GRAPHIC OPERATION CONTROLLER - MAIN UNIT

MODEL

GC43MH-32MR-D
GC43MH-16MR-D

INSTALLATION MANUAL

Thanks for choosing **G**raphic **O**peration **C**ontroller (GOC), a micro range of controller which consists of embedded PLC function, HMI function, illuminated keys and Ethernet port. User can attach upto 2 I/O extension units and 1 COM extension unit, to add I/Os and to enhance functionality. It is designed to cater most of the automation requirements of any small size standalone machine. Before installation and wiring of Main unit, please read this manual carefully for safety precautions, specifications, dimensional details, installation and wiring guidelines.

1 SAFETY RECOMMENDATIONS

- Read and understand the manual carefully before use, to avoid damages to persons, property and environment. Ensure safe and proper usage of this controller.
- The qualified personnel should only install and operate the controller. The personnel should be aware of safety of automation products and completely familiar with all associated documentation this controller.
- Manual should be located at the easily retrievable location for reference. Also, share this manual with the end user of this controller.
- Treat this controller as an industrial E-waste. For environmentally compliant recycling and disposal of your electronic waste, please contact to the certified agency.
- Protect the controller from conductive dust, corrosive gases, wire debris, flammable gases, rain and fluid from entering into the controller through ventilation slits. This may cause malfunction, damage, fire, electrical shock and deterioration to the controller.

The controller should not be exposed to direct sunlight, high explosive risk, excessive magnetic interference and inflammable substances.

Do not modify, dismantle, reconstruct and repair the controller. Do not paint the controller. For repair, contact the nearest authorized sales office or service support.

If this controller emits smoke or odour or unusual sound or unusual operation, immediately switch OFF the power to the controller. In such cases, contact the nearest authorized sales office or technical support team.

Provide external interlock circuit like emergency stop or protective circuit to keep the control system safe, in case if there is problem in the controller.

Mitsubishi Electric India Pvt. Ltd. shall have no responsibility or liability for any personnel injury or death or loss or damage to the property caused by said product, if used or operated in applications which are not intended or excluded by instructions, precautions or warnings provided in this document for the said product.

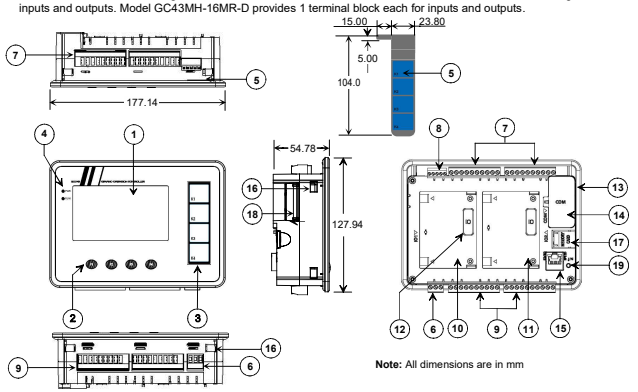
Specifications are subject to change without prior notice.

2 REFERENCES

Title	Document No.	Title	Document No.
GOC43 User Manual	*N18006AAMH01*	*GOC43 Tool Kit Installation Manual*	*N18006AAMH05*

3 NOMENCLATURE AND DIMENSIONS

Product packaging consists of Main unit, installation manual, mounting template and 4 mounting clamps. Main unit is dispatched with all the terminal blocks attached to it and default slide-in label inserted. Slot covers are attached to I/O slots and COM slot. The figure below shows model GC43MH-32MR-D with 2 terminal blocks each for digital inputs and outputs. Model GC43MH-16MR-D provides 1 terminal block each for inputs and outputs.



Note: All dimensions are in mm

1. 4.3", 480 x 272 pixels, Touch graphics LCD
2. 4 function keys [F1 to F4]
3. 4 illuminated keys [K1 to K4]
4. LED indications [PWR, RUN]
5. Slide-in label
6. 3-pin terminal block [+24VDC, 0V, Protective Earth]
7. 2 nos., 10-pin terminal block [Digital Inputs]
8. 1 no., 5-pin terminal block [Analog V/I Inputs]
9. 2 nos., 10-pin terminal block [Relay Outputs]
10. IO1 slot
11. IO2 slot
12. IO slot cover
13. COM slot
14. COM slot cover
15. Ethernet Port
16. Cut-out for mounting clamp at all the 4 corners
17. MicroSD card slot with door
18. USB port with door
19. FG [Functional Earth]

Unit	Ordering Description	Details
GC43MH-32MR-D	GOC- MAIN, 16DI + 16RL, 500mA + 2CH AI V/I	4.3" Touch Screen, 16 Pt. 24VDC Digital Input, sink/source + 16 Pt. Relay Output, 500mA per output, 220 VAC/30 VDC + 2 Pt. Analog Input Voltage/ Current. Horizontal model.
GC43MH-16MR-D	GOC- MAIN, 8DI + 8RL, 500mA + 2CH AI V/I	4.3" Touch Screen, 8Pt. 24VDC Digital Input, sink/source + 8 Pt. Relay Output, 500mA per output, 220 VAC/30 VDC + 2 Pt. Analog Input Voltage/ Current. Horizontal model.

4 GENERAL SPECIFICATIONS

Environmental		
Operating Temperature	Operating: 0 to 55°C	Storage: -40 to 70°C
Humidity	Operating: 10 to 95 % RH, No condensation	Storage: 10 to 95 % RH, No condensation
Altitude	2000 m or less	
Pollution Degree	PD 2 (only non-conductive pollution)	
Operating Atmosphere	Corrosive gases must not be present	
Overvoltage Category	OVC II	
Vibration, Shock	As required by EN- 61131-2, IEC 60068 -2-6 (test Fc), IEC 60068-2-27 test Ea	
Free Fall Withstand Test	As required by EN- 61131-2, with product packaging, IEC 60068-2-32	
Class of Equipment	Class III	
IP Protection	IP65 from front side IP20 from rear side	
Certification	CE	

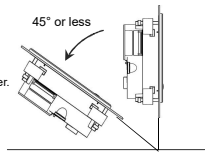
EMC–Immunity and Emission		
Electro Static Discharge (EN 61000-4-2)	±8 KV Air discharge, ±4 KV contact discharge	
Radiated RF Immunity (EN IEC 61000-4-3)	80 Mhz to 1000 Mhz, 10 V/m 1400 Mhz to 2000 Mhz, 3 V/m 2000 Mhz to 2700 Mhz, 1 V/m	
Electrical Fast Transient (EN 61000-4-4)	Power line: ±2 KV, Digital I/O: ±1 KV, Analog and communication I/O: ±1 KV	
Surge Immunity (EN 61000-4-5)	Power line: ±0.5 KV, Communication I/O: ±1 KV	
Conducted RF Immunity (EN 61000-4-6)	For power lines, digital and analog I/O and communication I/O. 10 V_{rms},150 Khz to 80 Mhz,80% AM (1 Khz)	
PF Magnetic Fields Immunity (EN 61000-4-8)	30 A/m, 3 axes (x, y, z), 50/ 60 Hz	
Conducted Emission (EN IEC 61000-6-4)	For Power lines and communication I/O, 0.15 MHz - 30 MHz	
Radiated Emission (EN IEC 61000-6-4)	Enclosure	30 MHz - 1GHz

5 INSTALLATION

Install the controller in an environment conforming to the general specifications and mounting recommendations and precautions.

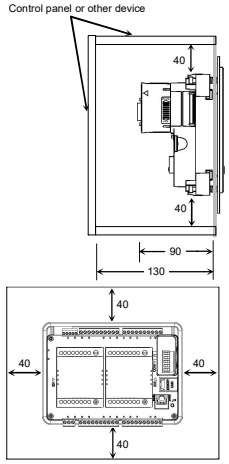
Mounting Recommendations

1. Mount controller on a firm, plane and conducting surface. Installation in orientation other than recommended one (as shown in adjacent figure), may cause overheating, damage, poor display visibility and malfunctioning of the controller.
2. Mount controller on non-vibrating surface and should be protected by rubber pads so that the shock is not felt.
3. Mounting plate thickness should not exceed 4 mm.



⚠ COM extension unit is optional and should be purchased separately.
Installation should take care of keeping free space considering depth of controller with COM extension unit installed on it i.e. 90 mm inclusive of additional space required for communication cable routing.

⚠ User can install upto 2 I/O extension units and 1 COM extension unit on the back side of Main unit.
Refer installation manual of respective extension units.

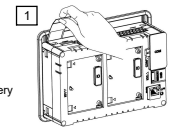


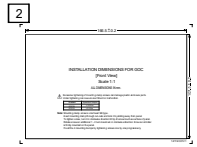
4. Ensure the gap of 40 mm between controller and cabinet walls, other equipments and wiring duct.
5. Leave a minimum space of 40 mm around the Main unit to facilitate air circulation for heat transfer by natural convection and easy fixing and removal of unit.

Precautions to be taken

1. Make sure to cut off all the phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
2. Maintain proper thermal distances between equipments producing heat (like heaters, transformers, etc) inside the control panel. Do not install controller above such equipments.
3. Exposure to humid environment for a long time can reduce component life. It may cause corrosion of electrical and electronic components, or may lead to shorts or malfunctions. Do not expose controller to humid atmosphere for an extended period.
4. Backside of I/O extension PCB is visible and exposed to external environment. Do not remove I/O extension unit specially relay output extension unit with AC power connected. It may cause electric shock.
5. Avoid controller exposure to excessive or continuous vibrations or shocks. Failure to do so may cause disenguagement of PCB components, sockets, on-board soldered components etc. from their counter positions.
6. Cover unused slots (IO and COM) to protect them against dust, moisture and ESD (Electric Static Discharge). Electrically conductive dust may cause short circuit or other failures.
7. Use controller within the range of general and technical specifications.
8. Connect protective earth terminal on 3-pin power supply terminal block to a good quality earth directly. If not, product may be susceptible to the noise.
9. Connect functional earth terminal located near RJ45 connector to a good quality earth directly. If not, Ethernet communication may be susceptible to the noise.

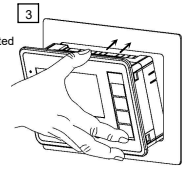
Fixing of Main Unit



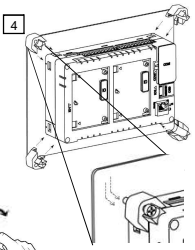


Detach all the terminal blocks (10-pin I/O terminal blocks, 3-pin power supply terminal block and 5-pin analog V/I input terminal block) from Main unit. Make sure that silicon rubber gasket on outer periphery of front panel backside is in place.

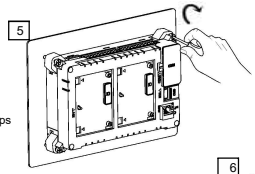
1. Main unit is provided with default slide-in label inserted. But user can remove it and insert customized label as shown in Figure 1. Slit is provided to insert slide-in label. Insertion slit is located at left top on the backside of front panel. See that top edge of slide-in label remains below groove of the gasket.



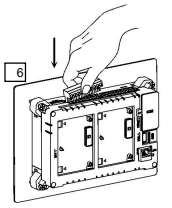
2. Remove adhesive tapes provided at corners of backside of mounting template and stick the mounting template on front panel where Main unit is to be mounted. Mark 4 corners of the rectangular cut-out and make a cut-out.
Dimensions of cut-out are 166.5 X 107.5 mm as shown on mounting template in Figure 2.



3. Insert Main unit from outside through cut-out on panel. Make sure that folded part of slide-in label is passed through the cut-out Hold Main unit by hand from outer side of the panel so that it will not fall during fitment of mounting clamps.

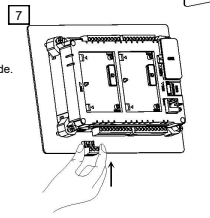


4. At each corner on back side of Main unit, cut-outs are provided to insert mounting clamps Insert clamp into matching cut-out and pull it away from panel to engage it into respective cut-out as shown in Figure 4.



5. Mounting clamp screw is of star head M4 type. Insert mounting clamp through cut-outs and lock it by sliding away from panel. To tighten screw, turn it in clockwise direction till tip of screw touches surface of panel. Rotate screw an additional 1-2 turn maximum in clockwise direction. Ensure controller is firmly mounted in the panel.
Fix all the 4 mounting clamps by tightening screws one by one progressively.

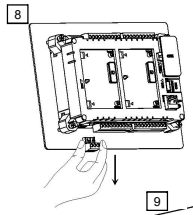
Note : Tightening torque should not exceed 0.2Nm.



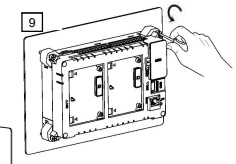
6. Insert 10-pin input terminal block/s at upper side.
Insert 5-pin analog V/I input terminal block at upper side.
Insert 10-pin output terminal block/s at lower side.
7. Insert 3-pin power supply terminal block at lower side.

Removal of Main Unit

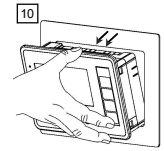
Cut off all the phases of the power supply to the control panel.



8. Remove 3 pin power supply terminal block. Remove all the I/O terminal blocks. For removal, pull terminal block from one side first. Once this part is out, pull remaining part easily.
9. Turn mounting clamp screws in anti-clockwise direction to loosen it.
Push body of clamp towards panel to disengage it from matching slots on the Main unit.
Pull body of clamps off the Main unit. Hold Main unit with one hand while undoing last of the clamps.



10. After removing all mounting clamps, hold and pull out unit from outside, to remove it from cut-out.



Insertion and Removal of microSD card

Refer "N18006AAMH01 GOC43 User Manual" section *"SD Card"*, for more details.

⚠ SD memory card slot is provided above RJ45 connector and is covered by door marked as MEMORY CARD.

6 TECHNICAL SPECIFICATIONS

Power Supply	
Input voltage	24 VDC (18 to 30 VDC) 413 mA, 9.9 Watts
Inrush current	23 Amps maximum for 10 ms duration
Fuse protection	Fuse protection T3.15A, 250V, Type 372
Reverse polarity	Protected by series diode up to 40 V
Dimensions (in mm)	Cut-out: 166.5 (W) x 107.5 (H)
	Front: 177.0 (W) x 127.8 (H) x 4 (D)
	Rear: 164.6 (W) x 105.6 (H) x 49.2 (D)
Terminal block	One 3-pins, removable screw type

HMI	
Display	4.3", 480 x 272 pixels, TFT Touch graphics LCD, 64 K Colors View size: 95.04 x 53.86 mm
Backlit Life	20,000 hrs. at ambient temperature
Function keys	4 function keys (F1 to F4)
Illuminated keys	4 illuminated keys (K1 to K4) with dual colored LEDs (Red, Green)
Slide-in label	Inserted over illuminated keys

Analog Input		
No. of input channels	2, Non-isolated, 12 bits	
Input types and digital format	Voltage : 0 to 10V	Current : 0 to 20mA
	0 to 4000	0 to 4000
Resolution	2.5 mV	5 µA
Overall accuracy	± 0.4 at 25°C	± 1.5 at 25°C
	± 0.6 at 60°C	± 1.8 at 60°C
Input impedance	900 KΩ	260 Ω
Engineering scaling	Supported	
Absolute max. input	±30 VDC/ ±30 mA	
Digital filter	Time constant : 50 ms (Default) Supported range : 10 to 5000 ms	
Averaging	No. of avg. samples : 4(Default), 8, 16, 32	
Module updation time	**For digital filter,** **[Cyclic interval X (No. of input channels enabled +** No. of input channels with open circuit)] + (Time const. X 10)	
	For averaging, Cyclic interval X (No. of input channels enabled + No. of input channels open circuit) X (No. of averaging samples)	
	For No filter, Cyclic interval X (No. of input channels enabled + No. of input channels open circuit)	
Channel protection	PTC for over current upto 100 mA	
Isolation	No isolation	
I/O terminal block	One 5-pin, removable screw type	

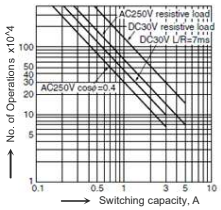
Digital Inputs (Sink/ Source type)		
Number of inputs	16 for GC43MH-32MR-D 8 for GC43MH-16MR-D	
Type	Sink or Source, in group of 4	
Voltage rating	24 VDC (18 to 30 VDC)	
ON voltage level	18 VDC minimum	
OFF voltage level	5 VDC maximum	
ON / OFF current	ON current : 6 mA at 24VDC	OFF current : 2.5 mA maximum
Input impedance	5.1 KΩ Typically	
Transition delay	10 ms (Default filter time)	
Isolation between	Input and internal circuit	Optical 1.5 KV
	Groups	1.5 KV
	Individual input points	Nil
I/O terminal blocks [Removable screw type]	Two 10-pin, for **GC43MH-32MR-D** One 10-pin, for **GC43MH-16MR-D**	

Relay Outputs		
Number of outputs	16 for GC43MH-32MR-D 8 for GC43MH-16MR-D	
Type of output	Non latching normally open (NO) contact Electro-mechanical relay	
Max. switching voltage	250 V(AC), 110 V(DC) (0.4A)	
Max. switching current	5A (AC, DC)	
Minimum load	1 mA	
Contact resistance	Max. 30 mΩ (By voltage drop 6VDC, 1A)	
Contact life	Electrical life (at 20 times/ min.)	Min. 10^4 (3 A 250 VAC, 30 VDC, resistive load) Min. 5×10^4 (5 A 250 VAC, 30 VDC, resistive load)
	Mechanical life	min 20 lacs (180 times/min)
Response time	OFF to ON : 10 ms	ON to OFF : 5 ms
Conditions (Operating/ Transport/ Storage)	Ambient temperature	-40°C to 90°C (-40°F to 194°F)
	Humidity	5 to 85% R.H.
	Max. operating speed	20 times/ minute
Initial breakdown voltage	Between open contacts	1 KVrms for 1 minute. (Detection current: 10 mA)
	Between contact and coil	3 KVrms for 1 minute. (Detection current: 10 mA)
Surge breakdown voltage	Between contact and coil	6 KV
I/O terminal blocks [Removable screw type]	Two 10-pin, for **GC43MH-32MR-D** One 10-pin, for **GC43MH-16MR-D**	

Digital Inputs Special Functions (User Configurable)				
Single phase counters (up to 2 nos.)	**Counter**		**Input**	
	Counter0		Input I00	
	Counter3		Input I03	
	Input frequency: 20 KHz maximum			
	Pulse ON/ OFF time: 20 µsec minimum			
Quadrature encoder (Up to 2 nos.)	**Encoder**	**A phase**	**B phase**	**Z marker**
	Encoder0	Input I00	Input I01	Input I02
	Encoder3	Input I03	Input I04	Input I05
	Input frequency: 10 KHz maximum (for each phase)			
	Pulse ON / OFF time for A and B phase: 20 µsec minimum. Pulse ON / OFF time for Z marker pulse: 50 µsec minimum.			

RTC	
Real time clock	Onboard
	Super capacitor backup: 2 weeks duration nominal at 25°C ambient
	Max error: ± 2 Secs max per day

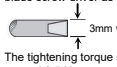
Life curve of Relay :



7 WIRING

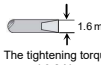
Wiring recommendations

- 3-pin power supply and 10-pin I/O terminal block pitch size is 5.08 mm.
- Use stranded (flexible) or solid wire of size 0.5 to 1.5 mm² (AWG 28 to 16).
- Terminal has M3 size of screw. For tightening terminal screw, use flat blade screw driver as shown in figure.



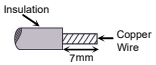
- The tightening torque should not exceed 0.5 Nm.

- 5-pin analog terminal block pitch size is 3.81 mm.
- Use stranded (flexible) or solid wire of size 0.5 to 1.5 mm² (AWG 28 to 16).
- Terminal has M2 size of screw. For tightening terminal screw, use flat blade screw driver as shown in figure.

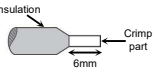


- The tightening torque should not exceed 0.2 Nm.

- Strip insulation of stranded wire and twist the strands to prevent it from spreading and crimp the lug.



- Below figure shows recommended size of lug.

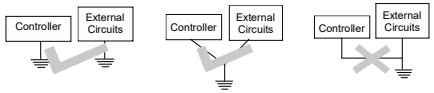


Precautions to be taken

- Make sure to cut off all phases of the power supply externally before attempting installation or wiring work. Failure to do so may cause electric shock or damage to the product.
- Do not use wire without lug. Do not solder-plate the wire ends.It may cause loose connection. Ensure that only one lug is connected to one terminal.
- Ensure that size of wire and lug used are as per the specifications. Use screw driver with specified size of tip. Tightening torque should be as per the specifications.
  Consider maximum rated current and inrush current of power supply module while selecting 24 VDC power supply source.
- Ensure that the external breaker or fuse is used in series with 24 VDC.
- Separate wiring by signal types. Bundle wiring with similar electrical characteristics together.
- Differnetiate wiring with different electrical characteristics by coloured insulations e.g. AC wiring and DC wiring
- Make sure that there is a separate bundle and routing for input and output wires. Fixup the wire bundle with support on panel so that there is no stress on wires and subsequently on unit. Ensure that bunch is routed properly and wires are not kept hanging.
- Confirm that the source of voltages and currents are within specified ranges.
- Do not bundle 24 VDC I/O wires with main control panel wiring. Do not bundle cable carrying low level signals like communication and analog signals with input output wiring and control panel wiring.
- 50 to 100 meter long wiring for input/output will not cause any problems of noise but, generally, the wiring length should not exceed 30 meters to ensure the safety. For longer distance, route the input and output signal lines separately.
- Ensure that length of wire that connects 24 VDC power supply to I/O unit is less than 3 meters. Locate 24 VDC power supply near to the controller

Power Supply Wiring

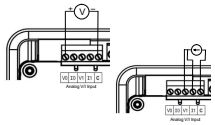
- Connect EARTH terminal directly to clean earth in the control panel avoiding ground loops.
- Perform Class D grounding. (Grounding resistance: 100 Ω or less)
- Ground the controller independently. If it cannot be grounded independently, ground it jointly as shown.



- Ensure that EARTH cable is thick and short as far as possible to provide low impedance path.
- If EARTH is not connected, it may result in electric shock or erroneous operation.
- It is recommended to twist power supply cable to minimize adverse effects of noise.

Analog Input Wiring

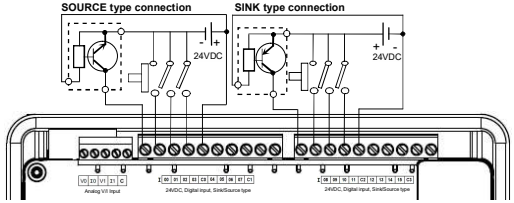
Unit provides terminals V, I and C. C is common for both channels.
Connect voltage signal between terminals V and C.
Connect current signal between terminals I and C, with terminals V and I connected together.
As shown in adjacent figure,
channel0 is connected for voltage input and channel1 is connected for current input.



Digital Input Wiring

Unit provides 1 common each for a group of 4 inputs. Any group can be wired for sink or source operation independently. The wiring diagram below shows how to connect field input devices like potential free push buttons and limit switches for sink and source operation. The diagram also shows connection of NPN type of switch connected for source type of operation and PNP type of switch connected for sink type of input operation.
Here, input group **I00** to **I03** connected for source type of operation and input group **I08** to **I11** connected for sink type of operation.

⚠ Some of the input devices like proximity switches may malfunction due to inherent off state leakage current. Ensure that proper bleeder resistor is connected as a load considering maximum OFF current specified.

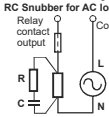


⚠ Main unit model GC43MH-32MR-D provides 2 input terminal blocks.
Model GC43MH-16MR-D provides 1 input terminal block.

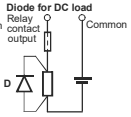
Relay Output Wiring

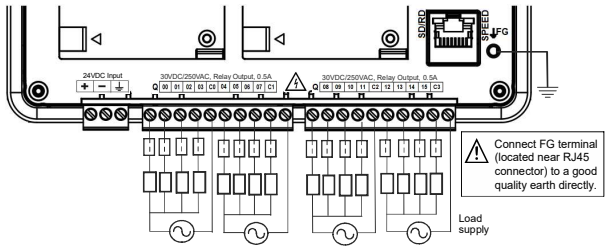
- External fuse links or fused terminals are recommended for relay output wiring to avoid any burnout of internal copper tracks due to excessive current flow due to external short circuit, overload or inductive surges.
- The life of relay contacts can be enhanced by the use of RC snubber (spark quenchers) across the AC load. A suggested combination for of the R and C could be R=220Ω/ Half watt and C=0.1 µF/1000 Volts
- For DC loads a free-wheeling diode such as 1N4007 should be used in reverse polarity to avoid effects of back EMFs generated by inductive load.
- The diode and the snubber should be positioned and wired up as near as possible to the external load for maximum effect

RC Snubber for AC load



Diode for DC load





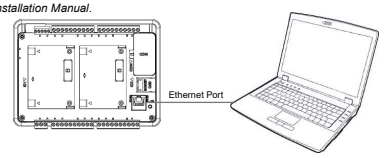
⚠ Connect FG terminal (located near RJ45 connector) to a good quality earth directly.

⚠ Main unit model GC43MH-32MR-D provides 2 output terminal blocks.
Model GC43MH-16MR-D provides 1 output terminal block.

8 CONFIGURATION AND PROGRAMMING

Programming software CoDeSys V3.5 is required to program the controller. Install GOCToolkit V3.
Also refer *N18006AAMH05 GOC43 Tool Kit Installation Manual*.

⚠ For programming of GOC43, buit-in Ethernet port can be used.
Use STP (Shielded Twisted Pair) or UTP (Unshielded Twisted Pair), category 5 or higher is recommended.

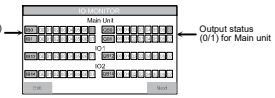


⚠ USB port is used to download firmware and access is restricted to MEI authorized persons only.

9 STATUS AND DIAGNOSTICS ON LCD SCREEN

After powering on the controller, CPU detects presence of Main unit as well as extension units as per the configuration. User can monitor ordering code of Main unit in System menu and CoDeSys online, in Global variables list. Click on IEC objects tab, _SysVarCPU→AMODULEOREDERINGCODE→AMODULEOREDERINGCODE[0].

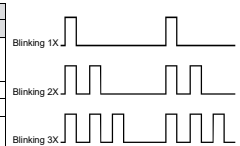
Long press F1 key invokes IO Monitor screen where user can monitor status of all the I/O points of Main unit and Extension units.
Long press F2 key invokes System menu. User can monitor status and diagnostics in various menu screens. User can set parameters like IP settings, RTC values, Display settings. Also, user can calibrate touch panel.
Refer "N18006AAMH01 GOC43 User Manual" for more details.



LED Indications

Main unit provides 2 LED indications on front panel. The table below explains the significance of CPU diagnostics related LEDs

Status	PWR	RUN
	Red	*Green*
OFF	No power	User stop, Stop due to system error, New firmware download
ON	Power ON	Run mode
Blinking 1x	Not applicable	IO Error
Blinking 2x		Forcing is active, Power fail error
Blinking 3x		Watchdog fault
Flashing		Memory Error, Application Download in progress, Illuminated Key Error - If any illuminated key is observed as pressed, at power ON - Illuminated key (Hardware) fault occurs. Function Key Error - If any function key is observed as pressed, at power ON - Function key (Hardware) fault occurs. Touch screen Error - If touch screen is observed as pressed, at power ON - Touch screen (Hardware) fault occurs



⚠ CPU permanently goes in Stop mode, when input supply falls below 18 VDC. It continues in stop mode even though input supply is recovered above 18 VDC for safety purpose.

Specifications are subject to change without prior notice
Document No. N18006AAMH02 Version: V5.0 Published Oct. 2023

PRINTED IN INDIA

MITSUBISHI ELECTRIC INDIA PVT. LTD.
Factory Automation and Industrial Division
ICC-Devi Gaurav Technology Park, Unit no. 402,
Opp. Vallabh Nagar Bus Depot,
Pune-411018, Maharashtra, India.
Board Line No. : +91 020 4624 2100
Email – MEI-FAID-INFO@asia.meap.com
Web – http://in.mitsubishielectric.com