SDMNT

Multi-Axis Step Motor EtherCAT Control Module

Hardware Guide

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ACS MOTION CONTROL

SDMnt

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Revision History

Date	Revision	Description
January 2018	2.20.20	Added product picture to title page
December 2017	2.20.10	Reformatted
January 2013	2.20	Version 2.20

Conventions Used in this Guide

Text Formats

Format	Description
Bold	Names of GUI objects or commands.
BOLD+ UPPERCASE	ACSPL+ variables and commandss
Monospace + grey background	Code example.
Italic	Names of other documents.
Blue	Web pages, and e-mail addresses.
[ ]	In GUIs indicates optional item(s)
|	In GUIs indicates either/or items

Flagged Text

	**Note** - includes additional information or programming tips.
	**Caution** - describes a condition that may result in damage to equipment.
	**Warning** - describes a condition that may result in serious bodily injury or death.
	**Model** - highlights a specification, procedure, condition, or statement that depends on the product model.
	**Advanced** - indicates a topic for advanced users.

Related Documents

Documents listed in the following table provide additional information related to this document.

The most updated version of the documents can be downloaded by authorized users from www.acsmotioncontrol.com/downloads.

Online versions for all ACS software manuals are available to authorized users at ACS Motion Control Knowledge Center.

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 .NET Library Reference	.NET Methods, Properties, and Events for Communication with the Controller
SPiiPlus MMI Application Studio User Guide	Explains how to use the SPiiPlus MMI Application Studio and associated monitoring tools
SPiiPlus Utilities User Guide	A guide for using the SPiiPlus User Mode Driver (UMD) for settingup communication with the SPiiPlus motion controller.
SPiiPlusNT/DC Hardware Guide	Technical description of the SPiiPlus NT/DC product line..
SPiiPlus PDMnt Hardware Guide	Technical description of the SPiiPlus PDMnt Network Interface.
SPiiPlus UDMnt Hardware Guide	Technical description of the SPiiPlus UDMnt Universal Drive Module.
MC4U Hardware Guide	Technical description of the MC4U Control Module integrated motion control product line.
HSSI Expansion Modules Guide	High-Speed Synchronous Serial Interface (HSSI) for expanded I/O, distributed axes, and nonstandard devices.
PEG and MARK Operations Application Notes	Provides details on using the PEG commands.

Table of Contents

1. SDMNT Control module overview

The SDMNT Multi-Axis Step Motor EtherCAT Control Module is a panel mounted, four or eight axis EtherCAT slave module designed for running step motors. It can run seven two-phase unipolar step motors and one two-phase bipolar motor.

The SDMNT Control Module is designed for slaving to any ACS Motion Control EtherCAT Master. The unit operates over a 40Vdc bus and 3A current and up to 16 micro-step resolution.

> There are two SDMNT Control Module versions: SDMnt-x-040A-003-yy - This unit is fed with 115/230 Vac nominal voltage and generates a 40 Vdc motor bus internally. The 40 Vdc is also available as an output to power other units.

> SDMnt-x-040D-003-yy - This unit is fed with 12-40 Vdc to power the motors. The unit does not have an internal 115/230 Vac to 40 Vdc supply.

where:

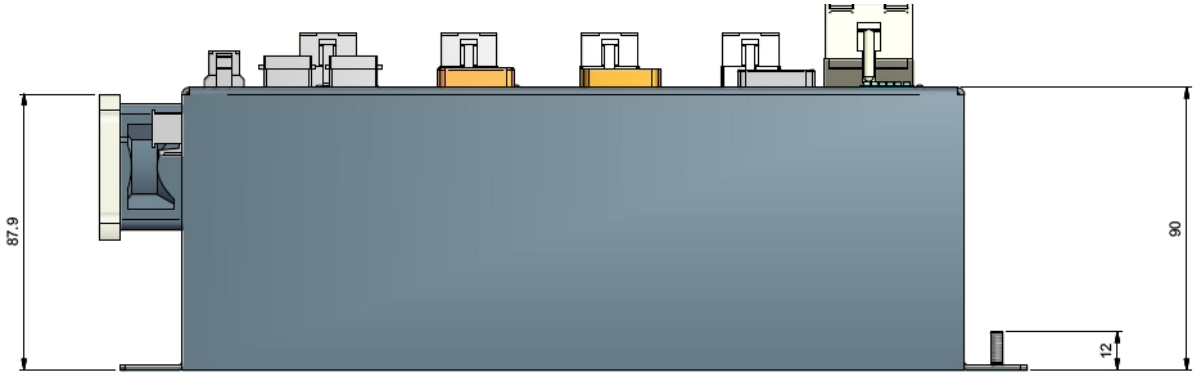
x - number of drives, 4 or 8

yy -

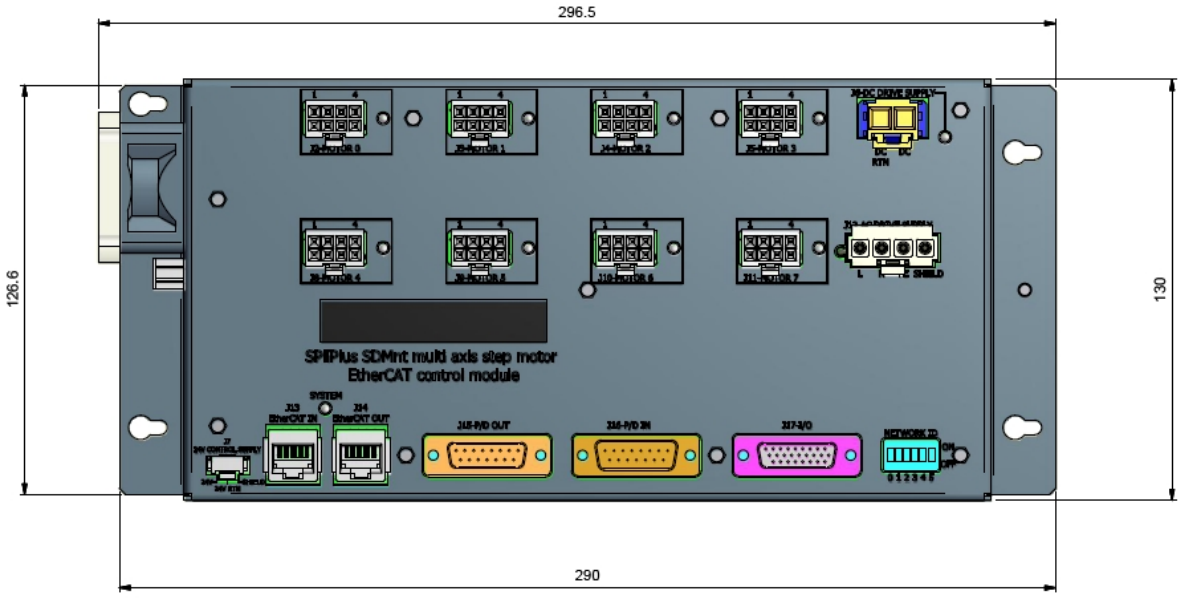
- 00 - Only for SPiiPlusNTM network
- 01 - Any EtherCAT network

1.1 Dimensions

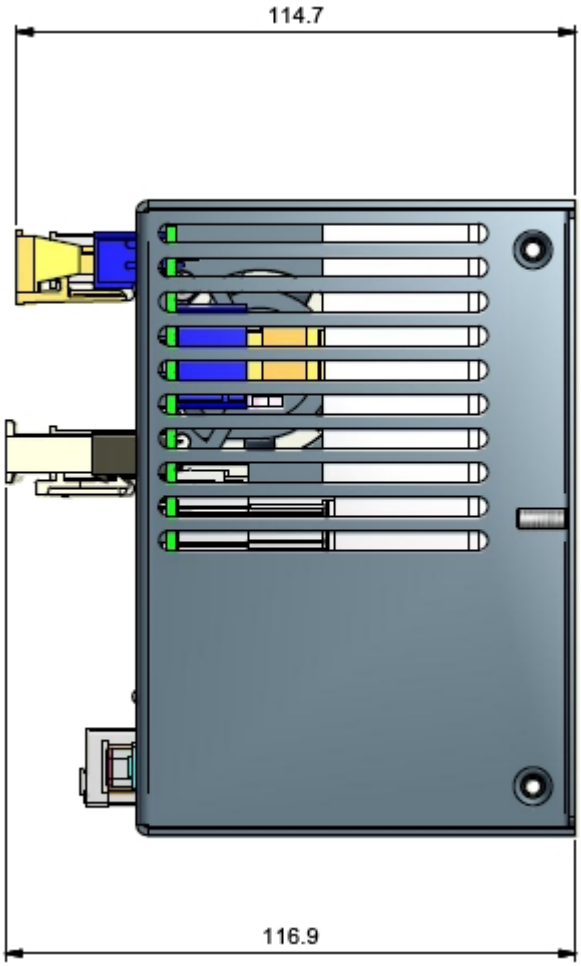
The following figures present the SDMNT Control Module physical dimensions (in mm).



Control module dimensions from the top



Control module dimensions from the front



Control module dimensions from the side

1.2 Module features

The principal features of the SDMNT Control Module product line are:

- 1 Bipolar Motor Axis
- 7 Unipolar Motor Axes
- 4 Fast Inputs
- 4 Fast Outputs
- 2 Pulse/Direction Inputs
- 2 Pulse/Direction Outputs
- 2 Opto-isolated Slow Inputs
- 2 Opto-isolated Slow Outputs
- EtherCAT Input & Output Ports
- Internal 240W AC/DC Power Supply

1.2.1 Control supply input

	Description	Remarks
Signal Designation	24V, 24V_RTN	
Quantity	1	
Input Voltage	24 Vdc ±10%	
Input Current	Maximum input current: 0.45 A @ 21.6 V	
Protection	Reverse polarity. Short current.	

When it is needed to ensure that the motors are not powered, the Drive power supply has to be removed; however, the Control supply should remain connected.

1.2.2 Drive power supply

The SDMnt Control Module module is available in two versions, one with and one without an internal drive supply. The internal supply is limited to 240 W. Using an external supply, the total power extracted from the unit is 420 W.

SDMnt-8 includes a regeneration circuit for 117W, 10 Joules,

5% duty cycle. Care should be taken to keep the motor drive voltage below 44 V under any conditions; otherwise the unit may be damaged. The motor drive voltage can be measured on connector: J6 - DC Drive Supply Input/Output.

- SDMnt-x-040A-003-yy - This unit is fed with 115/230 Vac nominal voltage and generates a 40 Vdc motor bus internally. The 40 Vdc is also available as an output to power other units.
- SDMnt-x-040D-003-yy - This unit is fed with 12-40 Vdc to power the motors, but does not include the 115/230 Vac to 40 Vdc supply.

There is no restriction of the on-off sequence main power supplies, Drive supply and Control supply (24 V).

	Description	Remarks
Signal Designation	N, L, PE	
Quantity	1	
Input Voltage	95Vac to 240Vac	Automatically selected.
Input Current	< 4 A @	

	Description	Remarks
	100 Vac	
Inrush Current <2ms	< 60 A @ 230 Vac	
Output Voltage	40 V	The 40 V is available as an output DC drive supply to feed other slave modules via connector J9 (see Motor connectors).
Output Power (with internal supply).	240 W	
Maximum Output Current	< 5A	
AC Frequency	50/60 Hz	

1.2.3 External DC drive supply input

Use of an external 12-40 Vdc power supply is available only in the SDMnt-x-040D-003-yy models. This voltage must be connected to the unit through a 16A fuse.

	Description	Remarks
Signal Designation	VP+, VP_RTN	
Quantity	1	
Input Voltage Range	12 - 40 Vdc	
Input Current	< 10.5 A	
Inrush Current < 2ms	< 130 A @ 40 Vdc	
Protection	Short Circuit: external fuse will blow Reverse Polarity: external fuse will blow	

1.2.4 Unipolar power bridge

	Description	Remarks
Signal Designation	OUTA, OUTA-, OUTB, OUTB-	Per axis
Quantity	7 (designated 1,2, 3,4,5,6,7)	
Type	Two-phase unipolar step motor. Microstepping -16 per full step. (3200 micro steps per revolution with a 1.8 step motor)	Step mode is programmable using the **SLCPRD$** variable (see Micro Stepping Configuration).
Output Current	Up to 3 A ±5% per phase	1A,1.5A,2A or 3A which is programmable using the **XCURI$** and **XCURV$** variables (see Current Amplitude Configuration).
Motor Configuration	Two-phase unipolar	
Protection	> Short Circuit: 4.5 A ±5% (for recovery after short, 24V logic supply should be switched off/on) > Over Temperature: 80°C (on the transistor case. For recovery disable/enable the axis) > Over Voltage: 44 V ±3%) for recovery disable/enable the axis) > Under Voltage: 10 V ±3% (for recovery disable/enable the axis)	

1.2.5 Power bridge bipolar

	Description	Remarks
Signal Designation	OUT0A, OUT0A-,	The bipolar axis is axis number 0

	Description	Remarks
	OUT0B, OUT0B-	
Quantity	1 (designated 0)	
Type	Two-phase bipolar step motor. Microstepping -16 per full step. (3200 micro steps per revolution with a 1.8 step motor)	Does not support eighths step mode.
Output Current	Up to 3 A ±5% per phase	1A,1.5A,2A or 3A which is programmable using the **XCURI$** and **XCURV$** variables (see Current Amplitude Configuration).
Motor Configuration	Two-phase bipolar	
Minimum Motor Inductance	> 7.5 mH @ 40 V	
Protection	> Short Circuit: 6A±5% (for recovery disable/enable the axis) > Over Temperature: 80°C (on the transistor case. for recovery disable/enable the axis) > Over Voltage: 44 V ±3% (for recovery disable/enable the axis) > Under Voltage: 10 V ±3% (for recovery disable/enable the axis)	

1.2.6 Fast input

	Description	Remarks
Signal Designation	FIN2 - FIN5+, FIN2 - FIN5-	

	Description	Remarks
Quantity	4 pairs	
Type	Differential RS422	
Default State	V < 0.2V input = not defined	

1.2.7 Fast output

	Description	Remarks
Signal Designation	FOUT2 - FOUT5+, FOUT2 - FOUT5-	
Quantity	4 pairs	
Type	Differential RS422	
Default State	Output = '0'	

1.2.8 Pulse/Dir Input

	Description	Remarks
Signal Designation	PULSE_I_0+, PULSE_I_1+, DIR_I_0+, DIR_I_1+	Can be read by the **F2*** variables (**F2POS** or **F2VEL** - see *SPiiPlus Command & Variable Reference Guide*).
Quantity	2 pairs for Pulse, and 2 pairs for Direction	
Type	Differential RS422	
Default State	Pulse < 0.2 V, no counting	

1.2.9 Pulse/Dir Output

	Description	Remarks
Signal Designation	PULSE_O_0+, PULSE_O_1+, DIR_O_0+, DIR_O_1+	Can be any one out of eight axes, programmable using **SLPROUT0** and **SLPROUT1** (see *SPiiPlus Command & Variable Reference Guide*).

	Description	Remarks
Quantity	2 pairs for Pulse, and 2 pairs for Direction	
Type	Differential RS422	
Default State	Pulse ='1' Dir ='0'	

1.2.10 General_purpose_inputs

	Description	Remarks
Signal Designation	IN0+, IN0and IN1+, IN1-	
Quantity	2	
Type	24 Vdc +20%, Opto-isolated, floating cathode and anode (two pins).	Can be used as drive fault input from an external drive or as E-stop.
Input Current	< 15 mA	
Default State	No current, input = off	

1.2.11 General purpose outputs

	Description	Remarks
Signal Designation	OUT0+, OUT0and OUT1+, OUT1-	
Quantity	2	
Type	24 Vdc +20%, Opto-isolated, floating cathode and anode (two pins).	Can be used as an enable signal for external drives.
Output Current	< 50 mA	

	Description	Remarks
Maximum Drop Output	< 1.7 V @ 50 mA	
Default State	No current, output = off	

1.2.12 EtherCAT port

	Description	Remarks
Signal Designation	Transmit: ETH#_TX± Receive: ETH#_RX±	
Quantity	2	
Type	EtherCAT protocol	
Speed	100 Mbps	

1.3 Cooling fan

The SDMNT Multi-Axis Step Motor EtherCAT Control Module unit can simultaneously drive all axes at 1A without a cooling fan. However if more than 1A is required for all axes, or 3A for three axes and above, a cooling fan with a minimum 15 CFM must be added. If needed, a cooling fan, P/N FA-1608K-100/LF, may be ordered from ACS Motion Control. In any case, the maximum input power cannot be more than 420W.

1.4 EtherCAT network cable limitation

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

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

1.5 EMC

With the installation of a ferrite ring (Ferroxcube MNF P/N T36/23/15-3C81) motor filter with 7 windings of the motor wire between the SDMNT Control Module drive connector and the motor the unit complies with the following standards:

- EN 61326:2002
- SEMI F47-0200

1.6 Safety

The SDMNTControl Module complies with the IEC 61010-1:01 standard.

1.7 Environmental temperatures

The SDMNT Control Module is designed for the following temperatures:

- Operating temperatures range: 0° to +40°C
- Storage and transport temperature range: -25° to +60°C

1.8 Ordering options

Below are the ordering options for the SDMNT Control Module product line. The SDMNT Control Module ordering code elements are:

SPiiPlus SDMnt - Drive# - 040[A|D] - 003 - [Slave]

These elements and options are described below.

Element and Descrption	Options
SDMNT - Product Name	SDMNT Control Module
Drive# - the number of integrated step drives	Where Drive# can be: 4 - for four drives 8 - for eight drives
040[A|D] - input bus voltage supply, up to 40 Vdc	A - for 110 Vac/220 Vac input voltage (internal power supply included) D - for DC input voltage (internal power supply is not included)
003 - Current level of the integrated drives, 3 A	
Slave - slave option	Where Slave can be: 00 - slave to SPiiPlusNTM network controller 01- slave to MC4Unt Control Module

2. Safety and EMC Guidelines

2.1 General safety guidelines

Read and understand the following precautions before operating the SDMNT Control Module!

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 disconnect device

The SDMNT Control Module is permanently connected. This being the case, a switch or circuit breaker that disconnects all current-carrying conductors must be included during installation at the site.

The disconnecting device must meet the requirements of IEC60947-1 or IEC60947-3 and the current rating must be not more than 6A.

The device shall be in close proximity to the equipment and within easy reach of the operator and shall be clearly marked as the disconnecting device for the SDMNT Control Module.

A power cord with conductor area of not less than 0.75mm^2, with a voltage rating of not less than 300V, rated to 105ºC or more, and complying with IEC60227 or IEC60245 must be used for the AC drive supply input. Only the Green –Yellow wire of the cable is to be used for connection to the protective conductor terminal.

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

2.1.2 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.

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).

3. Electrical_Interfaces

3.1 Motor connectors

Label:

DRIVE1 J2 - MOTOR 0

DRIVE2 J3 - MOTOR 1

DRIVE3 J4 - MOTOR 2

DRIVE4 J5 - MOTOR 3

DRIVE2 J8 - MOTOR 4

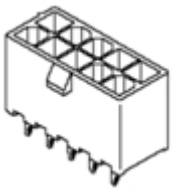
DRIVE3 J9 - MOTOR 5

DRIVE4 J10 - MOTOR 6

DRIVE2 J11 - MOTOR 7

Connector Type: 8-pin Molex 5566-08A-210 (0039288080)

Mating Type: Molex 5557-08R



The cable connecting the motor to the DRIVE connector must not be more than 3 meters in length; otherwise damage could occur to the unit.

Motor connector pinout

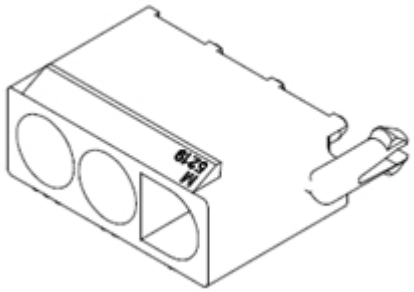
Pin	Name	Description
1	OUTA+	Motor phase A+
2	OUTB+	Motor phase B+
3	COMMON_VP_A	DC Bus voltage common phase A (not applicable for bipolar axis)
4	EGND	Electrical ground/shield
5	OUTA-	Motor phase A-
6	OUTB-	Motor phase B-
7	COMMON_VP_B	DC Bus voltage common phase B (not applicable for bipolar axis)
8	EGND	Electrical ground/shield

3.2 J12 - AC Drive Supply Input

Label: 12 AC DRIVE SUPPLY (INPUT)

Connector Type: 4-pin Molex (p/n 5219-04A-201)

Mating Type: Molex p/n 0019091046



J12 - AC Drive Supply Input Connector Pinout

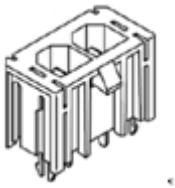
Pin	Name	Description
1	L	AC phase input
2	N	AC neutral input
3	PE	Electrical ground/PE
4	Shield	Shield

3.3 J6 - DC Drive Supply Input/Output

Label: J6 DC Drive SUPPLY (INPUT/OUTPUT)

Connector Type: 2-pin Molex p/n 0431600102

Mating Type: Molex p/n 0444412002



J6 - DC Drive Supply Input/Output Connector Pinout

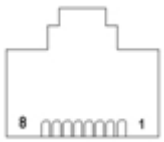
Pin	Name	Description
1	VP+	DC drive supply output (input when no internal 40 V power supply exists)
2	VP_RTN	DC drive supply return

3.4 J13 - Ethernet Input Connector

Label: J13 ETHERNET INPUT

Connector Type: RJ45 CAT5

Mating Type: Ethernet plug



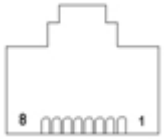
Pin	Name	Description
1	TD+	Positive transmit signal
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	NC	Not connected
5	NC	Not connected
6	RD-	Negative receive signal
7	NC	Not connected
8	NC	Not connected

3.5 J14 - Ethernet Output Connector

Label: J14 ETHERNET OUTPUT

Connector Type: RJ45 CAT5

Mating Type: Ethernet plug

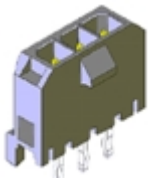


Pin	Name	Description
1	TD+	Positive transmit signal
2	TD-	Negative transmit signal
3	RD+	Positive receive signal
4	NC	Not connected
5	NC	Not connected
6	RD-	Negative receive signal
7	NC	Not connected
8	NC	Not connected

3.6 J7 - 24 Volt Control Supply

Connector Type: 3-pin Molex p/n 0436500315

Mating Type: Molex p/n 0436450300

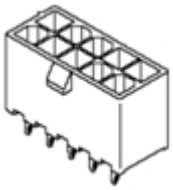


Pin	Name	Description
1	24V	24V control supply
2	24V_RTN	24V control supply return
3	PE	Electrical ground/PE

3.7 J1 - 24V FAN

Connector Type: 4-pin Molex p/n 0039288040

Mating Type: Molex p/n 0039012045



Pin	Name	Description
1	24V	24V control supply
2	24V_RTN	24V control supply return
3	FAN FAULT	Fan Input fault (0= fault)
4	NC	Not Connected

3.8 J17 - Input/Output

Connector Type: DB26 high density female

Mating Type: DB26 high density male

Pin	Name	Description
1	FIN2+	Fast input 0 non-inverted
2	FIN3+	Fast input 1 non-inverted
3	FIN4+	Fast input 2 non-inverted
4	FIN5+	Fast input 3 non-inverted
5	FOUT2+	Fast output 0 non inverted
6	FOUT3+	Fast output 1 non inverted
7	IN0+	Digital input 0 non inverted
8	IN1+	Digital input 1 non inverted
9	OUT0+	Digital output 0 non inverted
10	FIN2-	Fast input 0 inverted
11	FIN3-	Fast input 1 inverted
12	FIN4-	Fast input 2 inverted
13	FIN5-	Fast input 3 inverted
14	FOUT2-	Fast output 0 inverted
15	FOUT3-	Fast output 1 inverted
16	IN0-	Digital input 0 inverted
17	IN1-	Digital input 1 inverted
18	OUT0-	Digital output 0 inverted
19	FOUT4+	Fast output 2 non inverted
20	FOUT4-	Fast output 2 inverted
21	FOUT5-	Fast output 3 non inverted
22	FOUT5-	Fast output 3 inverted
23	DGND	Digital ground
24	DGND	Digital ground
25	OUT1+	Digital output 1 non inverted
26	OUT1-	Digital output 1 inverted

With the SDMNT installed in a network, the user can obtain the exact mapping of the ACSPL+ **IN** and **OUT** variables to the connector pins for each device 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)
IN0.0	00000000 (DIP=0) (ID=0)	J8(IN0)
IN0.1	00000000 (DIP=0) (ID=0)	J8(IN1)
IN0.2	00000000 (DIP=0) (ID=0)	J8(IN2)
IN0.3	00000000 (DIP=0) (ID=0)	J8(IN3)
IN0.4	00000000 (DIP=0) (ID=0)	J8(IN4)

3.9 J16 - Pulse Direction/Input

Connector Type: 15-pin male

DB Mating Type: 15-pin female DB

Pin	Name	Description
1	NC	Not Connected
2	DGND	Digital ground
3	NC	Not Connected
4	DIR_I_1+	Dir input 1 non inverted
5	DIR_I_0+	Dir input 0 non inverted
6	NC	Not Connected
7	PULSE_I_1+	Pulse input 1 non inverted

Pin	Name	Description
8	PULSE_I_0+	Pulse input 0 non inverted
9	NC	Not Connected
10	NC	Not Connected
11	DIR_I_1-	Dir input 1 inverted
12	DIR_I_0-	Dir input 0 inverted
13	NC	Not Connected
14	PULSE_I_1-	Pulse input 1 inverted
15	PULSE_I_0-	Pulse input 0 inverted

3.10 J15 - PULSE DIR OUTPUT

Connector Type: 15-pin female

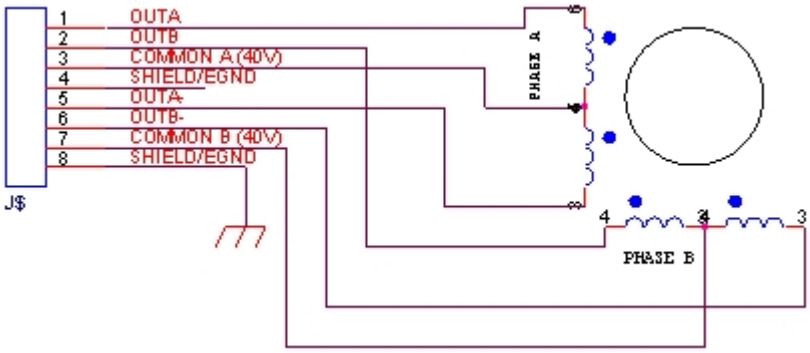
DB Mating Type: 15-pin male DB

Pin	Name	Description
1	PULSE_O_0+	Pulse output 0 non inverted
2	PULSE_O_1+	Pulse output 1 non inverted
3	NC	Not Connected
4	DIR_O_0+	Dir output 0 non inverted
5	DIR_O_1+	Dir output 1 non inverted
6	NC	Not Connected
7	DGND	Digital Ground
8	NC	Not Connected
9	PULSE_O_0-	Pulse output 0 inverted
10	PULSE_O_1-	Pulse output 1 inverted
11	NC	Not Connected
12	DIR_O_0-	Dir output 0 inverted
13	DIR_O_1-	Dir output 1 inverted
14	NC	Not Connected

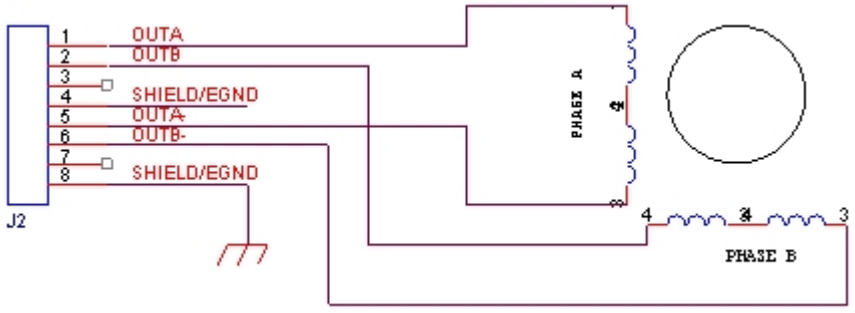
Pin	Name	Description
15	NC	Not Connected

3.11 Control module motor connectivity

3.11.1 Two-Phase Unipolar Step Motor



3.11.2 Two-Phase Bipolar Step Motor



4. LED Indicators

Designator	Desxription	Remark
24V	Yellow > Off - Logic supply is not functioning. > On - Power supply is ok.	Located on connector J14
Link/Activity	Green > Off- No link Blinking -Link and activity > On -Link without activity	One located on connector J13 and one located on connector J14
Run	Yellow > Off -The device is in the INIT state > Blinking (slow) -The device is in the PREOPERATIONAL 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	Located on connector J13
System	Bicolor > Red -Communication fault (with the master) > Green - Communication is OK. > Blinking – SW command.	
Axis	Bicolor > Off - Axis is disabled > Green - Axis is enabled > Red - Axis fault	One per axis
DC drive supply	Green > On - 40V bus voltage	

Designator	Desxription	Remark
	exists > Off- No 40V bus voltage exists	

5. Troubleshooting

5.1 Diagnosing Faults

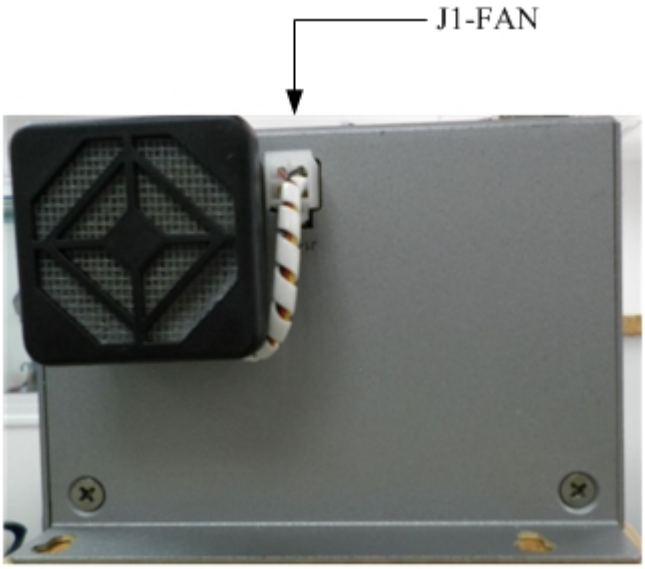
During SDMNT Control Module operation, it is strongly recommended employing the SPiiPlus MMI Application Studio **Variables Manager Watch Mode** (see the *SPiiPlus MMI Application Studio User Guide*) to monitor the **FAULT** variable, in particular bits 4 (**#HOT**) and 9 (**#DRIVE**).

5.2 Cooling Fan (Motor Overheat)

If the SDMNT Control Module is fitted with a cooling fan (P/N FA-1608K-100/LF) and the Motor Overheat fault keeps appearing, it means that there is a problem with the cooling fan.

If the SDMNT Control Module has been purchased without a cooling fan, **FAULT.#HOT** may always be active.

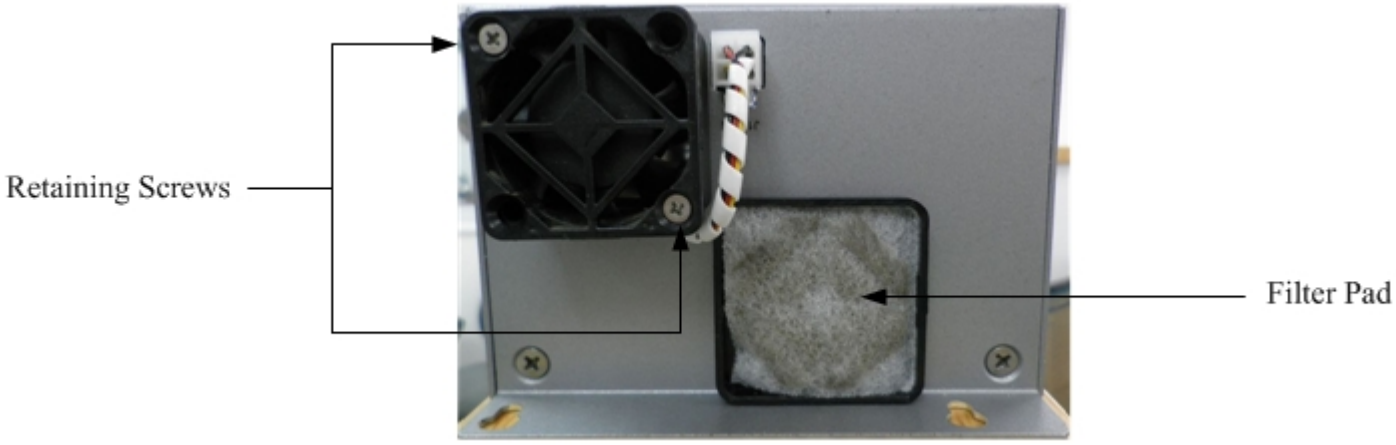
The cooling fan is installed on the left side of the SDMNT Control Module and connected to **J1-FAN** as shown.



If the Motor Overheat fault appears, it can be caused either by the filter being blocked or the fan being faulty.

1. Disconnect all the SDMNT Control Module connectors.
2. Remove the cap of the fan and check the filter pad (see below).
   - If it is dirty, either clean it or replace it.
   - Replace the cap on the cooling fan.
   - Reconnect all connections to the SDMNT Control Module.

If Motor Overheat fault is no longer present, the problem is solved - exit the procedure.



3. If the filter pad is not dirty:
   - Disconnect the cooling fan from J1-FAN.
   - Remove the two retaining screws .
   - Replace the cooling fan with a new fan and secure it with the retaining screws.
   - Replace the cooling fan cap and reconnect all the SDMNT Control Module connections.

5.3 Drive Alarm

A Drive Alarm can be triggered either because communication with the master is lost or the SDMNT Control Module is faulty.

If the SDMNT Control Module goes into the Alarm state, the following occurs:

> System and Axes LEDs are red
> Pulse signal goes to default level (high)
> I/O goes to default (off, no current)
> Drive Enable goes to default state (disable)
> The Drive Alarm fault is displayed in the Watch window

To attempt recovery from the Alarm state:

1. First check that the net master is operating, if not, try resetting the master.
2. If the SDMNT Control Module exits the Alarm state, the problem is solved. If the master is operating, check all the connections to the SDMNT Control Module. If they are not correctly connected, reseat the connections and then:
   - Disconnect the 24 Vpower from
   - J7. Reconnect the 24 V power. If SDMNT Control Module exits the Alarm state, the problem is solved.
3. If none of the above works, replace the SDMNT Control Module.

6. Unipolar motor selection

The following formula is employed when calculating the minimum continuous inductance required by a unipolar step motor:

$$I_{cont\_min} = \frac{V_{BB}}{R_{total}} \left(\frac{T_{off}}{e^{\tau}} - 1 \right)$$

where

V_{BB} - the main power supply

R_{total} - the total equivalent driver and motor resistance, where:

R_{total} =

R_m (the motor phase resistance) +

0.33Ω (the power MOSFET ON resistance) +

0.16Ω (the internal current sensing resistor)

τ - the driver and motor equivalent time constant, where:

τ = [the motor phase inductance]/R_{total}

Values of T_{off} are given in the table below.

Driver Step Sequencing	Minimum Step Phase Current [Istep_min, for 3A]	PWM Off Time [T_{off}, µs]
Full step	3	12
Half step	2.12	12
Quarter step	1.15	9
Eighth step	0.59	7
Sixteenth step	0.29	7

For continuous operation the **Icont_min** value should be equal to or less than **Istep_min**.

7. Control Module Configuration

7.1 P/D Inputs and Outputs

The SDMNT Control Module provides two pairs of P/D (Pulse and Direction signals) inputs that can receive pulses from another SDMNT Control Module or any other P/D generator device. The SDMNT Control Module counters tracks the pulses, received from P/D inputs, and transfers counter value to the master controller as position feedback. The position values are reflected by **F2POS** variable, calculated velocity values are reflected by **F2VEL** variable. The variable index can be i or i+1, where i is an index of the first axis (axis #0) handled by the specific SDMNT Control Module. The index i corresponds to P/D input 0, i+1 corresponds to P/D input 1.

The SDMNTt Control Module also provides two pairs of P/D outputs that can generate the same pulses that are actually transferred to one of the 8 step axis. The pulses for the step axes are generated by the master controller and transferred over the network. The selection of each pulse that should be transferred to P/D outputs is done by the **SLPROUT** variable:

SLPROUT(i) = Axis or SLPROUT(i+1) = Axis, where i is an index of the first axis (axis #0) handled by the specific SDMNT Control Module.

Axis is a relative number which can be between 0 to 7.

The index i defines P/D output 0, i+1 defines P/D output 1. SLPROUT(i) = 15 switches output pulses off.

This feature enables achieving a strict synchronization between two or several SDMNT Control Modules, by using pulse from one SDMNT Control Module as master position and sending to another SDMNT Control Module (slave axis).

Default for **SLPROUT** variables is 0.

7.2 Micro Stepping Configuration

The SDMNT Control Module allows defining the number of micro steps: 2, 4, 8, 16. The micro steps are configured through the **SLCPRD** variable.

For SDMNT Control Module channel 0 the values are:

SLCPRD(i)	Step Mode	Micro Steps
100..199	0	Full Step (70% current)
200	0	Full Step (70% current)
201..399	1	Half Step
400..799	2	Quarter Step
800..1599	3	Quarter Step
>1600	4	Sixteenth Step

Where i is an index of the first axis (axis #0) handled by the specific SDMNT Control Module.

For SDMNT Control Module channels 1-7:

SLCPRD(i)	Step Mode	Micro Steps
100..199	0	Full Step (70% current)
200	1	Full Step (100% current)
201..399	2	Half Step
400..799	4	Quarter Step
800..1599	5	Eighth Step
>1600	5	Sixteenth Step

The default **SLCPRD** value sets step mode to 6 and micro steps to 16.

7.3 Current Amplitude Configuration

The SDMNT Control Module allows defining maximum current amplitudes of: 1A, 1.5A, 2A, 3A. The current levels are configured by the **XCURI, XCURV** variables as follows:

XCURI(i), XCURV(i)	30%	50%	70%	100%
Motor output maximal current (A)	1	1.5	2	3

The default **XCURI/XCURV** values set the current to 1.5A at standstill and 3A when moving.

7.4 Decay Mode Configuration

The SDMNT Control Module allows defining a Decay Mode.

Decay Mode only affects the first SDMNT Control Module axis.

The Decay Mode is configured by the **XRMS** variable as follows:

XRMS(i)	0%	<8%	<26%	<26%
Percentage of Fast decay(A)	0% (Slow Decay)	8% (7 cycles)	26% (23 cycles)	100% (Fast Decay)

The default **XRM** value sets decay to fast. When the motion is at standstill, the decay is always set to slow.

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