High Speed Link-High Speed, Real-Time Distributed I/O Solution

Master Site — Remote Site

HSL Master Board

Memory ⟷ Master IC

Slave Module 1 — ID

Slave Module 2 — ID ID

Slave Module N — ID ID ID ID

Polling Cycle

Note: ID is slave index

High Speed Link (HSL) is an innovative distributed I/O technology designed for automation applications that is based on an open standard RS-422, which is designed for full/half-duplex, multi-drop serial transmission. The network employs standard CAT 5 cable for point-to-point connections between its major components and CRC-12 for error-correction. Sensors and controls at I/O points connect to the system through simple copper wires. HSL solutions include digital and analog I/O modules, thermal couple input modules and motion control modules. Some digital I/O modules are designed with a low-profile compact size suitable for limited space.

All digital I/O modules are hot swappable. Replacing failed modules in the field is simplified by not having to power down the system. Since RS-422 operates with polling, data collisions are not a factor and message overhead is extremely low. HSL offers 3/6/12Mbps transmission speeds. Every HSL network port can connect up to 63 slave indexes. The PCI-7852 (PMC-7852/G) has up to two HSL network ports and can connect up to 126 salve indexes. For example, if using the HSL-DI16DO16 module, up to 126 can be connected for up to 2016 DI and 2016 DO channels.

HSL is a real-time system. Scanning every slave index is time deterministic according to transmission speed selection. Every slave module completes data exchanges with the master board within a fixed time period. Transmission lengths can reach up to 300m away from host PC at 3Mbps.
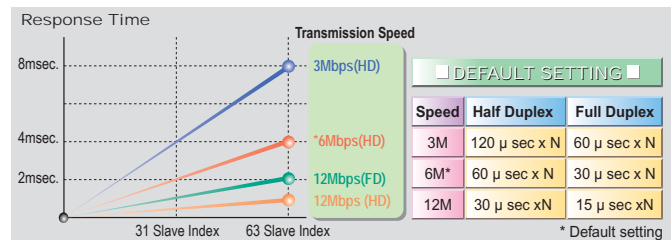
As a result, slave modules can be placed near monitored or controlled I/O points, reducing wiring and minimizing potential noise and signal loss. We also provide a remote motion module that can connect servomotors, stepping motors, and linear motors. HSL is the best choice for an optimal high-speed and easy distributed I/O solution.

High Speed

The command-response communication operates between the master board and slave modules. There are HSL communication ICs embedded in the master board and slave modules. The HSL solution offers 3/6/12Mbps transmission speeds running on full/duplex RS-422.

Real Time

The time for a HSL master to scan every slave index is deterministic. The overall scanning cycle time is exactly proportional to the number of slave indices. An HSL system with 30 digital I/O modules (such as the HSL-DI16DO16), the scanning cycle time is precisely 30 x 30.4 µs 0.912ms at 6Mbps, full duplex mode.

Response Time

Transmission Speed: 3Mbps(HD), *6Mbps(HD), 12Mbps(FD), 12Mbps (HD)

8msec. / 4msec. / 2msec.

31 Slave Index — 63 Slave Index

DEFAULT SETTING

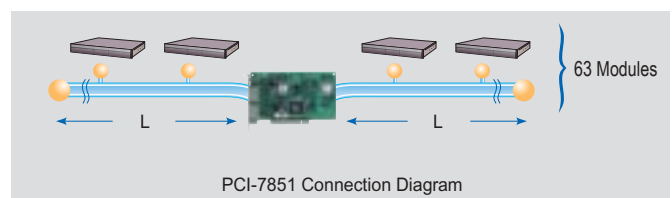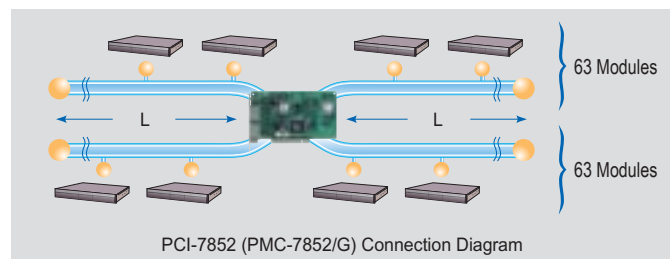| Speed	Half Duplex	Full Duplex
3M	120 µ sec x N	60 µ sec x N
6M*	60 µ sec x N	30 µ sec x N
12M	30 µ sec xN	15 µ sec xN

* Default setting

Easy Wiring

The connection among the HSL master and all slave I/O modules merely requires the commercial ethernet cables, which dramatically reduce the wiring effort. Bare wire is an another choice. With just Ethernet cables, high number of I/O data can be transmitted between the HSL master and slave I/O modules. This is absolutely the easiest and most cost effective wiring solution.

Huge Number of I/O Points

Up to 12 HSL master boards (PCI-7851/PCI-7852) can be installed in one PC. The PCI-7852 includes two HSL network ports. Up to 126 HSL-DI16DO16 slave modules can be connected to each network for a total of 24,192 digital I/O channels.

63 Modules / 63 Modules

L / L

PCI-7852 (PMC-7852/G) Connection Diagram

63 Modules

L / L

PCI-7851 Connection Diagram

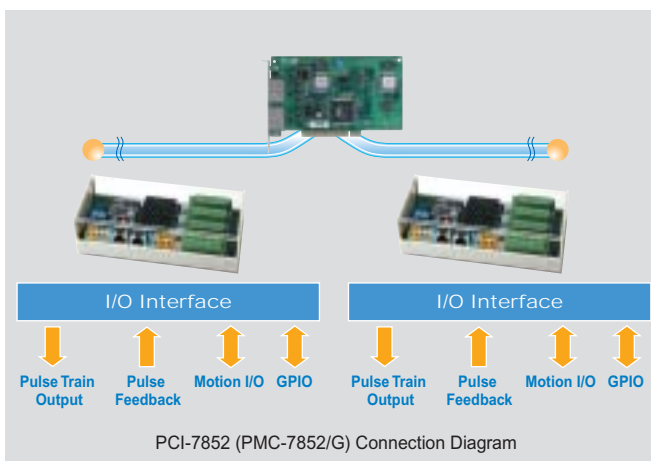| Transmission Speed	L (m)
3Mbps	300
6Mbps	200
12Mbps	100

High Speed Link-High Speed, Real-Time Distributed I/O Solution

Easy and Flexible I/O Expansion

To expand I/O points of add-on card needs not only the card itself but also a free PCI slot. What you need to do is to select the I/O type and module number by easy serial wiring, clips an Ethernet cable with RJ45 between modules.
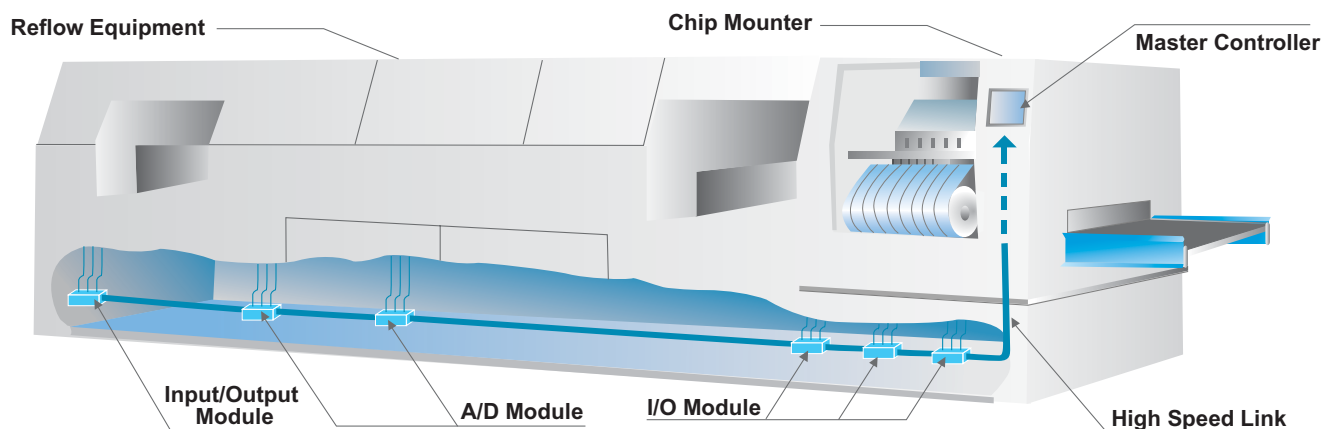
Remote Motion Control is Available

HSL also offers motion control solutions combined with distributed I/O. HSL motion control solutions can be connected with servomotors, stepping motors, and linear motors. PTP (Point-to-Point), linear interpolated, and circular interpolated moves are efficiency executed with our point table management and motion scripts. Each module can connect to up to 4 axes for up to 60 controllable axes in one HSL network.
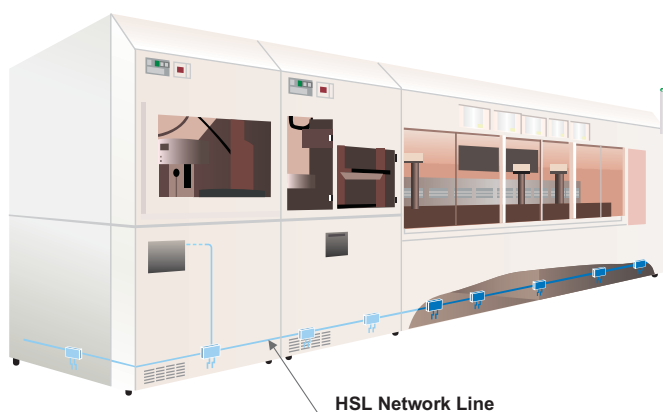
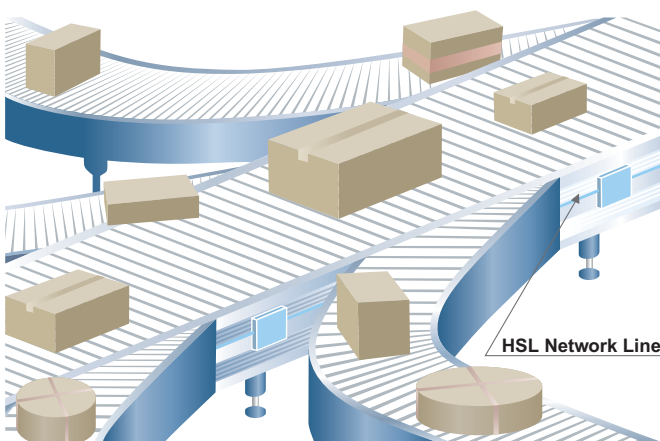| I/O Interface				I/O Interface			
Pulse Train Output	Pulse Feedback	Motion I/O	GPIO	Pulse Train Output	Pulse Feedback	Motion I/O	GPIO

PCI-7852 (PMC-7852/G) Connection Diagram

Applications

● Chip Mounter

Reflow Equipment — Chip Mounter — Master Controller

Input/Output Module — A/D Module — I/O Module — High Speed Link

● Semiconductor Back-End / LCD Equipment

HSL Network Line

● Goods Conveyer

HSL Network Line

1 GEME

2 Motion Control

3 Machine Vision

4 High Speed Link

5 Communications

6 Industrial Computers

7 CompactPCI Products

8 NuDAM

9 Software
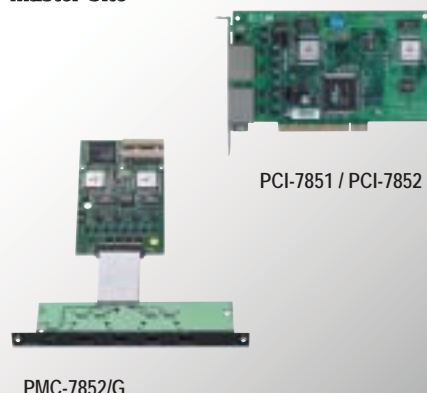
HSL Real-Time Remote I/O Product Selection Guide

Physical Architecture

Master Site

PCI-7851 / PCI-7852

PMC-7852/G

Remote Site

| Discrete I/O | Analog I/O | Thermocouple Input | Relay Switch |

Low-Profile Discrete I/O

Motion Control

◢ Master Board Selection

Form Factor	PCI		PMC
Board Type	PCI-7851	PCI-7852	PMC-7852/G
HSL Network Ports	1	2	2
Max. Slave Index Support	63	126	126
Transmission Speed	3 / 6 / 12Mbps Selectable		
Transmission Mode	Half / Duplex Mode Selectable		
Max. Distance	300M at 12Mbps		
Connection Interface	RJ-45 x 2	RJ-45 x 4	RJ-45 x 4
Embedded Memory	32KB	32KB x 2	32KB x 2
LED Diagnostic	Yes		

◢ Discrete Digital I/O Module Selection

Type	Input Channel	Output Channel	ID Consumption	Transmission Speed	Transmission Mode	Terminal Board	Metal Case	CE Certification
HSL-DI32-M-X	32	–	2	6 Mbps (Fixed)	Full Duplex (Fixed)	HSL-TB32-M-DIN	Yes	Yes
HSL-DO32-M-Y	–	32	2					
HSL-DI16DO16-M-XY	16	16	1					
HSL-DI32-DB-X	32	–	2			HSL-TB64/ HSL-TB32-U-DIN	No	No
HSL-DO32-DB-Y	–	32	2					
HSL-DI16DO16-DB-XY	16	16	1					

Note: X is input circuit type. Y is output circuit type.

HSL-DI16DO16- ☐ - X Y

- N: NPN Sinking Output   P: PNP Souring Output
- N: NPN Sinking Input   P: PNP Souring Input
- M: With metal cover
- DB: Without metal cover

◢ Discrete Relay Control Module Selection

Type	Input Channel	Relay Channel	ID consumption	Transmission Speed	Transmission Mode	Terminal Board	Metal Case	CE Certification
HSL-R8DI16-M-X	16	8	1	6Mbps (Fixed)	Full Duplex (Fixed)	HSL-TB32-M-DIN	Yes	Yes

Note: X is input circuit type and can be N (for NPN sinking input) or P (for PNP sourcing input).

Low-Profile

◢ Discrete Low-Profile Digital I/O Module Selection

Type	Input Channel	Output Channel	ID consumption	Transmission Speed	Transmission Mode	Terminal Board	Metal Case	CE Certification
HSL-DI8-L-X	8	–	1	6Mbps (Fixed)	Full Duplex (Fixed)	Not Used	Yes	Yes
HSL-DO8-L-Y	–	8	1					
HSL-DI4DO4-L-XY	4	4	1					

Note: X is input circuit type. Y is output circuit type.

HSL-DI4DO4- ☐ - X Y

- N: NPN Sinking Output   P: PNP Souring Output
- N: NPN Sinking Input   P: PNP Souring Input
- L: Low-Profile Feature

◢ Analog I/O Module Selection

Type	Input Channel	Output Channel	ID consumption	Transmission Speed	Transmission Mode	Terminal Board	Metal Case	CE Certification
HSL-AI16AO2-M-VV	16V	2V	2	3/6/12 Mbps	Full Duplex (Fixed)	HSL-TB32-M-DIN	Yes	Yes
HSL-AI16AO2-M-AV	16C	2V	2					
HSL-TC08	8T	2V	2			Not Used		

Note: V/C/T descriptions stand for voltage, current, and thermal couple respectively.

◢ Motion Control Selection

Type	Controllable	Axes ID consumption	Transmission Speed	Transmission Mode	Terminal Board	CE Certification
HSL-4XMO-CG-Y	4	2	3/6/12Mbps	Full / Half Duplex	Not Used	Yes
HSL-4XMO-CD-Y	4	2	3/6/12Mbps	Full / Half Duplex	Not Used	Yes

Note: Y can be N (for NPN sinking output) or P (for PNP sourcing output).

PCI-7851/PCI-7852
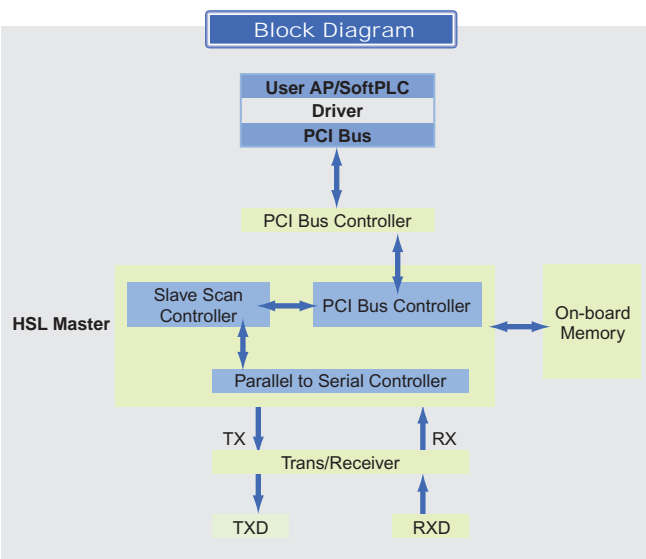
High Speed Link Master Controller Interface Cards ⋮•

1 GEME

2 Motion Control

3 Machine Vision

4 High Speed Link

5 Communications

6 Industrial Computers

7 CompactPCI Products

8 NuDAM

9 Software

Block Diagram

HSL Master

User AP/SoftPLC
Driver
PCI Bus

PCI Bus Controller

Slave Scan Controller → PCI Bus Controller ← On-board Memory

Parallel to Serial Controller

TX — RX

Trans/Receiver

TXD — RXD

Features

- Single/dual independent network operation
- One network port with 2 separate connectors
- Max. 300m x 2 communication distance at 12 Mbps
- Jumper selectable transmission speed: 3M/6M/12M bps transmission speed
- Jumper selectable transmission mode: full/half duplex
- On board memory
- Programmable timer interrupt
- RJ45 phone jack for easy installation
- LED diagnostic

Software Support

- Windows 98/NT/2000/XP Library
- Linux Driver for Redhat kernel 2.4.x
- Link Master Utility

Ordering Information

PCI-7851	Single HSL master controller card with two separate connectors
PCI-7852	Dual HSL master controller interface card with four separate connectors

Specifications

- PCI local bus specification Rev. 2.1 compliance
- Master controller ASIC
- Built-in 32KB SRAM for PCI-7851; built-in 32KB x 2 for PCI-7852 and PMC-7852
- Full/Half duplex, RS-422 with transformer isolation
- Transmission speed: 3/6/12M bps
- PCB Dimensions: 176 (L) x 107 (W) mm
- Operating Temperature: 0 to 70°C
- Storage Temperature: -20 to 80°C
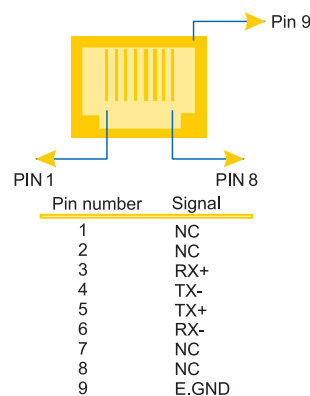- Power Consumption: +5V @500 mA typical
- Pin Assignment

Pin 9

PIN 1   PIN 8

Pin number	Signal
1	NC
2	NC
3	RX+
4	TX-
5	TX+
6	RX-
7	NC
8	NC
9	E.GND

HSL-DI32-M-N/-P
32-CH Discrete Input Module ⁚•

◤ Specifications

Slave ID consumption	2 consecutive from odd
Interface	N: for NPN sinking type sensor input or dry contact
	P: for PNP sourcing type sensor input or wet contact
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7KΩ
Input current	±10mA(Max), ±12.5mA(Peak)
Input voltage	±40V (Max)
LED Indicator	Power, Link and Input status
Power Supply	18V to 28V$_{DC}$
Operating Temperature	0 to 60°C
Storage Temperature	-20 to 80°C
Power Consumption	1.8W
CE certificate	Ready

HSL-DO32-M-N/-P
32-CH Discrete Output Module ⁚•

◤ Specifications

Slave ID consumption	2 consecutive from odd
Interface	N: for NPN sinking type output
	P: for PNP sourcing type output
Switch capacity	Single channel 500mA; all channels 60mA at 24V$_{DC}$
Photo couple isolation voltage	2500V$_{RMS}$
Response time	ON → OFF: 180µs, OFF → ON : 1.2µs
LED indicator	Power, Link and Output status
Power supply	18V to 28V$_{DC}$
Operating temperature	0 to 60°C
Storage temperature	-20 to 80°C
Power consumption	1.8W
CE certificate	Ready

HSL-DI16DO16-M-NN/-NP/-PN/-PP
16-CH Discrete Input 16-CH Discrete Output Module ⁚•

◤ Specifications

Slave ID consumption	1
Interface	NN: for NPN sinking type sensor input or dry contact and NPN sinking type output
	NP: for NPN sinking type sensor input or dry contact and PNP sourcing type output
	PN: for PNP sourcing type sensor input or wet contact and NPN sinking type output
	PP: for PNP sourcing type sensor input or wet contact and PNP sourcing type output
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7KΩ
Input current	±10mA(Max) , ±12.5mA(Peak)
Input voltage	±40V (Max)
Output switching capacity	Single channel 500mA; all channels 60mA at 24V$_{DC}$
Output response time	ON → OFF: 180µs, OFF → ON: 1.2µs
LED indicator	Power, Link and I/O status
Power supply	18V to 28V$_{DC}$
Operating temperature	0 to 60°C
Storage temperature	-20 to 80°C
Power consumption	1.8W
CE certificate	Ready

HSL-R8DI16-M-N/-P
8-CH Relay Output 16-CH Discrete Input Module ⁚•
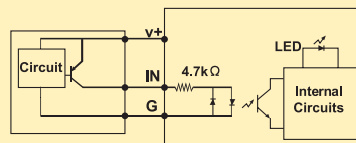
◤ Specifications

|	
Slave ID consumption	1
Interface	N: for NPN sinking type sensor or dry contact
	P: for PNP sourcing type sensor input or wet contact
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7KΩ
Input current	±10mA(Max) , ±12.5mA(Peak)
Input voltage	±40V (Max)
Relay rating	30V$_{DC}$ / 2A, 250V$_{AC}$ / 2A
Relay switching frequency	Max. 20 times/minute at rating load
Relay response time	ON → OFF: Max. 3ms, OFF → ON: Max. 6ms
Nominal voltage for relay	24V$_{DC}$
Input impedance	4.7KΩ
Input current	±10mA(Max), ±12.5mA(Peak)
Input voltage	±40V (Max)
LED indicator	Power, Link and I/O status
Power supply	18V to 28V$_{DC}$
Operating temperature	0 to 60°C
Storage temperature	-20 to 80°C
Power consumption	1.8W
CE certificate	Ready

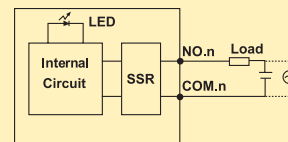**NPN Sinking type sensor Input**
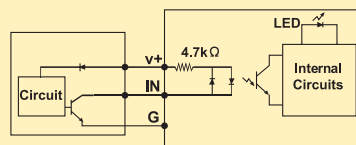
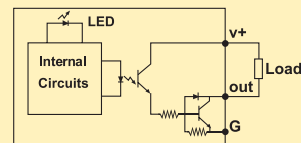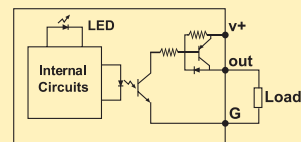**PNP Sourcing Type Sensor Input**

Dry Contact Input
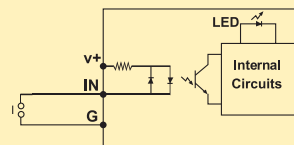
Wet Contact Input
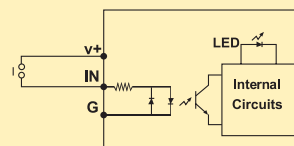
Relay Output

NPN Sinking Output

PNP Sourcing Output

HSL-TC08

8-CH Thermocouple Input/2 Analog Output Module

Specifications

Slave ID consumption	2
Interface	8-CH thermocouple inputs and 2 analog outputs
Power Supply	+22V to +26VDC
Resolution	16-bit
Analog output range	±10V (±0.1%)
Thermocouple Input Type	J, K, T, E, R, S, N, C
	J : 0˚C~760˚C
	K : 0˚C~1370˚C
	T : -100˚C~400˚C
	E : 0˚C~1000˚C
	R : 500˚C~1750˚C
	S : 500˚C~1750˚C
	N : -270˚C~1300˚C
	C : 0˚C~2320˚C
	Auto calibration for analog inputs and analog outputs

HSL-AI16A02-M-VV/-AV

16-CH Analog Input/2 Analog Output Module

Specifications

Slave ID consumption	2
Interface	16-CH single-ended or 8-CH differential analog input
	2-CH single-ended analog output
AD resolution	16-bit (14-bit guarantee)
DA resolution	16-bit
AD voltage input range	±10V, ±5V, ±2.5V, ±1.25V
AD current input range	±20mA
DA voltage output range	±10V
AD conversion time	10 µs
DA settling time	10 µs
Over-voltage protection	±30V
LED indicator	Power and Link
Power supply	+22V to +26V$_{DC}$
Operating temperature	0 to 60˚C
Storage temperature	-20 to 80˚C
Power consumption	2.9W

HSL-DI8-L-N/-P

NEW

8-CH Low-Profile Discrete Input Module

Specifications

Slave ID consumption	1
Interface	N: for NPN sinking type sensor input or dry contact
	P: for PNP sourcing type sensor input or wet contact
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7k
Input current	±10mA(Max), ±12.5mA(Peak)
Input voltage	±40V(Max)
LED indicators	Power, Link and Input status
Power supply	22V to 26V$_{DC}$
Operation temperature	0 to 60°C
Storage temperature	- 20 to 80°C
CE certification	Ready

HSL-DO8-L-N/-P

NEW

8-CH Low-Profile Discrete output Module

Specifications

Slave ID consumption	1
Interface	N: for NPN sinking type output
	P: for PNP sourcing type output
Output switching capacity	Single channel 500mA; all channels 60mA at 24V$_{DC}$
Photo couple isolation voltage	2500V$_{RMS}$
Output response time	ON → OFF: 180µs, OFF → ON:1.2µs
LED indicators	Power, Link and Output status
Power supply	22V to 26V$_{DC}$
Operation temperature	0 to 60°C
Storage temperature	-20 to 80°C
CE certification	Ready

1 GEME

2 Motion Control

3 Machine Vision

4 High Speed Link

5 Communications

6 Industrial Computers

7 CompactPCI Products

8 NuDAM

9 Software

HSL-DI4DO4-L-NN/-PN/-NP/-PP

4-CH Low-Profile Discrete Input 4-CH Discrete Output Module

Specifications

Slave ID consumption	1
Interface	NN: for NPN sinking type sensor input or dry contact and NPN sinking type output
	NP: for NPN sinking type sensor input or dry contact and PNP sourcing type output
	PN: for PNP sourcing type sensor input or wet contact and NPN sinking type output
	PP: for PNP sourcing type sensor input or wet contact and PNP sourcing type output
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7k
Input current	±10mA(Max), ±12.5mA(Peak)
Input voltage	±40V(Max)
LED indicators	Power, Link and Input status
Power supply	22V to 26V$_{DC}$
Operation temperature	0 to 60˚C
Storage temperature	-20 to 80˚C
CE certification	Ready

HSL-4XMO-CG-N/-P, HSL-4XMO-CD-N/-P

4-Axis Pulse Train Motion Control Module

HSL-4XMO-CG-N/-P

HSL-4XMO-CD-N/-P

Motion Control Features

- Pulse Train Frequency up to 6.55MHz
- Point-to-Point Motion
- Linear/Circular Interpolation
- On-the-Fly Speed / Position Change
- Continuous Contour Motion
- 13 Home Return Modes
- 4-Axis Position Compare & Trigger Output Channels
- 4-Axis High-Speed Position Counter Latches
- Dedicated Motion I/O: EL, ORG, INP, RDY, SVON, ERC, and ALM
- Hardware Emergency Stop

Specifications

Slave ID consumption	4
Number of controllable axes	4
Maximum number of HSL-4XMO in single HSL network	15
Position range (28 bit)	Pulse output is programmable to be OUT/DIR or CW/CCW
	28-bit up/down counter for encoder feedback signal
	-134217728 to + 134217728 pulse
General-purpose input type	NPN/PNP jumper selectable
General-purpose input voltage	ON: 6.5V to 24V, OFF: 0V to 3V
General-purpose output	N for NPN sinking type output
	P for PNP sourcing type output
General-purpose output current	±90mA (Max.)
	18V$_{DC}$ to 28V$_{DC}$
CE Certification	Ready

General Features

- HSL Communication Protocol
- Transmission Speed Selectable: 3/6/12Mbps
- Support for Half / Full Duplex Mode
- On-Board DSP
- 4-Axis Pulse Train Output Channels
- Up to 60 Axes on a Single HSL Network
- Motion Point Table Management
- Motion Script Download (G-Code-Like Language)

Notes:
1. HSL-4XMO-CG-N/-P provides general-purpose interface for connection. Users can easily connect steppers, linear motors, and other pulse train type amplifiers.
2. HSL-4XMO-CD-N/-P provides D-sun interface for connection. Users can easily connect servo motors with a transfer cable.

HSL-DI16DO16-DB-NN/-NP/PN/-PP

16-CH Discrete Input 16-CH Discrete Output Daughter Board Module ⦂•

◥ Specifications

Slave ID consumption	1
Interface	NN: for NPN sinking type sensor input or dry contact and NPN sinking type output NP: for NPN sinking type sensor input or dry contact and PNP sourcing type output PN: for PNP sourcing type sensor input or wet contact and NPN sinking type output PP: for PNP sourcing type sensor input or wet contact and PNP sourcing type output
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7kΩ
Input current	±10mA(Max), ±12.5mA(Peak)
Input voltage	±40V(Max)
Output switching capacity	300mA/ch at 24V$_{DC}$
LED indicator	Power, Link and I/O status
Power supply	18V to +28V$_{DC}$
Operating temperature	0 to 60°C
Storage temperature	-20 to 80°C
Power consumption	1.8W

HSL-DI32-DB-N/-P

32-CH Discrete Input Daughter Board Module ⦂•

◥ Specifications

Slave ID consumption	2
Interface	N: for NPN sinking type sensor input or dry contact P: for PNP sourcing type sensor input or wet contact
Photo couple isolation voltage	2500V$_{RMS}$
Input impedance	4.7kΩ
Input current	±10mA(Max), ±12.5mA(Peak)
Input voltage	±40V(Max)
LED indicator	Power, Link and Input status
Power supply	18V to +28V$_{DC}$
Operating temperature	0 to 60°C
Storage temperature	-20 to 80°C
Power consumption	1.8W

HSL-DO32-DB-N/-P

32-CH Discrete Output Daughter Board Module ⦂•

◥ Specifications

Slave ID consumption	2
Interface	N: for NPN sinking type output P: for PNP sourcing type output
Photo couple isolation voltage	2500V$_{RMS}$
Output switching capacity	Single channel 500mA; all channels 60mA at 24V$_{DC}$
Output response time	ON → OFF: 180μs, OFF → ON: 1.2μs
LED indicator	Power, Link and Output status
Power supply	18V to +28V$_{DC}$
Operating temperature	0 to 60°C
Storage temperature	-20 to 80°C
Power consumption	1.8W

1 GEME

2 Motion Control

3 Machine Vision

4 High Speed Link

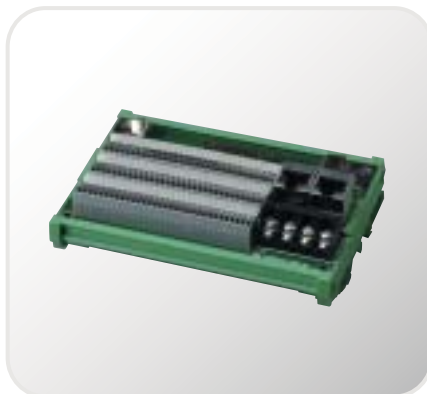5 Communications

6 Industrial Computers

7 CompactPCI Products

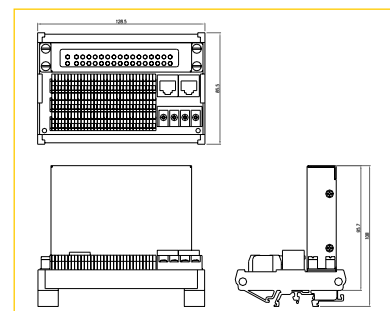8 NuDAM

9 Software

HSL-TB32-M-DIN

32-CH I/O Terminal Base ⠶
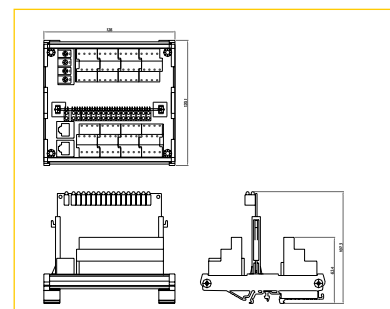
▶ Specifications

General Description	Field I/O wiring connection for HSL I/O modules
	Spring terminal for easy field wiring
	Power and ground included for each signal channel
	Interlocking design for rugged installation
	Power LED indicator
	DIN rail mounting
	Terminator resistor on board
I/O Wire Gauge	20 AWG. (max.); 28AWG. (min.)
Power supply	18V to +28V$_{DC}$

Dimensions

HSL-TB32-M-DIN Series

128.5mm x 85.5mm x 108mm

HSL-TB32-U-DIN

32 Points Universal Terminal Base ⠶

▶ Specifications

General Description	Field I/O wiring connection for HSL I/O modules
	Spring terminal for easy field wiring
	Power and ground included for each signal channel
	Interlocking design for rugged installation
	Power LED indicator
	DIN rail mounting
	Terminator resistor on board
I/O Wire Gauge	20 AWG. (max.); 28AWG. (min.)
Power supply	18V to +28V$_{DC}$

Dimensions

HSL-TB32-U-DIN Series

126mm x 120.1mm x 107.3mm

HSL-TB64

64 Points High Density Terminal Base ⠶

▶ Specifications

|	
General Description	Field I/O wiring connection for HSL I/O modules
	Spring terminal for easy field wiring
	Power and ground included for each signal channel
	Interlocking design for rugged installation
	Power LED indicator
	DIN rail mounting
	Terminator resistor on board
I/O Wire Gauge	20 AWG. (max.); 28AWG. (min.)
Power supply	18V to +28V$_{DC}$

Dimensions

HSL-TB64-DIN Series
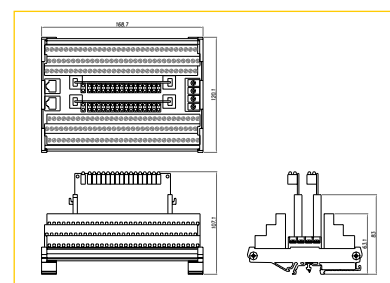
168.7mm x 120.1mm x 107.1mm
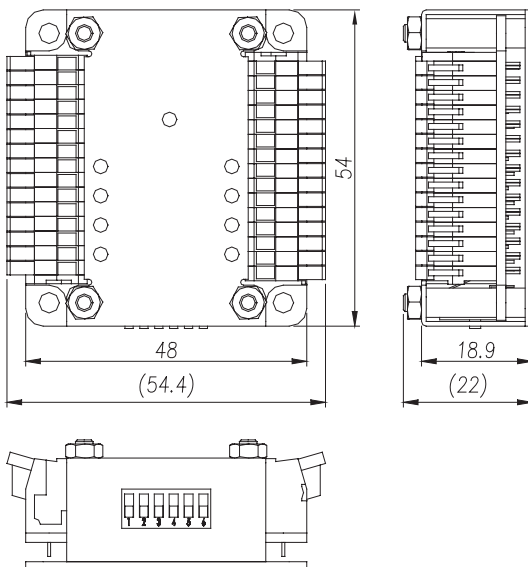
Slave Module Dimensions

HSL-DI16DO16-M-XY / HSL-DI32-M-X / HSL-DO32-M-Y /
HSL-R8DI16-M-X / HSL-AI16AO2-M-VV / HSL-AI16AO2-M-AV
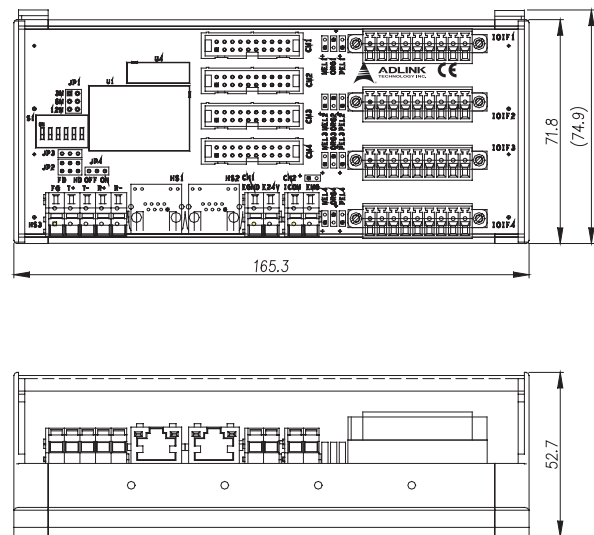(125mm x 22.4mm x 80mm)
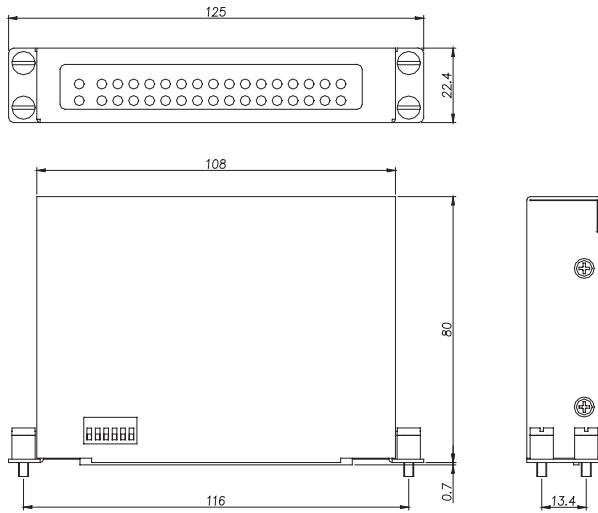
HSL-DI16DO16-DB-XY / HSL-DI32-DB-X / HSL-DO32-DB-Y
(100mm x 78.2mm)
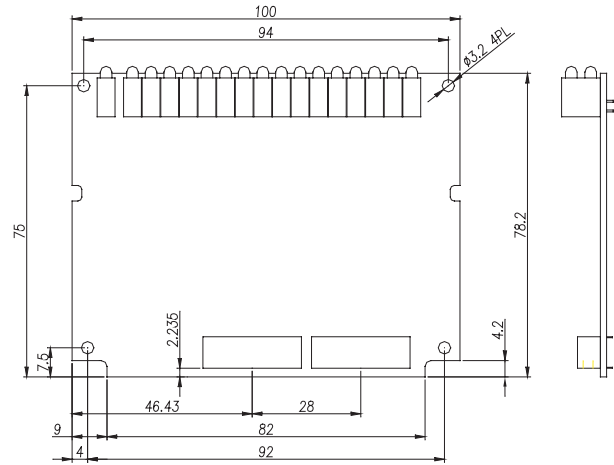
HSL-DI8-L-X/HSL-DO8-L-Y/HSL-DI4DO4-L-XY
(54.4mm x 54 mm x 22 mm)

HSL-4XMO-CG-Y (165.3 mm x 74.9 mm x 52.7 mm)

1 GEME

2 Motion Control

3 Machine Vision

4 High Speed Link

5 Communications

6 Industrial Computers

7 CompactPCI Products

8 NuDAM

9 Software