Honeywell

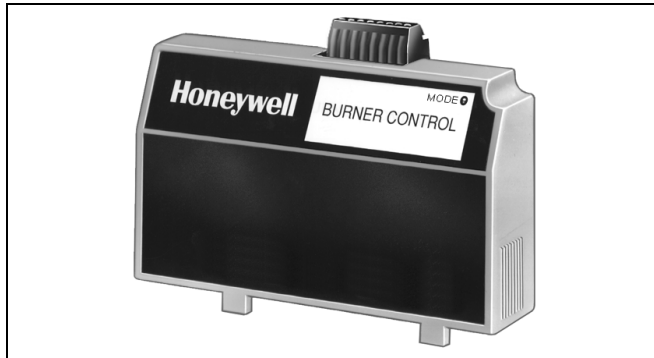# S7810M
ModBus™ Module

APPLICATION

The Honeywell 7800 SERIES is a microprocessor-based integrated burner control for automatically fired gas, oil or combination fuel single-burner applications. The 7800 SERIES is programmed to provide a level of safety, functional capability and features beyond the capacity of conventional controls. Functions provided by the 7800 SERIES include automatic burner sequencing, flame supervision, system status indication, system or self-diagnostics and troubleshooting.

The S7810M ModBus™ Module supports remote mounting of a Keyboard Display Module (KDM), personal computer/PLC interface for multi-dropped 7800 SERIES subnetworks, and remote control of a 7800 SERIES Relay Module.

FEATURES

• **Multi-dropped communications bus interface.**

• **Remote control capabilities:**

— Standby Hold
— Drive to High Fire
— Drive to Low Fire
— Reset

• **Ability to remotely mount a Keyboard Display Module.**

• **S7810M1029 meets Gastec approval (cannot be reset through data highway).**

• **ModBus™ RTU slave device.**

SPECIFICATIONS

Model:
S7810M ModBus™ Module.

Electrical Ratings:
Voltage and Frequency: 13 Vdc peak full-wave rectified (+20/-15%)
Power Dissipation: 2W maximum.

Terminal Ratings:
Power: 13 Vdc peak full-wave rectified.
Earth ground.
ControlBus™ (1,2,3) and Multi-Drop ModBus™ (6,7,8):
    5 Vdc at 60 mA maximum.

Electrical Connector (included):
ControlBus™: 208727 8-pin electrical connector.

Environmental Ratings:
Ambient Temperature:
Operating: -40°F to +140°F (-40°C to +60°C).
Storage: -40°F to +150°F (-40°C to +66°C).
Humidity: 85% relative humidity, continuous, noncondensing.
Vibration: 0.5G environment.

Weight: 4 ounces.

Replacement Part: 208727 eight-pin connector.

Approvals: S7810M1029: Gastec EN268, Report 1156791.

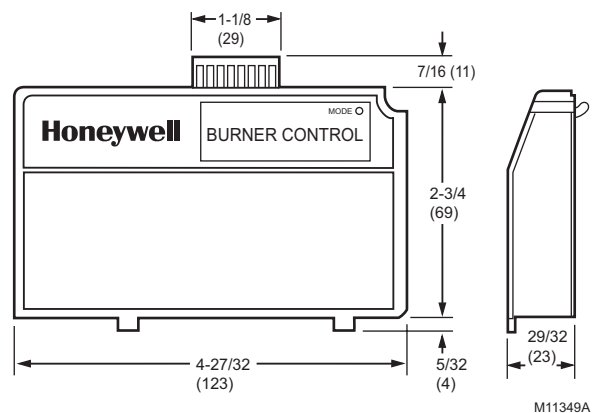**Dimensions:** See Fig. 1.

Fig. 1. Mounting dimensions of S7810M ModBus™ Module in in. (mm).

INSTALLATION

When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and marked on the product to make sure the product is suitable for your application.
3. The installer must be a trained, experienced flame safeguard technician.
4. Disconnect the power supply before beginning installation to prevent electrical shock and equipment damage. More than one power supply disconnect can be required.
5. Wiring must comply with all applicable codes, ordinances and regulations.
6. After installation is complete, check out product operation as provided in these instructions.

IMPORTANT:

> *This equipment can cause interference with radio communications.*
>
> *This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the Instructions Manual, may cause interference with radio communications. It has been tested and found to comply with the limits for a Class B computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case, users, at their own expense, will be required to take whatever measures may be required to correct the interference. Any unauthorized modification of this equipment may result in the revocation of the owner's authority to continue its operation. When operating the S7810M remotely with a separate power supply, FCC compliance is not guaranteed unless an FCC-approved power supply is used.*

Canadian EMI: This digital apparatus does not exceed the Class B limits for radio noise emission from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques depassant les limites applicables aux appareils numériques de la Classe B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Humidity

Install the S7810M where the relative humidity never reaches the saturation point. The S7810M is designed to operate in a maximum humidity environment of 85 percent relative humidity, continuous, noncondensing moisture.

Weather

The S7810M is not designed to be weather-tight. When installed outdoors, protect the S7810M with an approved weather-tight enclosure.

Vibration

Do not install the S7810M where it could be subjected to vibration in excess of 0.5G continuous maximum vibration.

Mounting the S7810M ModBus™ Module (Fig. 2).

1. Align the two ears of the ModBus™ Data ControlBus™ Module with the two mating slots on the 7800 SERIES Relay Module.
2. Insert the two interlocking ears into the two mating slots and, with a hinge action, push on the lower corners of the ModBus™ Data ControlBus™ Module to secure it to the 7800 SERIES Relay Module.

Fig. 2. ModBus™ Module mounting.

ORDERING INFORMATION

When purchasing replacement and modernization products from your TRADELINE® wholesaler or distributor, refer to the TRADELINE® Catalog or price sheets for complete ordering number.

If you have additional questions, need further information, or would like to comment on our products or services, please write or phone:
1. Your local Honeywell Automation and Control Products Sales Office (check white pages of your phone directory).
2. Honeywell Customer Care
   1885 Douglas Drive North
   Minneapolis, Minnesota 55422-4386
In Canada—Honeywell Limited/Honeywell Limitée, 35 Dynamic Drive, Toronto, Ontario M1V 4Z9.
International Sales and Service Offices in all principal cities of the world. Manufacturing in Australia, Canada, Finland, France, Germany, Japan, Mexico, Netherlands, Spain, Taiwan, United Kingdom, U.S.A.

Fig. 3. Wiring S7810M ModBus™ Module.
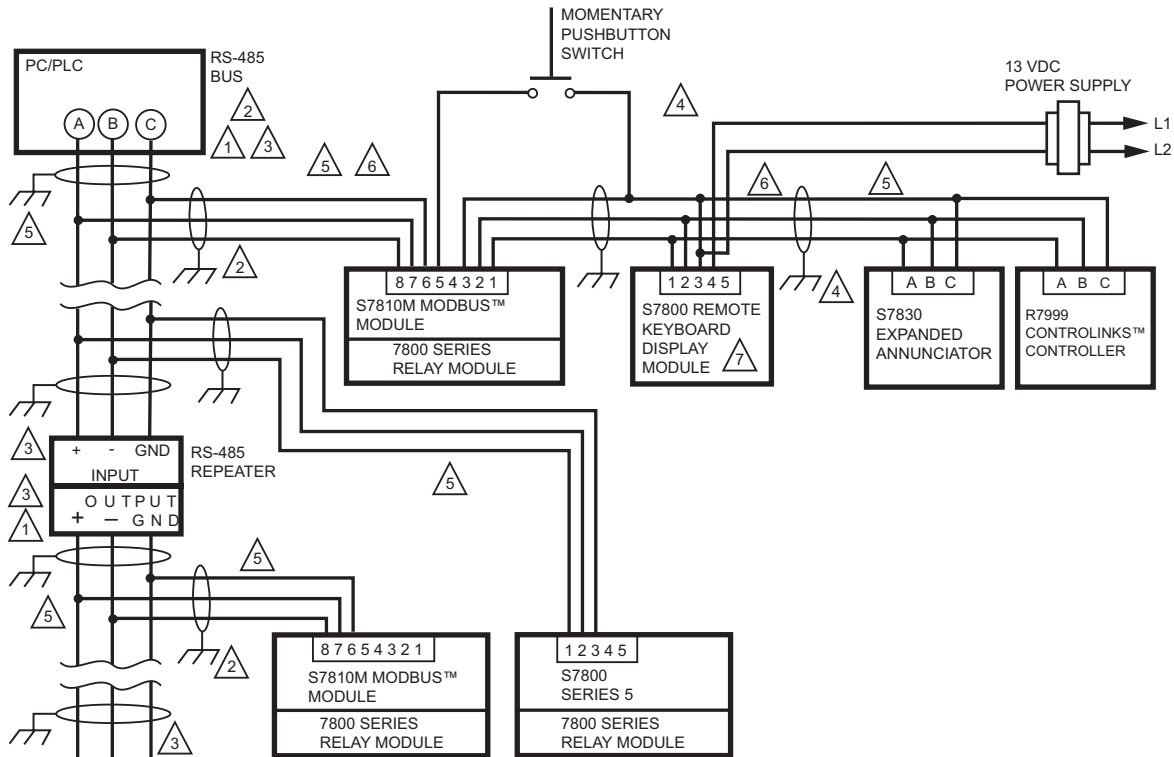
△1 MULTI-DROP RS-485 COMMUNICATION BUS. UP TO 31 S7810M MODBUS™ MODULES CAN BE CONNECTED TO A SINGLE BUS WITHOUT AN RS-485 REPEATER. UP TO 99 S7810M MODBUS™ MODULES (SUBNETWORKS) CAN BE CONNECTED TO A BUS WITH RS-485 REPEATERS. WHEN USING AN RS-485 REPEATER, THE REPEATER MUST BE INSTALLED EVERY 30TH MODULE.

△2 THE SUBNETWORKS MUST BE WIRED IN A DAISY CHAIN CONFIGURATION. RECOMMEND THAT THE PC/PLC BE AT ONE END OF THE DAISY CHAIN.

△3 MODBUS™ COMMUNICATION BUS TERMINATION RESISTORS:

  A. WITHOUT RS-485 REPEATER:
     MODULES AT THE CLOSEST AND FARTHEST END OF THE DAISY CHAIN REQUIRE TERMINATION RESISTORS. INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS A AND B OF THE PC/PLC (IF INSTALLED AT ONE END THE DAISY CHAIN). INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS 7 AND 8 OF THE LAST S7810M MODBUS™ MODULE IN THE DAISY CHAIN.

  B. WITH RS-485 REPEATER:
     WHEN AN RS-485 REATER IS USED, TWO DAISY CHAIN CONFIGURATIONS ARE EFFECTIVELY FORMED. MODULES AT THE CLOSEST AND FARTHEST ENDS OF EACH DAISY CHAIN REQUIRE TERMINATION RESISTORS. INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS A AND B OF THE PC/PLC (IF INSTALLED AT THE END OF THE DAISY CHAIN). INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN INPUT TERMINALS DATA+ AND DATA- OF THE RS-485 REPEATER. INSTALL A 120 OHM, 1/4 WATT RESISTOR BETWEEN TERMINALS 7 AND 8 OF THE LAST S7810M MODBUS™ MODULE IN THE ADDITIONAL DAISY CHAIN.

△4 LOCAL RS-485 COMMUNICATIONS BUS. THE DEVICES ON THIS BUS MUST BE WIRED IN A DAISY CHAIN CONFIGURATION. THE ORDER OF INTERCONNECTION IS NOT IMPORTANT. THE MODULES ON THE CLOSEST AND FARTHEST ENDS OF THE DAISY CHAIN REQUIRE A 120 OM, 1/4 WATT TERMINATION RESISTOR BETWEEN TERMINALS 1 AND 2 OR A AND B.

△5 THREE WIRE SHIELDED CABLE (BELDEN 8723 SHIELDED OR EQUIVALENT) IS RECOMMENDED AND SHOULD BE GROUNDED AS FOLLOWS: IF NO INTERFERENCE IS PRESENT, OR TO REDUCE CAPACITIVE INTERFERENCE, THE SHIELD SHOULD BE GROUNDED AT ONE END. WHEN GROUNDING ONLY ONE END OF THE THE SHIELD, THE SHIELD END CLOSEST TO THE S7810M MODBUS™ MODULE SHOULD BE ATTACHED TO EARTH GROUND. TO REDUCE INDUCTIVE INTERFERENCE (RF INTERFERENCE), THE SHIELD SHOULD BE GROUNDED AT BOTH ENDS.

△6 THE MODBUS™ BUS COMMON, S7810M MODBUS™ TEREMINAL 6, AND THE LOCAL BUS COMMON (S7810M MODBUS™ TERMINAL 3), MUST NOT BE ELECTRICALLY CONNECTED TOGETHER.

△7 TERMINAL NUMBERS ARE ON 203541 5-WIRE CONNECTOR (SUPPLIED WITH REMOTE MOUNTING BRACKET).

M23807

Wiring (Fig. 3)

1. Refer to Fig. 3 for proper wiring.
2. All wiring must comply with all applicable electrical codes, ordinances and regulations.
3. Recommended wiring size and type:

   a. For all communications, use 22 AWG, 3-wire shielded cable (Belden part number 8723 or equivalent).
   b. For 13 Vdc and remote reset switch operation, use 22 AWG wire insulated for voltages and temperatures in the application. Suggested wire types include TW (60°C), THW (75°C) and THHN (90°C). Terminal identification numbers and letters are shown in Table 1.

4. Wire routing:
  a. Do not route the communication cable in conduit with line voltage circuits.
  b. Do not route the communication cable close to the ignition transformers.
  c. Route the communication cable outside of conduit if properly supported and protected from damage.
  d. Route the communication cable so that all devices are connected in a daisy chain configuration. See Fig. 3.
5. Maximum wire lengths:
  a. Communications bus, 4000 feet (1219 meters).
  b. Remote reset switch, 1000 feet (305 meters).

Table 1. S7810M Terminal Identification.

Signal	S7810M Terminal
ControlBus™ Data +	1
ControlBus™ Data -	2
Common • ControlBus™ Common • +13 Vdc Common • Remote Reset Common	3
+13 Vdc	4
Remote Reset	5
ModBus™ Common	6
ModBus™ Data +	7
ModBus™ Data -	8

MODE LED Light Patterns
Table 2 explains the MODE LED light patterns.

Table 2. Explanation of MODE LED light patterns

LED Code/ Behavior	Pulse Period	Interval	Meaning
Always OFF		OFF	Not powered or device failure.
Always ON		ON	S7810M device failure.
Mostly ON with 1 blink	50 ms (OFF)	1 second	Both ControlBus™ and ModBus™ are active
Mostly OFF with 1 flash	50 ms (ON)	3.85 seconds	ControlBus™ is active, and ModBus™ is not active.
Mostly OFF with 2 pulses	2 x (200 ms ON, 200 ms OFF)	1.75 seconds	Program CRC error.
Mostly OFF with 3 pulses	3 x (200 ms ON, 200 ms OFF)	2.15 seconds	No ControlBus™ signal from the Burner Control

OPERATION
The S7810M ModBus™ Data ControlBus™ Module has two communications ports. The ControlBus™ communications port allows communications on a bus that contains a 7800 SERIES burner controller and an S7800 Keyboard Display Module and/ or an S7830 Expanded Annunciator and/or an R7999 ControlLinks™ Controller.

A second communications port supports RS-485 communications using ModBus™ protocol. The following tables provide ModBus™ mapping information.

Table 10 provides register mapping. It identifies the mapping of the 7800 SERIES parameters to ModBus™ registers. These codes are transmitted by the relay modules and the S7830 Expanded Annunciator.

Function Codes
Supported function codes of ModBus™ Protocol Reference Guide (PI-MBUS-300 Rev. J) are 3, 4, 6, and 17. Function codes 3 and 4 are treated the same by the S7810M. Two registers need to be read when the data format is a U32 value (4 bytes); if both registers are not read, then a data value of 0 (zero) is returned. U32 values are in little endian format. The maximum number of addresses that can be queried is 127 (0x7F) for query messages 3 and 4.

Tables 3 through 7 provide information on the function codes.

NOTE: All Query and Response cells below are 1 byte.

Table 3. Query Message Format for Function Codes 3 and 4.

Slave Address	Function Code	Starting Address High	Starting Address Low	Number of Addresses High	Number of Addresses Low	CRC	CRC
01	03	00	0A	00	01	A4	08

Table 4. Response Message Format for Function Codes 3 and 4.

Slave Address	Function Code	Byte Count	Data High	Data Low	CRC	CRC
01	03	02	00	22	38	5D

Table 5. Query Message Format for Function Code 6 (Broadcast is supported by using a slave address of 00).

Slave Address	Function Code	Starting Address High	Starting Address Low	Preset Data High	Preset Data Low	CRC	CRC
01	06	00	7F	00	04	B9	D1

Table 6. Response Message Format for Function Code 6 (There is no response if the query was broadcast.)

Slave Address	Function Code	Starting Address High	Starting Address Low	Preset Data High	Preset Data Low	CRC	CRC
01	06	00	7F	00	04	B9	D1

Table 7. Query Message Format for Function Code 17.

Slave Address	Function Code	CRC	CRC
03	11	C1	4C

NOTE: See Table 20 for function code 17 response format.

Table 8. Exception Response Message Format.

Slave Address	Function Code + 80h	Exception Code	CRC	CRC

Table 9. Exception Codes.

Exception Code	Definition	Description
01	Illegal Function	An illegal function as requested. Only 3, 4, 6 and 17 are supported.
02	Illegal Data Address	Too many bytes requested, address is out of range, register is read only, or the number of address requested is past the last register.
03	Illegal Data Value	The "Preset Data" from function code 6 is invalid/out of range.

Fig. 4. 7810M Address Switches and Baud Rate Jumper.

NOTE: In Tables 10, 15 and 19: Line 1 and Line 2 refer to the two lines of text on the S7800 Keyboard Display Module. In Tables 15, 17 and 19: The String Code column references Table 16, String Codes. In Table 15: The Burner Control State Bits column references Table 22, Burner Control State Bits.

Device Address and Baud Rate

Assign each S7810M in the system a unique address by setting the MODBUS ADDRESS switches on the bottom of the device to the correct number. See Fig. 4. Only RTU communications with 1 Start Bit, 8 Data Bits, 1 Stop Bit and no parity is supported.

NOTE: Assign a device address number from 01 to 99. 00 is not an acceptable address number and will not work.

The default baud rate is 9600. To change the baud rate to 19.2K, use a needlenose pliers to remove the jumper. See Fig. 4.

IMPORTANT:
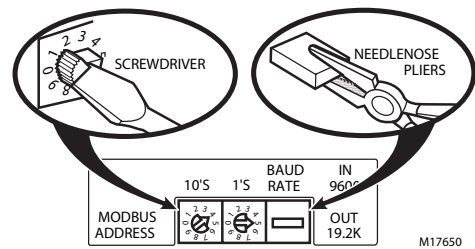*S7999B requires a baud rate of 19.2K.*

Table 10. ModBus™ Register Assignments.

Address (hex)	Register (dec)	Parameter Name	Read/Write	Format	Notes
0000	40001	Burner Control (BC) Fault Code	R	U16	See Table 17. Non-zero value = Lockout number.
0001	40002	BC Fault String Code	R	U16	See Table 16. Lockout text.
0002	40003	BC Sequence State	R	U16	See Table 15 (current only if Fault code = 0).
0003	40004	BC State String Code (line 1)	R	U16	See Table 16. Simulates Line 1 of S7800.
0004	40005	BC State String Code (line 2)	R	U16	See Table 16. Simulates Line 2 of S7800.
0005	40006	BC Sequence time	R	U16	0-4095 Seconds.
0006	40007	BC Total cycles	R	U32	Max value is 0xFFFFFFFF.
0008	40009	BC Total hours	R	U32	Max value is 0xFFFFFFFF.
000A	40011	BC Flame 1 signal strength	R	U16	0 to 255 represents 0.0 to 25.5 volts. Not clipped to 5.0V like S7800 and S7999B.
000B	40012	Unused			
000C	40013	BC State Bits	R	U16	See Table 22.
000D	40014	S7830 First Out Code	R	U16	See Table 19.
000E	40015	S7830 State Bits	R	U32	Bit 31 (MSB) to Bit 0 (LSB) represent Terminals T31 to T0 of the Expanded Annunciator. Only T4-T22 are used.
0010-0019	40017-40026	BC Fault history record 1	R		Newest fault record. See Table 18.
001A-0023	40027-40036	BC Fault history record 2	R		Second newest fault record. See table 18.
0024-002D	40037-40046	BC Fault history record 3	R		Third newest fault record. See Table 18.
002E-0037	40047-40056	BC Fault history record 4	R		Fourth newest fault record. See Table 18.
0038-0041	40057-40066	BC Fault history record 5	R		Fifth newest fault record. See Table 18.
0042-004B	40067-40076	BC Fault history record 6	R		Oldest fault record. See Table 18.
004C	40077	BC Flame Failure Response Time	R	U16	Tenths of Seconds.
004D	40078	BC Manufacturing code	R	U32	
004F	40080	BC Type Code	R	U16	See Table 21.
0050	40081	S7810M/BC Software version	R	U32	
0052	40083	EA Software version	R	U32	
0054	40085	BC Remote Command status	R	U16	Bit 0: Autonomous. Bit 1: Remote commanded off. Bit 2: Remote commanded High Fire. Bit 3: Remote commanded Low Fire. Bit 4: Remote reset has/will be sent to BC.[a] Bits 5-14: Unused. Bit 15: Copied after the most recent write to the burner control command (40128 bit 15).
0055	40086	BC Flame Amplifier type	R	U16	0 = Standard 1 = Unknown 2 = Amplicheck or missing amplifier 3 = Shutter
0056	40087	BC Purge Time	R	U16	Seconds
0057-0065	40088-40102	BC Diagnostics	R	U16	String codes indicating terminal/jumper state. See Table 16. There are up to 15 codes. Not all are used for some burner controls.
0066	40103	Post-Purge time	R	U16	Seconds

Table 10. ModBus™ Register Assignments. (Continued)

Address (hex)	Register (dec)	Parameter Name	Read/ Write	Format	Notes
0067	40104	Valve Proving Mode	R	U16	0 = Valve Proving is not enabled 1 = Enabled before Run 2 = Enabled after Run 3 = Enabled before and after Run 4 = Enabled split half before and half after Run
0068	40105	Valve Proving option	R	U16	1 = Uncommissioned 2 = Commissioned
0069	40106	Valve Proving time	R	U16	Seconds
0066-007E	40103-40127	Unused			
007F	40128	BC Remote Command	R/W	U16	Only one bit in the LSByte must be set, with the exception of bit 15: Bit 0 = Revert to autonomous operation. Bit 1 = Don't fire, remain off. Bit 2 = Go to Hi Fire during Run. Bit 3 = Go to Lo Fire during Run. Bit 4 = Remote reset.[a] Bits 5-7 must be 0. Bits 8-14 are ignored. Bit 15: Copied to the control status register. The remote control status register can be used to verify operation of the command. NOTE: Bits 1-3 must be refreshed at least every 120 seconds, but not more than once a second, for the burner control to remain in the commanded state.

[a] Remote Reset command not accepted by S7810M1029.

Table 11. ModBus™ R7999 Register Assignments.

Address (hex)	Register (dec)	Parameter Name	Format	Notes
0080	40129	R7999 reserved	U16	Not used—always zero.
0081	40130	R7999 program mode	U16	0—Initiate State. 1—Normal Operation. 2—Alarm Initiate State. 3—Lockout. 4—Not Configured. 5—Factory Test. 6—Low Voltage. 7—Commissioning. 8—Reset.
0082	40131	R7999 fault code	U16	See Table 26.
0083	40132	R7999 operational status	U16	00—Standby Hold. 01—Standby Stop Position. 02—Standby Main Valve. 03—Standby Low Fire Main Valve. 04—Standby Purge. 05—Fault 1. 06—Standby Hi Fire Main Valve. 07—Fault 2. 08—Processing Demand. 09—Light Off. 10—Modulate. 11—Light Off Low Fire Main Valve. 12—Purge. 13—Fault 3. 14—Purge Main Valve. 15—Fault 4. 16—Initialize. 17—Post Purge.

Table 11. ModBus™ R7999 Register Assignments. (Continued)

Address (hex)	Register (dec)	Parameter Name	Format	Notes
0084	40133	R7999 air position	U16	0-4095
0085	40134	R7999 active fuel position	U16	0-4095
0086	40135	R7999 FGR position	U16	0-4095
0087	40136	R7999 fuel ID	U16	0 = Fuel 1 1 = Fuel 2
0088-0089	40137-40138	R7999 cycles	U32	0—1,000,000 Same as register 40410.
008A	40139	R7999 diagnostic bits.	U16	Bit Meaning 15—LCO state 14—HFP state 13—LFP state 12—ALARM state 11—LCI state 10—HF state 9—MV state 8—LF state 7—LCO Relay Drive 2 feedback 6—LCO Relay Drive 1 feedback 5—LCM state 4—AUTO/MAN select 3—Selected Fuel 2—Fuel Select 2 Input 1—Fuel Select 1 Input 0—Hold State (Bit will be set On if Aux Input is in a hold condition or disabled)
008B	40140	R7999 firing rate input	U16	0-255 = 0-21.1 mA.
008C	40141	R7999 manual pot input	U16	0-255 = 2.1-44.1 mA.
008D	40142	R7999 auxiliary input	U16	0-255 = 0-21.1 mA.
008E	40143	Unused		
008F	40144	R7999 Hold	U16	Same as register 40139 bit 0
0090-009E	40145-40159	Unused		

Table 12. ModBus™ R7999 Register Assignments.

Address (hex)	Register (dec)	Parameter Name	Bytes	Notes
009F	40160	R7999 Message Counter		Format—U16 Bits 0-2 = The Buffer Index of the oldest information from the R7999. (Incremented by the BC status message once a second.) Bits 0-15 = A counter synchronized with R7999 messages.
00A0-00A5	40161-40166	R7999 buffer # 0	0-11	These buffers store an 8-second history of status data from the R7999. The oldest buffer is indicated by register 40160, bits 0-2. This scheme forms a circular buffer of information. A buffer will contain all zeros if the S7810M received bad data for the buffer time slot. See Table 25 for interpretation of bytes 0-11.
00A6-00AB	40167-40172	R7999 buffer # 1	0-11	
00AC-00B1	40173-40178	R7999 buffer # 2	0-11	
00B2-00B7	40179-40184	R7999 buffer # 3	0-11	
00B8-00BD	40185-40190	R7999 buffer # 4	0-11	
00BE-00C3	40191-40196	R7999 buffer # 5	0-11	
00C4-00C9	40197-40202	R7999 buffer # 6	0-11	
00CA-00CF	40203-40208	R7999 buffer # 7	0-11	

Table 13. ModBus™ R7999 Register Assignments.

Address (hex)	Register (dec)	Parameter Name	Format	Notes
00D0-015F	40209-40352	R7999 Profile		See Table 23.
0160	40353	Fuel 1 closed endpoint	U16	0-4095
0161	40354	Fuel 1 open endpoint	U16	0-4095
0162	40355	Fuel 2 closed endpoint	U16	0-4095
0163	40356	Fuel 2 open endpoint	U16	0-4095
0164	40357	Inactive motor position	U16	0-4095
0165	40358	Registers 40353-40357 are current	U16	0-1
0166	40359	Air closed endpoint position	U16	0-4095
0167	40360	Air open endpoint position	U16	0-4095
0168	40361	FGR closed endpoint position	U16	0-4095
0169	40362	FGR open endpoint position	U16	0-4095
016A	40363	Unused	U16	
016B	40364	Registers 40359-40363 are current	U16	0-1
016C-018F	40365-40400	R7999 Fault Information		Ref. Table 24.
0190	40401	Air Total Resistance	U16	0-4095. Air actuator feedback pot resistance.
0191	40402	Fuel 1 Total Resistance	U16	0-4095. Fuel 1 actuator feedback pot resistance.
0192	40403	Fuel 2 Total Resistance	U16	0-4095. Fuel 2 actuator feedback pot resistance.
0193	40404	FGR Total Resistance	U16	0-4095. FGR actuator feedback pot resistance.
0194	40405	Air Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0195	40406	Registers 40401-40405 are current	U16	0-1
0196	40407	Fuel 1 Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0197	40408	Fuel 2 Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0198	40409	FGR Resistance Change	U16	0-4095. Bit 15 is a sign flag. 1 = negative, 0 = positive.
0199	40410-40411	LCO Cycle Count	U32	0-1,000,000 Same as 40137
019B	40412	Registers 40407-40411 are current	U16	0-1
019C	40413	Air Purge Preset Position	U16	0-4095
019D	40414	Fuel Purge Preset Position	U16	0-4095
019E	40415	FGR Purge Preset Position	U16	0-4095
019F	40416	Air Lightoff Preset Position	U16	0-4095
01A0	40417	Fuel Lightoff Preset Position	U16	0-4095
01A1	40418	Registers 40413-40417 are current	U16	0-1
01A2	40419	Lightoff Preset FGR	U16	0-4095
01A3	40420	Air Standby Position	U16	0-4095
01A4	40421	Fuel Standby Position	U16	0-4095
01A5	40422	FGR Standby Position	U16	0-4095
01A6	40423	Non-Selected Fuel Standby Position	U16	0-4095
01A7	40424	Registers 40419-40423 are current	U16	0-1
01A8	40425	Number of Profile Points	U16H	0-23
		Major Software Revision	U16L	
01A9	40426	Minor Software Revision	U16H	
		Software Version Code	U16L	

Table 13. ModBus™ R7999 Register Assignments. (Continued)

Address (hex)	Register (dec)	Parameter Name	Format	Notes
01AA	40427	R7999 ControlBus™ revision	U16H	Bits 0-3 FlameNet™ and R7999 display.
		R7999 Compatibility Code for ZM7999	U16L	
01AB	40428	R7999 Software Build Code	U16	0x0000-0xFFFF
01AC	40429	Abort Code	U16H	0-255
		Abort Code Count	U16L	0-255
01AD	40430	Registers 40425-40429 are current	U16	0-1
01AE	40431	Low Fire Hold Configuration	U16H	0—Disabled (Not configured—See note in register 40139) 1—Low Fire Hold (Position the FGR, Air and Fuel actuators at the Light Off Position). 2—Modulate with FGR closed (FGR closed, Air and fuel modulating). 3—Low Fire Hold with FGR closed (FGR closed, Air and Fuel at Light Off Position).
		Configuration Options	U16L	If a Bit = 1, then the option is configured. Bit 0: FGR is set to follow the profile (curve) during purge. Bit 1: Maximum Firing rate is controlled by the Manual Firing Rate input. Bits 2-15: Unused.
01AF	40432	Min Auxiliary Temperature	U16	0x0000-0xFFFF. Subtract 40 to get the actual value.
01B0	40433	Max Auxiliary Temperature	U16	0x0000-0xFFFF. Subtract 40 to get the actual value.
01B1	40434	Auxiliary Release Temperature Counts	U16	Release the Low Fire Hold condition and allow Modulation after the Aux. temperature reaches this temperature or higher. See Note 5.
01B2	40435	Auxiliary Enforce Temperature Counts	U16	Initiate a Hold condition when the Aux. temperature reaches this temperature or lower. See Note 5.
01B3	40436	Registers 40431-40435 are current	U16	0-1
01B4-01B5	40437-40438	Running Time in Hours	U32	
01B6	40439	Running Time in Minutes	U16H	
		Unused	U16L	
01B7-01B8	40440-40441	Unused	U32	
01B9	40442	Registers 40437-40440 are current	U16	0-1
01BA	40443	Device Data Ready	U16	Device data was properly received by S7810M. Bit(s) Device 0 RM78XX 1 R7999 2 S7830 Expanded Annunciator 3 EC78XX 4-15 Unused
01BB	40444	S7810M Device Compatibility with Current Software Revision	U16	Device is compatible with the S7810M version Bit Device 0 RM78XX 1 R7999 2 S7830 Expanded Annunciator 3 EC78XX 4-7 Unused
		S7810M Software Revision Compatibility with Legacy Software Revisions.		Used for indication of S7810M revision compatibility. Bit(s) Compatible with: 8 Series 2 9-15 Future

NOTES:

1. Due to the amount of data provided by the R7999, some registers contain two parameters, one in the Data Hi byte and one in the Data Lo byte. Using Register 40429 as an example: The format for "Abort Code" is "U16H", meaning the Data Hi byte is the parameter's value, and for "Abort Code Count", with a format of "U16L", the Data Lo byte is the parameter's value. So a query of 01 03 01 AC 00 01 might result in a response of 01 03 00 02 05 10 which means "Abort Code = 5" and "Abort Code Count = 0x10". Each parameter value is a byte.

2. Parameter values in this table change infrequently and can take up to 39 seconds for all data to be available, except for registers 40443 through 40444, which are updated twice a second.

3. "Device Data Ready" and "S7810M Compatibility" bits can be used to quickly check device availability and compatibility then read/write registers of only these devices.

4. If "Device Data Ready" is true for the R7999, then all "Registers nnnnn-nnnnn are current" flags are true. If "Device Data Ready" is false for the R7999, then one or more of the "Registers nnnnn-nnnnn are current" flags are false. This is used to verify that the R7999 parameter values were received when expected. Otherwise, the values for the register range could be greater than 40 seconds old.

5. R7999 Auxiliary Temperature data: Release Temperature, Enforce Temperature and Auxiliary Input Temperature need to be calculated. use the following conversion formulas:

   a. $m = ((MaxAuxTmp) - (MinAuxTmp))/3108$.
   b. $b = MinAuxTmp - (m * 777)$.
   c. **Release Temperature** $= (m * ReleaseTemperatureCounts) + b$.
   d. **Enforce Temperature** $= (m * EnforceTemperatureCounts) + b$.
   e. $mAux = 193.37/(MaxAuxTmp - MinAuxTmp)$.
   f. $bAux = 48.34 - (mAux * MinTmp - 40))$
   g. **Auxiliary Input Temperature** $= (AuxiliaryInput - bAux)/mAux$

   See Table 14 for register numbers and variables.

6. 0-4095 translates to 0-115 degrees except for pot resistance which translates to 0-10000 ohms. The actuators have a maximum movement of 115 degrees.

   115 / 4095 = about 0.028 degrees per count. All positions are in reference to the actuators' closed endpoint.
   To translate to Degrees:
   Closed Endpoint is considered a virtual = 0 degrees
   Span = (Open Endpoint – Closed Endpoint) * 0.028
   Current Position = (Current Position – Closed Endpoint) * 0.028
   Actuator Preset Position = (Actuator Preset – Closed Endpoint) * 0.028
   To Translate to Percent 0-100%:
   Position = ((Current Position – Closed Endpoint) / (Open Endpoint – Closed Endpoint))* 100
   Preset Position = ((Preset Position – Closed Endpoint) / (Open Endpoint – Closed Endpoint))* 100

Table 14. Temperature Data Registers

Register (Decimal)	Variable
40142	AuxiliaryInput
40432	MinAuxTmp
40433	MaxAuxTmp
40334	ReleaseTemperatureCounts
40435	EnforceTemperatureCounts

7800 SERIES Sequence State Codes

Sequence state codes are provided by the Burner Control. Each code is translated into two string codes for displaying an associated message in two lines. Each code is also translated into burner control state bits which may be used to generate and control system diagrams on an operator interface.

The Sequence State Codes shown in Table 15 are current only if the Fault Code has a value of zero. If the Fault Code is non-zero, the sequence state field contains the sequence state code when the lockout occurred.

The codes can also be retrieved from registers 40004, 40005, and 40013.

Table 15. 7800 SERIES Sequence State Codes and Associated register code values.

Register 40003	7800 SERIES Sequence State	String Code Line 1	String Code Line 2	Uses mm:ss	Burner Control State Bits
Fault code not zero	LOCKOUT	52	Table 17		8000h
0	UNUSED HISTORY	0	0		0000h
1	INITIATE	48	0	✓	0001h
2	INITIATE HOLD: AC FREQUENCY/ NOISE	49	8		4001h
3	INITIATE HOLD: AC LINE DROPOUT	49	9		4001h
4	INITIATE HOLD: AC FREQUENCY	49	7		4001h
5	INITIATE HOLD: LOW LINE VOLTAGE	49	60		4001h
6	STANDBY	103	0		0002h
7	STANDBY HOLD: REM REMOTE CONTROL	104	94		4002h
8	STANDBY HOLD: START SWITCH	104	106		4002h
9	STANDBY HOLD: F/G FLAME DETECTED	104	35		4002h
10	STANDBY HOLD: T20 PREIGNITION	104	86		4002h
11	STANDBY HOLD: T7 RUNNING INTERLOCK	104	101		4002h

Table 15. 7800 SERIES Sequence State Codes and Associated register code values. (Continued)

Register 40003	7800 SERIES Sequence State	String Code Line 1	String Code Line 2	Uses mm:ss	Burner Control State Bits
12	STANDBY HOLD: T7 LOCKOUT INTERLOCK	104	54		4002h
13	STANDBY HOLD: AIRFLOW SWITCH	104	13		4002h
14	PURGE HOLD: T19 HIGH FIRE SWITCH	93	40		4004h
15	PURGE DELAY: T19 HIGH FIRE JUMPRD	89	39		4004h
16	PURGE HOLD: TEST RUN/TEST SWITCH	93	98		4004h
17	PURGE DELAY: T18 LOW FIRE JUMPRD	89	56		4004h
18	PURGE HOLD: F/G FLAME DETECTED	93	35		4004h
19	PURGE	87	0	✓	0004h
20	PURGE HOLD: T18 LOW FIRE SWITCH	93	58		4004h
21	PURGE HOLD: T7 Running Interlock	93	101		4004h
22	PURGE HOLD: LOCKOUT INTERLOCK	93	54		4004h
23	PURGE HOLD: AIRFLOW SWITCH	93	13		4004h
24	PURGE HOLD: START SWITCH	93	106		4004h
25	PILOT IGN	78	0	✓	0008h
26	PILOT HOLD: TEST RUN/TEST SWITCH	77	98		4008h
27	PILOT HOLD: START SWITCH	77	106		4008h
28	MAIN IGN	66	0	✓	0010h

Table 15. 7800 SERIES Sequence State Codes and Associated register code values. (Continued)

Register 40003	7800 SERIES Sequence State	String Code Line 1	String Code Line 2	Uses mm:ss	Burner Control State Bits
29	MAIN IG HOLD: MANUAL-OPEN SWITCH	67	72		4010h
30	RUN	95	0		0020h
31	RUN PV HOLD: LOW FIRE SWITCH	96	58		4020h
32	PVHOLD IGN	77	46	✓	4008h
33	PV HOLD: PV HOLD SWITCH	77	45		4008h
34	RUN/LOWFIRE: TEST RUN/TEST SWITCH	97	98		4020h
35	POSTPURGE	83	0	✓	0040h
36	STATE UNKNOWN	31	0		0000h
37	RESET/ALARM TEST	111	0		6000h
38	SAFETY START	102	105		4002h
39	SAFETY1-1	102	2	✓	0008h
40	SAFETY1-2	102	3	✓	0008h
41	SAFETY1-3	102	4	✓	0008h
42	SAFETY1-4	102	5	✓	0008h
43	SAFETY1-5	102	6	✓	0008h
44	Blank	0	0		A000h
45	PREIGNITION	84	0	✓	0080h
46	SAFETY 1	102	1	✓	0008h
47	PILOT STAB.	79	0		0008h
48	MAIN TRIAL	68	0	✓	0010h
49	MAIN TRIAL	68	0		0010h
50	STANDBY HOLD: RUN/TEST SWITCH	104	98		4002h
51	STATE 51	31	0		A000h
52	STATE 52	31	0		A000h
53	SAFETY 1: RUN/TEST SWITCH	102	98		4008h
54	STATE 54	31	0		A000h
55	STANDBY HOLD: PURGE FAN SWITCH	104	92		4002h
56	STATE 56	31	0		A000h
57	PURGE HOLD: PURGE FAN SWITCH	93	92		4004h

Table 15. 7800 SERIES Sequence State Codes and Associated register code values. (Continued)

Register 40003	7800 SERIES Sequence State	String Code Line 1	String Code Line 2	Uses mm:ss	Burner Control State Bits
58	STANDBY HOLD FLAME DETECTED	104	35		4002h
59	STANDBY HOLD COMB. PRESSURE	104	26		4002h
60	VP START	210	0	✓	0100h
61	VP MV2 ON	211	0	✓	0100h
62	VP LOW DLY	212	0	✓	4100h
63	VP LOW TST	213	0	✓	0100h
64	VP MV1 ON	214	0	✓	0100h
65	VP HIGH DLY	215	0	✓	4100h
66	VP HIGH TST	216	0	✓	0100h
67	INITIATE HOLD: AC AC PHASE ERROR	49	10		4001h
68	STANDBY HOLD: PRE-IGNITION ILK	104	85		4002h
69	SETUP NEEDED	217	0		A000h
70	STATE 70	31	0		A000h
71	BURNER OFF: T6 BURNER SWITCH	22	23		4002h
72	STANDBY HOLD: T6 (EA) HOLD MSG	184	30		4002h
73	STANDBY HOLD: (EA) CIRCUIT FAULT	184	25		4002h
74	STANDBY HOLD (EA)	184	Varies		4002h
75	PURGE HOLD (EA)	185	Varies		4004h
76	Unused	0	Varies		0000h
77	Unused	0	Varies		0000h
78	Unused	0	Varies		0000h
79	STANDBY HOLD (EA)	184	Varies		4002h
80	STANDBY HOLD (EA)	184	Varies		4002h
81	STANDBY HOLD (EA): VALVE CLOSURE	184	109		4002h
82	STANDBY HOLD (EA) OTHER PII	184	75		4002h

7800 SERIES String Codes

Table 16 contains a listing of all string codes provided by the S7810M. The associated string is not implemented in the S7810M; it is a string equivalent to that displayed on the S7800 Keyboard Display Module or similar device.

Table 16. 7800 SERIES String codes.

String Code	String
0	(blank)
1	1
2	1-1
3	1-2
4	1-3
5	1-4
6	1-5
7	AC FREQUENCY
8	AC Frequency/Noise
9	AC LINE DROPOUT
10	AC PHASE
11	ACCESSORY FAULT
12	AIRFLOW SW. ON
13	AIRFLOW SWITCH
14	ATOMIZING SW
15	AUX INTERLOCK #4
16	AUX INTERLOCK #5
17	AUX LIMIT #1
18	AUX LIMIT #2
19	AUX LIMIT #3
20	BLOCK INTAKE
21	BOTH FUELS SELECT
22	BURNER OFF
23	BURNER SWITCH
24	CALL SERVICE
25	CIRCUIT FAULT
26	COMB. PRESSURE
27	CONTROL ON
28	DELAYED MV ON
29	DEVICE SPECIFIC
30	EA HOLD MESSAGE
31	UNKNOWN STATE
32	FLAME AMP TYPE
33	FLAME AMP/SHUTR
34	FLAME AMPLIFIER
35	FLAME DETECTED
36	FLAME TOO STRONG
37	FLAME-OUT TIMER
38	FUEL SELECT OFF
39	HIGH FIRE JUMPERED
40	HIGH FIRE SWITCH
41	HIGH GAS PRESSURE

Table 16. 7800 SERIES String codes. (Continued)

String Code	String
42	HIGH LIMIT
43	HIGH OIL PRESSURE
44	HIGH OIL TEMP
45	HOLD SWITCH
46	IGNITION
47	IGNITION ON
48	INITIATE
49	INITIATE HOLD
50	JUMPERS CHANGED
51	JUMPERS WRONG
52	LOCKOUT
53	LOCKOUT ILK ON
54	LOCKOUT INTERLOCK
55	LOCKOUT SWITCH
56	LOW FIRE JUMPERED
57	LOW FIRE SW OFF
58	LOW FIRE SWITCH
59	LOW GAS PRESSURE
60	LOW LINE VOLTAGE
61	LOW OIL PRESSURE
62	LOW OIL TEMP
63	LWCO
64	MAIN FLAME FAIL
65	MAIN FLAME IGN.
66	MAIN IGN
67	MAIN IGN HOLD
68	MAIN TRIAL
69	MAIN VALVE ON
70	MAN-OPEN SW. OFF
71	MAN-OPEN SW. ON
72	MAN-OPEN SW.
73	NO PURGE CARD
74	OTHER INTERLOCKS
75	OTHER PREIGN ILK
76	PILOT FLAME FAIL
77	PILOT HOLD
78	PILOT IGN
79	PILOT STABILIZE
80	PILOT VALVE 1 ON
81	PILOT VALVE 2 ON
82	POOR FLAME SENSOR
83	POSTPURGE
84	PREIGNITION
85	PREIGNITION ILK
86	PREIGNITION
87	PURGE
88	PURGE CARD ERROR

Table 16. 7800 SERIES String codes. (Continued)

String Code	String
89	PURGE DELAY
90	PURGE FAN SW OFF
91	PURGE FAN SW ON
92	PURGE FAN SWITCH
93	PURGE HOLD
94	REMOTE CONTROL
95	RUN
96	RUN HOLD
97	RUN/LOWFIRE
98	RUN/TEST SWITCH
99	RUNNING ILK
100	RUNNING ILK ON
101	RUNNING INTERLOCK
102	SAFETY
103	STANDBY
104	STANDBY HOLD
105	START
106	START SWITCH
107	START SWITCH ON
108	TEST STATE
109	VALVE CLOSURE
110	ALL SWITCHES ON
111	RESET/ALARM TEST
112	Run/Test Switch RUN
113	Run/Test Switch TEST
114	Operator Control T6 = 0
115	Operator Control T6 = 1
116	Interlock T7 = 0
117	Interlock T7 = 1
118	Airflow Interlock T7 = 0
119	Airflow Interlock T7 = 1
120	Block Intake T7 = 0
121	Block Intake T7 = 1
122	Valve T8 = 0
123	Valve T8 = 1
124	Intrptd PV T8 = 0
125	Intrptd PV T8 = 1
126	Main Valve T9 = 0
127	Main Valve T9 = 1
128	Ignition T10 = 0
129	Ignition T10 = 1
130	PV Hold T16 = 0
131	PVHold T16 = 1
132	Input A T16 = 0
133	Input A T16 = 1
134	ManOpenSw T17 = 0
135	ManOpenSw T17 = 1

Table 16. 7800 SERIES String codes. (Continued)

String Code	String
136	Input B T17 = 0
137	Input B T17 = 1
138	PreIgn ILK T17 = 0
139	PreIgn ILK T17 = 1
140	LowFire Sw T18 = 0
141	LowFire Sw T18 = 1
142	Purge Fan T18 = 0
143	Purge Fan T18 = 1
144	HighFire Sw T19 = 0
145	HighFire Sw T19 = 1
146	PreIgn ILK T20 = 0
147	PreIgn ILK T20 = 1
148	Lockout Inp T20 = 0
149	Lockout Inp T20 = 1
150	Comb Press T20 = 0
151	Comb Press T20 = 1
152	Valv/Start T21 = 0
153	Valv/Start T21 = 1
154	Intmitt PV T21 = 0
155	Intmitt PV T21 = 1
156	Terminal T6 = 0
157	Terminal T6 = 1
158	Terminal T7 = 0
159	Terminal T7 = 1
160	Terminal T8 = 0
161	Terminal T8 = 1
162	Terminal T9 = 0
163	Terminal T9 = 1
164	Terminal T10 = 0
165	Terminal T10 = 1
166	Terminal T16 = 0
167	Terminal T16 = 1
168	Terminal T17 = 0
169	Terminal T17 = 1
170	Terminal T18 = 0
171	Terminal T18 = 1
172	Terminal T19 = 0
173	Terminal T19 = 1
174	Terminal T20 = 0
175	Terminal T20 = 1
176	Terminal T21 = 0
177	Terminal T21 = 1
178	Jumper 1 Intact
179	Jumper 1 Clipped
180	Jumper 2 Intact
181	Jumper 2 Clipped
182	Jumper 3 Intact

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Table 16. 7800 SERIES String codes. (Continued)

String Code	String
183	Jumper 3 Clipped)
184	STANDBY HOLD (EA)
185	PURGE HOLD (EA)
186	PILOT HOLD (EA)
187	MAIN IG HOLD (EA)
188	RUN HOLD (EA)
189	POSTPURGE HOLD (EA)
190	PREIGNITION HOLD (EA)
191	-SKIPPED-
192	DEMAND T6 = 0
193	DEMAND T6 = 1
194	PILOT VALVE T8 = 0
195	PILOT VALVE T8 = 1
196	INTERMIT PV T8 = 0
197	INTERMIT PV T8 = 1
198	MAIN VALVE1 T9 = 0
199	MAIN VALVE1 T9 = 1
200	VP SWITCH T16 = 0
201	VP SWITCH T16 = 1
202	MAIN VALVE2 T17 = 0
203	MAIN VALVE2 T17 = 1
204	INTRUPTD PV T21 = 0
205	INTRUPTD PV T21 = 1
206	DELAYED MV T21 = 0
207	DELAYED MV T21 = 1
208	START SW T21 = 0
209	START SW T21 = 1
210	VP START
211	VP MV2 ON
212	VP LOW DLY
213	VP LOW TST
214	VP MV1 ON
215	VP HIGH DLY
216	VP HIGH TST
217	VP SETUP NEEDED
218	MAIN VALVE 1 OFF
219	MAIN VALVE 2 OFF
220	MAIN VALVE 1 ON
221	MAIN VALVE 2 ON
222	VPS OFF
223	VPS ON
224	HIGH CYCLE RATE

7800 SERIES Fault Codes

Table 17 is a complete list of fault codes that may appear in the fault code register. The Fault String Code register will contain the corresponding String code identified in the table.

Table 17. 7800 SERIES Fault Codes.

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 16)
0	*Blank (no fault)*	0
1	FAULT 1: NO PURGE CARD	73
2	FAULT 2: AC FREQUENCY/NOISE	8
3	FAULT 3: AC LINE DROPOUT	9
4	FAULT 4: AC FREQUENCY	7
5	FAULT 5: LOW LINE VOLTAGE	60
6	FAULT 6: PURGE CARD ERROR	88
7	FAULT 7: FLAME AMPLIFIER	34
8	FAULT 8: FLAME AMP/SHUTR	33
9	FAULT 9: FLAME DETECTED	35
10	FAULT 10: PREIGNITION ILK	85
11	FAULT 11: RUNNING ILK ON	100
12	FAULT 12: LOCKOUT ILK ON	53
13	FAULT 13: AIRFLOW SW. ON	12
14	FAULT 14: HIGH FIRE SWITCH	40
15	FAULT 15: FLAME DETECTED	35
16	FAULT 16: FLAME-OUT TIMER	37
17	FAULT 17: MAIN FLAME FAIL	64
18	FAULT 18: FLAME DETECTED	35
19	FAULT 19: MAIN FLAME IGN.	65
20	FAULT 20: LOW FIRE SW OFF	57
21	FAULT 21: RUNNING ILK	99
22	FAULT 22: LOCKOUT ILK	54
23	FAULT 23: AIRFLOW SWITCH	13
24	FAULT 24: CALL SERVICE	24
25	FAULT 25: CALL SERVICE	24
26	FAULT 26: MAN-OPEN SW. OFF	70
27	FAULT 27: START SWITCH ON	71
28	FAULT 28: PILOT FLAME FAIL	76
29	FAULT 29: LOCKOUT ILK	54
30	FAULT 30: RUNNING ILK	101
31	FAULT 31: LOW FIRE SW OFF	57
32	FAULT 32: AIRFLOW SWITCH	13
33	FAULT 33: PREIGNITION ILK	85
34	FAULT 34: CONTROL ON	27
35	FAULT 35: CALL SERVICE	24
36	FAULT 36: CALL SERVICE	24
37	FAULT 37: CALL SERVICE	24
38	FAULT 38: CALL SERVICE	24
39	FAULT 39: CALL SERVICE	24
40	FAULT 40: CALL SERVICE	24

Table 17. 7800 SERIES Fault Codes. (Continued)

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 16)
41	FAULT 41: MAIN VALVE ON	69
42	FAULT 42: PILOT VALVE 1 ON	80
43	FAULT 43: IGNITION ON	47
44	FAULT 44: PILOT VALVE 2 ON	81
45	FAULT 45: LOW FIRE SW OFF	57
46	FAULT 46: FLAME AMP TYPE	32
47	FAULT 47: JUMPERS CHANGED	50
48	FAULT 48: DELAYED MV ON	28
49	FAULT 49: MAN-OPEN SW. ON	71
50	FAULT 50: JUMPERS WRONG	51
51	FAULT 51: FLAME TOO STRONG	36
52	FAULT 52: CALL SERVICE	24
53	FAULT 53: LOCKOUT SWITCH	55
54	FAULT 54: COMB. PRESSURE	26
55	FAULT 55: PURGE FAN SW ON	91
56	FAULT 56: BLOCK INTAKE	20
57	FAULT 57: PURGE FAN SW OFF	90
58	FAULT 58: COMB.PRESSURE/ FLAME	26
59	FAULT 59: CALL SERVICE	24
60	FAULT 60: CALL SERVICE	24
61	FAULT 61: MV1 OFF	218
62	FAULT 62: MV2 OFF	219
63	FAULT 63: MV1 ON	220
64	FAULT 64: MV2 ON	221
65	FAULT 65: VPS OFF	222
66	FAULT 66: VPS ON	223
67	FAULT 67: AC PHASE	10
68	FAULT 68: PREIGNITION ILK	85
69	FAULT 69: CALL SERVICE	24
70	FAULT 70: CALL SERVICE	24
71-75	FAULT 71-75: DEVICE SPECIFIC	29
76-93	FAULT 76-93: ACCESSORY FAULT	11
94-127	FAULT 94-127: CALL SERVICE	24
128	FAULT 128: POOR FLAME SENSOR	82
129–141	FAULT 129-141: CALL SERVICE	24
142	FAULT 68z: OTHER PREIGN ILK[EA]	75
143	FAULT 68y: VALVE CLOSURE[EA]	109
144	FAULT 33z: OTHER PREIGN ILK[EA]	75
145	FAULT 33y: VALVE CLOSURE[EA]	109
146	FAULT 32s: OTHER INTERLOCKS[EA]	74
147	FAULT 32r: AUX INTERLOCK #5[EA]	16
148	FAULT 32q: AUX INTERLOCK #4[EA]	15

Table 17. 7800 SERIES Fault Codes. (Continued)

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 16)
149	FAULT 32p: AIRFLOW SWITCH[EA]	13
150	FAULT 32o: LOW GAS PRESSURE[EA]	59
151	FAULT 32n: HIGH GAS PRESSURE[EA]	41
152	FAULT 32m: ATOMIZING SW[EA]	14
153	FAULT 32k: LOW OIL TEMP[EA]	62
154	FAULT 32j: HIGH OIL TEMP[EA]	44
155	FAULT 32i: LOW OIL PRESSURE[EA]	61
156	FAULT 32h: HIGH OIL PRESSURE[EA]	43
157	FAULT 32g: BOTH FUELS SELECT[EA]	21
158	FAULT 32f: FUEL SELECT OFF[EA]	38
159	FAULT 32e: AUX LIMIT #3[EA]	19
160	FAULT 32d: HIGH LIMIT[EA]	42
161	FAULT 32c: LWCO[EA]	63
162	FAULT 32b: AUX LIMIT #2[EA]	18
163	FAULT 32a: AUX LIMIT #1[EA]	17
164	FAULT 30s: OTHER INTERLOCKS[EA]	74
165	FAULT 30r: AUX INTERLOCK #5[EA]	16
166	FAULT 30q: AUX INTERLOCK #4[EA]	15
167	FAULT 30p: AIRFLOW SWITCH[EA]	13
168	FAULT 30o: LOW GAS PRESSURE[EA]	59
169	FAULT 30n: HIGH GAS PRESSURE[EA]	41
170	FAULT 30m: ATOMIZING SW[EA]	14
171	FAULT 30k: LOW OIL TEMP[EA]	62
172	FAULT 30j: HIGH OIL TEMP[EA]	44
173	FAULT 30i: LOW OIL PRESSURE[EA]	61
174	FAULT 30h: HIGH OIL PRESSURE[EA]	43
175	FAULT 30g: BOTH FUELS SELECT[EA]	21
176	FAULT 30f: FUEL SELECT OFF[EA]	38
177	FAULT 30e: AUX LIMIT #3[EA]	19
178	FAULT 30d: HIGH LIMIT[EA]	42
179	FAULT 30c: LWCO[EA]	63
180	FAULT 30b: AUX LIMIT #2[EA]	18

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Table 17. 7800 SERIES Fault Codes. (Continued)

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 16)
181	FAULT 30a: AUX LIMIT #1[EA]	17
182	FAULT 29s: OTHER INTERLOCKS[EA]	74
183	FAULT 29r: AUX INTERLOCK #5[EA]	16
184	FAULT 29q: AUX INTERLOCK #4[EA]	15
185	FAULT 29p: AIRFLOW SWITCH[EA]	13
186	FAULT 29o: LOW GAS PRESSURE[EA]	59
187	FAULT 29n: HIGH GAS PRESSURE[EA]	41
188	FAULT 29m: ATOMIZING SW[EA]	14
189	FAULT 29k: LOW OIL TEMP[EA]	62
190	FAULT 29j: HIGH OIL TEMP[EA]	44
191	FAULT 29i LOW OIL PRESSURE[EA]	61
192	FAULT 29h: HIGH OIL PRESSURE[EA]	43
193	FAULT 29g: BOTH FUELS SELECT[EA]	21
194	FAULT 29f: FUEL SELECT OFF[EA]	38
195	FAULT 29e: AUX LIMIT #3[EA]	19
196	FAULT 29d: HIGH LIMIT[EA]	42
197	FAULT 29c: LWCO[EA]	63
198	FAULT 29b: AUX LIMIT #2[EA]	18
199	FAULT 29a: AUX LIMIT #1[EA]	17
200	FAULT 23s: OTHER INTERLOCKS[EA]	74
201	FAULT 23r: AUX INTERLOCK #5[EA]	16
202	FAULT 23q: AUX INTERLOCK #4[EA]	15
203	FAULT 23p: AIRFLOW SWITCH[EA]	13
204	FAULT 23o: LOW GAS PRESSURE[EA]	59
205	FAULT 23n: HIGH GAS PRESSURE[EA]	41
206	FAULT 23m: ATOMIZING SW[EA]	14
207	FAULT 23k: LOW OIL TEMP[EA]	62
208	FAULT 23j: HIGH OIL TEMP[EA]	44
209	FAULT 23i LOW OIL PRESSURE[EA]	61
210	FAULT 23h: HIGH OIL PRESSURE[EA]	43
211	FAULT 23g: BOTH FUELS SELECT[EA]	21
212	FAULT 23f: FUEL SELECT OFF[EA]	38
213	FAULT 23e: AUX LIMIT #3[EA]	19

Table 17. 7800 SERIES Fault Codes. (Continued)

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 16)
214	FAULT 23d: HIGH LIMIT[EA]	42
215	FAULT 23c: LWCO[EA]	63
216	FAULT 23b: AUX LIMIT #2[EA]	18
217	FAULT 23a: AUX LIMIT #1[EA]	17
218	FAULT 22s: OTHER INTERLOCKS[EA]	74
219	FAULT 22r: AUX INTERLOCK #5[EA]	16
220	FAULT 22q: AUX INTERLOCK #4[EA]	15
221	FAULT 22p: AIRFLOW SWITCH[EA]	13
222	FAULT 22o: LOW GAS PRESSURE[EA]	59
223	FAULT 22n: HIGH GAS PRESSURE[EA]	41
224	FAULT 22m: ATOMIZING SW[EA]	14
225	FAULT 22k: LOW OIL TEMP[EA]	62
226	FAULT 22j: HIGH OIL TEMP[EA]	44
227	FAULT 22i: LOW OIL PRESSURE[EA]	61
228	FAULT 22h: HIGH OIL PRESSURE[EA]	43
229	FAULT 22g: BOTH FUELS SELECT[EA]	21
230	FAULT 22f: FUEL SELECT OFF[EA]	38
231	FAULT 22e: AUX LIMIT #3[EA]	19
232	FAULT 22d: HIGH LIMIT[EA]	42
233	FAULT 22c: LWCO[EA]	63
234	FAULT 22b: AUX LIMIT #2[EA]	18
235	FAULT 22a: AUX LIMIT #1[EA]	17
236	FAULT 21s: OTHER INTERLOCKS[EA]	74
237	FAULT 21r: AUX INTERLOCK #5[EA]	16
238	FAULT 21q: AUX INTERLOCK #4[EA]	15
239	FAULT 21p: AIRFLOW SWITCH[EA]	13
240	FAULT 21o: LOW GAS PRESSURE[EA]	59
241	FAULT 21n: HIGH GAS PRESSURE[EA]	41
242	FAULT 21m: ATOMIZING SW[EA]	14
243	FAULT 21k: LOW OIL TEMP[EA]	62
244	FAULT 21j: HIGH OIL TEMP[EA]	44
245	FAULT 21i: LOW OIL PRESSURE[EA]	61

Table 17. 7800 SERIES Fault Codes. (Continued)

Fault Code (Reg 40001)	Fault Message (NOTE: FAULT n: is not in the Fault and Strings Code)	Fault String Code (Table 16)
246	FAULT 21h: HIGH OIL PRESSURE[EA]	43
247	FAULT 21g: BOTH FUELS SELECT[EA]	21
248	FAULT 21f: FUEL SELECT OFF[EA]	38
249	FAULT 21e: AUX LIMIT #3[EA]	19
250	FAULT 21d: HIGH LIMIT[EA]	42
251	FAULT 21c: LWCO[EA]	63
252	FAULT 21b: AUX LIMIT #2[EA]	18
253	FAULT 21a: AUX LIMIT #1[EA]	17
254	FAULT 10z: OTHER PREIGN ILK[EA]	75
255	FAULT 10y: VALVE CLOSURE[EA]	109

7800 SERIES Burner Control Fault History Records

Table 18 describes the registers that are part of a fault history record. To determine the actual register address for a parameter within the record, add the register offset to the start address of the record.

Table 18. Fault History Record Format.

Offset	Parameter Name	Access	Format	Notes
0	Fault code	R	U16	See Table 17.
1	Fault String	R	U16	See Table 16.
2	Sequence State	R	U16	See Table 15.
3	First line message	R	U16	See Table16.
4	Second line message	R	U16	See Table 16.
5	Sequence time	R	U16	Seconds.
6-7	Total cycles	R	U32	
8-9	Total hours	R	U32	

Expanded Annunciator

The codes shown in Table 19 are available in the Expanded Annunciator First Out Code Register. These codes are normally translated to the appropriate fault code by the Burner Control. The fault code will then be translated to the appropriate first and second line messages as shown in Table 17 for use by the UMC800 Operator Interface.

Table 19. Expanded Annunciator First Out Code.

EA Status Value (binary)	Status Message	Line 2 String Code (Table 16)
0xx 00000	No Expanded Annunciator	N/A
0xx 00001	Burner Sw.	23
0xx 00010	Control On	27
0xx 00011	Aux. Limit #1	17
0xx 00100	Aux. Limit #2	18
0xx 00101	LWCO	63
0xx 00110	High Limit	42
0xx 00111	Aux. Limit #3	19
0xx 01000	FuelSelect Off	38
0xx 01001	BothFuelSelect	21
0xx 01010	High Oil Pres.	43
0xx 01011	Low Oil Pres.	61
0xx 01100	High Oil Temp	44
0xx 01101	Low Oil Temp.	62
0xx 01110	Atomizing Sw.	14
0xx 01111	High Gas Pres.	41
0xx 10000	Low Gas Pres.	59
0xx 10001	Airflow Sw.	13
0xx 10010	Aux. ILK #4	15
0xx 10011	Aux. ILK #5	16
0xx 10100	All Switches On (or) Other PII (if hold or lockout condition exists)	110
		74
0x1 XXXXX	Valve Closure	109
00XX XXXX	Gas Select	N/A
01XX XXXX	Oil Select	N/A
If the BC is in Standby and the 5LSB value is 1-16, then the cause of the Standby Hold is the 5LSB value; otherwise the hold is "Circuit Fault".		

Response Message Format for Function Code 17.

This format is device specific and is only available for the 7800 SERIES burner control. See Table 20.

Table 20. Response Message Format for function code 17 (11h), (26 bytes).

	Slave Address	Function Code	Byte Count	Slave ID[a]	Run Indicator Status[b]	Device Description[c]	N/A	CRC	CRC
Byte	0	1	2	3	4	5-15	16-23	24	25

[a] Slave ID: Always 0x78 when using RM78xx or EC78xx Relay Modules(1 byte) (byte 3).

[b] Run Indicator Status: Always FF=ON (one byte)(byte 4).

[c] Device Description: ASCII OS number for the Burner Control (11 bytes) (bytes 5-15).

Burner Control Type Codes

The burner control type code indicates the exact model number of the burner control. See Table 21.

Table 21. Burner Control Type Codes

CODE	DEVICE DESCRIPTION
0	(undefined)
100	RM7800E
101	RM7800G
102	RM7800L
103	RM7800M
104	RM7838A
105	RM7838B
106	RM7840E
107	RM7840G
108	RM7840L
109	RM7840M
110	RM7885A
111	RM7888A
112	RM7890A
113	RM7895A
114	RM7895B
115	RM7823A
116	RM7824A
117	RM7830A
118	RM8738C
119	RM7845A
120	RM7850A
121	RM7865A
122	RM7865B
123	RM7865C
124	RM7890B
125	RM7890C
126	RM7890D
127	RM7895C
128	RM7895D
129	RM7895E
130	RM7895F
131	RM7896A
132	RM7896B
133	RM7896C
134	RM7896D
135	RM7897A
136	RM7897C

Table 21. Burner Control Type Codes (Continued)

CODE	DEVICE DESCRIPTION
137	RM7898A
138	R7140G
139	R7140L
140	R7140M
199	RM78xx
200	EC7810A
201	EC7820A
202	EC7830A
203	EC7850A
204	EC7885A
205	EC7890A
206	EC7895A
207	EC7895C
208	EC7823A
209	EC7840L
210	EC7865
299	EC78xx

7800 SERIES Burner Control State Bits

The burner control sequence state is translated into State Bit Register as shown in Table 22.

Table 22. Burner Control State Bits.

BIT	Description	BC State Bits Register
0	Initiate	0000 0000 0000 0001
1	Standby	0000 0000 0000 0010
2	Purge	0000 0000 0000 0100
3	Pilot Ignition	0000 0000 0000 1000
4	Main Ignition	0000 0000 0001 0000
5	Run	0000 0000 0010 0000
6	Postpurge	0000 0000 0100 0000
7	Pre-Ignition	0000 0000 1000 0000
8	Valve Proving	0000 0001 0000 0000
13	Alarm	1010 0000 xxxx xxxx NOTE: Lockout bit is also set.
14	Hold	0100 0000 xxxx xxxx One other bit may be on.
15	Lockout	1010 0000 0000 0000 NOTE: Alarm bit is also set.

R7999 Profile Data Structure

If an R7999 uses less than 24 indexes for its profile, then the unused index data will be zero (refer to "Number of Profile Points" parameter to get the actual number of profile points). Note that the profile information will be zero for an unconfigured or disconnected R7999. Up to 24 sets of data are used to build the profile. See Table 23.

Table 23. R7999 Profile Data Structure.

Offset	Parameter Name	Format	Notes
0	Index	U16H	0-23
	Type	U16L	0x00 = Unused 0x01 = Used 0x02 = Light Off 0x04 = Minimum 0x08 = Maximum 0x10 = Purge 0x20 = Stop 0x40 = Not Implemented 0x80 = Valid Segment
1	Firing Rate for the current point.	U16	0-4095
2	Air actuator position for the current point.	U16	0-4095
3	Fuel actuator position for the current point.	U16	0-4095
4	FGR actuator position for the current point.	U16	0-4095
5	Data in the previous 5 registers is current.	U16	0-1

R7999 Fault History Data Structure

This information is repeated 5 times for a total of 6 fault history structures. See Table 24.

Table 24. R7999 Fault History Structure.

Offset	Parameter Name	Format	Notes
0	Fault Buffer Index	U16H	0-5
	Next Fault Index	U16L	Faults are stored in a circular buffer. This register points to the index of the next fault to be logged. 0-5.
1	Cycle Count at the time the alarm occurred.	U32	0-1,000,000
3	Fault Code	U16H	See Table 26.
	Operating State of the device at the time the alarm occurred.	U16L	Same text enumeration as "R7999 Status Message 0x0C" byte 5. Register 40132.
4	Not implemented	U16H	1-6
	Unused	U16L	255
5	Data in the previous 5 registers is current.	U16	0-1

NOTE: The Next Fault Position points to the oldest fault. For example: If the Next Fault Position is 4, then the order of faults from the newest to the oldest is: 3, 2, 1, 0, 5, 4.

R7999 Status Message

The R7999 Status Message is added to an indexed circular buffer once a second. An 8-second history of the data is available in registers 40160-40208. Table 25 identifies the register data structure which is the same for each buffer, 0-7. Register 40160, bits 0-2, points to the oldest buffer information, so if the Buffer Index is 3, then buffer order from oldest to newest would be: 3, 4, 5, 6, 7, 0, 1, 2.

In a byte, bits are identified as bit 7 (MSBit) through bit 0 (LSBit). In a word consisting of two bytes, all values are big-endian, that is, bit 15 of the word is the MSBit of the first (lowest numbered) byte, bit 8 is the LSBit of this byte, bit 7 is the MSBit of the next byte, and bit 0 is the LSBit.

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Table 25. R7999 Status Message.

Byte(s)	Description—R7999 circular buffer data structure of registers 40161-40208. Some of this data is interpreted by the S7810M and is available in registers 40129-40144.
0	Program Mode/Selected Fuel Bits Description 7 Selected Fuel 0 = Fuel 1, 1 = Fuel 2 6 Fuel select input 2 5 Fuel select input 1 4 Active hold (4-20 mA Aux. Input is below its threshold) 0-3 Program Mode—Enumerated 0 Initiate State 1 Normal Operation 2 Alarm Initiate State 3 Lockout 4 Not Configured 5 Factory Test 6 Low Voltage 7 Commissioning 8 Reset
1	**Current Fault**—See Table 26.
2	**Current Operating Status**—Enumerated: 0 Standby Hold 1 Standby Programmed Standby 2 Standby Main Valve 3 Standby Low Fire Main Valve 4 Standby Purge 5 Fault 1 6 Standby High Fire Main Valve 7 Fault 2 8 Processing Demand 9 Light Off 10 Modulate 11 Light Off Low Fire Main Valve 12 Purge 13 Fault 3 14 Purge Main Valve 15 Fault 4 16 Initialize 17 Post Purge

Table 25. R7999 Status Message. (Continued)

Byte(s)	Description—R7999 circular buffer data structure of registers 40161-40208. Some of this data is interpreted by the S7810M and is available in registers 40129-40144.
3-4	Air Actuator Position/Terminal States Bits Description 15 LCO State 14 HFP State 13 LFP State 12 ALARM State 11-0 Current position of the Air Actuator (0-4095)
5-6	Active Fuel Actuator Position/Terminal States Bits Description 15 LCI State 14 HF State 13 MV State 12 LF State 11-0 Current position of the active Fuel Actuator (0-4095)
7-8	FGR Actuator Position/Terminal States Bits Description 15 LCO Relay Drive 2 feedback 14 LCO Relay Drive 1 feedback 13 LCM State—the LCM state is the feedback in between LCI and LCO 12 Auto/Manual select—Auto mode when it is 0 and Manual when it is 1 11-0 Current position of the FGR Actuator (0-4095)
9	**Firing Rate Input**—The current non-filtered analog-to-digital reading of the CmA (SSLC) 4-20 mA firing rate input. (0-255 = 0-21.1 mA).
10	**Manual Pot Input**—The current non-filtered analog-to-digital reading of the Manual Potentiometer firing rate input. (0-255 = 2.1-44.1 mA)
11	**Auxiliary Input**—The current non-filtered analog-to-digital reading of the XmA (Auxiliary) 4-20 mA firing rate input. (0-255 = 0-21.1 mA)

R7999 Fault Text

The R7999 Fault Text is shown indexed by hexadecimal values. A value of 0x11 means there is currently no fault.

Table 26. R7999 Fault Text.

Fault Code (hexadecimal)	Fault Text
0x11	No Fault
0x13	MV On
0x14	HF and LF on
0x15	Burner Control Transition
0x25	Move Limit Test
0x26	Target Move Test
0x36	Fuel Selection
0x37	HFP/LFP Output
0x41	Air Pot Feedback
0x42	F1 Pot Feedback
0x43	F2 Pot Feedback
0x44	FGR Pot Feedback
0x45	Air Wiper Resistance
0x46	F1 Wiper Resistance
0x47	F2 Wiper Resistance
0x48	FGR Wiper Resistance
0x49	Air Total Resistance
0x51	F1 Total Resistance
0x52	F2 Total Resistance
0x53	FGR Total Resistance
0x58	Stuck Reset
0x61	Initiate Timeout
0x67	Fuel Off Curve
0x68	FGR Off Curve
0x69	Air Off Curve
0x71	Air Offline
0x72	F1 Offline
0x73	F1 Offline
0x74	FGR Offline
0x82	Motor Speed
0x83	Air No Response
0x84	F1 No Response
0x85	F2 No Response
0x86	FGR No Response
0x91	CmA Out of Range - Less than 3mA or greater than 20mA
0x92	Manual Pot Range
0x93	XmA Out of Range
0x94	Demand Too Long
0x99	Error Reading Fuel Selection

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