ECLIPSE® 706GWR

SIL Safety Manual for Eclipse® Model 706

High Performance Guided Wave Radar Level Transmitter

This manual complements and is intended to be used with the Magnetrol® Eclipse® Model 706 High Performance Guided Wave Radar Installation and Operating manual (Bulletin 57-606).

Application

The HART® version of the ECLIPSE Model 706 Guided Wave Radar level transmitter can be applied in most process or storage vessels, bridles, and bypass chambers up to the probe's rated temperature and pressure. It can be used in liquids, slurries, or solids with a dielectric constant in the range 1.4–100 to meet the safety system requirements of IEC 61508 (Edition 2.0, 2010) and IEC 61511-1.

Benefits

The MAGNETROL ECLIPSE Model 706 (HART) transmitter provides the following benefits to your operation:

- Suitable for use to SIL 2 (Safe Failure Fraction = 93%) as standalone device independently assessed (hardware assessment) by exida as per IEC 61508/ IEC 61511-1.
- Probe designs to +850 °F (+454 °C), 6250 psig (430 bar) and full vacuum.
- Cryogenic applications to -320 °F (-190 °C).
- Intrinsically safe, Explosion-proof and Non-Incendive approvals.
- Quick connect/disconnect probe coupling.

Magnetrol®

Eclipse® Model 706 High Performance Guided Wave Radar Level Transmitter

SIL Safety Manual for Eclipse® Model 706

Table of Contents

1.0 Introduction

1.1 Product Description

The ECLIPSE Model 706 High Performance Guided Wave Radar Level Transmitter is a loop-powered, 24 VDC level transmitter, based on Guided Wave Radar (GWR) technology.

NOTE: For Safety Instrumented Systems usage, it is assumed that the 4–20 mA output is used as the primary safety variable.

The analog output from the Model 706 meets the NAMUR NE 43 standard (3.8 mA to 20.5 mA usable). The transmitter contains self-diagnostics and is programmed to drive the output to a user-selected failure state, either low or high, upon internal detection of a diagnostic indicator. The device can be equipped with or without a graphic liquid crystal display (LCD).

Table 1 indicates the version of the ECLIPSE Model 706 transmitter suitable for SIL 2 applications based on the hardware assessment.

Table 1
ECLIPSE 706 Model Number

Model 706-511x-xxx (HART)

1.2 Theory of Operation

Guided Wave Radar is based upon the principle of TDR (Time Domain Reflectometry). TDR utilizes pulses of electromagnetic energy transmitted down a wave guide (probe). When a pulse reaches a liquid surface that has a higher dielectric constant than the air ($\varepsilon_r = 1$) in which it is traveling, a portion of the pulse is reflected. The transit time of the pulse is then measured via ultra high-speed timing circuitry that provides an accurate measure of the liquid level. The amplitude of the reflection depends on the dielectric constant of the product. The higher the dielectric constant, the larger the reflection.

1.3 Determining Safety Integrity Level (SIL)

The ECLIPSE Model 706 is classified as a Type B device according to IEC61508.

Tables 2 & 3 define the criteria for the achievable SIL against the target mode of operation in Demand Mode Operation.

- Table 2 shows the relationship between the Safety Integrity Level (SIL) and the Probability of Failure on Demand Average (PFDavg).
- Table 3 is used to determine the achievable SIL as a function of the Hardware Fault Tolerance (HFT) and the Safe Failure Fraction (SFF) for the complete safety function (Type B—complex components as per IEC 61508 Part 2) *of which the level transmitter is one component.*

Table 2
SIL vs. PFDavg

Safety Integrity Level (SIL)	Target Average probability of failure on demand (PFDavg)
4	$\geq 10^{-5}$ to $<10^{-4}$
3	$\geq 10^{-4}$ to $<10^{-3}$
2	$\geq 10^{-3}$ to $<10^{-2}$
1	$\geq 10^{-2}$ to $<10^{-1}$

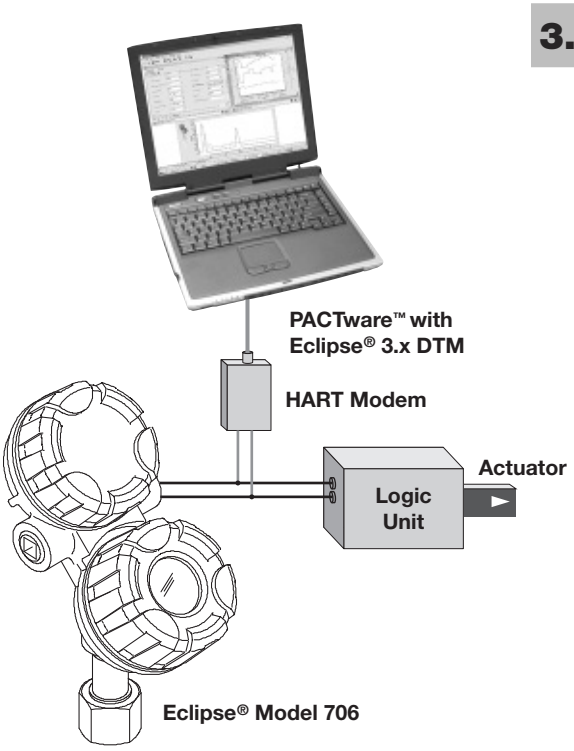
Table 3
Minimum hardware fault tolerance
Type B sensors, final elements and non-PE logic solvers

SFF	Hardware Fault Tolerance (HFT)		
	0	1	2
None: <60%	Not Allowed	SIL 1	SIL 2
Low: 60% to <90%	SIL 1	SIL 2	SIL 3
Medium: 90% to <99%	SIL 2	SIL 3	
High: ≥99%	SIL 3		

2.0 Applicable Models

This manual is only applicable to the following HART versions of the ECLIPSE Model 706 Transmitter:

3.0 Level Measuring System



The diagram at left shows the structure of a typical measuring system incorporating the ECLIPSE Model 706 transmitter. This SIL-rated device is only available with an analog signal (4–20 mA) with HART communications; and, the measurement signal used by the logic solver must be the analog 4–20 mA signal proportional to the level generated.

- For fault monitoring, the logic unit must recognize both high alarms (≥ 21.5 mA) and low alarms (≤ 3.6 mA).
- If the logic solver loop uses intrinsic safety barriers, caution must be taken to ensure the loop continues to operate properly under the low alarm condition.
- The only unsafe mode is when the unit is reading an incorrect level within the 4–20 mA range (> ±2% deviation).
- MAGNETROL defines a safe failure as one in which the 4–20 mA current is driven out of range (i.e., less than 3.8 mA or greater than 21.5 mA).

3.1 Miscellaneous Electrical Considerations

Following are miscellaneous electrical issues to be considered in a safety system.

3.1.1 Pollution Degree 2

The ECLIPSE Model 706 transmitter is designed for use in a Category II, Pollution Degree 2 installation, which is defined by a nonconductive pollution of the sort where occasionally a temporary conductivity caused by condensation must be expected.

This is the usual pollution degree used for equipment being evaluated to IEC/EN 61010.

3.1.2 Over-voltage

The ECLIPSE Model 706 transmitter has, as standard, over-voltage protection per CE requirements. When considering Hi-pot, Fast Transients and Surge, this protection is to 1000 volts (1 KV). Therefore, there should be no unsafe failure modes up to 1 KV.

Overvoltage Category II is a local level, covering appliances, portable equipment, etc., with smaller, transient, overvoltages than those characteristic of Overvoltage Category III. This category applies from the wall plug to the power-supply isolation barrier (transformer).

As the typical plant environment is Overvoltage Category II, most equipment evaluated to the requirements of IEC/EN 61010 are considered to belong in that classification.

4.0 Mean Time To Restoration (MTTR)

SIL determinations are based on a number of factors including the Mean Time To Restoration (MTTR). The analysis for the ECLIPSE Model 706 is based on a MTTR of 24 hours.

5.0 Supplementary Documentation

- The ECLIPSE Model 706 Installation and Operating Manual 57-606 must be available to ensure proper installation of the transmitter.
- One of the following Electronic Device Description Files is also required if HART is used:
  - Manufacturer Code 0x56
  - Model 706 Device ID 0x56E0, device revision 1, DD revision 2.
- For device installations in a classified area, the relevant safety instructions and electrical codes must be followed.

6.0 General Instructions

6.1 Systematic Limitations

The following instructions must be observed to avoid systematic failures.

6.1.1 Application

Choosing the proper Guided Wave Radar (GWR) probe is the most important decision in the application process. Coaxial, twin flexible cable, and single element (rod or cable) are the three basic configurations. As the probe configuration establishes fundamental performance characteristics, the probe for use with the ECLIPSE Model 706 transmitter should be selected as appropriate for the application.

Careful selection of probe design and materials for a specific application will minimize media buildup on the probe. Refer to Installation and Operating Manual 57-606 for more information.

6.1.2 Environmental

Refer to Installation and Operating Manual 57-606 for Environmental limitations.

6.1.2.1 Storage

The device should be stored in its original shipping box and not be subjected to temperatures outside the storage temperature range of -50 to +185 °F (-46 to +85 °C).

6.2 Installation

Refer to the Model 706 Installation and Operating Manual 57-606 manual for complete installation instructions.

I/O Manual 57-606:

- Contains information on the use, changing and resetting of the password-protection function.
- Provides menu selection items for configuration of the transmitter as a level sensing device.
- Offers configuration recommendations.

NOTE: This SIL evaluation has assumed that the customer will be able to acknowledge an over- or under-current condition via the Logic Solver.

6.3 Skill Level of Personnel

Personnel following the procedures of this safety manual should have technical expertise equal to or greater than that of a qualified Instrument Technician.

6.4 Necessary Tools

Following are the necessary tools needed to carry out the prescribed procedures:

- Open-wrenches or adjustable wrench to fit the process connection size and type.
  - Coaxial probe: 1½" (38mm)
  - Twin Rod and Single rod probes: 1⅞" (47mm)
  - Transmitter: 1½" (38mm)
  - Torque wrench is highly desirable
- Flat-blade screwdriver
- Cable cutter and 3/32" (2.5mm) hex wrench (7y1, 7y2, 7y5 and 7y7 Flexible probes only)
- Digital multimeter or digital volt/ammeter
- 24 VDC power supply, 23 mA minimum

6.5 Configuration

6.5.1 General

The ECLIPSE Model 706 Transmitter can be configured via the local display, a HART compatible handheld terminal, or a personal computer using PACT*ware*™ and the associated DTM.

6.5.2 Configuration

Ensure the parameters have been properly configured for the application and probe. Special consideration should be given to the following configuration parameters:

DIELECTRIC: Ensure this is set to "Below 1.7" for propane and butane applications or "1.7–3.0" for the majority of typical hydrocarbon applications.

FAULT: DO NOT choose HOLD for this parameter as a Fault will not be annunciated on the current loop.

BLOCKING DISTANCE: This value MUST be Zero for SIL applications. Consult factory prior to making any changes.

LOOP CONTROL MODE: Ensure this is set to ENABLED.

THRESHOLD: Set to FIXED if used in a hydrocarbon application with any possibility of water bottoms.

PASSWORD: Must be changed to a specific value other than Zero.

6.5.3 Write Protecting / Locking

The Model 706 transmitter is password protected with a numerical password between 0 and 99,999.

NOTE: Default Password = 0 = Password disabled.

Refer to the Model 706 Installation and Operating Manual Bulletin 57-606 for additional information on password protection.

It is required that, after configuration of the system is complete, a password is utilized to prevent inadvertent changes to the device.

6.6 Site Acceptance Testing

To ensure proper operation after installation and configuration, a site acceptance test should be completed. This procedure is identical to the Proof Test Procedure described in Section 7.1.4.

6.7 Recording Results

Results of Site Acceptance Testing must be recorded for future reference.

6.8 Maintenance

6.8.1 Diagnostics

Internal diagnostic testing within the Model 706 transmitter occurs approximately five times per second (1 every 200 mS). A message will appear and the output current will be driven to 3.6 or 22mA (customer dependent) upon detection of a Fault.

6.8.2 Troubleshooting

Report all failures to the MAGNETROL Technical Support Department.

Refer to the Model 706 Installation and Operating Manual Bulletin 57-606 for troubleshooting device errors.

- As there are no moving parts in this device, the only maintenance required is the SIL Proof Test.
- Firmware can only be upgraded by factory personnel.

7.0 Recurrent Function Tests

7.1 Proof Testing

7.1.1 Introduction

Following is the procedure utilized to detect Dangerous Undetected (DU) failures.

This procedure will detect approximately 84% of possible DU failures in the Model 706-511x-xxx.

7.1.2 Interval

To maintain the appropriate Safety Integrity Level of a Safety Instrumented System, it is imperative that the entire system be tested at regular time intervals (shown as TI in the appropriate standards). The suitable SIL for the Model 706 transmitter is based on the assumption that the end user will carry out this test and inspection at least once per year.

NOTE: It is the responsibility of the owner/operator to select the type of inspection and the time period for these tests.

7.1.3 Recording Results

Results of the Proof Test should be recorded for future reference.

7.1.4 Suggested Proof Test

The suggested proof test below, in combination with the built-in automatic diagnostics, will detect 98% of possible DU failures in Model 706-511x-xxx.

Step	Action
1	Bypass the PLC or take other action to avoid a false trip.
2	Inspect the Unit in detail outside and inside for physical damage or evidence of environmental or process leaks a.) Inspect the exterior of the Unit housing. If there is any evidence of physical damage that may impact the integrity of the housing and the environmental protection, the unit should be repaired or replaced. b.) Inspect the interior of the Unit. Any evidence of moisture, from process or environment, is an indication of housing damage, and the unit should be repaired or replaced.
3	Use the Unit's DIAGNOSTICS menu to observe Present Status, and review EVENT HISTORY in the Event Log. Up to 10 events are stored. The events will be date and time stamped if the internal clock is set and running. It is suggested that the internal clock be set at the time of commissioning of the unit. If the clock is set at the time of the proof test, event times are calculated. a.) Choose the menu DIAGNOSTICS / Present Status. i.) Present Status should indicate OK. b.) Choose the menu DIAGNOSTICS / EVENT HISTORY/ Event Log i.) Any FAULT or WARNING messages must be investigated and understood. ii.) Corrective actions should be taken for FAULT messages.
4	Use the DIAGNOSTICS menu to perform a "CURRENT LOOP TEST". Select DIAGNOSTICS / ADVANCED DIAGNOSTICS / TRANSMITTER TESTS / Analog Output Test to change the output loop current and confirm the actual current matches the value chosen. a.) Send a HART command to the transmitter (or use the local interface) to go to the high alarm current output, 22 mA, and verify that the analog current reaches the valve. i.) This step tests for compliance voltage problems such as low supply voltage or increased wiring resistance. ii.) This also tests for current loop control circuitry and adjustment problems. b.) Send a HART command to the transmitter (or use the local interface) to go to the low alarm current output, 3.6 mA, and verify that the analog current reaches the valve. i.) This step tests for high quiescent current and supply voltage problems. ii.) This also tests for current loop control circuitry and adjustment problems. c.) Exit the "Analog Output Test" and confirm that the output returns to its original state—with the proper loop current as indicated and controlled by the unit.

continued on next page

Step	Action
5	Use the DIAGNOSTICS menu to observe the present Echo Curve. Confirm that the ECHO Waveform is normal. The echo curve is dependent on the type of probe, the installation conditions and the level of process on the probe. Comparison of the present Echo Curve to the one stored at the time of commissioning the unit gives additional confidence of the normal operation of the unit. Use of the DTM and digital communications is necessary for comparison of echo curves. a.) Select DIAGNOSTICS/ ECHO CURVE/ View Echo Curve i.) Observe the present Echo Curve, identify the characteristic portions of the waveform related to the FIDUCIAL, Process level, End of Probe and other features. ii.) Confirm that the FIDUCIAL appears acceptable. Confirm the FIDUCIAL is located where expected. iii.) Confirm that the signal from the process level appears normal and is located as expected. iv.) Verify that the baseline of the waveform is smooth and flat. v.) Compare to Echo Curve from commissioning in the FIDUCIAL area. b.) Access the Fiducial Ticks and Fiducial Strength values in the menu: DIAGNOSTICS / ADVANCES DIAGNOSTICS / INTERNAL VALUES i.) Observe and record: 1.) Fiducial Ticks _____ 2.) Fiducial Strength _____ ii.) Confirm that these values match the previous values. 1.) Fiducial Ticks differs within ±100 2.) Fiducial Strength differs within ±15
6	Perform two-point calibration check of the transmitter by applying level to two points on the probe and compare the transmitter display reading and the current level value to a known reference measurement.
7	If the calibration is correct the proof test is complete. Proceed to step 9.
8	If the calibration is incorrect, remove the transmitter and probe from the process. Inspect the probe for buildup or clogging. Clean the probe, if necessary. Perform a bench calibration check by shorting the probe at two points. Measure the level from the bottom of the probe to the two points and compare to the transmitter display and current level readings. a.) If the calibration is off by more than 2%, contact the factory for assistance. b.) If the calibration is correct, the proof test in complete. c.) Re-install the probe and transmitter.
9	Restore loop to full operation.
10	Remove the bypass from the safety PLC to restore normal operation.

8.0 Appendices

8.1 SIL Declaration of Conformity

Functional safety according to IEC 61508/IEC 61511.

Magnetrol International, Incorporated, 705 Enterprise Street, Aurora, Illinois 60504, declares as the manufacturer, that the level transmitter:

Guided Wave Radar (4–20 mA) Model 706-51x-xxx is suitable for the use in safety instrumented systems according to IEC 61511-1, if the safety instructions and following parameters are observed:

Product	Model 706-511x-xxx
SIL	2
Proof Test Interval	1 Year
Device Type	B
SFF	93.0%
PFD_{avg}	6.67E-04
λ_{sd}	0 FIT ①
λ_{su}	78 FIT
λ_{dd}	728 FIT
λ_{du}	61 FIT

① FIT = Failure in Time (1×10-9 failures per hour)

8.2 FMEDA Report: exida Management Summary

Failure Modes, Effects and Diagnostic Analysis

Project:
Eclipse Model 706 Level Transmitter

Company:
Magnetrol International
Aurora, IL
USA

Contract Number: Q11/07-016
Report No.: MAG 11/07-016 R001
Version V1, Revision R1, 16 October 2012
Griff Francis

Management Summary

This report summarizes the results of the hardware assessment in the form of a Failure Modes, Effects, and Diagnostic Analysis (FMEDA) of the Eclipse Model 706 Level Transmitter. The hardware version is defined by the assembly drawings in section 2.5.1. The software version was 0.8d0. A Failure Modes, Effects, and Diagnostic Analysis is one of the steps to be taken to achieve functional safety certification per IEC 61508 of a device. From the FMEDA, failure rates and Safe Failure Fraction are determined. The FMEDA that is described in this report concerns only the hardware of the Model 706-511*-***. For full functional safety certification purposes all requirements of IEC 61508 must be considered.

The Model 706-511*-*** is a loop-powered, 24 VDC level transmitter, based on Guided Wave Radar (GWR) technology. For safety instrumented systems usage it is assumed that the 4 – 20mA output is used as the primary safety variable. The analog output meets NAMUR NE 43 (3.8mA to 20.5mA usable). The transmitter contains self-diagnostics and is programmed to send its output to a specified failure state, either low or high upon internal detection of a failure (output state is programmable). The device can be equipped with or without display.

Table 1 gives an overview of the different versions that were considered in the FMEDA of the Model 706-511*-***.

Table 1 Version Overview

Option 1	Model 706-511*-***

The Model 706-511*-*** is classified as a Type B[1] element according to IEC 61508, having a hardware fault tolerance of 0.

The analysis shows that the device has a Safe Failure Fraction between 90% and 99% (assuming that the logic solver is programmed to detect over-scale and under-scale currents) and therefore meets hardware architectural constraints for up to SIL 2 as a single device.

The failure rates for the Model 706-511*-*** are listed in Table 2.

[1] Type B element: "Complex" element (using micro controllers or programmable logic); for details see 7.4.4.1.3 of IEC 61508-2, ed2, 2010.

Table 2 Failure rates Model 706-511*-*

Failure Category	Failure Rate (FIT)	
Fail Safe Undetected		78
Fail Dangerous Detected		728
Fail Detected (detected by internal diagnostics)	571	
Fail High (detected by logic solver)	73	
Fail Low (detected by logic solver)	84	
Fail Dangerous Undetected		61
No Effect		455
Annunciation Detected		8
Annunciation Undetected		29

In addition to the failure rates listed above, the external leakage failure rate of the Model 706-511*-*** is 2 FIT. External leakage failure rates do not directly contribute to the reliability of the transmitter, but should be reviewed for secondary safety and environmental issues.

These failure rates are valid for the useful lifetime of the product, see Appendix A.

The failure rates listed in this report do not include failures due to wear-out of any components. They reflect random failures and include failures due to external events, such as unexpected use, see section 4.2.2.

Table 3 lists the failure rates for the Model 706-511*-*** according to IEC 61508, ed2, 2010.

Table 3 Failure rates according to IEC 61508 in FIT

Device	λ_{SD}	λ_{SU}[2]	λ_{DD}	λ_{DU}	SFF
Model 706-511*-***	0	78	728	61	93.0%

A user of the Model 706-511*-*** can utilize these failure rates in a probabilistic model of a safety instrumented function (SIF) to determine suitability in part for safety instrumented system (SIS) usage in a particular safety integrity level (SIL). A full table of failure rates is presented in section 4.4 along with all assumptions.

[2] 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.

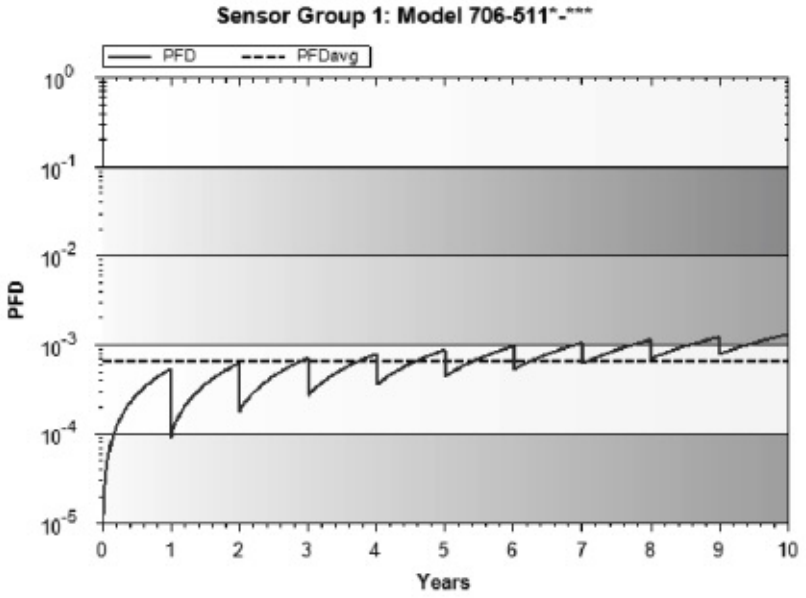
8.3 Specific Model 706 Values

Specific Model 706

Product	ECLIPSE Model 706-51Ax-xxx
SIL	SIL 2
HFT	0
SFF	93.0%
PFD_{avg}	6.67E-04
Proof Test Interval	Annually (refer to PFD Graph below)

8.4 PFD Graph

The resulting PFD_{AVG} Graph generated from the exSILentia tool for a proof test interval of one year is displayed below.



PFD_{AVG} value for a single, Model 706-511x-xxx with proof test intervals of one year.

It is the responsibility of the Safety Instrumented Function designer to perform calculations for the entire SIF. ***exida*** recommends the accurate Markov-based exSILentia tool for this purpose.

For SIL 2 applications, the PFD_{AVG} value needs to be ≥ 10^{-3} and < 10^{-2}. This means that for a SIL 2 application, the PFD_{AVG} for a 1-year Proof Test Interval of the Model 706-511x-xxx is approximately equal to 6.7% of the range.

These results must be considered in combination with PFD_{AVG} values of other devices of a Safety Instrumented Function (SIF) in order to determine suitability for a specific Safety Integrity Level (SIL).

8.5 Report: Lifetime of Critical Components

According to section 7.4.9.5 of IEC 61508-2, a useful lifetime, based on experience, should be assumed.

Although a constant failure rate is assumed by probabilistic estimation method, this only applies provided that the useful lifetime of components is not exceeded. Beyond their useful lifetime the result of the probabilistic calculation method is therefore meaningless, as the probability of failure significantly increases with time. The useful lifetime is highly dependent on the subsystem itself and its operating conditions.

The assumption of a constant failure rate is based on the bathtub curve. Therefore it is obvious that the PFD_{AVG} calculation is only valid for components that have this constant domain and that the validity of the calculation is limited to the useful lifetime of each component.

The expected useful life of ECLIPSE Model 706-511x-xxx is at least 50 years.

It is the responsibility of the end user to maintain and operate the Model 706-511x-xxx per manufacturer's instructions. Furthermore, regular inspection should indicate that all components are clean and free from damage.

When plant experience indicates a shorter lifetime than indicated here, the number based on plant experience should be used.

References

- IEC 61508 Edition 2.0,2010 "Functional Safety of Electrical/Electronic/ Programmable Electronic Safety Related Systems"
- ANSI/ISA-84.00.01-2004 Part 1 (IEC 61511-1Mod) "Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 1 Hardware and Software Requirements"
- ANSI/ISA-84.00.01-2004 Part 2 (IEC 61511-2Mod) "Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 2 Guidelines for the Application of ANSI/ISA84.00.01-2004 Part 1 (IEC 61511-1 Mod) – Informative"
- ANSI/ISA-84.00.01-2004 Part 3 (IEC 61511-3Mod) "Functional Safety: Safety Instrumented Systems for the Process Industry Sector – Part 3 Guidance for the Determination of the Required Safety Integrity Levels – Informative"
- ANSI/ISA-TR84.00.04 Part 1 (IEC 61511 Mod) "Guideline on the Implementation of ANSI/ISA-84.00.01-2004"

Disclaimer

The SIL values in this document are based on an FMEDA analysis using exida's SILVER Tool. MAGNETROL accepts no liability whatsoever for the use of these numbers or for the correctness of the standards on which the general calculation methods are based.

ASSURED QUALITY & SERVICE COST LESS

Service Policy

Owners of MAGNETROL controls may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by prepaid transportation. MAGNETROL will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory prior to the material's return. This is available through a MAGNETROL local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

Magnetrol®

705 Enterprise Street • Aurora, Illinois 60504-8149 • 630-969-4000 • Fax 630-969-9489
info@magnetrol.com • www.magnetrol.com

BULLETIN: 57-656.1
EFFECTIVE: June 2015
SUPERSEDES: January 2013