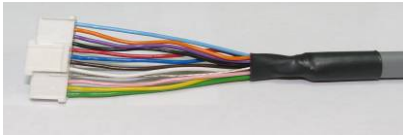# Harmonica and Bassoon
Digital Servo Drive Cable Kits
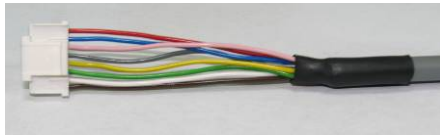

Main Feedback: CBL-MLXFDBK
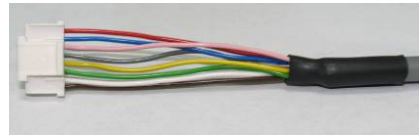(general purpose)   CBL-MLXFDBK-5

Encoder: CBL-MTRENC1
(for SAR,SA,SB,SC)   CBL-MTRENC1-5

Encoder: CBL-MTRENC3
(for SE)   CBL-MTRENC3-5

Aux. Feedback: CBL-MLXAUX
CBL-MLXAUX-5

Digital Input: CBL-MLXDI
CBL-MLXDI-5

Digital Output: CBL-MLXDO
CBL-MLXDO-5

Analog Input: CBL-MLXAI
CBL-MLXAI-5

Aux. Power: CBL-MLX24
CBL-MLX24-5

RS-232 Com.:   CBL-RJ452321
CBL-RJ452321-5
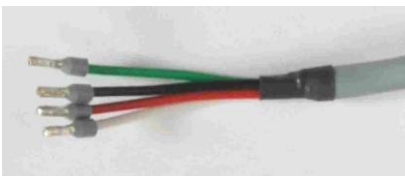

RS-232 Com.:   JCA-HAR11
JCA-HAR11-5

CAN Com.:   CBL-RJ45CAN1
CBL-RJ45CAN1-5

CAN Com.:   CBL-RJ45CAN2

Motor Power: CBL-MTRPWR
(general purpose) CBL-MTRPWR-5

Motor Power: CBL-MTRPWR1
(for SAR,SA,SB,SC)   CBL-MTRPWR1-5

Motor Power: CBL-MTRPWR2
(for SE)   CBL-MTRPWR2-5

December 2008 (Version 3.4)

Important Notice

This guide is delivered subject to the following conditions and restrictions:

- This guide contains proprietary information belonging to Elmo Motion Control Ltd. Such information is supplied solely for the purpose of assisting users of the Harmonica and Bassoon servo drives in assembling the required cables for their drive.

- The text and graphics included in this manual are for the purpose of illustration and reference only. The specifications on which they are based are subject to change without notice.

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Revision History:

Version	Release Date	Changes/Remarks
Version 3.4	December 2008	Formatting updated.
Version 3.3	November 2004	Cable Cross-Reference table updated, wire colors on CBL-MTRPWR1 and CBL-MTRPWR5 changed.
Version 3.2	August 2004	Cable colors modified, cable catalog numbers updated, cables and kits added for Metronix motors.

Contents

1.   Introduction

This document provides the wiring details for the cables used to connect Elmo Harmonica and Bassoon digital servo drives with the end-user application. The servo drive-side pinouts are provided in Chapter 3 of the installation guide for each drive.

The cables come in two lengths: 2 meters (6.5 feet) or 5 meters (16.5 feet). The default length is 2 meters. Other lengths are indicated by an extended suffix in the cable part number. Thus, cable part number CBL-MTRENC1 indicates a 2-meter cable and cable part number CBL-MTRENC1-5 indicates a 5 meter cable.

CBL-RJ45CAN2 is an exception to the part number convention described above. For CBL-RJ45CAN2, the 2 suffix designates a 20 cm cable.

1.1   Harmonica Connectors

The table below presents the connector panel of the Harmonica drive and specifies the cable connectors.

Pins	Type	Connector Manufacturer and Part Number	Port	Connector Location
8	RJ-45	**RJ-45 plug**	J1	
8	2 mm Pitch	**Molex 35507-0800**	J2	
12	2 mm Pitch	**Molex 35507-1200**	J3	
2	2 mm Pitch	**Molex 35507-0200**	J4	
8	2 mm Pitch	**Molex 35507-0800**	J5	
4	2 mm Pitch	**Molex 35507-0400**	J6	
3	2 mm Pitch	**Molex 35507-0300**	J7	
7	5.08 mm Pitch Terminal Block	**Phoenix MSTB 2.5/7-ST-5.08**	J8	

Table 1-1: ***Connectors on the Harmonica Drive***

1.2   Bassoon Connectors

The table below presents the connector panel of the Bassoon and specifies the cable connectors.

Pins	Type	Connector Manufacturer and Part Number	Port	Connector Location
8	RJ-45	**RJ-45 plug**	J1, J8, J9	
8	2 mm Pitch	**Molex 35507-0800**	J2, J5	
12	2 mm Pitch	**Molex 35507-1200**	J3	
2	2 mm Pitch	**Molex 35507-0200**	J4	
4	2 mm Pitch	**Molex 35507-0400**	J6	
3	2 mm Pitch	**Molex 35507-0300**	J7	
7	5.08 mm Pitch Terminal Block	**Phoenix MSTB 2.5/7-ST-5.08**	**Main power**	

*Table 1-2: **Connectors on the Bassoon Drive***

1.3   Cable Cross Reference

1.3.1   Harmonica

Cable Application	Cable Part. No.	Pins	Pin Location	Page
Main Feedback (general purpose)	CBL-MLXFDBK-5	12	J3	3-1
Encoder (for SAR, SA, SB, SC)	CBL-MTRENC1-5	12	J3	3-2
Encoder (for SE)	CBL-MTRENC3-5	12	J3	3-3
Auxiliary Feedback	CBL-MLXAUX-5	8	J2	4-1
Digital Input	CBL-MLXDI-5	8	J5	5-1
Digital Output	CBL-MLXDO-5	4	J6	6-1
Analog Input	CBL-MLXAI-5	3	J7	7-1
Auxiliary Power	CBL-MLX24-5	2	J4	8-1
RS-232 Communications (RJ-45)	CBL-RJ452321-5	8	J1	9-1
RS-232 Communications (pitchfork)	JCA-HAR11-5	3 of 8	See page 9.2	9-2
CAN Communications	CBL-RJ45CAN1-5	8	J1	9-3
CAN Communications (daisy chain)	CBL-RJ45CAN2	8	see page 9.4	9-4
Motor Power (general purpose)	CBL-MTRPWR-5	4	PE/M1/M2/M3	10-1
Motor Power (for SAR, SA, SB, SC)	CBL-MTRPWR1-5	4	PE/M1/M2/M3	10-2
Motor Power (for SE)	CBL-MTRPWR2-5	4	PE/M1/M2/M3	10-3

*Table 1-3: **Cable and Pin Cross-Reference for the Harmonica Drive***

1.3.2 Bassoon

Cable Application	Cable Part. No.	Pins	Pin Location	Page
Main Feedback (general purpose)	CBL-MLXFDBK-5	12	J3	3-1
Encoder (for SAR, SA, SB, SC)	CBL-MTRENC1-5	12	J3	3-2
Encoder (for SE)	CBL-MTRENC3-5	12	J3	3-3
Auxiliary Feedback	CBL-MLXAUX-5	8	J2	4-1
Digital Input	CBL-MLXDI-5	8	J5	5-1
Digital Output	CBL-MLXDO-5	4	J6	6-1
Analog Input	CBL-MLXAI-5	3	J7	7-1
Auxiliary Power	CBL-MLX24-5	2	J4	8-1
RS-232 Communications	CBL-RJ452321-5	8	J1	9-1
CAN Communications	CBL-RJ45CAN1-5	8	J8, J9	9-3
CAN Communications (daisy chain)	CBL-RJ45CAN2	8	J8, J9	9-4
Motor Power (general purpose)	CBL-MTRPWR-5	4	PE/M1/M2/M3	10-1
Motor Power (for SAR, SA, SB, SC)	CBL-MTRPWR1-5	4	PE/M1/M2/M3	10-2
Motor Power (for SE)	CBL-MTRPWR2-5	4	PE/M1/M2/M3	10-3

*Table 1-4: **Cable and Pin Cross-Reference for Bassoon Drive***

2. Cable Kits

Two cable kits can be purchased from Elmo. Each kit includes ten cables.

The -5 suffix on a kit (for example, CBL-MLXFDBK-5) or on the cables indicates that the cables are 5 m long. Cables and kits that do not include a suffix are 2 m long. CBL-RJ45CAN2 is an exception: For CBL-RJ45CAN2, the 2 designates a 20 cm cable.

Customers may purchase individual cables of a specific type or cable kits. The contents of the kits are listed below:

Cable Application	Cable Part. No.	CBL-MLXKIT01 CBL-MLXKIT01-5	CBL-MLXKIT02 CBL-MLXKIT02-5
Main Feedback (gen-purpose)	CBL-MLXFDBK-5	1	–
Encoder (for SAR, SA, SB, SC)	CBL-MTRENC1-5	–	1
Encoder (for SE)	CBL-MTRENC3-5	–	–
Auxiliary Feedback	CBL-MLXAUX-5	1	1
Digital Input	CBL-MLXDI-5	1	1
Digital Output	CBL-MLXDO-5	1	1
Analog Input	CBL-MLXAI-5	1	1
Auxiliary Power	CBL-MLX24-5	1	1
RS-232 Communications	CBL-RJ452321-5	1	1
RS-232 Communications	JCA-HAR11-5	1	1
CAN Communications	CBL-RJ45CAN1-5	1	1
CAN Communications	CBL-RJ45CAN2	–	–
Motor Power (general purpose)	CBL-MTRPWR-5	1	–
Motor Power (for SAR, SA, SB, SC)	CBL-MTRPWR1-5	–	1
Motor Power (for SE)	CBL-MTRPWR2-5	–	–

*Table 2-1: **Cable Kits for the Harmonica and Bassoon Drives***

3. *Main Feedback Cable*

The main feedback cables are made from 24 AWG shielded twisted pair (STP) cable. There are three types of feedback cables. All three cables use a 12-pin Molex 2.0 mm pitch plug on the *SimplIQ* side.

- The General Purpose Main Feedback Cable (CBL-MLXFDBK) is open on the motor side so that it can be connected to customer-specific connectors.

- The Encoder Cable (CBL-MTRENC1) has a 15-pole socket on the motor side for Metronix APM-SAR, SA, SB and SC motors.

- The Encoder Cable (CBL-MTRENC3) has a 17-pole Amphenol socket on the motor side for Metronix APM-SE motors.

3.1 General Purpose Main Feedback Cable (CBL-MLXFDBK-5)

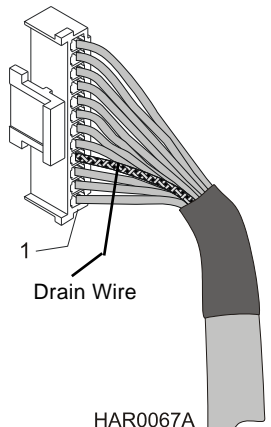| Molex Pin No.	Color	Twisted & Shielded Wire	Description	
1	Green	pair	see Installation Guide	
2	Yellow			
3	Pink		see Installation Guide	
4	Drain Wire		see Installation Guide	
5	White	pair	see Installation Guide	
6	Brown			
7	Blue	pair	see Installation Guide	
8	Red			
9	Black	pair	see Installation Guide	
10	Purple			
11	Orange	pair	see Installation Guide	
12	Cyan			

*Table 3-1: **Main Feedback Cable for the Harmonica and Bassoon Drives***

The specific functionality of each pin is fully outlined in the *Harmonica and Bassoon Installation Guides*.
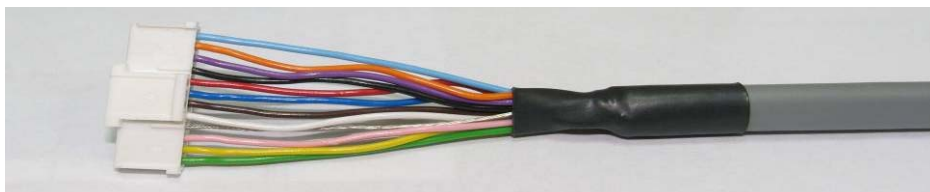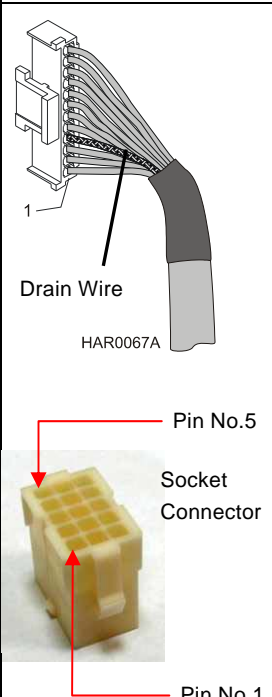
*Figure 1: **Single-sided Main Feedback Cable** (Part No.* CBL-MLXFDBK-5*)*

3.2   Encoder Cable (CBL-MTRENC1-5 for SAR, SA, SB, SC)

Molex Pin No.	Color	Socket Pin No.	Twisted & Shielded Wire	Signal	Description	
1	Green	11	Pair	HC	Hall sensor C input	
2	Yellow	9		HB	Hall sensor B input	
3	Pink	7		HA	Hall sensor A input	
4	Drain wire	15		SUPRET	Drain wire connection	
5	White	14	Pair	SUPRET	Supply return	
6	Brown	13		+5 V	Encoder\Hall supply +5 V	
7	Blue	6	Pair	INDEX-	Index complement	
8	Red	5		INDEX	Index	
9	Black	4	Pair	CHB-	Channel B complement	
10	Purple	3		CHB	Channel B	
11	Orange	2	Pair	CHA-	Channel A complement	
12	Cyan	1		CHA	Channel A	

*Table 3-2: **Encoder Cable for the Harmonica and Bassoon Drives***

*Figure 2: **Encoder Cable** (Part No. CBL-MTRENC1-5, for Metronix SAR, SA, SB, SC motors)*

3.3   Encoder Cable (CBL-MTRENC3-5 for SE motors)

Molex Pin No.	Color	Amphenol Pin No.	Twisted & Shielded Wire	Signal	Description	
1	Green	P	Pair	HC	Hall sensor C input	
2	Yellow	M		HB	Hall sensor B input	
3	Pink	K		HA	Hall sensor A input	
4	Drain Wire	J		SUPRET	Drain wire connection	
5	White	G	Pair	SUPRET	Supply return	
6	Brown	H		+5V	Encoder\Hall supply +5 V	
7	Blue	F	Pair	INDEX-	Index complement	
8	Red	E		INDEX	Index	
9	Black	D	Pair	CHB-	Channel B complement	
10	Purple	C		CHB	Channel B	
11	Orange	B	Pair	CHA-	Channel A complement	
12	Cyan	A		CHA	Channel A	

*Table 3-3: **Encoder Cable** for the Harmonica and Bassoon Drives*

*Figure 3: **Encoder Cable** (Part No. CBL-MTRENC1-5, for SE motors)*

4.   *Auxiliary Feedback Cable (CBL-MLXAUX-5)*

The auxiliary feedback cable is a 24 AWG shielded twisted pair cable. It is connected using an 8-pin Molex plug.

As described in the *Auxiliary Feedback* section(s) in the Harmonica and Bassoon *Installation Guides,* the following four options are available for auxiliary feedback:

- Main encoder buffered outputs
- Differential encoder inputs
- Single-ended encoder input
- Pulse-and-direction input

The general pinout of the auxiliary feedback cable is as follows:

Pin No.	Color	Twisted & Shielded Wire	Description	
1	Brown	Pair	see Installation Guide	
2	White			
3	Green	Pair	see Installation Guide	
4	Yellow			
5	Gray	Pair	see Installation Guide	
6	Pink			
7	Blue	Pair	see Installation Guide	
8	Red			HAR0068A

*Table 4-1: **Auxiliary Feedback Cable for the Harmonica and Bassoon Drives***

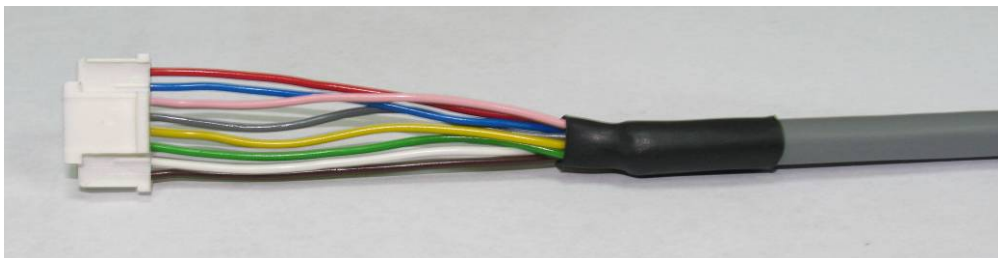✒ The specific functionality of each pin is fully outlined in the Harmonica and Bassoon *Installation Guides*.

*Figure 4: **Auxiliary Feedback Cable** (Part No. CBL-MLXAUX-5)*

5. *Digital Input Cable (CBL-MLXDI-5)*

The digital input cable is a 24 AWG shielded twisted pair cable. It is connected using an 8-pin Molex plug.

Pin No.	Color	Twisted & Shielded Wire	Signal	Description	
1	Brown	Pair	IN1	Programmable input 1	
2	White		IN2	Programmable input 2	
3	Green	Pair	IN3	Programmable input 3	
4	Yellow		IN4	Programmable input 4	
5	Gray	Pair	IN5	Programmable input 5	
6	Pink		IN6	Programmable input 6	
7	Blue	Pair	INRET	Programmable input return	
8	Red		INRET	Programmable input return	HAR0068A

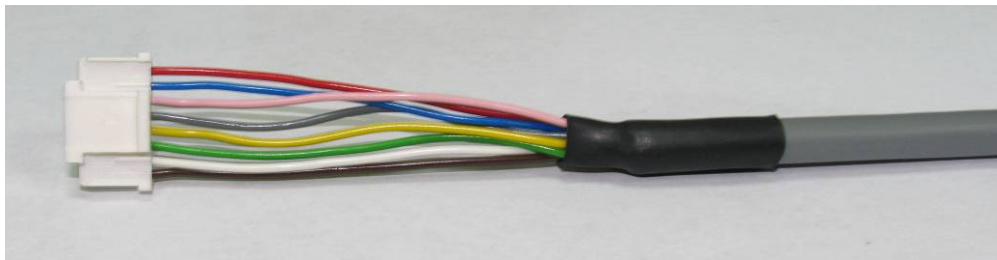*Table 5-1:* **Digital Input Cable for the Harmonica and Bassoon Drives**

Figure 5: **Digital Input Cable** *(Part No.* CBL-MLXDI-5)

6.   Digital Output Cable (CBL-MLXDO-5)

The digital output cable is a 26 AWG shielded twisted pair cable. It is connected using a 4-pin Molex plug.
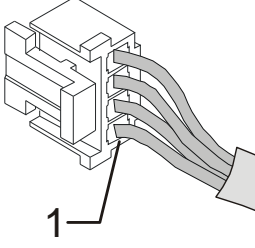
Pin No.	Color	Twisted & Shielded Wire	Signal	Description	
1	Brown	Pair	OUT1	Programmable output 1	
2	White		OUTRET1	Programmable output return 1	
3	Green	Pair	OUT2	Programmable output 2	
4	Yellow		OUTRET2	Programmable output return 2	1

*Table 6-1: **Digital Output Cable for the Harmonica and Bassoon Drives***

*Figure 6: **Digital Output Cable** (Part No. CBL-MLXDO-5)*

7. *Analog Input Cable (CBL-MLXAI-5)*

The analog input cable is a 26 AWG shielded twisted pair cable. It is connected using a 3-pin Molex plug.
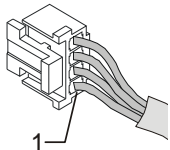
Pin No.	Color	Twisted & Shielded Wire	Signal	Description	
1	Green	Pair	ANLIN1+	Analog input 1+	
2	Yellow		ANLIN1-	Analog input 1-	
3	White		ANLRET	Analog ground	

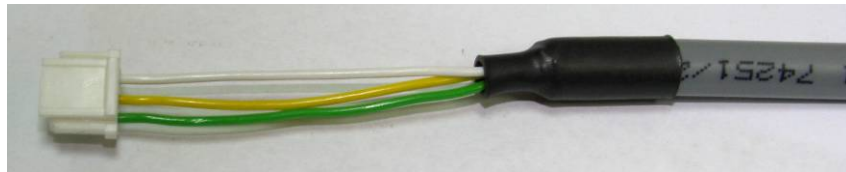*Table 7-1:* ***Analog Input Cable for the Harmonica and Bassoon Drives***

Figure 7: ***Analog Input Cable*** *(Part No.* CBL-MLXAI-5*)*

8.   Auxiliary Power Cable (CBL-MLX24-5)

The auxiliary power cable is a 24 AWG shielded twisted pair cable. It is connected using a 2-pin Molex plug.
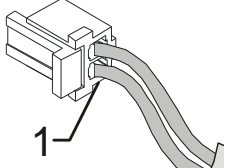
Pin No.	Color	Twisted & Shielded Wire	Signal	Description	
1	Red	Pair	+24 VDC	+24 VDC auxiliary power supply	
2	Black		RET 24 VDC	Return (common) of 24 VDC auxiliary power supply	

Table 8-1: ***Auxiliary Power Cable for the Harmonica and Bassoon Drives***

Figure 8: ***Auxiliary Power Cable*** *(Part No.* CBL-MLX24-5)

9. *Communication Cables*

The communication cables use 26-AWG twisted pair shielded cable. They are connected using an 8-pin RJ-45 plug or, in the case of an extended Harmonica, with a special *pitchfork* connector. Elmo drives can communicate using the following options:

- RS-232, full duplex
- CANopen

9.1 RS-232 Option (CBL-RJ452321-5)

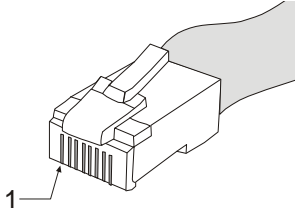| RJ45 Pin No.	Color	D-type Female Pin No.	Signal	Description	
1	–	–	–	–	
2	–	–	–	–	
3	Brown	2	Tx	RS-232 transmit	
4	-	–	–	–	
5	White	5	COMRET	Communication return	
6	Green	3	Rx	RS-232 receive	
7	–	–	–	–	
8	–	–	–	–	
Body	Drain Wire	Body	Shield	Cable Shield	

*Table 9-1: **RS-232 Cable for the Harmonica and Bassoon Drives***

✍ The shields of the RJ-45 and D-type plugs are connected to each other through the cable braid.

*Figure 9: **RS-232 Cable** (Part No. CBL-RJ452321-5)*

9.2   RS-232 *Pitchfork* Option (JCA-HAR11-5)

This cable is connected to the Harmonica through a vent opening on the top of the Harmonica.
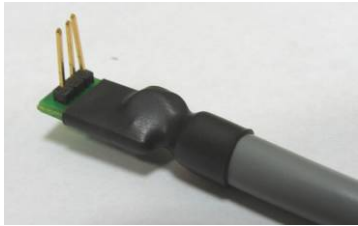
Color	D-type Female Pin No.	Signal	Description	
Brown	2	Tx	RS-232 transmit	
Green	3	Rx	RS-232 receive	
White	5	COMRET	Communication return	
	Body	Shield	Cable Shield	

*Table 9-2: **Communication Cable for the Extended Harmonica Drive***

*Figure 10: **RS-232 Pitchfork Cable** (Part No. JCA-HAR11-5)*

9.3   CAN Option (CBL-RJ45CAN1-5)

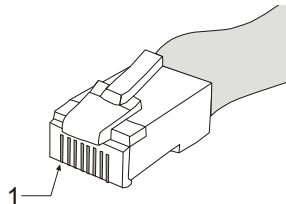| RJ45 Pin No.	Color	D-type Female Pin No.	Signal	Description	
1	Green	7	CAN-H	CAN_H bus line	
2	Yellow	2	CAN_L	CAN_L bus line	
3	White	3	CAN_GND	CAN ground	
4	–	–	–	–	
5	–	–	–	–	
6	–	–	–	–	
7	–	–	–	–	
8	–	–	–	–	
Body	Drain Wire	Body	Shield	Cable Shield	

*Table 9-3: **CAN RJ-45 Option Cable for the Harmonica and Bassoon Drives***

The shields of the RJ-45 and D-type plugs are connected to each other through the cable braid.

*Figure 11: **CAN Cable** (Part No. CBL-RJ45CAN1-5)*

9.4   CAN Option (CBL-RJ45CAN2)

Cable CBL-RJ45CAN2 is 20 cm long and is used to daisy-chain CAN nodes. On the Harmonica, this cable is connected to the External Dual Can Port.

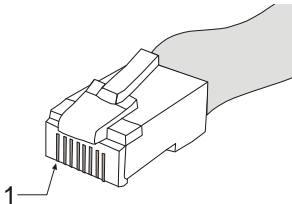| RJ45 Pin No.	Color	RJ45 Pin No.	Signal	Description	
1	Green	1	CAN-H	CAN_H bus line	
2	Yellow	2	CAN_L	CAN_L bus line	
3	White	3	CAN_GND	CAN ground	
4	–	–	–	–	
5	–	–	–	–	
6	–	–	–	–	1
7	–	–	–	–	
8	–	–	–	–	
Body	Drain Wire	Body	Shield	Cable Shield	

*Table 9-4: **CAN Cable for the Harmonica and Bassoon Drives***

The shields of the two RJ-45 plugs are connected to each other through the cable braid.

*Figure 12: **CAN Cable** (Part No. CBL-RJ45CAN2)*

10. *Motor Power Cables*

There are three types of power cables:

- General Purpose Motor Power Cable (CBL-MTRPWR) has pin terminals on the *SimplIQ* drive side and is open on the motor side.

- CBL-MTRPWR1 has pin terminals on the *SimplIQ* drive side and a 4-pole socket on the motor side for Metronix APM-SAR, SA, SB and SC motors.

- CBL-MTRPWR2 has pin terminals on the *SimplIQ* drive side and a 4-pole Amphenol connector on the motor side for Metronix APM-SE motors.

10.1 Motor Power Cable (CBL-MTRPWR-5 for General Purpose Use)

CBL-MTRPWR is a general purpose motor power cable. It is made from four 14-AWG shielded wires with pin terminals on the *SimplIQ* drive side. The other end is open so that it can be attached to a customer-specific connector.

Color	Signal	Description
White	U	Motor Phase U
Black	V	Motor Phase V
Red	W	Motor Phase W
Green	Earth	Ground

Table 10-1: **General Purpose Motor Power Cable for the Harmonica and Bassoon Drives**
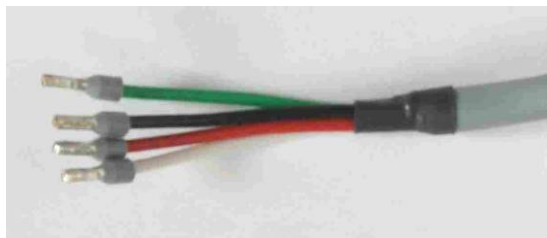

Figure 13: **General Purpose Motor Power Cable** (*Part No.* CBL-MTRPWR-5)

10.2 Motor Power Cable (CBL-MTRPWR1-5 for Metronix SAR, SA, SB and SC motors)

CBL-MTRPWR1 is a 24-AWG shielded cable in which each wire on the *SimplIQ* drive side is connected to a pin terminal, and the wires on the motor side are connected to a 4-pole socket. This cable is designed to connect the Harmonica or Bassoon drive to the Metronix APM-SAR, SA, SB and SC motors.

Socket Pin No.	Color	Signal	Description
1	Brown & White	U	Motor Phase U
2	Pink & Gray	V	Motor Phase V
3	Blue & Red	W	Motor Phase W
4	Green & Yellow	Earth	Ground

Table 10-2: ***Motor Power Cable for the Harmonica and Bassoon Drives*** *(Metronix SAR, SA, SB and SC motors)*

Figure 14: Motor Power Cable *(Part No CBL-MTRPWR1-5, for Metronix SAR, SA, SB and SC motors)*

Through November 2004, cables that were labeled CBL-MTRPWR1-5 which were sold individually or as part of the CBL-MLXKIT02-5 cable kits were wired as follows:

Socket Pin No.	Color	Signal	Description
1	Brown & White	U	Motor Phase U
2	**Green & Yellow**	V	Motor Phase V
3	Blue & Red	W	Motor Phase W
4	**Pink & Gray**	Earth	Ground

Table 10-3: ***Motor Power Cable*** *(Part No. CBL-MTRPWR1-5, wiring plan prior to November 2004)*

10.3 Motor Power Cable (CBL-MTRPWR2-5 for Metronix SE motors)

CBL-MTRPWR2 is a 14-AWG shielded cable in which each wire on the *SimplIQ* drive side is connected to a pin terminal, and the wires on the motor side are connected to a 4-pole Amphenol connector. This cable is designed to connect the Harmonica or Bassoon drive to the Metronix APM-SE motor.

Amphenol Pin No.	Color	Signal	Description	
A	Brown & White	U	Motor Phase U	
B	Pink & Gray	V	Motor Phase V	
C	Blue & Red	W	Motor Phase W	
D	Green & Yellow	Earth	Ground	

*Table 10-4: **Motor Power Cable for the Harmonica and Bassoon Drives** (Metronix SE Motors)*

*Figure 15: **Motor Power Cable** (Part No. CBL-MTRPWR2-5, for Metronix SE Motors)*