

# OMRON

Model

## 3G3AX-MX2-MRT-E

### INSTRUCTION SHEET

Thank you for purchasing an OMRON product. Read this thoroughly and familiarize yourself with the functions and characteristics of the product before using it. Keep this instruction sheet for future reference.



OMRON Corporation

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### ■ General Precautions

The user must operate the product according to the performance specifications described in this instruction sheet and in the operation manual of the inverter.

Before using the product under conditions which are not described in the inverter manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.

- The MX2-A□ inverter with a mounted 3G3AX-MX2-MRT-E option board is a general purpose product combination. It is a system component and is used in conjunction with other items of industrial equipment such as PLCs.
- A detailed system analysis and job safety analysis should be performed by the system designer or system integrator before including the inverter option board combination in any new or existing system. Consult your OMRON representative for application specific system integration information if required.
- The product will be used to control an adjustable speed drive connected to high voltage sources and rotating machinery that is inherently dangerous if not operated safely. Interlock all energy sources, hazardous locations, and guards in order to restrict the exposure of personnel to hazards. The adjustable speed drive may start the motor without warning. Signs on the equipment installation must be posted to this effect. A familiarity with auto-restart settings is a requirement when controlling adjustable speed drives. Failure of external or ancillary components may cause intermittent system operation, i.e., the system may start the motor without warning or may not stop on command. Improperly designed or improperly installed system interlocks and permissives may render a motor unable to start or stop on command.
- This Instruction Sheet does not contain illustrations of the product with protective covers removed from the MX2-A□ inverter. Make sure that these protective covers are on the inverter before use.

### ■ Safety Precautions

Definition of Precautionary Information

**⚠ WARNING** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.

**⚠ Caution** Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury, or property damage.

### ■ Warnings and Cautions

**⚠ WARNING** Do not attempt to take an option board apart or touch any internal parts while the power is being supplied. Doing so may result in electric shock.

**⚠ WARNING** Do not touch the conductive parts such as the internal PCB or connector while power is being supplied. Doing so may result in electrical shock.

**⚠ WARNING** Do not attempt to disassemble, repair, or modify an option board. Any attempt to do so may result in malfunction, fire, or electric shock. Wiring, maintenance or inspection must be performed by authorized personnel. Not doing so may result in electrical shock or fire.

**⚠ WARNING** Turn OFF the power supply before performing wiring, maintenance or inspection. Wait for the time specified on the Inverter front cover for the capacitors to discharge. Not doing so may result in electrical shock.

**⚠ WARNING** Provide safety measures in external circuits, i.e. not in the option board. This ensures safety in the system if an abnormality occurs due to malfunction of the option board or another external factor affecting the option board operation. Not doing so may result in serious accidents.

**⚠ WARNING** Emergency stop circuits, interlock circuits, limit circuits, and similar safety measures must be provided in external control circuits.

**⚠ WARNING** Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes. Not doing so may result in serious accidents.

**⚠ Caution** Do not touch the inverter during power-on, and immediately after power-off. Hot surface may cause injury.

### ■ Operating Environment Precautions

**⚠ Caution** Do not operate the MX2-A□ inverter with a mounted 3G3AX-MX2-MRT-E option board in the following locations (doing so may result in malfunction, electric shock or burning):

- Locations subject to direct sunlight
- Locations subject to temperatures or humidity outside the range specified in the specifications
- Locations subject to condensation as the result of severe changes in temperature
- Locations subject to corrosive or flammable gases
- Locations subject to dust (especially iron dust) or salts
- Locations subject to exposure to water, oil, or chemicals
- Locations subject to shock or vibration

**⚠ Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations (doing so may result in malfunction):

- Locations subject to static electricity or other forms of noise
- Locations subject to strong electromagnetic fields
- Locations subject to possible exposure to radioactivity
- Locations close to power supplies

**⚠ Caution** The operating environment of the MX2-A□ inverter with a mounted 3G3AX-MX2-MRT-E option board can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the system. Make sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

### ■ Application Precautions

**⚠ WARNING** Failure to abide by the following precautions could lead to serious or possibly fatal injury. Always read these precautions.

- In the event the Inverter is in a Trip state, be sure to investigate the cause of this Trip state thoroughly before clearing the Trip. Not checking the cause may result in unexpected operation.
- Always connect the grounding cable to one of the ground terminals of the MX2-A□ inverter.
- Check any user program in the system that acts as a Mechatrolink II master before actually running it. Not checking the program may result in unexpected operation.

**⚠ Caution** Failure to abide by the following precautions could lead to faulty operation of the option board or the inverter, or could damage either of the two. Always read these precautions.

- Install external breakers and take other safety measures against short-circuits in external wiring. Not observing this may result in burning.
- Be sure that the cable connectors are properly locked into place. Incorrect insertion of connectors may result in malfunction.
- Do not allow metal clippings to enter either option board or inverter when wiring or installing the unit.
- Follow the network configuration and wiring instructions provided in "Mechatrolink II Installation Guide" (MMA Manual No. TDEP 011A).
  - Wire correctly using recommended cables. Incorrect wiring may result in burning.
  - Apply termination at the end of a Mechatrolink network. Do not apply termination at Mechatrolink masters that provide termination itself.
- Be sure that the option board is mounted correctly. Improper mounting may result in malfunction.

- Disconnect the grounding cable when performing withstand voltage tests. Not disconnecting the grounding cable may result in burning.
- Check the inverter settings for proper inverter behaviour before actually operating the inverter remotely via the Mechatrolink II network.
- Check the network related inverter settings regarding Mechatrolink node address and Mechatrolink frame size. Not doing so may result in unexpected operation.
- Check the inverter's EzSQ program and its interaction with the Mechatrolink II master before actually running it on the inverter. Not checking the program may result in unexpected operation.
- When replacing an inverter be sure that all inverter settings of the inverter being replaced are restored to the replacement.
- Be sure that the units of the inverter registers match the application when replacing an equivalent inverter type with an MX2□ inverter.
- Restoring parameters stored in the remote operator also restores the Mechatrolink node address. Always check the node address and other network related inverter settings after restore.
- Confirm that no adverse effect will occur at the moment the Mechatrolink II master stops communicating with the inverter or at the moment the Mechatrolink II master has not yet started communicating to the inverter.
- Confirm that no adverse effect will occur in the inverter before force-setting/force-resetting any bit in the system that acts as a Mechatrolink II master.

### ■ Handling, Storage and Disposal

- Before touching the option board or inverter, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.
- When transporting or storing the option board, cover the PCBs with electrically conductive materials to prevent electronic components from being damaged by static electricity. Also keep the product within the specified storage temperature range.
- Never dispose electrical components by incineration. Contact your state environmental agency for details on disposal of electrical components and packaging in your area.

### ■ Compliance with EC Directives

- This product complies with EC Directives when mounted on an MX2-A□ inverter and having connected the grounding cable. For grounding, cable selection, and any other conditions for EMC compliance, refer to the MX2 User's Manual for installation.

### ■ References

Please be sure to read the related user manuals to use the 3G3AX-MX2-MRT-E option board safely and properly. Be sure you are using the most current version of the manual.

Name	Cat No.
MX2 User's Manual	I570
Mechatrolink II Installation Guide	MMA manual TDEP 011A
Mechatrolink I/II Command Specifications for Inverters	MMA manual TDEP 015A

### SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products. Take all necessary steps to determine the suitability of the product for the systems, machines, and equipment with which it will be used. Please know and observe all prohibitions of use applicable to the products. NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM. See also product catalogs for Warranty and Limitations of Liability.



## Option Board Description

The 3G3AX-MX2-MRT-E is an option board which can be attached to an MX2-A□ series inverter. The 3G3AX-MX2-MRT-E allows controlling, monitoring and parameterization of the inverter via a Mechatrolink II network. The application in the system that acts as a Mechatrolink II master is responsible for correct behaviour of the system. The 3G3AX-MX2-MRT-E is a gateway that passes the communicated register values from the Mechatrolink II network to the inverter and vice versa.

## MX2 Inverter Support

MX2-A□ inverter version can be read from the inverter type label. Please check whether revision characters have been placed in the bottom-right corner of the type label. The revision characters have a layout as shown in the figure, with the asterisks replaced by a revision character. If the inverter does not contain such a revision label, this version **\*\*\*\*** does not support the 3G3AX-MX2-MRT-E.

The 3G3AX-MX2-MRT-E does not support an inverter in PM mode if the inverter is marked with either of the following revision labels:



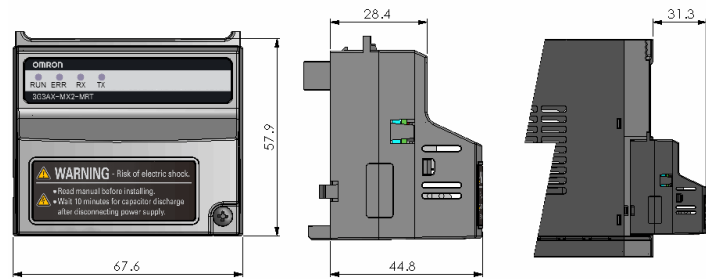
Inverter parameter b171 (Inverter mode selection) cannot be set to 3 (PM) when using these MX2-A□ inverter versions.

## MX2 Inverter Safety (ISO 13849-1)

MX2-A□ inverters provide the Gate Suppress function to perform a safe stop according to the EN60204-1, stop category 0. The option board has been designed not to interfere with this safety function.

## External Dimensions

External dimensions of the option board, shown in millimeters:



## Installation Procedure

Follow the next steps to install a 3G3AX-MX2-MRT-E on an MX2-A□ series inverter:

- Power down the inverter
- Loosen the screw of the option board cover on the inverter, remove the cover and put the cover aside
- For inverters up to 4.0 kW only: loosen the screws of the terminal block cover and remove the cover to enable access to the chassis ground terminal screws
- Connect the grounding cable to the chassis ground of the inverter (located on the cooling fin)
- If removed, mount the terminal cover again and tighten the screw(s)
- Push the 3G3AX-MX2-MRT-E option board into the previous location of the option board cover until it clicks into place
- Tighten the screw of the option board (do not over-tighten).
- Select the right warning language from the warning label sheet and replace the English warning if appropriate.
- Power up the inverter and select
  - the station number via inverter parameter P196
  - the frame length via parameter P195
 For other option board related inverter parameters see below
- Power down the inverter before attaching the Mechatrolink connector

## Mechatrolink Wiring

The 3G3AX-MX2-MRT-E option board is supplied with two Mechatrolink connectors. Use recommended cables to create connections to other Mechatrolink devices and create a Mechatrolink II network.

Recommended cables are:

- JEPMC-W6002-□□-E
- JEPMC-W6003-□□-E

Mount a terminator (JEPMC-W6022) on one of the connectors if the 3G3AX-MX2-MRT-E option board is located at the end of a Mechatrolink II network.

For details refer to the Mechatrolink II Installation Guide.

## Using an Omron Trajexia Motion Controller

An MX2□ inverter with a 3G3AX-MX2-MRT-E option board provides standard inverter functionality to an Omron Trajexia Motion Controller.

Please refer to the Trajexia Programming Manual (cat. no. I52E) or the CJ1W-MCH72 Operation Manual (cat. No. I55E) for the following commands:

INVERTER\_COMMAND  
INVERTER\_READ  
INVERTER\_WRITE

## Supported Mechatrolink Profile

The 3G3AX-MX2-MRT-E implements the Mechatrolink I/II Command Specifications for Inverters. It supports the following Main Commands:

Command code	Command abbreviation	Command description
00	NOP	No operation
01	PRM_RD	Read parameter
02	PRM_WR	Write parameter
03	ID_RD	Read identification (product name, version)
04	CONFIG	Store all previously written parameters
05	ALM_RD	Read alarm or warning information
06	ALM_CLR	Clear alarm or warning
0D	SYNC_SET	Start synchronous communications
0E	CONNECT	Establish connection
0F	DISCONNECT	Release connection
1C	PPRM_WR	Write and store parameter
40	INV_CTL	Inverter operation control

In 32-byte frame mode the 3G3AX-MX2-MRT-E also supports the following Subcommands:

Command code	Command abbreviation	Command description
00	NOP	No operation
01	PRM_RD	Read parameter
02	PRM_WR	Write parameter
05	ALM_RD	Read alarm or warning information
1C	PPRM_WR	Write and store parameter
41	INV_I/O	Inverter I/O control

For all command details please refer to the Mechatrolink I/II Command Specifications for Inverters (MMA manual no. TDEP 015A).

Note: The ALM\_RD command responds with alarm codes that correspond with the inverter's trip code, not the alarm codes listed in the Mechatrolink I/II Command Specifications for Inverters.

## LED Indicators

Indicator	Status	Meaning
RUN	ON	Normal operating status
	Flashing	The option board is operating in commissioning mode (see below)
	OFF	The option board and/or inverter are initializing
ERR	ON	The option board detected an error and cannot continue
	Flashing	The option board has problems communicating with the inverter or The option board has detected a problem in the inverter parameters
	OFF	The option board is operating normally
	TX	ON
	OFF	Sending data stopped, hardware reset
RX	ON	Searching for receiving carrier
	OFF	No receiving carrier found, hardware reset

The commissioning mode maximises the throughput while accessing parameters. The commissioning mode is typically activated by tools like CX-Drive.

## General Specifications

Item	Specifications
Mechatrolink II Specification	Designed to conform
Mechatrolink Cycle Time	500µs to 8ms
Ambient operating temperature	See MX2 inverter User's Manual
Ambient operating humidity	See MX2 inverter User's Manual
Storage temperature	-20 °C to 65 °C
Weight	170g

## Option Board Related Inverter Parameters

Various inverter parameters influence the behaviour of the option board. The table below shows these parameters. Please note that most parameter changes require a power cycle of the inverter or a restart of the option board.

Mechatrolink Network Related Parameters		
Par	Description	Setting
P195	Mechatrolink Frame Length	Set to 0 for 32 byte frame length Set to 1 for 17 byte frame length
P196	Mechatrolink Station Number	21 to 3E hexadecimal (default: 21)
P045	Action on Network Error	Set to 0 for inverter trip (default) Set to 1 for deceleration and trip Set to 2 for no action Set to 3 for stop due to free-run Set to 4 for deceleration and stop
P048	Action on Mechatrolink watchdog failure	
Source Selection Parameters		
Par	Description	Setting
A001	Motor 1 Frequency Source	Set to 4 for option board as source
A002	Motor 1 Run Command Source	Set to 4 for option board as source
P033	Torque Command Source	Set to 6 for option board as source
P036	Torque Bias Mode	Set to 5 for option board as source
C028	Analog Output AM Source	Set to 16 for option board as source
Option Board Behaviour Related Parameters		
Par	Description	Setting
C102	Reset Mode Selection	Set to 3 for resetting trip only
P160	INV_CTL / INV_I/O selectable reference register contents	Modbus register mapped into selectable reference registers 4 to 13
P169		
P170	INV_CTL / INV_I/O selectable monitor register contents	Modbus register mapped into selectable monitor registers 4 to 13
P179		

## Controlling the Inverter in Torque Mode

The 3G3AX-MX2-MRT-E allows controlling the inverter in torque mode using the torque reference and other torque related registers in the INV\_CTL command. Follow the following steps to enable torque mode in the inverter:

- Configure the inverter to HD using parameter b049
- Configure the inverter control strategy via parameter A044 to 3: SLV
- Configure the torque command source: set parameter P033 to 6
- Configure a digital input to enable torque mode by setting the applicable register in the range C001-C007 to 52: ATR

Override the configured digital input to 1 using the Operation Signals sent in the INV\_CTL command.

## Mechatrolink Inverter Status

The 3G3AX-MX2-MRT-E responds to all Mechatrolink Main Commands with an ALARM byte located at byte offset 1 and two status bytes located at byte offset 2. The table below shows the layout of the status bytes. Unlisted bits are reserved.

Bit Location	Name	Description
Byte 2, bit 0	ALM	1: Trip condition active / 0: No trip
Byte 2, bit 1	WARNG	1: Warning condition active / 0: No warning
Byte 2, bit 2	CMDRDY	1: Mechatrolink command processed 0: Busy processing Mechatrolink command
Byte 2, bit 4	PON	1: AC power present / 0: No AC power
Byte 2, bit 5	RUNX	1: Inverter running / 0: Inverter not running
Byte 2, bit 6	OSP	1: Motor at zero speed / 0: Motor running
Byte 2, bit 7	REV	1: Reverse / 0: Forward
Byte 3, bit 0	_RESET	1: Fault reset in Operation Signals active 0: Fault reset in Operation Signals inactive
Byte 3, bit 1	AGREE	1: Speed agree 0: Still accelerating / decelerating
Byte 3, bit 2	INV_READY	1: Inverter ready / 0: Inverter not ready
Byte 3, bit 5	REMOTE	1: Remote inverter control active 0: Remote control (partially) inactive

The ALARM byte provides the inverter's Trip code if a Trip condition is active and the inverter's Warning code if a Warning condition is active.

## INV\_CTL Message Layout

The INV\_CTL message allows controlling the inverter. The command provides operation signals, frequency reference and other references. The response provides the ALARM byte, status bytes, frequency monitor and other monitors.

The contents of the messages are partially flexible using the concept of SEL REF and SEL MON. Two registers in the command message can be selected from a set of 13 reference registers and two registers in the

response message can be selected from a set of 13 monitor registers. The two sets are described in the "Selectable Registers" section.

The table below shows the layout of the INV\_CTL command and response. The items that span two bytes are coded in little-endian, i.e. low-byte first.

Note: The unit of the frequency and speed registers is 0.01Hz unless the inverter is in high-frequency mode. In high-frequency mode the unit is 0.1Hz.

Byte	Command	Response		
01	INV_CTL (40 Hex)	INV_CTL (40 Hex)		
02		ALARM		
03	Operation Signals	STATUS		
04				
05	Speed Reference	Output Frequency		
06				
07	Torque Reference in 1%	Output Current in 0.01A		
08				
09	SEL REF 1	SEL REF 2	SEL REF 1	SEL REF 2
10	SEL MON 1	SEL MON 2	SEL MON 1	SEL MON 2
11	Reference Register selected using SEL REF 1	Monitor Register selected using SEL MON 1		
12				
13	Reference Register selected using SEL REF 2	Monitor Register selected using SEL MON 2		
14				
15	WDT	RWDT		

The Operation Signals provide the following means to control the inverter:

Bit Location	Function	Description
Byte 3, bit 0	Forward	1: Start running forward on rising edge 0: Do not run forward
Byte 3, bit 1	Reverse	1: Start running reverse on rising edge 0: Do not run reverse
Byte 3, bit 2	Digital Input 1	1: Override digital input state to 1 0: Use inverter digital input state
Byte 3, bit 3	Digital Input 2	1: Override digital input state to 1 0: Use inverter digital input state
Byte 3, bit 4	Digital Input 3	1: Override digital input state to 1 0: Use inverter digital input state
Byte 3, bit 5	Digital Input 4	1: Override digital input state to 1 0: Use inverter digital input state
Byte 3, bit 6	Digital Input 5	1: Override digital input state to 1 0: Use inverter digital input state
Byte 3, bit 7	Digital Input 6	1: Override digital input state to 1 0: Use inverter digital input state
Byte 4, bit 0	External Trip	1: Force inverter into trip condition 0: Keep inverter state as is
Byte 4, bit 1	Trip Reset	1: Reset trip condition on rising edge 0: Keep trip condition
Byte 4, bit 2	Digital Input 7	1: Override digital input state to 1 0: Use inverter digital input state
Byte 4, bit 14	Trip History Clear	1: Clear trip history on rising edge 0: Leave trip history as is

## Selectable Registers

The 3G3AX-MX2-MRT-E allows selection of registers in the Mechatrolink commands INV\_CTL and the INV\_I/O. The table below shows the registers available in the selection.

SEL Value	Selected Reference	Selected Monitor
0	(no reference)	(no monitor, zero is responded)
1	Torque Bias in 1%	Output Frequency
2	Analog Output AM in 0.1%	Torque Reference in 1%
3	(not supported)	Position Feedback
4 - 10	Set using P160 - P166	Set using P170 - P176
11	Set using P167	Set using P177, if set to 0: Input Terminal Status
12	Set using P168	Set using P178
13	Set using P169	Set using P179
14	(not supported)	(no monitor, zero is responded)
15	(not supported)	(no monitor, zero is responded)

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Note: Specification is subject to change without notice