





MM300 Installation Recommendations



| Title | Name | Signature | Date |
|-------------|-----------------|--|-------------|
| Prepared By | Eider Brazal |  | 11 Oct 2019 |
| Revised By | Jokin Galletero |  | 14 Oct 2019 |



Contents:

| | | |
|-----------|---|-----------|
| 1. | INTRODUCTION | 3 |
| 2. | MM300 PERFORMANCE | 3 |
| 2.1. | HARDWARE | 3 |
| 2.2. | RELIABILITY | 4 |
| 2.3. | WARRANTY | 5 |
| 3. | MECHANICAL RECOMMENDATIONS | 6 |
| 4. | THERMAL RECOMMENDATIONS | 13 |
| 5. | ELECTRICAL RECOMMENDATIONS | 18 |



1. INTRODUCTION

The MM300 is a modular motor protection and control system designed specifically for low-voltage motor applications. It was launched to the market in 2007.

The aim of this report is to provide recommendations for the installation of the MM300 relay that may be considered to optimize motor protection reliability.

At the date of this report there are more than 37000 units supplied worldwide and installed in many different applications and countries.

2. MM300 PERFORMANCE

2.1. Hardware

The MM300 is packaged in a modular arrangement.

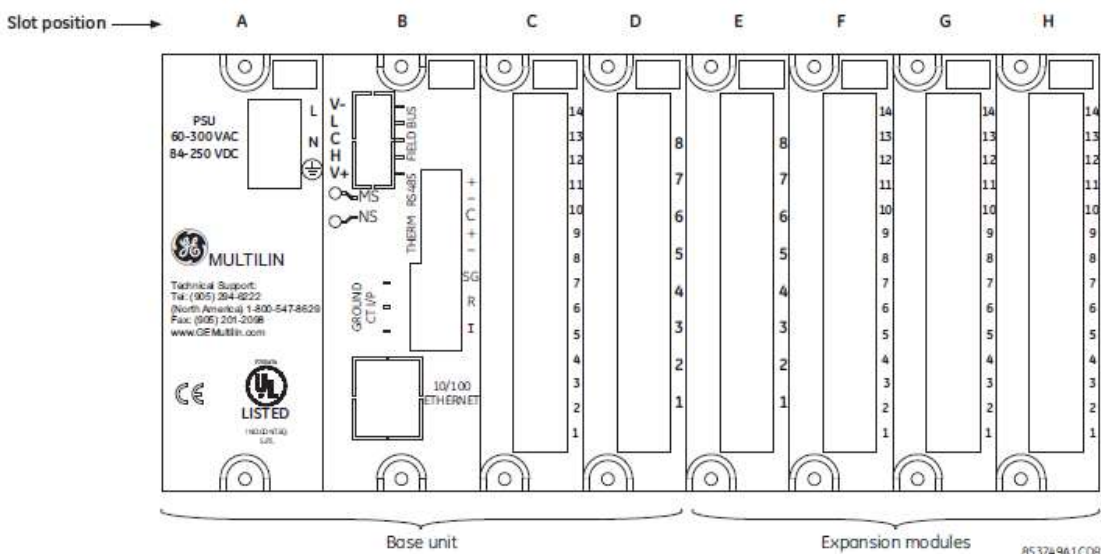


Fig. 1 Relay base and expansion modules.

The base module consists of:

- Slot A: power supply.
- Slot B: CPU and communication module.
- Slot C: IO_C Vac Inputs/Outputs module or IO_E Vdc Inputs/Outputs module.
- Slot D: IO_A CT module.



The expansion module is configurable and different modules can be ordered for slots E, F, G and H:

| | Base | | | | | Expanded | | | | | |
|----------------------|-------|---|---|---|---|----------|---|---|---|---|--|
| | MM300 | * | E | * | * | * | * | A | * | * | * |
| Interface | MM300 | | | | | | | | | | MM300 Motor Management System |
| Control panel | X | | | | | | | | | | No control panel |
| | B | | | | | | | | | | Basic control panel, no USB |
| | G | | | | | | | | | | Graphical control panel with USB |
| Power supply | | | H | | | | | | | | High: 80 to 250 V DC (Standard); 60 to 300 V AC |
| | | | L | | | | | | | | Low*: 24 V DC (24 to 48 V DC Nominal) |
| Communications | | | S | | | | | | | | Standard communications: RS485 Modbus RTU |
| | | | D | | | | | | | | Standard plus DeviceNet Slave and 10/100 Modbus TCP |
| | | | P | | | | | | | | Standard plus Profibus DP Slave and 10/100 Modbus TCP |
| Options | | | S | | | | | | | | Standard: Starter control and event recorder |
| | | | 1 | | | | | | | | Option 1: Standard plus undervoltage autorestart |
| | | | 2 | | | | | | | | Option 2: Option 1 plus waveform capture and data logger |
| | | | 3 | | | | | | | | Option 3: Option 2 plus FlexLogic™ |
| Protection | | | | | | | X | X | X | X | No Additional Protection |
| | | | | | | | B | | | | Three-phase voltage metering and three-phase underpower, undervoltage, overvoltage, phase reversal |
| | | | | | | | G | G | G | G | Bank of three (3) RTDs: 100PT (maximum of 2 banks) |
| Input/output modules | | | | | | C | C | C | C | C | Two (2) 10 A form-A relays and six (6) 60 to 300 V AC digital Inputs |
| | | | | | | E | E | E | E | E | Two (2) 10 A form-A relays and six (6) 20 to 60 V DC digital Inputs |
| | | | | | | D | D | D | D | D | Four (4) 10 A form-C relays |

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slot E slot F slot G slot H

Fig. 2 Expansion modules options.

2.2. Reliability

The MTBF (Mean Time Between Failures) is 505 years as of April 3, 2019 latest recorded figures.

This is equivalent to a failure rate of:

$$FR = 1 / MTBF = 1 / 505 = 0.20 \% / \text{year}$$

This performance has been constant since that date due product maturity and our continuous improvement program.



2.3. Warranty



Fig.3 Ten years warranty logo in the web.

GE guarantees all MM300 supplied since October 1st, 2013 for 10 years as the rest of protection and control products that are in active life cycle status.

This warranty includes materials and workmanship when the product is wired, set and connected as per the instruction manual and within the published specifications.

This extended warranty has been possible as a result of many product and process improvements in the last 10 years using modern techniques of product design, manufacturing, components selection and field returns continuous improvement.

To achieve the best performance, cybersecurity, etc. GE publishes periodically new firmware versions with the corresponding release notes that customers may download and upgrade at no charge in the field if they feel the new version provides significant advantages.



3. MECHANICAL RECOMMENDATIONS

In order to ensure good connection of the boards, please follow recommendations below:

- 1- Cable harnesses must not be too tight.



Fig. 4 Example of a proper wiring.

This allows good connection between the boards and the internal bus board of the relay.



It also avoids damaged connectors as per the pictures below:

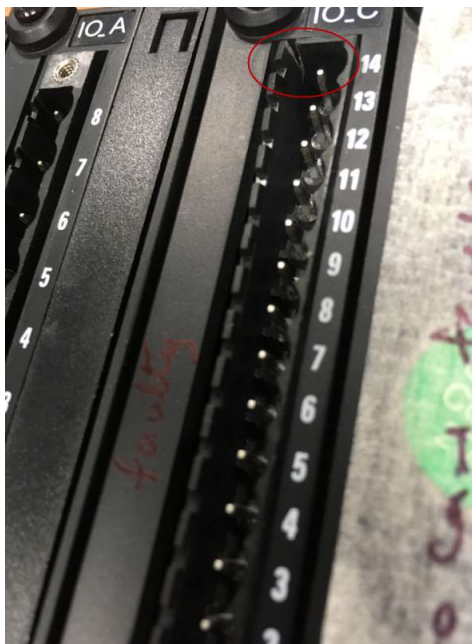


Fig. 5 Example of broken connector.

And avoids sagged pins in the boards:



Fig. 6 Example of sagged pin.



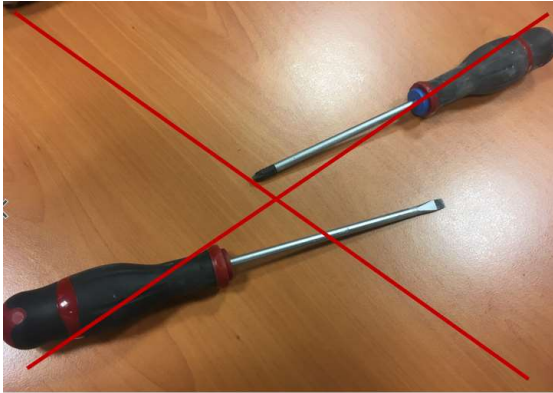
Cards screw properly inserted.



Fig. 7 Screws properly inserted.



- 2- Do not use big, flat head nor electric screwdrivers. Use only small manual Philips screwdriver.



NO



NO



Yes



Fig. 8 Use only small manual Philips screwdriver.

This is an example of a relay case damaged due to excessive screw tightening.



Fig. 9 Relay case damaged due to excessive screw tightening.

Maximum tightening torque is 10lb.in.C as per the instruction manual. As the screw is made of steel and the relay case is plastic, it has low tightening torque. Therefore, manual small Philips screwdriver is recommended.

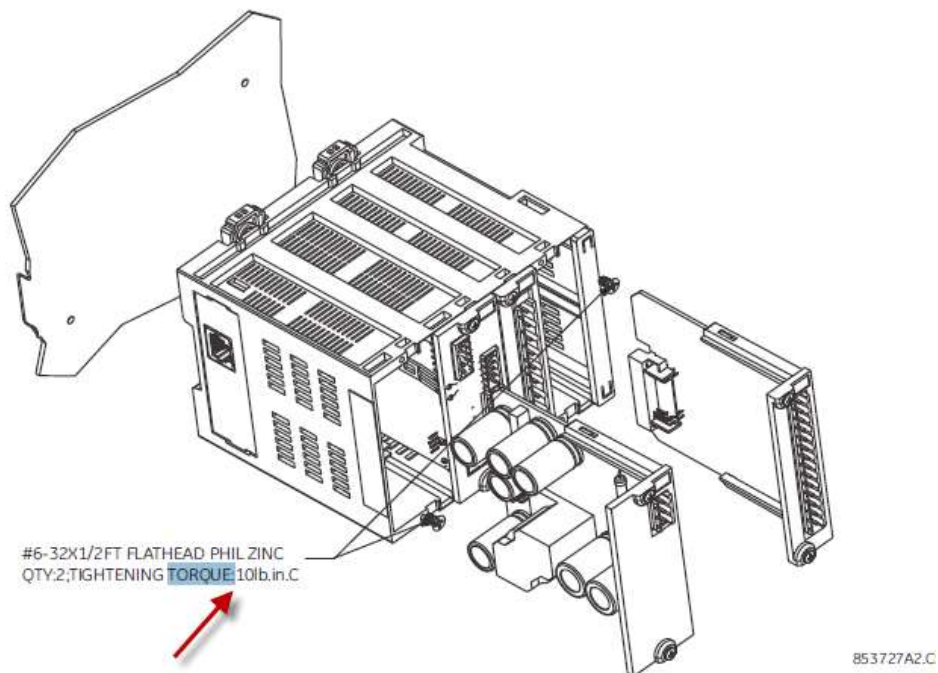


Fig. 10 Maximum tightening torque specified in the instruction manual.

- 3- The MM300 motor Protection series has been designed to be installed in compact drawers in harsh industrial environments.



In general, the relay may be installed in the front of the panel, assembled together with the graphical control panel (GCP) and a short 2 inches RJ45 cable that connects the main unit with the display.

It may also be installed in a DIN rail in the bottom of the panel.

It may also be fixed by screws at the end of the panel. When installing the relay in the back of the panel, remove case tabs in order to have the relay flat and guarantee good connection.



Fig. 11 Case tabs.

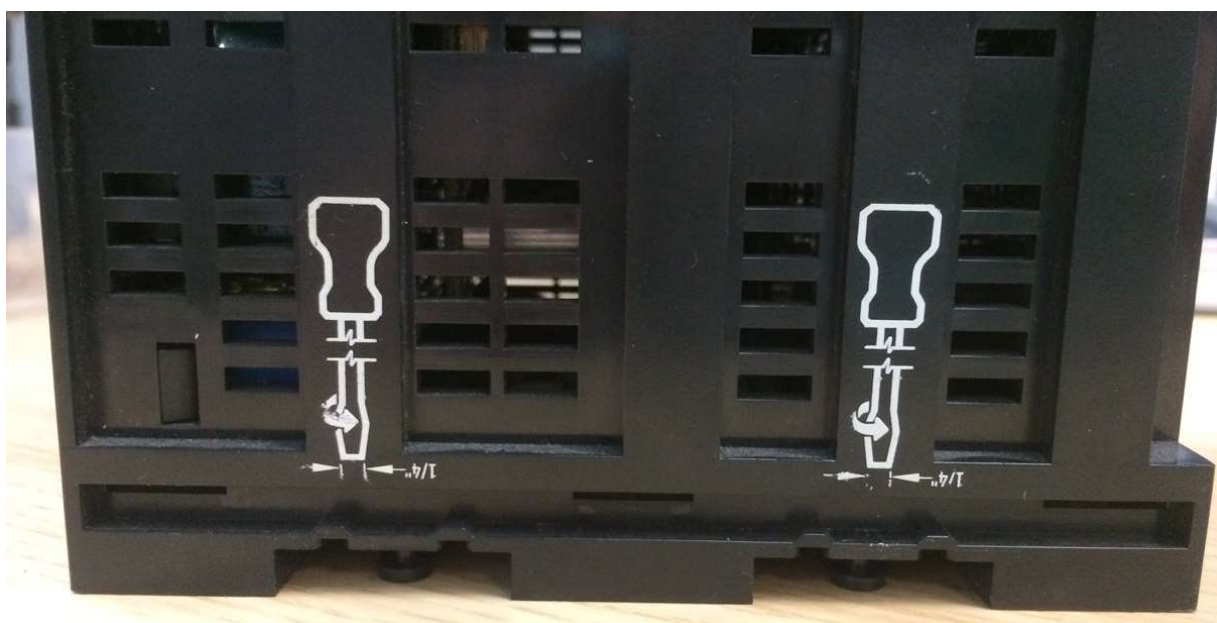


Fig. 12 Relay case with the tabs already removed.



- 4- Ensure that the expansion module tabs have not been damaged.



Fig. 13 Expansion module tabs damaged.



4. THERMAL RECOMMENDATIONS

Temperature may affect all electronics in general, so that in the MM300 we have taken special precaution in the design stage in the following aspects:

- a. Microcontrollers and memories thermal rating is among the maximum available in the market, frequently automotive range.
- b. Electrolytic capacitors in the power supply have been designed and specified to last long life and rated and high ripple current withstand.

However, in order to avoid excessive heat inside the relay, please follow recommendations below:

- 1- Boards slots need to be free to facilitate air circulation. Do not attach tapes around.



Fig. 14 Do not install self-adhesive tape covering case slots.



Fig. 15 Do not install self-adhesive tape covering case slots.

- 2- Try to install the relay at the bottom of the relay as it is the cooler part. Please find below a picture of the temperature of the drawer taken with an infrared camera:

Infrared Camera

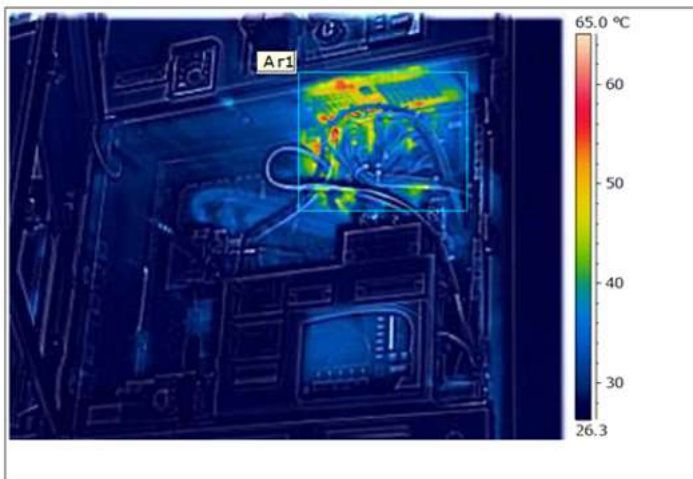


Fig. 16 temperature of the drawer.



- 3- There must be around 2" or 6 cm around the relay to allow air circulation. It has been tested and the CPU internal temperature is reduced 9°C:

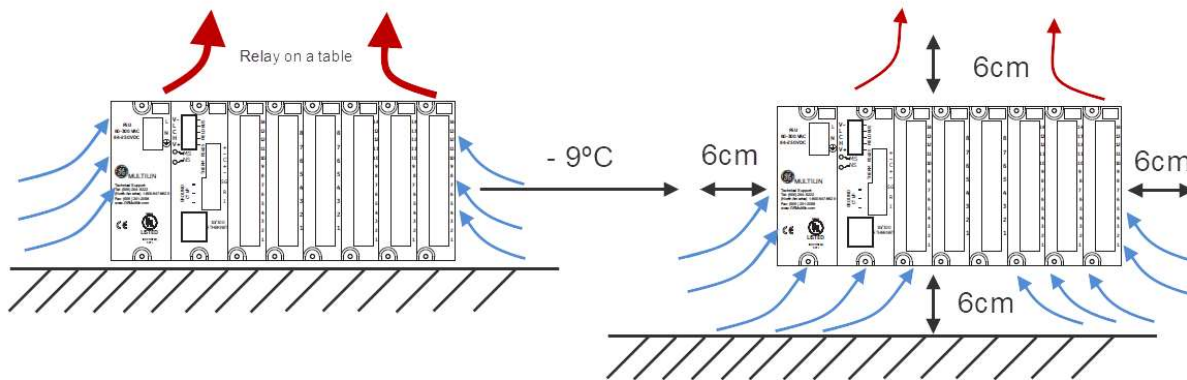


Fig. 17 Temperature reduces around 9°C when leaving 6cm around the relay

- 4- Relay can be installed in vertical or horizontal position. However, in vertical mode internal temperature is around 5°C more.
- 5- Avoid installing heat sources below the relay.
- 6- There are 3 mechanism for heat dissipation:
- a. Conduction. In the case of MM300 is limited as the base unit housing is made of plastic.
 - b. Convection. This is the most relevant mechanism for MM300 thanks to its slots in the housing.
 - c. Radiation. This is only applicable for very high temperatures as it goes with the fourth power of the temperature in Kelvin scale and is not relevant in MM300 cooling.

Everything done to ensure convection will reduce hot spots within the product and will ensure longer reliability.

Air ventilators can be installed inside the drawer or the cabinet.



Fig. 18 Example of forced ventilation inside the drawer.

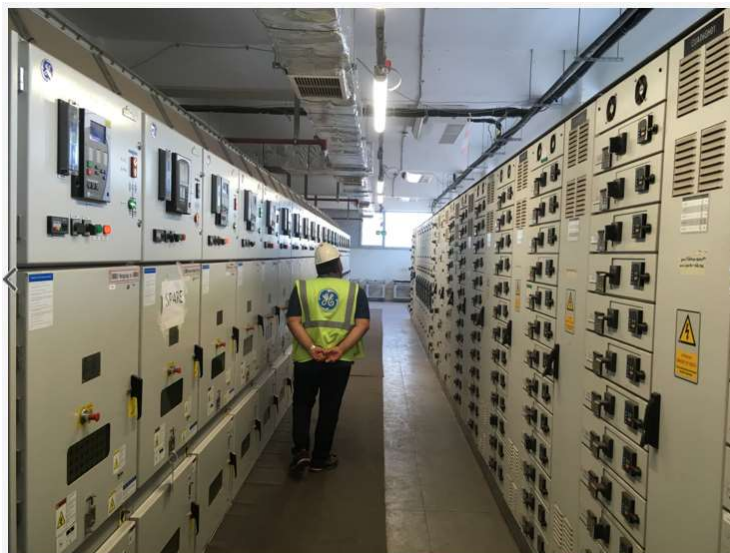


Fig. 19 Best practice fans in each panel (10 drawers/panel).





Fig. 20 Best practice fans up in the panel.

- 7- When the relay order code has more that one IO_C or IO_E inputs use should be distributed. For example, if six inputs are needed for the application and the relay has two IO_C modules, we suggest configuring three inputs of slot C and the other three in slot F, in order to balance heat dissipation and reduce maximum temperatures.
- 8- The maximum temperature of the CPU should not exceed 90°C. In the CPU module there is a temperature sensor that provides information of the internal temperature of the relay. This information can be checked using factory password by GE authorized. employees.

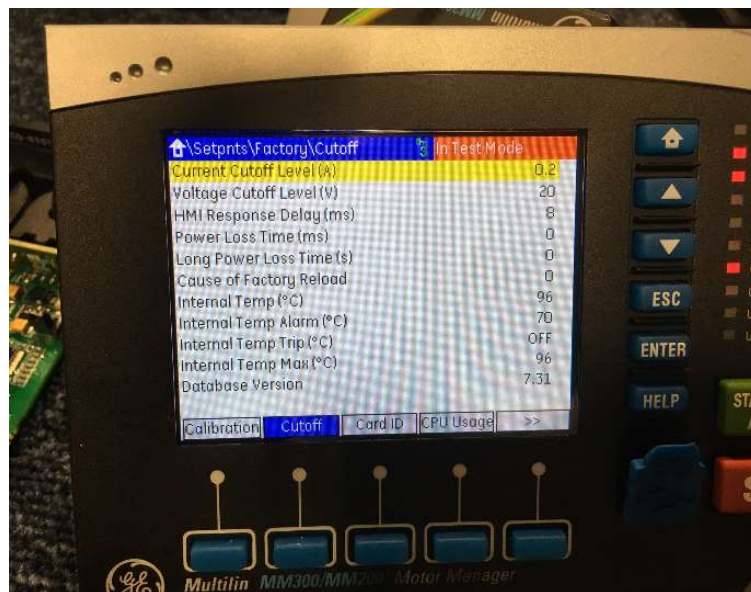


Fig. 21 Example of CPU maximum temperature measurement.



5. ELECTRICAL RECOMMENDATIONS

- a. The distance of the cable between the GCP and the relay must be below 6.6ft (2m):
 - i. If direct connection is done between the relay and the display, 1.5ft (0.5m), 3ft (1m) or 6.6ft (2m) cables can be used.

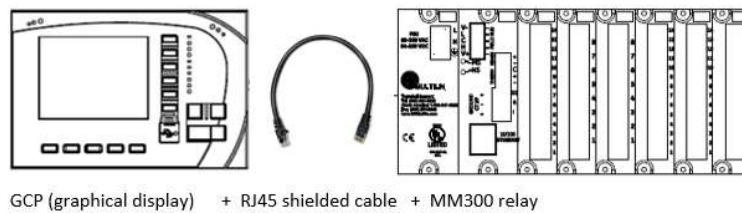


Fig. 22 Direct connection.

- ii. If Control Panel Switch (CPS) is used between the displays and the MM300 relay, both cables in total cannot exceed 6.6ft (2m).

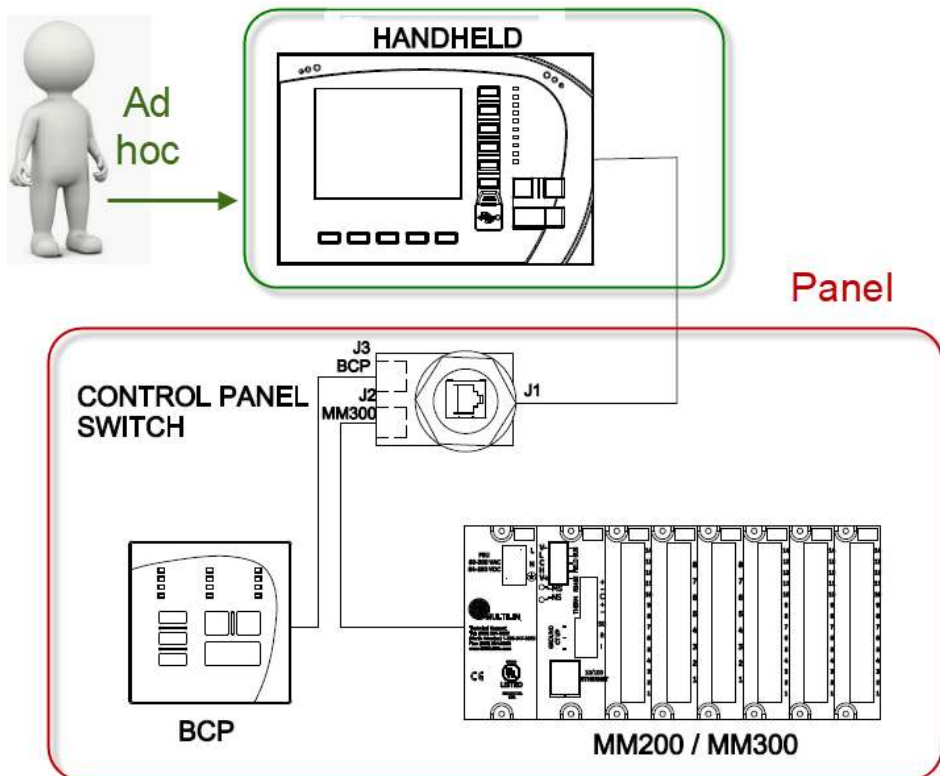


Fig.23 Connection of the CPS.



J2 cable plus J1 cable < 6.6ft (2m)

J2 cable plus J3 cable < 6.6ft (2m)

- b. Cables used must be GE supplied ones. 5V are supplied from the relay and nearest to these 5V need to arrive to the display. GE Cables have been selected with the minimum resistance to allow these distances.



- 2- Minimum length cable should be use. Do not use long cables inside small drawers as it can lead in excessive electromagnetic noise coupling.



Fig. 24 Do not install longer cables that the ones needed.

GE cables are 1.5ft (0.5m), 3ft (1m) or 6.6ft (2m).

3ft (1m) and 6.6ft (2m) cables can be ordered in the online store:

<https://store.gegridsolutions.com/ProdCategory.aspx?PID=1354&TYPE=ACCESSORY>

MM300/MM200 3Ft Connector Cable

List Price (\$US): **\$30.00**

Part Number: 0804-0169



Buy Now

MM300/MM200 6.6ft cable

List Price (\$US): **\$35.00**

Part Number: 0804-0010



Buy Now

Fig. 25 RJ45 cables available in the online store.



Fig. 26 1.5ft cable.