

*FM-3 Programming Module  
Installation Manual*



P/N 400508-02

Revision: A2

Date: August 23, 2000

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# FM-3 Programming Module Installation Manual

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EMERSON Motion Control  
12005 Technology Drive  
Eden Prairie, Minnesota 55344  
U.S.A.

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**FAX****(952)995-8011**

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You can FAX questions and comments to EMERSON Motion Control. Just send a FAX to the number listed above.

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**Website:****[www.emersondrivesolutions.com](http://www.emersondrivesolutions.com)**

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If you have Internet capabilities, you also have access to technical support using our Website at <http://www.emersondrivesolutions.com>. The Website includes technical notes, frequently asked questions, release notes and other technical documentation. This direct technical support connection lets you request assistance and exchange software files electronically.

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EMERSON Motion Control's products are backed by a team of professionals who will service your installation wherever it may be. Our customer service center in Eden Prairie, Minnesota is ready to help you solve those occasional problems over the telephone. Our customer service center is available 24 hours a day for emergency service to help speed any problem solving. Also, all hardware replacement parts, should they ever be needed, are available through our customer service organization.

When you call, please be at your computer, have your documentation in hand, and be prepared to provide the following information:

Product version number, found by choosing **About** from the **Help** menu.

The type of controller or product you are using.

Exact wording of any messages that appear on your screen.

What you were doing when the problem occurred.

How you tried to solve the problem.

You can also contact us by email: [service@emersondrivesolutions.com](mailto:service@emersondrivesolutions.com)

Need on-site help? EMERSON Motion Control provides service, in most cases, the next day. Just call EMERSON's customer service center when on-site service or maintenance is required.

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**Sales:** **(952)995-8000**

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Email: [sales@emersondrivesolutions.com](mailto:sales@emersondrivesolutions.com)  
Authorized EMERSON Motion Control distributors may place orders directly with our Order Processing department by calling the number listed above. For information on your local distributor, call EMERSON Motion Control.

# Document Conventions

Manual conventions have been established to help you learn to use this manual quickly and easily. As much as possible, these conventions correspond to those found in other Microsoft® Windows®<sup>1</sup> documentation.

Menu names and options are printed in bold type: the **File** menu.

Dialog box names begin with uppercase letters: the Axis Limits dialog box.

Dialog box field names are in quotes: “Field Name”.

Button names are in italic: *OK* button.

Source code is printed in Courier font: Case ERMS .

In addition, you will find the following typographic conventions throughout this manual.

This	Represents
<b>bold</b>	Characters that you must type exactly as they appear. For example, if you are directed to type <b>a:setup</b> , you should type all the bold characters exactly as they are printed.
<i>italic</i>	Place holders for information you must provide. For example, if you are directed to type <i>filename</i> , you should type the actual name for a file instead of the word shown in italic type.
ALL CAPITALS	Directory names, file names, key names, and acronyms.
SMALL CAPS	Non-printable ASCII control characters.
KEY1+KEY2 example: (Alt+F)	A plus sign (+) between key names means to press and hold down the first key while you press the second key.
KEY1,KEY2 example: (Alt,F)	A comma (,) between key names means to press and release the keys one after the other.

Special nomenclature is provided for people working with these products, as follows:



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## Warning

For the purpose of this manual and product, “Warning” indicates death, severe personal injury or substantial property damage CAN result if proper precautions are not taken.

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## Caution

For the purpose of this manual and product, “Caution” indicates minor personal injury or property damage CAN result if proper precautions are not taken.

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## Note

For the purpose of this manual and product, “Note” indicates information about the product or the respective part of the manual which is essential to highlight.

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Throughout this manual, the word “drive” refers to an E Series drive.

1. See page ii of the preface.

# Safety Instructions

## General Warning

Failure to follow safe installation guidelines can cause death or serious injury. The voltages used in the product can cause severe electric shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to it. The installation must comply with all relevant safety legislation in the country of use.

## Qualified Person

For the purpose of this manual and product, a “qualified person” is one who is familiar with the installation, construction and operation of the equipment and the hazards involved. In addition, this individual has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground and tag circuits and equipment in accordance with established safety practices.
- Is trained in the proper care and use of protective equipment in accordance with established safety practices.
- Is trained in rendering first aid.

## Reference Materials

The following related reference and installation manuals may be useful with your particular system.

- *FM-3 Speed Module Reference Manual* (P/N 400508-01)
- *Epsilon Eb and E Series EN Drives Reference Manual* (P/N 400501-01)

# Safety Considerations

## Safety Precautions

This product is intended for professional integration into a complete system. If you install the product incorrectly, it may present a safety hazard. The product and system may use high voltages and currents, carry a high level of stored electrical energy, or control mechanical equipment that can cause injury.

You should give close attention to the electrical installation and system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. Read and follow this safety information and the instruction manual carefully.

## Enclosure

This product is intended to be mounted in an enclosure which prevents access except by trained and authorized personnel, and which prevents the ingress of contamination. This product is designed for use in an environment classified as pollution degree 2 in accordance with IEC664-1. This means that only dry, non-conducting contamination is acceptable.

## Setup, Commissioning and Maintenance

It is essential that you give careful consideration to changes to drive settings. Depending on the application, a change could have an impact on safety. You must take appropriate precautions against inadvertent changes or tampering. Restoring default parameters in certain applications may cause unpredictable or hazardous operation.

## Safety of Machinery

Within the European Union all machinery with which this product is used must comply with Directive 89/392/EEC, Safety of Machinery.

The product has been designed and tested to a high standard, and failures are very unlikely. However the level of integrity offered by the product's control function – for example stop/start, forward/reverse and maximum speed – is not sufficient for use in safety-critical applications without additional independent channels of protection. All applications where malfunction could cause injury or loss of life must be subject to a risk assessment, and further protection provided where needed.



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### Warning

#### General warning

Failure to follow safe installation guidelines can cause death or serious injury. The voltages used in this unit can cause severe electric shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to this equipment. The installation must comply with all

relevant safety legislation in the country of use.

**AC supply isolation device**

The AC supply must be removed from the drive using an approved isolation device or disconnect before any servicing work is performed, other than adjustments to the settings or parameters specified in the manual. The drive contains capacitors which remain charged to a potentially lethal voltage after the supply has been removed. Allow at least 3 minutes for Epsilon and 30 seconds for E Series drives after removing the supply before carrying out any work which may involve contact with electrical connections to the drive.

**Products connected by plug and socket**

A special hazard may exist where the drive is incorporated into a product which is connected to the AC supply by a plug and socket. When unplugged, the pins of the plug may be connected to the drive input, which is only separated from the charge stored in the bus capacitor by semiconductor devices. To avoid any possibility of electric shock from the pins, if they are accessible, a means must be provided for automatically disconnecting the plug from the drive (that is, a latching contactor).

**Grounding (Earthing, equipotential bonding)**

The drive must be grounded by a conductor sufficient to carry all possible fault current in the event of a fault. The ground connections shown in the manual must be followed.

**Fuses**

Fuses or over-current protection must be provided at the input in accordance with the instructions in the manual.

**Isolation of control circuits**

The installer must ensure that the external control circuits are isolated from human contact by at least one layer of insulation rated for use at the applied AC supply voltage.

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# Table of Contents

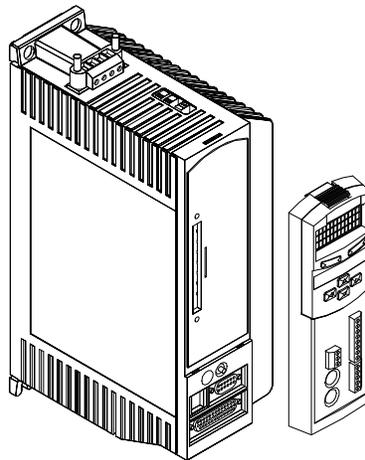
Customer Service . . . . .	iii
Reference Materials . . . . .	vi
Safety Considerations . . . . .	vii
<b>Introduction</b>	<b>1</b>
<b>Installation</b>	<b>3</b>
Basic Installation Notes . . . . .	3
Mechanical Installation . . . . .	3
Software Installation . . . . .	5
PC System Configuration . . . . .	5
Preparing for PowerTools FM-3 Installation . . . . .	5
Installing PowerTools FM-3 . . . . .	5
Starting and Exiting PowerTools . . . . .	6
Accessing Help . . . . .	7
<b>Diagnostics and Troubleshooting</b>	<b>9</b>
Diagnostic Display . . . . .	9
Fault Codes . . . . .	10
Brake Operation . . . . .	16
Analog Outputs . . . . .	17
Diagnostic Analog Output Test Points . . . . .	18
Drive Faults . . . . .	20
Error Messages . . . . .	20
Programming Error Messages . . . . .	22
Online Status Indicators . . . . .	27
<b>Specifications</b>	<b>29</b>
Dimensions and Clearances . . . . .	29
Cable Diagrams . . . . .	31
<b>Index</b>	<b>45</b>



# Introduction

FM-3 is a compact and rugged function module that attaches to the front of the E Series drive. It provides eight digital input lines and four digital output lines, in addition to the four input and three output lines available on the E Series EN drive.

Unlike other function modules, the FM-3 offers complex motion profiling. A complex motion profile consists of two or more indexes that are executed in sequence such that the final velocity of each index except the last is non-zero. Logical instructions between index statements can provide a powerful tool for altering motion profiles 'on the fly'. The FM-3 defines complex motion by a configuration file that includes setups, function assignments and programs. The configuration file is created using EMERSON Motion Control PowerTools® FM-3 software<sup>1</sup>. Setup views have the same look and feel as dialog boxes. The wiring of input and output functions is done through assignments in the software. Emerson Motion Control PowerTools FM-3 is an easy-to-use Microsoft® Windows®<sup>2</sup> based setup and diagnostics tool.



*Figure 1: E Series EN Drive with FM-3 Function Module*

Note that the E Series drive's firmware is disabled whenever a Function Module such as the FM-3 is attached. Therefore, if the E Series drive's hardware is FM compatible, then the E Series drive's firmware can be any version because the programming features reside in the function module's flash memory. Flash files used for firmware upgrades are available on the Emerson Motion Control webpage.

1. In this manual, Emerson Motion Control PowerTools FM-3 software will be referred to as PowerTools FM-3.
2. See page ii of the preface

## FM-3 Programming Module Installation Manual

The FM-3 stores E Series drive setup parameters within the module itself. This allows you to transfer the FM-3 to another E Series drive without losing setup parameters.

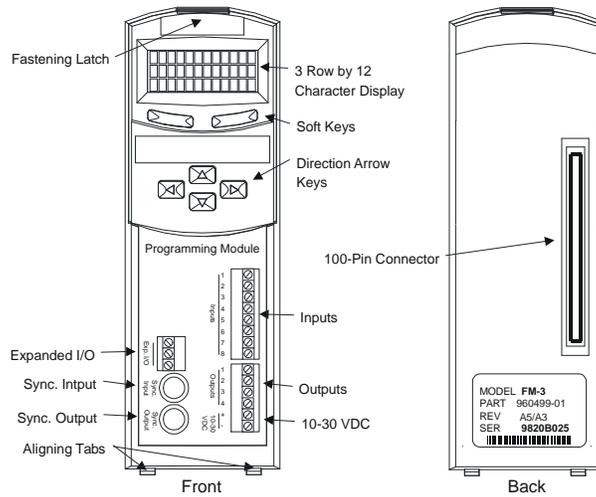


Figure 2: FM-3 Programming Module Features

# Installation

## Basic Installation Notes

You are required to follow all safety precautions during start-up such as providing proper equipment grounding, correctly fused power and an effective Emergency Stop circuit which can immediately remove power in the case of a malfunction. See the “Safety Considerations” section for more information.

## Mechanical Installation

The FM-3 detects and verifies the drive serial number when its attached to an E Series drive. If an FM-3 is moved from one drive to another, it will detect the difference in serial numbers and generate an Invalid Configuration fault.

Two aligning tabs, a locking latch and a 100-pin connector are used to attach the FM-3 to an E Series drive. All electrical connections between the FM-3 and the E Series drive are accomplished with the single connector located on the rear of the FM-3.

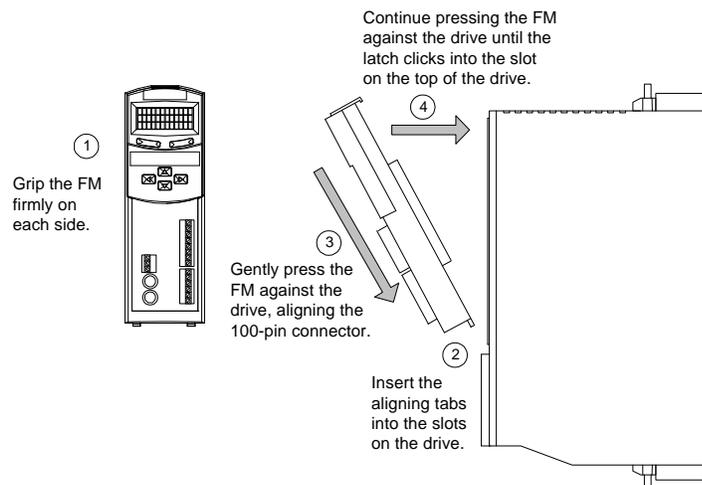


Figure 3: Attaching the FM-3 to an E Series Drive



### Caution

Do not attach or detach the FM-3 when power is applied to the drive. It could cause drive instability.

## FM-3 Programming Module Installation Manual

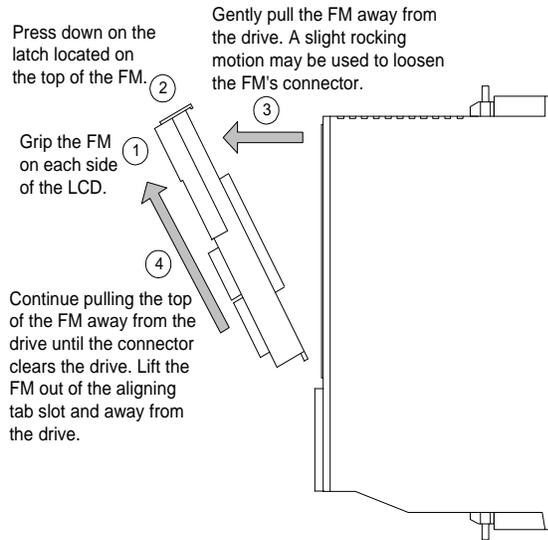


Figure 4: Detaching the FM-3 from the Drive Connections



### Caution

Do not attach or detach the FM-3 when power is applied to the drive. It could cause drive instability.

## Modbus Communications

The drive's serial communication protocol is Modbus RTU slave with a 32 bit data extension. The Modbus protocol is available on most operator interface panels and PLC's.

Serial Communications Specifications	
Max baud rate	19.2k (default)
Start bit	1
Stop bit	2
Parity	none
Data	8

EMERSON Motion Control's Motion Interface panels are supplied with a Modbus master communications driver.

## Software Installation

Emerson Motion Control PowerTools® FM-3 software was designed for users who need access to all setup options and diagnostic information for the drive. The software provides access to all commonly used drive parameters.

## PC System Configuration

### Required:

- Microsoft® Windows® 95/98 or Microsoft Windows NT® 4.0 (service pack 3)
- Serial port
- Mouse
- 3.5" floppy drive for installation

### Recommended:

- 16 MB or more RAM for Windows 95/98, and 32 MB or more for Windows NT.
- Up to 45 MB of hard disk space required for a full installation; 15 MB for minimum installation.

### Optional:

- Windows-compatible printer
- Modem and Internet access

## Preparing for PowerTools FM-3 Installation

- Close all programs and turn off virus protection software to prevent installation conflicts.
- If you have another version of PowerTools on your computer and do not want to overwrite that version, change the default installation folder for PowerTools during installation setup.
- To avoid overwriting programs you have customized or created, place them into a separate folder before you install.

## Installing PowerTools FM-3

You must be running Microsoft Windows 95/98 or Microsoft Windows NT 4.0 to install M-3.

### To install PowerTools:

1. Insert the PowerTools disk 1 into the floppy drive.
2. From the Start menu, choose **Run**.

## FM-3 Programming Module Installation Manual

3. In the Run dialog box, type *a:/setup*, where *a* is the letter assigned to your 3.5" floppy drive.
4. Click the *OK* button, then follow the instructions on your screen.

Installation will take about five minutes. The install program automatically:

- Creates the directory on your hard drive named:  
C:\EMERSON\PT-FM3
- Creates a new Windows group called "EMERSON Motion Control-FM3".
- Loads the required DLL's into your Windows system directory.
- Loads PowerTools into the EMERSON\PT-FM3 directory.
- Loads drive setup files into the EMERSON\APPS directory.



---

### Note

To complete the installation for Windows 98 and NT, you may be required to restart Windows.

---

Refer to the readme.txt file located on the installation floppy for more information.

### If You Need Help with Installation

If you encounter problems while installing PowerTools, call Technical Support at (952)995-8033 (24 hour assistance).

## Starting and Exiting PowerTools

### Starting the Software

1. Click the Start button on the taskbar at the bottom left of the screen.



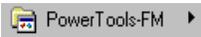
2. Click on the Programs selection. The Programs menu appears.



3. Click on the "EMERSON Motion Control" folder icon.



4. Click on the "PowerTools" folder icon.



5. Click on the PowerTools program icon.



## Exiting the Software

Choose **File** from the menubar, then click Exit. If you are using the keyboard, press the shortcut key combination Alt+F, X.

If you made changes, PowerTools displays an Alert dialog box asking whether you want to save your current work. Click the *Yes* button or press Enter to save your work, or click the *No* button to quit without saving.

## Accessing Help

All PowerTools tabs and dialog boxes provide a *Help* button. This retrieves help for that particular subject and provides details to assist you in the use of each tab or dialog box. Also, provided is a index-based help system. There is the ability to search the online help using a keyword. Lastly, PowerTools has context sensitive help capability.

Online Help displays detailed procedural and reference information. It contains some information that does not appear in this manual.

**To display Help in PowerTools, do one of the following:**

- Press F1.
- Choose a command from the Help menu.
- Click the *Help* button on a dialog box or tab.
- Click the Help icon on the toolbar.
- Click the Context Sensitive Help button on the toolbar and then the field on the tab.

## FM-3 Programming Module Installation Manual

# Diagnosics and Troubleshooting

## Diagnostic Display

The diagnostic segment display on the front of the drive shows drive status, FM-3 status, and fault codes. When a fault condition occurs, the drive will display the fault code, overriding the status code. The alphanumeric display on the FM-3 provides additional fault information.

The decimal point is “On” when the drive is enabled, and the stop input is not active. This indicates that the drive is ready to run and any motion command will cause motion. Motion commands will not cause motion unless you are Ready (R) and the decimal point is “On”.

Display Indication	Status	Description	FM-3 Keypad Display
	Ready	The FM-3 and E Series drive system is functioning normally and is ready to execute a motion command.	Drive Type    Address Motor Type Menu Groups
	Disabled	Power Stage is disabled.	Drive Type    Address Motor Type Menu Groups
	RMS Foldback	Motor torque is limited to 80 percent.	Drive Type    Address Motor Type Menu Groups
	Stall Foldback (E Series drive only)	Drive output current is limited to 80 percent of drive stall current.	Drive Type    Address Motor Type Menu Groups
	Ready to Run	Drive enabled. No stop input.	Drive Type    Address Motor Type Menu Groups
	Homing	Home is executing.	Drive Type    Address Motor Type Menu Groups
	Indexing	Index is executing.	Drive Type    Address Motor Type Menu Groups

## FM-3 Programming Module Installation Manual

Display Indication	Status	Description	FM-3 Keypad Display
	Jogging	Jog is executing.	Drive Type    Address Motor Type Menu Groups
	Program	Program is executing.	Drive Type    Address Motor Type Menu Groups

## Fault Codes

A number of diagnostic and fault detection circuits are incorporated to protect the drive. Some faults, such as high DC bus and amplifier or motor over temperature can be reset with the Reset button on the front of the drive or the Reset input function. Other faults, such as encoder faults, can only be reset by cycling power “Off” (wait until the diagnostics display turns “Off”), then power “On”.

The drive accurately tracks motor position during fault conditions. For example, if there is a "Low DC Bus" fault where the power stage is disabled, the drive will continue to track the motor's position provided the logic power is not interrupted.

The +/- Limit faults are automatically cleared when the fault condition is removed. The table below lists all the fault codes in priority order from highest to lowest. This means that if two faults are active, only the higher priority fault will be displayed.

Segment Display	Fault	Action to Reset	Bridge Disabled	FM-3 Display
	Flash Invalid	Reprogram the FM's Flash	Yes	
	Watchdog Timer	Button or Input	Yes	Watch Dog
	Power Up Test	Power	Yes	Power Up Tst
	NVM Invalid	Button or Input	Yes	NVM Invalid

## Diagnostics and Troubleshooting

Segment Display	Fault	Action to Reset	Bridge Disabled	FM-3 Display
U	Invalid Configuration	Button or Input	Yes	Invalid Conf
Z	Power Module	Button or Input	Yes	Power Module
H	High DC Bus	Button or Input	Yes	High DC Bus
U	Low DC Bus	Button or Input	Yes	Low DCBus
P	Encoder State	Power	Yes	Encoder State
E	Encoder Hardware	Power	Yes	Encoder HW
M	Motor Overtemp	Button or Input	Yes	MotorOvrTemp
S	RMS Shunt Power	Button or Input	Yes	RMS ShuntPowr
O	Overspeed	Button or Input	Yes	Over Speed
F	Max Following Error	Button or Input	Yes	Following Err
L	Travel Limit +/-	Auto	No	TravLmtMinus TravLmtPlus

## FM-3 Programming Module Installation Manual

Segment Display	Fault	Action to Reset	Bridge Disabled	FM-3 Display
	All "On"	Normally on for one second during power up	Yes	
	FM-3			** Fault ** ***** Depend on Fault

### Fault Descriptions



#### Flash Invalid

This fault indicates that the firmware checksum has failed. Use the Tools Program Flash menu item from Emerson Motion Control PowerTools® to reprogram/upgrade the firmware stored in flash memory. If this problem persists, call EMERSON Motion Control. A common cause would be an interrupted F/W Flash upgrade (cable disconnected during an upgrade process).



#### Watchdog Timer

The watchdog timer ensures that the firmware is operating normally. If the firmware fails to reset this timer every 10 ms, the drive hardware will be reset, all inputs and outputs will be cleared ("Off"), and a Watchdog Timer fault is generated.



#### Power Up Test

This fault indicates that the power-up self-test has failed. This fault cannot be reset with the reset command or reset button.



#### NVM Invalid

At power-up the drive tests the integrity of the non-volatile memory. This fault is generated if the contents of the non-volatile memory are invalid.



#### FM-3 Fault

A 3 will be displayed in the segment display on the E Series drive when the FM-3 experiences a fault. See the table above for more information about the various faults.

---

**Invalid Configuration**


---

The FM was not on this drive during its previous power-up and it is not known if the setup data in the FM matches the drive and motor to which the FM is now attached.

This can also happen when a FM is removed from a drive and the drive is powered-up.

To reset the fault, create or open a configuration file with the correct drive and motor selections and download the configuration to the FM or drive. If you are certain that the setup data in the FM or drive matches the system configuration, press and hold the E Series drive's Reset button for 10 seconds (until the fault is cleared).




---

**Caution**

Damage may occur to the drive, motor or both if the fault is cleared using the Reset button when the setup data in the FM does not match the current drive and motor.

---

**Power Module**


---

This fault is generated when a power stage over-temperature, over-current or loss of power stage logic supply occurs. This can be the result of a motor short to ground, a short in the motor windings, a motor cable short or the failure of a switching transistor.

It can also occur if the drive enable input is cycled "Off" and "On" rapidly (>10 Hz).

---

**High DC Bus**


---

This fault will occur whenever the voltage on the DC bus exceeds 440 VDC. The most likely cause of this fault would be an open shunt fuse, a high AC line condition or an application that requires an external shunt (that is, a large load with rapid deceleration).

---

**Low DC Bus**


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This fault will occur whenever the voltage on the DC bus drops below 96 volts. The most likely cause of this fault is a reduction (or loss) of AC power. A 50 ms debounce time is used with this fault to avoid faults caused by intermittent power disruption.

---

**Encoder State**


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Certain encoder states and state transitions are invalid and will cause the drive to report an encoder state fault. This is usually the result of noisy encoder feedback caused by poor shielding.

---

	<b>Encoder Hardware</b>
<p>If any pair of encoder lines are in the same state, an encoder line fault is generated. The most likely cause is a missing or bad encoder connection.</p>	
<hr/>	<hr/>
	<b>Motor Overtemp</b>
<p>This fault is generated when the motor thermal switch is open due to motor over-temperature or incorrect wiring.</p>	
<hr/>	<hr/>
	<b>RMS Shunt Power</b>
<p>This fault is generated when RMS shunt power dissipation is greater than the design rating of the internal shunt.</p>	
<hr/>	<hr/>
	<b>Overspeed</b>
<p>This fault occurs when the actual motor speed exceeds the Overspeed Velocity Limit parameter. This parameter can be accessed with PowerTools FM-3 software.</p>	
<hr/>	<hr/>
	<b>Max Following Error</b>
<p>This fault is generated when the following error exceeds the following error limit (default following error limit is .2 revs). With PowerTools FM-3 you can change the Following Error Limit value on disable in the Position view.</p>	
<hr/>	<hr/>
	<b>Travel Limit +/-</b>
<p>This fault is caused when either the + or - Travel Limit input function is active.</p>	
<hr/>	<hr/>
	<b>All "On"</b>
<p>This is a normal condition during power up of the drive. It will last for less than 1 second. If this display persists, call EMERSON for service advice.</p>	

## FM-3 Specific Fault Descriptions

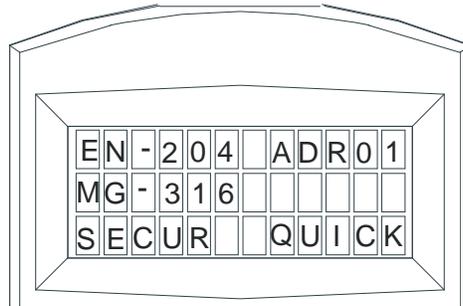


Figure 5: FM-3 display is used to display drive and FM-3 faults

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### Traj Fault

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This fault occurs when the drive has received trajectory data from the FM-3 that indicates a problem. Check the user units, velocities, accels and decels for correct values.

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### ISR Overrun

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This fault is generated when a module flash memory problem occurs. To correct, replace the FM-3.

---

### OutofSync

---

This fault is generated when the system is out of sync. To correct it, press the reset button and check the configuration.

---

### ProgramFault

---

This fault indicates an FM-3 user program fault. For example the program is attempting to divide by zero, or overflows and math errors caused by numbers that are too large, or non-existing parameters.

---

### ProgramInvalid

---

The user program in flash memory will not run. Download the User Program again using PowerTools FM-3. A common cause of this problem could be an interrupted configuration download, such as a cable being disconnected during a download.

## Brake Operation

MG motor brake operation is controlled by the Brake Release and Brake Control destinations. These destinations can be used together to control the state of the Brake source. The table below shows the relationship between the Brake sources and destinations (see “Diagnostic Display”).



### Note

No motion should be commanded while the brake is engaged.

Brake Release Destination		Off		On	
Brake Control Destination		On	Off	On	Off
Drive Power Stage	Enabled	0	1	1	1
	Disabled	0	0	1	1

### Brake Release

The Brake Release destination function will release the brake under all conditions. When this function is active, the Brake output will be on (that is, release brake). This function overrides all other brake control, thus allowing the brake to be released while a fault is active or the power stage is disabled. See also Brake source function.

### Brake Control

The Brake destination function, when active, will engage the brake unless overridden by the Brake Release function. This function lets you externally engage the brake while allowing the drive to also control the brake during fault and disabled conditions.

### Brake

The Brake source function is used to control the motor holding brake. If the Brake function is off, the brake is mechanically engaged. When the brake is engaged, the diagnostic display on the front of the drive will display a “b”.

The drive outputs are limited to 150 mA capacity, therefore, a suppressed relay is required to control motor coil. EMERSON Motion Control offers a relay, model # BRM-1.

## Analog Outputs

The drive has two 10 bit Analog Outputs which may be used for diagnostics, monitoring or control purposes. These outputs are referred to as Channel 1 and Channel 2. They can be accessed from the command connector on the drive or from the diagnostics output pins located on the front of the drive.

Each Channel provides a programmable Analog Output Source. (In early releases, the FM-3 analog output is fixed at the default selections.)

### Default Analog Output Source:

- Channel 1 = Velocity Feedback
- Channel 2 = Torque Command

Output	Source	Offset	Scale
1	Velocity Feedback	0	600 RPM/volt
2	Torque Command	0	30% /volt

Each channel includes a programmable Analog Output Offset and an Analog Output Scale. This feature allows you to “zoom in” to a desired range effectively increasing the resolution. The units for both of these parameters is dependent upon the Analog Output Source selection.

### Analog Output Offset units:

- Velocity Feedback = RPM
- Torque Command = Percent of continuous torque

### Analog Output Scale units:

- Velocity Feedback = RPM/volt
- Torque Command = Percent of continuous torque/volt

### Example:

You could use the Analog Outputs to accurately measure velocity overshoot. For example, to measure a target velocity of 2000 RPM at a resolution of  $\pm 10V = \pm 200$  RPM do the following.

1. Selected Velocity Feedback for the Analog Output Source.
2. Set the Analog Output Offset to 2000 RPM.
3. Set the Analog Output Scale to 20 RPM/VOLT.

This will provide an active range from -10 to +10 Volts to represent 1800 to 2200 RPM. Therefore, the measured resolution has been increased.

## Diagnostic Analog Output Test Points

The DGNE cable was designed to be use with either an oscilloscope or a meter. The wires are different lengths to avoid shorting to each other. However, if signals do get shorted to GND, the drive will not be damaged because the circuitry is protected.

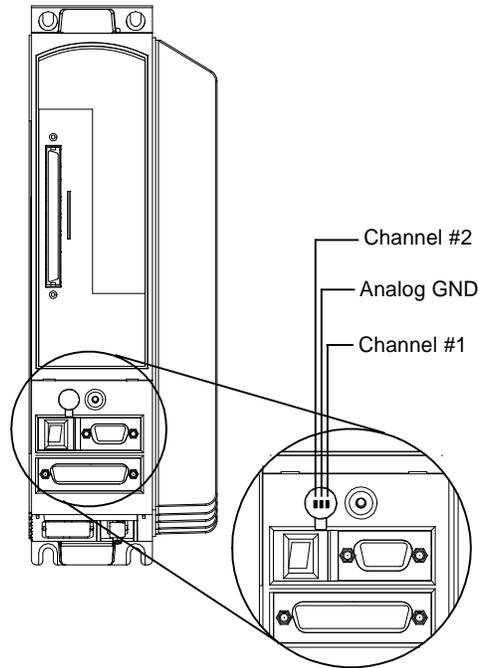


Figure 6: Diagnostic Output Test Points

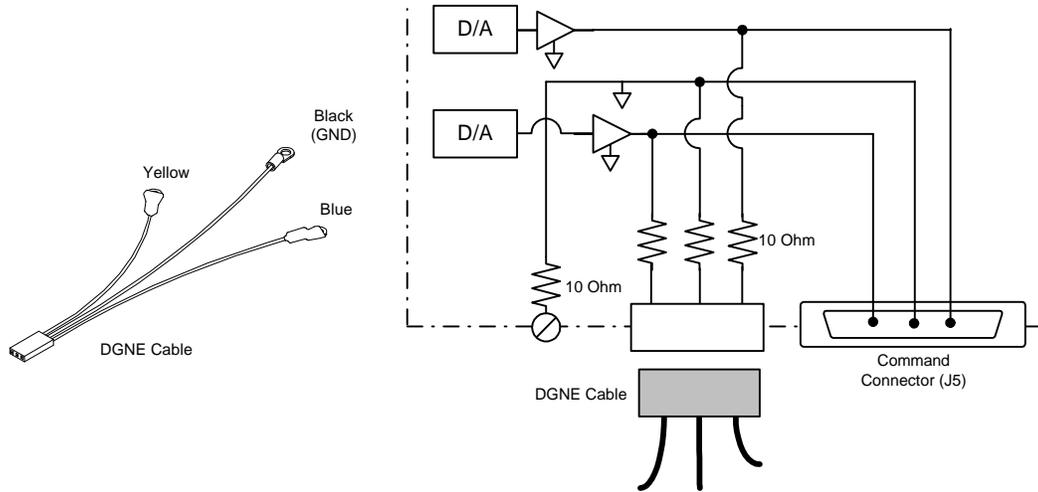


Figure 7: Diagnostic Cable (DGNE) Diagram

## Drive Faults

The Active Drive Faults dialog box is automatically displayed whenever a fault occurs. There are two options in this dialog box: Reset Faults and Ignore Faults.

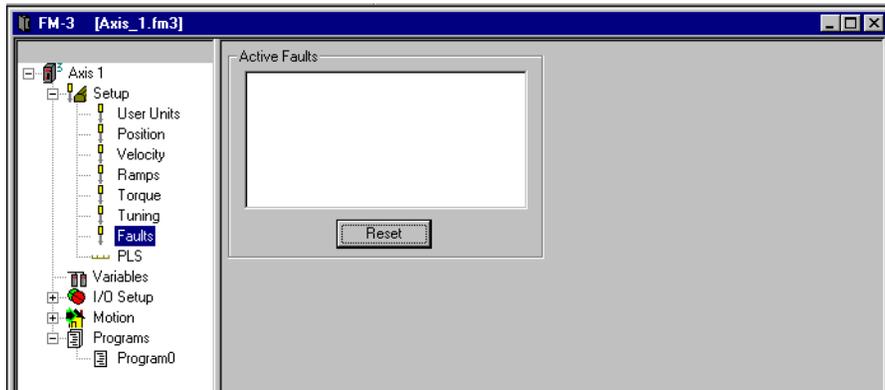


Figure 8: Active Drive Faults Dialog Box

### Resetting Faults

Some drive faults are automatically reset when the fault condition is cleared. Others require drive power to be cycled or the drive to be “rebooted” to be cleared. If you wish to continue working in the PowerTools software without resetting the fault, click the *Ignore Fault* button.

To reset faults that can be reset with the *Reset Faults* button, simply click the *Reset Faults* button in the Drive Faults Detected dialog box or push the Reset button on the front of the drive where the fault occurred.

### Viewing Active Drive Faults

To view all active drive faults, select the View Faults command from the **Device** menu. The dialog box displayed is the same as Active Drive Faults dialog box described above.

### Rebooting the Drive

To reboot the drive, cycle power or select the Reboot Drive command from the **Device** menu. This command reboots the drive attached to the active Configuration Window.

## Error Messages

PowerTools will pop-up an error message box to alert you to any errors it encounters. These message boxes will describe the error and offer a possible solution.

The terms below appear in the list of common problems you might encounter when working with PowerTools software along with the error message displayed, the most likely cause and solution.

**Assign** means to set a value using an equation. For example,  $x = 2$ , you are assigning the value of 2 to  $x$ .

A **Boolean value** is a value that represents two states such as On or Off. In the FM3 there are three variable types that have Boolean values. They are Boolean Variables, Input Event Variables and Output Event Variables. They all have a Boolean Value and can be used in equations to assign their Boolean value to another variable or in a conditional test.

In an equation, conditional tests such as  $(vel > 3.1)$  become Boolean values.

In FM3 Programming, unquoted text names are used to represent Boolean constants. Several different names are available. They all represent the two Boolean states and therefore are interchangeable.

An **Expression** is a collection of mathematical operands (variables, constants and numbers) and operators( +, -, \*, <, >, etc) that form a value. The right hand side of an equation (to the right of the =) is an expression.

The **Parser** is an internal component of PowerTools software that reads your program text file and generates executable code used by the FM3 Module firmware. The parser detects errors that are reported to you as Red Dot Error Messages.

Your program errors are displayed in the program view in **Red Dot Error Messages**. They are indicated with red dots. To get further information on the cause of the error you use the programming tool bar's red dotted question mark. This is an on/off setting that enables error message displays and application help messages.

## Non-Programming Error Messages

These messages occur while you are working in a view other than the Program View. The Program View has error messages specific to it, and they are described in a Programming Error Messages section. The Popup messages are listed below.

---

**Can Not Add Index, until current is valid.,  
Can Not Add Jog, until current is valid.,  
Can Not Add Program, until current is valid.**

---

The current View must be valid before you can create a new instance of Index, Jog or Home.

---

**Error: The maximum limit of Instances is reached.**

---

The number of Index instances, Jog Instances and Home Instances is limited. If you attempt to add an instance and the number of existing instances is at the maximum, you will get this message.

## Programming Error Messages

These Red Dot Error messages occur while you are working in the Program View.

When creating a program, the parser is executed when you left mouse click, when you arrow off the current Line, when you enter the carriage return, when you paste or when you drop a drag source. The parser detects errors and marks the line with a "Red Dot". To get further information on the cause of the error you use the programming tool bar's red dotted question mark. This is an on/off setting that enables error message displays and application help messages.

---

### **Error: Your Application is not valid to download ...**

---

This message lets the user know that there are errors such as "Red Dot" errors in one or more programs that prevent the program from being downloaded to the module. The message will provide more information such as which program is invalid to help the user correct the problem.

---

### **FYI: Your Application has ...**

---

This message lets the user know that there are errors such as "Red Dot" errors in one or more programs. The operation (i.e. file save) was completed, however other operations such as download would fail for this application. The message will provide more information such as which program is invalid to help the user correct the problem.

---

### **Error: A FM3 number's decimal Point resolution can not be greater than ten**

---

The FM3 does not use standard floating point. It uses Integer arithmetic to prevent round off errors. Decimals are used, but decimal point position is handled separately from the integer value. Zero puts the decimal point to the far right. Ten puts the decimal point at the far left. The mantissa must be between -2147483648 and 214748364. The decimal point position must be between zero and ten.

---

### **Error: A FM3 number's mantissa must be between -2147483647 and 2147483647.**

---

The mantissa must be between -2147483648 and 214748364. The decimal point position must be between zero and ten.

---

### **Error: A numeric variable can only be assigned a numeric value**

---

The Variable is a numeric. It only accepts types consisting of numeric values.

---

**Error: A string variable can only be assigned a quoted text string**

---

The Variable is string. It only accepts types consisting of text strings.

---

**Error: Can only compare(>,<,etc) numeric results**

---

This message occurs in conditional Expressions (i.e. If then). Variables are type identified, so equation and assignments ( $x = 9$ ) can be verified. In an expression only numerical values can be compared for greater than and less than conditions.

---

**Error: Couldn't find named Variable**

---

Could not find the variable.

---

**Error: Couldn't find named Variable from Text**

---

Could not find the variable defined by program text.

---

**Error: Destination Event variables can only be assigned an Event or Boolean**

---

The Variable is an Input event. It only accepts types consisting of Boolean, and events.

---

**Error: Program Instance does not Exist**

---

You attempted the "Call Program.#", but the program does not exist.

---

**Error: Single value expressions can only be Boolean constants, Events or Boolean variables**

---

This message occurs in conditional Expressions (i.e. If then). Variables are type identified, so equation and assignments ( $x = 9$ ) can be verified. In an expression you can use single variables without a comparison, but, then they must be a Boolean constants, Events or Boolean variable.

---

**Error: String does not represent a predefined name..**

---

The string needs to match one of the defined strings on record in the FM3 Registry data base.

---

**Error: String is not a selection.**

---

The string matches one of the defined strings, but that string is not a selection.

---

**Error: Syntax error encountered**

---

Parser Error Message. The Parser can not understand your text sequence.

---

**Error: Text Strings are limited to 12 characters...**

---

To change a Name you assign a quoted text string to that name. In FM3, text strings are fixed at 12 characters. If you use fewer than 12 characters, blanks are automatically inserted. An error occurs if you attempt to use more than 12 characters.

---

**Error: The Boolean variables can only be assigned an Event or Boolean value.**

---

The Variable only accepts types consisting of Boolean, and events.

---

**Error: The destination variable does not accept Data**

---

The Variable's internal data type attribute was not found.

---

**Error: The destination variable does not accept negative numbers**

---

You attempted to assign a negative number to an unassigned variable .

---

**Error: The destination variable is Read Only**

---

This message occurs when trying to assign a value to a read only variable.

---

**Error: The destination variable only accepts a numeric value**

---

---

**Error: The destination variable only accepts a Boolean or Event value**

---

---

**Error: The destination variable only accepts quoted "text"**

---

---

**Error: The destination variable only accepts selection text**

---

---

**Error: The destination variable's resolution is less than the resolution of the number**

---

You attempted to assign a number with a greater resolution of decimal points than the variable will accept (ie `index.0.vel = 2.34567`). The User Units setup will allow you to define the desired decimal point resolution.

---

**Error: The number is outside the range of the destination variable**

---

You attempted to assign a number that is outside the variable's range. To determine the range comment out this instruction and use the red dot help on the variable.

---

**Error: The mix of variable or expressions types can not be added or subtracted**

---

This message occurs in equations. Variables are type identified, so equation and assignments (`x = 9`) can be verified. In an equation only numerical values can be multiplied or divided. Booleans, Selections, text and events can not be added.

---

**Error: The mix of variable or expressions types can not be compared(=)**

---

This message occurs in conditional Expressions (i.e. If then). Variables are type identified, so equation and assignments (`x = 9`) can be verified. In an expression numerical, Boolean and event values can be compared for equality conditions. Selections and text can not be used.

---

**Error: The mix of variable or expression types can not be multiplied or divided**

---

This message occurs in equations. Variables are type identified, so equation and assignments (`x = 9`) can be verified. In an equation only numerical values can be multiplied or divided. Booleans, Selections, text and events can not be compared.

---

**Error: The Source Event- <variable name> can only be assigned <max number> times**

---

The limits to Source Event assignments are the number of destinations assigned to a single Output event is limited. Generally this is three. For Selections it is one. The Waitfor Instruction temporarily assigns its Output Event Operands. This is subject to the assignment limitations. To use an Output Event in a waitfor instruction, there must be at least one free assignment.

---

**Error: The Selection variable can only be assigned a Selection value.**

---

The destination variable only accepts selection values. Selection values are fixed unquoted text. The selection text must exactly match the available selections of the Destination variable.

---

**Error: This instance does not exist.**

---

This variable is referencing an instance that has not been created in your application. For example "Index.9.vel" the instance 9 of index has not been defined.

---

**Error: This is not a fully qualified variable.**

---

To use a variable it must be fully defined. Some variables are global variables and only the name is defined. Other Variables require a name.name convention. Other variables require an instance number (index.1.vel). All the components identifying the variable must be available to qualify the variable.

---

**Error: This variable cannot be assigned a selection value**

---

The variable that you are attempting to define with a selection does not accept selection values.

---

**Error: This variable type cannot be assigned a value**

---

The Variable is of a type that does not accept any assignments. A Source Event variable is an example. You can not assign a value to an output event.

---

**Error: The selection is not valid for this variable**

---

The variable that you are attempting to define with a selection does accept selection values. However the selection you are attempting to use is not accepted by this variable.

---

**Error: Trying to assign a selection variable with bad selection data**

---

When checking to see if the selection goes with the destination variable, the source is not a defined selection for the destination variable.

## Online Status Indicators

### Global Where Am I Button

The Program View, when online and executing a program or sequence of programs, can display current program status. Pressing the Where Am I button on the PowerTools FM-3 toolbar creates a blue triangle that appears on the line of the program currently being executed.

The Global Where Am I can be used for diagnostics. When the user needs to know where in a complicated program the drive is or when the user wishes to follow the logical flow of the program.

### Motion Status

While the drive is online, the name of the program currently running or the motion type currently running will appear in the status bar at the bottom left corner of the PowerTools FM-3 screen.

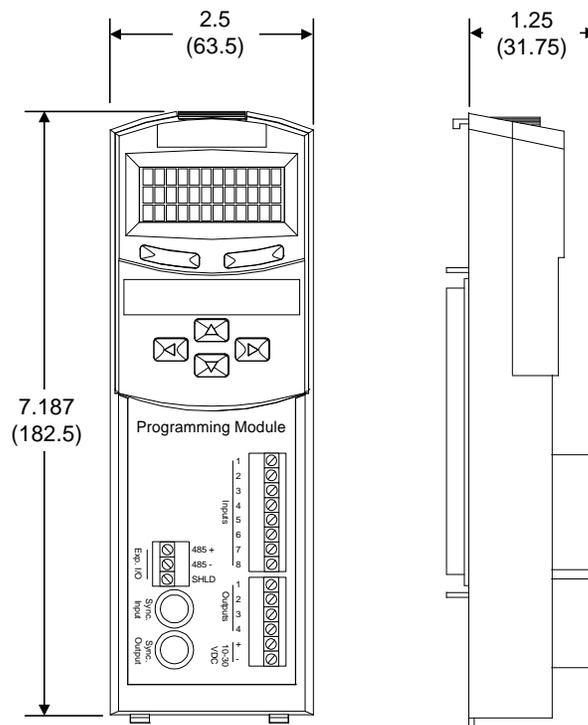
## FM-3 Programming Module Installation Manual

# Specifications

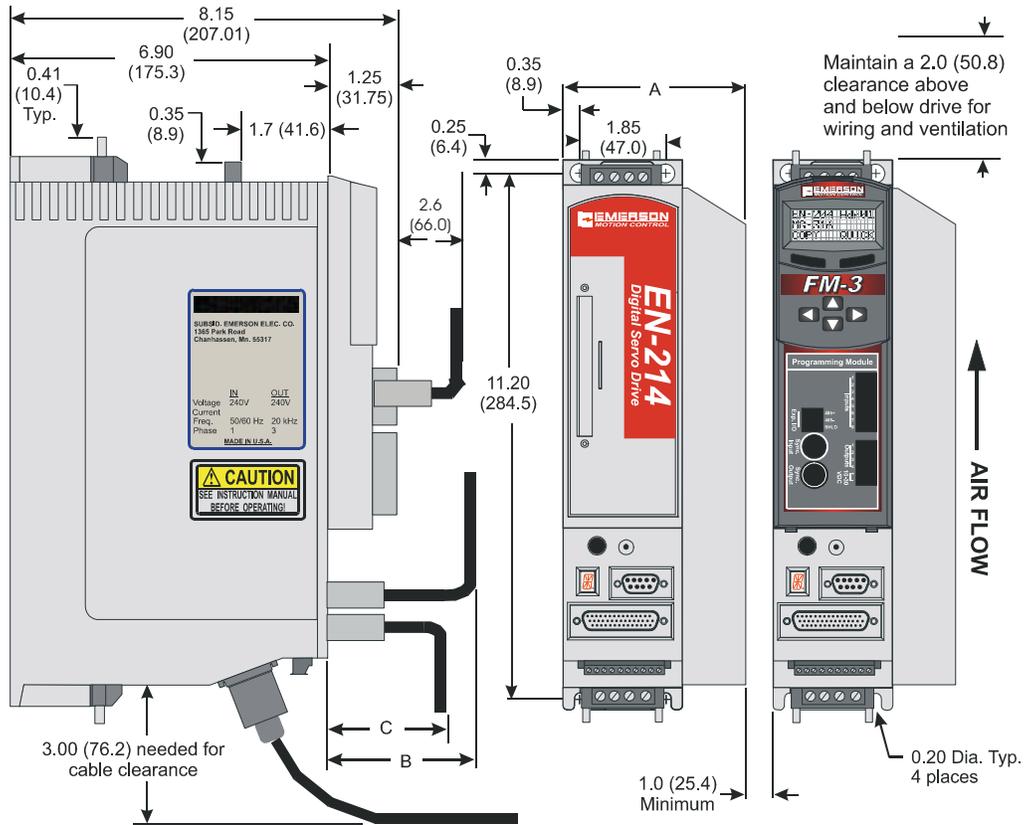
Power consumption: 3W from E Series drive power supply.  
 I/O Supply Voltage: 10-30 VDC.

Function		Electrical Characteristics
Inputs	ON State Voltage	10-30 VDC
	ON State Current	2mA-6.5mA
	OFF State Voltage	0-3VDC
	OFF State Current	0-400 $\mu$ A
Outputs	Max. ON State Voltage	I/O Supply Voltage -1.5V
	Max. ON State Current	150mA
	Max. OFF State Current	100 $\mu$ A

## Dimensions and Clearances



# FM-3 Programming Module Installation Manual

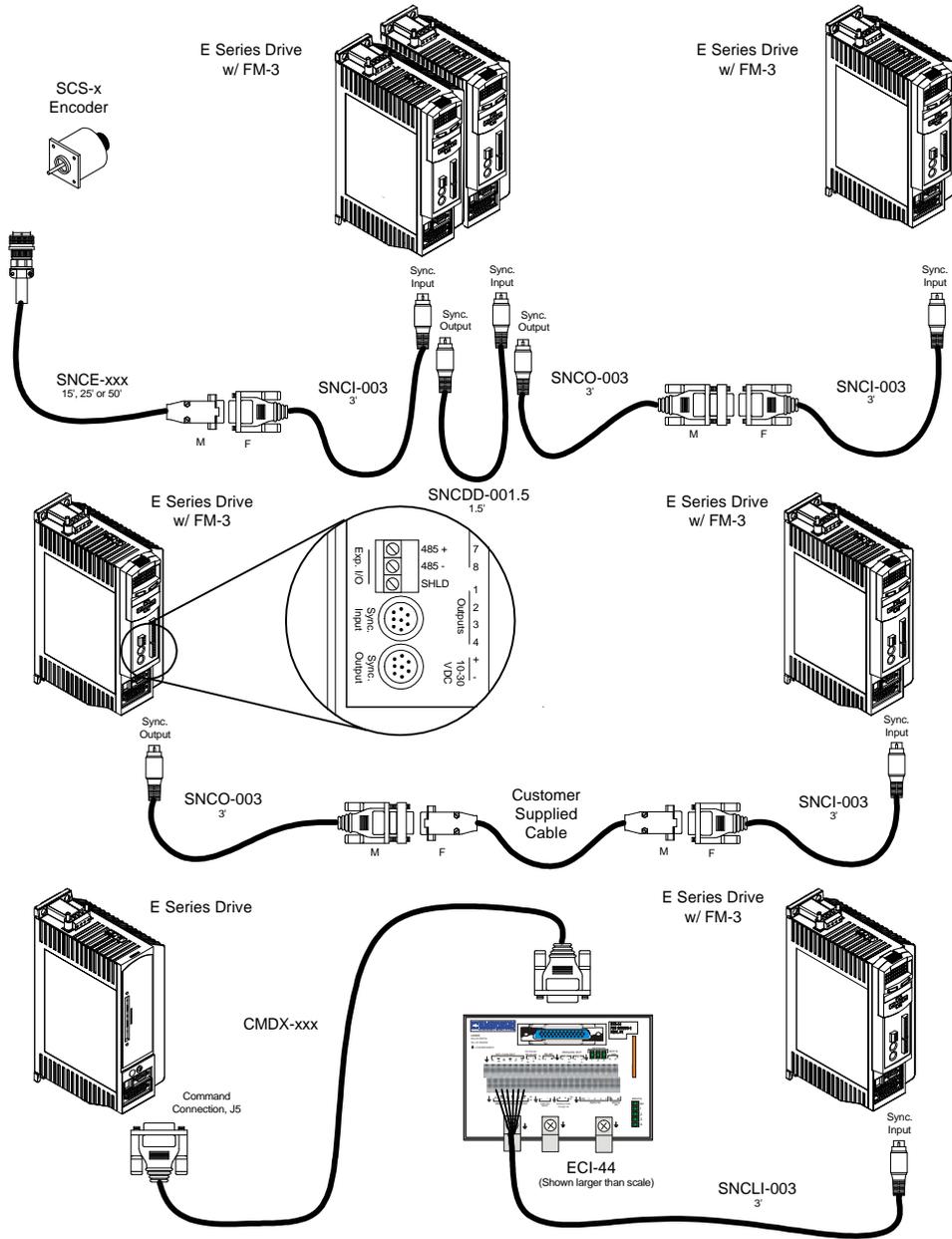


Model	A
EN-204	2.93 (74.4)
EN-208	3.43 (87.1)
EN-214	3.93 (99.8)

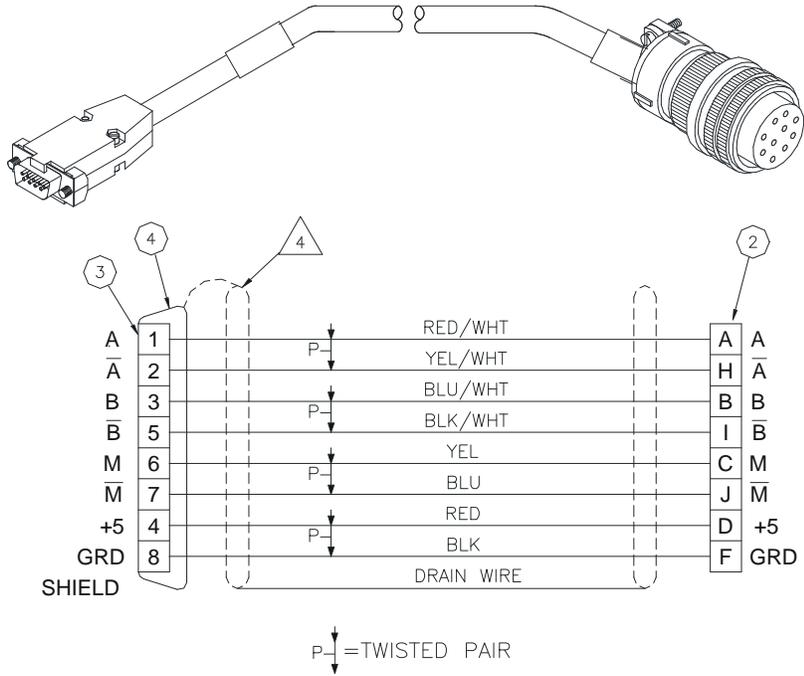
Model	B	C
All Drive Models	TIA Cable CO485-XXX	CMDX CMDO AX-CEN CDRO
	2.5 (63.5)	3.5 (88.9) 1.75 (44.5)

Dimensions in ( ) are millimeters

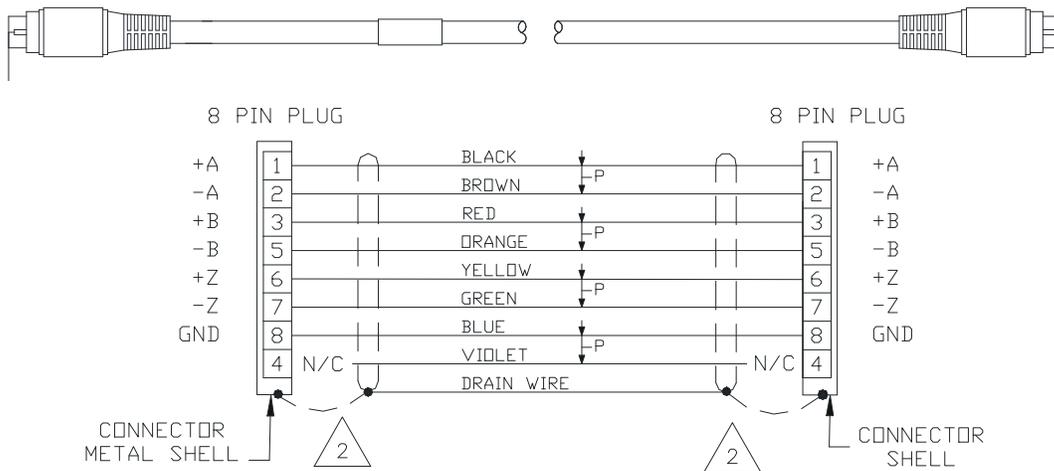
# Cable Diagrams



### SNCE-XXX Cable

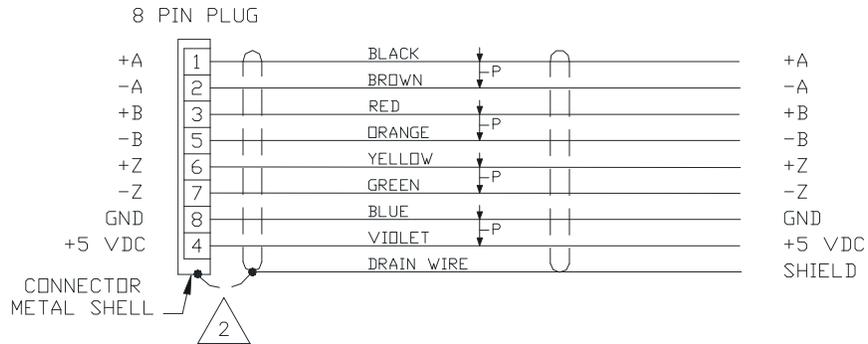
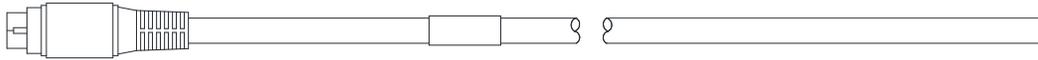


### SNCDD-001.5 Cable

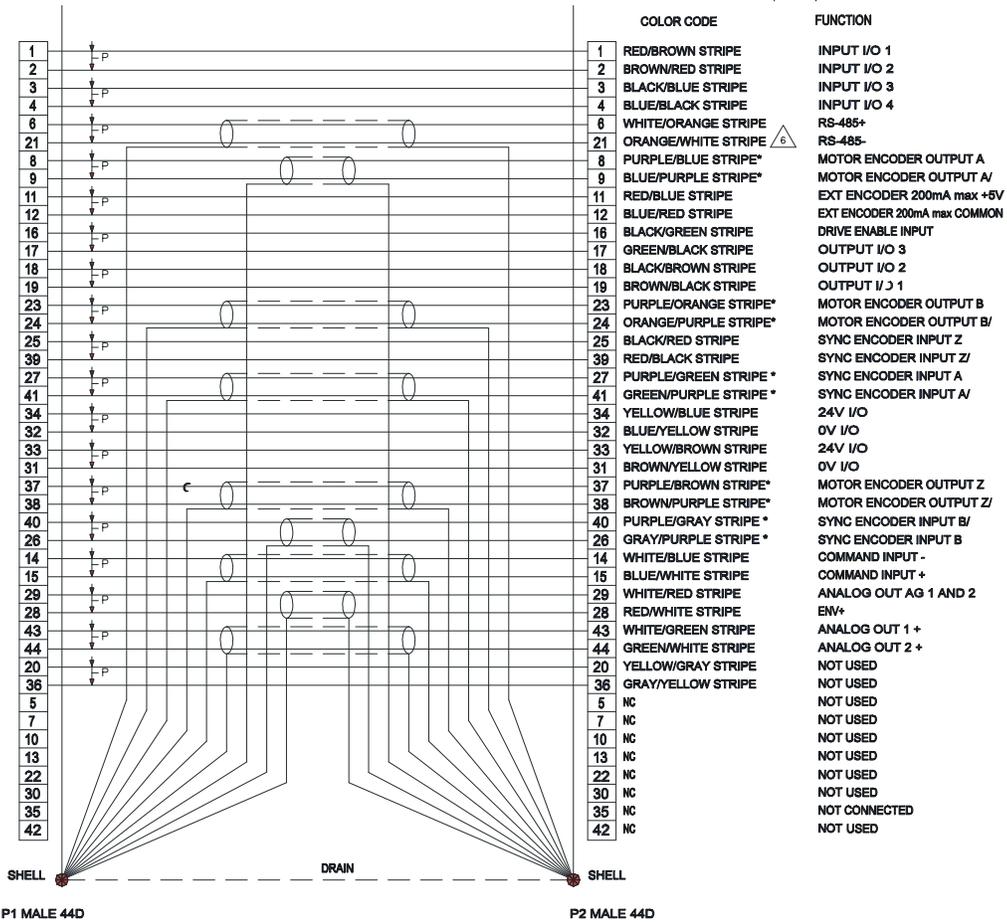
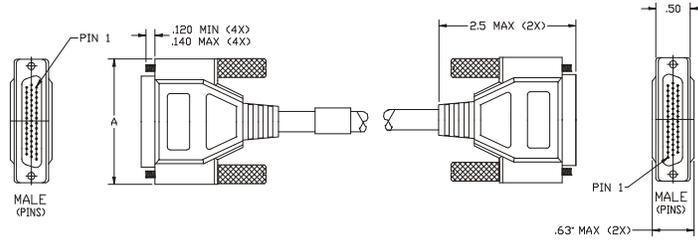




## SNCLI-003 Cable



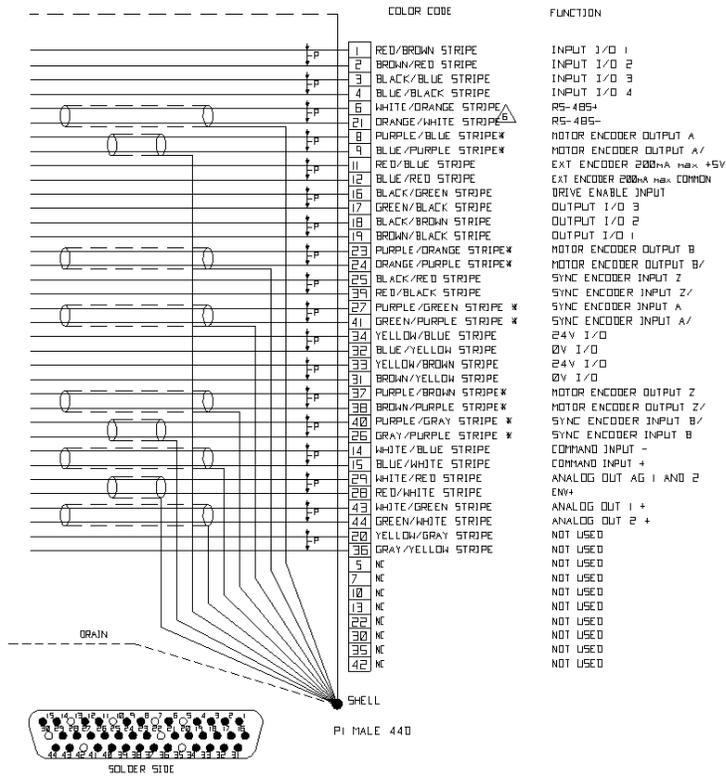
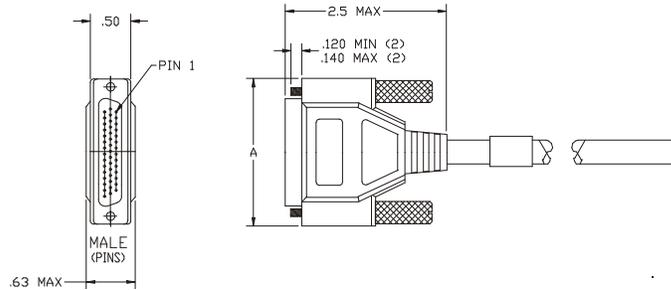
### CMDX-XXX Cable



#### Note

Some CMDX cables may have White/Yellow and Yellow/White wires in place of the White/Orange and Orange/White shown in the figure above (pins 6 and 21).

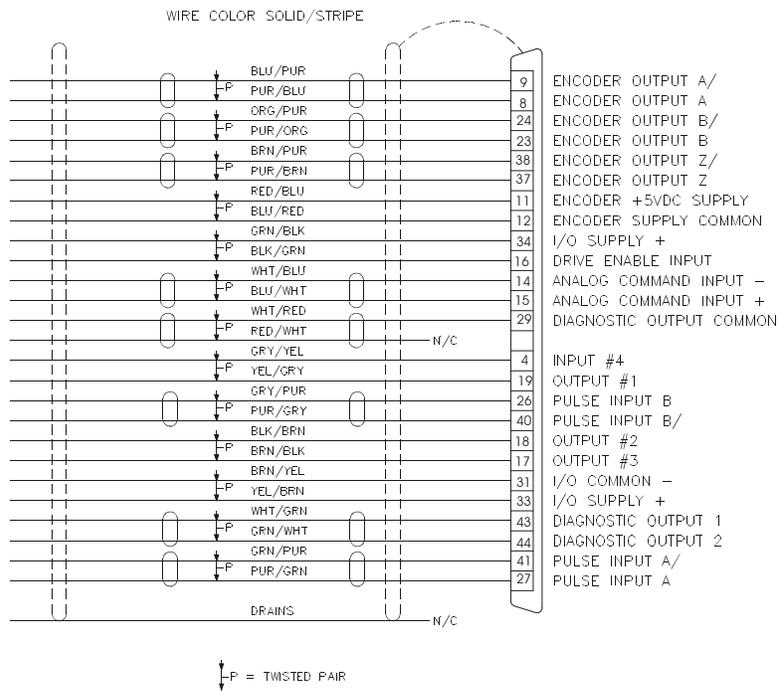
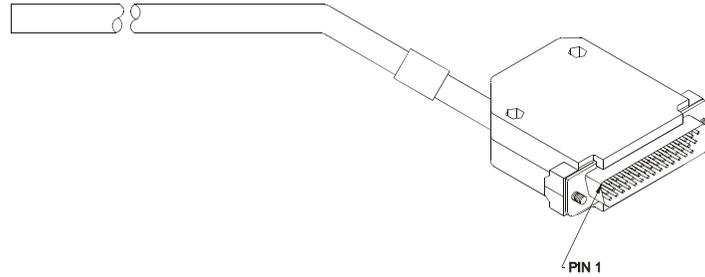
## CMDO-XXX Cable



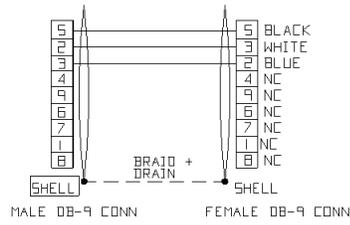
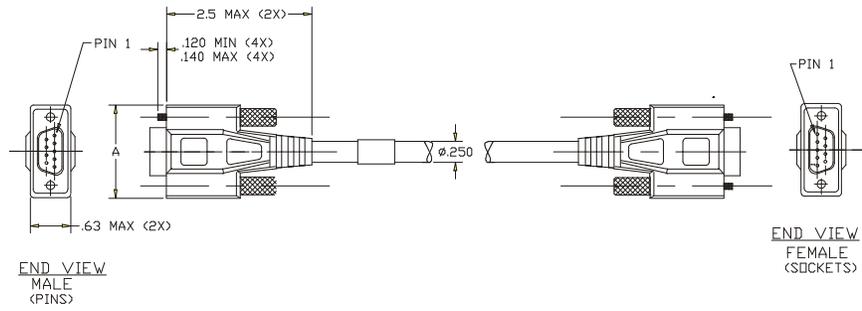
### Note

Some CMDO cables may have White/Yellow and Yellow/White wires in place of the White/Orange and Orange/White shown in the figure above (pins 6 and 21).

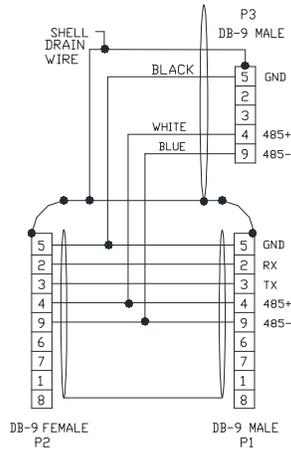
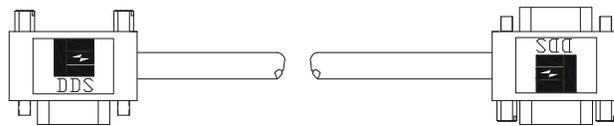
CDRO-XXX Cable



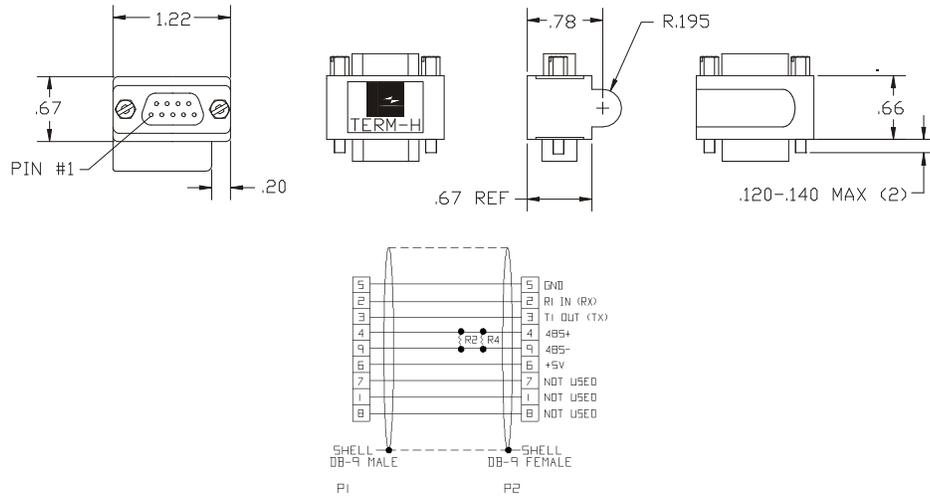
### TIA-XXX Cable



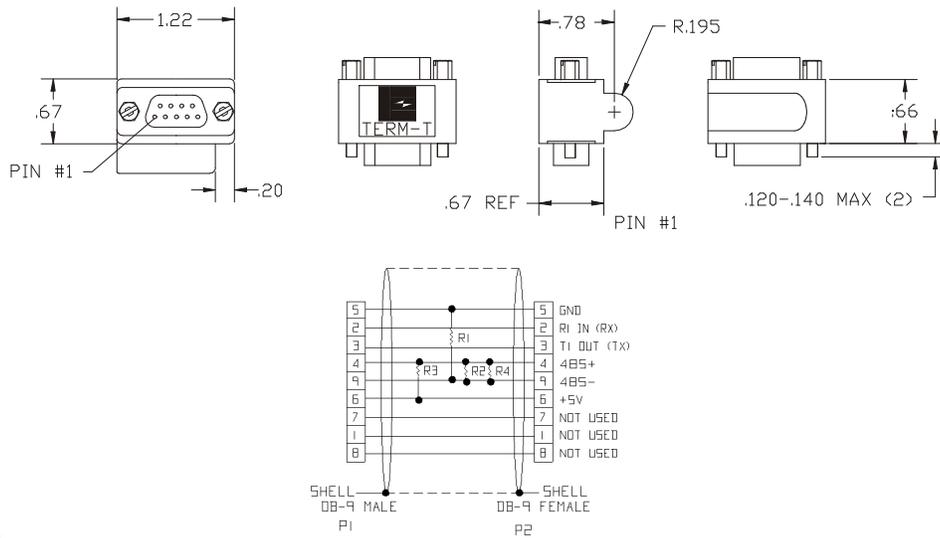
### DDS-XXX Cable



### TERM-H (Head) Terminator



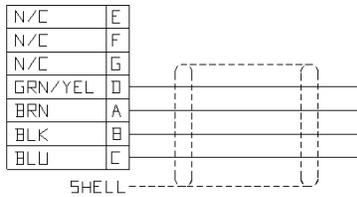
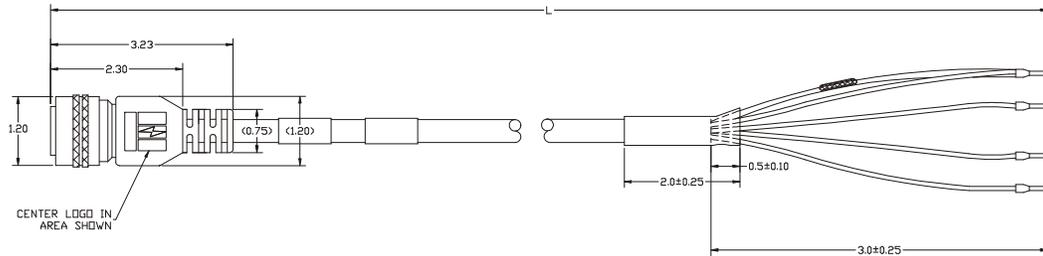
### TERM-T (Tail) Terminator



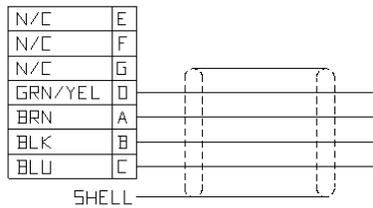
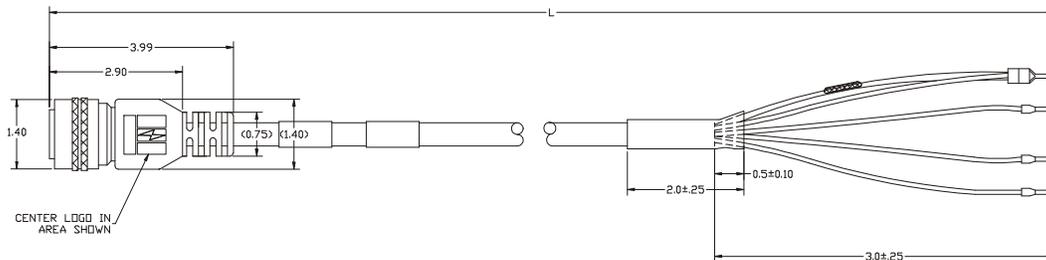
#### Note

See the "Multi-drop Communications" section for resistor values.

### CMDS-XXX Cable

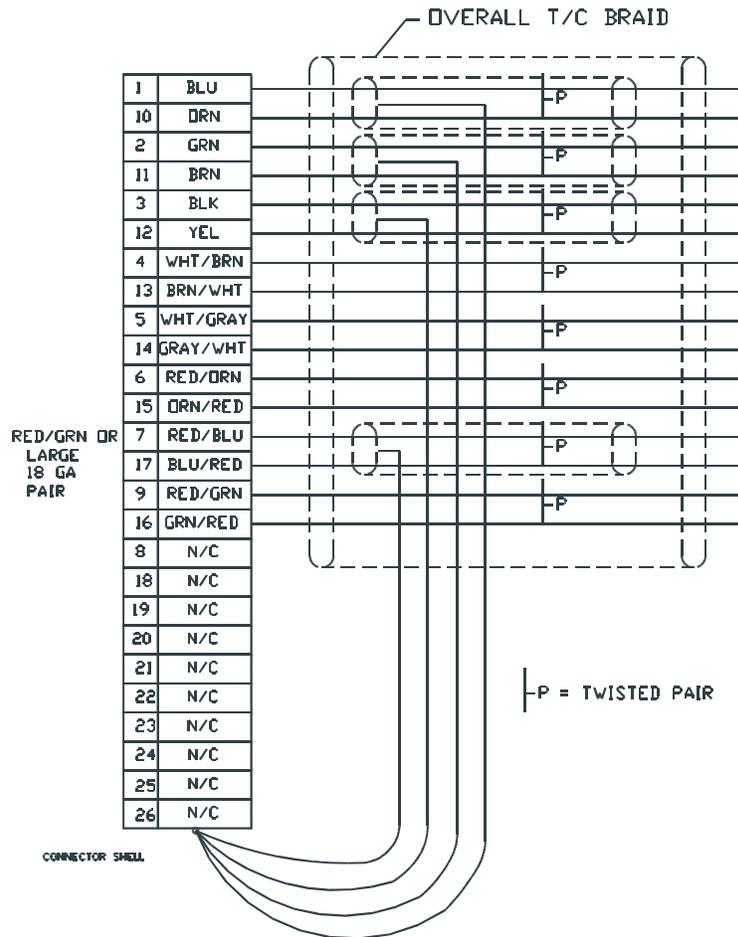
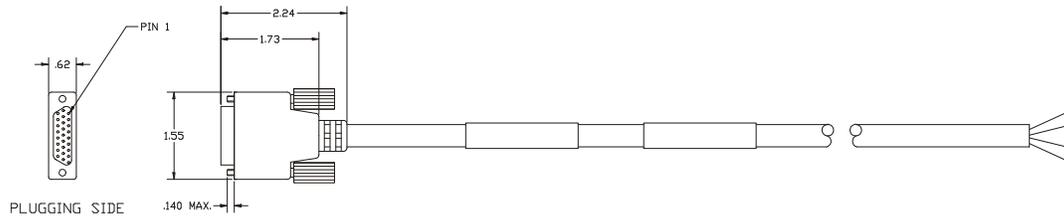


### CMMS-XXX Cable

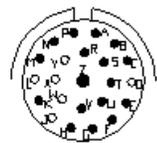
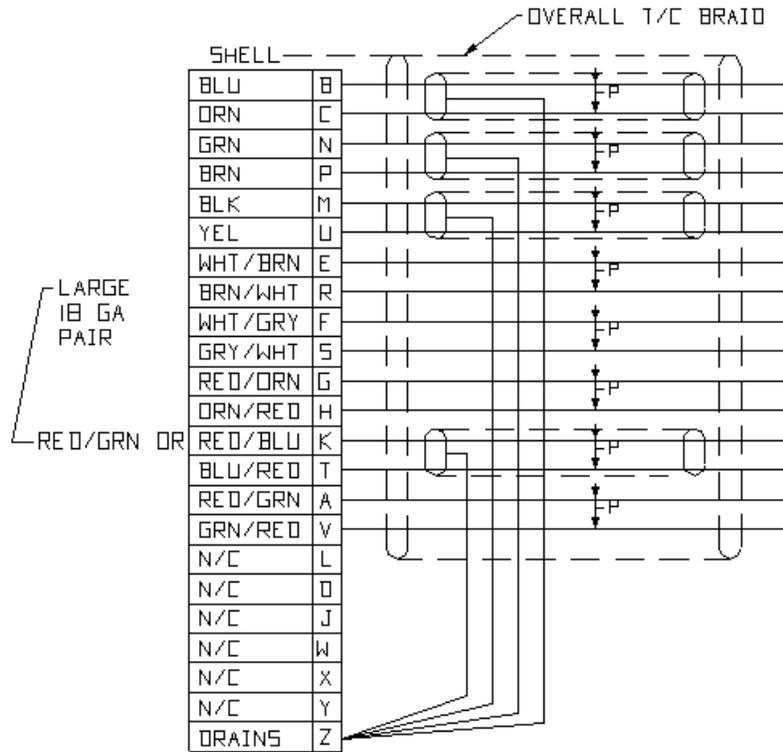




### CFCO-XXX Cable



### CFOS-XXX Cable



SOLDER SIDE

↓ P = TWISTED PAIR

## Vendor Contact Information

Schaffner (AC Line Filters) (800) 367-5566 or (201) 379-7778	<a href="http://www.schaffner.com">www.schaffner.com</a>
Cooper Industries, Inc. Crouse-Hinds Division (Cable Shield Grommets) (315) 477-5531	<a href="http://www.crouse-hinds.com">www.crouse-hinds.com</a>
Bussman P.O. Box 14460 St. Louis, MO. 63178-4460 (314) 394-3877	<a href="http://www.bussman.com">www.bussman.com</a>
Littlefuse 800 E. Northwest Hwy Des Plaines, IL. 60016 (847) 824-0400	<a href="http://www.littlefuse.com">www.littlefuse.com</a>
Wickmann USA 4100 Shirlel Dr. Atlanta, GA. 30336 (404) 699-7820	<a href="http://www.wickmann.com">www.wickmann.com</a>
Corcom 844 E. Rockland Road Libertyville, IL 60048 (847) 680-7444	<a href="http://www.corcom.com">www.corcom.com</a>

# Index

## Symbols

+/- Limit, 14

## A

All "On", 14

Analog Output, 17

## B

Brake Operation and Wiring, 16

## C

Cable Diagrams, 31

CDRO-XXX Cable, 37

CFCO-XXX Cable, 42

CFCS-XXX Cable, 41

CFOS-XXX Cable, 43

CMDO-XXX Cable, 36

CMDS-XXX Cable, 40

CMDX-XXX Cable, 35

CMMS-XXX Cable, 40

## D

DDS-XXX Cable, 38

Diagnostic Display, 9

Drive Faults, 20

## E

Encoder Line Fault, 14

Encoder State, 13

Error Messages, 20

## F

Fault Codes, 10

Fault Descriptions, 12

Firmware Checksum, 12

Following Error Fault, 14

## H

High DC Bus Fault, 13

## I

Installation Notes, 3

Introduction, 1

Invalid Configuration, 12, 13

## L

Low DC Bus Fault, 13

## M

Modbus Communications, 4

Motor Over Temperature Fault, 14

## **N**

Non-volatile Memory Invalid, 12

## **O**

Over Speed Fault, 14

## **P**

Power Stage Fault, 13

Power-Up Self-Test Failure, 12

Programming Error Messages, 22

## **R**

RMS Shunt Power Fault, 14

## **S**

Safety Considerations, vii

Safety of Machinery, vii

Safety Precautions, vii

Setup, Commissioning and Maintenance, vii

status codes

    decimal point, 9

    Ready, 9

    Ready to Run, 9

## **T**

TERM-H (Head) Terminator, 39

TERM-T (Tail) Terminator, 39

TIA-XXX Cable, 38

## **W**

Watchdog Timer, 12



Since 1979, EMERSON Motion Control, a subsidiary of the Emerson Electric Company, has been a leader in the development and manufacturing of motion control equipment and software. EMERSON Motion Control continues to lead the industry in supplying motion control devices designed to improve production efficiency.

For more information about EMERSON Motion Control products and services, call 1.800.39-SERVO or contact our website at [www.emersondrivesolutions.com](http://www.emersondrivesolutions.com).

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