STT700 SmartLine Temperature Transmitter

HART® Communications Options

Safety Manual

34-TT-25-20

Revision 3

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About This Document

Release Information

STT700 SmartLine Transmitter HART® Communications Options Safety Manual, # 34-TT-25-20.

Revision	Date of Change	Details of Change
1	June 2017	1st release
2	December 2018	Links and failure rate info updated
3	June 2019	Updated worst case internal fault detection time and standard display reference for Integral meter release.

References

The following list identifies publications that may contain information relevant to the information in this document.

- STT700 SmartLine Temperature Transmitter Specifications, # 34-TT-03-19
- STT700 SmartLine Temperature Transmitter Quick Start Installation Guide, # 34-TT-25-19
- STT700 SmartLine Temperature Transmitter User Manual, Document # 34-TT-25-17
- STT700 SmartLine Temperature Transmitter HART/DE Option User's Manual, # 34-TT-25-18

Patent Notice

The Honeywell STT700 SmartLine Temperature Transmitter family is covered by one or more of the following U. S. Patents: 5,485,753; 5,811,690; 6,041,659; 6,055,633; 7,786,878; 8,073,098; and other patents pending.

Support and Contact Information

For Europe, Asia Pacific, North and South America contact details, refer to the back page of this manual or the appropriate Honeywell Solution Support web site:

Honeywell Corporate	www.honeywellprocess.com
Honeywell Process Solutions	www.honeywellprocess.com/temperature-transmitters/
Training Classes	http://www.honeywellprocess.com/en-US/training

Telephone and Email Contacts

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Terms and Abbreviations

1oo1	One out of one
Basic Safety	The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition
DU	Dangerous Undetected failures
FMEDA	Failure Modes, Effects and Diagnostic Analysis
Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system
GTS	Global Technical Support Center
HART®	Highway Addressable Remote Transducer
HFT	Hardware Fault Tolerance
Low demand mode	Mode, where the frequency of demands for operation made on a safety-related system is no greater than one per year and no greater than twice the proof test frequency.
PFD_{AVG}	Average Probability of Failure on Demand
Safety	Freedom from unacceptable risk of harm
Safety Assessment	The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems. Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.
SFF	Safe Failure Fraction, the fraction of the overall failure rate of a device that results in either a safe fault or a diagnosed unsafe fault.
SIF	Safety Instrumented Function, a set of equipment intended to reduce the risk due to a specific hazard (a safety loop).
SIL	Safety Integrity Level, discrete level (one out of a possible four) for specifying the safety integrity requirements of the safety functions to be allocated to the E/E/PE safety-related systems where Safety Integrity Level 4 has the highest level of safety integrity and Safety Integrity Level 1 has the lowest.
SIS	Safety Instrumented System – Implementation of one or more Safety Instrumented Functions. A SIS is composed of any combination of sensor(s), logic solver(s), and final element(s).

Contents

1 — Requirements

Requirements for use of the manual

This section is intended for user's who have our STT700 SmartLine Temperature Transmitter with the HART® Communication option with SIL. Any other option is not specifically covered by this manual.
IEC 61508 Ed. 2.0 compliant hardware/software revisions for the STT700 SmartLine Temperature Transmitter can be found in the Exida and TÜV Certification Reports.

In addition, the most recent release information can be found in the following document:
https://www.honeywellprocess.com/library/support/Public/Documents/SmartLineHARTTemperatureFirmwareRevisions.zip

2 — Safety Function

Primary Safety Functions

The HONEYWELL STT700 measures the temperature (or mV or ohms) of a process and reports the measurement within a safety accuracy of 2%.

Secondary Safety Functions

The HONEYWELL STT700 performs automatic diagnostics to detect internal failures and reports these failures via out-of-band signals on the 4 – 20 mA output.
The transmitter needs a power cycle in order to recover from this condition.

Systematic Integrity: SIL 3 Capable

SIL 3 Capability:

The product has met manufacturer design process requirements of Safety Integrity Level (SIL) 3. These are intended to achieve sufficient integrity against systematic errors of design by the manufacturer. A Safety Instrumented Function (SIF) designed with this product must not be used at a SIL level higher than the statement without “prior use” justification by end user or diverse technology redundancy in the design. This is a Type B device.

3 — Designing with the HONEYWELL STT700

Diagnostic Response Time

The HONEYWELL STT700 will report an internal failure within 30 minutes of fault occurrence (worst case).

The transmitter will be put to burnout output if

1. PV is not updated in 7 seconds
2. 4-20mA Output Current is not as expected in 30 seconds
3. Electronics fault is found in 30 minutes (worst case).

The transmitter needs to be power cycled in order to recover from the burnout condition.

Logic Solver Inputs

The logic solver must be configured so that the engineering range in the transmitter matches the expected range of the logic solver.

To take advantage of the internal diagnostics in the STT700, the logic solver must be configured to annunciate an out of band current reading (greater than 20.8 mA. or less than 3.8 mA.) in standard configuration or (greater than 20.5 mA. or less than 3.8 mA.) with Namur configuration as a diagnostic fault. The logic solver configuration must consider the slew time of the current signal and ensure that filtering is used to prevent a false diagnostic failure annunciation.

Reliability data and lifetime limit

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from HONEYWELL. This report details all failure rates and failure modes, common cause factors for applications with redundant devices and the expected lifetime of the HONEYWELL STT700.

The HONEYWELL STT700 is intended for low demand mode applications up to SIL 2 for use in a simplex (1oo1) configuration, depending on the PFD_{AVG} calculation of the entire Safety Instrumented Function. STT700 is classified as type B device according to IEC61508, having a hardware fault tolerance of 0.

The development process of the HONEYWELL STT700 is certified up to SIL3, allowing redundant use of the transmitter up to this Safety Integrity Level, depending the PFD_{AVG} calculation of the entire Safety Instrumented Function.

When using the HONEYWELL STT700 in a redundant configuration, a common cause factor should be included in reliability calculations. For reliability calculation details, useful lifetime and SFF, see the FMEDA report.

The reliability data listed the FMEDA report is only valid for the useful life time of the HONEYWELL STT700. The failure rates of the HONEYWELL STT700 may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for mission times beyond the lifetime may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

Failure rates of the T/C, RTD, and E/U meter must be added and considered in the overall failure rate for the STT700.

Environmental limits

The environmental limits of the HONEYWELL STT700 are specified in the customer spec sheet as given in the STT700 Specification 34-TT-03-19.

Application limits

The application limits of the HONEYWELL STT700 are specified in the STT700 User Manual 34-TT-25-17. If the transmitter is used outside of the application limits the reliability data provided becomes invalid.

4 — Installation with the HONEYWELL STT700

The person with knowledge of safety operations will be required to do the installation and operation. No special installation is required in addition to the standard installation practices outlined in the STT700 Smart Transmitter User Manual. However please note that when the device is in safety operation that the optional write protect must be set in software so that the device is write protected and HART® devices must be disconnected. Also note that when the device is in safety operation that the Latching and Break Detect parameters must be enabled. See STT700 Smart Transmitter User Manuals for details concerning these parameters

The software write protect is also available in the device with a password to disable the software write protect. The default password is "0000". It can be enabled / disabled through HART host. IEC 61508 Ed. 2.0 compliant hardware/software revisions for the STT700 can be found in the Exida and TÜV Certification Reports.

Parameter settings

The following parameters need to be set in order to maintain the designed safety integrity:

mA Fault action (Upscale/Downscale)	The transmitter is shipped with a default failsafe direction of upscale (21.5 mA.). This is acceptable for all high trip applications. For low trip applications, the fail-safe direction is downscale (3.58 mA.). Transmitter configuration for burnout operation may be changed from Host (DD/DTM) to accomplish this action, see the User Manual.
Engineering Range	All engineering range parameters must be entered to match the trip points in the safety logic solver. These parameters must be verified during the installation and commissioning to ensure that the correct parameters are set in the transmitter.

5 — Operation and Maintenance with the HONEYWELL STT700

Proof test

The objective of proof testing is to detect failures within the HONEYWELL STT700 that are not detected by the automatic diagnostics of the transmitter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.
The frequency of proof testing, or the proof test interval, is to be determined in reliability calculations for the safety instrumented functions for which the HONEYWELL STT700 is applied. The Exida exSILentia® tool is recommended for these calculations. The proof tests must be performed more frequently than, or as frequently as specified in the calculation in order to maintain the required safety integrity of the safety instrumented function.
The following proof test is recommended. It consists of a simple HART® driven min to max output test. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Any failures that are detected and that compromise functional safety should be reported to the Global Technical Support Center (GTS).
See STT700 Smart Transmitter User Manual for more details # 34-TT-25-17.

Step	Action
1	Bypass the safety PLC or take other appropriate action to avoid a false trip, following Management of Change procedures.
2	Send a HART® command to the transmitter to go to the high alarm current output and verify that the analog current reaches that value. This procedure tests for compliance voltage problems such as a low loop power supply voltage or increased wiring resistance. This also tests for other possible failures.
3	Send a HART® command to the transmitter to go to the low alarm current output and verify that the analog current reaches that value. This test checks for possible quiescent current related failures.
4	Use the HART® communicator to view detailed critical and non-critical device status to ensure no alarms or warnings are present in the transmitter.
5	Verify all safety critical configuration parameters.
7	Calibrate the device as per calibration procedure given below.
8	Restore the loop to full operation.
9	Power cycle or cold reset to clear soft errors in memory (RAM).
10	Remove the bypass from the safety PLC or otherwise restore normal operation.

This test will detect approximately 85% of possible DU failures in the transmitter (Proof Test Coverage).

The person(s) performing the proof test of the HONEYWELL STT700 should be trained in SIS operations, including transmitter maintenance and company Management of Change procedures. Tools required are: handheld communicator.

Calibration procedure

The transmitter should be taken out of service. The source for the input Temperature must be very precise, and certified for correct operation. Refer STT700 SmartLine Transmitter User Manual for more details # 34-TT-25-17 on performing calibration using Standard Display.
The procedure given below is for calibration using HART host.

Step	Action
1	Connect the HART host and establish the communications.
2	Go to Online > Device Setup > Advanced Configuration > Calibration > Calibration Methods menu.
3	Go to “D/A trim”
4	Message “Warn loop should be removed from automatic control” will appear. Press “Ok”.
5	Message “Connect reference meter” will appear. Connect the reference meter and press “Ok”.
6	Message “Setting fld device output to 4mA” will appear. Press “Ok”. Message “Enter meter value (4,000mA)” will appear with a textbox to enter actual value observed on meter. Enter the actual value and press “Enter”.
7	Message “Fld dev output 4,000mA equal to reference meter?” will appear with Yes/No selection. Select “Yes” and “Enter”.
8	Message “Setting field device output to 20mA” will appear. Press “Ok”.
9	Message “Fld dev output 20,000mA equal to reference meter?” will appear with Yes/No selection. Select “Yes” and “Enter”.
10	Message “Returning fld dev to original output” will appear. Press “Ok”.
11	Now Double click “URV Correct” method
12	Message “WARN-Loop should be removed from automatic control” will appear. Press “Ok”.
13	Message “Please enter calibration date” will appear. Enter the current date and press “Ok”.
14	Message “Please enter current calibration time in 24 hr clock format (hour field)” will appear. Enter the current time hour and press “Ok”.
15	Message “please enter current calibration time (min field)” will appear. Enter the current time minutes and press “Ok”.
16	Message “Apply URV Temperature” will appear.
17	Adjust the PV input to the required URV value. Press “Ok”.
18	Message “Press ok when Temperature is stable” will appear. Press “Ok”
19	The correct URV operation will happen.
20	Message “Loop may be returned to automatic control” will appear. Press “Ok”.
21	Follow the same procedure for “Correct LRV” (replace URV in above procedure by LRV) and “Correct LRV” operation will get executed.

Remote Parameter Configuration Verification

When configuring the HONEYWELL STT700 through a remote host, it is recommended that parameters that affect the 4-20ma analog output be verified using an alternate utility, before using the transmitter in a SIS. This helps to ensure that the parameters that are entered remotely by the host are not inadvertently changed from the user intended values.

The procedure can consist of listing the parameters and their values entered in the host application. Then, using an alternative application, the same parameters are read back and noted in the same form. The form is then signed, dated, and filed for future reference. See Table 1 - Example Verification Form for an example of this form.

Note that using the same host application to verify the remotely entered values will not provide as much assurance as using an alternate application. The same verification form and steps must be followed if the parameters that affect the 4-20 mA analog output are configured using Standard Display interface.

Table 1 - Example Verification Form

Parameter	Host Value	Verified Value
Verified By:		
Date:		

Repair and replacement

Any failures that are detected and that compromise functional safety should be reported to the Global Technical Support Center (GTS).
When replacing the HONEYWELL STT700 the procedures in the installation manual should be followed.

Firmware update

The user will not be required to perform any firmware updates. If the user has selected the firmware upgrade option, it can be done by Honeywell service representative.

6 - Security

Security Guidelines

1. Ensure the device has Software write protect on enabled the device to prevent any unauthorized configuration changes.
2. Physical access to device: A malicious operation on the transmitters will result in system shutdown, starting the system expectedly or impact process control. For maximum security, the transmitter device must be protected against unauthorized physical access.
3. Be aware of any unauthorized access of a secondary master alarm present in Distributed Control System (DCS). If this is because of a secondary handheld device being connected then this can be ignored.

How to report a security vulnerability

For the purpose of submission, a security vulnerability is defined as a software defect or weakness that can be exploited to reduce the operational or security capabilities of the software or device. Honeywell investigates all reports of security vulnerabilities affecting Honeywell products and services.
To report potential security vulnerability against any Honeywell product, please follow the instructions at:
https://honeywell.com/pages/vulnerabilityreporting.aspx
Submit the requested information to Honeywell using one of the following methods:

- Send an email to security@honeywell.com

or

- Contact your local Honeywell Process Solutions Customer Contact Centre (CCC) or Honeywell Technical Assistance Centre (TAC) listed in the “Support and Contact information” section of this document.

Sales and Service

For application assistance, current specifications, pricing, or name of the nearest Authorized Distributor, contact one of the offices below.

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