



Operating Manual
Model 9010/9020 SIL
Control Unit



Order No.: 10171754/00



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1 Safety Regulations

1.1 Correct Use

The Control Unit 9010/9020 SIL, hereafter called control unit, is designed for use as fixed gas warning device. It is used to monitor industrial premises and installations for combustible, explosive and toxic gases or air/vapour mixtures and for oxygen content.

The control unit provides:

- power for the connected detectors and transmitters
- signal conditioning and display of measured gas concentrations
- alarm thresholds
- outputs for external peripherals (horns, beacons. etc.)
- self-monitoring diagnostics
- 4-20 mA output (not intended for safety related applications).

The unit can be used for:

EX-monitoring: to protect operational plants and workers by continuously monitoring the atmospheres for potentially explosive gases/vapours in air before they reach the lower explosion limit – activating alarms and initiating risk aversion measures. The control unit is in conformance with ATEX directive.

OX-monitoring to protect individuals by continuously monitoring the atmosphere for oxygen deficiency or oxygen enrichment or monitoring the inerting of operational plants. The control unit is in conformance with ATEX directive.

TOX-monitoring to protect individuals by continuously monitoring toxic gas concentrations in the atmosphere.

If the set limit values are reached; e.g. maximum/minimum concentration in the atmosphere, an alarm will be activated.

Typical applications are:

- Chemical and petrochemical industry
- Paint and solvent industry
- Gas-processing industry
- Wastewater treatment plants or similar municipal facilities



WARNING!

In case of operation with catalytic combustion detectors: To guarantee the unambiguity of catalytic combustion detector operation, it must be made sure (e.g. by checking with hand-held test instruments) each time before turning on the detectors and the system that the environmental atmosphere to be monitored by the detectors does not contain dangerous gas concentrations of combustible gases.

It is imperative that this operating manual be read and observed when using the device. In particular, the safety instructions, as well as the information for the use and operation of the device, must be carefully read and observed. Furthermore, the national regulations applicable in the user's country must be taken into account for a safe use.

 **WARNING!**

This device is supporting life and health. Inappropriate use, maintenance or servicing may affect the function of the device and thereby seriously compromise the user's life.

Before use the device operability must be verified. The device must not be used if the function test is unsuccessful, it is damaged, a competent servicing/maintenance has not been carried out, genuine MSA spare parts have not been used.

Alternative use, or use outside this specification will be considered as non-compliance. This also applies especially to unauthorised alterations to the device and to commissioning work that has not been carried out by MSA or authorised persons.

1.2 Liability Information

MSA accepts no liability in cases where the device has been used inappropriately or not as intended. The selection and use of the device are the exclusive responsibility of the individual operator.

Product liability claims, warranties and guarantees made by MSA with respect to the device are voided, if it is not used, serviced or maintained in accordance with the instructions in this manual.

2 Description

The control unit enables connection of one or two detectors/transmitters, depending on its design. The board is available in two versions:

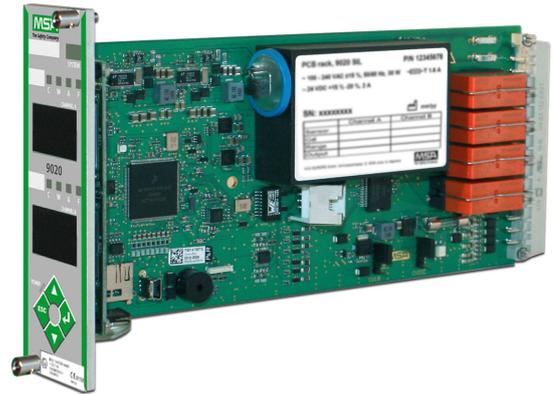
- **Control Unit 9010 SIL** for connecting one general purpose input (catalytic combustion detector or semiconductor detector or 4/20 mA transmitter)
- **Control Unit 9020 SIL** for connecting two general purpose inputs (catalytic combustion detectors, semiconductor detectors or 4/20 mA transmitters)

Both versions are available in the following installation options:

- 19" rack module - to be used as plug-in module into a standard 19" rack (Fig. 1 and Fig. 2)
- Wall mounted unit for direct wall installation (Fig. 3 and Fig. 4).



1 9010 rack board version



2 9020 rack board version



3 9010 wall mounted version



4 9020 wall mounted version

The Control Unit 9010/9020 SIL fulfils the requirements of ATEX directive as well as SIL 2 requirements based on EN 61508 standard.

The control units connected to detectors or transmitters that operate in potentially hazardous areas must be configured according to ATEX directive requirements for detection of combustible gases or oxygen.

Besides the ATEX configuration, the control unit can be configured for the use of individual channels depending on different application requirements.

Main features of the control unit:

- Passive catalytic and semiconductor detectors or 4-20 mA transmitters using 2 or 3 wire connection can be connected.
- Input can be configured as dual state (digital) inputs
- Front panel LCD display and four key keypad (up, down, ESC, Enter) for ease of configuration and calibration. Specific messages on the display inform and identify any operational failure and any erroneous data setting.
- 3 alarm thresholds (C- CAUTION, W- WARNING, A- ALARM) based on preset values.
- Intermittent module diagnostics for information on module status and drive failure relay in case of module or connected detectors malfunction.
- Indication of output alarms via relay contacts.
- External horn can be connected.
- The control unit provides a 0(4)-20 mA output signal; it is independent for individual channels.
- The control unit can be fully parametrized via front panel keypad.
- Passwords and access codes prevent accidental or unwanted unit configuration.

Symbols and Abbreviations Used in this Manual

	Description
ACK	Acknowledgement
EMC	Electromagnetic Compliance
FS	Full Scale
LED	Light Emission Diode
LEL	Lower Explosive Limit - measurement units for gas detection point detectors
LELm	Lower Explosion Limit meter - measurement units for gas detection open path detectors
PCB	Printed Circuit Board
SPDT	Single Pole Dual Throw
STEL	Short Time Exposure Limit
TWA	Time Weighted Exposure Limit
VAC	Alternate Current Voltage
VDC	Direct Current Voltage
SCADA	Supervisory Control and Data Acquisition
PLC	Programmable Logic Controller
DCS	Distributed Control System
SIL	Safety Integrity Level
	Earth Terminal
	Protective Conductor Terminal
	Important Note
	Caution, risk of danger (See note)

The board is available in two versions:

19" Rack Module

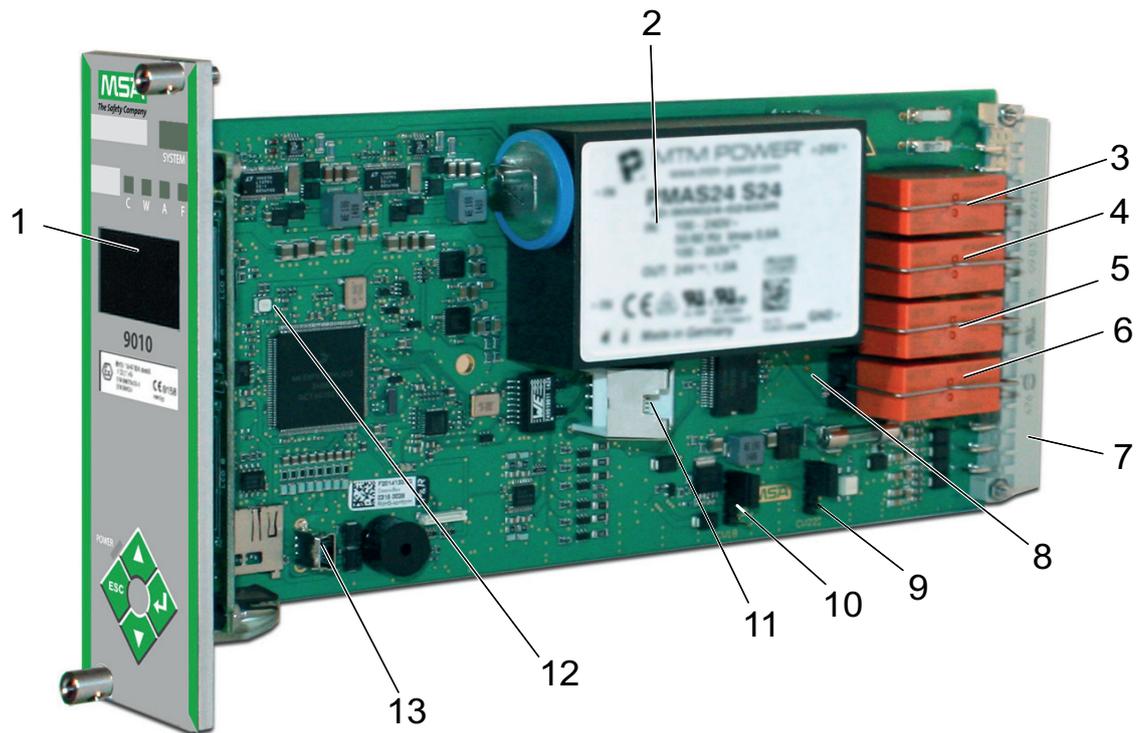


Fig. 1 19" rack module

- | | | | |
|---|---|----|--|
| 1 | Front panel with display | 8 | Hardware revision information on the PCB |
| 2 | Module power supply | 9 | Configuration jumper (CV18) |
| 3 | ALARM relay | 10 | Configuration jumpers (CV22) |
| 4 | FAILURE relay | 11 | Ethernet connector (Modbus TCP) |
| 5 | WARNING relay | 12 | "Heartbeat" LED indication (Firmware) |
| 6 | HORN relay | 13 | USB connector (for MSA service only) |
| 7 | Backplane connector - Label with actual firmware version is on the back | | |

Heartbeat LED Indication Description:

Red/green are fading on and off
LED is off

Firmware is running
Watchdog failure

Wall Mounted Unit



Fig. 2 Wall mounted unit

- | | | | |
|---|-------------------------|---|--------------------------|
| 1 | Display board connector | 2 | Backplane terminal board |
|---|-------------------------|---|--------------------------|



2.1 Front Panel

Depending on configuration, there are 2 different front panels available for 9010 Module (1 display unit) and 9020 module (2 display units).

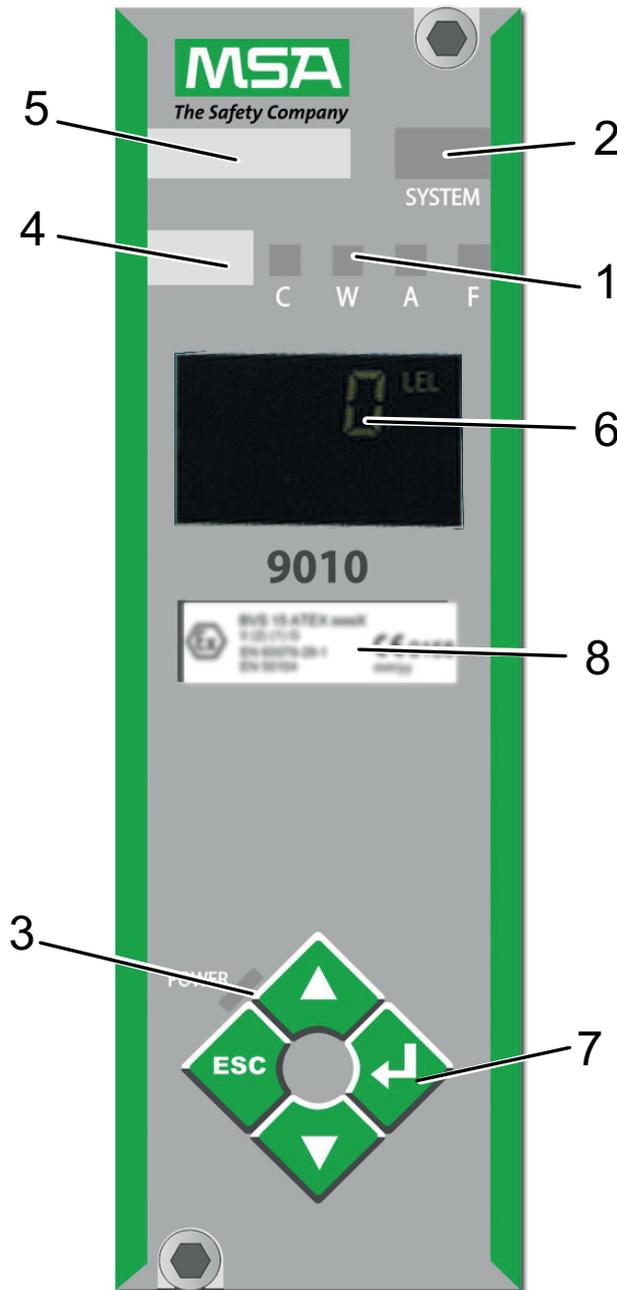


Fig. 3 9010

- 1 Status LEDs (red/yellow)
- 2 System Failure LED (yellow)
- 3 POWER LED (green)
- 4 Gas Information Tag

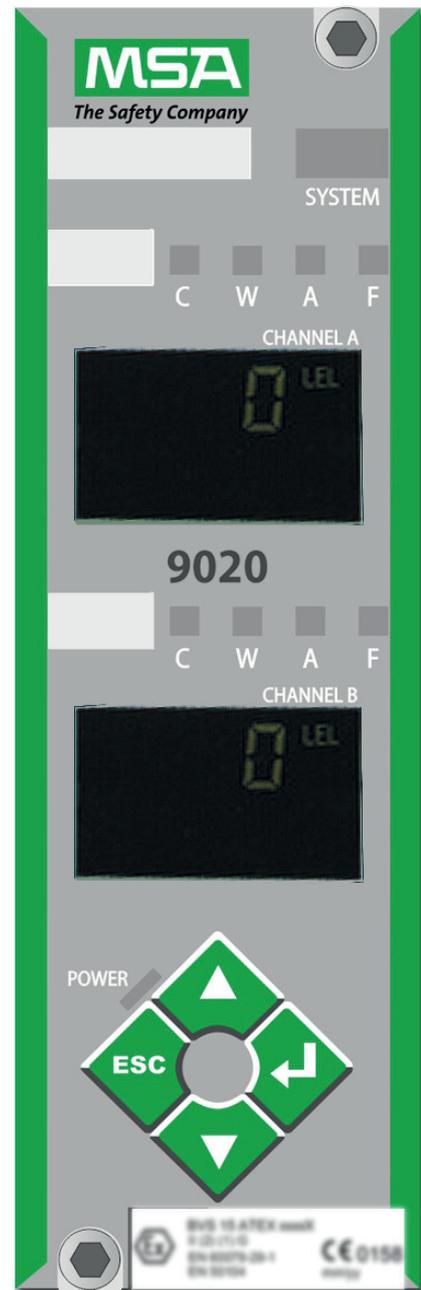


Fig. 4 9020

- 5 Site Information Tag
- 6 Display
- 7 Keypad
- 8 Approval label

GB

LEDS

	Red alarm status LEDs (C, W, A) for the optical indication of reaching the alarm thresholds.
Status LEDs	Yellow failure status LED (F) for the optical indication of a possible failure or out-of-service condition. Status LED information is available for both channels individually if Control Unit 9020 SIL is used.
SYSTEM FAILURE LED	The SYSTEM FAILURE LED lights up during system start and if an internal system failure occurs. The SYSTEM FAILURE LED information applies to both channels if Control Unit 9020 SIL is used.
POWER LED	A green LED next to the keypad. It lights up if the device is turned on and it blinks when entering an access code. The POWER LED information applies to both channels if Control Unit 9020 SIL is used.

Gas Information Tag

For specifying the gas type being monitored.

An individual gas name tag is available for each channel if Control Unit 9020 SIL is used.

Site Information Tag

For identifying the measuring site. It applies to both channels if Control Unit 9020 SIL is used.

2.2 Display

The control unit has a 4 digit back lit LCD for each measuring channel.

There is additional information available on the display besides the value of the measured gas concentration:

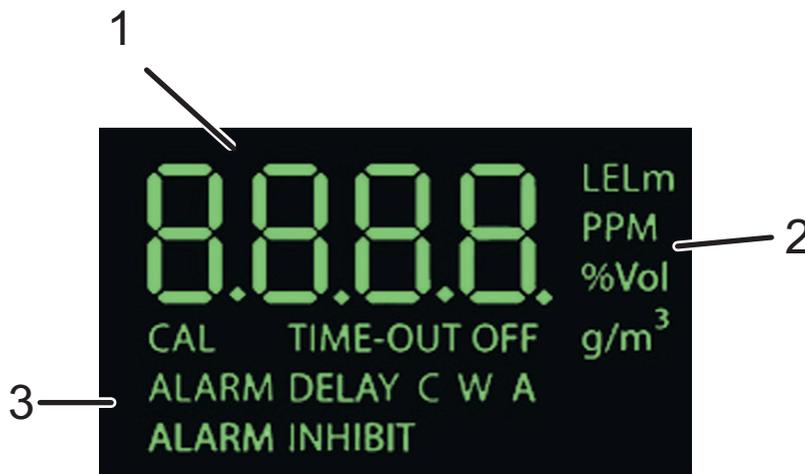


Fig. 5 Display

- 1 Measured value
- 2 Measuring units
- 3 Important unit configuration settings (CAL, TIME OUT OFF, Alarm Delay C/W/A, Alarm Inhibit)

Measured Values

The display shows the actual gas concentration. The decimal point position can be set in Access Code No.4.

Measuring Units

The measuring units can be set to LEL, LELm, PPM, %Vol, g/m3 or no units.

For more information about measuring units setting, see chapter 5.4.

Access code 4 - Configuration operations.

Status of Control Unit

ALARM INHIBIT	ALARM INHIBIT is blinking in the display of the channel with inhibited alarms. If inhibited the alarm relays will not be activated in case the measured concentration reaches the alarm level. For more information about ALARM INHIBIT see chapter 5.2 "Access code 2 - Settings for Particular Operating Conditions".
ALARM DELAY	ALARM DELAY is displayed if Alarm delay is activated for the individual channel. For more information see chapter 5.4 "Access code 4 - Configuration".
TIME-OUT OFF	TIME-OUT OFF is displayed if the TIME-OUT function is disabled. The TIME-OUT function checks if a front panel key is pressed (e.g. during configuration of the unit). For more information about TIME-OUT function see chapter 5.2 "Access code 2 - Settings for Particular Operating Conditions".
CAL	The CAL indicator provides information about the pre-set calibration term and about detector sensitivity reduction during calibration procedure. CAL indicator starts blinking if the calibration pre-set time interval expires. CAL is steadily displayed if the detector signal during the calibration is below 50 % of the signal achieved during the previous calibration. For more information see chapter 5.1 "Access Code 1 - Calibration".

2.3 Keypad

	Enter key	To select the access codes and confirm data settings	
	UP key	For increasing the value to be modified in the configuration menu	Can be used for alarms acknowledgement/horn silence and alarm reset in normal operating mode.
	Down key	For decreasing the value to be modified in the configuration menu	Can be used for alarms acknowledgement/horn silence and alarm reset in normal operating mode.
	Escape key	To leave the actual menu or cancel the changes	

2.4 Input Signal Configuration

The input configuration is set in Access Code 52, P2, see chapter 5.7.

2.5 Alarms and Overrange Functions

The alarm set-points are:

- **CAUTION (C)** caution threshold
- **WARNING (W)** warning threshold
- **ALARM (A)** alarm threshold (STEL or TWA)
- **Overrange (EEEE)** indication on the display if the full scale is exceeded (>103 %)

Exceeding the alarm set-points will cause the relevant alarm LED as well as the digital output (relay or opto-coupler) to be activated.

CAUTION, WARNING and ALARM Thresholds

The alarms can be configured in Access Code 4, which, besides setting the intervention thresholds, allows the following configuration:

- setting alarm activation in case of rising or falling signal.
- setting the status of relay coils in normal conditions (energized or not energized).

Different reset modes:

- Automatic reset (1A)
- Automatic reset with memorization of alarm event (2A)
- Manual reset (1M)
- Manual reset with memorization of alarm event (2M)

For more information on the alarm reset modes see chapter 12.1. Acknowledging an alarm (silencing the horn) and manual alarm reset can either be done with the UP or DOWN key on the front panel or be performed remotely (see TERMINAL CONNECTIONS DIAGRAMS, Fig. 7 and Fig. 8).



WARNING!

The Alarm set points are scaled in percentage related to the defined measuring range. It is necessary to check C, W, A alarm thresholds after the measuring range is modified.

ATEX mode only: C, W, A alarm thresholds can be set within the interval 0 % - 100 % FS.

Overrange indication is always active.

In the ATEX mode, the W and A relays coil is normally energized.

STEL and TWA Alarms

In the non-ATEX mode, with the measurement unit PPM, it is possible to set alarms based on 15 min (STEL) average calculation and/or on 8 h (TWA) average calculation.

STEL Average CALCULATION

Average value of last 15 measurements (any negative values are considered as 0 ppm).

The value of the STEL average will be available after 15 min from start-up. The sampling time for the calculation is 1 min.

TWA Average CALCULATION

Average value of last 480 measurements (any negative values are considered as 0 ppm).

The value of the TWA average will be available after 480 min (8 h) from start-up. The sampling time for the calculation is 1 min.

OVERRANGE

The **OVERRANGE** function indicates when 103 % of the full scale is exceeded. Refer to the status of alarms and outputs depending on the unit configuration below:

A) Input Signal is Over 103 % FS

	Non ATEX mode	ATEX Mode
Display	"EEEE"	"EEEE"
C,W,A	*Activated	*Activated
FAILURE	Activated	Activated
HORN	*Activated	*Activated
4-20 mA Output	As it is configured in Access Code 4, P20	22 mA

* Can be acknowledged by operator pressing UP or DOWN key

B) Input Signal Returns Back to Measuring Range Interval

	Non ATEX mode	ATEX Mode
Display	"EEEE" alternates with actual measured value	"EEEE" stays displayed until it is acknowledged manually
C,W,A	*Activated stays activated until it is reset manually	*Activated stays activated until it is reset manually
FAILURE	In normal state	Activated stays activated until it is reset manually
HORN	*Activated stays activated until it is reset manually	*Activated stays activated until it is reset manually
4-20 mA Output	Follows the input change	stays at 22 mA until it is reset manually

* Can be acknowledged by operator pressing UP or DOWN key

The CAUTION set-point, which threshold can be set to 100 % of full scale, can be used for the remote OVERRANGE indication.

 **WARNING!**

In case of an OVERRANGE signal, it is necessary to check that the area around a detector on site is free from dangerous gas concentration for the specific channel before an alarm reset is performed.

Failure Conditions

Besides the red alarm LEDs, the control units are equipped with a yellow LED (FAILURE) which signals possible failures of control unit functions (individual for each channel when using a Control Unit 9020 SIL). The remote indication is accomplished via a related relay (FAILURE), which is equipped with two free voltage contacts connected in series to guarantee reliability of switching function. The failure type is shown on the display, a list can be found in chapter 8.1.

SYSTEM failure condition is monitored by an internal watchdog and in case of any system malfunction the SYSTEM failure LED and the Failure relay are activated.



In the ATEX mode, the Failure relay coil is normally energized.

With Control Unit 9020 SIL, the failure is indicated once for both channels if output relays are used.

Analogue output status in failure conditions follows a setting made in Access Code 4 P20.

2.6 Configuration Jumpers

For setting some pre-defined basic features, configuration jumpers are used. There are two jumpers available on the main board (see Fig. 5 for jumper location).

Jumper CV18 - for configuration of DC power mode (internal or external).

Jumper No.	Position	Function
CV18	1-2	Internal 24 VDC power supply is used to supply the external auxiliary circuits (e.g. relays, interfaces, transmitters, etc.)
CV18	2-3	External 24 VDC power supply is used (e.g.: battery backup, power supply modules, etc.)

Jumper CV22 - for CAUTION output configuration if relays are used

Jumper No.	Position	Function
CV22	1-2	Opto-isolated CAUTION output needs the external negative on terminal 7
CV22	2-3	Opto-isolated CAUTION output uses the negative as common to the default board

For jumper identification on the main board refer to Fig. 5.

2.7 Output Signals

Relay Outputs

The control units are equipped with four SPDT relays 8A/250 VAC:

- 2 relays related to **WARNING**, and **ALARM** status,
- 1 relay related to **FAILURE** status
- 1 relay that can operate the external **HORN**.

For more information about backplane terminal board connection see chapter 3.2.

Voltage-free contacts must be used according to electrical characteristics are listed in chapter 9.

The control unit with relay outputs can be configured using Access Code 52: For more information see chapter 5.7.

If the opto-isolated CAUTION output is used and 24 VDC external power supply is not available then set CV22 in position 2-3 and CV18 in position 1-2.



CAUTION alarm is designed as an opto-isolated output only.



Common relay outputs are used for both channels related to Control Unit 9020 SIL.

Analog Outputs

The control unit provides independent analog outputs for each channel. The output signal can be configured using Access Code 2 and Access Code 4.

0-20 mA, 4-20 mA, 20-0 mA or 20-4 mA output signal can be set. For more information see chapter 5.2.

2.8 Digital Interfaces

RS485 Interface

The serial interface RS485 can be used for the connection with SCADA supervision system or other PLCs, DCS, etc.

The data transmitted on RS485 is half duplex type (38400 / 9600 baud) with Modbus protocol. See chapter 5.6 for RS485 interface setting.

Refer to Modbus documentation No.D0754156 which can be found on the enclosed CD.

USB Port

The control unit has the USB interface for connecting the control unit to the computer. The USB interface is reserved for MSA service access only.

Contact MSA for any technical questions. For local MSA contacts go to our website www.MSAafety.com.

Ethernet Interface

The control unit has a build in web interface. The web interface allows the operator to see the controller status. To access the web interface, enter the IP address of the control unit into the address bar of a web browser. The default username "Customer" and the default password "MSA" have to be entered to see all information.

See chapter 5.6 for Ethernet interface setting.

Ethernet connection is only available for the wall mounted version due to mechanical reasons.



WARNING!

For safety reasons, the 9010/9020 SIL Ethernet connection and the connected Modbus TCP Master (SCADA system or PLC) must be used in an own, separated network.

3 Installation



Before starting the installation, check that the delivered components are complete and correct by referring to the shipping documents.



WARNING!

The area where the 9010/9020 SIL control unit is installed must be outside of a hazardous area Zone 0, 1 or 2 and it must be free of ignitable, explosive or corrosive gases. Detector installation at the Control unit must be carried out according to relevant local and national regulation (EN 60079-14).

The installation location for the control unit must be outside of any potentially explosive area and free of corrosive gases. Detectors for use in the Ex area must have the appropriate Ex approval and must be installed in accordance with all relevant local and national regulations.

The gas warning system must only be installed by qualified personnel after reading the relevant documentation (instruction manual for selected detector or transmitter).

The correct assignment of each detector and control unit must be ensured during installation by referring to the serial numbers indicated on the calibration data sheet provided by MSA.

3.1 Mechanical Installation

Depending on the version the control unit can be installed as a module in 19" rack or as a stand-alone unit (wall mounted version).

Do not install the control unit in environments that are particularly humid, oxidizing, corrosive, subject to notable vibrations or in which the temperature limits listed in the Technical Data chapter are exceeded.

If installation is planned inside cabinets, the standards for maximum permissible temperature must be observed. Cabinets must provide sufficient heat convection to dissipate heat from various electronic components on the boards.

There must be sufficient space between the 19" racks allowing a good air ventilation. Sufficient space also needs to be left at the back of the rack to allowing a correct cables connection to the backplane terminal boards.

The outline dimensions of the available 19" racks can be found in the Appendix. See chapter 12.2. Backplane terminal unit screws, front panel screws (including blank panels) and rack mounting screws (M6) must be tighten with a special torque moment in 19" rack.

- 0.3 Nm for backplane terminal screws
- 0.8 Nm for front panel screws
- 10 Nm for rack mounting screws (M6)

The outline dimensions of the available 19" racks can be found in the Appendix. See chapter 12.2. Wall mounted unit installation instruction:

- (1) Mark the holes as shown in chapter 12.3 for the four fixing screws.
- (2) Drill four holes (diameter according to used screws).
- (3) Remove the lid from the housing.
- (4) Fix the control unit to the wall with appropriate screws.
- (5) Close the lid with lid screws.

In case the PCB has to be removed (for example if M4 terminal access is needed) release the 3 fixing screws. When re-installing the PCB, tighten the fixing screws using a torque of 1,5 Nm.



Fig. 6 PCB fixing screws

3.2 Electrical installation

The installation location must be chosen in accordance with environmental conditions listed in chapter 9 – Technical data.



WARNING!

The control unit must be installed in compliance with all applicable regulations, otherwise the safe operation of the control unit is not guaranteed.

During installation, use the internal earth connection to ground the instruments.

If an external earth connection is permitted or demanded by the local authorities, it serves merely as additional earthing (See Appendix 12Fig. 18).

The control units were tested and developed in compliance with the EMC directives and the current standards EMC (EN 50270). In order to guarantee conformity with the EMC standards, several rules need to be observed during the installation phase:

- Avoid installations in areas with a presence of strong electromagnetic fields.
- To connect control units to the main power supply, a failure-free ground or failure-free potential bonding conductor must be provided.
- The user must ensure an appropriate supply voltage in accordance with EMC directives.
- The main supply source must not be subjected to voltage variations exceeding the limits specified in this manual.
- The main supply source must be free of any surges and sudden voltage changes due to heavy electrical loads and disturbances caused by inductive or capacitive loads, false contacts and strong electromagnetic interference
- All detector and control cables must be shielded. Shielded cables must have at least 80 % coverage.
- Shielded cables must be laid in a group. If cable lengths are to be extended using terminal boxes, the boxes must be shielded and the internal connections must be kept as short as possible.
- If the devices are supplied using a DC power supply, the supply cable must be properly shielded.
- Control and detector cables must be installed physically separate from power supply cables, with a distance of at least 30 cm.
- External devices used (horns, beacons, motors, etc.) must be shielded from radio frequencies and must conform to EMC directives.
- MSA cannot be held liable for malfunctions and/or damage caused by electrical disturbances that are due to natural phenomena (e.g. lightning strikes).

⚠ WARNING!

When opening the control unit housing, there is a risk of high voltage danger from relay contacts and main power supply. Only authorized persons should open the control unit when it is switched off and secured against unintentional switch-on. Before opening the housing, it must be confirmed that power is off for all poles.



MSA recommends protecting the control unit with appropriate external switches (automatic switches, differential switches) as close as possible to the installed unit, the installation should comply with the standards IEC 60947-1 and IEC 60947-3.

Make the electrical connections (power supply, detectors, alarms, etc.) to the backplane terminal board of the control unit referring to the specific TERMINAL CONNECTIONS DIAGRAMS (Fig. 7 and Fig. 8) with relay or opto-isolated output.

230 VAC Internal Power Supply

The control unit is provided with an internal power supply 100 VAC - 230 VAC / 24 VDC (max. input current 0.6 A). The main supply input is protected by a non-replaceable fuses (T 1.6 A). Internal power supply can be used to supply external auxiliary devices (e.g. relays, transmitters). For this purpose the internal power supply provides 24 VDC supply output available at terminals 4 (+) and 5 (-). The maximum power that can be connected depends on the power requirements of the connected detectors / transmitters. The output is protected by a fuse.

⚠ WARNING!

No capacitive or inductive loads, maximum current for external devices 100 mA.

⚠ WARNING!

High temperatures may result in supply power reduction and can have a negative impact on the internal power supply lifetime.

24 VDC External Power Supply

The external 24 VDC power supply (e.g. battery) can be used as back up option or if main power is not available. The external 24 VDC supply input is protected by a replaceable fuse (2 A). When the control units are connected to external power supply make sure that the voltage remains within the values listed in chapter 9.

If 24 V DC power supply is used only, the user has to make sure that the controller is properly grounded.

The control unit measures the status of both of internal and external power supplies. Failure indication is displayed if any supply is out of the acceptable limits.

⚠ WARNING!

The control unit is not predisposed for battery backup charging; this function needs to be implemented by external devices.

Check Fig. 7 and Fig. 8 to identify the main and DC power supply line connection terminals. For better EMC performance external line filters are recommended to be used on both internal and external power supplies connection lines (e.g. line filters of the EPCOS SIFI-H B84113H0000B06) series).



Refer to the following table for CV18 jumper position and optimal Access Code functions setting.

Use electrical conductors suitable for the power values mentioned in chapter 9.

Supply Configuration	Jumper Position	Function
Using internal power supply only	CV18: 1-2	<p>The control unit and connected detectors are supplied from the main power supply only.</p> <p>This configuration is used if back up power supply is not required.</p> <p>Set Access Code 2: P4 as de-activated (nA)</p> <p>Set Access Code 2: P5 as activated (A)</p>
Using external 24 VDC output from internal power supply	CV18: 1-2	<p>The control unit, connected detectors and possible auxiliary devices are supplied from the main power supply only.</p> <p>This configuration is used if back up power supply is not required.</p> <p>Set Access Code 2: P4 as activated (A)</p> <p>Set Access Code 2: P5 as activated (A)</p>
Using external 24 VDC power supply only	CV18: 2-3	<p>The control unit and connected detectors and possible auxiliary use an external power supply only.</p> <p>This configuration is used if back up power supply is not required.</p> <p>Set Access Code 2: P4 as activated (A)</p> <p>Set Access Code 2: P5 as de-activated (nA)</p>
Using internal power supply with external 24 VDC backup	CV18: 2-3	<p>The control unit and connected detectors use an internal power supply. If main supply goes off, the control unit will switch over to external 24 VDC back up automatically</p> <p>The configuration is used if back up power supply is required</p> <p>Set Access Code 2: P4 as activated (A)</p> <p>Set Access Code 2: P5 as activated (A)</p>

Contact MSA for any technical questions. For local MSA contacts go to our website www.MSAafety.com.



Contacts are shown in non-energized state in the two connection diagrams.

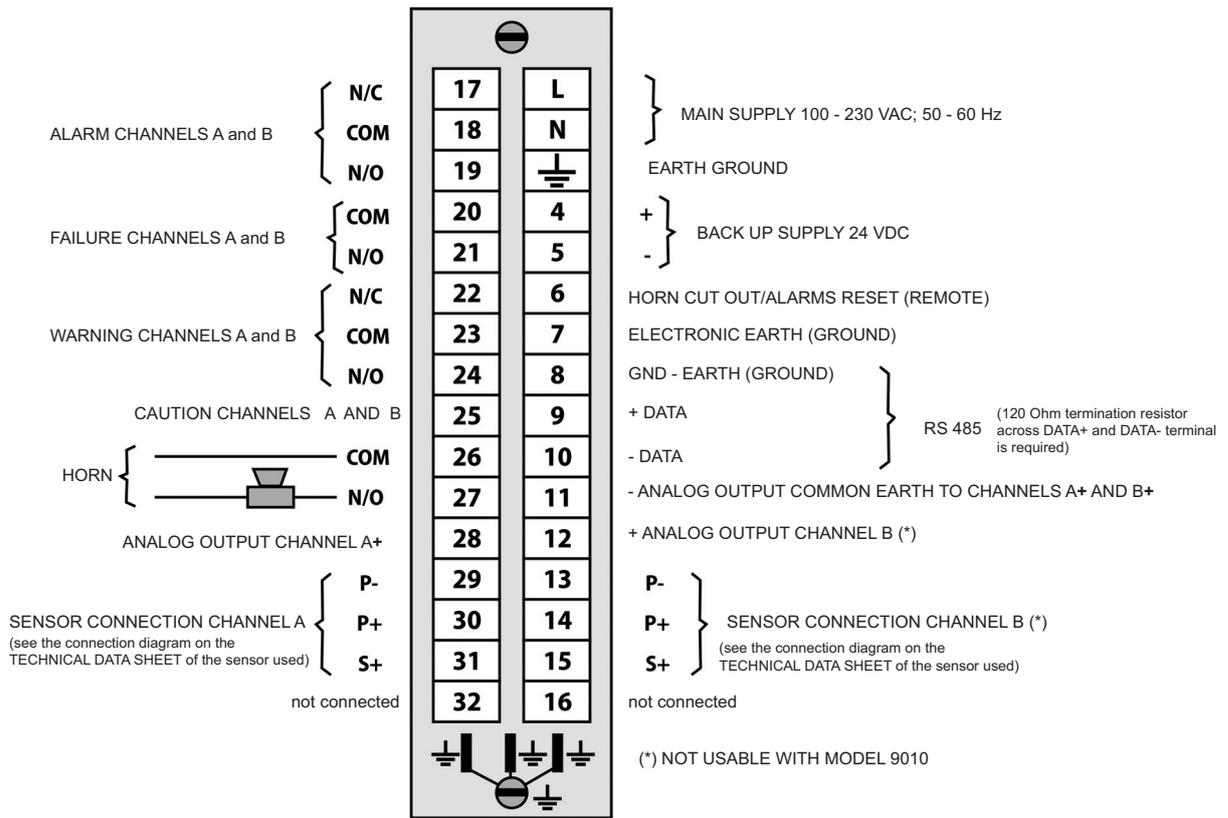


Fig. 7 19" rack version – Terminal connection with relay outputs

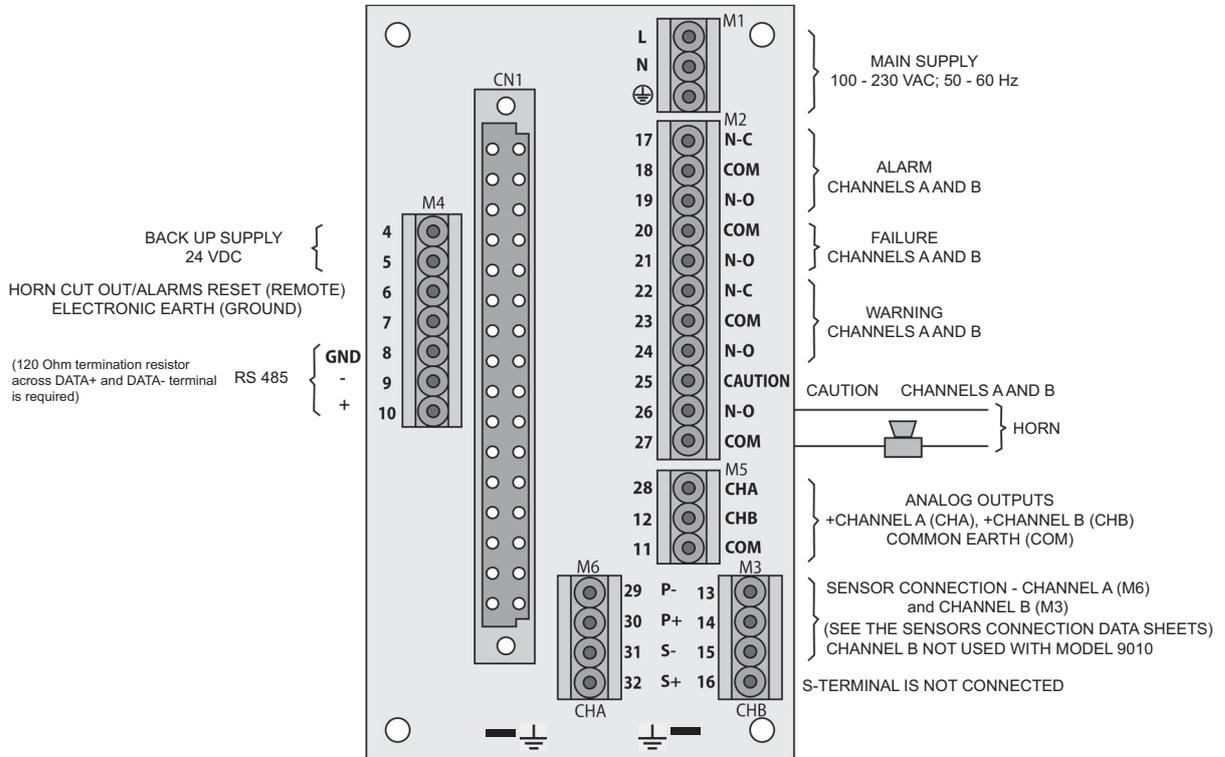


Fig. 8 Wall mounted version – Terminal connection

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Detector or Transmitter Connections

If the control unit is supplied with a pre-calibrated option for passive detectors, MSA recommends to record the serial numbers of individual modules and connected detectors for proper identification. The Control Unit 9020 SIL has one serial number for both channels (A and B), so the channel type needs to be recorded as well.

4-20 mA transmitters can be connected to the control unit depending on its configuration.

The connection of the detector to the control unit must be carried out via shielded cable unless there are different instructions from MSA.

The number of conductors necessary for connecting the detector, determined during configuration, is indicated on the CALIBRATION DATA SHEET.

Refer to diagrams in chapter 12.6 to get the minimum cable cross wiring section required.



WARNING!

The shielding of the connection cable to the detector must be uniquely connected to the screw or to the fast-on earth terminal adjacent to the backplane terminal board for connection of the control unit. It is important that the shielding from the detector side is carefully isolated. It must absolutely not be connected to the earthing screw that is located inside the detector case. The case must be connected to earth via a different conductor to be fixed to the screw on the outside of the box.

If it is necessary to install more lengths of cable between the control unit and detector, it is necessary to make the joints via welds; it is recommended to use welding for the wire terminals as well.



WARNING!

In case of operation with catalytic combustion detectors: To guarantee the unambiguity of catalytic combustion detector operation, it must be made sure (e.g. by checking with hand-held test instruments) each time before turning on the detectors and the system that the environmental atmosphere to be monitored by the detectors does not contain dangerous gas concentrations of combustible gases.

Connectable Detectors and Transmitters

The following types of active and passive MSA detectors can be connected to the 9010/9020 SIL unit:

Designation	Measuring Principle	Use	Passive detector	4-20 mA Transmitter
Series 47K*	Catalytic	EX	X	
D-7100	Catalytic	EX	X	
D-7010	Catalytic	EX	X	
DF-7100	Catalytic	EX		X
DF-7010	Catalytic	EX		X
DF-9200	Electrochemical	TOX/OX		X
DF-9500	Electrochemical	TOX/OX		X
DF-8510	Electrochemical	Fire Detection		X
Ultima XE*	Various	EX/TOX/OX		X
Ultima XIR*	Infrared	EX		X
Prima X*	Various	EX/TOX/OX		X
PrimaX IR*	Infrared	EX		X
FlameGard 5 MSIR	Infrared	Flame		X
FlameGard 5 UV/IR	Ultraviolet/ Infrared	Flame		X
FlameGard 5 UV/IR-E	Ultraviolet/ Infrared	Flame		X
Ultima MOS-5	Semiconductor	TOX		X
Ultima MOS-5E	Semiconductor	TOX		X
Ultima OPIR 5	Infrared	EX		X
UltraSonic EX-5	Acoustic	Leakage		X
UltraSonic IS-5	Acoustic	Leakage		X

*Performance compliance with EN 60079-29-1 for individual detector / transmitter was tested by notified body

For information about specific gases and vapours to be detected refer to instruction manual of individual detectors.

Check Fig. 10 and Fig. 11 to identify the detector connection terminals. For further information of individual detectors connection check chapter 12.5.

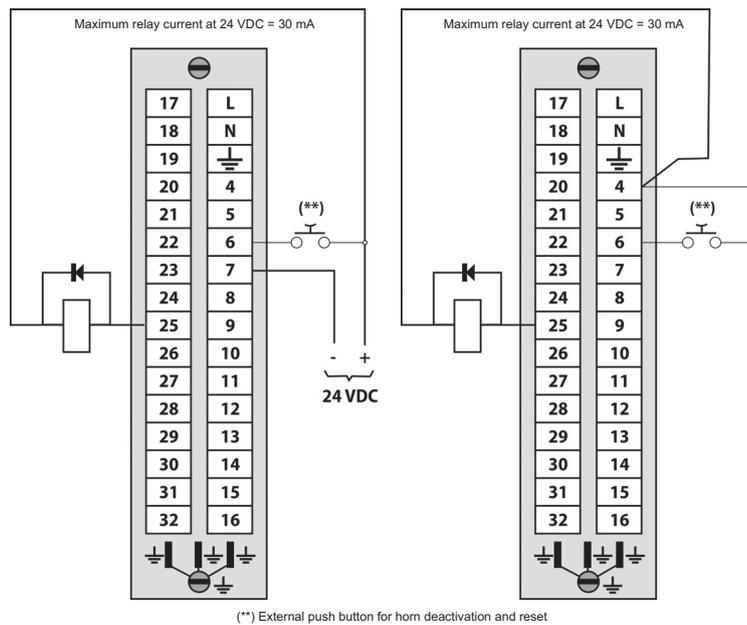


Fig. 9 „CAUTION“ output connection to external relay and for button for remote acknowledgement and alarm reset

3.3 Initial System Check after Installation

The entire system must be checked after the initial installation ensuring correct function in accordance with the EN 60079-29-2 and the applicable international, national, industry-specific or company regulations.

- (1) Run initial start-up procedure (See chapter 4.1).
- (2) Perform a functional test of connected detectors applying zero and test gas with an equivalent gas concentration (in general higher than the preset alarm thresholds).
- (3) Check whether the gas value on the display corresponds with a concentration of the test gas. Detectors providing output signal outside of their accuracy interval must be recalibrated or replaced.
- (4) Check the CAUTION, WARNING and ALARM LEDs and outputs activation as well as the HORN relay activation individually for each alarm level during the functional test.
- (5) Check the FAILURE LED and relay activation in case of detector/transmitter failure simulation.
- (6) Record test results in the protocol according to local regulations.

4 Operation

4.1 Start-Up

Before energizing the control unit, make sure that:

- Mechanical and electrical installation conforms to what is described in chapter 3 and also conforms to the valid standards.
- The serial number of the control unit corresponds to the specified detector type (for pre-calibrated version only).

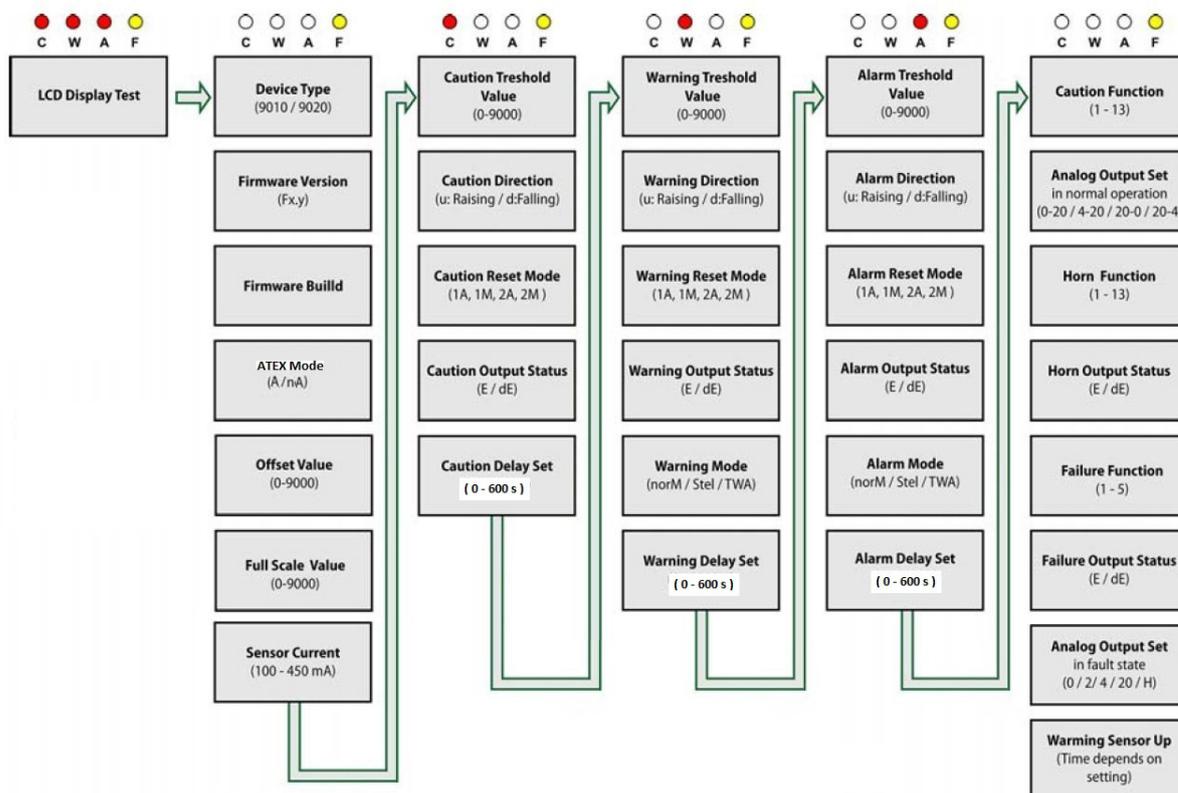
As soon as supply voltage is connected to the control unit, the start-up procedure is performed for each channel to check the correct operation of control unit and connected devices. The start-up procedure takes 2 min.

All modules which are installed in 19" rack are tested simultaneously during start-up operation.

WARNING!

At the beginning of the startup procedure, the output relays are checked. This leads to a temporary change of output contacts. It may activate an external horn or additional circuits. During the startup procedure, the alarms are inhibited and the 4/20 mA analog output is as set in Access Code 4, P20. The FAILURE indication is activated if the ATEX mode is set.

Sequence shown here for 9010 SIL:



During start-up procedure the green POWER LED on the front panel flashes.

At the end of the start-up procedure, the CAL symbol is shortly displayed and the control unit starts the regular operating mode.

The start-up procedure can be accelerated with the front keys:

- Press Enter/Up/Down key to display next item immediately.
- Press ESC key to skip the start-up procedure



Detector warm up runs in the background during the start-up procedure. If this warm up takes longer than the start-up procedure, the warming detector countdown is displayed at the end of start-up procedure.

4.2 Configuration Menu

If required, the control units are delivered already configured and calibrated by MSA based on the specifications provided by the customer. The configuration is recorded in the CALIBRATION DATA SHEET.

Modifications can be made via the various steps in each of the Access Codes recorded below. To identify various menu functions related to individual access codes refer to chapter 5.

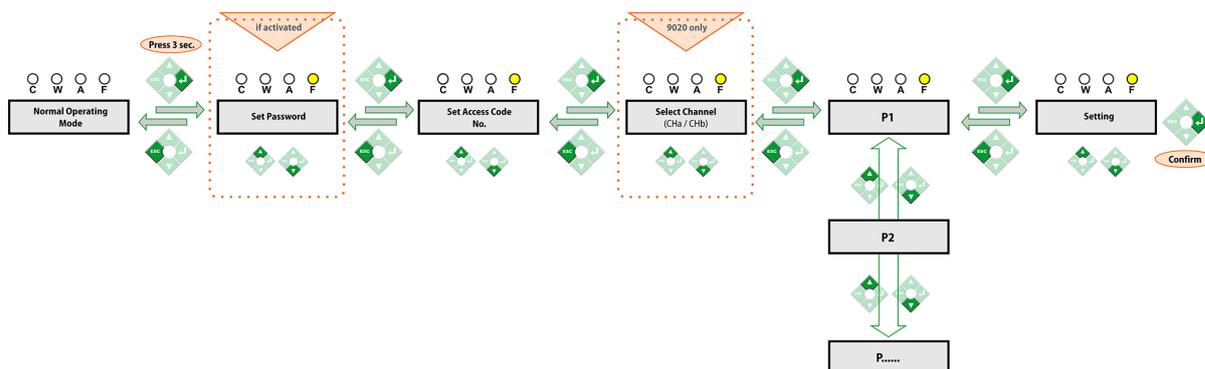
Access Code 1	Calibration
Access Code 2	Settings for particular operating conditions
Access Code 3	Simulation and function tests
Access Code 4	Configuration
Access Code 6	Basic setup
Access Code 7	Peripherals setup
Access Code 52	Input and Output Setup
Access Code 53	Default settings
Access Code 123	Access code for setup menus: 2, 4, 7, 52, 53
Access Code 223	Password setup

4.3 Use of the Keys for Access to the Codes

The Access Codes are accessed by holding down the ENTER key in normal operating mode (for approx. 3 s) until the green POWER LED on the front panel starts blinking.

To ensure greater protection against unwanted access, the password needs to be entered.

4.4 Example for Use of the Keys for Access to the Access Codes



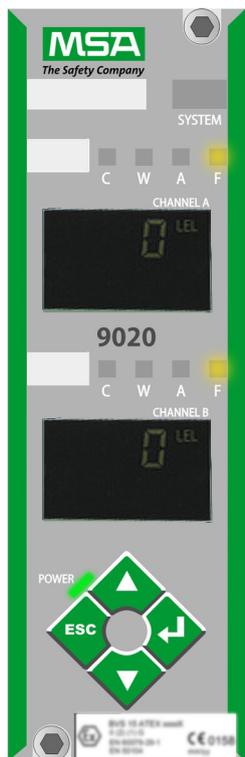
- (1) Press ENTER key for 3 seconds until the green POWER LED starts blinking.
- (2) Press the UP or DOWN key to select password. Then confirm with ENTER key.
- (3) Press the UP or DOWN key to select a desired Access Code number. Then confirm with ENTER key
- (4) For 9020 only:
 - a) CHa appears in the upper display.
 - b) Press ENTER to operate with channel A.
 - c) Press the UP key to operate with channel B
 - d) Press ENTER key to confirm the choice.
- P1 appears in the upper display.*
- (5) Press the UP or DOWN key to select a desired function (e.g. P1). Confirm with ENTER key.
- (6) Press the UP or DOWN keys to modify as necessary.
- (7) Press ENTER key to accept a new setting or press ESCAPE to leave it without change.

In order to exit the configuration menu, press ESCAPE. Depending on the position in the menu, it may be necessary to press ESCAPE several times.

The Control Unit automatically returns step by step to regular operation if the keys are not pushed within two minutes (TIME-OUT function).

The TIME-OUT function may possibly be disabled (see chapter 5.2).

ATEX mode – Operating Modes of the Control Unit with one of the Access Codes Entered



When the configuration menu is entered:

- The connected detectors are monitored in the background and alarm thresholds are active.
- The Failure LED is on (for both channels for Control Unit 9020 SIL).
- The FAILURE relay is in a state of failure.
- The value of the analog signals of both the channels follows the configuration setting. Refer to Access Code 4.

Non ATEX mode – Operating Modes of the Control Unit with one of the Access Codes Entered



When the ENTER key is released:

- The connected detectors are monitored in the background and alarm thresholds are active.

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5 Settings Parameters

5.1 Access Code 1 - Calibration

WARNING!

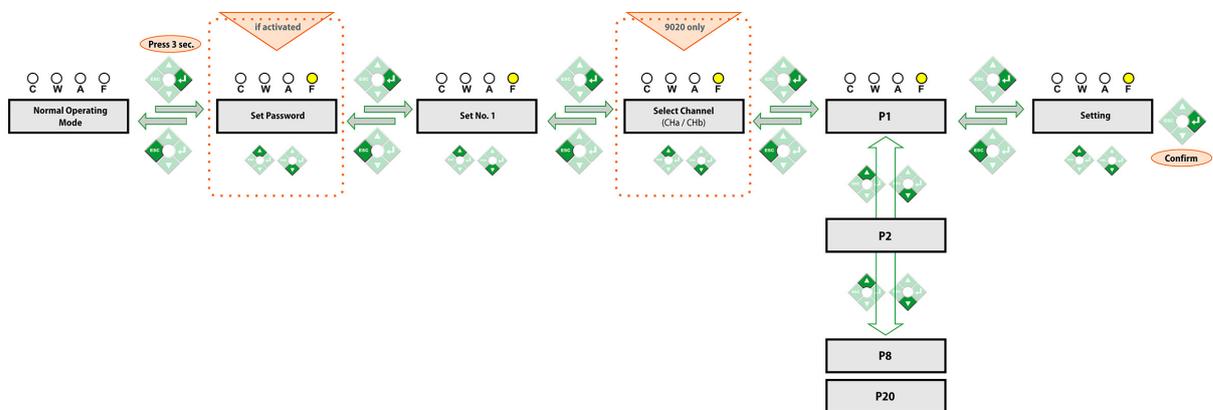
During a calibration, the detectors that are being calibrated are set to inhibit. Therefore a safe operation of the area usually monitored by the now inhibited detectors must be ensured by other means.

Entering the menu keeps outputs as follows:

- Alarms are inhibited
- 4/20 mA output is set according to Access Code 2, P2.
- Failure LED and failure relay active

WARNING!

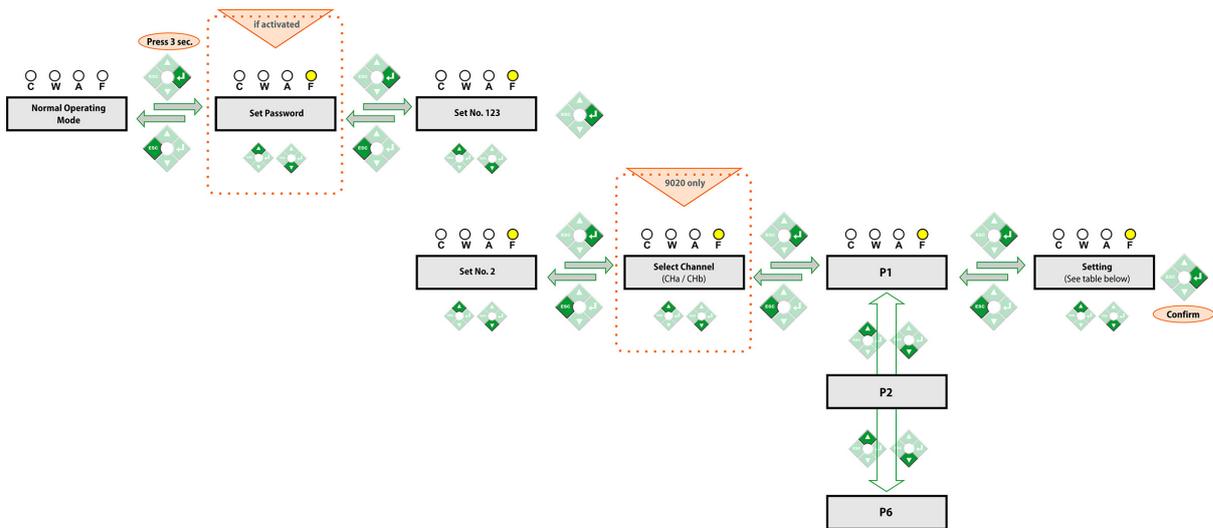
ATEX mode is active then 4-20 mA output follows setting made in Access Code 4, P 20.



Step	Function
P1	Zero Calibration Adjusting the clean air value
P2	Span Calibration Gas Concentration Possible settings: 2 % - 100 % of measuring range, default 50 %
P3	Span Calibration (Apply calibration gas with a concentration set at P2 in the detector). Confirm after value is stabilized
P4	Display Actual Gas Concentration (detected by the detector after the calibration)
P5	Display Full Scale Detector Signal at Calibration (depends on connected detector / transmitter) It displays Ux value (mV) for passive detectors or value of full scale signal (mA) for transmitters achieved during last calibration procedure.
P6	Set Time Interval between Calibrations Notification Possible settings: 0-999 days, default: 0 (disabled) CAL symbol starts blinking if calibration interval is reached.
P7	Enable 4-20 mA Transmitters Calibration Possible settings: A: enabled, nA: disabled, default: nA If enabled, then zero (4 mA) and span (20 mA) calibration signals must be within the limit interval $\pm 10\%$ from the measured value. Otherwise E1 error is displayed.

Step	Function
P8	Detector Sensitivity Reduction Warning Possible settings: A: enabled, nA: disabled, default: nA / disabled
	CAL symbol is displayed if the detector signal during the calibration is below 50 % of the signal achieved during previous calibration
P9	Display Actual Detector Signal (depends on connected detector / transmitter) It displays actual Ux value in mV for passive detectors or value in mA for transmitters.
P10	Display Full Scale Delta Detector Signal at Calibration It displays the calculated full scale delta Ux value (mV) for passive sensors or delta Ix value (mA) for transmitters achieved during last calibration procedure.
P20	Save Current Settings as User Defaults Saved user defaults can be reloaded in menu 53 P2
	stor: save user channel parameters
	sall: save all user parameters

5.2 Access code 2 - Settings for Particular Operating Conditions

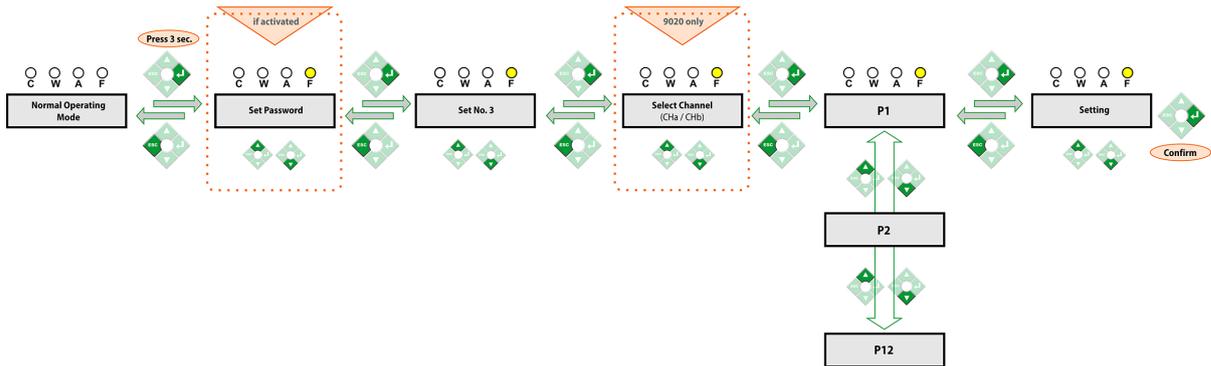


Step	Function	Note
	<p>Time Out Function</p> <p>If enabled the control unit automatically returns one step back in the menu if no key is pressed within 2 min</p> <p>Maximum time for getting into normal operating mode is 6 minutes</p> <p>A - Enabled (TIME OUT tag is off)</p> <p>d - Disabled (TIME OUT tag is blinking)</p>	
P1		For selected channel Always activated In ATEX mode
	<p>Analog Output Status Settings</p> <p>To define a status of analog output in time of channel calibration</p> <p>H = frozen - last output value is fixed</p> <p>F = fluctuating - actual measured value is displayed</p> <p>0 = 0 mA is set</p> <p>4 = 4 mA is set</p> <p>20 = 20 mA is set</p>	For selected channel Not configurable in ATEX mode. Output status is equal to the configuration in failure case Access Code 4, P20
P2		For selected channel In ATEX mode the FAILURE relay remains activated even unit returns into normal operation.
P3	<p>Inhibit Alarms</p> <p>A = alarms active,</p> <p>nA = alarms inhibited</p> <p>If inhibited then "ALARM INHIBIT" tag flashes on the display of related channel. 4-20 mA Analog signal remains active.</p>	Horn output is activated only if signal goes into OVER-RANGE status. (EEEE is shown on display)
	<p>Undervoltage Indication of External 24 VDC</p> <p>A - Enabled</p> <p>nA - Disabled</p>	It is not possible to de-enable both P4 and P5 undervoltage indications. At least one of each other must be enabled. Common for both of the channels
P4	<p>If enabled it indicates low external 24 VDC voltage (below 18 VDC).</p> <p>"LOU 1" tag alternates on display with actual gas concentration</p> <p>Failure relay is activated</p>	

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Step	Function	Note
	Undervoltage Indication of External 115/230 VAC A - Enabled nA - Disabled	
P5	If enabled it indicates a missing of 24 VDC on the output of main power supply. "LOU 2" tag alternates on display with actual gas concentration Failure relay is activated	It is not possible to de-enable both P4 and P5 undervoltage indications. At least one of each other must be enabled. Common for both of the channels

5.3 Access code 3 - Simulation and Functionality Operations Table



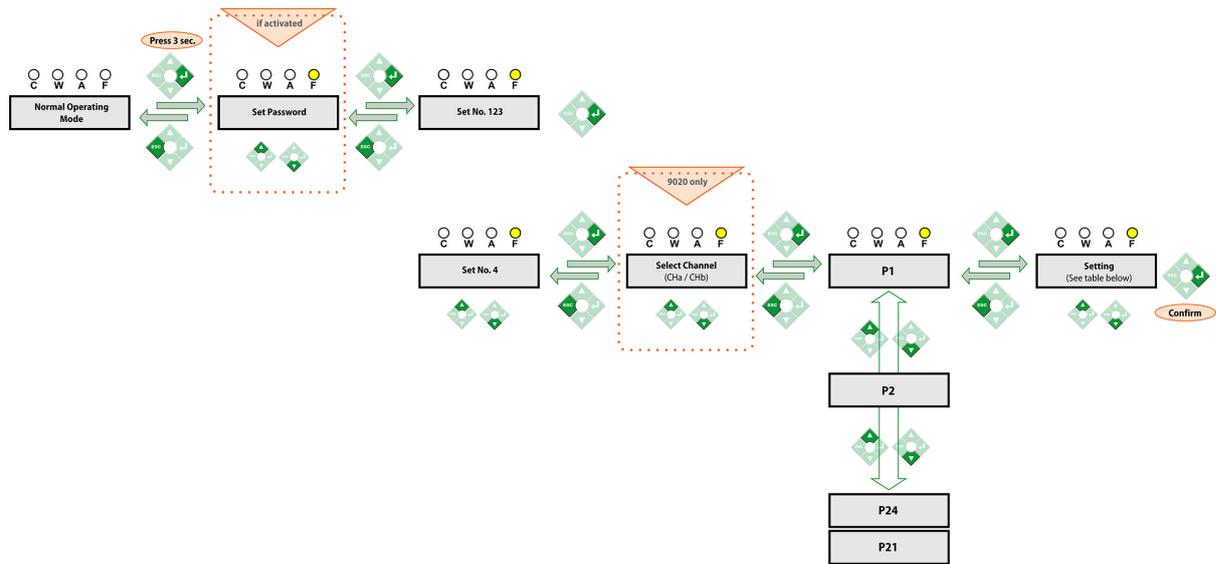
Step	Function	Note
P1	Display Test Test LCD display, front panel LEDs and internal buzzer functionality: Check proper function of all the segments of the display, LEDs light activation and buzzer sound.	System Failure LED is not activated during this test. For testing SYSTEM FAILURE LED, the control unit must be powered off and on again.
P2	Input Value Simulation (Excluding Relays) Set up desired concentration via UP and DOWN keys Alarm LEDs are active Relays are not activated. Analog output follows the simulated value level.	Press the ESCAPE key for exit
P3	Display Detector Supply Current Set Display selected supply current for catalytic combustion or semiconductor detectors If 4-20 mA transmitter or digital input is selected then "VOLT" is displayed.	
P4	Display Detector Supply Current Measured Display actual supply current.	

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Step	Function	Note
P5	<p>Display Module Parameters</p> <p>Display the following information in automatic sequence:</p> <p><i>General Information</i></p> <ul style="list-style-type: none"> • Device Type (9010/9020) • Firmware Version (Fx.y) • Firmware Build • ATEX Mode <p><i>Individual for each channel</i></p> <ul style="list-style-type: none"> • Offset Value (0-9000) • Full Scale Value (1-9000) • Detector Current (100 - 450 mA) • Caution Threshold Value (0-9000) • Caution Direction (u/d) • Caution Reset Mode (1A, 1M, 2A, 2M) • Caution Output Status (E / dE) • Caution Delay Set (0-600 s) • Warning Threshold Value (0-9000) • Warning Direction (u / d) • Warning Reset Mode (1A, 1M, 2A, 2M) • Warning Output Status (E / dE) • Warning Mode (norM / Stel / TWA) • Warning Delay Set (0-600 s) • Alarm Threshold Value (0-9000) • Alarm Direction (u / d) • Alarm Reset Mode (1A, 1M, 2A, 2M) • Alarm Output Status (E / dE) • Alarm Mode (norM / Stel / TWA) • Alarm Delay Set (0-600 s) • *Caution Function (1-13) • Analog Output Set in normal operation (0-20 / 4-20 / 20-0 / , 20-4) • *Horn Function (1-13) • Horn Output Status (E / dE) • *Failure Function (1-5) • Failure Output Status (E / dE) • Analog Output Set in failure state (0 / 2 / 3 / 4 / 20 / H) 	<p>Press Enter/Up/Down key to display next item immediately. Press ESC key to skip.</p> <p>*Caution, Horn and Failure functions are set during manufacturing process and cannot be changed by user.</p> <p>Caution, Horn and Failure functions are set to 1 as default for ATEX mode.</p>
	<p>View STEL / TWA "WARNING" Thresholds Values</p> <p>Displays the average STEL / TWA value depending on setting in Access Code 4.</p> <p>If ppm symbol is blinking then STEL or TWA time interval is not reached yet.</p>	<p>Available only if "PPM" measuring units are set.</p>

Step	Function	Note
	View STEL / TWA "ALARM" Thresholds Values	
P7	Displays the average STEL / TWA value depending on setting in Access Code 4. If ppm symbol is blinking then STEL or TWA time interval is not reached yet.	Available only if "PPM" measuring units are set.
	Input Value Simulation (Including Relays)	
P11	Allows simulating a change of gas concentration via the UP and DOWN keys with alarms unblocked. Set up desired concentration via UP and DOWN keys Alarm LEDs are active Digital outputs are active. Analog output follows the simulated value level.	If any alarm is activated during the test it can be acknowledged with ENTER. Press ESCAPE in order to exit.
	Digital Outputs Test	
P12	A change of status of all digital outputs (optocouplers or relays). Status is changed even if the alarms are blocked in Access Code 2, P3. 1 = Digital outputs remain in the configuration set in Access Code 4 2 = Digital outputs change their status compared to condition 1. When exiting P12, the status of the digital outputs will return to condition 1 automatically.	In the ATEX mode the FAILURE output does not change its state. Failure relay is already activated when entering the configuration menu.

5.4 Access code 4 - Configuration



Step	Function	Note
P1	Supply Current Possible settings: 100 - 450 mA for 9010 unit 100 - 350 mA for 9020 unit	For catalytic combustion and semiconductor detectors only.
	P2 Minimum 4-20 mA Transmitter Supply Current Possible settings: 1 - 450 mA)	If detector current is below selected value then failure F1.6 is displayed and FAILURE relay is activated.
P3	Maximum Negative Drift Set the max. allowed negative drift value (Possible settings: -1 to -10 % FS). in ATEX mode negative drift is limited to -1 to -5 % FS only.	Reaching the preset value activates the FAILURE relay and "-d1" is displayed, 4/20 mA analog output follows the setting in Access Code 4, P20.
	P4 Measuring Units Select desired measuring units from a list: (LEL, LELm, PPM, %Vol., g/m3, no unit) Selection %Vol. for oxygen analysis is possible only after the configuration of Access Code 52, P2 or P3, depending on the type of transmitter).	In ATEX mode, LEL, LELm or %Vol. units can be set only. In ATEX mode %Vol. units shall be used for oxygen detection applications only
P5	P5 Measuring Range - Offset Set minimal value of measuring range. (Possible settings 0-9000)	In ATEX mode the offset value is "0"
P6	P6 Measuring Range - Full Scale Set maximal value of measuring range. (Possible settings 0-9000) Full scale value change affects alarms set points and calibration	In ATEX mode permissible values are between 1 and 100 for the combustible gas and 1-30 % vol. for oxygen settings.

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"C" (CAUTION) SETTINGS - OUTPUT WITH OPTO-COUPLER

P7	"CAUTION" Alarm Direction and Threshold	
	Selection of the direction of activation of the alarms u: rising, d: falling Settings the alarm threshold Permissible values: 0-100 % FS	If LEL units are chosen in ATEX mode, only rising alarm type is selectable
P8	Caution Opto-Coupler State	
	E: conducting/Energized dE: not conducting/not Energized	
P9	Caution Reset Mode	
	Possible setting: 1A; 1M; 2A; 2M	
	1A = Automatic reset 1M = Manual reset	See chapter 12.1
	2A = Automatic reset with memorization of alarm event 2M = Manual reset with memorization of alarm event	
P10	Caution Delay	
	Possible setting: 0-600 s	In ATEX mode alarm delay is not possible.

"W" (WARNING) SETTINGS - OUTPUT WITH RELAY

P11	"WARNING" Alarm Direction and Threshold	
	Alarm Type u: rising, d: falling Settings the intervention threshold Permissible values: 0-100 % FS	If LEL units are chosen in ATEX mode, only rising alarm type is selectable
P12	Warning Relay State	
	E: conducting/Energized dE: not conducting/not Energized	For 9020 unit status of WARNING relay is defined in Channel A setting. In ATEX mode the relay status is always set as conducting/Energized
P13	Warning Reset Mode	
	Sequences: 1A; 1M; 2A; 2M	See chapter 12.1
P14	Warning Delay	
	Possible setting 0-600 s If PPM is set as unit of measure, the Control Unit shows the selection SteL, TuA (TWA) and norM; by selecting norM it is possible to set the delay.	In ATEX mode alarm delay is not possible.

"A" (ALARM) SETTINGS - OUTPUT WITH RELAY

P15	"ALARM" Alarm Direction and Threshold Selection of the direction of activation of the alarms u: rising, d: falling Settings the intervention threshold Permissible values: 0-100 % FS	If LEL units are chosen in ATEX mode, only rising alarm type is selectable
	Alarm Relay State E: conducting / Energized dE: not conducting / not Energized	For 9020 unit status of ALARM relay is defined in Channel A setting. In ATEX mode the relay status is always set as conducting/ energized
P17	Alarm Reset Mode Sequences: 1A; 1M; 2A; 2M	See chapter 12.1 In ATEX mode 1M and 2M reset is allowed
P18	Alarm Delay (Possible setting 0-600 s) If PPM is set as unit of measure, the Control Unit shows the selection SteL, TuA (TWA) and norM; by selecting norM it is possible to set the delay.	In ATEX mode alarm delay is not possible.

ANALOG OUTPUT SETTINGS

P19	Analog Output Settings (in Normal Operating Condition) Set Analog output configuration in normal operation Available ranges: 0-20 mA 4-20 mA 20-0 mA 20-4 mA	in ATEX mode, only 4-20 mA output is available
	Analog Output Signal Value in Case of Failure Available values: 0 mA 2 mA 3 mA 4 mA 20 mA h (hold) - Output keeps the last value before failure occurred	In ATEX mode 0, 2 or 3 mA output options are possible only

"A" (ALARM) SETTINGS - OUTPUT WITH RELAY**Decimal Places**

Defines a number of decimal places for gas concentration displayed

	Full scale range	Max.decimal places	Default setting
P21	1000 - 9000	0	0
	100 - 999	1	0
	10 - 99	2	1
	1- 9	2	2

Region

P27	CHS	Settings for region China (complies with CCCF standards)
	EU	Settings for Europe and International region (complies with ATEX standards if ATEX mode is activated)
	USA	Settings for North America region (complies with CSA standards)

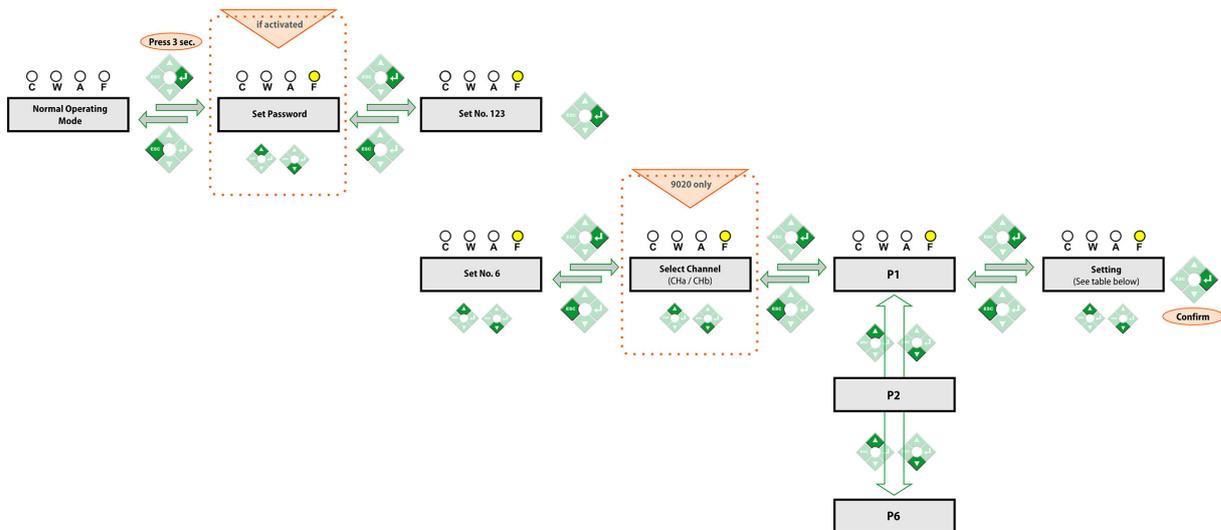
Region setting sets the unit in compliance with different regions requirements.

Only EU and International version is a subject of description in this manual. For detailed settings for other regions (China, USA) please refer to individual manuals for these regions

**WARNING!**

Setting a wrong region may result different functionality of the control unit in relation with regional standards.

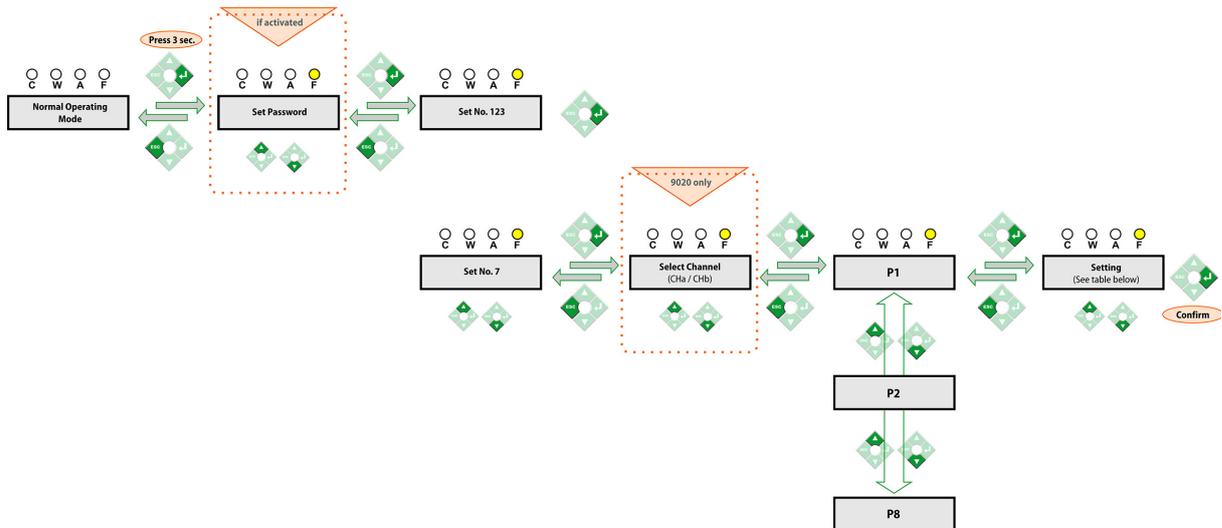
5.5 Access Code 6 - Basic Setup



Step	Function
	Display Firmware and Bootloader Version
	Example: F1.01 - Firmware version
P1	1001 - Firmware build number B1.01 - Bootloader version 1001 - Bootloader build number
	ATEX Mode
	A= ATEX mode activated
P2	nA = non ATEX mode activated If ATEX mode is set then some functions are limited according to ATEX Directive or general safety requirements
	Start-up Sound
P3	Activates sound beep in case of start-up on= enabled off = disabled
	Key Press Sound
P4	on= enabled off= disabled
	Date
P5	Set system date (YYYY/MM/DD format)
	Time
P6	Set system time (HH/MM/SS format)
	Display Serial Number
P7	Serial number is displayed in sections of 4 digits For scrolling the number on a display press ENTER key
	Set Beeper Mode
P8	Allows to set different sound options being generated by internal beeper in case of HORN relay is activated: OFF - Beeper is inhibited 1, 2, 3 - Select different number for different sound of the beeper.

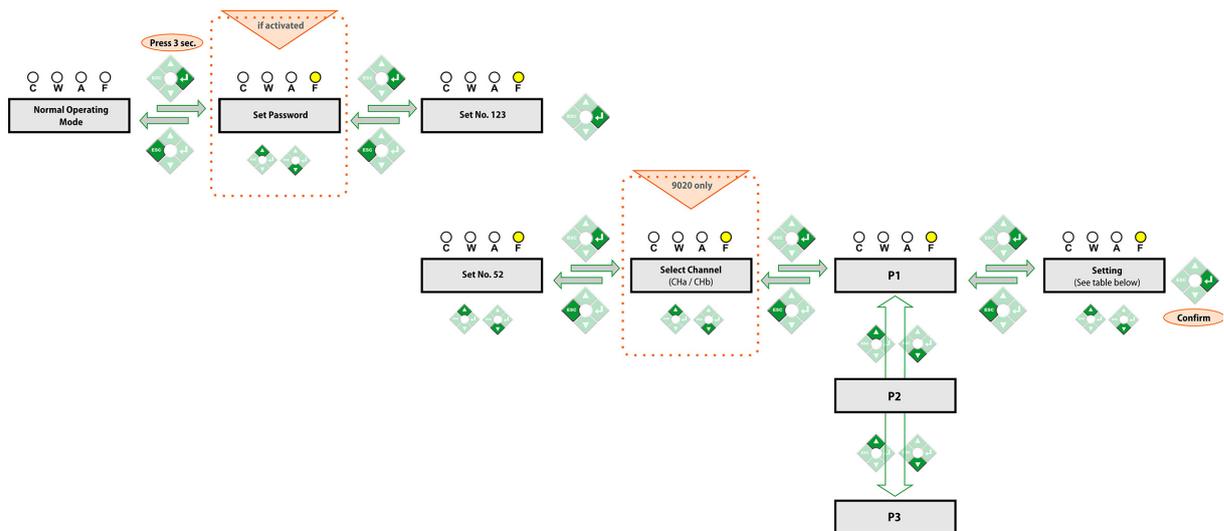
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5.6 Access Code 7 - Peripheral Addresses



Step	Function	Note
P1	RS485 Address Permissible values 1-247	
P2	RS485 Baud Rate Permissible values 9600 or 38400 Bd	Default setting is 38400
P3	Ethernet Configuration OFF - Ethernet is not enabled dhcP - IP Address provided by DHCP server Stc - Use static IP address Default: DHCP	
P4	Static IP Address setting the address in "aaa/bbb/ccc/ddd" format	
P5	Subnet Mask setting the address in "aaa/bbb/ccc/ddd" format	
P6	Gateway IP Address setting the address in "aaa/bbb/ccc/ddd" format	
P7	DNS IP Address setting the address in "aaa/bbb/ccc/ddd" format	
P8	Show IP address IP address is displayed step by step in "aaa/bbb/ccc/ddd" format	

5.7 Access code 52 - Input and Output Setup

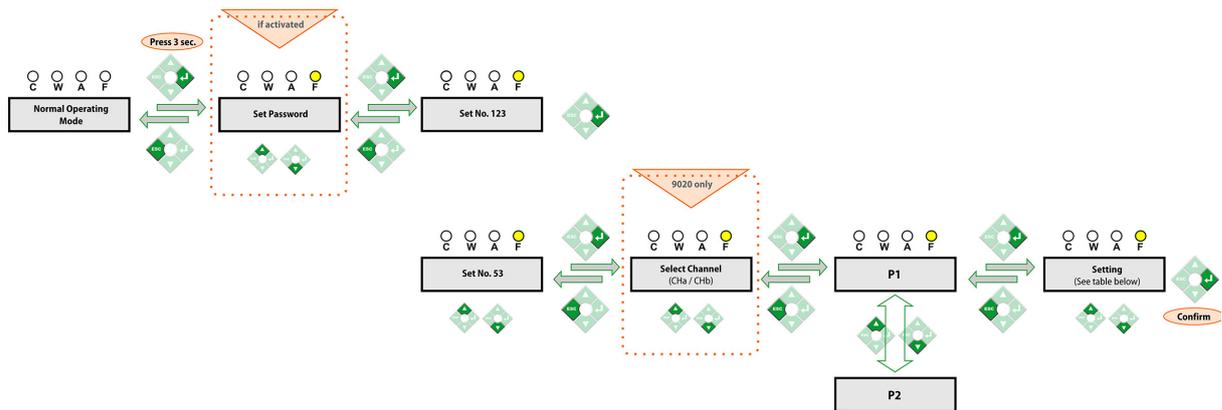


Step	Function	Note
	Digital Output Type	
P1	Define the outputs hardware configuration 1 = Relay 2 = not used	Common for both of the channels
	Input Signal Type	
P2	Setting the type of input signal 1 = catalytic combustion detectors 2 = 4-20 mA transmitters (two or three wires connection) 3 = passive semiconductor detectors 4 = digital input	If catalytic combustion detectors input is set in ATEX mode then LEL or LELm measuring units can be selected in Access Code 4 -P4 only
	Transmitter Type	
P3	Define the way how 4-20 mA transmitter is connected 2 - two wires connection 3 - three wires connection	



If the control unit is configured for connection with 4-20 mA transmitters or digital inputs according to P3 menu function then the signal input needs not to be calibrated.

5.8 Access Code 53 - Default Settings



Step	Function
P1	Load Factory Default Settings "def" symbol is displayed if menu is activated. Press ENTER to load factory default values.
P2	Load User Default Settings "defC" symbol is displayed if menu is activated. Press ENTER to load user default values.

Default Factory Configuration

Access Code	Description	Default Value
-	Overrange Function (EEEE)	A (Enabled)
-	Positive Dead Band Zero Value	+2 %
-	Negative Dead Band Zero Value	-2 %
-	Horn Output Status	dE (Normally not energized),
AC1 P2	Span Calibration Gas Concentration	50 % FS
AC1 P6	Time Interval Between Calibrations Notification	0 (Disabled)
AC1 P8	Detector Sensitivity Reduction Warning	nA (Disabled)
AC2 P1	Time out function	A (Enabled)
AC2 P2	Analog Output signal (during a calibration procedure)	2 mA
AC2 P3	Alarm Inhibited	A (Alarms active)
AC2 P4	Undervoltage of External 24 VDC	nA (Disabled)
AC2 P5	Undervoltage of External 115/230 VAC	A (Enabled)
AC4 P1	Detector Supply Current Setting	310 mA
AC4 P2	Minimum 4-20 mA Transmitter Supply Current	25 mA
AC4 P3	Maximum Negative Drift	-3%
AC4 P4	Measuring Units	LEL
AC4 P5	Offset Value	0
AC4 P6	Full Scale Value	100
AC4 P7/ P11/ P15	Alarm Direction	C / W / A - U (Rising alarm)
AC4 P7/ P11/ P15	Alarm Thresholds Values	C=15, W=15, A=30
AC4 P8/ P12/ P16	Digital Outputs Status	C / W / A - E (Energized)
AC4 P9/ P13/ P17	Alarm Reset mode	C=1A, W=1A, A=1M
AC4 P10/ P14/ P18	Alarm Mode	norM (no STEL or TWA)

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Access Code	Description	Default Value
AC4 P10/ P14/ P18	Alarm Delay	C=0, W=0. A=0 (Disabled)
AC4 P19	Analog Output Settings (in a normal operating condition)	4-20 mA
AC4 P20	Analog Output Settings (in a failure condition)	2 mA
AC4 P21	Decimal Places	0
AC4 P27	Region	EU (Europe)
AC6 P2	ATEX Mode	A (Enabled)
AC6 P3	Startup Sound	on (Enabled)
AC6 P4	Key Press Sound	on (Enabled)
AC6 P8	Beeper Mode	OFF
AC7 P1	Modbus Address	1
AC7 P2	RS485 Baud Rate	38400 bd
AC7 P3	Ethernet Configuration	DHCP
AC7 P4	Static IP Address	192.168.1.23
AC7 P5	Subnet Mask	255.255.255.0
AC7 P6	Gateway IP Address	192.168.1.1
AC7 P7	DNS IP Address	192.168.1.1
AC52 P1	Output Type	1 (Relays)
AC52 P2	Detector Type	1 (Catalytic detector)
AC223	Password	0001 (Enabled)

5.9 Access Code 223 - "Admin" Password Setup

A password enables further protection from tampering with the set data. When set, the operator must first enter the password in order to access any of the Access Codes.

Action	Display
1. Hold ENTER until green POWER LED starts blinking	
2. Set Access Code 223 using UP or DOWN keys and press ENTER to confirm	Display shows "1"
3. Press ENTER to confirm	Display shows "0"
4. Set desired password using UP, DOWN and ENTER keys (UP, DOWN keys increase or decrease the digit value, ENTER moves cursor to another digit) (permissible values: 0001-9999), if 0000 is set then password is disabled	
5. Press ENTER to confirm the setting or ESCAPE to exit without change	

The set password, cannot be displayed unless the same password is re-entered, or via the super password, known only by the MSA Technical Support Department. This super password will not be relayed to third parties. With Control Unit 9020 SIL it is sufficient to set the password once corresponding to channel A.

Use of the "Admin" Password

If one of the Access Codes is required, the pre-set password needs to be entered as specified below, the display shows 0 after ENTER has been pressed for 3 seconds.

If instead it shows 1, no access code is necessary.

Enter the password using the UP/DOWN keys. Press ENTER to confirm.

Modifying the "Admin" Password

Action	Display
1. Hold ENTER until green POWER LED starts blinking	
2. Set a preset password using UP or DOWN keys and press ENTER to confirm	
3. Set Access Code 223 using UP or DOWN keys and press ENTER to confirm	Display shows "0"
4. Press ENTER to confirm	
5. Modify the password using UP or DOWN keys (permissible values: 1-9999)	
6. Press ENTER to confirm the setting or ESCAPE to exit without change	



In case of forgetting the password, contact the local MSA representative.



User Password (AC223 P2) is intended for CHS region only and has no meaning in EU or NA region. (Refer to AC4 P27)

6 Calibration

WARNING!

During calibration, the detectors being calibrated are set to inhibit and the control unit does not ensure the safe operation of the site. During this phase, the alarms are inhibited, and the 4/20 mA analog output is as set in Access Code 4, P20; the failure indication for the ATEX mode is active.

WARNING!

A control unit configured for receiving 4/20 mA input signals from 2-wire or 3-wire transmitters does not need any calibration. Check the Calibration Data Sheet to identify the detector/transmitter connected to the Control Unit.

- Two persons are required to perform calibrations:
 - Person 1 operating the unit and Person 2 supplying the detectors with gas.
- It is necessary for them to communicate during the calibration.

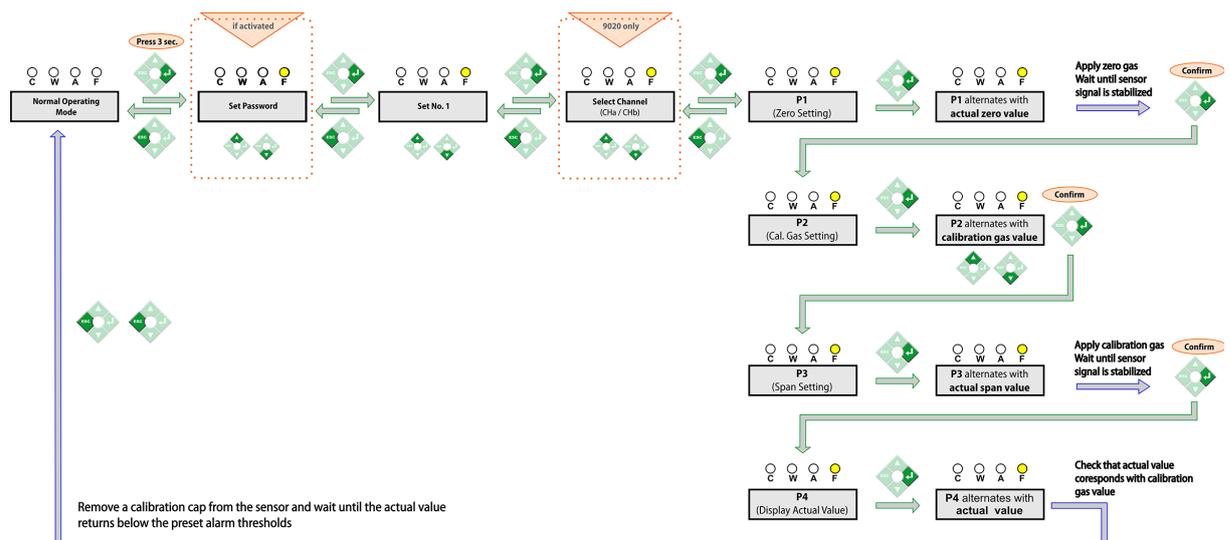
The procedure for passive detector calibration is carried out using Access Code 1 and consists of 4 steps:

- P1: Zero calibration
- P2: Set calibration gas concentration
- P3: Span calibration
- P4: Display the actual gas concentration

- During the calibration operations when span calibration is confirmed, error messages may be displayed depending on detector signal conditions. For the meaning of error messages refer to chapter 8.2.

The heating time before calibration must be at least 30 min for the catalytic detectors and 60 min for the electrochemical detectors.

6.1 9010 / 9020 SIL Module Calibration (for Passive Detectors Only)



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Action	Display
Hold ENTER until green configuration diode starts flashing.	Display shows "0"
Set password using UP or DOWN keys and press ENTER to confirm the choice.	Display shows "0"
Set Access Code 1 using UP or DOWN keys and press ENTER to confirm	9010 only: Display shows "P1" 9020 only: Display shows "Cha"
For 9020 only:	
Set "Cha" (Channel A) or CHb (Channel B) using UP or DOWN keys and press ENTER to confirm the choice	Display shows "P1"
Make sure that the detector/transmitter is in the required conditions for the zero-setting [zero gas or with the cap for performing the zero-setting using the appropriate adapter contained in the calibration kit]. Press ENTER to confirm	Display alternates showing "P1" and the indication related to the detector signal
Wait until detector signal is stabilized Press ENTER to confirm zero setting	Display shows "P2"
Press the ENTER button to confirm	Display alternates between showing "P2" and the expected value of calibration gas.
Check that the set value effectively corresponds to the calibration gas concentration in the cylinder. If the calibration gas concentration is different, modify it using the UP/DOWN buttons.	Display alternates between showing "P2" and the expected value of calibration gas.
Press ENTER to confirm	Display shows "P3"
Press ENTER to confirm	Display alternates between showing "P3" and the indication related to the detector signal.
Apply calibration gas to the detector and wait until the detector signal I is stabilized. Then press ENTER to confirm	Display shows "P4"
Press ENTER to confirm	Display alternates between showing "P4" and the indication related to the detector signal
Check the indication related to the detector signal corresponds with calibration gas concentration. Remove the calibration cap from the detector and wait until the indication goes back below the values corresponding to the preset alarm thresholds.	
Press ESCAPE to exit configuration menu	

7 Maintenance

The device does not need special maintenance except for periodic functional checks (see procedure in chapter 5.1, Access Code 1, chapter 5.3, Access Code 3, P12).

The system must be checked at regular intervals (not greater than 6 months) to ensure that it is functioning properly in accordance with the EN 60079-29-2 and the applicable international, national, industry-specific or company regulations. The sensitivity and the zero point of the connected detectors must be adjusted as necessary in accordance with the operating instructions for the types of detectors connected to the system.

Detectors which are no longer able to generate the minimum signal must be replaced.

The following checks need to be made with the same frequency: The efficiency of the FAILURE relay contacts and the WARNING and ALARM relays.

These checks also need to be carried out with the board with opto-isolated outputs, if the relays are installed outside the control unit.

In the event of a failure, contact local MSA representative.

MSA shall not be held liable for damage to items or persons if such checks are not made periodically as indicated above.

Be Aware of the Procedures for Handling Electrostatically Sensitive Electronics

The device contains electrostatically sensitive components. Do not open or repair the device without using appropriate electrostatic discharge (ESD) protection. The warranty does not cover damage caused by electrostatic discharges.

Observe Proper Battery Maintenance

Non replaceable backup battery is included in the 9010/9020 SIL control unit. The expected battery lifetime is 10 years. Dispose it in accordance with local health and safety regulations. The backup battery is used to backup internal system time and its malfunction (f.e. due to discharged battery) does not affect a safe function of the unit.

Contact your local MSA representative for battery replacement if necessary.

8 Failure, Error and Status Messages

8.1 901/9020 SIL - Failure Indications

In case of malfunctions, the following messages are displayed:

Failure Code	Description	**Failure Priority
F1.1*	<p>The supply current to the connected transmitter is too high >350 mA for 9020 >450 mA for 9010 Check the connected transmitter or a short-circuit between P+ and P-.</p>	2
F1.2*	<p>4-20 mA input protection failed Voltage on the 4-20 mA input is higher than 5 V For transmitters, check if a short-circuit between S+ and P+ exists. Check the signal from the transmitter.</p>	11
F1.3	<p>Possible shortcut on passive detector side The current voltage on pin P+ deviates from the stored voltage during calibration by more than 1.8 V. Recalibrate the detector. Check for a shortcut between P+ and P- terminal. If detector or bridge current has been changed then new calibration is always required.</p>	4
F1.4*	<p>Default configuration has been loaded The factory default or user default configuration (See chapter 5.8 - Access Code 53 Default Settings). During start-up the factory default configuration was loaded because an invalid configuration was found.</p>	90
F1.5*	<p>The connected transmitter is not delivering a constant current Please check for proper function of the connected transmitter. 4 to 20 mA driver could be defective.</p>	10
F1.6	<p>The transmitter is consuming less current than set in Access Code 4 / P2 (For 3 wire transmitter setup in Access Code 52 / P3 only).</p>	80
F1.7	<p>The transmitter current is turned off If a transmitter or digital input requires too much current (>350 mA for 9020 or >450 mA for 9010) or if a board temperature is outside of acceptable limits (-20 to +75 °C), the transmitter/detector current is turned off. Check if the transmitter or digital input are connected correctly.</p>	2
F5.1	<p>ADC convertor failure The analog-to-digital converter is not working correctly. Unit has to be replaced.</p>	80
F5.2	<p>ADC Backup convertor failure The backup analog-to-digital converter is not working correctly. Unit has to be replaced.</p>	80
F5.3	<p>ADC convertor failure The analog-to-digital converter is not working correctly Unit has to be replaced.</p>	80
F5.4	<p>Detector current cannot be set Check detector connection. (For passive detectors only)</p>	20
F5.5	<p>Testing voltage is too low If voltage < 0.1 V on the S+ terminal is measured. Check detector connection. (For catalytic combustion detectors only)</p>	3

Failure Code	Description	**Failure Priority
	Testing voltage is too high	
F5.6	If voltage >0.1 V on the S+ terminal is measured. Check detector connection. (For semiconductor detectors only)	3
F5.7	The transmitter supply voltage on the P+ pin is above the acceptable limit (28.0 VDC)	10
F5.8	The transmitter supply voltage on the P+ pin is below the acceptable limit (20.0 VDC)	10
F6.1	External Watchdog was triggered Possible firmware malfunction. Unit has to be replaced.	10
	External Watchdog Failure	
F6.2	External watchdog did not work correctly during start-up diagnostics. Unit has to be replaced.	99
	Internal Supply Voltage Failure	
F6.3*	Internal 3.3 VDC supply voltage is below acceptable limit. Unit has to be replaced	90
	Internal Supply Voltage Failure	
F6.4*	Internal 3.3 VDC supply voltage is above acceptable limit. Unit has to be replaced	90
	Internal Supply Voltage Failure	
F6.5*	Internal 5.0 VDC supply voltage is below acceptable limit. Unit has to be replaced	90
	Internal Supply Voltage Failure	
F6.6*	Internal 5.0 VDC supply voltage is above acceptable limit. Unit has to be replaced	90
	Digital Output Failure	
F7.1*	The relays are not working correctly. Check if all relays are working correctly.	9
	Digital Output Failure	
F7.2	Digital relays did not work correctly during start-up diagnostics. Check if the output type at Access Code 52 / P1 is set correctly. Check if all relays are present in the system. Relays need to be changed.	100
	Digital Output Failure	
F7.3	The FAILURE relay is not working correctly. Check the FAILURE relay.	100
	Selftest Failure	
F8.1	The firmware detected a hardware failure. Unit has to be replaced.	100
F8.2	Selftest RAM 1 Failure Unit has to be replaced.	100
F8.3	Selftest RAM 2 Failure Unit has to be replaced.	100
F8.4	Selftest Flash Failure Unit has to be replaced.	100
F8.5	Selftest Configuration Failure Unit has to be replaced.	100

Failure Code	Description	**Failure Priority
F8.6	Selftest CPU Failure Unit has to be replaced.	100
F8.7	Selftest Clock Failure Unit has to be replaced.	100
F9.1	Some settings were changed because of switching to ATEX mode in Access Code 6 / P2 Verify settings	0
F9.2	Factory default values were loaded (Using Access Code 53 / P1)	0
F9.3	User default values were loaded (Using Access Code 53 / P2)	0
F9.4	Factory default values or User default values cannot be loaded. (Using Access Code 53 / P1 or Access Code 53 / P2)	0
F9.5	User default values were not saved (Using Access Code 1 / P20)	0
F9.6	Password not accepted The entered password was not accepted. Check the password and try settings again	0
-d1	Input signal is below limit The detector/transmitter signal is below limit set in Access Code 4, P3 Perform detector/transmitter calibration to eliminate this error.	1
EEEE	Input signal is over measuring range limit (> 103 % FS)	101
LOU 1*	External 24 VDC voltage is below acceptable limit (<18 VDC) Check external power supply. Check setting in Access Code 2 / P4 & P5. This message is visible only if you have the external 24VDC connected as well.	91
LOU 2*	Internal 24 VDC from main power supply 115/230 VAC is below acceptable limit Check the main supply voltage connection. Check setting in Access Code 2 / P4 & P5. This message is visible only if you have the external 24VDC connected as well.	90
LOU 3*	Supply voltage is too high. Check power supply.	90
LOU 4*	Temperature of internal electronic circuits is too low (< -20°C). Check the ambient conditions on site	90
LOU 5*	Temperature of internal electronic circuits is too high (> +75°C). Check the ambient conditions on site	90

Failure message will disappear as soon as the failure is resolved.
 * Failure message must be acknowledged by operator pressing UP or ENTER key on the front panel.
 **Failure code with the highest priority is always displayed as the first.
 Up to 5 failure codes can be stored in the memory for individual channels.



8.2 Error Indications

These error messages are shown in the display during the calibration or when calibration is complete.

Display	Triggered levels	Description
E1	<p>Catalytic combustion detectors: If signal $U_x < 0.1 \text{ mV}/\%LEL$</p> <p>Semiconductor detectors If the difference between the zero signal and the full scale signal $U_x < 120 \text{ mV}$</p> <p>4-20 mA Transmitters If the zero calibration signal is outside of $4\text{mA} \pm 10\%$ limits and if full scale calibration signal is outside of $20\text{mA} \pm 10\%$ limits</p>	<p>E1 symbol indicates that detector sensitivity is too low. New calibration values will not be accepted, the original calibration values are used.</p> <p>After leaving the configuration menu E1 symbol toggles with the actual measured value until new calibration values are accepted.</p> <p>If ATEX function is activated then "Failure" signal is triggered until it is acknowledged by user</p>
E2	<p>Catalytic combustion detectors: If the difference between the zero signal and full scale signal $U_x > 200 \text{ mV}$</p> <p>Semiconductor detectors If the difference between the zero signal and full scale signal $U_x > 1800 \text{ mV}$</p>	<p>E2 symbol indicates that detector sensitivity is too high. New calibration values are accepted.</p>
E3	<p>Catalytic combustion detectors: If the U_x signal is between $0,1 \text{ mV}/\%LEL$ and $0,12 \text{ mV}/\%LEL$</p> <p>Semiconductor detectors If the difference between the zero signal and the full scale signal $U_x < 200 \text{ mV}$.</p>	<p>E3 symbol indicates that detector needs to be exchanged soon. New calibration values are accepted.</p>
E4	<p>If the signal exceeds $+300 \text{ mV}$ with the calibration referred to the full scale.</p>	<p>E4 symbol indicates that detector signal may be out of optimized range. New calibration values are accepted. It is recommended to check and optimize a bridge resistance</p>
E5	<p>Detector zero is out of the limits</p>	<p>U_x signal for zero is out of acceptable limits (-75 to $+75 \text{ mV}$)</p>
E10	<p>Appears when the same value is set for offset value and full scale value.</p>	

9 Technical Data

	9010 SIL	9020 SIL
Number of connected detectors	1	2
Detectors types	Catalytic combustion detectors Semiconductor detectors 0 (4) - 20 mA transmitters Digital inputs	
Power supply	AC: 85 VAC - 265 VAC 50/60 Hz DC: 19 - 32 VDC, ripple included, ripple <5 %	
No-load Consumption		
AC power supply	13 VAC	15 VAC
External DC Power supply	3 W	4 W
Detectors/Transmitters Supply		
Passive detectors power supply	Constant current	
	100 - 450 mA (9010)	100 - 350 mA (9020)
4-20 mA transmitters supply	Constant voltage 24 VDC 350mA	
Connection modes	Catalytic combustion detectorss	3 wires
	Semiconductor detectors	3 wires
	4-20 mA transmitters	2, 3 wires,
	Digital input	2 wires
Terminal board	for wires up to 2.5 mm ²	
Input signals	Catalytic combustion detectors 5÷200 mV DC 4-20 mA transmitters 4÷20 mA	

	9010 SIL	9020 SIL
Analog Output	1x 0-20 mA / 4-20 mA (configurable by user) max. loop resistance 500 Ohms	2x 0-20 mA / 4-20 mA (configurable by user) max. loop resistance 500 Ohms
In failure state	0 / 2 / 3 / 4 / 20 mA / h (hold) - Output keeps the last value before failure occurred In ATEX mode 0, 2 or 3 mA output options are possible only	
Alarm Thresholds	3 Alarms CAUTION WARNING ALARM	Hysteresis 2 %
Digital Outputs		
Alarm Relays	2 x SPDT Relay 8 A/ 250 VAC, resistive load min. current 10 mA max. current 2 A Related to alarm set points WARNING and ALARM Relays are common for both channels in 9020 module	
Failure Relay	1x SPDT Relay 8 A/ 250 VAC, resistive load min. current 10 mA max. current 2 A Relay is common for both channels in 9020 module	
Horn Relay	1x SPDT Relay 8 A/ 250 VAC, resistive load min. current 10 mA max. current 2 A Relay is common for both channels in 9020 module	
Open collector output (Open Emitter output optionally)	max. 30 mA, 24 VDC max, resistive load Related to set point CAUTION max. cable length 3 m	
Communication Interface		
Serial interface	RS485 Half duplex, ModBus RTU, not safety related	
Ethernet interface	Connection format 8-pos. RJ45 female connector; Transmission speed 10/100 Mbps; Maximum network segment expansion 100 m	
USB interface	USB 2.0 Fullspeed Maximum cable length 3 m Connector Mini USB A The USB interface is reserved for MSA service access only.	
Alarm Management		
Reset mode	automatic (1A, 2A) or manual (1M, 2M)	
Activation delay	0-600 s For non ATEX mode only	
Alarm inhibit	See Access Code 2	
Display refresh time:	0.25 s	

Communication Interface	
	for the change from 0 to 50 % FS
	Analog output =< 1.0 s
Response time (without detector)	WARNING relay =< 0.6 s
	ALARM relay =< 0.6 s
	Failure relay =< 0.7 s
Zero and span drift (without detector)	< ± 0.5 % FS. ± 1 digit/month
Accuracy (without detector)	± 1 % FS. ± 1 digit
Ambient Conditions (including spare parts)	
Operating temperature	-10 °C - +55 °C
Storage temperature	-20 °C - +60 °C
Humidity	max. 90 % RH non condensing
Vibration	10 - 30 Hz, amplitude 1 mm 31 - 100 Hz, max. acceleration 19,6 m/s ²
Ingress Protection	IP 20 (19" rack version) IP 65 (Wall mounted version)
Dimensions (WxHxD)	19" rack module: 41 x 129 x 220 mm Wall Mounted Unit: 255 x 180 x 90 mm
Weight	19"rack module 450 g Wall mounted version:1.3 kg

10 Markings, Certificates and Approvals

10.1 ATEX Directive

Manufacturer:	MSA Europe GmbH Schlüsselstr. 12 CH - 8645 Rapperswil-Jona
Product:	CONTROL UNIT 9010 / 9020 SIL
Standards:	EN 60079-29-1 :2007 EN 50104 :2010 EN 50271 :2010
Marking:	II (1)G Remote detector has to be connected with intrinsic safe supply to the CONTROL UNIT 9010 / 9020 SIL II (1)G (2)G
EU-Type Examination Certificate:	BVS 16 ATEX G001 X
Quality Assurance Notification:	0158
Year of Manufacture:	see Label
Serial No.:	see Label
National Certification:	PFG 16 G 001 X
Standards:	EN 50104:2010 EN 50271:2010

10.2 Special Conditions for Safe Use According to EU-Type Examination Certificate

- The control unit shall be operated with activated ATEX mode to meet the requirements of the standards EN 60079-29-1, EN 50104 and EN 50271
- The operation of the fail relays, as well all other relays, must be annually checked as part of the preventive maintenance (see chapter 7).
- A test of the display and LEDs on the front panel is available on request and must be performed at least once per year.
- Based on the connected detectors and local regulations the 9010/9020 SIL Control unit has to be calibrated and tested in regular intervals.
- The operation manuals of the connected detectors has to be carefully read and understand before use.
- In the case of measurement combustible gases the alarm threshold for the main alarm must be in the latching mode.
In ATEX Mode:
If two or more alarm set points are used for the same direction (activation at increasing or decreasing concentration, respectively) the last alarm shall be of a latching type.
- For the safety related use of each relay, the alarm and failure relays of the 9010/9020 SIL Control unit has to be used in the following condition:
 - (1) Relay under power
 - (2) Alarm or failure contact is closed

Thereby it will be assured that the relay contacts will give a failsafe signal at power fail or line disconnection.
- When operating with 4...20 mA interface remote measuring heads, the specification of the 4...20 mA interface as well as the behaviours below 4 mA and above 20 mA have to be taken into account (See Appendix 12.5).
- Before start-up it must be made sure that, in view of the considerably longer setting periods, the possible rising speed of the measure gas concentration in the field use cannot lead to safety-endangering situations.
- A failure status indicates a malfunction of the control unit or the connected detector or transmitter and therefore a service is required immediately. The connection of the switching outputs of the failure relays has to enable an immediate triggering message.

**10.3 Special Conditions for the Safe Use of the Gas Warning Unit 9010/9020 in SIL Applications
Safety Relevant Parameters for the Gas Warning Unit 9010/9020**

Typ	B
Structure	1oo1 or 1oo2
HFT	0 or 1
MTTR	72 h
T1	1 Year (Proof-Test-Interval)
β	2 %
β_D	2 %
SC 3	systematic capability

Using Relays

SFF = 98 %	DC = 96 %	
$\lambda_S = 2313.8 \text{ fit}$	$\text{PFD}_{\text{avg}1\text{oo}1} = 5.5 \times 10^{-4}$	$\text{PFD}_{\text{avg}1\text{oo}2} = 1.1 \times 10^{-5}$
$\lambda_D = 2253.8 \text{ fit}$	$\text{PFD}_{\text{avg}1\text{oo}1\% \text{SIL}2} = 5.5 \%$	$\text{PFD}_{\text{avg}1\text{oo}2\% \text{SIL}3} = 1.1 \%$
$\lambda_{DU} = 88.5 \text{ fit}$	$\text{PFH}_{1\text{oo}1} = 8.9 \times 10^{-8} \frac{1}{\text{h}}$	$\text{PFH}_{1\text{oo}2} = 1.9 \times 10^{-9} \frac{1}{\text{h}}$
$\lambda_{SD} = 2224.6 \text{ fit}$	$\text{PFH}_{1\text{oo}1\% \text{SIL}2} = 8.9 \%$	$\text{PFH}_{1\text{oo}2\% \text{SIL}3} = 1.9 \%$
$\lambda_{DD} = 2165.2 \text{ fit}$		

Possible Structures and Acquirable SILs

The following table shows, which structure has to be selected, to fulfill the requirements of a special SIL.

LDM = Low Demand Mode

HDM = High Demand or Continuous Mode

Using Relays

	SIL 1		SIL 2		SIL 3	
	LDM	HDM	LDM	HDM	LDM	HDM
Structure 1oo1	X	X	X			
Structure 1oo2	X	X	X	X	X	X

Depending on the selected configuration the following safety-relevant parameters have to be considered while implementing the safety loop:

General Conditions for Safe Use

- (1) The application advice and the limitations of the manual have to be considered.
- (2) For calibration and maintenance, the regional and national regulations have to be considered.
- (3) A defect Gas Warning Unit 9010/9020 has to be repaired within 72 h.
- (4) An ambient temperature above 40 °C is to be avoided.
- (5) External power supplies must fulfil the requirements of EN 60950 and EN 50178 for SELV, PELV.
- (6) The communication interfaces are not allowed to be used for the transmission of safety related data.
- (7) The 4...20 mA - Output is not allowed to be used for safety function.



- (8) The “CAUTION” - Output and the “HORN”- relay is not allowed to be used for safety function.
- (9) The STEL- and TWA- storage functions are not allowed for SIL applications.
- (10) The relays must be energized under normal conditions.
- (11) The alarm and relay functions must be tested at least once per year.
- (12) The relay contacts must be protected with a fuse rated 0.6 of the nominal specified relay contact current.
- (13) The failure relay contacts must be safety related processed for warning purposes.
- (14) After installation a functional check / calibration has to be done for the complete system.
- (15) The alarm conditions of the Gas Warning Unit 9010/9020 must be periodically checked together with the typical gas calibration checks.
- (16) A system check has to be done every year.
- (17) For the 1oo2 – structure two independent devices must be used.
- (18) In case of redundancy installation the relay contacts must to be monitored regarding deviations.
- (19) It is only allowed to use the approved Hardware and Software Versions.

10.4 Permitted Hardware/Software Versions

Module	Hardware Version	Software Version
Control Unit 9010 SIL	6	1.02.1000
Control Unit 9020 SIL	6	1.02.1000

The actually used hardware version can be found on the printed circuit board. The firmware version is printed or on the label on the back of backplane connector. Refer to Fig. 1 "19" rack module" for precise localization.

11 Ordering Information

Description	Order Number
Control unit 9010 SIL 19"rack module	10162570
Control unit 9010 SIL 19"rack module (customized)	10162570-DE
Control unit 9020 SIL 19"rack module	10162591
Control unit 9020 SIL 19"rack module (customized)	10162591-DE
Control unit 9010 SIL wall mounted	10162592
Control unit 9010 SIL wall mounted (customized)	10162592-DE
Control unit 9020 SIL wall mounted	10162593
Control unit 9020 SIL wall mounted (customized)	10162593-DE
Spare Parts & Accessories	
Standard backplane terminal board	10166724
Rear terminal wall mounted version	10061934-SP
Set of Spare Relays	10162598
Set of cable glands M20 (8 off)	10173033
Set of fuses 2A/250 VAC (10 off)	10174743
Blank Plate	10175205
Half Blank Plate	10175206
19" Rack (2 modules)	10164881
19" Rack (5 modules)	10164882
19" Rack (10 modules)	10164883
Plastic Rails (Set of 10 pcs)	10164870
9010 SIL Lid for wall mounted unit (with display)	10164888
9020 SIL Lid for wall mounted unit (with display)	10164887
9010 SIL Mainboard PCBA (wall mount)	10164886
9020 SIL Mainboard PCBA (wall mount)	10164885
Connection cable for wall mounted unit	10164884
RACK 19"/2, 9010/20SIL, for 1 Slot pre-wired	10168374
RACK 19"/2, 9010/20SIL, for 2 Slots pre-wired	10168375
RACK 19"/5, 9010/20SIL, for 1 Slots pre-wired	10168376
RACK 19"/5, 9010/20SIL, for 2 Slots pre-wired	10168377
RACK 19"/5, 9010/20SIL, for 3 Slots pre-wired	10168378
RACK 19"/5, 9010/20SIL, for 4 Slots pre-wired	10168379
RACK 19"/5, 9010/20SIL, for 5 Slots pre-wired	10168380
RACK 19"/10, 9010/20SIL, for 1 Slot pre-wired	10168381
RACK 19"/10, 9010/20SIL, for 2 Slots pre-wired	10168382
RACK 19"/10, 9010/20SIL, for 3 Slots pre-wired	10168383
RACK 19"/10, 9010/20SIL, for 4 Slots pre-wired	10168384
RACK 19"/10, 9010/20SIL, for 5 Slots pre-wired	10168385
RACK 19"/10, 9010/20SIL, for 6 Slots pre-wired	10168386
RACK 19"/10, 9010/20SIL, for 7 Slots pre-wired	10168387
RACK 19"/10, 9010/20SIL, for 8 Slots pre-wired	10168388
RACK 19"/10, 9010/20SIL, for 9 Slots pre-wired	10168389
RACK 19"/10, 9010/20SIL, for 10 Slots pre-wired	10168390

12 Appendix

12.1 Alarms Sequence - Reset Modes

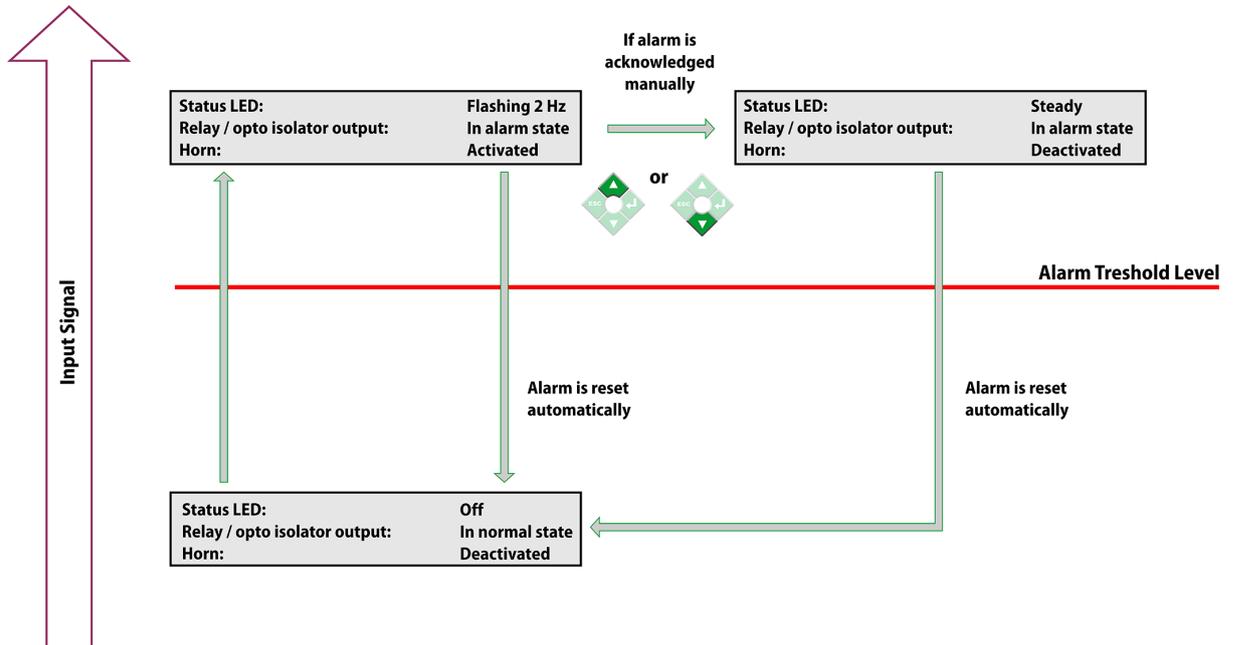


Fig. 10 1A - Automatic reset configuration

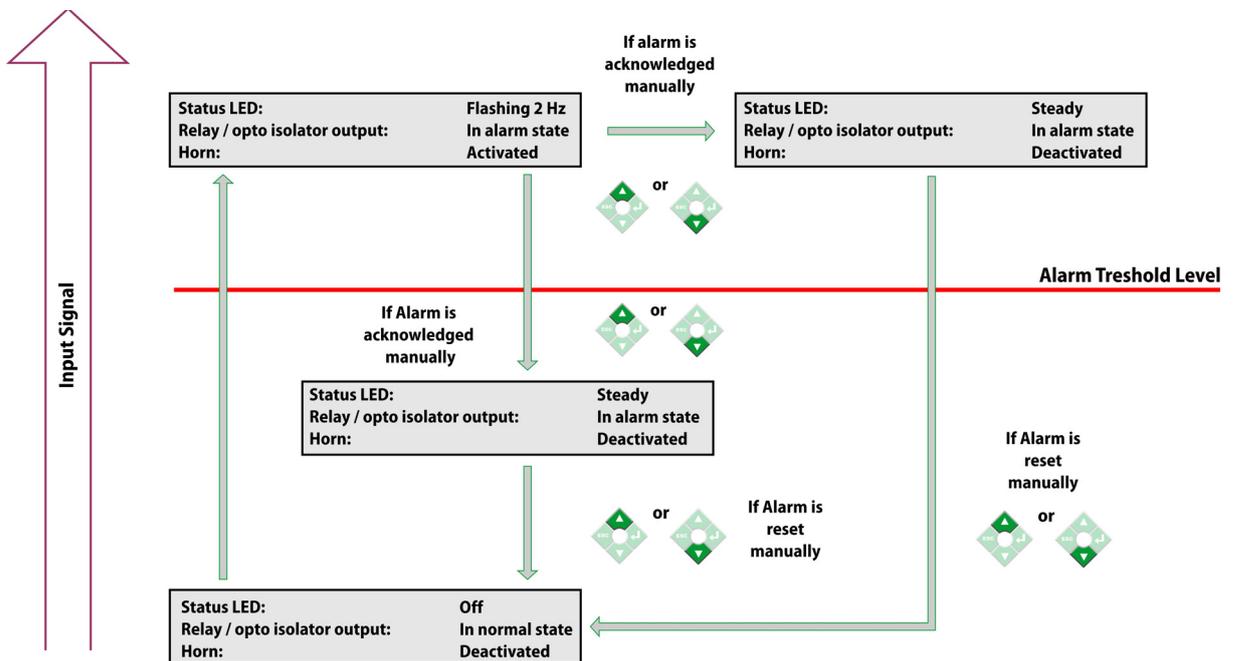


Fig. 11 1M - Manual reset configuration

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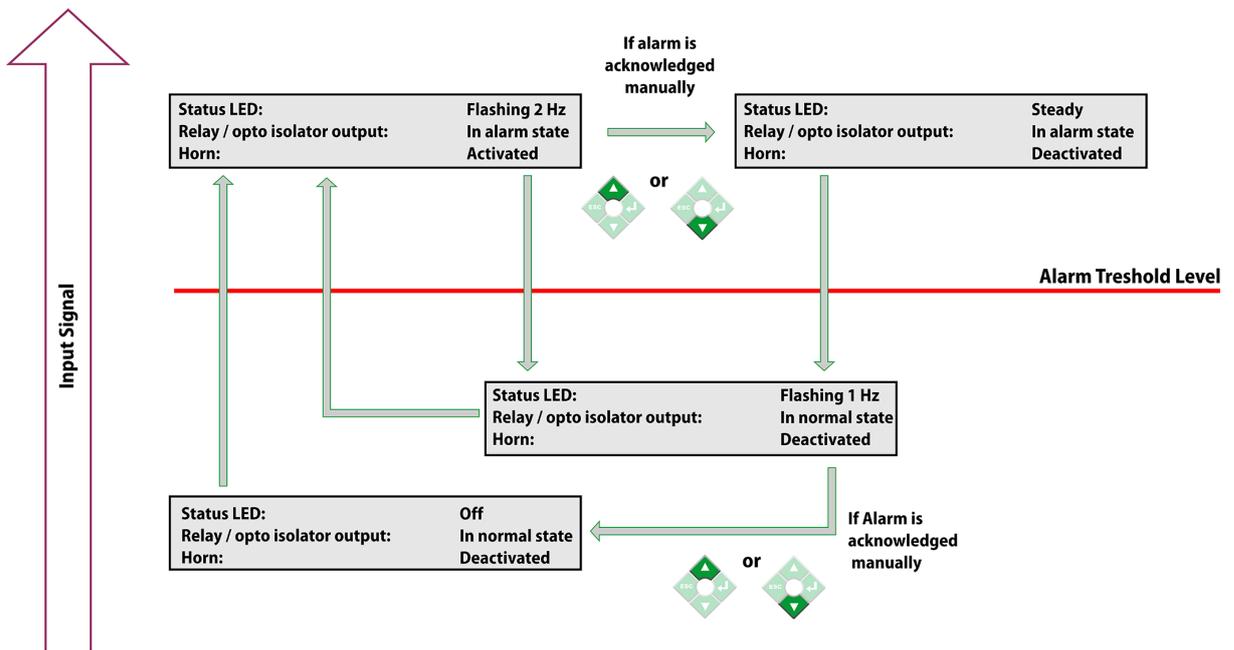


Fig. 12 2A - Automatic reset configuration with alarm memorisation

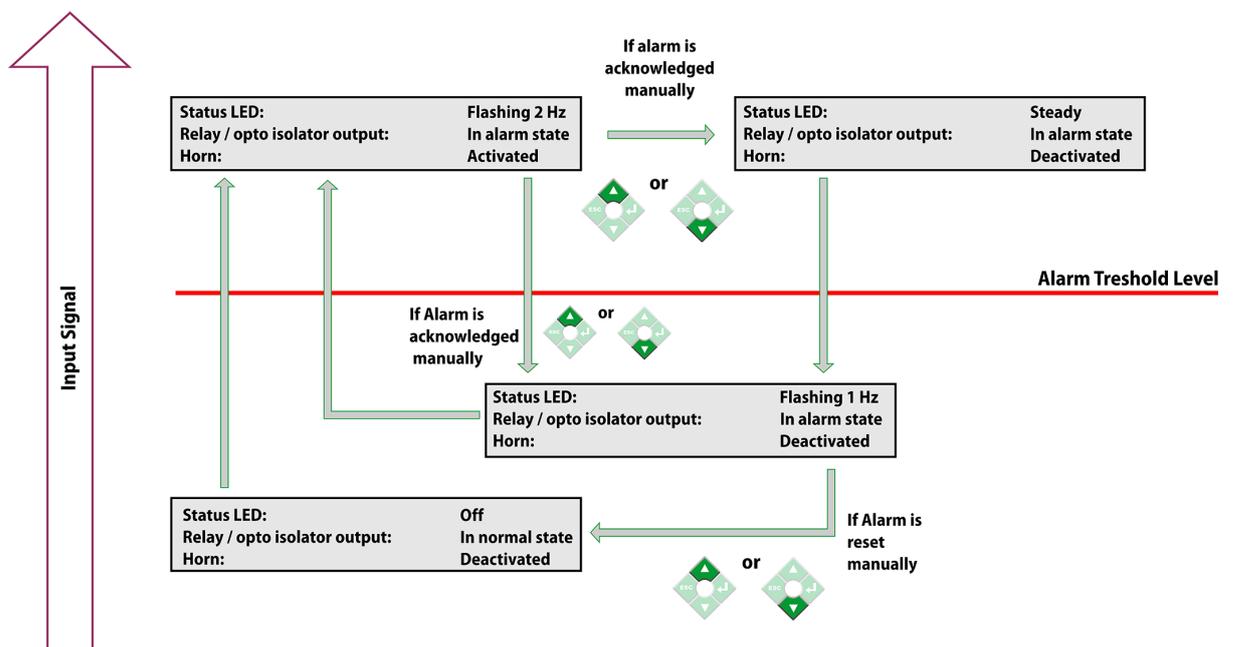


Fig. 13 2M - Manual reset configuration with alarm memorisation

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12.2 Outline Dimensions
19" Rack Versions

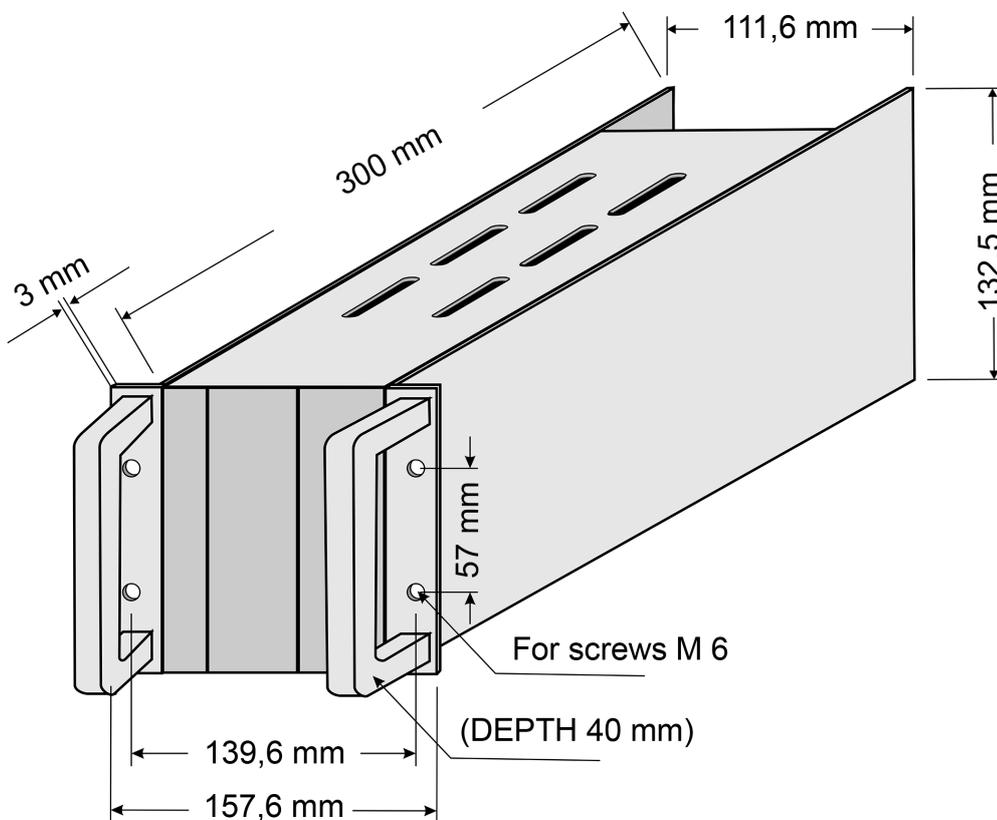


Fig. 14 Rack for 2 modules (Panel cut out 124 x 133 mm)

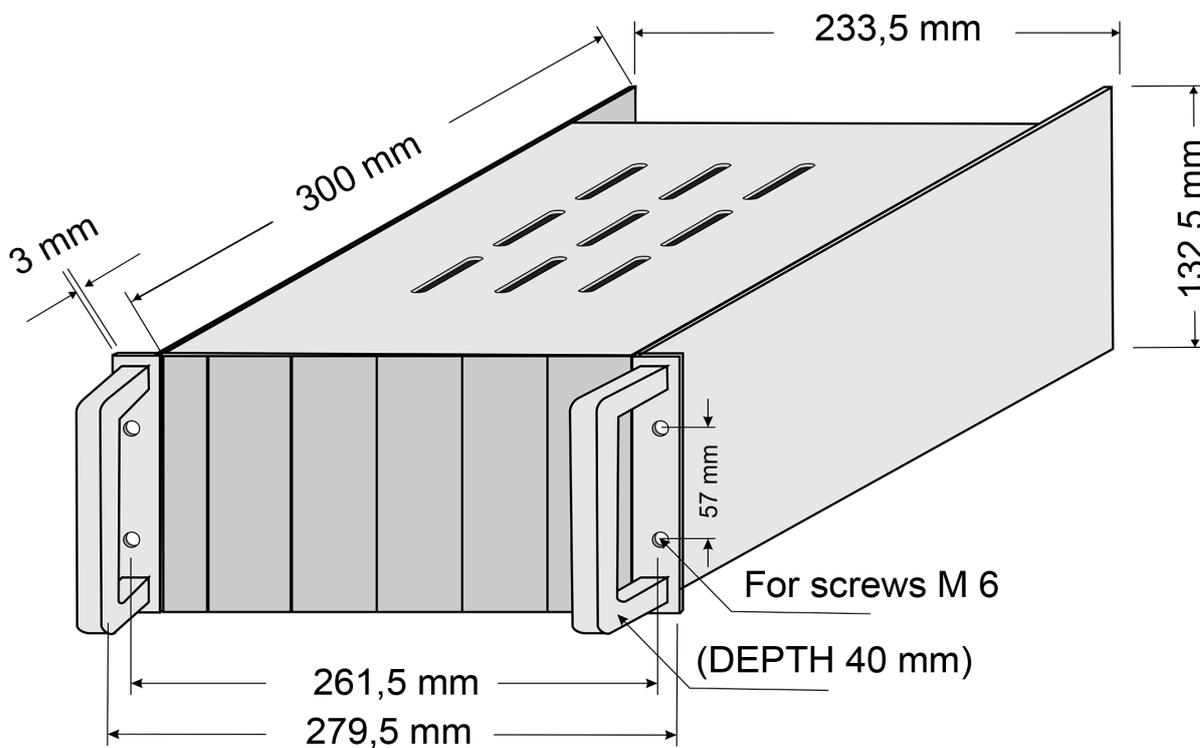


Fig. 15 Rack for 5 modules (Panel cut out 246 x 133 mm)



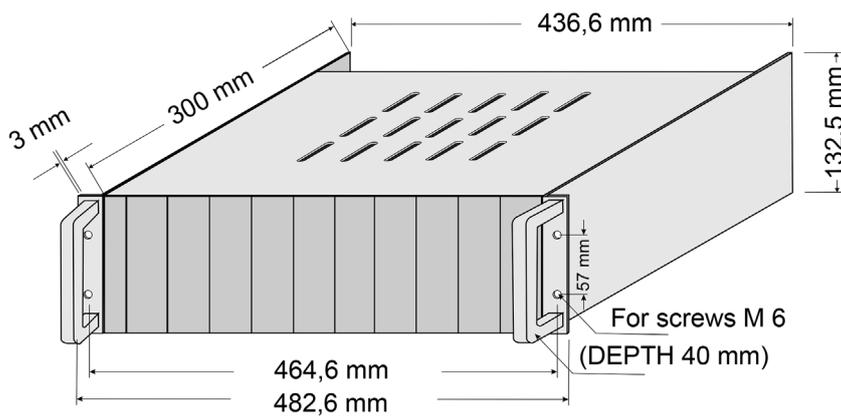


Fig. 16 Rack for 10 modules (Panel cut out 448 x 133 mm)

12.3 Wall Mounted Version

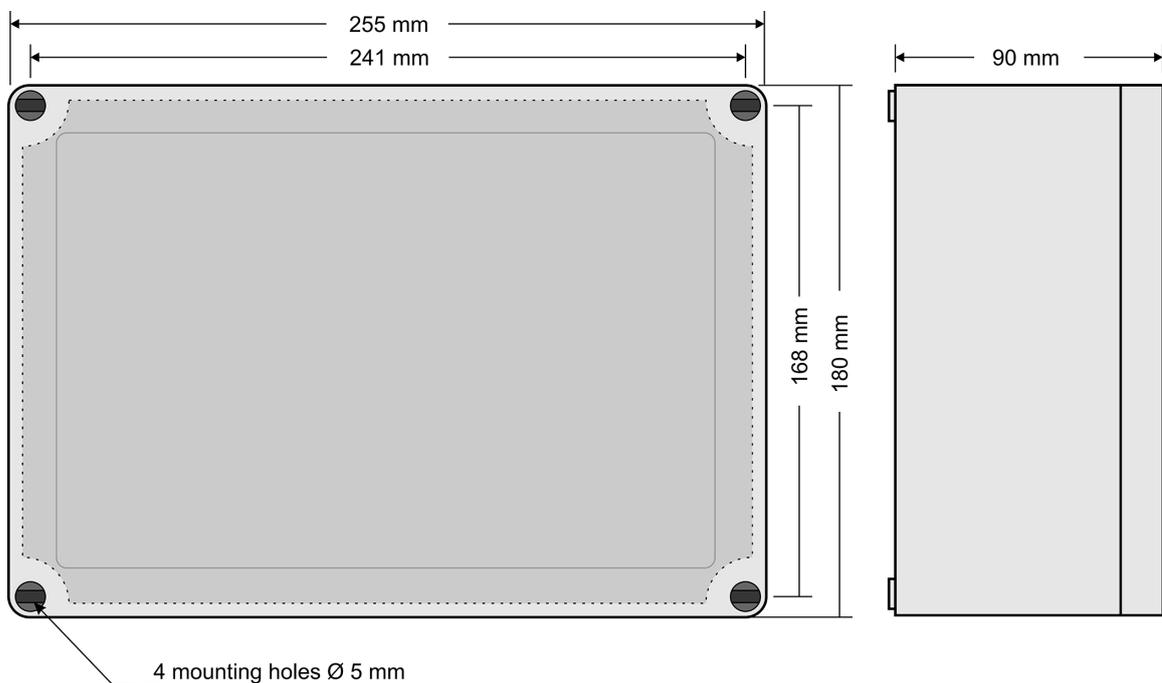


Fig. 17 Wall mounted plastic housing for 1 (9010) or 2 (9020) channels

Maximum screw diameter 5 mm
 Maximum screw head diameter 8 mm

12.4 External earth Connection

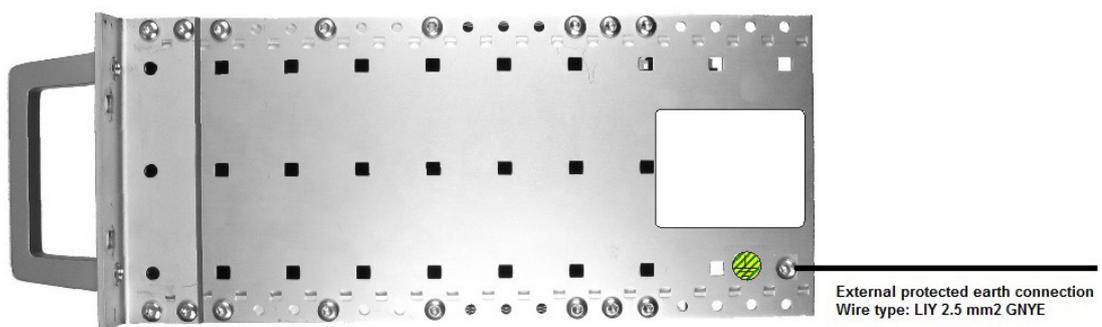


Fig. 18 External earth connection

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12.5 4-20 mA Transmitter Connections

Control Units 9010 SIL and 9020 SIL can accept, respectively, one or two input signals originating from transmitters. These transmitters, with a 4-20 mA circuit will have to have the right CE (EU) type certificate and will have to conform to Section 1.5 of Attachment II of Directive 2014/34/EU. Control unit channels A and B configured for an input signal of 4-20 mA
Measurement range 0-100 % LEL

Input 4/20 mA	Theoretical reading	Display reading 9010/9020 SIL Module	
		Ch A	Ch B
2	-12,5	-d1	-d1
4	0	0	0
6	12,5	12	12
8	25	25	25
10	37,5	37	37
12	50	50	50
14	62,5	62	62
16	75	75	75
18	87,5	87	87
20	100	100	100
21	106,3	EEEE	EEEE
22	112,5	EEEE	EEEE

Input signal (mA)	C / W / A	Horn	Failure
2	in normal state	in normal state	activated
4-20	depends on alarm setting	activated with a new alarm	activated with a new failure
21	activated	activated	activated
22	activated	activated	activated

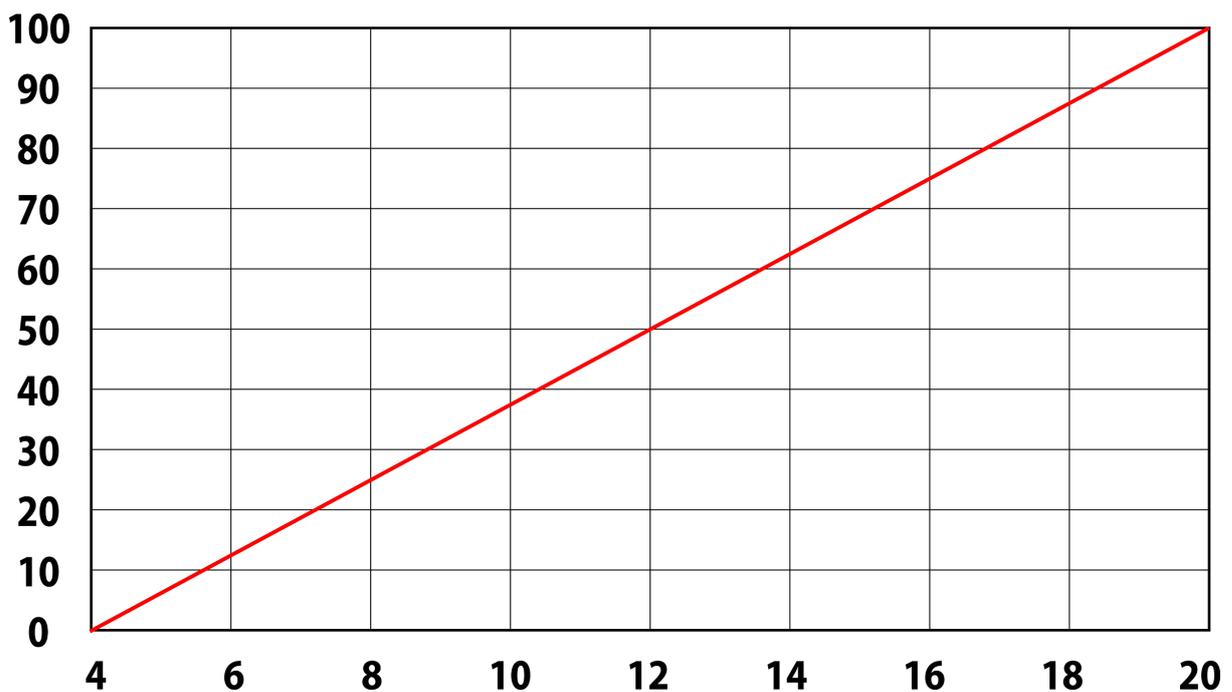
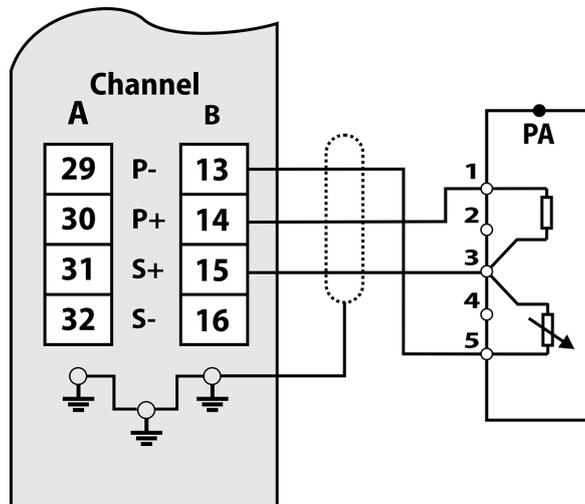


Fig. 19 Response curve for mA input (Equal for both Channel A and Channel B)

12.6 Detectors Connection Data Sheet

Detectors Connection Data Sheet Series 47K- PRP (S47K- ST) Gas Detector



WARNING!

Before connecting the measuring head reduce detector current to minimum

The cable screen is connected to the control unit only.

Detector type: Catalytic/passive/constant current supply (3 wire passive)

Detector simulation module: Order No. 10030263

Bridge current	310 mA
Maximum nominal current	350 mA
Power consumption	1.0 W typical (without cable length)
Cable type	3 core, 80 % screened
Maximum loop resistance	36 ohms
Maximum cable length	1000 m (at wires cross section 1.5 mm ²)
Wires allowed	Screw terminals: cross section 0,5 -2,5 mm ² Spring terminal: cross section 0,5 -1,5 mm ²
Cable diameter	7 ...12 mm
Junction box II 2G Ex d IIC T6 or T4	
II 2D Ex tD A21 IP6x T85 °C or T135 °C	Order No. 10051080
Junction box II 2G Ex e IIC T6 or T4	
II 2D Ex tD A21 IP6x T85 °C or T135 °C	Order No. 10051091
Mounting	Wall mounted

For further details see detector's operation manual.

Open / Short Circuit Failure Indication

X - Signal Failure (Failure LED)

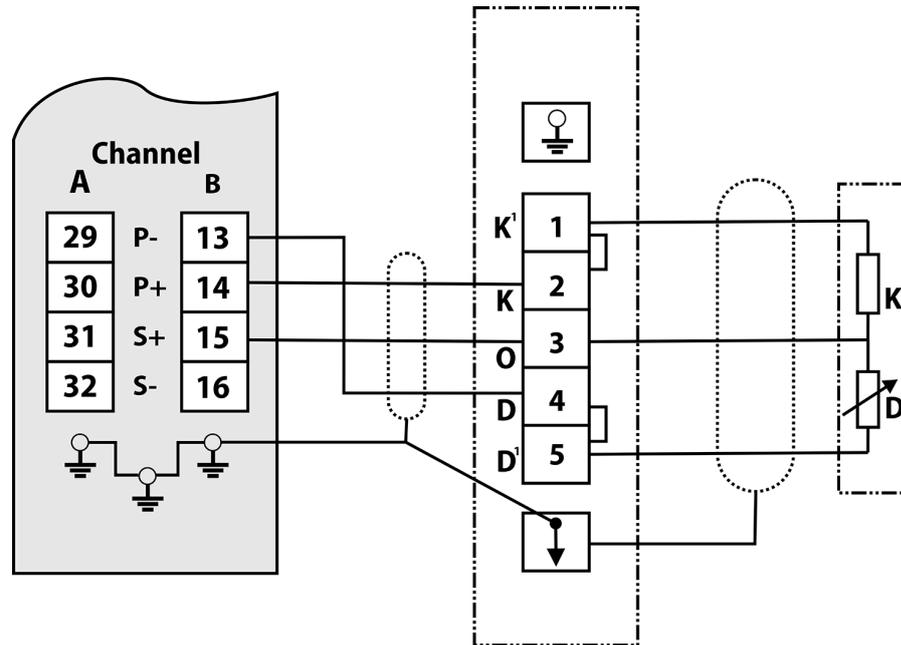
XX - Alarm LEDs, Signal exceeded, Signal Failure (Failure LED)

XXX - Alarms only

XXXX – No change of indication

	Wire (Terminal No.)			Disconnect plug
	P+ (14 or 30)	S+ (15 or 31)	P- (13 or 29)	
Open circuit at 9010/9020 Terminal	X	X	X	X
Open circuit at max. cable length	X	X	X	
Short circuit at 9010/9020 terminal	Between P+ and S+ (terminals 14 and 15, or 30 and 31) XX	Between P+ and P- (terminals 13 and 14, or 29 and 30) X	Between P- and S+- (terminals 13 and 15, or 29 and 31) X	
Short circuit at max.cable length	Between P+ and S+ (Between terminals 14 and 15, or 30 and 31) XX	Between P+ and P- (terminals 13 and 14, or 29 and 30) X	(Between terminals 13 and 14, or 29 and 30) X	
At conductor resistance 0 ...1.7 ohms per lead	XX	X	X	

Detectors Connection Data Sheet Series 47K- HT-PRP



⚠ WARNING!

Before connecting the measuring head reduce detector current to minimum

The cable screen is connected to 9010/9020 SIL module only.

Detector type: Catalytic/passive/constant current supply (3 wire passive)

Detector simulation module: Order No. 10030263

Bridge current	280 mA
Maximum nominal current	350 mA
Power consumption	1.0 W typical (without cable length)
Cable type	3 core, 80 % screened
Maximum loop resistance	36 ohms
Maximum cable length	1000 m (at wires cross section 1.5 mm ²)
Wires allowed	Cross section 1.0 2.5 mm ²
Cable diameter	712 mm
Junction box	Order No 10151980
Mounting	Wall mounted

For further details see detector's operation manual.

Open / Short Circuit Failure Indication

X - Signal Failure (Failure LED)

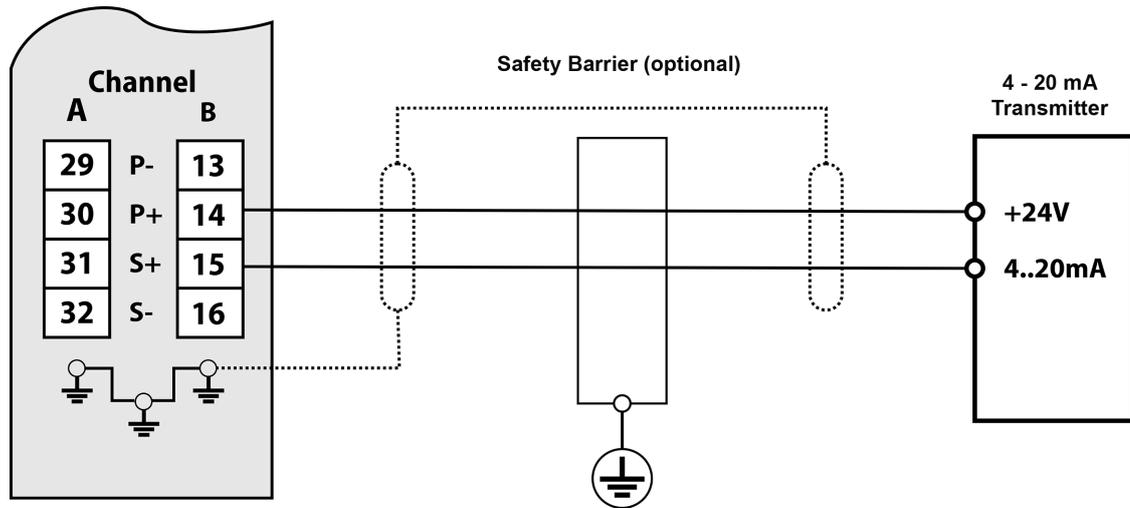
XX - Alarm LEDs, Signal exceeded, Signal Failure (Failure LED)

XXX - Alarms only

XXXX – No change of indication

	Wire (Terminal No.)			Discon- nect plug
	P+ (14 or 30)	S+ (15 or 31)	P- (13 or 29)	
Open circuit at 9010/9020 Terminal	X	X	X	X
Open circuit at max. cable length	X	X	X	
Short circuit at 9010/9020 terminal	Between P+ and S+ (terminals 14 and 15, or 30 and 31) XX	Between P+ and P- (terminals 13 and 14, or 29 and 30) X	Between P- and S+ (terminals 13 and 15, or 29 and 31) X	
Short circuit at max.cable length	Between P+ and S+ (Between terminals 14 and 15, or 30 and 31) XX	Between P+ and P- (terminals 13 and 14, or 29 and 30) X	(Between terminals 13 and 14, or 29 and 30) X	
At conductor resis- tance 0 -1.7 ohms per lead	XX	X	X	

4-20 mA Transmitter (2 Wires)



Supply Current	max. 30 mA
Maximum Power Consumption	approx. 768 mW
Cable type	2 core, 80 % screened
Maximum Load	Transmitter dependent
Maximum cable length	Transmitter dependent
Cable diameter	9 ... 17 mm
Cross section per wire allowed	0.75 - 2.5 mm ²

Simulation Module: Order No. 10030262

MSA recommended transmitters	PrimaX I, Ultima XE (2 wire), UltraSonic IS-5
Recommended safety barriers	See manual of transmitter

Open / Short Circuit Failure Indication

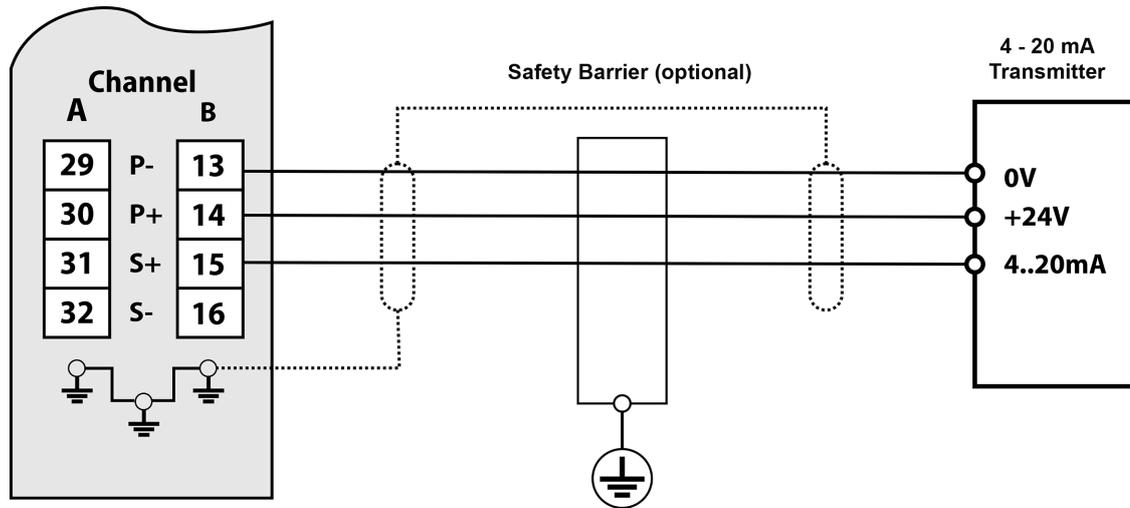
X - Signal Failure (Failure LED)

XX - Alarm LEDs, Signal exceeded, Signal Failure (Failure LED)

	4-20 mA (Terminal 15 or 31)	+24 VDC (Terminal 14 or 30)	Disconnect plug
Open circuit at 9010/ 9020 Terminal	X	X	X
Open circuit at max. cable length	X	X	
Short circuit at 9010/ 9020 terminal	(Between terminals 14 and 15, or 30 and 31) XX		
Short circuit at max. cable length	(Between terminals 14 and 15, or 30 and 31) XX		

Conditions for use: For further details see operation manual of the transmitter.

4-20 mA Transmitter (3 Wires)



Supply Voltage	19 - 30 VDC
Supply current	max. 450 mA (9010) max. 350 mA (9020)
Cable type	3 core, 80 % screened
Maximum Load	Transmitter dependent
Maximum cable length	Transmitter dependent
Cable diameter	9 ...17 mm
Cross section per wire allowed	0.75 - 2.5 mm ²

Simulation Module: Order No. 10030262

MSA recommended transmitters	PrimaX P, PrimaX IR, Ultima XE (3 wire), Ultima XIR, Ultima MOS 5, Ultima MOS 5E, FlameGard 5 MSIR, FlameGard 5 UV/IR, FlameGard 5 UV/IR-E, UltraSonic Ex 5
Recommended safety barriers	See manual of transmitter

Conditions for use: For further details see operation manual of the transmitter.

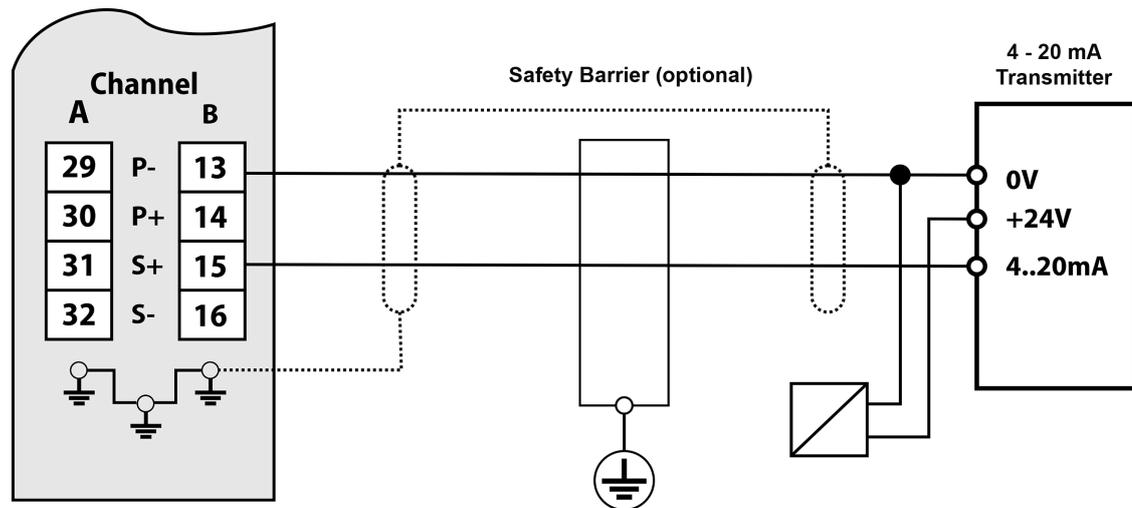
Open / Short Circuit Failure Indication

X - Signal Failure (Failure LED)

XX - Alarm LEDs, Signal exceeded, Signal Failure (Failure LED)

	Wire (Terminal No.)			
	4-20 mA (Terminal 15 or 31)	+24 VDC (Terminal 14 or 30)	0 V (Terminal 13 or 29)	Disconnect plug
Open circuit at 9010/9020 Terminal	X	X	X	X
Open circuit at max. cable length	X	X	X	
Short circuit at 9010/9020 terminal	(Between terminals 14 and 15, or 30 and 31) XX	(Between terminals 13 and 15, or 29 and 31) X	(Between terminals 13 and 14, or 29 and 30) X	
Short circuit at max. cable length	(Between terminals 14 and 15, or 30 and 31) XX	(Between terminals 13 and 15, or 29 and 31) X	(Between terminals 13 and 14, or 29 and 30) X	

4-20 mA Transmitter (with External Power Supply)



Supply Voltage	See operation manual
Cable type	3 core, 80 % screened
Maximum Load	Transmitter dependent
Maximum cable length	Transmitter dependent
Cable diameter	9 ... 17 mm
Cross section per wire allowed	0.75 - 2.5 mm ²

Simulation Module: Order No. 10030262

MSA recommended transmitters	Ultima OPIR 5,
Recommended safety barriers	See manual of transmitter

Open / Short Circuit Failure Indication

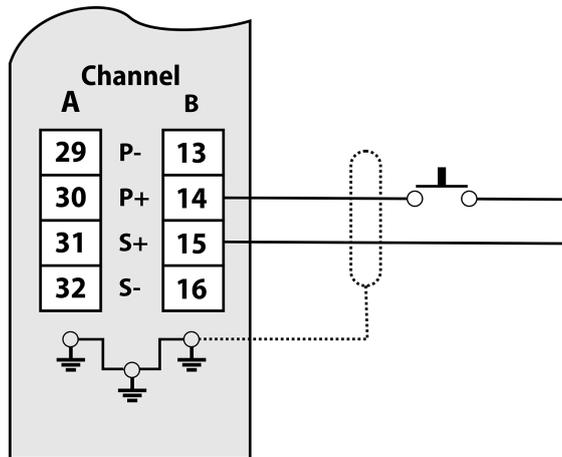
X - Signal Failure (Failure LED)

XX - Alarm LEDs, Signal exceeded, Signal Failure (Failure LED)

	4-20 mA (Terminal 15 or 31)	0 V (Terminal 13 or 29)	Disconnect plug
Open circuit at 9010/ 9020 Terminal	X	X	X
Open circuit at max. cable length	X	X	
Short circuit at 9010/ 9020 terminal	(Between terminals 13 and 15, or 29 and 31) XX		
Short circuit at max. cable length	(Between terminals 13 and 15, or 29 and 31) XX		

Conditions for use: For further details see operation manual of the transmitter.

Digital Input



	Display
Open circuit	100
Closed circuit	0

For local MSA contacts, please visit us at [MSAsafety.com](https://www.MSA.com)

*Because every life has a **purpose...***