

RM/EC 7800 Burner Controller

1 Scope and Purpose of the Document

This document provides an overview of the user responsibilities for installation and operation of the Honeywell 7800 Series Relay Modules in order to maintain the designed safety level. Items that will be addressed are proof testing, repair and replacement of the device, reliability data, lifetime, environmental and application limits, and parameter settings.

This Safety Manual is limited to Models: RM7800, RM7823, RM7830, RM7838, RM7840, RM7845, RM7850, RM7865, RM7885, RM7888, RM7890, RM7895, RM7896, RM7897, RM7898, EC7820, EC7823, EC7830, EC7840, EC7850, EC7890, EC7895 with one of the following Flame Detectors and Flame Amplifiers:

Table 1. 7800 Series Burner Controller Models and Series

MODEL	SERIES	MODEL	SERIES	MODEL	SERIES	MODEL	SERIES
RM7800	9	RM7850	5	RM7895	6	EC7820	7
RM7823	6	RM7865	4	RM7896	6	EC7823	4
RM7830	5	RM7885	5	RM7897	6	EC7830	6
RM7838	9	RM7888	5	RM7898	6	EC7840	5
RM7840*	8	RM7890	9			EC7850	6
RM7845	3					EC7890	5
						EC7895	5

*NOTE: RM7840E1016, RM7840L1018 and RM7840L1026 are Series 5

Table 2. R78xx Flame Amplifier Models and Series

MODEL	SERIES
R7847B	5
R7852B	1
R7847C	5
R7851C	2
R7861A	2
R7886A	2

Table 3. C7xxx Flame Sensor Models and Series

MODEL	SERIES
C7008A	1
C7009A	1
C7915A	1
C7012E	1
C7012F	1
C7061A	1
C7061F	1
C7076A	1
C7076D	1
C7961E	1
C7961F	1

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2 Using the Honeywell 7800 Series Relay Modules

2.1 Safety Function

The 7800 Series provides automatic burner flame sequencing and flame supervision with protection against loss of flame.

2.2 Fail Safe State

The Safety Shutdown (Lockout) mode is the failsafe state for the Honeywell 7800 Series Relay Modules where all safety critical terminals (main and pilot valves, and ignition transformer) are de-energized and a manual reset is required to return to normal operation.

2.3 Safety Response Time

The Honeywell 7800 Series Relay Modules (all models except of EC7823 and RM7823) will respond to loss of flame by means of shutting off all safety outputs and transitioning to the Safety Shutdown (Lockout) state within the published Flame Failure Response Time (FFRT) for the selected Flame Amplifier and Flame Sensor.

EC7823 and RM7823 will respond to loss of flame by means of shutting off the safety outputs and transitioning to the Idle state within the published Flame Failure Response Time (FFRT) for the selected Flame Amplifier and Flame Sensor. Safety Shutdown (Lockout) state is not entered and manual reset action is not needed in this case.

2.4 Diagnostic Response Time

The Honeywell 7800 Series Relay Modules will report a detectable internal failure within 3 seconds for faults to the main 7800 Relay Module and within 15 seconds for faults to the Flame Detector / Flame Amplifier.

2.5 Maximum Achievable SIL

The 7800 Relay Modules, Flame Amplifiers and Flame Detectors covered by this safety manual are suitable for use in both high and low demand mode of operation Safety Integrity Functions (SIF) up to SIL 3 in simplex (1oo1) configurations. The achieved SIL for a particular SIF needs to be verified by PFH or PFDavg calculation for the entire SIF including the failure rates of the associated sensors and actuators that are also part of the SIF.

Use of the Honeywell 7800 Series Relay Modules in a redundant (1ooN) configurations is not supported.

The 7800 Series Burner Controller System is classified as a Type B¹ element according to IEC 61508, having a hardware fault tolerance of 0.

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

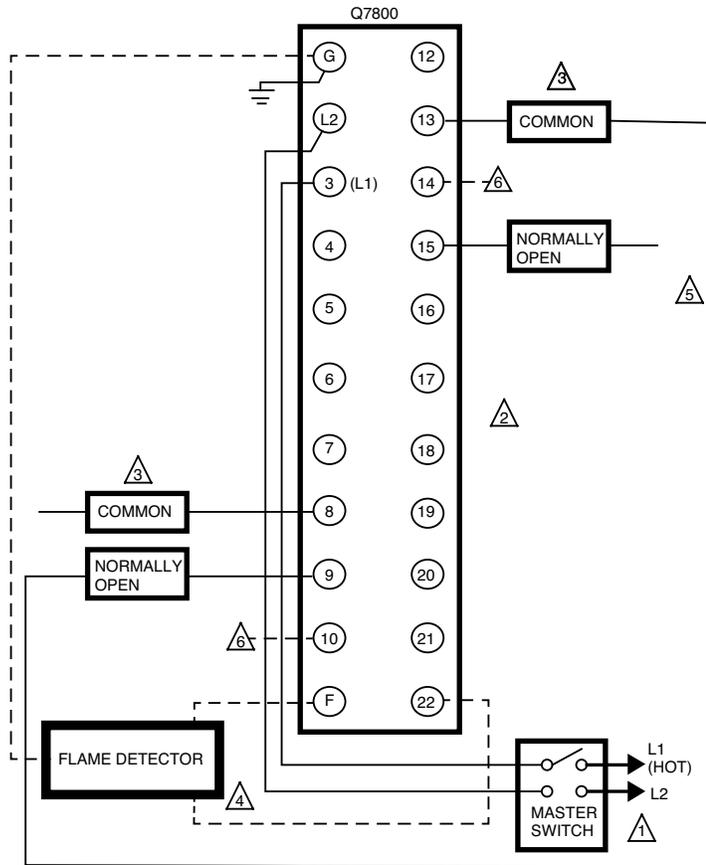
2.6 Model Selection and Specification of Honeywell 7800 Series Relay Modules

The Honeywell 7800 Series Relay Modules and optional components for certified SIL applications shall only be selected and specified for applications consistent with the guidelines presented in the Installation Instructions document and additional technical literature released for the specific model available at web site <https://customer.honeywell.com> and further restricted to the certified Flame Amplifiers and Flame Detectors identified in section 1 of this Safety Manual.

2.7 Installation

The Honeywell 7800 Series Relay Module sub-base must be installed, wired and the “Final Wiring Check” and “Static Checkout” procedures successfully completed according to the guidelines published in the Installation Instructions document for the specific model available at web site <https://customer.honeywell.com>. The Static Checkout procedure must be successfully performed prior to installation of the relay module on the sub-base.

For RM7823 and EC7823 models, in SIL 3 applications, both sets of COM-N.O. outputs (terminals 8, 9 and 13, 15) must be wired in series, i.e. terminal 9 must be tied to terminal 13. The N.C. outputs (terminals 10 and 14) can't be used in SIL 3 applications.

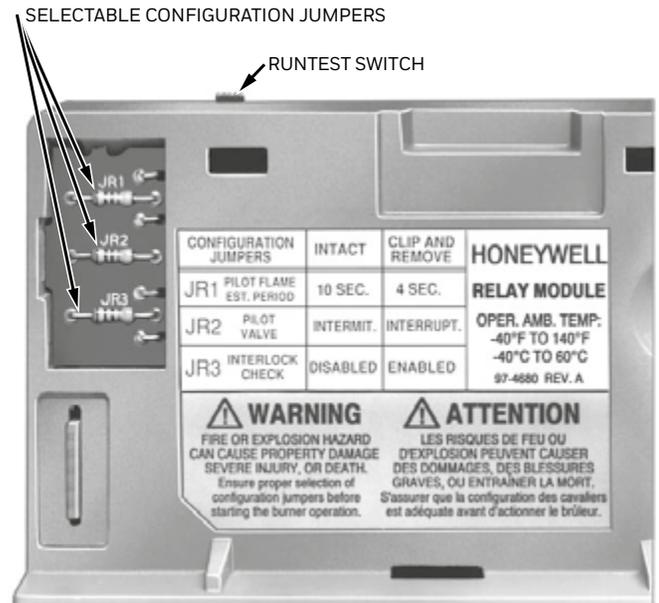


- ⚠️ 1 120V, 50/60 HZ (RM7823); 220-240V, 50/60 Hz (EC 7823) POWER SUPPLY. PROVIDE DISCONNECT MEANS AND OVERLOAD PROTECTION AS REQUIRED.
 - ⚠️ 2 DO NOT CONNECT ANY WIRES TO UNUSED TERMINALS
 - ⚠️ 3 OUTPUTS SHOWN ARE WHEN THE DEVICE DOES NOT SEE FLAME.
 - ⚠️ 4 SEE FLAME DETECTOR INSTALLATION INSTRUCTIONS FOR CORRECT WIRING.
 - ⚠️ 5 TERMINALS 9 AND 13 MUST BE WIRED TOGETHER (BOTH COM-N.O. RELAY OUTPUTS ARE WIRED IN SERIES)
 - ⚠️ 6 TERMINALS 10 AND 14 MUST NOT BE USED.
- NOTE: FOR EC7823, A 220/240V TO 120V, 10 VA, STEP-DOWN TRANSFORMER IS REQUIRED.

Fig. 1. RM7823 and EC7823 wiring for SIL 3 applications

2.8 Required configuration settings

The following user settable options need to be properly configured for the individual application in order to provide the designed safety integrity for that application. Jumpers JR1 through JR3 site-configurable jumpers come factory installed for one configuration and must be selectively clipped out to select the actual desired configurations as documented on the warning label adjacent to the jumper positions as shown in Figure 1 below. Note that the actual jumper configuration setting may differ by product model number.



NOTE: CONFIGURATION JUMPERS SHOWN FOR RM7800G/7840G

Fig. 2. Site-configurable jumpers

Note that the cut jumper condition is the safest setting so that failure to cut a jumper during installation can result in a configuration that does not meet the requirements for the particular application.

In addition, many models require the use of a factory pre-set Purge Timer Card configures the 7800 Module for the required purge time (between 2 seconds and 30 minutes). These cards are preset to a particular purge time at the factory and must be ordered according to the needs of the particular application.

2.9 Reliability data

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from Honeywell Thermal Solutions with all failure rates and failure modes for use in SIL verification.

Note that the failure rates of the associated sensors and actuators need to be accounted for in the SIF level PFH / PFDavg calculation.

2.10 Lifetime limits

The expected lifetime of the Honeywell 7800 Series Relay Modules is approximately 10 years. The reliability data listed in the FMEDA report is only valid for this period. The failure rates of the Honeywell 7800 Series Relay Modules may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for lifetimes beyond 10 years may yield results that are too optimistic, i.e. the calculated Safety Integrity Level may not be achieved.

2.11 Proof Testing

The objective of proof testing when used in low demand mode of operation is to detect failures within Honeywell 7800 Series Relay Module and its associated sensors and actuators that may not be detected by the normal self-diagnostics. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.

The frequency of the proof tests (or the proof test interval) is to be determined in the reliability calculations for the safety instrumented functions for which the Honeywell 7800 Series Relay Modules is applied. The actual proof tests must be performed at least as frequently as specified in the calculation in order to maintain required safety integrity of the safety instrumented function.

The following tools may be needed to be available to perform proof testing

- Voltmeter (1M Ohm minimum input impedance) set on the 0-300 Vac scale.
- Two jumper wires; no. 14 wire, insulated, 12 inches (304.8 mm) long with insulated alligator clips at both ends.

The person(s) performing the proof test of the Honeywell 7800 Series Relay Modules should be a trained, experienced, flame safeguard service technician, trained in Honeywell 7800 Series Relay Modules maintenance and company management of change procedures.

The following tests need to be specifically executed when a proof test is performed. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Failures that are detected should be reported to Honeywell Thermal Solutions.

2.11.1 Test (except 7823 models)

Functional test:

1. Remove the 7800 Module from the wiring sub-base
2. Perform the “Static Checkout” procedure documented in the Installation Instructions and verify proper response to all test conditions
3. Reinstall the 7800 Module to the wiring sub-base.
4. While in “Run” sequence interrupt the flame signal by either manually blocking the fuel supply or blocking the sensor input from “seeing” the flame and verify unit goes to Safety Shutdown (Lockout) state.
5. Restore fuel supply or visibility of flame sensor to the flame.
6. Power cycle the unit and verify unit returns to Safety Shutdown (Lockout) state upon reapplication of power.

7. Remove any remaining bypasses and restore normal operation.
8. Press reset and verify return to normal operation..

When all the tests listed above are executed a proof test coverage of 36% can be claimed.

2.11.2 Test (7823 models only)

Functional test:

1. Remove the 7823 Module from the wiring sub-base
2. Perform the “Static Checkout” procedure documented in the Installation Instructions and verify proper response to all test conditions
3. Reinstall the 7823 Module to the wiring sub-base.
4. While in “Run” sequence interrupt the flame signal by either manually blocking the fuel supply or blocking the sensor input from “seeing” the flame and verify unit goes to Standby state and all safety critical terminals become de-energized.
5. Restore fuel supply or visibility of flame sensor to the flame and verify return to the normal operation.

When all the tests listed above are executed a proof test coverage of 13% can be claimed.

2.12 Repair and replacement

In the unlikely event that the Honeywell 7800 Series Relay Modules has a failure, the failures that are detected should be reported to Honeywell Thermal Solutions.

When replacing the Honeywell 7800 Series Relay Modules power should be removed and the procedure in the installation manual should be followed.

The person(s) performing the repair and / or replacement of the Honeywell 7800 Series Relay Modules should be a trained, experienced, flame safeguard service technician.

2.13 Firmware update

In case firmware updates are required they will only be performed at factory where proper replacement procedures are in place. The user is not permitted to perform any firmware updates.

2.14 Environmental and EMC based limits

The environmental and EMC based limits of the Honeywell 7800 Series Relay Modules are specified in the user installation manual [32-00143 Rev 12-17].

3 Definitions and Abbreviations

3.1 Definitions

Safety	Freedom from unacceptable risk of harm
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
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
Verification	The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis and / or testing
Validation	The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing
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.

3.2 Abbreviations

FMEDA	Failure Mode, Effects and Diagnostic Analysis
BPCS	Basic Process Control System
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SLC	Safety Lifecycle

4 Status of the document

4.1 Releases

Version:	V3			
Revision:	R4			
Version History:	Date	Author	Changes	
V3, R4	Dec 6, 2019	Radomir Svoboda	Series numbers of R78xx Flame Amplifier corrected	
V3, R3	Nov 15, 2019	Radomir Svoboda	Document title updated to show 7823 Flame switch separately. Model table split to three tables to list modules, amplifiers and sensors separately. Safety function split to address 7823 flame switch differences.	
V3, R2	Oct 2, 2019	Radomir Svoboda	Remaining references to 7824 system removed (not in scope)	
V3, R1	Oct 2, 2019	Radomir Svoboda	Added a proof test specific to 7823	
V3, R0	Sep 24, 2019	Radomir Svoboda	Added RM7823 and EC7823 models (flame switch)	
V2, R0	Nov 14, 2019	John Grebe	Updated OS models, company name, and changed to released status	
V1, R0	June 2, 2019	John Grebe	Added Safety Function section 2.1 and changed to released status	
VO, R3	May 28, 2019	John Grebe	Update Diagnostic Response Time based on Fault Injection Tests	
VO, R2	May 27, 2019	John Grebe	Make client requested changes to product model numbers	
VO, R1:	April 3, 2019	John Grebe	Clean up to more clearly represent products	
VO, R0:	March 15, 2019	John Grebe	Draft	
Review:	VO, R3	reviewed by Michael Medoff (exida)		
	VO, R1:	review by client and Michael Medoff (exida)		

Release status: Reviewed and released

4.2 Open issues

None

4.3 Future enhancements of the document

None anticipated

For More Information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschröder and Maxon. To learn more about our products, visit ThermalSolutions.honeywell.com or contact your Honeywell Sales Engineer.

Honeywell Process Solutions

Honeywell Thermal Solutions (HTS)
1250 West Sam Houston Parkway
South Houston, TX 77042

ThermalSolutions.honeywell.com

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32-00231-01 Edition 11.19
Printed in United States

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