PDMnt Network Interface

Hardware Guide

Version NT 2.20

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PDMnt Network Interface

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Changes in Version NT 2.20

Page	Change

Conventions Used in this Document

Text Formats

Several text formats and fonts, illustrated in **Table 1**, are used in the text to convey information about the text.

Table 1 Text Format Conventions

Text	Description
BOLD CAPS	ACSPL+ elements (commands, functions, operators, standard variables, etc.) when mentioned in the text. Software tool menus, menu items, dialog box names and dialog box elements.
bold	Emphasis or an introduction to a key concept.
Bold Blue	Links within this document, to web pages, and to e-mail addresses.
Italics Blue	Used to highlight referenced documentation.

Flagged Text

The following symbols are used for flagging text in this document:

Note	
	*Notes include helpful information or tips.*

Caution 	***A Caution describes a condition that may result in damage to equipment.***

Warning 	***A Warning describes a condition that may result in serious bodily injury or death.***

Advanced 	*Indicates a topic for advanced users.*

Model 	*Highlights a specification, procedure, condition, or statement that depends on the product model.*

Related Documents

The following documents provide additional details relevant to this guide:

Table 2 Related Documentation (page 1 of 2)

Document	Description
SPiiPlus Command & Variable Reference Guide	Complete description of all variables and commands in the ACSPL+ programming language.
SPiiPlus C Library Reference	C++ and Visual Basic® libraries for host PC applications. This guide is applicable for all the SPiiPlus motion control products.
SPiiPlus COM Library Reference	COM Methods, Properties, and Events for Communication with the Controller.
SPiiPlus MMI Application Studio User Guide	A complete guide for using the SPiiPlus MMI Application Studio and associated monitoring tools.
SPiiPlus NT/DC Hardware Guide	Technical description of the SPiiPlus NT/DC product line.
SPiiPlus SDMnt Hardware Guide	Technical description of the SPiiPlus SDMnt Step Motor Drive Module.
SPiiPlus UDMnt Hardware Guide	Technical description of the SPiiPlus UDMnt Universal Drive Module.

Table 2 Related Documentation (page 2 of 2)

Document	Description
MC4U-CS Control Module Hardware Guide	Technical description of the MC4U Control Module integrated motion control product line.
SPiiPlus IOMnt EtherCAT Module	Technical description of the SPiiPlus IOMnt EtherCAT Module which is a general purpose digital IO module for Ethernet systems.
SPiiPlus NT PEG and MARK Operations Application Notes	Provides details on using the PEG commands in NT systems.

About this Document

This document provides the technical details for the PDMnt Network Interface, which is a network module designed for controlling external drives and I/Os. The document is organized as follows:

- **Chapter 1 - PDMnt Network Interface Overview**
- **Chapter 2 - Safety and EMC Guidelines**
- **Chapter 3 - Electrical Interfaces**
- **Chapter 4 - Jumpers and DIP Switches**
- **Chapter 5 - LED Indicators**

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1 PDMnt Network Interface Overview

The PDMnt is a network module designed for controlling external drives and I/Os.

There are three PDMnt versions:

- PDMnt-4 - A 4-axes Pulse/Dir interface for step and servo motors.
- PDMnt-8/8-D - An 8 x digital output and 8 x digital input that can operate off 5Vdc or 24Vdc and can be configured either as a sink or source.
- PDMnt-4-8/8-D- Combines the PDMnt-4 and PDMnt-8/8-D for providing a 4 x Pulse/Dir interface, 8 x digital inputs and 8 x outputs.

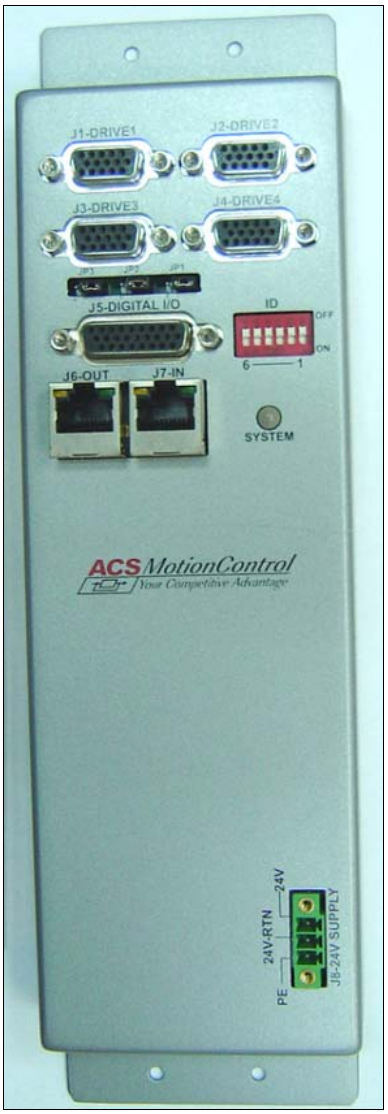


Figure 1 PDMnt Network Interface

This chapter provides the PDMnt technical details.

1.1 PDMnt Dimensions

Figure 2 presents the PDMnt physical dimensions (in mm).

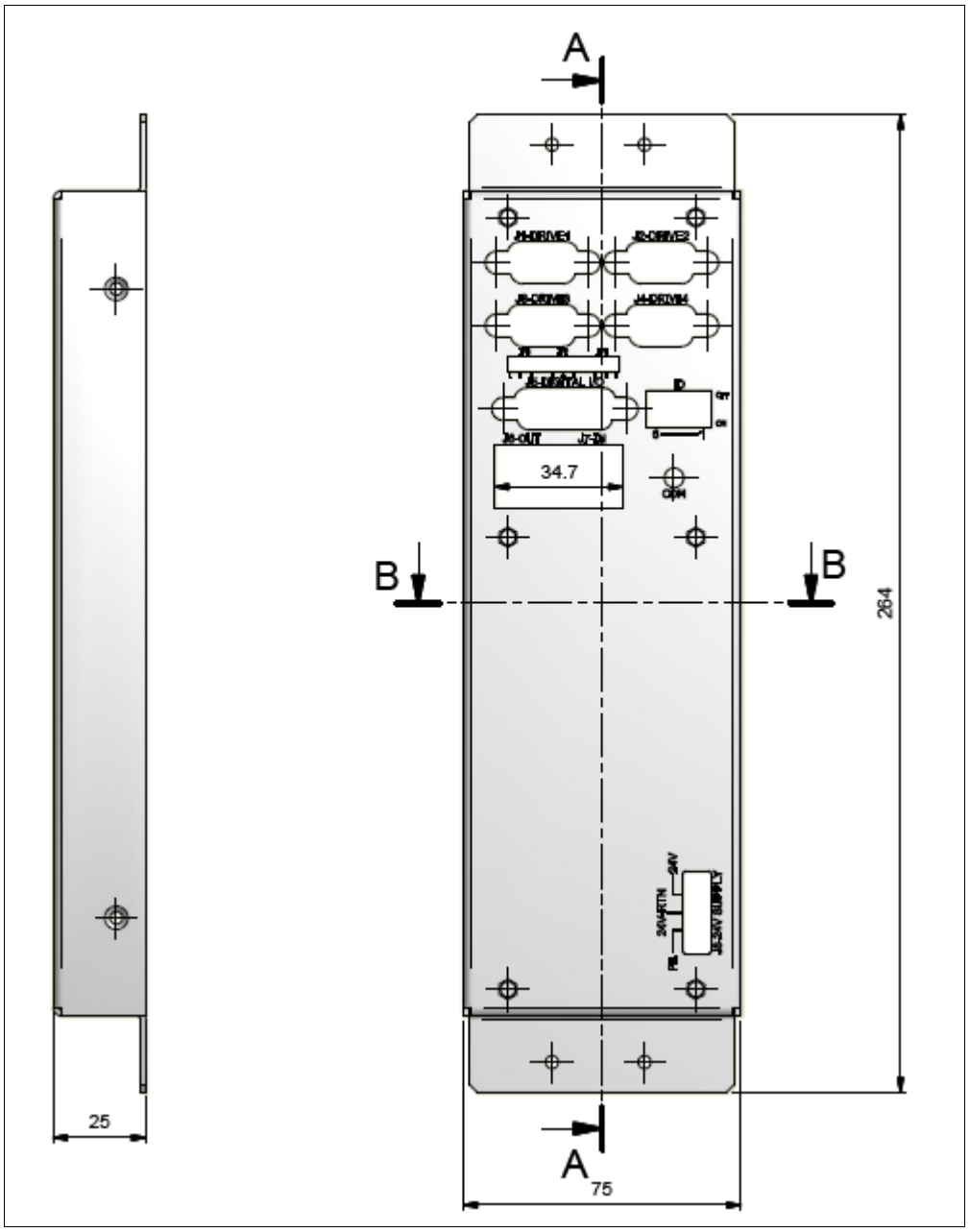


Figure 2 PDMnt Dimensions

1.2 Drive Interfaces

Table 3 presents the PDMnt Drive interfaces.

Table 3 PDMnt Drive Interfaces (page 1 of 2)

	Description	Remarks
Pulse/Dir Output		
Signal Designation	#_PULSE± #_DIR±	# - can be: 0, 1, 2, or 3 # - can be: 1(count up), 0 (count down)
Quantity	Four pairs (one pair per axis)	
Interface type	Differential, RS422 compatible.	
Maximum frequency	4 MHz (4,000,000 pulses per second)	The pulse width should be less than half a cycle of the maximal P/D frequency. For example, if the maximum velocity is 500,000 pulses/Sec, the maximum pulse width should be 1µSec
Minimum pulse width	120 ns	
Maximum pulse width	50 µS	
Default state	Pulse= '1' Dir = '0'	On power-up
Drive Enable		
Signal Designation	#_ENA	
Quantity	Four, one per axis.	
Interface type	Opto-isolated, sink/source, two terminal, 5 Vdc ±10% or 24 Vdc ±20%, up to 20 mA. Maximum drop voltage ≤0.8 V. Upon power-up, the signal is high impedance (no current through the output transistor). Short and over-current protected.	
Drive Fault		
Signal Designation	#_FLT	
Quantity	Four, one per axis.	
Interface type	Opto-isolated, sink/source, two terminal, 5 Vdc ±10% or 24 Vdc ±20%, up to 20 mA. Maximum input current ≤14 mA. Fault state (drive alarm) = no current via input	

Table 3 PDMnt Drive Interfaces (page 2 of 2)

	Description	Remarks
Safety Inputs		
Signal Designation	#_RL #_LL	
Quantity	Eight (two per axis)	
Interface type	Single-ended, opto-isolated. Configurable by the user as either source or sink: 5 Vdc ±10% or 24 Vdc ±20% Maximum input current ≤14 mA Reference: V_SUP_SFTY. Limit off = No current via input.	Sink/Source configured by jumper JP1. Default = Sink. **Section 4.1 - PDMnt Jumpers**.

1.3 General Purposes I/O

Table 4 presents the PDMnt general purpose I/O signals.

Table 4 PDMnt General Purpose I/O Signals (page 1 of 2)

	Description	Remarks
General Purpose Inputs		
Signal Designation	IN0, IN1, IN2, IN3, IN4, IN5, IN6, IN7	
Quantity	Eight.	
Type	Single-ended, opto-isolated. Configurable by the user as either source or sink: 5Vdc (±10%) or 24Vdc (±20%). Referenced to V_SUP_IO (Sink) or V_RET_IO (Source) Maximum input current ≤14 mA Input off = No current via input.	Sink/Source configured by jumper JP3. Default = Sink. See **Section 4.1 - PDMnt Jumpers**.

Table 4 PDMnt General Purpose I/O Signals (page 2 of 2)

	Description	Remarks
General Purpose Outputs		
Signal Designation	OUT0, OUT1, OUT2, OUT3, OUT4, OUT5, OUT6, OUT7	
Quantity	Eight	
Type	Single-ended, opto-isolated. Configurable by the user as either source or sink: 5 Vdc ±10% or 24 Vdc ±20% Referenced to V_RET_IO (Sink) or V_SUP_IO (Source). Maximum output current ≤50 mA Total output power: 400 mA Drop voltage ≤1.8V Upon power-up, signal is high impedance (no current through the output transistor). Short and over-current protected.	Sink/Source configured by jumper JP2. Default= Sink. **Section 4.1 - PDMnt Jumpers**

1.4 Ethernet Communication Channels

Table 5 presents the PDMnt Ethernet communication signals.

Table 5 PDMnt Ethernet Communication Signals

	Description	Remarks
Signal Designation	Transmit: ETH#_TX± Receive: ETH#_RX±	
Line impedance	100Ω	Galvanic Isolated
Quantity	Two ETH1(IN) and ETH2(OUT)	
Protocol	TPC/IP 10/100Mbps	

1.5 Voltage Supplies

Table 6 details the voltages have to be provided to the PDMnt for normal operation. Each voltage must be provided with its own return line.

Note	
	*All voltages are galvanically isolated inside the PDMnt.*

Table 6 Voltage Supplies

	Description	Remarks
24V control supply	24V Supply for internal circuits	User has to provide this voltage only when the PDMnt is a stand-alone unit. If it is installed in the MC4U, the supply is internal.
Range	24 V ± 10%	
Maximum current	250 mA	
Maximum input power	5.5 W @ 21.6 V	
V_SUP_IO	Supply for general purpose I/O	User has to provide this voltage for I/O supply
Range	5 Vdc ±10% or 24 Vdc ±20%	
Maximum current	≤ 500 mA	
V_SUP_SFTY	Supply for safety inputs (limits)	User has to provide this voltage for safety inputs supply
Range	5 Vdc ±10% or 24 Vdc ±20%	
Maximum current	≤ 150 mA	

1.6 EtherCAT Network Cable Limitation

Caution	
	***For proper operation of the unit installed in an EtherCAT network strict adherence to the cable length limitations given in this section is required.***

The minimum cable length between units in an EtherCAT network is 1m; the maximum length is 25m.

Note	
	*ACS Motion Control recommends using BECKHOFF ZK1090-9191-0250 cable, or its equivalent.*

2 Safety and EMC Guidelines

2.1 General Safety Guidelines

Warning	
	***Read and understand the following precautions before operating the PDMnt!***

Under emergency situations the unit should be completely disconnected from any power supply. The Left/Right Limits on ACS Motion Control products are designed for use in conjunction with customer-installed devices to protect driver load. The end user is responsible for complying with all Electrical Codes.

2.1.1 Emergency Stop Device

1. Locate an emergency stop device at each operator control station and other operating stations where an emergency stop may be required.
2. The emergency stop device shall disconnect all electrical equipment connected to the PDMnt from their respective power supplies.
3. It will not be possible to restore the circuit until the operator manually resets the emergency stop.
4. In situations with multiple emergency stop devices the circuit shall not be restored until all emergency stops devices are manually reset.

2.1.2 Fail-Safe Logic Recommendation

ACS Motion Control recommends connecting all safety inputs (limit inputs and emergency stop input) with a fail safe logic. The intention is that during normal operation the inputs are active. When a safety event happens (or the input wire is cut) the input becomes zero and the controller identifies that as a fault.

2.1.3 Initial Logic State of Outputs

The relevance of analog and digital output pins is product and model dependent. The initial logic state of the inactive analog and digital pins is undefined. They may carry a potential of 5V relative to ground.

2.2 Grounding

Grounding system electrical components is crucial.

Warning	
	***Verify that all electric circuits and electrical components, including motion controllers, power drives, motors, etc., have a grounding system. Grounding of AC and DC equipment must be in accordance with 29 CFR 1910.304(f).***

2.3 Fault & Error Handling

If, from any reason, communication with the master is lost, the PDMnt goes into the Alarm state. In the Alarm state the following occurs:

- System LED is red.
- Pulse signal goes to default level (high)
- Direction signals goes to default level (low)
- I/O goes to default (off, no current)
- Drive Enable goes to default state (disable).

There are two recovery options for Alarm state:

1. Power the 24 Voff and then on.
2. Reset bit using the **FCLEAR** command.

3 Electrical Interfaces

This chapter details the PDMnt on-board connectors and connectivity.

3.1 J1-J4 - Drive Connectors

Label: DRIVE1 J1

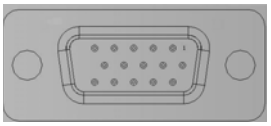
DRIVE2 J2

DRIVE3 J3

DRIVE4 J4

Connector Type: DB-HD, 15-pin female

Mating Type: DB-HD, 15-pin male



The pinout for the J1-J4 connectors is given in **Table 7**.

Table 7 J1-J4 Drive Connector Pinout

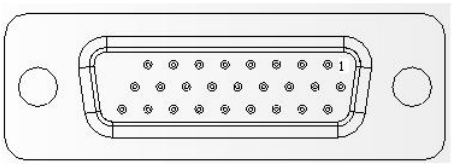
Pin	Name	Description
1	#_RL	Right limit
2	#_LL	Left limit
3	V_SUP_IO	Input/Output Supply (for ease of installation, use this voltage for drive Enable/Fault if isolation is not required between I/O and Drive Enable/Fault)
4	#_DIR-	Direction inverted
5	#_PULSE-	Clock inverted
6	V_SFTY_RTN	Safety supply return.
7	V_SUP_SFTY	Safety supply.
8	V_RTN_IO	Input/Output Supply Return (for ease of installation, use this voltage for drive Enable/Fault if isolation is not required between I/O and Drive Enable/Fault)
9	#_DIR+	Direction non-inverted
10	#_PULSE+	Clock non inverted
11	#_FLT+	Fault input non-inverted.
12	#_FLT-	Fault input inverted
13	#_ENA+	Enable output non-inverted
14	#_ENA-	Enable output non-inverted
15	DGND	Internal digital supply return.

3.2 J5 - General Purpose I/O Connector

Label: J5 DIGITAL I/O

Connector Type: DB-HD, 26-pin female

Mating Type: DB-HD, 26-pin male



The pinout for the J5 connector is given in **Table 8**.

Table 8 J5 - General Purpose I/O Connector Pinout (page 1 of 2)

Pin	Name	Description
1	OUT1	Digital Output 1
2	OUT3	Digital Output 3
3	OUT5	Digital Output 5
4	OUT7	Digital Output 7
5	IN1	Digital Input 1
6	IN3	Digital Input 3
7	IN5	Digital Input 5
8	IN7	Digital Input 7
9	V_SUP_IO	Input/Output Supply
10	OUT0	Digital Output 0
11	OUT2	Digital Output 2
12	OUT4	Digital Output 4
13	OUT6	Digital Output 6
14	IN0	Digital Input 0
15	IN2	Digital Input 2
16	IN4	Digital Input 4
17	IN6	Digital Input 6
18	V_RTN_IO	Input/Output Supply Return
19	24VDC	+24 Vdc (for ease of installation, if the GP I/O and safety works with 24 V and no isolation is required between safety, I/O and 24V control supply, then short this pin to 9 and 22 so additional 24 V power supply is not required for I/O and safety)
20	24VRTN	24 Vdc (for ease of installation, if the GP I/O and safety works with 24 V and no isolation is required between safety, I/O and 24V control supply, then short this pin to 18 and 21so additional 24 V power supply is not required for I/O and safety)

Table 8 J5 - General Purpose I/O Connector Pinout (page 2 of 2)

Pin	Name	Description
21	V_SFTY_RTN	Safety supply return.
22	V_SUP_SFTY	Safety supply.
23	-	Not connected
24	-	Not connected
25	-	Not connected
26	-	Not connected

Note

With the PDMnt installed in a network, the user can obtain the exact mapping of the ACSPL+ **IN** *and* **OUT** *variables to the connector pins for each unit in the system through the SPiiPlus MMI Application Studio:*

1. *Select* **Toolbox → Setup → System Configuration Wizard → View System Task**
2. *Click* **View Report**, *the* **System Configuration Report** *is displayed, for example:*

Input / Output information

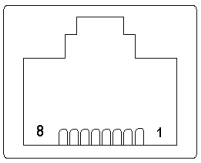
ACSPL+ Name	Network ID #	Connector Name (Pin Name)
OUT0.0	00000000 (DIP=0), (ID=0)	J8(OUT0)
OUT0.1	00000000 (DIP=0), (ID=0)	J8(OUT1)
OUT0.2	00000000 (DIP=0), (ID=0)	J8(OUT2)
OUT0.3	00000000 (DIP=0), (ID=0)	J8(OUT3)
OUT0.4	00000000 (DIP=0), (ID=0)	J8(OUT4)
OUT0.5	00000000 (DIP=0), (ID=0)	J8(OUT5)
OUT0.6	00000000 (DIP=0),	J8(OUT6)

3.3 J6 - Ethernet Output Connector

Label: J6 OUTPUT

Connector Type: RJ45

Mating Type: Ethernet plug



The pinout for the J6 connector is given in **Table 9**.

Table 9 J6 - Ethernet (Master) Connector Pinout

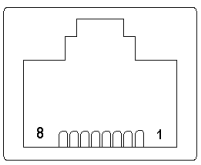
Pin	Name	Description
1	TD+	Positive transmit signal
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	-	Not connected
5	-	Not connected
6	RD-	Negative receive signal
7	-	Not connected
8	-	Not connected

3.4 J7 - Ethernet Input Connector

Label: J7 INPUT

Connector Type: RJ45

Mating Type: Ethernet plug



The pinout for the J7 connector is given in **Table 10**.

Table 10 J7 - Ethernet (Slave) Connector Pinout

Pin	Name	Description
1	TD+	Positive transmit signal
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	-	Not connected
5	-	Not connected
6	RD-	Negative receive signal
7	-	Not connected
8	-	Not connected

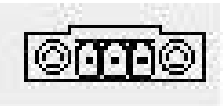
3.5 J8 - 24V Control Supply Connector

Model	
	*This connector is relevant only for stand-alone units.*

Label: J8

Connector Type: Phoenix MCV 1,5/ 3-GF-3,81

Mating Type: Phoenix MCV 1,5/ 3-STF-3,81



The pinout for the J8 connector is given in **Table 11**.

Table 11 J8 - 24V Control Supply Connector Pinout

Pin	Name	Description
1	24VDC	+24 Vdc supply
2	24VRTN	24 Vdc supply return
3	PE	Protected Earth

3.6 PDMnt Connectivity

This section details the PDMnt Network Interface connectivity.

3.6.1 Drive Enable Signal

Figure 3 depicts the connection of the Drive Enable signal.

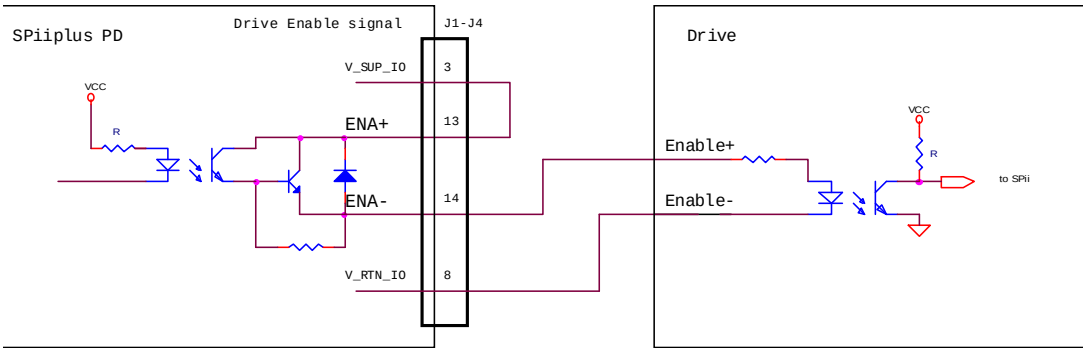


Figure 3 Drive Enable Connectivity

3.6.2 Drive Fault (Alarm) Signal

Figure 4 depicts the connection of the Drive Fault (Alarm) signal.

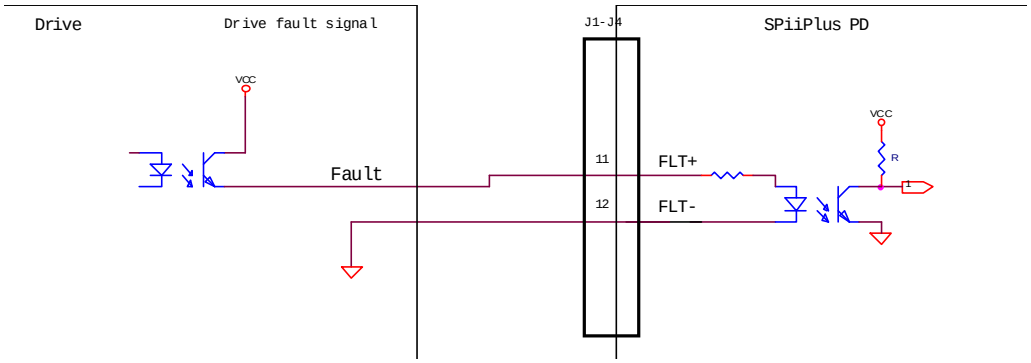


Figure 4 Drive Fault (Alarm) Connectivity

3.6.3 GP Input Signal in Sink Mode

Figure 5 depicts the connection of the GP input signal connectivity in sink mode.

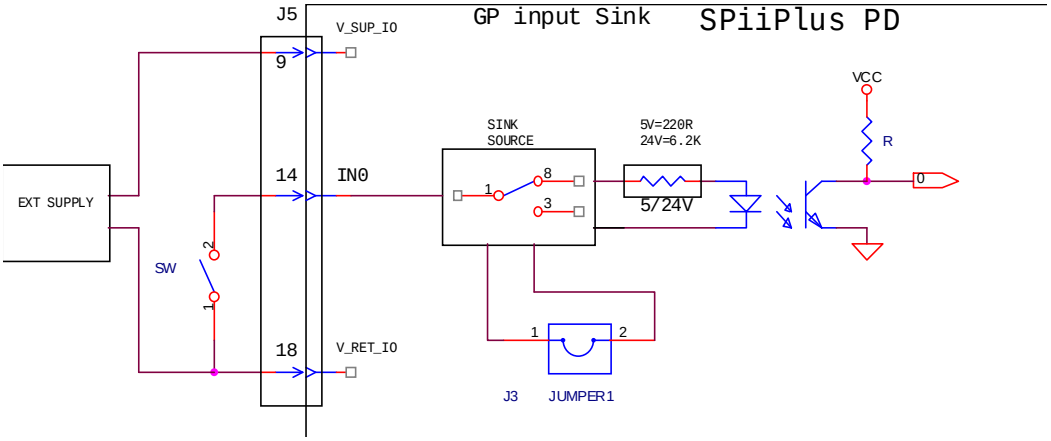


Figure 5 GP Input Signal in Sink Mode Connectivity

3.6.4 GP Input Signal in Source Mode

Figure 6 depicts the connection of the GP input signal connectivity in source mode.

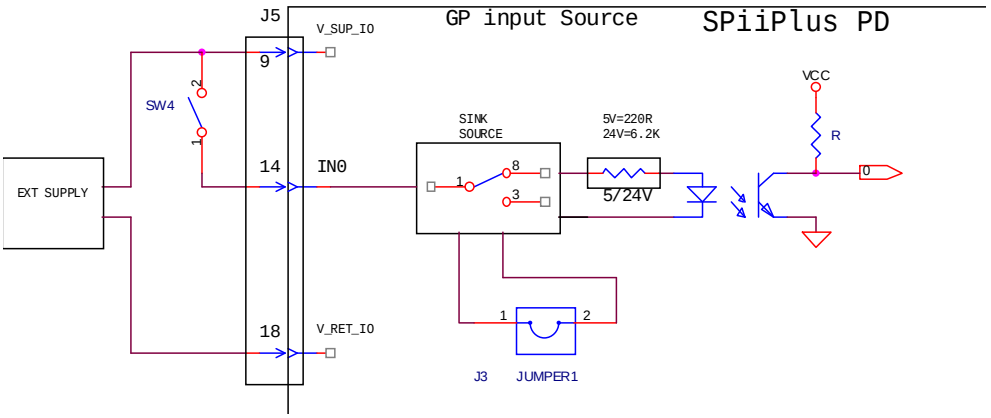


Figure 6 GP Input Signal in Source Mode Connectivity

3.6.5 Safety (Limits) Input Signals in Sink Mode

Figure 7 depicts the connection of the Safety (Limits) input signals connectivity in sink mode.

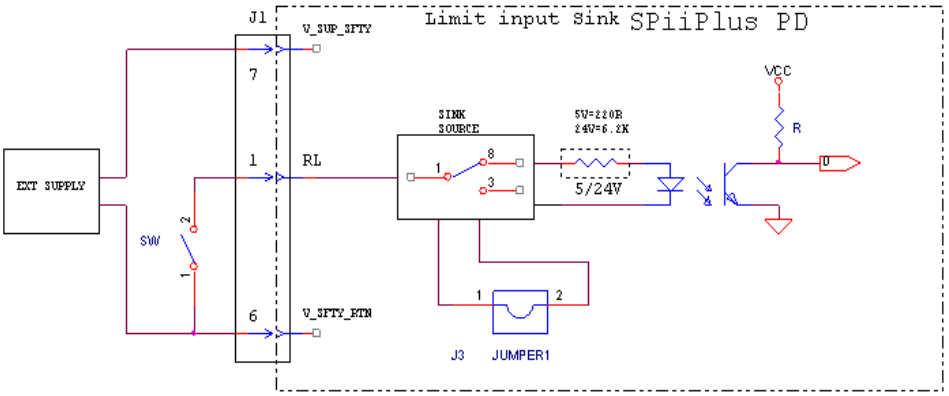


Figure 7 Safety (Limits) Input Signals Sink Mode Connectivity

3.6.6 Safety (Limits) Input Signals in Source Mode

Figure 8 depicts the connection of the Safety (Limits) input signals connectivity in source mode.

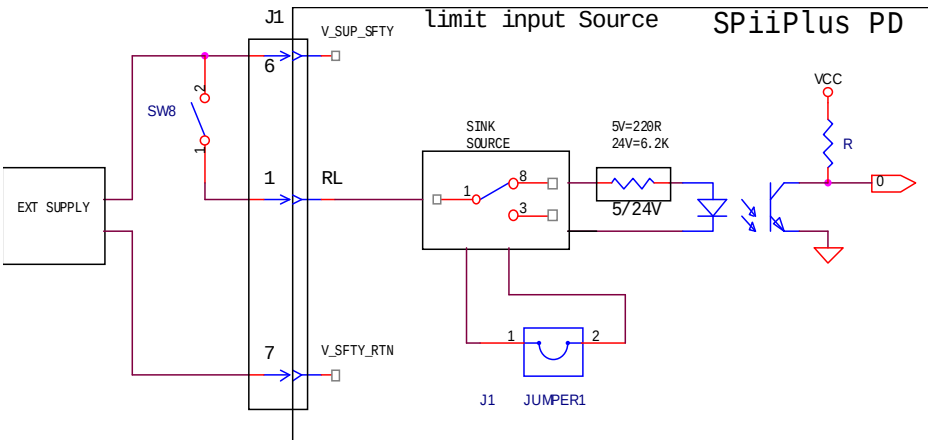


Figure 8 Safety (Limits) Input Signals in Source Mode Connectivity

3.6.7 GP Output Signal in Sink Mode

Figure 9 depicts the connection of the GP output signal connectivity in sink mode.

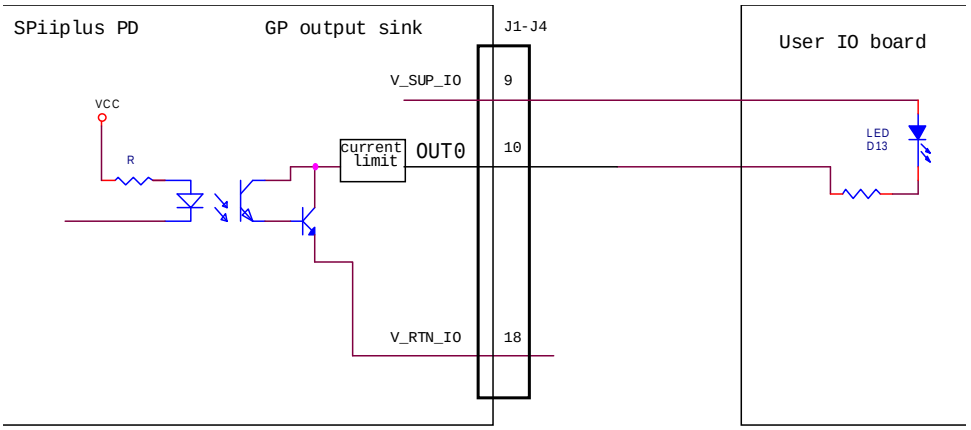


Figure 9 GP Output Signal in Sink Mode Connectivity

3.6.8 GP Output Signal in Source Mode

Figure 10 depicts the connection of the GP output signal connectivity in source mode.

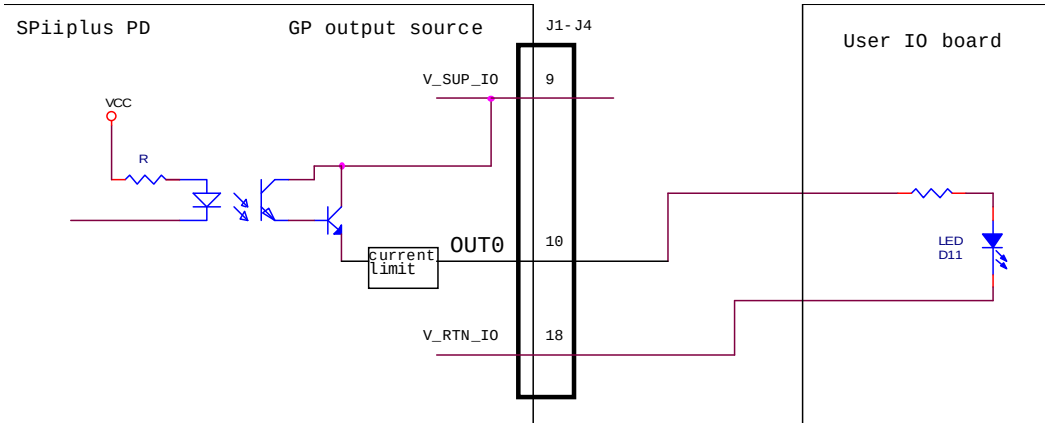


Figure 10 GP Input Signal in Source Mode Connectivity

Note	*For ease of installation, if the GP I/O and safety inputs supply is 24 V and no isolation is required between the safety, I/O and 24V control supply, then short pins number 18 to pin to 21 and 22, and make additional shorts between pins number 22 to 19 and 9. Then the external 24 V power supply for I/O and safety can be eliminated.*

3.7 Pulse/Dir Interface

Figure 11 depicts the PDMnt Pulse/Dir interface.

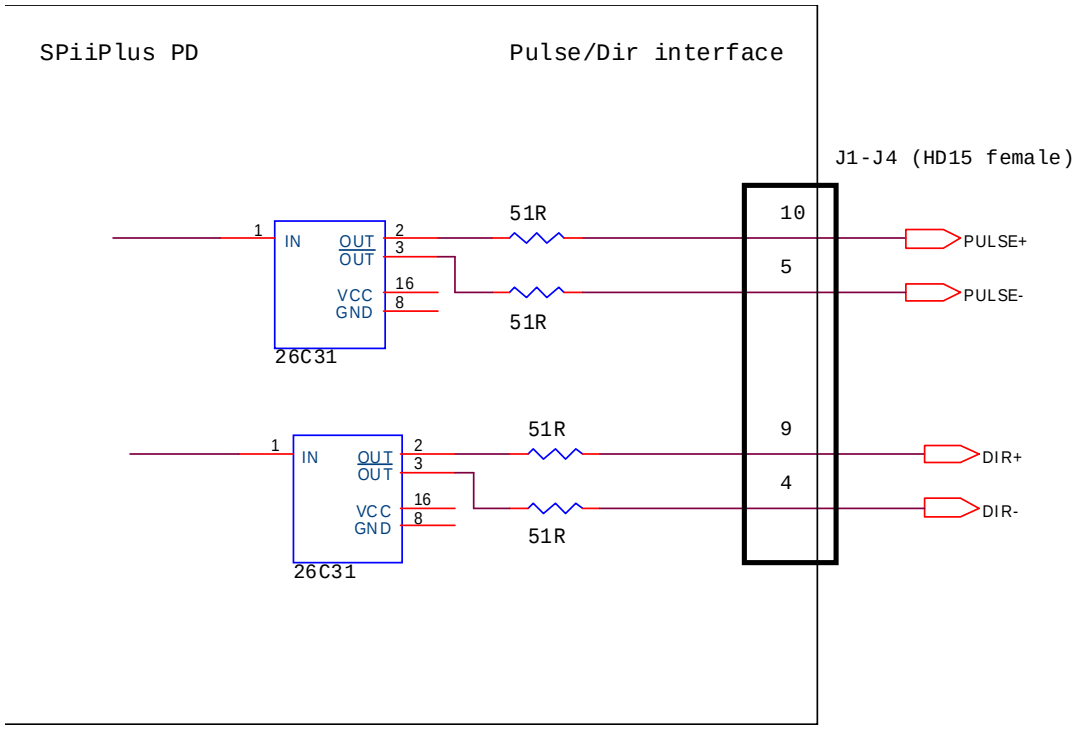


Figure 11 Pulse/Dir Interface

4 Jumpers and DIP Switches

This chapter provides details of the PDMnt jumpers and switches.

4.1 PDMnt Jumpers

The jumpers located on the PDMnt serve for setting:

- Safety inputs in sink and source configuration
- Digital outputs in sink and source configuration
- Digital inputs in sink and source configuration.

There are three jumpers as shown in **Figure 12** located between connectors J3 and J5.

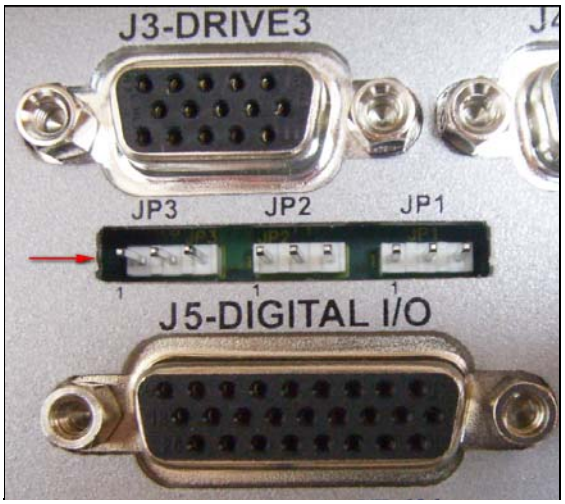


Figure 12 PDMnt Jumpers

Table 12 PDMnt Jumpers and Setting

Jumper	Function	Jumper Settings
JP1	Safety inputs in sink and source	Position 1,2 - sink Position 2,3 - source Default: sink
JP2	Digital outputs in sink and source	Position 1,2 - sink Position 2,3 - source Default: sink
JP3	Digital inputs in sink and source	Position 1,2 - sink Position 2,3 - source Default: sink

4.2 PDMnt DIP Switches

There are 6 DIP switches, numbered 1 to 6, on the card that the user can use to set the node number (binary code) of the PDMnt in the net.

The number is set by positioning the switches in either the OFF or ON position, where:

OFF - “0”

ON - “1”

Switch 1 is the LSB

The switch settings and their associated Node ID are given in **Table 13**.

Table 13 DIP Switch Settings (page 1 of 3)

DIP Switch Node ID	1	2	3	4	5	6
0	OFF	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF	OFF
5	ON	OFF	ON	OFF	OFF	OFF
6	OFF	ON	ON	OFF	OFF	OFF
7	ON	ON	ON	OFF	OFF	OFF
8	OFF	OFF	OFF	ON	OFF	OFF
9	ON	OFF	OFF	ON	OFF	OFF
10	OFF	ON	OFF	ON	OFF	OFF
11	ON	ON	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON	OFF	OFF
13	ON	OFF	ON	ON	OFF	OFF
14	OFF	ON	ON	ON	OFF	OFF
15	ON	ON	ON	ON	OFF	OFF
16	OFF	OFF	OFF	OFF	ON	OFF
17	ON	OFF	OFF	OFF	ON	OFF
18	OFF	ON	OFF	OFF	ON	OFF
19	ON	ON	OFF	OFF	ON	OFF
20	OFF	OFF	ON	OFF	ON	OFF
21	ON	OFF	ON	OFF	ON	OFF
22	OFF	ON	ON	OFF	ON	OFF
23	ON	ON	ON	OFF	ON	OFF
24	OFF	OFF	OFF	ON	ON	OFF
25	ON	OFF	OFF	ON	ON	OFF

Table 13 DIP Switch Settings (page 2 of 3)

DIP Switch Node ID	1	2	3	4	5	6
26	OFF	ON	OFF	ON	ON	OFF
27	ON	ON	OFF	ON	ON	OFF
28	OFF	OFF	ON	ON	ON	OFF
29	ON	OFF	ON	ON	ON	OFF
30	OFF	ON	ON	ON	ON	OFF
31	ON	ON	ON	ON	ON	OFF
32	OFF	OFF	OFF	OFF	OFF	ON
33	ON	OFF	OFF	OFF	OFF	ON
34	OFF	ON	OFF	OFF	OFF	ON
35	ON	ON	OFF	OFF	OFF	ON
36	OFF	OFF	ON	OFF	OFF	ON
37	ON	OFF	ON	OFF	OFF	ON
38	OFF	ON	ON	OFF	OFF	ON
39	ON	ON	ON	OFF	OFF	ON
40	OFF	OFF	OFF	ON	OFF	ON
41	ON	OFF	OFF	ON	OFF	ON
42	OFF	ON	OFF	ON	OFF	ON
43	ON	ON	OFF	ON	OFF	ON
44	OFF	OFF	ON	ON	OFF	ON
45	ON	OFF	ON	ON	OFF	ON
46	OFF	ON	ON	ON	OFF	ON
47	ON	ON	ON	ON	OFF	ON
48	OFF	OFF	OFF	OFF	ON	ON
49	ON	OFF	OFF	OFF	ON	ON
50	OFF	ON	OFF	OFF	ON	ON
51	ON	ON	OFF	OFF	ON	ON
52	OFF	OFF	ON	OFF	ON	ON
53	ON	OFF	ON	OFF	ON	ON
54	OFF	ON	ON	OFF	ON	ON
55	ON	ON	ON	OFF	ON	ON
56	OFF	OFF	OFF	ON	ON	ON
57	ON	OFF	OFF	ON	ON	ON
58	OFF	ON	OFF	ON	ON	ON
59	ON	ON	OFF	ON	ON	ON
60	OFF	OFF	ON	ON	ON	ON
61	ON	OFF	ON	ON	ON	ON

Table 13 DIP Switch Settings (page 3 of 3)

DIP Switch Node ID	1	2	3	4	5	6
62	OFF	ON	ON	ON	ON	ON
63	ON	ON	ON	ON	ON	ON

For example, if the switches are set as follows:

Switch 1 - OFF

Switch 2 - ON

Switch 3 - OFF

Switch 4 - ON

Switch 5 - OFF

Switch 6 - ON

The node number is: 101010 (or 42 in decimal).

5 LED Indicators

Figure 13 shows the location of each PDMnt LED indicator, and **Table 14** details their functions.

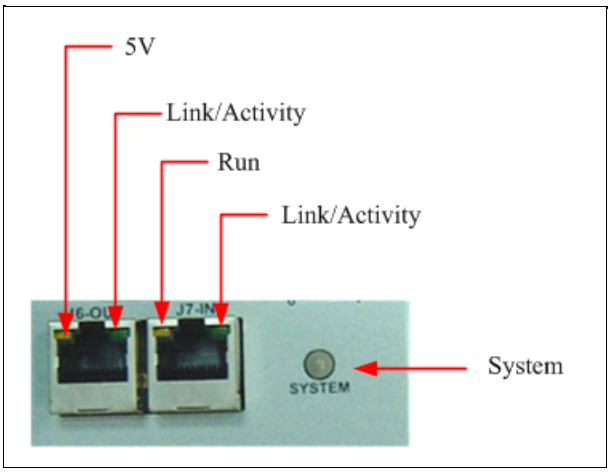
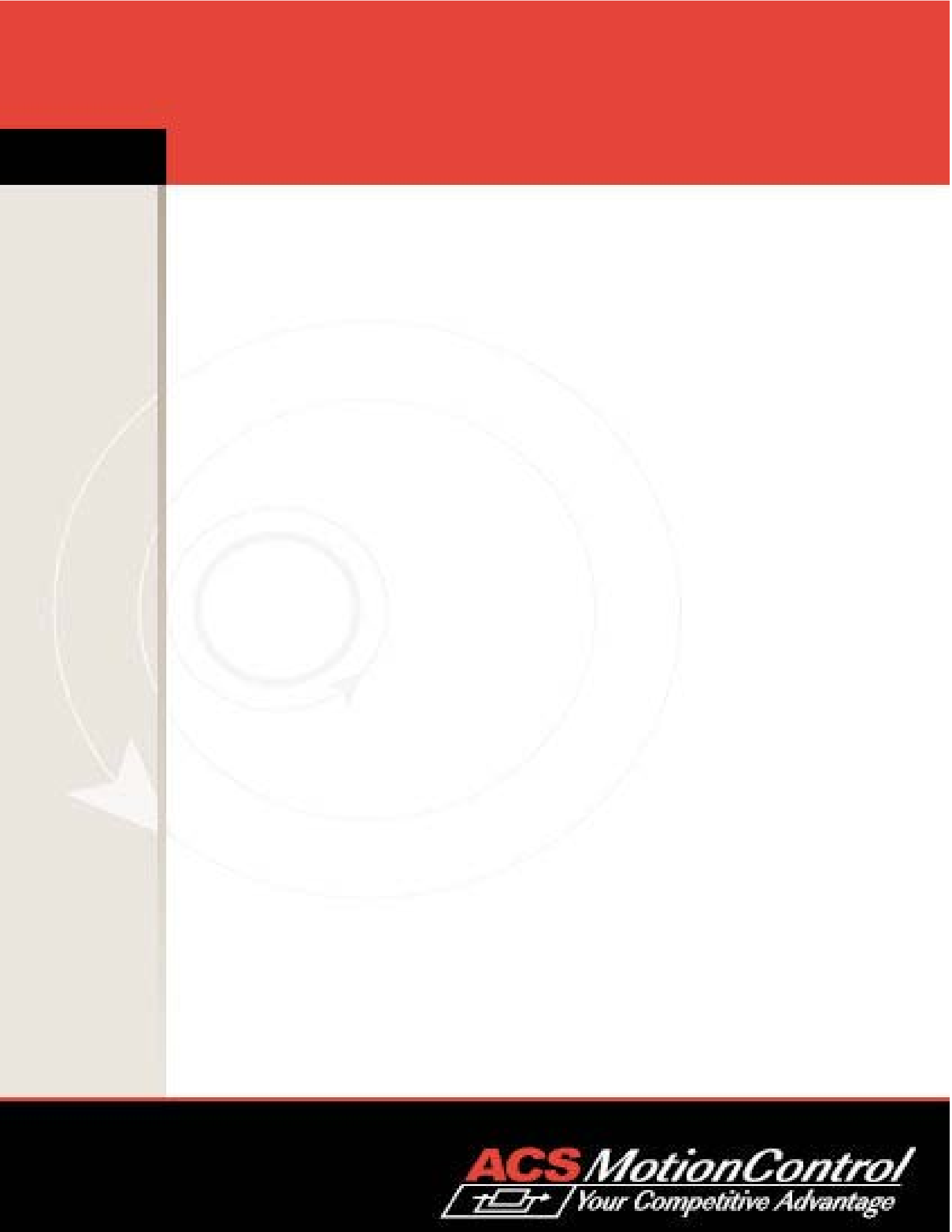


Figure 13 PDMnt LED Locations

Table 14 PDMnt LED Indicators

Designator	Description
5V	Yellow Illuminates when 5 V power supply is OK
Link/Activity	Green ❑ Off- No link ❑ Blinking -Link and activity ❑ On -Link without activity
Run	Yellow ❑ Off -The device is in the INIT state ❑ Blinking (slow) -The device is in the PRE-OPERATIONAL state ❑ Single Flash - The device is in the SAFE-OPERATIONAL state ❑ On -The device is in OPERATIONAL state ❑ Flickering (fast) -The device is in the BOOTSTRAP state
System	Bicolor ❑ Red -Communication fault (with the master) ❑ Green - Communication is OK. ❑ Blinking – SW command.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