

process measurement solutions

Magne-Sonic

MSC900 Series

Industrial Transmitter

Control Unit

Software Version 1.3

**Installation & maintenance
instructions**



MSC900 is the generic name used in this manual for the MSC900 range of control units comprising :-

MSC901
MSC902
MSCLOG



Safety Precautions

The following safety precautions should be observed before using this product or working on the attached cables.

This MSC900 product is intended for use by qualified personnel who recognise shock hazards and are familiar with the safety precautions required to avoid possible injury. Read the operating information carefully before using the product.

The types of product users are:

Responsible body: This is the individual or group responsible for the use and maintenance of equipment, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They do not require access to the electrical connections within the control box, and would normally only operate the external keypad and monitor the display.

Maintenance personnel perform routine procedures on the product to keep it operating, for example, checking the line voltage or checking electrical connections, replacing mains fuses etc.

Service personnel are trained to work on live circuits, and perform safe installations and repairs of products. Only properly trained service personnel may perform installation and service procedures. However, the only serviceable part in MSC900 is the mains cartridge fuse.

Users of this product must be protected from electric shock at all times. Product users must be trained to protect themselves from the risk of electric shock.

MSC900 Control Units are double insulated and do not require a mains earth.

Periodically inspect the connecting cables for possible wear, cracks, or breaks.

The fuse must only be replaced with same type and rating for continued protection against fire hazard.


To clean the instrument, use a damp cloth with a mild, water based cleaner. Clean the exterior of the instrument only. Do not allow liquids to enter or spill on the instrument.

WARNING - If this equipment is used in a manner not specified by Solartron Mobrey, the protection provided may be impaired. The MSC900 is regarded as permanently installed equipment and as such a switch or circuit breaker must be included in the installation. This should be in close proximity to the equipment and be marked as its disconnecting device.

Under no circumstances must voltages higher than those stated in this manual be applied.

An Intrinsically Safe earth must be connected for all hazardous area systems.

The installation of the MSC900 and its associated power cables must be such that tank overflow, local flooding or pump failure do not cause these to be submerged or subject to flows of water. Sensors and sensor cabling can be submerged without hazard to equipment operators when correctly connected as described in this manual.

Explanation of symbols: The Intrinsically Safe Earth Symbol is :  = functional (Intrinsically Safe) earth

 = Double insulated

 = Refer to manual

CHECK THAT THE POWER SUPPLY IS SUITABLE BEFORE SWITCHING POWER ON.

Internal adjustments can select mains 115 Volts AC power, which makes the equipment unsuitable for 230V AC supplies. Check this Voltage selection switch is set suitable for the available power supply.

HAZARDOUS AREA SYSTEMS :-

Where the MSC900 is connected to a transmitter located in a hazardous area, additional instructions apply. Refer to page 8 and safety instruction.

The symbol  in the text of this manual refers the reader to 8 and safety instruction leaflet.

CONTENTS

	Page
1. Product Introduction	4
1.1 Control Unit functions	4
2. Magne-Sonic MSC900 Series Controller	5
2.1 Display and keypad	5
2.2 Type numbering system	6
2.3 Safety data	6
2.4 Electrical Specifications	7
3. MSC900 Control Unit Installation	8
3.1 Environmental specifications	8
3.2 MSC900W Wall Mounting models	8
3.2.1. Electrical connections : MSC900W	10
3.3. MSC900P Panel Mounting models	11
3.3.1. Mounting in the panel	11
3.3.2. Electrical connections : MSC900P	13
3.4. Notes on transmitter installation & cabling	14
3.5. Mains power connection	16
3.6. Earthing	16
3.7. Relays	16
3.8. Current output	17
3.9. Digital (Trigger) inputs	17
3.10. RS232	18
4. Maintenance	18
5. Accessories	18

Appendices

Appendix 1 Introduction to programming the MSC900

Associated manuals

Quickstart Manual covering use of the MSC900 with a ultrasonic transmitter

Quickstart manual for Differential system

Detailed technical programming and operating manual

Safety Instruction Manual

Quickstart manual for Logging system

Footnote :-

In this manual the following terms are used which refer to trademarks from other manufacturers:

HART: is the protocol adopted for the MSC900 SMART Communications.

HART is a registered trademark of the HART Communications Foundation and is a mnemonic For Highway Addressable Remote Transducer.

1.0 Product Introduction

MSC900 is the generic family name for a range of industrial transmitter control units, providing a wide range of control functions and a visual display of the measured variable. There are two mounting styles available; a tough IP66 Wall mounting control unit for either indoor or outdoor installation, and a Panel mounting control unit designed for direct mounting in a control panel. The controller will accept a 4-20mA signal from a self-powered transmitter or can provide 24V dc power to the transmitter if required.

A HART transmitter, powered from the MSC900, can be connected to the MSC900 and all Universal plus some Common Practice commands will be implemented.

The MSC900 may be connected to a 4-20mA transmitter installed in a hazardous area. However, the mains powered MSC900 is designed for mounting in a non-hazardous (safe) area.

Control functionality is provided by the 5 SPCO voltage free contact relays in the MSC900. There is also an isolated 4-20mA signal out.

For applications where the functionality of the MSC900 is linked to other external events, 2 digital input ports are provided to accept contact closure signals.

The MSC900 is simply programmed using the 6 key membrane keypad on the front of the unit. Menu structured programming is employed, with the display assisting the user with dynamic help text.

1.1. Control Unit Functions

Using either a standard 4-20mA input or a digital HART input from a transmitter, the MSC900 control unit will provide the following functions :

- Calculation and display of the MSC900 Primary Variable (PV).

The user can choose this to be the reading coming from the transmitter, which may be a depth or distance measurement from a HART ultrasonic transmitter or may be a mA reading from a pressure transmitter, or some other value calculated by the MSC900 based on the transmitter input, which could be a level, distance, contents or flow reading. A totaliser function is also included.

The MSC900 is factory programmed with a set of standard volumetric and flow equations to convert a level signal to contents or flow, and also has a 21 point user programmed look-up table for non-standard applications.

MSC902 units calculate the difference, sum or product of 2 separate 4-20mA inputs.

MSLOG units have a 4800 event on board logging capability.

- 4-20mA signal out from the MSC900 control unit.

The MSC900 current output is usually proportional to the displayed PV, and is displayed in bargraph form on the display (0-100%).

- Relay control functions.

There are 5 freely assignable relays. Relay 5 is a fault relay by default, which may be assigned to control duty if required. The other 4 relays are available for the user to programme to operate at chosen values of the displayed PV, or other calculated values.

The MSC900 is factory programmed with a selection of popular pump control routines for wet well and sump control, along with energy saving over-rides.

- Voltage free (digital) contact input

Up to two voltage free contact closure inputs may be connected, allowing external over-ride of control unit functions if desired.

- Programming a transmitter from the MSC900 control unit

As the MSC900 will communicate digitally with any HART compatible transmitter powered by the MSC900, it is possible to programme a HART transmitter using the MSC900 keypad.

Full communication with Magne-Sonic HART ultrasonic transmitters, allowing access to all transmitter parameters is supported, whilst Universal and some Common Practice commands of other HART transmitters is possible in accordance with HART protocol.

2.0 MSC900 Series Controller

2.1 Display and Keypad (Model MSC900P shown)



Figure 1 : MSC900 keypad and LCD display

Note : The keypad, display and operation are common to both Wall and Panel mounting options.

The MSC900 display is fully field configurable and may be customised to suit the requirements of the user.

Typically the 4 line display is as shown in Figure 2, The top line shows whether the programme lock is open together with the time display. The actual measurement, the MSC900 Primary Variable (PV) is displayed in the centre using double height characters. The lower line shows a bargraph representation of the 4-20mA current output of the control unit, proportional to the PV, 0-100%.

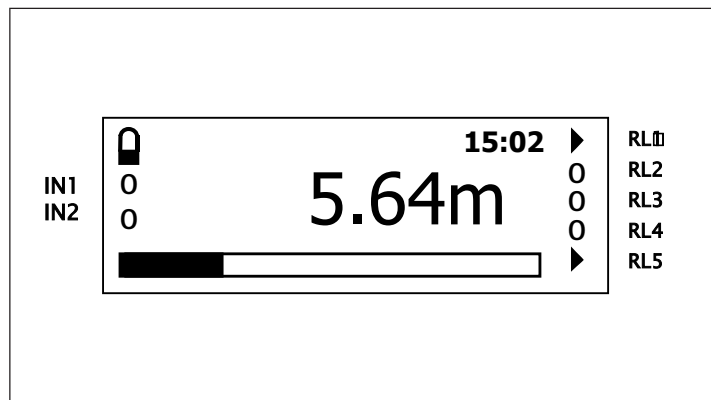


Figure 2 : Typical MSC900 liquid crystal display

Additional flags on the display show the status of the five relay outputs, RL1 to RL5, and of the digital control inputs into the MSC900.

Keypad Operation :


There are 6 buttons on the MSC900 front panel. The four ARROWS allow navigation around the programming menu and the "ESC" and "↵" buttons allow movement from one screen to the next. By pressing "ESC" repeatedly, the screen will always return to the normal display as shown in Fig 2. Movement through the menu structure using the arrows is shown by the titles being "highlighted", ie reversed to show white letters on a dark background. The LCD is backlit for operator convenience. (This can be turned off if required).

Some basic introductory programming details are given in Appendix 1, whilst full programming and operating instructions are given in Manual IP2030/OM. Quickstart manuals, are also available, covering use of the MSC900, MSC902 and MSLOG with a Magne-Sonic ultrasonic transmitter(s).

2.2 Type Numbering System

MSC	Mobrey Control Unit
901	115V ac/230V ac Mains powered, Standard model
902	115V ac/230V ac Mains powered, Differential model
LOG	115V ac/230V ac Mains powered, Logging model
WX	Wall mounting
PX	Panel mounting
-A	ATEX certified

2.3 Safety Data

Type numbers	See above
Certificate number	BAS00ATEX7064 and BAS01ATEX7225X
ATEX Coding (EU Directive 94/9/EC)	 II [1] G
Cenelec Coding	[EEx ia] IIC -40°C ≤ Ta ≤ 55°C

Safety Parameters

Terminal 1 (24V) w.r.t. terminal 2 (lin) Terminal 1 (24V) w.r.t. terminal 3 (Earth)	Terminal 2 (lin) w.r.t. terminal 3 (Earth)
$U_i = 0$ $U_o = 28V$ $I_o = 120mA$ $P_o = 0.82W$ $L_i = 0.2mH$ $C_i = 0.6nF$	$U_i = 30V$ $I_i = 120mA$ $L_i = 0.1mH$ $C_i = 0.6nF$ $U_o = 6.51V$ (Cap. charging only) $I_o = 0$ $P_o = 0$

The capacitance and either inductance or inductance to resistance ratio L/R of the cable and equipment connected to the intrinsically safe output terminals must not exceed the following values :

Group	Capacitance	Inductance	or	L/R Ratio
IIC	0.082* μF	1.2mH		42 $\mu H/\Omega$
IIB	0.65 μF	10.9mH		172 $\mu H/\Omega$
IIA	2.15 μF	21.9mH		346 $\mu H/\Omega$

* 0.082 μF of which total C_i of the hazardous area apparatus connected must not exceed 0.020 μF .

Terminal 2 (I_{IN}) w.r.t. Terminal 3 (Earth) must be treated as a 6.51V source. The 6.51V is considered as being the theoretical maximum to which a capacitive load across these terminals could become charged through leakage through internal series blocking diodes. This voltage does not contribute to the short circuit sparking risk of any external source connected to these terminals.

2.4 Electrical Specifications

Cable Entry	5 x Ø 20mm, (3 blanking plugs, 2 cable glands)
Cable connections	Cage clamp terminal block, suitable for 2.5mm ² max cable.
Supply voltage	Switch selected : 115Vac, voltage range 98Vac - 127Vac 50-60Hz 230Vac, voltage range 196Vac - 254Vac 50-60Hz
Power consumption	10VA at nominal supply voltage 18VA Max.
Fuse	200mA (T) 5 x 20mm 250V
Transmitter input	4-20mA (Earth referenced in MSC900)
Digital inputs	Unit accepts two trigger input signals. (Voltage free contact closure)
Relay Outputs	5 x SPCO Relays, rated 5 Amp at 250 V AC Resistive Please refer to section 3.7 for safety use.
Current Output	4-20 mA isolated into 1kΩ max. If externally powered then max. voltage is 30Vdc
DC Power Output	24V DC for transmitter, 25mA max. load
HART	HART digital communications to transmitter

See "WARNING" in section Safety Precautions on Page 2

3.0 Installation

The control unit must not be mounted in areas where an explosion hazard exists.



If connecting the MSC900 to a 4-20mA transmitter located in a hazardous area, refer also to instructions on page 6 and in safety instruction leaflet.

Refer also to the important safety precautions detailed at the start of this manual.

3.1 Environmental Specification

Ambient temperature	-40°C to 55°C
Max Altitude	2000m
Max Humidity	100% RH
Electrical Safety	Conforms to EN61010-1
Installation Category	III Supply voltage <127Vac - IEC60664 II Supply voltage <254Vac - IEC60664
Pollution Degree	2 - IEC60664

3.2 MSC900W Wall Mounting models

The control unit housing is rated IP65. It is suitable for mounting outside, but this should be above any flood level, away from any overflow water path, and away from direct sunlight. Do not mount the MSC900W on a structure that is subject to vibration, or in a position where damage may be caused by impact, thermal stress or liquid ingress.

The mass of the MSC900W is 1.4kg. To conform with safety requirements, the wall on which the MSC900W is mounted should be capable of supporting 4 times this weight.

It is not necessary or advisable to remove the lid to the upper part of the box, containing the LCD and keypad. There are no user serviceable parts inside. The control unit must not be modified in any way. Mount the unit on a suitable wall or structure using the 3 fixing points as shown in figure 3. The most convenient way is to position the central top fixing first, then hang the control unit on this. Use a spirit level to ensure the unit is horizontal, then mark the two lower fixing positions on the wall. (These are accessible once the terminal cover is removed).

The MSC900W is supplied with IP65 Nylon cable glands for connections to the field mounted transmitter and the mains power supply. MSLOG has an additional connector which is used to download logged data.

It is the responsibility of the user to ensure that cable glands and connection to the MSC900W is in accordance with local or national standards.

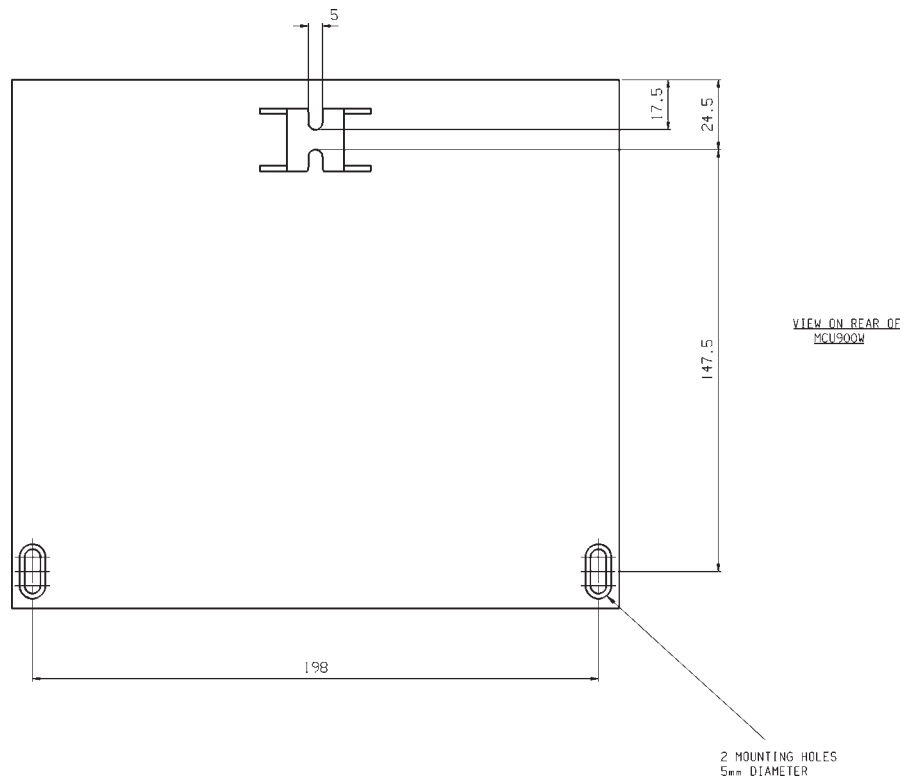
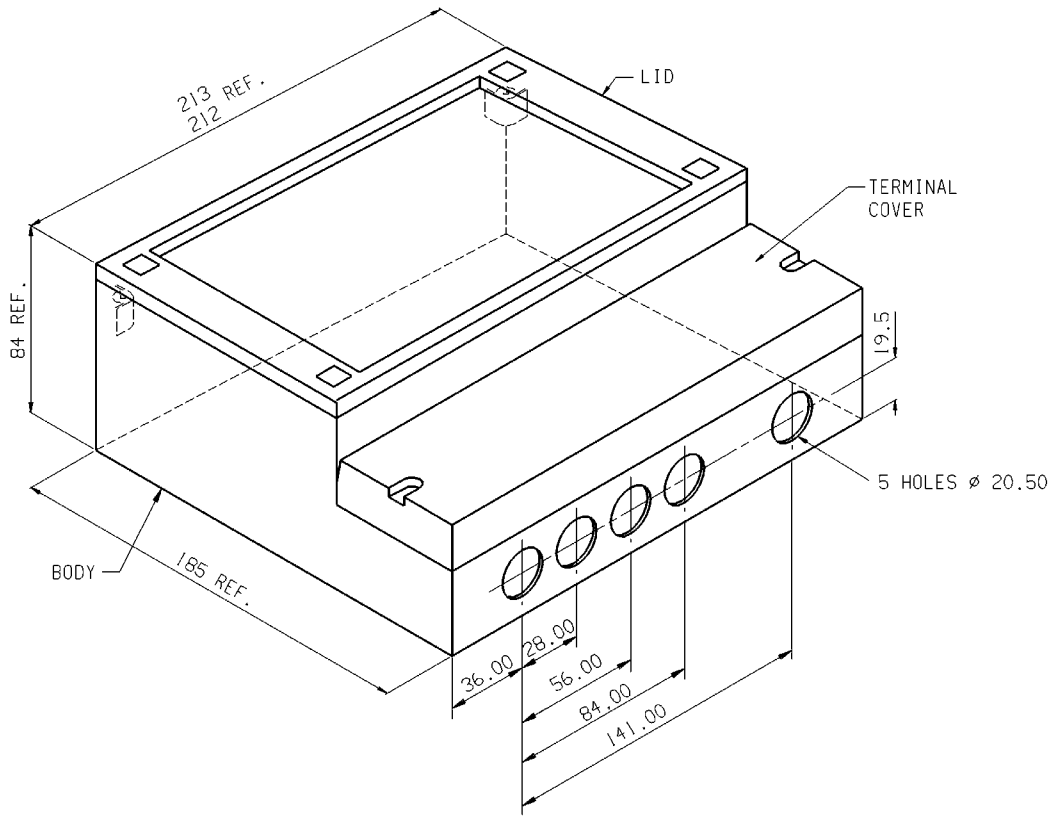


Figure 3 : MSC900W Control Unit Dimensions

3.3.2 Electrical connections : MSC900P Panel mounting models.



All connections are made at the rear of the control unit using the two part terminal connectors provided. Note that it is the responsibility of the installer to observe all local regulations and approval requirements, and to use cable to suit the environmental requirements of the particular application. Obtain and check any hazardous area work permits before applying power to the MSC900.

Figure 7 below show the layout of the terminal connections. Terminal blocks are suitable for wires 0.5mm² to 2.5mm². Insulation should be stripped back 7mm.

Note the protective shield surrounding the transmitter connection terminals (1 –3). On no account must this shield be damaged or removed as it is an integral part of the Intrinsically Safe design of the MSC900P.

The I.S. Earth (Terminal 30) must be connected to an Intrinsically Safe earth if the transmitter connected to terminals 1 and 2 is located in a hazardous area.

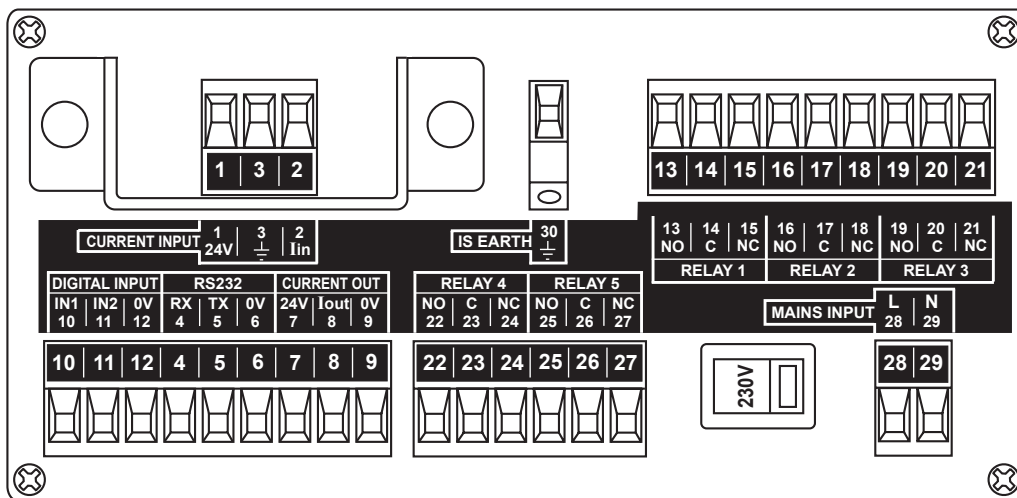


Figure 7

Connection descriptions

Terminal	Function	Layout
1	Loop supply	24V
2	Current Input	Iin
3	Screen	⏚
4-6	RS232	RX-TX-0V
7-9	Current Output	24V- Iout-0V
10-12	Digital Input 1 & 2	IN1-IN2-0V
13-15	Relay 1	NO-COM-NC
16-18	Relay 2	NO-COM-NC
19-21	Relay 3	NO-COM-NC
22-24	Relay 4	NO-COM-NC
25-27	Relay 5	NO-COM-NC
28-29	Mains Input	L-N
30	IS Earth	⏚

Data download socket
MSCLOG control units
only:-

Connect the flying leads
from the pre-wired socket
provided as follows :-

- 4 - White RX
- 5 - Red TX
- 6 - Black OV

Note that the plug/socket connectors are polarised to prevent inter changeability and incorrect connection.

3.4 Notes on transmitter installation and cabling



Connection of a transmitter to the MSC900 does not confer Intrinsic Safety on the transmitter. It is the responsibility of the user to ensure any transmitter installed in a hazardous area is suitable for use and certified accordingly for use in the hazardous area. The installation should be in accordance with a recognised code of practice.

Check the parameters of the installed system of MSC900, transmitter, any loop devices and interconnecting cable to ensure compliance with the individual product certificates and technical data (Refer to page 6).

Particular attention must be given to the cable and the transmitter to ensure that the total capacitance and inductance limits stated in the MSC technical data in Section 2.3 are not exceeded.

Cable joins are allowable in cabling to the transmitter provided that the joint is made within an IP20 (minimum) enclosure suitable for the environment, and that the wiring withstands a test voltage of 500V r.m.s. to earth.

The maximum length of cable permissible between the transmitter and MSC900 is determined by the limits imposed by the intrinsically Safe certificates of the instruments.

No other outputs from the MSC900 must be routed through a hazardous area unless protected by an additional I.S. Barrier.

It is the responsibility of the user to ensure that any transmitter is installed in accordance with the manufacturer's instructions supplied with the transmitter.

Cable between the MSC900 and the transmitter should be twisted pair shielded with the shield connected to terminal 3 marked "⊥" in the MSC900. The shield should be left unconnected at the transmitter unless there is a terminal specifically provided for this purpose.

Cable runs should be separate from any high voltage or mains cables to avoid crosstalk or interference.

Multicore cable may be used provided that other cores carry only low voltage (24V dc nom) signals and each pair of cores is individually shielded.

Loop powered transmitters must be connected to terminals 1 - 3 as shown below : (Note different arrangement of terminals in MSC900W and MSC900P).

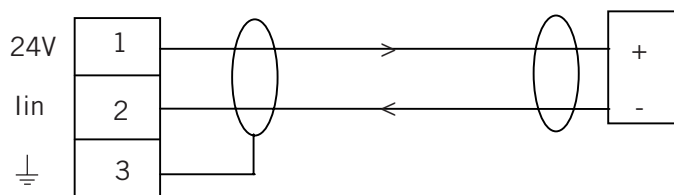


Figure 8 :

The MSC900 is able to provide 24V dc to a transmitter with a max load of 25mA.

Separately powered transmitters must be connected to terminals 2 and 3 as shown below :

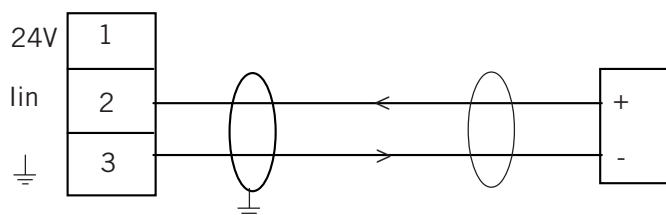


Figure 9 :

3.5 Mains power connection

The MSC900 is powered by mains AC power. Select the AC voltage as 230V or 115V using the voltage selector slide switch.

A switch or circuit breaker should be installed in close proximity to the instrument, and labelled as such.

Although the MSC900 meets all European standards for surge immunity on power and signal lines, it is recommended that lightning suppressors, such as made by Telematic Ltd., are fitted if local conditions make this advisable.

3.6 Earthing

- MSC900 control units are double insulated and DO NOT require a mains earth.

DO NOT connect a mains earth to terminal 30.

Terminal 30 is provided for use as an Intrinsically Safe (or functional) earth connection which MUST be used when a transmitter is mounted in a hazardous area and is connected to terminals 1 & 2.

Terminal 3 is to be used for connection of the shield of the twisted pair transmitter cable when the MSC900 is powering the transmitter. See Fig. 8 and 9. Note that this shield should be left unconnected at the transmitter end unless there is a terminal provided specifically for this purpose.

3.7. Relays

The 5 voltage free contact relays are grouped in the following configuration :

MSC900W Wall Mount Control Unit			MSC900P Panel Mount Control Unit		
Relay 1 & 2	-	Group 1	Relay 1, 2 & 3	-	Group 1
Relay 3 & 4	-	Group 2	Relay 4 & 5	-	Group 2
Relay 5	-	Group 3			

The relay NO-C-NC labels represent the relay terminals in the de-energised state.

Note that, whilst each relay is individually double insulated, their arrangement is such that insulation between relays in the same group is standard or 'basic' insulation.

Care must be taken in order to avoid the risk of electric shock. It is not allowed to use relays in the **same Group** to control circuits with both mains and dc or low voltage circuits.

3.8 Current Output

The current output may be connected in internally powered mode or loop-powered mode. See connections in Fig 10 below.

In Loop-powered mode an external power source is required. A minimum of 2.5V is required across terminals 7 and 8 for correct operation. The external voltage must not be more than 30V dc.

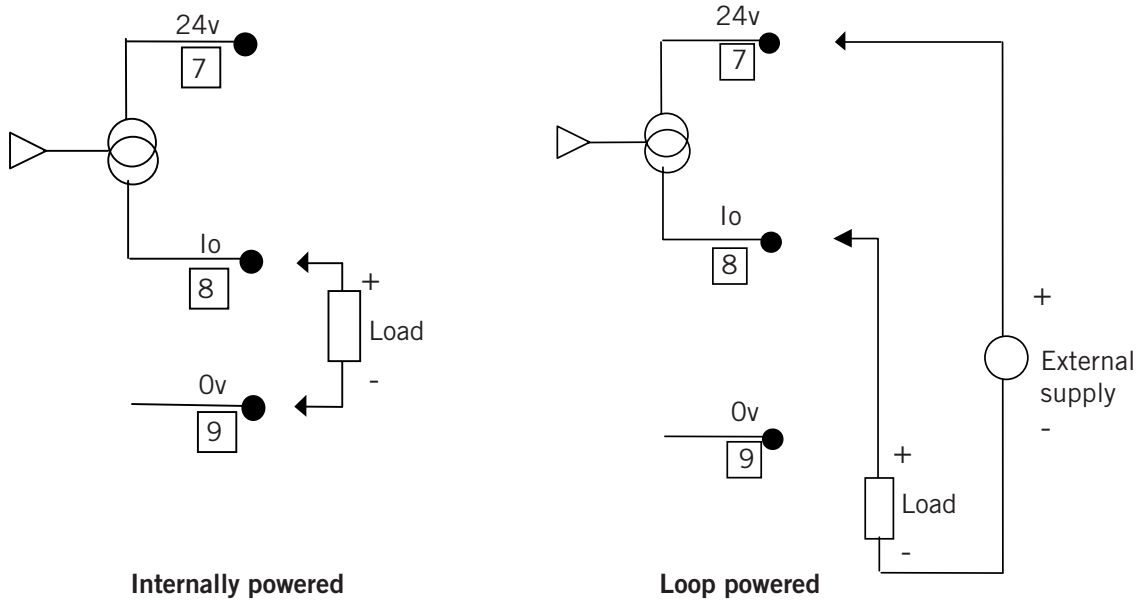


Figure 10 : Alternative current output configurations

3.9 Digital Control Voltage free contact inputs

There are 2 trigger inputs IN1 and IN2. The digital trigger input is connected as shown below:

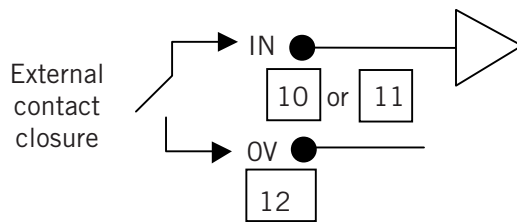


Figure 11 : Connection for external trigger input

