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 Magne-Sonic, 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 Instrinsically 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 page8 and safety instruction.
The symbol ⟨Ex⟩ in the text of this manual refers the reader to 8 and safety instruction leaflet.

CONTENTS

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 calculated the difference, sum or product of 2 separate 4-20mA inputs.
MSCLOG 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%.

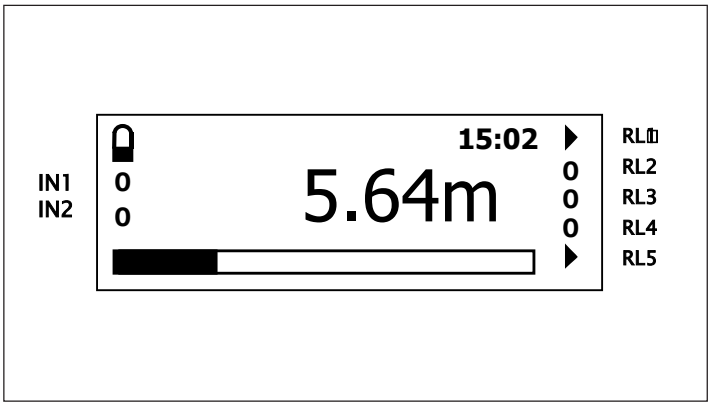


Figure 2 : Typical MSC900 liquid crystal display

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 is also available, covering use of the MSC900, MSC902 and MSCLOG with a Magne-Sonic ultrasonic transmitter(s).

2.2 Type Numbering System

MSC Magne-Sonic 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) ⟨Ex⟩ II [1] G

Cenelec Coding [EEx ia] IIC -40°C ≤ Ta ≤ 55°C

Safety Parameters

Terminal 1 (24V) w.r.t. terminal 2 (Iin) Terminal 1 (24V) w.r.t. terminal 3 (Earth)	Terminal 2 (Iin) w.r.t. terminal 3 (Earth)
Ui = 0 Uo = 28V Io = 120mA Po = 0.82W Li = 0.2mH Ci = 0.6nF	Ui = 30V Ii = 120mA Li = 0.1mH Ci = 0.6nF Uo = 6.51V (Cap. charging only) Io = 0 Po = 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 µH/Ω
IIB	0.65µF	10.9mH	172 µH/Ω
IIA	2.15µF	21.9mH	346 µH/Ω

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

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

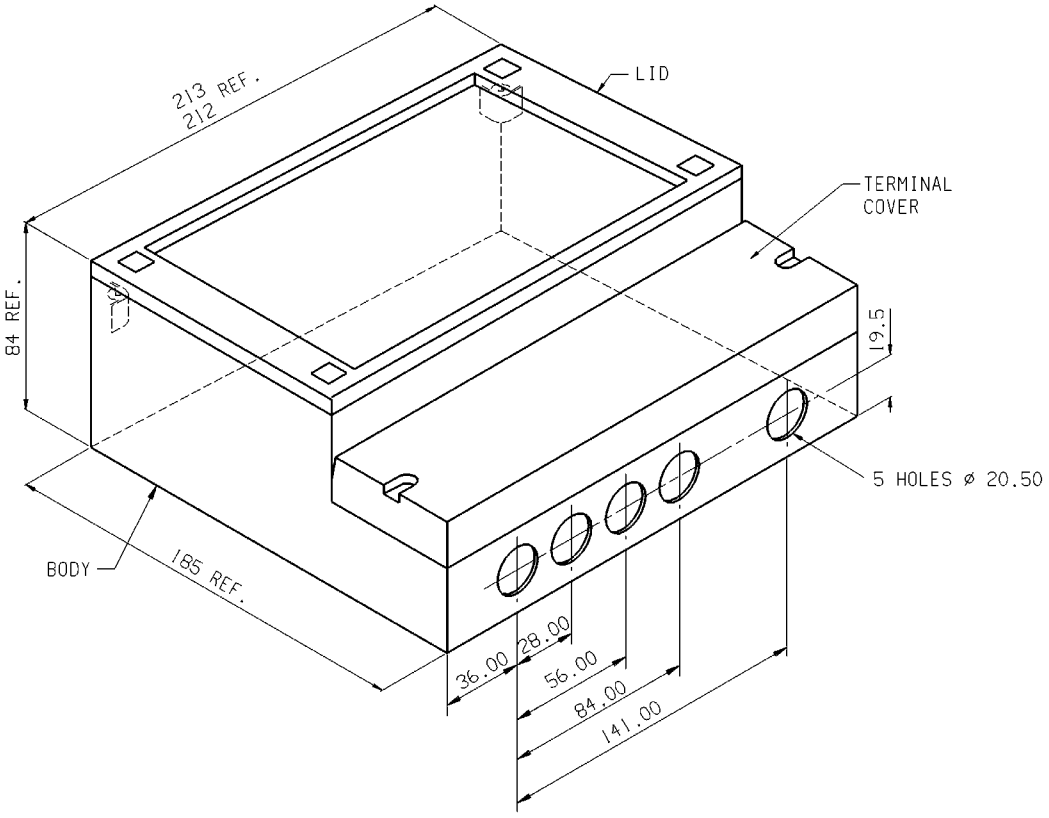
The control unit housing is rated IP65. It is suitable for mounting outside, but this should be above any flood level, away from any overflow water path, and away from direct sunlight. Do not mount the MSC900W on a structure that is subject to vibration, or in a position where damage may be caused by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



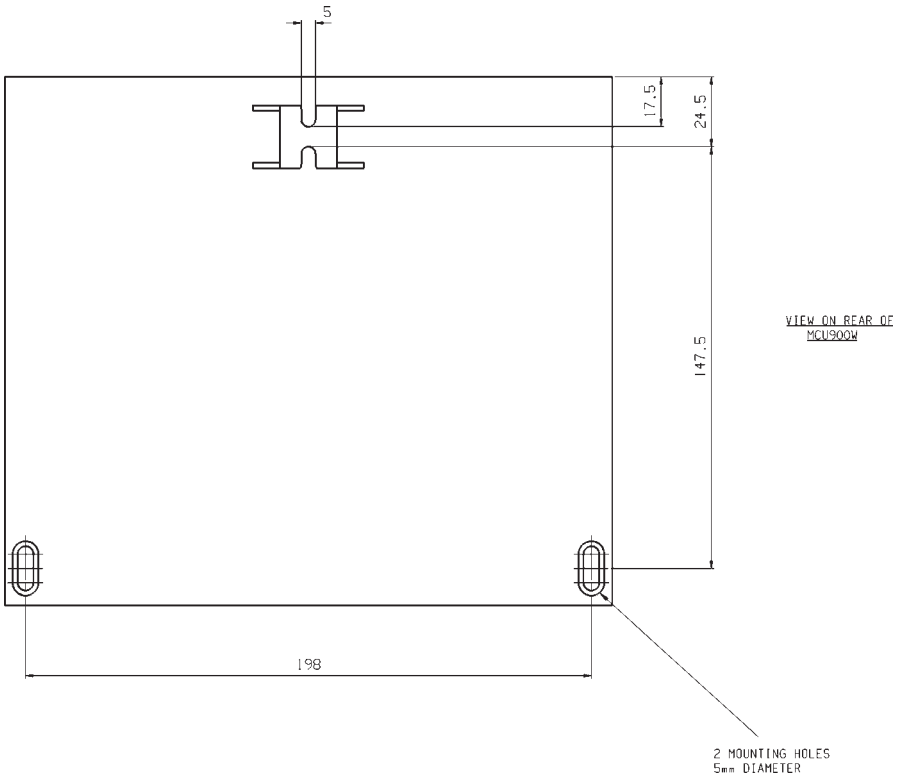


Figure 3 : MSC900W Control Unit Dimensions

3.2.1 Electrical Connections : MSC900W Wall mounting models

All field wiring connections are accessible by removing the lower terminal cover, which is secured by two screws. 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 required before applying power to the MSC900. On no account should the mechanical barriers separating the terminal area from the main enclosure and the transmitter terminals from the other terminals be removed or modified.

The diagram below shows the layout of external connection terminals: all terminal blocks are suitable for wires 0.5mm^2 to 1.5mm^2 (2.5mm^2 for mains terminals). Insulation should be stripped back 7mm.

Two cable glands, rated IP65 and suitable for cable with outside diameter 4mm to 7mm, are supplied for use with the mains supply and transmitter cable. The three other connection positions are supplied with M20 blanking plugs. All glands and plugs are supplied in a separate plastic bag. The installer must fit these, or suitable equivalents, in place of the transit red-caps, to ensure weatherproofing of the MSC900. Note that the white sealing washers supplied with the all cable glands and blanking plugs must be fitted on the outside of the enclosure under the gland or blanking plug. It is the responsibility of the user to ensure suitable cable glands or conduit connections are used when wiring to the MSC900 to maintain the enclosure integrity. The 5 cable entry positions are pre-drilled to accept M20 cable glands. MSCLOG has a data download socket factory fitted in one of the positions.

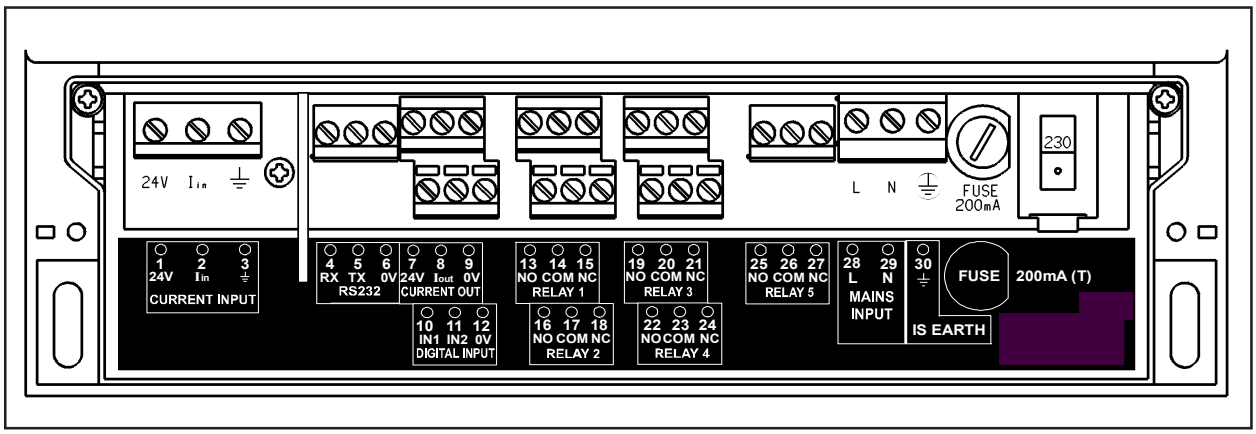


Figure 4: Connection Terminal Layout

Note that not all of the terminals are labelled on the pcb - a wiring label is positioned in the box.

The transmitter connections are on the left side of the terminal enclosure.

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.

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	⏚

3.3. MSC900P Panel mounting models

Do not mount the MSC900P on a panel that is subject to vibration, or in a position where damage may be caused by impact, thermal stress or liquid ingress.

The MSC900P control unit is rated IP40 and is designed for panel mounting in a weatherproof environment. An optional fascia overlay hood is available which improves the IP rating to IP65 (See appendix 1).

A Rack mounting kit is available which allows mounting of an MSC900P in a standard 19" rack. Up to two control units can be mounted in one rack; each MSC900P requires a mounting kit. (See appendix 1).

Where 3 or more MSC900P control units are fitted in the same cabinet or panel, ensure that there is adequate air circulation to aid cooling. It is recommended that an air circulation fan be fitted.

The MSU900P requires at least 165mm clearance behind the mounting panel to avoid fouling.

Once mounted, all wiring is made at the rear of the unit using the two part terminal blocks provided.

A pre-wired logged data download socket suitable for front panel mounting is provided with MSCLOG control units.

3.3.1 – Mounting in the panel

Mount the control unit on a panel with thickness between 1.5mm to 10mm, ensuring the panel is strong enought to support the 1.2kg weight of the MSC900.
Ensuring there is enough clearance behind the chosen position in the panel (165mm min.), cut a slot 138mm long by 68mm high (i.e. landscape or horizontal slot) in the panel and remove any rough edges.

Unpack the two screw clips provided. Identify the moulded lugs in the moulded recesses on each side of the control unit (ignore the recesses on the top and bottom of the control unit).
Holding the screwdriver slot end of the threaded spindle of one of the screw clamps and looking at the rear of the control unit, locate the screw clip frame on the side of the control unit and see how the 4 steel lugs of the screw clamp frame locate on the moulded lugs of the control unit. Gently pull the screw clamp such that the lugs engage with each other. (see Figure 5).

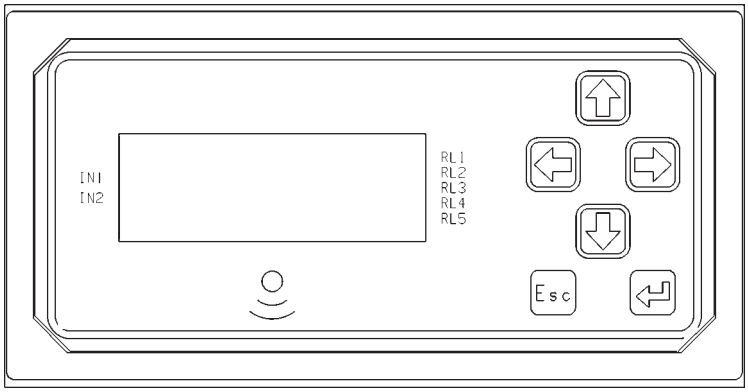
Figure5

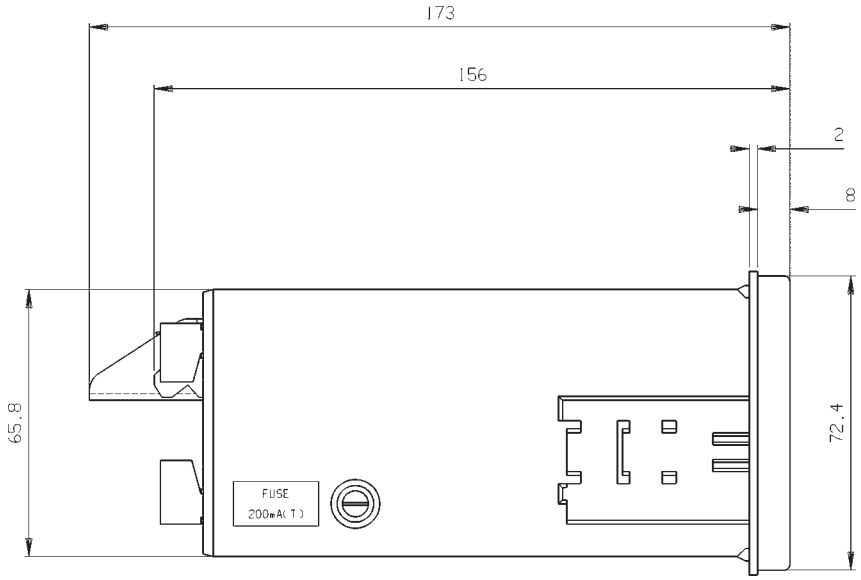
Remove the screw clamp and slide the control unit into the panel, ensuring that the panel seal provided is in place behind the control unit bezel.

Re-fit the screw clamps, one on each side of the control unit and tighten with a screwdriver to clamp the control unit in place against the panel.

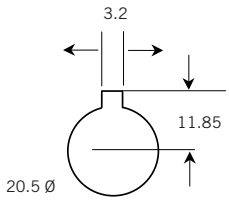
Figure 6 : MSC900P Control Unit dimensions

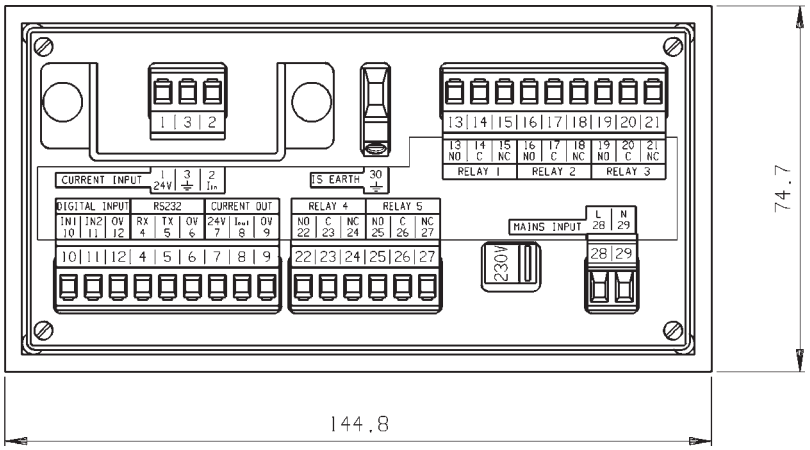
Panel mounting details
Panel cut-out : 138mm x 68mm
Allow 165mm clearance behind panel.





Logged data download socket : MSCLOG control units only.
Drill a hole Ø in the panel at a suitable location such that the socket flying leads can be wired to terminals 4, 5 and 6 at the rear of the MSC900P.
See page13 for wiring instructions.





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 0.5mm^2 to 2.5mm^2. 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.

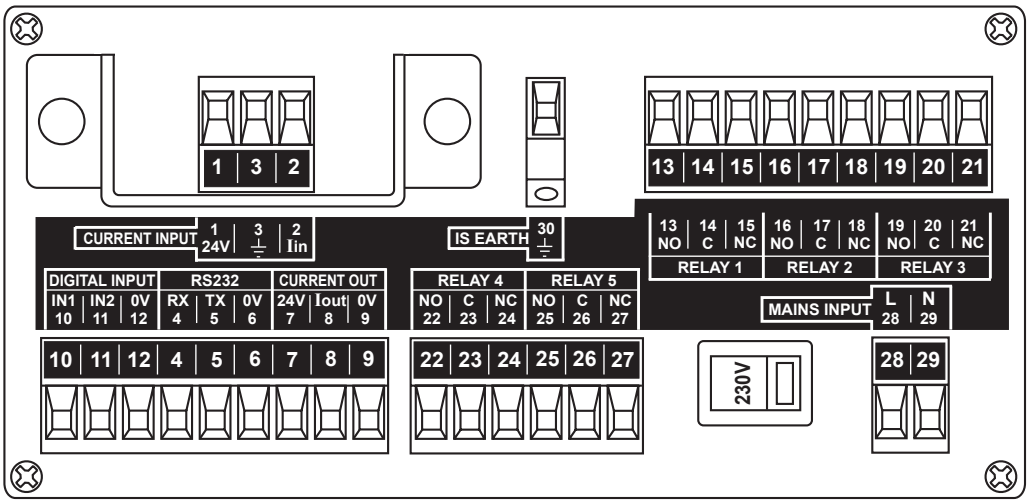


Figure 7

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 0V

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).

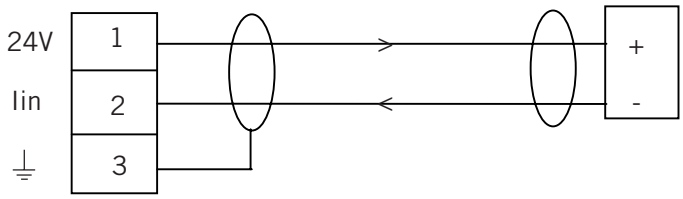


Figure 8 :

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 :

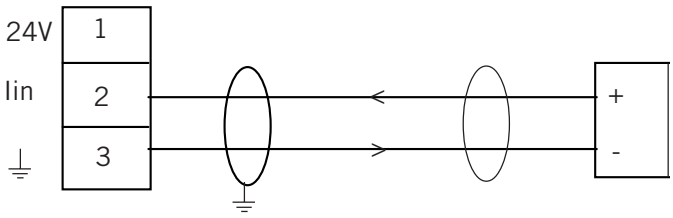
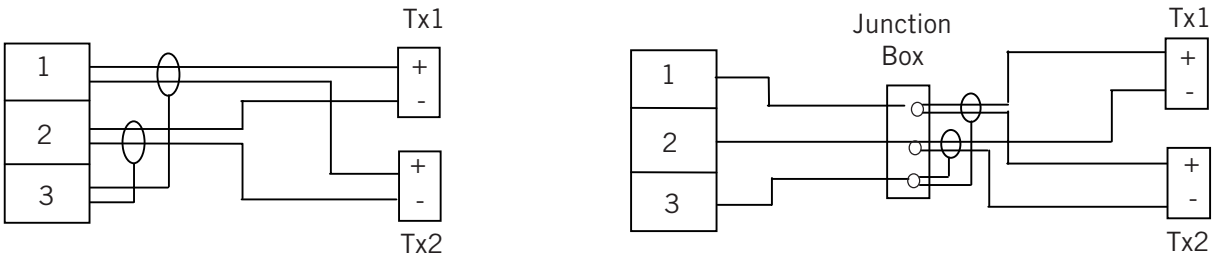


Figure 9 :

3.4.1
Special notes for connecting HART transmitters (including MST900SH-A transmitters) to the MSC902 Control Unit.

The MSC902 Control Unit takes the input from two HART transmitters and will perform various calculations to create the sum, difference or product of the two inputs.
The transmitters must be HART compatible for the MSC902 to operate correctly.

Connection of the transmitters to the MSC902 may be by cabling both transmitter cables into the MSC902 using the cable glands provided, or may be on a single cable using one of the cable glands provided, with the two transmitters connected to this cable in a suitable local junction box.



For correct operation, each transmitter must be changed to “multi-drop” mode so that they can communicate with the MSC902 through a common connection. Each transmitter must therefore have it’s poll address changed from the factory default address of “0” to a unique address. The MSC902 is used to achieve this, but this requires that the transmitters be connected in sequence as detailed below :-

a) With the power supply turned off, connect the first transmitter to terminals 1-3 in the MSC902 control unit.
b) Check that the power selector switch is set to the correct voltage (115 or 230 V ac) and turn the power supply on.
c) The MSC902 will detect the transmitter and automatically change the poll address of the transmitter from “0” to “1”. This transmitter will also be automatically allocated to Channel 1 of the MSC902.
Note, the MSC902 control unit may also offer the user the opportunity to set the bottom reference of the MST900SH-A transmitter at this point, which may be done or ignored by pressing the “Esc.” Key.
d) Turn the power supply off and connect the second transmitter, either at the same terminals 1-3 as the first transmitter or at a local junction box, such that both transmitters are now connected.
e) Turn the power supply back on and the MSC902 will once again search for and detect any transmitters connected. Once the second transmitter is found, the MSC902 will automatically change the poll address from “0” to “2”, and the transmitter will also be automatically allocated to Channel 2 of the MSC902.
Note, the MSC902 control unit may also offer the user the opportunity to set the bottom reference of the MST900SH-A transmitter at this point, which may be done or ignored by pressing the “Esc.” Key.

Installation of the transmitters is now complete.

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.

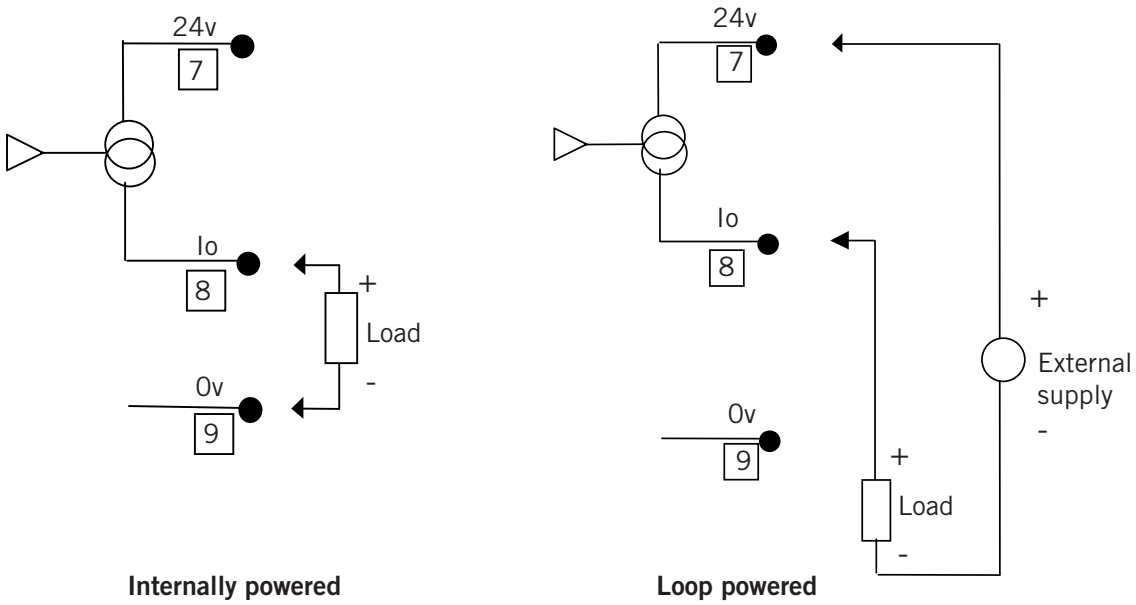


Figure 10 : Alternative current output configurations

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:

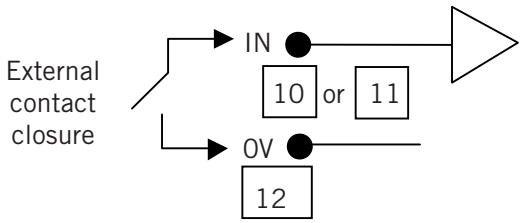


Figure 11 : Connection for external trigger input

3.10 RS232

The RS232 connections (Terminals 4-6) may be used for exchanging data with a PC or handheld device. The configuration of the Control Unit may be read or modified using an application such as the Magne-Sonic H-Conf401 running on a PC.

For the MSCLOG, the logged data is downloaded from the RS232 port via a socket connection provided, using Magne-Sonic LogView running on a PC.

4	Rx
5	Tx
6	0V

4.0 Maintenance

CONTROL UNIT
No maintenance is required beyond occasional cleaning of the enclosure with a damp cloth. Solvents or bleaches should not be used. Do not modify or attempt to repair the unit.

APPENDIX 1

Introduction to programming the MSC900

The following few pages give a brief introduction to programming the MSC900.

A1 The MCU900 keypad and menu navigation

The 4 red/white arrow keys are used to move around the menu structure, and the yellow enter key to confirm data input. The red Esc key allows a backward step to the previous screen.

Practice now using the keypad to customise the system settings in the MCU900. You may like to set the date, time and language of the display.

- Press the enter key to display the Main Menu.
- Press the down arrow once to highlight "SETUP" and press the enter key. (Note the beep which confirms each key press)
- Select "MCU CONTROL UNIT" and press the enter key to reveal the "SETUP" menu.
- Use the down arrow to move down the list. Note that there are more than the three items shown in the list, as indicated by an arrow pointing down in the lower right of the screen. Highlight "SYSTEM" and press the enter key.
- The SYSTEM menu comprises 6 items. Press the down arrow several times, or the right arrow once, to highlight "SETTINGS" and press the enter key.
- Select "Time" and press the enter key. You may now edit the time if appropriate.
- Press the enter key which will highlight the first "hours" digit. Use the up and down arrows to select the correct value then press the right arrow to move to the next digit. Continue until the time shown is correct, then press the enter key to save the time shown. Press Esc to jump back to the "SETTINGS" screen and select another setting to customise as appropriate, for example, display language.
- Once the MCU900 has been customised to your satisfaction, press the Esc key repeatedly to return to the main display screen.

A2 Programming the MCU900 for your application

The MCU900 is capable of complex control functionality, much of which is specific to certain duties. To programme the MCU900 for a specific application, it has to be told what the application is and then certain application details to allow the MCU900 to perform the necessary calculations.

To assist the user in understanding MCU900 programming, it is convenient to imagine these application specific data to be stored in memory locations called "Parameters", each of which has a unique address. Not all parameters are necessary for each application.
Programming the correct parameters for your particular application is made easy by Magne-Sonic "Wizards", which navigate the user around the menu structure and request only the data needed for your chosen application.

A listing of the MCU900 parameters, their location in the menu structure and their units / default values is given at the rear of this manual. Also, the parameter listing for the Magne-Sonic MS900SH is given, as this is a popular choice of transmitter to use with this MSC900 control unit.

You are strongly recommended to use these Wizards whenever possible.

Before the Magne-Sonic wizards are explained in more detail, it is important that the user understands the input to the MSC900 and what is being shown on the display.

A2.1 Understanding the input to the MSC900 and what is shown on the display.

The MSC900 may be used with either a 4-20mA transmitter or a digital HART transmitter.

A2.1.1 Using a transmitter with a standard 4-20mA output.

Any transmitter with a 4-20mA output may be connected to the MSC900.
Exactly what this 4-20mA represents is a function of the transmitter. The transmitter can not be re-ranged by the MSC900.
For example, if a level transmitter designed to give a 4-20mA output over 5m is installed in a 3m deep tank, the input to the MSC900 is going to be 4-13.6mA.

When a standard 4-20mA transmitter is connected, the MSC900 will recognise the input and the PV shown on the main display will be in % of current input, where 4mA is 0% and 20mA is 100%.
Note, in the example above, the maximum current that the MSC900 will see will be 13.6mA, so the PV on the display will only ever show 60% maximum.
It is possible to scale this input in the MSC900 and give a 4-20mA output from the MSC900.

A2.1.2 Using a HART compatible transmitter

Any HART compatible transmitter can be connected to the MSC900.
The MSC900 will recognise a HART transmitter and automatically start digital communications. The PV shown on the display will be extracted directly from the transmitter, along with the associated measurement units.

You will notice a small "~" icon next to the padlock in the upper left corner of the display which shows digital communications are in operation.

A2.1.3 Using the MSC902

The MSC902 accepts inputs from two HART transmitters arranged in multi-drop mode.
Transmitters **MUST BE** HART compatible to be used with the MSC902. See Section 3.4.1.

A2.2 Using Wizard assisted programming

With a transmitter connected and operating, you should now tell the MSC900 what duty it is to perform – Wet well pump control, Level measurement, Contents measurement or Flow measurement.

- Press enter and navigate to the Duty Wizard selection screen "SETUP / MSC900 CONTROL UNIT / DUTY (mode) / Duty Wizard.
- Press enter to start the duty wizard and select the duty for the MSC900
- Enter data as requested by the MSC900, which will automatically set up the input scaling and current output of the MSC900.

At the end of any duty wizard you will automatically be offered further wizards which are appropriate to you chosen application. For example, the "MSC Relay WIZARD", which allows you to set up relay control or alarm points as required, or the "TOTALISER WIZARD" relevant to open channel flow measurement and totalisation.

A2.3 Useful programming information

The following information is given to assist users in programming other popular functions of the MSC900.

A2.3.1 Password protection

The MSC900 may be protected from unauthorised programming by setting a PIN number.
Follow the path “SETUP / MSC CONTROL UNIT / SYSTEM / SETTINGS / PIN” and enter a 4 digit PIN.

A2.3.2 Configure the display

The MSC900 display may be customised to show a variety of data. The display is sectioned into 3 horizontal zones, Upper, Middle and Lower.
Follow the path “SETUP / MSC CONTROL UNIT / OUTPUT / DISPLAY” and select which part of the display you wish to customise. You may then select from a list of data which may be displayed there.

A2.3.3 Set up a digital input

Two voltage free contact inputs may be connected to the MSC900 and be programmed to cause certain actions should they activate.
Follow the path “SETUP / MSC CONTROL UNIT / DIGITAL INPUT / Digital Input 1 “ and you can then customise the input to suit your requirements.

A2.3.4 Commissioning aids

The MSC900 has several useful commissioning aids on-board.
Follow the path “SETUP / MSC CONTROL UNIT / SYSTEM / TEST “ and you can choose to autocycle the MSC900 over the full range of the current input without changing the transmitter input or level in a tank, trim input and output currents or use the MSC to drive a set output current into the loop.

A2.3.5 Re-setting default values

If the MSC900 is not operating as you would expect or you are unsure of some of the data you have programmed in, you can re-set the MSC900 to it’s factory default condition. This action causes default values to be loaded into all of the MSC900 parameter locations. Note, all previously entered data will be overwritten or lost.
Follow the path “SETUP / MSC CONTROL UNIT / SYSTEM / DEFAULTS” and follow the instruction to load defaults.

A2.3.6 Direct parameter access

Proficient users who become familiar with the parameter numbers of the MSC900 can access parameters directly by parameter number.
Follow the path “DIRECT” and select either Pxxx or Dxxx. “D” type parameters are diagnostic parameters and are read only.
Once a parameter number is entered and displayed, the user can use the up and down keys to scroll through the full parameter list.

A2.3.7. Programming menus

The following pages detail the menu structure of the MSC control unit.

Function Menu Option	Sub-menu Level 1	Sub-menu Level 2	Sub-menu Level 3	Par No.	Parameter Name	Units	Default
Cancel Password					Cancel Password	-	-
Go Offline ?					Go Online/Offline ?	-	-
SETUP	INPUT CHANNEL			P111	Channel 1 Input Source	-	Tx1 : PV
				P321	Current Input 1 Damping	sec	5
				P112	Channel 1 Input Offset	-	0
				P113	Channel 1 Profile	-	Scaled
				P114	Channel 1 Input Scale Factor	-	1
				P115	Channel 1 Non-Linear Data	-	0
				P116	Channel 1 Post Scale	-	1
				P117	Channel 1 Low Cut-off	as P201	AUTO
	DUTY(Mode)				Duty Wizard	-	0
		UNITS		P200	PV Units	-	%
				P201	SV Units	-	%
				P202	TV Units	-	%
				P203	FV Units	-	°C
		PV DAMPING		P210	Output PV Damping	s	0
				P240	Description	-	MCU CONTROL
				P241	Message	-	MESSAGE
				P242	Tag Number - Control Unit	-	MSP2000
		CUSTOM		P250	Start On	-	None
				P251	Stop On	-	None
				P252	Stop If	-	None
				P253	Start Time	hh.mm	07:00
				P254	Interval	hh.mm	01:00
				P255	Start Time #2	hh.mm	00:00
				P256	Interval #2	hh.mm	00:00
				P257	Max Retries	-	10
		OVERRIDES		P270	Auto Sequence Enable	-	Off
				P271	Auto Sequence Qualifier	-	0
				P272	Pump-down Relay	-	0
				P273	Pump-down Interval	hh.mm	00:00
				P274	Pump-down Duration	hh.mm	00:00
				P275	Energy Saving Start Time	hh.mm	00:00
				P276	Energy Saving Relay Select	-	0
				P277	Scum Line Prevention variance	-	0
				P278	Scum Line Prevention relay	-	0
	DIGITAL INPUT	DIGITAL INPUT 1		P340	Digital Input 1 Action	-	Free
				P341	Digital Input 1 Delay	mmm:ss	000:00
				P342	Digital Input 1 On State	-	Closed
		DIGITAL INPUT 2		P345	Digital Input 2 Action	-	Free
				P346	Digital Input 2 Delay	mmm:ss	000:00
				P347	Digital Input 2 On State	-	Closed
	OUTPUT	CURRENT OUTPUT		P400	Lower range value	as P200	0
				P401	Upper range value	as P200	100
				P402	Alarm action	-	3.6mA
		RELAY			Relay Wizard	-	0
					Reset RL Params		
			RELAY 1	P410	Relay 1 Mode	-	None
				P411	Relay 1 PV ON Point	as P200	0
				P412	Relay 1 PV OFF Point	as P200	0
				P413	Relay 1 Minimum ON Time	mmm:ss	000:00
				P414	Relay 1 Maximum ON Time	mmm:ss	000:00
				P415	Relay 1 Minimum OFF Time	mmm:ss	000:00
			RELAY 2	P420	Relay 2 Mode	-	None
				P421	Relay 2 PV ON Point	as P200	0
				P422	Relay 2 PV OFF Point	as P200	0
				P423	Relay 2 Minimum ON Time	mmm:ss	000:00
				P424	Relay 2 Maximum ON Time	mmm:ss	000:00
				P425	Relay 2 Minimum OFF Time	mmm:ss	000:00
			RELAY 3	P430	Relay 3 Mode	-	None
				P431	Relay 3 PV ON Point	as P200	0
				P432	Relay 3 PV OFF Point	as P200	0
				P433	Relay 3 Minimum ON Time	mmm:ss	000:00
				P434	Relay 3 Maximum ON Time	mmm:ss	000:00
				P435	Relay 3 Minimum OFF Time	mmm:ss	000:00
			RELAY 4	P440	Relay 4 Mode	-	None
				P441	Relay 4 PV ON Point	as P200	0
				P442	Relay 4 PV OFF Point	as P200	0
				P443	Relay 4 Minimum ON Time	mmm:ss	000:00
				P444	Relay 4 Maximum ON Time	mmm:ss	000:00
				P445	Relay 4 Minimum OFF Time	mmm:ss	000:00
			RELAY 5	P450	Relay 5 Mode	-	Fault
				P451	Relay 5 PV ON Point	as P200	0
				P452	Relay 5 PV OFF Point	as P200	0
				P453	Relay 5 Minimum ON Time	mmm:ss	000:00
				P454	Relay 5 Maximum ON Time	mmm:ss	000:00
				P455	Relay 5 Minimum OFF Time	mmm:ss	000:00
			ALARM	P490	Rising level alarm delay	mmm:ss	000:00
				P491	Relay operations	-	0
				P492	Relay operations relay select	-	Disabled
				P493	Relay runtime	hh.mm	00:00
				P494	Relay runtime relay select	-	Disabled
				P495	Pump efficiency limit	-	0
				P496	Pump Efficiency relay select	-	0
				P497	No activity delay	hh:mm	00:00
				P498	No activity relay	-	0

A2.3.7.1 Menu structure and parameter list for the MSC901/MSCLOG

		TOTALISER			Totaliser Wizard	-	0
				P530	Totaliser Factor	-	0
				P531	Totaliser Units	-	None
				P534	Totaliser Pulse width	ms	100
				P535	Sampler Factor	-	0
		ALARM		P540	PV Out of Limits	-	None
				P541	Current Output Saturated	-	None
				P542	Logging Memory Filling	-	None
				P543	Digital Input 1 Active	-	None
				P544	Maximum number of retries	-	None
				P545	Current Input Saturated	-	None
				P547	Rising level	-	None
			RELAY	P548	Relay operations	-	None
				P549	Relay runtime	-	None
				P550	Pump efficiency	-	None
				P551	No activity	-	None
		FAULT		P560	System Fault Alarm	-	Both
				P561	Control Unit Temperature over Limits	-	None
				P562	Transmitter Fault	-	Both
		DISPLAY		P570	Display Select 1 (upper)	-	P731-Time
				P571	Display Select 2 (mid)	-	D800-PV
				P572	Display Select 3 (lower)	-	Bargraph
				P573	Decimal places	-	3
				P575	Backlight On/Off	-	On
	LOGGING				Logging Wizard	-	0
				P590	Logging interval	min	0
				P591	Fast logging select mode	as P200	0 (=Off)
				P592	Do/Do not overwrite old data	-	On
				P593	Low Memory Alarm Threshold	%	0
	SYSTEM	TEST	AUTO-CYCLE		Self Test	-	-
			DISPLAY		Display Test	-	-
			CURRENT INPUT		4mA input adjust	-	-
					20mA input adjust	-	-
			CURRENT OUTPUT	P700	4mA output adjust	-	-
				P701	20mA output adjust	-	-
				P702	Set Current	mA	0
		DEFAULTS			DEFAULTS	-	-
		COMMS		P710	Comms Address	-	0
				P711	Interface Type	-	Log download
				P712	Baud Rate	-	9600
				P713	No. of Start Bits	-	1
				P714	No. of Data Bits	-	8
				P715	Parity of Data	-	Even
				P716	No. of Stop Bits	-	1
		SETTINGS		P730	Date	-	01/01/00
				P731	Time	-	-
				P734	Date format	-	dd/mm/yy
				P735	Keypad Sound On/Off	-	On
				P737	Language	-	English
				P740	Personal Identification Code	-	0000
					Xmtr Wizard	-	0
		FIXED		D750	Model Code	-	MCU902WX-A
				D751	Serial Number - Control Unit	-	000000
				D752	Hardware Revision	-	8
				D753	Software Version	-	12
			HART	D760	Manufacturer's Code	-	Sol. Mobrey
				D761	Unique ID	-	000000
				D762	Universal Command Revision	-	5
				D763	Transmitter Spec. Command Rev.	-	1
				D764	Preamble Bytes	-	5
				D765	Flags	-	1

MONITOR	READINGS	ANSWERS		D800	Primary Variable	as P200	-
				D801	Secondary Variable	as P201	-
				D802	Tertiary Variable	as P202	-
				D803	Fourth Variable	as P203	-
				D804	Ullage	as P200	-
				D805	% Current Output	%	-
				D806	Current output	mA	-
				D809	Rate of Change	PV/min	-
		RELAY	RELAY OPERATIONS	D811	Relay 1 Operations	-	0
				D812	Relay 2 Operations	-	0
				D813	Relay 3 Operations	-	0
				D814	Relay 4 Operations	-	0
				D815	Relay 5 Operations	-	0
				D820	Relay Status	-	-
			RELAY RUN TIME	D821	Relay 1 Run-Time	hh:mm	-
				D822	Relay 2 Run-Time	hh:mm	-
				D823	Relay 3 Run-Time	hh:mm	-
				D824	Relay 4 Run-Time	hh:mm	-
				D825	Relay 5 Run-Time	hh:mm	-
				D828	Totaliser 1 Value	P531	-
				D830	Alarm report	-	None
				D831	Fault report	-	None
	DIAGNOSTICS			D835	Digital input status	-	-
				D840	Current input	mA	-
				D842	Current input %	%	-
				D844	Temperature of Control Unit	°C	-
				D845	Time to next Pump Down	hh:mm	-
				D846	Logging Memory Free	%	-
				D848	Date of Last Change	dmy	--/--/--
				D849	Date of 1st Power-On	dmy	--/--/--
		CHANNELS		D851	Channel 1 output	P201	-
		PUMP EFFICIENCY		D861	Pump efficiency RL1	%	-
				D862	Pump efficiency RL2	%	-
				D863	Pump efficiency RL3	%	-
				D864	Pump efficiency RL4	%	-
DIRECT	Pxxx				-	-	-
	Dxxx				-	-	-

A2.3.7.2 Menu structure and paramter list for the MSC902

Function Menu Option	Sub-menu Level 1	Sub-menu Level 2	Sub-menu Level 3	Par No.	Parameter Name	Units	Default
Cancel Password					Cancel Password	-	-
Go Offline ?					Go Online/Offline ?	-	-
SETUP	PV CALCULATION	CHANNEL 1		P111	Channel 1 Input Source	-	Tx1 : PV
				P112	Channel 1 Input Offset	-	0
				P113	Channel 1 Profile	-	Scaled
				P114	Channel 1 Input Scale Factor	-	1
				P115	Channel 1 Non-Linear Data	-	0
				P116	Channel 1 Post Scale NLP	-	1
				P117	Channel 1 Low Cut-off	as P201	AUTO
		CHANNEL 2		P121	Channel 2 Input Source	-	Tx2 : PV
				P122	Channel 2 Input Offset	-	0
				P123	Channel 2 Profile	-	Scaled
				P124	Channel 2 Input Scale Factor	-	1
				P125	Channel 2 Non-Linear Data	-	0
				P126	Channel 2 Post Scale NLP	-	1
				P127	Channel 2 Low Cut-off	as P202	AUTO
		>		P150	Output Mapping	-	Ch1
		>		P151	MCU Fourth Variable Source	-	Tx1 : FV
		>		P321	Current Input 1 Damping	sec	5
	DUTY(Mode)	>			Duty Wizard	-	0
		UNITS		P200	PV Units	-	%
				P201	SV Units	-	%
				P202	TV Units	-	%
				P203	FV Units	-	°C
		PV DAMPING		P210	Output PV Damping	s	0
		>		P240	Description	-	MCU CONTROL
		>		P241	Message	-	MESSAGE
		>		P242	Tag Number - Control Unit	-	MSP2000
		CUSTOM		P250	Start On	-	None
				P251	Stop On	-	None
				P252	Stop If	-	None
				P253	Start Time	hh.mm	07:00
				P254	Interval	hh.mm	01:00
				P255	Start Time #2	hh.mm	00:00
				P256	Interval #2	hh.mm	00:00
				P257	Max Retries	-	10
		OVERRIDES		P270	Auto Sequence Enable	-	Off
				P271	Auto Sequence Qualifier	-	0
				P272	Pump-down Relay	-	0
				P273	Pump-down Interval	hh.mm	00:00
				P274	Pump-down Duration	hh.mm	00:00
				P275	Energy Saving Start Time	hh.mm	00:00
				P276	Energy Saving Relay Select	-	0
				P277	Scum Line Prevention variance	-	0
				P278	Scum Line Prevention relay	-	0
	DIGITAL INPUT	DIGITAL INPUT 1		P340	Digital Input 1 Action	-	Free
				P341	Digital Input 1 Delay	mmm:ss	000:00
				P342	Digital Input 1 On State	-	Closed
		DIGITAL INPUT 2		P345	Digital Input 2 Action	-	Free
				P346	Digital Input 2 Delay	mmm:ss	000:00
				P347	Digital Input 2 On State	-	Closed
	OUTPUT	CURRENT OUTPUT		P400	Lower range value	as P200	0
				P401	Upper range value	as P200	100
				P402	Alarm action	-	3.6mA
		RELAY			Relay Wizard	-	0
					Reset RL Params		
			RELAY 1	P410	Relay 1 Mode	-	None
				P411	Relay 1 PV ON Point	as P200	0
				P412	Relay 1 PV OFF Point	as P200	0
				P413	Relay 1 Minimum ON Time	mmm:ss	000:00
				P414	Relay 1 Maximum ON Time	mmm:ss	000:00
				P415	Relay 1 Minimum OFF Time	mmm:ss	000:00
			RELAY 2	P420	Relay 2 Mode	-	None
				P421	Relay 2 PV ON Point	as P200	0
				P422	Relay 2 PV OFF Point	as P200	0
				P423	Relay 2 Minimum ON Time	mmm:ss	000:00
				P424	Relay 2 Maximum ON Time	mmm:ss	000:00
				P425	Relay 2 Minimum OFF Time	mmm:ss	000:00
			RELAY 3	P430	Relay 3 Mode	-	None
				P431	Relay 3 PV ON Point	as P200	0
				P432	Relay 3 PV OFF Point	as P200	0
				P433	Relay 3 Minimum ON Time	mmm:ss	000:00
				P434	Relay 3 Maximum ON Time	mmm:ss	000:00
				P435	Relay 3 Minimum OFF Time	mmm:ss	000:00
			RELAY 4	P440	Relay 4 Mode	-	None
				P441	Relay 4 PV ON Point	as P200	0
				P442	Relay 4 PV OFF Point	as P200	0
				P443	Relay 4 Minimum ON Time	mmm:ss	000:00
				P444	Relay 4 Maximum ON Time	mmm:ss	000:00
				P445	Relay 4 Minimum OFF Time	mmm:ss	000:00

			RELAY 5	P450	Relay 5 Mode	-	Fault
				P451	Relay 5 PV ON Point	as P200	0
				P452	Relay 5 PV OFF Point	as P200	0
				P453	Relay 5 Minimum ON Time	mmm:ss	000:00
				P454	Relay 5 Maximum ON Time	mmm:ss	000:00
				P455	Relay 5 Minimum OFF Time	mmm:ss	000:00
			ALARM	P490	Rising level alarm delay	mmm:ss	000:00
				P491	Relay operations	-	0
				P492	Relay operations relay select	-	Disabled
				P493	Relay runtime	hh.mm	00:00
				P494	Relay runtime relay select	-	Disabled
				P495	Pump efficiency limit	-	0
				P496	Pump Efficiency relay select	-	0
				P497	No activity delay	hh:mm	00:00
				P498	No activity relay	-	0
		TOTALISER			Totaliser Wizard	-	0
				P530	Totaliser 1 Factor	-	0
				P531	Totaliser 1 Units	-	None
				P532	Totaliser 2 Factor	-	0
				P533	Totaliser 2 Units	-	None
				P536	Totaliser 2 Source	-	None
				P534	Totaliser Pulse width	ms	100
				P535	Sampler Factor	-	0
			ALARM	P490	Rising level alarm delay	mmm:ss	000:00
				P491	Relay operations	-	0
				P492	Relay operations relay select	-	Disabled
				P493	Relay runtime	hh.mm	00:00
				P494	Relay runtime relay select	-	Disabled
				P495	Pump efficiency limit	-	0
				P496	Pump Efficiency relay select	-	0
				P497	No activity delay	hh:mm	00:00
				P498	No activity relay	-	0
		TOTALISER			Totaliser Wizard	-	0
				P530	Totaliser 1 Factor	-	0
				P531	Totaliser 1 Units	-	None
				P532	Totaliser 2 Factor	-	0
				P533	Totaliser 2 Units	-	None
				P536	Totaliser 2 Source	-	None
				P534	Totaliser Pulse width	ms	100
				P535	Sampler Factor	-	0
		ALARM		P540	PV Out of Limits	-	None
				P541	Current Output Saturated	-	None
				P542	Logging Memory Filling	-	None
				P543	Digital Input 1 Active	-	None
				P544	Maximum number of retries	-	None
				P545	Current Input Saturated	-	None
				P547	Rising level	-	None
			RELAY	P548	Relay operations	-	None
				P549	Relay runtime	-	None
				P550	Pump efficiency	-	None
				P551	No activity	-	None
		FAULT		P560	System Fault Alarm	-	Both
		FAULT		P561	Control Unit Temperature over Limits	-	None
		FAULT		P562	Transmitter Fault	-	Both
		DISPLAY		P570	Display Select 1 (upper)	-	P731-Time
		DISPLAY		P571	Display Select 2 (mid)	-	D800-PV
		DISPLAY		P572	Display Select 3 (lower)	-	Bargraph
		DISPLAY		P573	Decimal places	-	3
		DISPLAY		P575	Backlight On/Off	-	On
	LOGGING				Logging Wizard	-	0
				P590	Logging interval	min	0
				P591	Fast logging select mode	as P200	0
				P592	Do/Do not overwrite old data	-	On
				P593	Low Memory Alarm Threshold	%	0
	SYSTEM	TEST	AUTO-CYCLE		Self Test	-	-
		TEST	DISPLAY		Display Test	-	-
		TEST	CURRENT INPUT		4mA input adjust	-	-
		TEST	CURRENT INPUT		20mA input adjust	-	-
		TEST	CURRENT OUTPUT	P700	4mA output adjust	-	-
		TEST	CURRENT OUTPUT	P701	20mA output adjust	-	-
		TEST	CURRENT OUTPUT	P702	Set Current	mA	0
		DEFAULTS			DEFAULTS	-	-
		COMMS		P710	Comms Address	-	0
		COMMS		P711	Interface Type	-	Log download
		COMMS		P712	Baud Rate	-	9600
		COMMS		P713	No. of Start Bits	-	1
		COMMS		P714	No. of Data Bits	-	8
		COMMS		P715	Parity of Data	-	Even
		COMMS		P716	No. of Stop Bits	-	1

		SETTINGS		P730	Date	-	01/01/00
		SETTINGS		P731	Time	-	-
		SETTINGS		P734	Date format	-	dd/mm/yy
		SETTINGS		P735	Keypad Sound On/Off	-	On
		SETTINGS		P737	Language	-	English
		SETTINGS		P740	Personal Identification Code	-	0000
		>			Xmtr Wizard	-	0
		FIXED		D750	Model Code	-	MCU902WX-A
		FIXED		D751	Serial Number - Control Unit	-	000000
		FIXED		D752	Hardware Revision	-	8
		FIXED		D753	Software Version	-	12
		FIXED	HART	D760	Manufacturer's Code	-	Sol. Mobrey
		FIXED	HART	D761	Unique ID	-	000000
		FIXED	HART	D762	Universal Command Revision	-	5
		FIXED	HART	D763	Transmitter Spec. Command Rev.	-	1
		FIXED	HART	D764	Preamble Bytes	-	5
		FIXED	HART	D765	Flags	-	1
MONITOR	READINGS	ANSWERS		D800	Primary Variable	as P200	-
		ANSWERS		D801	Secondary Variable	as P201	-
		ANSWERS		D802	Tertiary Variable	as P202	-
		ANSWERS		D803	Fourth Variable	as P203	-
		ANSWERS		D804	Ullage	as P200	-
		ANSWERS		D805	% Current Output	%	-
		ANSWERS		D806	Current output	mA	-
		>		D809	Rate of Change	PV/min	-
		RELAY	RELAY OPERATIONS	D811	Relay 1 Operations	-	0
		RELAY	RELAY OPERATIONS	D812	Relay 2 Operations	-	0
		RELAY	RELAY OPERATIONS	D813	Relay 3 Operations	-	0
		RELAY	RELAY OPERATIONS	D814	Relay 4 Operations	-	0
		RELAY	RELAY OPERATIONS	D815	Relay 5 Operations	-	0
		RELAY	>	D820	Relay Status	-	-
		RELAY	RELAY RUN TIME	D821	Relay 1 Run-Time	hh:mm	-
		RELAY	RELAY RUN TIME	D822	Relay 2 Run-Time	hh:mm	-
		RELAY	RELAY RUN TIME	D823	Relay 3 Run-Time	hh:mm	-
		RELAY	RELAY RUN TIME	D824	Relay 4 Run-Time	hh:mm	-
		RELAY	RELAY RUN TIME	D825	Relay 5 Run-Time	hh:mm	-
		>		D828	Totaliser 1 Value	P531	-
		>		D829	Totaliser 2 Value	P533	-
		>		D830	Alarm report	-	None
		>		D831	Fault report	-	None
	DIAGNOSTICS			D835	Digital input status	-	-
				D840	Current input	mA	-
				D842	Current input %	%	-
				D844	Temperature of Control Unit	°C	-
				D845	Time to next Pump Down	hh:mm	-
				D846	Logging Memory Free	%	-
				D848	Date of Last Change	dmy	--/--/--
				D849	Date of 1st Power-On	dmy	--/--/--
		CHANNELS		D851	Channel 1 output	P201	-
				D852	Channel 2 output	P202	-
		PUMP EFFICIENCY		D861	Pump efficiency RL1	%	-
				D862	Pump efficiency RL2	%	-
				D863	Pump efficiency RL3	%	-
				D864	Pump efficiency RL4	%	-
DIRECT	Pxxx				-	-	-
	Dxxx				-	-	-