MNET-4MXO Series

MNET-4XMO/MNET-4XMO-C

Motionnet Distributed 4-axis
Motion Control Module

User's Manual



Manual Rev.: 3.1

Revision Date: February 11, 2025

Part No.: 50-11165-2010

Recycled Paper

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Advance Technologies; Automate the World.

Revision History

Revision	Release Date	Description of Change(s)
3.0	2012/07/13	Version 3.0 for new PCB
3.1	2025/02/11	Version 3.1 - Getting started updated

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Table of Contents

List of Figures ..... **vii**

List of Tables ..... **ix**

Preface ..... **xi**

1 Introduction **1**
1.1 Specifications 2
1.2 Supported Software 4

2 Getting Started **5**
2.1 Installation Environment 5
2.2 Package Contents 6
2.3 MNET-4XMO / MNET-4XMO-C Schematics 7
2.3.1 J8 Pin Assignment 9
2.3.2 HS1-2 (RJ-45) Pin Assignment 9
2.3.3 CN1 Pin Assignment: Servo Interface Braking Signals 10
2.3.4 IOIF1-4 Pin Assignment: Mechanical I/O and GPIO Signal Connector 11
2.4 CM1-4 Pin Assignments: Servo Interface 12
2.5 S1: Switch Settings for MNET Slave ID 13
2.6 S2: Communication Speed Selection Switch 13
2.7 S3, S5: Enable/Disable DO to Reset Servo Driver 14
2.8 S6: Enable/Disable Termination Resistor (TMR) and TUD 14
2.9 S7: Grounding CM1-4 (FGND) 15
2.10 JP4: Enable/Disable EMG Signal 15
2.11 JP5/JP6: Common Power or Different Power Selection 16

3 Signal Connections **17**
3.1 Emergency Stop Output Signal 17

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3.2 Trigger Output Signals CMP+ and CMP- (*) 18
3.3 Pulse Output Signals OUT and DIR 21
3.4 Encoder Feedback Signals EA, EB and EZ 23
3.5 Origin Signal ORG 25
3.6 End-Limit Signals PEL and MEL 27
3.7 In-position Signal INP 28
3.8 Alarm Signal ALM 30
3.9 General Purpose Signal SVON 30
3.10 Deviation counter clear signal ERC 32
3.11 General-purpose Signal RDY 33
3.12 General Purpose Digital Output Signals DO 34
3.13 General Purpose Digital Input Signals DI 35
3.14 NMET 4XMO LED Indicator 36

4 Motionnet Master-Slave Motion System 39
4.1 MNET System Architecture 39
4.2 MNET System Specifications 41
4.2.1 Wiring Cable 42
4.2.2 MNET System Communication 43

5 Operation Theory 45
5.1 Classifications of Motion Controller 45
5.1.1 Analog Type Motion Control Interface 45
5.1.2 Pulse Type Motion Control Interface 46
5.1.3 Network Type Motion Control Interface 46
5.1.4 Software Real-time Motion Control Kernel 46
5.1.5 ASIC Motion Control Kernel 47
5.1.6 MNET-4XMO's Motion Controller Type 47
5.2 Motion Control Modes 48
5.2.1 Single Motion 48
5.2.2 Home Return 65
5.3 Motion Status and Related IO Monitoring 77

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.3.1 Position control and feedback 78
5.3.2 Velocity feedback 79
5.3.3 Motion I/O status 79
5.3.4 Motion status 81
5.4 Driver Management 82
5.5 E-Gear (Move Ratio)..... 83
5.6 MNET-4XMO-C Continuous Trigger Function (*) 85
5.7 MNET-4XMO-C Path Move Function(*)..... 88
5.8 MNET-4XMO-C Fast Index Move Function(*) 92

6 MotionCreatorPro 2 93
6.1 Execute MotionCreatorPro 2 94
6.2 About MotionCreatorPro 2 94
6.3 MotionCreatorPro 2 Form Introducing 95
6.3.1 Main Window 95
6.3.2 Motionnet Distributed Motion Manager..... 98
6.4 Return Error Code 117

7 Appendix 119

Getting Service..... 121

Important Safety Instructions 123

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

List of Figures

Figure 2-1: MNET-4MXO Top View 7
Figure 2-2: MNET-4MX0 Side View 7
Figure 2-3: MNET-4XMO Board Features 8
Figure 2-4: MNET-4XMO Brake Signal Connection Map 10
Figure 2-5: MNET Slave ID Switch Settings 13
Figure 2-6: Communication Speed Selection 13
Figure 2-7: Alarm Reset Signals Enable Selection 14
Figure 2-8: TMR and TUD Settings 14
Figure 2-9: FGND Connection 15
Figure 2-10: MNET EMG Signal Enable/Disable Jumper Setting. 15
Figure 2-11: Common Power with
Differential Power Jumper Setting 16
Figure 3-1: Emergency Stop Output Wiring 18
Figure 3-2: DI Signal Wiring 36
Figure 4-1: Motionnet System Architecture 39

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

List of Tables

Table 2-1: Board Features Legend 9
Table 2-2: JP8 Pin Assignment 9
Table 2-3: HS1-HS2 (RJ-45) Pin Assignment 10
Table 2-4: CN1 Pin Assignment 10
Table 2-5: IOIF1-4 Pin Assignment: MNET-4XMO 11
Table 2-6: IOIF1-4 Pin Assignment: MNET-4XMO-C 11
Table 2-7: CM1~4 Pin Assignment for MNET-4XMO-C 12
Table 4-1: Motionnet Master Controllers 40
Table 4-2: MNET System Specifications 41
Table 5-1: Motion I/O Status Bit Definition 80
Table 5-2: Motion Status Definition Table 81

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Preface

Copyright 2025 ADLINK Technology, Inc.

This document contains proprietary information protected by copyright. All rights are reserved. No part of this manual may be reproduced by any mechanical, electronic, or other means in any form without prior written permission of the manufacturer.

Disclaimer

The information in this document is subject to change without prior notice in order to improve reliability, design, and function and does not represent a commitment on the part of the manufacturer.

In no event will the manufacturer be liable for direct, indirect, special, incidental, or consequential damages arising out of the use or inability to use the product or documentation, even if advised of the possibility of such damages.

Environmental Responsibility

ADLINK is committed to fulfill its social responsibility to global environmental preservation through compliance with the European Union's Restriction of Hazardous Substances (RoHS) directive and Waste Electrical and Electronic Equipment (WEEE) directive. Environmental protection is a top priority for ADLINK. We have enforced measures to ensure that our products, manufacturing processes, components, and raw materials have as little impact on the environment as possible. When products are at their end of life, our customers are encouraged to dispose of them in accordance with the product disposal and/or recovery programs prescribed by their nation or company.

Trademarks

Product names mentioned herein are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.



Additional information, aids, and tips that help users perform tasks.



Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.



Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

1 Introduction

The MNET-4XMO is a 4-axis motion controller module for Motionnet distributed motion systems. It can generate fast frequency pulses (9.9 MHz) to drive stepper or servomotors in the machine automation field. As a motion controller, it can provide comprehensive motion functions which include 2 axis circular interpolation, 2-4 axis linear interpolation, or continuous interpolation for continual velocity and so on. Also, changing position/speed on the fly is available with a single axis operation.

Multiple MNET-4XMO modules can be used in one Motionnet system. Incremental encoder interface on all four axes provide the ability to correct positioning errors generated by inaccurate mechanical transmissions. By integrating Motionnet technology, whole motion functions are able to perform with time-deterministic cycle time with less CPU resource. In addition, a mechanical sensor interface, servo motor interface, and general-purposed I/O signals are provided for easy system integration.

The MNET-4XMO applies with brand-new Motion ASIC technology to perform all 4 axes motion controls and one MNET satellite to communicate with Host PC and Motionnet protocol. The motion control functions include linear and S-curve acceleration/deceleration, circular interpolation between two axes, linear interpolation between 2-4 axes and 13 home return modes. All these functions and complex computations are performed internally by the ASIC, thus limiting the impact on the PC's CPU usage.

In addition to the motion functions offered, ADLINK offers another model (the MNET-4XMO-C) that comes equipped with real-time position comparison and trigger pulse output function to easy integrate into Automated Optical Inspection application system. Up to 100 KHz trigger output frequency and easy trigger the most frame grabber or CCD to realize the line scan application. The path move function features the continuous moving with constant velocity. By using the path moving function, you can save the Host PC resource with path auto-reload function and is able to guarantee the time-deterministic, continuous and smooth in whole motion progression.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

1.1 Specifications

Motionnet Communication	
Slave ID Consumption	1 (Manually Selectable by Switch)
Communication speed	2.5MHz, 5MHz , 10MHz, 20MHz (Manually selectable by switch)
Communication broken action	Module Reset or Keep working selectable by switch
Keep mode	When Keep working is selected, users can select motion EMG stop or keep moving
Hardware	
Number of Controllable Axes	4
Reference Clock	30 Mhz
Pulse Output Rate	0.01 pps to 9.9 Mpps
Positioning Range	-2,147,483,648 to +2,147,483,647
Acceleration / Deceleration	1-65,535 (16-bit)
Speed Resolution	16-bit
Counters	Counter 1: Command position counter (32 bit) Counter 2: Mechanical position counter (32 bit) Counter 3: defection counter (16 bit) Counter 4: general-purpose counter (32 bit)
Comparators	x 5 for each axis (32 bit)
Trajectories	
Acceleration / Deceleration Type	Pure S, T, Bell Curve programmable
Interpolation Mode	Any 2-4 axes Linear Interpolation Any 2 axes Circular Interpolation
Speed override	Speed override in speed mode and position mode
Position Override	Override in forward position and backward position
Triangle driver elimination	Automatically slow down maximum speed in small distance profile

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Vibration Restriction	Decrease machine vibration in stopping
Home return modes	13 modes and support auto search
Single Axis Mode	Position/Speed mode
Other I/O	
EMG Input	1
CMP Output (*1)	4 (differential types)
Dedicated LED (Blink when system not working)	
Motionnet communication status	Green
Motion I/O status	PEL/MEL/ORG
EMG	Red
End-Limit & Servo & Other Motion I/O logic setting (General)	
Logic Type	NH/NL (Software Programmable for each axis)
Trigger Function (*1) (channel to channel ONLY)	
Table Mode	Linear / Table
Trigger Spec.	Max. 100 Khz / 4-axes
Trigger pulse width	Depends on condition and counter speed
Table Size	32,768 points / 4-axes (8,192 points / axis)
Linear Mode parameters	Start/Repeat times/Interval for each axis
Trigger Condition	Greater / Equal / Smaller mode
High-Speed Trigger Function (*1) (Linear function ONLY)	
Trigger Spec.	Max. 1Mhz / 1-axis
Linear parameters	Start/Repeat times/Interval for first axis
Trigger pulse width	0.1us - 1s (programmable)
Trigger Type	Normal High/Low/Toggle programmable
Trigger Condition	Equal mode
Path Move (*1)	
Path number	2,048 points total (min.)
Auto Reload	Point index check
Continuous move	1 Group (includes single axis move or linear / circular interpolation move)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

General Specifications	
Dimensions	165.3 L × 74.9 W × 52.7H mm
Module Power Supply Input (I24V,IGND)	24V DC±10% (Consumption current, 0.3A max.)
I/O Power Supply Input (E24V, EGND)	24V DC input (can be common to module power input by jumper)
Operating Temperature	0°C – 70°C
Storage Temperature	-20°C – 80°C

*1: MNET-4XMO-C only

1.2 Supported Software

Program Library

ADLINK provides a Windows WDM driver and DLL function library for the MNET-4XMO. The MNET-4XMO also support a consistency function library, the APS function library. Please refer to the APS function library user manual for details. These function libraries are shipped with the board and support Windows 2000/XP/Vista.

MotionCreatorPro 2 Utility

This Windows-based utility is used to setup cards, motors, and systems. It can also aid in debugging hardware and software problems. It allows users to set I/O logic parameters to be loaded in their own program. This product is also bundled with the card.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2 Getting Started

This chapter describes the proper installation environment, installation procedures, package contents and basic information users should be aware of regarding the MNET-4XMO/MNET-4XMO-C.

We suggest the following order of actions:

1. Unpack the MNET-4XMO/MNET-4XMO-C
2. Ensure the package contents are complete
3. Check the MNET-4XMO/MNET-4XMO-C module for visible damage
4. Install the module
5. Install the driver

2.1 Installation Environment

When unpacking and preparing to install, please refer to Important Safety Instructions.

Only install equipment in well-lit areas on flat, sturdy surfaces with access to basic tools such as flat- and cross-head screwdrivers, preferably with magnetic heads as screws and standoffs are small and easily misplaced.

Recommended Installation Tools

- Phillips (cross-head) screwdriver
- Flat-head screwdriver
- Anti-static wrist strap
- Antistatic mat



The equipment must be protected from static discharge and physical shock. Never remove any of the socketed parts except at a static-free workstation. Use the anti-static bag shipped with the product to handle the equipment and wear a grounded wrist strap when servicing.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.2 Package Contents

Inspect the carton and packaging for damage. Shipping and handling could cause damage to the equipment inside. Make sure that the equipment and its associated components have no damage before installation. In addition to this User's Guide, the package also includes either the

MNET-4XMO: Distributed 4-axis Motion Control Module

or the

MNET-4XMO-C: Distributed 4-axis Motion Control Module with High-Speed Trigger Function

Please ensure the correct model is present and check the package condition.

If any of these items are missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton to ship or store the product in the future.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.3 MNET-4XMO / MNET-4XMO-C Schematics

NOTE:

All dimensions shown are in mm.

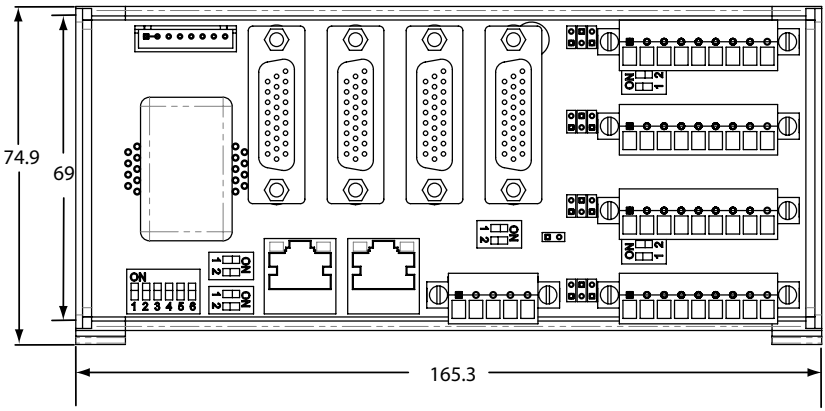


Figure 2-1: MNET-4MXO Top View

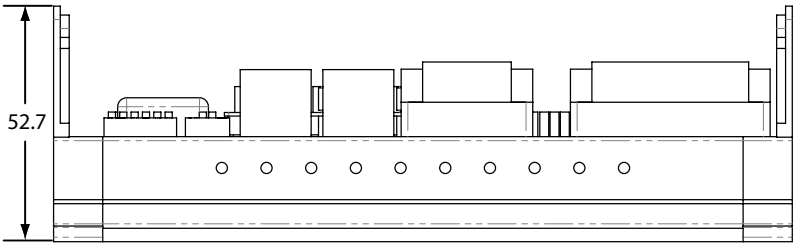


Figure 2-2: MNET-4MX0 Side View

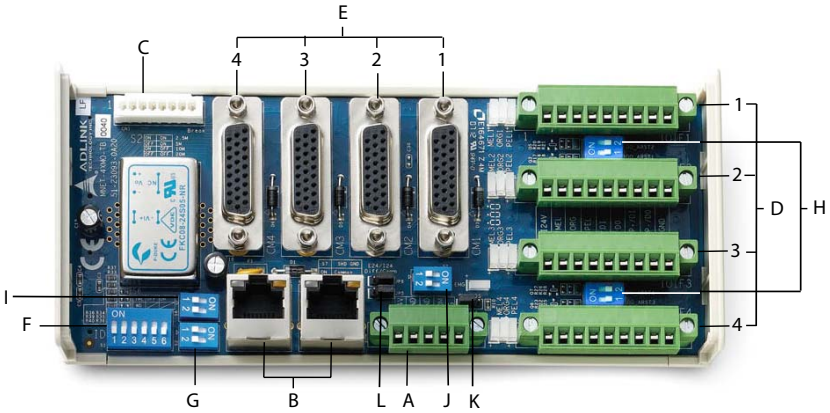


Figure 2-3: MNET-4XMO Board Features

	Item	Function
A	J8	External power input connector (+24V), digital input common, earth ground, and Emergency input pin
B	HS1, HS2	Motionnet communication signal connector (RJ45)
C	CN1	Brake signal from servo interface
D	IOIF1-4	Mechanical I/O and GPIO signal connector
E	CM1-4	Servo Interface Signal Connector
F	S1	Slave ID Switch
G	S2	Communication Speed Selector
H	S3, S5	Enable/Disable Digital Output connecting to reset servo driver
I	S6	▶ Termination Resistor Enable/Disable ▶ Maintain current state/Reset motion chipset
J	S7	Connects ground of CM1-4 to earth ground (FGND)
K	JP4	Enable/Disable EMG signal
L	JP5, JP6	Common or Differential power selection jumper

Table 2-1: Board Features Legend

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.3.1 J8 Pin Assignment

Pin	Description
E24V	+24VDC ± 5% External power supply (for module usage)
EGND	External power ground (for module usage)
FGND	Ground
DICOM	Mechanical Input and General Input Common
EMG	Emergency stop input

Table 2-2: JP8 Pin Assignment

NOTE:

DICOM should be connected to either IGND or I24V.

2.3.2 HS1-2 (RJ-45) Pin Assignment



Pin	Assignment
1	NC.
2	NC.
3	NC.
4	DATA–
5	DATA+
6	NC.
7	NC.
8	NC.

Table 2-3: HS1-HS2 (RJ-45) Pin Assignment

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.3.3 CN1 Pin Assignment: Servo Interface Braking Signals

CN1 Pin	Description
Brake1+	Braking signal 1 (+)
Brake1-	Braking signal 1 (-)
Brake2+	Braking signal 2 (+)
Brake2-	Braking signal 2 (-)
Brake3+	Braking signal 3 (+)
Brake3-	Braking signal 3 (-)
Brake4+	Braking signal 4 (+)
Brake4-	Braking signal 4 (-)

Table 2-4: CN1 Pin Assignment

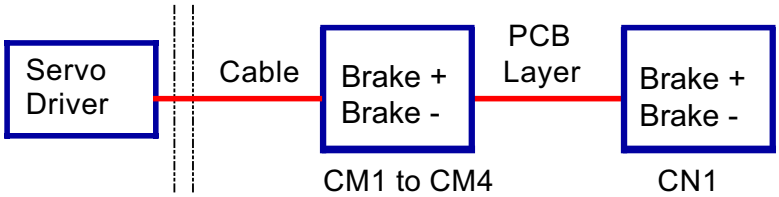


Figure 2-4: MNET-4XMO Brake Signal Connection Map

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.3.4 IOIF1-4 Pin Assignment: Mechanical I/O and GPIO Signal Connector

Pin	Name	Description
1	I24V	I/O power supply, +24V
2	MEL	End limit input signal (-)
3	ORG	Origin input signal
4	PEL	End limit input signal (+)
5	DI1/SD/ LTC	(default for DI) Ramp-down/position latch input signal
6	DO1	General purpose output 1
7	DI2	General purpose input 2
8	DO2	General purpose output 2
9	IGND	I/O power ground

Table 2-5: IOIF1-4 Pin Assignment: MNET-4XMO

Pin	Name	Description
1	I24V	I/O power supply, +24V
2	MEL	End limit input signal (-)
3	ORG	Origin input signal
4	PEL	End limit input signal (+)
5	DI/SD/LTC	(default for DI) Ramp-down/position latch input signal
6	DO	General purpose output
7	CMP+	Position compare output
8	CMP-	Negative compare output
9	IGND	I/O power ground

Table 2-6: IOIF1-4 Pin Assignment: MNET-4XMO-C

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

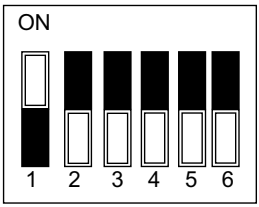
2.4 CM1-4 Pin Assignments: Servo Interface

Pin	Name	Function	Pin	Name	Function
1	SVON	Servo on output signal	2	INP	In-position input signal
3	ERC	Deviation counter clear output signal	4	RDY	Ready input signal
5	OUT-	Pulse signal (-)	6	OUT+	Pulse signal (+)
7	EA-	Encoder A-phase (-)	8	EA+	Encoder A-phase (+)
9	BRAKE+	Braking signal(+)	10	RST	Alarm reset output signal
11	ALM	Alarm input signal	12	I24V	I/O power supply, +24V
13	IGND	I/O power ground	14	BRAKE-	Braking signal(-)
15	IGND	I/O power ground	16	EB-	Encoder B-phase (-)
17	EB+	Encoder B-phase (+)	18	IGND	I/O power ground
19	EMG	Emergency stop output signal	20	IGND	I/O power ground
21	IGND	I/O power ground	22	IGND	I/O power ground
23	DIR-	Direction signal (-)	24	DIR+	Direction signal (+)
25	EZ-	Encoder Z-phase (-)	26	EZ+	Direction signal (+)

Table 2-7: CM1~4 Pin Assignment for MNET-4XMO-C

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.5 S1: Switch Settings for MNET Slave ID



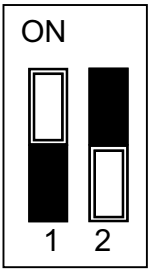
ON = 1

000000	Address 0 (default)
100000	Address 1
010000	Address 2
	~
011111	Address 62
111111	Address 63

OFF = 0

Figure 2-5: MNET Slave ID Switch Settings

2.6 S2: Communication Speed Selection Switch



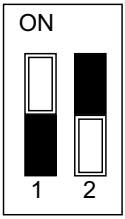
ON = 0

1	2	Speed
ON	ON	2.5M
OFF	ON	5M
ON	OFF	10M
OFF	OFF	20M (default)

Figure 2-6: Communication Speed Selection

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.7 S3, S5: Enable/Disable DO to Reset Servo Driver



ON = Reset servo driver

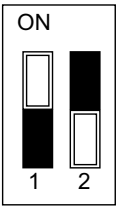
SW	1	2	
S3	ON		Reset servo driver 1
S3		ON	Reset servo driver 2
S5	ON		Reset servo driver 3
S5		ON	Reset servo driver 4

OFF is default

Figure 2-7: Alarm Reset Signals Enable Selection

There are 4 alarm reset signals on the MNET-4XMO(C), programmed by IOIF DO signals. The switches, after switching 'ON', pass DO1 signals to reset the servo (CM1.10 - CM4.10).

2.8 S6: Enable/Disable Termination Resistor (TMR) and TUD

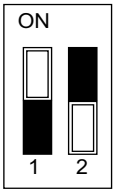


TMR 1	TUD 2	Function
ON		TMR ON
OFF		TMR OFF (default)
	ON	Reset Motion Chipset
	OFF	Keep current state (default)

Figure 2-8: TMR and TUD Settings

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.9 S7: Grounding CM1-4 (FGND)



1	2	
ON	OFF	Set FGND as Common GND
OFF	ON	Set FGND as Common GND
ON	ON	Set FGND as Common GND (default)
OFF	OFF	Separate the ground of CM 1-4 from FGND

Figure 2-9: FGND Connection

2.10 JP4: Enable/Disable EMG Signal

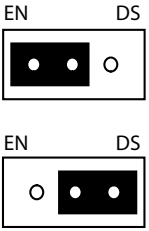


Figure 2-10: MNET EMG Signal Enable/Disable Jumper Setting

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

2.11 JP5/JP6: Common Power or Different Power Selection

The E24V is a DC 24V external power supply, providing system power with 5V and 3V and 1.5V. The I24V is a DC 24V I/O power supply. The I24V Provides ‘Servo Input IO and EMG’ with 24V.The I24V can use IOIF input DC 24V or use common power E24V.

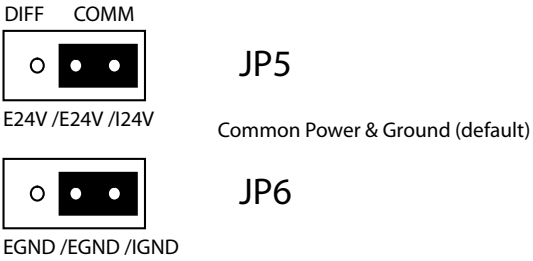


Figure 2-11: Common Power with Differential Power Jumper Setting

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3 Signal Connections

Signal connections of all I/O's are described in this chapter. Refer to the contents of this chapter before wiring any cable between the MNET 4XMO / MNET 4XMO-C and any motor driver.

3.1 Emergency Stop Output Signal

There is emergency stop input pin for this module. When EMG is active, all the motion pulse output command will be rejected until the EMG is deactive. The emergency stop switch should have a contact capacity of +24V @ 6mA minimum. 'B-type' (normal closed) contact switches can be used. The type of switch can be configured by software.

CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
19	EMG	1	19	EMG	2

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
19	EMG	3	19	EMG	4

JP8 Pin No	Signal Name	Axis #
5	EMG	All

The following wiring diagram is for Emergency stop output signal.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

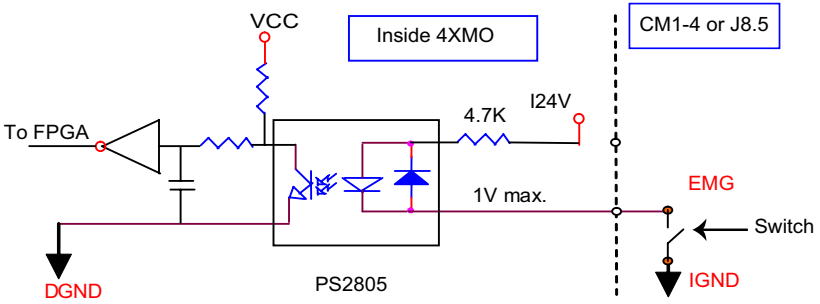


Figure 3-1: Emergency Stop Output Wiring

3.2 Trigger Output Signals CMP+ and CMP- (*)

The Trigger output signals only for MNET-4XMO-C version. The MNET-4XMO-C provides 4 comparison output channels. The comparison output channel will generate a pulse signal when the encoder counter reaches a pre-set value set by the user. Refer to section 5.6 for details of the logical characteristics of the CMP signal. In this section, the electrical characteristics of the CMP signal are detailed. Each signal consists of a pair of differential signals. For example, CMP1 consists of CMP1+ and CMP1- signals. The following table shows all pulse output signals on IOIF1-IOIF4.

IOIF1 Pin No.	Signal Name	Description	Axis #
7	**CMP1+**	Trigger signal (+)	1
8	**CMP1-**	Trigger signal (-)	1
IOIF2 Pin No.	Signal Name	Description	Axis #
7	**CMP2+**	Trigger signal (+)	2
8	**CMP2-**	Trigger signal (-)	2

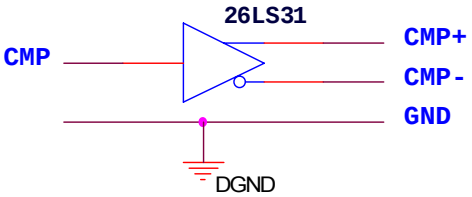
IOIF3 Pin No.	Signal Name	Description	Axis #
7	**CMP3+**	Trigger signal (+)	3
8	**CMP3-**	Trigger signal (-)	3

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

IOIF4 Pin No.	Signal Name	Description	Axis #
7	**CMP4+**	Trigger signal (+)	4
8	**CMP4-**	Trigger signal (-)	4

The following wiring diagram is for CMP signal of axis.

MNET 4XMO-C



Note: (*): Only applies to MNET-4XMO-C

CMP trigger type can be set as normal low (rising edge) or normal high (falling edge). Default setting is normal high.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3.3 Pulse Output Signals OUT and DIR

There are 4 axes pulse output signals on the MNET 4XMO-(C). For each axis, two pairs of OUT and DIR differential signals are used to transmit the pulse train and indicate the direction. The OUT and DIR signals can also be programmed as CW and CCW signal pairs. In this section, the electrical characteristics of the OUT and DIR signals are detailed. Each signal consists of a pair of differential signals. For example, OUT1 consists of OUT1+ and OUT1- signals. The following table shows all pulse output signals on CM1-CM4.

CM1 Pin No.	Signal Name	Description	Axis #
6	**OUT1+**	Pulse signal (+)	1
5	**OUT1-**	Pulse signal (-)	1
24	**DIR1+**	Direction signal (+)	1
23	**DIR1-**	Direction signal (-)	1

CM2 Pin No.	Signal Name	Description	Axis #
6	**OUT2+**	Pulse signal (+)	2
5	**OUT2-**	Pulse signal (-)	2
24	**DIR2+**	Direction signal (+)	2
23	**DIR2-**	Direction signal (-)	2

CM3 Pin No.	Signal Name	Description	Axis #
6	**OUT3+**	Pulse signal (+)	3
5	**OUT3-**	Pulse signal (-)	3
24	**DIR3+**	Direction signal (+)	3
23	**DIR3-**	Direction signal (-)	3

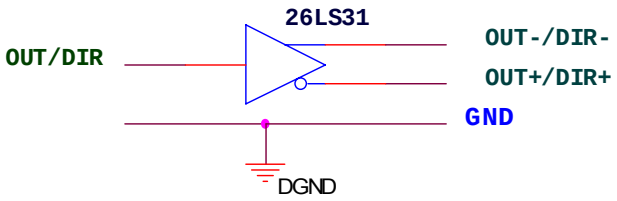
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

CM4 Pin No.	Signal Name	Description	Axis #
6	**OUT4+**	Pulse signal (+)	4
5	**OUT4-**	Pulse signal (-)	4
24	**DIR4+**	Direction signal (+)	4
23	**DIR4-**	Direction signal (-)	4

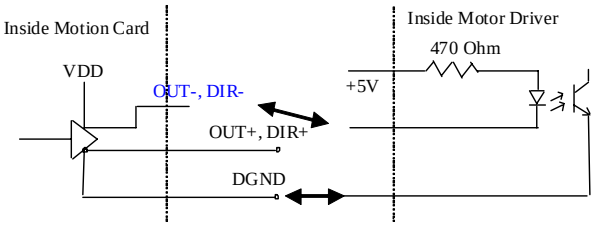
The default setting of OUT and DIR is set to differential line driver mode.

The following wiring diagram is for OUT and DIR signals of axis.

MNET 4XMO-(C)



Note: Suggest Usage: See the following figure. Choose OUT-/ DIR- to connect to driver's OUT/DIR



Warning: The sink current must not exceed 20mA or the 26LS31 will be damaged!

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3.4 Encoder Feedback Signals EA, EB and EZ

The encoder feedback signals include EA, EB, and EZ. Every axis has six pins for three differential pairs of phase-A (EA), phase-B (EB), and index (EZ) inputs. EA and EB are used for position counting, and EZ is used for zero position indexing. Its relative signal names, pin numbers, and axis numbers are shown in the following tables:

CM1-CM2

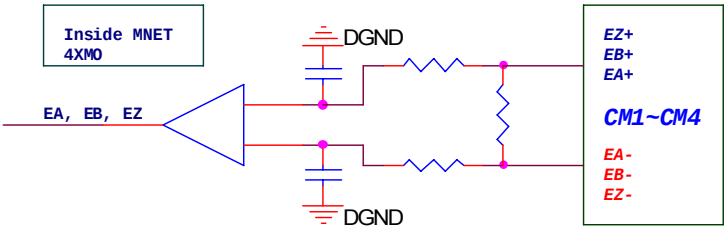
CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
8	EA1+	1	8	EA2+	2
17	EB1+	1	17	EB2+	2
26	EZ1+	1	26	EZ2+	2
7	EA1-	1	7	EA2-	2
16	EB1-	1	16	EB2-	2
25	EZ1-	1	25	EZ2-	2

CM3-CM4

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
8	EA3+	3	8	EA4+	4
17	EB3+	3	17	EB4+	4
26	EZ3+	3	26	EZ4+	4
7	EA3-	3	7	EA4-	4
16	EB3-	3	16	EB4-	4
25	EZ3-	3	25	EZ4-	4

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The input circuit of the EA, EB, and EZ signals is shown as follows:

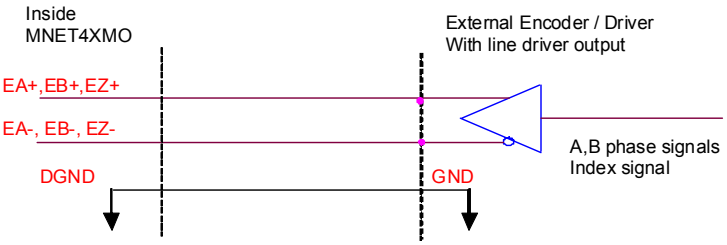


Please note that the voltage across each differential pair of encoder input signals (EA+, EA-), (EB+, EB-), and (EZ+, EZ-) have ±7V common mode range. Therefore, the output current must be observed when connecting to the encoder feedback or motor driver feedback as not to over drive the source. The differential signal pairs are converted to digital signals EA, EB, and EZ; then feed to the PCL6046 ASIC side.

Below is example of connecting the input signals with an external circuit. The input circuit can be connected to an encoder or motor driver if it is equipped with: a differential line driver

Connection to Line Driver Output

To drive the MNET 4XMO-(C) encoder input, the driver output must provide at least 0.2V across the differential pairs. The case grounds of both sides must be tied together. The maximum frequency is 5Mhz or more depends on wiring distance and signal conditioning.



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3.5 Origin Signal ORG

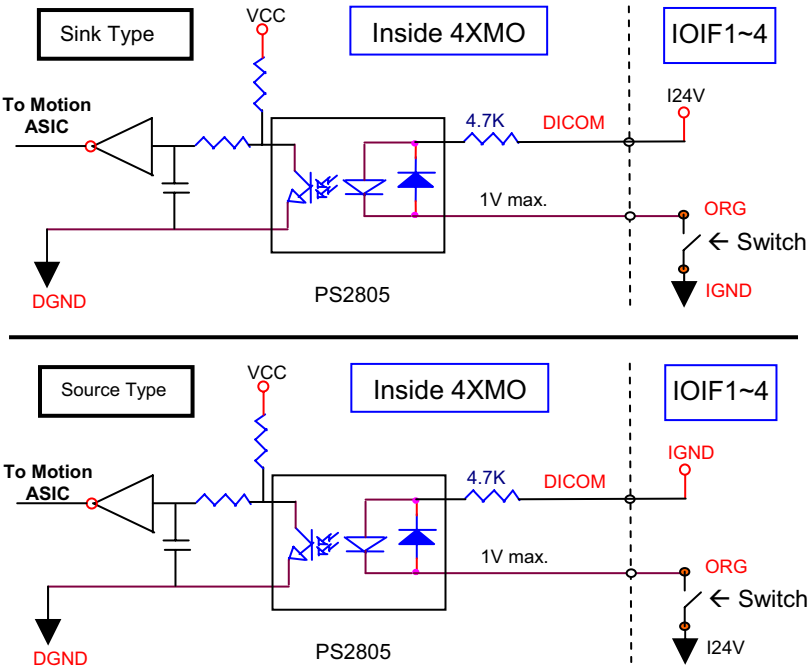
The origin signals (ORG1-ORG4) are used as input signals for the origin of the mechanism. The following table lists signal names, pin numbers, and axis numbers:

IOIF1 Pin No	Signal Name	Axis #	IOIF2 Pin No	Signal Name	Axis #
3	ORG1	1	3	ORG2	2

IOIF3 Pin No	Signal Name	Axis #	IOIF4 Pin No	Signal Name	Axis #
3	ORG3	3	3	ORG4	4

The input circuit of the ORG signals is shown below. Usually, a limit switch is used to indicate the origin on one axis. The specifications of the limit switch should have contact capacity of +24V @ 6mA minimum. An internal filter circuit is used to filter out any high frequency spikes, which may cause errors in the operation.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



When the motion controller is operated in the home return mode, the ORG signal is used to inhibit the control output signals (OUT and DIR).

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3.6 End-Limit Signals PEL and MEL

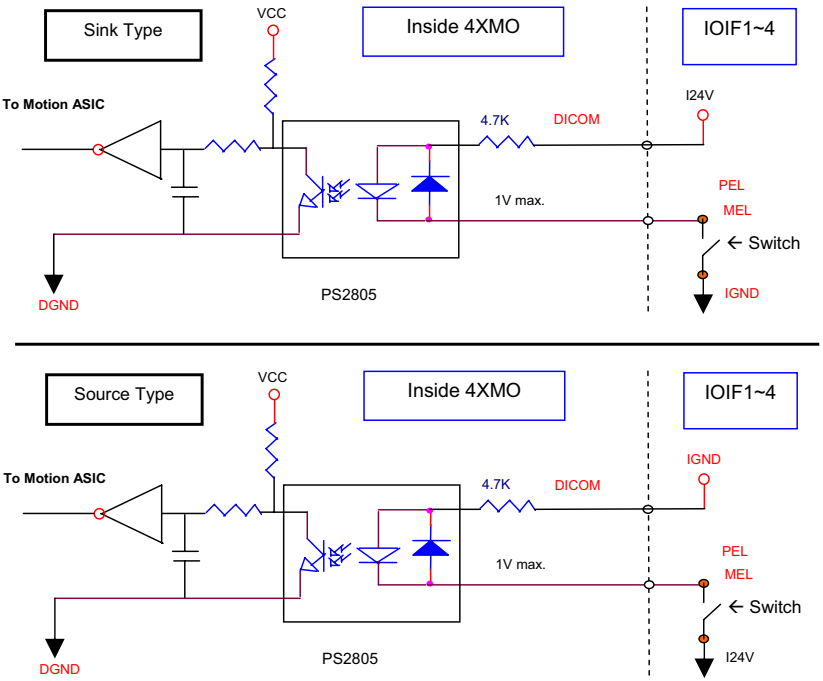
There are two end-limit signals PEL and MEL for each axis. PEL indicates the end limit signal is in the plus direction and MEL indicates the end limit signal is in the minus direction. The signal names, pin numbers, and axis numbers are shown in the table below:

IOIF1 Pin No	Signal Name	Axis #	IOIF2 Pin No	Signal Name	Axis #
4	PEL1	1	4	PEL2	2
2	MEL1	1	2	MEL2	2

IOIF3 Pin No	Signal Name	Axis #	IOIF4 Pin No	Signal Name	Axis #
4	PEL3	3	4	PEL4	4
2	MEL3	3	2	MEL4	4

A circuit diagram is shown in the diagram below. The external limit switch should have a contact capacity of +24V @ 6mA minimum. Either ‘A-type’ (normal open) contact or ‘B-type’ (normal closed) contact switches can be used. The type of switch can be configured by software. For more details on EL operation, refer to section 5.3.3.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



3.7 In-position Signal INP

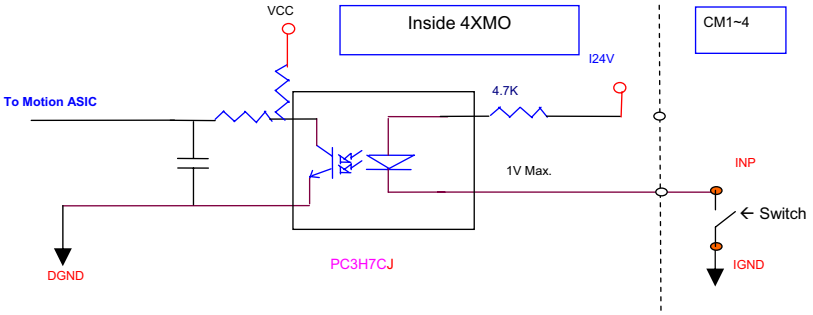
The in-position signal INP from a servo motor driver indicates its deviation error. If there is no deviation error then the servo's position indicates zero. The signal names, pin numbers, and axis numbers are shown in the table below:

CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
2	INP1	1	2	INP2	2

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
2	INP3	3	2	INP4	4

The input circuit of the INP signals is shown in the diagram below:

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



The in-position signal is usually generated by the servomotor driver and is ordinarily an open collector output signal. An external circuit must provide at least 6mA current sink capabilities to drive the INP signal.

3.8 Alarm Signal ALM

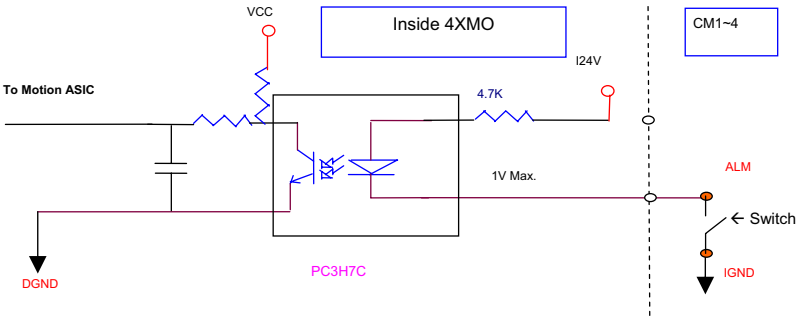
The alarm signal ALM is used to indicate the alarm status from the servo driver. The signal names, pin numbers, and axis numbers are shown in the table below:

CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
11	ALM1	1	11	ALM2	2

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
11	ALM3	3	11	ALM4	4

The ALM signal usually is generated by the servomotor driver and is ordinarily an open collector output signal. An external circuit must provide at least 6mA current sink capabilities to drive the ALM signal. For more details of ALM signal operations, refer to section 5.3.3. The input circuit of the ALM signals is shown in the diagram below:

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



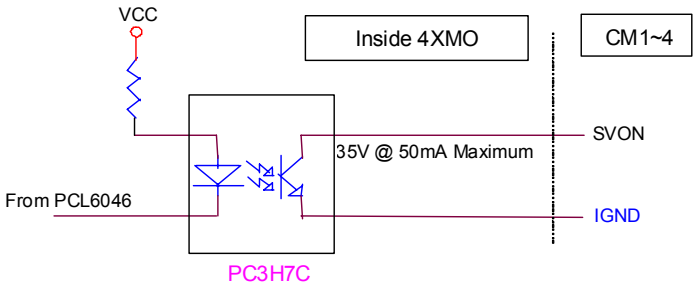
3.9 General Purpose Signal SVON

The SVON signal can be used as a servomotor-on control or general purpose output signal. The signal names, pin numbers, and its axis numbers are shown in the following table:

CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
1	SVON1	1	1	SVON 2	2

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
1	SVON 3	3	1	SVON 4	4

The output circuit for the SVON signal is shown below:



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3.10 Deviation counter clear signal ERC

The deviation counter clear signal (ERC) is active in the following 4 situations:

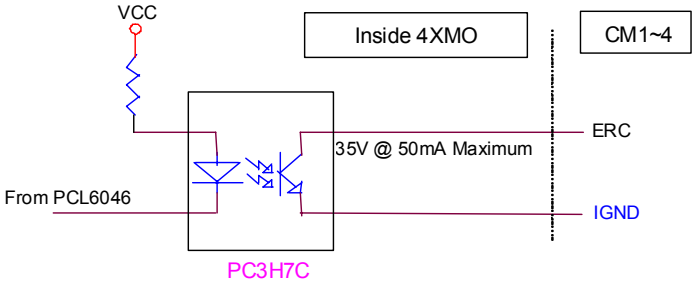
1. Home return is complete
2. End-limit switch is active
3. An alarm signal stops OUT and DIR signals
4. An emergency stop command is issued by software (operator)

The ERC signal is used to clear the deviation counter of the servo-motor driver. The ERC output circuit is an open collector with a maximum of 35V at 6mA driving capacity. For more details of ERC operation, refer to section 5.3.3.

CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
3	ERC1	1	3	ERC2	2

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
3	ERC3	3	3	ERC4	4

The output circuit for the ERC signal is shown below:



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

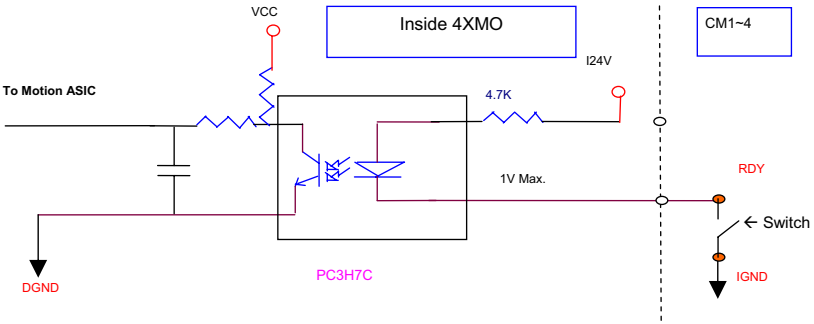
3.11 General-purpose Signal RDY

The RDY signals can be used as motor driver ready input or general purpose input signals. The input circuit of RDY signal is shown in the following diagram:

CM1 Pin No	Signal Name	Axis #	CM2 Pin No	Signal Name	Axis #
4	RDY1	1	4	RDY 2	2

CM3 Pin No	Signal Name	Axis #	CM4 Pin No	Signal Name	Axis #
4	RDY 3	3	4	RDY 4	4

The output circuit for the RDY signal is shown below:



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

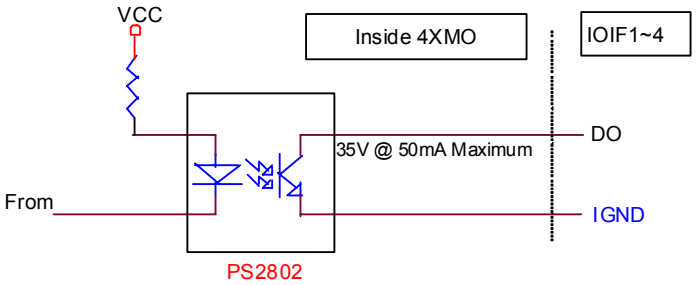
3.12 General Purpose Digital Output Signals DO

The MNET 4XMO-C/4XMO provides 4/8 General Purpose output channels: DO1 to DO4/ (DO1 to DO8). The General Purpose output channels are located on IOIF1 - IOIF4. The signal names, pin numbers, and axis numbers are shown below:

IOIF1 Pin No	Signal Name	Axis #	IOIF2 Pin No	Signal Name	Axis #
6	DO1	1	6	DO2	2
8	DO5	--	8	DO6	--

IOIF3 Pin No	Signal Name	Axis #	IOIF4 Pin No	Signal Name	Axis #
6	DO3	3	6	DO4	4
8	DO7	--	8	DO8	--

The following wiring diagram is of the DO signal:



3.13 General Purpose Digital Input Signals DI

The MNET 4XMO-C/4XMO provides 4/8 General Purpose Input channels: DI1 to DI4/ (DI1 to DI8). The General Purpose output channels are located on IOIF1-IOIF4. The signal names, pin numbers, and axis numbers are shown below:

IOIF1 Pin No	Signal Name	Axis #	IOIF2 Pin No	Signal Name	Axis #
5	DI1	1	5	DI2	2

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

7	DI5	--	7	DI6	--

IOIF3 Pin No	Signal Name	Axis #	IOIF4 Pin No	Signal Name	Axis #
5	DI3	3	5	DI4	4
7	DI7	--	7	DI8	--

The following wiring diagram is of the DI signal:

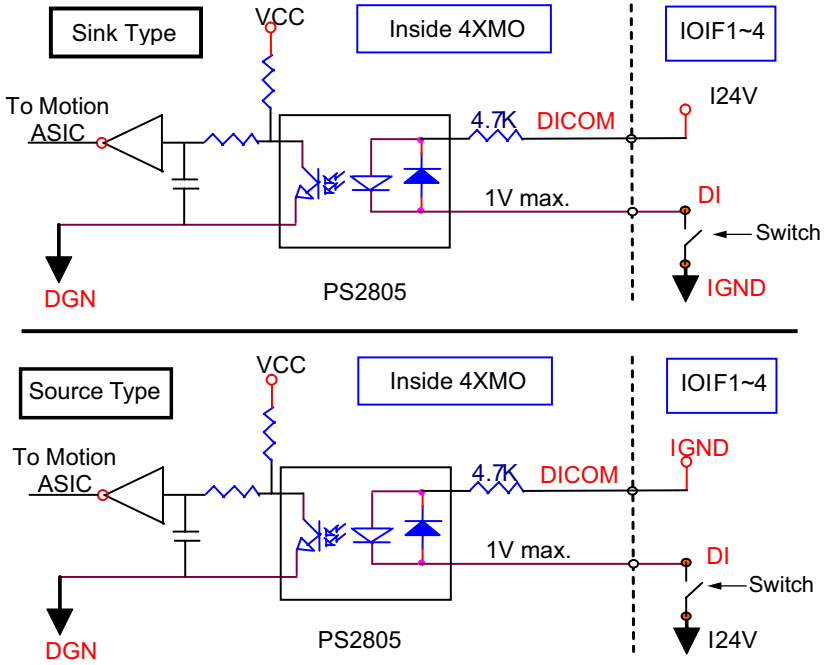


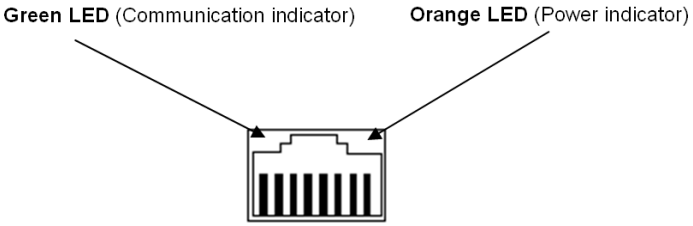
Figure 3-2: DI Signal Wiring

3.14 NMET 4XMO LED Indicator

The LED indicator on MNET-4XMO (-C) provides communication status. Green LED indicates MotionNet status and Orange LED indicates power status. Before power on MotionNet, Orange LED and green LED will be off. Orange LED will be on after power on

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

MNET-4XMO (-C). Green LED will be blinking at 1 HZ frequency after power on MNET-4XMO (-C). Once the Host connects to MNET 4XMO (-C) modules, green LED will be on. Once Motion-Net communication stop or breaking, green LED will continue blinking at 1 HZ.



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

4 Motionnet Master-Slave Motion System

4.1 MNET System Architecture

Motionnet (called “MNET”) is an ultra-high-speed serial communication system proposed by NPM (Nippon Pulse Motor) with strong performance with MNET serial connection application. The maximum transfer speed is up to 20 Mbps. ADLINK offers three kinds of master controller to connect MNET slaves and was listed as follows:

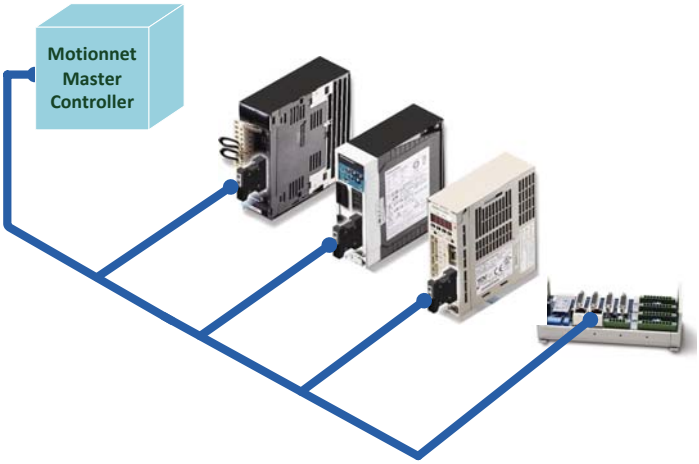


Figure 4-1: Motionnet System Architecture

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Master Controller	Description	Configuration
DPAC-3000 	Distributed Programmable Automation Controller with HSL and Motionnet Buses	Motion Bus: Motionnet x 1 I/O Bus: HSL x 1
PCI-7856 	Master-Slave Distributed Motion and I/O Master Controller	Motion Bus: Motionnet x 1 I/O Bus: HSL x 1
DB-8153 	Single Master Controller Board of Motionnet which equipped with PCI-8154/8158	Motion Bus: Motionnet x 1

Table 4-1: Motionnet Master Controllers

All controllers are equipped with one MNET port to offer up to 256 axis control via serial connections. With an ADLINK MNET solution, we not only offer single axis configuration but also provide 4-axis control with interpolation functions. The individual devices can control Mitsubishi J3, Yaskawa Sigma series, and Panasonic A4 series servo drives. The controller can be used for executing continuous operations at constant speeds, performing linear acceleration/deceleration and S-curve acceleration/deceleration, carrying out preset positioning operations, and zero return operations, etc. In addition, a 4-axis motion controller can also support linear/circular interpolation functions. For connection distance, the cable length can be extended up to 100 m using an ordinary CAT5/CAT5e/CAT6 LAN cable while connecting 64 axes (single axis controller) or 256 axes (4-axis controller) at 20 Mbps. ADLINK MNET solutions highlight the easy-to-use motion control feature. All function library designs comply with ADLINK PCI series motion controller and MNET bus motion controller. ADLINK MNET solution not only offers single axis connection suitable for multiple PTP (point-to-point) movement applications but also provides 4-axis motion controller with linear and circular interpolation functions.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

4.2 MNET System Specifications

Functions of MNET system can be classified as serial communications and motion control.

Item	Specifications
Total serial communication line length	**Maximum of 100 m** (At a data transfer speed of 20 Mbps with 32 devices connected)
	Maximum of 50 m (At a data transfer speed of 20 Mbps with 64 devices connected)
	Maximum of 100 m (At a data transfer speed of 10 Mbps with 64 devices connected, using our recommended cables)
Serial communication interface	Pulse transformer and RS-485 specification line transceiver
Serial communication protocol	Our proprietary protocol
Serial communication	NRZ signed
Serial communication method	Half-duplex communication
Connection method	Multi-drop connection using a LAN cable (CAT5/ CAT5e STP/S-STP)
Serial data transfer speed	20/10/5/2.5 Mbps programmable speed settings
Maximum No. of MNET modules	64 (Total axes can be 64 if you connect all single axis modules, otherwise the total axes will be 256 axes if all modules belong to MNET-4XMO)

Table 4-2: MNET System Specifications

4.2.1 Wiring Cable

This system guarantees enhanced quality for high-speed communication, and is designed to be connected with LAN cables suitable for 100 BASE and 1000 BASE. These cables have well known specifications, are cheap and easily obtained close to you. Therefore, we do not include these items in our product lines and do not supply them. To select cables you need to connect, make sure they meet the following specifications.

Wiring standard:

- TIA/EIA-568-B
- Category 5 (CAT5)
- Enhanced category 5 (CAT5e)
- Category 6 (CAT6)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

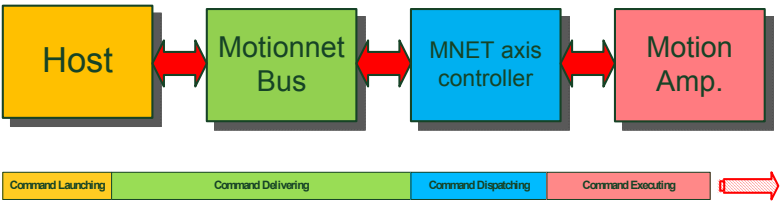
UTP (UnshieldedTwistedPair) cables or STP (ShieldedTwisted-Pair) cables that meet the specifications above. For an environment with lots of electromagnetic noise, use a shielded cable (STP).

Observe the following when connecting your system.

1. Total serial line length
   This system employs a multi-drop connection method. The maximum total extension distance of the line varies, depending on the data transfer speed and the number of local boards that are connected.
   - ▷ Max. 100 m (Transfer speed; 20 Mbps with 32 modules connected)
   - ▷ Max. 50 m (Transfer speed; 20 Mbps with 64 modules connected)
   - ▷ Max. 100 m (Transfer speed; 10 Mbps with connecting 64 modules connected)
2. Minimum cable length
   The shortest cable must be at least 60 cm long.
3. Do not mix cables of different types and model in the same serial line.
4. Keep the total serial line length as short as possible.
5. If you are using shielded cables, do not connect the shield on both ends to the FG terminals.
   Connecting only one end of the shield on each cable will improve noise immunity.

4.2.2 MNET System Communication

There is MNET system communication block diagram as following.



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Command Launching:

Inside the MNET system, those remote modules communicate with each other with MNET network packets. Actually, users do not have to understand what the content of the packet is. Instead, we provide many kinds of API functions for controlling this module. They are very easy to understand and to use.

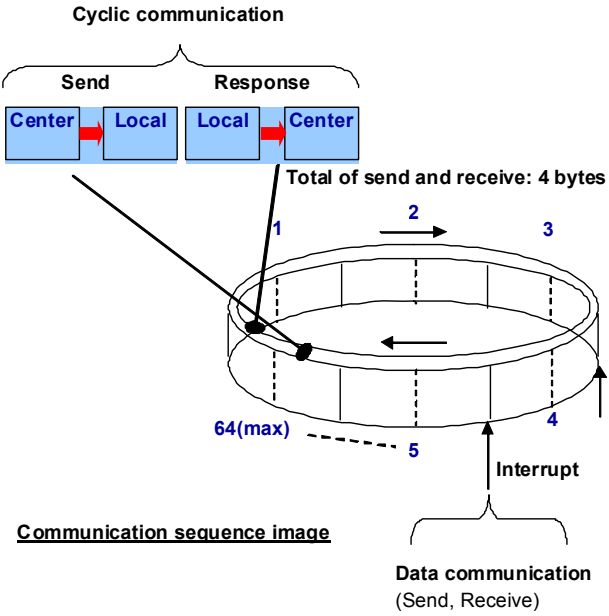
Those APIs can analyze the parameters from user's command and pack them as MNET network packets. Next, the packets are passed to the remote modules. Then, the remote modules will interpret those packets and execute the commands correctly. Before launching the packet, all the commands issued by users are written into the RAM and transferred on MNET network.

Consequently, the RAM is the bridge between MNET master controller and host PC. The accessing time of RAM for one packet is about 600ns. It is quiet fast on host PC. Furthermore, the delivering time of one command on network depends on the number of modules and operating clock rate. Besides the basically RAM usage, user is able to write data into a FIFO in the central device, and issue a send command either above method. This communication will be sent and received automatically by interrupting the cyclic communication. A complete command delivering time depends on the number of MNET packets. One packet command could be delivered in one MNET scan (cycle) time.

Command Delivery:

For command deliver procedure which transferred. In cyclic communication, the time allowed for communication by a single module is fixed. However, in data communication, the communication time will vary, depending on how the communication is controlled by the user's program and the time needed to access the MNET controllers. We will skip these elements and simply calculate the basic data communication time in this section.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000


Cyclic communication
Send
Response
Center
Local
Local
Center
Total of send and receive: 4 bytes
1
2
3
4
5
64(max)
Interrupt
Communication sequence image
Data communication
(Send, Receive)

5 Operation Theory

This chapter describes the detail operation of the motion controller card.

Contents of the following sections are as follows:

Section 5.1: Classifications of Motion Controller

Section 5.2: Motion Control Modes

Section 5.3: Motor Driver Interface

Section 5.4: Mechanical switch Interface

Section 5.5: The Counters

Section 5.6: The Comparators

Section 5.7: Other Motion Functions

5.1 Classifications of Motion Controller

When motor/stepper control first started, motion control was widely discussed instead of motor control. Motor control was separated into two layers: motor control and motion control. Motor control relates to PWM, power stage, closed loop, hall sensors, vector space, etc. Motion control relates to speed profile generating, trajectory following, multi-axes synchronization, and coordinating.

5.1.1 Analog Type Motion Control Interface

The interfaces between motion and motor control are changing rapidly. Early on, a voltage signal was used as a command to the motor controller. The amplitude of the signal shows how fast a motor is rotating and the time duration of the voltage change shows the speed of the motor acceleration. The voltage signal as a command to the motor driver is called “analog” motion controller. It is much easier to integrate into an analog circuit of motor controller; however noise is sometimes a big problem for this type of motion control. Also, to do positioning control of a motor, the analog motion controller must have a feedback signal with position information and use a closed loop control algorithm to make it possible. This increases the complexity of motion control and is not easy to use for a beginner.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.1.2 Pulse Type Motion Control Interface

The second interface of motion and motor control is a pulse train type. As a digital world trend, pulse trains represent a new concept to motion control. The number of pulses illustrates how many steps a motor rotates, and the frequency of pulses illustrates how fast a motor runs. The time duration of frequency changes represent the acceleration rate of a motor. This interface makes a servo or stepper motor easier than an analog type for positioning applications, because it allows motion and motor control to be separated easier. Each interface provides gains tuning. For analog position controllers, the control loops are built inside and gains are tuned from the controller. For pulse type position controllers, the control loops are built outside on the motor drivers and the gains are tuned on the drivers. For operating more than one axis, motion control seems more important than motor control. In industrial applications, reliability is a very important factor. Motor driver vendors make good performance products and motion controller vendors make a powerful variety of motion software. Integrating the two products make this ideal.

5.1.3 Network Type Motion Control Interface

Recently, a new control interface was introduced--a network motion controller. In this new interface the command between motor driver and motion controller is neither an analog nor a pulse signal, it is a network packet containing position and motor information. This controller is more reliable than previous controllers because it is digitized and packetized. Because a motion controller must be real-time, the narrow must have real-time capacity at a cycle time below 1 mini-second. This means that non-commercial networks cannot do this job. A specific network is required, such as Mitsubishi SSCNET. The network may also be built with fiber optics to increase communication reliability.

5.1.4 Software Real-time Motion Control Kernel

For motion control kernel, there are three ways to accomplish it: DSP, ASIC, and software real-time. A motion control system needs an absolute real-time control cycle. It orders for the motor to run smoothly the calculation on the controller must provide a con-

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

trol data. The PC's computing power is often used to do this. A feedback counter card can simply be used and a voltage output or pulse output card to make it. This method is low cost but required extensive software effort. Real-time software is used to ensure real-time performance. This method increases the complexity of the system, but is the most flexible for professional motion control designers. Most of these methods are on NC machines.

5.1.5 ASIC Motion Control Kernel

An ASIC motion control kernel falls between software kernel and DSP kernel in terms of difficulty. All motion functions are done via the ASIC elimination all real-time problems. The ASIC requires parameters to be preset for motion control. ASIC motion control separates all system integration problems into 4 parts: motor driver's performance, ASIC outputting profile, vendor's software parameters to the ASIC, and users' command to vendor's software. It makes motion controller co-operated more smoothly between devices.

5.1.6 MNET-4XMO's Motion Controller Type

The MNET-4XMO / MNET-4XMO-C are a ASIC based pulse type motion controller. This motion controller was made into five blocks: on-board ASIC, FPGA for the position comparison and point table, MNET communication ASIC, and APS function library. Through using the APS function library and the MNET-4XMO easily utilizes for complex motion manipulation which involving jogging, point-to-point positioning, multiple axes interpolation motion, high-speed position comparison and so on.

By using the brand-new motion ASIC and it offers faster pulse command output frequency up to 9.9 MHz and encoder input frequency up to 20 MHz which under 4xAB mode. Not only provides the general motion operation but also provides more comprehensive motion functions, like programmable acceleration and deceleration to eliminate jerk and smooth velocity profile,

5.2 Motion Control Modes

Motion control makes the motors run according to a specific speed profile, path trajectory and synchronous condition with other axes.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The following sections describe the motion control modes of this motion controller could be performed.

5.2.1 Single Motion

In this section, single motion functions are discussed. Single motion means the motion is commanded by one function call only. For example, APS_relative_move(), this function will allow an axis to move a certain distance with a specified speed and other motion parameter, such as accel/decel time and so on.

In this manual, in order to reduce and manage the programming of motion operation, therefore, user has to config whole motion type and parameter via function APS_set_axis_param() in arrear of motion operation firstly.

Single motion functions can be categorized into the following types according to their functionality.

- Section 5.2.1.1: Single Axis Velocity Motion
- Section 5.2.1.2: Single Axis P-to-P Motion
- Section 5.2.1.3: Linear Interpolation
- Section 5.2.1.4: Circular Interpolation
- Section 5.2.1.5: Speed Override
- Section 5.2.1.6: Position Override

5.2.1.1 Single Axis Velocity Motion

Velocity mode means the motion command is continuously outputting until a stop command is issued. The motor will run without a target position or desired distance unless it was stopped by other reasons. The output command profile will accelerate from a starting velocity to a specified maximum velocity. It can be follow a linear or S-curve acceleration shape. The command output rate is kept at maximum velocity until another velocity command overrode or a stop command issued. The velocity could be overridden by a new speed setting.

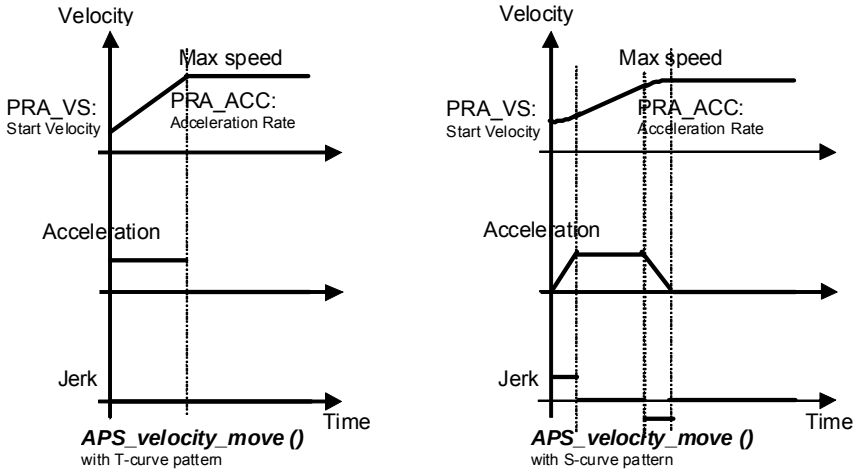
In this section, the following functions are discussed.

```
APS_set_axis_param(Axis_ID, AXS_Param_No,
     AXS_Param)
APS_velocity_move(Axis_ID, Max_speed)
```

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The single axis velocity motion function will allow the axis to accelerate from a starting velocity, '**PRA_VS**', to a specified constant velocity, '**Max_speed**'. The axis will continue to travel at this constant velocity until the velocity is changed by overwriting the function **APS_velocity_move**() or stopped by the functions **APS_stop_move**(), **APS_emg_stop**().

Two kinds of acceleration method are available. By using T-curve speed pattern, the acceleration is constant as shown in the in left diagram below. By using S-curve speed pattern, the derivative of acceleration, the 'jerk', is a constant as Illustrated in the right diagram below. The speed profile of this kind of motion is shown as below:



Note: Please refer to section 6.11 – "Definition table" to set the axis parameter.

PRA_VS means start velocity; PRA_VE means end velocity; PRA_ACC/DEC means acceleration or deceleration.

5.2.1.2 Single Axis P-to-P Motion

In this section, the following functions are discussed.

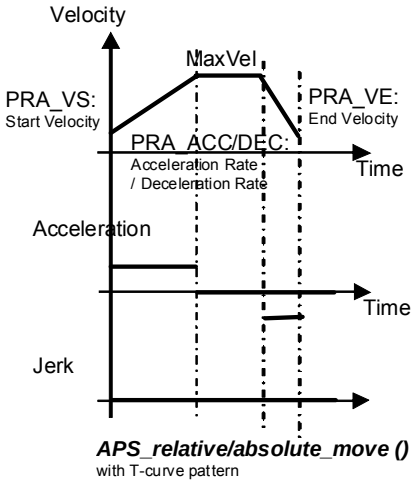
```
APS_relative_move(Axis_ID, Distance, Max_speed)
APS_absolute_move(Axis_ID, Position, Max_speed)
```

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

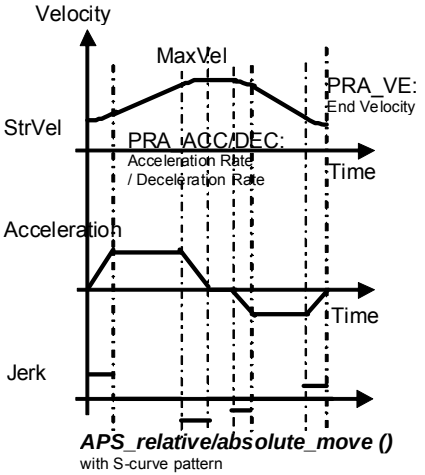
Single axis P-to-P motion functions will allow the axis to move a specified distance or move to a specified position. Above two functions are pretty straightforward. 'Relative' and 'absolute' characterizes the function and provides information about the position method to achieve the target position. States like upside section, user is able to define the velocity profile pattern, start velocity, acceleration / deceleration rate before, which via using function **APS_set_axis_param**().

If the velocity profile applied is '**Trapezoidal**'. That is the acceleration and deceleration is a constant (shown in left diagram).

If the velocity profile applied is 'S-**Curve**'. This is a derivative of acceleration, '**jerk**', and is a constant (shown in right diagram).



APS_relative/absolute_move ()
with T-curve pattern



APS_relative/absolute_move ()
with S-curve pattern

Note: Please refer to section 6.11 – "Definition table" to set the axis parameter.

PRA_VS means start velocity; PRA_VE means end velocity; PRA_ACC/DEC means acceleration or deceleration.

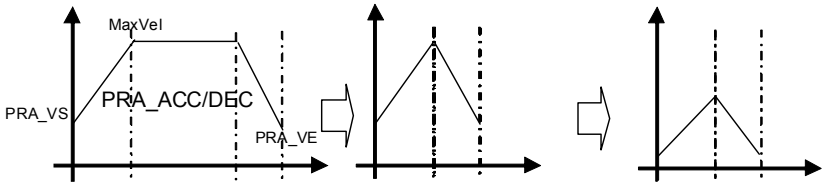
The distance moved during acceleration and deceleration can be calculated using the following formula. (For both trapezoidal and S-curve profiles)

```
Dist_acc = 0.5 * (StrVel + MaxVel) * Tacc
```

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

```
Dist_dec = 0.5 * (FinVel + MaxVel) * Tdec
```

In some cases, the distance moved may not be long enough. For example, the 'Distance ' in APS_relative_move() is too small or 'Position' in APS_absolute_move() is too close to the current position. These two function calls mentioned above automatically slows down the velocity. The change in the velocity profile is illustrated in the diagram below.



Case 1:
The distance is longer then acceleration and deceleration needed.

Case 2:
The distance is equal to acceleration and deceleration needed.

Case 3:
The distance is smaller than acceleration and deceleration needed.

Case 1 to Case 2: The constant velocity period is reduced while the **PRA_VS, PRA_VE, Max. velocity and PRA_ACC/DEC** remain unchanged.

Case 2 to Case 3: The constant velocity period vanished, and, **PRA_VS, PRA_VE, Max. velocity** become smaller according to the ratio described below. While the **PRA_ACC/DEC** remain unchanged.

```
New_PRA_VS = K * Original_ PRA_VS
New_Max speed= K * Original_Max speed
New_PRA_VE = K * Original_PRA_VE
```

Where K = Dist/(Distacc_needed + Distdec_needed)= Dist/(Distjust_case)

5.2.1.3 Linear interpolation

"Interpolation between multi-axes" means these axes start simultaneously, and reach their ending points at the same time. Linear means the ratio of speed of every axis is a constant value. In this section, the following functions are described.

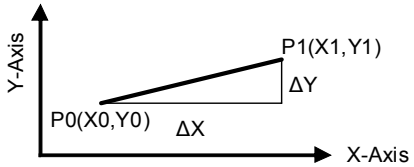
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

```
APS_absolute_linear_move (Dimension,
     Axis_ID_Array, Position Array,
     Max_Linear_speed)
APS_relative_linear_move (Dimension,
     Axis_ID_Array, Distance Array,
     Max_Linear_speed)
```

These two functions applied to any 2, any 3 or any 4 of the 6 axes in one card, so that these axes can “start simultaneously, and reach their ending points at the same time” and the ratio of speed between these axes is a constant value. Because the speed parameter is in vector direction within parameter table setting, this function will take the master axis’s acceleration and deceleration time constant to calculate. The master axis is the minor axis number that user perform an interpolation.

2 Axes Linear Interpolation

As in the diagram below, 2 axes linear interpolation means to move the XY (or any 2 of the 4 axis) position from P0 to P1. The 2 axes start and stop simultaneously, and the path is a straight line.



The speed ratio along X-axis and Y-axis is (ΔX: ΔY), respectively, and the vector speed is:

$$\frac{\Delta P}{\Delta t} = \sqrt{(\frac{\Delta X}{\Delta t})^2 + (\frac{\Delta Y}{\Delta t})^2}$$

When calling the 2 axes linear interpolation functions, it is the **vector speed** to define the start velocity (master axis), **PRA_VS**, and maximum velocity, **Max_Linear_speed**, both trapezoidal and S-curve profile are available.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Example:

```
//…Initial card
I32 Dimension = 2;
I32 Master_Axis_ID = 1; //Master axis
I32 Axis_ID_Array[4] = {1, 2}; //Axis ID 1 is
     master axis.
I32 Position_Array [4] = {1000, 2000}; //(Unit:
     pulse)
```

This cause the two axes (axes 1 & 2) to perform a linear interpolation movement, in which:

```
ΔX = 1000 pulse
ΔY = 2000 pulse
I32 Max_Linear_Speed = 1000;  //(Unit: pulse/
     second)
```

This way sets the maximum speed to 1000 pulse per second during performing 4-axes interpolation motion.

```
I32 Ret;
APS_set_axis_param(Master_Axis_ID, PRA_CURVE, 0);
     //Set T-curve
APS_set_axis_param(Master_Axis_ID, PRA_ACC,
     10000);// Set acceleration
APS_set_axis_param(Master_Axis_ID, PRA_DEC,
     10000);// Set deceleration
```

This way sets the master axis acceleration and deceleration to 10000 pulses per square of second during performing 2-axes interpolation motion. Above program is also set master axis to perform the velocity profile with T-curve.

```
…
Ret = APS_absolute_linear_move ( Dimension,
     Axis_ID_Array, Position_Array,
     Max_Linear_Speed );
…
```

After whole parameter setting completed and then user is able to perform the linear interpolation function. If needs operating in relative mode, perform function **APS_relative_linear_move** (). The change in the velocity profile is illustrated in the diagram below.

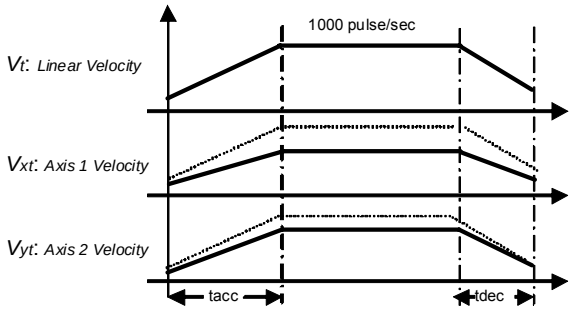
For example, according to preceding description that start vector speed linear interpolation will be equal to start velocity of master

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

axis, is 10 pulses per second and its end velocity is also equal to end velocity of master axis, is 30 pulses per second. Basically, MNET-4XMO calculates the acceleration time-'tacc' and deceleration time-'tdec' and then generates the actual acceleration/deceleration rate for axis 1 and 2 which based on the mathematical model (ratio) as following.

$$Vt = \sqrt{(Vxt)^2 + (Vyt)^2}$$

In which Vt is vector speed of linear interpolation motion; Vxt is speed along x direction (first axis); Vyt is speed along y direction (second axis).

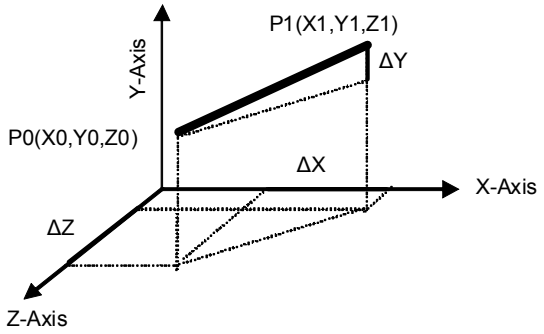


As illustrated above, the x and y axis will be achieved the maximum speed at the same time that means the linear speed also achieves maximum linear speed in the meanwhile.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

3 Axes Linear Interpolation

Any 3 of the 4 axes of MNET-4XMO may perform 3 axes linear interpolation. As the figure below, 3 axes linear interpolation means to move the XYZ (if axes 0, 1, 2 are selected and assigned to be X, Y, Z respectively) position from P0 to P1 and start and stop simultaneously. The path is a straight line in space.



The speed ratio along X-axis, Y-axis and Z-axis is (X: Y: Z), respectively, and the vector speed is:

$$\frac{\Delta P}{\Delta t} = \sqrt{(\frac{\Delta X}{\Delta t})^2 + (\frac{\Delta Y}{\Delta t})^2 + (\frac{\Delta Z}{\Delta t})^2}$$

When calling the 2 axes linear interpolation functions, it is the **vector speed** to define the start velocity (master axis), **PRA_VS**, and maximum velocity, **Max_Linear_speed**, both trapezoidal and S-curve profile are available.

Example:

```
//…Initial card
I32 Dimension = 4;
I32 Master_Axis_ID = 1; //Master axis
I32 Axis_ID_Array[4] = {1, 2, 3}; //Axis ID 1 is
     master axis.
I32 Position_Array [4] = {1000, 2000, 3000}; //
     (Unit: pulse)
```

This cause the four axes (axes 1, 2 and 3) to perform a linear interpolation movement, in which:

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

```
ΔX = 1000 pulse
ΔY = 2000 pulse
ΔZ = 3000 pulse
I32 Max_Linear_Speed = 1000;  //(Unit: pulse/
     second)
```

This way sets the maximum speed to 1000 pulse per second during performing 4-axes interpolation motion.

```
I32 Ret;
APS_set_axis_param(Master_Axis_ID, PRA_CURVE, 0);
     //Set T-curve
APS_set_axis_param(Master_Axis_ID, PRA_ACC,
     10000);// Set acceleration
APS_set_axis_param(Master_Axis_ID, PRA_DEC,
     10000);// Set deceleration
```

This way sets the master axis acceleration and deceleration to 10000 pulses per square of second during performing 3-axes interpolation motion. Above program is also set master axis to perform the velocity profile with T-curve.

```
…
Ret = APS_absolute_linear_move ( Dimension,
     Axis_ID_Array, Position_Array,
     Max_Linear_Speed );
…
```

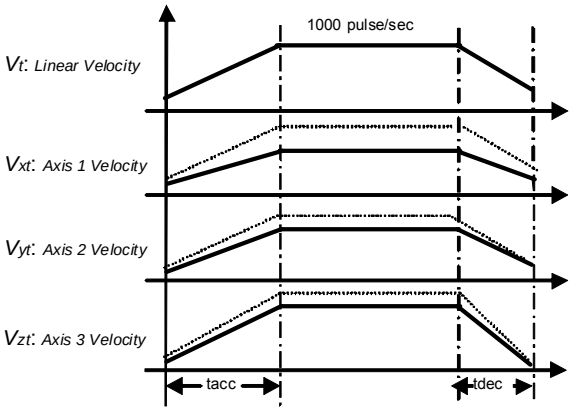
After the whole parameter setting completed and then user is able to perform the linear interpolation function in absolute mode. The change in the velocity profile is illustrated in the diagram below.

For example, according to preceding description that start vector speed linear interpolation will be equaled to start velocity of master axis, is 10 pulses per second and its end velocity is also equaled to end velocity of master axis, is 30 pulses per second. Basically, MNET-4XMO calculates the acceleration time-‘tacc’ and deceleration time-‘tdec’ and then generates the actual acceleration/deceleration rate for axis 1 and 2 which based on the mathematical model (ratio) as following.

$$\frac{\Delta P}{\Delta t} = \sqrt{(\frac{\Delta X}{\Delta t})^2 + (\frac{\Delta Y}{\Delta t})^2 + (\frac{\Delta Z}{\Delta t})^2}$$

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

In which Vt is vector speed of linear interpolation motion; Vxt is speed along x direction (first axis); Vyt is speed along y direction (second axis); Vzt is speed along y direction (third axis).



As illustration like above, the x, y and z axis will be achieved the maximum speed at the same time that means the linear speed also achieves maximum linear speed in the meanwhile.

4 Axes Linear Interpolation

In 4 axes linear interpolation, the speed ratio along X-axis, Y-axis, Z-axis and U-axis Is (ΔX: ΔY: ΔZ: ΔU), respectively, and the vector speed is:

$$\frac{\Delta P}{\Delta t} = \sqrt{(\frac{\Delta X}{\Delta t})^2 + (\frac{\Delta Y}{\Delta t})^2 + (\frac{\Delta Z}{\Delta t})^2 + (\frac{\Delta U}{\Delta t})^2}$$

Regarding to the behavior of 4 axes interpolation, the operation theory is similar to 2 or 3 axes linear interpolation, please refer to above mentioned.

Note: All axes must be of the same motion controller.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.2.1.4 Circular interpolation

Any 2 of the 4 axes of MNET-4XMO can perform circular interpolation. As the example below, the circular interpolation means XY (if axes 0, 1 are selected and assigned to be X, Y respectively) axes simultaneously start from initial point, (0,0) and stop at end point,(1800,600). The path between them is an arc, and the **Max_Arc_Speed** is the tangential speed. In this section, the following functions are described.

```
APS_absolute_arc_move (Dimension, Axis_ID_Array,
     Center_Pos_ Array, Max_Arc_speed, Angle)
APS_relative_ arc _move (Dimension,
     Axis_ID_Array, Center_Offset_ Array,
     Max_Arc_speed, Angle)
```

Example:

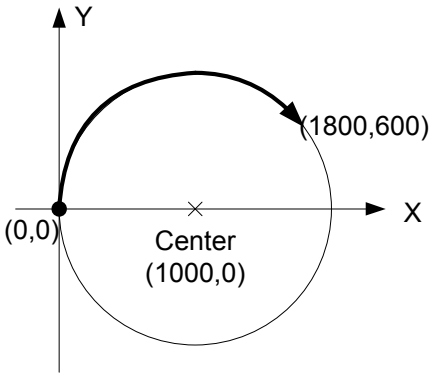
```
//…Initial card
I32 Dimension = 2;
     //2 Dimension only
I32 Axis_ID_Array[2] = { 2, 4 }; //Axis_ID 2 is
     the master axis
I32 Master_Axis_ID = 2; //Axis_ID 2 is the master
     axis
I32 Center_Pos_Array[2] = {1000, 0}; //Set center
     of circle(Unit: pulse)
I32 Max_Arc_Speed = 1000; // pulse/sec
I32 Angle = -143; // clockwise 180 degree
I32 Ret; //Return code
```

To specify a circular interpolation path, the following parameters have to be defined clearly.

Center point: The coordinate of the center of arc (In absolute mode) or the offset distance to the center of arc (In relative mode)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Angle: The moving angle, either clockwise (-) or counter clockwise (+)




```
//…
APS_set_axis_param( Master_Axis_ID, PRA_CURVE, 1
     ); //Set S-curve
APS_set_axis_param( Master_Axis_ID, PRA_ACC,
     100000 ); //Set acceleration
APS_set_axis_param( Master_Axis_ID, PRA_DEC,
     100000 ); //Set deceleration
Ret = APS_absolute_arc_move( Dimension,
     Axis_ID_Array, Center_Pos_Array,
     Max_Arc_Speed, Angle );
//Perform a circular interpolation
```

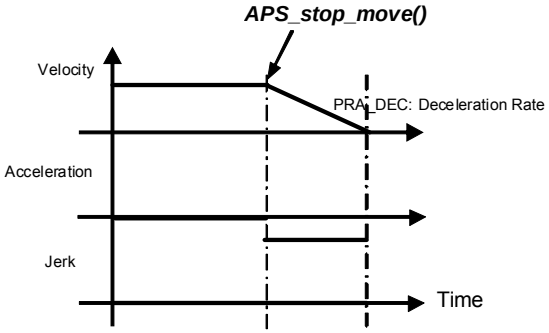
After whole parameter setting completed and then user is able to perform the circular interpolation function in absolute mode.

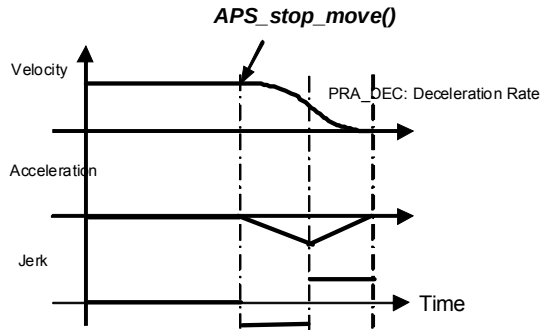
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.2.1.5 Speed Override

Speed override means that users can change command's speed during the operation of motion. User is easy to modify the speed profile during motion operation by re-executing the function **APS_velocity_move**().This function can be applied on other motion in position or velocity mode. If the running motion is S-curve or bell curve, the speed override will be a pure s-curve. If the running motion is t-curve, the speed override will be a t-curve.

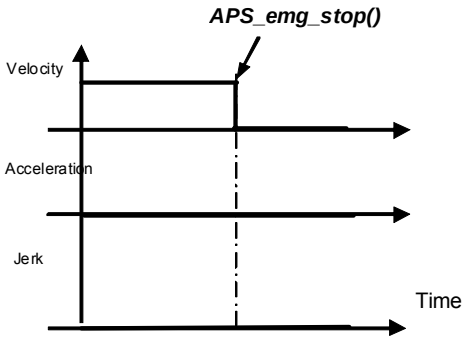
The function **APS_stop_move**() and **APS_emg_stop**() are used to stop a moving axis. If user wants to adjust the moving speed of an axis and just need to overwrite the velocity move function again. Function **APS_stop_move**() stops the specified '**Axis**' with a deceleration rate and a "Trapezoidal" or "S-Curve" velocity profile during deceleration. See diagram below.





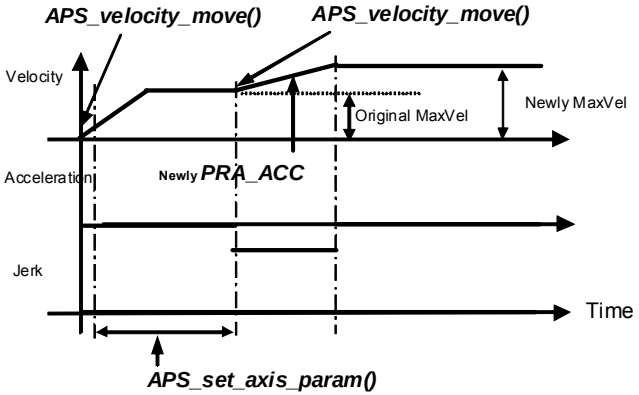
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The function **APS_emg_stop**() stops the a specified '**Axis**' immediately without deceleration. See diagram below.

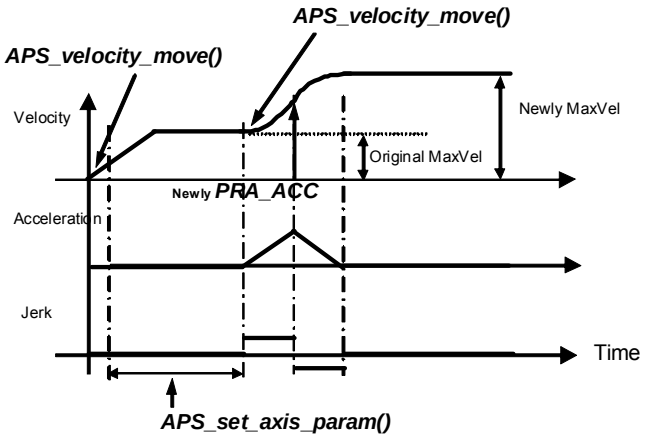


By re-perform the function **APS_velocity_move**(), user is able to changes the moving speed of a specified '**Axis**' with specified acceleration rate, '**PRA_ACC**', and a 'Trapezoidal' velocity profile during acceleration. If user needs different acceleration rate between original and newly parameter setting and then has to perform the function **APS_set_axis_param**() to re-define the new velocity profile with new acceleration rate.

The new parameter table is available to fill during previous motion traveling.



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



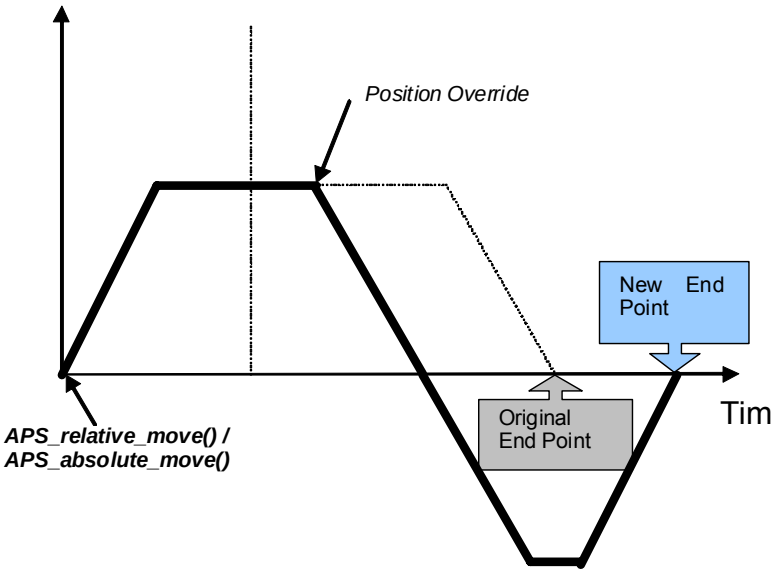
There is same method to change the velocity during axis traveling with S-curve velocity profile.

Note: All change speed on the fly function calls can be applied any time, which included the period of acceleration and deceleration, when an axis is moving but cannot be overridden by other motion modes like Jog, home, manual pulse generation and contour motion. Users must stop axis motion before switching to those modes mentioned above.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

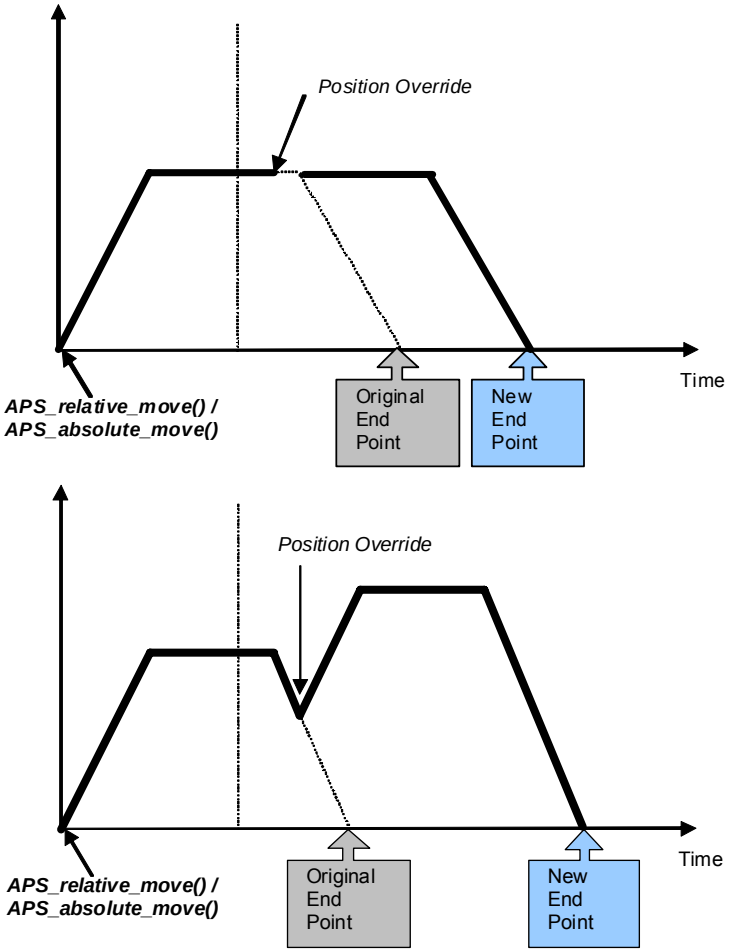
5.2.1.6 Position override

Position override means that when users issue a positioning command and want to change its target position during this operation. If the new target position is behind current position when override command is issued, the motor will slow down then reverse to new target position. If the new target position is far away from current position on the same direction, the motion will remain its speed and run to new target position. If the override timing is on the deceleration of current motion and the target position is far away from current position on the same direction, it will accelerate to original speed and run to new target position. The operation examples are shown as below. Note that if the relative pulses for new target position are smaller than original pulses for slow down period, this function cannot work properly.



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

By re-perform the function **APS_relative_move**() or **APS_absolute_move**(), user is easily able to changes the destination of a specified '**Axis**' with specified acceleration / deceleration rate, '**PRA_ACC**', '**PRA_DEC**' and a 'Trapezoidal' velocity profile during acceleration. If you need different acceleration rate between original and newly parameter setting and then has to perform the function **APS_set_axis_param**() to re-define the new velocity profile with refreshed acceleration / deceleration rate.

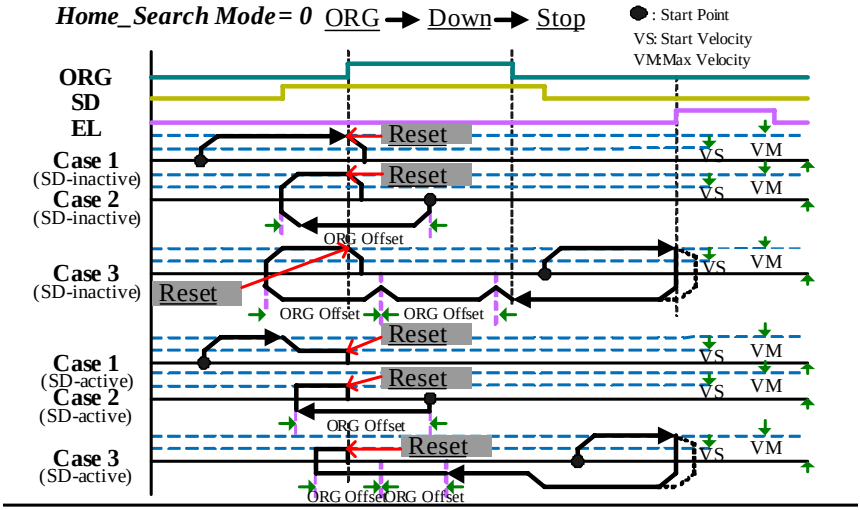


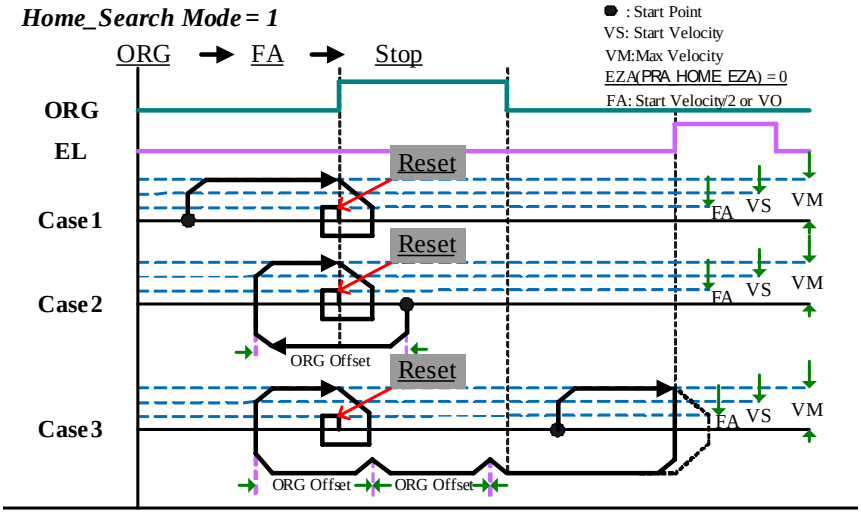
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

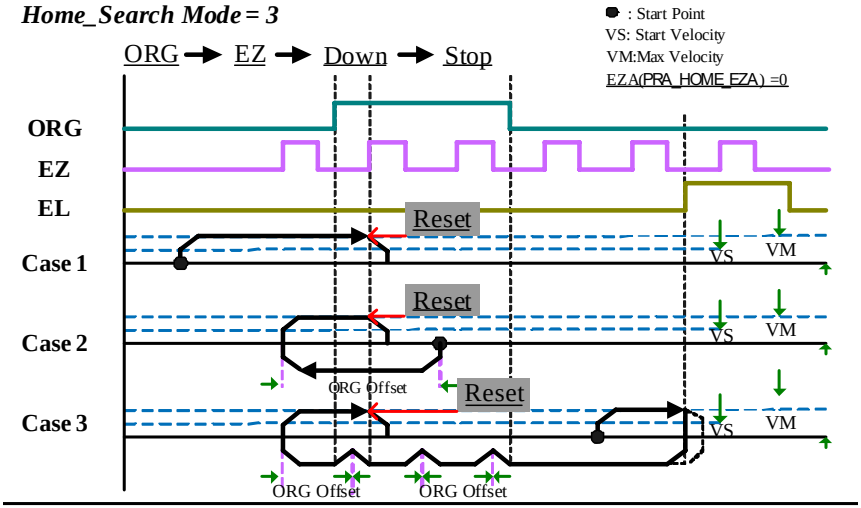
5.2.2 Home Return

5.2.2.1 Auto Home Search Mode

This mode is used to add auto searching function on normal home return mode described in next section no matter which position the axis is. The following diagram is shown the example for home mode 2 via home search function. The ORG offset can't be zero. Suggested value is the double length of ORG area. MNET-4XMO and MNET-4XMO-C provide 13 auto-homing mode with next 13 specified home modes.

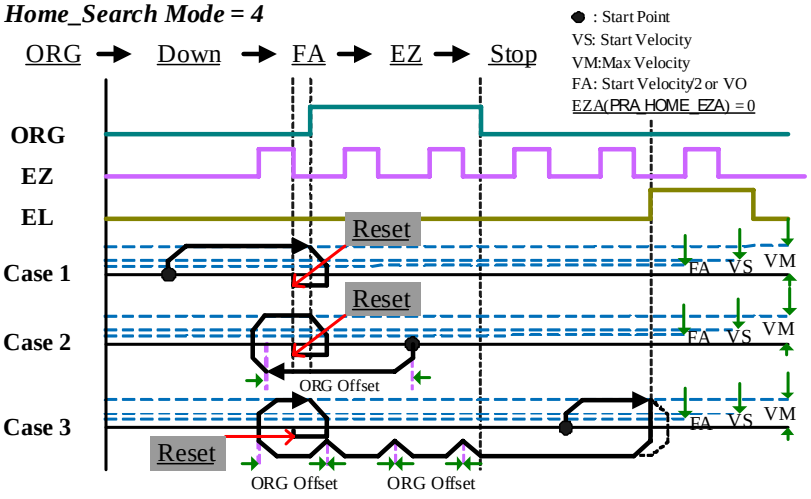




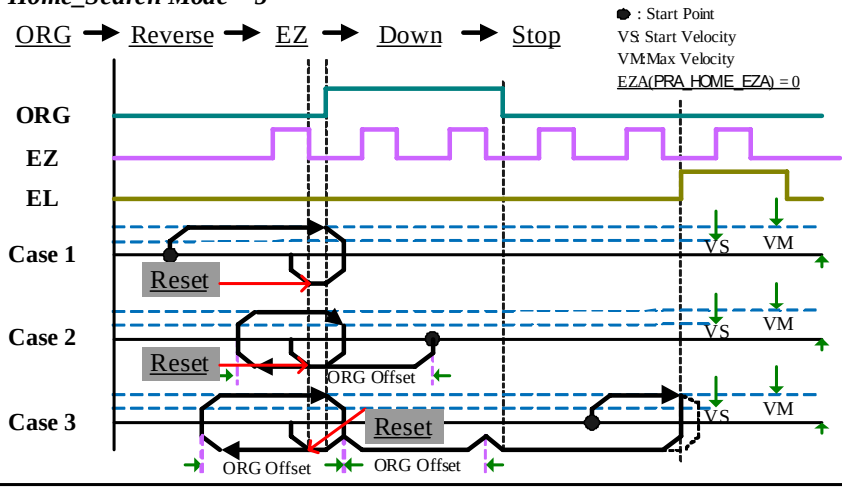


LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Home_Search Mode = 4

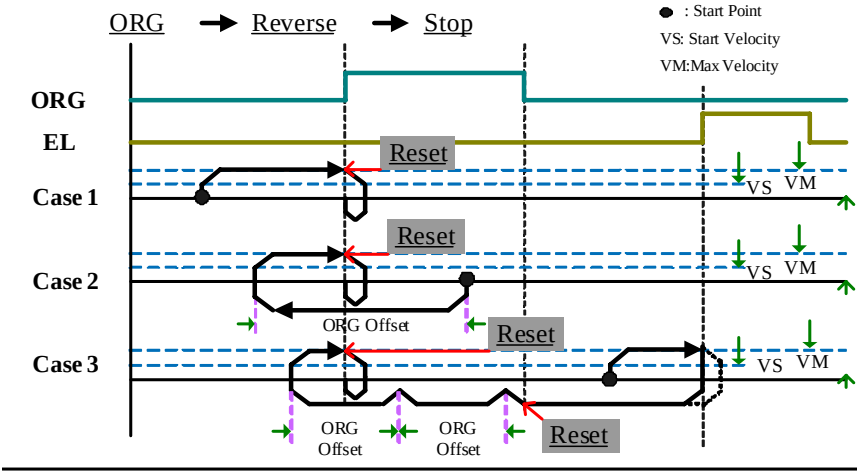


Home_Search Mode = 5

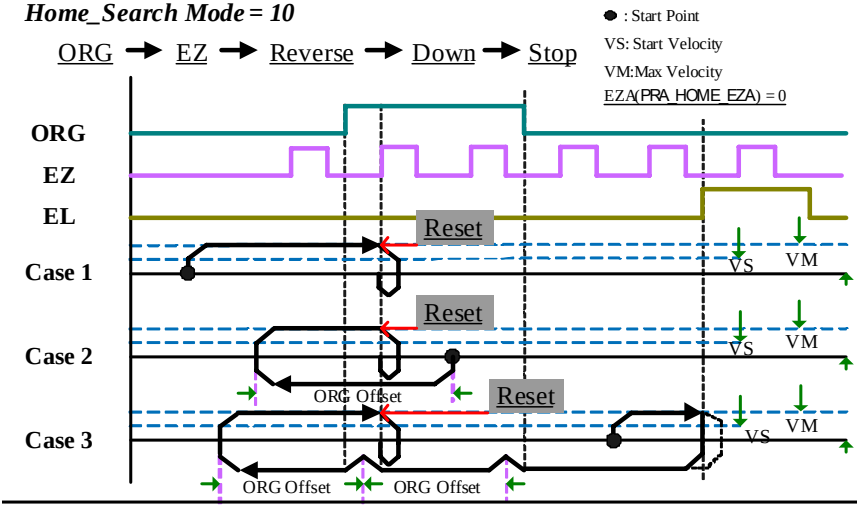


LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Home_Search Mode = 9

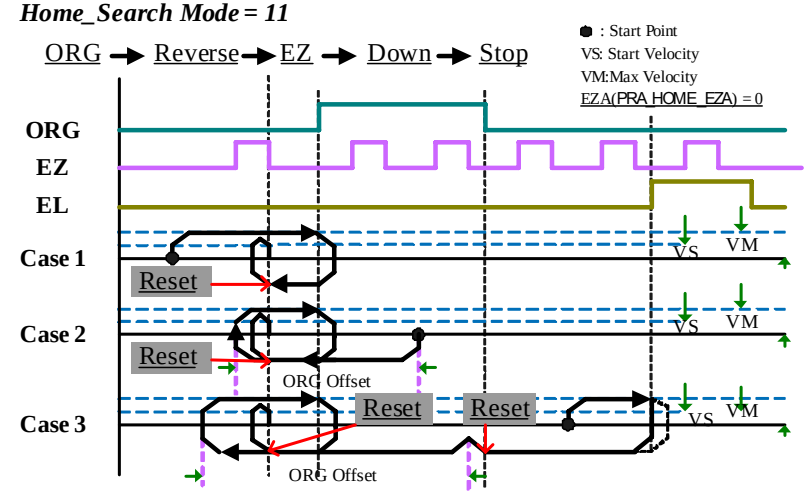


Home_Search Mode = 10

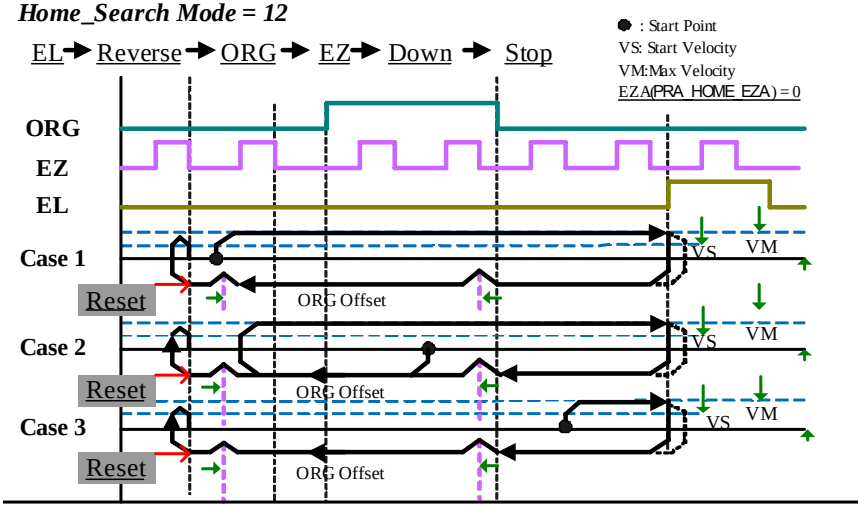


LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Home_Search Mode = 11



Home_Search Mode = 12



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.2.2.2 Home Return Mode

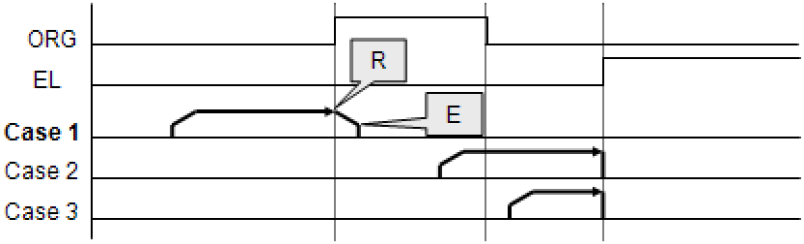
Home return means searching a zero position point on the coordinate. Sometimes, users use an ORG, EZ or EL pin as a zero position on the coordinate. At the beginning of machine power on, the program needs to find a zero point of this machine. Our motion controller provides a home return mode to make it.

We have many home modes and each mode contents many control phases. All of these phases are done by ASIC. No software efforts or CPU loading will be taken. After home return is finished, the target counter will be reset to zero at the desired condition of home mode. For example, a rising edge when ORG input. Sometimes, the motion controller will still output pulses to make machine show down after resetting the counter. When the motor stops, the counter may not be at zero point but the home return procedure is finished. The counter value you see is a reference position from machine's zero point already. The following figures show the various home modes: R means counter reset (command and position counter). E means ERC signal output.

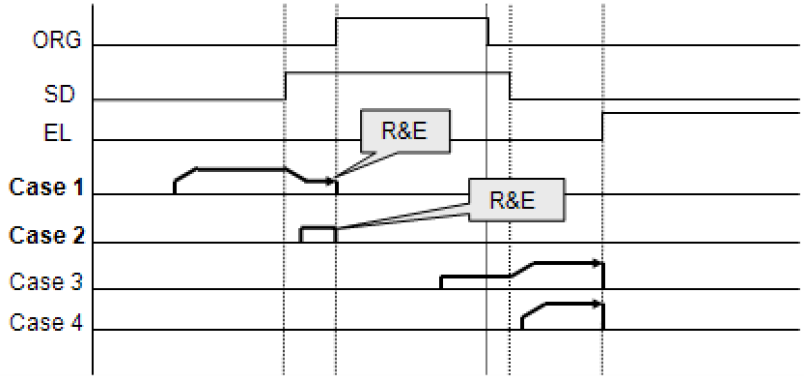
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Home mode=20: (ORG Turn ON then reset counter)

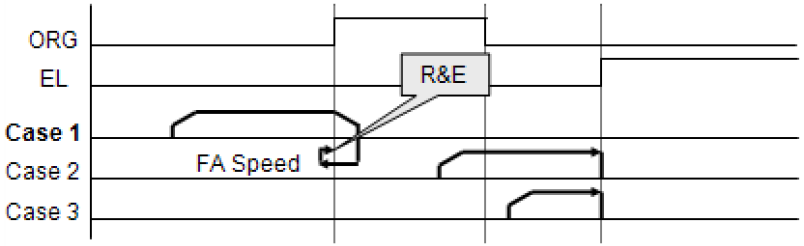
▶ When SD is not installed



▶ When SD is installed and SD is not latched

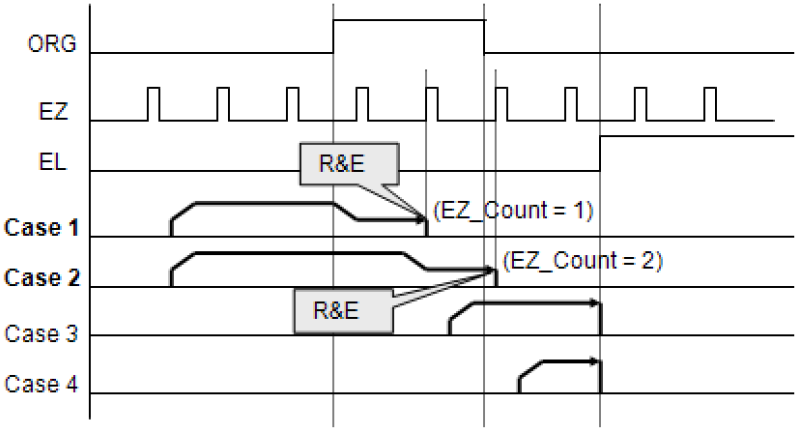


Home mode=21: (Twice ORG turn ON then reset counter)

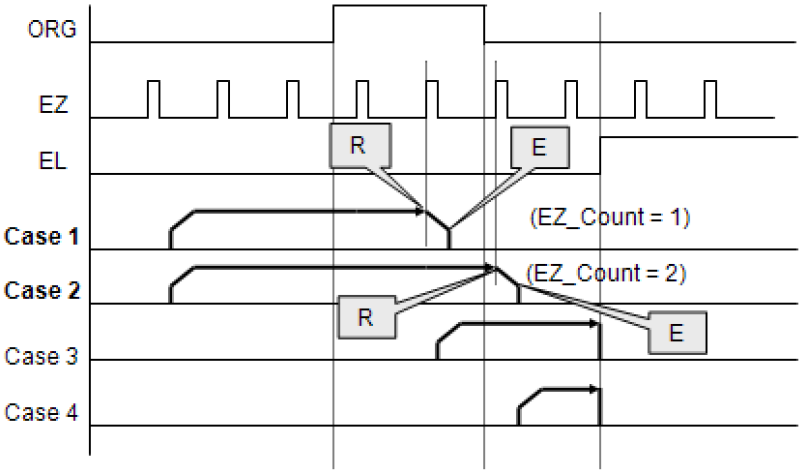


LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Home mode=22: (ORG ON then Slow down to count EZ numbers and reset counter)

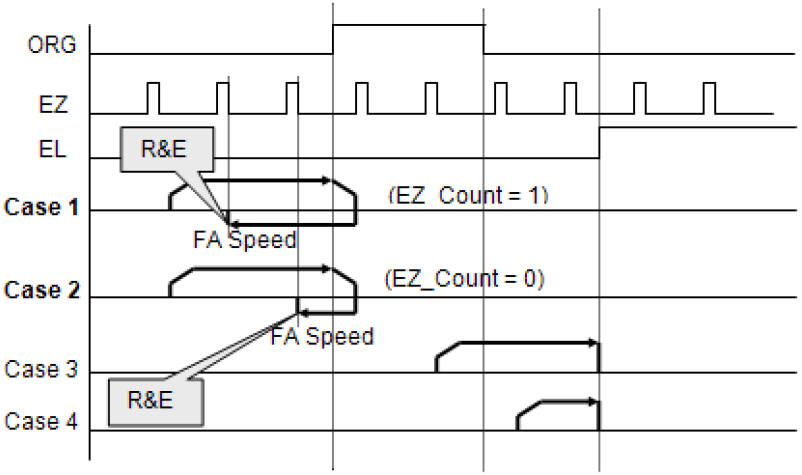


Home mode=23: (ORG ON then count EZ numbers and reset counter)

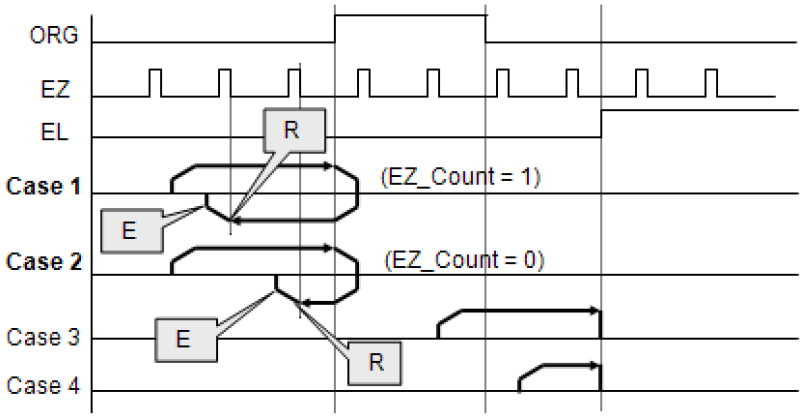


LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

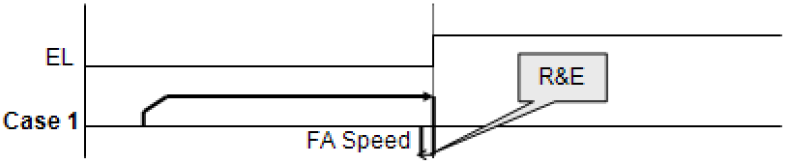
Home mode=24: (ORG On then reverse to count EZ number and reset counter)



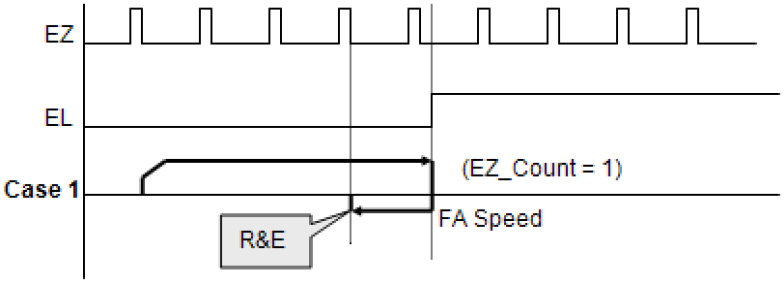
Home mode=25: (ORG On then reverse to count EZ number and reset counter, not using FA Speed)



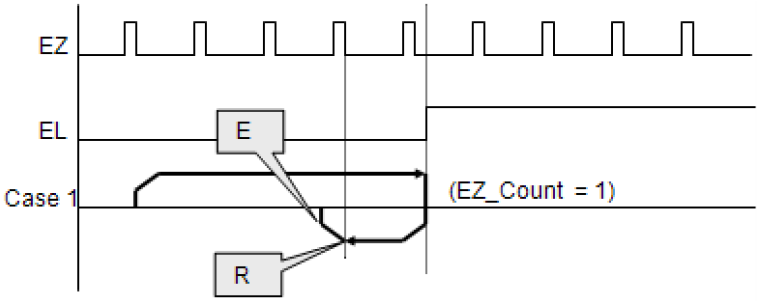
Home mode=26: (EL On then reverse to leave EL and reset counter)



Home mode=27: (EL On then reverse to count EZ number and reset counter)

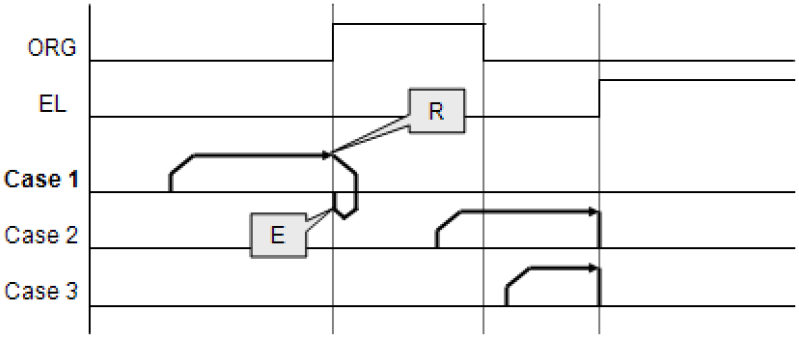


Home mode=28: (EL On then reverse to count EZ number and reset counter, not using FA Speed)

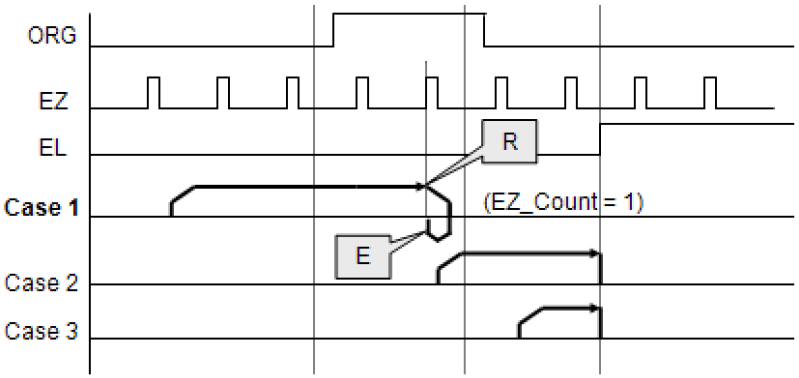


LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

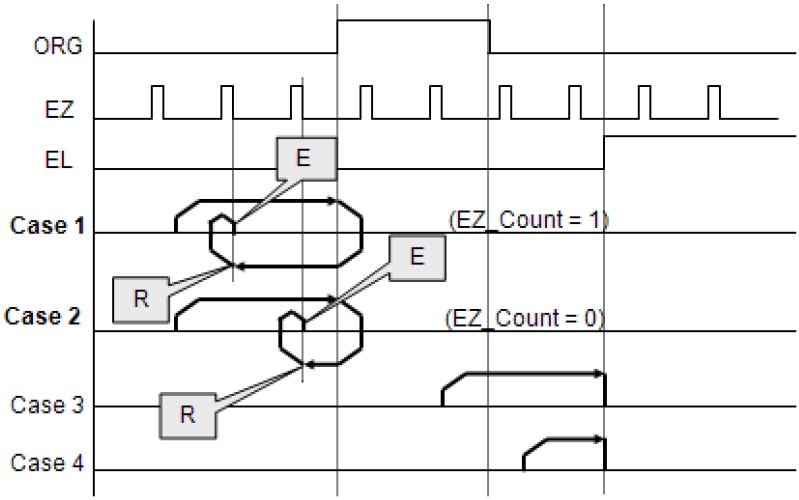
Home mode=29: (ORG On then reverse to zero position, an extension from mode 0)



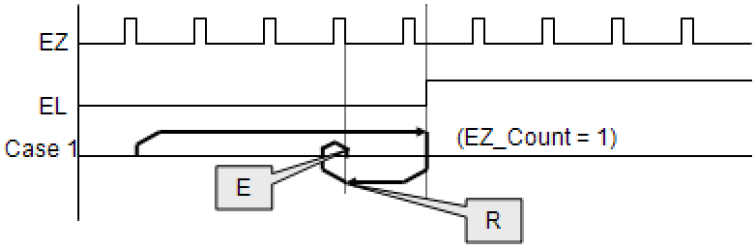
Home mode=30: (ORG On then counter EZ and reverse to zero position, an extension from mode 3)



Home mode=31: (ORG On then reverse to counter EZ and reverse to zero position, an extension from mode 5)



Home mode=32: (EL On then reverse to count EZ number and reverse to zero position, an extension from mode 8)



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.3 Motion Status and Related IO Monitoring

The MNET-4XMOand MENT-4XMO-C board has vast dedicated I/O and can roughly be divided into 2 categories. They are the motion related I/O's and the motion status. Motion related I/O's are input and output signals dedicated to motion. For example: PEL/MEL, position feedback…etc. Furthermore, the motion status will be updated cyclically by motion status monitoring function within per motionnet cycle time. This section will concentrate on the motion related I/O and their function calls.

- Section 5.3.1: Position control and feedback
- Section 5.3.2: Velocity feedback
- Section 5.3.3: Motion I/O status
- Section 5.3.4: Motion status

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.3.1 Position control and feedback

In this section, the following functions are discussed.

```
APS_set_position(Axis_ID, Position)
APS_get_position(Axis_ID, *Position)
APS_set_command(Axis_ID, Command)
APS_get_command(Axis_ID, *Command)
```

Set position

The **APS_set_position**() function allows users to set a current position counter value for the servo driver.

Get position information

The MNET-4XMO and MNET-4XMO-C sends a command to and receives a response from the servo driver via encoder feedback. Through command and response, an abundant amount of information is carried in and out, including position command and position feedback. The function call **APS_get_position**() will retrieve such information. The parameter '***Position**' retrieves the current position feedback.

Set command

This function is used to set the position information of one axis. The information is in unit of pulse. The function '**APS_set_command**()' will change current position or command to a new one.

Get command information

For each motionnet cycle, the MNET-4XMO and MNET-4XMO-C sends a command to and receives a response from the servo driver via encoder feedback. The function call **APS_get_command**() will retrieve command information with the parameter '***Command**' from the MNET-4XMO and MNET-4XMO-C.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.3.2 Velocity feedback

In this section, the following functions are discussed.

```
APS_get_command_velocity(Axis_ID, *Velocity)
```

Get command velocity information

For each motionnet cycle, the MNET-4XMO and MNET-4XMO-C sends a command to and receives a response from the servo driver. The function call **APS_get_command_velocity**() will retrieve command information with the parameter '***Velocity**' from the MNET-4XMO and MNET-4XMO-C.

5.3.3 Motion I/O status

In this section, the following function is discussed.

```
APS_motion_io_status(Axis_ID)
```

The "motion DIO" mentioned here refers to the motions dedicated to the digital I/O signals including PEL, MEL, ORG, and EMG. Each axis has its own motion DIO signal except EMG. All axes from a single card shares the same EMG signal. User has to configure the related I/O logic by function '**APS_set_axis_param**()' firstly to insure that the signal works legally. In other way, for detailed of motion I/O status, user is able to refer to motion I/O status table to check each I/O bit definition in function library section.

End-limit signals

The end-limit signals are used to stop the axis when they are active. There are two optional stop modes, one is "stop immediately", and, the other is "decelerate to start velocity then stop". The parameter 'PRA_EL_Mode' in 'APS_set_axis_param()' are used to select the mode. Furthermore, user is able to use either an 'a' contact switch or a 'b' contact switch by setting the parameter '**Logic**'.

PEL signal indicates the end-limit in the positive (plus) direction. The MEL signal indicates the end-limit in the negative (minus) direction. When the axis is moving towards the positive direction, the axis will be stopped when the PEL signal becomes active, while the MEL signal is no affect in this case, and vise versa.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

When the PEL is active, only the negative (minus) direction motion is allowed.

The PEL/MEL status can be monitored through the function **APS_motion_io_status**().

ORG signal

The ORG signal is used, when the axis is operating under the home return mode. The logic polarity of the ORG signal is selectable using the parameter '**Logic**' of '**APS_set_axis_param**()'. The ORG status can be monitored using the function **APS_motion_io_status**().

EMG signal

Each MNET-4XMO and MNET-4XMO-C has an EMG signal input. Whenever this EMG signal becomes active, all the axes controlled by in the card will stop moving immediately.

The logic polarity of the EMG signal is selectable using the parameter '**Logic**' of '**APS_set_axis_param**()'. The EMG status can be monitored using the function **APS_motion_io_status**().

Except above mentioned motion I/O, this function retrieves more motion related I/O status simultaneously which included alarm signal, in position signal, servo on signal and so on. For detailed information of motion I/O status, user can refer to motion I/O table to understand the definition of each bit as following table.

7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
SVON	INP	EZ	EMG	ORG	MEL	PEL	ALM
15	**14**	**13**	**12**	**11**	**10**	**9**	**8**
--	--	--	--	--	--	--	RDY

Table 5-1: Motion I/O Status Bit Definition

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.3.4 Motion status

In this section, the following function is discussed.

```
APS_motion_status(Axis_ID)
```

This function is used to get one axis' motion status. The status includes running, normal stop, abnormal stop by reasons, in waiting other axis, follow status, in some modes, in accelerating or decelerating and so on. Status can be more than two such like mode and running. Users need to use this function to check whether the 'Fire-and-forget' function is done in polling system. In even-driven system, users can use interrupt event functions. For detailed of each bit of motion status, user is able to refer to motion status table to check each bit definition in function library section.

0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
CSTP	VM	ACC	DEC	DIR	NSTP	HMV	SMV
8	**9**	**10**	**11**	**12**	**13**	**14**	**15**
LIP	CIP	SMO	PMV	PDW	PPS	SLV	JOG
16	**17**	**18**	**19**	**20**	**21**	**22**	**23**
ASTP	SVONS	EMGS	ALMS	WANS	PELS	MELS	SEMGS
24	**25**	**26**	**27**	**28**	**29**	**30**	**31**
SPELS	SMELS	STPOA	--	--	--	ERRS	--

Table 5-2: Motion Status Definition Table

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.4 Driver Management

In this section, the following function is discussed.

```
APS_set_servo_on(Axis_ID, Servo_on)
```

This function is able to command one axis to servo on individually, moreover, if user wants to monitor the status for servo on/off, the function **APS_motion_status**() is useful to indicate the axis's servo current status.

5.5 E-Gear (Move Ratio)

This function is used to adjust the command pulse number of one revolution (Resolution) for a servo system.

Users must set the "User define resolution" before motion starts.

$$\text{Move ratio (R)} = \frac{\text{Encoder resolution}}{\text{User - define resolution}(2^N)}$$

User-define resolution = 2N; N= 12 - 18

(Axis parameter: PRA_EGEAR)

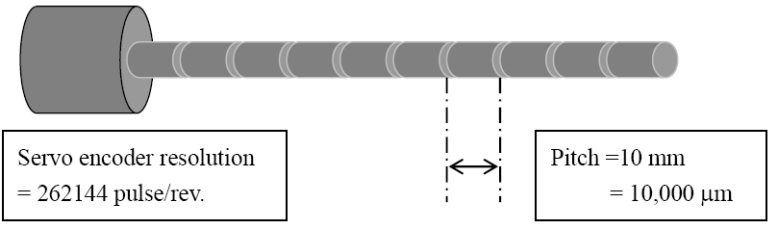
For example, by using Mitsubishi MR-J3A servo motor, its encoder resolution is 262144 pulse / rev. The following table shows the

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

relationship between parameter N, user-define resolution and move ratio R.

N	User define res. Pulse / Rev.	E-gear ratio (R)
18	$2^N = 262144$	1
17	$2^N = 131072$	2
16	$2^N = 65536$	4
15	$2^N = 32768$	8
14	$2^N = 16384$	16
13	$2^N = 8192$	32
12	$2^N = 4096$	64

Example:



When N = 13, (R = 32)

$$\text{Linear resolution} = \frac{\text{Screw pitch}}{\text{Encoder resolution}} \times \frac{\text{Encoder resolution}}{\text{User define res.}}(R)$$

$$= \frac{10\,\text{mm}}{262144} \times 32 \quad = 0.001221\ \text{mm/pulse}$$

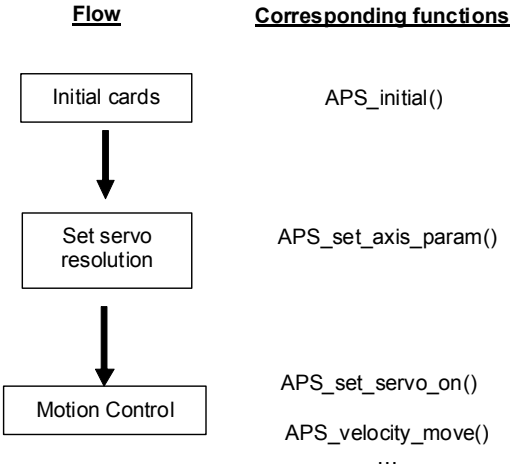
$$= \frac{10{,}000\,\mu\text{m}}{262144} \times 32 \quad = 1.221\ \mu\text{m/pulse}$$

Distance: 1,000 pulse = 1,000 pulse X 1.221 μm/pulse = 1221 μm

Velocity: 1,000 pps = 1,000 pulse/sec X 1.221 μm/pulse
= 1221 μm/sec.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Programming flow example:



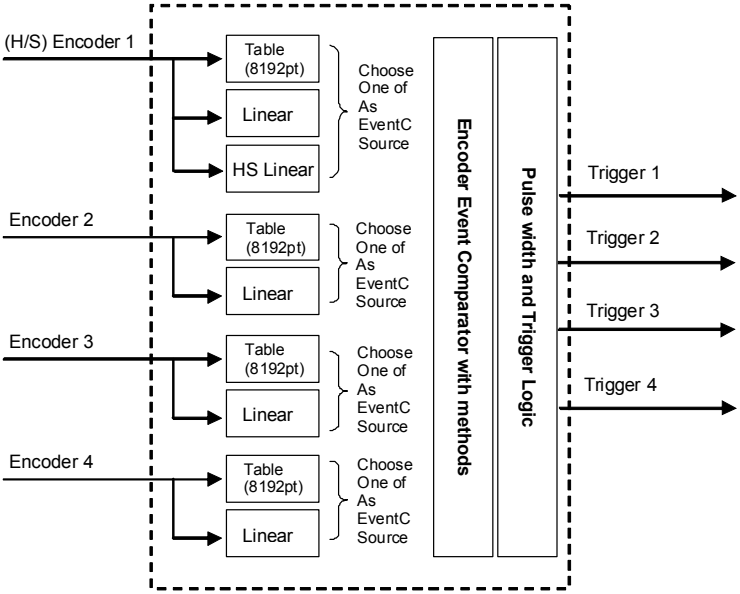
5.6 MNET-4XMO-C Continuous Trigger Function (*)

MNET-4XMO-C provides 4 trigger output differential pair pins on IOIF# connectors. The trigger source is from encoder event. The encoder event is from encoder comparator. An encoder is used to record motion axis' position continuously. It has forward and backward counting capability.

In some applications, users want to set an encoder event and use trigger signal to turn on some devices like frame grabber trigger inputs, solenoid valves, relays, opto-isolated and so on. If users need multiple encoder events in one axis' movement like on the fly trigger of frame grabber, the continuous trigger of MNET-4XMO-C is capable for this purpose. Each of 4 trigger supports up to 100 KHz high speed continuous trigger which cover most of frame grabber processing frequency in the world. MNET-4XMO also provides one additional trigger function which supports up to 1 MHz trigger for ultra high speed applications.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The block diagram of MNET-4XMO-C trigger module is as follows:



Note: (*): Only applies to MNET-4XMO-C

From the block diagram, the signal flow is from left to right. There are two kinds of encoder event comparator source, table and linear. The comparator source is for continuous trigger purpose. Once the comparator with method has finished an encoder event, the next encoder event will be loaded from comparator source. Each encoder event represents one encoder (position) value. When encoder counter passes by the encoder event, we say the comparator with method is active then trigger a pulse according to its pulse width and logic settings.

The encoder event comparator source by table means all the encoder event values are preset in the table for comparator with method to load. This mode is also called non-linear on the fly encoder event mode. Users can store any number in increasing or decreasing series with non-equal interval. The size of table is 8192 points for each encoder.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The encoder event comparator source by linear means the encoder event values can be represented as one-order linear function for comparator with method to load. Users only need to set linear function's start value, repeat times and interval. This mode is also called linear on the fly encoder event mode. The 'interval' could be positive or negative for direction of series number. The total trigger counts have no limitation, not like table mode.

MNET-4XMO-C has one additional encoder event comparator source for encoder 1 which support ultra high speed trigger up to 1 MHz. That means only this encoder can be used for 1 MHz trigger speed. This mode supports only linear encoder event comparator source. It has independent parameters for linear settings.

Note that only one encoder event comparator source can be used at the same time for one encoder.

After choosing encoder event comparator source for each encoder channel, users can set its comparator's method. The methods are equal with direction, equal with directionless, greater than and smaller than. Ultra high speed trigger channel's methods have no greater than and smaller than modes.

Finally, users can set each trigger channel's pulse width and logic. The pulse width range is quiet big. It ranges from 100ns to 21.47sec with 10ns resolution. Normally, 0.5us to 1sec is suggested range according to your trigger frequency and trigger input devices.

The logic means normally high/low of trigger channel. It also has toggle mode and bypass mode. Toggle mode means the trigger level will be switched for each compared encoder event. The bypass mode means trigger channel will bypass encoder input signal to trigger output pin directly.

Note that the modes of each encoder channel must be set properly. The modes are quadrature with 1,2,4 times, CW/CCW and OUT/DIR modes. Please refer to encoder signal section for details.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.7 MNET-4XMO-C Path Move Function(*)

The MNET-4XMO-C provides one dedicated on-board SRAM to store path data and makes continuous path move standalone possible. Users can define one path move with any dimension less than 4 one each MNET-4XMO-C. The path point data are sequentially sent to MNET-4XMO-C and executed in order. If the total path points exceed on-board SRAM, users can dynamically load new points if there has space on SRAM like a FIFO buffer.

The maximum number of points is 1,048,560. The SRAM buffer can preset 2048 points for 1-axis path single motion. If users need interpolation, 1024 points for 2-axis or 682 points for 3-axis or 512 points for 4-axis are possible includes circular motion. The circular motion is only for 2-axis setting.

MNET-4XMO-C not only can make path locus running continuously without host PC's control but also can make path speed continuously by auto calculating from our software. Users only need to give maximum speed and target position data and don't need to take care of starting speed for inter-command speed's continuity. This is so called auto speed profile feature.

A dwell move can be a part of path move. Dwell move means a certain time of axis still. The speed profile before and after the dwell will be automatically decreased to zero and accelerated from zero.

The acceleration and deceleration rate are fixed from the beginning setting for whole path move. Please pre-defined the value before path move.

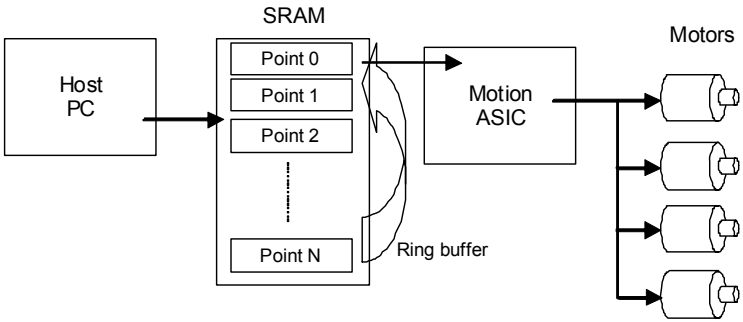
There is only one limitation for these piecewise point data: The distance for each segment must be long enough to support the time from current speed to be accelerated or decelerated to target maximum speed. Or it will return path data error.

Those axes not included in path move can be used in other single move function.

Note that this mode and fast index move mode can't be used at the same time.

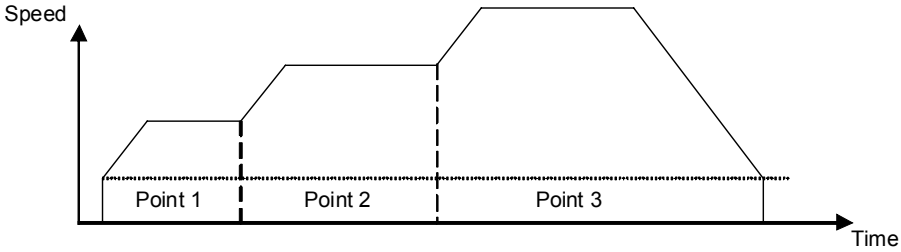
LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

The following is the block diagram of SRAM and path move data.



The auto speed profile has four conditions:

Case 1: Next command's max. speed is higher

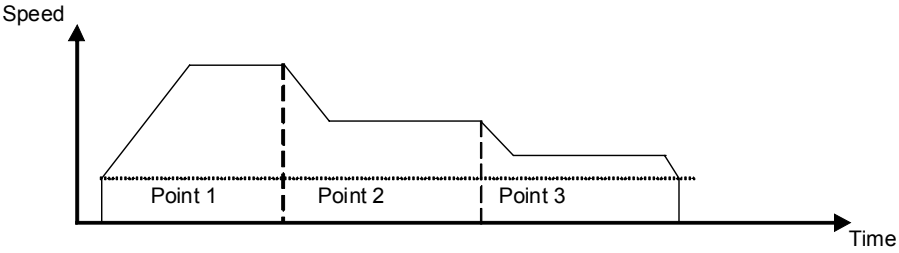


In this case, our software will auto calculate each segment's starting speed and make it reach next command's max. speed.

Note that final point can't be a circular move.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Case 2: Next command's max. speed is lower

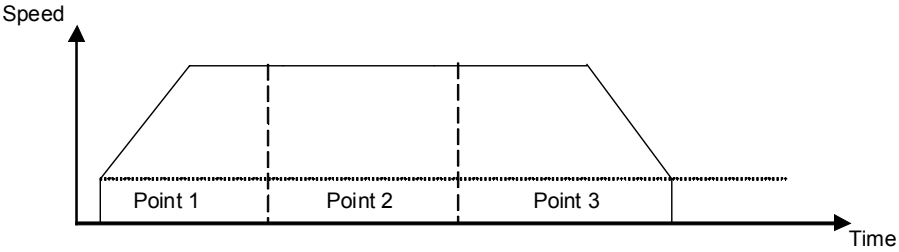


In this case, our software will auto calculate each segment's starting speed and make it reach next command's max.(target) speed.

Note that final point can't be a circular move.

Note that if Point 2 is a circular move, maximum speed of Point3 can't be smaller than that of Point2. Or it will return a path move error.

Case 3: Next command's max. speed is equal

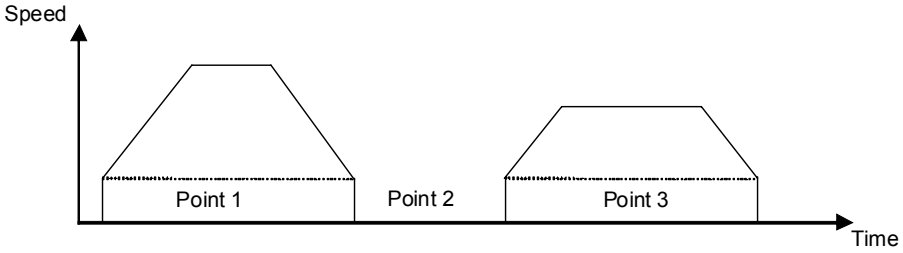


In this case, our software will auto disable each segment's starting speed and make all max. speed to be the same.

Note that final point can't be a circular move.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Case 4: Has dwell move in between



In this case, our software will auto calculate each segment's starting speed. If the first point's starting speed is zero, point 1 will decelerate to zero speed and point3 will accelerate from zero speed.

Note that final point can't be a circular move.

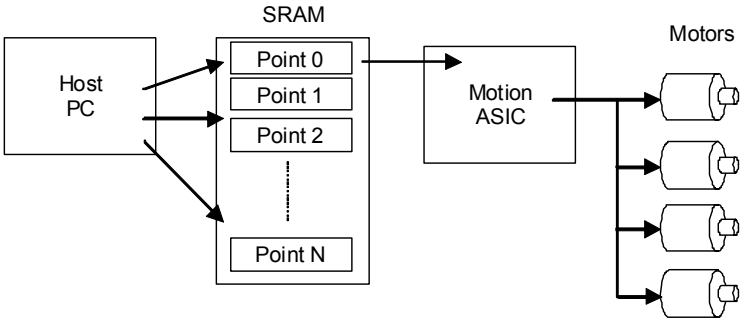
Note: (*): Only applies to MNET-4XMO-C

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

5.8 MNET-4XMO-C Fast Index Move Function(*)

MNET-4XMO-C provides a faster way to start a move. Because MNET-4XMO-C is using communication way to send/receive command and data not like other PCI motion board, the access time depends on the network speed and the amount of data. For a single move function, the master card may need to send several parameters to MNET-4XMO-C and it takes many communication cycles. If we have one way to let users to preset known data on SRAM, it can save much time on communication only by a point index command. That's the basic concept of this index move function.

The following is the block diagram of SRAM and index move data.



Note that this mode and path move mode can't be used at the same time.

The point 0 to point N are not necessary in the same dimension and axis combinations.

Note: (*): Only applies to MNET-4XMO-C

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6 MotionCreatorPro 2

After installing the hardware (Chapters 2), it is necessary to correctly configure all cards and double check the system before running. This chapter gives guidelines for establishing a control system and manually testing the cards to verify correct operation.

The MotionCreatorPro 2 software provides a simple yet powerful means to setup, configure, test, and debug a distributed motion & I/O control system that uses PCI-7856 cards.

Note that MotionCreatorPro 2 is only available for Windows 2000/XP/Vista with a screen resolution higher than 1024x768. Recommended screen resolution is 1024x768. It cannot be executed under the DOS environment.

6.1 Execute MotionCreatorPro 2

After installing the software drivers for the card in Windows 2000/XP/Vista, the MotionCreatorPro 2 program can be located at <chosen path>\PCI-Motion\MotionCreatorPro2. To execute the program, double click on the executable file or use Start -> Program Files -> ADLINK -> PCI-7856 -> MotionCreatorPro 2.

6.2 About MotionCreatorPro 2

Before running MotionCreatorPro 2 please note that MotionCreatorPro 2 is a program written in VB.NET 2003, and is available only for Windows 2000/XP/Vista with a screen resolution higher than 1024x768. It cannot be run under DOS. There are several files is necessary for this program.

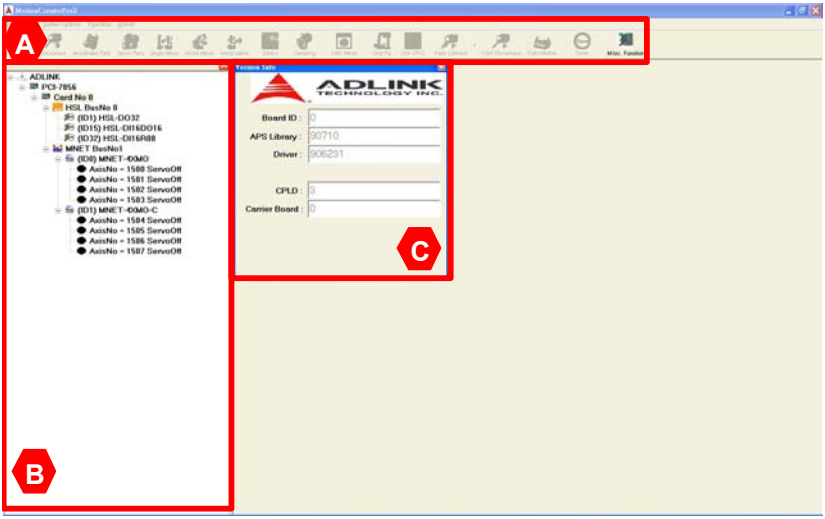
1. MCP2.mdb record parameters and graphics.
2. MCPro2.ini record initial setting

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.3 MotionCreatorPro 2 Form Introducing

6.3.1 Main Window

The main menu appears after running MotionCreatorPro 2. Refer to the following illustrations for a description of the available functions: File\Exit: Close and then exit this program.



A. Icons for operation modes. Some will be active when a filed bus / motion item in the tree view was selected and some will be active when an axis item is selected.

▶ Functions Button: Use these buttons to select function you want test.

▷ Configuration

Button	Function	Description
	Axis/Board Configuration	Configure axis or board parameter.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

▷ Movement

Button	Function	Description
	Single Movement	Single Axis movement (PTP), include absolute and relative function.
	Home Return Movement	Home return movement.
	Interpolation	Interpolation function.
	Sampling	Sampling function, it can select source and drew its profile.
	2D Movement	Execute 2D motion movement

▷ Field Bus

Button	Function	Description
	Field Bus Connect	Connect Motionnet / HSL module. Please select baud rate at button right side and connect.
	Field Bus Disconnect	Disconnect Motionnet / HSL module.
	Field Bus Module Test	If connect correctly, select module and use this to do module test.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

B. All automation products found by MotionCreatorPro2. The tree view can displayed both motion axes and field bus I/O.

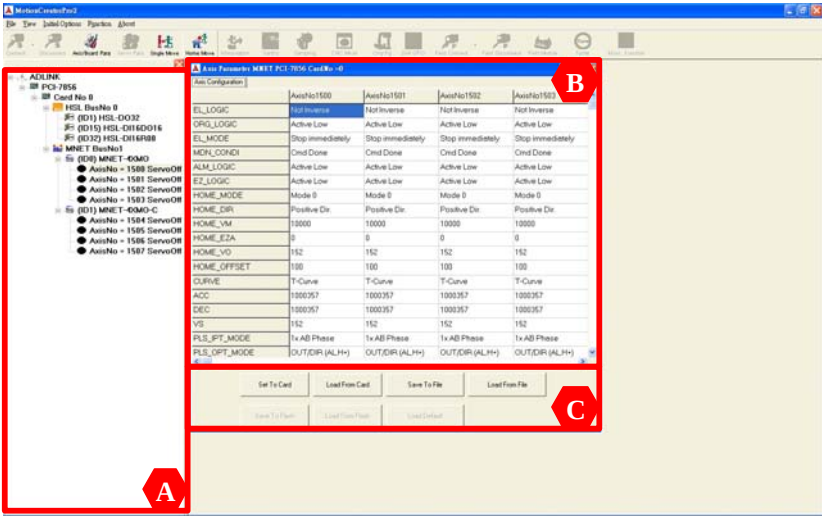
ICON	Function	Description
(Yellow)	Warning	Servo Warning
(Red)	Alarm	Servo Alarm
(Black)	Normal (Servo OFF)	No Error and servo off
(Green)	Normal (Servo ON)	No Error and servo on

C. Board information about software, firmware and hardware version.

6.3.2 Motionnet Distributed Motion Manager

The motionnet manager offers the motion operations that include single axis operation, homing return operation, axis parameter setting, etc.

6.3.2.1 Parameters Managemen



Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Operation Instructions:

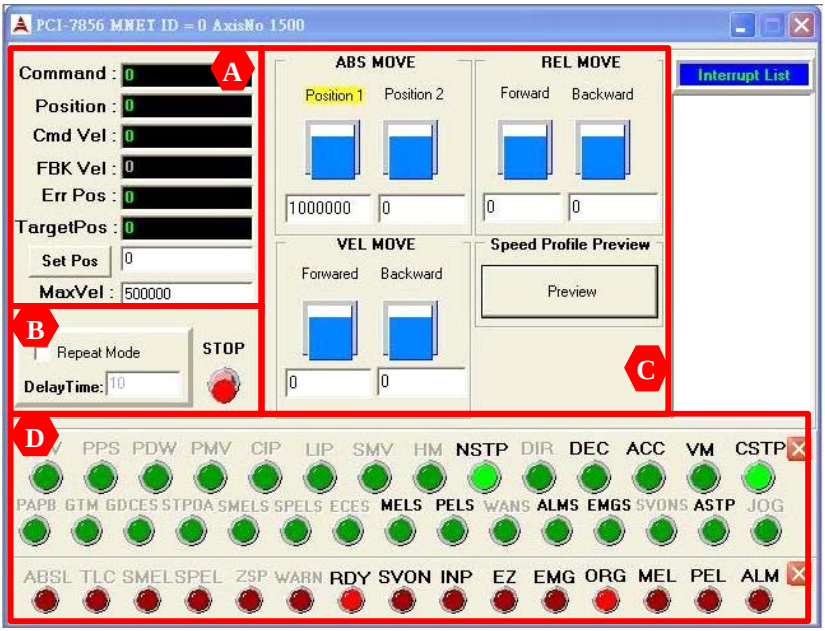
A. Parameter type display

B. Parameter values of all axes

C. Parameter management button for load/save parameters to flash or users' file. Users must use set to card to make this table active.

Operation hints: Click the mouse right button, users can apply all parameters to other axes.

6.3.2.2 Single Movement



Operation Instructions:

A. Command, feedback, error and target position information. Command and feedback speed information. The minimum speed value may limit by speed calculation cycle time for low speed display.

B. Optional operation setting and button. The repeat mode check box can be used in relative and absolute mode. The axes will move between two positions or forward/backward distance

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

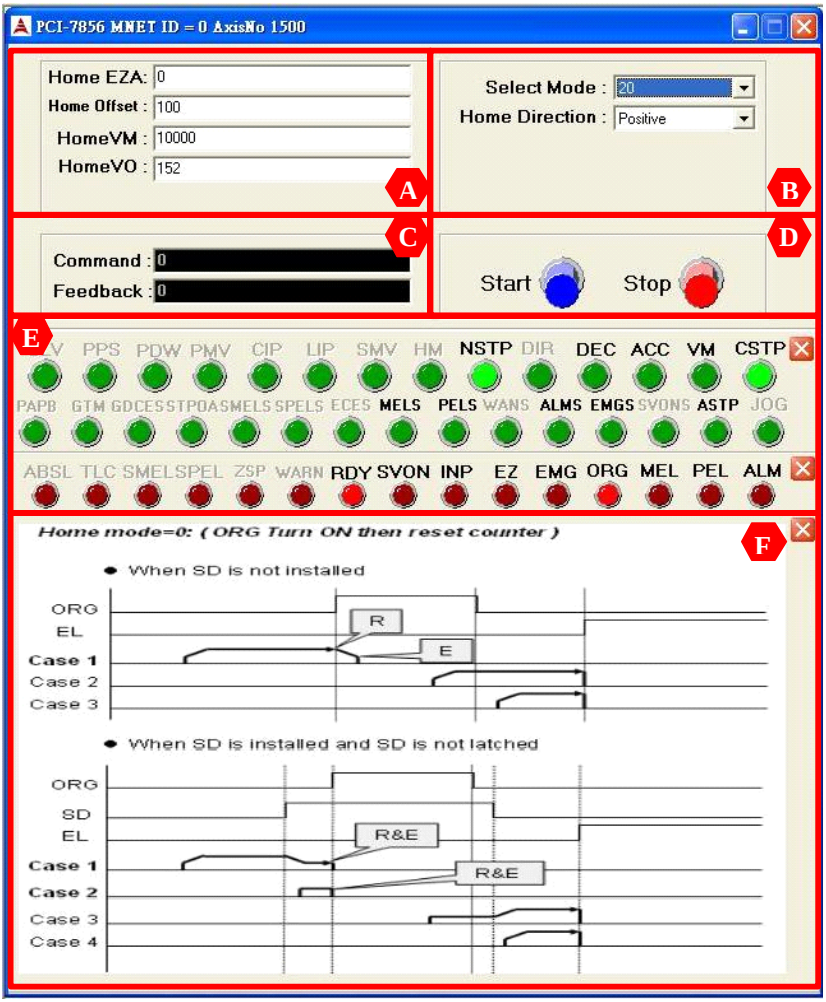
cyclically. You can set the delay time between each move in unit of mini-second. The minimum value is 1ms. The stop button is for relative, absolute and velocity modes.

C. Operation buttons and setting for 3 modes. You can switch operation between relative, absolute and velocity modes. The parameters of each mode must be set before operation like position1&2, forward/backward distance and forward/backward velocity. Remember to set MaxVel before executing relative and absolute mode. When using jog mode, the other three modes will be disabled.

D. Motion status, I/O status and interrupt status display area.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.3.2.3 Home Return



Operation instructions:

A. Speed parameter of homing profile, please refer to the figure of area F.

B. Modes setting of homing function, you can select one of items in pull down menu

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

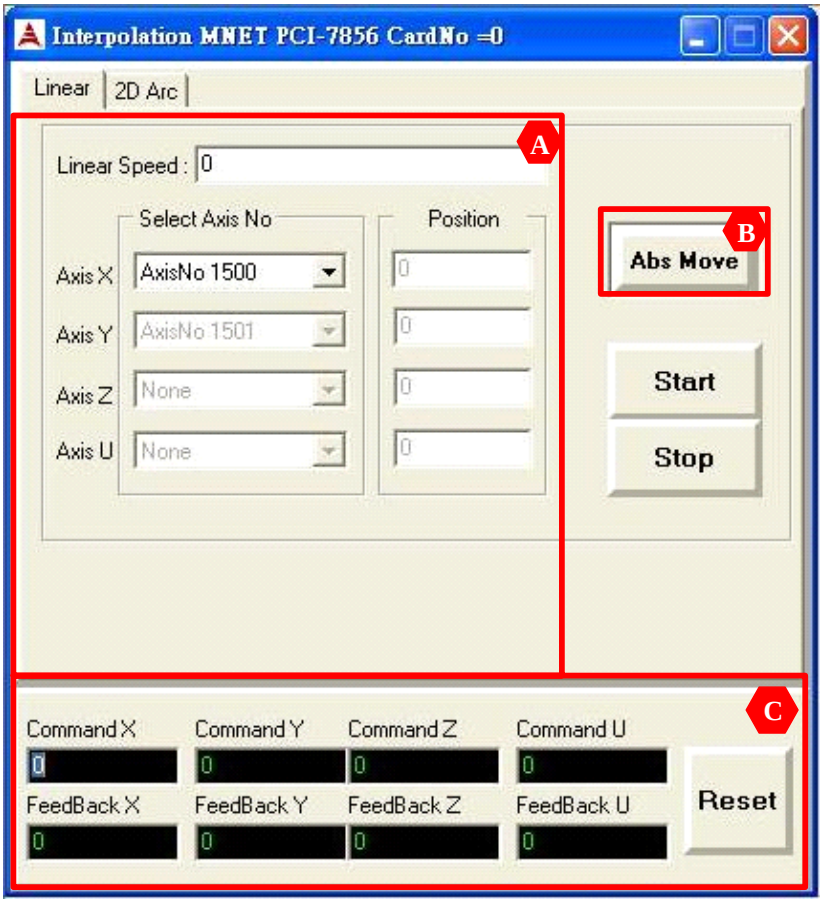
C. Command and position information when homing. After the home is done, the command counter will be reset to zero at the edge of ORG ON when VA speed.

D. Operation button for start homing or stop/abort homing function

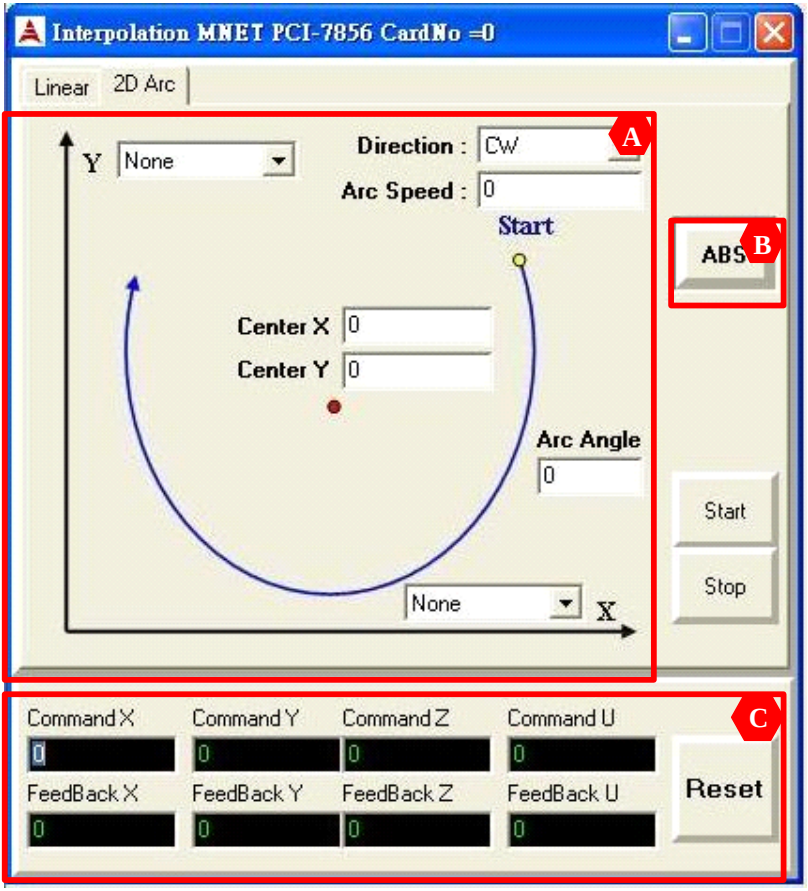
E. Motion and I/O status when homing

F. The timing chart of homing function

6.3.2.4 Interpolation



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000



Operation Instructions:

A. Interpolation axes selection and operation parameter settings including center position in ARC mode or target position in Linear mode. The arc angle parameter can be larger than 360.

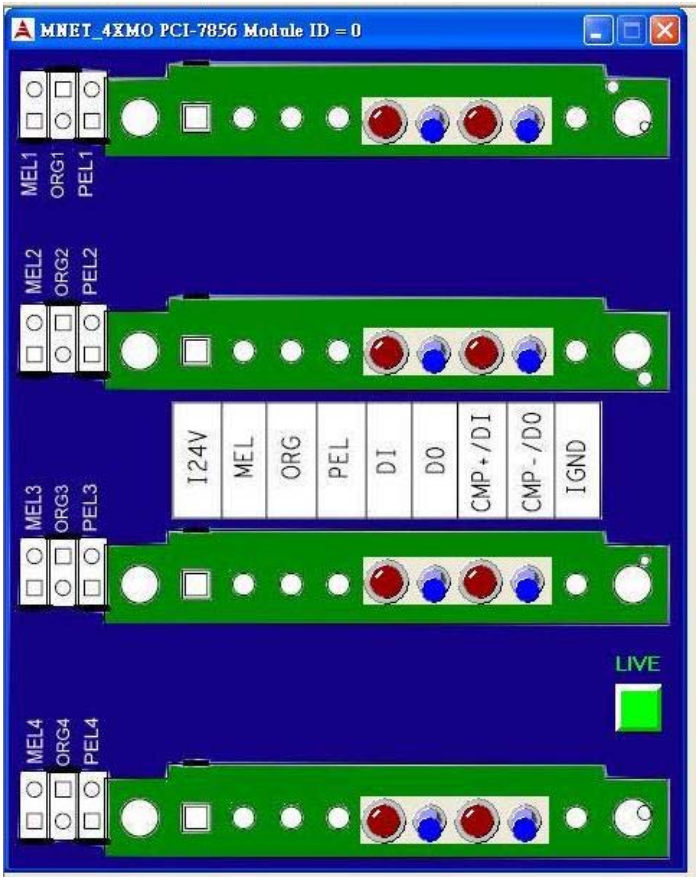
B. Absolute or relative interpolation mode selection. In ARC mode, it is about center position. In Linear mode, it is about target position.

C. Command and position information. In Arc mode, only two of them will be active.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

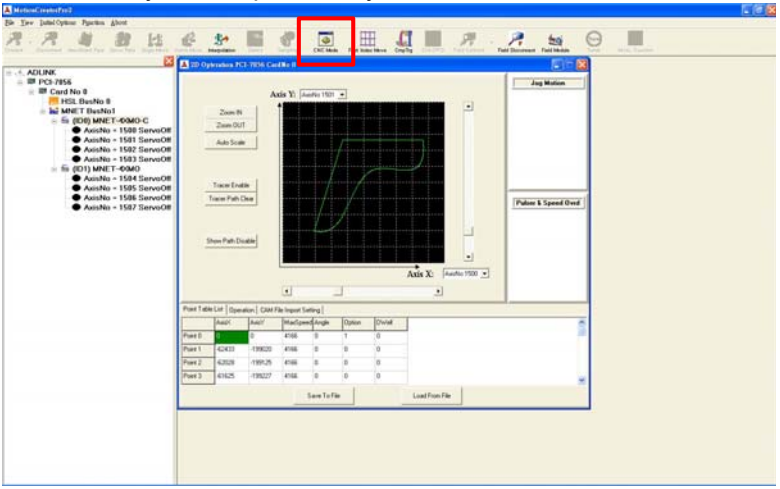
6.3.2.5 Dedicated Motion I/O status

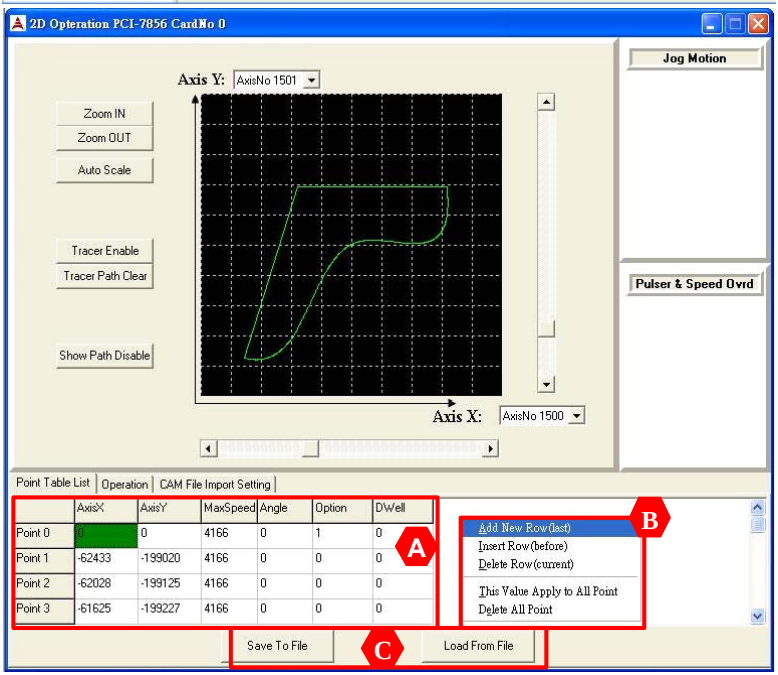
You are easily able to monitor or configure motion input and output channel well.



6.3.2.6 Point Table

You can select the “CNC” button to enable the 2D point table editor and easily set the point array to realize a continuous motion.





You can fill the position/distance what you want to move into the column of axis X and axis Y accordingly. And click the right button of mouse to select the edition window that includes “Add New Row”, “Insert New Row”, “Delete New Row” and apply the value for single column or for all.

A. Point edition window

B. Editor Bar

- ▷ Add New Row: Add a new point behind the selected point.
- ▷ Insert Row: Insert a new point ahead the selected point.
- ▷ Delete Row: Delete the current point.
- ▷ This Value Apply to All Points
- ▷ Delete All Points

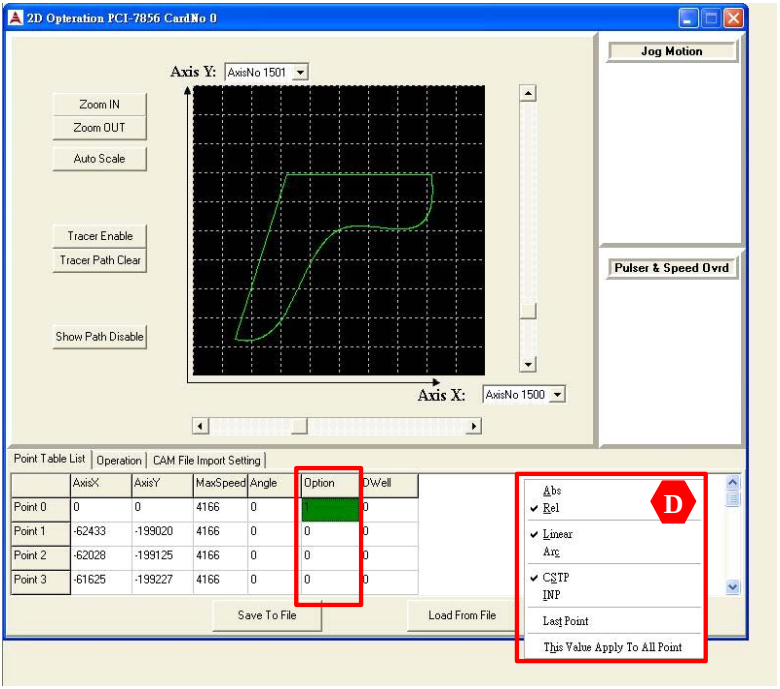
C. Save / Load point array:

- ▷ Save: After finished the point table edition and then you can push the button “Save To File” to save the finished table into the disk with the file type as “.ini”.
- ▷ Load: MotionCreatorPro 2 supports 2 file formats which are Point Table (*.ini).

D. Option: Set the properties of each points

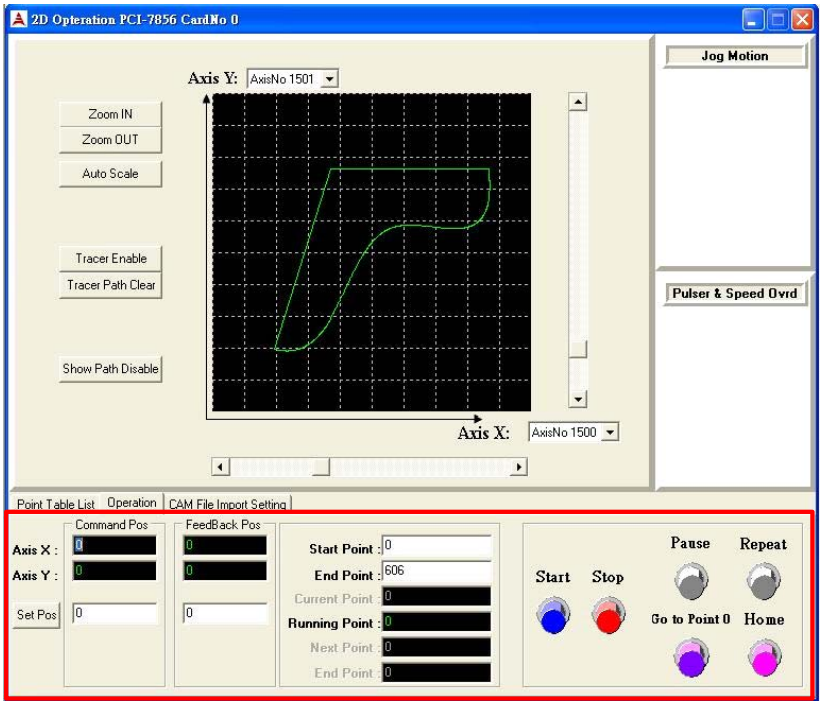
- ▷ Abs: This point belongs to absolute movement.
- ▷ Rel: This point belongs to relative movement.
- ▷ Linear: This point belongs to 2D linear interpolation movement.
- ▷ Arc: This point belongs to 2D circular interpolation movement.
- ▷ CSTP: After CSTP signal comes and then execute next point movement.
- ▷ INP: After INP signal comes and then execute next point movement.
- ▷ Last Point: the last point of Point Table.
- ▷ This Value Applies to All Points

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000


2D Opteration PCI-7856 CardNo 0
Axis Y:
AxisNo 1501
Zoom IN
Zoom OUT
Auto Scale
Tracer Enable
Tracer Path Clear
Show Path Disable
Axis X:
AxisNo 1500
Jog Motion
Pulser & Speed Ovrd
Point Table List
Operation
CAM File Import Setting
AxisX
AxisY
MaxSpeed
Angle
Option
DWell
Point 0
Point 1
Point 2
Point 3
Save To File
Load From File
Abs
Rel
Linear
Arc
CSTP
INP
Last Point
This Value Apply To All Point
D

Operation

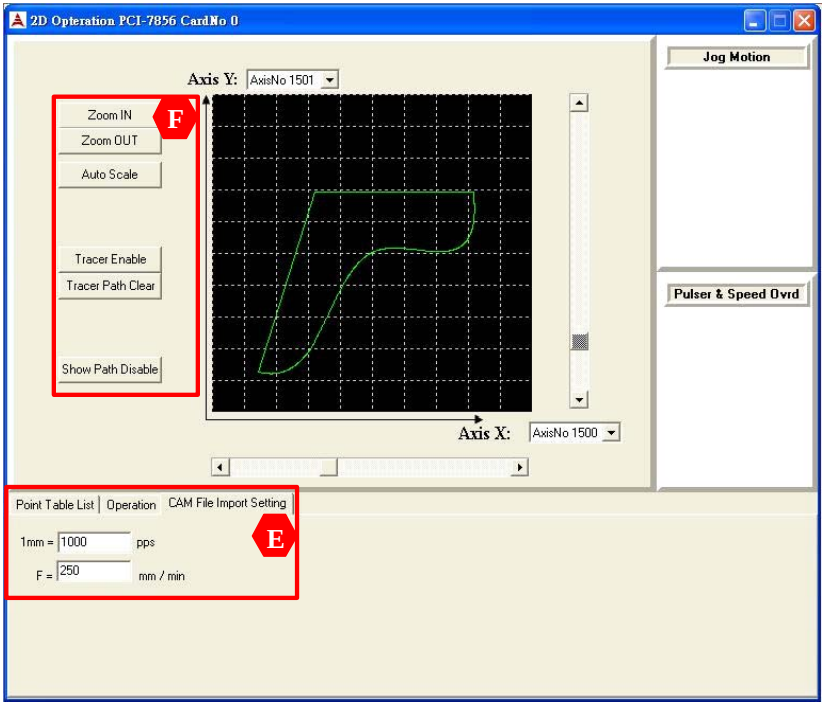
Use this page to manipulate the configured point table.



- **Set Pos Button**: Set Axis X and Axis Y Command Pos and Feed Back Pos.
- **Start Point**: Set the start point of Point Table.
- **End Point**: Set the final point of Point Table. If you fill all points manually and the final point will set to end point automatically by system.
- **Running Point**: The current point which is executing in hardware.
- **Start Button**: Start the point table movement.
- **Stop Button**: Stop the point table movement.
- **Go To Point 0 Button**: Go back to the first point.
- **Home**: Home movement.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Cam File Import Setting & 2D Point Path Preview



E. When you are executing the point-table which you want to move and you shall understand what does the exact length you move on, for example, you have to know what does the exact pulse you need to fill when the mechanism go 1 mm forward. Otherwise, you also need to know what does the feeding rate of the tool you need and it will transfer to the maximum velocity of whole movement.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

F. 2D Point Path Preview

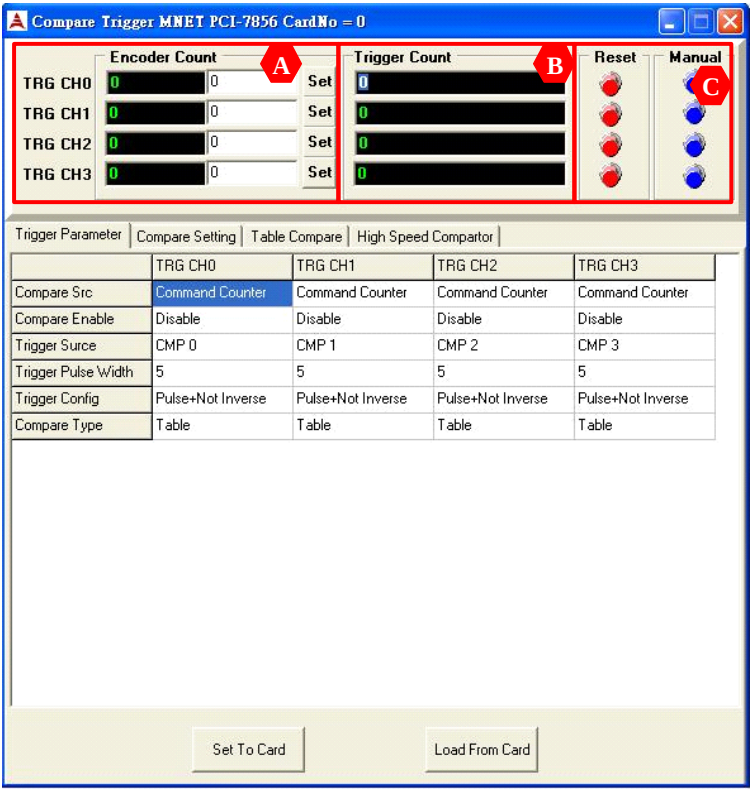
- ▷ **Zoom In**
- ▷ **Zoom Out**
- ▷ **Auto Scale**
- ▷ **Tracer Enable**: When you enable the “Tracer” function and you can observe a “Red Point” to identify where you are. Furthermore, the MotionCreatorPro 2 presents the past line with “Red” color.
- ▷ **Tracer Path Clear**: Clear the presented path.
- ▷ **Show Path Disable**: Enable/Disable Point Table path preview.

6.3.2.7 Compare Trigger Page

You can select the “CmpTrg” button to enable the position comparison and trigger pulse output configuration editor and easily set the

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

trigger point and comparison method to realize position comparison function.



	TRG CH0	TRG CH1	TRG CH2	TRG CH3
Compare Src	Command Counter	Command Counter	Command Counter	Command Counter
Compare Enable	Disable	Disable	Disable	Disable
Trigger Surce	CMP 0	CMP 1	CMP 2	CMP 3
Trigger Pulse Width	5	5	5	5
Trigger Config	Pulse+Not Inverse	Pulse+Not Inverse	Pulse+Not Inverse	Pulse+Not Inverse
Compare Type	Table	Table	Table	Table

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

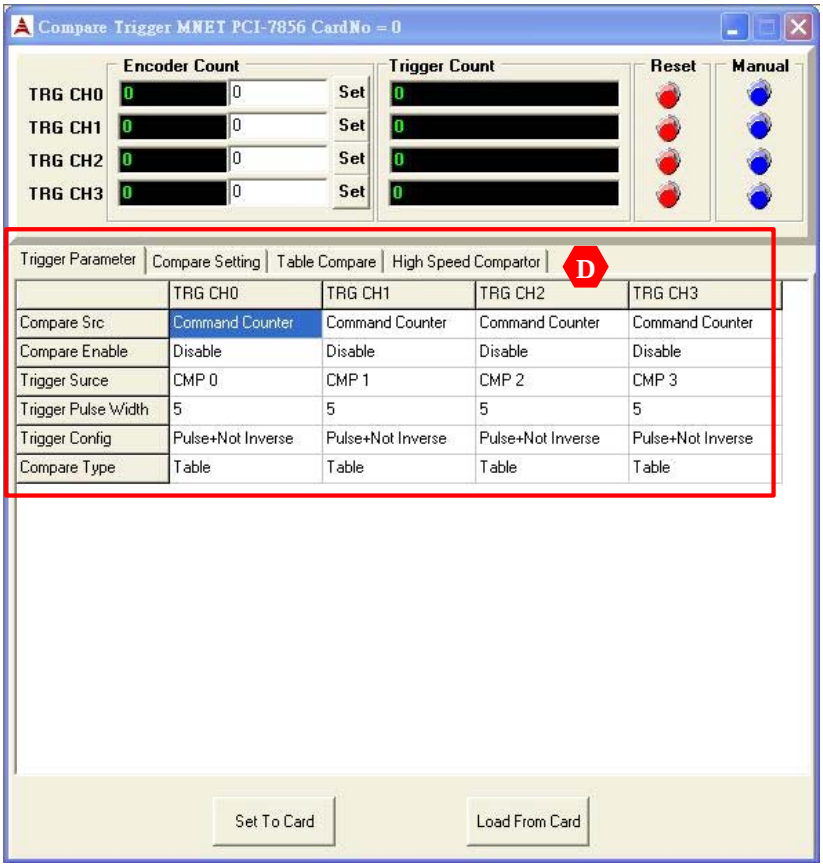
A. **Encoder Count**: Counts and presents the encoder value for per axis channel.

B. **Trigger Count**: Counts and presents the amount of trigger output pulse counter for per trigger channel.

C. **Manipulation**:

- ▷ **Reset**: Reset Trigger Counter.
- ▷ **Manual**: Force the trigger pulse output.

D. **Trigger Parameter**:



LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

- **Compare Source**: You can select the compare source which from Command Counter (Internal) or Position Counter (External).
- **Compare Enable**: There are six mode can be selected as following,

Mode:

- **0**: Disable
- **1**: Always compare the encoder position no matter use UP/ DOWN counter
- **2**: Compare the encoder position with UP counter usage
- **3**: Compare the encoder position with DOWN counter usage
- **4**: When encoder position > compared position then send the trigger pulse out.
- **5**: When encoder position < compared position then send the trigger pulse out.

Trigger Source:

- **0**: None (No any CMP Source)
- **1**: use CMP 0 as compared source
- **2**: use CMP 1 as compared source
- **3**: use CMP 2 as compared source
- **4**: use CMP 3 as compared source
- **5**: CMP H: Ultra-high speed comparison

Note: You have to configure the Ultra-high speed position comparison in the “High Speed Comparator Setting” page.

Trigger Pulse With: Define each trigger pulse width

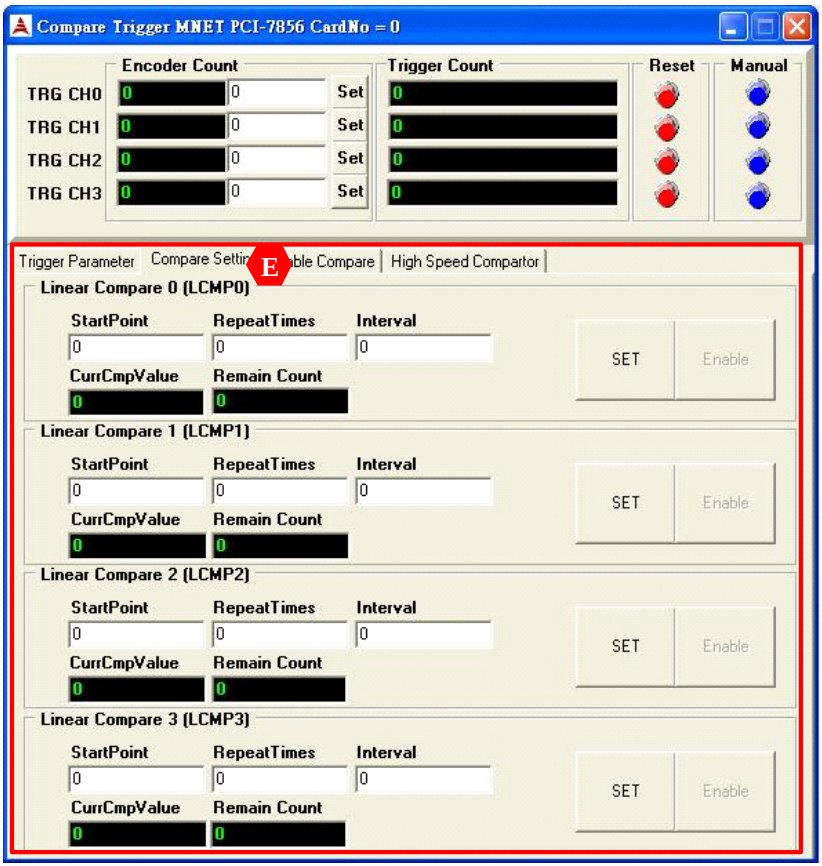
Trigger Config: There are four modes for your usage and they are Pulse Toggle, ByPass, Disable individually

Compare Type: Table / Linear position comparison method

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

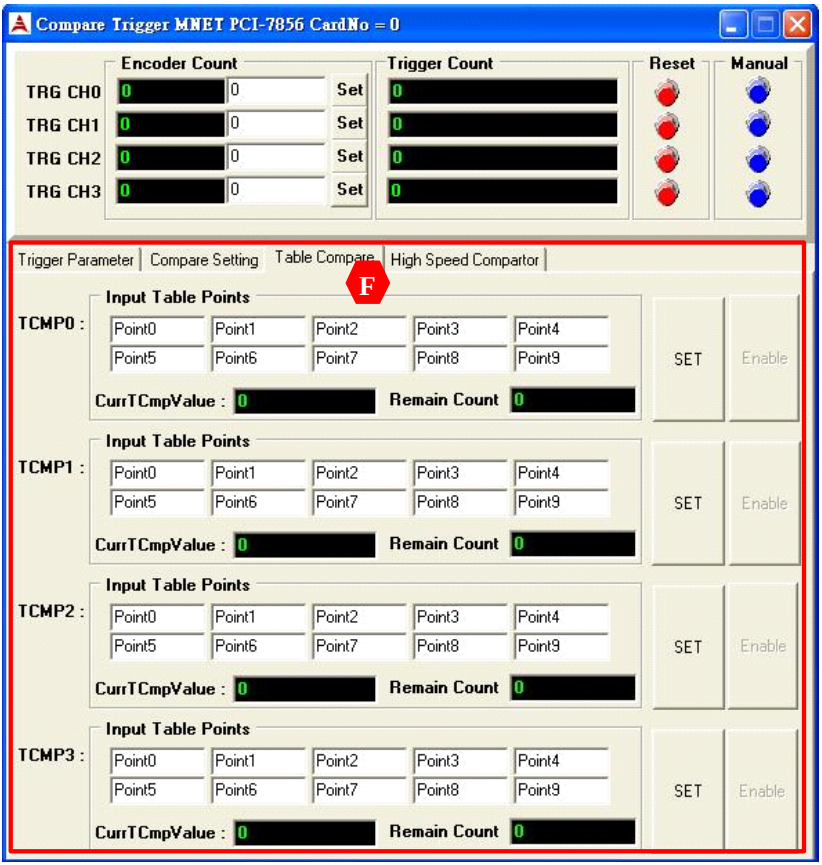
E. Compare Setting

There are four linear comparator can be used. You always select one kind of the linear/table comparison to use. You can set one comparison method for one channel. If you choose the linear comparison method and you have to finish whole configuration and then enable this function after pressed the “SET” button.

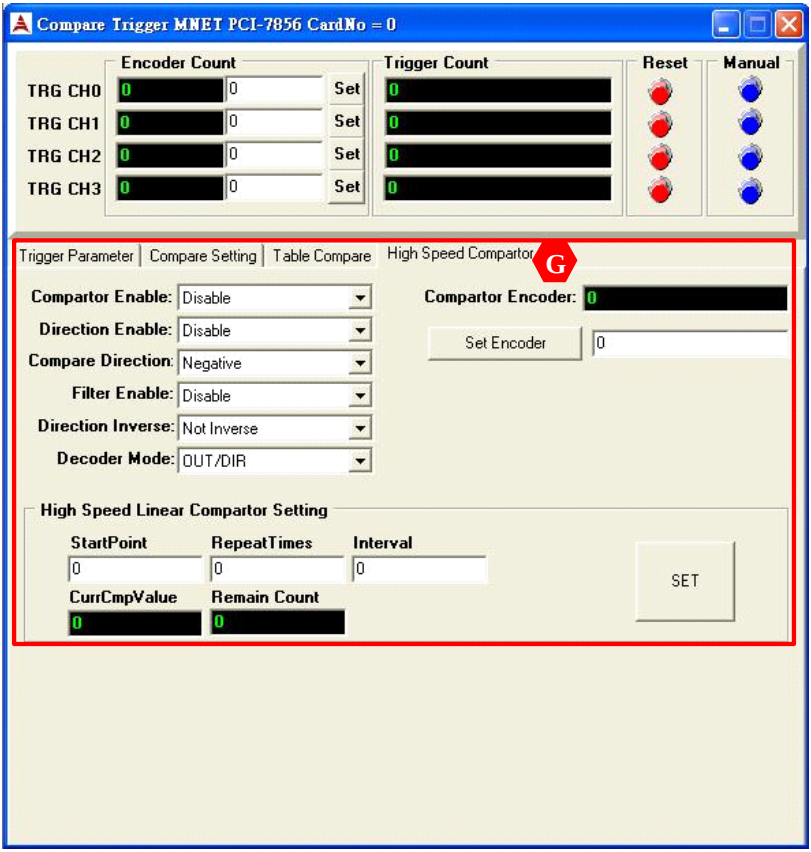


F. Table Compare

There also have four table comparator can be used. You always select one kind of the linear/table comparison to use. You can set one comparison method for one channel. If you choose the table comparison method and you have to finish whole configuration and then enable this function after pressed the “SET” button. Each table comparison method supports 10 compared points for your evaluation.



G. High Speed Comparator



- **Comparator Enable**: Enable the Ultra-high speed position comparator.
- **Direction Enable**: Enable the counter direction (UP/DOWN)
- **Compare Direction**: Choose the counter direction (UP/DOWN)
- **Filter Enable**: Enable/Disable encoder input filter
- **Direction Inverse**: Inverse the counter direction
- **Decoder Mode**: CW/CCW, Out/Dir, 1XAB, 2XAB, 4XAB modes can be set
- **Comparator Encoder**: Retrieve the encoder position
- **Set Encoder**: Set the encoder position
- **High Speed Linear Comparator Setting**: Use Ultra-high speed position comparator. (ONLY supports linear comparison method)

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

6.4 Return Error Code

The meaning is described in following:

- (-1) Operation System type mismatched
- (-2) Open device driver failed - Create driver interface failed
- (-3) System memory insufficiently
- (-4) Cards not be initialized
- (-5) Cards not found(No card in your system)
- (-6) Cards' ID is duplicated.
- (-7) Cards have been initialed
- (-8) Cards' interrupt events not enable or not be initialized
- (-9) Function time out
- (-10) Function input parameters are invalid
- (-11) Set data to EEPROM failed
- (-12) Get data from EEPROM failed
- (-13) Function is not available in this step, The device is not support this function or Internal process failed
- (-14) Firmware error, please reboot the system
- (-15) Previous command is in process
- (-16) Axes' ID is duplicated.
- (-17) Slave module not found.
- (-18) System ModuleNo insufficiently
- (-51) Set data to SRAM failed
- (-52) Get data from SRAM failed
-
- (-1000) No such INT number, or WIN32_API error. Please contact ADLINK's FAE staff.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

A Appendix

Execution Time of Motion Command

For 4-Axes module: (Suppose communication speed = **20 Mbps**)

Function Name	Bus	Time(μs)		
	MNET-4XMO MNET-4XMO-C	1 Module	4 Modules	8 Modules
APS_set_axis_param(I32 AXS_Param)		51	51	51
APS_set_axis_param(I32 AXS_Param)		51	51	51
APS_set_axis_param(I32 AXS_Param) x 5 times		51*5	51*5	51*5
APS_set_axis_param(I32 AXS_Param) x 5 times		51*5	51*5	51*5
APS_set_position(I32)		51	51	51
APS_set_position(I32)		51	51	51
APS_motion_io_status(I32 *io_status)		70	70	70
APS_motion_io_status(I32 *io_status)		116	116	116
APS_get_position(I32 *Pos)		63	63	63
APS_get_position(I32 *Pos) - Direct IO		106	106	106
APS_relative_move(I32 Dist, I32 MV)		133	133	133
APS_relative_move(I32 Dist, I32 MV) - Direct IO		184	184	184
APS_relative_linear_move(I32 *Pos_Array, I32 Line_Speed)		200	200	200
APS_relative_linear_move(I32 *Pos_Array, I32 Line_Speed)		328	328	328

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

This page intentionally left blank.

Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Getting Service

Ask an Expert: https://www.adlinktech.com/en/Askanexpert

ADLINK Technology, Inc.
Address: No. 66, Huaya 1st Road, Guishan District
Taoyuan City 333, Taiwan
Tel: +886-3-216-5088
Fax: +886-3-328-5723
Email: service@adlinktech.com

Ampro ADLINK Technology, Inc.
Address: 6450 Via Del Oro, San Jose, CA 95119-1208, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-600-1189
Email: info@adlinktech.com

ADLINK Technology (China) Co., Ltd.
Address: 300 Fang Chun Rd., Zhangjiang Hi-Tech Park, Pudong New Area
Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5132-3588
Email: market@adlinktech.com

ADLINK Technology GmbH
Address: Hans-Thoma-Strasse 8-10, 68163 Mannheim, Germany
Tel: +49-621-43214-0
Fax: +49-621 43214-30
Email: emea@adlinktech.com

Please visit the Contact page at www.adlinktech.com for information on how to contact the ADLINK regional office nearest you.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

Important Safety Instructions

For user safety, please read and follow all **instructions**, **WARNINGS**, **CAUTIONS,** and **NOTES** marked in this manual and on the associated equipment before handling/operating the equipment.

- Read these safety instructions carefully.
- Keep this user's manual for future reference.
- Read the specifications section of this manual for detailed information on the operating environment of this equipment.
- When installing/mounting or uninstalling/removing equipment:
  - Turn off power and unplug any power cords/cables.
- To avoid electrical shock and/or damage to equipment:
  - Keep equipment away from water or liquid sources;
  - Keep equipment away from high heat or high humidity;
  - Keep equipment properly ventilated (do not block or cover ventilation openings);
  - Make sure to use recommended voltage and power source settings;
  - Always install and operate equipment near an easily accessible electrical socket-outlet;
  - Secure the power cord (do not place any object on/over the power cord);
  - Only install/attach and operate equipment on stable surfaces and/or recommended mountings; and,
  - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000

- Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.
- A Lithium-type battery may be provided for uninterrupted, backup or emergency power.



Risk of explosion if battery is replaced with an incorrect type; please dispose of used batteries appropriately.

- Equipment must be serviced by authorized technicians when:
  - The power cord or plug is damaged;
  - Liquid has penetrated the equipment;
  - It has been exposed to high humidity/moisture;
  - It is not functioning or does not function according to the user's manual;
  - It has been dropped and/or damaged; and/or,
  - It has an obvious sign of breakage.

LRI Distribuída no Brasil pela LRI | vendas@lri.com.br | 51 2129-3000