

Product Data Sheet

00816-0100-4745, Rev CA

Catalog 2002 – 2003

Rosemount Transmitter Diagnostics Reduce Maintenance Costs

ROSEMOUNT TRANSMITTER DIAGNOSTICS...

- *Reduce the Necessity of Trips to the Field by 85%*
- *Eliminate “Ghost Chasing” by Checking Transmitter Diagnostics On-line—save \$100/device*
- *Commissioning Instruments—Loop Checks—Labor Savings of 88%*
- *75% Reduction in Loop Test Time on Start-up*

FEATURES AND BENEFITS

- *Monitoring field instruments allows predictive and proactive maintenance*
- *Operator can check transmitter status before scheduling maintenance trip to field*
- *Provides the ability to configure, troubleshoot, and test connected devices and maintain a database of these devices*
- *Device specific diagnostics show health of device or sensor*
- *As Found/As Left audit trail meets ISO and OSHA compliance requirements*



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EMERSON™
Process Management

CONTROLLING MAINTENANCE COSTS

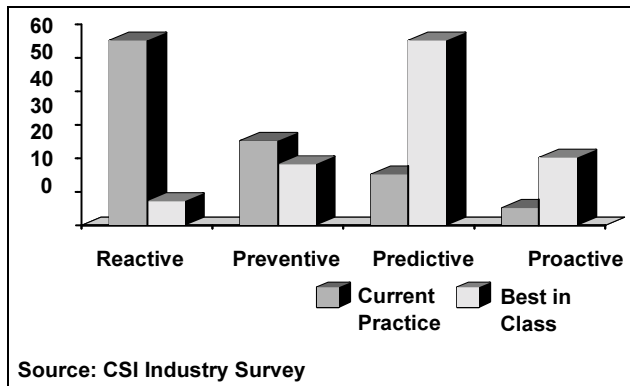
In today's process control industries, maintenance costs are increasing and having a direct impact on profitability. Controlling these costs is now a key strategy for most process plants. For most plants, where to invest in maintenance is still a major issue.

The four most well known maintenance strategies are reactive, preventative, predictive, and proactive. Unfortunately, over 50% of the current maintenance practices are reactive. Maintenance is scheduled when the equipment has reached complete failure. This correlates to expensive, unscheduled downtime and costly equipment repairs.

The second most typical maintenance practice is preventative. This practice usually involves a time-based system for scheduling maintenance. An example of preventative maintenance for process instrumentation is a calibration check every eight months on critical instruments. While this may uncover some possible problems, most of the checks are unnecessary since the instrumentation is healthy.

Today, management is beginning to recognize the importance of plant availability on profits. While preventative practices are still important, there is a growing need for predictive and proactive maintenance programs.

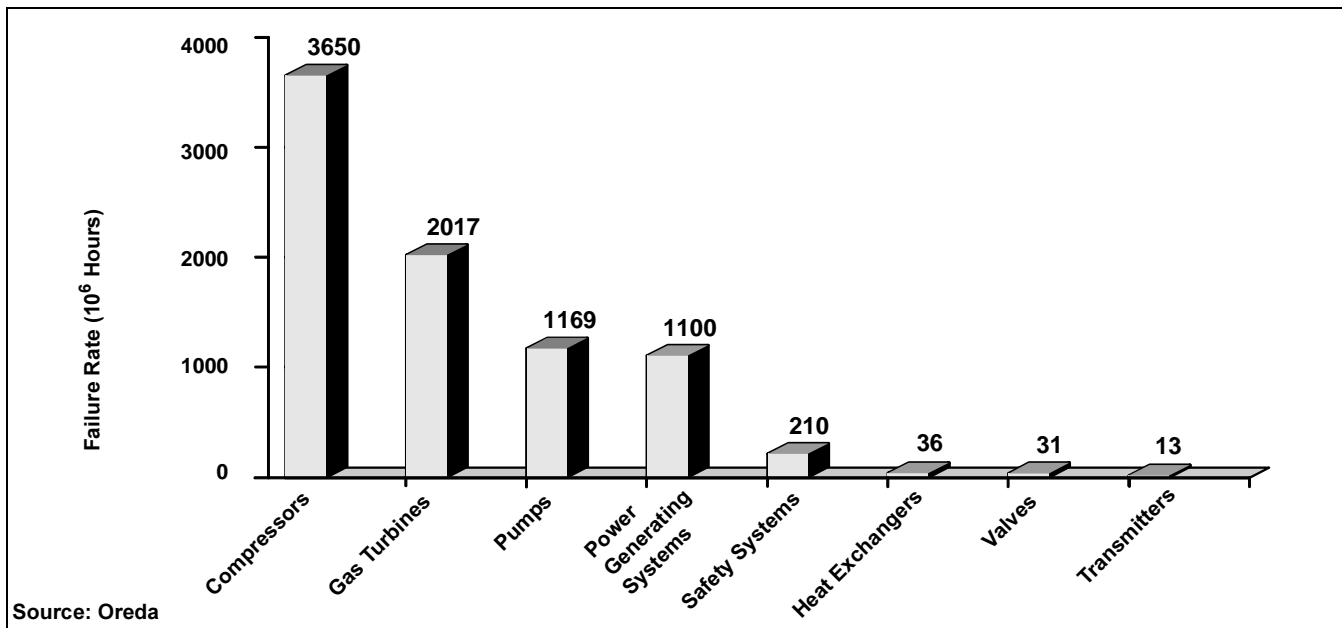
FIGURE 1. Plant Maintenance Strategies



A predictive maintenance program includes the ability to look at the status of instrumentation on-line. By continuous monitoring of equipment condition, a plant operator can identify possible problems before complete failure occurs.

Proactive maintenance is a new concept that allows you to determine the general time frame that an instrument will fail *before* it does. This concept is designed to minimize the risk of failure by eliminating the root cause.

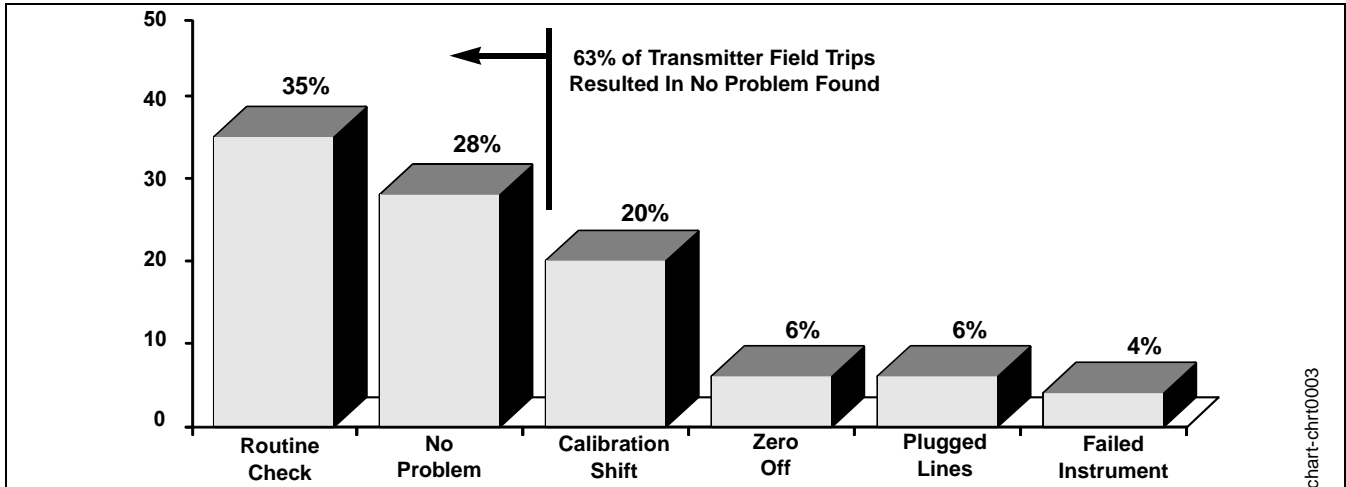
FIGURE 2. Maintenance Failures by Equipment Type



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FIGURE 3. Transmitter Check Results



Monitoring Devices

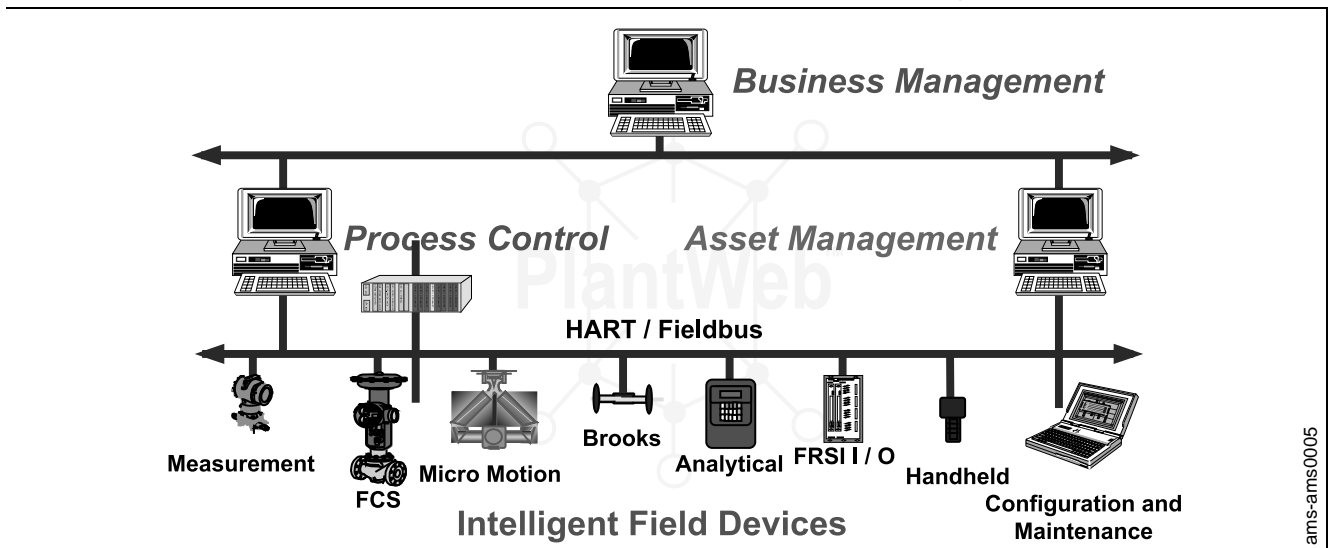
Choosing what to monitor on-line can be a difficult decision. In most process plants, rotating equipment tends to be the least reliable component. Investing in on-line systems to monitor this type of equipment is therefore becoming more popular. On the other hand, the transmitters are the most reliable device in the plant. Should you also monitor them?

While transmitter instrumentation tends to be the most reliable, they are also the most frequently checked process equipment. Since transmitters are typically the primary sensor reading into a control system, they are the first 'suspect' when a problem occurs.

However, most of these transmitter checks are unnecessary. In one large chemical plant, 63% of the trips to the field to check on a transmitter resulted in no problem found (see Figure 3). At an average cost of \$300 per trip, a considerable savings can be achieved if the health of the instrument is known before making the field call.

Monitoring of field instrumentation can therefore be very cost effective. Through the use of digital communications, on-line monitoring can be achieved easily and directed to where the information is most needed.

FIGURE 4. PlantWeb Provides both Process Control and Asset Management Solutions



Predictive and Proactive Maintenance

Through the use of Asset Management Solutions (AMS) from Fisher-Rosemount, predictive and proactive maintenance become a reality.

Intelligent field devices utilizing the HART® digital communication standard can easily be integrated into an Asset Management Solution while still providing the needed control signals.

Built-In Diagnostics

Each Rosemount intelligent device provides extensive diagnostics to indicate the health of the instrument, as well as some key predictive information. These diagnostics are available on-line through the use of the HART multipliers and/or pass through with Fisher-Rosemount control systems, connected to AMS.

Using AMS, maintenance personnel can determine which instrument is causing a process upset before taking a trip to the field. Each device in the suspect control loop can independently be checked by AMS for diagnostic status. If a problem has occurred in the instrument, the corresponding status bit will be flagged.

An alert monitor is also available to scan connected devices for anomalies. Should a fault occur in a scanned device, AMS will show an alert and indicate which instrument is in trouble. Many instruments also have built-in alarms that predict future problems.

Preventing Failures Before They Occur

In the process control industries, many instruments fail due to overheating. However, most transmitters from Rosemount include an internal temperature sensor that warns maintenance personnel when the temperature has exceeded specifications. AMS alerts the maintenance personnel of this condition, and they take actions to reduce the temperature prior to device failure, thereby saving the instrument and preventing costly downtime.

Additional AMS Features

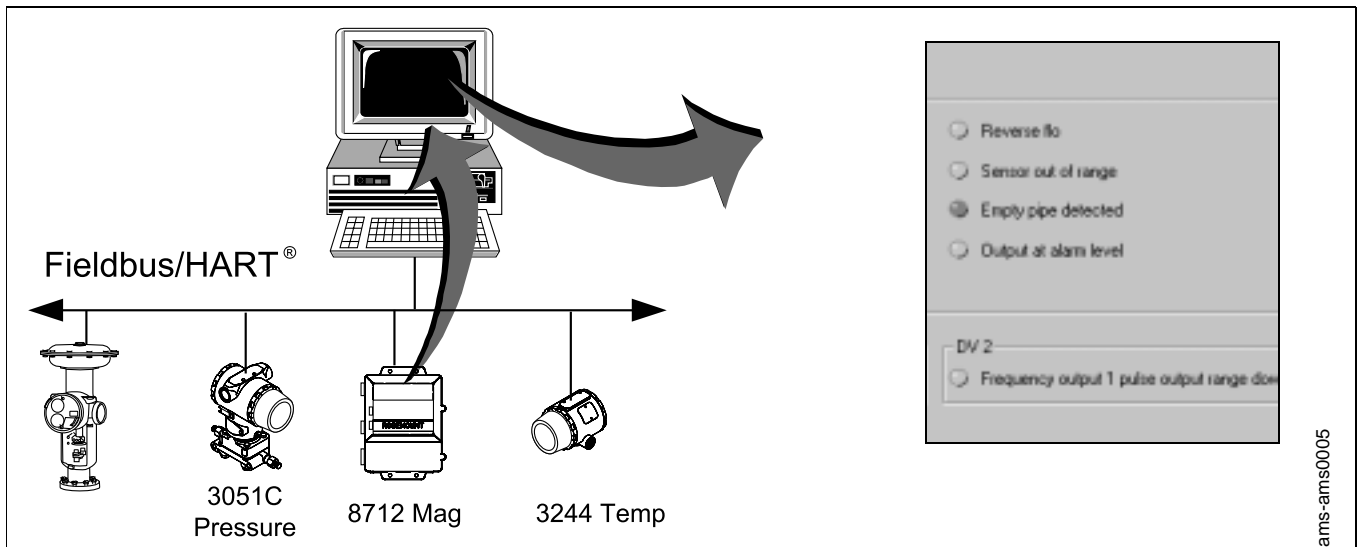
In addition to on-going monitoring of instrumentation, AMS provides the ability to configure, troubleshoot, and test connected devices and maintain a database of these devices (see Figure 6). All of the installed, spare and new field devices that need to be configured, calibrated, commissioned, monitored, and reported on are managed through the powerful features of AMS. AMS also provides the capability to upload and download configuration information from the Model 275 HART Communicator.

Full audit trail capabilities of each device is also recorded, including as found and as left calibration history. This critical information is often required for OSHA and ISO regulations.

AMS is Available Today

AMS communicates with all HART devices from Fisher-Rosemount. Currently over 3.5 million Rosemount HART devices are installed world-wide which can provide these valuable diagnostics.

FIGURE 5. AMS On-Line Monitoring of Transmitter Health Status



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The savings of using an on-line AMS system quickly add up on an annual basis:
 TABLE 1.

Start-up savings	\$150 /device
Streamlined configuration	100 /device
Streamlined calibration	50 /device
Self-documenting Tools	130 /device
Reduce “No problem Found” trips	60 /device
Reduce unnecessary valve rebuilds	617 /device

With AMS you can work with all Rosemount devices – HART® and FOUNDATION® fieldbus. Adding AMS to your control system reduces your current maintenance costs, while at the same time enhance your process and protect your plant investment.

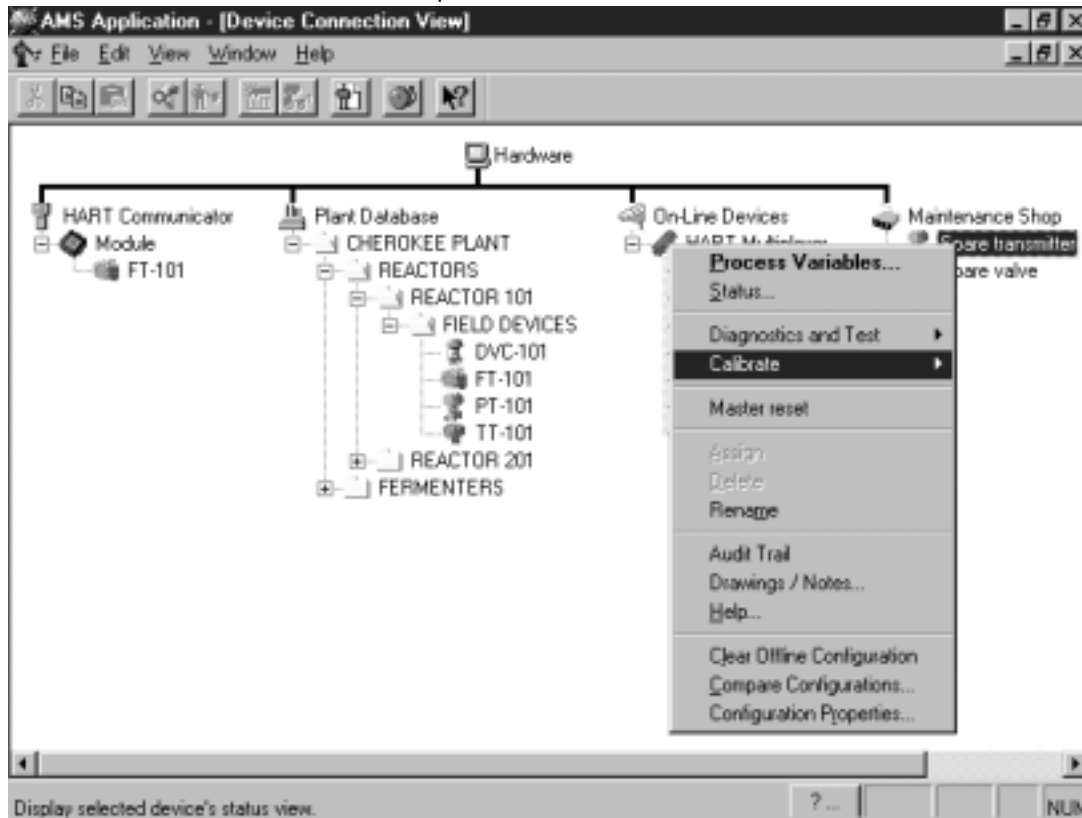
For more information on how AMS can help your plant, contact your local Fisher-Rosemount representative.

NOTE

Pages 6 through 17 of this document identify the diagnostic information for each Rosemount device that is available through AMS.

Fisher-Rosemount HART Devices that Communicate with AMS		
Pressure	Temperature	Flow
Model 3051C	Model 3144	Model 8800
Model 3051T	Model 3244	Model 8712
Model 1151S	Model 644	Model 8712C
Model 2088	Model 3044	Model 8712U
Model 2090 P		Model 8732
Model 2090 F		Model 8712H
		Model 9712
		Model 9739
		Model 9701
		Model 3095FT
		Model 3095MV
		Probar™
		Mass Probar™
Level	Valves	Analytical
Model 3001	DVC 5000 Series	Model 2061pH
Model 3201HIU	Oxymitter 4000	Model 2081C
Model 3202HIU	OPM 2000R	Model 3081pH
APEX	Model 3081SG	Model WC 3000
Model 3095 C		Model 3081C
		Model 54pH

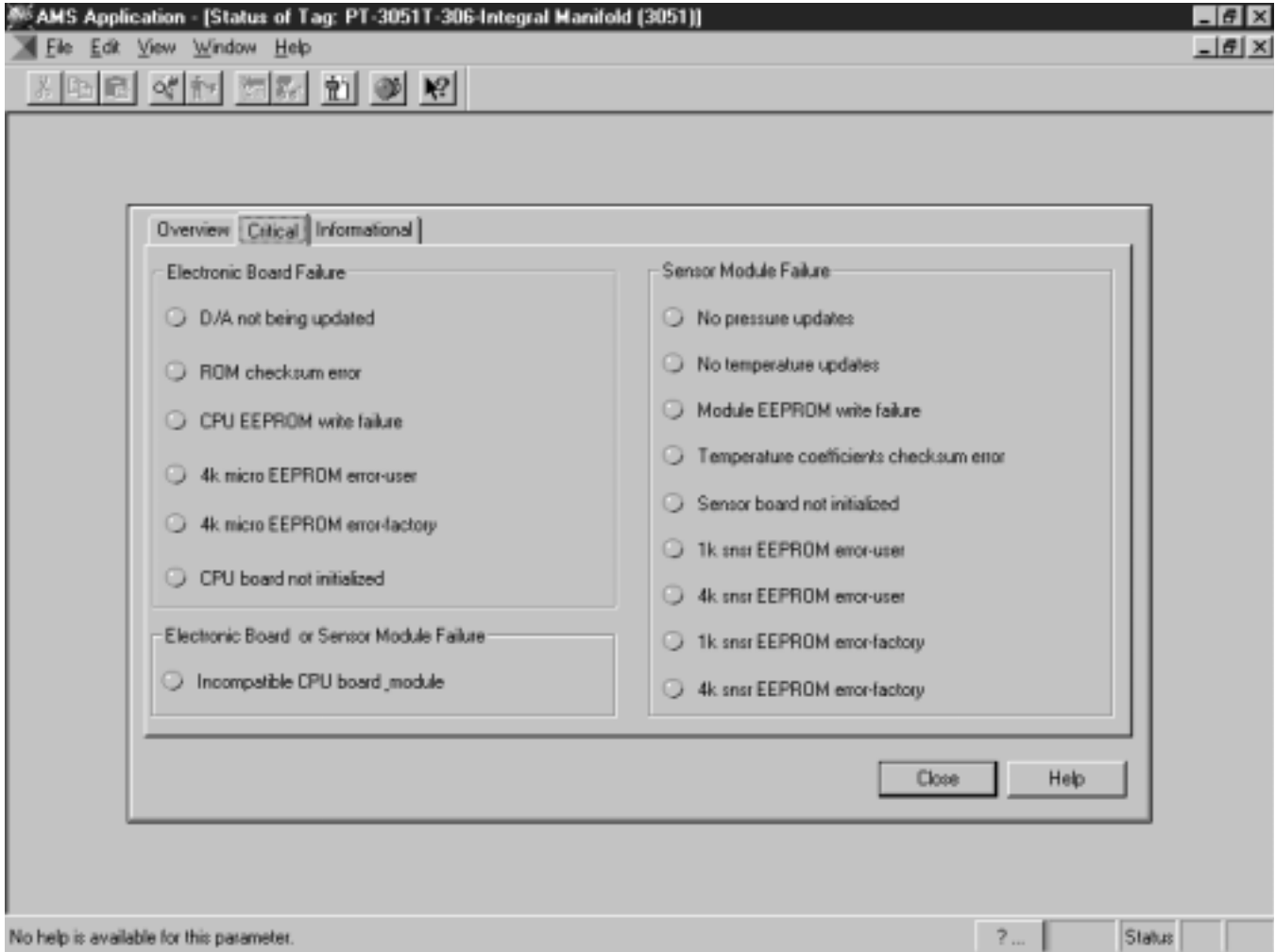
FIGURE 6. Example – AMS Database of Connected Devices



ams-1011

MODEL 3051 TRANSMITTER DIAGNOSTICS

FIGURE 7. AMS Critical Diagnostics Screen for the Model 3051 Pressure Transmitter Family



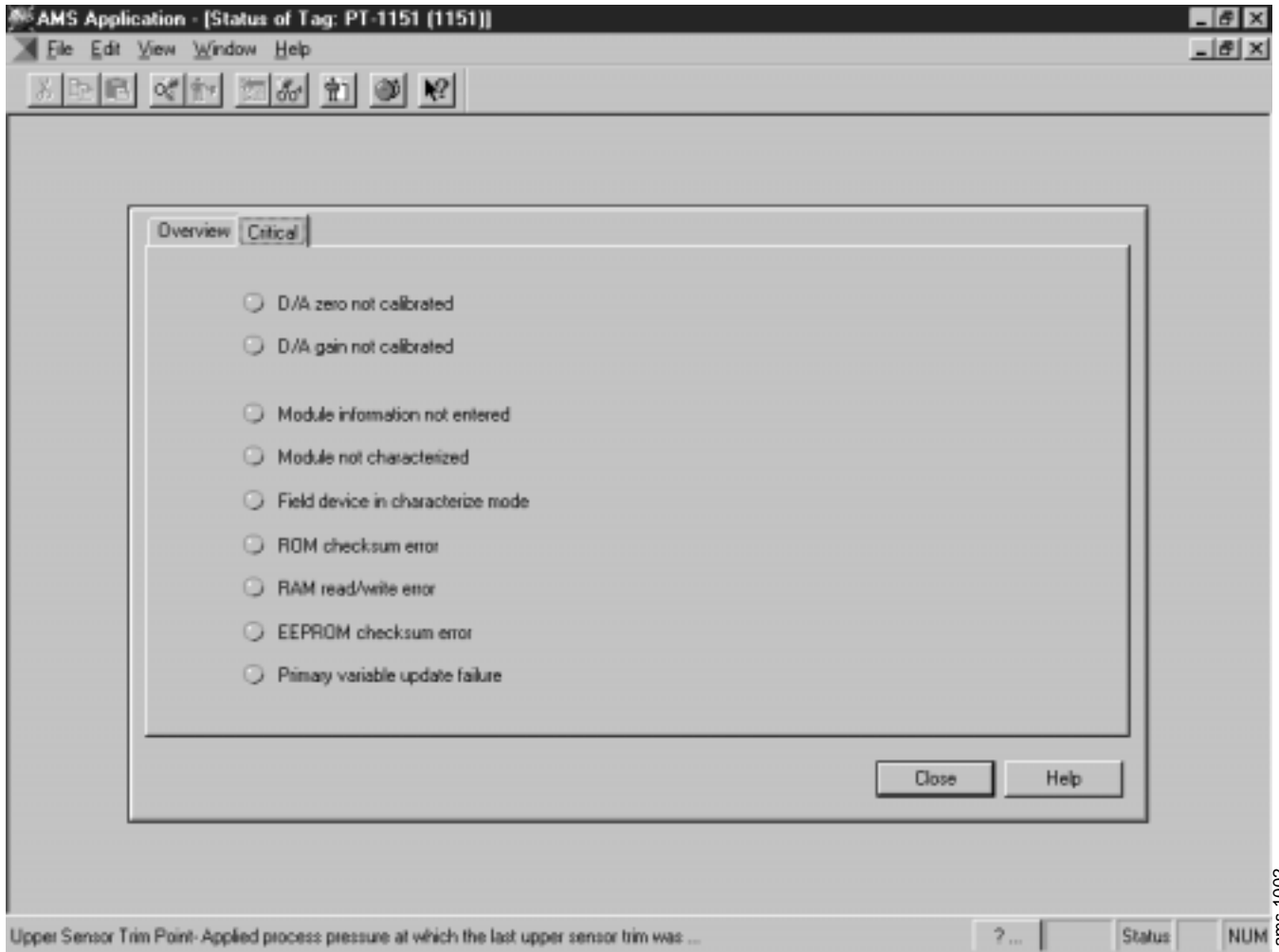
ams-1001

AMS Diagnostics Available for the Model 3051 Pressure Transmitter Family

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
D/A Not Updated	No Pressure Updates	Primary Variable Out of Limits	Configuration Changed
ROM Checksum Error	No Temperature Updates	Non-Primary Variable Out of Limits	Primary Variable Analog Output Fixed
CPU EEPROM Write Fail	Sensor Board EEPROM Write Fail	Primary Variable Analog Output Saturated	
Temperature Coefficient Checksum Error	Sensor Board Not Initialized		
Software Error 3			
Software Error 2			
Software Error 1			
CPU Board Not Initialized			
Incompatible CPU Board and Module			

MODEL 1151 TRANSMITTER DIAGNOSTICS

FIGURE 8. AMS Critical Diagnostics Screen for the Model 1151S Pressure Transmitter Family



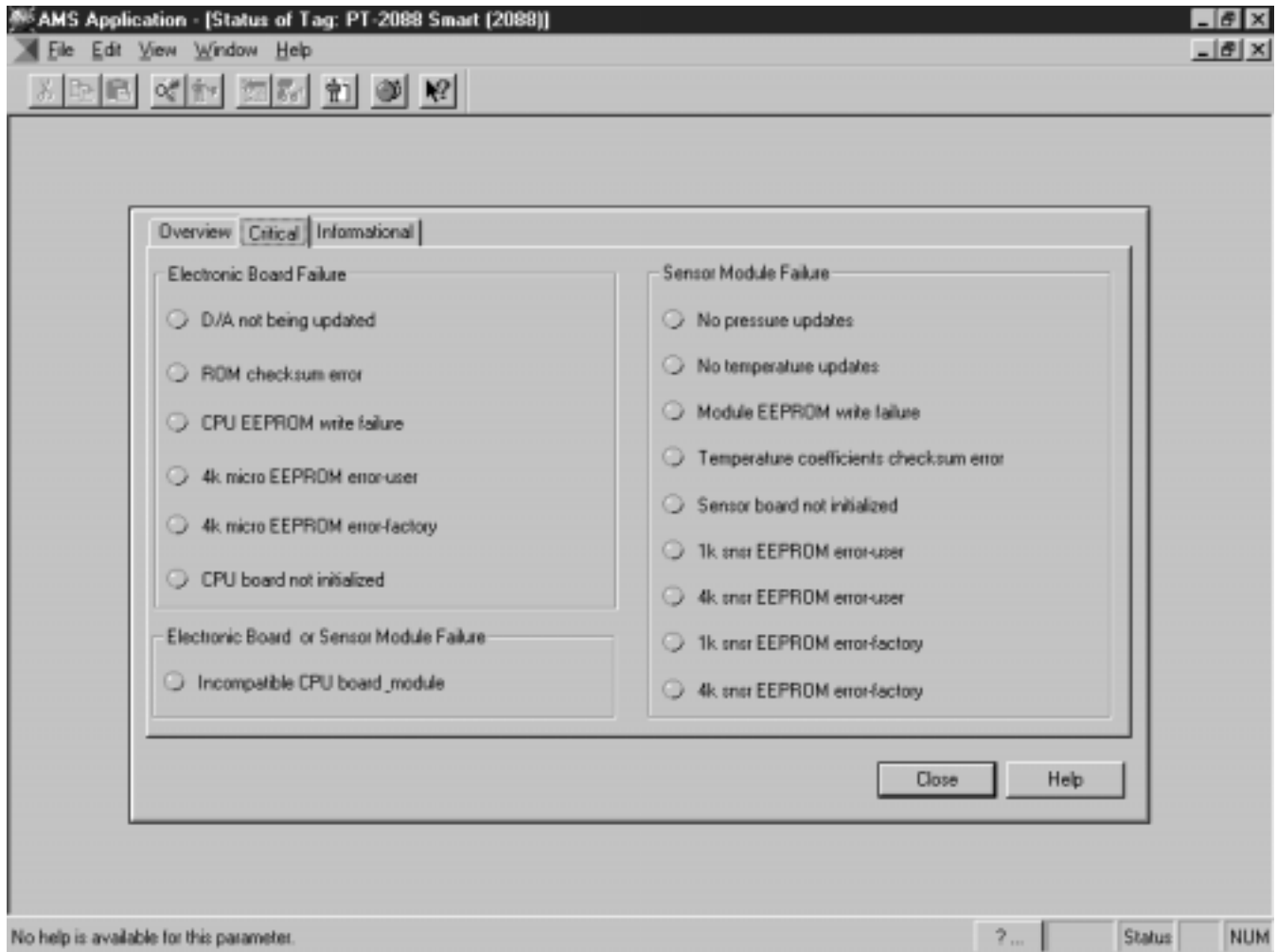
ams-1002

AMS Diagnostics Available for the Model 1151S Pressure Transmitter Family		
Electronics Failure	Process Condition	Configuration Warning
D/A Not Calibrated	Primary Variable Out of Limits	Field Device Not Installed
D/A Zero Not Calibrated	Primary Variable Analog Output Saturated	Module Range/Type Not Entered
D/A Gain Not Calibrated		Module Not Characterized
Transmitter Fault		Transmitter in Characterize Mode
ROM Checksum Error		Primary Variable Analog Output Fixed ⁽¹⁾
RAM Selftest Error		Configuration Changed ⁽¹⁾
EEPROM Checksum Error		Final Assembly Number Not Entered ⁽²⁾
Pressure Update Failure		

(1) Only available for Model 1151S Versions 5.
 (2) Only available for Model 1151S Version 1, 2, 3, or 4.

MODEL 2088 TRANSMITTER DIAGNOSTICS

FIGURE 9. AMS Critical Diagnostics Screen for the Model 2088 Pressure Transmitter Family



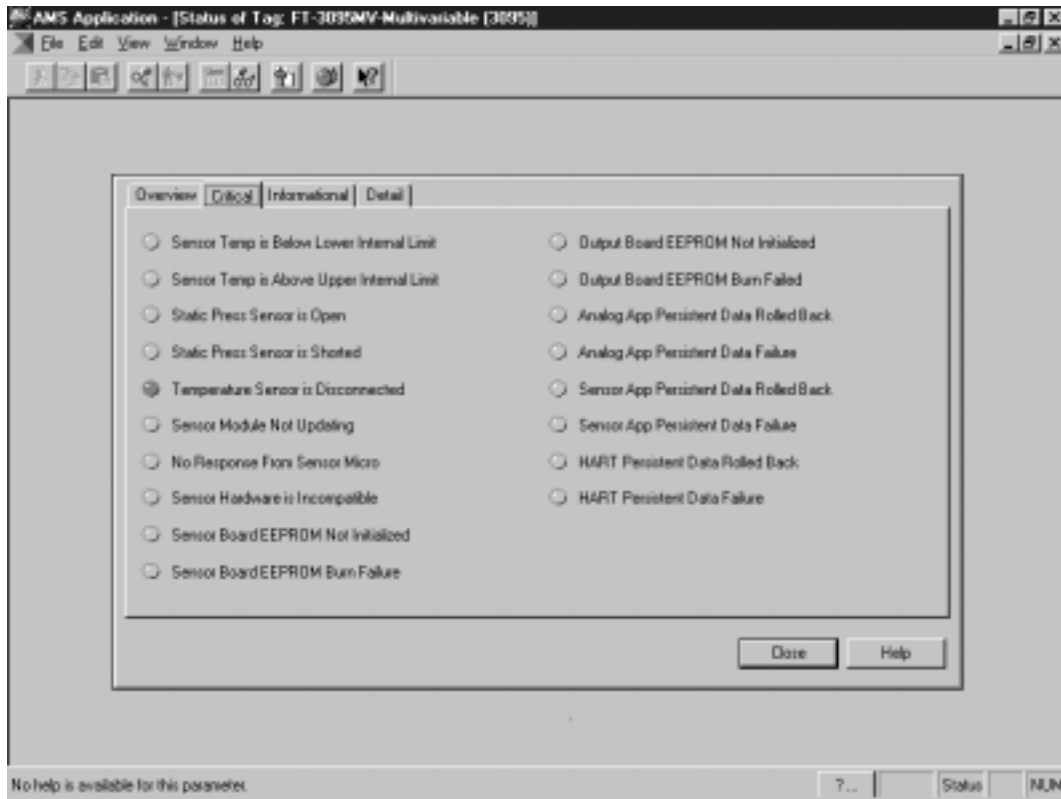
ams-1013

AMS Diagnostics Available for the Model 2088 Pressure Transmitter Family

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
D/A Not Updated	No Pressure Updates	Primary Variable Out of Limits	Configuration Changed
ROM Checksum Error	No Temperature Updates	Non-Primary Variable Out of Limits	Primary Variable Analog Output Fixed
CPU EEPROM Write Fail	Module EEPROM Write Fail	Primary Variable Analog Output Saturated	Local Buttons Operator Error
4k Micro EEPROM Error-User	Sensor Board Not Initialized		
4k Micro EEPROM Error-Factory	1k Sensor EEPROM Error-User		
Incompatible CPU Board Module	4k Sensor EEPROM Error-User		
Temperature Coefficients	1k Sensor EEPROM Error-Factory		
Checksum Error	4k Sensor EEPROM Error-Factory		
4k Micro EEPROM Error-User No Out	1k Sensor EEPROM Error-User No Out		

MODEL 3095 MV TRANSMITTER DIAGNOSTICS

FIGURE 10. AMS Critical Diagnostics Screen for the Model 3095 MV Mass Flow Transmitter



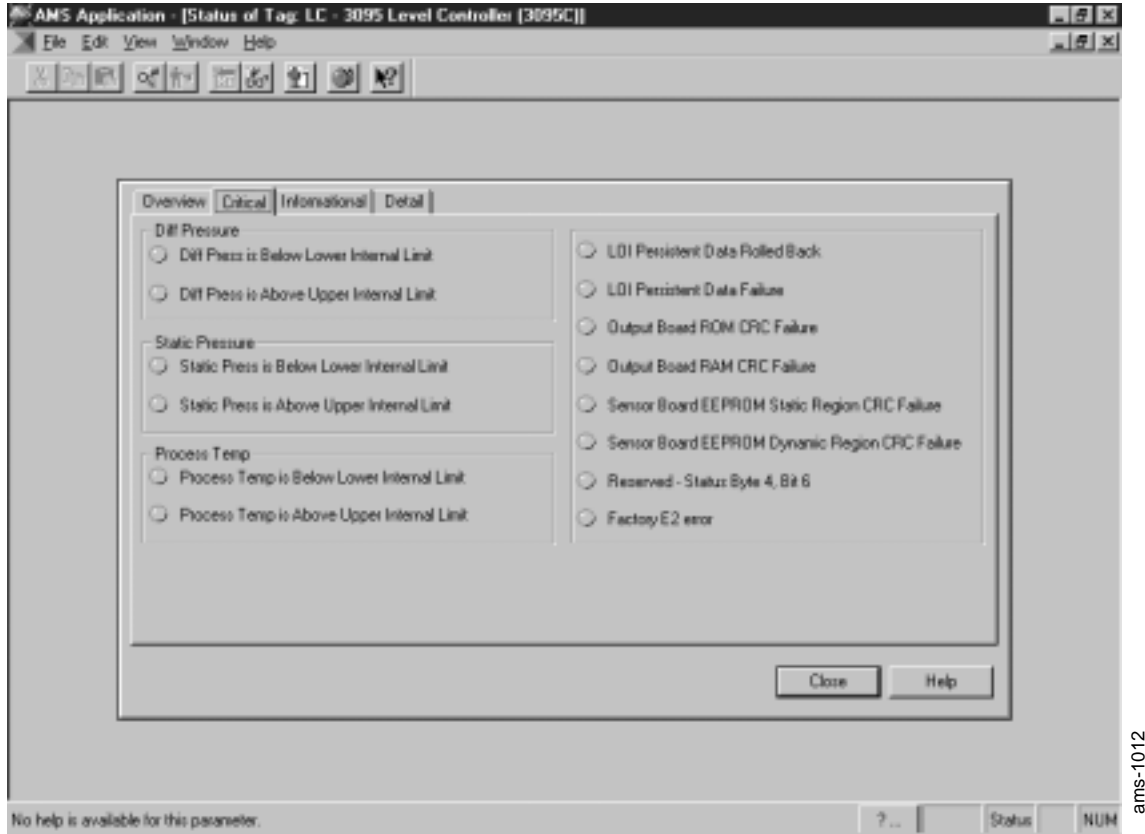
ams-1003

AMS Diagnostics Available for the Model 3095 MV Mass Flow Transmitter

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
HART Persistent Data Failure	Sensor Board EEPROM Burn Failure	Sensor Temp is Above Upper Internal Limit	Reverse Flow Detected
HART Persistent Data Rolled Back	Sensor Board EEPROM Not Initialized	Sensor Temp is Below Lower Internal Limit	Primary Variable Analog Output Fixed
Sensor App Persistent Data Failure	Sensor Hardware is Incompatible	Process Temp is Above Upper Internal Limit	Configuration Changed
Sensor App Persistent Data Rolled Back	No Response From Sensor Micro	Process Temp is Below Lower Internal Limit	Cold Start
Analog App Persistent Data Failure	Sensor Module Not Updating	Static Press is Above Upper Internal Limit	
Analog App Persistent Data Rolled Back	Temperature Sensor is Disconnected	Static Press is Below Lower Internal Limit	
Output Board EEPROM Burn Failed	Static Press Sensor is Shorted	Diff Press is Above Upper Internal Limit	
Output Board EEPROM Not Initialized	Static Press Sensor is Open	Diff Press is Below Lower Internal Limit	
Self Test Failed		Flow - PT is Above Upper Operating Limit	
Software Detected Error		Flow - PT is Below Lower Operating Limit	
Reserved Bit Set - Status Byte 3, Bit 5		Flow - SP is above Upper Operating Limit	
Reserved Bit Set - Status Byte 3, Bit 4		Flow - SP is Below Lower Operating Limit	
Application #2 Persistent Data Failure		Primary Variable Out of Limits	
Application #2 Persistent Data Rolled Back		Non-Primary Variable Out of Limits	
Flow Persistent Data Failure		Primary Variable Analog Output Saturated	
Flow Persistent Data Rolled Back			
Flow Configuration Error			
Flow Calculation Math Error			
Flow is Above Upper Internal Limit			
Field Device Malfunction			

MODEL 3095 MV LEVEL CONTROLLER

FIGURE 11. AMS Critical Diagnostics Screen for the Model 3095 MV Level Controller



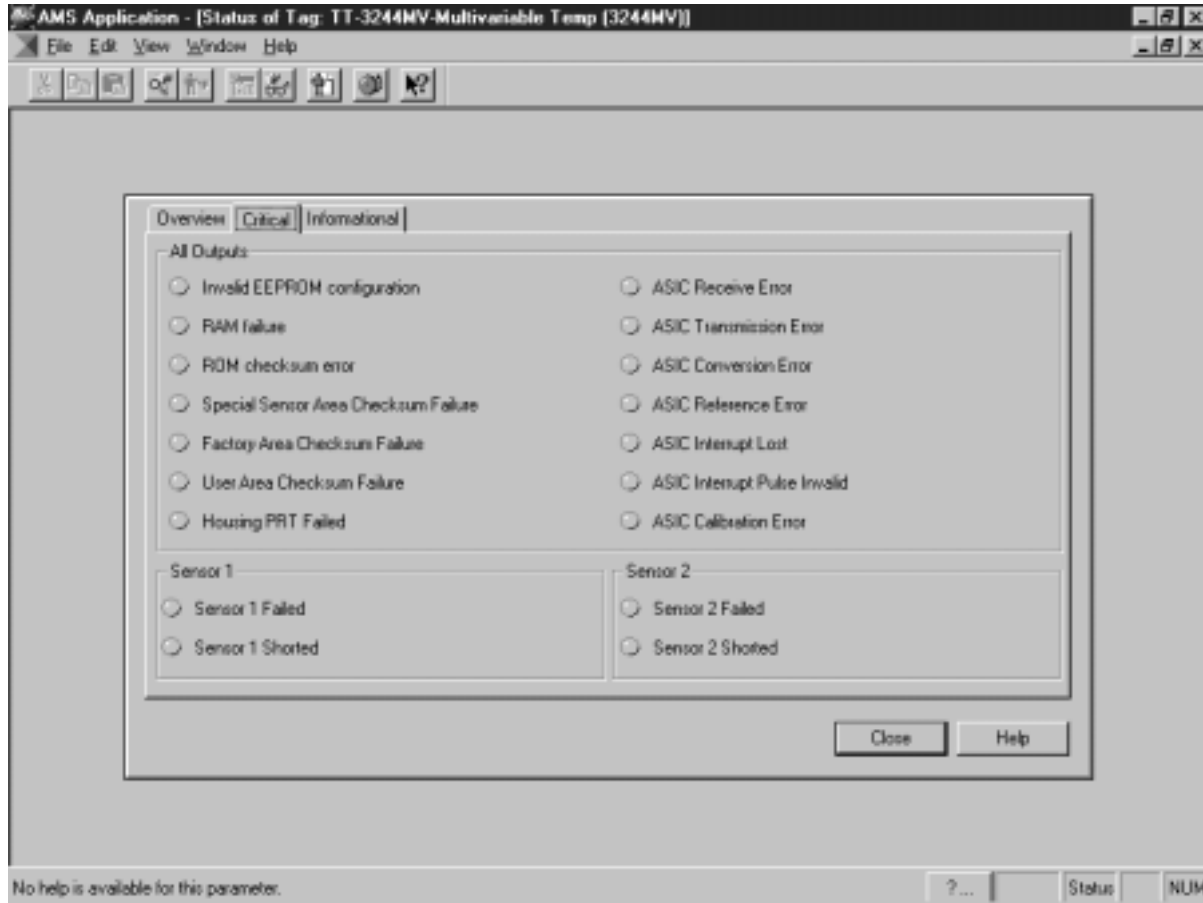
ams-1012

AMS Diagnostics Available for the Model 3095 MV Level Controller

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
Field Device Malfunction	Sensor Board EEPROM Static Region CRC Failure	Primary Variable Out of Limits	Primary Variable Analog Output Fixed
Control Persistent Data Rolled Back	Sensor Board EEPROM Dynamic Region CRC Failure	Non-Primary Variable Out of Limits	Cold Start
Control Persistent Data Failure	Static Press Sensor is Open	Primary Variable Analog Output Saturated	
LOI Persistent Data Rolled Back	Static Press Sensor is Shorted	More Status Available	
LOI Persistent Data Failure	Temperature Sensor is Disconnected	Diff Press is Below Lower Internal Limit	
Level Persistent Data Rolled Back	Sensor Module Not Updating	Diff Press is Above Upper Internal Limit	
Level Persistent Data Failure	No Response From Sensor Microprocessor	Static Press is Below Lower Internal Limit	
Auto-Tuner Persistent Data Rolled Back	Sensor Hardware is Incompatible	Static Press is Above Upper Internal Limit	
Auto-Tuner Persistent Data Failure	Sensor Board EEPROM Not Initialized	Process Temp is Below Lower Internal Limit	
Bad Level Status	Sensor Board EEPROM Burn Failure	Process Temp is Above Upper Internal Limit	
Self Test Failed		Sensor Temp is Below Lower Internal Limit	
Output Board ROM CRC Failure		Sensor Temp is Above Upper Internal Limit	
Output Board RAM CRC Failure			
Reserved-Status Byte 4, Bit 6			
Factory E2 Error			
Output Board EEPROM Not Initialized			
Output Board EEPROM Burn Failed			
Analog App Persistent Data Rolled Back			
Analog App Persistent Data Failure			
Sensor App Persistent Data Rolled Back			
Sensor App Persistent Data Failure			
HART Persistent Data Rolled Back			
HART Persistent Data Failure			

MODEL 3244 TEMPERATURE TRANSMITTER

FIGURE 12. AMS Critical Diagnostics Screen for the Model 3244 Temperature Transmitter



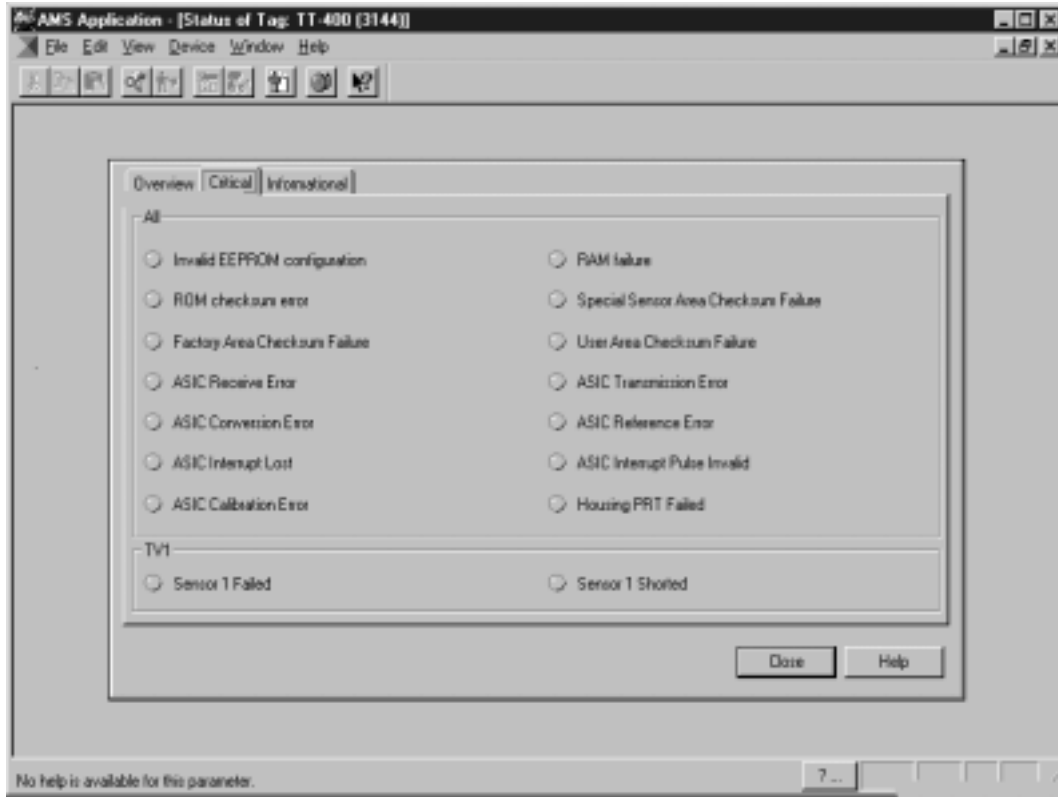
ams-1004

AMS Diagnostics Available for the Model 3244 Temperature Transmitter Family

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
EEPROM Invalid Configuration	Sensor Failure	Primary Variable Out of limits	Excess Correction
RAM Failure	Housing Failure	Non-Primary Variable Out of Limits	Operator Error
ROM Checksum Failure	Sensor 1 Failed	Primary Variable Analog Output Saturated	Configuration Changed
EEPROM Write Failure	Sensor 1 Shorted	Sensor 1 Out of Range	Primary Variable Analog Output Fixed
EEPROM Special Sensor Checksum Error	Sensor 2 Failure	Sensor 2 Out of Range	
EEPROM Factory Area Checksum Failure	Sensor 2 Shorted	Hot Backup Active	
EEPROM User Area Checksum Failure			
EEPROM Checksum Failure			
ASIC Receive Error			
ASIC Transmission Error			
ASIC Conversion Error			
ASCI Reference Error			
ASIC Interrupt Lost			
ASIC Interrupt Pulse Invalid			
ASIC Calibration Error			
ASIC General Failure			
Electronics Failure			
Housing Failure			
Housing PRT Failed			
No Trim Update			

MODEL 3144 TEMPERATURE TRANSMITTER

FIGURE 13. AMS Critical Diagnostics Screen for the Model 3144 Temperature Transmitter



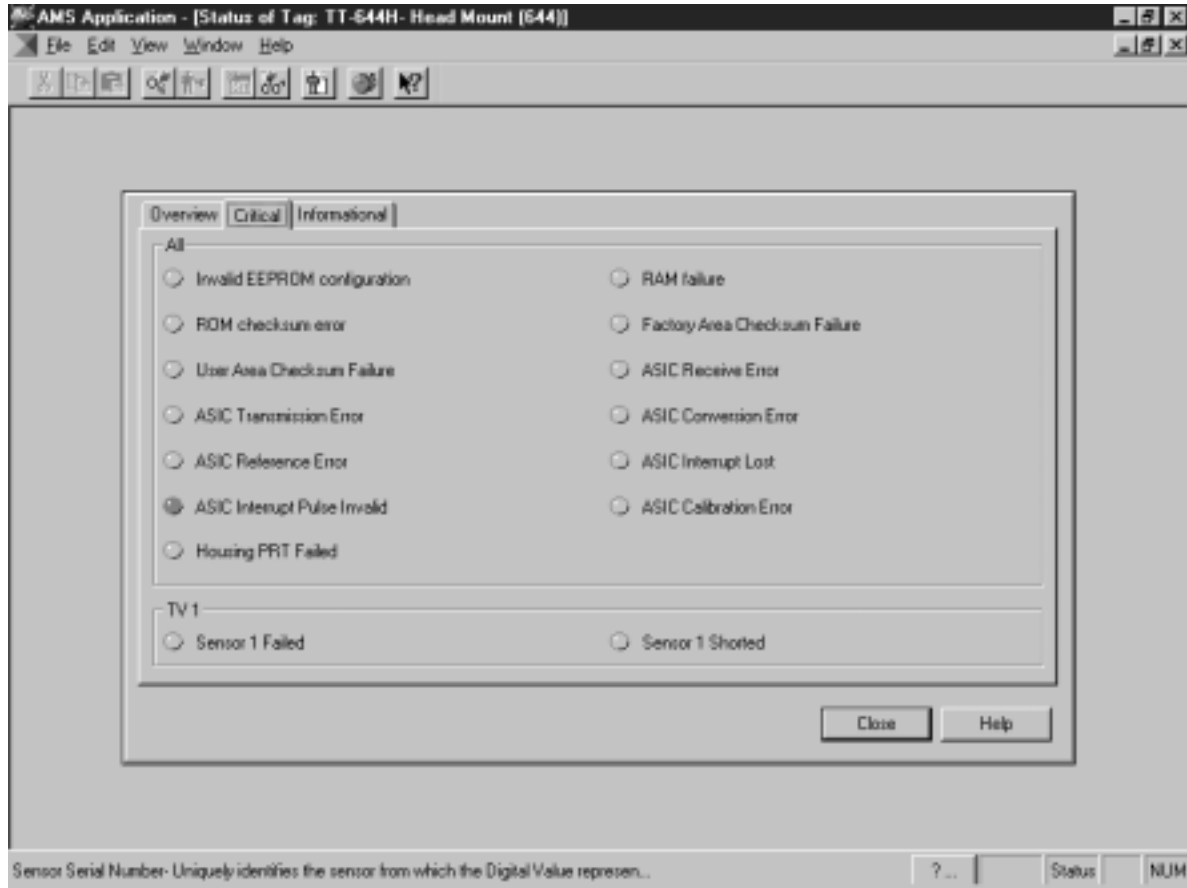
ams-1005

AMS Diagnostics Available for the Model 3144 Temperature Transmitter Family

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
EEPROM Invalid Configuration	Sensor Failure	Sensor 1 Out of Range	Primary Variable Analog Output Fixed
RAM Failure	Housing Failure	PRT Out of Range	Excess Correction
ROM Checksum Failure	Sensor 1 Failed	Primary Variable Out of Limits	Configuration Changed
EEPROM Write Failure	Sensor 1 Shorted	Non-Primary variable Out of Limits	
EEPROM Special Sensor Checksum Error		Primary Variable Analog Output Saturated	
EEPROM Factory Area Checksum Failure			
EEPROM User Area Checksum Failure			
EEPROM Checksum Failure			
ASIC Receive Error			
ASIC Transmission Error			
ASIC Conversion Error			
ASIC Reference Error			
ASIC Interrupt Lost			
ASIC Interrupt Pulse Invalid			
ASIC Calibration Error			
ASIC General Failure			
No Trim Update			
Electronics Failure			
Housing Failure			
Housing PRT Failed			

MODEL 644 TEMPERATURE TRANSMITTER

FIGURE 14. AMS Critical Diagnostics Screen for the Model 644 Temperature Transmitter

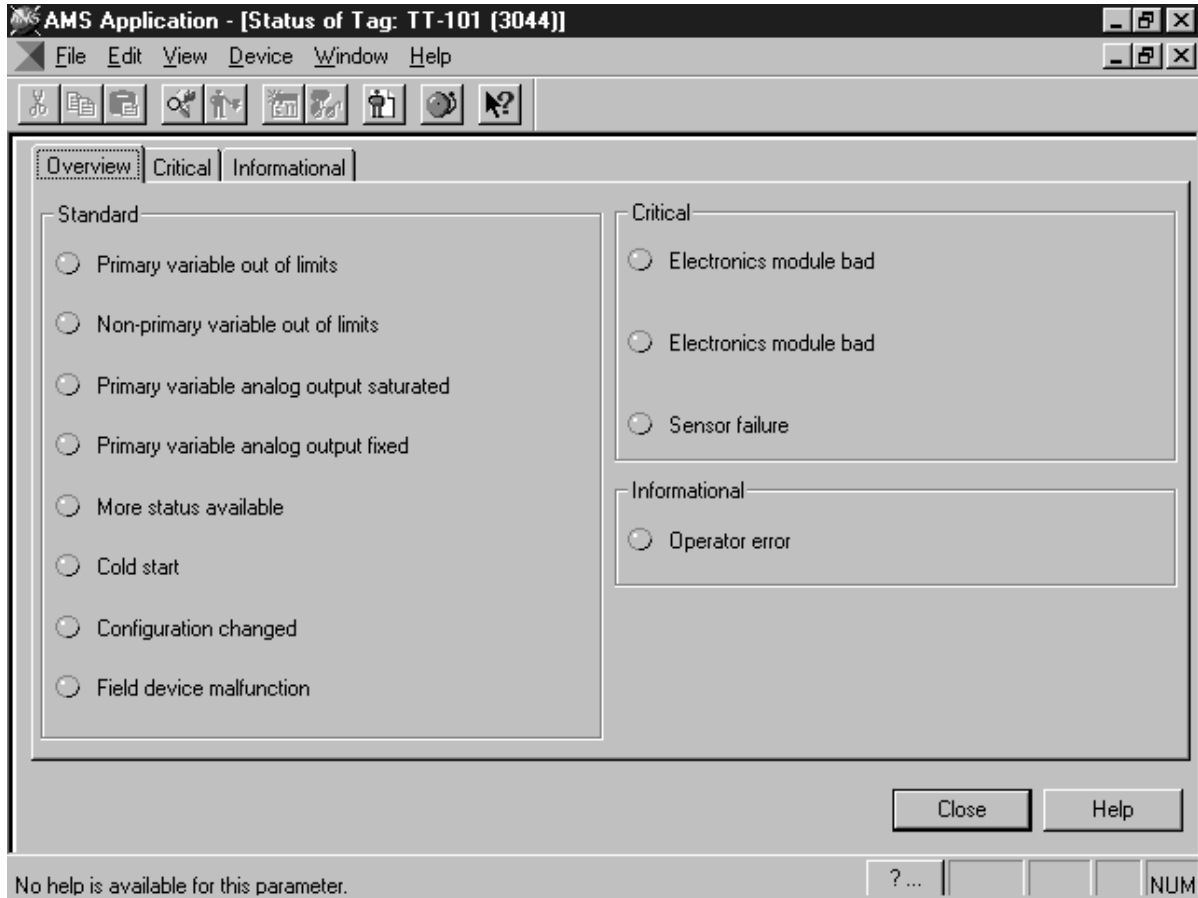


ams-1006

AMS Diagnostics Available for the Model 644 Temperature Transmitter Family			
Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
EEPROM Invalid Configuration	Sensor Failure	Sensor 1 Out of Range	Primary Variable analog Output Fixed
RAM Failure	Sensor 1 Failed	PRT Out of Range	Configuration Changed
ROM Checksum Failure	Sensor 1 Shorted	Primary Variable Out of Limits	Excess Correction
EEPROM Factory Area Checksum Failure		Primary Variable Analog Output Saturated	Operator Error
EEPROM User Area Checksum Failure			
EEPROM Checksum Failure			
ASIC Receive Error			
ASIC Transmission Error			
ASIC Conversion Error			
ASCI Reference Error			
ASIC Interrupt Lost			
ASIC Interrupt Pulse Invalid			
ASIC Calibration Error			
ASIC General Failure			
No Trim Update			
Electronics Failure			
Housing Failure			
Housing PRT Failed			

MODEL 3044 TEMPERATURE TRANSMITTER

FIGURE 15. AMS Overview Diagnostics Screen for the Model 3044 Temperature Transmitter



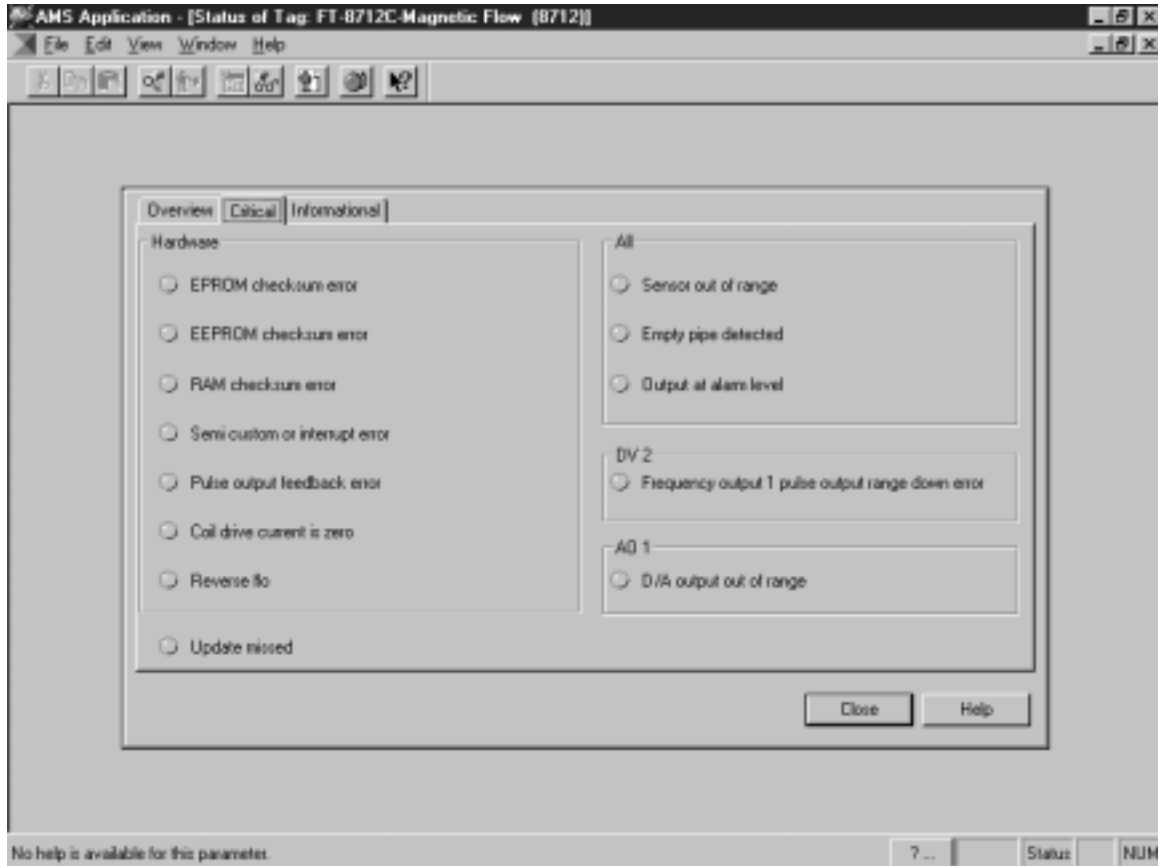
ams-1007

AMS Diagnostics Available for the Model 3044 Temperature Transmitter Family

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
Invalid EEPROM Configuration	Bad Upper and/or Lower Range Values for Sensor	Primary Variable Out of Limits	Fatal Configuration Error
RAM Failure	Sensor Failure	Non-Primary Variable Out of Limits	Configuration Changed
ROM Checksum Error		Primary Variable Analog Output Saturated	Primary Variable Analog Output Fixed
Sensor Board EEPROM Checksum Error			Operator Error
Micro Board EEPROM Checksum Error			User Trim Error: Excess Error
ASIC Start/Stop Bit Error			
ASIC Parity Error			
ASIC Control World Mismatch			
Improper Nominal ASIC Count			
Loss of ASIC Interrupt			
ASIC Interrupt Too Wide			
Generalized ASIC Failure			
No Trim Update			
Electronics Module Failure (sensor board)			
Electronics Module Failure (micro board)			

MODEL 8712C, 8712H, AND 8712U MAGNETIC FLOWMETERS

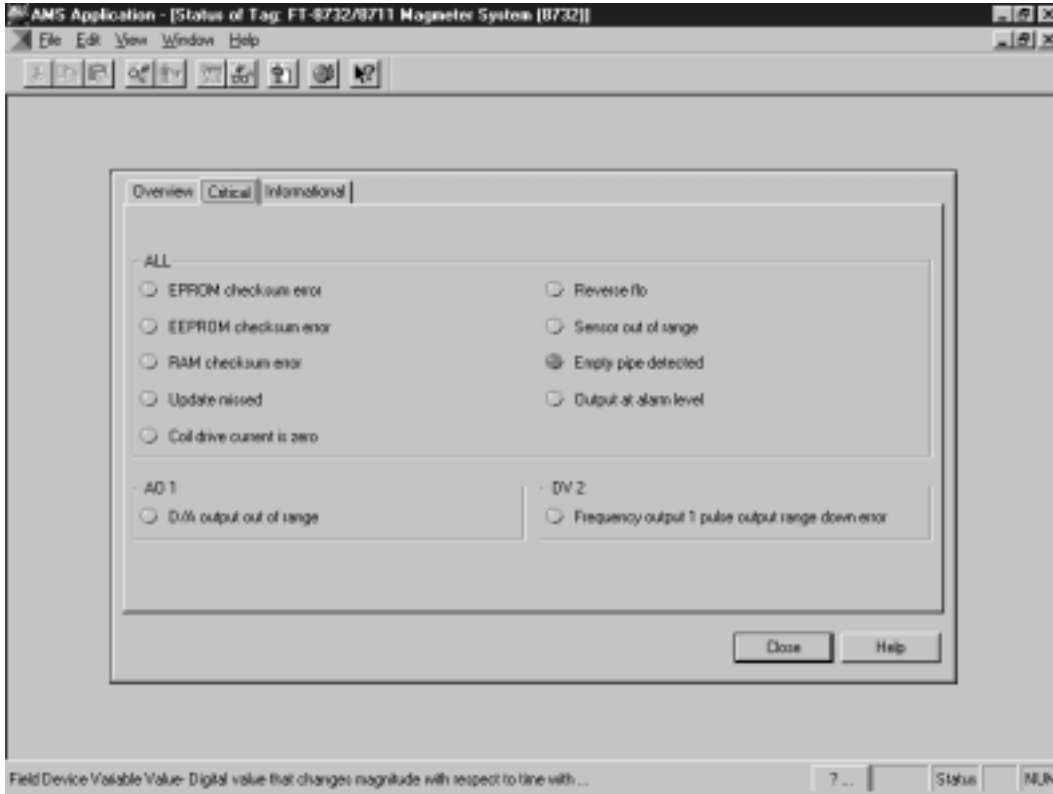
FIGURE 16. AMS Critical Diagnostics Screen for the Model 8712 Magnetic Flowmeters



AMS Diagnostics Available for the Model 8712C, 8712H and 8712U Magnetic Flowmeters			
Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
Electronics Failure	Coil Drive Current is Zero	Positive Zero Return Activated	Primary Variable Analog Output Fixed
EEPROM Checksum Error	Coil Drive Fault	Reverse Flow	Configuration Changed
RAM Checksum Error	Electrodes Open Circuit	Sensor Out of Range	
Semi Custom or Interrupt Error	Automatic Zero Failure	Empty Pipe Detected	
Pulse Output Feedback Error		D/A Output Out of Range	
Digital Trim Fail		Frequency Output 1 Pulse Output Range Down Error	
		Update Missed	
		Output at Alarm Level	
		Excess Calibration Correction, Zero Too Low	
		Excess Calibration Correction, Zero Too High	
		Excess Calibration Correction, Gain Too Low	
		Excess Calibration Correction, Gain Too High	
		Calibration Attempt Without Calibrator	
		Excess Automatic Zero Correction, Zero Too Low	
		Excess Automatic Zero Correction, Zero Too High	
		Automatic Zero Attempt With Nonzero Flow	
		Reverse Flow Rate Detected	
		Frequency Output 1 Pulse Output out of Range	
		Positive Zero Return Output Active	
		Primary Variable Out of Limits	
		Non-Primary Variable Out of Limits	
		Primary Variable Analog Output Saturated	

MODEL 8732 MAGNETIC FLOWMETER

FIGURE 17. AMS Critical Diagnostics Screen for the Model 8732 Magnetic Flowmeter



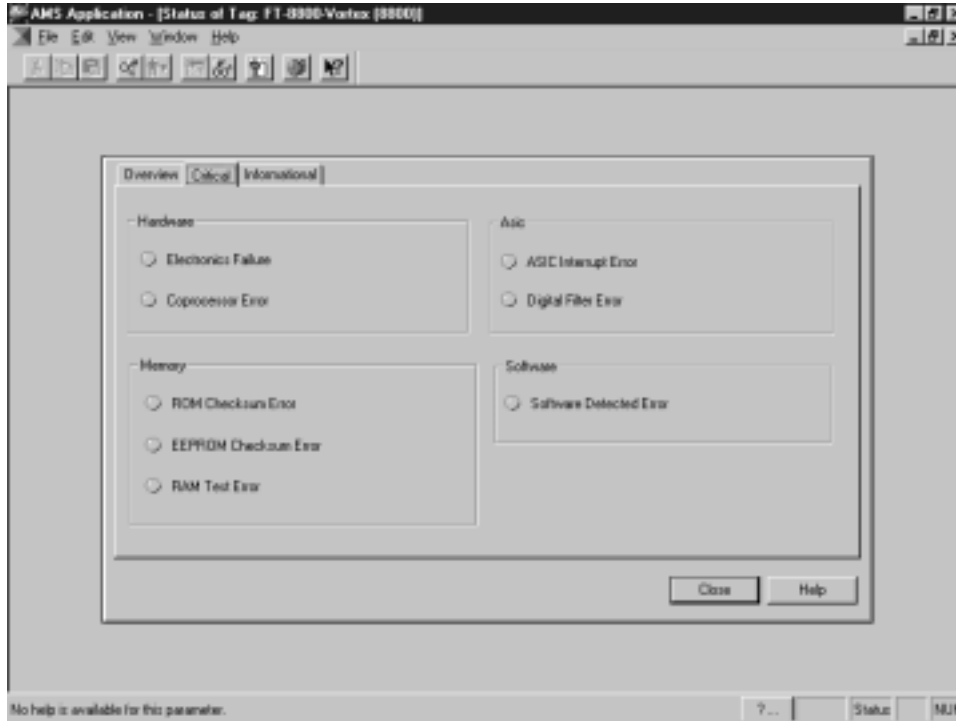
ams-1009

AMS Diagnostics Available for the Model 8732 Magnetic Flowmeter

Electronics Failure	Sensor Failure	Process Condition	Configuration Warning
Electronics Failure	Coil Drive Open Circuit	Positive Zero Return Activated	Primary Variable Analog Output Fixed
Digital Trim Fail	Electrodes Open Circuit	Reverse Flow	Configuration Changed
EEPROM Checksum Error	Automatic Zero Failure	Sensor Out of Range	
RAM Checksum Error	Coil Drive Current is Zero	Empty Pipe Detected	
Semi Custom or Interrupt Error		D/A Output Out of Range	
Pulse Output Feedback Error		Frequency Output 1 pulse Output Range Down Error	
		Update Missed	
		Output at Alarm Level	
		Excess Calibration Correction, Zero Too Low	
		Excess Calibration Correction, Zero Too High	
		Excess Calibration Correction, Gain Too Low	
		Excess Calibration Correction, Gain Too High	
		Calibration Attempt Without Calibrator	
		Excess Automatic Zero Correction, Zero Too Low	
		Excess Automatic Zero Correction, Zero Too High	
		Automatic Zero Attempt With Nonzero Flow	
		Reverse Flow Rate Detected	
		Frequency Output 1 Pulse Output Out of Range	
		Positive Zero Return Output Active	
		Primary Variable Out of Limits	
		Non-primary Variable Out of Limits	
		Primary Variable Analog Output Saturated	

MODEL 8800 VORTEX FLOWMETER

FIGURE 18. AMS Critical Diagnostics Screen for the Model 8800 Vortex Flowmeter



ams-1010

AMS Diagnostics Available for the Model 8800 Vortex Flowmeter		
Electronics Failure	Process Condition	Configuration Warning
Electronics Failure	Trigger Level Overrange	Parameters Not Configured
Software Detected Error	Low Pass Filter Overrange	Update Missed
Coprocessor Error	Low Flow Cut Overrange	Primary Variable Analog Output Fixed
Digital Filter Error	Ambient Temp Overrange	Configuration Changed
ASIC Interrupt Error	Primary Variable Out of Limits	
RAM Test Error	Non-primary Variable Out of Limits	
EEPROM Checksum Error	Primary Variable Analog Output Saturated	
ROM Checksum Error		
Factory EEPROM Config Error		

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Emerson Process Management

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