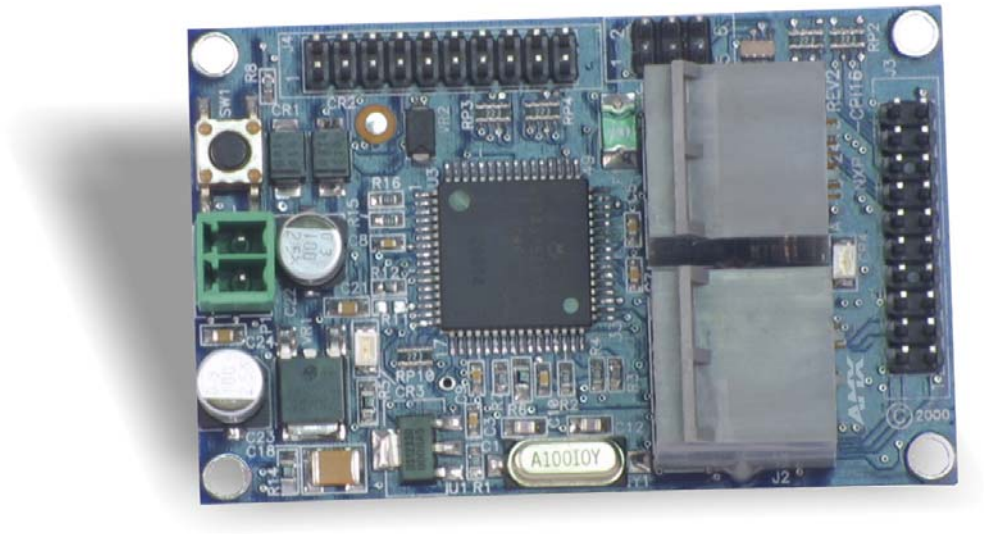
Operation/Reference Guide

NXP-CPI16

NetLinx Custom Panel Interface



Custom Panel Interfaces

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Table of Contents

Product Information

The AMX NXP-CPI16 is a NetLinx panel device that allows system integrators to connect switches, indicators, and rotary encoders to a NetLinx control system. Providing contact closure inputs and feedback outputs for up to 16 buttons, the miniature PC board contains two 20-pin headers for ribbon cable installation or direct mounting to a printed circuit board. FIG. 1 shows an NXP-CPI16.

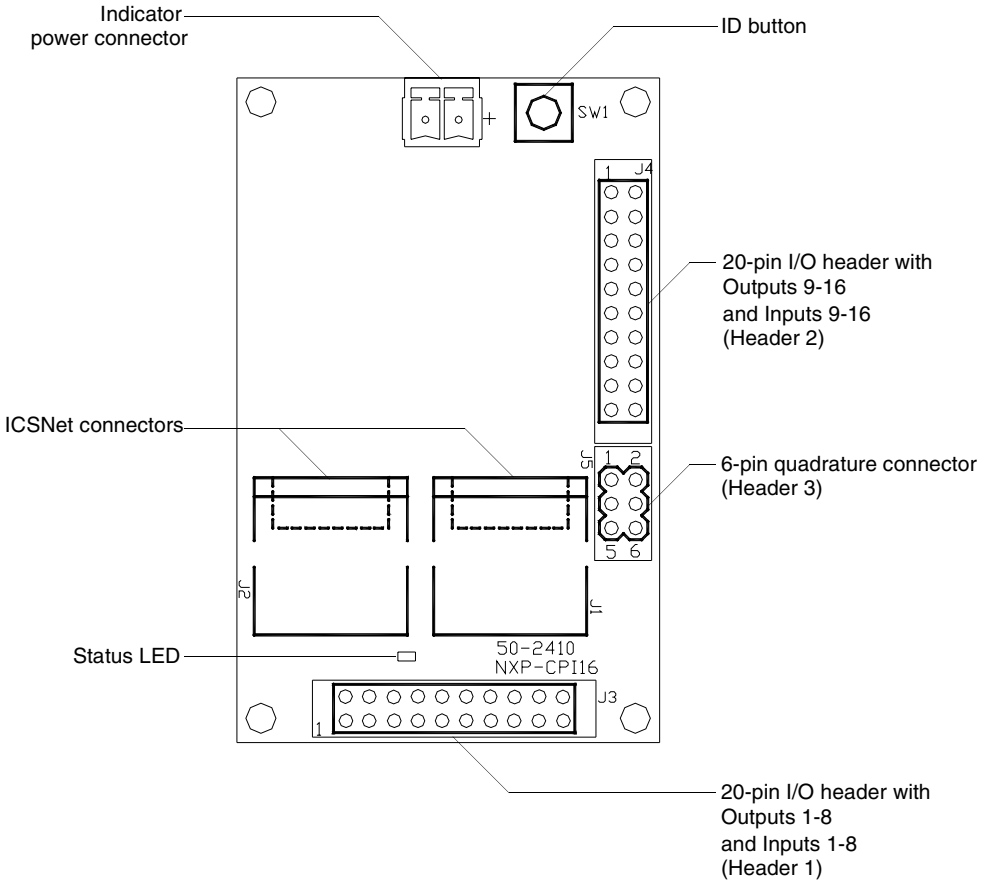


FIG. 1 NXP-CPI16

Specifications

The table below lists the NXP-CPI16 specifications.

NXP-CPI16 Specifications	
Power Requirement	12 VDC (300 mA max.)
Input Connectors:	
Indicator Power	Two-pin 3.5 mm captive-wire. This connector is used to supply a higher voltage and more current to the power pins of Header 1 and Header 2. The external supply connected to the two-pin captive-wire must be greater than +12 V. If the external supply voltage is less than that, the ICSNet supply (+12 V) will be used for the Power pin of the I/O connectors (not the external supply).
Closure Inputs	16 closure inputs activated with a GND or TTL Low (< 0.8 V). Inputs are sampled approximately every 10 msec and are debounced in software.
Rotary Encoder Inputs	2 quadrature inputs on a 2 x 3 header with a +5 V supply pin (supplying up to 100 mA) and a GND pin.
ICSNet	2 RJ-45 connectors for ICSNet connection
ID Button	Generates an event from the CPI16 to allow you to assign new Device numbers, using ID mode in the NetLinx Studio software program.
LED	ICSP status indicator (green)
Open Collector Outputs	16 open-collector outputs, acting as a switch to ground, up to 100 mA. Outputs can be connected to voltages ranging between 0 V and +28 V. Each output is updated approximately every 10 msec.
Dimensions (HWD)	2.75" x 1.75" x 0.062" (69.85 mm x 44.45 mm x 1.557 mm)
Weight	8.10 oz (229.6 g)
Accessories	• 6-pin header with 3 feet (0.91 m) of ribbon cable • Two mating 20-pin headers, each with 3 feet of ribbon cable attached • One green 2-pin 3.5 mm pitch captive wire connector for external indicator power.

Input and Output Connectors

To install the NXP-CPI16, connect ribbon cables or a PC board to one or more of the headers. The table below shows the pinouts for the two 20-pin headers.

I/O Connector Pinouts					
Header 1			Header 2		
Pin	Signal	Function	Pin	Signal	Function
1	Output 1	OC to Ground	1	Output 9	OC to Ground
2	Output 2	OC to Ground	2	Output10	OC to Ground
3	Output 3	OC to Ground	3	Output 11	OC to Ground
4	Output 4	OC to Ground	4	Output 12	OC to Ground
5	Output 5	OC to Ground	5	Output 13	OC to Ground
6	Output 6	OC to Ground	6	Output 14	OC to Ground
7	Output 7	OC to Ground	7	Output 15	OC to Ground
8	Output 8	OC to Ground	8	Output 16	OC to Ground
9	Ground	Signal Ground	9	Ground	Signal Ground
10	Power	Power Supply	10	Power	Power Supply
11	Ground	Signal Ground	11	Ground	Signal Ground
12	Ground	Signal Ground	12	Ground	Signal Ground
13	Input 1	Logic Input	13	Input 9	Logic Input
14	Input 2	Logic Input	14	Input 10	Logic Input
15	Input 3	Logic Input	15	Input 11	Logic Input
16	Input 4	Logic Input	16	Input 12	Logic Input
17	Input 5	Logic Input	17	Input 13	Logic Input
18	Input 6	Logic Input	18	Input 14	Logic Input
19	Input 7	Logic Input	19	Input 15	Logic Input
20	Input 8	Logic Input	20	Input 16	Logic Input

Quadrature Connectors

The table below lists the connector pinouts for the quadrature connector.

Quadrature Connector Pinouts		
Header 3		
Pin	Signal	Function
1	Ground	Signal ground
2	1A	Encoder # 1, Input A
3	1B	Encoder # 1, Input B
4	2A	Encoder # 2, Input A
5	2B	Encoder # 2, Input B
6	+5 V	Encoder power

Quadrature Inputs

By default, the quadrature inputs expect the phase relationship, shown in FIG. 2, for a clockwise rotation of the encoder to generate a positive level change. If the phase relationship does not match the example, a clockwise rotation will generate a negative level change. This can be corrected in two ways:

- Inputs A and B can be wired in reverse so the phase relationship is obtained at the quadrature encoder input pins.
- Insert a QDIR Send_Command in the NetLinx program.

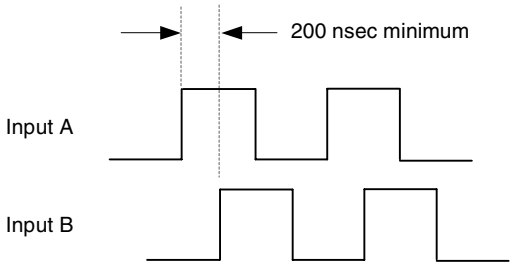


FIG. 2 Quadrature inputs phase relationship for clockwise rotation

Programming

There are two modes of Channel Assignments: Discrete Output and Default Mode. Both modes are set using the 'STATUS-ON' and 'STATUS-OFF' commands. Discrete Output mode should be used if channel status feedback for the outputs needs to be separate from the inputs. The tables below provide channel assignment information on both modes. For more information, refer to the *Send_Commands* section on page 6.

Status ON Mode Channel Assignment	
I/O	Corresponding Channel Assignment
Inputs 1 - 8	Channels 1 - 8 (On/Push/Off/Release)
Outputs 1 - 8	Channels 9 - 16 (On/Off only)
Inputs 9 - 16	Channels 17 - 24 (On/Push/Off/Release)
Outputs 9 - 16	Channels 25 - 32 (On/Off only)

Status OFF Mode Channel Assignment	
I/O	Corresponding Channel Assignment
Inputs 1 - 8	Channels 1 - 8 (Push/Release only)
Outputs 1 - 8	Channels 1 - 8 (On/Off only)
Inputs 9 - 16	Channels 9 - 16 (Push/Release only)
Outputs 9 - 16	Channels 9 - 16 (On/Off only)

Levels

By default all levels have a data type of byte (8-bits), which gives a range of 0-255 for the Level Value. The 'LVL_SZ' Send_Command sets the size of the value for levels 1 - 4. It is important that the variable in any SEND_LEVEL command and CREATE_LEVEL statement in the NetLinx program match the data type selected by the 'LVL_SZ' Send_Command. Incorrect levels may occur if the data types do not match.

The input and output Level values will not be sent until a 'LEVON' command message is received by the CPI16. A transmission of levels will cease after the receipt of a 'LEVOFF' command.

The values of Levels 1 and 2 (quadrature inputs) will be sent whenever the input changes.

Levels	
Level	Function
1	Quadrature Input 1
2	Quadrature Input 2
3	Bargraph 1 (Outputs 1 - 8) - if configured for bargraph mode
4	Bargraph 2 (Outputs 9 - 16) - if configured for bargraph mode

Send_Commands

Use the Send_Commands listed in the table below to program the NXP-CPI16.

Send_Commands	
BMODE Configures either set of 8 outputs as an 8-segment bargraph display.	Syntax: 'BMODE <bargraph #> <bargraph mode>' Variables: Where <bargraph #> 1 - Selects bargraph 1 (outputs 1 - 8) 2 - Selects bargraph 2 (outputs 9 - 16) Where <bargraph mode> 0 - normal bar mode 1 - normal dot mode (only one peak LED on at a time) 2 - special bar mode (a level of 1 - 15 still has the first LED on) 3 - special dot mode (a level of 1 -15 still has the first LED on) 4 - inverse normal bar mode 5 - inverse normal dot mode 6 - inverse special bar mode 7 - inverse special dot mode 8 - individual element, discrete mode 9 - inverse individual element, discrete mode OFF - disables bargraph mode [default] The command is used to configure either set of 8 outputs as an 8-segment bargraph display. By default, Bargraph mode is OFF and all outputs are discrete outputs that are controlled via CHANNEL ON/OFF messages. If this command is received, the selected bank of 8 outputs will respond according to the selected mode. In modes 8 and 9, the discrete LEDs that are ON correspond to the bit mask sent via a Send_Level command. For Example: SEND_LEVEL CPI16, 3, $5A Turns on LEDs 2, 4, 5, and 7 of bargraph #1. Example: SEND_COMMAND 'BMODE 1 0' Reconfigures Outputs 1 - 8 such that they now act as an 8-segment bargraph.
LEVOFF Keeps any level value from transmitting.	Syntax: 'LEVOFF' The NXP-CPI16 will not transmit any level value messages after the receipt of this command until the receipt of another LEVON command.
LEVON	Syntax: 'LEVON' The NXP-CPI16 transmits level value messages after the receipt of this command.

<table>
<tr><th colspan="2">Send_Commands (Cont.)</th></tr>
<tr><td>LVL_SZ
Sets the size (data type) of the value that will be used by the NXP-CPI16 when receiving and sending LEVEL messages.</td><td>The default is byte (8-bits), which yields a range of 0 - 255 for the level value.
Syntax:
'LVL_SZ <level #> <data type of level value>'
Variables:
Where <level #>
1 - Quadrature Input 1
2 - Quadrature Input 2
3 - Bargraph 1 (using outputs 1 - 8)
4 - Bargraph 2 (using outputs 9 - 16) and <data type of level value>
B - Byte (8-bits); range of 0 - 255 [default level data type]
I - Integer (16 bits); range of 0 - 65,535
S - Signed Integer (signed 16-bits); range of -32,768 to 32,767
Example:
SEND_COMMAND 'LVL_SZ 2 S'
Quadrature Input 2's data type is now Signed Integer.</td></tr>
<tr><td>STATUS-OFF
Puts the NXP-CPI16 in Default Mode (non-Discrete Output Mode).</td><td>Syntax:
'STATUS-OFF'
The CPI16 remembers the last Mode it was set for. Therefore, once a 'STATUS-OFF' Send_Command is received, Default Mode becomes the power-up mode of the CPI16. It is not necessary to send a 'STATUS-OFF' Send_Command each time the device is powered. Once the CPI16 is programmed for Default Mode, it remains in that mode until a 'STATUS-ON' Send_Command is received; see chart below.
<table><tr><td>Inputs 1 - 8 ◄⟷► Channels 1 - 8 (Push/Release only)</td></tr><tr><td>Outputs 1 - 8 ◄⟷► Channels 1 - 8 (On/Off only)</td></tr><tr><td>Inputs 9 - 16 ◄⟷► Channels 9 - 16 (Push/Release only)</td></tr><tr><td>Outputs 9 -16 ◄⟷► Channels 9 - 16 (On/Off only)</td></tr></table>It is not necessary to send a 'STATUS-OFF' Send_Command each time the device is powered. Once the CPI16 is programmed for Default Mode, it will remain in Default Mode until a 'STATUS-ON' Send_Command is received.</td></tr>
<tr><td>STATUS-ON
Puts the NXP-CPI16 in Discrete Output Mode.</td><td>Syntax:
'STATUS-ON'
The CPI16 remembers the last Mode it was set for. Therefore, once a 'STATUS-ON' Send_Command is received, Discrete Output Mode becomes the power-up mode of the CPI16. It is not necessary to send a 'STATUS-ON' Send_Command each time the device is powered. Once the CPI16 is programmed for Discrete Output Mode, it remains in that mode until a 'STATUS-OFF' Send_Command is received.; see chart below.
<table><tr><td>Inputs 1 - 8 ◄⟷► Channels 1 - 8 (On/Push/Off/Release)</td></tr><tr><td>Outputs 1 - 8 ◄⟷► Channels 9 - 16 (On/Off only)</td></tr><tr><td>Inputs 9 - 16 ◄⟷► Channels 17 - 24 (On/Push/Off/Release)</td></tr><tr><td>Outputs 9 -16 ◄⟷► Channels 25 - 32 (On/Off only)</td></tr></table></td></tr>
</table>

QDIR
Controls the direction of rotation that will correspond to a positive level increase on the quadrature inputs. The default rotation for both quadrature inputs is CW (clockwise).
	Please note that the actual direction of rotation for a positive level change will depend upon the phase relationship of the outputs on the quadrature encoder selected. If the correct phase relationship is not met, it may be necessary to send a CCW (counter-clockwise) QDIR command to get a positive level change for a *clockwise* rotation of the encoder.
	Syntax:
	`'QDIR <input #> <direction or rotation for a positive level change>'`
	Variables:
	Where <input#>
	1 - Quadrature Input 1
	2 - Quadrature Input 2 and <direction of rotation for a positive level change>
	CW - Clockwise rotation
	CCW - Counter-Clockwise rotation
	Example:
	`SEND_COMMAND 'QDIR 2 CCW'`
	The quadrature input 2 is set for counter-clockwise rotation.

QRATE
Sets the number of pulses that must be seen on the quadrature input in a given direction in order to reach the maximum attainable level.
	Syntax:
	`'QRATE <input #> <# of pulses that represent the maximum level allowed>'`
	Variables:
	Where <input #>
	1 - Quadrature Input 1
	2 - Quadrature Input 2
	and <# of pulses that represent the maximum level allowed>
	0-32,767
	This number should be calculated as follows:
	Pulses = <pulses/rotation> x <# of rotations to reach maximum level>
	The default for Pulses is 24.
	Example:
	Pulses/rotation = 50 (get from encoder data sheet)
	# of rotations desired to reach max. level = 2
	Therefore, the equation reads: 50 x 2 = 100.
	This value will be used to scale the level reported to the NetLinx master as follows:
	level change = (<maximum level> / <Pulses>) x <current pulse count>
	Example:
	`SEND_COMMAND 'QRATE 1 100'`
	The full range of quadrature input 1 is set for 100 pulses from the encoder.

The NXP-CPI16 uses input channels to report user input on the contacts or switches attached to the input terminals. Output channels are used to turn on the lamp or LED display devices to indicate the button status to the user.

The NXP-CPI16 default mode is STATUS-OFF, and in this mode the programmer cannot poll the NXP-CPI16 to determine the state of the output channel. This is because in this mode the output and input channels use the same number assignments. Inputs are sent by the NXP-CPI16 only as input changes.

When set for STATUS-ON mode the output channels are assigned a different channel number than the input channels. This allows the programmer to monitor the status of an output channel. However the channel offset must be accommodated in the programming code.

Statements such as this example can be used in a program.

```
IF[CPI16,25]  (* output channel assigned to input channel 9 on P3 connector *)
```

Each of the two 20-pin connectors is assigned a group of 8 input and output channels. The table below shows the relation of input and output channels in the STATUS modes.

Input/Output STATUS Mode			
Mode	Connector	STATUS-OFF (default)	STATUS-ON
Inputs	J3	Chan 1-8	Chan 1-8
	J4	Chan 9-16	Chan 17-24
Outputs	J3	Chan 1-8	Chan 9-16
	J4	Chan 9-16	Chan 25-32

The NXP-CPI16 may be configured to default to STATUS-ON mode using the following method. The commands can force a change to the mode no matter what default mode is configured for the device.

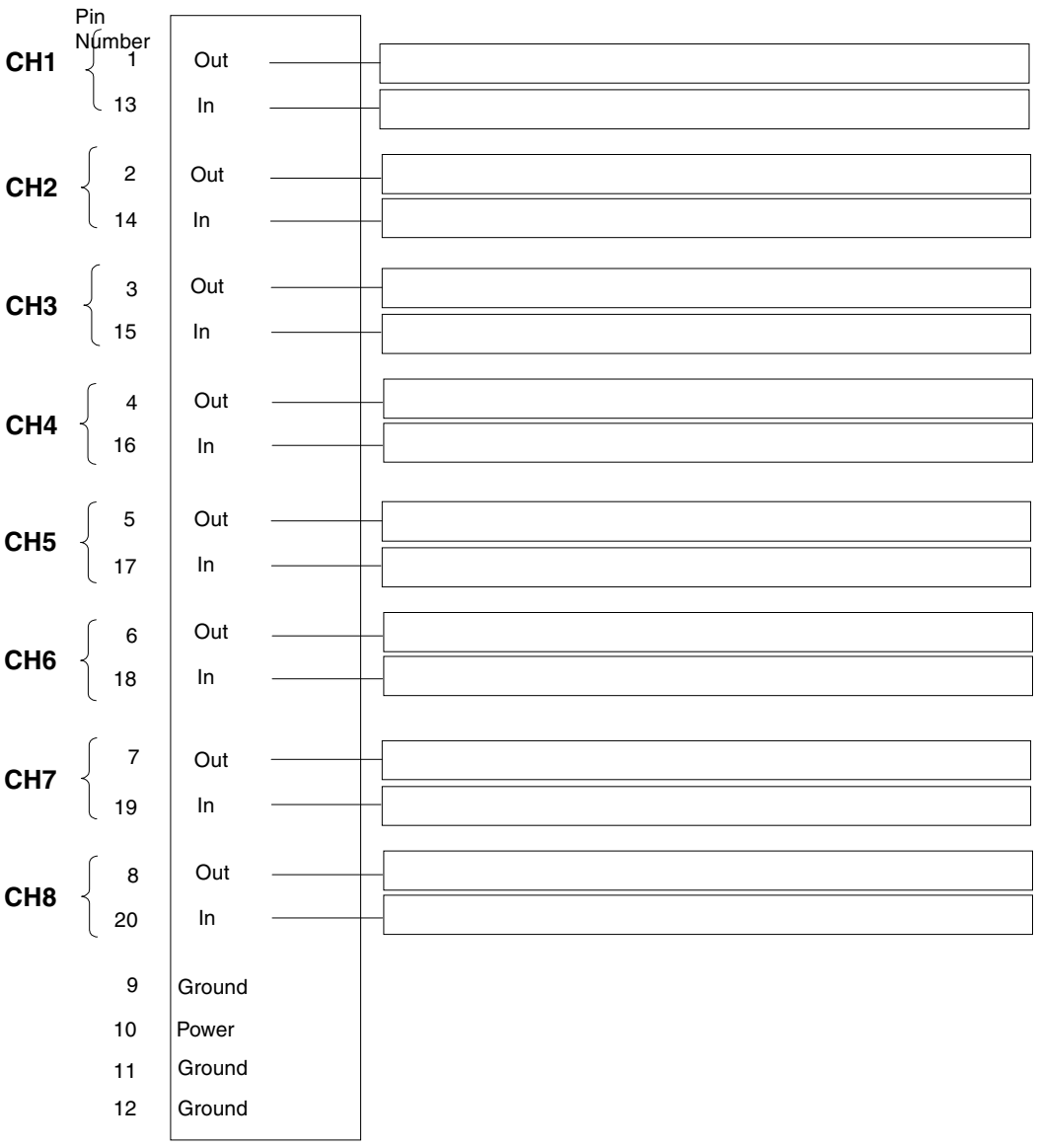
STATUS-ON Mode:

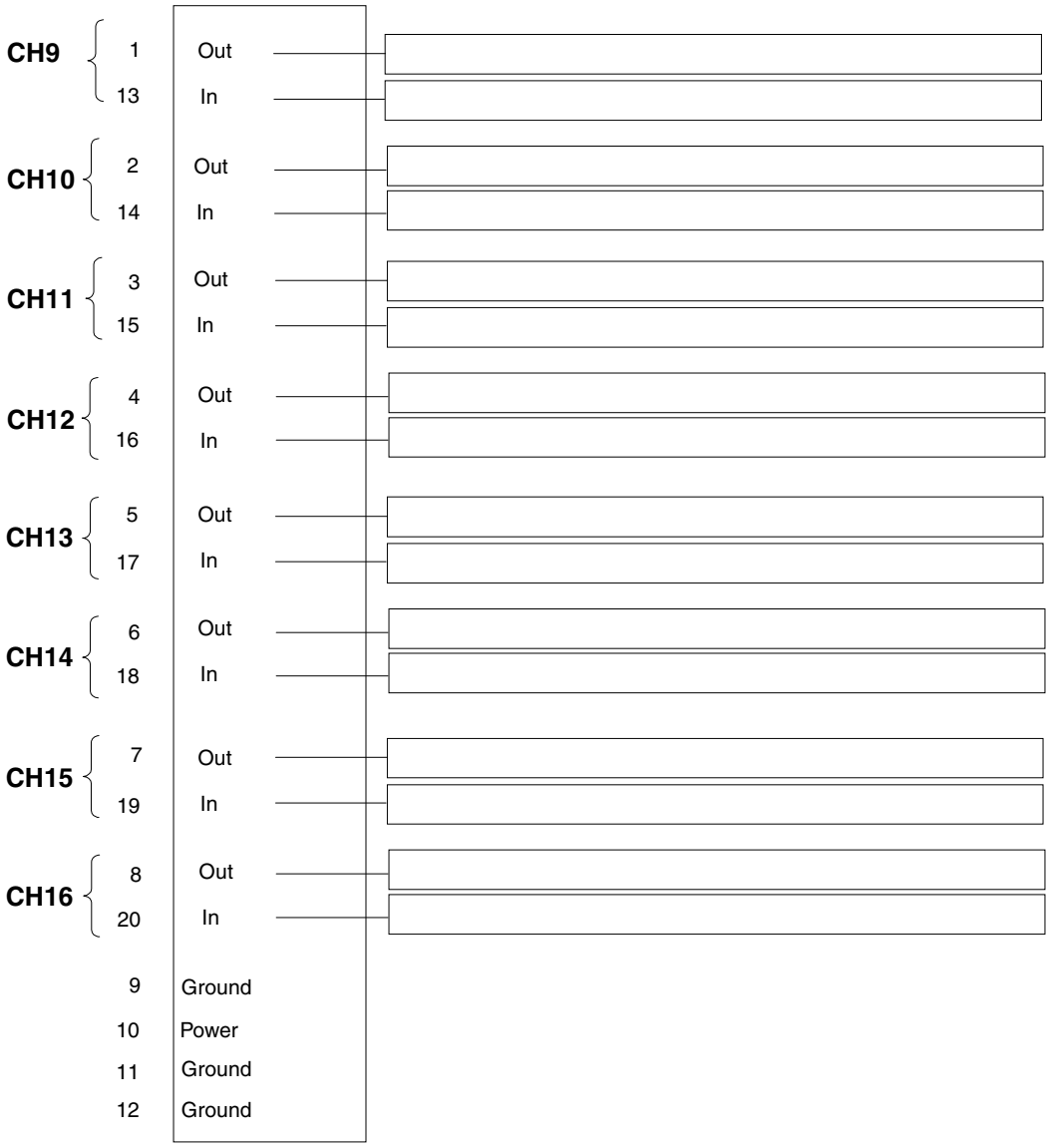
Remove R7 (1K ohm) resistor OR short across R8 for STATUS-ON mode. Firmware remains the same for standard and STATUS-ON mode NXP-CPI16 units.

System Worksheets

Dealer ID		Date	
Dealer		PO Number	
Job		SO Number	
Description		Serial Number	
Rev Number		Device Number	

Header 1





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