YASKAWA
A World of Automation Solutions™

SMC–4000 Installation Guide

Upon receipt of the product and prior to initial operation, read these instructions thoroughly and retain for future reference.

⚠ WARNING

YASKAWA manufactures component parts that can be used in a wide variety of industrial applications. The selection and application of YASKAWA products remain the responsibility of the equipment designer or end user. YASKAWA accepts no responsibility for the way its products may be incorporated into the final system design.

Under no circumstances should any YASKAWA product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically under all circumstances. All products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. Any warnings provided by Yaskawa must be promptly provided to the end user.

YASKAWA offers an express warranty only as to the quality of its products in conforming to standards and specifications published in YASKAWA'S manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. YASKAWA assumes no liability for any personal injury, property damage, losses or claims arising from misapplication of its products.

Introduction

The SMC–4000 is a multi-axis Ethernet motion controller designed for use with Yaskawa's SIGMA series and LEGEND Digital Torque Amplifier.

It provides a structured text programming environment and the ability to perform many modes of motion including camming, gearing, and contouring. High speed product registration is also available as a standard feature.

Additionally, the Ethernet function allows multiple devices to communicate with the controller using a TELNET or MODBUS protocol.

Part Numbers

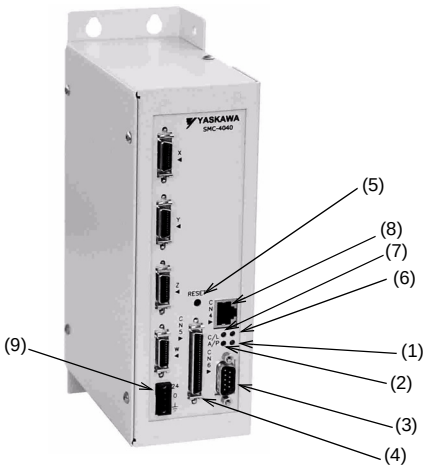
		Description	Part Number
Controller	a)	Two axis motion controller	SMC4020
		Two axis motion controller w/ absolute encoder option	SMC4020W
		Four axis motion controller	SMC4040
		Four axis motion controller w/ absolute encoder option	SMC4040W
Encoder Cables	b)	Pigtail (5 feet)	SMCCBL005
		Pigtail (10 feet)	SMCCBL010
		Pigtail (15 feet)	SMCCBL015
		Prewired for SGD, SGDA, or SGDG (2 feet)	SMCCBL102
		Prewired for SGD, SGDA, or SGDG (5 feet)	SMCCBL105
		Prewired for SGD, SGDA, or SGDG (10 feet)	SMCCBL110
		Prewired for SGD, SGDA, or SGDG (15 feet)	SMCCBL115
		Prewired for SGDB or SGDH (2 feet)	SMCCBL202
		Prewired for SGDB or SGDH (5 feet)	SMCCBL205
		Prewired for SGDB or SGDH (10 feet)	SMCCBL210
		Prewired for SGDB or SGDH (15 feet)	SMCCBL215
		Prewired for SGDB or SGDH (2 feet) Includes Alarm & Reset	SMCCBLH02
		Prewired for SGDB or SGDH (5 feet) Includes Alarm & Reset	SMCCBLH05
		Prewired for SGDB or SGDH (10 feet) Includes Alarm & Reset	SMCCBLH10
		Prewired for SGDB or SGDH (15 feet) Includes Alarm & Reset	SMCCBLH15
		Prewired for SGD, SGDA, or SGDG (2 feet) with additional pigtail	SMCCBLA02
		Prewired for SGD, SGDA, or SGDG (5 feet) with additional pigtail	SMCCBLA05
		Prewired for SGD, SGDA, or SGDG (10 feet) with additional pigtail	SMCCBLA10
		Prewired for SGD, SGDA, or SGDG (15 feet) with additional pigtail	SMCCBLA15
		Prewired for SGDB or SGDH (2 feet) with additional pigtail	SMCCBLB02
		Prewired for SGDB or SGDH (5 feet) with additional pigtail	SMCCBLB05
		Prewired for SGDB or SGDH (10 feet) with additional pigtail	SMCCBLB10
		Prewired for SGDB or SGDH (15 feet) with additional pigtail	SMCCBLB15

		Description	Part Number
I/O	c)	1.0m pigtail cable	JZSP-CKIO1-1(A)
		2.0m pigtail cable	JZSP-CKIO1-2(A)
		3.0m pigtail cable	JZSP-CKIO1-3(A)
		1.0m cable with OMRON terminal block	JUSP TA50P
		0.5m 50 pin I/O cable to DSUB	JZSP-CKIOD-D50
		1.0m 50 pin I/O cable to DSUB	JZSP-CKIOD-01
		2.0m 50 pin I/O cable to DSUB	JZSP-CKIOD-02
		CN5 Connector Kit (same as SGDH 1CN kit)	JZSP-CKI9
Serial	d)	2.0m CN6 serial port cable (included with YTerm software)	SMCCBL7
Software	e)	YTerm Integrated Development Environment	SMCGUI1
		SMCComm serial & ethernet driver for application development for all SMC products	SMCOCX1
Other	f)	Replacement power supply connector	UFS-0118

Start-up

Front Panel Descriptio

No.	Name	Description
(1)	Power ON	A green LED that indicates power is being applied to the SMC–4000.
(2)	Alarm/ Error	A red LED that will flash ON at power up and stay lit for approximately 2 seconds. After power up, the LED will illuminate for the following reasons: • An axis has a position error greater than the error limit. The error limit is set by using the ER command. • The reset input on the controller is held low or is being affected by noise. • There is a failure in the controller and the processor is resetting itself. • There is a failure in the output IC which drives the error signal.
(3)	CN6	9 pin male D-Sub serial port connector
(4)	CN5	3M 50 pin high density I/O connector
(5)	RST	Reset button. Causes the controller to reboot, and load the application program and parameters from flash. If the program contains an #AUTO label, it will automatically execute.
(6)	Ethernet status	A green LED that is lit when there is an Ethernet connection to the controller. This LED indicates physical connection, not active communication.
(7)	Ethernet status	The yellow LED indicates traffic across the Ethernet connection. This LED will show both transmit and receive activity across the connection. If there is no Ethernet connection or IP address assigned, the LED will flash at regular intervals to show that the BOOTP packets are being broadcast.
(8)	CN4	10 BaseT Ethernet RJ45 Connector
(9)		Power Connector (+24VDC, 0VDC, FG⏚)



Axis Connector (20–pin)

SMC Axis Connector			SGDH CN1
PIN	SIGNAL	Reference	Pin
1	PA	input	33
2	/PA	input	34
3	PB	input	35
4	/PB	input	36
5	PC	input	19
6	/PC	input	20
7	Motor Command	output	9
8	+5 / +12 / -12 Common	output	10
9	+5 / +12 / -12 Common	output	2
10	+5 / +12 / -12 Common	output	6
11	Amplifier Enable	output	40
12	Step	output	11
13	Sen/Dir	output	4
14	+5 / +12 / -12 Common	output	1
15	Alarm +	input	31
16	Reset	output	44
17	ALM -	input	32
18	n/c		
19	+24 VDC	output	47
20	n/c		

I/O Connections (50-pin CN5)

SMC Output Connector CN5	
PIN (Numerical Order)	SIGNAL
1	Home W
2	Home Z
3	Home Y
4	Home X
5	Input 1
6	Input 4
7	Input 7
8	Output 3
9	Output 5
10	Output 8
11	X Aux Encoder A+
12	X Aux Encoder B-
13	Y Aux Encoder B+
14	Reverse Limit W
15	Reverse Limit Z
16	Reverse Limit Y
17	Reverse Limit X
18	Input 2
19	Input 5
20	Input 8
21	Output 2
22	Output 7
23	X Aux Encoder A-
24	Y Aux Encoder A+
25	Y Aux Encoder B-
26	Reset
27	Forward Limit W
28	Forward Limit Z
29	Forward Limit Y
30	Forward Limit X
31	Input 3
32	Input 6
33	Abort
34	Output 1
35	Output 4
36	Output 6
37	X Aux Encoder B+
38	Y Aux Encoder A-
39	E-Stop1

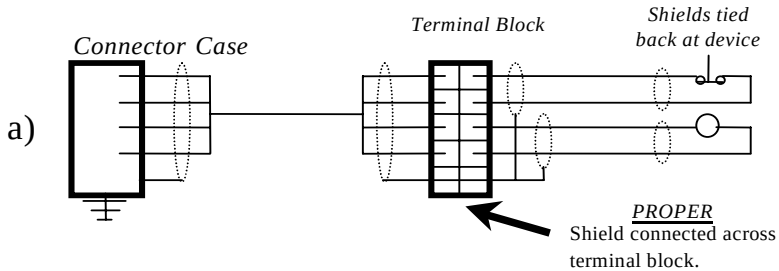
SMC Output Connector CN5	
SIGNAL (Alphabetical Order)	PIN
Abort	33
E-Stop1	39
E-Stop2	40
Forward Limit W	27
Forward Limit X	30
Forward Limit Y	29
Forward Limit Z	28
Home W	1
Home X	4
Home Y	3
Home Z	2
Input 1	5
Input 2	18
Input 3	31
Input 4	6
Input 5	19
Input 6	32
Input 7	7
Input 8	20
Output 1	34
Output 2	21
Output 3	8
Output 4	35
Output 5	9
Output 6	36
Output 7	22
Output 8	10
Reset	26
Reverse Limit W	14
Reverse Limit X	17
Reverse Limit Y	16
Reverse Limit Z	15
Spare 1	49
Spare 2	50
W Aux Encoder A-	46
W Aux Encoder A+	45
W Aux Encoder B-	48
W Aux Encoder B+	47
X Aux Encoder A-	23

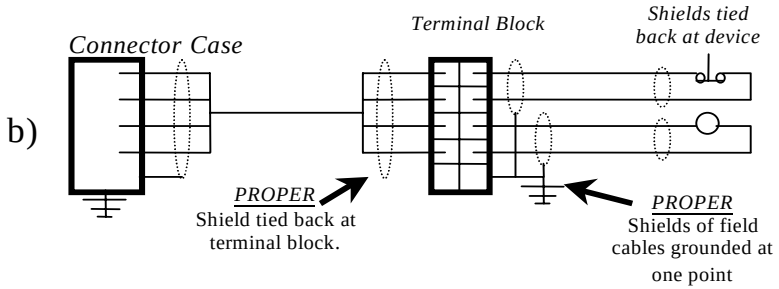
SMC Output Connector CN5	
PIN (Numerical Order)	SIGNAL
40	E-Stop2
41	Z Aux Encoder A+
42	Z Aux Encoder A-
43	Z Aux Encoder B+
44	Z Aux Encoder B-
45	W Aux Encoder A+
46	W Aux Encoder A-
47	W Aux Encoder B+
48	W Aux Encoder B-
49	Spare 1
50	Spare 2

SMC Output Connector CN5	
SIGNAL (Alphabetical Order)	PIN
X Aux Encoder A+	11
X Aux Encoder B-	12
X Aux Encoder B+	37
Y Aux Encoder A-	38
Y Aux Encoder A+	24
Y Aux Encoder B-	25
Y Aux Encoder B+	13
Z Aux Encoder A-	42
Z Aux Encoder A+	41
Z Aux Encoder B-	44
Z Aux Encoder B+	43

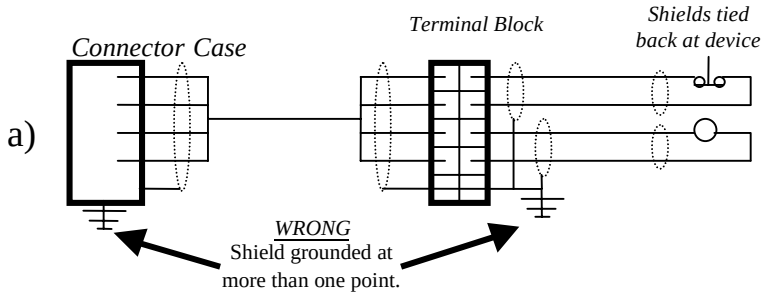
Cable Shielding, Segregation and Noise Immunity

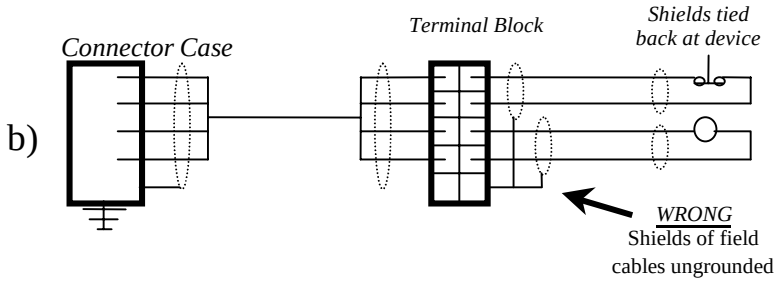
Proper





Improper

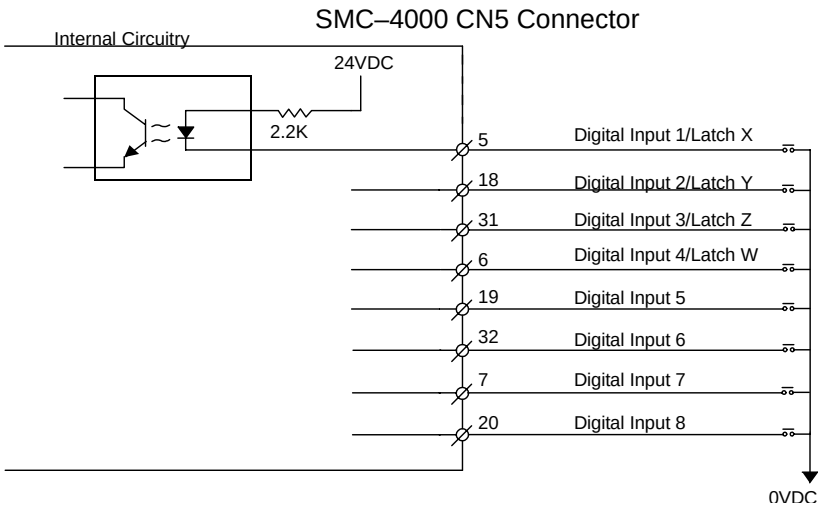




Digital I/O

Digital Input

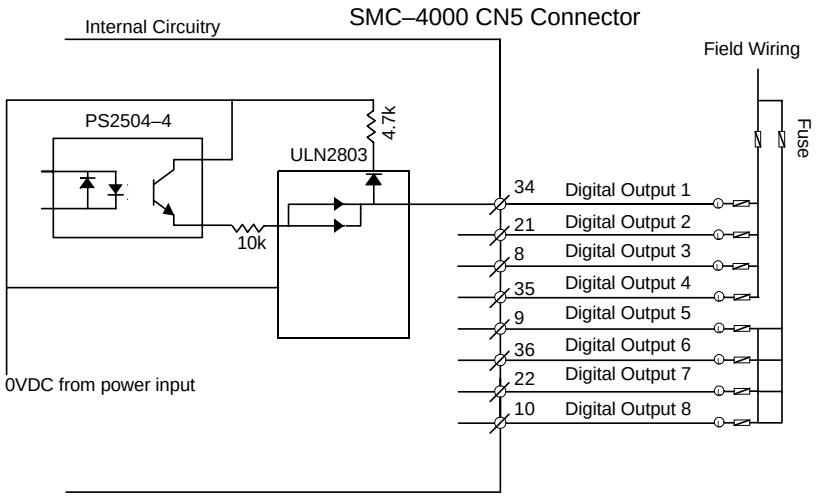
Item	Specifications
Number of Input Points	8
Input Format	Sinking
Isolation	Optical
Voltage	24VDC ± 20%
Current Rating (ON)	5.3mA to activate
Input Impedance	2.2kΩ
Operation Voltage	Logic 0 <5V Logic 1 >15V
OFF Current	0.9mA or less
Response Time (Hardware)	OFF to ON: <0.5ms ON to OFF: <1.5ms
Latch response time	Less than 25µsec
Minimum latch width	9µsec
NOTE: Inputs float high unless the input is held low.	



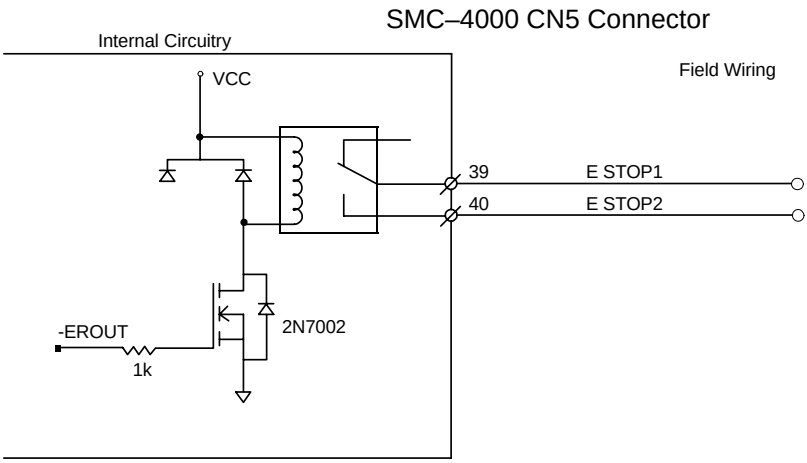
Digital Output

Item	Specifications
Number of Output Points	8
Output Format	Sinking
Output Classification	Transistor Output
Isolation	Optical
Load Voltage	24VDC ± 20%
Load Current	200mA/Output (600mA if activated individually)
Response Time	OFF to ON <0.25ms ON to OFF <0.5ms
External Common Power	24VDC ± 20% 15mA
Common User Fuse Rating	800mA per bank of four
Individual User Fuse Rating	200mA recommended

NOTE: The ULN 2803 output chip is capable of 600mA at a single output, or 800mA for the eight outputs simultaneously.



Emergency Stop Chain



The SMC–4000 closes the relay contact under normal operating conditions. The relay is controlled by the same circuit as the error LED. The relay will be open if the error LED is ON.

Ratings:

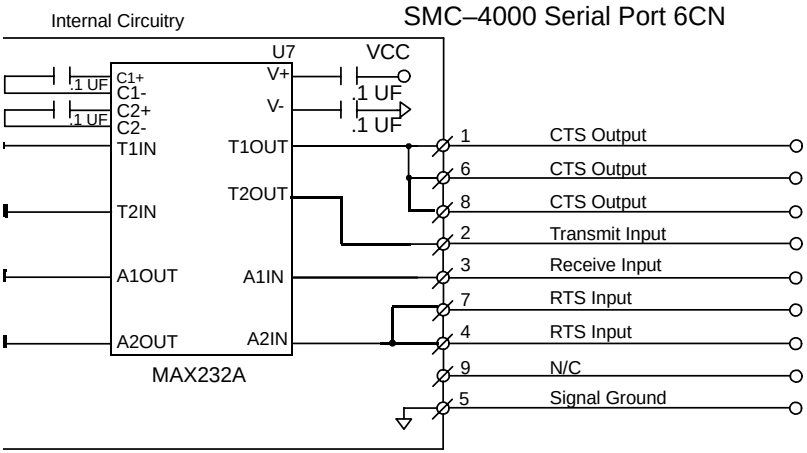
1.0A @ 24VDC

0.5A @ 125VDC

Maximum switching power: 62.5VA, 30W

Serial Communication

Item	Specifications
Baud Rate	9600 or 19200 settable by jumper JP2, default is 19200
Data Bits	8
Parity	None
Stop Bits	1

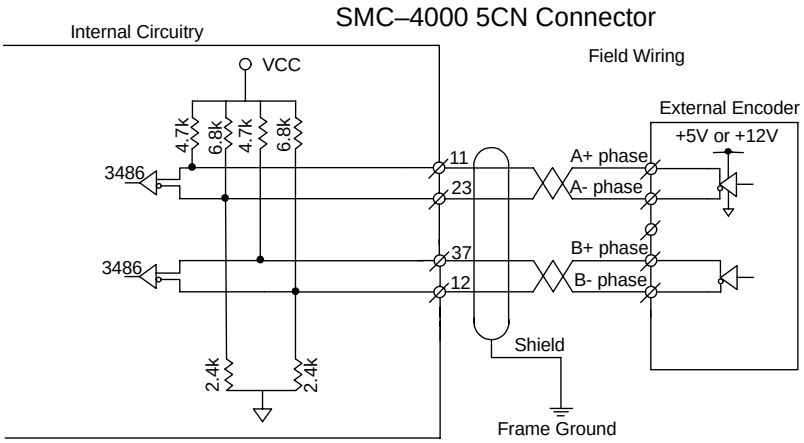


NOTE: Hardware handshaking must be used with the SMC–4000. If it is impossible to implement hardware handshaking, use a jumper between pins 1 and 4 in the connector.

NOTE: Do not connect pin 5 to a 24V ground. This would defeat the opto isolation.

External Encoder Specifications

Item	Specifications
Number of External Encoders	One per Main Axis
Input Format	Quadrature or Pulse and Direction
Maximum Frequency	12 MHz
Current Draw	940 µAmp

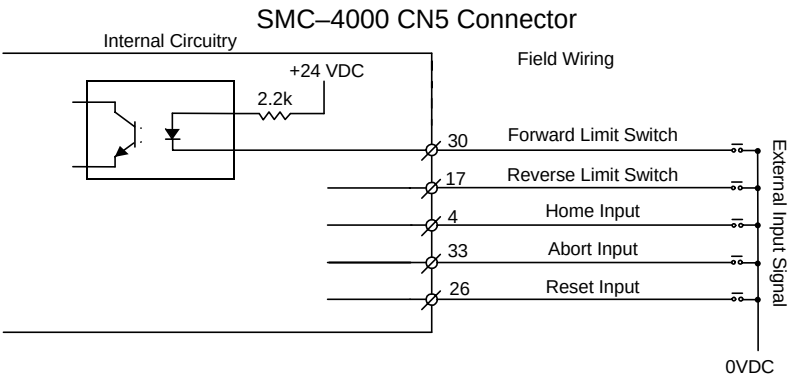


X axis internal encoder shown
See 5CN connector for other axis pin connections.

Standard voltage levels are TTL (0V to 5V), however, voltage levels up to 12V are acceptable. If using differential 12V signals, no modification is required. Single ended 12V signals require a bias voltage applied to the complimentary input, i.e.; use two 10k resistors, one connected to +12V and the other connected to the encoder signal ground to hold the /A phase and /B phase at 6VDC. Do not use a 24VDC encoder.

Dedicated Inputs

Item	Specifications
Number of Input Points	Forward limit, Reverse limit, Home for all axes; and Abort, Reset
Input Format	Sinking
Isolation	Optical
Voltage	24 VDC ± 20%
Current Rating (ON)	5.3 mA to activate
Input Impedance	2.2k Ω
Operation Voltage	Logic 0 <5V Logic 1 >15V
OFF Current	0.9 mA or less
Limit Switch Response Time	OFF to ON: <0.5 ms ON to OFF: <1.5 ms



X axis dedicated inputs shown. Other axes are the same.

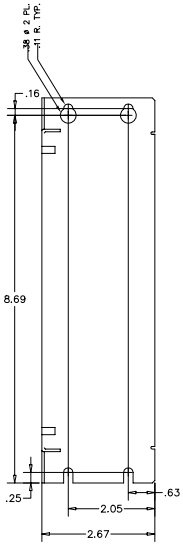
Physical Specifications

Description	Specifications
Depth	5 inches
Width	2.6 inches
Height	9.1 inches
Weight	3.52lbs (1.6kg)
Vibration	9.8 $msec^2$ (1.0g)
Ambient Temperature	0 ~ 70° C (32 ~ 158° F)
Humidity	Less than 95%
Noise	IEC Level 3

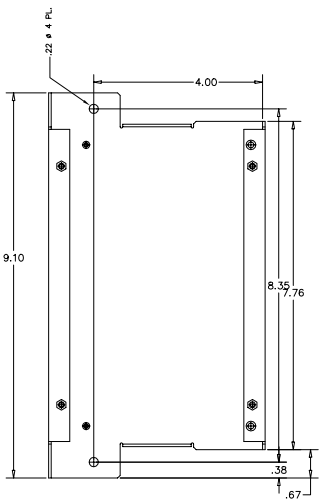
Hardware Specifications

Description	Specifications
CPU	25MHz Motorola
Servo Update	1000µs default, 250µs minimum
Digital Inputs	(8), +24VDC
Dedicated Inputs	(2) +24VDC +3 per axis @24VDC
Digital Outputs	(8), +24VDC
Serial port	(1) 9600 or 19200 baud
Ethernet	(1) 10-base-T
Power Input	24 VDC – 600mA

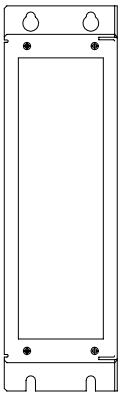
Dimensional Drawings



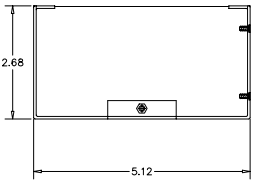
Back



Side

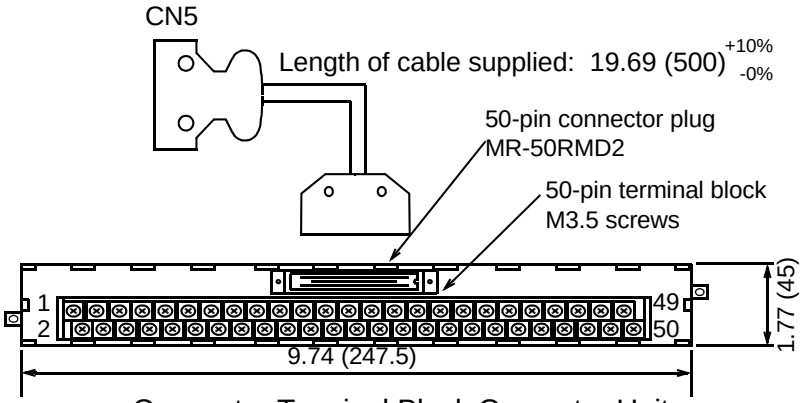


Front



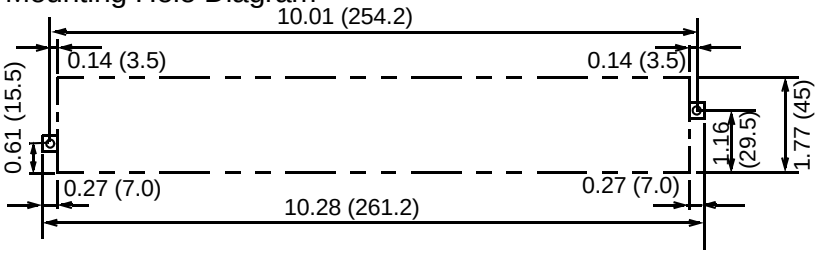
Top

I/O Cable with Terminal Block JUSP-TA50P



Connector Terminal Block Converter Unit
JUSP-TA50P* (cable included)

Mounting Hole Diagram



* Terminal specifications: see I/O Connections (50-pin CN5), page 6.

NOTES

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