two types of power:

- 24 VDC block logic power.
- 24 VDC field power.

The block develops its own operating voltages from redundant 24 VDC block logic power (BLP). The 24 VDC field power operates field devices and some I/O channel circuitry. Both internally powered (i.e., I/O system powered) and externally powered field devices are supported.

The field power can be supplied in three different forms: Internal field power (IFP), external local field power (LFP), and external remote field power (RFP). IFP power is distributed to the I/O blocks through the block mounting columns, LFP power is wired to each I/O block, and RFP power is wired to individual I/O channels.

The choice of using IFP or LFP power is jumper selectable for each I/O block. This selection affects all I/O channels of a block. The IFP/LFP field power select jumpers are located on the back of the I/O module.

The choice of using IFP/LFP power or RFP power is selectable on a per channel basis where appropriate. The analog output, digital input, and digital output channel jumpers are located inside the I/O module; analog input channel jumpers are located on the base.

Note: 24 VDC LFP power is required to operate IISAC01 stations connected to the CIO block.

Related Documents

Number	Document Title
WBPEEUD240001??	Harmony Analog Input/Output, Data Sheet
WBPEEUD240002??	Harmony Digital Input/Output, Data Sheet
WBPEEUD240004??	Harmony Input/Output System, Data Sheet
WBPEEUS240008??	Harmony Input/Output System, Overview

CIO-100 Specifications

Property		Characteristic/Value ¹
Type		Control loop in/out
Channels		4 nonisolated analog inputs 2 nonisolated analog outputs 4 isolated digital inputs 4 isolated digital outputs
AI	Input range	4 to 20 mA 1 to 5 VDC
	Full scale range Current Voltage	18 mA 4.5 V
	Maximum error Current Voltage	±0.20% of full scale range ±0.05% of full scale range
	Fastest update rate ² (all channels)	40 per second
	Response time per channel (100% step change)	700 msec to 95% of final value
	Number of A-to-D converters	1
	A-to-D resolution	16 bit
	Rejection (50-60 Hz) Normal mode Common mode	-70 dB -90 dB
	Channel fault currents ³ Shorted transmitter Shorted + to ground	70 mA nominal (IFP/LFP) 186 mA nominal (IFP/LFP)
AO	Output range	4 to 20 mA 1 to 5 VDC
	Full scale range Current Voltage	18 mA 4.5 V
	Maximum error Current Voltage	±0.20% of full scale range ±0.10% of full scale range
	Fastest update rate ² (all channels)	40 per second
	Response time per channel (0 to 95% step change)	500 µsec (resistive load)
	Number of D-to-A converters	2
	D-to-A resolution	12 bit
	Load compliance Resistive (current) Resistive (voltage) Inductive	0 to 600 Ω >1 kΩ 600 mH
	Channel fault currents (IFP/LFP)	50 mA nominal
DI	24 VDC 48 VDC 125 VDC 120 VAC 240 VAC	19.5 to 28 VDC 39 to 56 VDC 95 to 144 VDC 85 to 138 VAC 190 to 265 VAC
	Response time ⁴	1 msec

Property		Characteristic/Value ¹																							
DI	Turn on voltage (minimum)																								
	24 VDC	19.5 VDC																							
	48 VDC	39 VDC																							
	125 VDC	95 VDC																							
	120 VAC	85 VAC																							
	240 VAC	190 VAC																							
	Turn off voltage																								
	24 VDC	12 VDC																							
	48 VDC	18 VDC																							
	125 VDC	58 VDC																							
120 VAC	40 VAC																								
240 VAC	87 VAC																								
On current ⁵ (typical)		4.6 to 7.3 mA																							
Off leakage current		<1.5 mA																							
AC frequency		47 to 63 Hz																							
Channel fault currents:																									
24 VDC		31 mA nominal																							
48 VDC		8.1 mA nominal																							
125 VDC		14 mA nominal																							
120 VAC		15 mA nominal																							
240 VAC		15 mA nominal																							
DO	Open collector outputs:																								
	24 VDC off	28 VDC																							
	on	2.5 VDC																							
	Load current	250 mA																							
Switching speed		<0.25 msec																							
Off leakage current		<1 mA																							
Common mode isolation for DI/DO Tested		300 VDC/V _{RMS} at 60 Hz 1,400 V _{RMS} at 60 Hz for 2 sec																							
Microprocessor		16-bit processor running at 16 MHz																							
Memory		64 kb SRAM 512 kb Flash RAM																							
Station connectors		2																							
Station link (RS-485)		40 kbaud																							
Block logic power (BLP)		21.6 VDC minimum 24.0 VDC nominal 28.0 VDC maximum																							
BLP current (24 VDC)		300 mA typical 330 mA maximum																							
Field power (IFP/LFP)		24.0 VDC nominal																							
24 VDC IFP/LFP current – exclusive of station power		<table><tr><th>Property</th><th>Typical⁶</th><th>Maximum⁷</th><th>Fault⁸</th></tr><tr><td>AI</td><td>60 mA</td><td>80 mA</td><td>200 mA</td></tr><tr><td>AO</td><td>20 mA</td><td>40 mA</td><td>70 mA</td></tr><tr><td>DI</td><td>20 mA</td><td>37 mA</td><td>44 mA</td></tr><tr><td>DO</td><td>300 mA</td><td>1 A</td><td>450 mA</td></tr></table>				Property	Typical ⁶	Maximum ⁷	Fault ⁸	AI	60 mA	80 mA	200 mA	AO	20 mA	40 mA	70 mA	DI	20 mA	37 mA	44 mA	DO	300 mA	1 A	450 mA
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DI	20 mA	37 mA	44 mA																						
DO	300 mA	1 A	450 mA																						

Property	Characteristic/Value ¹						
Heat dissipation ⁹	Property		Typical		Maximum		
	AI, AO, DO, 24 VDC DI		8.6 W		11.3 W		
	AI, AO, DO, 48 VDC DI		8.7 W		11.5 W		
	AI, AO, DO, 125 VDC DI		9.9 W		14.2 W		
	AI, AO, DO, 120 VAC DI		9.9 W		14.1 W		
	AI, AO, DO, 240 VAC DI		11.6 W		17.5 W		
Dimensions	Type	Height		Width		Depth	
		mm	in.	mm	in.	mm	in.
	I/O module	266	10.5	76	3.0	162	6.4
	Base	267	10.5	138	5.4	169	6.7
Overvoltage (installation) category	ANSI/ISA-S82.01-1994 and IEC 1010-1 I for circuits above 150 V II for circuits below 150 V						
Environmental	Refer to the Harmony I/O System data sheet for environmental specifications and design standards including certification and CE mark directives.						
Design standards							

NOTES:

1. All specification values are maximums unless stated otherwise.
2. This is the rate at which the block reads and updates values. The rate at which the values are actually read and become available to the system depends on the scan cycle of the controller.
3. Remote field powered I/O may need external protection.
4. Software selectable in 1-msec increments up to 255 msec (debounce period).
5. Actual input current depends on input type selection.
6. Three AI, one AO, three DI, three DO channels active with no faults.
7. All channels active with no faults.
8. Two channels on (maximum); one channel faulted.
9. Heat dissipation values include both BLP and IFP/LFP power.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

CIO-110 Specifications

Property	Characteristic/Value ¹																							
Type	Electric drive/pulse positioner termination																							
Station connectors	2																							
Field power (LFP) voltage ²	24.0 VDC nominal																							
Dimensions	<table><tr><th colspan="2">Height</th><th colspan="2">Width</th><th colspan="2">Depth</th></tr><tr><th>mm</th><th>in.</th><th>mm</th><th>in.</th><th>mm</th><th>in.</th></tr><tr><td>266</td><td>10.5</td><td>144</td><td>5.7</td><td>169</td><td>6.7</td></tr></table>						Height		Width		Depth		mm	in.	mm	in.	mm	in.	266	10.5	144	5.7	169	6.7
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Environmental	Refer to the Harmony I/O System data sheet for environmental specifications and design standards including certification and CE mark directives.																							
Design standards																								

NOTES:

1. All specification values are maximums unless stated otherwise.
2. 24 VDC to power IISAC01 stations.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Fuse Specifications

Fuse	Rating ¹	Part Number	Description	CIO-100	CIO-110
Block power (A and B)	1.6 A, 250 V	1949438A1601	5 x 20 mm, fast-acting, low break capacity (IEC 127-2/II)	•	•
Field power	3.15 A, 250 V	1949532A3151	5 x 20 mm, time-lag, medium break capacity (IEC 127-2/VI)	•	
Station fuse	4.0 A, 250 V	1949438A4001	5 x 20 mm, fast-acting, low break capacity (IEC 127-2/II)		•
	6.3 A, 250 V	1949532A6301	5 x 20 mm, time-lag, medium break capacity (IEC 127-2/VI)	•	

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