

Description

The DigiFlex® Performance™ (DP) Series digital servo drives are designed to drive brushed and brushless servomotors. These fully digital drives operate in torque, velocity, or position mode and employ Space Vector Modulation (SVM), which results in higher bus voltage utilization and reduced heat dissipation compared to traditional PWM. The drive can be configured for a variety of external command signals. Commands can also be configured using the drive's built-in Motion Engine, an internal motion controller used with distributed motion applications. In addition to motor control, these drives feature dedicated and programmable digital and analog inputs and outputs to enhance interfacing with external controllers and devices.

Network communication is accomplished using either RS-485/232 or Modbus RTU. This DP Series drive features a single serial interface used for drive commissioning via DriveWare® 7, available for download at www.a-m-c.com.

The DPR Hardware Installation Manual is available for download from www.a-m-c.com. All drive and motor parameters are stored in non-volatile memory.

Power Range

Peak Current	15 A (10.6 A _{RMS})
Continuous Current	7.5 A (7.5 A _{RMS})
Supply Voltage	100 - 240 VAC



Features

- ▲ Four Quadrant Regenerative Operation
- ▲ Space Vector Modulation (SVM) Technology
- ▲ Fully Digital State-of-the-art Design
- ▲ Programmable Gain Settings
- ▲ Fully Configurable Current, Voltage, Velocity and Position Limits
- ▲ PIDF Velocity Loop
- ▲ PID + FF Position Loop
- ▲ Compact Size, High Power Density
- ▲ 16-bit Analog to Digital Hardware
- ▲ Built-in brake/shunt regulator
- ▲ On-the-Fly Mode Switching
- ▲ On-the-Fly Gain Set Switching
- ▲ Dedicated Safe Torque Off (STO) Inputs

MODES OF OPERATION

- Current
- Position
- Velocity

COMMAND SOURCE

- PWM and Direction
- Encoder Following
- Over the Network
- ±10 V Analog
- Sequencing
- Indexing
- Jogging

FEEDBACK SUPPORTED

- Resolver
- ±10 VDC Position
- Auxiliary Incremental Encoder
- Tachometer (±10 VDC)

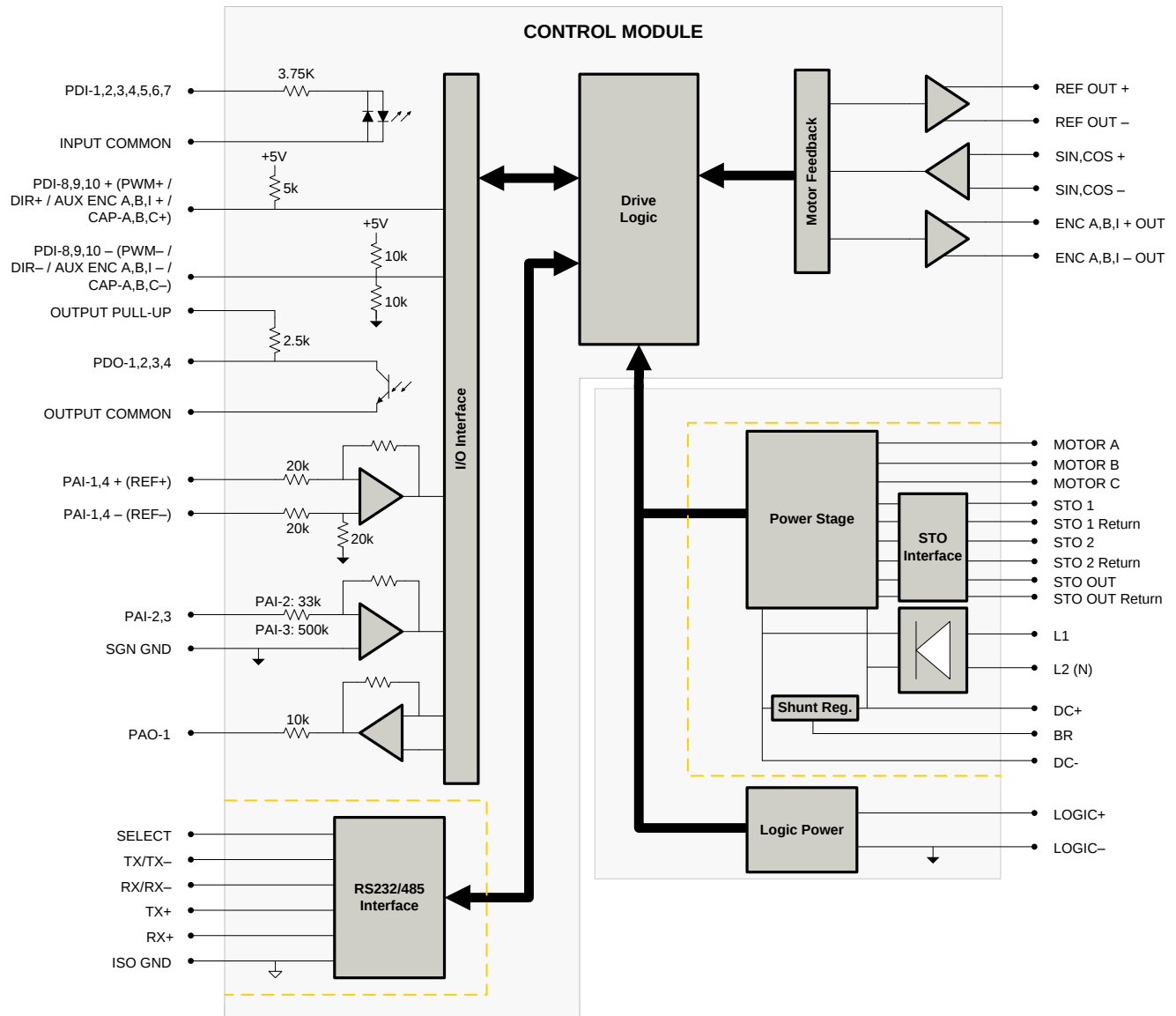
INPUTS/OUTPUTS

- 3 High Speed Captures
- 4 Programmable Analog Inputs (16-bit/12-bit Resolution)
- 1 Programmable Analog Output (10-bit Resolution)
- 3 Programmable Digital Inputs (Differential)
- 7 Programmable Digital Inputs (Single-Ended)
- 4 Programmable Digital Outputs (Single-Ended)

COMPLIANCES & AGENCY APPROVALS

- UL
- cUL
- CE Class A (LVD)
- CE Class A (EMC)
- RoHS II
- TÜV Rheinland® (STO)

BLOCK DIAGRAM



Information on Approvals and Compliances



US and Canadian safety compliance with UL 508c, the industrial standard for power conversion electronics. UL registered under file number E140173. Note that machine components compliant with UL are considered UL registered as opposed to UL listed as would be the case for commercial products.



Compliant with European EMC Directive 2004/108/EC on Electromagnetic Compatibility (specifically EN 61000-6-4:2007/A1:2011 for Emissions, Class A and EN 61000-6-2:2005 for Immunity, Performance Criteria A). LVD requirements of Directive 2006/95/EC (specifically, EN 60204-1:2006/A1:2009, a Low Voltage Directive to protect users from electrical shock).



The RoHS II Directive 2011/65/EU restricts the use of certain substances including lead, mercury, cadmium, hexavalent chromium and halogenated flame retardants PBB and PBDE in electronic equipment.



Functional Safety STO is TÜV Rheinland® certified and meets requirements of the following standards:

- EN ISO 13849-1 Category 4 / PL e
- EN IEC 61800-5-2 STO (SIL 3)
- EN62061 SIL CL3
- IEC 61508 SIL 3

SPECIFICATIONS

Power Specifications		
Description	Units	Value
Rated Voltage	VAC (VDC)	240 (339)
AC Supply Voltage Range	VAC	100 - 240
AC Supply Minimum	VAC	90
AC Supply Maximum	VAC	264
AC Input Phases	-	1
AC Supply Frequency	Hz	50 - 60
DC Supply Voltage Range ¹	VDC	127 - 373
DC Bus Over Voltage Limit	VDC	394
DC Bus Under Voltage Limit	VDC	55
Logic Supply Voltage	VDC	20 - 30 (@ 850 mA)
Safe Torque Off Voltage	VDC	24 (±6)
Maximum Peak Output Current ²	A (Arms)	15 (10.6)
Maximum Continuous Output Current ³	A (Arms)	7.5 (7.5)
Max. Continuous Output Power @ Rated Voltage ⁴	W	2415
Max. Continuous Power Dissipation @ Rated Voltage	W	127
Internal Bus Capacitance	µF	540
External Shunt Resistance Minimum Resistance ⁵	Ω	25
Minimum Load Inductance (Line-To-Line) ⁶	µH	600
Switching Frequency	kHz	20
Maximum Output PWM Duty Cycle	%	100
Low Voltage Supply Outputs	-	+5 VDC (250 mA)
Control Specifications		
Description	Units	Value
Communication Interfaces	-	RS-485/232 / Modbus RTU
Command Sources	-	±10 V Analog, Encoder Following, Over the Network, PWM and Direction, Sequencing, Indexing, Jogging
Feedback Supported	-	±10 VDC Position, Auxiliary Incremental Encoder, Resolver, Tachometer (±10 VDC)
Commutation Methods	-	Sinusoidal
Modes of Operation	-	Current, Position, Velocity
Motors Supported	-	Closed Loop Vector, Single Phase (Brushed, Voice Coil, Inductive Load), Three Phase (Brushless)
Hardware Protection	-	40+ Configurable Functions, Over Current, Over Temperature (Drive & Motor), Over Voltage, Short Circuit (Phase-Phase & Phase-Ground), Under Voltage
Programmable Digital Inputs/Outputs (PDIs/PDOs)	-	10/4
Programmable Analog Inputs/Outputs (PAIs/PAOs)	-	4/1
Primary I/O Logic Level	-	24 VDC
Current Loop Sample Time	µs	50
Velocity Loop Sample Time	µs	100
Position Loop Sample Time	µs	100
Resolver Reference/Excitation Signal	Vrms	4 Vrms @ 5 kHz
Expected Resolver Transformation Ratio	Vrms	0.5
Feedback Resolution / Emulated Encoder Resolution ⁷	bit	High Res: 14 (16384 counts/resolver cycle), Low Res: 12 (4096 counts/resolver cycle)
Maximum Motor Speed Per Feedback Resolution	RPM	High Res: 5000, Low Res: 20000
Internal Shunt Regulator	-	Yes
Internal Shunt Resistor	-	No
Mechanical Specifications		
Description	Units	Value
Agency Approvals	-	CE Class A (EMC), CE Class A (LVD), cUL, RoHS II, TÜV Rheinland® (STO), UL
Size (H x W x D)	mm (in)	177.50 x 123.39 x 44.45 (6.99 x 4.86 x 1.75)
Weight	g (oz)	894 (31.5)
Heatsink (Base) Temperature Range ⁸	°C (°F)	0 - 75 (32 - 167)
Storage Temperature Range	°C (°F)	-40 - 85 (-40 - 185)
Form Factor	-	Panel Mount
Cooling System	-	Natural Convection
+24V LOGIC Connector	-	2-port, 3.5 mm spaced insert connector
AUX ENCODER Connector	-	15-pin, high-density, male D-sub
COMM Connector	-	9-pin, female D-sub
FEEDBACK Connector	-	15-pin, high-density, female D-sub
I/O Connector	-	26-pin, high-density, female D-sub
POWER Connector	-	10-port, 5.08 mm spaced, enclosed, friction lock header
STO Connector	-	8-port, 2.0 mm spaced, enclosed, friction lock header

Notes

1. Large inrush current may occur upon initial DC supply connection to DC Bus.
2. Capable of supplying drive rated peak current for 2 seconds with 10 second foldback to continuous value. Longer times are possible with lower current limits.
3. Continuous I_{Arms} value attainable when RMS Charge-Based Limiting is used.
4. $P = (DC \text{ Rated Voltage}) * (Cont. RMS Current) * 0.95$.
5. ADVANCED Motion Controls recommends using an external fuse in series with the shunt resistor. A 3 amp motor delay fuse is typical.
6. Lower inductance is acceptable for bus voltages well below maximum. Use external inductance to meet requirements.
7. Higher and lower resolution options are available. Contact Applications Engineering for more information.
8. Additional cooling and/or heatsink may be required to achieve rated performance.

PIN FUNCTIONS

+24V LOGIC - Logic Power Connector			
Pin	Name	Description / Notes	I/O
1	LOGIC GND	Logic Supply Ground (Common with Signal Ground)	GND
2	LOGIC PWR	Logic Supply Input	I

AUX ENCODER - Auxiliary Feedback Connector			
Pin	Name	Description / Notes	I/O
1	RESERVED	Reserved	-
2	RESERVED	Reserved	-
3	RESERVED	Reserved	-
4	PDI-8 + (PWM+ / AUX ENC A+ / CAP-B+)	Programmable Digital Input or PWM or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open)	I
5	PDI-8 - (PWM- / AUX ENC A- / CAP-B-)		I
6	PDI-9 + (DIR+ / AUX ENC B+ / CAP-C+)	Programmable Digital Input or Direction Input or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open)	I
7	PDI-9 - (DIR- / AUX ENC B- / CAP-C-)		I
8	PDI-10 + (AUX ENC I+ / CAP-A+)	Programmable Digital Input or Auxiliary Encoder or High Speed Capture (For Single-Ended Signals Leave Negative Terminal Open)	I
9	PDI-10 - (AUX ENC I- / CAP-A-)		I
10	SGN GND	Signal Ground	SGND
11	SGN GND	Signal Ground	SGND
12	SGN GND	Signal Ground	SGND
13	+5V OUT	+5V Encoder Supply Output (Short Circuit Protected)	O
14	PAI-4 +	Differential Programmable Analog Input (12-bit Resolution)	I
15	PAI-4 -		I

COMM - RS232/RS485 Communication Connector			
Pin	Name	Description / Notes	I/O
1	SELECT	RS232/485 selection. Pull to ground (CN1-5) for RS485.	I
2	RS232 TX / RS485 TX-	Transmit Line (RS-232 or RS-485)	O
3	RS232 RX / RS485 RX-	Receive Line (RS-232 or RS-485)	I
4	RESERVED	Reserved	-
5	ISO GND	Isolated Signal Ground	IGND
6	RS485 TX+	Transmit Line (RS-485)	O
7	RESERVED	Reserved	-
8	RS485 RX+	Receive Line (RS-485)	I
9	RESERVED	Reserved	-

FEEDBACK - Feedback Connector			
Pin	Name	Description / Notes	I/O
1	RESERVED	Reserved	-
2	RESERVED	Reserved	-
3	RESERVED	Reserved	-
4	REF OUT +	Resolver Reference/Excitation Output	O
5	REF OUT -		O
6	SIN+	Resolver Sine Input	I
7	SIN-		I
8	COS+	Resolver Cosine Input	I
9	COS-		I
10	RESERVED	Reserved	-
11	RESERVED	Reserved	-
12	SGN GND	Signal Ground	SGND
13	+5V OUT	+5V Encoder Supply Output (Short Circuit Protected)	O
14	PAI-3	Programmable Analog Input (12-bit Resolution)	I
15	RESERVED	Reserved	-

I/O - Signal Connector			
Pin	Name	Description / Notes	I/O
1	PDO-1	Isolated Programmable Digital Output	O
2	OUTPUT COMMON	Digital Output Common	OGND
3	PDO-2	Isolated Programmable Digital Output	O
4	PAI-1 + (REF+)	Differential Programmable Analog Input or Reference Signal Input (16-bit Resolution)	I
5	PAI-1 - (REF-)		I
6	PAI-2	Programmable Analog Input (12-bit Resolution)	I
7	PAO-1	Programmable Analog Output (10-bit Resolution)	O
8	OUTPUT PULL-UP	Digital Output Pull-Up For User Outputs	I
9	PDI-5	Isolated Programmable Digital Input	I
10	PDO-3	Isolated Programmable Digital Output	O
11	PDI-1	Isolated Programmable Digital Input	I
12	PDI-2	Isolated Programmable Digital Input	I
13	PDI-3	Isolated Programmable Digital Input	I
14	PDO-4	Isolated Programmable Digital Output	O
15	INPUT COMMON	Digital Input Common (Can Be Used To Pull-Up Digital Inputs)	IGND
16	SGN GND	Signal Ground	SGND
17	PDI-4	Isolated Programmable Digital Input	I
18	PDI-6	Isolated Programmable Digital Input	I
19	PDI-7	Isolated Programmable Digital Input	I
20	ENC A+ OUT	Emulated Encoder Channel A Output	O
21	ENC A- OUT		O
22	ENC B+ OUT	Emulated Encoder Channel B Output	O
23	ENC B- OUT		O
24	ENC I+ OUT	Emulated Encoder Index Output	O
25	ENC I- OUT		O
26	SGN GND	Signal Ground	SGND

STO – Safe Torque Off Connector			
Pin	Name	Description / Notes	I/O
1	STO OUTPUT	Safe Torque Off Output	O
2	RESERVED	Reserved	-
3	STO-1 RETURN	Safe Torque Off 1 Return	STORET1
4	STO-1	Safe Torque Off – Input 1	I
5	STO-2 RETURN	Safe Torque Off 2 Return	STORET2
6	STO-2	Safe Torque Off – Input 2	I
7	RESERVED	Reserved	-
8	STO OUT RETURN	Safe Torque Off Output Return	STORETO

POWER - Power Connector			
Pin	Name	Description / Notes	I/O
1	MOTOR A	Motor Phase A	O
2	MOTOR B	Motor Phase B	O
3	MOTOR C	Motor Phase C	O
4	SHIELD	Motor cable shield. Internally connected to protective earth ground.	-
5	PE	Protective Earth Ground	-
6	L1	AC Supply Input (Single Phase)	I
7	L2 (N)		I
8	DC+	Internal DC Bus Voltage. If using an external brake resistor, connect between this port and BR. For DC Supply operation, connect DC supply +HV IN to this port.	I
9	BR	External Brake Resistor Connection. If using an external brake resistor, connect between this port and DC+.	-
10	DC-	Internal DC Bus Voltage. For DC Supply operation, connect DC supply ground to this port.	I

HARDWARE SETTINGS

Switch Functions

Switch	Description	Setting	
		On	Off
1	Bit 0 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
2	Bit 1 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
3	Bit 2 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
4	Bit 3 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
5	Bit 4 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
6	Bit 5 of binary RS-485 drive address. Does not affect RS-232 settings.	1	0
7	Bit 0 of drive RS-485 baud rate setting. Does not affect RS-232 settings.	1	0
8	Bit 1 of drive RS-485 baud rate setting. Does not affect RS-232 settings.	1	0

Additional Details

The drive can be configured to use the address and/or bit rate stored in non-volatile memory by setting the address and/or bit rate value to 0. Use the table below to map actual bit rates to a bit rate setting.

Baud Rate (kbps)	Value For Bit Rate Setting
Load from non-volatile memory	0
9.6	1
38.4	2
115.2	3

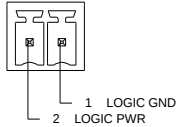
Safe Torque Off (STO) Inputs

The Safe Torque Off (STO) Inputs are dedicated +24VDC max sinking single-ended inputs. A dedicated STO Disable Key connector is included and should be installed for applications where STO is not required.

MECHANICAL INFORMATION

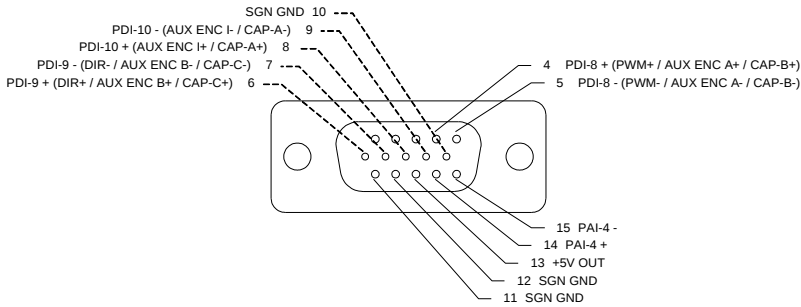
+24V LOGIC - Logic Power Connector

Connector Information		2-port, 3.5 mm spaced insert connector
Mating Connector	Details	Phoenix Contact: P/N 1840366
	Included with Drive	Yes



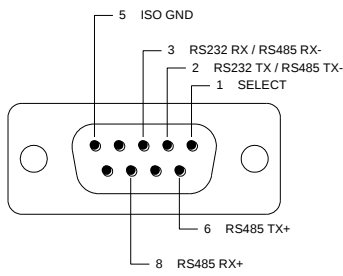
AUX ENCODER - Auxiliary Feedback Connector

Connector Information		15-pin, high-density, male D-sub
Mating Connector	Details	TYCO: Plug P/N 1658681-1; Housing P/N 5748677-1; Terminals P/N 1658686-2 (loose) or 1658686-1 (strip)
	Included with Drive	No



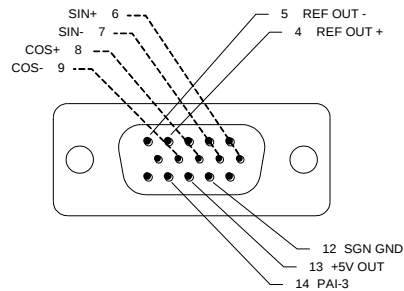
COMM - RS232/RS485 Communication Connector

Connector Information		9-pin, female D-sub
Mating Connector	Details	TYCO: Plug P/N 205204-4; Housing P/N 5748677-1; Terminals P/N 1658540-5 (loose) or 1658540-4 (strip)
	Included with Drive	No

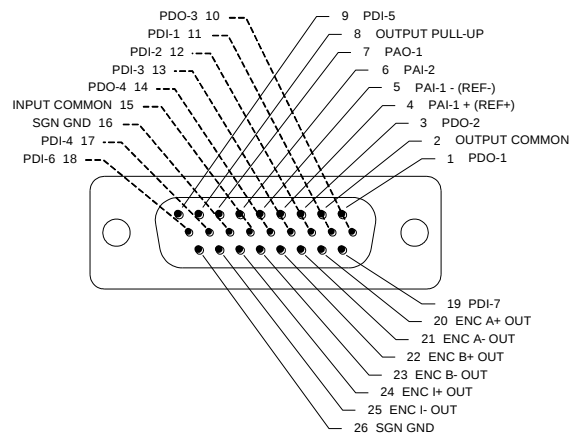


FEEDBACK - Feedback Connector

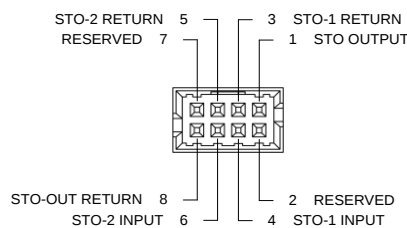
Connector Information		15-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 748364-1; Housing P/N 5748677-1; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No


I/O - Signal Connector

Connector Information		26-pin, high-density, female D-sub
Mating Connector	Details	TYCO: Plug P/N 1658671-1; Housing P/N 5748677-2; Terminals P/N 1658670-2 (loose) or 1658670-1 (strip)
	Included with Drive	No


STO – Safe Torque Off Connector

Connector Information		8-port, 2.00 mm spaced, enclosed, friction lock header
Mating Connector	Details	Molex: P/N 51110-0860 (housing); 50394-8051 (pins)
	Included with Drive	No



POWER - Power Connector

Connector Information		10-port, 5.08 mm spaced, enclosed, friction lock header
Mating Connector	Details	Phoenix Contact: P/N 1781069
	Included with Drive	Yes

