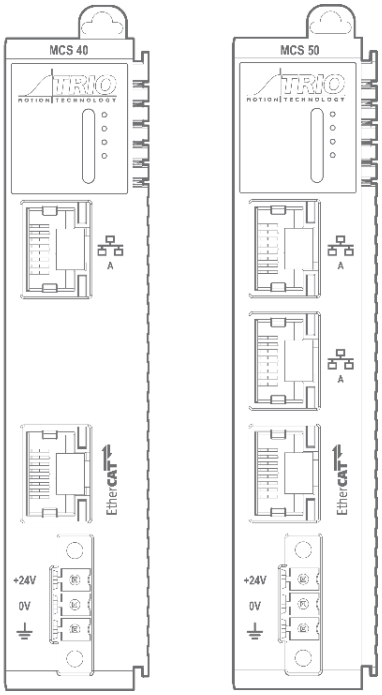
TRIO MOTION TECHNOLOGY

A MEMBER OF THE ESTUN GROUP



Motion-PLC

MCS 40 & MCS 50

USER MANUAL

About this Manual

Purpose

This manual provides the information required for the Selection, Wiring, Connection, Setup, Operation and Functions of the *Motion*-PLC MCS Controllers.

Models covered by this manual are:

Part Number	Model
P620	MCS 40
P625	MCS 50

Please read and understand this manual to ensure correct usage of the product.

Terms

Terms that may be used in this manual are defined as follows.

Term	Meaning
Axis	A software control that operates a Servo or Stepper Motor.
Drive	A Servo or Stepper Drive, which is used for controlling the Motor.
Servo System	A Servo Control System that includes a Motor, a Drive, a host controller (Motion Coordinator) and peripheral devices.
WDOG ON	Setting the control word on EtherCAT to signal that the Drives may be Enabled.
WDOG OFF	Clear the control word to signal that the Drives must be Disabled.
Motion Perfect	The PC Tool for commissioning and programming the Trio product suite.
Pulse + Direction	An electronic output from the Motion Coordinator that produces one pulse per step of the motor position, with a second output to signal the direction of motion.
Motion-iX	The motion-centric programming language, an extension of BASIC.
EtherCAT	Ethernet based fieldbus for synchronized control of slave devices in real-time.

Revision History

Date	Version	Revised Contents
Dec 2024	1.00	Initial release
Jun 2025	1.10	Formatting updated
Jul 2025	1.20	Updated following review

Safety Warning

During the installation or use of a control system, users of Trio products must ensure there is no possibility of injury to any person, or damage to machinery.

Control systems, especially during installation, can malfunction or behave unexpectedly.

Users must ensure that in all cases of normal operation, controller malfunction, or unexpected behaviour, the safety of operators, programmers or any other person is totally ensured.

If the Trio product is used in a manner not specified by **Trio Motion Technology LTD**, the protection provided by the product may be impaired.

Contents

Motion-PLC MCS Controllers

Overview

The MCS Controllers are ‘Flexible Machine Controllers’ ideal for simple or advanced machines. With local I/O expansion through a slice interface and Trio’s MS I/O system, remote expansion through EtherCAT and Ethernet communications for both programming and factory communications it provides a flexible solution for machine control.

The MS I/O system supports up to 16 slices. Remote expansion supports up to 48 EtherCAT devices (up to 8 Axis) and update rates down to 1ms.

Both the MS I/O system and EtherCAT are synchronized to the Motion-iX core, allowing deterministic behaviour of all devices for use with motion and machine applications.

The Ethernet port supports application programming along with fieldbus protocols including Modbus TCP, PROFINET IO and Ethernet/IP.

Application development is done through Motion Perfect, a single tool for all Trio devices, programming, diagnostics and debugging. User programs can be written in the industry standard programming languages of IEC61131-3; Structured Text (ST), Ladder Diagram (LD), Function Block Diagram (FBD), Sequential Function Chart (SFC) with motion supported through PLCopen motion library. Or using TrioBASIC, Trio’s established multi-tasking programming language.

Programming

The multi-tasking ability of the Motion-PLC allows different parts of a complex application to be developed, tested and run independently.

All programs are run in Processes. Execution of these processes is managed by the multi-tasking scheduler. The processes available can be used for TrioBASIC[1] programs or IEC 61131-3 tasks. Multiple processes can be run at the same time, allowing the programmer to select the best features of each.

Axis Positioning Functions

The motion control generation software receives instructions to move an axis or axes from the TrioBASIC or IEC 61131-3. The motion generation software provides target positions to ensure smooth, coordinated movements with the velocity profiled as specified by the motion parameters and the controlling program.

[1]TrioBASIC requires a Feature Enable Code (FEC)

Motion types supported include datum functions, continuous motion, single and multi-axis linear interpolation, circular and helical interpolation, software gearbox with simple follow ratio, advanced software gearbox functions for phased ration changes of fixed master distance, merging of motion for complex paths.

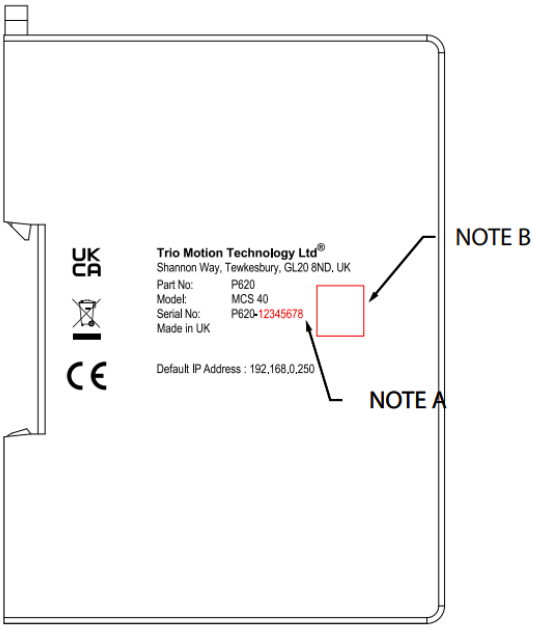
For more details on motion functions see the TrioBASIC help file and the IEC / PLCopen help files all of which are installed with Motion Perfect which is available as a free download from Trio's web site: www.triomotion.com.

Feature Enable Code

Product features can be updated in the field using Feature Enable Codes (FEC). These can be purchased through Trio's eStore which is accessible from Trio's web site. A list of supported FEC on these products is detailed in the specification table.

Product Label

Product details are printed in the left-hand side of the product (when viewed from the front).



This shows details of the part number, serial number, and default IP address.

NOTE A: Serial Number, combination of the part number and a unique 8-digit number.

NOTE B: QR code containing serial number.

Specification Table

	Part Number	P620	P625
	Model Number	MCS 40	MCS 50
Physical	Dimensions H x D x W (mm)	100 x 75 x 23	100 x 75 x 23
	Weight (g)	100	100
	Mounting Type	DIN Rail Mounting	DIN Rail Mounting
	Power Supply Main	24V DC ± 10% (15W max)	24V DC ± 10% (15W max)
	Display	LED Status	LED Status
Performance	Cores	1	2
	Processor	ARM Cortex A55	ARM Cortex A55
	Clock Frequency	600MHz	600MHz
	Maths precision	IEEE 457 Double	IEEE 457 Double
	Real Time Clock	Yes	Yes
	Position register precision	64-bit	64-bit
Ports	Ethernet	1 port, 10/100BASE-T	2 ports, 10/100BASE-T
	EtherCAT	1 port, 10/100BASE-T	1 port, 10/100BASE-T
	Memory Expansion	SD card	SD card
	I/O Expansion	MS I/O System	MS I/O System
	Max # I/O modules	16	16
Ethernet	Ethernet Protocols	Uniplay, Motion Perfect, Modbus TCP, PROFINET IO, Ethernet/IP	Uniplay, Motion Perfect, Modbus TCP, PROFINET IO, Ethernet/IP
EtherCAT	EtherCAT nodes	32	48
	EtherCAT protocols	CoE, FoE	CoE, FoE
	CoE Features	CSP, CSV, CST, TP	CSP, CSV, CST, TP
	EtherCAT PDO data	1514 bytes (≥2ms) 896 bytes (≤1ms)	1514 bytes (≥2ms) 896 bytes (≤1ms)
Programming	Languages	IEC61131-3	IEC61131-3
	Motion Features	PLCopen (Advanced)	PLCopen (Advanced)
	Motion Cycle Time	1ms, 2ms, 4ms	1ms, 2ms, 4ms
	Maximum Programs	48	48
	Maximum Processes	4 (12 with TrioBASIC FEC)	4 (12 with TrioBASIC FEC)
	User memory	8 MB	8 MB
	Table memory	512000 values	512000 values
	Max VR variables	4096	8192
	Move Buffer Limit	64	64
	Execution Benchmark (lines/ms)	70 (1 core)	70 (2 core)
Axes and I/O	Max Axes	8	8
	Max Physical Axes	4	4
	Max Remote Axes (EtherCAT)	2 (up to 4 with FEC)	2 (up to 8 with FEC)
	Max digital input points	256 (to 1024 + FEC)	256 (to 1024 + FEC)

	Part Number	**P620**	**P625**
	Model Number	**MCS 40**	**MCS 50**
	Max digital output points	256 (to 1024 + FEC)	256 (to 1024 + FEC)
	Max analogue inputs	32 (to 128 + FEC)	32 (to 128 + FEC)
	Max analogue outputs	32 (to 128 + FEC)	32 (to 128 + FEC)
Upgrades	Feature Enabled Codes	P982 (Add One Axis) P981 (Increase I/O) P984 (TrioBASIC) P751 (Security)	P982 (Add One Axis) P981 (Increase I/O) P984 (TrioBASIC) P751 (Security)
Environmental	Operating temperature	-20 to +55ºC	-20 to +55ºC
	IP rating	IP20	IP20
	Certifications	RoHS, CE	RoHS, CE

Certifications

EN IEC 61000-6-4:2019 Electromagnetic Compatibility (EMC) Part 6-4: Generic standard – Emission standard for industrial environments

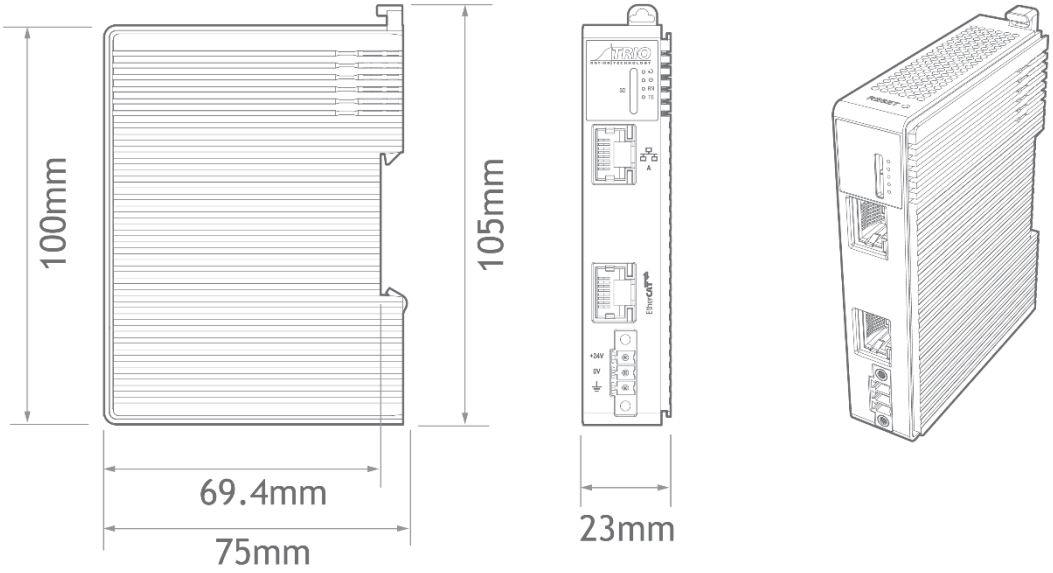
EN IEC 61000-6-2:2019 Electromagnetic Compatibility (EMC) Part 6-2: Generic standard - Immunity for industrial environments

Selection of materials and components should be in accordance with:

Directives 2011/65/EU (RoHS2) and 2015/863 (RoHS3) - Restriction of the use of certain Hazardous Substances in electrical and electronic equipment

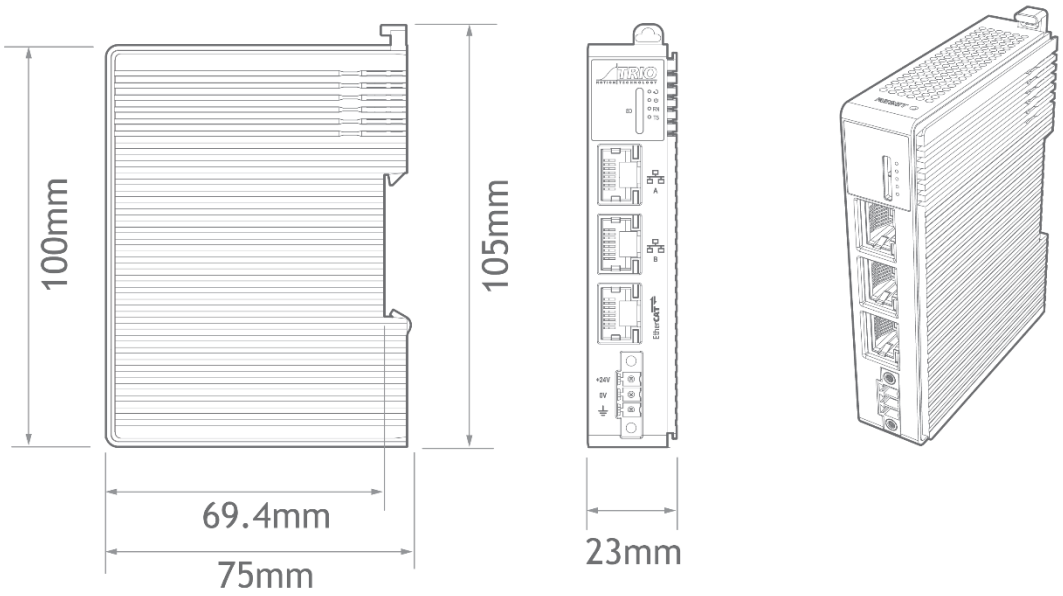
Dimensions

MCS 40



All dimensions are in mm.

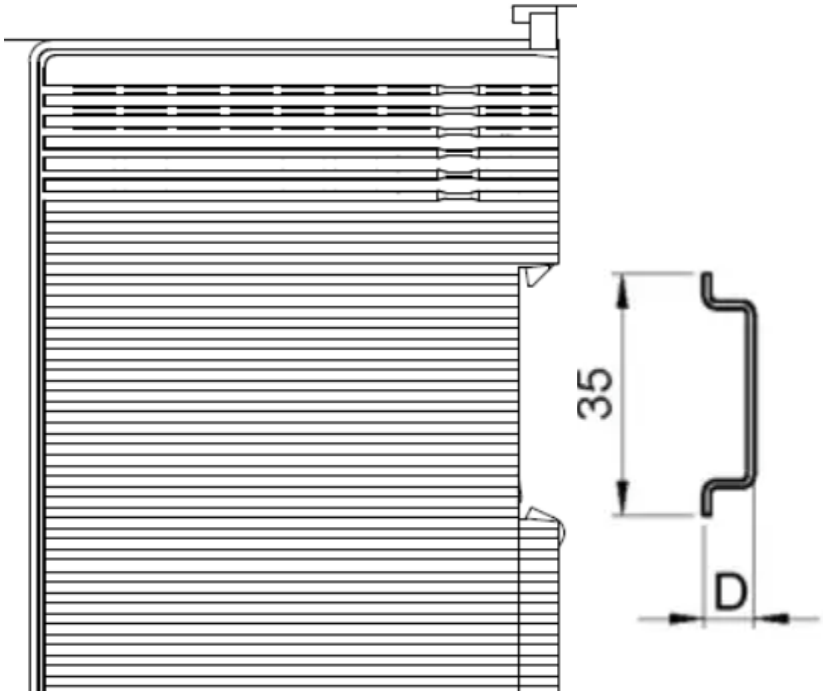
MCS 50



All dimensions are in mm.

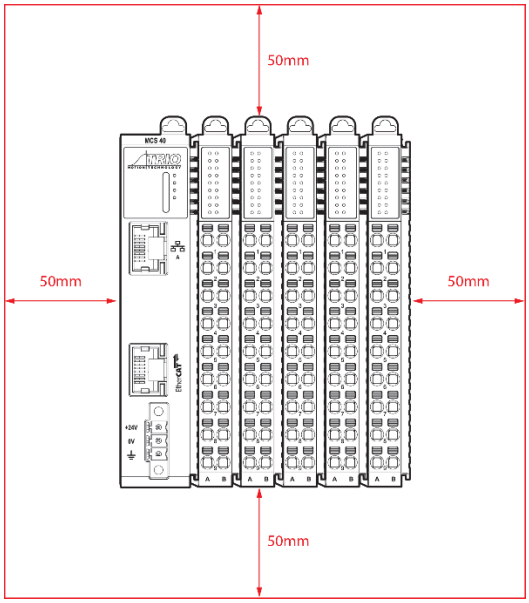
Installation

The Motion-PLC has a standard DIN rail mount with over-centre clip operated by a lever on the upper face. This is design to mount on a 35 mm DIN rail.



It must be installed vertically with the vents on the top and bottom faces. The DIN rail should be mounted on an unpainted metal plate with a connection to earth.

The Motion-PLC must be mounted in an enclosed cabinet, there must be an adequate volume of circulating air to maintain the environmental temperature within the operating temperature range. There must be an air gap of 50 mm around the product to allow suitable airflow.



NOTE: Place below heat sources such as drives and power supplies.

Environmental

Operating Temperature

Operating Temperature Range -20 to +55ºC with <95% humidity (non-condensing)

Storage Temperature

Storage Temperature Range -40 to +85ºC with <95% humidity (non-condensing)

Vibration

The Motion PLC is tested for vibration up to 0.5 g based on IEC 60068-2-6 methodology and shock up to 10 g based on IEC 60068-2-27 methodology. If the unit is used in a high vibration environment it is recommended that some additional vibration mitigation is fitted; for example, DIN rail clamping or vibration suppression mounts.

Wiring

Use copper conductors only. Use ferrules on all wires for best connection.

EMC Considerations

Electromagnetic Interference problems can usually be avoided by careful wiring and following a few basic rules.

- Mount noise generators such as contactors, solenoid coils and relays as far away as possible from the Motion-PLC.
- Where possible use solid-state contactors and relays.
- Fit suppressors across coils and contacts.

- Place high voltage cables in separate trunking to low voltage and signal cables.
- Ensure all the modules have a secure earth connection.
- Where screened cables are used, terminate the screen with a 360 degree termination rather than a “pig-tail”. Connect both ends of the screen to earth. The screening should be continuous, even where the cable passes through a cabinet wall or connector.

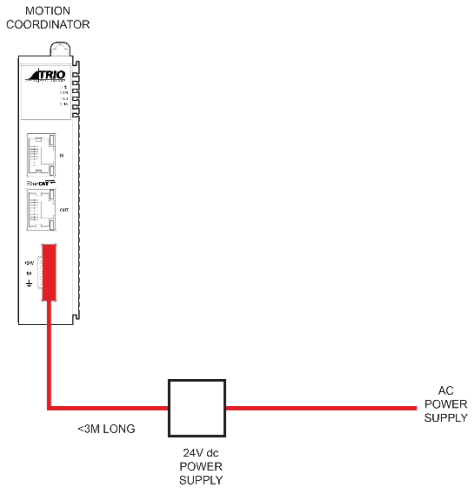
For more advice, see section **Electromagnetic Compatibility**.

The consideration of EMC implications is a legal requirement for the supplier of a product to the end customer to ensure that it does not cause interference with other equipment and that it is not itself susceptible to interference from other equipment.

Surge Protection

Single power supply

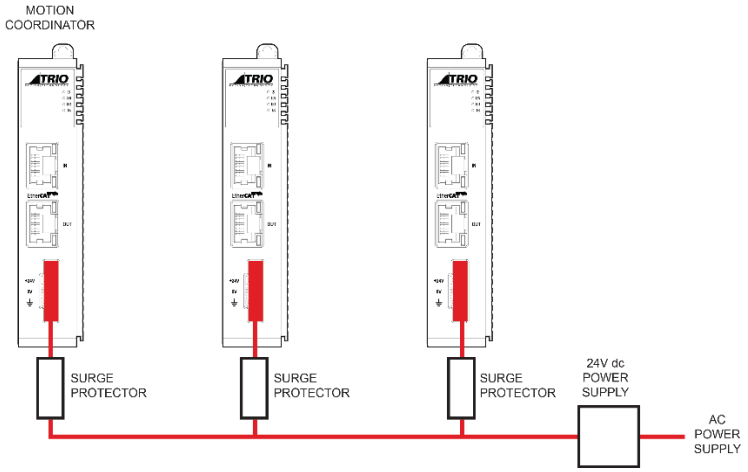
Where the device is supplied with 24V DC from one dedicated 24V power source and the connecting cable is less than 3 metres, there is no need for a separate surge protection device.



Motion Coordinator with dedicated power source

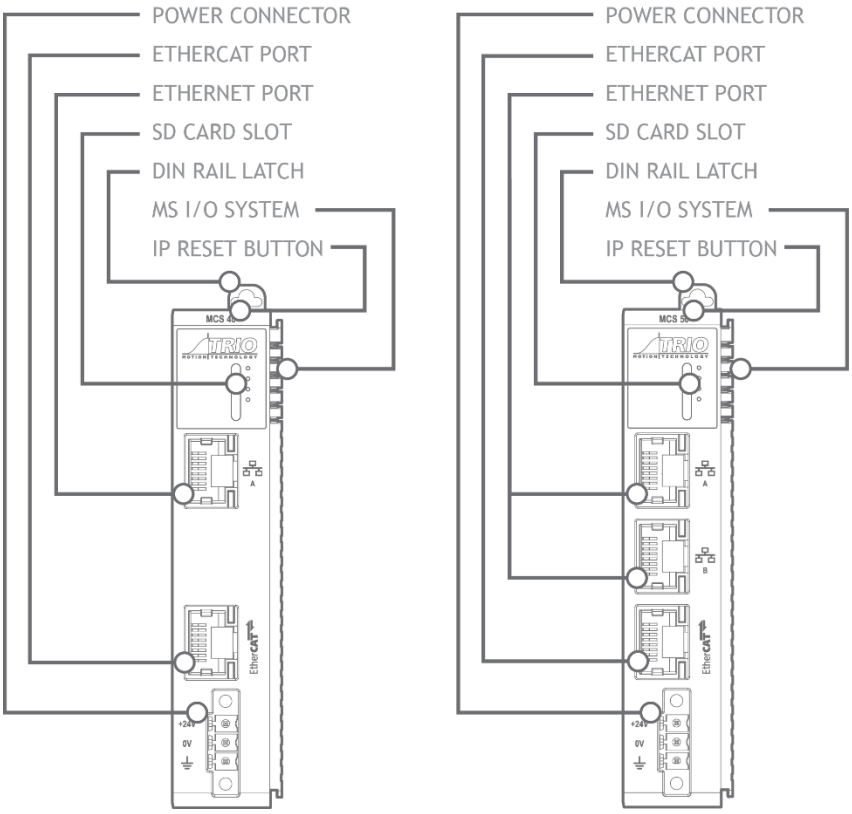
Distributed power supply

If the device is connected to a distributed power supply or the cable length between the power source and the device is longer than 3 metres, then a surge protection device must be fitted to comply with the CE EMC directive.



Distributed power supply with surge protection

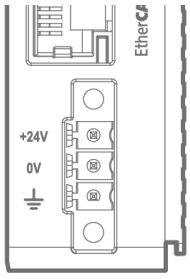
Connectors and Ports



Power Connector

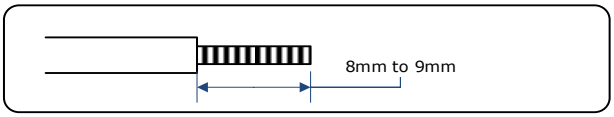
The Motion-PLC requires a 24V DC supply (with a tolerance of ±10%). The power supply must be a Class 2 transformer capable of a minimum of 1A.

A 3-pin connector is provided which has pluggable terminal with mounting screws. Recommended wire cross section 0.2 to 1.3 mm^2 or 24 AWG to 16 AWG.

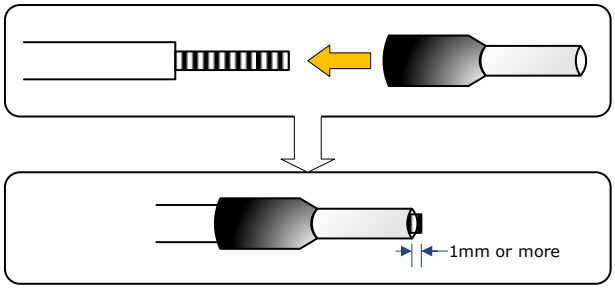


Wires should be fitted with ferrules.

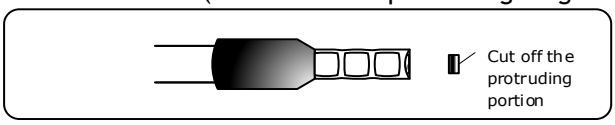
Peel off the sheath so that the conductor portion of the cable will protrude from the tip of the ferrule.



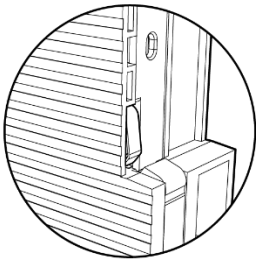
Insert the cable into the ferrule (It should protrude 1 mm or more from the ferrule).



Crimp the cable that has been inserted into the ferrule and cut off the cable conductor portion protruding from the ferrule (The allowable protruding length after cutting should not be more than 0.5 mm).



For details on surge protection see chapter **Surge Protection**.

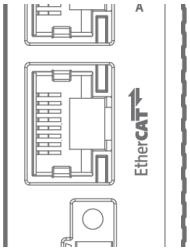


Earth Connection

The earth connection point on the power connector should be wired to a ground point. For information, this pin is connected to the spring contact on the rear of the product which will contact the DIN rail when mounted.

EtherCAT Port

Lower RJ45 socket (100BASE-T)



The Motion-PLC acts as an EtherCAT master. EtherCAT drives and I/O devices are normally connected in a chain.

Straight through (patch) or cross-over cables can be used between EtherCAT devices.

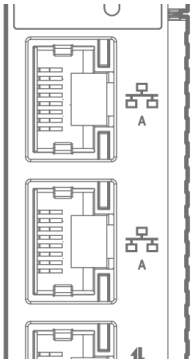
Minimum cable specification: CAT 5e shielded SF/UTP cable is required.

EtherCAT standard pin assignment:

Pin	Signal	Description
1	TD+	Transmission data +
2	TD-	Transmission data –
3	RD+	Receive data +
6	RD-	Receive data –

Ethernet Port

Upper RJ45 socket(s) (100BASE-T)



The Ethernet port(s) is the primary communications connection to the Motion-PLC.

- MCS 40 has 1x 10/100BASE-T
- MCS 50 has 2x 10/100BASE-T

Protocols supported include Trio specific protocols for Motion Perfect, Uniplay HMI and Unified API along with the industry standard protocols of Modbus TCP (Client and Server), Ethernet IP (Server) and PROFINET IO.

The default IP address is 192.169.0.250

The IP address can be changed using Motion Perfect, see chapter **IP Address**.

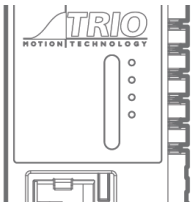
In the case of the MCS 50 the two Ethernet ports act as a simple Ethernet switch so share the same IP address. This supports the use case of a commissioning tool and an HMI both connected to the controller via Ethernet.

Minimum cable specification: CAT 5e shielded SF/UTP cable is required.

Ethernet standard pin assignment:

Pin	Signal	Description
1	TD+	Transmission data +
2	TD-	Transmission data –
3	RD+	Receive data +
6	RD-	Receive data –

SD Card Slot



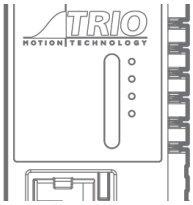
The Motion-PLC has a microSD Card slot which allows a simple means of transferring programs, firmware and data without a PC connection. Offering the OEM easy machine replication and servicing.

The memory slot is compatible with a wide range of SD/SDHC microSD cards up to 32 GBytes using the FAT32 compatible file system.

LED Indicators

The status of the Motion PLC is reflected by the LEDs below the Trio logo. There are 4 LEDs:

- WDOG – axis status
- Power – power supply status
- RN – EtherCAT status
- TS – MS-Bus telegram status



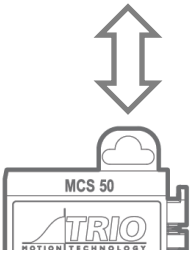
The table below details the meaning of the LEDs.

Indicator	Status	Meaning
WDOG (RED)	ON	Axes Disabled
	Uniform Flash	Axis error(s) present
	OFF	Axes Enabled
Power (GREEN)	ON	Power supply is normal
	OFF	Power supply is abnormal
RN (GREEN)	ON	EtherCAT state is OP (operational)
	Uniform Flash	EtherCAT state is PRE-OP (pre-operational)
	Brief Flash	EtherCAT state is SAFE-OP (safe-operational)
	OFF	EtherCAT state is INIT (initializing)
TS (GREEN)	ON	MS-Bus is active
	Uniform Flash	MS-Bus has a timeout error
	Brief Flash	MS-Bus has an error
	OFF	MS-Bus is not initialized

DIN Rail Latch

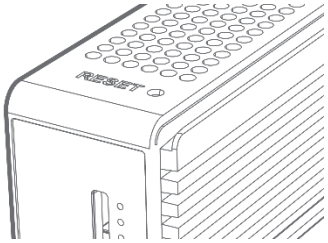
The Motion PLC is designed to be mounted on a 35 mm DIN rail. The DIN rail latch on the rear of the product is operated by red tab at the rear of the product. The latch has 2 positions.

- Up, where the DIN rail clips are dis-engaged.
- Down, where the clips are engaged with the DIN rail.



When the unit is shipped the DIN rail latch is in the down position. To mount the product onto a DIN rail, pull the latch vertically until it locks in to the Up position, place the product onto the DIN rail and push the clip down to return the latch to the Down position. To remove from the DIN rail, pull the clip vertically into the Up position.

IP Reset Button



The rest button on top of the device is used to force the IP address to the default 192.168.0.250. To force the IP address to the default value:

- Power off the unit
- Press and hold the reset button
- Power on the unit
- Release the reset button after 10 seconds

Using the reset button to force the IP address does not affect the saved IP address, subsequent power cycles without using the reset button will revert to the saved IP address.

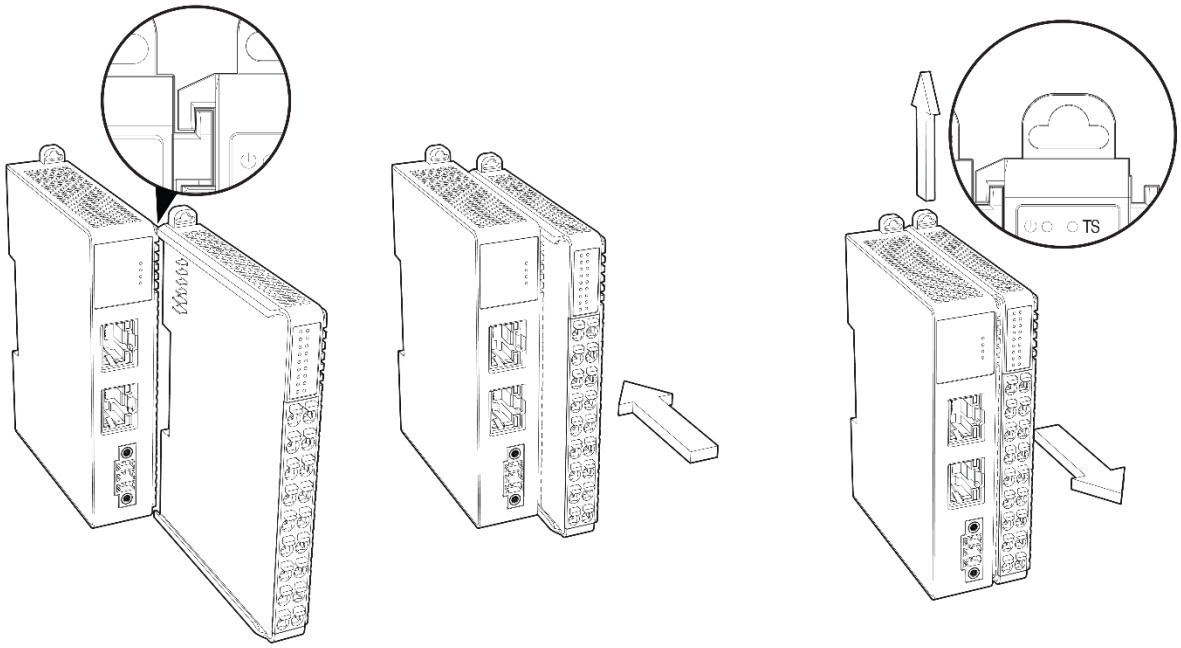
See section IP Address for more details on changing the IP address.

MS I/O System

The Motion-PLC allows IO expansion via a slice-based terminals using the MS-BUS connector on the right-hand side. The slices are front face insertion with guide rails top and bottom to ensure correct alignment. Each slice connects to the unit on its left and provides a connection for expansion to the right. Slices should only be added or removed when the system is powered off.

Up to 16 slices can be connected in any order. All slices are detected and configured automatically by the Motion-PLC on startup. These may be used for system interaction or may be defined to be used by the controller for end of travel limits, soft registration, datuming and feedhold functions if required.

The Motion-PLC can have up to 1024 external digital input and output channels and 128 analogue input and output channels connected using a combination of the local MS-BUS and remote EtherCAT I/O via the P659 bus coupler module.



Real Time Clock (RTC)

The Motion-PLC has an integrated Real-Time clock (RTC). It charges while the device is powered and should maintain good timekeeping for 20 days or more without power. The date and time can be set in several ways.

Motion Perfect can be used to synchronise the controller with the PC clock when connected in tool or sync mode.

You can also set the date and time from TrioBASIC by setting the DATE and TIME variables.

If your network has a connection to the internet and your gateway setting on the controller has been configured, you can enable NTP (Network Time Protocol) and update the date/time automatically to UTC. This mode is enabled by setting the date as follows: "DATE=01:01:2000". Setting the date by either of the other methods will disable the NTP setting. It can take several minutes for the controller to synchronise with the network time.

The Operating System (OS) derives its own clock from the RTC at boot. It is good practice to power cycle the controller after a major time/date change so that the OS can adopt to the new setting. From a user's point of view it will help the controller to maintain accurate file timestamps and logs. Note that due to a restriction in the OS, setting a historical date earlier than the 14th of February 2019 will be considered inaccurate and rounded up. This will not affect the RTC, and the controller will still track the date/time as was set.

Programming

IP Address

The IP address is used to communicate with the product over Ethernet. The selection of the correct IP address depends on the system being connected to see section **Motion Perfect** for details on setting up an Ethernet connection between a Motion PLC and Trio's Motion Perfect software.

This can be changed in several ways, using Trio's Motion Perfect software it can be altered using the IP_Address command or creating an MC_CONFIG program on the control that sets the IP_Address.

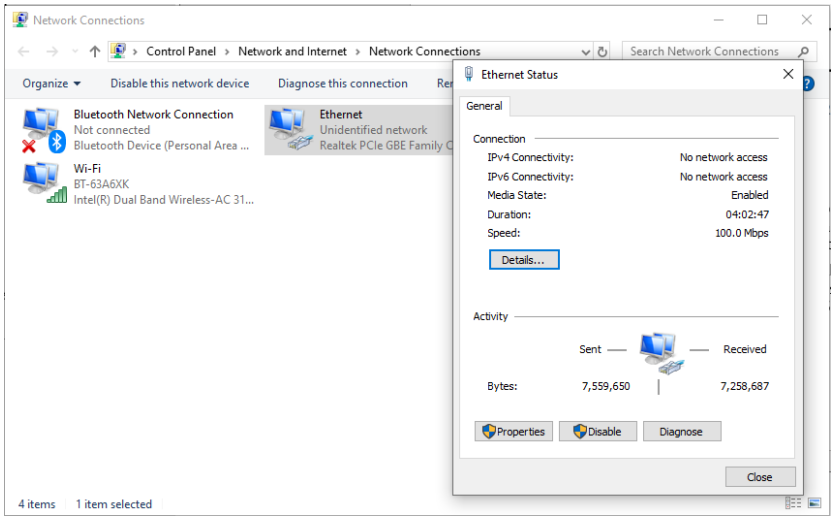
If connecting to Motion Perfect is not an option, the IP address can be changed using a SD Card. This is done by creating a .txt file on a blank SD card and naming it "TRIOINIT.bas" Then write IP_Address = 192.168.0.191 or whichever address is required to the first line and save the file. The SD card is the inserted into the powered down control and the Motion-PLC is then powered cycled. This will alter the IP address to what is specified in the .bas file.

Motion Perfect

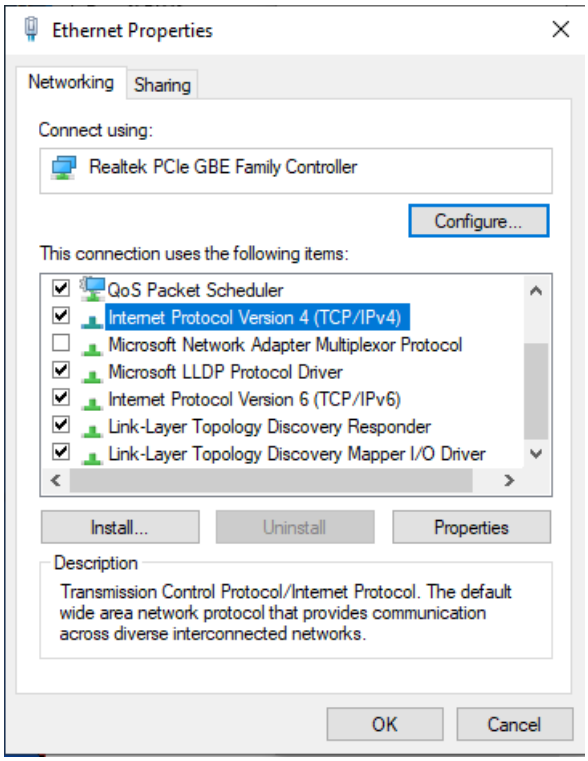
Motion Perfect version 5.5.1 or later is required for configuration, programming, and system debug. A PC running Microsoft Windows (Windows 10 or later recommended) is required. Download Motion Perfect from www.triomotion.com and install on the PC.

Configuring the Ethernet Port

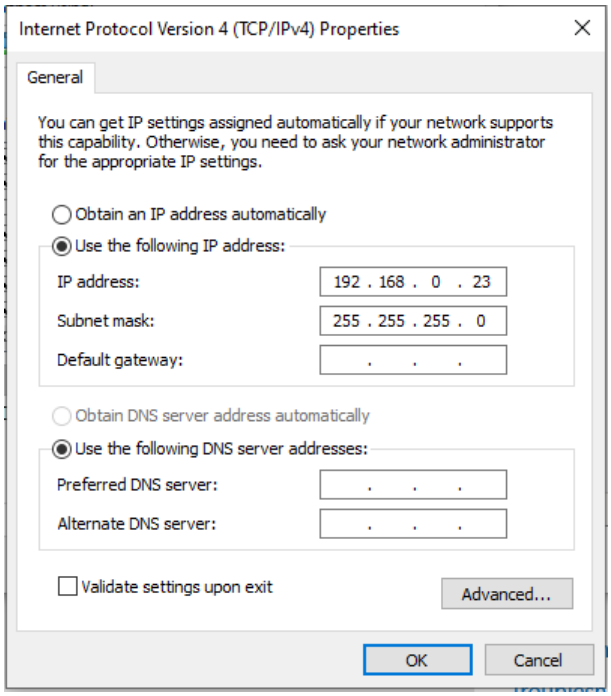
Connection is via the Ethernet port. Ensure that the PC has a valid Ethernet Address. For single point-to-point connection, a fixed IP address must be set in the PC. Go to Settings, Network and Internet then open Change Adapter Settings. Open the Ethernet port.



Click the Properties button and then select Internet Protocol Version 4 (TCP/IPv4).



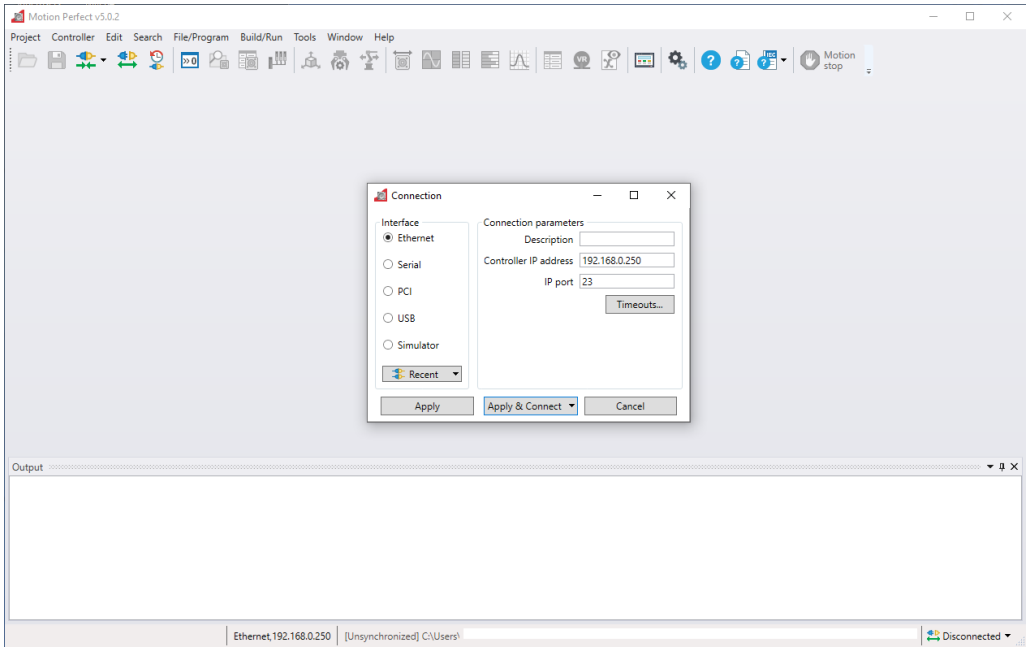
Click Properties and select Use the following IP address. Set an IP address in the same subnet as the Motion-PLC. Usually this will be 192.168.0.xxx.



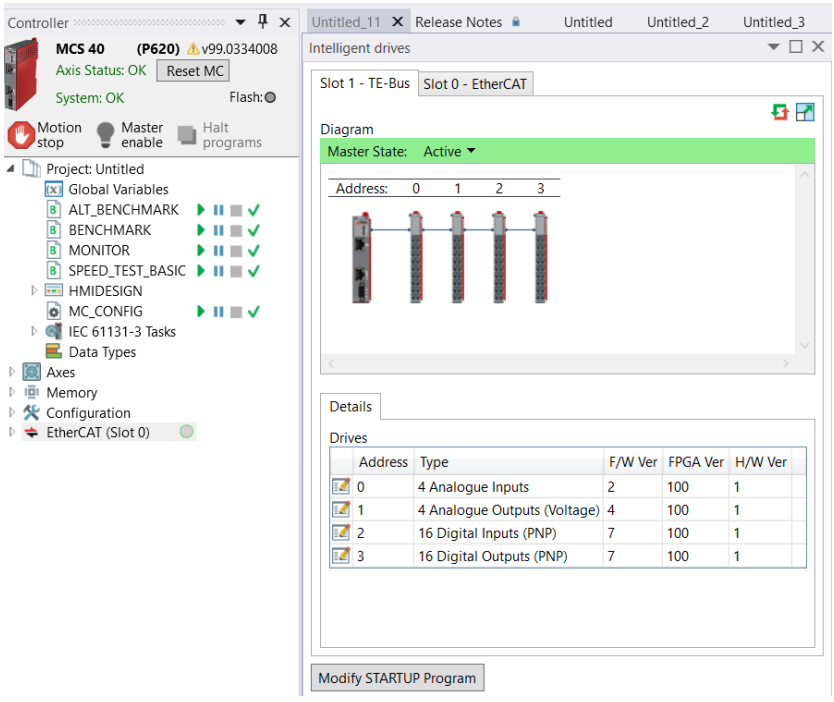
Click OK and close the Ethernet setup dialogues.

Connect to the Motion PLC

Launch Motion Perfect and select the IP address of the Motion-PLC. As mentioned earlier, by default this will be 192.168.0.250. Click the Apply and Connect button.

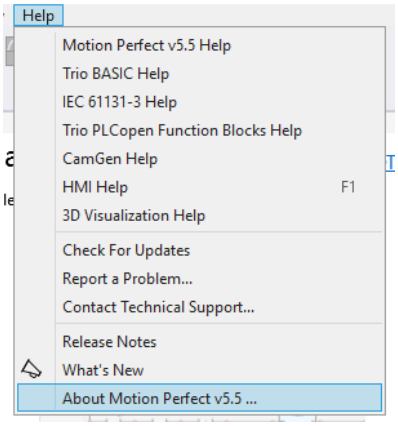


If the IP Address of the Motion-PLC is not known, the IP address can be reset following the procedure mentioned before.



Motion Perfect in Synchronised connection mode.

Programming in Motion Perfect



Motion Perfect provides the IDE for programming the Motion PLC. The Motion PLC supports IEC-61131 languages of ST, LD, FBD and SFC as well as TrioBASIC. More details on all programming languages and using Motion Perfect can be found in the help files installed with Motion Perfect.

Motion Perfect Help – Using Motion Perfect IDE

TrioBASIC Help – TrioBASIC language; syntax and keywords

IEC 61131-3 Help – IEC languages; ST, LD, FBD, SFC

Trio PLCopen Function Blocks Help – PLCopen motion library

CamGen Help – Using Cam generation software within Motion Perfect

HMI Help – Using Trio Uniplay HMI system

3D Visualisation Help – Using the 3D visualisation within Motion Perfect

Below is a table showing the different programming languages available to the Motion PLC.

Part Number	Model	Standard	With FEC
P620	MCS 40	IEC 61131-3 (ST, LD, FBD, SFC)	TrioBASIC
P625	MCS 50	IEC 61131-3 (ST, LD, FBD, SFC)	TrioBASIC

Feature Enable Code (FEC)

The feature set of the Motion PLC products can be extended using feature enable codes. These are codes that are applied to the controller to unlock additional features. Each FEC is unique to the controller.

In the case of the Motion PLC the feature enable codes are:

Part Number	Model	FEC Part Number	Description
P620	MCS 40	P751	**User Security** Downloaded free of charge from the eStore, used in conjunction with SET_ENCRYPTION_KEY for project security
		P981	**Add One Axes**, can be applied twice. FEC2 - Increase axis count from 2 to 3. FEC3 - Increase axis count from 3 to 4.

Part Number	Model	FEC Part Number	Description
		P982	**Increase I/O**, can be applied once. FEC17 - Increase DIO from 256 to 1024 / AIO from 32 to 128
		P984	**TrioBASIC**, can be applied once. FEC19 - Enabled TrioBASIC

Note: FEC 0, 1 and 16 are loaded at the factory.

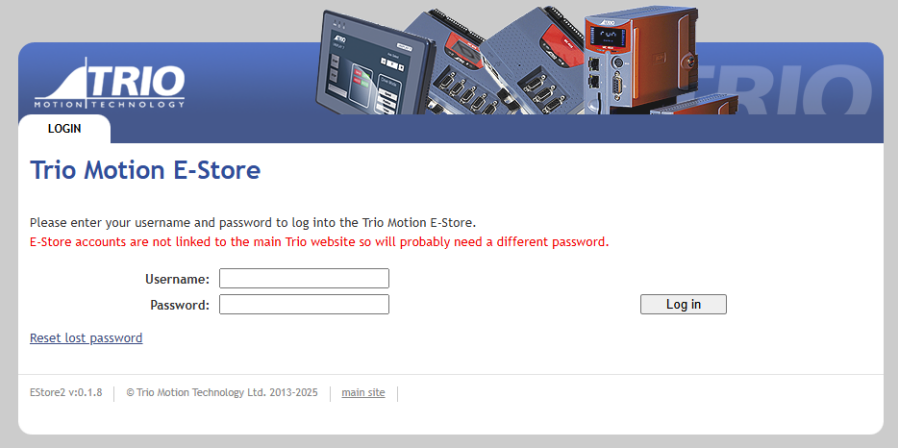
Part Number	Model	FEC Part Number	Description
P625	MCS 50	P751	**User Security** Downloaded free of charge from the eStore, used in conjunction with SET_ENCRYPTION_KEY for project security
		P981	**Add One Axes**, can be applied six times. FEC2 - Increase axis count from 2 to 3. FEC3 - Increase axis count from 3 to 4. FEC4 - Increase axis count from 4 to 5. FEC5 - Increase axis count from 5 to 6. FEC6 - Increase axis count from 6 to 7. FEC7 - Increase axis count from 7 to 8.
		P982	**Increase I/O**, can be applied once. FEC17 - Increase DIO from 256 to 1024 / AIO from 32 to 128
		P984	**TrioBASIC**, can be applied once. FEC19 - Enabled TrioBASIC

Note: FEC 0, 1 and 16 are loaded at the factory.

Feature Enabled Codes can be obtained from Trio or from Trio's eStore (Trio Motion Technology • E-Store).

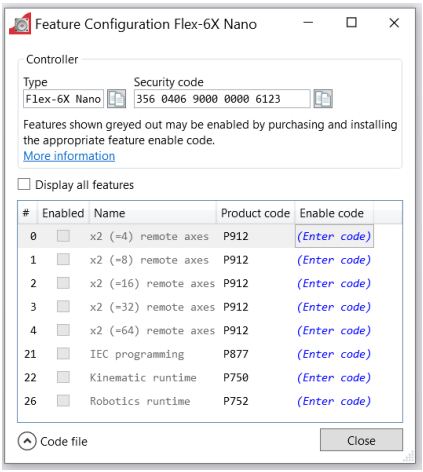
eStore

Trio's eStore allows download of feature enable codes.



These codes are unique to each product and locked to a specific serial number. Only registered owners of products can access codes from the eStore.

Motion Perfect



New Feature Enable Code can be applied to the controller using Motion Perfect. First connect to the controller in 'sync-mode' or 'tool-mode'.

Select 'Enable Features' from the 'Controller' menu. This will show the Feature Configuration dialog.

Enter the code against the appropriate FEC number. After the code has been applied, power cycle the controller for it to take effect.

Programming and Motion Libraries

Trio supports motion through TrioBASIC keywords and IEC function blocks. The IEC motion library is PLCopen.

Part Number	Model	Standard Motion Library	With FEC
P620	MCS 40	PLCopen (advanced)	TrioBASIC
P625	MCS 50	PLCopen (advanced)	TrioBASIC

MCS 40 and MCS 50 support a complete PLCopen motion library, for advanced motion applications.

Administrative		***Motion***	
Single Axis	***Multiple Axis***	***Single Axis***	***Multiple Axis***
MC_Power	MC_CamTableSelect	MC_Home	MC_CamIn
MC_ReadStatus		MC_Stop	MC_CamOut
MC_ReadAxisError		MC_Halt	MC_GearIn
MC_ReadParameter		MC_MoveAbsolute	MC_GearOut
MC_ReadBool Parameter		MC_MoveRelative	MC_GearInPos
MC_WriteParameter		MC_MoveAdditive	MC_PhasingAbsolute

MC_WriteBoolParameter
MC_ReadDigitalInput
MC_ReadDigitalOutput
MC_WriteDigitalOutput
MC_ReadActualPosition
MC_ReadActualVelocity
MC_ReadActualTorque
MC_ReadAxisInfo
MC_ReadMotionState
MC_SetPosition
MC_SetOverride
MC_TouchProbe
MC_DigitalCamSwitch
MC_Reset
MC_AbortTrigger
MC_HaltSuperimposed

MC_MoveSuperimposed	MC_PhasingRelative
MC_MoveVelocity	MC_CombineAxis
MC_MoveContinuousAbsolute	
MC_MoveContinuousRelative	
MC_TorqueControl	
MC_PositionProfile	
MC_VelocityProfile	
MC_Acceleration	

Function Block Naming Conventions

IEC function blocks are pre-fixed with a number of letters and an underscore. This prefix indicates the type of function block.

Prefix	Type	Comment
MC_	PLCopen motion	See above tables
MCV_	PLCopen motion (vendor specific)	Included with advanced PLCopen libraries
TC_	Trio Motion Commands	Included with TrioBASIC FEC
TCR_	Trio Command (Read)	Always available
TCW_	Trio Command (Write)	Always available

Firmware Update

The firmware on the Motion PLC is field updatable through Motion Perfect. The latest firmware is available for download from the Trio Web Site. The file download from the web site is a .zip file, extract the .out file for download.

To update the firmware connect Motion Perfect to the controller via Ethernet. Select ‘Load Firmware’ from the ‘Controller’ menu, follow the download guide and select the .out file.

Once the download is complete the new firmware will execute without the need for a power cycle.

Note: A firmware update will erase all files from the controller. Motion Perfect will restore the project at the end of the update cycle.

Firmware recovery

In the unlikely event that the Motion Coordinator firmware becomes corrupted, and the processor will not start the Ethernet port and allow communication, the Motion-PLC, has a firmware recovery mode. The recovery is triggered by powering the Motion-PLC with the SD card fitted, containing the r_620.out recovery file.

The following equipment is needed to complete the Firmware Recovery:

- Micro SD card formatted to FAT32. Max size 32GB.
- Firmware file for the controller, downloaded from the Trio Website.

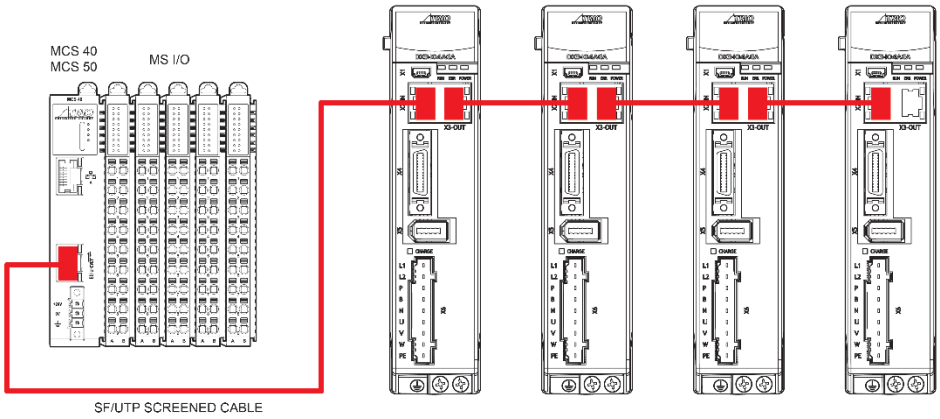
Rename the firmware file to r_620.out and copy it to the root folder on the microSD card.

With the power off, insert the microSD card into the slot and then turn on the power. Update will take a little over 3 minutes. Please DO NOT REMOVE POWER until the led status indicates it is safe to do so. After a reboot the IP address will have been restored to the default 192.168.0.250, subnet mask 255.255.255.0 and default gateway 192.168.0.255.

EtherCAT Network

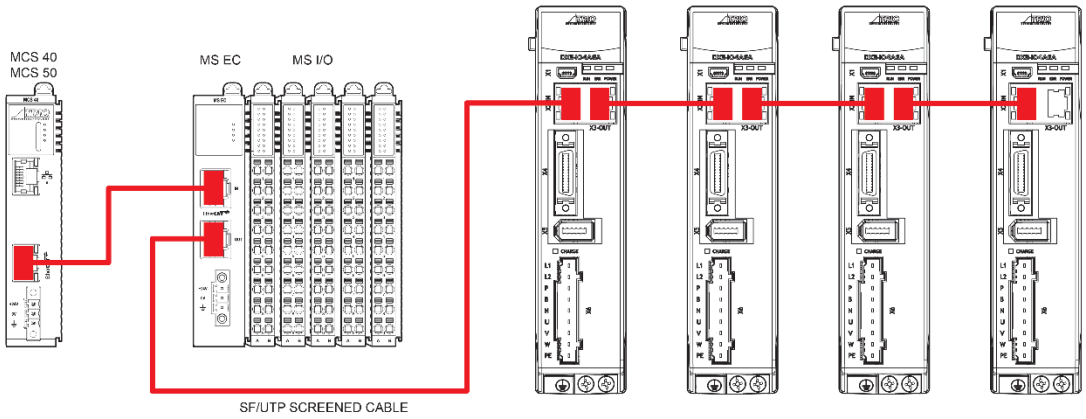
EtherCAT slave devices may be added to make a network. Device addresses will default to their position on the network with the local I/O being located first ahead of any external devices. Addresses can be altered by settings in the slaves or in the master if required.

Example 1



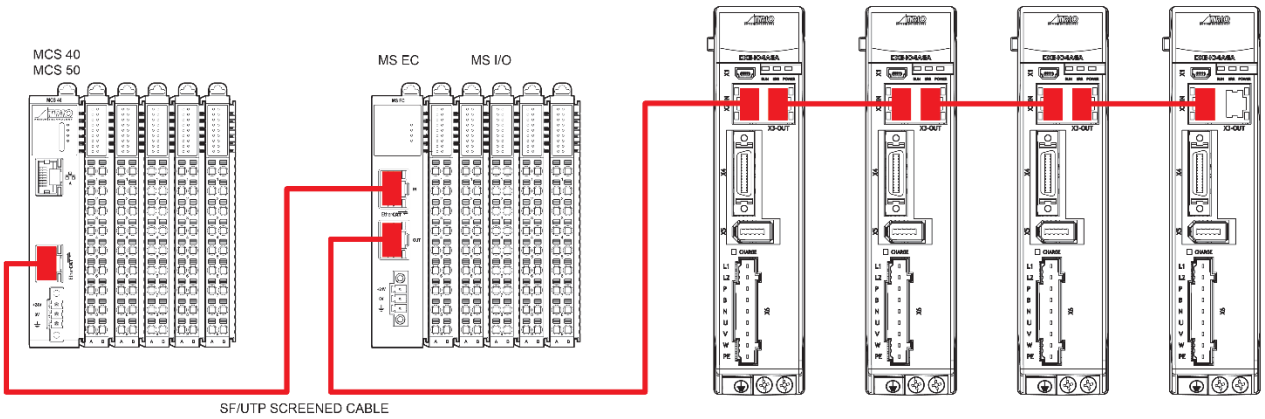
MCS controller with local I/O and remote EtherCAT drives

Example 2



MCS controller with remote EtherCAT I/O and drives

Example 3



MCS controller with local and remote EtherCAT I/O and drives

Electromagnetic Compatibility

Trio Motion Technology products are certified to comply with the requirements of Annex I to the Directive 2014/30/EU on Electromagnetic disturbance and Electromagnetic immunity and are tested against EMC standards below.

EMC (CE)	EMISSIONS – EN IEC 61000-6-4 : 2019 IMMUNITY – EN IEC 61000-6-2 : 2019
EMC (UKCA)	EMISSIONS – BS EN IEC 61000-6-4 : 2019 IMMUNITY – BS EN IEC 61000-6-2 : 2019

To achieve this compliance, certain requirements or best engineering practices must be implemented by the corresponding system designer.

Intended conditions of use

Trio Motion Technology products are designed for operation in Industrial environments with high noise levels that may induce currents or electrical potentials that are damaging to microelectronics. Our products are nevertheless designed and tested to withstand the level of electromagnetic disturbance common to these environments, on the provision that the appropriate EMC guidelines have been employed by a qualified competent system integrator.

The Trio Motion Technology product range is designed to be integrated, by the customer, as a control system for industrial machines and auxiliary equipment.

Product specific requirements

Trio Motion’s extensive product and application knowledge combined with product testing reflect that the best immunity is achieved by placing some constraint on the system into which the product is being integrated. The information is presented in this section for the commissioning engineer.

Feature	Requirements	Notes
0V wire (current return)	1. Always connect ALL 0V current return wires 2. Do not use the screen for 0V current return 3. It is highly recommended to avoid connecting 0V across internal isolation barriers. If a single 24V supply is used for the main power and IO power then these two isolated 0V will have to be connected but this should only be done if the 24V supply is free from switching noise. 4. Do not join together 0V from high power and / or noisy sources with the 0V from signal ports (incl. CAN bus DC input). 5. Do not use any controller 0V connection as a current return for peripheral devices.	24V-IN supply 0V isolated from all other 0V.
All 24V DC ports	1. It is highly recommended to use surge filters on all DC supply and 0V return. If more than one device is connected to the same PSU then this is a requirement. See Surge Protection below.	
Cable routing	1. Maintain 150mm separation of parallel Class I and Class II cable (IEC 61000-5-2:1997) 2. Unless otherwise specified, all cables must be <30m in length	
Proximity to source of disturbance	1. Place controllers and expansion modules as far from mains cables, mains filters, contactors, circuit breakers, drives, transducers or other high power sources of EM disturbance as physically possible within the enclosure design.	
Enclosure / Safety Cabinet design	1. Trio's products should always be installed within a locked cabinet with access limited to authorised personnel only.	
Ethernet	1. TIA Cat5e, minimum. 2. Shielded cable. 3. Cable ≤30m in length.	Overall Foil Braided Shield with Unshielded Twisted Pairs. Compliant with Industrial SF/UTP.
EMC Earth Connection	1. Mount on bare metal backplane. 2. Use a minimum 10mm wide, braided conductor to connect backplane / chassis to PE. 3. Do not use circular cross-section wire.	When the Motion-PLC metal din-rail is screwed directly to the panel, the metal chassis provides the required EMC earth connection.

Recommended Installation

The following diagrams and information detail the typically required Surge Protection, EMC Earth and Cable Shields however more comprehensive information can be found in the corresponding Product Technical Manual (available at www.triomotion.com)

Surge protection device

Protection device - Minimum specification	
Operating Voltage	24V DC
Suppression Begins: Stage Two Stage Three	 30V 35V
Max. Clamp Volts for transients on the line: Stage Two Stage Three	 65V 77V
Surge Current (8/20mSec Pulse) + to - + to Earth - to Earth	 9000A 4000A 4000A
Surge Energy (2mSec Pulse) + to - + to Earth - to Earth	 94 Joules 44 Joules 44 Joules
Response Time	<5 nsec
Resistance to Earth: Max Over-Voltage Operating Voltage	 0.01 Ω > 1 MΩ

All goods supplied by Trio are subject to Trio's standard terms and conditions of sale.
This manual applies to systems based on the Motion PLC and MS I/O System.

The material in this manual is subject to change without notice. Despite every effort, in a manual of this scope errors and omissions may occur. Therefore, Trio Motion Technology Ltd. cannot be held responsible for any malfunctions or loss of data as a result.

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