



Safety Manual

AutroVu Model AV30 Universal Display



AUTRONICA

COPYRIGHT ©

This publication, or parts thereof, may not be reproduced in any form, by any method, for any purpose.

Autronica Fire and Security AS and its subsidiaries assume no responsibility for any errors that may appear in the publication, or for damages arising from the information in it. No information in this publication should be regarded as a warranty made by Autronica Fire and Security. The information in this publication may be updated without notice.

Product names mentioned in this publication may be trademarks. They are used only for identification.





SAFETY MANUAL

AutroVu® Universal Display Model AV30



SAFETY CERTIFIED MODEL AV30 UNIVERSAL DISPLAY

This manual addresses the specific requirements and recommendations applicable to the proper installation, operation, and maintenance of all Safety-Certified (SIL-Certified) AutroVu® Model AV30 Universal Display (AV30) product versions. For complete information regarding system overview, performance, installation, operation, maintenance and specifications of the AV30 refer to instruction manual 95-8784.

QUALITY POLICY STATEMENT

All quality assurance control measures necessary for safety management as specified in IEC 61508 Part 1 have been implemented. The quality management system of Autronica is based on the requirements of EN ISO 9001 and ANSI/ASQC Q9001. In addition, the Quality Management System complies with the European ATEX Directive requirements per EN 13980, the International Electrotechnical Commission requirements per OD005/V2, and the supervised testing requirements per ISO 17025.

SAFETY MESSAGES

Procedures and instructions in this section may require special precautions to ensure the safety of personnel performing the operations. Information that raises potential safety issues is indicated by the word "Warning". Always read and understand these safety messages.



WARNING

The AV30 is intended for use in hazardous environments that may include explosive levels of flammable gases and vapors. This product must be properly installed, operated and maintained. Improper installation or use could result in an explosion or fire resulting in death or serious injury.

- *Do not remove the cover in explosive environments when device power is on and circuits are live.*
- *Device must be properly installed, and cover must be fully engaged to meet hazardous area explosion-proof/non-incendive requirements.*

DESIGN

The AV30 is a stand alone device that performs all the functions of a gas controller and is classified as Type B smart device according to IEC61508. It provides an isolated 4-wire 4-20 mA output that is representative of the received input 4-20 mA level. The AV30 contains extensive self-diagnostics and will pass through the detector current output to a specified failure state. Pass-through means AV30 does not change the analog output, it only sets the relays based on the analog value provided by the sensor connected to its input.

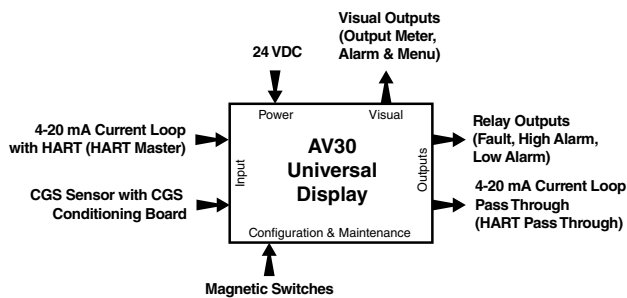
Alarm and Fault relay contact outputs are provided in addition to the analog signal output, and can be programmed in the field by the user. The relay output and analog output are not to be used in combination for the safety function.

Safety-Certification of the AV30 includes:

- the 4-20 mA input and output
- High Alarm, Low Alarm & Fault Relay outputs

Safety Certification of the AV30 includes the following non-interfering outputs:

- AV30 display and magnetic switches



DIAGNOSTIC RESPONSE TIME

The AV30 will perform all critical diagnostic functions within 58 minutes, worst case diagnostic detection time.

CERTIFICATION

The AV30 Safety-Certified version is certified by *exida*[®] to IEC61508 for single input use in low demand, SIL 2 Safety Instrumented Systems (SIS).

SAFETY-CERTIFIED PRODUCT IDENTIFICATION

Safety Certification of all AV30 models meeting SIL 2 safety standards is clearly identified on the product label.

INSTALLATION

NOTE

For complete information regarding performance, installation, operation, maintenance, and specifications of AV30, refer to instruction manual 95-8784.

No special or additional detector installation requirements exist above and beyond the standard installation practices documented in the AV30 instruction manual.

The operating temperature range for the Safety Certified AV30 is -40°C to $+75^{\circ}\text{C}$ for the analog output and relay outputs. Other environmental operating specifications are applicable as published in the general specifications section in the AV30 instruction manual.

The AV30 operating power distribution system should be designed and installed so the terminal voltage does not drop below 18 Vdc when measured at any specific location. The maximum current limit per device must be less than 2 amperes. The external system providing power to the AV30 must have over-voltage protection that ensures supply voltage does not exceed 30 Vdc.

COMMON MISUSE SCENARIOS

Refer to the Installation and Troubleshooting sections of the instruction manual for detailed information on avoidance and resolution of common misuse scenarios. Applications to avoid include the following:

- Locations where impact or other excessive mechanical stress is likely.
- Locations where the AV30 display is not easily viewable or accessible.
- Mounting the AV30 without properly sealing ALL conduit entries.

START-UP AND COMMISSIONING

NOTE

All safety functions of the AV30 are active within 150 seconds of power-up without any user action required.

Commissioning Personnel

The Safety Certified AV30 can be commissioned by any qualified person with knowledge of the detection instruments and configuration devices being used. Refer to the Start-Up and Calibration sections provided in the AV30 instruction manual.

Configuration

The AV30 faceplate display can be used to monitor internal status or to modify the display's factory settings. Refer to the AV30 instruction manual (95-8784) for guidance on using the AV30 LCD display. The proper Appendix is determined by the sensor being used with the AV30.

NOTE

Prior to device configuration (setting alarm thresholds, latch/non-latch function, etc.) all alarm outputs must be bypassed. The device is not safety certified during configuration change activities.

NOTE

All configuration changes to the AV30 must be verified by the user via a proof test, power cycle and re-check of settings, or other appropriate method.

Relay Configuration Requirements

Only the AV30's Alarm and Fault relay outputs may be used as part of a Safety Certified system. The end user must provide transient protection and current limiting on the output contacts of the relays. The maximum relay contact output must be limited to 2 amperes at 30 Vdc. The load must be a resistive load. The user must protect against transients by using standard protection methods such as proper grounding of shielded wire and separation of relay load wires from other lines carrying rapidly switched high current (e.g. large motor power supply lines).

If the 0-20mA pass-through signal output of the AV30 with 4-20mA (0-100% LFL) safety certified gas detection range is not being monitored for fault conditions, the status of the Fault relay must be monitored and appropriate action taken if a fault signal is received. The fault relay needs to be configured as normally energized in safety applications.

Configuration Protection

Upon completion of installation and commissioning, it is required that the user password-protect the AV30 safety related parameters that are accessible via the faceplate display in order to prevent accidental or deliberate change of configuration data during normal operation. To password protect the AV30, the user must set the write-protect function to "on" and enter an 8 character password.

The user will be required to disable write protect prior to any future configuration changes, and must re-enable write protect upon completion of these changes.

OPERATION, MAINTENANCE, INSPECTION AND PROOF TESTING

All normal installation, start-up, and field calibration recommendations as documented in the AV30 instruction manual are applicable to the Safety Certified AV30.

Safety-Certified AV30s require additional Proof testing to be performed in all cases.

Personnel performing Proof Test procedures shall be competent to perform the task. All proof test results must be recorded and analyzed. Any corrective actions taken must be documented in the event that an error is found in the safety functionality. The Proof tests must be performed at a frequency as shown in Table 1.

WARNING

Failure to perform the specified testing and inspection may lower or void the SIL rating for the product or system.

Table 1—Frequency for Performing Proof Tests

AV30 Proof Test Name	Commissioning	Frequency
Visual Field Inspection Proof Test	Yes	As needed, depending on level and type of contaminants present
Response Proof Testing AV30 Display	Yes	5 years
Response Proof Testing AV30-CGS	Yes	1 year

VISUAL FIELD INSPECTION PROOF TEST

Tools Required: None

Visual inspection of Safety-Certified AV30 and connected devices shall be conducted as needed to confirm that no external blockage of path into the sensing chamber/area exists, eg. debris, trash, snow, mud, external equipment, etc. Corrective action shall include removal of such impediments should they exist. All devices monitored by the AV30 must be inspected to ensure that they are capable of providing expected performance and protection.

Completion of Visual Field Inspection Proof test must be recorded and documented in the SIS logbook.

RESPONSE PROOF TEST

Tools Required: Compressed Calibration Gas Kit provided by Autronica, or other device stimulation method

The Response Proof Test must be performed while the AV30 and attached device are in NORMAL operation and requires application of sufficient stimulation to put the device into alarm state. The user must then inspect the signal output level to ensure that the signal output is accurately indicative of the applied condition.



WARNING

Any external alarm equipment, systems or signaling devices that could be automatically initiated by performing this test must be disabled or bypassed before performing this test!

Response Proof Test Sequence

1. Inhibit alarm and fault response at the control device.
2. Apply stimulation to the attached device that is sufficient to trip both the auxiliary and high alarm relays (the auxiliary and high alarm relays must be normally configured to trip at the same input 4-20 mA level).
3. Verify correct change of state at the control device for both alarm relay outputs and the 4-20 mA output. Criteria for the 4-20 mA inspection pass of a gas detector is a response signal within $\pm 3\%$ of applied gas concentration (generally, a 50% full scale test concentration is applied).
4. Optional (the display is not part of the AV30 safety function): Verify that the correct signal output is displayed on the AV30 faceplate.

5. Remove the test gas or other stimulation method and ensure that the unit returns to normal operation.
6. Induce a fault to the AV30; suggested fault induction methods are listed below:
 - Remove input power to the AV30.
 - Lower input supply voltage below 16 Vdc.
 - Remove input 4-20 mA source (i.e. remove connected gas sensor or other device).
7. Verify correct change of state to fault relay and 4-20 mA outputs at the control device.
8. Optional (the display is not part of the AV30 safety function): Verify that the correct fault signal output is displayed on the AV30 faceplate.
9. Remove the fault induction source and ensure that the unit returns to normal operation.
10. Re-activate alarm and fault response at the control device.

If response test is not within acceptable limits or fails for any reason, a Full Calibration procedure must be performed and the Proof Test re-performed. The Full Calibration procedure for gas detectors is listed below. For calibration of other devices, refer to the manual for the specific device.

Full Calibration

Tools Required: Compressed Calibration Gas Kit provided by Autronica
Magnet or HART Communicator

Full Calibration shall be conducted when required as documented in the Calibration section of the AV30 instruction manual. It is permissible to conduct the Full Calibration using either the onboard magnetic calibration switch or using an approved HART handheld field communicator. In all cases, the AV30 and attached gas detector should be allowed to warm up for one hour minimum before conducting calibration.

Completion of the Response Proof Test must be recorded and documented in the SIS logbook.



WARNING

Any external alarm equipment, systems or signaling devices that were disabled must be re-activated at the conclusion of proof testing activities.

FAULT/FAILURE ACTION PLAN

In the event of an unsuccessful Response Proof test after a Calibration has been performed, the standard Troubleshooting and Device Repair and Return procedures as listed in the AV30 instruction manual must be followed. Any failure to successfully complete the Response Proof Test must be recorded and documented in the SIS logbook.

PRODUCT REPAIR

The AV30 is not field repairable, and any internal device repairs must be conducted at the factory. No firmware changes are permitted or authorized. All failures detected by the device diagnostics or by the Proof Tests that cannot be resolved through the troubleshooting and maintenance procedures described in the instruction manual must be reported to the manufacturer.

OPERATING, ENVIRONMENTAL, AND PERFORMANCE SPECIFICATIONS

The Safety-Certified AV30 product versions fully comply with, and must be operated in accordance with the functional, environmental, and performance specifications provided in the AV30 instruction manual. A 24 hour mean time to repair should be assumed for safety availability calculations.

SPARE PARTS

Refer to “Replacement Parts” in the AV30 instruction manual. Safety Certification is based on a sufficient number of spares to achieve a 24-hour mean time to repair.

CERTIFICATION AND FAILURE RATE DATA

IEC61508: 2010

Type B Device

Systematic Capability: SIL 2 certified

HFT: 0

Low Demand Mode

PFDavg should be calculated for any safety instrumented function using the AV30. (Refer to FMEDA report for necessary information, including DU rate.)

Safety Accuracy: <4% error (see SPECIFICATIONS section of instruction manual for performance details).

Safety Response Time: The AV30 contributes less than 2 seconds to the worst case safety response time.

Product Life: 10 years, based on manufacturer data.

All failure rate data for SIL verification is in the FMEDA report, which is available upon request. Select failure rate data is shown in the IEC 61508 Failure Rates in the FIT Table on page 8.

NOTE

The CGS sensor must be replaced every 3 years for the AV30-CGS product model. Refer to the CTX10 Instruction Manual (95-8789) Section 3.2 for CGS sensor life, and Section 9.3 for sensor replacement instructions.

ADDITIONAL CERTIFICATIONS

FM, CSA, ATEX, IECEx

For complete information regarding performance, installation, operation, maintenance and specifications of AV30, refer to instruction manual 95-8784.

TERMS AND DEFINITIONS

FMEDA	Failure Mode Effects and Diagnostics Analysis
HART	Highway Addressable Remote Transducer
HFT	Hardware Fault Tolerance
LFL	Lower Flammable Limit
PFD	Probability of Failure on Demand (Probability of Dangerous Failure)
PFDavg	Average Probability of Failure on Demand
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
AV30	AutroVu® Model AV30 Universal Display

IEC 61508 Failure Rates in FIT*

Failure Category	λ_{sd}	λ_{su}^{**}	λ_{dd}	λ_{du}
AV30 Display	624	60	2100	186
AV30 Alarm Relay, De-Energize-to-Trip (DTT)	628	297	2199	325
AV30 Alarm Relay, Energize-to-Trip (ETT)	628	213	2199	428
AV30 with CGS Conditioning Board, Relay (DTT)***	785	645	4849	1532
AV30 with CGS Conditioning Board, Relay (ETT)***	785	561	4849	1636

* FIT = 1 Failure / 10⁹ Hours

** It is important to realize that the No Effect failures are no longer included in the Safe Undetected failure category according to IEC 61508, ed2, 2010.

*** The CGS model must be used in an environment where the target gas is usually not present in order for these failure rates to be valid.



Autronica Fire and Security AS
Bromstadveien 59, 7047 Trondheim, Norge | Tlf: +47 90 90 55 00 |
E-post: info@autronicafire.no | www.autronicafire.com