

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Emerson Motion Control TA-440* at our website: *Click HERE*

T/DX REVISIONS B1/B1 or NEWER (2/15/1989)
EXCLUDES: AX/X, TX/X, VX/X

EMERSON EMC

1365 Park Road
Chanhassen, Minnesota 55317
Sales: 612/474-1116
Service: 612/474-8833

POSITIONING DRIVES & MOTORS
- - -

Including IOM-1, PCM-1, PCM-5
T-16, Thumbwheels, and Parallel Programming

Other Manuals available, but bound separately:
T-21 Data Entry Panel

Information furnished by EMERSON EMC is believed to be accurate and reliable. However, no responsibility is assumed by EMERSON EMC for its use. EMERSON EMC reserves the right to change the design or operation of the equipment described herein and any associated motion products without notice. EMERSON EMC also assumes no responsibility for any errors that may appear in this document. Information in this document is subject to change without notice.

P/N 400206-00 **REV:B5**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

TABLE OF CONTENTS

LIST OF TABLES V

LIST OF FIGURES VI

INTRODUCTION 1

INTRODUCTION TO THE BASIC POSITIONING DRIVE AMPLIFIER 3
- OPERATOR INTERFACE 5

POSITIONING DRIVE SPECIFICATIONS 8

INSTALLATION 16
- ASSEMBLY AND INSTALLATION 18
  - Safety Considerations 18
  - Brake Option 18
  - Power Line 18
  - Grounding Considerations 19
- Electrical Noise 20
- Magnetic Coil Noise 20
  - Mechanical Consideration 21
  - Selecting An Enclosure 22
  - System Troubleshooting 22

AMPLIFIER MOUNTING INFORMATION 23

AMPLIFIER I/O LOCATIONS 26
- TA-420, TA-440, TA-460, DX-318, DX-430, DX-450 27
- DX-480, DX-780, DX-7120 28

MOTOR MECHANICAL INFORMATION 29
- RT-202 29
- RT-310 30
- RT-420, RT-440, RT-460 31
- DXM-202, DXM-205 32
- DXM-308, DXM-318 33
- DXM-430, DXM-450, DXM-480 34
- DXE-430, DXE-450, DXE-480 35
- DXM-780, DXM-7120 36

MOTOR WIRING - RT-202, 310, 420, 440, 460 37

MOTOR WIRING - DX* 308,318,430,450,480,780,7120 38

MOTOR WIRING - DXM-202,205 39

TDS/TDL CABLE WIRING 40

TDT CABLE WIRING DIAGRAM 40

OPTIONAL BULKHEAD CONNECTORS 41

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OPERATING MODES 42
MODE SELECTION 43
ANALOG MODE 44
PULSE MODE 46
Pulse/Direction Modes 47
POSITIONING DRIVE CONFIGURATION AND PROGRAMMING 49
ESTABLISHING COMMUNICATIONS 59
DISK FILE OPERATIONS 60
DRIVE SETUP 61
PARAMETERS 63
LIMITS 65

INDEXING OPERATION MODE 67
INDEX TYPES 68
JOG 72
HOME 73

OVERVIEW OF BASIC OPERATION MODES 81
INPUT/OUTPUT INTERFACE 82
Input/Output Connections 86
Detailed Descriptions of I/O Functions 87
Input Functions 87
Output Functions 92

DIAGNOSTICS 95
Status Indicator Codes 95
POSITION ERROR FAULT 97
FAULT INDICATOR CODES 98

STABILIZATION OF HIGH INERTIA LOADS 101

INSTALLATION OF THE IOM-1 102
INTRODUCTION 102

INPUT/OUTPUT INTERFACE 103
EXAMPLES OF I/O CONNECTIONS TO THE IOM-1 107

PARALLEL INTERFACE 109
THUMBWHEEL INTERFACE 110
PARALLEL PROGRAMMING INTERFACE 118

THUMBWHEEL AND PARALLEL PROGRAMMING SETUP AND OPERATION 124
PARALLEL PROGRAMMING INTERFACE 124

PARALLEL PROGRAMMING EXAMPLE 129
T-16 SETUP AND OPERATION 131

NUMBER OF DIGITS NOT DISPLAYED 132

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SCALER MULTIPLIER, DIVISOR, AND SUBTRACTOR 132

INSTALLATION AND CONNECTIONS OF THE PCM-1 133
INPUT/OUTPUT INTERFACE (PCM-1) 134
OVERVIEW 134
Output Functions 136
Input Functions 137
PCM-1 I/O Descriptions 139
Output Functions 141
WHAT ARE PROGRAMS? 142
DESCRIPTION OF PROGRAMMING FUNCTIONS 144
HOW TO CREATE A PROGRAM 146
PROGRAMMING CAPABILITIES 149

SUSPEND/RESUME FUNCTIONS 150
Extended Suspend/Resume Programming 151

INSTALLATION AND CONNECTIONS OF PCM-5 153
BASIC OPERATION 157
Application Examples 158
BI-POLAR SYNCHRONIZATION 163
INPUT/OUTPUT INTERFACE 164
Output Functions 166
Input Functions 167

ADDITIONAL PCM-5 PROGRAMMING 172
PARAMETERS 172
INDEX, HOME 174
PROGRAMS 175

SERIAL INTERFACE 177
EXAMPLE OF A SERIAL MULTI-DROP CONNECTION 178
SERIAL SIGNAL FLOW DIAGRAMS 178
SERIAL CABLES 181
SERIAL INTERFACE CONTROL 183
ASCII COMMANDS 184

SUMMARY OF SERIAL COMMANDS 205

INDEX 210

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

LIST OF TABLES

Table I	Positioning Drive Components	2
Table II	Positioning Drive Specifications	8
Table III	Fail Safe Brake	9
Table IV	User Memory Capacity	9
Table V	Number of User Programs (PCM only)	10
Table VI	Motor Load Specifications	10
Table VII	System Weights	10
Table VIII	T-Drive Thermal Ratings	14
Table IX	DX-Drives Thermal Ratings	15
Table X	Typical Line Ampacities & Wire Gauges	17
Table XI	Load Coupling	21
Table XII	Motion Control Modes	42
Table XIII	AVG Current Fault	98
Table XIV	Stabilization Of High Inertia Loads	101
Table XV	Character Data	122
Table XVI	Pair Selection Inputs	123
Table XVII	Number of Required User Programs	149
Table XVIII	Added Output Functions	162
Table XIX	PCM-5 Function (TIME BASE)	176
Table XX	PCM-5 Function (S = START COUNTER (ST CT)	176
Table XXI	Set Up Select Lines	203

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

LIST OF FIGURES

Figure 1	Peripherals	6
Figure 2	T-Series Speed Torque Curves	11
Figure 3	Typical Speed Torque Curves	12
Figure 4	Typical Speed Torque Curve	12
Figure 5	Typical Speed Torque curve	13
Figure 6	Typical Speed Torque Curve	13
Figure 7	Typical 120 VAC Line Sizing	16
Figure 8	Typical 120 VAC Drives	18
Figure 9	Grounding Illustration	19
Figure 10	External Disconnect Examples	19
Figure 11	Magnetic Coil Noise (DC Line)	20
Figure 12	Magnetic Coil Noise (AC Line)	20
Figure 13	Amp Mounting Info (TA-202, 310, DX-202, 205, & 308)	23
Figure 14	Amp Mounting Info (DX-318, 430, 450, TA-420, 440, & 460)	24
Figure 15	Amp. Mounting Information (DX-480, 780, & 7120)	25
Figure 16	Amplifier I/O Locations (TA-202, 310, DX-202, 205, & 308)	26
Figure 17	Amplifier I/O Locations (TA-420, 440, 460, DX-318, 430, 450)	27
Figure 18	Amp I/O Locations (DX-480, 780, & 7120)	28
Figure 19	Motor Mechanical Information (RT-202)	29
Figure 20	Motor Mechanical Information (RT-310)	30
Figure 21	Motor Mechanical Information (RT-420 440, & 460)	31
Figure 22	Motor Mechanical Information (DXM-202, & 205)	32
Figure 23	Motor Mechanical Information (DXM-308, & 318)	33
Figure 24	Motor Mechanical Information (DXM-430, 450, & 480)	34
Figure 25	Motor Mechanical Information (DXE-430, & 450)	35
Figure 26	Motor Mechanical Information (DXM-780, & 7120)	36
Figure 27	Motor Wiring RT-XXX	37
Figure 28	Motor Wiring DX-308, 318, 430, 450, 480, 780, & 7120	38
Figure 29	Motor Wiring DXM-202, & 205	39
Figure 30	Cable Wiring Diagram (TDS/TDL)	40
Figure 31	Cable Wiring Diagram (TDT)	40
Figure 32	Mounting Information, TDLB Cable	41
Figure 33	Mounting Information, TDTB Cable	41
Figure 34	Dipswitches/Mode Selection	43
Figure 35	Velocity/Torque Mode	44
Figure 36	Command Input Circuit	45
Figure 37	Command Connector	45
Figure 38	Pulse Mode	46
Figure 39	Command Connector Circuit	47
Figure 40	Example Of Sinking/Sourcing Connections	48
Figure 41	PCX Version 4.14	50
Figure 42	PCX Ver 4.14 Menu Hierarchy Diagram 1	51
Figure 43	PCX-4.14 Menu Hierarchy Diagram 2	52
Figure 44	PCX Ver 4.14 Menu Hierarchy Diagram 3	53
Figure 45	PCX Ver 4.14 Menu Hierarchy Diagram 4	54

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Figure 46 55
Figure 47 Main Menu 57
Figure 48 On-line Operations 57
Figure 49 Serial Cable Setup 59
Figure 50 Disk File Operations 60
Figure 51 Drive Setup 61
Figure 52 Define Motion 61
Figure 53 Drive configuration 62
Figure 54 Parameters 63
Figure 55 Mod-Sine Ramps/Liner Ramps 65
Figure 56 Limits 65
Figure 57 Velocity Vs Time Profiles For Positioning Products 68
Figure 58 Index/Incremental 68
Figure 59 Velocity Vs Time Profiles (Absolute Index) 69
Figure 60 Index/Absolute 69
Figure 61 Index/Registration 70
Figure 62 Registration Index Graph 70
Figure 63 Index/Feed Sensor 71
Figure 64 Velocity Vs Time Profiles (Index Feed sensor) 71
Figure 65 Jog Function 72
Figure 66 Example Of Home Cycle 73
Figure 67 Home Sensor Graph 74
Figure 68 Home Feed On/Off/Offset 74
Figure 69 Home To Resolver 0 + Offset 75
Figure 70 HOME/OFFSET 75
Figure 71 Home To Sensor Graph 76
Figure 72 Home To Sensor (Feed On) 76
Figure 73 Feed On/Offset Graph 77
Figure 74 Home 2 Feed On/Offset 77
Figure 75 Home Feed On/Off 78
Figure 76 Home Feed On/Off 78
Figure 77 Feed On/Off/Offset 79
Figure 78 Home 3 Feed On/Off/Offset 79
Figure 79 Home To Sensor Graph 80
Figure 80 Home Feed On/Off/On 80
Figure 81 Serial Control Mode 81
Figure 82 I/O Mode 82
Figure 83 I/O Nomenclature 83
Figure 84 I/O Connections 86
Figure 85 Diagnostic Display 95
Figure 86 I/O Connections (IOM-1) 102
Figure 87 I/O Nomenclature (IOM-1) 104
Figure 88 Examples Of I/O Connections (IOM-1) 107
Figure 89 Parallel Interface (With IOM-1) 109
Figure 90 Character Buffer 110
Figure 91 Cable Shielding 111
Figure 92 Thumbwheel Wiring 112

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Figure 93 Mounting Information For Thumbwheels 113
Figure 94 Thumbwheel Jumpers 113
Figure 95 Thumbwheel Jumpers (Character Buffer) 114
Figure 96 Data Entry Push Button 114
Figure 97 Thumbwheel/T-16/IOM-1 Cable Connections 115
Figure 98 Thumbwheel Configurations 116
Figure 99 Digital Drive Character Buffer 117
Figure 100 Cable Shielding 119
Figure 101 Typical Internal Circuitry 120
Figure 102 Character Data 122
Figure 103 Parallel Interface Options 124
Figure 104 Thumbwheel Example 127
Figure 105 Index Velocity (Thumbwheel) 128
Figure 106 Index Dist/pos(+/-) (Thumbwheel) 128
Figure 107 Parallel Programming Example 129
Figure 108 Field Function (Thumbwheel) 129
Figure 109 Index Number (Thumbwheel) 130
Figure 110 Thumbwheel Programming 130
Figure 111 Screen Menu-T-16 Numeric Display 131
Figure 112 I/O Locations PCM-1 133
Figure 113 PCM-1 Connections 135
Figure 114 Examples Of Connections To PCM-1 138
Figure 115 Define Motion 142
Figure 116 Compound Index Graph 143
Figure 117 Sample Program 146
Figure 118 Programming 147
Figure 119 Programming 147
Figure 120 Suspend/Resume Programming 151
Figure 121 Suspend Option 151
Figure 122 PCM-5 Installation & Connections 153
Figure 123 MSC-XXX Cable 154
Figure 124 2nd Axis application/PCM-5 154
Figure 125 SSC-XXX Multi Drop Sync Cable 155
Figure 126 SCS-2 Encoder Mech/Ele Info. 156
Figure 127 Conveyor Application W/PCM-5 158
Figure 128 PCM-5 Application (Second Drive) 159
Figure 129 PMC-5 Application (Multiple Axes) 160
Figure 130 Motion Cycle Graph 161
Figure 131 I/O Nomenclature (PCM-5) 165
Figure 132 Examples Of I/O To PCM-5 168
Figure 133 PCM-5 Drive Parameters 172
Figure 134 Index (PCM-5) 174
Figure 135 Home (PCM-5) 174
Figure 136 Program (PCM-5) 175
Figure 137 DX Serial Ports 177
Figure 138 Multi-Drop Connection 178
Figure 139 Serial Signal Flow Diagrams 178

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Figure 140 Dipswitches 179
Figure 141 Serial Cable Wiring Diagrams 181
Figure 142 Wiring Diagrams - TIX-25 Cable 182
Figure 143 Wiring Diagram - Multi-Drop Cable 182
Figure 144 (0) Incremental Distance Index 187
Figure 145 (1) Linear Absolute Position Index 187
Figure 146 (2) Feed To Sensor Index 187
Figure 147 (3) Registration Index 187
Figure 148 (0) - Home to Resolver Offset 191
Figure 149 (1) - Home to Sensor 191
Figure 150 (2) - Home to Sensor then Resolver Offset 191
Figure 151 (3) - Home to Sensor then Off Sensor 192
Figure 152 (4) - Home to Sensor then off Sensor then Resolver Offset 192
Figure 153 (5) - Home to Sensor then Off Sensor then On Sensor 192

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

LITERATURE REQUEST

Thank you for your interest in Emerson Electronic Motion Controls. For application assistance or the name of your nearest Emerson EMC Sales Engineer, call 612/474-1116.

I request the following:

____ Send me literature on Emerson's Positioning Servo Drives.

____ Send me Emerson's FREE Motor Sizing Software for use on IBM PCs.

____ Have a Factory Quality Representative call me to discuss product problems.

____ Send me information on Emerson's Technical Training Courses.

____ I would like to attend a seminar on Electronic Motion Controls.

Where_____ When_____
#People_____

My Electronic Motion Control Requirements:

____ I have another application requirement for motion control.

____ Have EMC Sales Engineer call for appointment/demonstration.

Type of actuators: ____ DC or AC Servo Motor
____ DC Stepper Motor
____ Servo Hydraulic

My application involves _____
_____

Number of axis: _____

Date I will purchase controls: _____

My company is a _____User, _____OEM, _____Systems House

_____ Keep me on your mailing list

Name_____ Title_____
Phone_____ EXT:_____
Company_____ Address_____
_____ Mailstop_____

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

---------- fold here ----------

---------- fold here ----------

EMERSON ELECTRONIC MOTION CONTROLS
1365 Park Road
Chanhassen, Minnesota 55317

ATTENTION: CUSTOMER SERVICES

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INTRODUCTION

OVERVIEW

The EMERSON EMC Positioning Drives are the first servo products specifically designed to offer high performance position control without the maze of boards, wires, connectors, pot adjustments and transformers normally associated with servo systems. There are two series of drives designated as (T) or (DX). The T-Series Drives support brush motors and range in size from 2 in-lbs. to 60 in-lbs., continuous. The DX-Series drives support brushless motors and range in size from 2 in-lbs. to 120 in-lbs., continuous. Special care in motor selection has resulted in drives that have excellent torque to inertia ratios.

The drives consist of ruggedly constructed enclosures which contains all the required components for position and velocity control. The drives also provide connections for interfacing with external machine inputs and outputs, and logic control, along with a serial interface port that is used to program the drive.

Calibration

Calibration of the Positioning Drive is virtually eliminated because all user potentiometer adjustments have been eliminated. The potentiometer adjustments have been replaced by firmware. The software pre-sets the compensation values and continuously adjusts these values during motion. This allows the system to operate over a large inertial range without any manual adjustments or tuning required.

Installation

Installation and wiring is fast and easy because the Positioning Drive operates in most environments directly from an AC line source without requiring a separate isolation transformer. The unit is designed to be back mounted within a standard Nema enclosure typically found in a production facility. The size has also been minimized to allow users to reduce the space requirements for incorporating a servo control into their production machinery.

Motor

Each Positioning Drive includes a high performance servo motor whose characteristics have been matched to the drive amplifier. Thus, the chance for a mismatch between the motor and the Positioning Drive is eliminated.

Programming and Troubleshooting

EMERSON EMC provides an easy to use software programming package with every drive that operates on an IBM PC/XT/AT or compatible computer with 512K bytes of RAM and a serial interface port. This software makes the Positioning Drive simple to program even for first time servo users. It is almost essential that the user of the positioning servo drive have access to a personal computer (PC). The PC can be used to change data, up and down load data and most importantly, help solve problems during operation and start up.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SYSTEM OVERVIEW

Following are the specific model numbers used in configuring the fourteen sizes of Positioning Drives.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table I Positioning Drive Components

T-202 (2 in-lbs.)	TA-202 Amplifier	
		RT-202 Motor
		TDL-XX Cable**
T-310 (10 in-lbs.)	TA-310 Amplifier	
		RT-310 Motor
		TDL-XX Cable**
T-420 (20 in-lbs.)	TA-420 Amplifier	
		RT-420 Motor
		TDL-XX Cable**
T-440 (40 in-lbs.)	TA-440 Amplifier	
		RT-440 Motor
		TDL-XX Cable**
T-460 (60 in-lb.)	TA-460 Amplifier	
		RT-460 Motor
		TDL-XX Cable**
DX-202 (2 in.-lbs)	DXA-202 Amplifier	
		DXM-202 Motor
		TDT-XX Cable**
DX-205 (5 in-lbs.)	DXA-205 Amplifier	
		DXM-202 Motor
		TDT-XX Cable**
DX-308 (8 in-lbs.)	DXA-308 Amplifier	
		DXM Motor
		TDL-XX Cable**
DX-318 (18 in-lbs.)	DXA-318 Amplifier	
		DXM Motor
		TDL-XX Cable**
DX-430 (30 in-lbs.)	DXA-430 Amplifier	
		DXM or DXE-430 Motor*
		TDL-XX Cable**
DX-450 (50 in-lbs.)	DXA-450 Amplifier	
		DXM or DXE-450 Motor*
		TDL-XX Cable**
DX-480 (80 in-lbs.)	DXA-480 Amplifier	
		DXM or DXE-480 Motor
		TDL-XX Cable**
DX-780 (80 in-lbs.)	DXA-780 Amplifier	
		DXM 780 Motor
		TDL-XX Cable**
DX-7120 (120 in-lbs.)	DXA-7120 Amplifier	
		DXM 7120 Motor
		TDL-XX Cable**

*NOTE: DX-430, DX-450 and DX-480 Drives can be provided with motors that have either typical English or metric flange and shaft dimensions. The metric motor is designated with a DXM prefix and the English version is designated with a DXE prefix.

NOTE: XX = CABLE LENGTH (FT)

15	15
25	25
50	50

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INTRODUCTION TO THE BASIC POSITIONING DRIVE AMPLIFIER

The Positioning Drive amplifier is different from common analog amplifiers in that it includes a position feedback loop and the electronics to control motion functions. To accomplish this, the motor uses resolver feedback. The resolver converter electronics in the amplifier develops velocity and position feedback signals required for high performance and precise velocity and position control.

In addition the amplifier offers three standard modes of control providing a host of alternatives for implementing real time motion control.

In the ANALOG TORQUE or VELOCITY mode, the amplifier responds to a conventional +/- 10 volt signal. Most variable speed drives and servo amplifiers on the market today receive commands via analog input.

The true power and versatility of the Positioning Drive is best utilized in the additional positioning control modes. In most applications the user will use one of the following modes of operation.

In the PULSE mode, the drive responds to a serial pulse train representing externally generated incremental position change commands. These commands are normally in the form of CW or CCW directional pulses. This mode is commonly used to control DC stepper motors or numeric controlled (CNC) machinery.

The INDEXING mode allows up to thirty-two different indexes or positions to be pre-programmed and stored in a non-volatile memory. These indexes plus other commands such as STOP and JOG are selected easily by the drive's parallel input/output (I/O) lines from devices such as PLCs or operator push buttons. Parallel I/O commands can be used for stand alone operation or, simultaneously in conjunction with any other two control modes.

Another powerful feature of the INDEXING mode allows ASCII commands through the standard RS423 serial interface. This interface port allows the user to down load new dimensional data e.g., position, distance, velocity, etc., and command an internally generated index using those parameters. These ASCII serial commands are well suited to operation from the RS232C serial interface on an IBM Personal Computer (PC) or Programmable Logic Controller (PLC) with ASCII or Basic Module.

For additional stand alone motion control capability, the drive is designed to accept a series of application oriented modules called "PCM" modules. The PCMs can be attached to any drive by simply plugging them onto the front. The PCM is designed to share the power supply inside of the drive and includes 12 additional optically isolated inputs/outputs (making a total of 24). When attached, the PCM module extends the operation of the Positioning Drive system.

The IOM-1, PCM-1, PCM-2, and PCM-5 modules are designed to be plug-on additions to EMERSON EMC's line of Positioning Drives. Each module is intended to enhance a specific performance characteristic of the positioning drives.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PERIPHERALS

IOM-1 Input/Output Expander Module

The IOM Module mounts to the front of the basic drive to double the I/O capability for those applications where the number of inputs and outputs provided with the basic unit are not adequate for interfacing motion to the machine logic controllers. Each of these lines are optically isolated and can be connected in either a current sinking or current sourcing arrangement. In addition the IOM-1 includes the parallel interface port required for connecting 1 or 2 thumbwheels and 1 remote display or parallel communications with a PLC.

PCM-1

The PCM-1 module converts the basic Positioning Drive from a "smart" servo drive system with indexing capabilities into a motion control system capable of executing numbered sequences of indexes called motion programs. Each motion program combines basic indexes to achieve complex motion profiles beyond what is possible with the basic drive. In addition, the PCM module greatly increases the non-volatile memory storage capability of the standard digital drive. This allows the user greater flexibility in both the size and the number of programs (and indexes) available. Another advantage of PCM-1 is that it increases the number of input lines from 8 to 16 and the number of output lines is increased from 4 to 8. All inputs and outputs are assignable from a standard list of I/O functions. Lastly, the PCM-1 allows the user to create compound indexes and includes the parallel interface port required for connecting 1 or 2 thumbwheels and 1 remote display or parallel communications with a PLC.

PCM-5

The PCM-5 has most of the capability of the PCM-1. The PCM-5 is able to do electronic synchronized line shafting and ratio control. This is accomplished by using an external encoder or drive representing a lead axis connected to the PCM-5. The drive with the PCM-5 can then be synchronized to the lead device. This mode of operation also allows for pulse counting of the lead device and indexing at velocities proportional to its speed. With this capability, flying shear/cutoff applications can easily be configured.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OPERATOR INTERFACE

Emerson EMC can provide three different peripheral devices to enhance the operator friendliness of your drive. The T-21 Data Entry Terminal is ideally suited for providing machine operators with the ability to enter and/or alter and display machine motion parameters controlled by a Emerson Positioning Drive. The T-16 displays position and velocity parameters using large sized LEDs that are visible from several feet away. Emerson EMC offers a simple thumbwheel interface called a TW-XXX that is offered in many different configurations. The TW-XXX is used to change data of a specific motion parameter or parameters. The thumbwheel option is ideal for applications needing minimum operator interface.

T-21 Data Entry Terminal

The T-21 communicates with any Emerson Positioning Drive using serial ASCII codes and allows the machine designer to access, display, or alter certain motion parameters such as index length. For frequently accessed motion parameters, the operator cam simply depress one of three user programmable function switches located on the front panel. By depressing the correct function key, the proper user created message is displayed. The message can be created to include information as to what setup parameter is being changed, on which axis, etc. If more than 3 operator altered setup parameters are required, a fourth F(x) key allows the user to store up to 95 additional operator alterable setup functions.

T-16 Numeric Display

The T-16 is used to display position or velocity of the drive. The T-16 has 7 large LEDs that are visible from several feet away. This allows the operator to view data shown on the display from different positions on a machine. The T-16 requires the use of the IOM-1 or a PCM-1 module. The T-16 plugs into the parallel port on the module.

TW-XXX Thumbwheel Interface

The thumbwheel interface provides the user with a non-serial interface method for making changes to specific motion functions. The user can set up the thumbwheel to change velocities, distances/positions, dwell times, index counts, and acceleration and deceleration times. All the thumbwheels are mounted in a small, self contained enclosure. Cables can be ordered in specific lengths from 3 feet to 50 feet. The TW-XXX requires the user to have an IOM-1 or a PCM-1 module. The TW-XXX plugs into the parallel port on the module.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

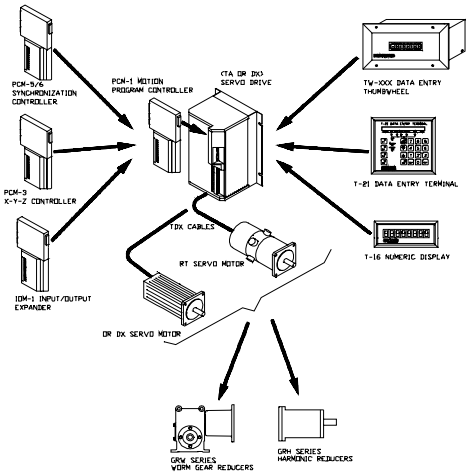


Figure 1 Peripherals

Servo Positioning Solutions ...

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERVICES

Emerson EMC offers a wide range of services to support our customers' needs. Listed below are some examples of these services.

SERVICE SUPPORT (612) 474-8833

Emerson Electronic 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 Minneapolis, Minnesota, is ready to help you solve those occasional problems over the telephone. It's there, at the Center, that we are 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. Need on-site help? Emerson provides on-site service, in most cases, the next day. Just call Emerson's Customer Service Center when on-site service or maintenance is required.

TRAINING SERVICES (612) 474-1116

Emerson EMC maintains a highly trained staff of instructors to familiarize customers with Emerson Electronic Motion Controls and their applications. A number of courses are offered, many of which can be taught in your plant upon request.

APPLICATION ENGINEERING (612) 474-1117

An experienced staff of factory Application Engineers provides complete customer support for tough or complex applications. Our engineers offer you a broad base of experience and knowledge of electronic motion control applications.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

POSITIONING DRIVE SPECIFICATIONS

Table II Positioning Drive Specifications

DRIVE PERFORMANCE

DRIVE MODEL#	MOTOR AMPLIFIER MODEL#	TORQUE CONT/PEAK CURRENT RATINGS	ROTOR INERTIA IN/LBS/SEC	MAX. RPM	BUS FUSE	SHUNT FUSE	KT IN-LBS/AMP	KE VOLTS/KRPM
		IN/LBS						
TA-202	RT-202	2/4	.0004	3000	7 AMP		2.00	25
	1/2							
TA-310	RT-310	10/20	.004	3000	7 AMP		2.00	25
	5/10							
TA-420	RT-420	20/40	.01	3000	10 AMP	5A(S.B.)	3.75	44
	5.3/10.6							
TA-440	RT-440	40/80	.02	3000	20 AMP	5A(S.B.)	3.75	44
	10.7/21.4							
TA-460	RT-460	60/120	.03	3000	25 AMP	5A(S.B.)	3.75	44
	16/32							
DX-202	DXM-202	2/4	.0000855	3000	7 AMP	2A(S.B.)	1.8	23
	1.1/2.2							
DX-205	DXM-205	5/10	.000253	3000	7 AMP	2A(S.B.)	1.8	23
	3.0/6.0							
DX-308	DXM-308	8/16	.0005	3000	10 AMP	2A(S.B.)	2.9	34
	2.8/5.6							
DX-318	DXM-318	18/36	.001	3000	10 AMP	5A(S.B.)	3.38	40
	5.4/10.8							
DX-430	DXM-430	30/60	.0026	3000	20 AMP	5A(S.B.)	3.38	40
	8.9/17.8							
DX-450	DXM-450	50/85	.0052	3000	25 AMP	5A(S.B.)	3.38	40
	14.8/24.0							
DX-480	DXM-480	80/160	.00772	3000	30 AMP	8A(S.B.)	3.36	42
	24/48							
DX-780	DXM-780	80/160	.013	3000	30 AMP	8A(S.B.)	3.38	40
	24/48							
DX-7120	DXM-7120	120/240	.021	2000	30 AMP	8A(S.B.)	5.57	66
	24/48							

Specifications +/- 10%

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT POWER: 96-132 VAC, 50/60 Hz, single phase only

SWITCHING FREQUENCY: T-202, T-310, T-420, T-440, T-460, DX-202, DX-205 DX-308, DX-430 = 20 KHz
DX-450, DX-480, DX-780, DX-7120 = 15 Khz

DEAD BAND: Zero

VELOCITY SIGNAL INPUT: ±10 vdc typical (10 bit resolution speed selection ±10 volt)

TORQUE SIGNAL INPUT: ±10 vdc typical (10 bit resolution torque selection ±10 volt)

PULSE MODE INPUT: TTL compatible, 500 nsec minimum pulse width, 210 Khz max frequency

ANGULAR RESOLUTION: 4096 steps per rev (5.3 minutes)

ANGULAR ACCURACY: ± 20 minutes ± 21600/SR where SR = STEPS/REV
-Valid for 200 ≤ SR ≤ 4096
-For 4096 < SR ≤ 25000 use SR=4096

USER UNITS/REV: Programmable Range (200-25000)

AMPLIFIER THERMAL SHUT DOWN AS DETECTED IN POWER STAGE:

All drives: 80^{o} - 90^{o} C

MOTOR THERMAL SHUT DOWN AS DETECTED IN MOTOR (CASE TEMP):

All motors: 100^{o} - 115^{o} C

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OPTIONAL FAIL-SAFE BRAKE: (Activated by the Positioning Drive)

Table III Fail Safe Brake

MODEL	HOLDING TORQUE IN-LBS
RT-202	5
RT-310	15
RT-420	120
RT-440	120
RT-460	120
DX-308	12
DX-318	25
DX-430	45
DX-450	75
DX-480	120
DX-780	120
DX-7120	180

PULSE MODE 5 vdc

COMMAND INPUTS 25 milliamps

ANALOG INPUTS -10 vdc to +10 vdc operating range

-12 vdc to +12 vdc absolute maximum
Differential input greater than 9K ohms

SERIAL INTERFACE RS423 signal compatible
Xmit, Rec, and GND

INPUTS AND OUTPUTS each. Outputs: sink or source (2 terminals);
200 mA (max) (external current limit required)

Inputs: 10 to 30 vdc (internal current limit provided)
10, 12, 15 and 24 vdc typical

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table IV User Memory Capacity

USER MEMORY CAPACITY

	Drive	Drive w/IOM-1	Drive w/PCM-1	Drive w/PCM-5
Jog	2	2	2	2
Home	1	1	1	1
Indexes	32	32	256	256
Programs	0	0	64	64

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table V Number of User Programs (PCM only)

NUMBER OF USER PROGRAMS	NUMBER OF REQUIRED	AVERAGE AVAILABLE STEPS PER PROGRAM
	1	1000
	2	500
	3	333
	4	250
	5	200
	-	-
	-	-
	-	-
	62	16
	63	15
	64	15

Table VI Motor Load Specifications

MOTOR	MAX RADIAL LOAD	MAX AXIAL LOAD
RT-202	15 lbs**	10 lbs
RT-310	20 lbs**	20 lbs
RT-420	50 lbs**	40 lbs
RT-440	50 lbs**	40 lbs
RT-460	50 lbs**	40 lbs
DXM-202	10 lbs**	8 lbs
DXM-205	10 lbs**	8 lbs
DXM-308	20 lbs**	15 lbs
DXM-318	20 lbs**	15 lbs
DX*-430	50 lbs**	20 lbs
DX*-450	50 lbs**	20 lbs
DX*-480	75 lbs**	40 lbs
DXM-780	150 lbs**	50 lbs
DXM-7120	150 lbs**	50 lbs

WHERE: AVERAGE NUMBER OF AVAILABLE STEPS = $\frac{1000}{\text{NUMBER OF PROGRAMS}}$

* M-(XXX) = Metric E-(XXX) = English

** Maximum radial load is rated 1 inch from the motor face.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table VII System Weights

MODEL	AMPLIFIER WEIGHT KG	AMPLIFIER WEIGHT LB	MOTOR WEIGHT KG	MOTOR WEIGHT LB
DX-202	6.0	13.0	1.4	3.0
DX-205	6.0	13.0	1.8	4.0
DX-308	6.0	13.0	3.2	7.0
DX-318	7.9	17.0	4.5	10.0
DX-430	7.9	17.0	7.3	16.0
DX-450	8.5	19.0	11.3	25.0
DX-480	13.1	29.0	16.8	37.0
DX-780	13.1	29.0	19.0	42.0
DX-7120	13.1	29.0	27.7	61.0

FOR ALL MODELS EXCLUDING DX-202 AND 205, ADD 10% FOR BRAKE OPTION

METRIC AND ENGLISH VERSIONS FOR A GIVEN MOTOR SIZE ASSUME IDENTICAL WEIGHTS

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

T-SERIES MOTORS AND AMPLIFIERS TYPICAL SPEED TORQUE CURVES

T-202, T-310, T-420, T-440, T-460

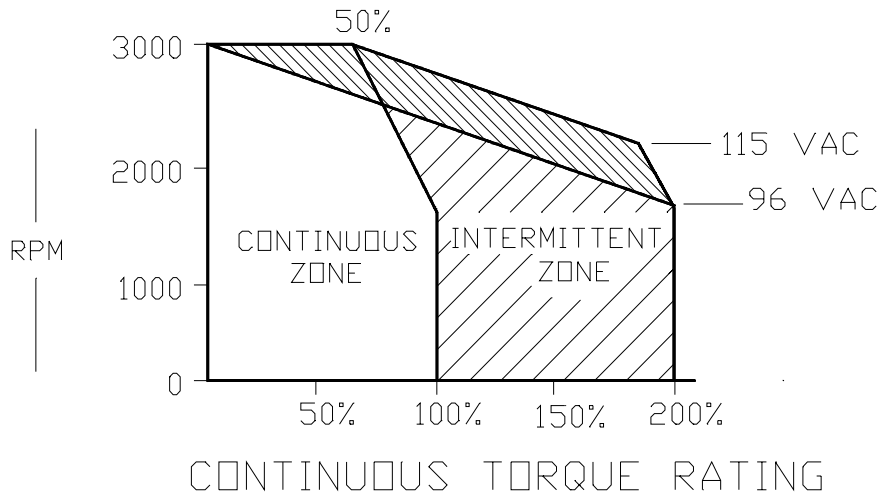


Figure 2 T-Series Speed Torque Curves

*** Continuous torque rating of the motors is measured using a 10" X 10" X 0.25" mounting plate that acts as a heatsink.**
***All specifications are ± 10%**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DX-SERIES MOTORS AND AMPLIFIERS TYPICAL SPEED TORQUE CURVES

DX-202, DX-308, DX-318, DX-430, DX-780, DX-480

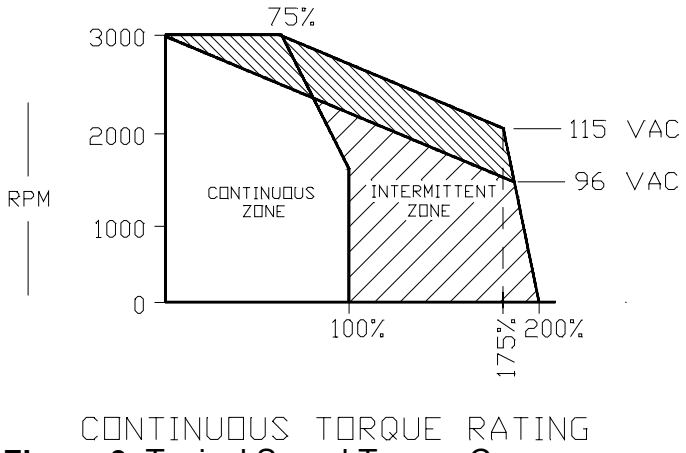


Figure 3 Typical Speed Torque Curves

DX-7120

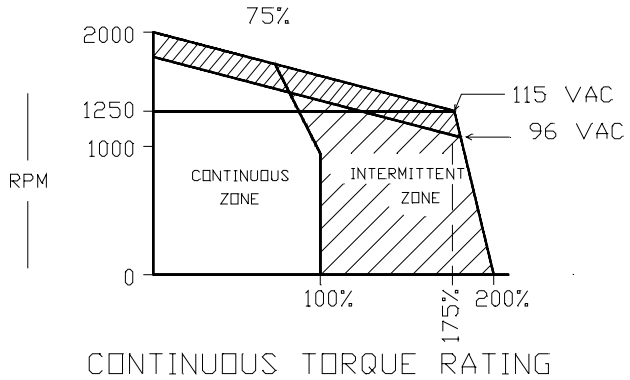


Figure 4 Typical Speed Torque Curve

*** Continuous torque rating of the motors is measured using a 10" X 10" X 0.25" mounting plate that acts as a heatsink.**

*** All specifications are ± 10%**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DX-205

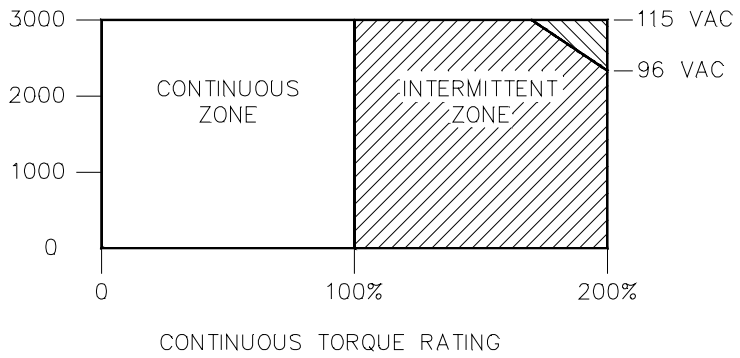


Figure 5 Typical Speed Torque curve

DX 450

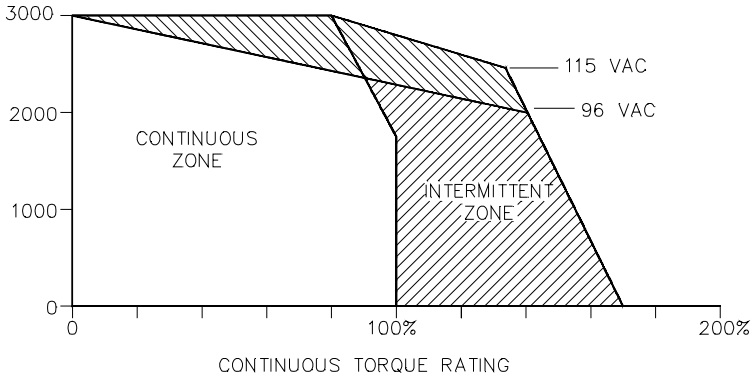


Figure 6 Typical Speed Torque Curve

*** Continuous torque rating of the motors is measured using a 10" X 10" X 0.25" mounting plate that acts as a heatsink.**

*** All specifications are ± 10%**

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

T-DRIVE THERMAL RATINGS BASED ON AMBIENT TEMPERATURE

Table VIII T-Drive Thermal Ratings

		MAXIMUM AMBIENT TEMP FOR CONTINUOUS TORQUE		DERATING FACTOR ABOVE MAXIMUM ABIENT TEMP	
DRIVE	CONTINUOUS TORQUE (in-lbs)	DRIVE (deg. C)	MOTOR (deg. C)	DRIVE xd (deg.C/W)	MOTOR (xm) (deg.C/W)
T-202	2.0	40*	35	0.19	1.43
T-310	10.0	40*	35	0.15	0.37
T-420	20.0	40*	35	0.098	0.14
T-440	40.0	40*	35	0.028	0.11
T-460	60.0	30*	35	0.023	0.075

* AMBIENT TEMPERATURE OF THE DRIVE SHOULD NOT EXCEED 60°C

1) Max motor output power (Watts) = $\frac{Tmax - Tamb}{Om}$ Tmax = 115°C

2) Max drive output power (Watts) = $\frac{Tmax - Tamb}{Od}$ Tmax = 60°C

(O_m, and O_d are the motor and drive de-rating factors from the table above.)

The lower of the two values determine the maximum continuous output power of the system in Watts. Using the equation below, determine the maximum output torque for the system.

3) Torque = $\frac{84.45 \times (Watts)}{RPM}$

Watts = Lowest value obtained from equation (1) or (2)

RPM = Average RPM. If RPM is greater than 1500, the system must be further de-rated by:

4) De-rated torque = Torque $\left(\frac{1500}{\text{Average RPM}}\right)$

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table IX DX-Drives Thermal Ratings

DRIVE	CONTINUOUS TORQUE (lb-in)	MAXIMUM AMBIENT TEMP FOR CONTINUOUS TORQUE: DRIVE (deg.C)	MAXIMUM AMBIENT TEMP FOR CONTINUOUS TORQUE: MOTOR (deg.C)	DERATING FACTOR ABOVE MAXIMUM AMBIENT TEMP: DRIVE Xd (deg.C/W)	DERATING FACTOR ABOVE MAXIMUM AMBIENT TEMP: MOTOR (Xm) (deg.C/W)
DX-202	2.0	45°*	50°	0.283	1.13
DX-205	5.0	45°*	50°	0.065	0.65
DX-308	8.0	45°*	50°	0.050	0.30
DX-318	18.0	45°*	50°	0.021	0.11
DX-430	30.0	45°*	50°	0.025	0.06
DX-450	50.0	35°*	50°	0.018	0.04
DX-480	80.0	45°*	50°	0.011	0.024
DX-780	80.0	45°*	50°	0.011	0.024
DX-7120	120.0	45°*	50°	0.011	0.024

* All drives must be derated between the maximum ambient temperature for continuous torque given in the table and an absolute maximum of 60° C.

1)Max motor output power (Watts) = $\frac{T_{max} - T_{amb}}{X_m}$ $T_{max} = 115^oC$

2) Max drive output power (Watts) = $\frac{T_{max} - T_{amb}}{X_d}$ $T_{max} = 60^oC$

(X_m, and X_d are the motor and drive de-rating factors from the table above.)

The lower of the two values determines the maximum continuous output power of the system in Watts. Using the equation below, determine the maximum output torque for the system.

3) Torque = $\frac{84.45 \times (Watts)}{RPM}$

Where:Watts = Lowest value obtained from equation (1) or (2)

RPM = Average RPM. If RPM is greater than 1500, the system must be further de-rated by:

4) De-rated torque = Torque $\left(\frac{1500}{\text{Average RPM}}\right) \times .75$

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INSTALLATION

OVERVIEW

The Positioning Drives were designed with simple installation in mind. The Drive normally back-mounts into a standard NEMA enclosure. Because of its small footprint and no need for external transformers, boards and power supplies, the Positioning Drive saves significant panel space and cost over alternative servo positioning systems. Wiring and connecting the drive is equally simple. AC line power (L1, NEUT, GND) is connected via provided screw terminals.

Inputs and outputs for control and status are wired to a 12 position, detachable terminal strip (this also makes servicing easy). The RS423 serial interface used for setup, status and control can be connected with a 9 pin D-type connector. The motor connections are simplest of all because the factory provides standard MS connectors on cables with each unit. Connect one end to the motor and the other end to the drive and you are done.

TYPICAL 120 VAC SINGLE PHASE MODELS

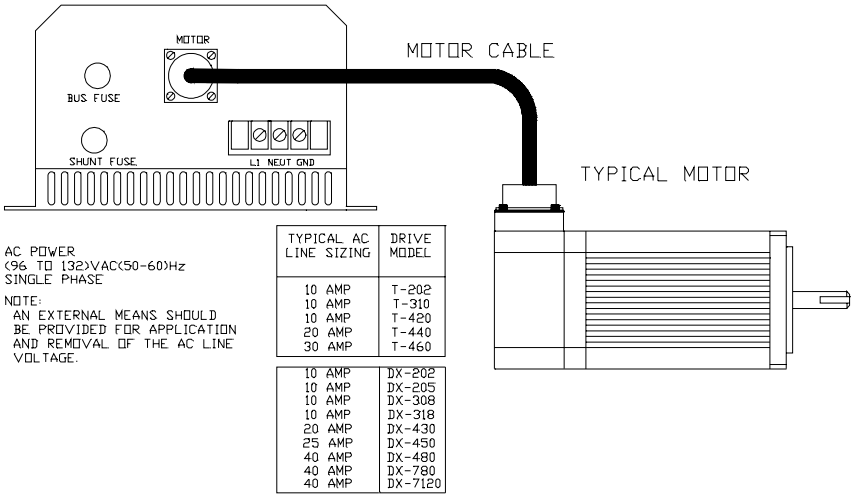


Figure 7 Typical 120 VAC Line Sizing

Transformer Sizing: If an input transformer is being used, the size will be determined by the application requirements of the system. Using a very conservative approach, the AC line source VA rating can be determined by multiplying the AC line current by 120 VAC.

Example: DX-780
Line sizing = 40 amp

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(40 amps) * (120 VAC) = 4800 VA

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The following table should be used as a guideline for minimum sizing the AC wiring.

Table X Typical Line Ampacities & Wire Gauges

MINIMUM DRIVE	TYPICAL LINE AMPACITIES	RECOMMENDED WIRE GAUGE
T-202	10 A	16 AWG
T-310	10 A	16 AWG
T-420	10 A	16 AWG*
T-440	20 A	12 AWG*
T-460	30 A	10 AWG*
DX-202	10 A	16 AWG
DX-205	10 A	16 AWG
DX-308	10 A	16 AWG
DX-318	10 A	16 AWG
DX-430	20 A	12 AWG
DX-450	25 A	12 AWG*
DX-480	40 A	10 AWG*
DX-780	40 A	10 AWG*
DX-7120	40 A	10 AWG*

* AC power lines that are farther than 50 ft. from the power source, may require a larger gauge than what is recommended above.

Wiring Considerations

If you are not sure of your grounding or signal wiring techniques, you should observe the recommended practices according to the IEEE Ground Book, ANSI Standard C1141 and the National Electric Code.

Wiring of any industrial equipment should be done with some consideration for future troubleshooting and repair. All wiring should be either color coded or tagged with industrial wire tabs.

All I/O wiring must be done with industrial grade insulated wire to withstand the environment of the application. 18 to 24 gauge wire must be used for I/O wiring. The use of larger gauge wire will cause the I/O terminals to prematurely fatigue. Each input and output to the control unit is designed to have high noise immunity. This does not mean that high voltage, noise emitting wiring on the rest of the application can be run adjacent to the control inputs. Precautions should be taken to eliminate any possible noise from reaching the drive.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ASSEMBLY AND INSTALLATION CONSIDERATIONS

The following procedures outline the methods necessary to assure reliable and trouble free installation of the EMERSON EMC Positioning Drive.

Safety Considerations

The user is responsible for emergency interlock switches. Any master interlock should be wired to shut down AC power to all parts of the system. Your system should be designed such that power is disconnected from the output loads any time the equipment is not running, or when the emergency stop is activated.

Brake Option

An additional safety and operational feature can be added by ordering the optional fail-safe brake. The brake allows the motor shaft to be held whenever power is removed from the brake coil (such as in a power failure). The user can control the on/off operation of the brake through either serial commands or an assigned input line. The power supply needed to operate the brake is provided internally in the drive.

Power Line

The 120 VAC, DX-202 thru DX-7120 drives are designed to operate on a 50/60 Hz, single phase AC power line. The AC voltage of this power line must be within the specified range of 96-132 VAC and be free of voltage transients which exceed this range. If it is found that the AC power does not meet these specifications, further AC line conditioning may be required. Also, if there is sensitive electronic equipment (digital computer, test equipment, etc.) operating on the same AC power line as the Drive, additional EMI/RFI filtering may be required to reduce the effects of conducted AC line noise. Operation at 96 VAC will reduce the drive's performance at high (max) speed.

The AC input lines are connected to the drive by means of the 3-position terminal strip located on the bottom plate of the drive. The AC line wires should be connected as shown below. Insufficient or incorrectly applied AC line power is a major cause of drive problems. Wire sizing and transformer selection (if necessary) should be done carefully.

CAUTION: To insure proper operation after a power down the user should wait a minimum of 10 seconds before reapplication of power.

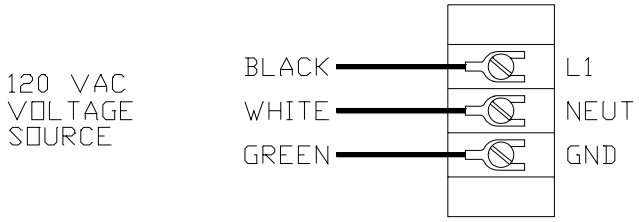


Figure 8 Typical 120 VAC Drives

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Grounding Considerations

The GND terminal of the drive is internally bonded to the frame. The enclosure ground and the drive ground should be a common single point that ultimately is a continuous electrical path to earth ground. The following example illustrates the ideal grounding arrangement of the AC power.

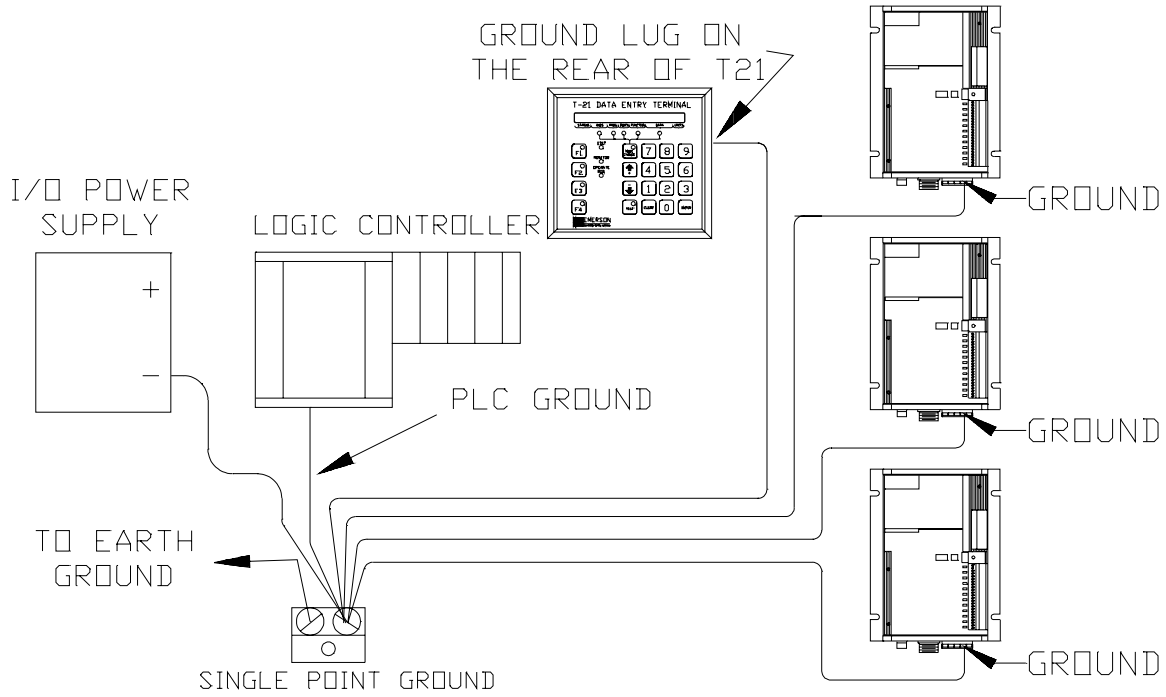


Figure 9 Grounding Illustration

NOTE: These ground wires should not be shared with other equipment. The following two circuits are given as EMC recommended external disconnecting examples.

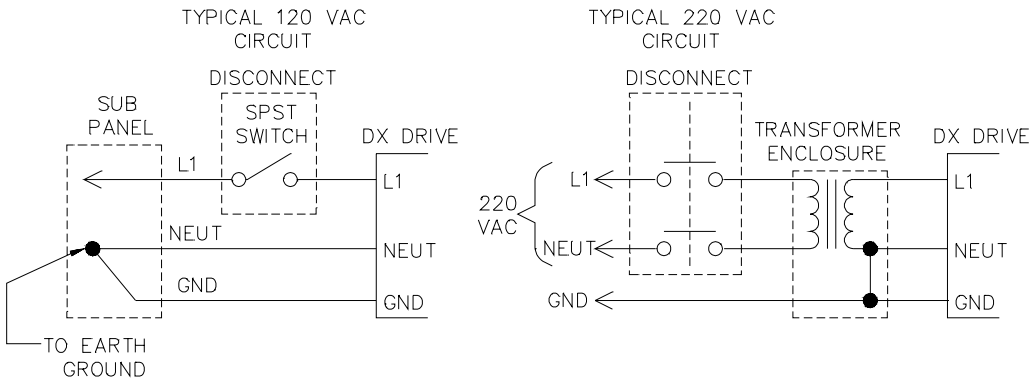


Figure 10 External Disconnect Examples

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Electrical Noise

Effects of electrical noise on the electronic equipment are greatly reduced when the techniques outlined below are closely followed.

1. Do not run low power control signals and high power wiring in the same raceway.

   NOTE: If mixing wires cannot be avoided, then the low voltage control input and output wiring must be shielded. The shield for these wires should only be connected to ground only at the source end of the signals.

2. Never connect both ends of a shielded cable to ground. This may cause a ground loop condition which could be very difficult to locate.

3. It is suggested that all the wires in the system be kept as short as possible.

Magnetic Coil Noise

In the case of DC relays, a diode is installed across the coil in a direction that will cause the voltage transient to be dissipated through the diode.



Figure 11 Magnetic Coil Noise (DC Line)

In the case of AC coils a capacitor and resistor are installed across the coil to suppress the unwanted transient.

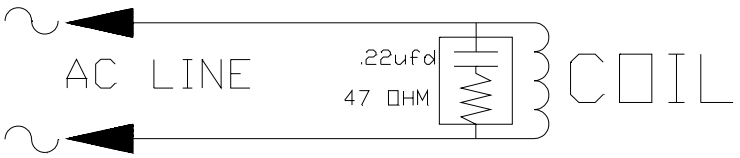


Figure 12 Magnetic Coil Noise (AC Line)

The specific values of resistance and capacitance may vary depending on the inductance of the coil. Consult the relay manufacturer for the proper values to use. These suppressor networks greatly extend the life of the contacts controlling the coil because the transient energy, which can easily reach 1000 volts, shunts through the suppressor rather than arcing across the controlling contacts as they open.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Mechanical Consideration

To provide good mechanical alignment the mounting surface of the motor face plate is held perpendicular to the motor shaft to within 0.005 inches of the motor shaft. Projecting above the plane of the mounting surface is a close tolerance circular pilot boss, which, when matched with a pilot hole in the mounting structure, facilitates interchanging the motor, and minimizes the need for mechanical adjustments. The mounting surface is fitted with four holes, equally spaced on a bolt circle pattern.

The mounting panel must be stiff enough so it does not deflect significantly when radial loads are applied to the motor shaft. The mounting panel should also have good thermal conductivity, especially if peak performance is demanded of the motor.

Mechanical shock to the motor case or shaft (e.g., from striking or dropping) must be avoided to prevent damage to the motor. Possible results from striking or dropping include: Misalignment of the resolver; damage to armature bearings; cracking of the motor case; unbonding or demagnetization of the permanent magnets. Any of these would render the motor unserviceable.

Load Coupling

A flexible coupling must be used on the motor shaft to minimize mechanical stress due to radial loads, axial loads and/or misalignment. Radial and axial loading cannot exceed specified values.

Table XI Load Coupling

MOTOR	MAX RADIAL LOAD		MAX AXIAL LOAD
RT-202	15 lbs**		10 lbs
RT-310	20 lbs**		20 lbs
RT-420	50 lbs**		40 lbs
RT-440	50 lbs**		40 lbs
RT-460	50 lbs**		40 lbs
DXM-202	10 lbs**		8 lbs
DXM-205	10 lbs**		8 lbs
DXM-308	20 lbs**		15 lbs
DXM-318	20 lbs**		15 lbs
DX*-430	50 lbs**		20 lbs
DX*-450	50 lbs**		20 lbs
DX*-480	75 lbs**		40 lbs
DXM-780	150 lbs**	50 lbs	
DXM-7120	150 lbs**	50 lbs	

* M-(XXX) = Metric E-(XXX) = English

** Maximum radial load is rated at 1 inch from the motor face

Gear Reducer Oil

It is strongly suggested that a synthetic oil is used in the gear reducer or rotary tables. This will reduce the amount of current it takes to drive the motor.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Selecting An Enclosure

The EMERSON EMC Positioning Drive is designed for the industrial environment. However, no sophisticated electronic system can tolerate certain atmospheric contaminants such as moisture, oils, conductive dust, chemical contaminates and metallic particles. Therefore, if the drive is going to be subjected to this type of environment, it must be mounted in a NEMA type 12 enclosure. Proper ventilation and filtering must also be provided.

System Troubleshooting

If you encounter a system problem, double check the installation instructions. These instructions eliminate most of the problems encountered. If you have a problem, call EMERSON EMC at (612) 474-8833 and ask for the Customer Service Department.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

AMPLIFIER MOUNTING INFORMATION

TA-202, TA-310, DX-202, DX-205, DX-308

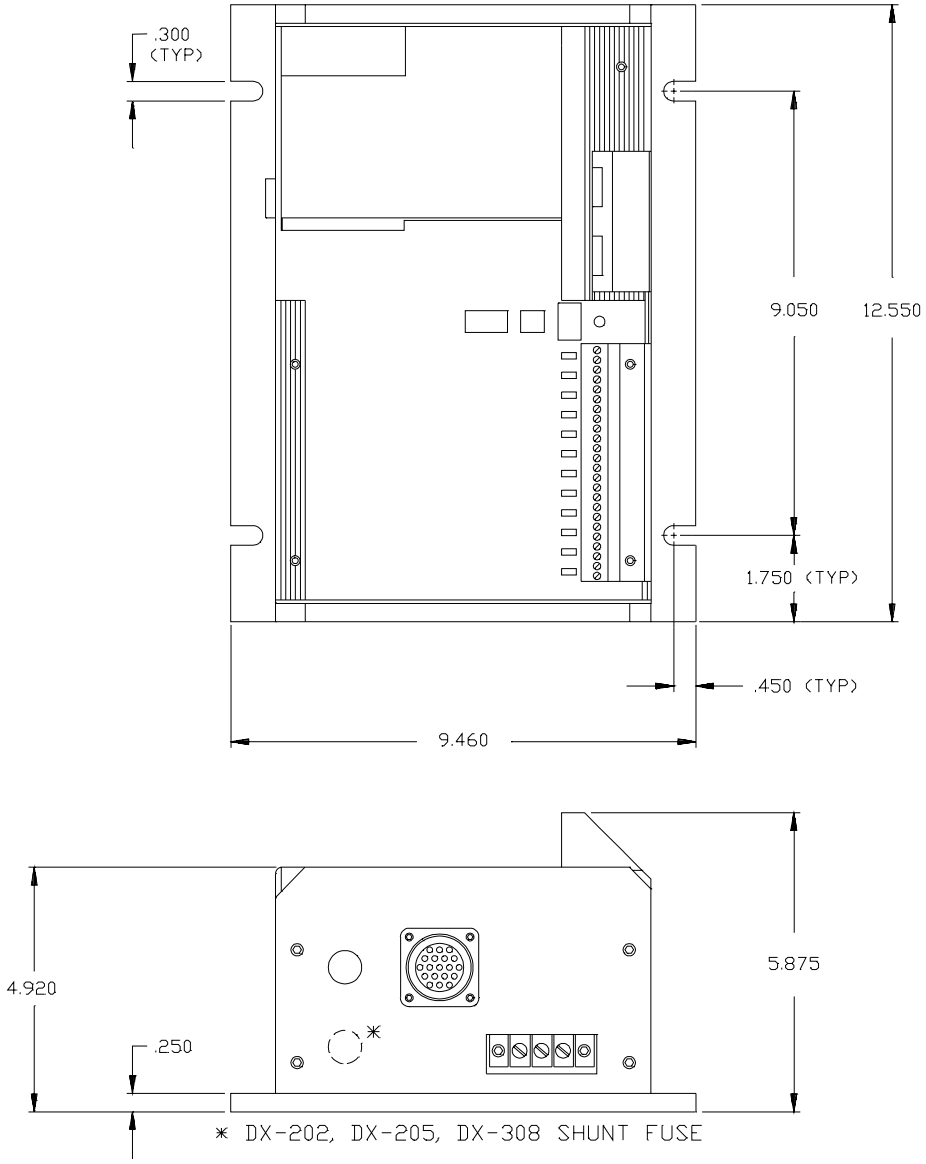
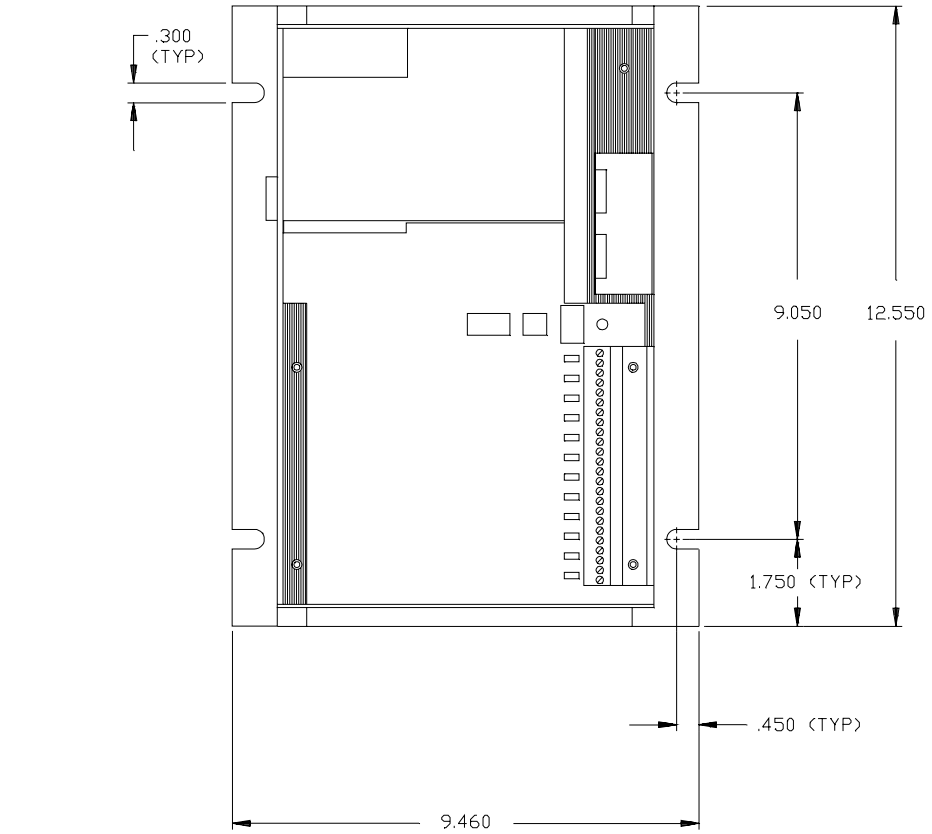


Figure 13 Amp Mounting Info (TA-202, 310, DX-202, 205, & 308)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

TA-420, TA-440, TA-460, DX-318, DX-430, DX-450



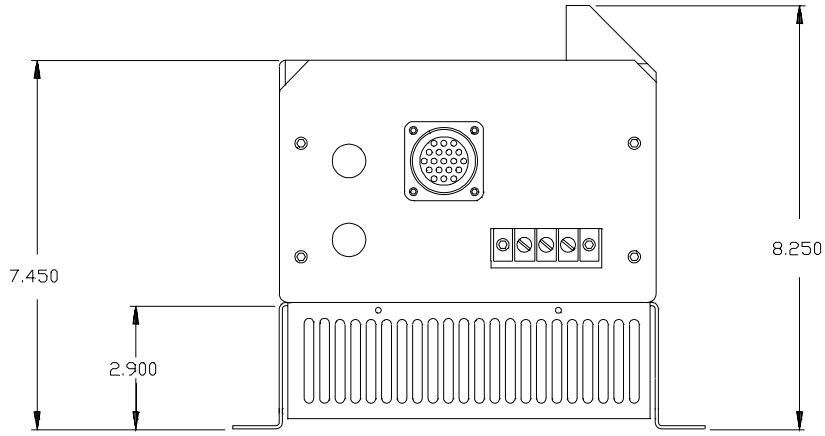


Figure 14 Amp Mounting Info (DX-318, 430, 450, TA-420, 440, & 460)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

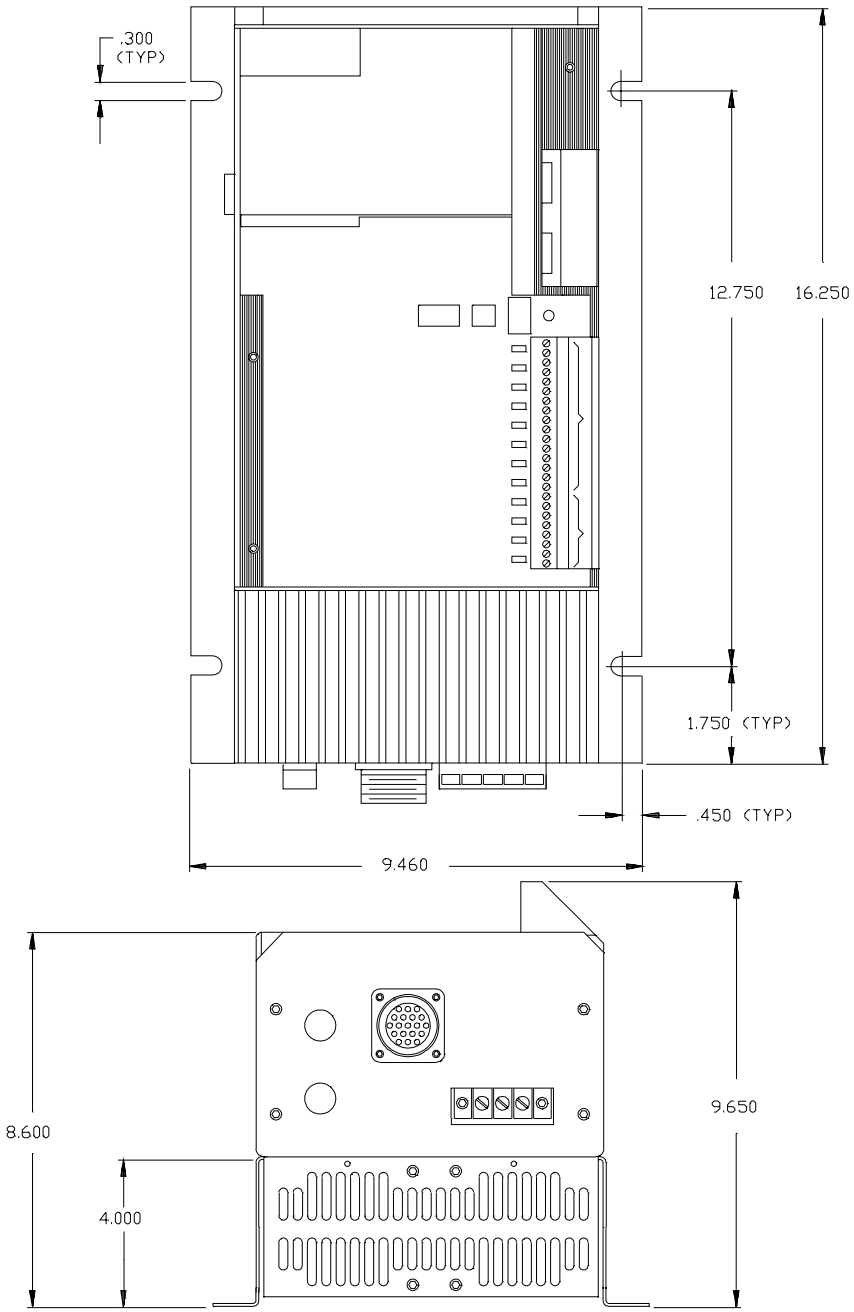


Figure 15 Amp. Mounting Information (DX-480, 780, & 7120)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

AMPLIFIER I/O LOCATIONS

TA-202, TA-310, DX-202, DX-205, DX-308

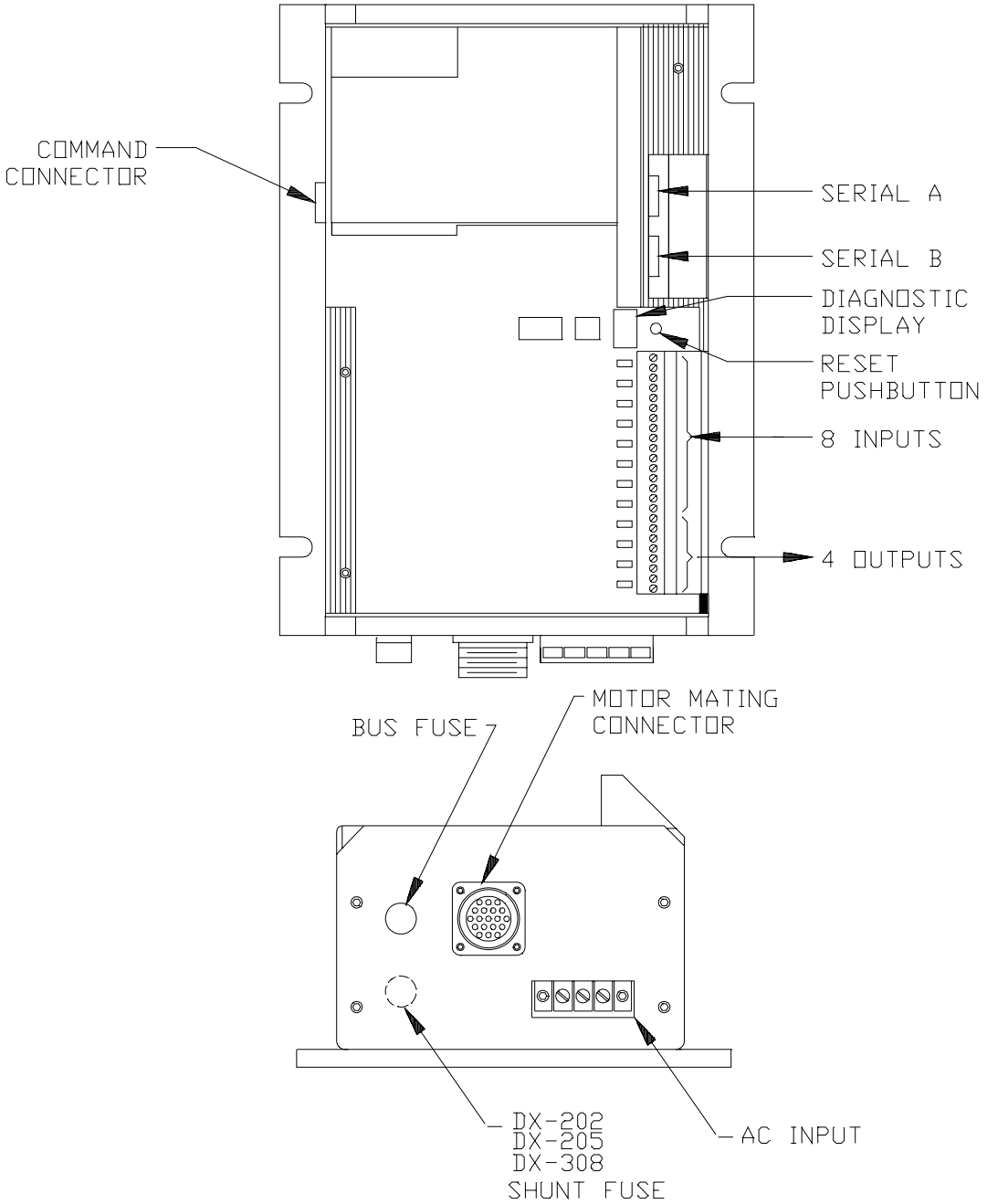


Figure 16 Amplifier I/O Locations (TA-202, 310, DX-202, 205, & 308)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

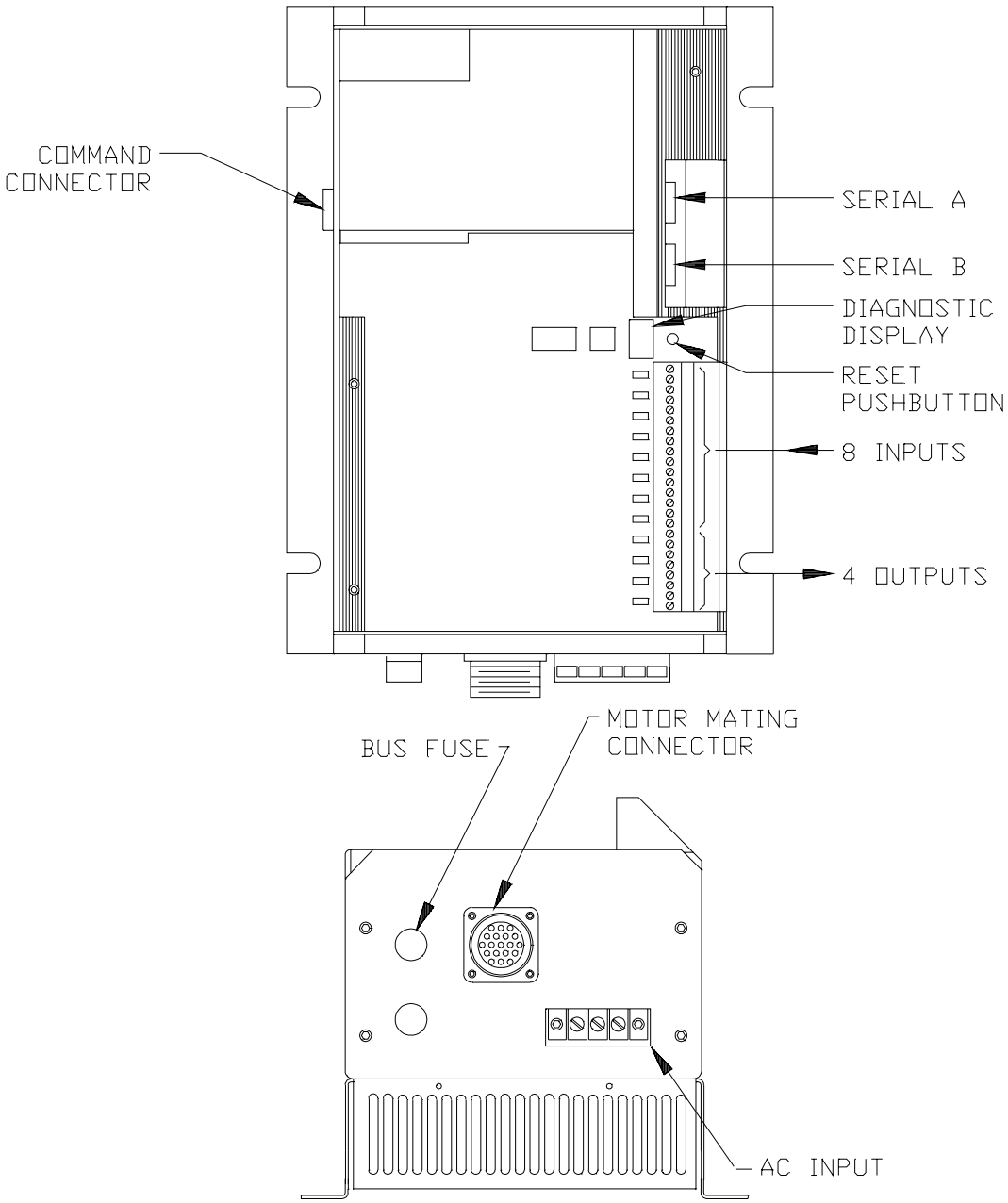


Figure 17 Amplifier I/O Locations (TA-420, 440, 460, DX-318, 430, 450)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

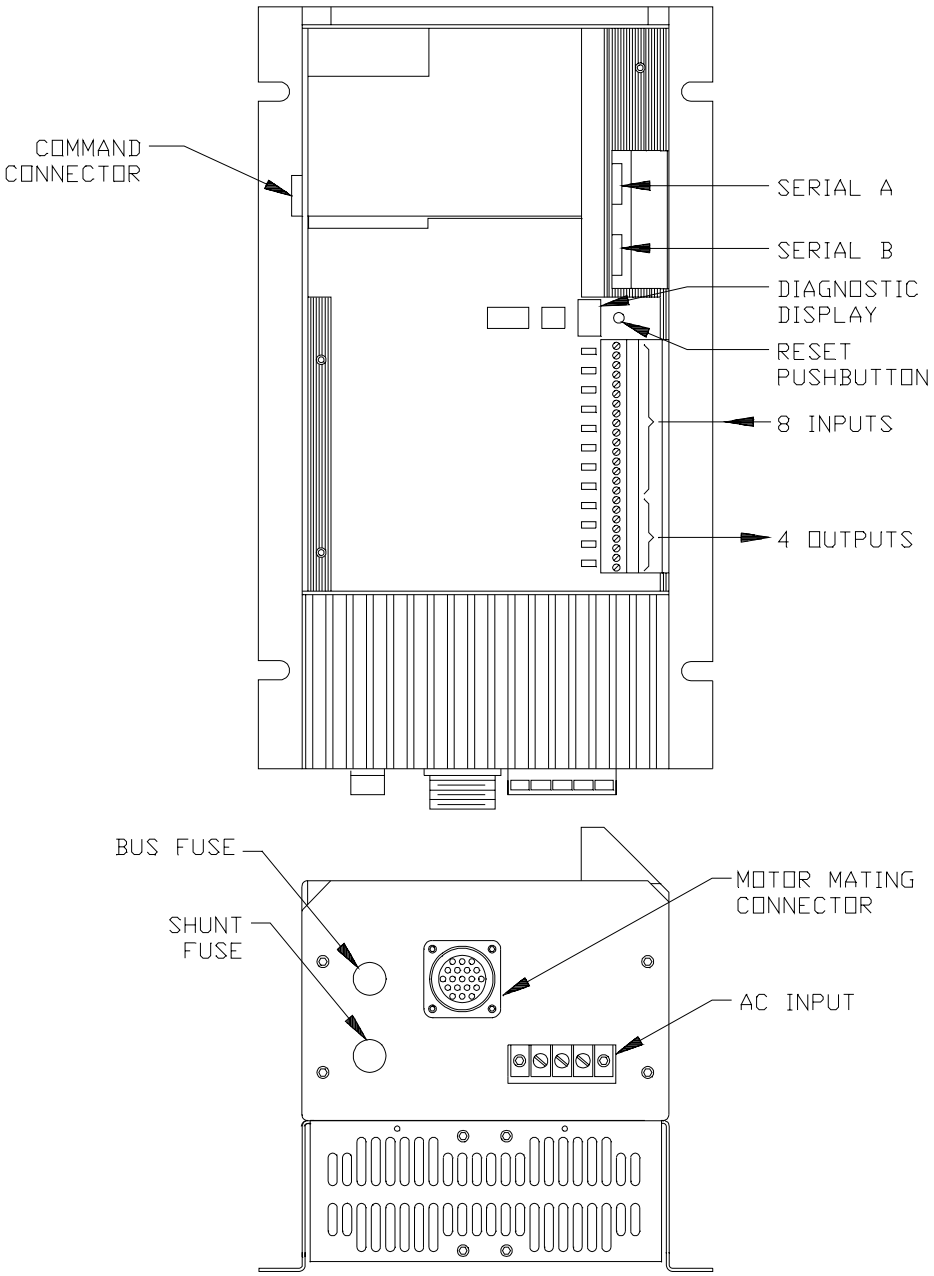
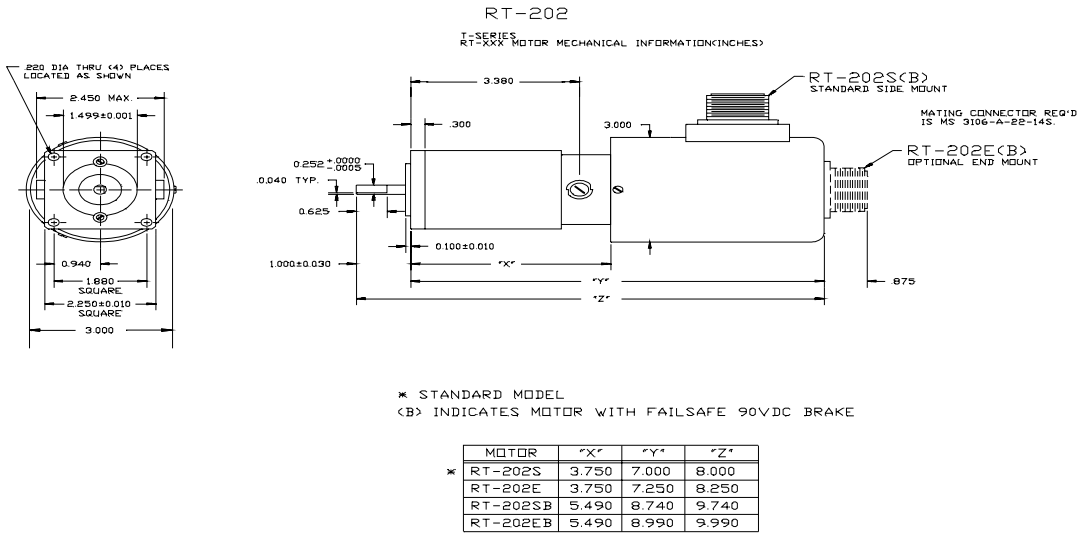


Figure 18 Amp I/O Locations (DX-480, 780, & 7120)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOTOR MECHANICAL INFORMATION

RT-202

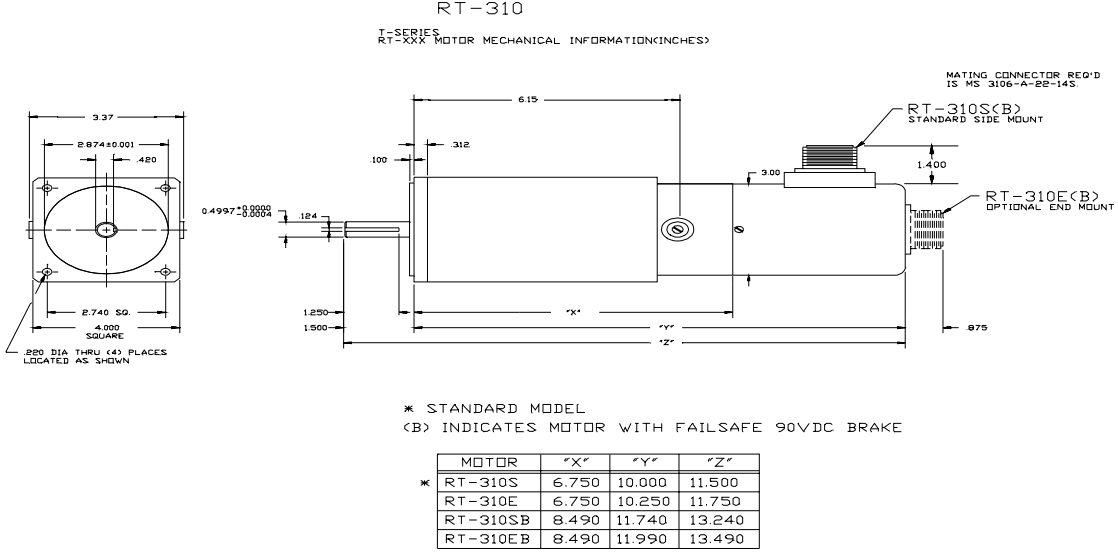


* STANDARD MODEL
(B) INDICATES MOTOR WITH FAILSAFE 90VDC BRAKE

	MOTOR	"X"	"Y"	"Z"
*	RT-202S	3.750	7.000	8.000
	RT-202E	3.750	7.250	8.250
	RT-202SB	5.490	8.740	9.740
	RT-202EB	5.490	8.990	9.990

Figure 19 Motor Mechanical Information (RT-202)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

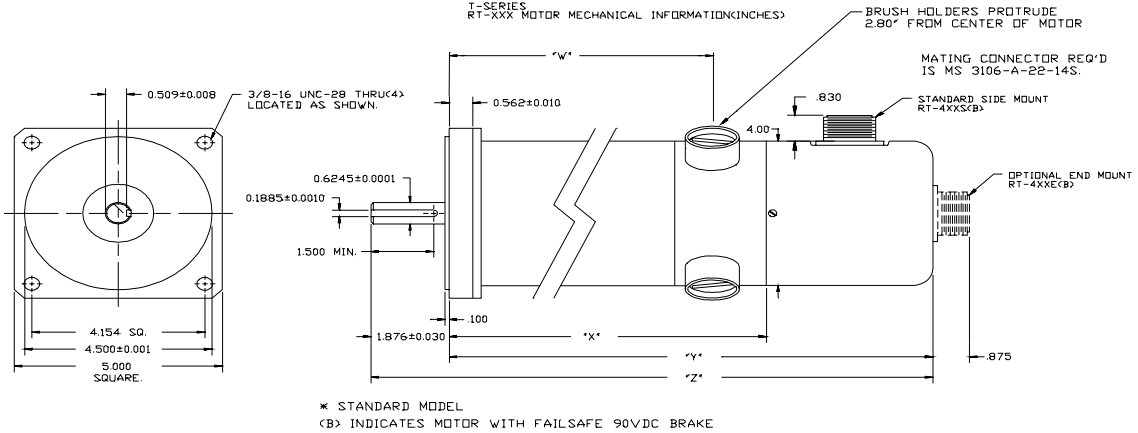


	MOTOR	"X"	"Y"	"Z"
*	RT-310S	6.750	10.000	11.500
	RT-310E	6.750	10.250	11.750
	RT-310SB	8.490	11.740	13.240
	RT-310EB	8.490	11.990	13.490

Figure 20 Motor Mechanical Information (RT-310)

RT-310

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



MOTOR	"W"	"X"	"Y"	"Z"
*RT-460S	7.75	9.120	12.910	14.786
RT-460E	7.75	9.120	12.660	14.536
RT-460SB	7.75	12.040	15.790	17.666
RT-460EB	7.75	12.040	15.540	17.416

MOTOR	"W"	"X"	"Y"	"Z"
*RT-440S	6.25	7.520	11.270	13.146
RT-440E	6.25	7.520	11.020	12.896
RT-440SB	6.25	10.440	14.190	16.066
RT-440EB	6.25	10.440	13.940	15.816

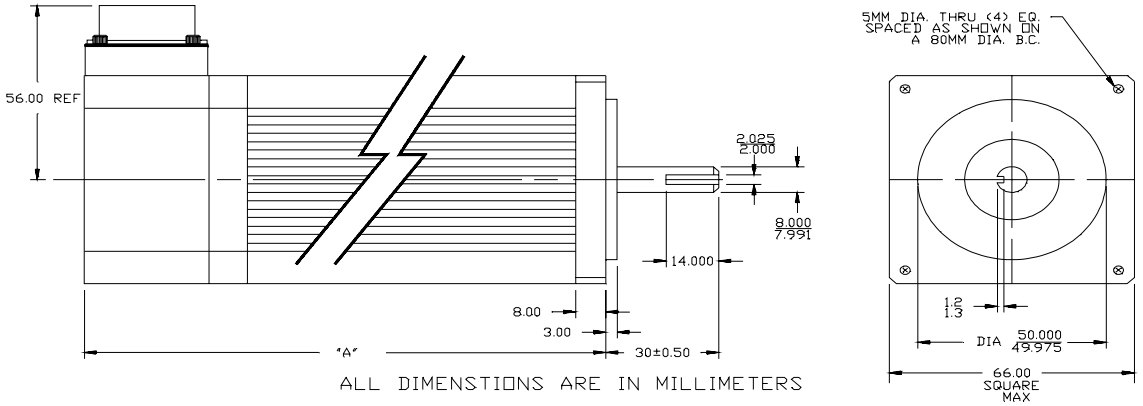
MOTOR	"W"	"X"	"Y"	"Z"
*RT-420S	4.64	5.950	9.700	11.576
RT-420E	4.64	5.950	9.450	11.326
RT-420SB	4.64	8.870	12.620	14.496
RT-420EB	4.64	8.870	12.370	14.246

Figure 21 Motor Mechanical Information (RT-420 440, & 460)

RT-420, RT-440, RT-460

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DXM-202, DXM-205

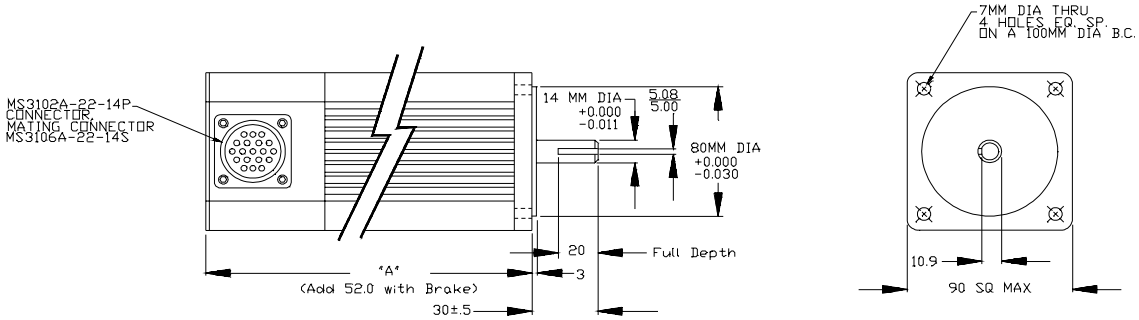


DXM-205, DXM-202 Motor Specifications

MECHANICAL AND ELECTRICAL DATA	DXM-205		DXM-202	
ROTOR MOMENT OF INERTIA	(kg-m²)	.0000285	(kg-m²)	.0000096
	(lb-in-s²)	.000253	(lb-in-s²)	.000086
MAX. CONT. OPERATING SPEED	(RPM)	3000	(RPM)	3000
COMPARATIVE BRUSH MOTOR(KE)	VOLTS/KRPM	23	VOLTS/KRPM	23
COMPARATIVE BRUSH MOTOR(KT)	IN.LB./AMP	1.9	IN.LB./AMP	1.9
CONT. STALL TORQUE	(lb-in)	5	(lb-in)	2
PEAK TORQUE	(lb-in)	10	(lb-in)	4
"A" DIMENSION (LENGTH)	max millimeters	163.0	max millimeters	115.0

Figure 22 Motor Mechanical Information (DXM-202, & 205)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

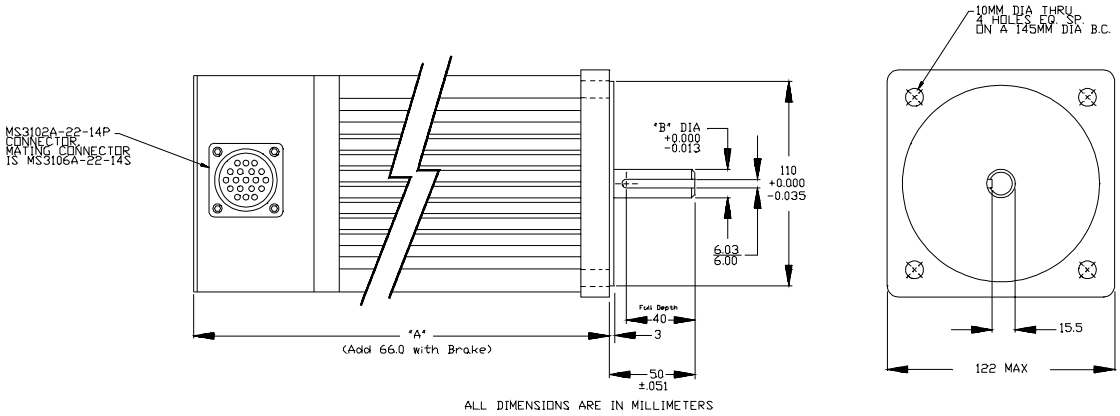


DXM-318, DXM-308 Motor Specifications

MECHANICAL AND ELECTRICAL DATA	DXM-318		DXM-308	
ROTOR MOMENT OF INERTIA	(kg-m²)	.00011	(kg-m²)	.000057
	(lb-in-s²)	.001	(lb-in-s²)	.0005
MAX. CONT. OPERATING SPEED	(RPM)	3000	(RPM)	3000
COMPARATIVE BRUSH MOTOR(KE)	VOLTS/KRPM	43	VOLTS/KRPM	34
COMPARATIVE BRUSH MOTOR(KT)	IN.LB./AMP	3.6	IN.LB./AMP	2.87
CONT. STALL TORQUE	(lb-in)	18	(lb-in)	8
PEAK TORQUE	(lb-in)	36	(lb-in)	16
"A" DIMENSION (LENGTH)	max millimeters	302.3	max millimeters	201.3

Figure 23 Motor Mechanical Information (DXM-308, & 318)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

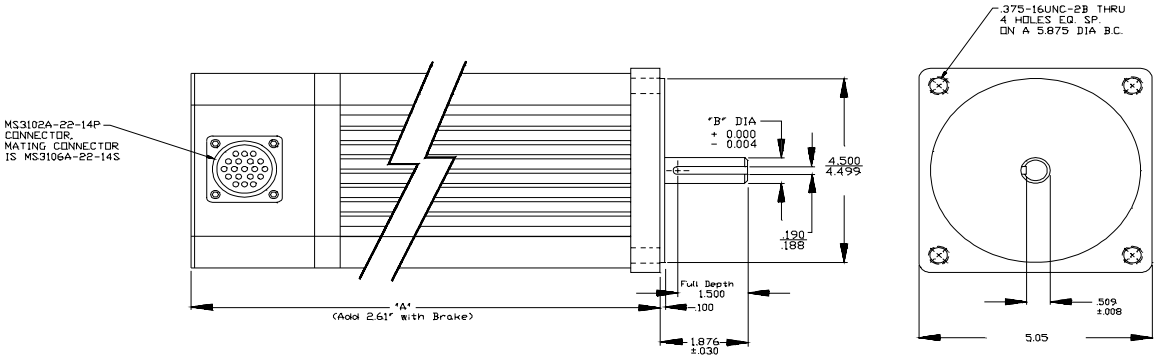


DXM-480, DXM-450, DXM-430 Motor Specifications

MECHANICAL AND ELECTRICAL DATA	DXM-480		DXM-450		DXM-430	
ROTOR MOMENT OF INERTIA	(kg-m²)	.000872	(kg-m²)	.00058	(kg-m²)	.0003
	(lb-in-s²)	.00772	(lb-in-s²)	.0052	(lb-in-s²)	.0026
MAX. CONT. OPERATING SPEED	(RPM)	3000	(RPM)	3000	(RPM)	3000
COMPARATIVE BRUSH MOTOR(KE)	VOLTS/KRPM	43	VOLTS/KRPM	43	VOLTS/KRPM	43
COMPARATIVE BRUSH MOTOR(KT)	IN.LB./AMP	3.6	IN.LB./AMP	3.6	IN.LB./AMP	3.6
CONT. STALL TORQUE	(lb-in)	80	(lb-in)	50	(lb-in)	30
PEAK TORQUE	(lb-in)	160	(lb-in)	100	(lb-in)	60
"A" DIMENSION (LENGTH)	millimeters	305.0	millimeters	263.2	millimeters	213.2
"B" DIMENSION (DIA)	millimeters	24.00	millimeters	19.00	millimeters	19.00

Figure 24 Motor Mechanical Information (DXM-430, 450, & 480)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

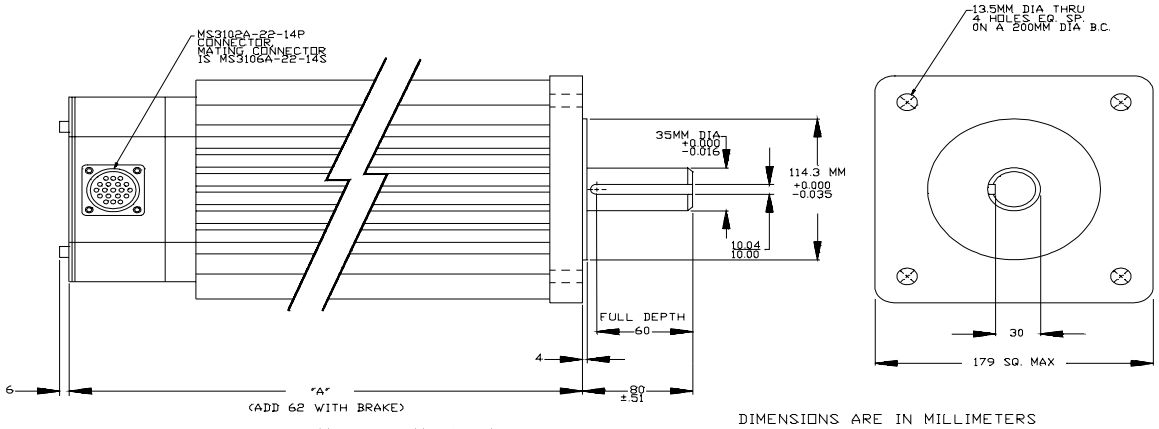


DXE-480, DXE-450, DXE-430 Motor Specifications

MECHNICAL AND ELECTRICAL DATA	DXE-480		DXE-450		DXE-430	
ROTOR MOMENT OF INERTIA	(lb-in-s²)	000872	(lb-in-s²)	.0052	(lb-in-s²)	.0026
MAXIMUM OPERATING SPEED	(RPM)	3000	(RPM)	3000	(RPM)	3000
COMPARATIVE BRUSH MOTOR(KE)	VOLTS/KRPM	43	VOLTS/KRPM	43	VOLTS/KRPM	43
COMPARATIVE BRUSH MOTOR(KT)	IN.LB./AMPS	3.6	IN.LB./AMPS	3.6	IN.LB./AMPS	3.6
CONT. STALL TORQUE	(lb-in)	80	(lb-in)	50	(lb-in)	30
PEAK TORQUE	(lb-in)	160	(lb-in)	100	(lb-in)	60
"A" DIMENSION (LENGTH)	max inches	12.00	max inches	10.55	max inches	8.37
"B" DIMENSION (DIA)	max inches	.875	max inches	.6245	max inches	.6245

Figure 25 Motor Mechanical Information (DXE-430, & 450)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



DIMENSIONS ARE IN MILLIMETERS

DXM-780, DXM-7120 Motor Specifications

MECHANICAL AND ELECTRICAL DATA	DXM-7120		DXM-780	
ROTOR MOMENT OF INERTIA	(kg-m²)	.0024	(kg-m²)	.0015
	(lb-in-s²)	.021	(lb-in-s²)	.013
MAX. CONT. OPERATING SPEED	(RPM)	2000	(RPM)	3000
COMPARATIVE BRUSH MOTOR(KE)	VOLTS/KRPM	66	VOLTS/KRPM	43
COMPARATIVE BRUSH MOTOR(KT)	IN.LB./AMP	5.57	IN.LB./AMP	3.6
CONT. STALL TORQUE	(lb-in)	120	(lb-in)	80
PEAK TORQUE	(lb-in)	240	(lb-in)	160
"A" DIMENSION (LENGTH)	millimeters	343	millimeters	266

Figure 26 Motor Mechanical Information (DXM-780, & 7120)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOTOR WIRING - RT-202, 310, 420, 440, 460

The diagram below indicates how the motor, resolver, thermostat and optional brake are wired.

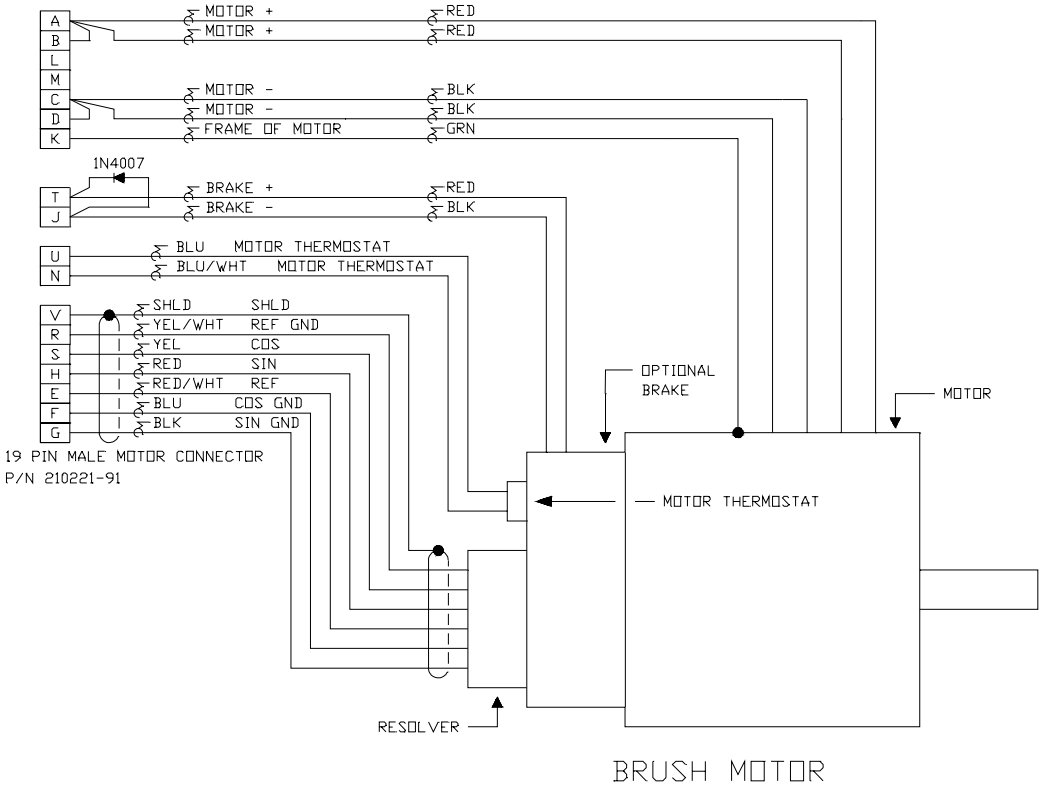


Figure 27 Motor Wiring RT-XXX

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOTOR WIRING - DX* 308,318,430,450,480,780,7120

*English or metric motors.

The diagram below indicates how the motor, resolver, thermostat and optional brake are wired.

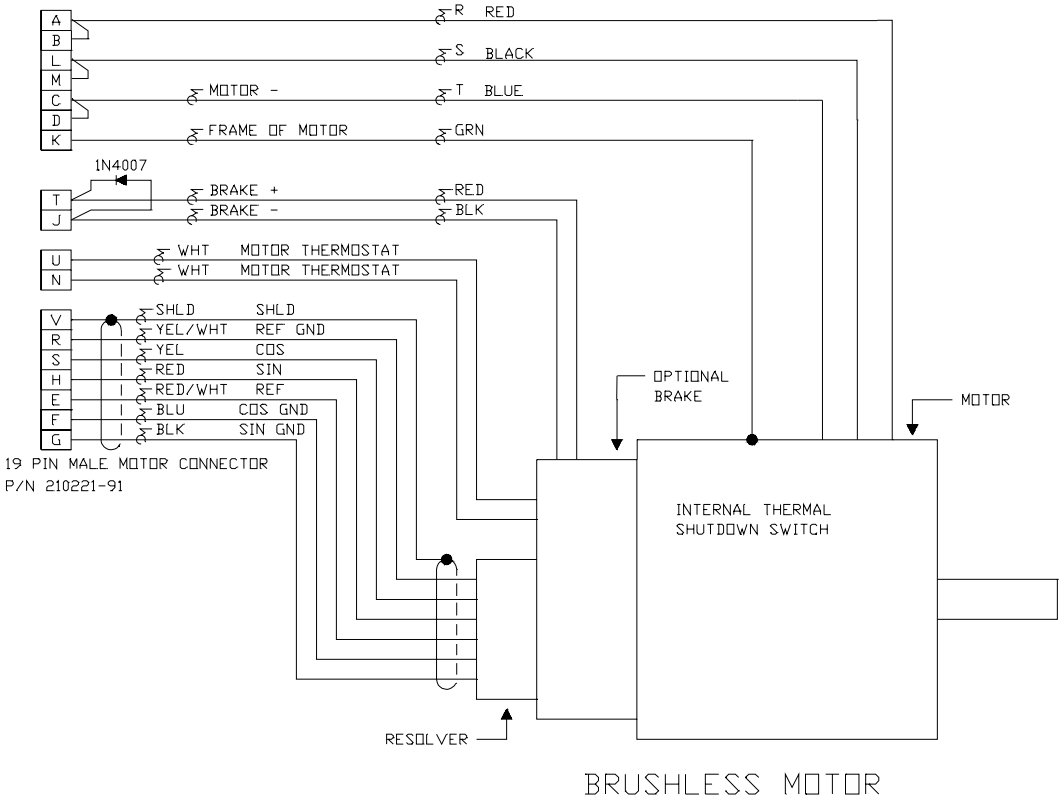


Figure 28 Motor Wiring DX-308, 318, 430, 450, 480, 780, & 7120

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

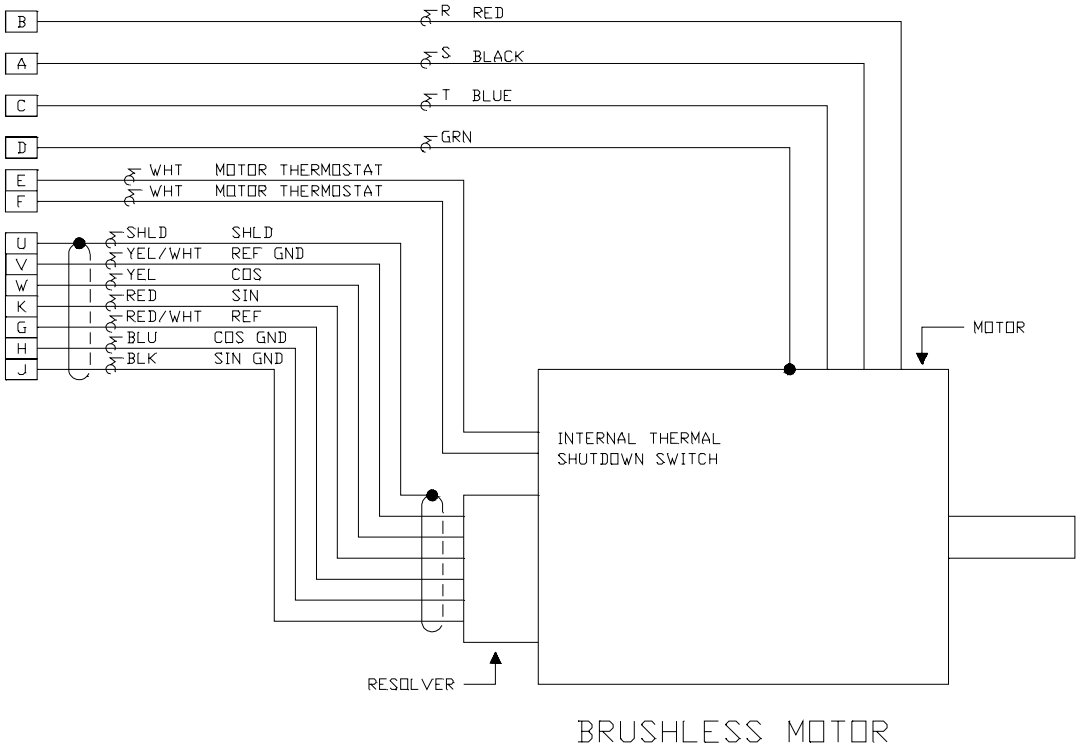


Figure 29 Motor Wiring DXM-202, & 205

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

TDS/TDL CABLE WIRING DIAGRAM

Shown below is a diagram on how the interconnect cable from the Drive to motor is assembled.

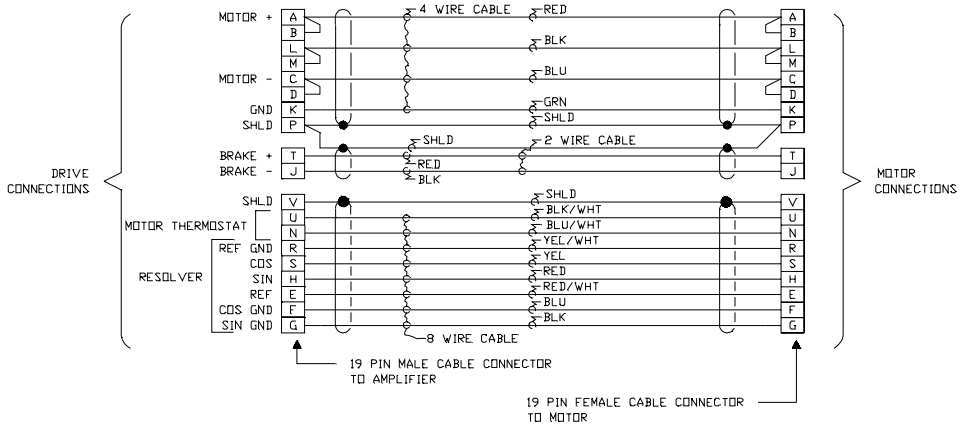


Figure 30 Cable Wiring Diagram (TDS/TDL)

The T-202, T-310, DX-308 and DX-318 use cable model TDS-XX the T-420, T-440, T-460, DX-430, DX-450, DX-780, and DX-7120 use model TDL-XX

WHERE XX DESIGNATES LENGTH

XX = LENGTH	(FT)
15	15
25	25
50	50

TDT CABLE WIRING DIAGRAM

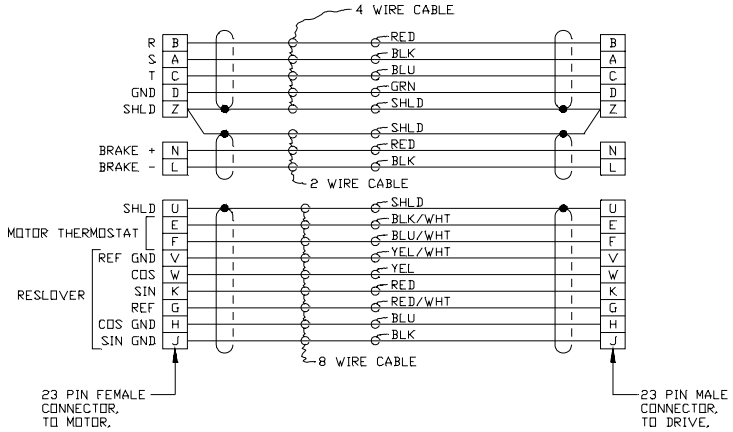


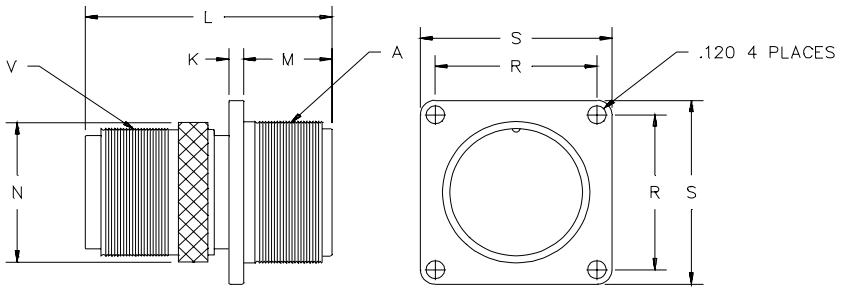
Figure 31 Cable Wiring Diagram (TDT)

The DX-202, and DX-205 use cable model number TDT-XX

WHERE XX DESIGNATES LENGTH:

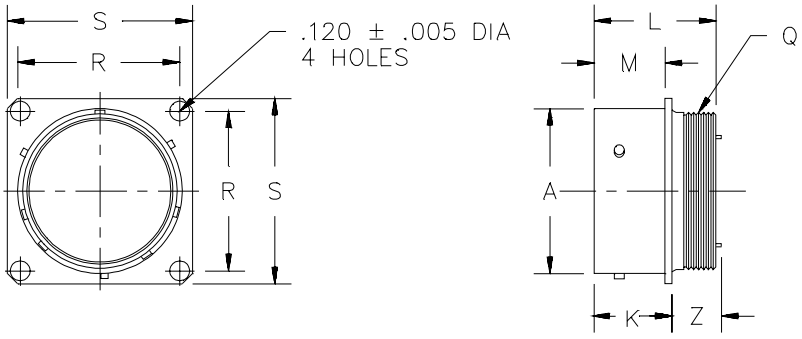
XX = LENGTH	(ft.)
15	15
25	25
50	50

OPTIONAL BULKHEAD CONNECTORS



	CONNECTOR SIZE	A COUPLING THREADS	K REF.	L MAX.	M REF.	N REF.	R REF.	S REF.	V FITTING THREADS
INCHES	22	1.375–18	.125	2.125	.75	1.375	1.25	1.625	1.188–18
MM			3.18	53.98	19.05	34.93	31.75	39.67	

Figure 32 Mounting Information, TDLB Cable



SHELL SIZE	R (TYP)	S MAX	A +.001 −.005	K +.020 −.010	L MAX	M +.010 −.000	Z MAX	Q THREAD CLASS 2A
16	.969	1.219	1.000	.493	.906	.431	.468	.9375–20 UNEF

Figure 33 Mounting Information, TDTB Cable

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OPERATING MODES

OVERVIEW

The Positioning Drive is differentiated from common analog servo drives in that the amplifier includes a position feedback loop. As a result, the amplifier will provide both precise position and velocity control of the motor. The drive utilizes resolver feedback for both velocity and position feedback. Thus, a tachometer is no longer required.

The drives include three different control modes providing alternatives for implementing motion control. The modes are listed below.

Table XII Motion Control Modes

MODE DEVICE	CONTROL	INTERFACE	COMMAND
ANALOG	VELOCITY	ZERO TO +/-10vdc	VELOCITY CONTROLLER
	TORQUE	ZERO TO +/-10vdc	TORQUE CONTROLLER
PULSE GENERATOR,	POSITION	PULSE & DIRECTION	MOTION
	INCREMENTS	+5 TO +15V LOGIC	INDEXER, CNC
GENERATOR,	POSITION	CW & CCW PULSES	MOTION
	INCREMENTS	+5 TO +15V LOGIC	INDEXER, CNC
INDEXING LOGIC,OPERATOR	INDEX,HOME,	INPUTS & OUTPUTS	RELAY
	JOG	1O TO +30vdc, OPTICALLY ISOLATED (SINK OR SOURCE)	CONTROL PANEL OR A PROGRAMMABLE LOGIC CONTROLLER
COMPUTER,	INDEX, HOME	RS423/422/232C	PERSONAL
	JOG AND MOTION PROGRAMMING	SERIAL INTERFACE XMIT/REC ASCII	ASCII UNIT ON PLC, ASCII TERMINAL

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MODE SELECTION

There are basically three separate operating modes: ANALOG, PULSE FOLLOWER, and INDEXING. The DIP switches 3 and 4 are used to help configure the operating modes. Units are shipped with DIP switches 3 and 4 OFF.

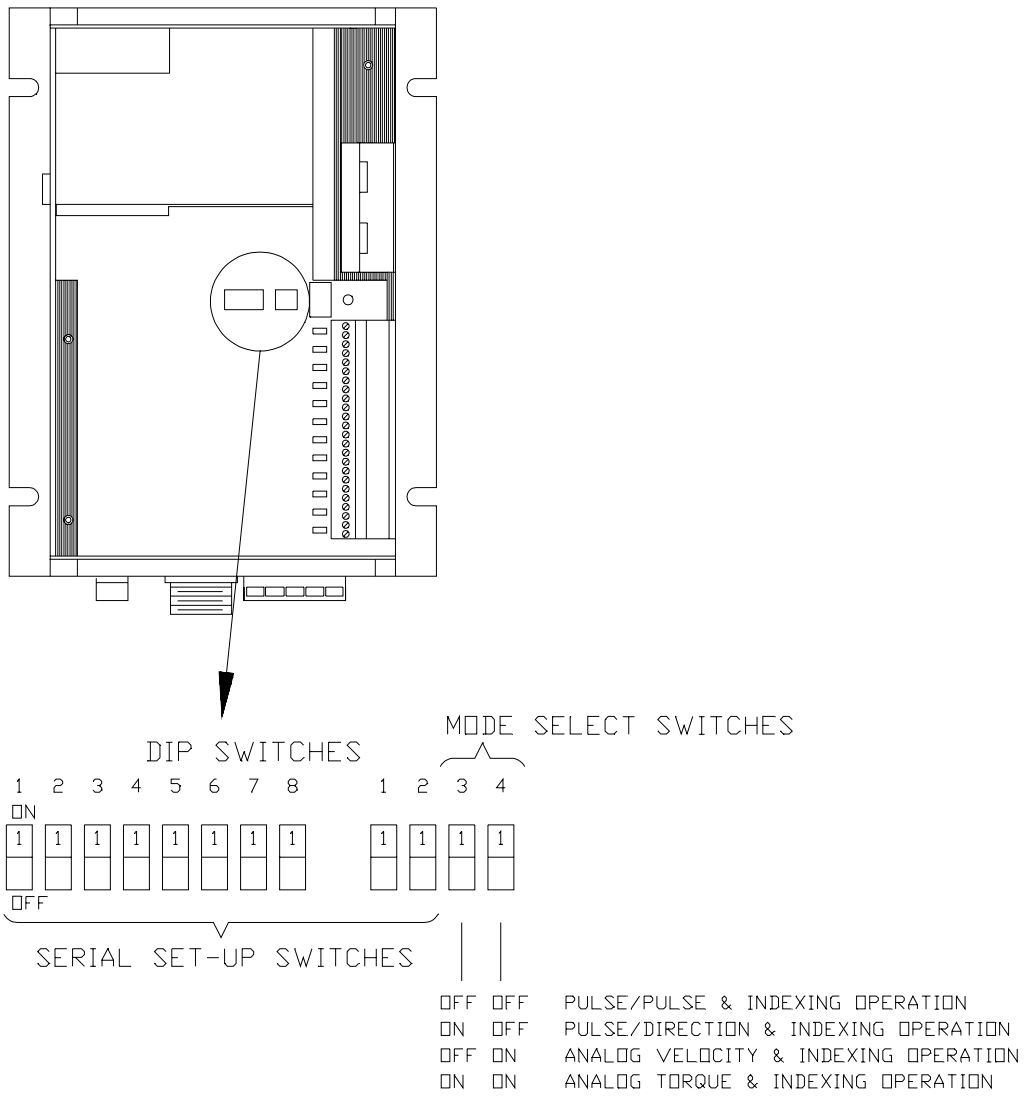


Figure 34 Dipswitches/Mode Selection

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ANALOG MODE

In the Analog Torque or Velocity mode, the servo amplifier responds to a conventional ±10 volt DC signal. Most variable speed drives and servo amplifiers on the market today receive commands via this type of signal. If the DIP switches are set to enable this mode, the display character of the digital drive will be an (A). In this mode, a +/-10 volt command signal is equated to +/- velocity or peak torque as determined by the drives pre-programmed velocity (3000 RPM default) or peak torque based on drive size. +/-10 = +/- peak torque. The external and serial control modes are not ignored if an (A) is on the display. Sending an SC=1 to the drive would disable analog control and enable serial control with an (E.) being on the display. If an (A) was on the display and an initiate index home or jog from the I/O occurs, then the (A) will be replaced with an (E) and the requested motion occurs. At the end of motion, the display and mode revert to (A).

In either of the two analog modes of operation a (+)/(-) 10 VDC signal is equated to either (CW) or (CCW) maximum programmed velocity in the velocity mode or CW or CCW full peak rating in the torque mode. The mode of operation can be selected via the mode select switches on the front of the servo drive.

NOTE: CW rotation is defined while facing the shaft end of the motor.

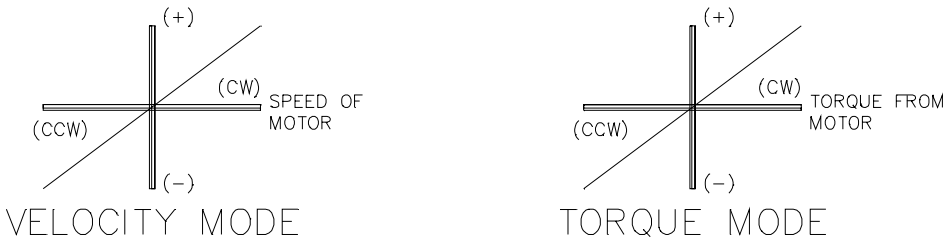


Figure 35 Velocity/Torque Mode

In either mode the +/- 10 VDC command signal is connected to the command input. The input circuit of the drive is a differential input amplifier with the following characteristics. Application of a + voltage to pin 7 with respect to pin 13 (GND) will produce either a CW motion or torque in the CW direction as viewed from the shaft end of the motor.

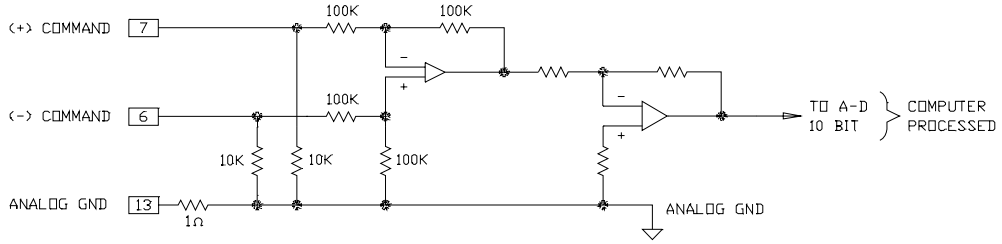


Figure 36 Command Input Circuit

MPORTANT: Voltages on pins 6 or 7 must not exceed +/-12 VDC with respect to analog ground.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

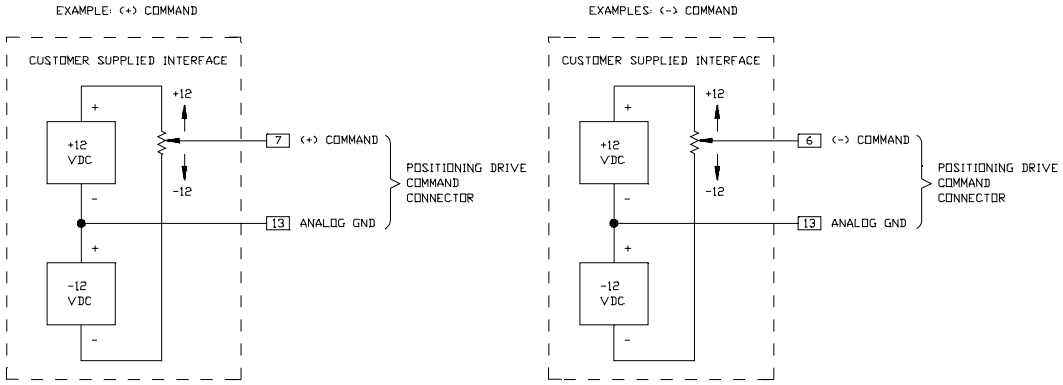


Figure 37 Command Connector

To execute the Analog Mode, the mode select switches must be set correctly for either Analog Velocity or Analog Torque control and apply +/-10 volts DC to the command connector on the amplifier.

REMINDER: Both the hardware and software position travel limits are active if they are set up.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PULSE MODE

In the Pulse mode, the Positioning Drive responds to a serial pulse train representing externally generated incremental position change commands. This mode is commonly used to control DC stepper motors or numeric controlled (CNC) machinery. The PULSE/PULSE or PULSE/DIRECTION operation are provided so that pulse inputs are converted to velocity and distance. The drive can be programmed to allow for pulses per revolution of 200 to 25,000. Once programmed, the total pulses received is converted to the equivalent distance in steps or pulses per revolution and the rate that pulses are received determines velocity. The base number system that the drive uses is binary with a resolution of 4096 per revolution. When using the pulse modes, there is no accumulative error. However, the positional accuracy is based on the lower of +/-1 part in 4096 or +/-1 of the programming resolution. At very low programming resolution such as 200 pulses per revolution, a dither of 360º/200 or 1.8º is typical. The maximum pulse rate input cannot exceed 204,800 Hz.

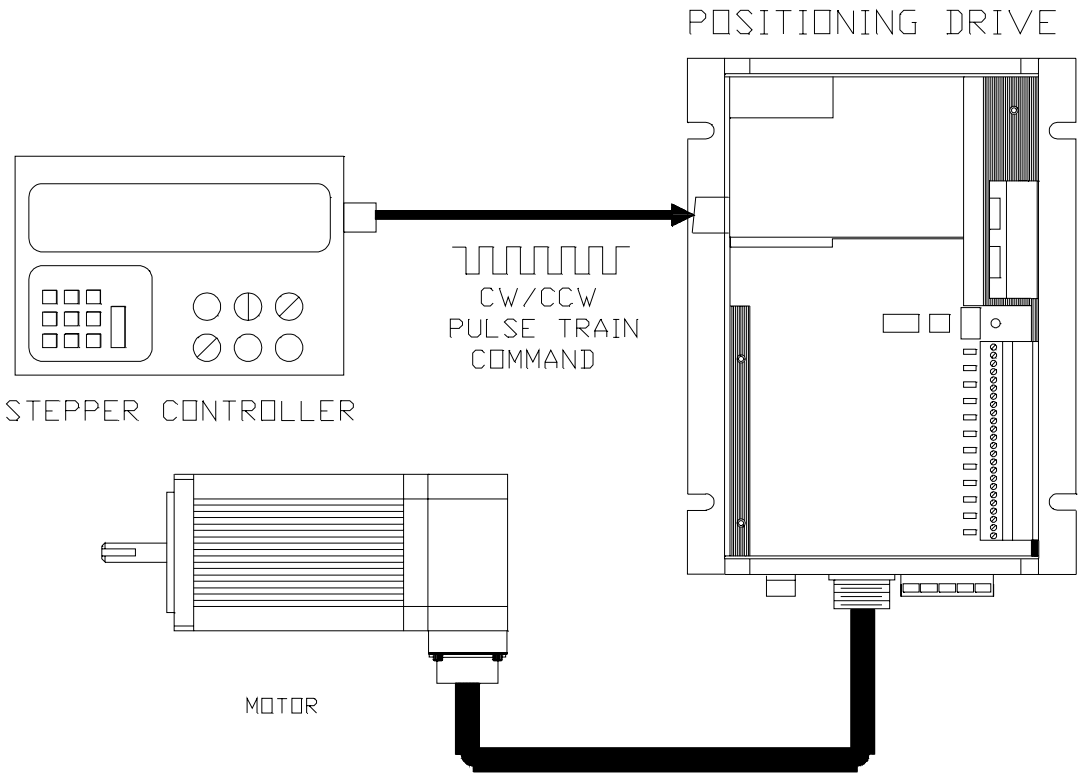


Figure 38 Pulse Mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Pulse/Pulse and Pulse/Direction Modes

Pulses on the CW pulse input line make the motor rotate CW and pulses on the CCW pulse input line make the motor rotate CCW as viewed from the shaft end of the motor.

To set up the pulses per revolution, select the drive parameters screen using PCX and change the default setting of 4000 steps/revolution to your desired configuration. The mode select switches can be set to operate the drive in the pulse/direction mode. In this mode, the CW pulse input line becomes the pulse input and the CCW pulse line becomes the direction input. If there is no current flowing in the direction input, the pulse input line is interpreted as CCW direction.

In either pulse mode, once motion is initiated with these inputs, motion in the opposite directions can not be achieved until motion in the initiated direction has been stopped as a result of stopping the pulses. Attempts to defeat this may cause erroneous and unpredictable operation.

In a pulse train application, the pulse trains are fed into the CW and CCW inputs on the command connector. The inputs are optically isolated and can be used for sinking or sourcing current; this requires two connections per input. In either case (sinking or sourcing), the noise immunity is improved when the normal state of the input does not cause current to flow in the optical coupler. Current should only flow when a motion pulse is applied by the external pulse generator, and each pulse must be at least between 0.5 to 1.5 micro seconds and between +5 and +15 VDC to be accepted as a valid pulse.

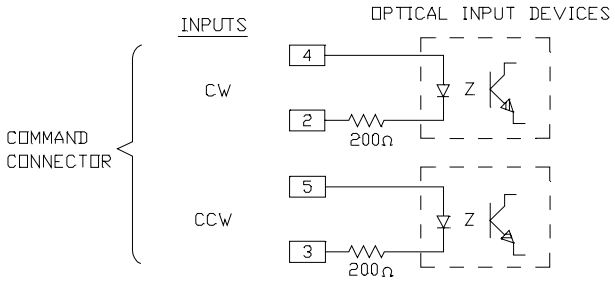


Figure 39 Command Connector Circuit

NOTE: CW rotation of the motor is established with the operator facing the shaft end of the motor.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

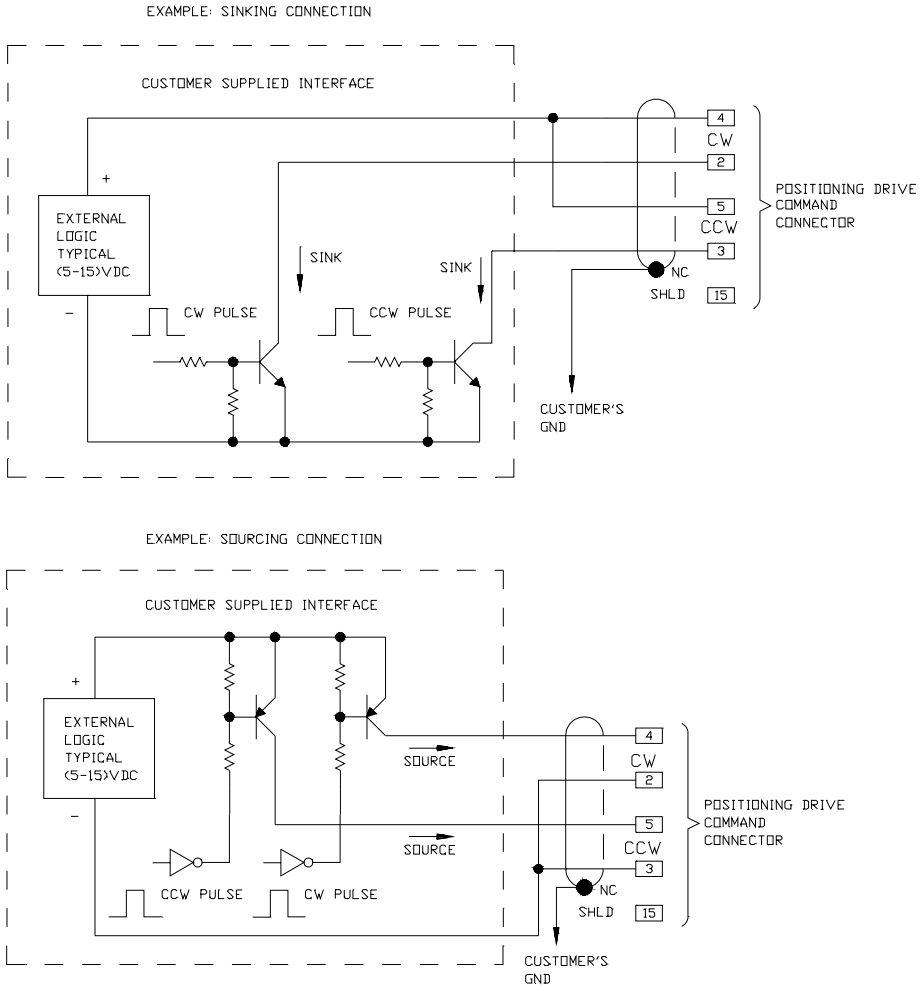


Figure 40 Example Of Sinking/Sourcing Connections

NOTE: Any connections between the customer supplied interface (stepper controller, etc.) and the command connector should be made through a shielded cable. The shield of this cable should be connected to the customer interface ground (source end). If no shield connection is available at the source end, then the shield connection on the command connector may be used. Keep in mind that this shield connection is connected internally to chassis ground of the drive.

To execute one of the two Pulse Modes, simply select the desired mode of operation on the mode select dip switches and put pulses into the command connector on the amplifier.

Even though the Pulse Mode of operation is being used, the Indexing Operation Mode functions are active. This means the user could feed pulses into the amplifier and then initiate the Indexing Mode functions from the input terminals. The serial control mode could also over-ride the Pulse Mode in this same manner.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

POSITIONING DRIVE CONFIGURATION AND PROGRAMMING

INTRODUCTION

EMERSON EMC's PCX programming software provides a simple, menu-driven format for question/answer set up and programming of EMERSON EMC Positioning Drives. The minimum requirements to successfully run the PCX software are any IBM PC or compatible PC with 512K bytes of RAM, one floppy disk drive and an RS232 serial interface port. The DOS version required by PCX is 3.0 or greater. PCX allows the user to look at set up data found in the Positioning Drive and make changes if desired. Programming data can be up-loaded (from the Positioning Drive to the PC) or down-loaded (from the PC to the Positioning Drive).

In addition, PCX allows the user to control or monitor motion functions in the Positioning Drive. All commands sent from the PC by PCX are simple two or three character ASCII letters preceded by a single character axis identifier and followed by data if required. In most cases, PCX is used to set up and program a Positioning Drive or PCM controller from a personal computer. After programming, the PC is disconnected and the user program remains in the Positioning Drive's non-volatile memory.

PCX provides descriptive question and answer formatting to assist the user. This allows minimum keystrokes to set up, program, monitor, or control, any Positioning Drive function without requiring an extensive user manual or knowledge of programming.

The PCX program also allows the user to edit files previously up loaded for multiple axes Positioning Drive systems at his desk and save them on a disk, without being connected to the drive. These parameters can be saved under a file name (user's choice) for later down-loading and non-volatile storage into the Positioning Drive.

The PCX software referred to in the manual is 4.14 or greater. Versions with less than 4.14 may not allow for full operation. Contact the factory to obtain the most recent version.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HOW TO START

The PCX software is supplied on a floppy diskette. The floppy diskette does not include the Disk Operating System (DOS). A backup copy of PCX should be made before starting. To initiate the PCX program, the user should type the letters "PCX" at the operating system prompt in the directory where PCX.EXE is located. Once the program has been loaded, the PCX diskette is no longer required to be in the disk drive. For certain file options, the user should ensure that a path is available to the COMMAND.COM file. This is accomplished by setting the DOS environment variable PATH or including the COMMAND.COM file in the current directory.

PCX PROGRAM REVISION

Once the PCX program has been loaded and is executing, the initial screen showing the program revision is displayed.

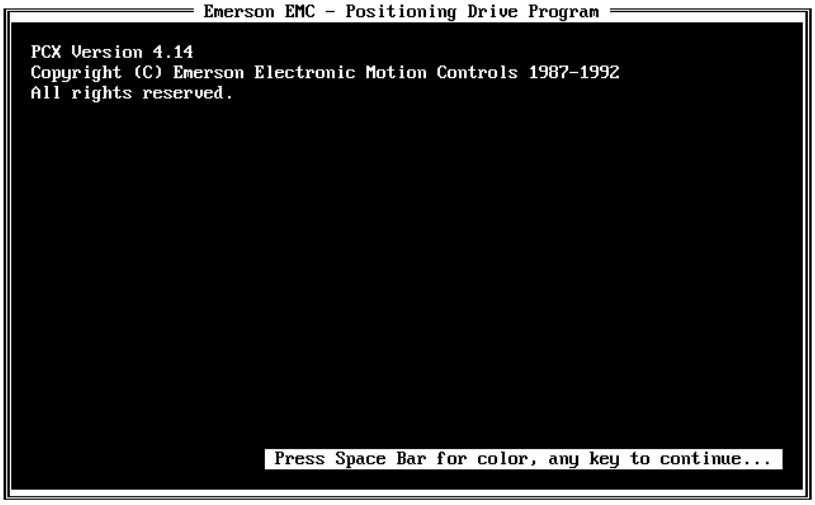


Figure 41 PCX Version 4.14

The PCX program is subject to changes. To assure that files generated with earlier versions of PCX are compatible with the latest version, the following procedure should be followed.

1. Using the old PCX, download the file to the positioning drive.

2. Using the new PCX, upload a file from the positioning drive.

The PCX program referred to in this manual is revision 4.14. Revisions with less than 4.14 may not allow for full operation. Contact the factory to obtain the most recent version.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MOVING THROUGH THE MENUS

PCX has a hierarchy system of menus (see 41 through 46). The top menu is the Main Menu. To proceed

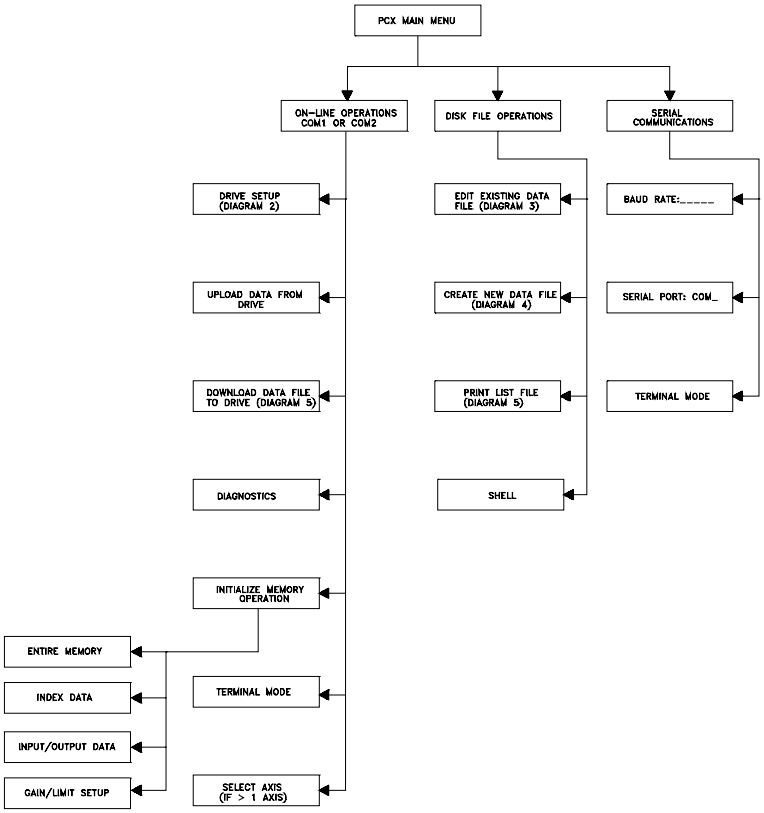


Figure 42 PCX Ver 4.14 Menu Hierarchy Diagram 1

into more specific levels, position the cursor on top of the desired option then press the "ENTER" key. There are two methods available to position the cursor. Pressing the first letter of the desired option will cause the cursor to move to that option. Pressing the "UP" and "DOWN" arrow keys will cause the cursor to move accordingly. The user may always back out to the main menu by pressing the "ESC" key. However, the "ESC" key will not cause program

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

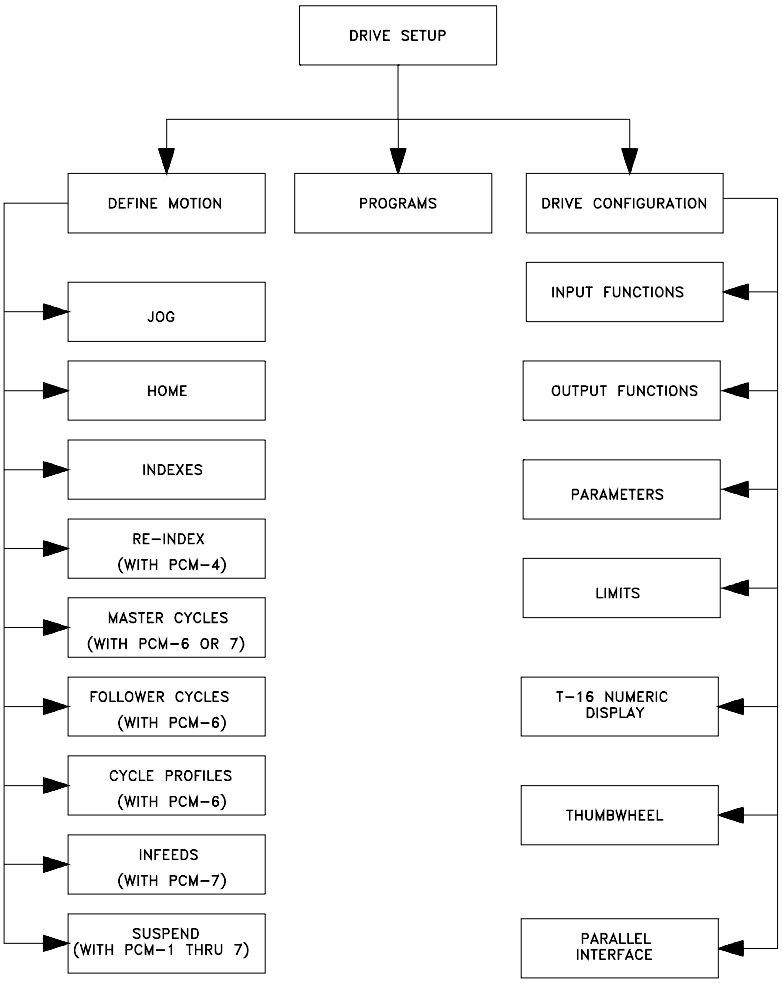


Figure 43 PCX-4.14 Menu Hierarchy Diagram 2

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

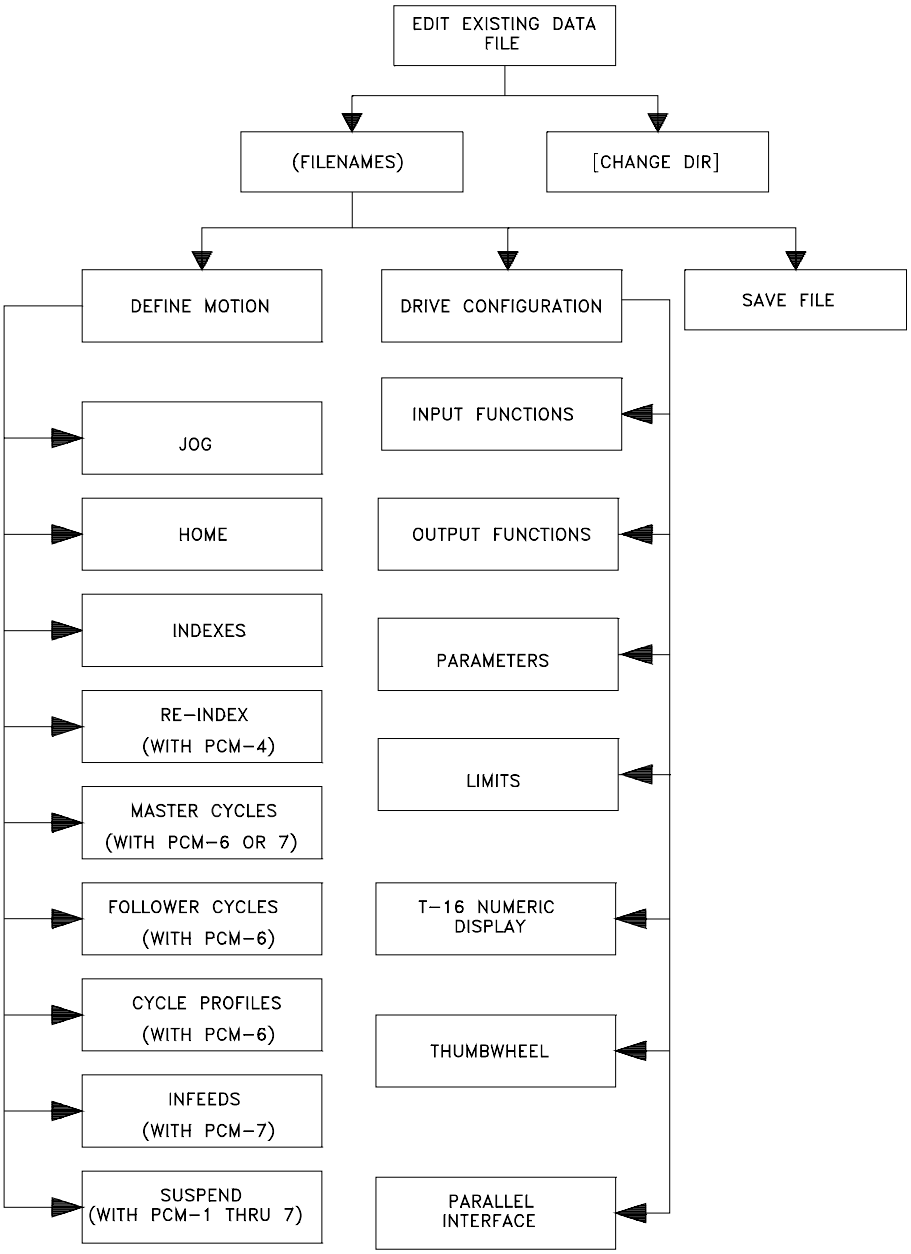


Figure 44 PCX Ver 4.14 Menu Hierarchy Diagram 3

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

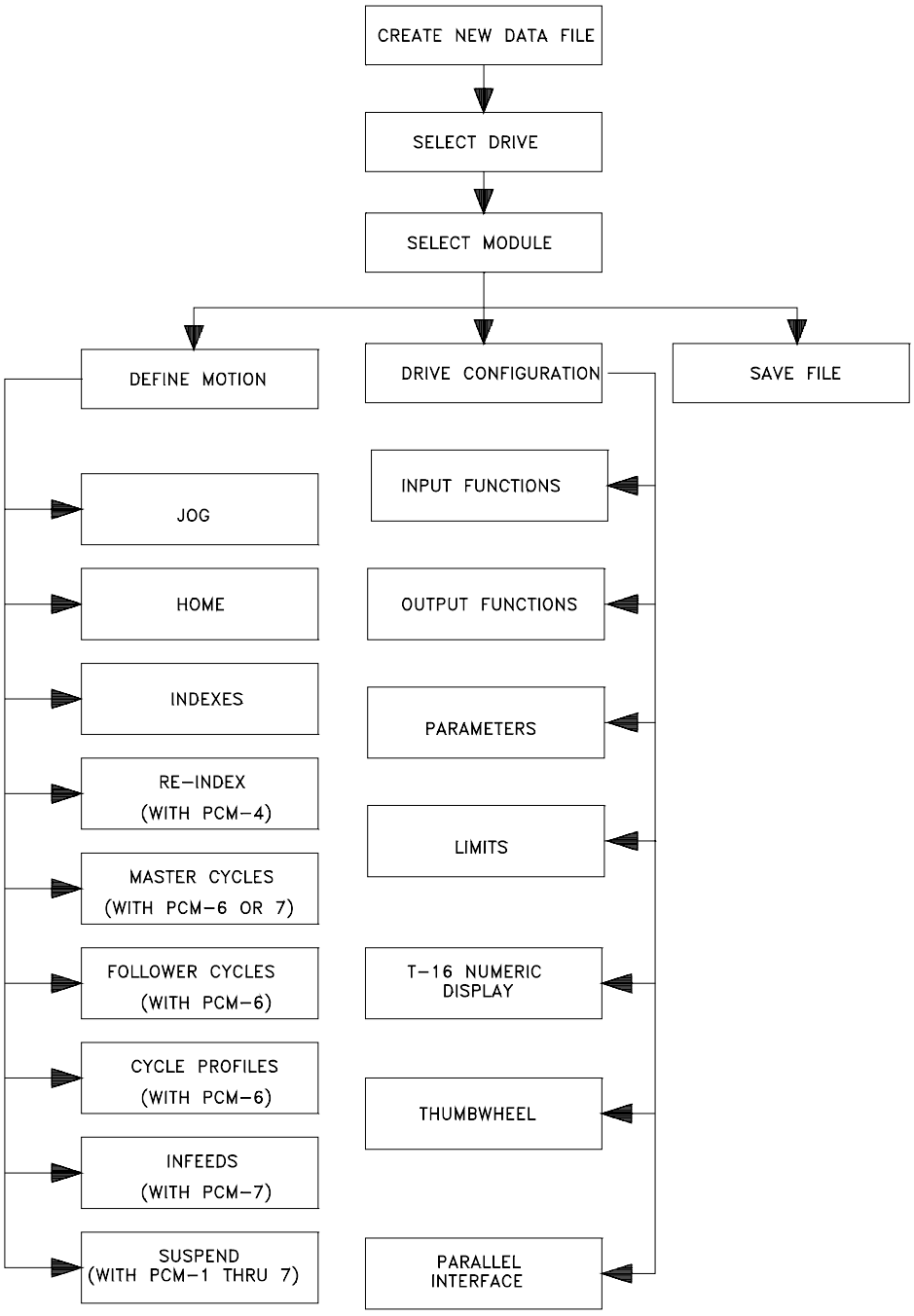


Figure 45 PCX Ver 4.14 Menu Hierarchy Diagram 4

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

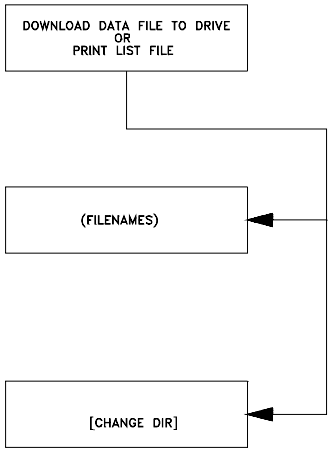


Figure 46

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CHANGING VALUES IN THE DATA ENTRY SCREENS

At the last level of the menu hierarchy, data entry screens are often presented. All data are validated and saved when the "ENTER" key is pressed. If they are out of range, the minimum or maximum acceptable value will be entered where applicable. Other data fields may require the use of the "LEFT" or "RIGHT" arrow keys to scroll through possible options. If data is not "ENTERED", the previous data will remain unchanged. The "ESC" key will return the user to the previous menu.

USING PCX DISK FILES

PCX provides two types of disk files,

1. DATA FILE

   A data file contains all the data in the positioning drive's memory in a transportable disk file. The upload, download, edit, create, and make options, all work with data files. Data files are always saved with the file extension of ".PCX" so it is not necessary for the user to specify one. Data files are stored in binary files and should only be edited by PCX.

2. LIST FILE

   A list file contains the values found in the PCX setup screens in an ASCII character text file. It is created from a data file with Make, in the disk file operations. A list file can be used for printing, word processing, troubleshooting, or as documentation. List files are always saved with the file extension of ".LST" so it is not necessary for the user to specify one.

Files that are created require a user file name to save the data. If possible, it is recommended that files be saved in the current directory. When files need to be recalled, PCX displays a list of files that are found in the current directory. To save to the current directory, simply type in a file name of eight characters or less. The correct file extension will automatically be appended. Files can be saved to any directory of any disk drive by specifying a complete file path.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MAIN MENU

When a key is pressed while viewing the introductory revision screen, the main menu will appear on the terminal screen.



Figure 47 Main Menu

From the main menu, the user may work directly with a drive or with a disk file. By selecting On-line Operations COM1 or COM2, PCX will automatically attempt serial communications with the drive. By selecting Disk File Operations, The user may setup a data file for a single axis without being hooked to the unit. Necessary values can be saved to floppy disk for download at a latter time. The serial communications option may be used to manually establish communications with the drive. This option may be helpful at start-up time if communications are not established with the On-line Operations.

ON-LINE OPERATIONS

When serial communications have been established with the drive, the On-line Operations menu will be presented on the screen.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Figure 48 On-line Operations

DRIVE SETUP

The setup options logically group together the necessary positioning drive values into data entry screens for editing. Everything necessary to prepare a drive for use can be accomplished in this option.

UPLOAD DATA FROM DRIVE

When this option is selected, PCX will read the values that are stored in the drives memory. Next, PCX will attempt to save the data to a user specified disk file name. When completed, the newly created file may be used for down loading to another drive or in the off line options, editing and printing. Up loading may take a few minutes to complete depending on the system being read from.

DOWNLOAD DATA FILE TO DRIVE

When this option is selected, PCX will attempt to list all files that have the extension of ".PCX" from the current directory. The user may select, from the list, a file to write to the drive. When selected, all values in the drive will be replaced by those from the file specified. If no files are found in the current directory, no down loading may take place. Down loading may take a few minutes to complete, depending on the system being written to.

DIAGNOSTICS

When this option is selected, PCX will monitor and display the status of the drive. This mode is useful when troubleshooting a system.

INITIALIZE MEMORY OPERATIONS

This option provides the user a way to reset the Drives non-volatile memory to its original (default) value. Different areas of memory can be specified as well as the "Entire Memory". Memory cannot be initialized while the drive is in motion.

NOTE: Use extreme caution when initializing memory. Input/Output functions that are reset could

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

cause motion to be initiated accidentally.

TERMINAL MODE

In this mode, the computer will operate as a dumb terminal. This means that the computer will send and receive ASCII serial commands. These commands can be used in place of the menus described in ON LINE SELECTION. However, this mode does not contain any help screens or instructions on how to program. The user must be cautious in this mode because whatever is typed is sent to the drive. Incorrect entries could be motion commands and if so, the drive would execute them.

NOTE: Programming should be done entirely with the PCX software or through the dumb terminal ASCII serial commands - BUT NOT BOTH. If both programming methods are used, there is a chance that not all the parameters entered through the dumb terminal will be transferred to the PCX software. This may lead to unpredictable behavior of the DX Drive.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ESTABLISHING COMMUNICATIONS

The On-line Options in PCX require serial communications between the personal computer and the Positioning Drive. When selecting On line Options the first time, PCX will attempt to communicate by transmitting a character and then receiving the echo. When the echo is the same as the character transmitted then communications have been established. PCX tries this procedure with all the possible baud rates. Once PCX has established communications, the program will continue by displaying the On-line Options. This procedure will not be called again unless communications are disrupted at a later time.

The following checklist should be addressed before attempting serial communications.

1. The serial cable must be connected to the personal computer serial port and the drive serial A port.

2. On a multi-axis system, the serial cables must be connected as shown below.

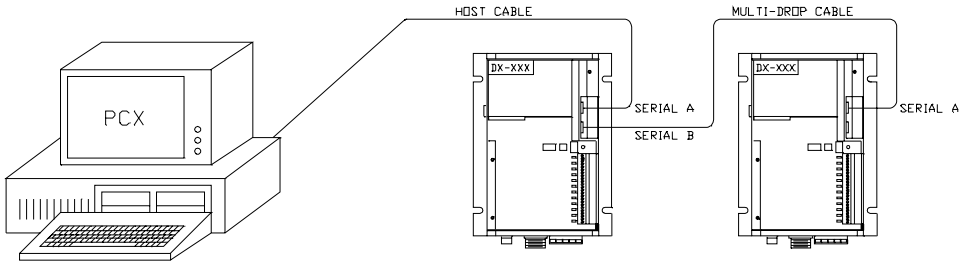


Figure 49 Serial Cable Setup

3. On a multi-axis system, make sure that the baud rate setting on each drive is the same.

4. On a multi-axis system, make sure that each positioning drive has a unique axis identifier.

5. Power to all Positioning Drives must be on.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DISK FILE OPERATIONS

When this operation is selected from the Main Menu, the Disk File Operations Menu will be presented on the screen.

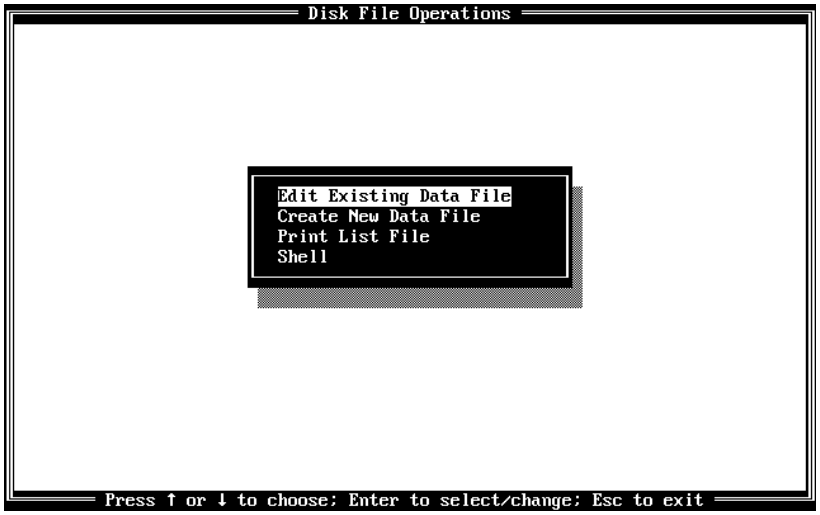


Figure 50 Disk File Operations

EDIT EXISTING DATA FILE

PCX will attempt to list all files that have the extension of ".PCX" from the current directory. The user may select, from the list, a previously saved data file to be recalled. Editing a file is very similar to the On-line Setup options except it allows the user to change any drive values without being connected to the drive. After editing, the file may be saved, renamed, or left unchanged. Editing may only be done on data files that have previously been up loaded or created.

CREATE NEW DATA FILE

PCX will allow the user to create a data file. The user must select the controller model and any optional PCM module for the file that is to be created. Once this has been done, the file may be edited and saved under a user file name for later use.

MAKE LIST FILE FROM DATA FILE

PCX will attempt to list all files that have the extension of ".PCX" from the current directory. The user may select a data file necessary to produce a list file. PCX will use the same filename but will append the extension ".LST" to the newly created list file. List files are ASCII character text files created from data files (see Using PCX Files).

PRINT LIST FILE

PCX will attempt to list all files that have the extension of ".LST" from the current directory. The user may select a list file to be printed. In order for printing to work properly, the PRINT.COM file must be accessible by PCX; This may be accomplished by using the DOS PATH or COPY command. The printer must also be available and online.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SHELL

A DOS shell provides the user with a way to enter DOS commands without exiting PCX. In order for shell to work properly, the COMMAND.COM file must be accessible by PCX; This may be accomplished by using the DOS PATH or COPY command.

DRIVE SETUP

When the setup, edit, or create option is selected, the Drive Setup menu will be displayed on the screen.

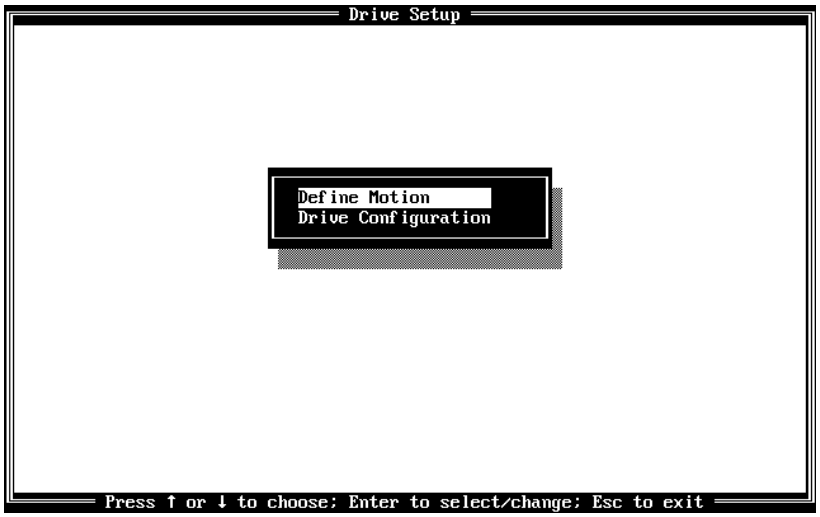


Figure 51 Drive Setup

From the Drive Setup Menu, there are two areas that need to be setup. The Define Motion menu item is where motion related items are setup. Data entry screens for Jog, Home, Index and programs are programmed here. The second option, Drive Configuration, is where all other drive items are located. The drive setup, Input and Output Functions, Parameters, and Limits, are all programmed from this option.



Figure 52 Define Motion

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com



Figure 53 Drive configuration

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

JOG, INDEX AND HOME

A drives basic motion functions are programmable by using these data entry screens. When on line with a drive, these options allow motion to be initiated and stopped by pressing the "SPACE BAR". The bottom section provides helpful information such as the range of possible values, available types, valid units, and any other special instructions. These screens are explained in greater detail in the external operating modes. Additional capabilities are described in the IOM and PCM sections of the manual.

INPUTS AND OUTPUTS

These two screens are used for assigning the input and output lines to a function. Line numbers correspond to those on the top of the drive and PCM modules. A function with a line number of zero designates that it is unused. Multiple functions can be assigned to a single line; it is common to assign all output faults to one output line. The left window allows the user to quickly determine what functions are assigned. The right window may be scrolled up and down to assign additional functions that are physically unable to fit on a screen. Refer to the input and output interface section for physical location and descriptions. Additional I/O capabilities for the IOM and PCM's are in those sections.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT POLARITY

Input functions that do not affect motion may be assigned as normally off (-, default) or normally on (+). When an input is assigned with "+" polarity, it is active while the input is not on. Input polarity is assigned by pressing the "+" or "-" key on the input function indicated by the cursor.

INPUT FILTERING

By pressing "ALT-F" on the input screen, PCX will pop-up the filtering data entry screen. Input filtering is a form of digital integration. It is not intended to reduce electrical noise or the effects of electrical noise in industrial environments. It is provided digitally qualify that an input is on for a pre-determined time. The drive services inputs at a minimum rate of .002 seconds. Therefore, the input or input filtering is always subject to a delay of (.0005 to .0025) seconds. The .0005 delay caused by propagation delay of the hardware and .0025 is the sum of the propagation delay plus the service time. The PCX program will only allow for this time to be entered in increments of .002 as this is the minimum service rate. When "ESC" is pressed, PCX will return to the input setup screen.

PARAMETERS

The Parameters screen allows the user to set up parameters for display purposes. These parameters include position units, distance decimal point, location, velocity units, velocity scale and velocity decimal point location. PCX and displays, such as EMERSON EMC's T-21 Data Entry Terminal, use these parameters to display familiar user units. Some examples would be: IN/SEC; RPM; STEPS/REV; FT/MIN, etc.

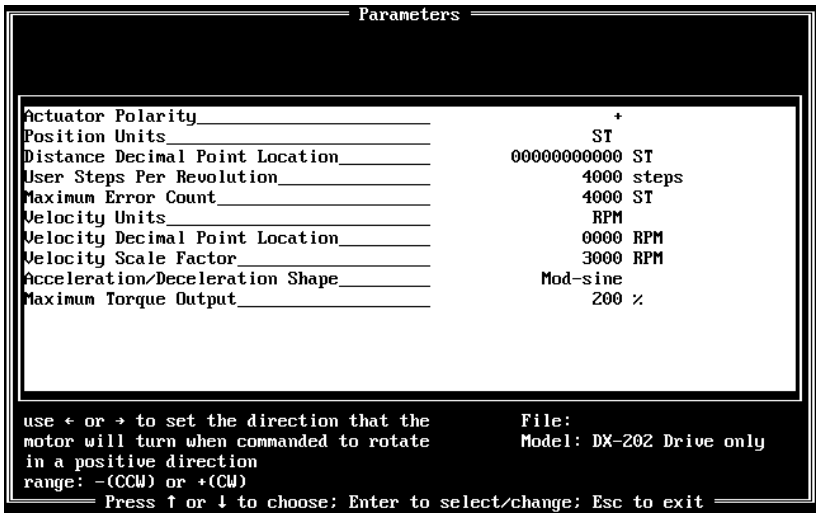


Figure 54 Parameters

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ACTUATOR POLARITY

The default (+) of this feature provides for CW rotation of the actuator for positive (+) motion initiation. For example, a CW JOG input will cause CW rotation of the actuator as viewed from the shaft end of the actuator. To change this relationship, a (-) can be programmed. During the time this change occurs using PCX, the bridge power is turned OFF and ON to accomplish a smooth transition.

VELOCITY UNITS, VELOCITY SCALE FACTOR, VELOCITY DECIMAL POINT LOCATION

To make the display data meaningful, the user must set up a conversion between his units and the units that are used by the drive.

Example: The user has a system that direct couples to a lead screw and would like to program velocity in IN/MIN and position in inches. He has a 5 pitch (5 REV/IN) LEAD SCREW. To determine the VELOCITY SCALE FACTOR he would have to calculate the following:

$$\frac{\text{3000 (MAX MOTOR RPM)}}{\text{5 (PITCH)}} = \text{600 INCHES PER MINUTE}$$

Since in his system 600 IN/MIN = 3000 RPM, the VELOCITY SCALE FACTOR would be set = 600 or 600.0. If inches per second were desired then division by 60 would yield either 10.000 or 10.00. Once these decisions are made, the numeric value, decimal point and velocity units can be programmed. Velocity units would be either IPM (INCHES PER MINUTE) or IPS (INCHES PER SECOND). Any 3 ASCII characters are accepted.

DISTANCE DECIMAL POINT LOCATION, USER STEPS PER REVOLUTION

The user may also set up a distance conversion because he is working in inches and the drive works in steps. He can use the USER STEPS PER REV to create this conversion.

We have: 1 IN = 5 LEAD SCREW REVS

Therefore, 1 IN = 5 MOTOR REVS

Now the user must decide how many steps per user rev. The drive will accept any number in a range of (200 to 25,000). The easiest way to do this is to divide the one inch by the 5 turns to find the number 0.2. This example yields three possible conversions; either 200, 2000 or 20,000. The number must be between 200 and 25,000.

If 2000 is chosen, then 2000 X 5 turns = 10,000 counts per inch

This would provide for a program resolution of .0001 inches

If 20,000 is chosen, then 20,000 X 5 turns = 100,000 counts per inch
This would provide for a program resolution of .00001 inches

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Once a decision is reached, the value for steps per revolution, decimal point and units can be entered. Low resolutions, less than 1000, are discouraged as dither is increased. For example, if 200 was selected, 360°/200 = 1.8° of dither. This could be objectionable.

ACCEL/DECEL SHAPE

This option also allows the user to choose either linear ramps or mod-sine ramps for acceleration or deceleration. The difference is shown below.

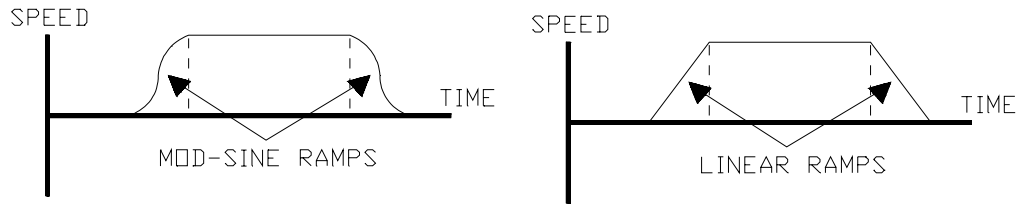


Figure 55 Mod-Sine Ramps/Liner Ramps

MAXIMUM TORQUE OUTPUT

The Maximum Torque Output controls the amount of available torque. 200% is the drives peak rating. 100% would be the amplifiers continuous rating. Peak torque is only available for short periods. Consult the MFR. specs for the amplifier in use.

LIMITS

The Limits screen allows the user to set the maximum and minimum operating parameters.

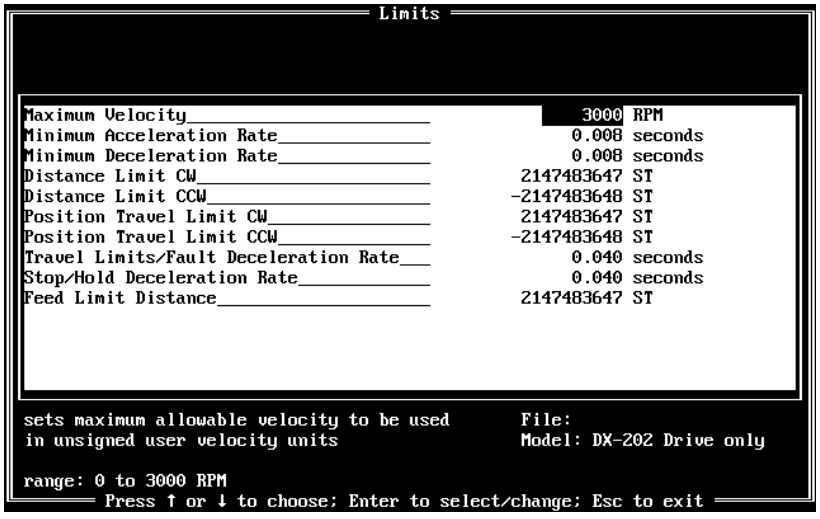


Figure 56 Limits

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

MAXIMUM VELOCITY

MAXIMUM VELOCITY limits velocity entries to the value entered here.

MINIMUM ACCELERATION RATE AND MINIMUM DECELERATION RATE

Used to limit the minimum time it takes to accelerate and decelerate the motor and load from zero to 3000 RPM or vice-versa. This time is greatly affected by load inertia and friction. Those factors should be considered when the time limits are set.

DISTANCE LIMIT CW AND DISTANCE LIMIT CCW

Used to set the maximum distance that can be programmed in an index.

POSITION (TRAVEL) LIM CW AND POSITION (TRAVEL) LIM CCW

Used during absolute positioning applications. The limit positions are given with reference to the home position. Because of this, a home cycle must be executed before these travel limits are enabled.

TRAVEL LIMITS/FAULT DECELERATION RATE

Used to set the deceleration rate after any fault occurs, or a travel limit (hardware or software) is tripped.

STOP DECELERATION RATE

Used as the deceleration rate for a stop command. (Serial or I/O).

FEED LIMIT DISTANCE

Used for feed sensor index applications. The user can limit the distance that the motor will travel after it has been commanded to look for sensor input. This entry prevents excessive travel if a feed sensor or switch fails.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INDEXING OPERATION MODE

In most applications the user will use the drive in this mode. The INDEXING mode of operation allows the user to execute up to 32 different indexes (distance or position moves) that can be stored in non-volatile memory. These 32 indexes, plus other motion functions such as stop, jog and home, are easily programmed either by entering the proper ASCII commands or by using the PCX programming software supplied with the drive. The PCX software provides descriptive 'prompts' and 'help' menus to make programming easy. Programming through ASCII serial commands tends to be more difficult, but is available for the user who wishes to program without the help of the PCX software.

The INDEXING OPERATION MODE is the most commonly used mode and is accessible by having the mode select DIP switches set for either the PULSE/PULSE or PULSE/DIRECTION settings. Both the PULSE FOLLOWER, and INDEXING OPERATION MODES are operational.

The numeric display on the Positioning Drive will indicate an (E) if the external mode is selected. This is also the default mode of operation.

In the INDEXING OPERATION MODE the optically isolated inputs and outputs are the primary source of data to execute motion such as INDEX, JOG, and HOME. With a PCM-1, additional capability in the form of programs is available.

Four types of indexes can be programmed into the drive as shown below.

INDEX TYPES

INCREMENTAL INDEX: Relative distance and direction from start.

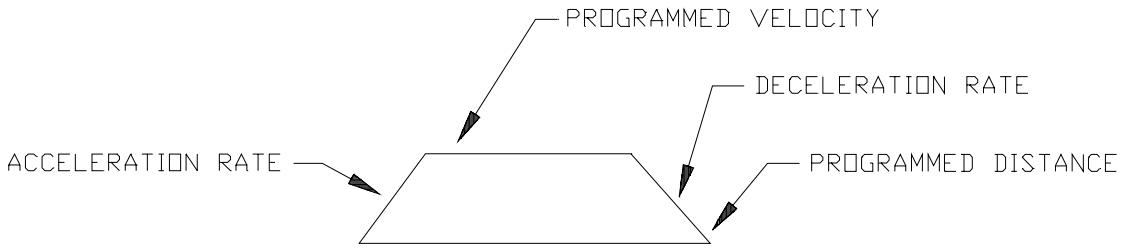


Figure 57 Velocity Vs Time Profiles For Positioning Products

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

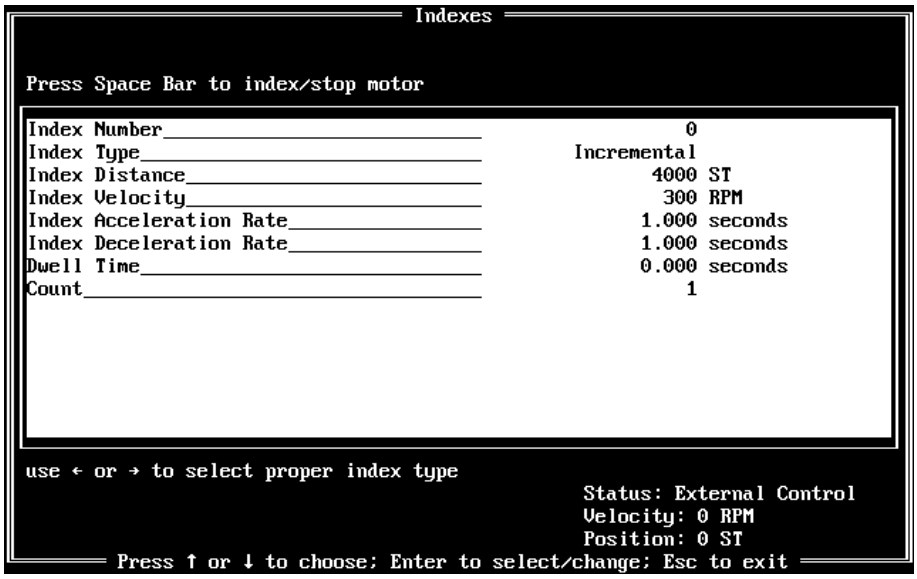


Figure 58 Index/Incremental

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ABSOLUTE INDEX: End position is absolute coordinate regardless of start.

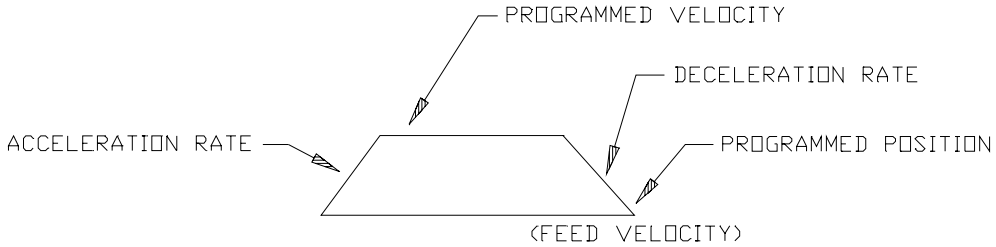


Figure 59 Velocity Vs Time Profiles (Absolute Index)

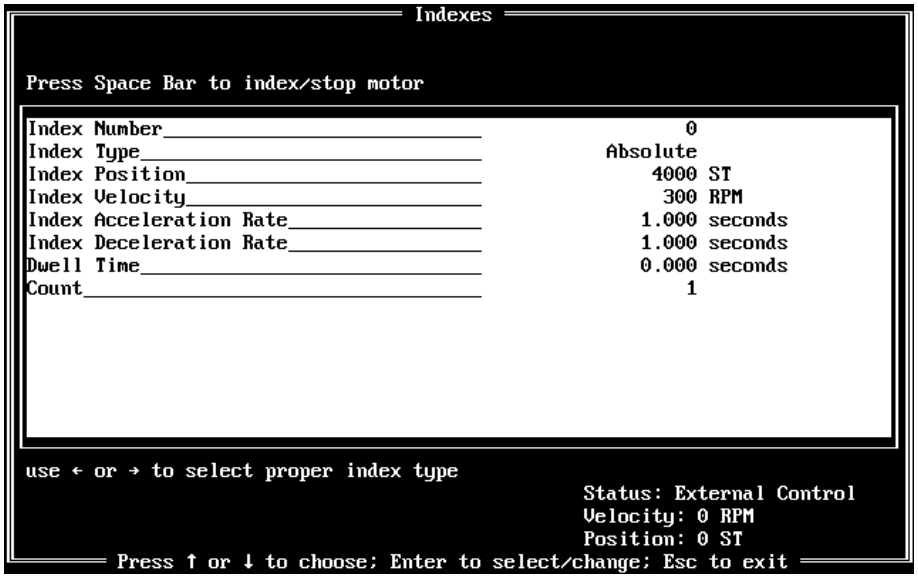


Figure 60 Index/Absolute

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

REGISTRATION INDEX:

Run at the sensor velocity until the sensor or limit distance is achieved. Once either of these occurs, the parameters of the index are run. If the limit distance assignable output is programmed, it will come ON when the limit occurs.

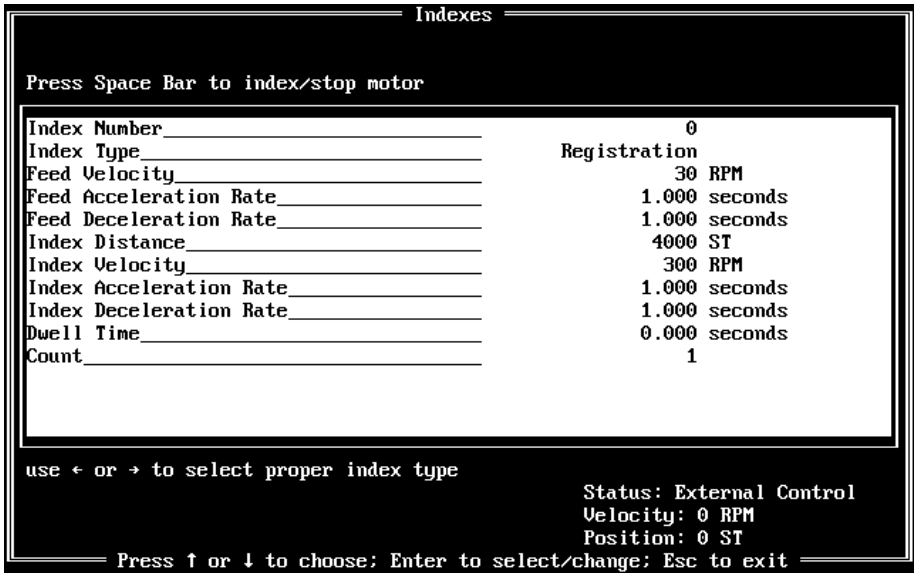


Figure 61 Index/Registration

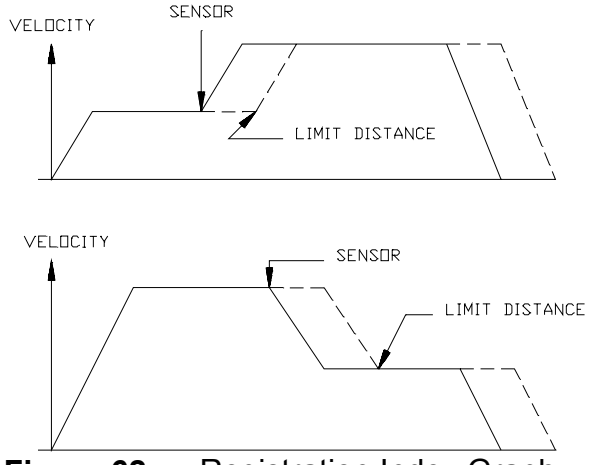


Figure 62 Registration Index Graph

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

FEED-TO-SENSOR INDEX:

Move an amount determined by the index parameters. Once achieved, move at a rate determined by the sensor velocity until either the sensor input or limit distance is achieved. If the limit distance assignable output is programmed, it will also come ON.

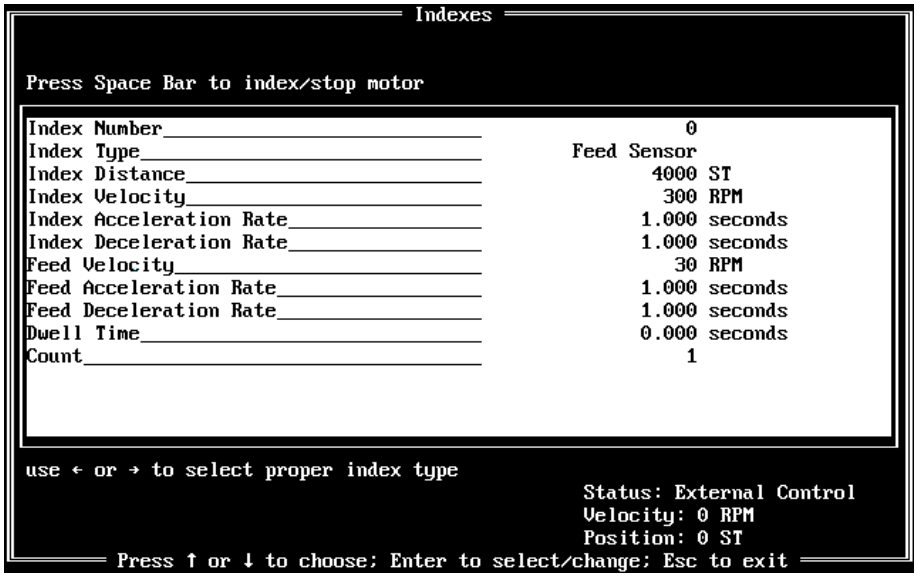


Figure 63 Index/Feed Sensor

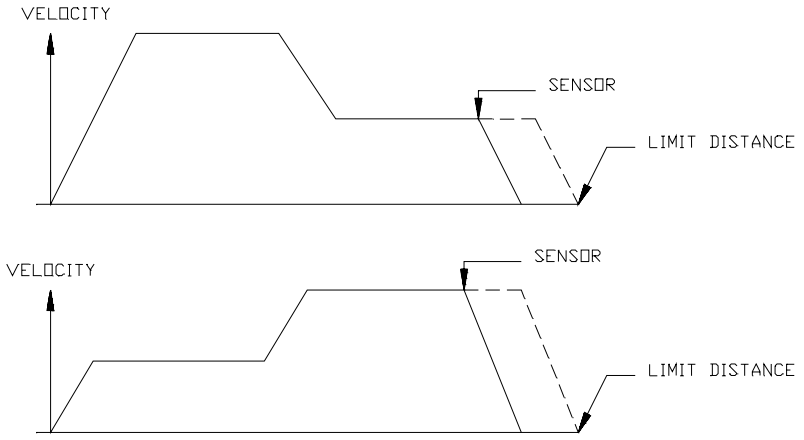


Figure 64 Velocity Vs Time Profiles (Index Feed sensor)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

JOG

The JOG function is provided to cause CW or CCW motion of the motor at controlled velocities. Initiation of JOG is usually accomplished by inputs connected to the optically isolated inputs although it can also be initiated through serial control and PCX. A FAST/SLOW input function can be programmed. Inputs can be programmed to have either a CW and CCW control or a JOG and a direction select. The default inputs provide for the CW and CCW inputs and JOG is assumed since the FAST/SLOW input isn't assigned. In programming JOG, three velocities can be programmed; SERIAL VELOCITY, JOG FAST, and JOG SLOW. The acceleration time and deceleration times are also programmable, but are used for all velocities programmed.

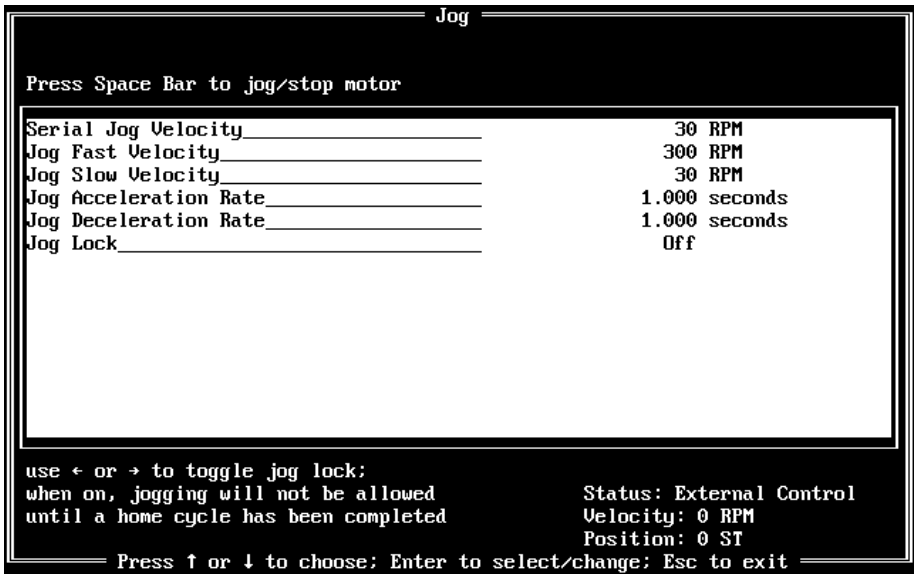


Figure 65 Jog Function

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HOME

The drive is equipped with a capability for six different HOME types:

TYPE

0 OFFSET (HOME TO RESOLVER 0 + OFFSET)
1 FEED ON (HOME TO SENSOR)
2 FEED ON/OFFSET (HOME TO SENSOR THEN RESOLVER 0 + OFFSET)
3 FEED ON/OFF (HOME TO SENSOR THEN OFF SENSOR)
4 FEED ON/OFF/OFFSET (HOME TO SENSOR THEN OFF SENSOR THEN RESOLVER 0 + OFFSET)
5 FEED ON/OFF/ON (HOME TO SENSOR THEN OFF SENSOR THEN ON SENSOR)

Home cycles are used in applications that require a starting (HOME) position to locate tooling, fixtures, carriages, etc. that are required as a prerequisite to initiation of other cycles. Two separate inputs can be programmed to accomplish HOME cycles, HOME SENSOR and HOME INITIATE. The integration of motion relative to these inputs is what determines any specific HOME cycle. Any of the HOME cycles may be set up as you program the HOME function with PCX.

An example of a HOME cycle could be demonstrated with a ball screw or rack and pinion drive that converts rotary motion output into linear motion.

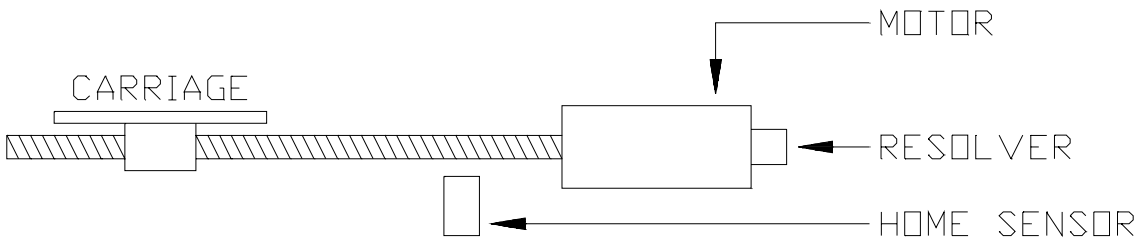


Figure 66 Example Of Home Cycle

This particular application would utilize most of the programming features in the HOME setup. In this application, we want to position the carriage to the physical location of the external HOME sensor and then to an offset.

This is a type 4 HOME, FEED ON/OFF/OFFSET (HOME TO SENSOR THEN OFF SENSOR THEN OFFSET).

Notice that an additional feature in programming is the HOME lock ON/OFF. If the HOME lock is ON, then upon powering up, the only request for motion that will be accepted is one for a HOME cycle.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Assuming the carriage is shown off the HOME sensor and that CCW (-) rotation of the motor causes motion toward the sensor, the following cycle would occur.

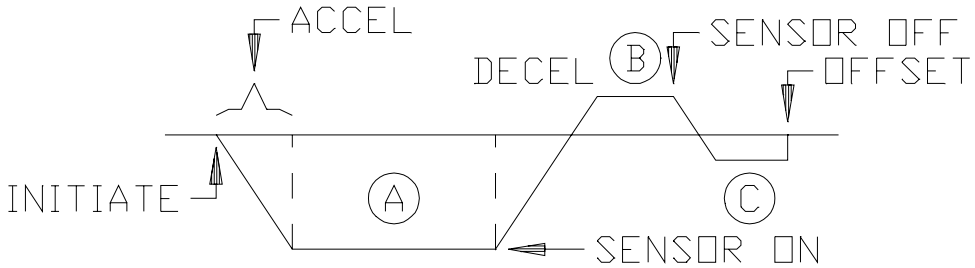


Figure 67 Home Sensor Graph

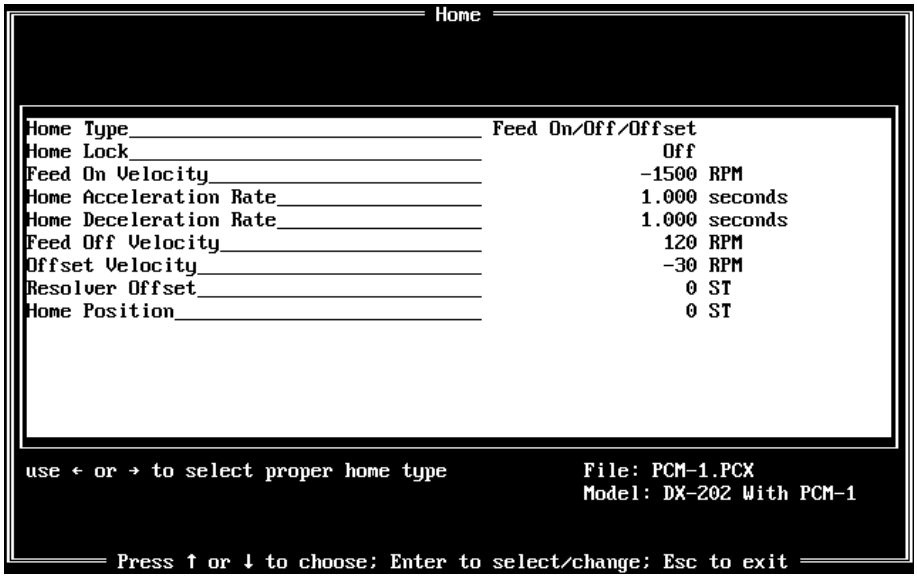


Figure 68 Home Feed On/Off/Offset

The (A) motion is the -1500 RPM to find the sensor.

The (B) motion is the +120 RPM to find the sensor "OFF."

The (C) motion is the -30 RPM to move to the once per revolution offset.

Note that the last two questions in programming are:

1) RESOLVER + OFFSET----------
2) HOME POSITION----------

The offset is the amount of user steps within one revolution. The HOME position is the position for reference in programming that you want to assign to HOME. These two values are frequently zero. The 6 home types are explained as follows:

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HOME TYPE 0. OFFSET (HOME TO RESOLVER 0 + OFFSET)

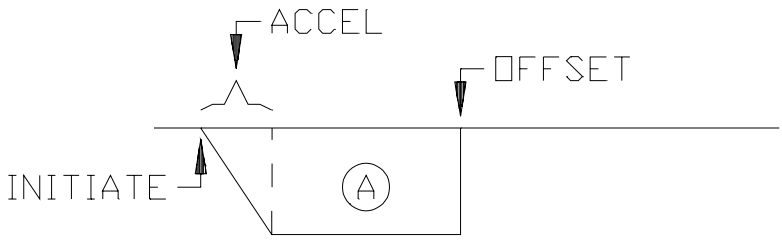


Figure 69 Home To Resolver 0 + Offset

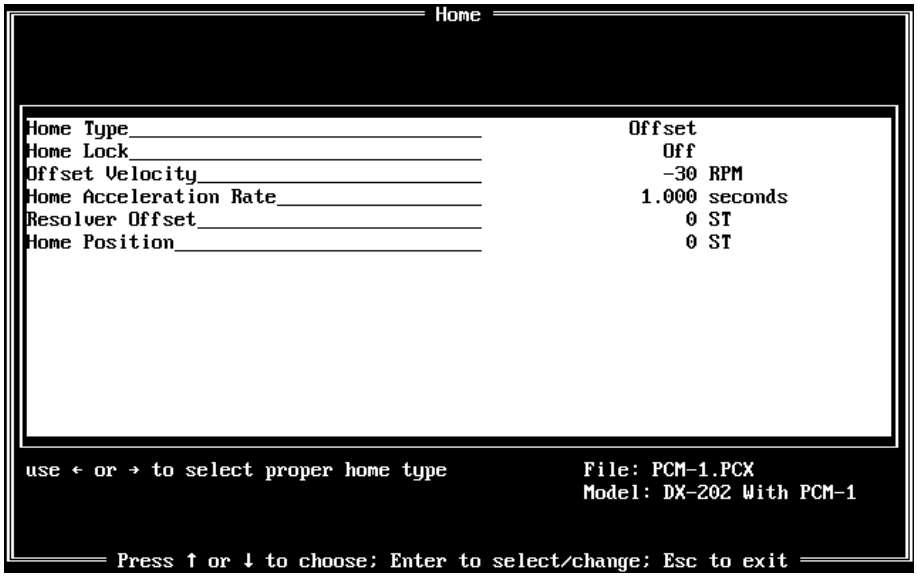


Figure 70 HOME/OFFSET

(A) is the -30 RPM velocity to find the offset.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HOME TYPE 1. FEED ON (HOME TO SENSOR)

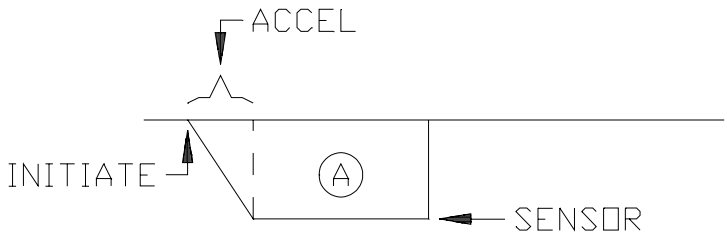


Figure 71 Home To Sensor Graph

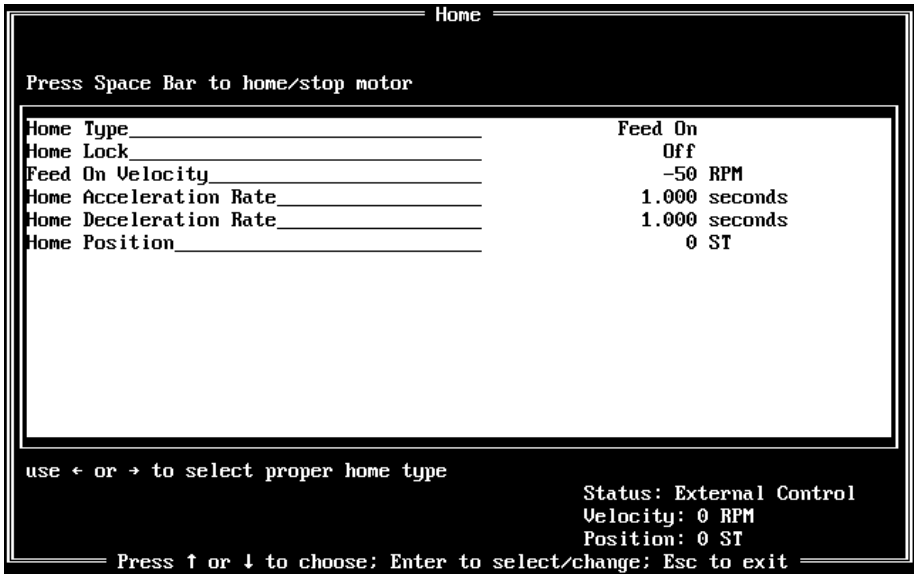


Figure 72 Home To Sensor (Feed On)

(A) is the -50 RPM velocity to find the sensor.

NOTE: THERE IS NO DECEL TIME ONCE THE SENSOR IS REACHED.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

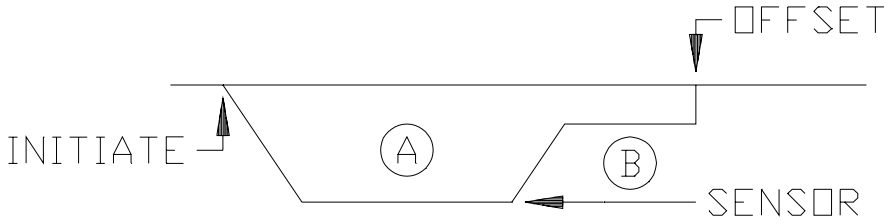


Figure 73 Feed On/Offset Graph

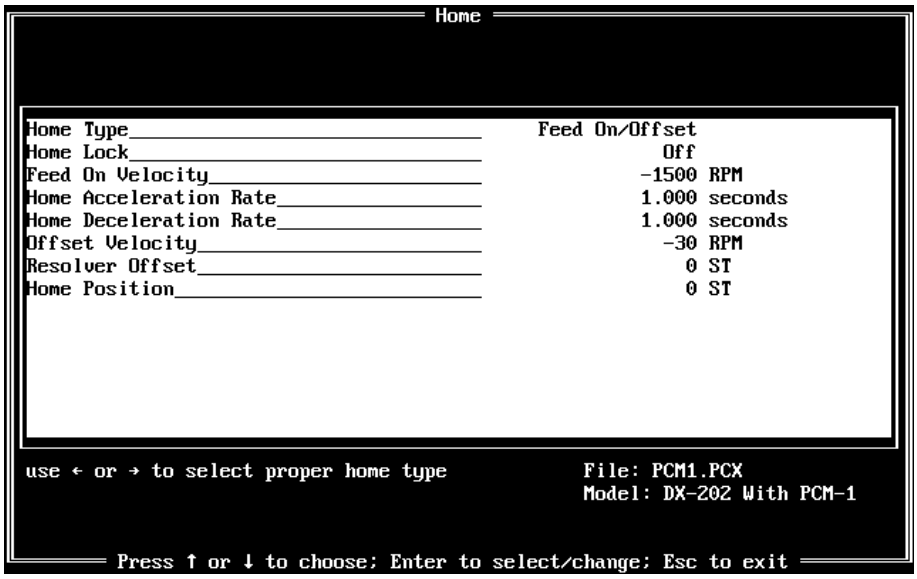


Figure 74 Home 2 Feed On/Offset

(A) is the -1500 RPM velocity to find the sensor.

(B) is the -30 RPM to find the offset.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

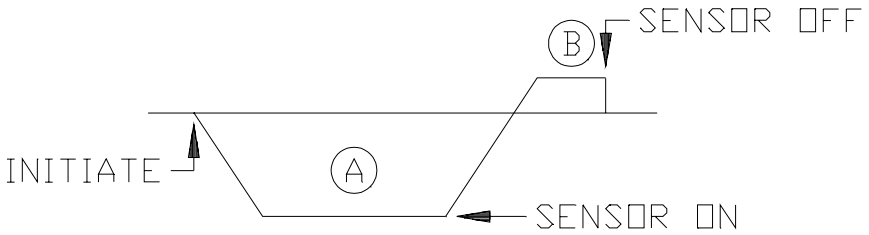


Figure 75 Home Feed On/Off

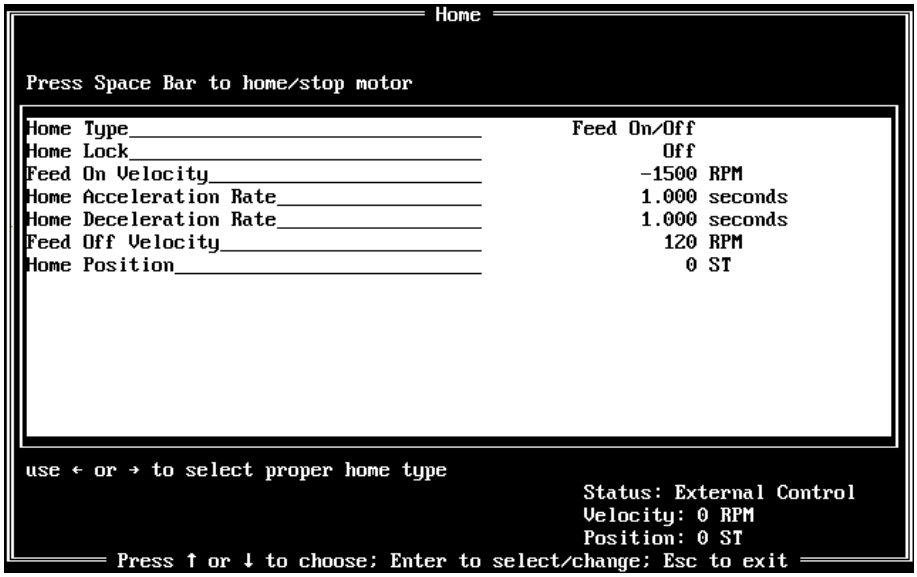


Figure 76 Home Feed On/Off

(A) is the -1500 RPM velocity to find the sensor.

(B) is the +120 RPM velocity to move off the sensor.

NOTE: THERE IS NO DECEL AT THE FINAL OFF POSITION.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HOME TYPE 4. FEED ON/OFF/OFFSET (HOME TO SENSOR THEN OFF SENSOR THEN RESOLVER 0 + OFFSET)

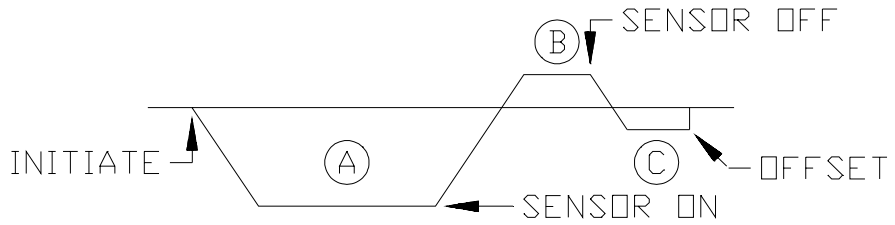


Figure 77 Feed On/Off/Offset

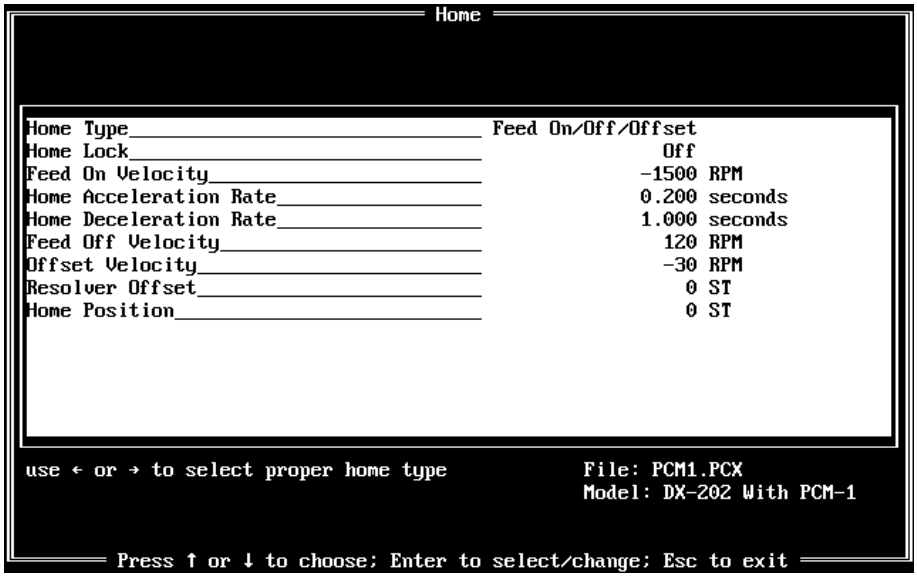


Figure 78 Home 3 Feed On/Off/Offset

(A) is the -1500 RPM velocity to find the sensor.

(B) is the +120 RPM velocity to turn the sensor "OFF."

(C) is the -30 RPM velocity to find the offset.

NOTE: THERE IS NO DECEL AT THE FINAL POSITION.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

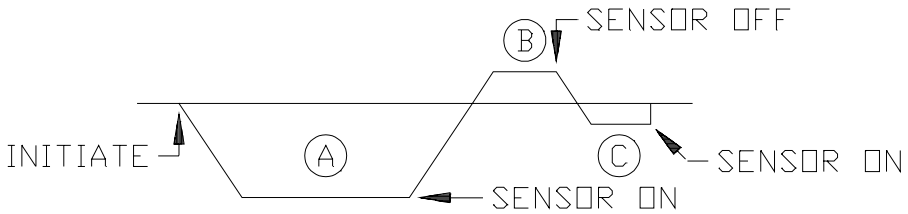


Figure 79 Home To Sensor Graph

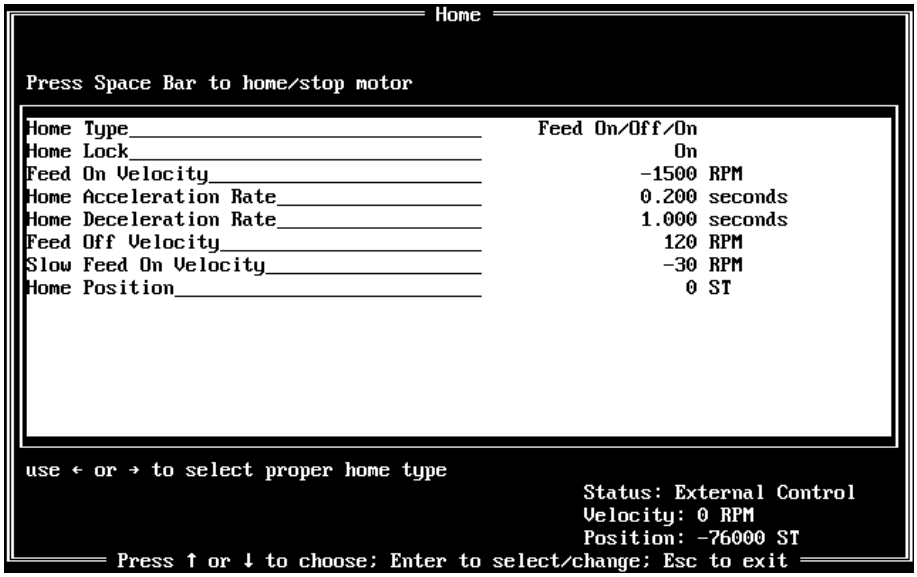


Figure 80 Home Feed On/Off/On

(A) is the -1500 RPM velocity to find the sensor.

(B) is the +120 RPM velocity to turn the sensor "OFF."

(C) is the -30 RPM velocity to turn the sensor on again.

NOTE: THERE IS NO DECEL AT THE FINAL POSITION.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OVERVIEW OF BASIC OPERATION MODES

The Indexing Operation Mode allows for different methods for executing the stored functions:

ASCII Serial Mode
PCX Programming Mode
Input/Output Mode

SERIAL MODE

The serial interface provides a capability that basically is an additional control mode beyond the three basic control modes (ANALOG, PULSE and INDEXING).

The Serial Control Mode can also be used to execute or program motion functions. The user can send the execution serial commands from his programming device through the serial interface to the drive. Common types of programming devices are programmable logic controllers (PLCs) equipped with BASIC or ASCII communication modules.

In Serial Control Mode, the numeric display indicates an (E.). This control mode is accessible via the serial connector "A" on the drive and the protocol is based on ASCII characters. To enter the Serial Control Mode, the digital drive must receive an SC=1 string preceded by an axis I.D. character if the appropriate DIP switches are set.

The serial interface is always accessible via serial ASCII commands. The difference, as far as the display is concerned, is that serial commands to initiate motion will be ignored unless the decimal point after the E is on (E.). If the decimal is on, meaning you are under Serial Control Mode, then motion initiation from the I/O is ignored. Stop commands from either serial or I/O are always accepted and additionally, both hardware or software travel limits are going to work if programmed in the (E) or (E.) modes.

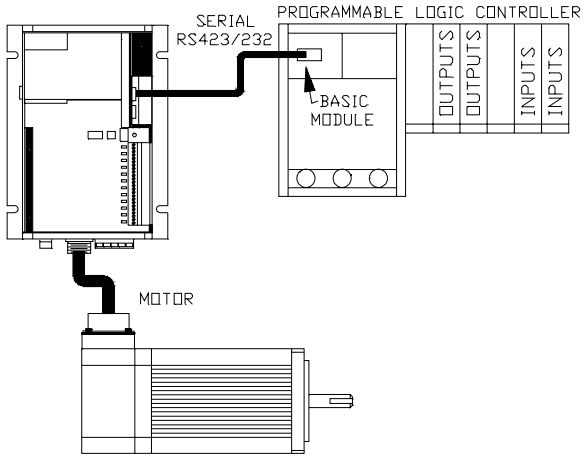


Figure 81 Serial Control Mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT/OUTPUT INTERFACE

OVERVIEW

The Drive is equipped with 8 inputs and 4 outputs which are optically isolated for +10 to +30 vdc operation. Each input and output has 2 screw terminals associated with it to provide for either sinking or sourcing operation. The first 8 pairs of designated terminals are inputs and the last 4 pairs of terminals are outputs. The outputs are capable of sinking or sourcing 200 mA.
It is the users responsibility to limit the output current to less than or equal to 200 mA.

These inputs and outputs allow for proper timing and coordination between the drive's motion and other machine control functions. The inputs and outputs typically are connected to the machine's programmable logic controller (PLC) or relay logic system. These inputs and outputs are also connected to limit switches, and/or switches and indicators on an operator's control panel.

A large number of input/output control functions are provided. The functions used are assigned to any of the input/output lines. This is accomplished through either serial interface commands or by using the PCX software provided with the drive. Inputs may be programmed as normally off or normally on. In addition, more than one function may be assigned to the same input line. Each Drive comes from the factory with the inputs and outputs predefined for frequently used I/O configurations.

Using the I/O inputs, specific pre-programmed index functions are addressed by coding the 0-31 index number in binary. Receiving the proper binary code prior to an Index Initiate determines the required index. An output function can be programmed on one of the output lines to indicate when the move is completed. Other functions such as JOG and Home have discrete inputs assigned which, when activated, cause that function to execute. The input lines can be used to execute functions which can be activated by the user through switches, sensors or possibly, a PLC's output. This provides an interface between the drive and other parts of a machine or system.

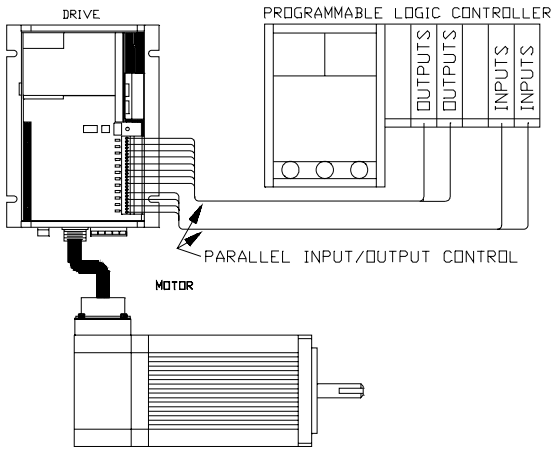


Figure 82 I/O Mode

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

An LED indicator is associated with each input and output. The input and output indicators are on if current is flowing in the associated line.

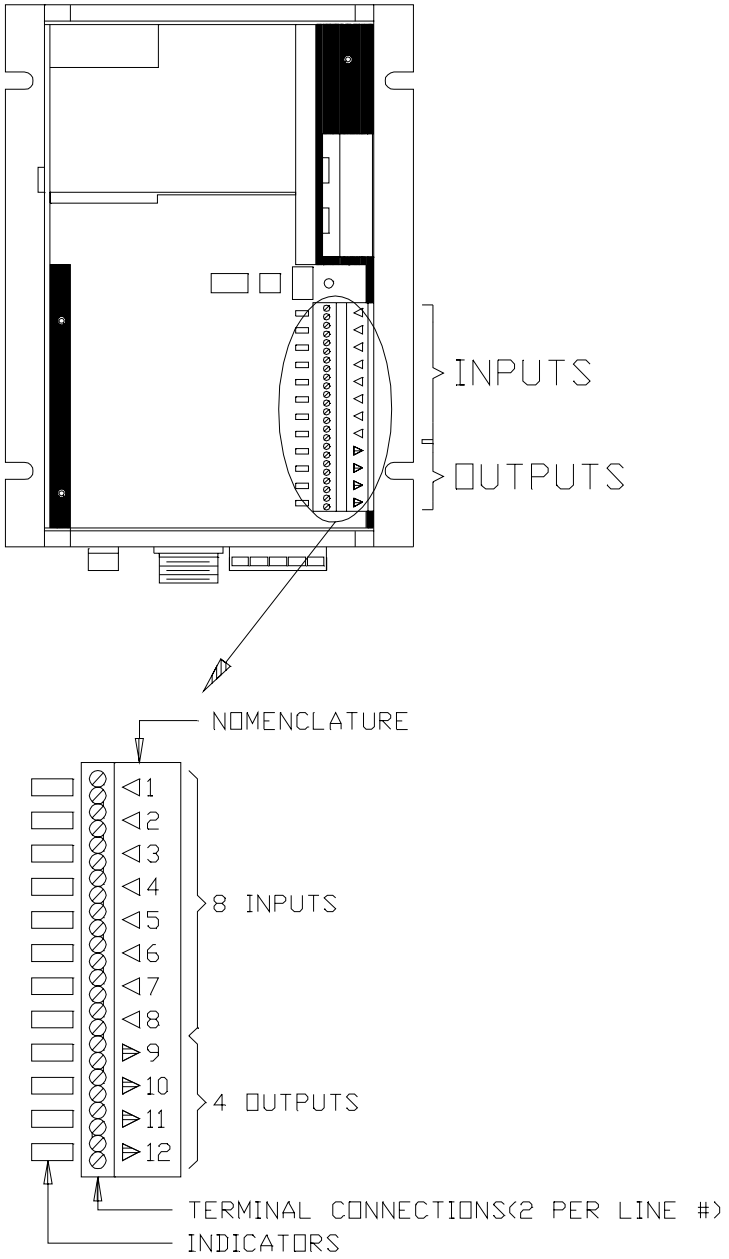


Figure 83 I/O Nomenclature

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

Following is the list of output functions provided with the drive.

OUTPUT FUNCTION #	BASIC DRIVE ONLY	DRIVE WITH IOM-1	DRIVE WITH PCM-1
0-READY	X	X	X
1-EXTERNAL MODE	X	X	X
2-IN MOTION	X	X	X
3-END OF INDEX	X	X	X
4-END OF HOME	X	X	X
5-END OF INDEX COUNT	X	X	X
6-HARDWARE FAULT	X	X	X
7-TRAVEL LIMIT FAULT	X	X	X
8-FOLLOWING ERROR FAULT	X	X	X
9-HOME COMPLETED	X	X	X
10-SENSOR LIMIT HIT	X	X	X
11-END OF SEQUENCE			X
12-PROGRAMMABLE OUTPUTS			X
13-END OF PROGRAM			X
14-END OF PROGRAM COUNT			X
15-IN SUSPEND			X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Functions

The following list of input functions are available for use in providing control through the standard I/O interface.

INPUT FUNCTION #	BASIC DRIVE ONLY	DRIVE WITH IOM-1	DRIVE WITH PCM-1
0-INDEX INITIATE	X	X	X
1-HOME INITIATE	X	X	X
2-CLEAR TO INITIATE	X	X	X
3-HOLD INDEX/HOME MOTION	X	X	X
4-JOG	X	X	X
5-JOG CW	X	X	X
6-JOG CCW	X	X	X
7-JOG DIRECTION	X	X	X
8-SLOW JOG	X	X	X
9-CW TRAVEL LIMIT	X	X	X
10-CCW TRAVEL LIMIT	X	X	X
11-STOP MOTION	X	X	X
12-INHIBIT (DRIVE)	X	X	X
13-BRAKE OVERRIDE	X	X	X
14-INDEX SELECT	X	X	X
15-HOME SENSOR	X	X	X
16-FEED SENSOR	X	X	X
17-CLEAR END OF INDEX	X	X	X
18-CLEAR END OF HOME	X	X	X
19-CLEAR END OF INDEX COUNT	X	X	X
20-CLEAR SENSOR LIMIT	X	X	X
21-CLEAR FAULT	X	X	X
22-ZERO POSITION		X	X
23-ZERO DISPLAY		X	X
24-REMEMBER POSITION			X
25-RETURN TO POSITION			X
26-CLEAR END OF SEQUENCE			X
27-CLEAR PROGRAM OUTPUTS			X
28-EXTERNAL INPUT			X
29-PROGRAM INITIATE			X
30-PROGRAM SELECT			X
31-SUSPEND PROGRAM			X
32-RESUME PROGRAM			X
33-CLEAR SUSPEND		X	
34-CLEAR END OF PROGRAM			X
35-CLEAR END PROGRAM COUNT			X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input/Output Connections

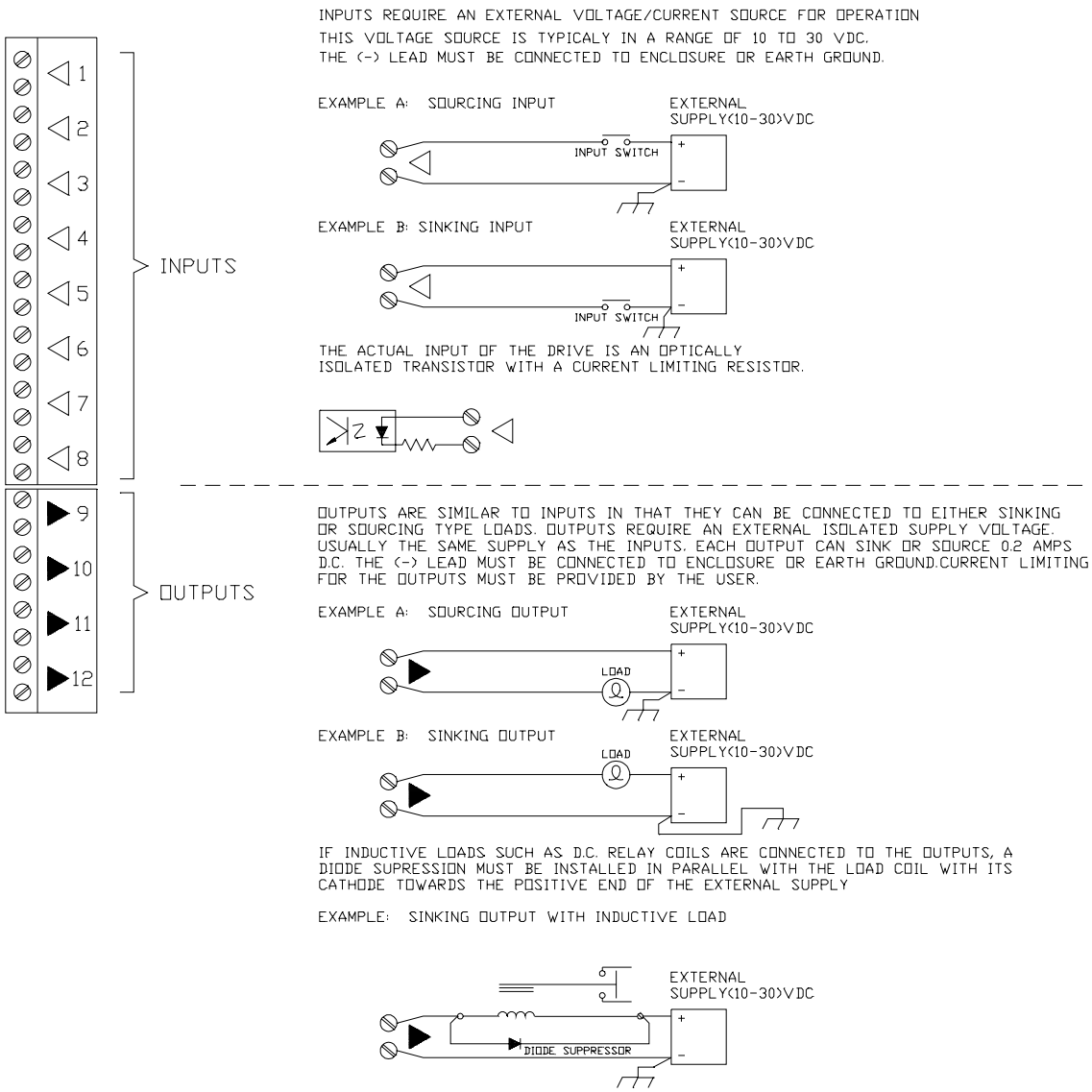


Figure 84 I/O Connections

NOTE: 18 to 24 gauge wire must be used for I/O wiring.The use of larger gauge wire will cause the I/O terminals to prematurely fatigue.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Detailed Descriptions of I/O Functions

Input Functions

FUNCTION #	DESCRIPTION
0	INDEX INITIATE
	Executes the selected index. If function #14 is not set up or there are no active I/O lines, INDEX 00 will initiate.
1	HOME INITIATE
	Executes the home cycle.
2	CLEAR TO INITIATE
	Informs the drive when it is OK to initiate another home, index or program. Program is for PCM only.
3	HOLD INDEX/HOME MOTION
	Stops index or home motion when the switch is pressed and resumes index or home motion when the switch is released.
4	JOG
	Starts and stops a jog in the direction specified by the JOG DIRECTION input functions. Defaults to the programmed jog fast velocity.
5	JOG CW
	Starts and stops a clockwise jog; motor rotation is defined while facing the shaft end of the motor. Defaults to the programmed jog fast velocity.
6	JOG CCW
	Starts and stops a counterclockwise jog; motor rotation is defined while facing the shaft end of the motor. Defaults to the programmed jog fast velocity.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

7 JOG DIRECTION

Sets the direction for the JOG input function (active = CCW).

8 SLOW JOG

Causes the jog slow velocity to be used when JOG, JOG CW, or JOG CCW are executed.

9 CW TRAVEL LIMIT

Forces clockwise velocity to zero and inhibits any further clockwise motion.

10 CCW TRAVEL LIMIT

Forces counterclockwise velocity to zero and inhibits any further counterclockwise motion.

11 STOP MOTION

Stops motion according to the programmed deceleration rate.

12 INHIBIT (DRIVE)

Prevents all motion by disabling the drive's bridge transistors and engaging the fail-safe brake.

13 BRAKE OVERRIDE

Releases the fail-safe brake when INHIBIT is active. This allows the motor to be rotated by hand.

14 INDEX SELECT

Sets the starting input line number for a given number of index select lines. If, for example, you require 4 index select lines and want them assigned to input lines 5, 6, 7, and 8. You would assign INDEX SELECT to input line 5 and program (through PCX or serial commands) the total number of index select lines to be 4.

15 HOME SENSOR

Provides a sensor input for home types which require it.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

16 FEED SENSOR

Provides a sensor input for feed sensor type indexes.

17 CLEAR END OF INDEX OUTPUT

Clears the END OF INDEX output. If not assigned, the END OF INDEX will automatically clear when the next motion occurs.

18 CLEAR END OF HOME

Clears the END OF HOME output. If not assigned, the END OF HOME will automatically clear when the next motion occurs.

19 CLEAR END OF INDEX COUNT OUTPUT

Clears the END OF INDEX COUNT output. If not assigned, the END OF INDEX COUNT will clear when the next motion occurs.

20 CLEAR SENSOR LIMIT DISTANCE HIT

Clears the SENSOR LIMIT HIT output. The sensor limit distance is programmed by PCX or serial commands.

21 CLEAR FAULT

Duplicates the function of the reset switch on the front of the digital drive. It will clear non-fatal drive faults.

22 ZERO POSITION

Sets the current position of the motor to zero. All absolute positions will be referenced to this set zero position.

23 ZERO DISPLAY

This zeroes all position query commands (FP and CP), they become zero and are referenced to this point. Absolute position is unaffected.

24 REMEMBER POSITION

Stores the current position of an absolute index.

25 RETURN TO POSITION

Returns to the position defined by REMEMBER POSITION.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

26 CLEAR END OF SEQUENCE OUTPUT

Clears the END OF SEQUENCE output. If not assigned, the END OF SEQUENCE output will automatically clear when the next motion occurs.

27 CLEAR PROGRAMMABLE OUTPUT

Clears a (PROGRAMMABLE OUTPUT). Each assigned PROGRAMMABLE OUTPUT will require a separate CLEAR PROGRAMMABLE OUTPUT.

28 EXTERNAL INPUT

Used with the WAIT FOR INPUT program function to stop program execution until the input line assigned with EXTERNAL INPUT is activated.

29 PROGRAM INITIATE

Executes the selected program.

30 PROGRAM SELECT LINES

Sets the starting input line number for a given number of program select lines. Then the number of program select lines is programmed through PCX or serial commands.

31 SUSPEND PROGRAM

Stops the execution of a program until the input line assigned with RESUME is activated.

Also see I/O Suspend Resume Feature Section in the PCM-1 Section.

32 RESUME PROGRAM

Resumes the execution of a suspended program.
Also see I/O Suspend Resume Feature Section in the PCM-1 Section.

33 CLEAR SUSPEND

Clears the IN SUSPEND output and returns the drive from a suspend cycle to normal operation without the need to "RESUME" and completion of the suspended program.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Also see I/O Suspend Resume Feature Section in the PCM-1 Section.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

34 CLEAR END OF PROGRAM OUTPUT

Clears the END OF PROGRAM output. If not assigned, the END OF PROGRAM output will automatically clear when further motion is initiated.

35 CLEAR END OF PROGRAM COUNT

Clears the END OF PROGRAM COUNT output. The END OF PROGRAM COUNT output will automatically clear when the next motion occurs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

FUNCTION#	DESCRIPTION
0	READY

This output is ON continuously after power up if the microprocessor and its memory are operating correctly. It turns OFF when either A WATCHDOG TIMER FAULT or USER MEMORY FAULT occurs.

1 EXTERNAL MODE

This output is ON when the digital drive is operated from an external source. This output is OFF when the drive is in serial control such as when the drive is executing a HOME, INDEX, JOG or PROGRAM (PROGRAM is for PCM only).

2 IN MOTION

This output is ON whenever the commanded velocity is not zero.

3 END OF INDEX

This output comes ON after the completion of executed index. If the INDEX COUNT is greater than 1, this output will come ON after each index execution. It is turned OFF automatically with the next motion or when the CLEAR END OF INDEX is used.

4 END OF HOME

This output comes ON after the completion of a HOME cycle. It is turned OFF automatically with the next motion or when the CLEAR END OF HOME is used.

5 END OF INDEX COUNT

This output comes ON only after an index is executed the number of times specified by the INDEX COUNT. It is turned OFF automatically with the next motion or when the CLEAR END OF INDEX COUNT is used.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

6 HARDWARE FAULT

This output comes ON after the occurrence of a hardware drive fault. The hardware fault is indicated by a number between 0 -7 on the diagnostics display. It is turned OFF when all hardware faults are cleared.

7 TRAVEL LIMIT FAULT

This output comes ON when either a hardware or software travel limit is hit and turned OFF when the fault is cleared.

8 FOLLOWING FAULT

This output comes ON when the maximum allowable following error is exceeded and turned OFF when the fault is cleared.

9 HOME COMPLETED

This output comes ON after the completion of a HOME cycle and stays ON continuously unless absolute position is lost.

10 SENSOR LIMIT DISTANCE HIT

This output comes ON during a feed sensor index if the SENSOR LIMIT DISTANCE is exceeded before a sensor signal is received. The only way to turn this output OFF is with the CLEAR SENSOR LIMIT input function.

11 END OF SEQUENCE

This output comes ON after the completion of a motion sequence. A motion sequence is completed when a HOME, INDEX, and/or PROGRAM or a combination thereof, is executed and no further motion commands are given. This output turns OFF automatically with the next motion or when the CLEAR END OF SEQUENCE is used.

12 PROGRAMMABLE OUTPUTS

The output lines assigned this function can be turned ON or OFF with the UPDATE OUTPUTS programming function.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

13 END OF PROGRAM

This output comes ON after each completion of a PROGRAM. It turns OFF automatically with the next motion or when the CLEAR END OF PROGRAM is used.

14 END OF PROGRAM COUNT

This output comes ON only after a program is executed the number of times specified by the PROGRAM COUNT. It is turned OFF automatically with the next motion or when the CLEAR END OF PROGRAM COUNT is used.

15 IN SUSPEND

This output is ON when the SUSPEND PROGRAM input function is active.

Also see I/O Suspend Resume Feature Section.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DIAGNOSTICS

A single alphanumeric LED display on the front of the Positioning Drive provides status and fault information immediately available to the user. The display aids in quickly identifying problems so that corrective action can be taken and machine downtime can be minimized. In addition, the standard serial interface includes diagnostic status and fault reporting by simple ASCII serial commands. See the Serial Interface Section under Run Time Command section.

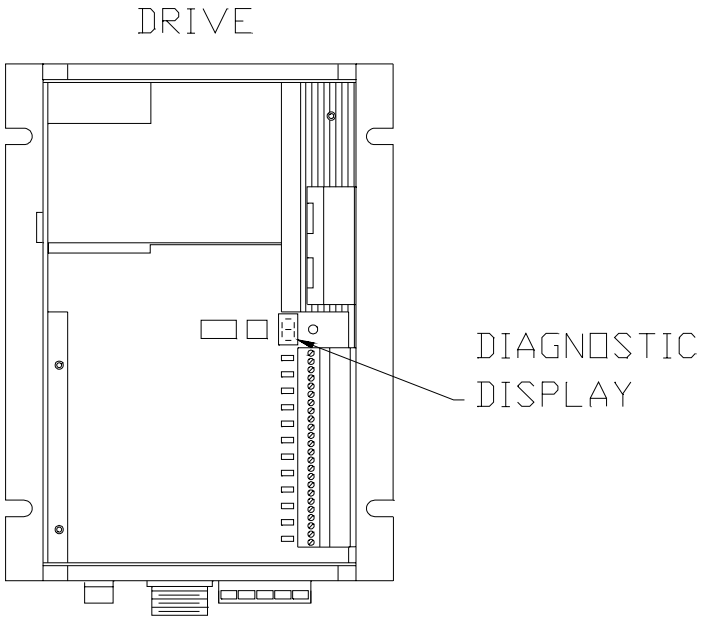


Figure 85 Diagnostic Display

Status Indicator Codes

Following is a list of different status diagnostics indicators.

. (Decimal point)

When the decimal point LED is on, this indicates the drive is in Serial Mode. In the Serial Mode, the parallel I/O lines that can initiate motion will not function. All other I/O lines will function.

P INDEXING

When the Drive is executing an Index or Dwell after the programmed index, the "P" will be displayed on the status indicator.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

H HOMING

An "H" will appear on the status indicator when the drive is executing the Home function or dwelling in the Home function.

J JOGGING

When the Drive is executing the Jog function a "J" will be displayed on the status indicator.

E EXTERNAL MODE

The Drive is ready to accept pulses, initiate one of the I/O functions (only if decimal point is OFF) or initiate motion from the Serial Interface (only if decimal point is ON). The "E" will be displayed if you are putting pulses into the unit and the motor is rotating.

A ANALOG MODE

When the mode select switches are set to either the Analog, Torque or Velocity Modes, an "A" will appear.

C CALIBRATE MODE

When the Drive is in a simulated Calibrate Mode, the "C" will appear on the display.

U UNINITIALIZED MEMORY FAULT

This occurs when the non-volatile memory of the Drive changes and no longer matches the stored checksum of the non-volatile memory. The major reason for this "U" fault occurring is due to the fluctuating line voltage out of the range of 96-132 VAC. To clear this fault, reset the Drive and down load the saved data on your PCX disk into the Drive.

L TRAVEL LIMIT

The "L" fault occurs when you hit either a hardware fault travel limit or a software fault travel limit. You must clear the fault before you can initiate motion by a serial, I/O or reset push button.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

F POSITION ERROR FAULT

This fault occurs when the motor is out of position by more than the program allowable error (default is one motor revolution). The major reason for this fault occurring is the motor is trying to overcome its torque capability or you are trying to go too fast with a low voltage AC line. Try the following to prevent this fault.

1. Program longer ramp times
2. Check your frictional loading
3. Check for synthetic oil in the gear reducer to minimize frictional loading at higher speeds
4. Read AC line voltage

   If the AC line drops to the drive during acceleration then voltage for the motor isn't available and a fault will occur. Typical causes for this are wrong size AC wiring, and insufficient KVA ratings for external transformers used to power the drive electronics.

   Example: The wire sizing for a DX-780 amplifier is 10 gauge and 40 amps. The amplifier operates on 120 VAC single phase.

   (120 VAC) * (40 amps) = 4800 watts or 4.8 KVA minimum.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

FAULT INDICATOR CODES

Following is a list of fault diagnostic indicators.

(0) Watch Dog Timer Fault

The drive has a 0.002 second timer that if not internally reset by software, will shut down the operation of the computer. If there is a problem, a "O" is indicated on the diagnostics display on the drive.

POSSIBLE CAUSES OF THE FAULT

1. INCORRECT AC LINE VOLTAGE (SPEC 96 - 132 VAC)

This can be caused by excessive AC line voltage or line voltage transients. The AC line voltage must be within specified range to avoid "false triggering" of this fault indicator.

2. NOISE ON THE AC LINES
3. NOISE ON THE I/O LINES
4. POOR (OR NO) GROUNDING
5. LACK OF NOISE SUPPRESSOR ON COILS AND RELAYS.

(1) AVG Current Fault

The drive monitors the current required to move the load. When the average current is greater than the continuous current rating of the drive for more than 1.5 to 5 seconds (see chart below), the drive will shut down and display a "1" fault on the diagnostics display on the drive. If you are producing (1) faults, you must determine what the excess load is and correct it. Excess load can be caused by friction, inertia or cycle times, or a combination of all of these. Continuous resetting of (1) faults without implementing correction will lead to (2) faults which could be catastrophic.

POSSIBLE CAUSES OF THE FAULT

1. THE LOAD ON THE MOTOR IS TO LARGE.
2. MECHANICAL BINDING OF THE MACHINE.
3. MOTION INDEXES ARE EXCEEDING THE DRIVE RATING.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table XIII AVG Current Fault

% OF CONTINUOUS CURRENT	APPROXIMATE TIME BEFORE "1" FAULT
100 (Continuous)	No Fault
120	5 Sec
140	3 Sec
160	2 Sec
180	1.8 Sec
200 (Peak)	1.5 Sec

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

(2) Shorts Fault

The drive is protected if the motor or the motor cable becomes shorted. If this happens, the diagnostic display on the drive will indicate "2".

POSSIBLE CAUSES OF THE FAULT

1. MOTOR IS SHORTED.
2. MOTOR CABLE IS SHORTED.
3. DRIVE BRIDGE IS DEFECTIVE.

NOTE: In some applications, a servo motor and amplifier are exposed to a condition that the user believes the (1) and (2) faults or electronics can protect. The condition is that the servo motor will be allowed to run into the end of a physical obstruction and cause an instantaneous stop. Neither the motor nor the electronics can withstand this type of misuse. The motion controller has software or hardware travel limits to avoid this.

(3) Resolver Fault

The drive monitors the three resolver signals (REF, SIN, COS). If any of the three signals are lost, the drive will display a "3" on the diagnostics display.

POSSIBLE CAUSES OF THE FAULT

1. MOTOR CABLE IS NOT PLUGGED INTO THE MOTOR.
2. MOTOR CABLE IS SHORTED OR DAMAGED.
3. RESOLVER ON THE REAR OF THE MOTOR HAS FAILED.

(4) Logic Supply Fault

The drive monitors its logic supply to insure that it is at minimum operating level. If any power supply voltage drops below the minimum operating level, the drive will display a "4" on the diagnostics display. The only way to clear a "4" fault is by turning power OFF, then ON.

POSSIBLE CAUSES OF THE FAULT

1. LOW LINE AC LINE VOLTAGE.
2. POWER SUPPLY FAILURE.
3. INSUFFICIENT AC LINE SIZING FOR THE AC WIRE, XFMR (IF REQUIRED) OR BOTH.

(5) Motor Temperature Fault

The motor has a thermal switch mounted internally. If the temperature is excessive, the thermal switch will open. The drive will shut down and display a "5" fault on the diagnostics display.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

POSSIBLE CAUSES OF THE FAULT

1. MOTOR IS NOT BEING OPERATED IN THE MOTORS OPERATING ZONE
2. MOTOR IS NOT RUNNING STABLE.
3. CABLE IS NOT PLUGGED IN.
4. BROKEN WIRES IN THE CABLE OR MOTOR.
5. DEFECTIVE THERMAL SWITCH ON THE MOTOR.

(6) Bus Fuse or Shunt Fuse Fault or low ac voltage.

If either the shunt fuse or the BUS fuse are open, the drive will display a "6". A "6" fault can also be caused by a low AC line voltage (less than 96 VAC).

NOTE: THE T-202 AND T-310 DRIVES DO NOT HAVE A SHUNT FUSE.

POSSIBLE CAUSES OF THE FAULT

1. EXCESSIVE INERTIAL LOAD HAS CAUSED THE DRIVE TO EXCEED ITS CONTINUOUS RATING
2. THE LOAD IS BACK-DRIVING THE MOTOR
3. LOW AC LINE VOLTAGE (IF BOTH FUSES ARE STILL GOOD)

(7) Amplifier Bridge Temperature Fault

The drive has a thermal switch mounted on its heat sink. If the heat sink temperature becomes excessive, the thermal switch will open. The drive will shut down and display a "7" fault on the diagnostic display.

POSSIBLE CAUSES OF THE FAULT

1. THE AMBIENT TEMPERATURE INSIDE THE ENCLOSURE IS TOO HIGH.
2. THE DRIVE AND MOTOR ARE TOO SMALL FOR THE LOAD.
3. FAN OR VENTILATION FAILURE

(8) NON-OPERATIONAL

(8.) The drive does not have a way to produce an (8.) error code. During power up for the first second power is applied an 8. appears on the display. This means the 16 bit microcontroller is not operational.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

STABILIZATION OF HIGH INERTIA LOADS

Using default gain parameters, the positioning drive's compensation control range is adequate to provide stable operation of loads whose inertias are five to ten times (15 times for DX-205/202) greater than the drive motor.

Generally, abnormal operation of the drive is a result of incorrect programming. Programming ramp times or velocities beyond the drive's physical capability is a major cause of incorrect operation. The drive will make every effort to complete its commanded motion profile. An inability to accomplish this smoothly is almost always diagnosed at some kind of a "servo gain problem" instead of a programming problem.

Instability of a servo system is usually correctly noted if at STOP or at specific velocities, loping occurs. Loping would be a noticed oscillation. This could be caused by excess loop gain beyond our present capability to correct. If this is determined, then using PCX and the dumb terminal mode of operation, other values for loop and auto gain could be tested. In the dumb terminal mode "EG" is loop gain and "VG3" is used by the auto gain algorithm. If an axis identifier is used, it must precede the command. A question mark "?" after the command allows for interrogation of the value and an equal sign after the command would allow for a change of the value. The values for either loop gain "EG" or auto gain "VG3" are hexadecimal. You must have cap locks on in the dump terminal mode.

If instability in the loop is determined, then reducing loop gain "EG" and increasing auto gain "VG3" may affect operation. Values in the following table can be tried.

Table XIV Stabilization Of High Inertia Loads

TEST	"EG"	"VG3"	ALTERNATIVE "VG3"
EXAMPLE	100	20	
1	F0	30	(0 - 7F)HEX
2	E0	40	(0 - 7F)HEX
3	D0	50	(0 - 7F)HEX
4	C0	60	(0 - 7F)HEX
5	B0	70	(0 - 7F)HEX
6	A0	77	(0 - 7F)HEX
7	90	TOO BIG - - STOP	(0 - 7F)HEX
8	80		(0 - 7F)HEX
9	70		(0 - 7F)HEX
10	60		(0 - 7F)HEX
11	50		(0 - 7F)HEX
12	40		(0 - 7F)HEX
13	30		(0 - 7F)HEX
	TOO LOW - - STOP		

Instability in the form of cyclic oscillation is generally improved by decreasing gain (EG). "VG3" alters the

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

velocity feedback gain as a function of command velocity. For example, at lower velocities, a larger value in "VG3" increases the velocity feedback. The alternative for "VG3" means that because of load condition for any value of "EG" a value of (Ø to 7F) HEX could work. Values out of the range listed could cause mis-operation and should not be tried without consulting EMERSON EMC Service department.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INTRODUCTION

The IOM-1 is added to either extend the basic input output capability of a Positioning Drive or facilitate the implementation of the parallel interface. The installation of the IOM-1 module is made easy by a direct "plug-in" design. All the electrical connections between the basic digital drive and the IOM-1 module are made via the 48 position connectors. Figure 1 shows how the 48-pin connectors mate on the Positioning Drive. This is the only electrical connection required between the two units. Once plugged in, the top and bottom handles snap into position to secure the module to the drive.

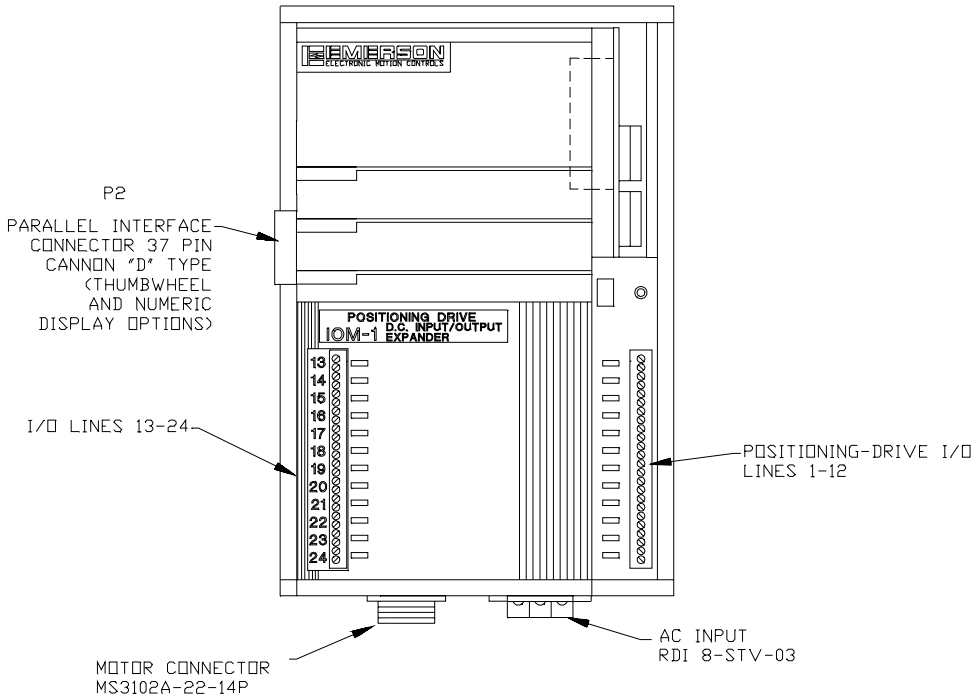


Figure 86 I/O Connections (IOM-1)

The IOM-1 module includes a parallel interface connector. The most common use of this connector is thumbwheel interfacing, numeric display, or parallel programming.

The input and output connections are split between two terminal strips; one strip on the IOM module #13-24 and one on the drive #1-12. Each strip consists of 8 input lines and 4 output lines.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT/OUTPUT INTERFACE

OVERVIEW

The IOM-1 is equipped with 8 inputs and 4 outputs which are optically isolated for +10 to +30 vdc operation. Each input and output has 2 screw terminals associated with it to provide for either sinking or sourcing operation. The first 8 pairs of designated terminals are inputs and the last 4 pairs of terminals are outputs. The outputs are capable of sinking or sourcing 200 mA. It is the users responsibility to limit the output current to less then or equal to 200 mA.

Adding the IOM-1 module will double the I/O capabilities of the standard digital drive. The number of input liens are increased from 8 to 16 and the number of output lines is increased from 4 to 8.

These inputs and outputs allow for proper timing and coordination between the drive's motion and other machine control functions. The inputs and outputs typically are connected to the machine's programmable logic controller (PLC) or relay logic system. These inputs and outputs are also connected to limit switches, and/or switches and indicators on an operator's control panel.

A large number of input/output control functions are provided. The functions used are assigned to any of the input/output lines. This is accomplished through either serial interface commands or by using the PCX software provided with the drive. Inputs may be programmed as normally off or normally on. In addition, more than one function may be assigned to the same input line. After the I/O lines have been set to the desired configuration, power should be cycled to the drive to ensure proper I/O operation. Each drive comes form the factory with the inputs and outputs predefined for frequently used I/O configurations.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

An LED indicator is associated with each input and output. The input and output indicators are on if current is flowing in the associated line.

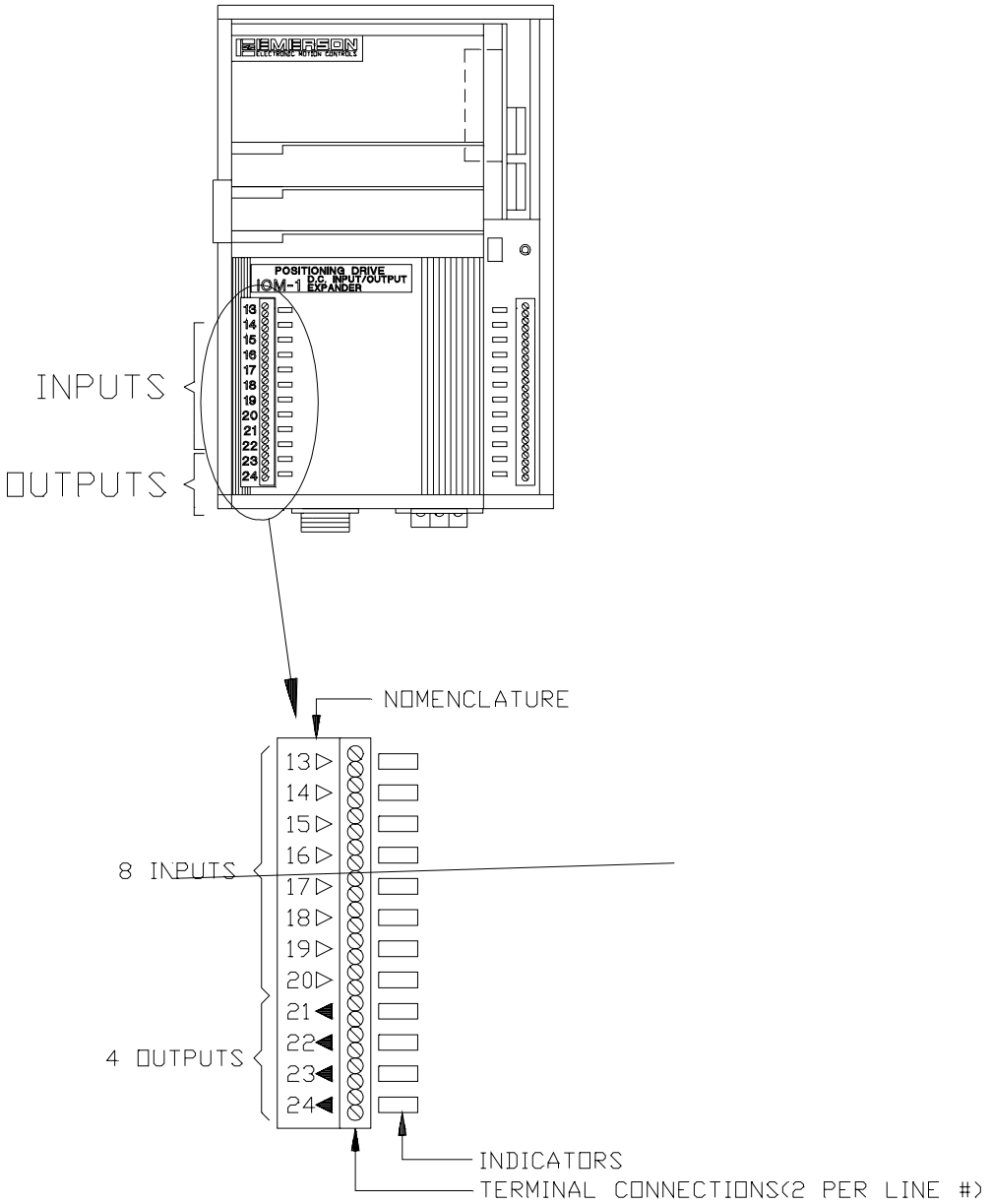


Figure 87 I/O Nomenclature (IOM-1)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

Following is the list of output functions provided with the drive.

OUTPUT FUNCTION #	BASIC DRIVE ONLY	WITH IOM-1	DRIVE
0-READY	X		X
1-EXTERNAL MODE	X		X
2-IN MOTION	X		X
3-END OF INDEX	X		X
4-END OF HOME	X		X
5-END OF INDEX COUNT	X	X	
6-HARDWARE FAULT	X		X
7-TRAVEL LIMIT FAULT	X	X	
8-FOLLOWING ERROR FAULT	X		X
9-HOME COMPLETED	X		X
10-SENSOR LIMIT HIT	X		X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Functions

The following list of input functions are available for use in providing control through the standard I/O interface. With the expansion of the IOM-1, two additional input functions are available:

INPUT FUNCTION #	BASIC DRIVE ONLY	IOM-1	DRIVE WITH
0-INDEX INITIATE	X		X
1-HOME INITIATE	X		X
2-CLEAR TO INITIATE	X		X
3-HOLD INDEX/HOME MOTION	X		X
4-JOG	X		X
5-JOG CW	X	X	
6-JOG CCW	X		X
7-JOG DIRECTION	X		X
8-SLOW JOG	X		X
9-CW TRAVEL LIMIT	X		X
10-CCW TRAVEL LIMIT	X		X
11-STOP MOTION	X		X
12-INHIBIT (DRIVE)	X		X
13-BRAKE OVERRIDE	X		X
14-INDEX SELECT	X		X
15-HOME SENSOR	X		X
16-FEED SENSOR	X		X
17-CLEAR END OF INDEX	X	X	
18-CLEAR END OF HOME	X		X
19-CLEAR END OF INDEX COUNT	X		X
20-CLEAR SENSOR LIMIT	X	X	
21-CLEAR FAULT	X		X
22-ZERO POSITION			X
23-ZERO DISPLAY			X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EXAMPLES OF I/O CONNECTIONS TO THE IOM-1

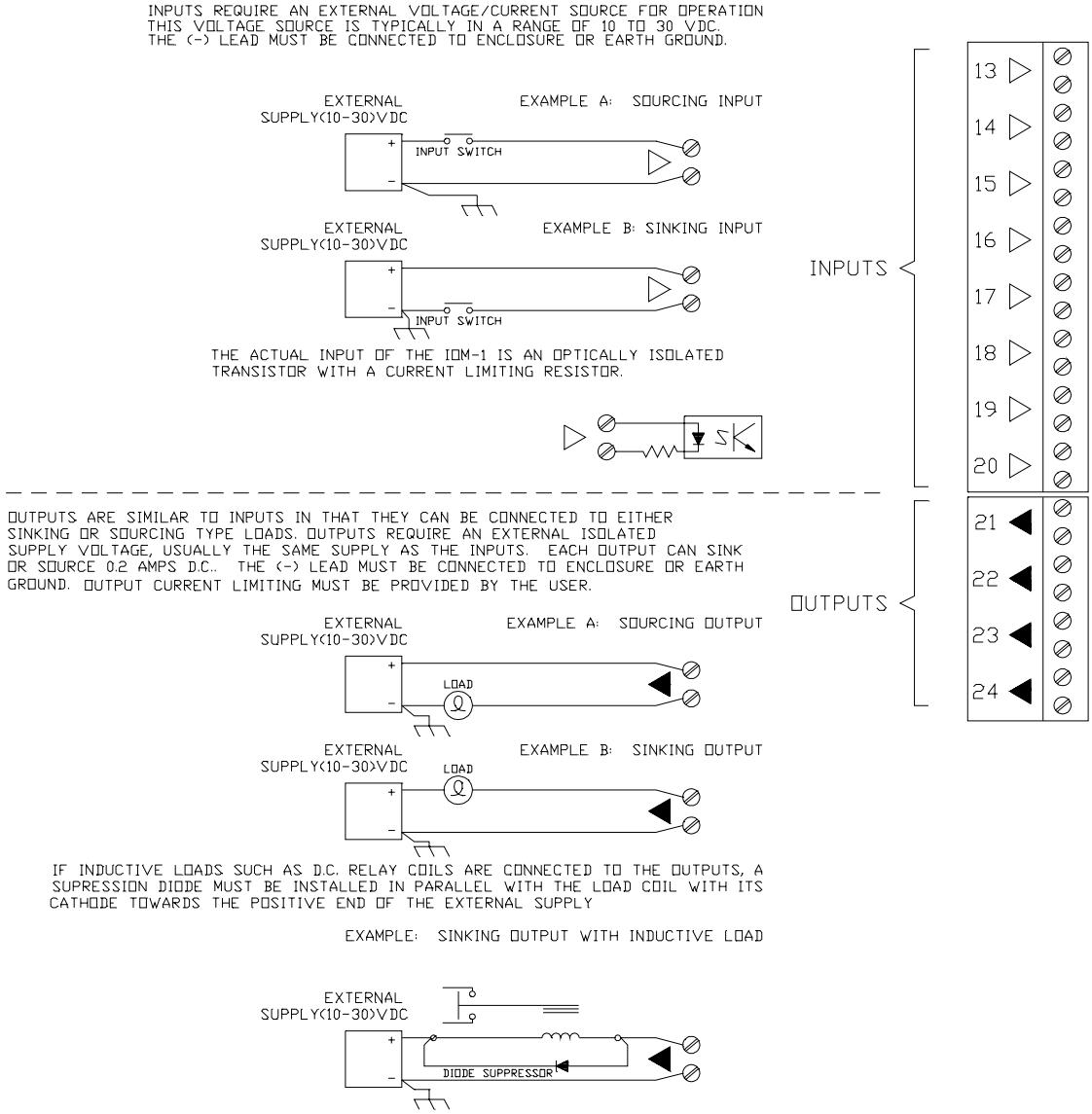


Figure 88 Examples Of I/O Connections (IOM-1)

NOTE: 18 to 24 gauge wire must be used for I/O wiring. The use of larger gauge wire will cause the I/O terminals to prematurely fatigue.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Detailed Descriptions of Additional I/O Functions With the Addition of the IOM-1

Input Functions

FUNCTION #	DESCRIPTION
22	ZERO POSITION

Sets the current position of the motor to zero. All absolute positions will be referenced to this set zero position.

23	ZERO DISPLAY

This zeroes all position query commands (FP and CP), they become zero and are referenced to this point. Absolute position is unaffected.

Output Function

With the addition of the IOM-1 there are no additional outputs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PARALLEL INTERFACE

Introduction

The IOM and PCM-1 Modules are equipped with a 37-pin Canon D type female connector for interfacing of customer provided thumbwheels, EMC provided thumbwheels, T-16 numeric displays and a parallel programming interface.

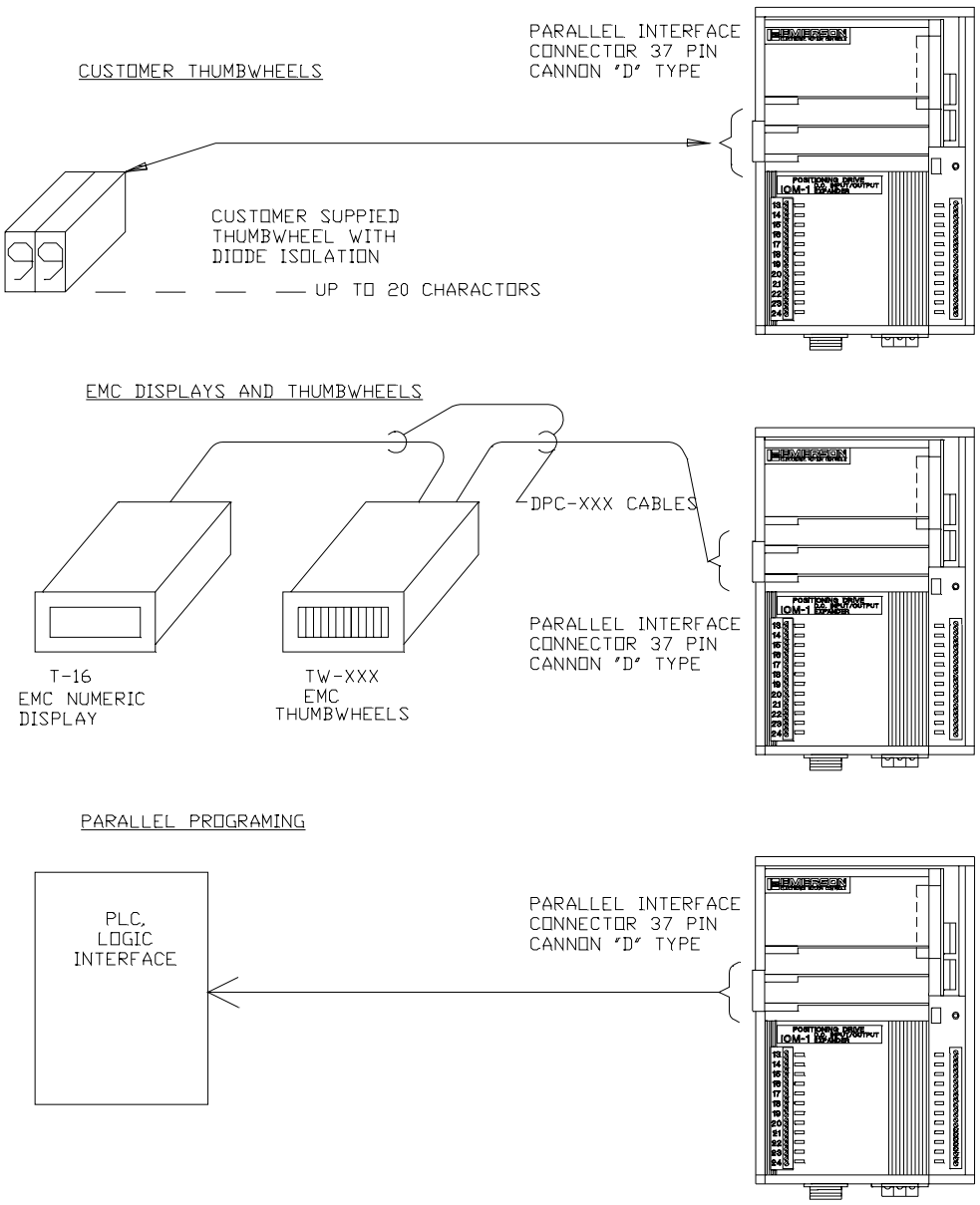


Figure 89 Parallel Interface (With IOM-1)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CUSTOMER SUPPLIED THUMBWHEEL INTERFACE

Introduction

The thumbwheel interface provides the user with a non-serial interface method for making changes to specific motion functions. The user can set up the thumbwheel to change velocities (in RPM only), distances/positions, dwell times, index counts and acceleration and deceleration times. As many as 20 external BCD characters can be read into the digital drive. Once read, these characters are stored in an internal character buffer. The actual buffer has a capacity for 32 characters to support other parallel interfaces. When customer thumbwheels are used, the 20 possible thumbwheels are read into the first 20 locations of the character buffer designated as (0-19).

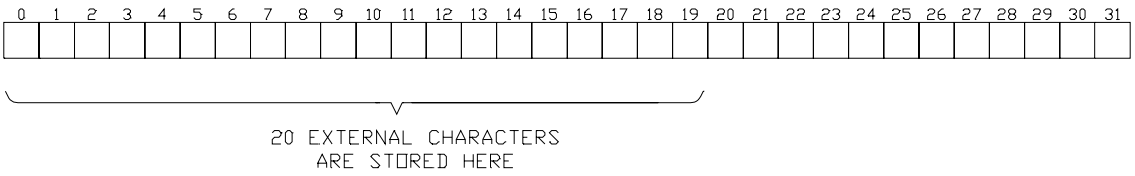


Figure 90 Character Buffer

The character buffer contents can be pre-programmed via serial commands to represent distance, velocity (in RPM only), count, etc. This mode of operation has 8 lines dedicated to transfer data and 10 lines dedicated to selection of data pairs.

Since 8 lines of data are provided and each BCD digit requires 4 lines, thumbwheel digits are read two at a time. The 10 select lines allow the use of up to 10 pairs of digits (20 thumbwheel digits). Once the thumbwheel data is set activating the (EXECUTE) input transfers the new data to its respective function and it becomes the active data.

An output called (ERROR) is provided as a means for the drive to tell an external device that data is out of range.

The inputs and outputs from this parallel interface are not optically isolated and are relatively low voltage (15VDC). Care must be taken to assure that electrical noise does not enter the digital drive by a careless wiring implementation of this interface. In general, the wiring should be kept short (5 to 20) feet. The wiring should be shielded with the shield connected at pin 37 of the parallel interface connector. The wiring cannot be run adjacent to any high voltage wiring.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

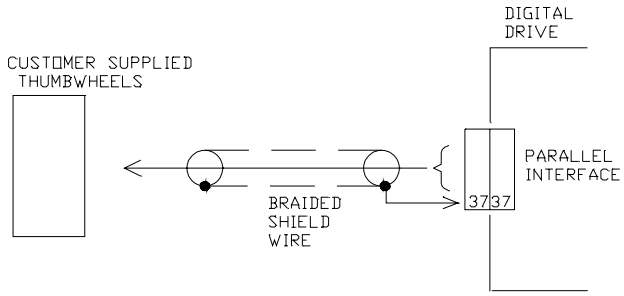


Figure 91 Cable Shielding

In addition to the described signals, the following voltage and ground signals are in the connector.

1)	+5	(25, 26, 27, 28)
2)	+15	(34)
3)	GND (Logic Common)	(29, 30, 31, 32)
4)	+ BUS	(33)
5)	SHIELD	(37)

These signals are provided for the parallel interface options only and cannot be used for any other purpose. The thumbwheel multiplexing uses +15, + BUS, GND and SHIELD.

Thumbwheel Wiring

The 37-pin parallel interface connector and a typical thumbwheel wiring schematic are shown on the following pages. All the necessary connections are shown. However, there are several important considerations:

1. The internal +15VDC logic supply of the drive should be used for the thumbwheel supply voltage. This connection is made by connecting pins 33 and 34 on the 37-pin connector (P2).

2. The cable used to connect the thumbwheel assembly to the 37-pin connector (P2) must not exceed 50 ft. in length. Also, this cable must be shielded with one end of the shield connected to pin 37 of P2. The other end of the shield must not be connected. Typical wire gauges used in this cable would be from 26 AWG to 32 AWG.

3. The thumbwheel digits must have the blocking diodes that are indicated on the wiring schematic. If not, the diodes can be added according to the schematic. A typical diode used for this would be a 1N914.

4. The 1, 2, 4, 8 coding for the data must be accomplished with BCD switches that are active "ON". These are the most common variety.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

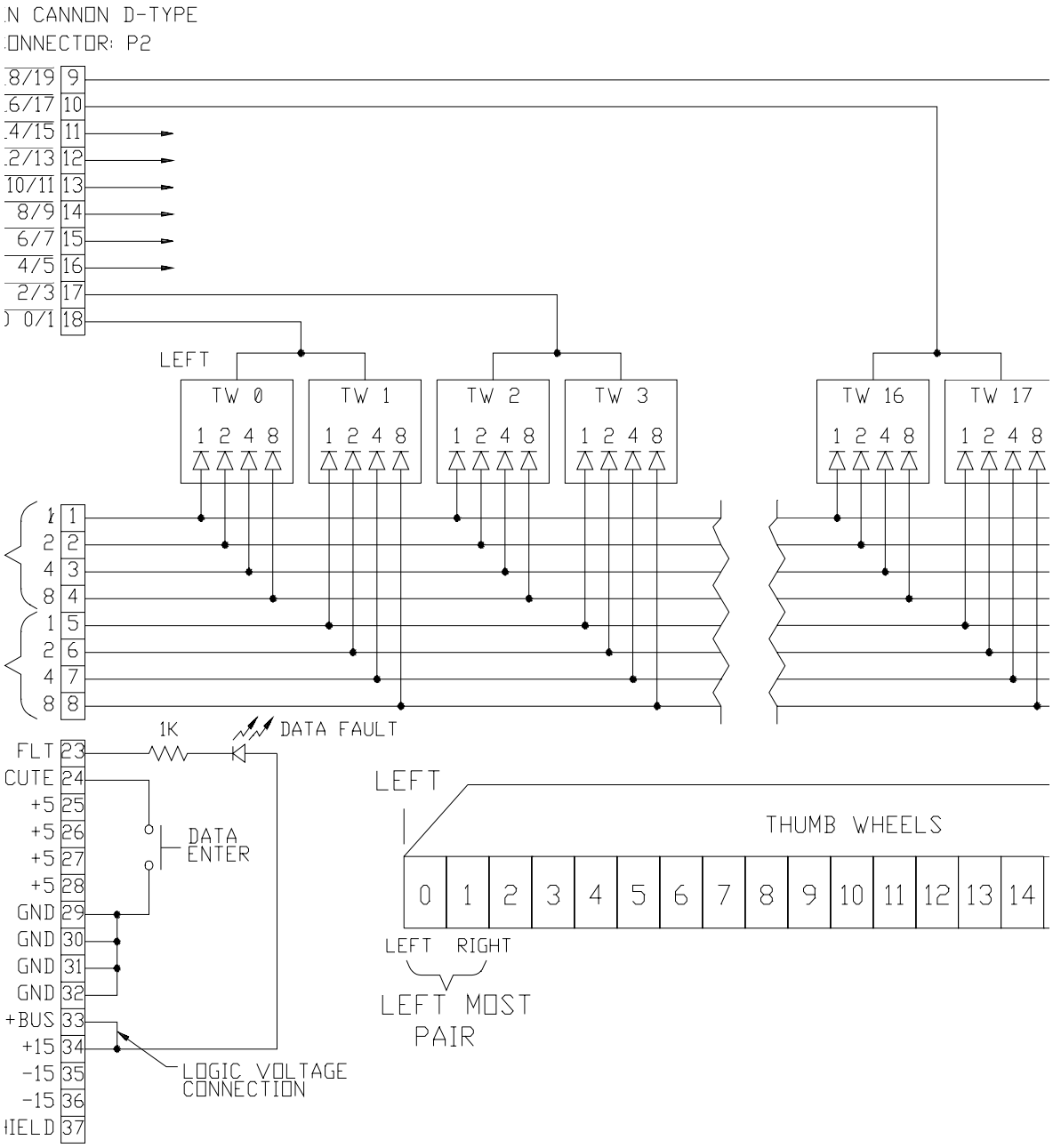


Figure 92 Thumbwheel Wiring

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Emerson EMC provides thumbwheels in 5 different configurations. The mechanical mounting for all of them is the same. They are designed for panel mounting.

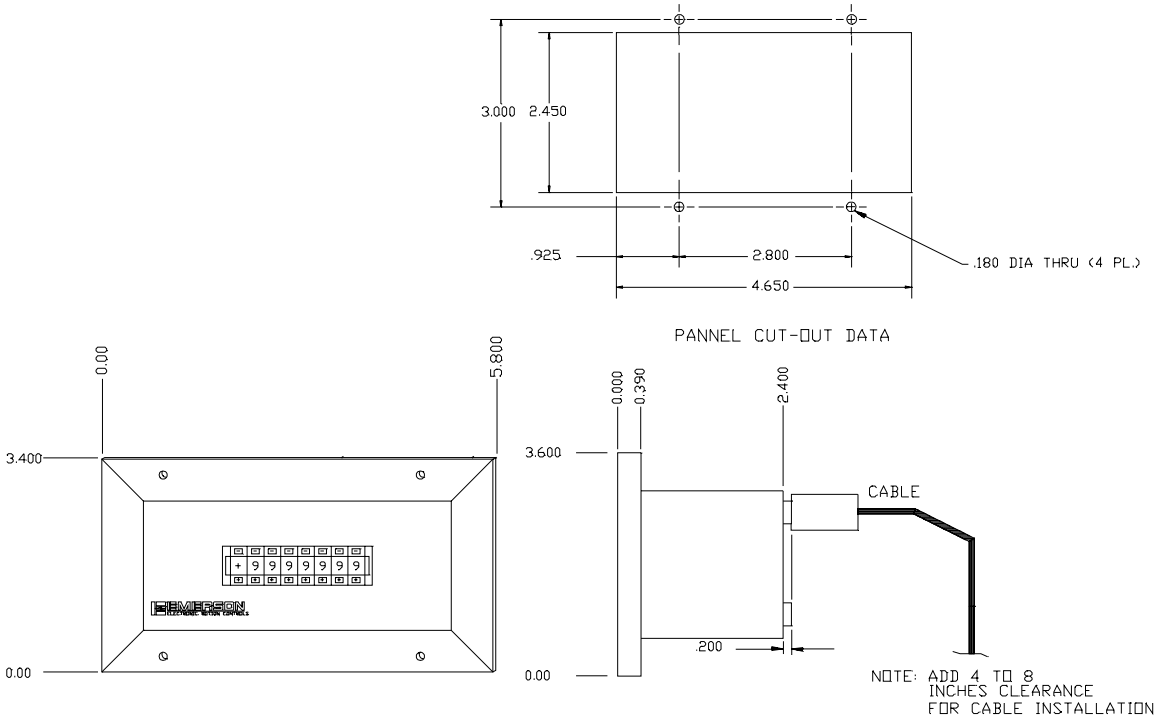


Figure 93 Mounting Information For Thumbwheels

The mechanics of these assemblies provides for up to 10 characters of thumbwheel data. This data is read into the digital drive character buffer. Since the character buffer can handle 20 characters, the thumbwheels have been designed with jumpers that can be switched at the rear of the thumbwheel assembly.

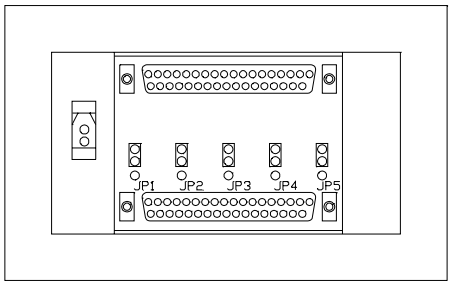


Figure 94 Thumbwheel Jumpers

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

With the jumpers connected as shown, the thumbwheel data is read into character positions (0-9) of the digital drive character buffer. Moving the jumpers to the bottom will cause the characters to be read into positions (10-19) of the character buffer.

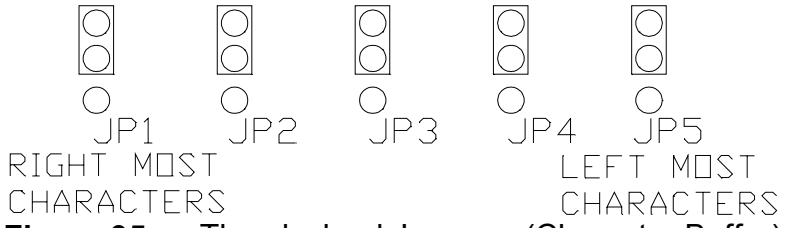


Figure 95 Thumbwheel Jumpers (Character Buffer)

To exclude erroneous data input caused by changing data, each thumbwheel assembly is equipped with an input for a data enter push button. This input must be made for thumbwheel data to transfer to the digital drive. The momentary push button switch must be provided by the customer. The mating Molex connector and pins are provided with the thumbwheel assembly. The connections are made at the rear of the assembly.

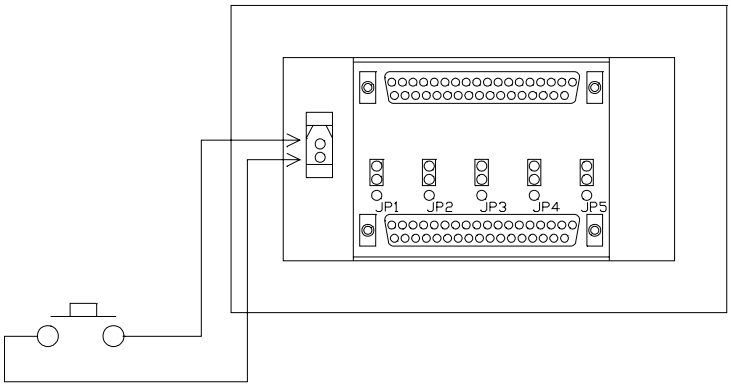


Figure 96 Data Entry Push Button

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Two connectors are provided as a means to daisy chain up to two thumbwheels and a numeric display (T-16) from one port.

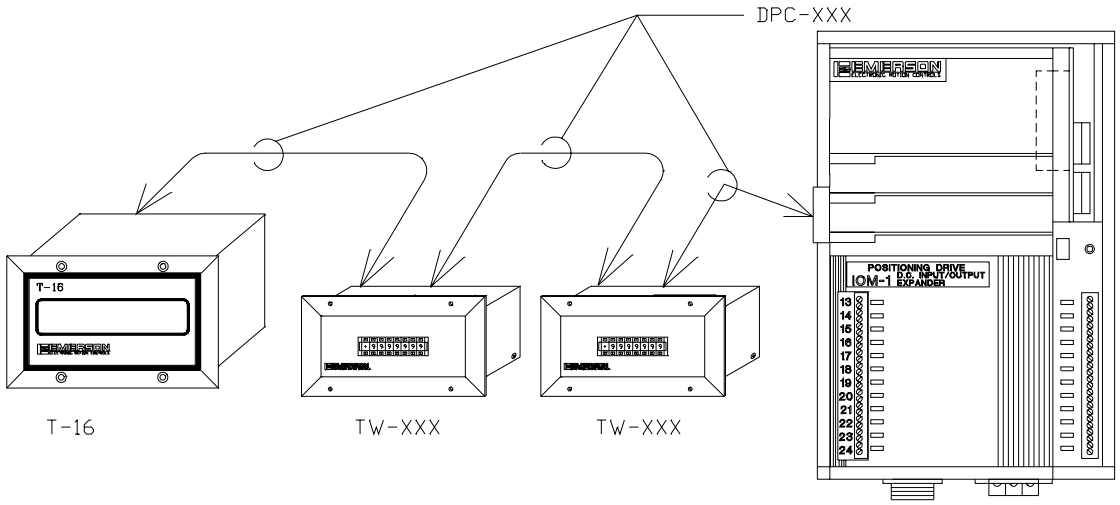


Figure 97 Thumbwheel/T-16/IOM-1 Cable Connections

The connectors on the back of the TW-XXX and T-16 are connected in parallel so the cabling is insensitive to position. The cables themselves can be obtained in different lengths.

DPC-003 3 FT.
DPC-006 6 FT.
DPC-015 15 FT.
DPC-025 25 FT.
DPC-050 50 FT.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The TW-XXX is available in five standard configurations.

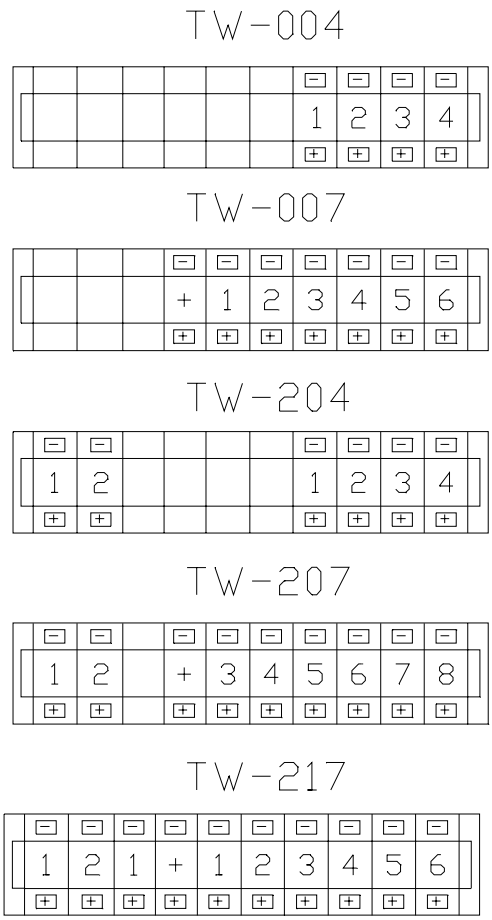


Figure 98 Thumbwheel Configurations

The (+/-) buttons above and below the data windows can be pushed to increment and decrement data.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Since the physical construction of the thumbwheel is based on 10 characters and the different models are accomplished with spacers, data from the thumbwheels is read into the digital drive character buffer as follows.

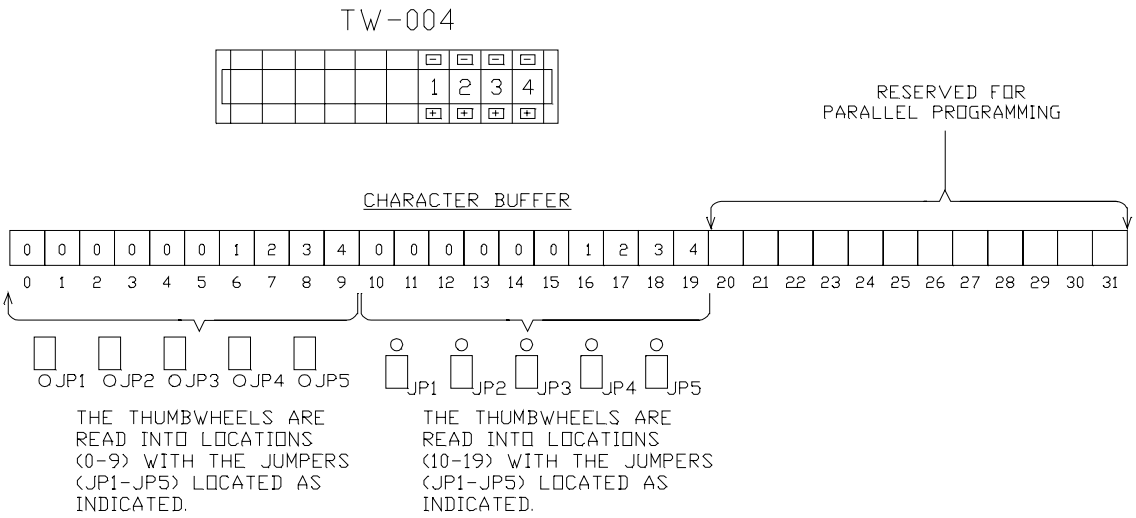


Figure 99 Digital Drive Character Buffer

Programming the 32 character drive character buffer is accomplished with serial commands and PCX.

The red LED indicator on the TW-XXX is provided as a means to tell that data is out of range. For example, if the 4 digits of a TW-004 were programmed as velocity and the data on the thumbwheels is greater than 3000 RPM when the ENTER button is pushed, then the LED will light.

The LED will go out when valid data is entered.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PARALLEL PROGRAMMING INTERFACE

Another feature of the parallel interface connector is that of a parallel interface that allows for programming. In this mode of operation a character buffer of 32 characters is provided for the user. The characters are designated as Ø through 31 (see 99).

These 32 characters can be pre-programmed via serial commands to represent distance, velocity (in RPM only), count, etc. The same basic functions and programming capabilities that are provided for thumbwheels are provided for this parallel interface.

The parallel interface has 8 lines dedicated to transfer data and 4 lines dedicated to selection of data pairs.

Since 8 lines of data are provided, each data transfer includes two characters. The additional 4 lines allow for a selection of 16 pairs of characters.

The operation of the data lines is for BCD data. The 4 lines of pair selections are coded in binary.

Four handshake lines are dedicated to accomplish data transfers. Two are inputs and two are outputs. One input (PAIR ENTER) is to tell the digital drive that the data and pair selection lines are ready for transferring to the character buffer. Once the 32-character buffer data content is programmed, another input (EXECUTE) is provided to transfer and start using any new data contained in the entire buffer.

One of the outputs (ACKNOWLEDGE) is provided as a means for the digital drive to tell the external device that it has received the proper input. This output comes ON to acknowledge either of the inputs. (PAIR ENTER) or (EXECUTE).

The second output is called (ERROR) and is provided as a means for the drive to tell an external device that data is out of range. The correct protocol for these handshake lines is to turn on the input, wait for the acknowledge and then shut off the inputs. The digital drive will then shut off (ACKNOWLEDGE).

The inputs and outputs from this parallel interface are not optically isolated and are relatively low voltage (5 to 15). Care must be taken to assure that electrical noise does not enter the digital drive by a careless wiring implementation of this interface. In general, the wiring should be kept short (5 to 20) feet. The wiring should be shielded with the shield connected at the external device. The wiring cannot be run adjacent to any high voltage wiring (see 100) .

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

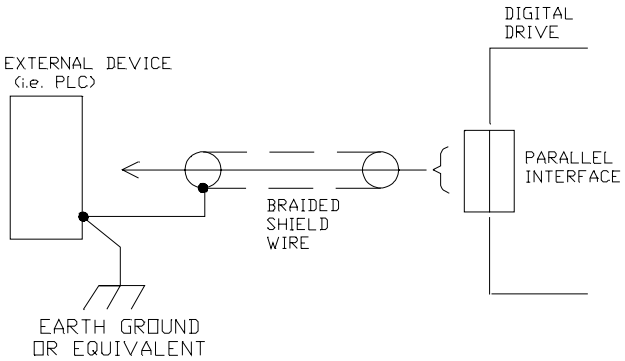


Figure 100 Cable Shielding

In addition to the described signals, the following voltage and ground signals are in the connector.

SIGNAL	PIN NUMBER
+5	(25, 26, 27, 28)
+15	(34)
GND	(29, 30, 31, 32)
+BUS	(33)
SHIELD	(37)

These signals are provided for level interface only and cannot be used for any other purpose.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

For the purpose of explanation, a circuit representing the inputs and outputs is shown here.

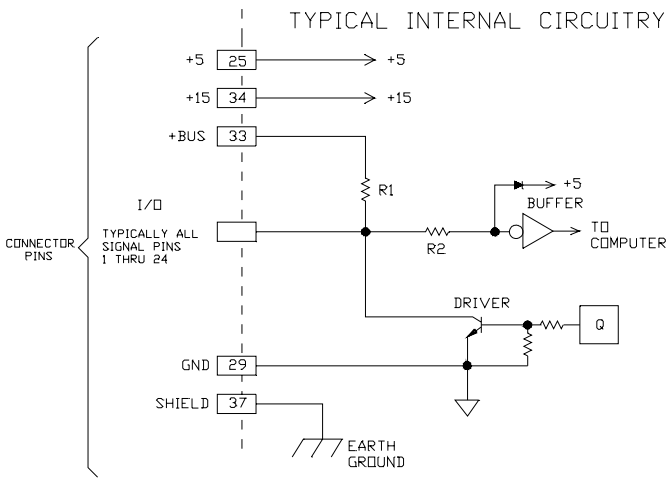


Figure 101 Typical Internal Circuitry

The I/O (typical of all signal pins) has an input buffer and output driver associated with it. This is done to provide a highly flexible hardware implementation. This parallel port is used for implementation of the T-16 numeric display and thumbwheels. Since each of the signal pins can be firmware configured, different features can be achieved.

Each of the I/O pins has a pull up resistor (R1) associated with it. This pull up resistor is connected to the 37 pin connector pin 33 (+BUS). This pin can be connected to pin 25 (+5) for a +5 volt interface. It can be connected to pin 34 (+15) for a +15 volt interface or it can be connected to the positive source of the external device which is the preferred method. The ground connection (29, 30, 31, 32) must be connected to the ground supply of the external device. The shield (37) is provided as an alternative place to connect the cable shield if a connecting place cannot be found at the external device. Never connect the shield at both ends.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The line number and functional description of each required signal for the parallel programming interface is as follows.

37-PIN PARALLEL INTERFACE CONNECTOR

PIN#	FUNCTION		
1	$\overline{1}$	LSB	
2	$\overline{2}$		
			(BCD) LEFT DIGIT
3	$\overline{4}$	MSD	
			(INPUTS)
4	$\overline{8}$	MSB	
5	$\overline{1}$	LSB	
6	$\overline{2}$		
			(BCD) RIGHT DIGIT
7	4	LSD	
			(INPUTS)
8	$\overline{8}$	MSB	
9			
10			
11			
12		DO NOT APPLY TO PARALLEL PROGRAMMING INTERFACE	
13			
15			
16			
17	$\overline{1}$	LSB	
18	$\overline{2}$		
		BINARY PAIR	
19	$\overline{4}$		SELECTION
			(INPUTS)
20	$\overline{8}$	MSB	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PIN#	FUNCTION	
21	PAIR ENTER	(INPUT)
22	ACKNOWLEDGE	(OUTPUT)
23	ERROR	(OUTPUT)
24	EXECUTE	(INPUT)
25		
26		
27	+5	
28		
29		
30		
31	GROUND (LOGIC COMMON)	
32		
33	+BUS	
34	+15	
35	DO NOT APPLY TO PARALLEL INTERFACE	
36		
37	SHIELD	

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Inputs to the digital drive are interpreted as ON (active) when an input pin is the grounded (connected to pins 29, 30, 31, 32 of the connector).

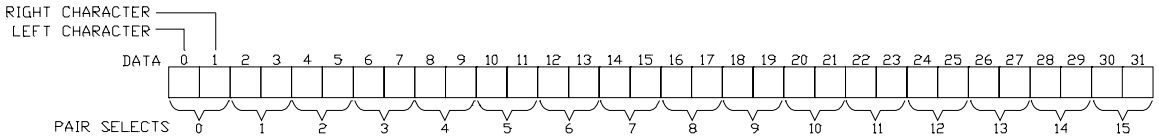


Figure 102 Character Data

There can be 32 characters designated as (Ø to 31) entered in pairs designated as (Ø to 15).

If, for example, no wires were hooked up to the data lines (1 through 8) or pair selects (17 through 20) and a wire was connected from pin 21 (PAIR ENTER) to pin 29 (GROUND) the motion controller would assume the user is trying to enter the data Ø, Ø for characters Ø and 1 and would in turn, turn ON the (ACKNOWLEDGE). The character data must be input in simple BCD form.

Table XV Character Data

-------- LSD | ------ MSD	DATA							
	LEFT				RIGHT			
	LSB			MSB	LSB			MSB
	1	2	3	4	5	6	7	8 -> PIN #
Ø, Ø	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
1, 1	GND	OPEN	OPEN	OPEN	GND	OPEN	OPEN	OPEN
2, 2	OPEN	GND	OPEN	OPEN	OPEN	GND	OPEN	OPEN
3, 3	GND	GND	OPEN	OPEN	GND	GND	OPEN	OPEN
4, 4	OPEN	OPEN	GND	OPEN	OPEN	OPEN	GND	OPEN
5, 5	GND	OPEN	GND	OPEN	GND	OPEN	GND	OPEN
6, 6	OPEN	GND	GND	OPEN	OPEN	GND	GND	OPEN
7, 7	GND	GND	GND	OPEN	GND	GND	GND	OPEN
8, 8	OPEN	OPEN	OPEN	GND	OPEN	OPEN	OPEN	GND
9, 9	GND	OPEN	OPEN	GND	GND	OPEN	OPEN	GND
+, +	OPEN	GND	OPEN	OPEN	OPEN	OPEN	OPEN	OPEN
-, -	OPEN	OPEN	GND	OPEN	OPEN	OPEN	GND	OPEN

NOTE: Do not enter data greater than 9 per digit. For example, all grounded inputs are not allowed. If the character is used as a sign (+ or -) for Index Distance or Position, the input lines (GND/OPEN) pattern is shown.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The pair selection inputs are in simple binary form.

Table XVI Pair Selection Inputs

SELECTED 17	18	19	20	->PIN #
Ø	OPEN	OPEN	OPEN	OPEN
1	GND	OPEN	OPEN	OPEN
2	OPEN	GND	OPEN	OPEN
3	GND	GND	OPEN	OPEN
4	OPEN	OPEN	GND	OPEN
5	GND	OPEN	GND	OPEN
6	OPEN	GND	GND	OPEN
7	GND	GND	GND	OPEN
8	OPEN	OPEN	OPEN	GND
9	GND	OPEN	OPEN	GND
10	OPEN	GND	OPEN	GND
11	GND	GND	OPEN	GND
12	OPEN	OPEN	GND	GND
13	GND	OPEN	GND	GND
14	OPEN	GND	GND	GND
15	GND	GND	GND	GND

For both truth tables "GND" means ON or Logic 1 and "OPEN" means OFF or Logic Ø. Both inputs, (PAIR ENTER) and (EXECUTE), are activated and turned on by connecting them to ground.

Both outputs (ACKNOWLEDGE) and (ERROR), are the equivalent of open collector NPN transistors whose emitters are connected to ground. The load for these outputs can be connected from the + BUS pin (DC voltage source) to the output pin. When the output is ON, current will flow through the sinking NPN's collector to ground. These transistors can sink a maximum of .04 amps DC and the + BUS voltage should not be greater than 15 VDC.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The procedure for setting up thumbwheels and parallel programming is identical with the exception of the character buffer size. Thumbwheels have 20 digits and parallel programming has 32. When the parallel option is selected from the PCX drive configuration menu, the following screen will be displayed.



Figure 103 Parallel Interface Options

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

THUMBWHEEL AND PARALLEL PROGRAMMING INTERFACE

For either of these options to work, they must be enabled. Neither the thumbwheels or the numeric display can be used if the parallel interface is enabled.

DATA FIELD NUMBER

There are eight (0-7) unique groupings of digits that may be set up. Each group, or field, has a corresponding "packet" of data associated with it. When a new data field is selected, all applicable information for that field will be displayed and ready to edit.

DATA FIELD PURPOSE

This packet item determines what the data field is to be used for. The fields may be setup to represent any of the following positioning drive functions.

Index Accel
Index Decel
Index Velocity
Index Dist/Pos (+/-)
Index Dist/Pos
Index Dwell
Index Count
Fast Jog Velocity
Slow Jog Velocity
Sensor Accel
Sensor Decel
Sensor Velocity
*Field Function

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INDEX NUMBER

*The field function is applied with another data field. Data entered the other field would be used with the field function. The field function data field would usually be setup as a two digit field.

Field Function	Apply Data To:
0	Index Accel
1	Index Decel
2	Index Velocity
3	Index Dist/Pos (+/-)
4	Index Dist/Pos
5	Index Dwell
6	Index Count
7	Fast Jog Velocity
8	Slow Jog Velocity
9	Sensor Accel
10	Sensor Decel
11	Sensor Velocity
12	Index Number

FIRST DIGIT IN DATA FIELD

This packet item specifies where the data field is to start. Left most digits start at number 0. On Emerson thumbwheels, simply count any leading blank digits from the left to determine the start of the data field.

NUMBER OF DIGITS IN DATA FIELD

This packet item simply specifies how many digits the data field consists of.

DATA FIELD MULTIPLIER

This packet item may be used to add zero's to the right of the data entered. This may be useful if digits need to be conserved and the data resolution is not critical. For example, Accel times may be entered from 0 to 65.535 seconds. If it is only necessary to make steps of 1 second or more, use only 2 digits (Number of Digits) with a multiplier of 1000.

APPLY TO INDEX NUMBER

This packet item specifies the first index to apply the data field to.

NUMBER OF ADDITIONAL INDEXES

This packet item is used in conjunction with the "APPLY TO INDEX NUMBER" item. It specifies how many more indexes, from the starting index, that the data field is to apply to (if any).

APPLY TO DATA FIELD

Some data field purposes (field function and Index Number) require a corresponding data field for additional information. When this is needed, enter a data field number from 0 to 7.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NUMBER OF ADDITIONAL DATA FIELDS

This packet item is used in conjunction with the "APPLY TO DATA FIELD" item. Continuous data fields can be applied to the field function and index number. See the parallel programming example for more detail.

THUMBWHEEL EXAMPLE

In this typical application, an Emerson thumbwheel is being used to set up index velocity and distance. Two data fields are needed; field 0 and 1.

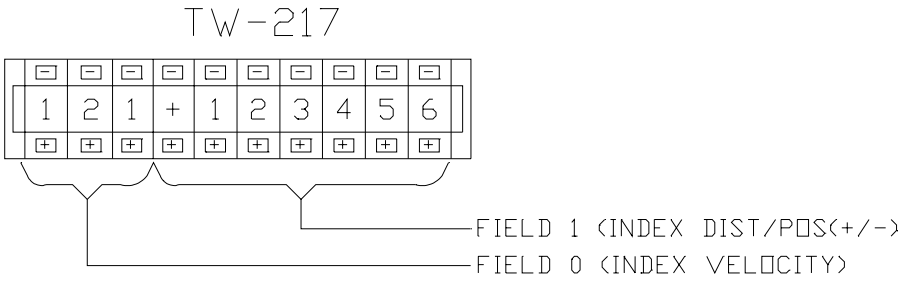


Figure 104 Thumbwheel Example

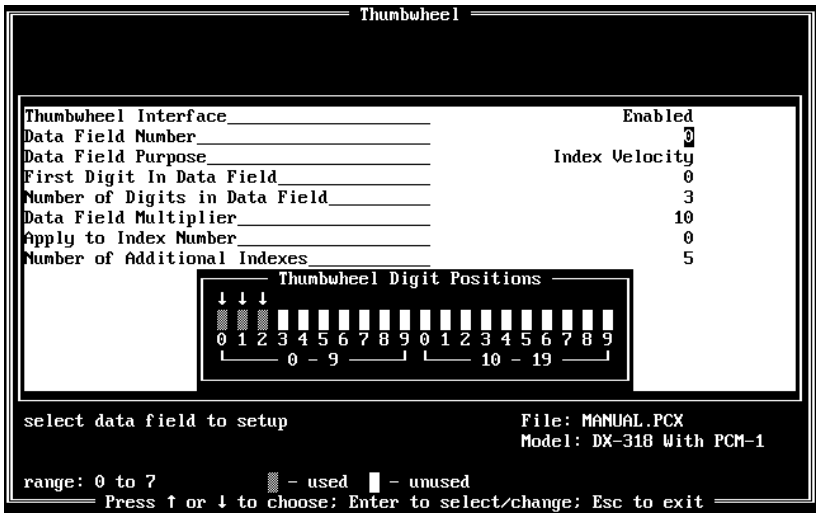


Figure 105 Index Velocity (Thumbwheel)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

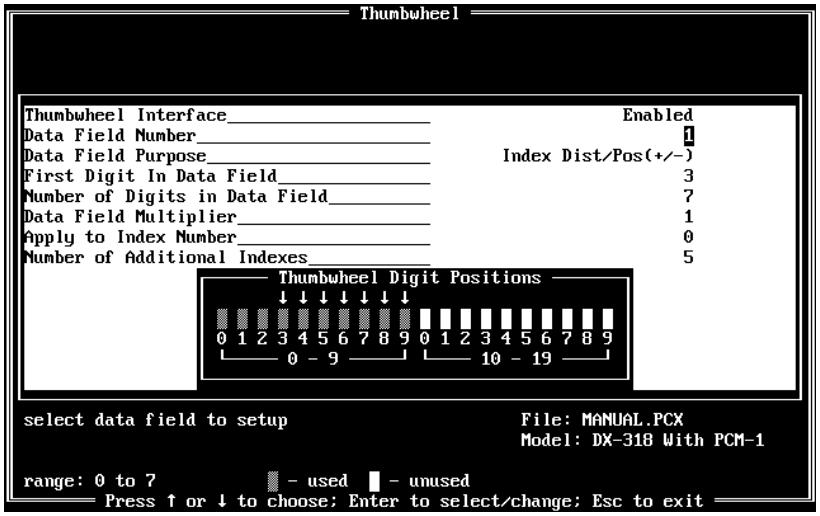


Figure 106 Index Dist/pos(+/-) (Thumbwheel)

Index velocities are multiplied by 10 before being sent to the positioning drive. Signed distances are used when a sign digit is available on the thumbwheel. When the above data is entered, the following values will be sent to indexes 0, 1, 2, 3, 4, and 5.

Index Velocity = 1210
Index Distance = 123456

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PARALLEL PROGRAMMING EXAMPLE

In this application, the parallel interface character buffer is being used to set up indexes. Three data fields will be used.

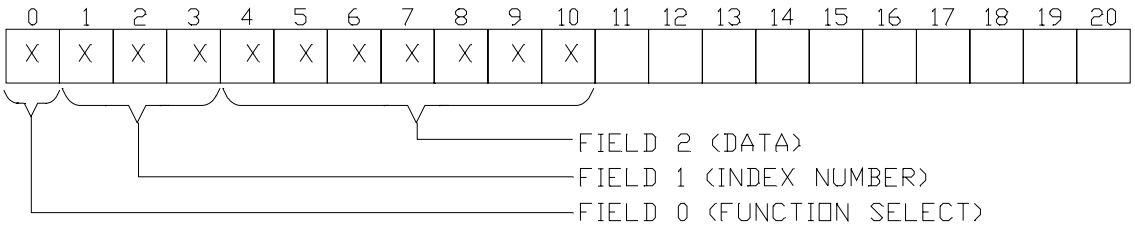


Figure 107 Parallel Programming Example

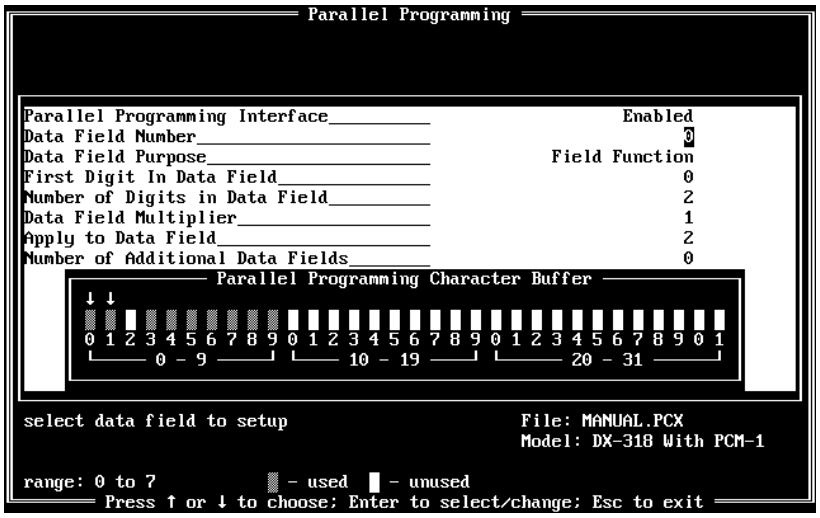


Figure 108 Field Function (Thumbwheel)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

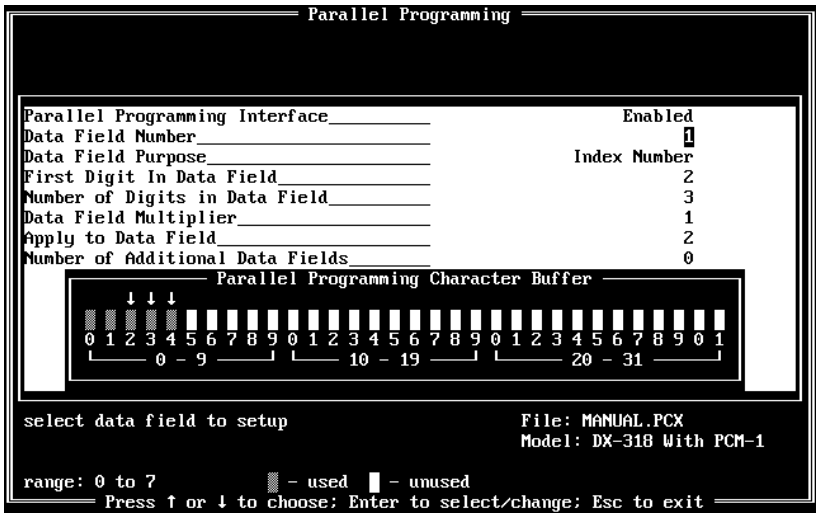


Figure 109 Index Number (Thumbwheel)

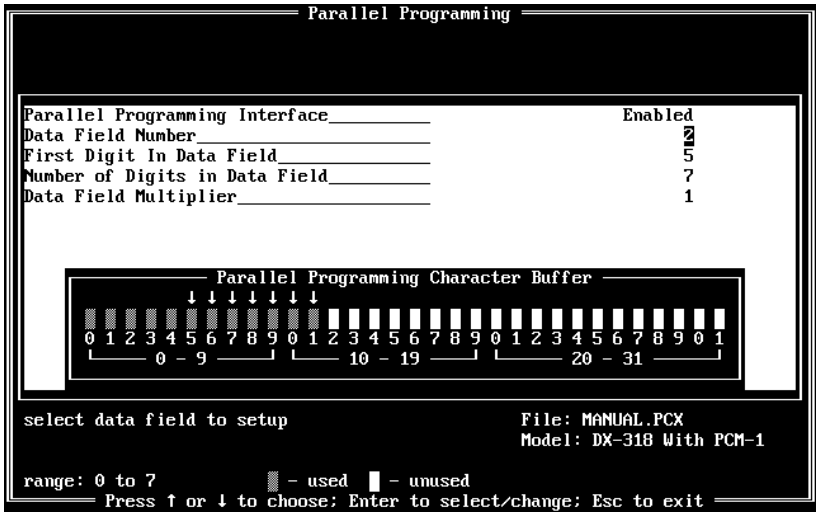


Figure 110 Thumbwheel Programming

The left two digits of the character buffer represent the Field Function (Data Field 0). The field function applies only for the digits setup in Data Field 2. In Data Field 1, digits 2-4 represent the index number that the data in Field 2 is also to use. Data Field 2 is the general purpose field that is used in conjunction with the other data fields. When the above data is entered as shown, the index velocity (Field Function 2) of index number 55 will be changed to 1200.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

T-16 SETUP AND OPERATION

The T-16 data entry screen is located in the parallel options in the PCX Setup Menu. Upon selection of the Numeric Display option, the following screen will be displayed.

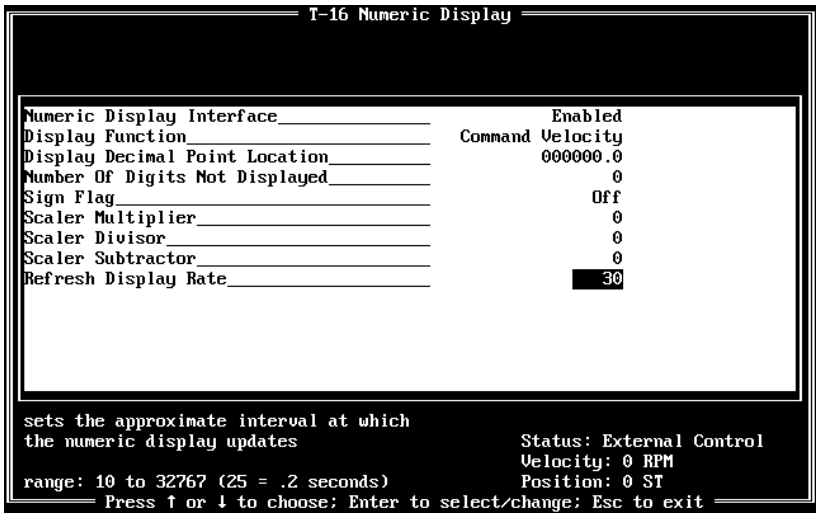


Figure 111 Screen Menu-T-16 Numeric Display

NUMERIC DISPLAY INTERFACE

In order for the numeric display to function it must be enabled. Neither the thumbwheels or the numeric displays can be used if the parallel interface is enabled.

DISPLAY FUNCTION

The numeric display may be setup to display any of the following positioning drive functions.

command position
command velocity
index count
index dwell time
motor current

DISPLAY DECIMAL POINT LOCATION

The user may place a decimal point at a fixed location on the numeric display. This option can be used to make the display show meaningful information.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

NUMBER OF DIGITS NOT DISPLAYED

Sometimes the least significant digits on the numeric display are insignificant. This option provides a way to drop digits (right to left) before they are displayed.

SIGN FLAG

If the sign flag is off, positive values will be displayed without a "+" sign. Negative values are always displayed with the "-" sign.

SCALER MULTIPLIER, DIVISOR, AND SUBTRACTOR

These items are provided to scale the normal positioning drive values before they are displayed. This option can be used to make the display show meaningful information (command position or command velocity.)

$$\text{DISPLAY} = \frac{(\text{Value} - \text{Subtractor}) * \text{Multiplier}}{\text{Divisor}}$$

These items may be any value from -32768 to 32767. A value of 0 disables any item without error.

REFRESH DISPLAY RATE

This option determines the approximate interval at which the numeric display updates. The actual rate may change depending on what else the positioning drive is doing. The default value of 25 represents about a .1 second rate (50 would be .2 seconds, etc.).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INSTALLATION AND CONNECTIONS OF THE PCM-1

INTRODUCTION

The PCM-1 allows for memory and I/O expansion as well as parallel in, and compound indexing. The installation of the PCM-1 module is made easy by a direct "plug-in" design. All the electrical connections between the basic drive and the PCM-1 module are made via the 48 position connectors. Figure 1 shows how the 48-pin connectors mate on the Positioning Drive. This is the only electrical connection required between the two units. Once plugged in, the top and bottom handles snap into position to secure the module to the drive.

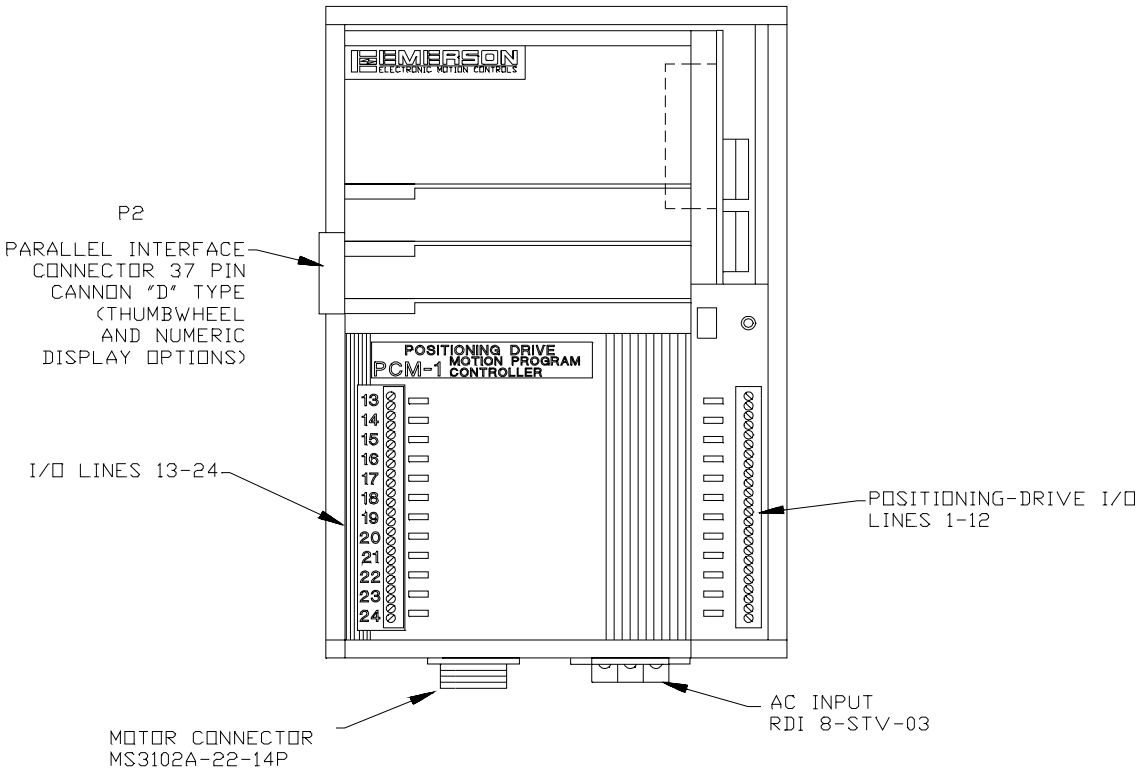


Figure 112 I/O Locations PCM-1

The PCM-1 module includes a parallel interface connector. The most common use of this connector is for thumbwheel interfacing and numeric display.

The input and output connections are split between two terminal strips; one strip on the PCM module #13-24 and one on the digital drive #1-12. Each strip consists of 8 input lines and 4 output lines.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT/OUTPUT INTERFACE (PCM-1)

OVERVIEW

The PCM-1 is equipped with 8 inputs and 4 outputs that are optically isolated and operate on +10 to +30 VDC. Each input and output has 2 screw terminals associated with it to provide for either sinking or sourcing operation. The first 8 pairs of designated terminals are inputs and the last 4 pairs of terminals are outputs. The outputs are capable of sinking or sourcing a maximum of 200 mA. The user is responsible for limiting the output current to less than or equal to 200 mA.

Adding the PCM-1 module will double the I/O capabilities of the standard Positioning Drive. The number of input lines are increased from 8 to 16 and the number of output lines are increased from 4 to 8.

These inputs and outputs allow for proper timing and coordination between the drives, motion, and other machine control functions. The inputs and outputs can be connected to the machine's programmable logic controller (PLC) or relay logic system. These inputs and outputs can also be connected to limit switches, or switches and indicators on an operator's control panel.

A large number of input/output control functions are provided. The functions needed can be assigned to any of the input/output lines. This is accomplished through either serial interface commands or by using the PCX software provided with the drive. Inputs may be programmed as normally off or normally on. More than one function may be assigned to the same input line. After the I/O lines have been set to the desired configuration, power should be cycled to the Positioning Drive to ensure proper I/O operation. Each Positioning Drive comes from the factory with the inputs and outputs predefined for frequently used I/O configurations.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

An LED indicator is associated with each input and output. The input and output indicators are on if current is flowing in the associated line.

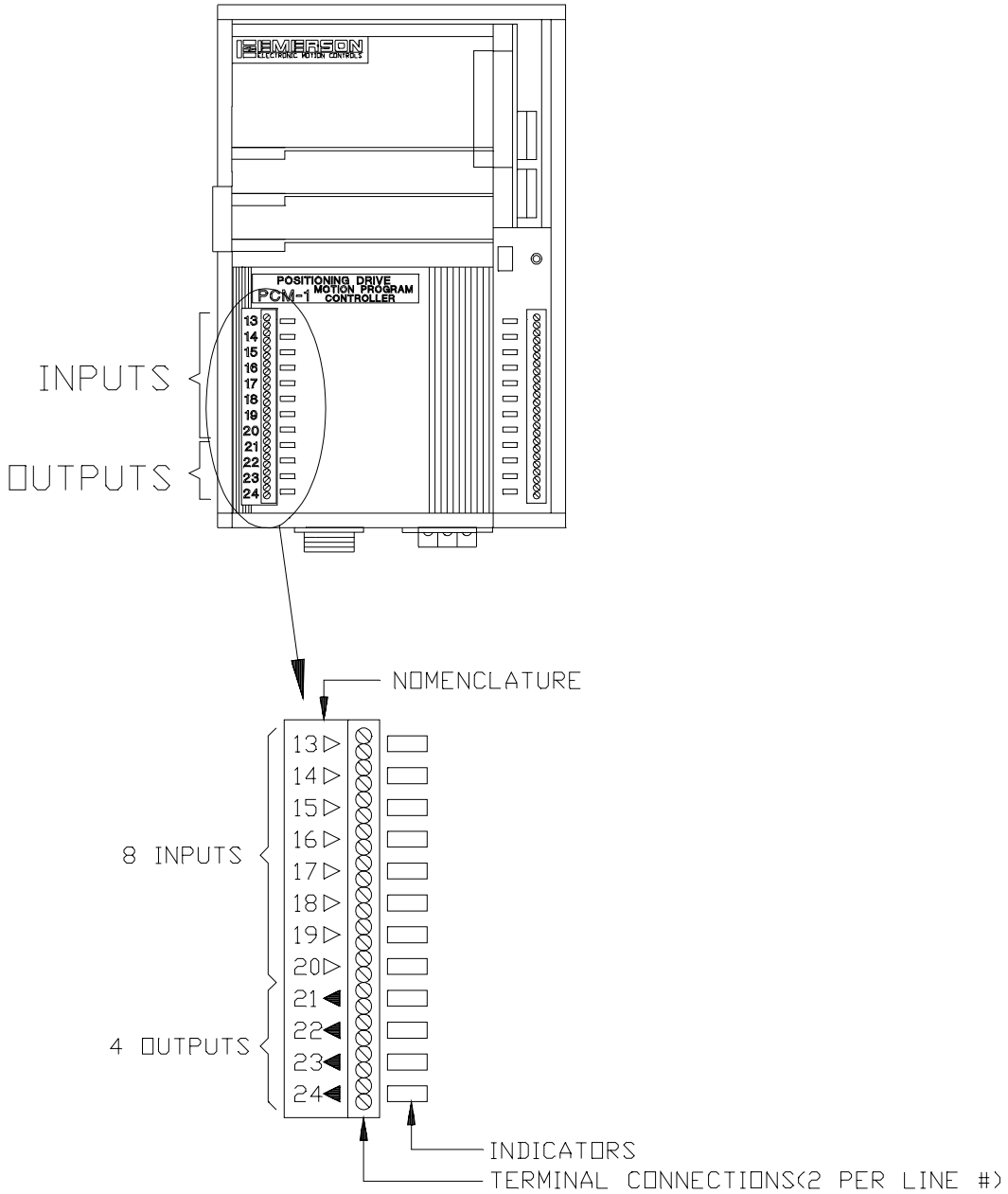


Figure 113 PCM-1 Connections

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

Following is the list of output functions provided with the drive and PCM-1.

OUTPUT FUNCTION #	BASIC DRIVE ONLY	DRIVE WITH PCM-1
0-READY	X	X
1-EXTERNAL MODE	X	X
2-IN MOTION	X	X
3-END OF INDEX	X	X
4-END OF HOME	X	X
5-END OF INDEX COUNT	X	X
6-HARDWARE FAULT	X	X
7-TRAVEL LIMIT FAULT	X	X
8-FOLLOWING ERROR FAULT	X	X
9-HOME COMPLETED	X	X
10-SENSOR LIMIT HIT	X	X
11-END OF SEQUENCE		X
12-PROGRAMMABLE OUTPUTS		X
13-END OF PROGRAM		X
14-END PROGRAM COUNT		X
15-IN SUSPEND		X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Functions

Following is a list of the input functions provided with the base drive and PCM-1.

INPUT FUNCTION #	BASIC DRIVE ONLY	DRIVE WITH PCM-1
0-INDEX INITIATE	X	X
1-HOME INITIATE	X	X
2-CLEAR TO INITIATE	X	X
3-HOLD INDEX/HOME MOTION	X	X
4-JOG	X	X
5-JOG CW	X	X
6-JOG CCW	X	X
7-JOG DIRECTION	X	X
8-SLOW JOG	X	X
9-CW TRAVEL LIMIT	X	X
10-CCW TRAVEL LIMIT	X	X
11-STOP MOTION	X	X
12-INHIBIT (DRIVE)	X	X
13-BRAKE OVERRIDE	X	X
14-INDEX SELECT	X	X
15-HOME SENSOR	X	X
16-FEED SENSOR	X	X
17-CLEAR END OF INDEX	X	X
18-CLEAR END OF HOME	X	X
19-CLEAR END OF INDEX COUNT	X	X
20-CLEAR SENSOR LIMIT	X	X
21-CLEAR FAULT	X	X
22-ZERO POSITION		X
23-ZERO DISPLAY		X
24-REMEMBER POSITION		X
25-RETURN TO POSITION		X
26-CLEAR END OF SEQUENCE	X	
27-CLEAR PROGRAM OUTPUTS		X
28-EXTERNAL INPUT		X
29-PROGRAM INITIATE		X
30-PROGRAM SELECT		X
31-SUSPEND PROGRAM		X
32-RESUME PROGRAM		X
33-CLEAR SUSPEND		X
34-CLEAR END OF PROGRAM		X
35-CLEAR END PROGRAM COUNT		X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Examples of I/O Connections to PCM-1

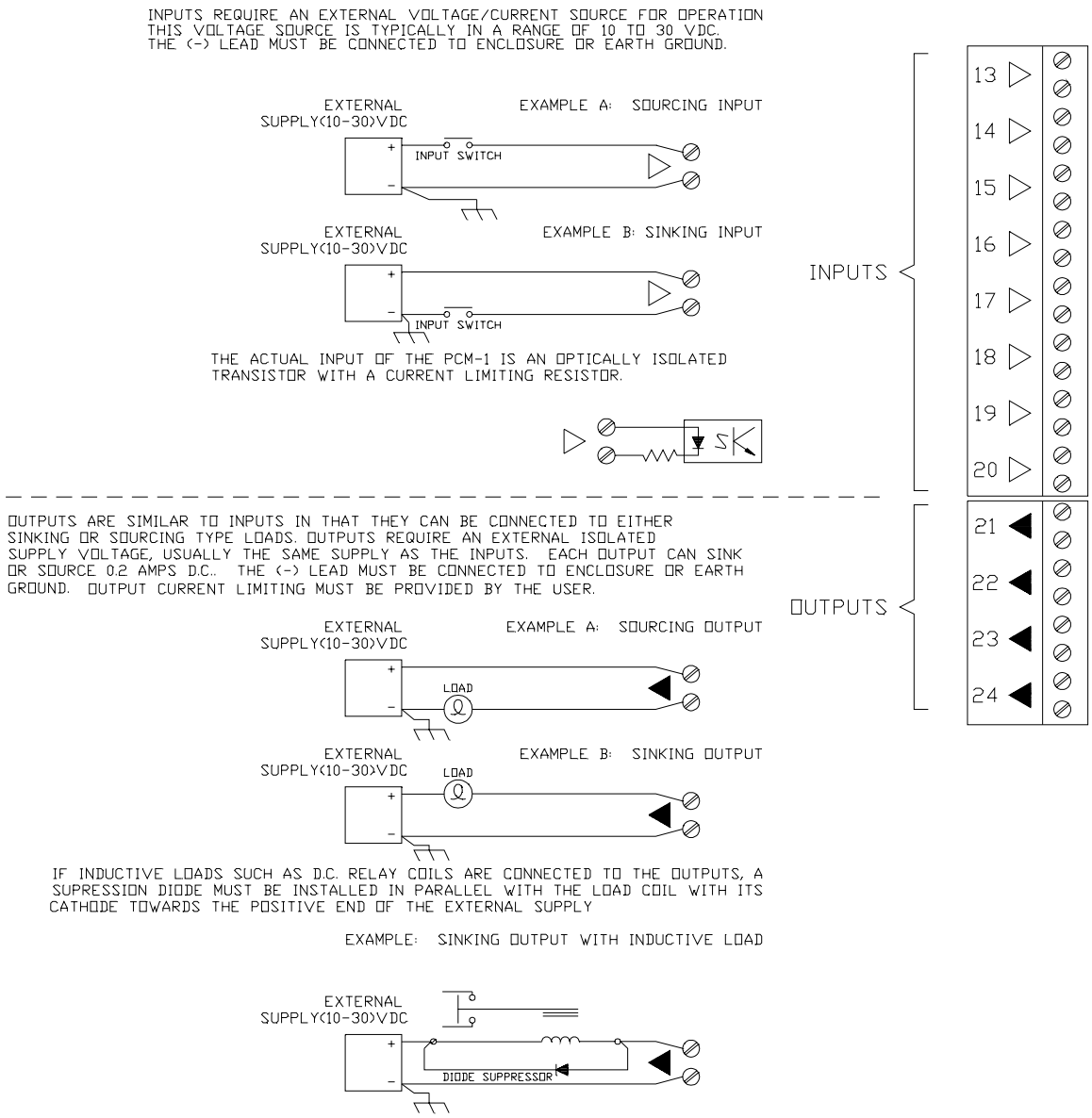


Figure 114 Examples Of Connections To PCM-1

NOTE: 18 to 24 gauge wire must be used for I/O wiring. The use of larger gauge wire will cause the I/O terminals to prematurely fatigue.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Functions

FUNCTION #	DESCRIPTION
22	ZERO POSITION

Sets the current position of the motor to zero. All absolute positions will be referenced to this set zero position.

23 ZERO DISPLAY

This zeroes all position query commands (FP and CP), they become zero and are referenced to this point. Absolute position is unaffected.

24 REMEMBER POSITION

Stores the current position in an absolute index. Defined by RI=(INDEX#) command. Default is Ø.

25 RETURN TO POSITION

Returns to the position defined by REMEMBER POSITION.

26 CLEAR END OF SEQUENCE OUTPUT

Clears the END OF SEQUENCE output, will not prevent output. The END OF SEQUENCE output will automatically clear when the next motion occurs.

27 CLEAR PROGRAMMABLE OUTPUT

Clears a (PROGRAMMABLE OUTPUT). Each assigned PROGRAMMABLE OUTPUT will require a separate CLEAR PROGRAMMABLE OUTPUT. This function will not prevent an output from activating. It will reset an active output.

28 EXTERNAL INPUT

Used with the WAIT FOR INPUT program function to stop program execution until the input line assigned with EXTERNAL INPUT is activated. This input is level triggered.

29 PROGRAM INITIATE

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Executes the selected program.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

30 PROGRAM SELECT LINES

Sets the starting input line number for a given number of program select lines. Then the number of program select lines is programmed through PCX or serial commands.

31 SUSPEND PROGRAM

Stops the execution of a program until the input line assigned with RESUME is activated. (See I/O Suspend Resume Feature Section.)

32 RESUME PROGRAM

Resumes the execution of a suspended program. (See I/O Suspend Resume Feature Section.)

33 CLEAR SUSPEND

Clears the IN SUSPEND output and returns the drive from a suspend cycle to normal operation without the need to "RESUME" and complete the suspended program. (See I/O Suspend Resume Feature Section.)

34 CLEAR END OF PROGRAM OUTPUT

Clears the END OF PROGRAM output. If not assigned, the END OF PROGRAM output will automatically clear when further motion is initiated.

35 CLEAR END OF PROGRAM COUNT

Clears the END OF PROGRAM COUNT output. The END OF PROGRAM COUNT output will automatically clear when the next motion occurs.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

FUNCTION#	DESCRIPTION

11 END OF SEQUENCE

This output comes ON after the completion of a motion sequence. A motion sequence is completed when a HOME, INDEX, or PROGRAM or a combination thereof, is executed and no further commands are pending. This output turns OFF automatically with the next motion or when the CLEAR END OF SEQUENCE is used.

12 PROGRAMMABLE OUTPUTS

The output lines assigned this function can be turned ON or OFF with the UPDATE OUTPUTS programming function.

13 END OF PROGRAM

This output comes ON after each completion of a PROGRAM. It turns OFF automatically with the next motion or when the CLEAR END OF PROGRAM is used.

14 END OF PROGRAM COUNT

This output comes ON only after a program is executed the number of times specified by the PROGRAM COUNT. It is turned OFF automatically with the next motion or when the CLEAR END OF PROGRAM COUNT is used.

15 IN SUSPEND

This output is ON when the SUSPEND PROGRAM input function is active. (See I/O Suspend Resume Feature Section.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

From the "Define Motion" screen of the PCX, two additional features are available, Programs and Suspend.



Figure 115 Define Motion

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

WHAT ARE PROGRAMS?

In order to understand what a PCM-1 motion "program" is, the user must first be familiar with what an "index" is. Basic index types were described in an earlier section of the manual. These index types are used as the "building blocks" to form a program. The set up program sequence involves taking the individual indexes that have been programmed and combining them into a complete motion program sequence.

Besides allowing the sequencing of indexes, the PCM-1 also provides a programming feature known as Compound Indexing. Compound Indexing allows the user to combine indexes of different velocities without stopping motion. Examples of this feature are shown below. Whenever an index number is used in a compound index, it cannot be used again in any program if it is designated by the same index number.

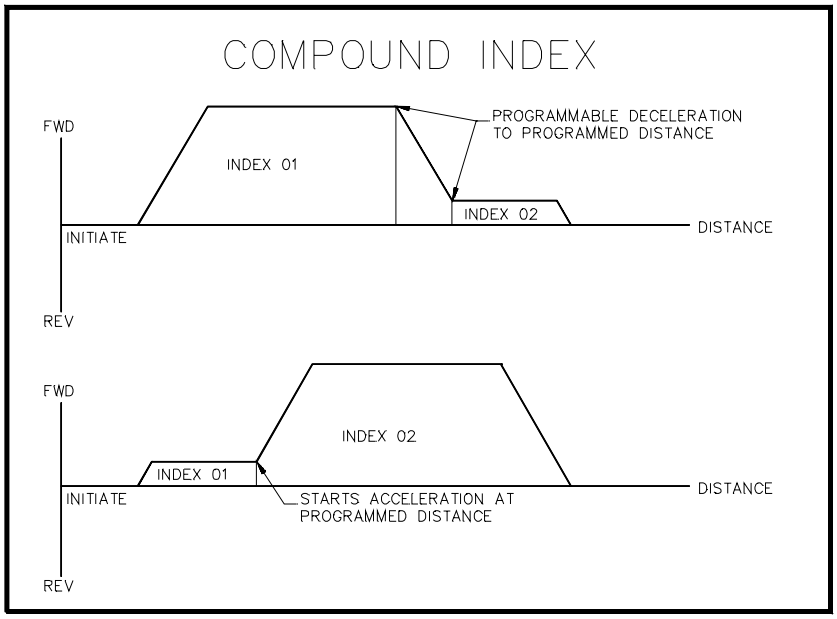


Figure 116 Compound Index Graph

In addition to the index and compound index execution capabilities, the user can do the following:

- Execute a home cycle
- Wait for input line to be changed
- Dwell for a chosen period of time
- Execute a program within a program
- Update output lines

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DESCRIPTION OF PROGRAMMING FUNCTIONS

HOME

The HOME types available with PCM-1 are identical to the HOME types available with the standard drive. A HOME cycle can be executed only after the motor velocity is brought to zero or before motion has begun.

WAIT FOR INPUT

The WAIT FOR INPUT function allows the user to wait for a change in the input line that has been assigned the EXTERNAL INPUT function. This function can be executed after a HOME cycle, after an INDEX, after a PROGRAM, after a DWELL time, and after an OUTPUT UPDATE.

DWELL TIME

The DWELL TIME function allows the user to create a dwell time (sec) between other program functions. A dwell time can be added after a HOME cycle, after a INDEX, after a PROGRAM, after a WAIT FOR INPUT, and after an OUTPUT UPDATE.

UPDATE OUTPUTS

The UPDATE OUTPUT function allows the user to change the status of one or all of the 8 output lines. This function is also called 'programmable outputs' and can be executed after a HOME cycle, after an INDEX, after a PROGRAM, after a WAIT FOR INPUT, and after a DWELL.

EXECUTE INDEX

The EXECUTE INDEX function is used to initiate the execution of an index. When this function is used, the index number must also be given.

EXECUTE PROGRAM

The EXECUTE PROGRAM function is used to initiate the execution of a program. When this function is used, the program number must also be given.

EXECUTE COMPOUND INDEX

This function is used to create compound indexes. The index number given with this function will be executed before the index number defined in the next program step. For instance, if index 3 is being compounded into index 8; index 3 will be executed before index 8. Motion will not be stopped between the execution of both indexes.

END

This function is used to designate the end of a program.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program Function Codes

Each of the previous program functions has a designated function code that will be used when creating a program with PCX software. The following is a list of these codes.

FUNCTION DESCRIPTION	FUNCTION CODE
GO HOME	H
WAIT FOR INPUT	W
DWELL TIME	D
UPDATE OUTPUTS	O
EXECUTE INDEX	I
EXECUTE PROGRAM	P
EXECUTE COMPOUND INDEX	C
END	E

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HOW TO CREATE A PROGRAM

A program sequence is created by listing the program functions in the order in which they are to be executed. PCX software provides a standard program format in which the program functions can be easily listed. The program sequence list is made up of single digit function codes designed to minimize the key strokes. The function codes are automatically described on the computer screen so the user can easily read through the program sequence. The function data (index numbers, program numbers, dwell times, etc.) is also displayed after each function description.

117 illustrates an example of the programming concepts.

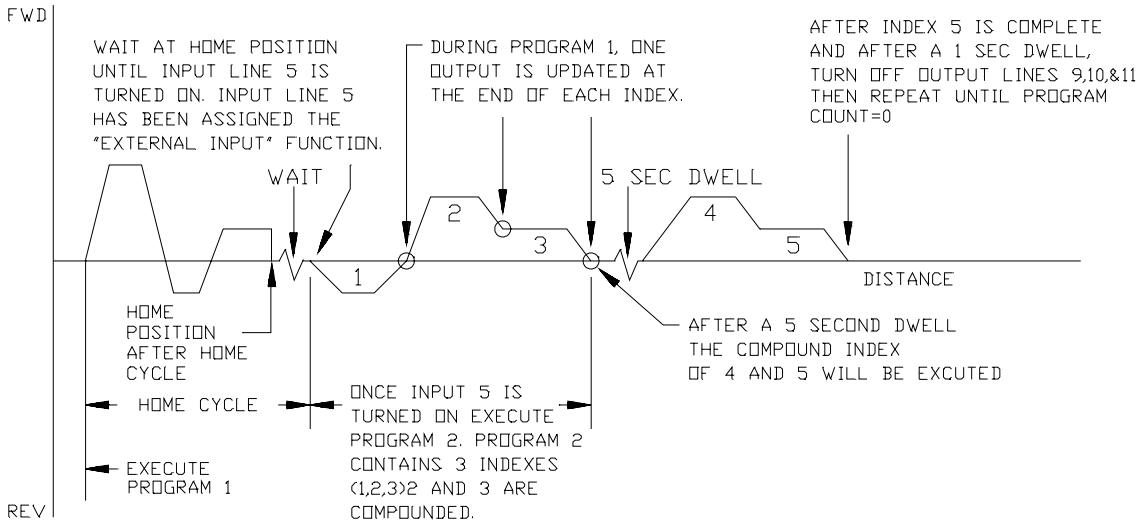


Figure 117 Sample Program

The selection of program and index numbers is arbitrary within the constraint of the memory capacity. The home cycles and indexes are pre-programmed prior to creating the desired program. The selection of inputs and outputs is pre-programmed. Programs provide the means of constructing a sequence. Although this sequence could be constructed using just one program, two programs are used to show the use of the execute program (P) commands. For this example, program numbers 1 and 2 are used and index numbers 1,2,3,4, and 5 are used.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The two PCX screens that show this example are shown in 118 & 119. These demonstrate how easily a motion program can be set up when using the PCX software. The user must first choose a program number between 0 and 63. Then the user must set the program count. The program count determines how many times the program will be executed. If the program number is set equal to zero, the program will not be executed; and if the program number is set equal to 65535, the program will be executed indefinitely. For this example, the program will be executed 10 times. Everything within Program 1 will repeat 10 times including Program 2.

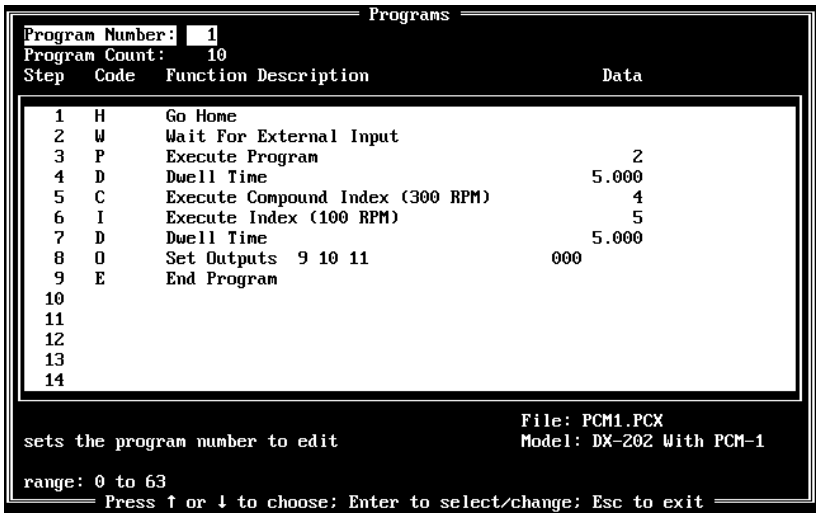


Figure 118 Programming

Program 2 is called from within Program 1 from step 3 of Program 1.

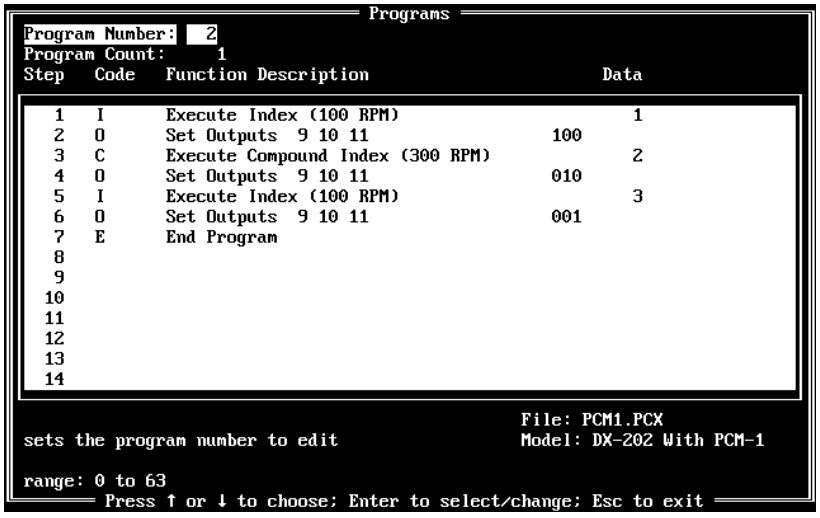


Figure 119 Programming

NOTE: COMMANDS "T","S",and "R" are not valid with a PCM-1.

The program sequence is stored in non-volatile memory under PROGRAM 1 and 2; shown in the upper left portion of the menu screen. After PROGRAM 1 is executed ten times (PROGRAM

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

COUNT =10), the controller will wait for the next command.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Before the UPDATE OUTPUTS function can be used, the output function "PROGRAMMABLE OUTPUTS (12)" must be assigned to the output lines. Once the outputs have been assigned, the UPDATE OUTPUTS will be valid. The data field for programmable outputs displays only the assigned output lines and is organized as shown below.

	DATA
	X X X X X X X X
SET OUTPUTS (9, 10, 11, 12, 21, 22, 23, 24)	9 10 11 12 21 22 23 24

For example, if output lines 9, 10 and 11 were to be updated, the data field would appear as follows:

	DATA
	X X X
SET OUTPUTS (9, 10, 11)	9 10 11

Each "X" would be a "1" or a "0", depending on how the outputs are set up. 1 = ON and 0 = OFF.

Like the UPDATE OUTPUTS function, the WAIT FOR INPUT function must have the input function EXTERNAL INPUT (28) assigned to an input line before WAIT FOR INPUT can be used as a program step.

Also, it should be noted that an index that is used in a compound index cannot be used again. If the user must use an identical index, it must be set up and stored under a new index number.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PROGRAMMING CAPABILITIES

Because there is a limited amount of non-volatile user memory, there are limitations to the number of available indexes, programs, and the average number of steps per program. The default number of available indexes is 256. The number of available programs and average number of steps per program are directly related to each other. The memory is set up such that should the user requires 64 programs (maximum), they can have an average of 15 program steps. The following table will illustrate this concept more clearly.

Table XVII Number of Required User Programs

NUMBER OF REQUIRED USER PROGRAMS	AVERAGE NUMBER OF AVAILABLE STEPS PER PROGRAM
1	1000
2	500
3	333
4	250
5	200
-	-
-	-
-	-
62	16
63	15
64	15

WHERE: AVERAGE NUMBER OF AVAILABLE STEPS = $\frac{1000}{\text{NUMBER OF PROGRAMS}}$

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SUSPEND/RESUME FUNCTIONS

Overview

The SUSPEND/RESUME functions included with the PCM-1 adds a powerful control structure to the unit when executing programs. The SUSPEND input may be used to temporarily suspend the current program that is executing. If operating in the serial control mode, an SP execution command will perform the same function. (A suspend will not be accepted while a hold cycle is active or while a previous suspend cycle is still active).

Once suspended, the controller will stop motion using the programmed stop/hold decel ramp, if necessary, and store the stopped position in the distance field of the current "RETURN TO POSITION" index. (This is INDEX 0 by default but may be changed, if desired, with the RI command.) The controller will remember the current task that was executing within the program and return control to the current execution mode.

At this point, the controller will accept and execute new motion commands (JOG, INDEX, HOME, PROGRAM) until a RESUME input is received. (If in serial control mode, a second SP execution command is used to resume.)

Once resumed, the controller will restart the original program with the task that was executing when the SUSPEND was received. If a DWELL cycle was executing, the remaining dwell time will begin to count down. If a HOME or ABSOLUTE INDEX was executing the home or index will be restarted from the beginning. If an INCREMENTAL INDEX was executing, the distance that was left to run in the index will now be completed. For the end point of the incremental index to match what would have been the original end point, the controller must be returned to where motion was suspended before issuing the RESUME command. This may be accomplished by executing the "return to position" index, placing the "return to position index" as the last motion step of a program executed during the suspend cycle, or by using the RETURN TO POSITION input in the external control mode. The user must insure that the "return to position" index is set up as an absolute index with the desired velocity/ramps used.

When the RESUME is accepted, the SUSPEND cycle is complete and another SUSPEND input will be accepted. Any STOP command will cancel an active SUSPEND cycle. A suspend cycle may also be cancelled with the CLEAR SUSPEND input or, in serial control mode, with the CL command. Clear commands will only be accepted when motion commands would be accepted (ie. when no other motion command is active).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Extended Suspend/Resume Programming

There are additional features available for use with programs concerning the suspend and resume capabilities. These features may be accessed by PCX when setting up any PCM module except for the PCM-3. When entering the "Define Motion" screen in PCX, the Suspend option appears just below the Programs option.



Figure 120 Suspend/Resume Programming

Upon selection of the Suspend option, the Suspend data entry screen is displayed.

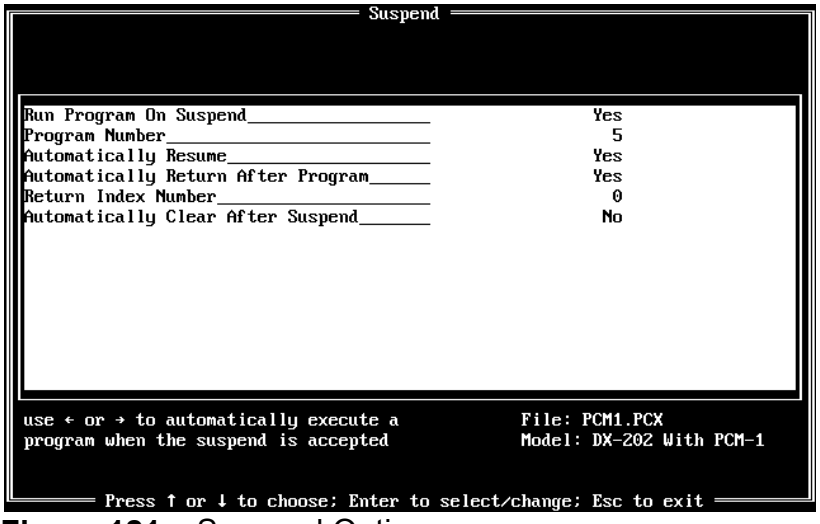


Figure 121 Suspend Option

Run Program On Suspend

This feature allows another program to be automatically initiated when a suspend is accepted. After stopping, the program specified by the "Program Number" will be executed without the need for a program initiate.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program Number

This value determines which program is to be initiated when a suspend is accepted and the "Run Program On Suspend" feature is used.

Automatically Resume

This feature will allow the controller to resume a suspended program without the need for a resume input. When used with the "Run Program On Suspend" feature, the automatic program will be executed before the automatic resume occurs.

Automatically Return After Program

This feature allows the "Return Index Number" index to be automatically initiated when a resume input is accepted. When a suspend input is accepted and the motor stops, the current position is stored in the index position specified by the "Return Index Number" value. When this index is setup as an absolute index with a count, the motor will return to the position where the suspend occurred and then will continue with the original program.

Return Index Number

This value determines which index is to be initiated when a resume is accepted and the "Automatically Return After Program" feature is used. When a suspend input is accepted, the current position will be saved to this index. All other index information should be setup by the user.

Automatically Clear After Suspend

This feature may be used to automatically terminate a suspend cycle. When used with the "Run Program On Suspend" feature, the automatic program will be executed before the automatic clear occurs. Once a suspend cycle is cleared, the original program will not be resumed and the controller will be free to accept another suspend input. When this feature is not used, a resume input is needed to clear the suspend cycle.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INSTALLATION AND CONNECTIONS OF PCM-5

INTRODUCTION

The PCM-5 allows for memory and I/O expansion, compound indexing, program storage and synchronization of an axis or multiple axis to an external lead axis. The installation of the PCM-5 module is made easy by a direct "plug-in" design. All the electrical connections between the basic digital drive and either module are made via the 48 position connectors. Figure 1 shows how the 48-pin connectors mate on the Positioning Drive. This is the only electrical connection required between the two units. Once plugged in, the top and bottom handles snap into position to secure the module to the drive.

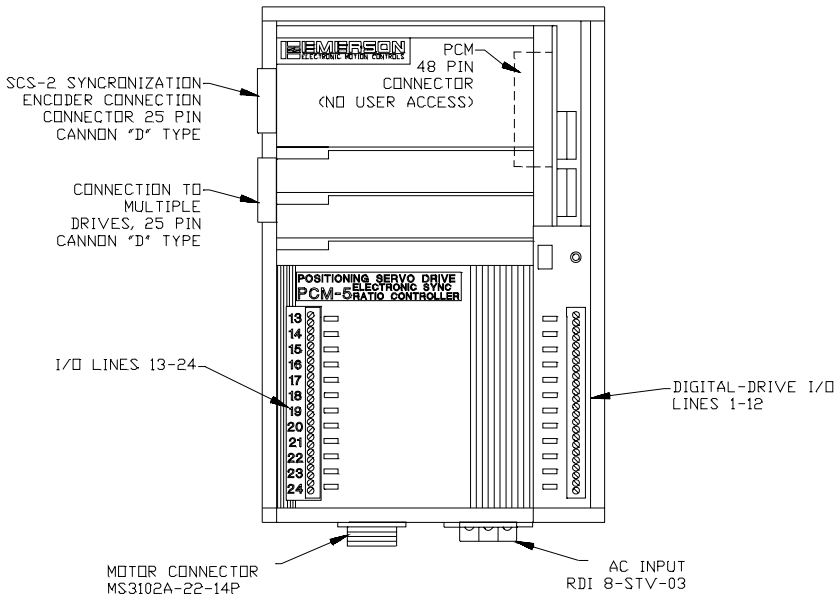


Figure 122 PCM-5 Installation & Connections

The input and output connections are split between two terminal strips; one strip on the PCM module #13-24 and one on the digital drive #1-12. Each strip consists of 8 input lines and 4 output lines.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SYNCHRONIZATION CABLE (ENCODER TO 1ST AXIS) MSC-XXX

If an external encoder is used as the method of accomplishing synchronization. As many as 10 axis can be synchronized to this encoder. The connection of the external encoder to the first axis is accomplished with this sync cable. (see 123)

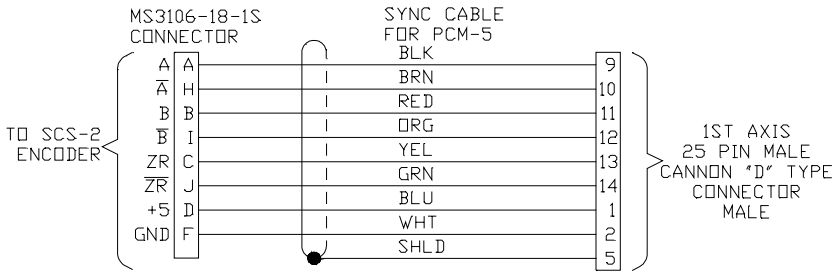


Figure 123 MSC-XXX Cable

The MSC-XXX cable is provided in different lengths.

MSC-015	15 FT.
MSC-025	25 FT.
MSC-050	50 FT.

For some applications, it may be an advantage to not have an external encoder as the source of synchronization. Instead, another digital drive could be the source. This is the purpose of the second connector on the PCM-5.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

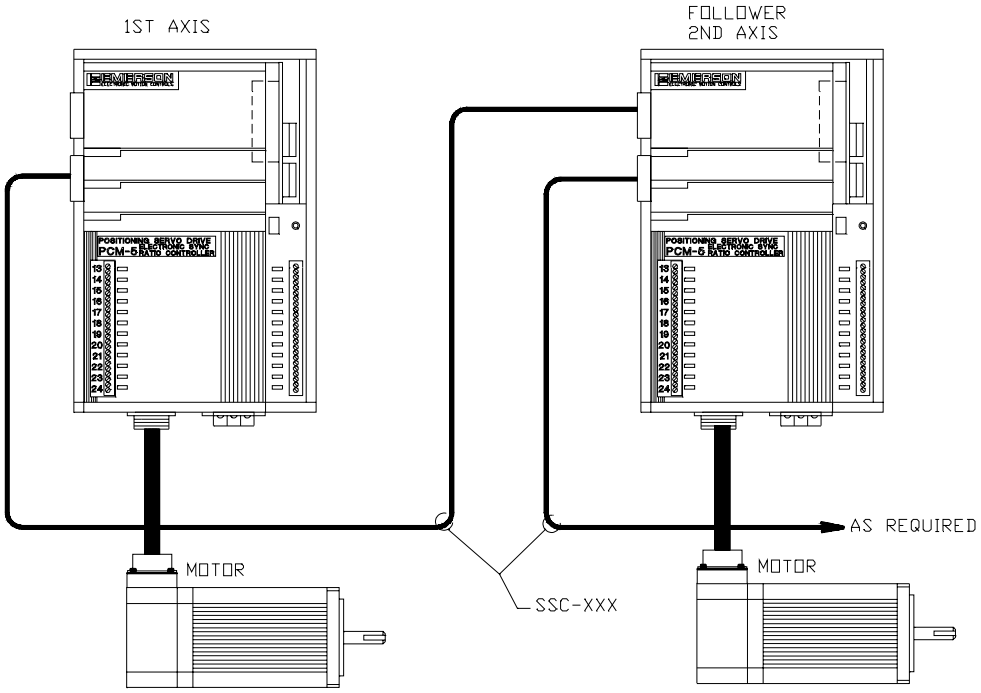


Figure 124 2nd Axis application/PCM-5

The first axis can provide the source of synchronization for the second axis. The interconnecting cable for this is an SSC-XXX cable and is available in different lengths.

SSC-003	3 FT.
SSC-006	6 FT.
SSC-010	10 FT.

The SSC-XXX cable is basically a symmetrical cable and its ends can be interchanged.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

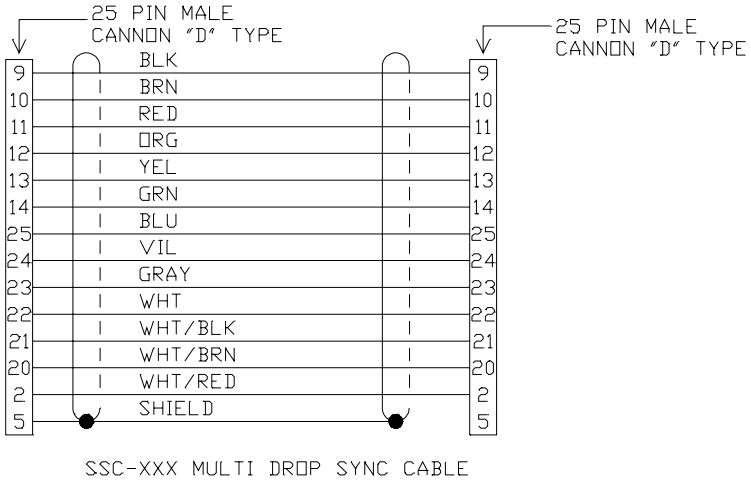
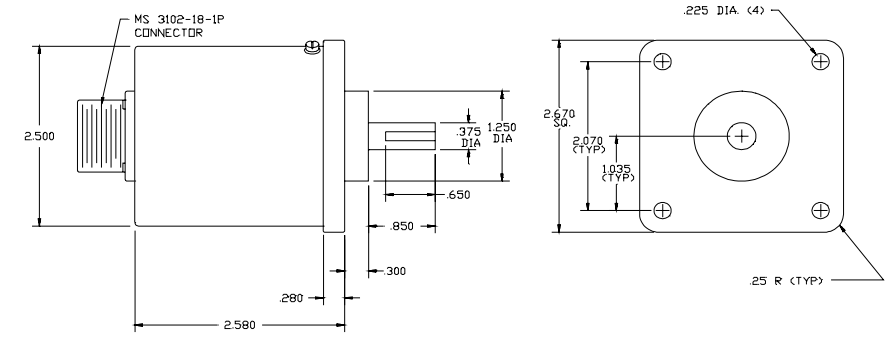


Figure 125 SSC-XXX Multi Drop Sync Cable

SCS-2 SYNC ENCODER - MECHANICAL AND ELECTRICAL



SPECIFICATIONS:

POWER REQUIREMENTS: 5VDC ±5%, .2 AMPS MAX.
SIGNAL CODE: 2 CHANNEL AMPLIFIED SINE, MARK COMPLIMENTARY
RESOLUTION: 1,000 LINES PER CHANNEL PER REVOLUTION
OUTPUT: OP-AMP.

CONNECTOR: MS 3102-18-1P

PIN	SIGNAL
A	A
B	B
C	ZR
D	+5
E	
F	GND
G	
H	$\overline{A}$
I	$\overline{B}$
J	$\overline{ZR}$

MATING CONNECTOR
MS 3106-18-1S

MECHANICAL CHARACTERISTICS

MAX SPEED: 3000 RPM
AXIAL LOAD: 40 LBS
RADIAL LOAD: 35 LBS
RUN OUT: .0005"
INERTIA: 4.1×10^{-4} OZ IN. SEC.^{2}

ENVIRONMENTAL CHARACTERISTICS

OPERATING TEMPERATURE: 0° TO 70° C
RELATIVE HUMIDITY: 0% TO 95% NON-CONDENSING

Figure 126 SCS-2 Encoder Mech/Ele Info.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

BASIC OPERATION

The external lead axis can, by programming, become the basic source for motion control of a second follower axis. Most of the capabilities of the IOM and PCM-1 are available with one additional input function (JOG SYNC) added and two additional outputs (AT SYNC) and (SYNC FAULT) added. The basis of operation is determined by the relationship of the external lead encoder, or drive, to the follower axis drive motor. The relationship is established based on the programmable ratio of follower axis turns to lead axis turns over a programmable sync ratio range of (.125 to 20). For example, if the user programs a sync ratio of "2", what is being asked is for two turns of the follower axis for every one turn of the lead.

The SCS-2 sync encoder is a two channel amplified sine wave encoder. Each of the channels has 1000 lines. The PCM-2 inputs are A, A {compliment}, B and B {compliment}. Quadrature encoding of these two signals produces a 4 times result so that one revolution of the sync encoder produces the equivalent of 4000 counts/steps per revolution. For resolving distance counting from the sync encoder, 4000 counts per turn becomes important.

The base number system used for the digital drive is binary and 12 bits. Resolution is one part in 4096. Since this number may be difficult to work with because of units, the drive electronics allow for a conversion of this to any number from 200 to 25,000 with the default being 4000. This is provided as a means to achieve meaningful units. When a follower axis is receiving its synchronization source from a digital drive lead axis, then the count source becomes the binary 4096 counts per turn.

There are mathematical limitations and hardware limitations to the precision of the ratio feature. An example is provided. The drive uses a term SR1. To compute the relationship (SR1 can be any whole integer from 200 to 32,000). The PCX software provides a user friendly conversion by asking for the number of follower turns wanted to equal lead turns. The formula which PCX uses is:

$$\frac{N}{(\text{TURNS})} = SR1$$

N = 4000 if lead count source is an encoder
= 4096 if lead count source is another digital drive

TURNS is the number you enter from PCX.

Consider you enter: 3.000

$$\frac{4000}{3} \text{ (Assume encoder for N)} = 1333\ 1/3 = SR1$$

But SR1 must be a whole integer between a range of 200 to 32,000 so PCX will use 1333 for the value going to the drive for SR1 and replace the value 3.000 you programmed with 3.0007502 -> {infinity}. PCX will also inform you that a perfect match does not exist The number 4000 in the above example is a constant based on the SCS-2 encoder. This constant changes to 4096 if you select the lead axis to be a digital drive.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Some Application Examples are:

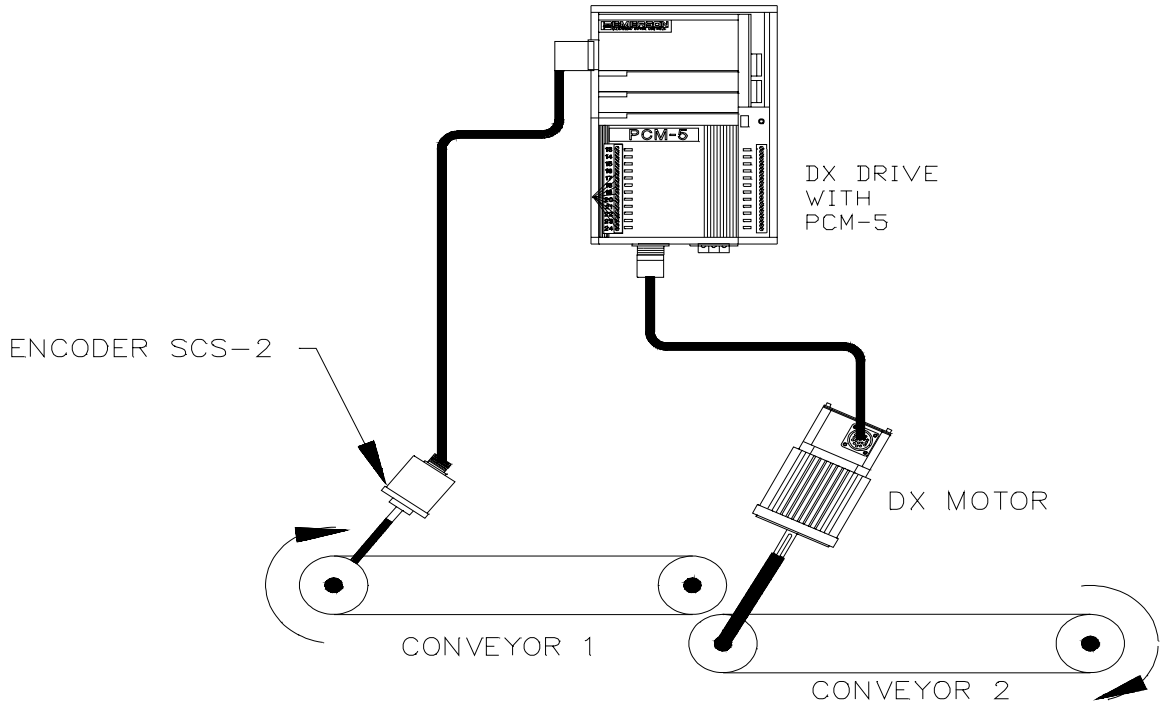


Figure 127 Conveyor Application W/PCM-5

Conveyor 1 and conveyor 2 must run at the same surface velocity. Conveyor 1 is driven with a simple variable speed drive.

Solution: Mount the SCS-2 sync encoder on conveyor 1 and use the drive with the PCM-5 for conveyor 2.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

To synchronize a second drive to a first drive, both the lead and follower axis would be equipped with a PCM-5.

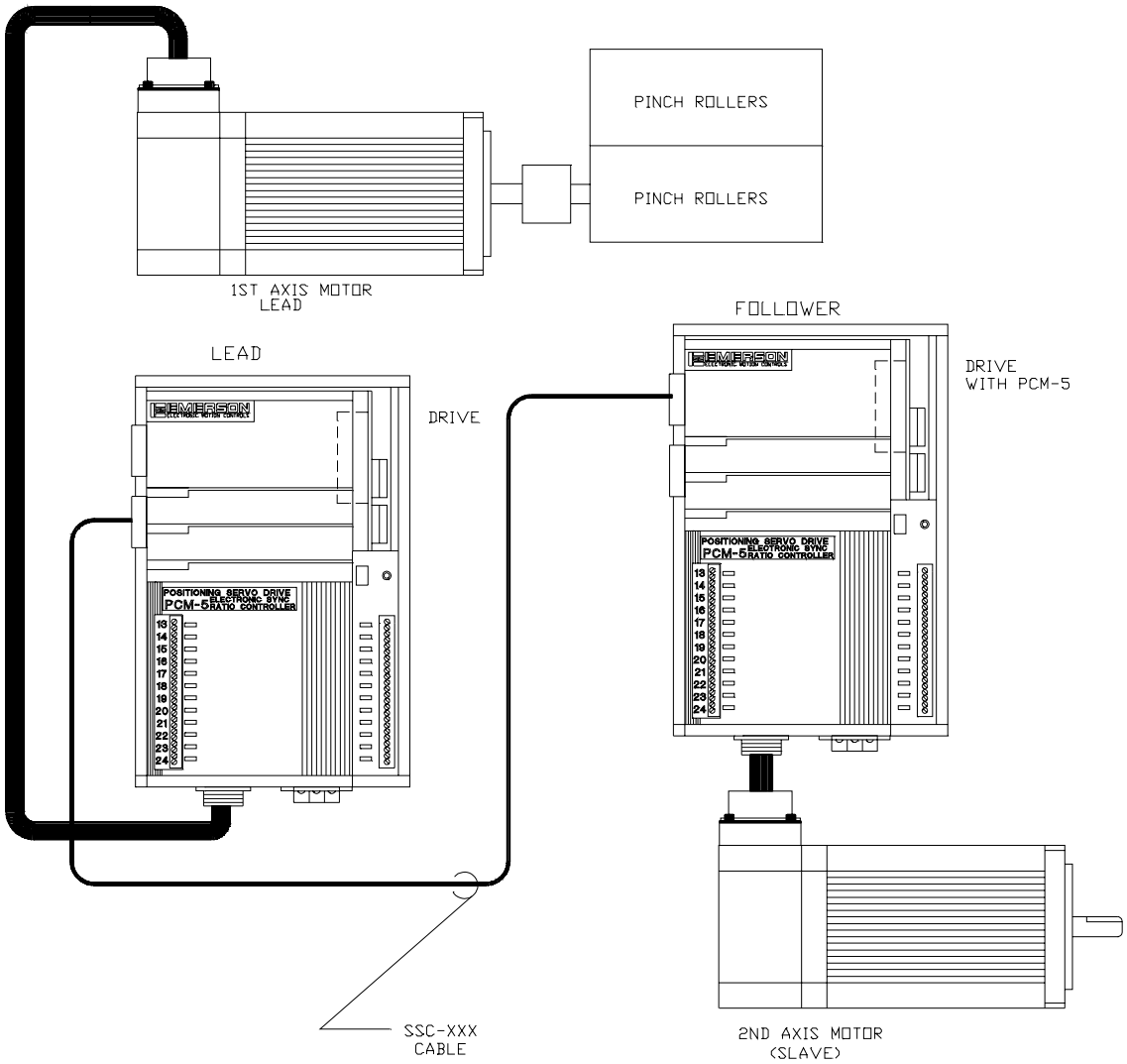


Figure 128 PCM-5 Application (Second Drive)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

If multiple axis of drives are to be synchronized or ratioed to a lead encoder, than all axes would be equipped with a PCM-5. The lead encoder signals would effectively be in parallel.

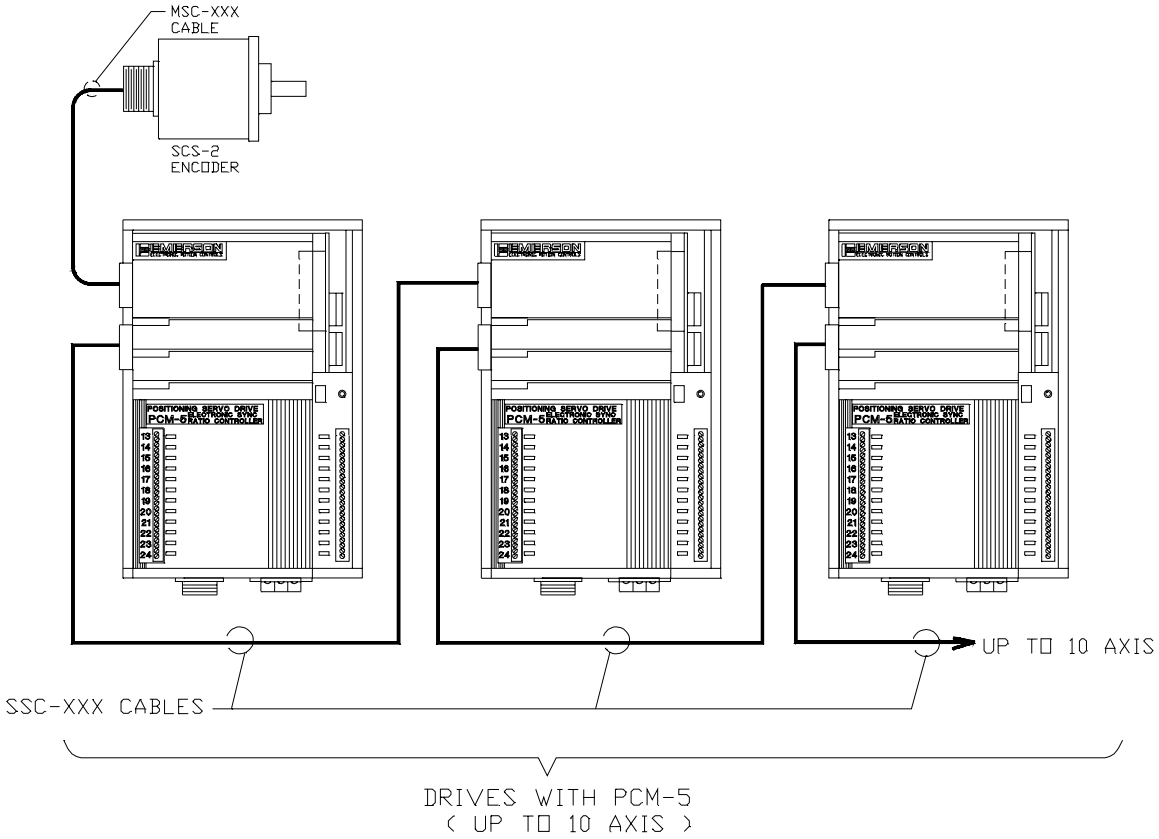


Figure 129 PMC-5 Application (Multiple Axes)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

One of the most common applications of synchronization is to accomplish synchronization a repetitive number of times based on a programmable number of pulses/counts from an external lead axis (encoder or digital drive). For these applications, with the PCM-5 properly programmed, the encoder can provide both synchronization control and the PCM-5 can be programmed to cause automatic cycle initiations at the completion of a programmable number of external axis counts. This is accomplished in the program set up mode with PCX. There are three additional codes that allow for this.

A (T) code allows you to insert (in front of an INDEX, PROGRAM, or DWELL), a choice for a time base. T = Time Base (TMBAS) and your choice is internal, being normal, or external, meaning the external encoder.

A (S) code allows you to start counting the external encoder pulses. The SCS-2 with 2 (1000 line) channels produces 4000 counts/steps per revolution. S = Start Counter (ST CT).

An (R) code allows you to wait for the desired number of counts before starting again. R = Wait for counter (WT CNT). When programming the (R) code you must program the desired number of counts in the data field and counting is determined by CW (+) rotation of the sync encoder as viewed from the shaft end of the sync encoder and CCW (-) counting is the opposite. The count is based from the last start external counter (S) or wait for counter (R) code.

A specific application of this is a flying shear cut where a ball screw is connected to an EMC motor and a drive with a PCM-5. The lead encoder is connected to a shaft that rotates pinch rolls. Material is fed through the pinch rolls at varying line feed speeds. The drive must start from a HOME position (a Positioning Drive feature), accelerate to the same linear velocity as the material (a PCM-5 feature), perform a machine operation such as cut, punch, print, etc., at line speed, then decelerate to zero velocity and return to the starting place by either homing or indexing back. Once back, it must wait for re-initiation from a programmed count (a PCM-5 feature).

The motion cycle would appear as follows.

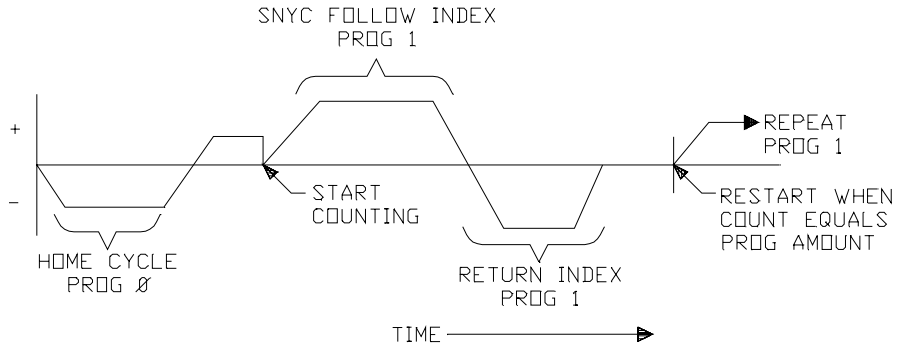


Figure 130 Motion Cycle Graph

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The cycle is accomplished by using two programs.

Program 0/ contains a HOME, initializes the external counter for the first count, and then executes Program 1.

Program 1 contains the T = Time Base (EXT) I = INDEX, (sync Index), T = Time Base (INT), I = INDEX (return to HOME), and R = wait for count. Program 0/ would have a count of 1 and Program 1 would be programmed to count forever. The values for XX in the data field of the index are the selected index numbers.

Initiation of Program 0/ starts the cycle.

Table XVIII Added Output Functions

	STEP	CODE	FUNCTION	DATA	
PROG	1	H	HOME		
0/	2	S	START EXTERNAL COUNTER		
COUNT=1	3	P	EXECUTE PROGRAM		1
	4	E	END		
	1	T	TIME BASE	ENCODER	
	2	I	INDEX (SYNC)		XX
PROG	3	T	TIME BASE	INTERNAL	
1	4	I	INDEX (BACK TO HOME)		XX
COUNT=	5	R	WAIT FOR EXTERNAL COUNT		+/-XXXXXXX
{INFINITY} 6	E	END			

This same example provides the best description of the added output functions at SYNC and SYNC FAULT. The at SYNC output would come on at the end of acceleration of the first index in program 1 and could be used as an initiation source for external control. The SYNC FAULT would come on if the WAIT FOR EXTERNAL COUNT program step was encountered and the specified count had already accumulated in the counting registers. This is an indication that the unit was not back to the HOME position in time to initiate the next auto restart (i.e., the cycle is too short or the return is too slow). The SYNC FAULT output will be reset when either the CLEAR FAULT input or the RESET push button are activated.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

BI-POLAR SYNCHRONIZATION

A special feature of the PCM-5 is Bi-Polar Synchronization. The added input enables this mode. In this mode of operation a complete bi-polar mode of following exists between the lead axis and follower axis. In other words, clockwise rotation of the lead axis causes CW rotation of the follower drive motor and CCW rotation causes CCW motor motion. The ratio between the two is programmable by the value of the sync ratio in the drive parameter setup with PCX. The range is (.125 to 20) turns of the follower axis to 1 turn of the lead axis. The lead axis can be either an external encoder or digital drive.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

INPUT/OUTPUT INTERFACE

OVERVIEW

The PCM-5 is equipped with 8 inputs and 4 outputs which are optically isolated for +10 to +30 vdc operation. Each input and output has 2 screw terminals associated with it to provide for either sinking or sourcing operation. The first 8 pairs of designated terminals are inputs and the last 4 pairs of terminals are outputs. The outputs are capable of sinking or sourcing 200 mA. The user is responsible for limiting the output current to less than or equal to 200 mA.

Adding the PCM-5 module will double the I/O capabilities of the standard digital drive. The number of input lines are increased from 8 to 16 and the number of output lines is increased from 4 to 8.

These inputs and outputs allow for proper timing and coordination between the drive's motion and other machine control functions. The inputs and outputs typically are connected to the machine's programmable logic controller (PLC) or relay logic system. These inputs and outputs are also connected to limit switches, and/or switches and indicators on an operator's control panel.

A large number of input/output control functions are provided. The functions used are assigned to any of the input/output lines. This is accomplished through either serial interface commands or by using the PCX software provided with the drive. Inputs may be programmed as normally off or normally on. In addition, more than one function may be assigned to the same input line. After the I/O lines have been set to the desired configuration, power should be cycled to the drive to ensure proper I/O operation. Each drive comes from the factory with the inputs and outputs predefined for frequently used I/O configurations.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

An LED indicator is associated with each input and output. The input and output indicators are on if current is flowing in the associated line.

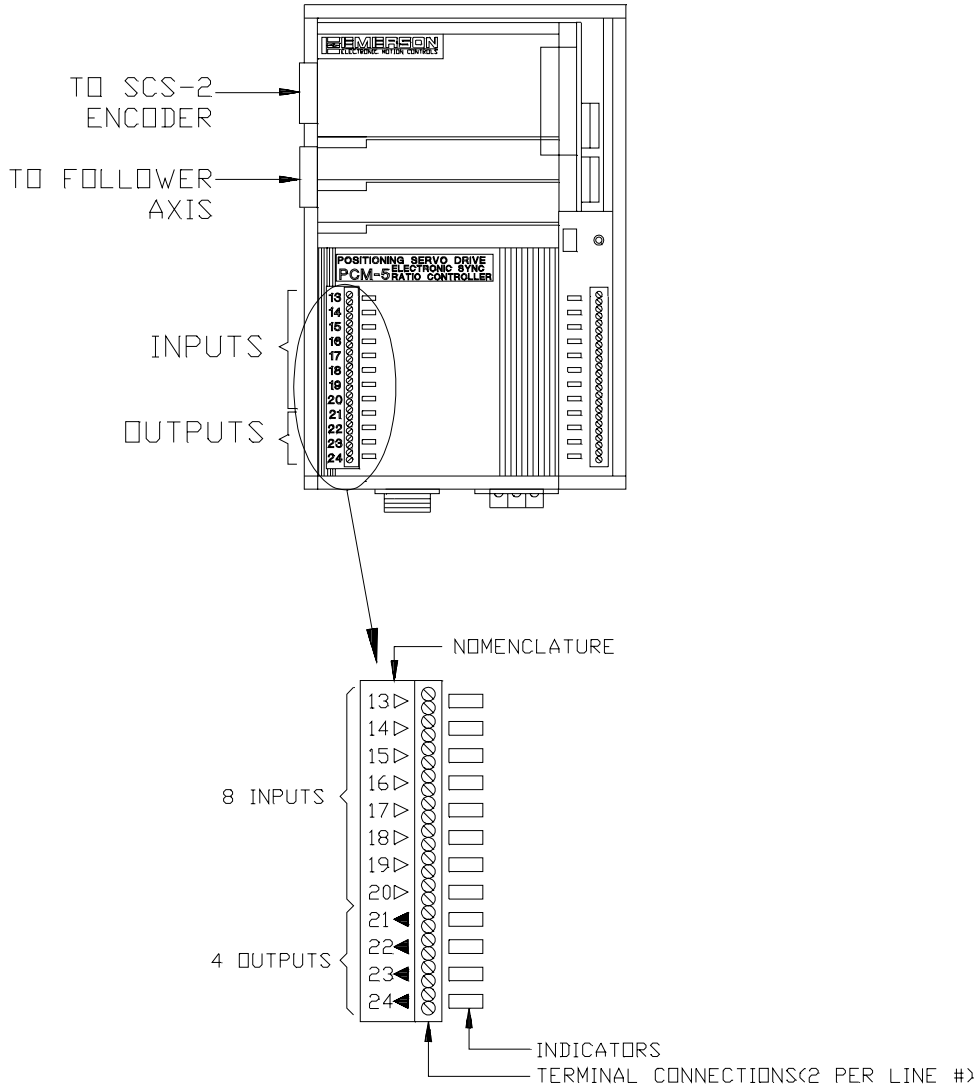


Figure 131 I/O Nomenclature (PCM-5)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

Following is the list of output functions provided with the drive and PCM-5.

OUTPUT FUNCTION #	BASIC DRIVE ONLY	DRIVE WITH PCM-5
0-READY	X	X
1-EXTERNAL MODE	X	X
2-IN MOTION	X	X
3-END OF INDEX	X	X
4-END OF HOME	X	X
5-END OF INDEX COUNT	X	X
6-HARDWARE FAULT	X	X
7-TRAVEL LIMIT FAULT	X	X
8-FOLLOWING ERROR FAULT	X	X
9-HOME COMPLETED	X	X
10-SENSOR LIMIT HIT	X	X
11-END OF SEQUENCE		X
12-PROGRAMMABLE OUTPUTS		X
13-END OF PROGRAM		X
14-END PROGRAM COUNT		X
15-IN SUSPEND		X
16-RESERVED		
17-AT SYNC		X
18-SYNC FAULT		X

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Input Functions

The following list of input functions are available for use in providing control through the standard I/O interface. With the expansion of the PCM-5, fourteen more input functions are available.

INPUT FUNCTION #	BASIC DRIVE ONLY	PCM-5	DRIVE WITH
0-INDEX INITIATE	X		X
1-HOME INITIATE	X	X	
2-CLEAR TO INITIATE	X	X	
3-HOLD INDEX/HOME MOTION	X	X	
4-JOG	X	X	
5-JOG CW	X	X	
6-JOG CCW	X	X	
7-JOG DIRECTION	X	X	
8-SLOW JOG	X	X	
9-CW TRAVEL LIMIT	X	X	
10-CCW TRAVEL LIMIT	X	X	
11-STOP MOTION	X	X	
12-INHIBIT (DRIVE)	X	X	
13-BRAKE OVERRIDE	X	X	
14-INDEX SELECT	X	X	
15-HOME SENSOR	X	X	
16-FEED SENSOR	X	X	
17-CLEAR END OF INDEX	X	X	
18-CLEAR END OF HOME	X	X	
19-CLEAR END OF INDEX COUNT	X	X	
20-CLEAR SENSOR LIMIT	X	X	
21-CLEAR FAULT	X	X	
22-ZERO POSITION		X	
23-ZERO DISPLAY		X	
24-REMEMBER POSITION		X	
25-RETURN TO POSITION		X	
26-CLEAR END OF SEQUENCE		X	
27-CLEAR PROGRAM OUTPUTS		X	
28-EXTERNAL INPUT		X	
29-PROGRAM INITIATE		X	
30-PROGRAM SELECT		X	
31-SUSPEND PROGRAM		X	
32-RESUME PROGRAM		X	
33-CLEAR SUSPEND		X	
34-CLEAR END OF PROGRAM		X	
35-CLEAR END PROGRAM COUNT		X	
36-RESERVED			
37-RESERVED			

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

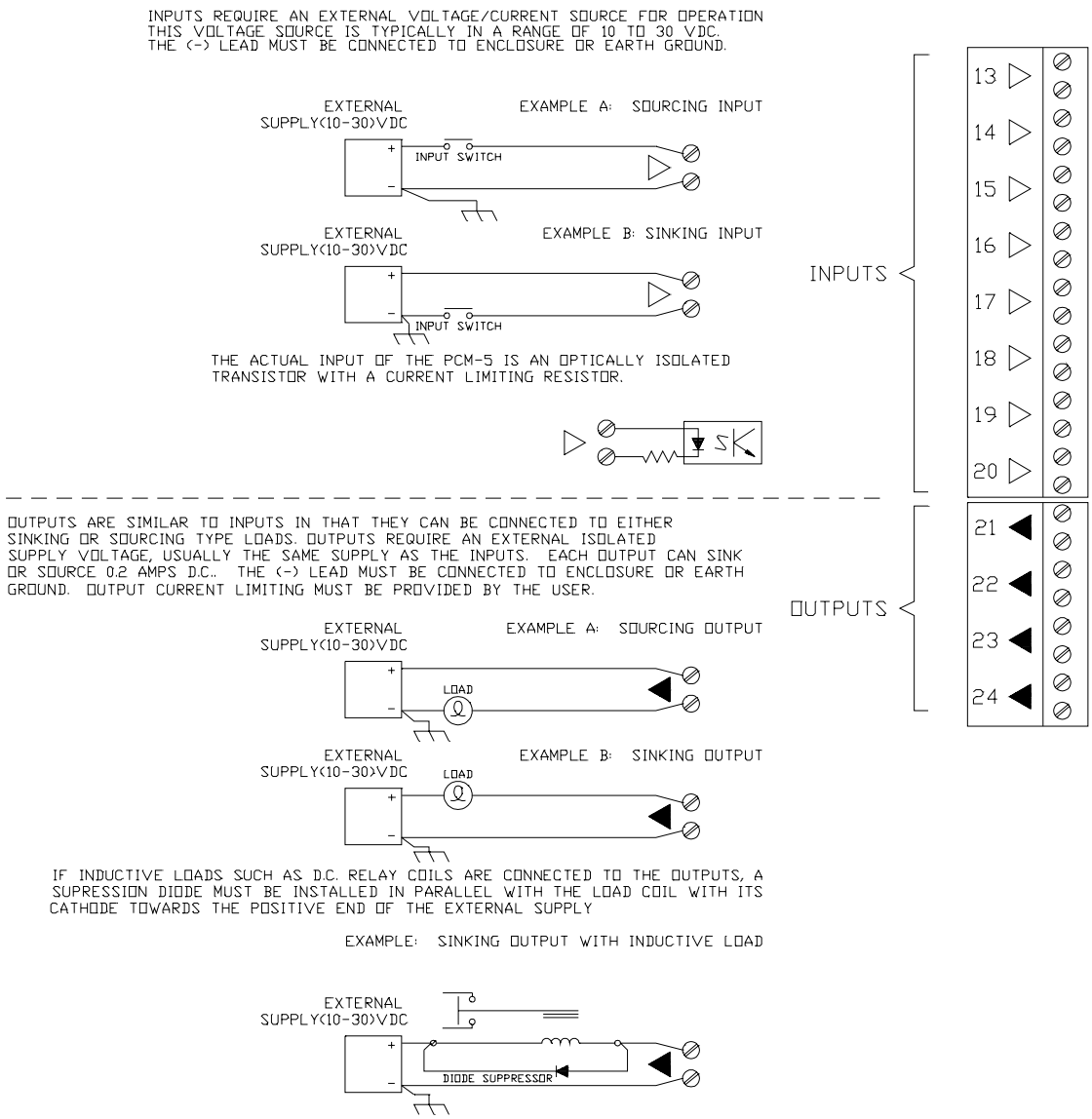


Figure 132 Examples Of I/O To PCM-5

NOTE: 18 to 24 gauge wire must be used for I/O wiring. The use of larger gauge wire will cause the I/O terminals to prematurely fatigue.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Detailed Descriptions of Additional I/O Functions With the PCM-5

Input Functions

FUNCTION #	DESCRIPTION

22 ZERO POSITION

Sets the current position of the motor to zero. All absolute positions will be referenced to this set zero position.

23 ZERO DISPLAY

This zeroes all position query commands (FP and CP), they become zero and are referenced to this point. Absolute position is unaffected.

24 REMEMBER POSITION

Stores the current position of an absolute index.

25 RETURN TO POSITION

Returns to the position defined by REMEMBER POSITION.

26 CLEAR END OF SEQUENCE OUTPUT

Clears the END OF SEQUENCE output. If not assigned, the END OF SEQUENCE output will automatically clear when the next motion occurs.

27 CLEAR PROGRAMMABLE OUTPUT

Clears a (PROGRAMMABLE OUTPUT). Each assigned PROGRAMMABLE OUTPUT will require a separate CLEAR PROGRAMMABLE OUTPUT.

28 EXTERNAL INPUT

Used with the WAIT FOR INPUT program function to stop program execution until the input line assigned with EXTERNAL INPUT is activated.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

29 PROGRAM INITIATE

Executes the selected program.

30 PROGRAM SELECT LINES

Sets the starting input line number for a given number of program select lines. Then the number of program select lines is programmed through PCX or serial commands.

31 SUSPEND PROGRAM

Stops the execution of a program until the input line assigned with RESUME is activated.

Also see I/O Suspend Resume Feature Section.

32 RESUME PROGRAM

Resumes the execution of a suspended program.

Also see I/O Suspend Resume Feature Section.

33 CLEAR SUSPEND

Clears the IN SUSPEND output and returns the drive from a suspend cycle to normal operation without the need to "RESUME" and completes the suspended program.

Also see I/O Suspend Resume Feature Section.

34 CLEAR END OF PROGRAM OUTPUT

Clears the END OF PROGRAM output. If not assigned, the END OF PROGRAM output will automatically clear when further motion is initiated.

35 CLEAR END OF PROGRAM COUNT

Clears the END OF PROGRAM output. If not assigned, the END OF PROGRAM output will automatically clear when the next motion occurs.

38 BI-POLAR SYNC

An active input allows for BI-POLAR ratioing of the sync encoder to the drive motor.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Output Functions

FUNCTION#	DESCRIPTION

11 END OF SEQUENCE

This output comes ON after the completion of a motion sequence. A motion sequence is completed when a HOME, INDEX, and/or PROGRAM or a combination thereof, is executed and no further motion commands are given. This output turns OFF automatically with the next motion or when the CLEAR END OF SEQUENCE is used.

12 PROGRAMMABLE OUTPUTS

The output lines assigned this function can be turned ON or OFF with the UPDATE OUTPUTS programming function.

13 END OF PROGRAM

This output comes ON after each completion of a PROGRAM. It turns OFF automatically with the next motion or when the CLEAR END OF PROGRAM is used.

14 END OF PROGRAM COUNT

This output comes ON only after a program is executed the number of times specified by the PROGRAM COUNT. It is turned OFF automatically with the next motion or when the CLEAR END OF PROGRAM COUNT is used.

15 IN SUSPEND

This output is ON when the SUSPEND PROGRAM input function is active.
Also see I/O Suspend Resume Feature Section.

17 AT SYNC

This output is on AT SYNC speed match as determined by the programmed ratio.

18 SYNC FAULT

If an auto cycle restart is used based on external encoder counts, this fault occurs if the count register is satisfied when a WAIT FOR EXTERNAL COUNT program step is encountered. This output is cleared with the CLEAR FAULT input or the RESET

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

pushbutton.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ADDITIONAL PCM-5 PROGRAMMING

PARAMETERS

Five additional questions can be answered when using a PCM-5 with a drive.

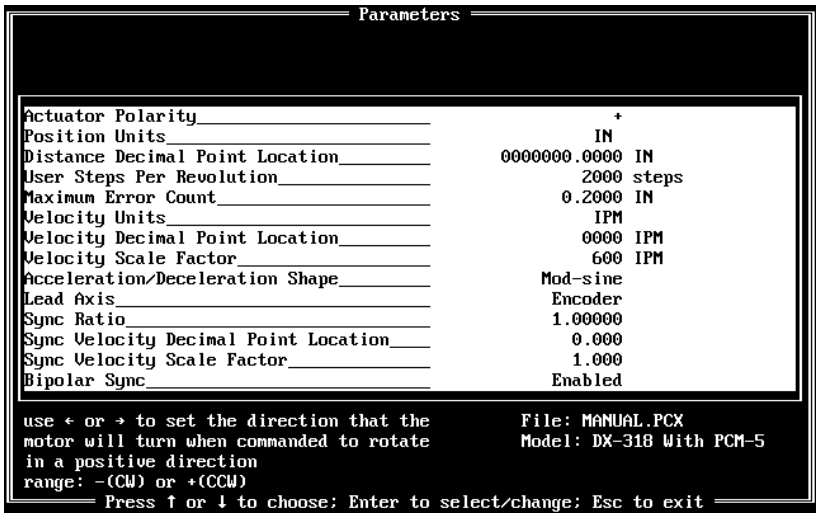


Figure 133 PCM-5 Drive Parameters

LEAD AXIS

The default condition (ENC) means that the SCS-2 will generate the sync pulses. Selecting (DRV) means that the lead axis is a digital drive.

SYNC RATIO

SYNC RATIO establishes the relationship of the follower axis to the lead axis. The relationship to establish is: How many turns of the follower axis equal one turn of the lead? The range is programmable from (.125 to 20) turns. Since, in a digital system, counting is based on bits with no way to resolve numbers between these bits, infinite resolution is not possible. PCX will convert, if required, your entry to the closest possible ratio. Since the standard SCS-2 encoder produces 4000 counts per revolution,and a digital drive is based on 12 bits binary (4096) then 4000 or 4096, become constants in the calculation. The digital drive through serial control, needs a numeric value in a range of 200 - 32,000. This is stored as "SR1". The relationship of these terms is

$$SR1 = \frac{N}{\text{TURNS OF FOLLOWER AXIS TO TURNS OF LEAD AXIS}}$$

WHERE N IS 4000 IF LEAD AXIS IS AN ENCODER
WHERE N IS 4096 IF LEAD AXIS IS A DIGITAL DRIVE

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PCX allows the more user friendly turns to be entered by transposing.

$$\frac{N}{TURNS} = SR1$$

And then sends to the drive the required value of SR1. If the computed value of SR1 has a fractional remainder, it will round it off and display the closest possible value to your entry.

Example:

You enter a value of 3, meaning you would like 3 turns of the follower axis for every turn of the lead.

PCX computes

$$\frac{4000}{3}\text{(Assume encoder for lead axis)} = 1333\ 1/3$$

The 1/3 is dropped

$$\frac{4000}{1333} = 3.0007502 = TURNS$$

This is the closest possible ratio based on an SR1 of 1333 and an encoder of 4000.

SYNC VELOCITY SCALE FACTOR AND SYNC VELOCITY DECIMAL POINT

These setups are provided for programming velocities which are used for synchronization. When using the sync feature, the motor's speed is a ratio of the lead axis speed. The default values are 1000 for sync scale factor with 3 as the decimal point. This produces a sync velocity of 1.000 for programming INDEX and HOME. What this means is, that when synchronization of follower axis and motor occurs (based on your sync ratio), you are at 1 to 1. These numbers can change to suit your application.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

BI-POLAR SYNC ENABLED

If this is answered with a yes (Y), the motor will follow the sync encoder at the programmed sync ratio if the bi-polar sync input is programmed and active.

INDEX, HOME

With a PCM-5, one additional question of TIME BASE (INT/EXT) can be answered.

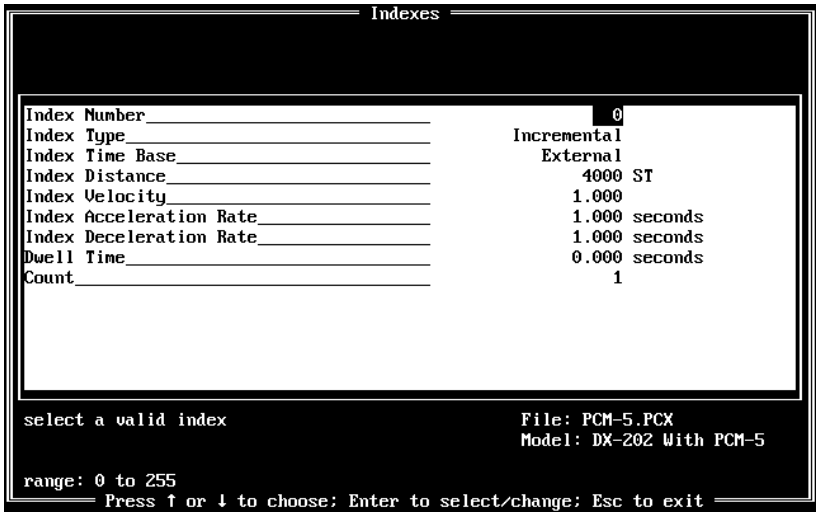


Figure 134 Index (PCM-5)

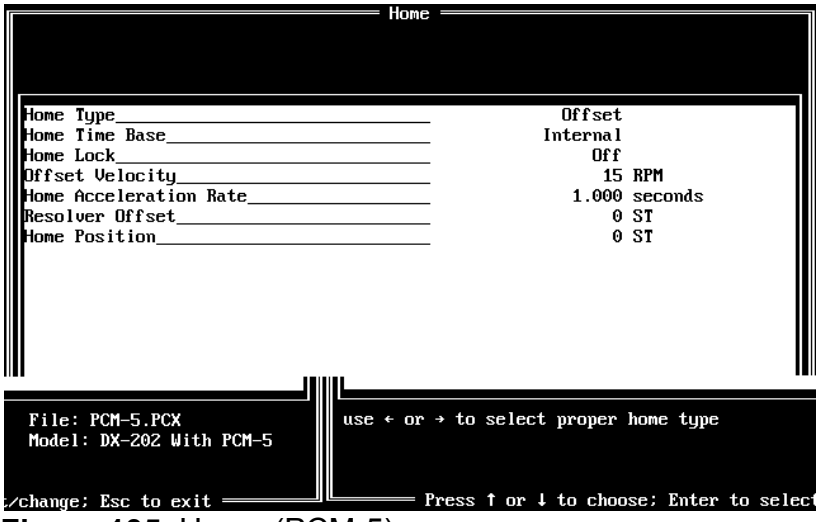


Figure 135 Home (PCM-5)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The TIME BASE (EXT/INT) relates to the velocity scale factor and decimal point pre-determined by drive parameters and is for display and programming purposes. If the TIME BASE is external, meaning you want sync, then you would program based on the sync scale factor. This becomes a more useful item when using INDEXes and HOMEs in programs. The program screens will show the chosen scale factors based on INT or EXT.

PROGRAMS

Several added features are shown on the program screen.

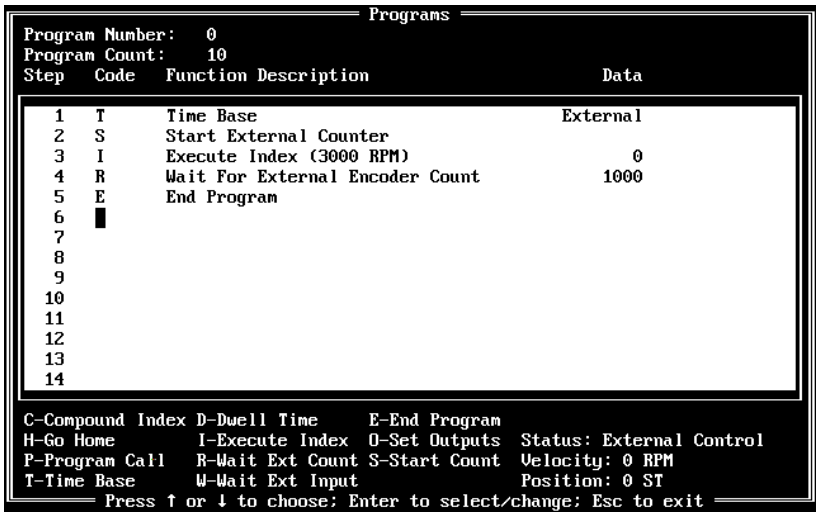


Figure 136 Program (PCM-5)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Three new codes are added.

T = TIME BASE (TMBAS)

This code determines whether the TIME BASE is external (sync encoder) or internal (normal) for anything after it, including DWELLs and HOMEs. It is important to remember that if you want just one thing done in sync, that you restore the TIME BASE to internal.

Example:

Table XIX PCM-5 Function (TIME BASE)

STEP	CODE	FUNCTION		DATA
1	T	TIME BASE	EXT	
2	I	INDEX (SCALE FACTOR)		XX
3	T	TIME BASE	INT	
4	E	END		

The XX in the data field for the STEP 2 INDEX is to specify what index number. When programming this index, you would choose what scale factor you wanted for display purposes. This program sample would (regardless of scale factor) cause this index to be ratioed to the sync encoder by the sync ratio turns determined in drive parameters. This happens because of the TIME BASE = EXT for STEP 1. At the end of the index, you would immediately be returned to the internal TIME BASE (NORMAL) because of STEP 3 TIME BASE = INT.

S = START COUNTER (ST CT)
R = WAIT FOR COUNT (WTCNT)

For repetitive synchronization of indexes based on a fixed number of counts from the external encoder, these two codes are provided

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table XX PCM-5 Function (S = START COUNTER (ST CT)

PROG COUNT 10

STEP	CODE	FUNCTION		DATA
1	S	START COUNTER		
2	T	TIME BASE	EXT	
3	I	INDEX (SCALE FACTOR)		XX
4	T	TIME BASE	INT	
5	I	INDEX (SCALE FACTOR)		YY
6	R	WAIT FOR ENCODER COUNT		+/-
(NUM)				

This program example would start a counter, execute a synchronized index specified by XX, execute a normal index specified by YY, and wait for the programmed count. As soon as the count is satisfied, the program would repeat 10 times because of the program count of 10. The encoder count is based on the SCS-2 encoder producing 4000 counts per revolution. Plus/minus (+/-) are determined by the physical rotation of the SCS-2. Plus (+) is CW rotation of the encoder as viewed from the shaft end.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERIAL INTERFACE

The Positioning Drive includes extensive capability for providing two way communication with an external intelligent controller or computer via an RS423 serial interface port. Complete programming of the motion parameters, input/ output functions, operating modes, indexes, and set up parameters can be accomplished through this port. Status and current position information is also available through this interface.

In addition to programming and editing, the serial interface may be used as the real-time control interface as an alternative to I/O. Due to transmission time, consideration must be given to system performance requirements prior to applying this method for real-time control.

The serial interface is RS423, RS232C and RS422 signal compatible. It has programmable baud rates from 110 to 19200 bps and can be connected using a simple three wire hook-up; transmitter, receiver and signal ground. Transmission is accomplished using standard, printable ASCII characters. This means that the Drive can communicate over the serial interface with a dumb terminal.

The connection to this serial interface is made through the 9-pin Canon D connector designated as "SERIAL A". All programming is done through this connector.

The basic drive also includes a second 9 pin, RS423 serial connector (designated as "SERIAL B") is used for a multi-drop networking scheme to other drives. This second connector cannot be used for programming other than in a multi-drop set up.

When using the multi-drop, the drive can automatically detect when there are other units "down the line" and redirect its serial signals to the appropriate drives. The serial commands are sent to the appropriate drives based on the axis identifier switch settings. All drives in a multi-drop configuration must be set to full duplex mode.

Figure 137 DX Serial Ports

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EXAMPLE OF A SERIAL MULTI-DROP CONNECTION

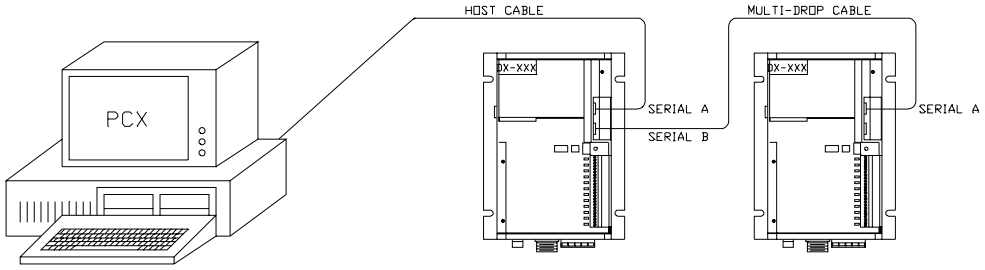
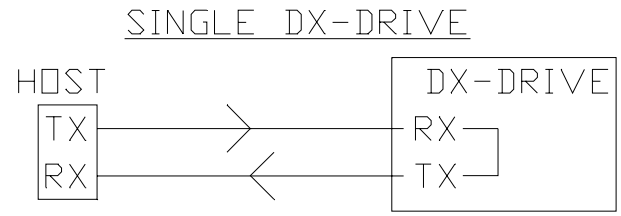


Figure 138 Multi-Drop Connection

SERIAL SIGNAL FLOW DIAGRAMS



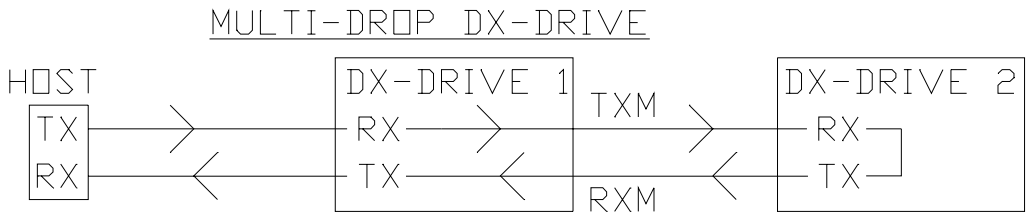


Figure 139 Serial Signal Flow Diagrams

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SETTING UP THE SERIAL INTERFACE SWITCHES AND PROTOCOL

The DIP switch numbers and their corresponding functions are shown on the following page and a description of each function will be given here.

LOCATIONS OF SWITCHES

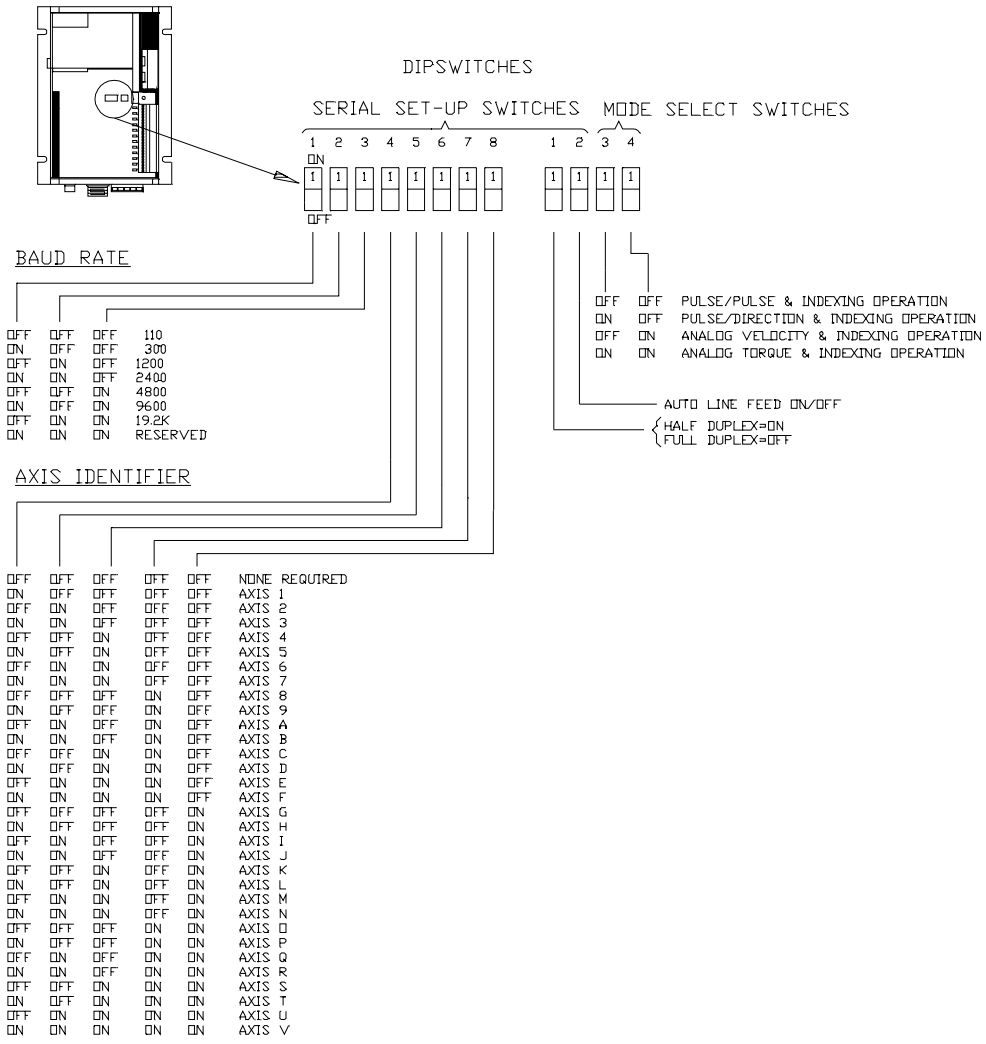


Figure 140 Dipswitches

Baud Rate Switches

Switches 1,2 and 3 of the eight position DIP switch are used to match the baud rate of the drive to the baud

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

rate of the programming device. If the two baud rates are not the same, serial communication will not be possible.

Axis Identifier Switches

Switches 4,5,6,7 and 8 are used to distinguish between drives in a multi-axis application. This allows each axis to be programmed individually over the same multi-drop serial cable.

Duplex Switch

Switch 1 of the four position DIP switch sets either Half or Full Duplex Mode. In Half Duplex Mode the serial data is not echoed back to the programming device for conformation or display. In Full Duplex Mode the data is echoed back to the programming device, allowing the data to be verified. In a multi-drop configuration, all drives must be set to full duplex mode.

Auto Line Feed

Switch 2 is used to determine if a line feed character should be echoed back to the programming device when a carriage return is received. This will alter the line spacing on the programming monitor.

NOTE: Switches 3 and 4 have been discussed previously in the "Optional Operating Modes" section.

Framing Information

When using serial communication, the data must be sent as a string of continuous bits. This string of data bits must be "framed" by start and stop bits so that valid data can be recognized.

The framework which the drive will recognize is as follows:

1 start bit
8 data bits
1 stop bit

The high order data bit is ignored by the drive. A parity bit may therefore be sent to the drive along with only seven data bits. When transmitting, the drive will always send a zero for the eighth data bit.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERIAL CABLES

The below listed cables are standard cables available from EMC. Also shown below and on the following page are the wiring diagrams should you prefer to make your own cables.

MODEL	DESCRIPTION
TD-25	T-21 TO DRIVE SERIAL CABLE, 25 FEET LONG
TIX-25	T-21 OR DRIVE TO IBM XT SERIAL CABLE, 25 FEET LONG. IBM END CONNECTOR IS FEMALE 25 PIN DB.
TIA-25	T-21 OR DRIVE TO IBM AT SERIAL CABLE, 25 FEET LONG. IBM END CONNECTOR IS FEMALE 9 PIN DB.
DD-6	DRIVE TO DRIVE SERIAL CABLE 6 FEET LONG (MULTI-DROP CABLE)

Wiring Diagrams From Computer to Drive

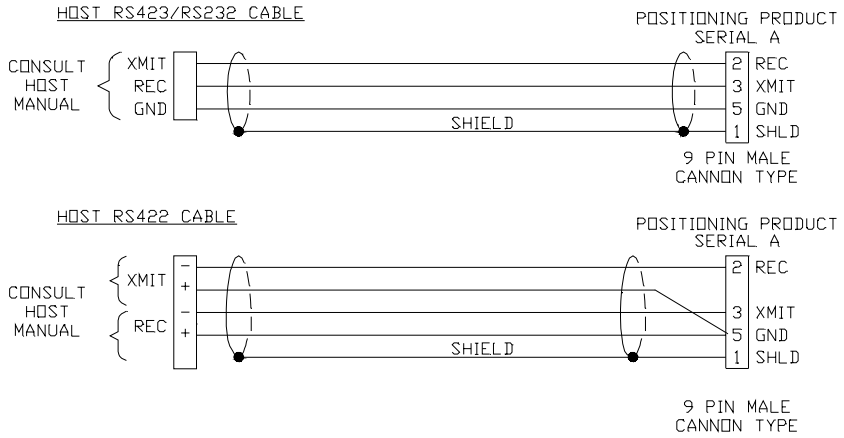


Figure 141 Serial Cable Wiring Diagrams

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

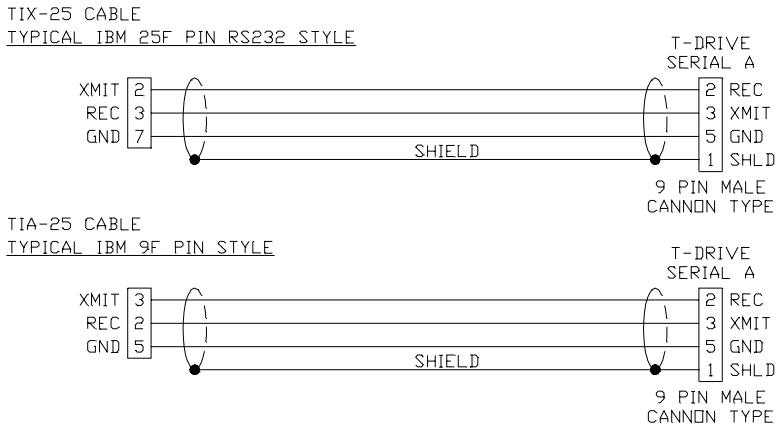


Figure 142 Wiring Diagrams - TIX-25 Cable

Wiring Diagram for DD-XXX Multi-Drop Cable

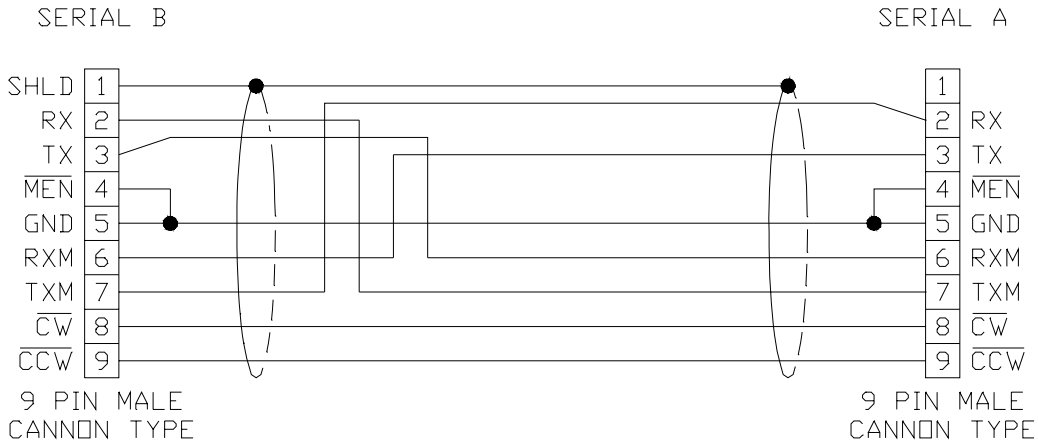


Figure 143 Wiring Diagram - Multi-Drop Cable

NOTE: The cable may be plugged in either direction and it will function properly.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SERIAL INTERFACE CONTROL

Most major programmable logic controllers (PLCs) are available with user programmable Basic or ASCII communications modules allowing the user to easily program and transmit serial commands or programming data to other serial devices. The Positioning Drive's RS423 serial interface provides a direct connection to these PLC modules for programming and control. In addition, the capability of this serial interface to be multi-dropped to as many as 31 axes of drives, plus the use of the optically isolated inputs and outputs on each drive, provides an easy method to accomplish multiple axis positioning control.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

ASCII COMMANDS

Overview

All programming done without PCX software must use the provided ASCII serial commands. There are presently three types of serial commands: Execution, set up, and query. Some commands may be only one type and others may be all three types.

In general, an execution command is one that requires the drive to take action. This may be in the form of starting motion, stopping motion, or changing status (example: Changing velocity). Execution commands should only be used after all motion functions have been programmed through the set up commands.

Set up commands are used to program motion functions such as indexes, home cycle and jog parameters. These commands provide the means to change velocities, accel/decel rates, and distances. Set up commands are also used for I/O assignment, initialization and run time control.

Query commands are used to ask for information from the drive. The drive will respond with the value, mode type, or status that has been programmed into memory. Query commands are useful during both set up and execution.

All three types of serial commands must follow a format that can be recognized by the drive. The format used for all serial commands is given below. If a command is not recognized or cannot be carried out, the drive will respond with a "?" as an error indication.

```
                {"?"     }
[ID] COMMAND [MODIFIER] {"="(INFO)} CR [LF]
                {(NULL)  }
```

ID - AXIS IDENTIFIER — An axis identifier is only needed when more than one drive is on the serial line, otherwise the axis identifier should not be transmitted in the command string. If axis identifiers are being used, an axis identifier of "0" in the transmitted command string will address all axes.

COMMAND — All serial commands consist of two ASCII characters.

MODIFIER — Some serial commands require a number modifier to identify the particular parameter being addressed with the command.

"?" Indicates a Query command. The axis will send a response in the format used for the setup command.

"=" Indicates a Setup command. The axis will respond with a "*".

(NULL) If neither a "?" or "=" is present the command is assumed to be an execution command that requires some action.

CR All commands are terminated with a carriage return.

LF An optional line feed may be sent with the command. The line feed will always be sent after the CR if auto line feed is set on the DIP switches.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Program Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
PRXX	EXECUTION ONLY	PROGRAM EXECUTION (PCM only)

Starts execution of Program XX. If no program number is included in the command, Program 0 will execute.

PR	SET UP/QUERY	NO SELECT LINE PROGRAM # (PCM only)

Sets the default program number that will be executed when an initiate input is received if no program select lines are assigned. The default is program number 0.

NP	SET UP/QUERY	NUMBER OF PROGRAMS (PCM only)

Sets the number of programs available for PCM modules. The default is 64 and the maximum is 256. Reducing the number of programs available will increase the number of steps available for each program. If the number is changed, all program information will be initialized (empty programs). If the setup command does not change the current value of NP it will have no affect.

SP	EXECUTION/SET UP/QUERY	SUSPEND/RESUME (PCM only)

As an execution command will toggle the current suspend/resume state of a program. If a program is running and a suspend state is not active, the program will enter the suspend state. If the suspend state is active, the original program that was suspended will be resumed.

As a set up command it sets the program number to be automatically executed upon receipt of a suspend command. The default is program 0. (See SG command.)

CL	EXECUTION ONLY	CLEAR SUSPEND (PCM only)

Clears a suspend cycle in the same manner as a clear suspend input.

SG	SET UP/QUERY	SUSPEND FLAGS (PCM only)

Sets various flags used for suspend/resume (hexadecimal).

bit 0 - set for auto program execution on suspend
1 - set for auto resume
2 - set for auto return (exec retn to position index) on resume
3 - set for auto clear after suspend/auto program

Example: SG=7 will set bits 0,1, and 2 causing auto program execution, auto return to position, and auto resume to all occur upon receipt of a suspend input.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Index Commands

All index commands may include a modifier indicating the particular index to which the command is directed. If no modifier is present in the command an index number of zero will be assumed. For example, the commands "DS=1000" and "DS0=1000" would both set the distance information of index zero to 1000, while the command "IN5" would execute index five. The modifier will be left out in the following index command summary for the sake of clarity and all commands will be discussed as if they were addressed to index zero.

COMMAND	TYPE OF COMMAND	DESCRIPTION
IN	EXECUTION ONLY	EXECUTE SELECTED INDEX

Starts index execution. The specified index will run with the programmed parameters for the number of times set in the index count parameter.

IN	SET UP/QUERY	NO SELECT LINE INDEX #

Sets the default index number that will be executed when an initiate input is received if no index select lines are assigned. The default is index number 0.

IT	SET UP/QUERY	INDEX TYPE

Selects the type of index from the following list:

0 - Incremental Distance Index
1 - Linear Absolute Position Index
2 - Feed Sensor Index
3 - Registration Index
4 - Rotary Absolute Position Shortest Path Index
5 - Rotary Absolute Position (forced direction CW)
6 - Rotary Absolute Position (forced direction CCW)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

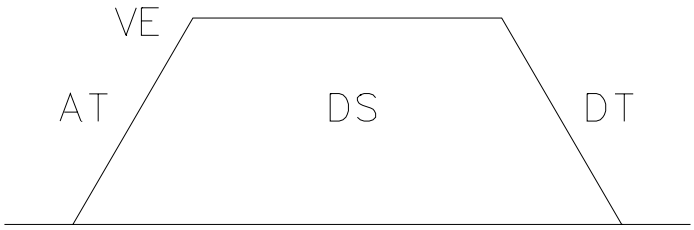


Figure 144 (0) Incremental Distance Index

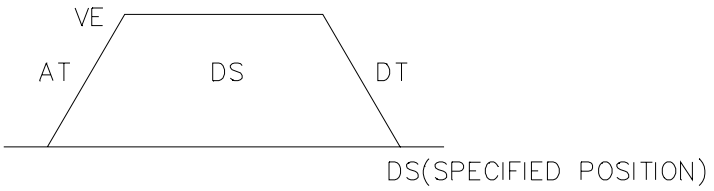


Figure 145 (1) Linear Absolute Position Index

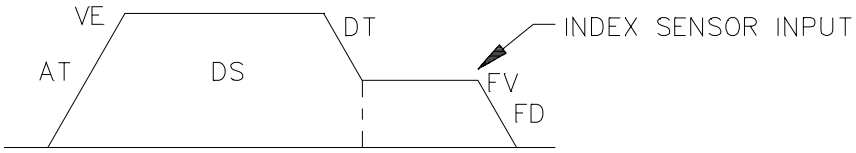


Figure 146 (2) Feed To Sensor Index

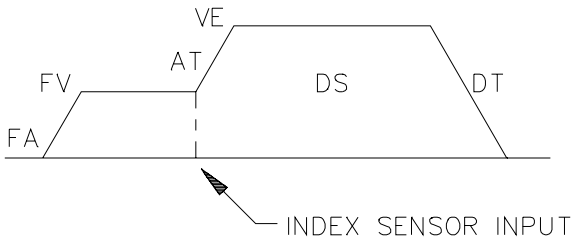


Figure 147 (3) Registration Index

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DS SET UP/QUERY INDEX DISTANCE/POSITION

Sets the index distance and direction for incremental index or the index position for absolute type indexes. "DS" is a signed quantity in user units.

VE SET UP/QUERY INDEX VELOCITY

Sets the maximum allowable velocity for the index. "VE" is an unsigned quantity in rpm (see "VU" command), since polarity for the index is set with the "DS" command.

AT/DT SET UP/QUERY INDEX ACCEL/DECEL RAMP

Sets the acceleration/deceleration ramp slopes for the index. Ramp slopes are programmed in milliseconds to the maximum system velocity. Note that the slopes are independent of index velocity. "VE" may be changed without affecting the index ramp slopes. All drives have a maximum system velocity of 3000 rpm and unless this is reprogrammed by the user, all acceleration and deceleration rates will be calculated from zero to 3000 rpm.

Example:

The user would like to reach an index velocity of 1500 rpm in 0.5 seconds. Since the acceleration rate is based on the maximum system velocity of 3000 rpm, the following ratio can be set up to find the desired acceleration time (AT).

$$\frac{\text{Desired Index Velocity}}{\text{Desired Time for Acceleration}} = \frac{\text{Maximum System Velocity}}{\text{Acceleration Time to be Programmed}}$$

ie: $\frac{1500 \text{ rpm}}{0.5 \text{ sec}} = \frac{3000}{AT}$

gives: $AT = \frac{3000\ (0.5)}{1500} = 1 \text{ sec}$

NOTE: Acceleration and deceleration times are limited by load inertia, friction and system torque. This must be remembered when accelerating and decelerating large loads.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DW SET UP/QUERY INDEX DWELL

Sets the dwell time for the index in milliseconds. When index motion is completed and the index is in position, the unit will wait the specified amount of time before continuing.

FV SET UP/QUERY INDEX FEED SENSOR VELOCITY

The "FV" command is used to set up the index feed sensor velocity and is only needed for the sensor type indexes (types 2 and 3). Feed velocity is a signed quantity which specifies both velocity (in rpm) and direction.

FA/FD SET UP/QUERY INDEX FEED SENSOR ACCEL/DECEL RAMPS

Sets the feed sensor acceleration/deceleration ramp slopes for sensor type indexes. This information is programmed in milliseconds to maximum velocity and is only needed for index types 2 and 3.

CO SET UP/QUERY INDEX COUNT

Sets the index count. When initiated, the index will execute the number of times set for this parameter. If the index count is set to zero, the index will not be initiated. If the index count is set to 65535, the index will repeat indefinitely.

NI SET UP/QUERY NUMBER OF INDEXES (PCM only)

Sets the number of indexes available. For basic drives, the number of indexes is fixed at 32 and cannot be changed. For PCM modules, the default is the maximum of 256 indexes. Reducing the number of indexes will increase the program space available. If the number is changed, all index and program information will be initialized to default values. If the setup command does not change the current value of NI it will have no affect.

RI SET UP/QUERY RETURN TO POSITION INDEX #

Sets the index number to be used as the return to position index. The default is index 0. If the return to position feature of the controller is being used, either directly through the return to position input or indirectly within the suspend/resume sequence, it is up to the user to set up the index with all necessary parameters other than position. This index will normally be set up as an absolute index. The distance/position field of this index will be automatically changed upon receipt of a remember position input or upon receipt of a suspend input.

LD SET UP/QUERY SENSOR LIMIT DISTANCE

Sets the sensor limit distance (unsigned) to be used for all sensor type

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

indexes.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

OM SET UP/QUERY PROGRAMMABLE OUTPUT MASK

Sets the pattern mask which determines which programmable outputs will be updated (affected) at the completion of the index. (Note that in order for the update to actually take place, the proper number number of programmable output lines must have been set up with the SL command and the programmableoutput function must be assigned to the starting line number with the OF command.) The mask is set with a hexadecimal bit pattern of up to eight bits. Also see "SC" and "OF" commands.

Example: OM21=0F will cause the low four programmable outputs (if assigned) to be updated at the end of index 21. If more than four programmable output lines are being used, only the low order four lines will be affected and the others will not be changed.

OP SET UP/QUERY PROGRAMMABLE OUTPUT PATTERN

Sets the output pattern to be set on the programmable output lines that have been selected to be updated by the index. Using the above example, OP21=03 will cause the low order two programmable output lines to be turned on and the high order two lines to be turned off. The pattern is a hexadecimal number.

OT SET UP/QUERY PROGRAMMABLE OUTPUT PULSE WIDTH

Sets the pulse width of active programmable outputs which are put out by the index. The pulse width is in milliseconds. A pulse width of 0 (the default) indicates that the pattern has infinite pulse width. In this case any outputs turned on will remain on until changed by another output pattern or until a programmable output reset is received for the line. The number programmed should be between 0 and 65535.

OD SET UP/QUERY PROGRAMMABLE OUTPUT DELAY

Sets the time delay (in milliseconds) from the end of index for the programmable output pattern update to take place. The number should be between -32768 and +32767 with 0 (the default) indicating an update at the completion of the index. A negative delay indicates that the update should be made before the end of index. If a negative delay is longer than the decel ramp of the index, the update will take place at the beginning of the decel ramp.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Home Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
HM	EXECUTION ONLY	EXECUTE HOME CYCLE

Starts execution of the Home cycle.

HT	SET UP/QUERY	HOME TYPE

Selects the type of Home cycle from the following list:

0 - Home to resolver offset
1 - Home to sensor
2 - Home to sensor then resolver offset
3 - Home to sensor then off sensor
4 - Home to sensor then off sensor then resolver offset
5 - Home to sensor then off sensor then on sensor

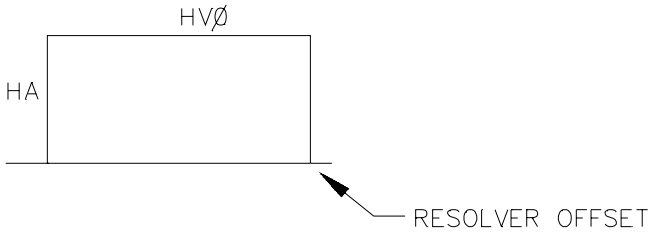


Figure 148 (0) - Home to Resolver Offset

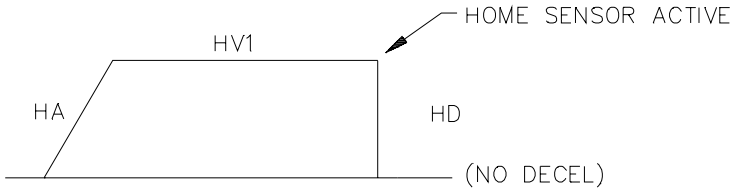


Figure 149 (1) - Home to Sensor

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

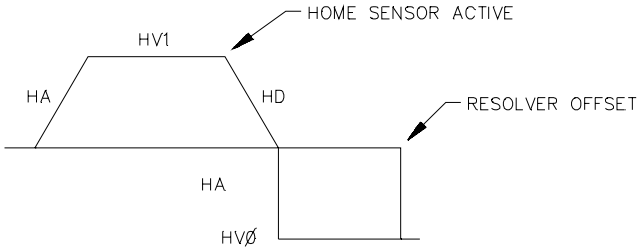


Figure 150 (2) - Home to Sensor then Resolver Offset

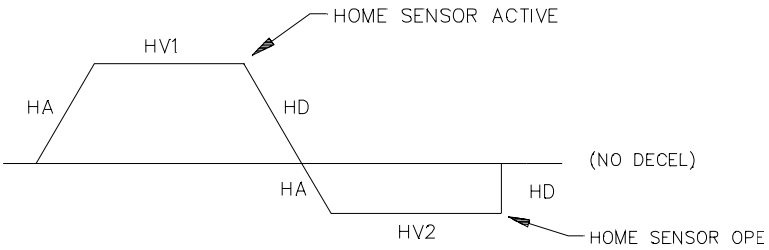


Figure 151 (3) - Home to Sensor then Off Sensor

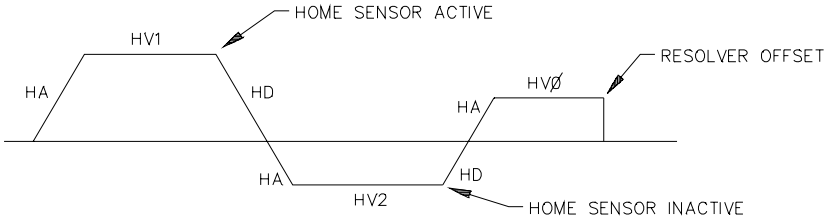


Figure 152 (4) - Home to Sensor then off Sensor then Resolver Offset

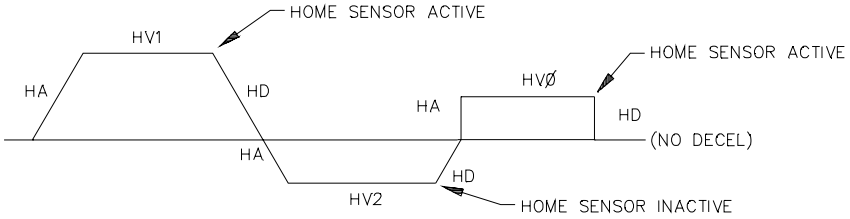


Figure 153 (5) - Home to Sensor then Off Sensor then On Sensor

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

HR/HI/HO SET UP/QUERY HOME VELOCITIES

Sets the velocity to be used for a segment of the Home cycle in user velocity units. Select the desired segment velocity based on the following:

HR - mark velocity
HI - feed on sensor velocity
HO - feed off sensor velocity

These are signed quantities specifying both velocity and direction for the particular Home segment.

HA/HD SET UP/QUERY HOME ACCEL/DECEL RAMPS

Sets the acceleration/deceleration ramp slopes to be used during the Home cycle in milliseconds to maximum velocity. Note that no deceleration is used at the end of the Home cycle, therefore the final Home segment velocity should be set low enough for the application requirements. No acceleration ramp is used during resolver offset cycle, so the resolver offset results should also be kept minimal.

HP SET UP/QUERY ABSOLUTE POSITION AFTER HOME

Sets the Home reference position in user units. At the conclusion of the Home cycle this will be the absolute position of system. Any index moves to an absolute position (index types 1, 4 and 5) will be referenced from this position. Any software travel limits are also referenced from this position. HP is a signed quantity.

RO SET UP/QUERY RESOLVER OFFSET

Sets the resolver offset in user units from the resolver zero position. RO is an unsigned quantity and must be less than the number of user units of distance per revolution. (See the SR command.) Since the resolver zero position is dependent on the mounted position of the resolver on the motor shaft, the "RO" command lets the user adjust the mark position within one revolution without having to make physical adjustments. This offset is used only during Home cycles that move to the resolver mark (types 0, 2, 4).

HL SET UP/QUERY HOME LOCK

Selects whether the power up Home Lock feature of the drive is enabled (HL=1) or disabled (HL=0). When enabled, no motion other than Home execution will be allowed until a Home cycle has been successfully completed. Since software travel limits are not enabled until the completion of a Home cycle, the Home Lock feature is a method that ensures the enabling of the software travel limits before allowing other motion commands.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Jog Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
JG	EXECUTION/SET UP/QUERY	JOG

When used as an execution command, "JG" will start Jog motion at the current serial Jog velocity.

As a setup command, "JG" sets the current serial jog velocity. If the drive is already executing a serial Jog when a new serial Jog velocity is issued, the drive will ramp to the new velocity. Serial jog velocity is a signed quantity in rpm.

JF/JS	EXECUTION/SET UP/QUERY	JOG FAST/SLOW

When used as an execution command, "JF" and "JS" will start Jog motion at the current fast Jog or slow Jog velocity respectively. The direction for the Jog may be specified by adding a "+" (clockwise) or "-" (counterclockwise) after the command. if no direction is specified, clockwise motion will be assumed.

As setup commands "JF" sets the fast Jog velocity and "JS" set the slow Jog velocity in unsigned rpm. If the velocity is changed while executing the appropriate Jog, the drive will ramp to the new velocity.

JA/JD	SET UP/QUERY	JOG ACCEL/DECEL RAMPS

Sets the acceleration/deceleration ramp slopes to be use for Jog motion. The ramps are programmed in milliseconds to maximum system velocity.

SJ	EXECUTION ONLY	JOG STOP

Stops Jog motion along the Jog decel ramp slope. This command is an alternative to the "ST" command which is usually programmed with a faster deceleration slope.

JL	SET UP/QUERY	POWER UP JOG LOCK

Selects whether the power up Jog Lock feature of the drive is enabled (JL=1) or disabled (JL=0). When enabled, jogging will not be allowed after power up until a home cycle has been successfully completed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Initialization Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
TD/SD	SET UP/QUERY	TRAVEL LIMIT/STOP ACCEL RAMPS

"TD" sets the decel ramp slope for faults and travel limits. "SD" sets the decel ramp slope to be used to stop. Both ramps are programmed in milliseconds from maximum system velocity.

TL	SET UP/QUERY	PROGRAMMABLE TRAVEL LIMITS

Sets the software travel limits. A modifier of 0 (TL0=...) sets the minimum (CCW) allowable absolute position and a modifier of 1 (TL1=...) sets the maximum (CW) allowable absolute position. Limits are set in signed user units and are referenced from the Home position. Software travel limits are not active until a Home cycle has been completed.

PL	SET UP/QUERY	PROGRAMMABLE INDEX POSITION/ DISTANCE LIMITS

Sets the limits for index distances or positions in the same manner as the "TL" command. Any attempt to program an index distance or position that is outside the specified range will generate an error.

VL	SET UP/QUERY	PROGRAMMABLE VELOCITY LIMITS

Sets the maximum allowable velocity which may be programmed in unsigned user velocity units. Any attempt to program a velocity of greater magnitude than this velocity limit will generate an error.

AL/DL	SET UP/QUERY	PROGRAMMABLE ACCEL/DECEL RAMP LIMITS

Sets the minimum (fastest) allowable acceleration/deceleration slope which may be programmed in milliseconds to maximum system velocity. Any attempt to program a faster accel/decel slope will generate an error.

SR & SR1	SET UP/QUERY	STEPS/USER REV

SR sets the number of user steps per user turn. SR1 sets the number of external steps per user turn (PCM only) used to determine the external/internal ratio for synchronization. The default setting for both values is 4000. The number programmed should be between 200 and 30000.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

TR SET UP/QUERY TURNS/USER REV

Sets the number of motor turns per user revolution. The default setting of 1 indicates that 1 motor turn is 1 user turn. An SR value of 4000 would then mean that there are 4000 user steps per motor revolution. In rare instances it may be desirable to program other than a 1:1 motor turn/ user turn ratio. If, for instance, due to gear box ratioing three motor turns was equal to 10 inches, the user could program TR=3 and SR=10000 allowing for programming in .001 inch increments with no cumulative error. Without the TR parameter the user would be forced to set SR=3333 but would have cumulative error of .001 inch every three motor turns. For the most part, this parameter can be ignored and the SR parameter may then be thought of as steps per motor revolution.

IMX EXECUTION ONLY INITIALIZE MEMORY PARAMETERS

Initializes various system/memory parameters.
X = 0 - initialize entire system
1 - initialize PCM information only
2 - initialize I/O information only
3 - initialize index information only
4 - initialize program arrays only
5 - initialize gain information only
6 - initialize limit information only

PF SET UP/QUERY POWER UP FLAGS

Sets a bit flag pattern used on power up. (Default=0) (HEX)

bit 0 - set to 1 to power up under serial control
1 - set to 0 for mode to be follow dip switches
set to 1 for mode to be set to EM2 parameter on power up
and for mode to be controlled through serial
2 - set to Ø for PCM-5 or PCM-6 pulses to come from an external encoder
set to Ø for pulses to come from a master axis

example: PF=01 will cause future power ONs to immediately force
the serial control mode of operation.

PY SET UP/QUERY ACTUATOR POLARITY

Sets the directional polarity of the system. PY=0 (default) causes CW rotation of the actuator for positive motion. PY=1 causes CCW rotation of the actuator for positive motion.

RPX SET UP/QUERY ROTARY POSITION LIMITS

Sets the rotary absolute position limits of the system. When absolute position passes the positive limit (RP1) it will roll over to the negative limit (RP0). Similarly, when the negative limit is passed, absolute position will roll over to the positive limit. The default settings are RP0= -2147483648 and RP1= +2147483647 which is the largest absolute position range that the system can maintain. In linear environments these limits will normally not need to be changed. In rotary applications, however, it may be convenient to keep absolute position within smaller bounds (eg. 0 to 359.99 or -179.99 to 180.00). These limits are used for rotary shortest path index

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

types to determine shortest path.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EMX SET UP/QUERY OPERATING MODE

0 - Sets/queries the current mode. (Note the setup command will not be accepted if mode is set from dip switches.)
1 - Sets the mode to be entered when the alternate mode input is active. (example EM1=4)
2 - Sets the power up mode (if not from dip switches). (See PF command.)

Valid modes are:

0 - pulse/pulse
1 - pulse/dir
2 - analog velocity
3 - analog torque
4 - encoder following (ratio)
5 - analog velocity, encoder time base

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Run Time Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
ST	EXECUTION ONLY	STOP

Causes the drive to stop motion. The drive will decel along the programmed stop decel ramp (SD). Another motion initiate command must be issued to restart motion.

QU	QUERY ONLY	CURRENT STATUS OF THE T-DRIVE

Causes a single ASCII letter to be returned indicating the current status of the drive according to the following list:

S - Drive is in serial control and ready for a command
E - Drive is in external Operating Mode
P - Drive is Profiling (indexing)
H - Drive is in a Home cycle
J - Drive is Jogging
F - Drive is faulted
L - Power up Home Lock is active
C - Drive is in Calibrate Mode

FE	QUERY ONLY	FOLLOWING ERROR

Returns the current following error of the drive in signed user units. Following error is equal to (commanded position minus feedback position).

CV	QUERY ONLY	CURRENT VELOCITY

Return the current velocity of the drive in signed user velocity units.

CI	QUERY ONLY	CURRENT INDEX

Returns the number of the index that is currently executing.

CD	QUERY ONLY	CURRENT DWELL

Returns the dwell time in milliseconds that is left to count down.

FS	QUERY ONLY	FAULT STATUS

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Returns a hexadecimal number (FS=XX) with the current fault status of the drive. If the number is not zero the active bit position indicates a fault according to the following list.

Bit	
0	Watchdog time out failure
1	Power up memory fault
2	Hardware fault on drive
3	Position error fault
4	CW travel limit
5	CCW travel limit
6	(unused)
7	(unused)

CP QUERY ONLY COMMANDED POSITION

Returns the current commanded position of the drive in signed user units.

FP QUERY ONLY FEED BACK POSITION

Returns the current feedback position of the drive in signed user units.

CC QUERY ONLY CURRENT COUNT

Returns the count of the number of indexes that are left to execute.

AF SET UP/QUERY AUTO FAULT REPORTING

Enables (AF=1) or disables (AF=0) the automatic fault reporting feature of the drive. If enabled the drive will issue the single character "F" when any fault condition occurs.

AP SET UP/QUERY AUTO END OF INDEX COUNT REPORTING

Enables (AP=1) or disables (AP=0) the automatic end of index count feature of the drive. If enabled, the drive will issue the single character "P" when an index has completely finished (all counts are complete). This may be used as in indication that the drive is ready for another execution command.

FH QUERY ONLY HARDWARE FAULT STATUS

When a hardware fault has taken place, the FH command may be used to determine the type of fault. The number returned will match the hardware fault number that will be shown on the 7-segment display (other than 0).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

0 - no fault
1 - rms
2 - shorts
3 - resolver
4 - supply
5 - motor temp
6 - fuse or low AC line voltage
7 - bridge temp

ZA EXECUTION ONLY ZERO ABSOLUTE POSITION

Zeroes the current absolute position. This command has the same affect as if a home command has completed (without moving) with the home position set at 0.

ZR EXECUTION ONLY ZERO RELATIVE POSITION

Zeroes the relative position causing position/distance information returned through CP and FP commands to be referenced from this point without affecting the actual absolute position of the system. Any absolute moves executed will still be referenced from the last home position.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Miscellaneous Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
SC	SET UP/QUERY	SERIAL CONTROL

This command puts the drive into (SC=1) or takes the drive out of (SC=0) the Serial Control Mode of operation. No motion execution commands will be accepted until the drive is in the Serial Control Mode, although set up and query command may be issued at any time.

BK	SET UP/QUERY	ACTIVATE BRAKE

Enables (BK=1) or disables (BK=0) the brake override if the motor is so equipped.

RS	EXECUTION ONLY	RESET DRIVE

Resets the drive after any drive fault. This command has the same effect as using the push-button reset.

LR	SET UP/QUERY	LINEAR RAMPS

Selects the linear (LR=1) or nonlinear (LR=0) method of ramping. The non-linear method uses a haversine ramp function when changing velocity. This results in slightly smoother ramp endings, but requires more current during the middle stages of acceleration/deceleration.

CKX	QUERY ONLY	CHECKSUMS

Returns a hexadecimal checksum of the desired area of system memory:

0 - prom
1 - all non-volatile memory parameters (T-drive/PCM if present)
2 - PCM nvm only
3 - index/home info only
4 - program info only

The prom checksum returned should always be the same. The other checksums may change as information is programmed.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

I/O Commands

COMMAND	TYPE OF COMMAND	DESCRIPTION
IF/OF	SET UP/QUERY	INPUT/OUTPUT FUNCTION LINE NUMBERS

If PCX software is not being used, the I/O lines can still be assigned through direct serial commands. These commands are sent to the drive by any ASCII serial device via the serial A connector. The serial commands for I/O assignment are given below:

IFXX=L, where "XX" is the input function number (0-26)
where "L" is the input line number (1-8)

OFYY=L, where "YY" is the output function number (0-11)
where "L" is the output line number (9-12)

IFXX=0, will unassign input function "XX"

OFYY=O, will unassign output function "YY"

To set input function polarity use the following commands.

IPXX=0, normally OFF default, where "XX" = input function number

IPXX=1, normally ON default, where "XX" = input function number

For example, to assign a Stop function to input line number 4. Using the ASCII serial device, type:

IF11=4, where 11 = Stop function and 4 = input line 4.

The following notes are important to remember while the I/O lines are being assigned.

1. If the clear index/clear home outputs are not assigned the outputs will clear on the next commanded motion.

2. If the clear to initiate input is not assigned the only safeguard on re-initiation of short indexes is that the initiate must go off before another one will be accepted.

3. More than one input may be assigned to the same line such as Jog CW/Slow, or Clear Index Output/Clear Home Output.

4. The clear fault input duplicates the function of the pushbutton.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

IP SET UP/QUERY INPUT FUNCTION POLARITY

This command selects the active polarity for input functions. The format is

IPXX = 0 {normally off}
IPXX = 1 {normally on}

where XX is the input function number.

SLX SET UP/QUERY SELECT LINES

Sets the number of lines to be used for multi-line i/o functions:

0 - index select lines
1 - program select lines
2 - programmable output lines
3 - programmable output reset lines

The number of lines should be between 0 and 8.

The following table shows how many select lines should be set:

Table XXI Set Up Select Lines

MAX TO SELECT NEEDED	NUMBER OF SELECT LINES
1	0 (use index 0)
2	1
3-4	2
5-8	3
9-16	4
17-32	5

DD SET UP/QUERY MINIMUM INPUT SIGNAL WIDTH

This command sets the minimum pulse width of an input signal that will be recognized as valid. The format is:

DDXX = PW where XX = input line number
where PW = pulse width in two millisecond increments

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

IOX SETUP/QUERY HARDWARE INPUT/OUTPUT

This command allows direct access to system I/O functions. All information is in hexadecimal.

X	QUERY	SETUP
0	Debounced user inputs	User inputs*
1	Actual user input status	Actual user outputs**
2	24-bit I/O port (low 8 bits)	24-bit I/O port (low 8 bits)***
3	24-bit I/O port (mid 8 bits)	24 bit I/O port (mid 8 bits)***
4	24-bit I/O port (high 8 bits)	24 bit I/O port (high 8 bits)***
5	Dip switch status (16 bits)	
6	Resolver (16 bits)	
7	External encoder (16 bits)	

* Any outputs set should be unassigned from any output function
** User I/O must be killed (KI=1), used for factory testing only.
*** Parallel port must be killed (KI1=1), used for testing only

KI SET UP/QUERY KILL INPUT/OUTPUT

This command kills (inhibits) access to user I/O from the system to do direct user I/O. This is normally only done for testing

(Outputs should be set to zero before re-enabling.)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SUMMARY OF SERIAL COMMANDS

E - EXECUTION COMMAND
Q - QUERY COMMAND (XX?)
S - SETUP COMMAND (XX=)

NOTE: IF AXIS I.D. IS NOT ZERO THEN ALL COMMANDS MUST BE PRECEDED WITH AN AXIS IDENTIFIER (WHICH MAY BE 0 TO ADDRESS ALL DRIVES IN CHAIN). IF AXIS I.D. IS ZERO THEN NO AXIS IDENTIFIER MAY BE USED (SINGLE AXIS).

CMD	EQS	DESCRIPTION	PAGE
AF	QS	AUTO FAULT REPORT ON(1)/OFF(0)	
AL	QS	USER PROGRAMMABLE ACCEL LIMIT	
AP	QS	AUTO END OF INDEX COUNT REPORT ON(1)/OFF(0)	
ARX	QS	ANALOG CHANNEL RESPONSE (HEX) (0-7)	
ATX	QS	ACCEL RAMP (MS TO MAX RPM)	
AV	QS	ANALOG COMMAND CHANNEL VELOCITY FULL SCALE (HEX)	
BK	QS	ACTIVATE BRAKE(1)/DEACTIVATE BRAKE(0) OVERRIDE	
BR	QS	INHIBIT BRIDGE(1)/ENABLE BRIDGE(0)	
CC	Q	CURRENT COUNT	
CD	Q	CURRENT DWELL	
CFX	QS	ANALOG CHANNEL FULL SCALE (HEX)	
CG	QS	CURRENT GAIN (HEX)	

NOTE: A MODIFIER (0,1,2) MAY BE PRESENT WITH THE NV,EG,VG,DG,LG,CG COMMANDS. IF NO MODIFIER IS PRESENT THE CURRENT SETTING IS SELECTED.

EXAMPLE: VG1? (QUERY ONLY)
0 - MINIMUM VALUE FOR DRIVE MODEL
1 - MAXIMUM VALUE FOR DRIVE MODEL
2 - DEFAULT VALUE FOR DRIVE MODEL

CHX	Q	ANALOG CHANNEL READING (0-5) (HEX)
CI	Q	CURRENT INDEX
CKX	Q	CHECKSUMS
CL	E	SERIAL CONTROL MODE CLEAR OF SUSPEND
CM	QS	CALIBRATE MODE
		CM = 0 NORMAL OPERATING MODE
		CM = 1 CALIBRATE MODE
CNX	QS	ANALOG CHANNEL NULL (HEX)
COX	QS	INDEX COUNT (0-65534) (65535 OR> = COUNT INFINITY)
CP	Q	COMMANDED POSITION (USER STEPS)
CTX	E	EXECUTE CALIBRATION TEST
		CT1 - SET NULL VELOCITY
		CT2 - SET VELOCITY GAIN (TACH SCALE FACTOR)

CAUTION:

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

CT2, CAUSES THE MOTOR TO RUN AND THERE MUST BE FREE TRAVEL.

CV	Q	CURRENT VELOCITY (RPM)
DBX	QS	ANALOG CHANNEL DEAD BAND (HEX)
DDX	QS	MINIMUM INPUT SIGNAL PULSE WIDTH

X = INPUT LINE NUMBER

EXAMPLE: DD4 = 5 INPUT LINE 4 MUST HAVE A SIGNAL PULSE LONGER THAN 10 MILLISECONDS TO BE RECOGNIZED AS VALID AND MUST BE OFF FOR 10 MILLISECONDS.

EXAMPLE: DD4 = 10 WOULD GIVE A 20 MILLISECOND TIME BEFORE

DEFAULT = 0 (IE. NOT USED)

DG	QS	DIFFERENTIAL GAIN (HEX)
DL	QS	USER PROGRAMMABLE DECEL LIMIT
DP	QS	USER DISTANCE DECIMAL POINT
DSX	QS	INDEX DISTANCE/POSITION
DTX	QS	DECEL RAMP (MS TO MAX RPM)
DU	QS	USER DISTANCE UNITS (3 LETTERS ASCII)
DWX	QS	INDEX DWELL (MS)
EG	QS	LOOP GAIN (HEX) (100H= 1 TO 1)
EMX	QS	EXTERNAL OPERATION MODE (Ø-5)
ET	QS	PARALLEL INTERFACE ENABLE

Ø - NOT ENABLED
1 - THUMBWHEELS
2 - NUMERIC DISPLAY
3 - THUMBWHEELS AND NUMERIC DISPLAY
4 - PARALLEL PROGRAMMING INTERFACE

FAX	QS	FEED SENSOR ACCEL RAMP (MS TO MAX RPM)
FDX	QS	FEED SENSOR DECEL RAMP (MS TO MAX RPM)
FE	Q	FOLLOWING ERROR
FG	QS	INDEX TIME BASE (HEX)
FH	Q	HARDWARE FAULT STATUS (0-9)
FH	Q	HARDWARE FAULT STATUS (0-8)

0 - NO FAULTS
1 - RMS
3 - ENCODER
4 - LOGIC SUPPLY
8 - EXT INPUT #1
9 - EXT INPUT #2

FP	Q	FEEDBACK POSITION (USER STEPS)
FS	Q	FAULT STATUS (HEX 0 TO FFFF) BITS 0-8 SET INDICATE

CURRENT FAULTS
0 - WATCHDOG TIME-OUT FAULT
1 - POWER UP MEMORY FAULT (UN-INITIALIZE)
2 - HARDWARE FAULT ON DRIVE
3 - POSITION ERROR FAULT
4 - HARDWARE CW TRAVEL LIMIT

5 - HARDWARE CCW TRAVEL LIMIT
6 - SOFTWARE CW TRAVEL LIMIT
7 - SOFTWARE CCW TRAVEL LIMIT
8 - EXTERNAL DISTANCE FAULT

FVX QS FEED SENSOR VELOCITY (RPM) (SIGNED)
(ONLY FOR SENSOR TYPE INDEXES)

HA QS HOME CYCLE ACCEL RAMP (MS TO MAX RPM)
HD QS HOME CYCLE DECEL RAMP (MS TO MAX RPM)
HF QS HOLD FUNCTION FOR INDEX (0/1)
"HF=1" = HOLD."HF = Ø = HOLD OFF

HG QS INDEX TIME BASE (HEX)
HI QS FEED ON HOME SENSOR VELOCITY
HL QS POWER UP HOME LOCK ON(1)/OFF(0)
HM E EXECUTE HOME CYCLE
HO QS FEED OFF HOME SENSOR VELOCITY
HP QS ABSOLUTE POSITION AFTER HOME
HR QS MARKER VELOCITY (ALSO HV)
HT QS HOME TYPE
0 - HOME TO MARKER
1 - HOME TO HOME SENSOR
2 - HOME TO HOME SENSOR THEN MARKER
3 - HOME TO/OFF HOME SENSOR
4 - HOME TO/OFF HOME SENSOR THEN MARKER
5 - HOME TO/OFF/TO HOME SENSOR

ID Q DRIVE IDENTIFIER
IFX QS INPUT FUNCTION LINE NUMBER
WHERE X = INPUT FUNCTION NUMBER
EXAMPLE: IF0 = 7 ASSIGNS INPUT FUNCTION 0 TO INPUT LINE 7

IMX E SET DEFAULT MEMORY PARAMETERS
IN QS SETS INDEX TO EXECUTE ON INIT IF NO SELECT LINES ASSIGNED
IN QS NO SELECT LINE INDEX
INX E EXECUTE SELECTED INDEX (X)
IPX QS INPUT FUNCTION POLARITY (0 OR 1)
WHERE X = INPUT FUNCTION NUMBER
0 SETS NORMALLY OFF (DEFAULT) POLARITY
1 SETS NORMALLY ON POLARITY

EXAMPLE: IP0 = 1 SETS THE POLARITY OF INPUT FUNCTION 0 TO NORMALLY ON (INPUT FUNCTION 0 WILL BE ACTIVE WHEN THE INPUT IS OFF)

NOTE: ASSIGNING AN INPUT OR OUTPUT FUNCTION TO LINE 0 WILL HAVE THE EFFECT OF UNASSIGNING THE FUNCTION FROM ANY LINE.

ITX QS INDEX TYPE

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

0 - INCREMENTAL DISTANCE
1 - LINEAR ABSOLUTE POSITION
2 - FEED SENSOR (INDEX THEN SENSOR)
3 - REGISTRATION (SENSOR THEN INDEX)
4 - SHORTEST PATH ROTARY ABSOLUTE
5 - FORCED - DIRECTION ROTARY ABSOLUTE CW
6 - FORCED - DIRECTION ROTARY ABSOLUTE CCW

JA	QS	JOG ACCEL RAMP (MS TO MAX RPM)
JD	QS	JOG DECEL RAMP (MS TO MAX RPM)
JF	QS	JOG FAST VELOCITY (RPM) (UNSIGNED)
JF+	E	EXECUTE CW JOG AT FAST JOG VELOCITY (ALSO JF)
JF-	E	EXECUTE CCW JOG AT FAST JOG VELOCITY
JG	E	EXECUTE JOG AT SERIAL JOG VELOCITY
JG	QS	SERIAL JOG VELOCITY (RPM) (SIGNED)
JL	QS	POWER UP HOME LOCK ON (1)/OFF (0) FOR JOG MOTION
JS	QS	JOG SLOW VELOCITY (RPM) (UNSIGNED)
JS+	E	EXECUTE CW JOG AT JOG SLOW VELOCITY (ALSO JS)
JS-	E	EXECUTE CCW JOG AT JOG SLOW VELOCITY
LD	QS	FEED SENSOR LIMIT DISTANCE (UNSIGNED)
LG	QS	LEAD GAIN (HEX)
LP	QS	POSITION LOOP ON(1)/OFF(0)
LR	QS	RAMPS

0 - MOD-SINE RAMPS
1 - LINEAR RAMPS

MA	Q	MINIMUM ACCEL TIME
MD	Q	MINIMUM DECEL TIME
ME	QS	MAXIMUM ALLOWABLE FOLLOWING ERROR
MV	QS	MAXIMUM VELOCITY (DEFAULT = 3000 RPM)
NDX	QS	NUMERIC DISPLAY PARAMETERS

Ø - DISPLAY FUNCTION (Ø=COMMAND POSITION, 1=COMMAND VELOCITY)
1 - DECIMAL POINT POSITION
2 - DIGITS HIDDEN
3 - Ø=SHOW SIGN, 1=SHOW ONLY "-" SIGN
4 - MULTIPLIER
5 - DIVISOR
6 - SUBTRACTOR
7 - UPDATE DELAY

NI	QS	NUMBER OF INDEXES (PCM ONLY)
NP	QS	NUMBER OF PROGRAMS (PCM ONLY)
NV	QS	NULL VELOCITY (HEX) (800H MID)
ODXX	QS	PROGRAMMABLE OUTPUT DELAY FROM END OF INDEX (+/-)
OFX	QS	OUTPUT FUNCTION LINE NUMBER (9-12)

WHERE X = OUTPUT FUNCTION NUMBER
EXAMPLE: OF2 = 9 ASSIGNS OUTPUT FUNCTION 2 TO
OUTPUT LINE 9

OMXX	QS	PROGRAMMABLE OUTPUT MASK (HEX)

OPXX	QS	PROGRAMMABLE OUTPUT PATTERN (HEX)
OTXX	QS	PROGRAMMABLE OUTPUT PULSE WIDTH (0=LEAVE ON TILL (RESET)
PF	QS	POWER UP FLAGS (HEX)
PL	QS	USER PROGRAMMABLE INDEX POS/DIST LIMIT (0-MIN,1-MAX) (0-MIN,1-MAX)
PR	QS	SETS PROGRAM TO EXECUTE ON INITIATE IF NO SELECT LINES ASSIGNED
PRXX	E	INITIATES PROGRAM XX
PY	QS	POLARITY (0=+VOLTAGE cw/1=+VOLTAGE CCW)
Q	-	QUERY COMMAND (XX?)
QU	Q	CURRENT STATUS OF THE DRIVE S - SERIAL CONTROL (READY FOR COMMAND) E - EXTERNAL CONTROL C - CALIBRATE MODE P - INDEXING H - HOMING J - JOGGING F - FAULTED (USE FS COMMAND TO GET EXACT FAULT TYPE) L - HOME LOCK
RI	QS	RETURN TO POSITION INDEX NUMBER (DEFAULT=0)
RL	QS	EXTERNAL DRIVE POSITIONAL LOOP GAIN RANGE
RO	QS	RESOLVER OFFSET POSITION FOR HOME TO MARKER
RPX	QS	ROTARY ABSOLUTE POSITION LIMITS (0-MIN(CCW),1-MAX(CW)
RS	E	RESET DRIVE
S	-	SETUP COMMAND (XX=)
SC	QS	SERIAL CONTROL SC = 0 NORMAL EXTERNAL OPERATION (PULSE) SC = 1 PUT UNIT UNDER SERIAL CONTROL FOR MOTION
SD	QS	STOP/HOLD DECEL RAMP (MS TO MAX RPM)
SG	QS	SUSPEND FLAGS (HEX) (DEFAULT=0)
SJ	E	STOP JOG ALONG JOG DECEL SLOPE
SLX	QS	NUMBER OF SELECT LINES 131
SP	EQS	SUSPEND/RESUME (E), SUSPEND PROGRAM NO. (Q/S) (DEFAULT=0)
SRX	QS	STEPS PER USER REV (0=INTERNAL/1=EXTERNAL) (DEFAULT=4000)
ST	E	STOP MOTION ALONG STOP/HOLD DECEL SLOPE
TD	QS	TRAVEL LIMIT/FAULT DECEL RAMP (MS TO MAX RPM)
TL	QS	USER PROGRAMMABLE TRAVEL LIMITS (0-MIN,1-MAX)
TR	QS	MOTOR TURNS PER USER REV (DEFAULT=1)
VC	QS	USER CALIBRATION (FULL SPEED) VELOCITY (0/1)
VEX	QS	INDEX VELOCITY (RPM) (UNSIGNED)
VG	QS	VELOCITY GAIN (HEX) (TACH SCALE FACTOR)
VL	QS	USER PROGRAMMABLE VELOCITY LIMIT
VP	QS	USER VELOCITY DECIMAL POINT (0/1)
VU	QS	USER VELOCITY UNITS (3 LETTERS ASCII)
XC	QS	EXTERNAL DRIVE CURRENT FEEDBACK SCALING (HEX)
XP	QS	EXTERNAL DRIVE INPUT POLARITY (HEX)
XT	QS	EXTERNAL DRIVE VELOCITY/CURRENT OPERATING MODE (HEX)

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

XV	QS	EXTERNAL DRIVE TACH SCALE FACTOR (HEX)
ZA	E	ZERO ABSOLUTE POSITION
ZR	E	ZERO RELATIVE POSITION (DISPLAY)

INDEX

AMPLIFIER I/O LOCATIONS 26
DX-480, DX-780, DX-7120 28
TA-202, TA-310, DX-202, DX-205, DX-308 26
TA-420, TA-440, TA-460, DX-318, DX-430, DX-450 27
AMPLIFIER MOUNTING INFORMATION 23
DX-480, DX-780, DX-7120 25
TA-202, TA-310, DX-202, DX-205, DX-308 23
TA-420, TA-440, TA-460, DX-318, DX-430, DX-450 24
BASIC OPERATION MODES 81
ASCII COMMANDS 81
SERIAL INTERFACE 81
SERIAL MODE 81
CABLES 40
BULKHEAD CONNECTORS 41
TDS/TDL CABLE WIRING DIAGRAM 40
TDT CABLE WIRING DIAGRAM 40
DIAGNOSTICS 95
AVG Current Fault 98
Bridge Temperature Fault 100
FAULT INDICATOR CODES 98
Fuse Fault/LOW VOLTAGE 100
HIGH INERTIA LOADS 101
Logic Supply Fault 99
Motor Temperature Fault 99
NOISE AC LINES - I/O LINES 98
NON-OPERATIONAL 100
POOR GROUNDING 98
POSITION ERROR FAULT 97
Resolver Fault 99
Shorts Fault 99
STATUS INDICATOR CODES 95
WATCH DOG TIMER FAULT 98
HOME TYPES
HOME 73
HOME TYPE 0. OFFSET (HOME TO RESOLVER 0 + OFFSET) 75
HOME TYPE 1. FEED ON (HOME TO SENSOR) 76
HOME TYPE 2. FEED ON/OFFSET (HOME TO SENSOR THEN OFFSET) 77
HOME TYPE 3. FEED ON/OFF (HOME TO SENSOR THEN OFF SENSOR) 78
HOME TYPE 4.FEED ON/OFF/OFFSET (HOME TO SENSOR THEN OFF SENSOR 79
HOME TYPE 5. FEED ON/OFF/ON (HOME TO SENSOR THEN OFF SENSOR T 80
INDEXING OPERATION MODE 67
ABSOLUTE INDEX 69
FEED-TO-SENSOR INDEX 71
INCREMENTAL INDEX 68
REGISTRATION INDEX 70
INPUT/OUTPUT INTERFACE 82
CONNECTIONS 86
DEFAULT CONFIGURATION 84

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

DESCRIPTIONS OF I/O FUNCTIONS 87
INPUT FUNCTIONS 85
OUTPUT FUNCTIONS 84
INSTALLATION 16
120 VAC SINGLE PHASE MODELS 16
Brake Option 18
Electrical Noise 20
External Disconnecting 19
Gear Reducer Oil 21
Grounding Considerations 19
Load Coupling 21
Magnetic Coil Noise 20
Mechanical Consideration 21
Power Line 18
Safety Considerations 18
Selecting An Enclosure 22
System Troubleshooting 22
Wiring Considerations 17
INTRODUCTION 1
BASIC POSITIONING DRIVE AMPLIFIER 3
Calibration 1
Installation 1
Motor 1
Programming and Troubleshooting 1
SYSTEM OVERVIEW 2
IOM-1 102
I/O CONNECTIONS 107
INPUT FUNCTIONS 106
INPUT/OUTPUT INTERFACE 103
INSTALLATION 102
OUTPUT FUNCTIONS 105
MODE SELECTION 43
(+)/(-) 10 VDC signal 44
+/-10 = +/- peak torque 44
ANALOG MODE 44
DIP SWITCHES 43
PULSE MODE 46
Pulse/Direction Modes 47
VELOCITY/TORQUE MODE 44
MOTOR MECHANICAL INFORMATION 29
DXE-430, DXE-450, DXE-480 35
DXM-202, DXM-205 32
DXM-308, DXM-318 33
DXM-430, DXM-450, DXM-480 34
DXM-780, DXM-7120 36
RT-202 29
RT-310 30
RT-420, RT-440, RT-460 31
MOTOR WIRING 37
DX* 308,318,430,450,480,780,7120 38

DXM-202,205 39
RT-202, 310, 420, 440, 460 37
PARALLEL INTERFACE 109
CABLE SHIELDING 119
CHARACTER BUFFER 117
CHARACTER DATA 122
INTRODUCTION 109
MOUNTING INFORMATION (THUMBWHEELS) 113
PARALLEL INTERFACE CONNECTOR 118
STANDARD CONFIGURATION (THUMBWHEELS) 116
THUMBWHEEL INTERFACE 110
THUMBWHEEL JUMPERS 114
Thumbwheel Wiring 111
THUMBWHEEL/T-16/IOM-1 CABLE CONNECTIONS 115
PARALLEL PROGRAMMING INTERFACE 118
DATA FIELD 124
DATA FIELD PURPOSE 125
FIRST DIGIT IN DATA FIELD 126
INDEX NUMBER 126
SETUP AND OPERATION 124
PCM-1 133
EXAMPLES OF I/O WIRING 138
I/O DESCRIPTIONS 139
INPUT FUNCTIONS 137
INPUT/OUTPUT INTERFACE 134
INSTALLATION AND CONNECTIONS 133
OUTPUT FUNCTIONS 136
PCM-1 PROGRAMMING 142
DESCRIPTION OF PROGRAMMING FUNCTIONS 144
DWELL TIME 144
END 144
EXECUTE COMPOUND INDEX 144
EXECUTE INDEX 144
EXECUTE PROGRAM 144
HOME 144
HOW TO CREATE A PROGRAM 146
PROGRAM FUNCTION CODES 145
PROGRAMMING CAPABILITIES 149
SET OUTPUTS (9, 10, 11) 148
UPDATE OUTPUTS 144
WAIT FOR INPUT 144
WHAT ARE PROGRAMS? 142
PCM-5 153
ADDED OUTPUT FUNCTIONS 162
ADDITIONAL I/O FUNCTIONS 169
ADDITIONAL PCM-5 PROGRAMMING 172
APPLICATION EXAMPLES 158
BASIC OPERATION 157
BI-POLAR SYNC ENABLED 174
BI-POLAR SYNCHRONIZATION 163

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EXAMPLES OF I/O CONNECTIONS 168
INDEX, HOME 174
INPUT FUNCTIONS 167
INPUT/OUTPUT INTERFACE 164
MSC-XXX 154
MULTIPLE AXIS DRIVES 160
OUTPUT FUNCTIONS 166
PARAMETERS 172
PCM-5 FEATURES 161
PROGRAMS 175
R = WAIT FOR COUNT (WTCNT) 176
S = START COUNTER (ST CT) 176
SCS-2 SYNC ENCODER 156
SSC-XXX 155
SYNC RATIO 172
SYNC VELOCITY SCALE FACTOR AND SYNC VELOCITY DECIMAL POINT 173
SYNCHRONIZATION CABLE 154
T = TIME BASE (TMBAS) 176
PERIPHERALS 4
IOM-1 Input/Output Expander Module 4
OPERATOR INTERFACE 5
PCM-1 4
PCM-5 4
T-16 Numeric Display 5
T-21 Data Entry Terminal 5
TW-XXX Thumbwheel Interface 5
PROGRAMMING 49
ACCEL/DECEL SHAPE 65
ACTUATOR POLARITY 64
CHANGING VALUES IN THE DATA ENTRY SCREENS 56
COMMAND.COM 50
CREATE NEW DATA FILE 60
DATA FILE 56
DEFINE MOTION 61
DIAGNOSTICS 58
DISK FILE OPERATIONS 60
Disk Operating System (DOS) 50
DISTANCE DECIMAL POINT LOCATION 64
DISTANCE LIMIT CW / CCW 66
DOWNLOAD DATA FILE TO DRIVE 58
DRIVE CONFIGURATION 62
DRIVE SETUP 58, 61
EDIT EXISTING DATA FILE 60
ESTABLISHING COMMUNICATIONS 59
FEED LIMIT DISTANCE 66
HOW TO START 50
INPUT FILTERING 63
INPUT POLARITY 63
INPUTS AND OUTPUTS 62
JOG 72

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

JOG, INDEX AND HOME 62
LIMITS 65
LIST FILE 56
MAKE LIST FILE FROM DATA FILE 60
MAXIMUM VELOCITY 66
MINIMUM ACCEL / DECEL RATE 66
MOVING THROUGH THE MENUS 50
ON-LINE OPERATIONS 57
PARAMETERS 63
PCX 49
POSITION (TRAVEL) LIM CW / CCW 66
PRINT LIST FILE 60
serial communications 57
SHELL 61
STOP DECELERATION RATE 66
TERMINAL MODE 58
TORQUE OUTPUT 65
TRAVEL LIMITS/FAULT DECELERATION RATE 66
UPLOAD DATA FROM DRIVE 58
USER STEPS PER REVOLUTION 64
USING PCX DISK FILES 56
VELOCITY DECIMAL POINT LOCATION 64
VELOCITY SCALE FACTOR 64
VELOCITY UNITS 64
SERIAL COMMANDS
RUN TIME COMMANDS 198
SERIAL INTERFACE 177
ASCII COMMANDS 184
AUTO LINE FEED 180
AXIS IDENTIFIER SWITCHES 180
BAUD RATE SWITCHES 180
DD-XXX MULTI-DROP CABLE 182
DUPLEX SWITCH 180
FRAMING INFORMATION 180
HOME COMMANDS 191
I/O COMMANDS 202
INDEX COMMANDS 186
INITIALIZATION COMMANDS 195
IOX SETUP/QUERY HARDWARE INPUT/OUTPUT 204
JOG COMMANDS 194
LOCATIONS OF SWITCHES 179
MISCELLANEOUS COMMANDS 201
PROGRAM COMMANDS 185
SERIAL CABLES 181
SERIAL INTERFACE CONTROL 183
SERIAL MULTI-DROP CONNECTION 178
SERIAL SIGNAL FLOW DIAGRAMS 178
SETTING UP THE SERIAL INTERFACE SWITCHES AND PROTOCOL 179
SUMMARY OF SERIAL COMMANDS 205
Wiring Diagrams From Computer to Drive 181

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

SPECIFICATIONS 8
ANALOG INPUTS 9
ANGULAR ACCURACY 8
COMMAND INPUTS 9
DX-DRIVES THERMAL RATINGS 15
DX-SERIES MOTORS AND AMPLIFIERS TYPICAL SPEED TORQUE CURVES 12
FAIL-SAFE BRAKE 9
INPUT POWER 8
INPUTS AND OUTPUTS 9
PULSE MODE 9
PULSE MODE INPUT 8
SERIAL INTERFACE 9
SWITCHING FREQUENCY 8
T-DRIVE THERMAL RATINGS 14
T-SERIES MOTORS AND AMPLIFIERS TYPICAL SPEED TORQUE CURVES 11
THERMAL SHUT DOWN 8
TORQUE SIGNAL INPUT 8
USER UNITS/REV 8
VELOCITY SIGNAL INPUT 8
SUSPEND/RESUME FUNCTIONS 150
AUTOMATICALLY CLEAR AFTER SUSPEND 152
AUTOMATICALLY RESUME 152
AUTOMATICALLY RETURN AFTER PROGRAM 152
EXTENDED SUSPEND/RESUME PROGRAMMING 151
PROGRAM NUMBER 152
RETURN INDEX NUMBER 152
RUN PROGRAM ON SUSPEND 151
SUSPEND CYCLE 150
T-16 SETUP AND OPERATION 131
NUMERIC DISPLAY INTERFACE 131
AMPLIFIER I/O LOCATIONS 26
DX-480, DX-780, DX-7120 28
TA-202, TA-310, DX-202, DX-205, DX-308 26
TA-420, TA-440, TA-460, DX-318, DX-430, DX-450 27
AMPLIFIER MOUNTING INFORMATION 23
DX-480, DX-780, DX-7120 25
TA-202, TA-310, DX-202, DX-205, DX-308 23
TA-420, TA-440, TA-460, DX-318, DX-430, DX-450 24
BASIC OPERATION MODES 76
ASCII COMMANDS 76
SERIAL INTERFACE 76
SERIAL MODE 76
CABLES 40
BULKHEAD CONNECTORS 41
TDS/TDL CABLE WIRING DIAGRAM 40
TDT CABLE WIRING DIAGRAM 40
DIAGNOSTICS 90
AVG Current Fault 93
Bridge Temperature Fault 95
FAULT INDICATOR CODES 93

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Fuse Fault/LOW VOLTAGE 95
HIGH INERTIA LOADS 96
Logic Supply Fault 94
Motor Temperature Fault 94
NOISE AC LINES - I/O LINES 93
NON-OPERATIONAL 95
POOR GROUNDING 93
POSITION ERROR FAULT 92
Resolver Fault 94
Shorts Fault 94
STATUS INDICATOR CODES 90
WATCH DOG TIMER FAULT 93
HOME TYPES
HOME 68
HOME TYPE 0. OFFSET (HOME TO RESOLVER 0 + OFFSET) 70
HOME TYPE 1. FEED ON (HOME TO SENSOR) 71
HOME TYPE 2. FEED ON/OFFSET (HOME TO SENSOR THEN OFFSET) 72
HOME TYPE 3. FEED ON/OFF (HOME TO SENSOR THEN OFF SENSOR) 73
HOME TYPE 4.FEED ON/OFF/OFFSET (HOME TO SENSOR THEN OFF SENSOR 74
HOME TYPE 5. FEED ON/OFF/ON (HOME TO SENSOR THEN OFF SENSOR T 75
INDEXING OPERATION MODE 62
ABSOLUTE INDEX 64
FEED-TO-SENSOR INDEX 66
INCREMENTAL INDEX 63
REGISTRATION INDEX 65
INPUT/OUTPUT INTERFACE 77
CONNECTIONS 81
DEFAULT CONFIGURATION 79
DESCRIPTIONS OF I/O FUNCTIONS 82
INPUT FUNCTIONS 80
OUTPUT FUNCTIONS 79
INSTALLATION 16
120 VAC SINGLE PHASE MODELS 16
Brake Option 18
Electrical Noise 20
External Disconnecting 19
Gear Reducer Oil 21
Grounding Considerations 19
Load Coupling 21
Magnetic Coil Noise 20
Mechanical Consideration 21
Power Line 18
Safety Considerations 18
Selecting An Enclosure 22
System Troubleshooting 22
Wiring Considerations 17
INTRODUCTION 1
BASIC POSITIONING DRIVE AMPLIFIER 3
Calibration 1
Installation 1

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Motor 1
Programming and Troubleshooting 1
SYSTEM OVERVIEW 2
IOM-1 97
I/O CONNECTIONS 102
INPUT FUNCTIONS 101
INPUT/OUTPUT INTERFACE 98
INSTALLATION 97
OUTPUT FUNCTIONS 100
MODE SELECTION 43
(+)/(-) 10 VDC signal 44
+/-10 = +/- peak torque 44
ANALOG MODE 44
DIP SWITCHES 43
PULSE MODE 46
Pulse/Direction Modes 47
SINKING/SOURCING CONNECTIONS 48
VELOCITY/TORQUE MODE 44
MOTOR MECHANICAL INFORMATION 29
DXE-430, DXE-450, DXE-480 35
DXM-202, DXM-205 32
DXM-308, DXM-318 33
DXM-430, DXM-450, DXM-480 34
DXM-780, DXM-7120 36
RT-202 29
RT-310 30
RT-420, RT-440, RT-460 31
MOTOR WIRING 37
DX* 308,318,430,450,480,780,7120 38
DXM-202,205 39
RT-202, 310, 420, 440, 460 37
PARALLEL INTERFACE 104
CABLE SHIELDING 114
CHARACTER BUFFER 112
CHARACTER DATA 117
INTRODUCTION 104
MOUNTING INFORMATION (THUMBWHEELS) 108
PARALLEL INTERFACE CONNECTOR 113
STANDARD CONFIGURATION (THUMBWHEELS) 111
THUMBWHEEL INTERFACE 105
THUMBWHEEL JUMPERS 109
Thumbwheel Wiring 106
THUMBWHEEL/T-16/IOM-1 CABLE CONNECTIONS 110
PARALLEL PROGRAMMING INTERFACE 113
DATA FIELD 119
DATA FIELD PURPOSE 120
FIRST DIGIT IN DATA FIELD 121
INDEX NUMBER 121
SETUP AND OPERATION 119
PCM-1 128

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EXAMPLES OF I/O WIRING 133
I/O DESCRIPTIONS 134
INPUT FUNCTIONS 132
INPUT/OUTPUT INTERFACE 129
INSTALLATION AND CONNECTIONS 128
OUTPUT FUNCTIONS 131
PCM-1 PROGRAMMING 137
DESCRIPTION OF PROGRAMMING FUNCTIONS 139
DWELL TIME 139
END 139
EXECUTE COMPOUND INDEX 139
EXECUTE INDEX 139
EXECUTE PROGRAM 139
HOME 139
HOW TO CREATE A PROGRAM 141
PROGRAM FUNCTION CODES 140
PROGRAMMING CAPABILITIES 144
SET OUTPUTS (9, 10, 11) 143
UPDATE OUTPUTS 139
WAIT FOR INPUT 139
WHAT ARE PROGRAMS? 137
PCM-5 148
ADDED OUTPUT FUNCTIONS 157
ADDITIONAL I/O FUNCTIONS 164
ADDITIONAL PCM-5 PROGRAMMING 167
APPLICATION EXAMPLES 153
BASIC OPERATION 152
BI-POLAR SYNC ENABLED 169
BI-POLAR SYNCHRONIZATION 158
EXAMPLES OF I/O CONNECTIONS 163
INDEX, HOME 169
INPUT FUNCTIONS 162
INPUT/OUTPUT INTERFACE 159
MSC-XXX 149
MULTIPLE AXIS DRIVES 155
OUTPUT FUNCTIONS 161
PARAMETERS 167
PCM-5 FEATURES 156
PROGRAMS 170
R = WAIT FOR COUNT (WTCNT) 171
S = START COUNTER (ST CT) 171
SCS-2 SYNC ENCODER 151
SSC-XXX 150
SYNC RATIO 167
SYNC VELOCITY SCALE FACTOR AND SYNC VELOCITY DECIMAL POINT 168
SYNCHRONIZATION CABLE 149
T = TIME BASE (TMBAS) 171
PERIPHERALS 4
IOM-1 Input/Output Expander Module 4
OPERATOR INTERFACE 5

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

PCM-1 4
PCM-5 4
T-16 Numeric Display 5
T-21 Data Entry Terminal 5
TW-XXX Thumbwheel Interface 5
PROGRAMMING 49
ACCEL/DECEL SHAPE 60
ACTUATOR POLARITY 59
CHANGING VALUES IN THE DATA ENTRY SCREENS 51
COMMAND.COM 50
CREATE NEW DATA FILE 55
DATA FILE 51
DEFINE MOTION 56
DIAGNOSTICS 53
DISK FILE OPERATIONS 55
Disk Operating System (DOS) 50
DISTANCE DECIMAL POINT LOCATION 59
DISTANCE LIMIT CW / CCW 61
DOWNLOAD DATA FILE TO DRIVE 53
DRIVE CONFIGURATION 57
DRIVE SETUP 53, 56
EDIT EXISTING DATA FILE 55
ESTABLISHING COMMUNICATIONS 54
FEED LIMIT DISTANCE 61
HOW TO START 50
INPUT FILTERING 58
INPUT POLARITY 58
INPUTS AND OUTPUTS 57
JOG 67
JOG, INDEX AND HOME 57
LIMITS 60
LIST FILE 51
MAKE LIST FILE FROM DATA FILE 55
MAXIMUM VELOCITY 61
MINIMUM ACCEL / DECEL RATE 61
MOVING THROUGH THE MENUS 50
ON-LINE OPERATIONS 52
PARAMETERS 58
PCX 49
PCX PROGRAM REVISION 50
POSITION (TRAVEL) LIM CW / CCW 61
PRINT LIST FILE 55
serial communications 52
SHELL 53, 56
STOP DECELERATION RATE 61
TERMINAL MODE 53
TORQUE OUTPUT 60
TRAVEL LIMITS/FAULT DECELERATION RATE 61
UPLOAD DATA FROM DRIVE 53
USER STEPS PER REVOLUTION 59

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

USING PCX DISK FILES 51
VELOCITY DECIMAL POINT LOCATION 59
VELOCITY SCALE FACTOR 59
VELOCITY UNITS 59
SERIAL COMMANDS
RUN TIME COMMANDS 193
SERIAL INTERFACE 172
ASCII COMMANDS 179
AUTO LINE FEED 175
AXIS IDENTIFIER SWITCHES 175
BAUD RATE SWITCHES 175
DD-XXX MULTI-DROP CABLE 177
DUPLEX SWITCH 175
FRAMING INFORMATION 175
HOME COMMANDS 186
I/O COMMANDS 197
INDEX COMMANDS 181
INITIALIZATION COMMANDS 190
IOX SETUP/QUERY HARDWARE INPUT/OUTPUT 199
JOG COMMANDS 189
LOCATIONS OF SWITCHES 174
MISCELLANEOUS COMMANDS 196
PROGRAM COMMANDS 180
SERIAL CABLES 176
SERIAL INTERFACE CONTROL 178
SERIAL MULTI-DROP CONNECTION 173
SERIAL SIGNAL FLOW DIAGRAMS 173
SETTING UP THE SERIAL INTERFACE SWITCHES AND PROTOCOL 174
SUMMARY OF SERIAL COMMANDS 200
Wiring Diagrams From Computer to Drive 176
SPECIFICATIONS 8
ANALOG INPUTS 9
ANGULAR ACCURACY 8
COMMAND INPUTS 9
DX-DRIVES THERMAL RATINGS 15
DX-SERIES MOTORS AND AMPLIFIERS TYPICAL SPEED TORQUE CURVES 12
FAIL-SAFE BRAKE 9
INPUT POWER 8
INPUTS AND OUTPUTS 9
PULSE MODE 9
PULSE MODE INPUT 8
SERIAL INTERFACE 9
SWITCHING FREQUENCY 8
T-DRIVE THERMAL RATINGS 14
T-SERIES MOTORS AND AMPLIFIERS TYPICAL SPEED TORQUE CURVES 11
THERMAL SHUT DOWN 8
TORQUE SIGNAL INPUT 8
USER UNITS/REV 8
VELOCITY SIGNAL INPUT 8
SUSPEND/RESUME FUNCTIONS 145

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

AUTOMATICALLY CLEAR AFTER SUSPEND 147
AUTOMATICALLY RESUME 147
AUTOMATICALLY RETURN AFTER PROGRAM 147
EXTENDED SUSPEND/RESUME PROGRAMMING 146
PROGRAM NUMBER 147
RETURN INDEX NUMBER 147
RUN PROGRAM ON SUSPEND 146
SUSPEND CYCLE 145
T-16 SETUP AND OPERATION 126
NUMERIC DISPLAY INTERFACE 126

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP