Honeywell

# Software Interface Specification

SOLA MODBUS INTERFACE

**PRODUCT DATA**

## INTRODUCTION

This document describes the interface to the SOLA on either the MB1 or MB2 Modbus ports. Each Modbus port is a communications port that allows configuration and status data to be read and written to the SOLA. These ports are RS-485 connectors that use the Modbus communication protocol for its interface.

The SOLA functions as a Modbus slave (server) on this interface. It responds to a single Modbus address to service the requests of the Modbus master (client) on the RS-485 network.

This document does not describe the Modbus protocol. It only describes how this protocol is used in this interface.

### Definitions

The following definitions are used in this document:

| | |
|---|---|
| **Modbus** | Application layer communication protocol standard adopted by the Modbus-IDA trade association. Recognized as an industry standard protocol for RS-485 serial communication. |
| **PCB** | Parameter Control Block. Files that customize the user interface with the ICP. PCBs reside in the non-volatile storage in the ICP and are uploaded from the ICP into the user interface. |
| **PM** | Program Module. Plug that can be inserted into the ICP to enable Lead Lag and to backup & restore parameter settings in the ICP. |
| **RTU** | Remote Terminal Unit serial transmission mode. Mode used to encode data for Modbus where each 8-bit byte is sent as two 4-bit hexadecimal characters. |
| **U8** | Unsigned 8-bit data format |
| **U16** | Unsigned 16-bit data format |
| **U32** | Unsigned 32-bit format |

### References

The following documents are referenced by this document:

MODBUS Application Protocol Specification V1.1a, June 4, 2004, http://www.Modbus-IDA.org.

## INTERFACE

### Physical Layer

The ICP Modbus port is a 3-pin connector that interfaces to the following RS-485 signals (Table 1):

**Table 1. RS-485 signals**

| Signal | Terminal |
|---|---|
| Data + (a) | 1 |
| Data – (b) | 2 |
| Common (c) | 3 |

The serial transmission mode on the Modbus network is a RTU mode. The message format has the characteristics shown in Table 2.

**Table 2. RS-485 message format**

| Coding system | 8-bit binary |
|---|---|
| Number of data bits per character | 10 =<br>1 start bit<br>8 data bits<br>No parity bit<br>1 stop bit |
| Bit transfer rate | 38400 bps |
| Duplex | Half duplex |
| Error checking | 2 byte CRC-16 polynomial |
| Bit transfer order | LSB first |
| End of message | Idle line for 3.5 or more characters |

### Application Layer

The ICP Modbus interface supports the following function codes:

- 03 (0x03) Read Holding Registers
- 06 (0x06) Write Single Register
- 16 (0x10) Write Multiple Registers
- 17 (0x11) Report Slave ID

All of the configuration and status data are accessed as 16-bit holding registers in this interface. Since all ICP digital signals accessed in this interface are read only, these digital signals are mapped to bits within holding registers instead of coils or discrete inputs to simplify the interface. Variable length data are also represented by holding registers, and therefore, must be accessed individually and not as part of a group. The

length of the variable length data is returned in the response. All 32-bit data items are accessed as two consecutive 16-bit holding registers, i.e., each item uses 2 register address spaces.

The holding register map is defined in Table 5. Except for variable length data items the registers can be accessed as a single register or up to 20 registers for writes and 125 registers for reads. Data is mapped into logical groups with room for future expansion, so some gaps exist in the register map.

Data organization is intended to allow for efficient register access. Status data is organized into register blocks by application function and a function status change indicator is used to denote when any data has changed within the register block since the last time the registers were read (see Fig. 1). The ICP sets the status change indicator bit when at least one of the registers in the functional block has changed value since it was last read. The Modbus master can read the status change register and determine which functional register blocks have changed value since its last access and only read those register blocks. The Modbus master can ignore the status change register and poll status data as it deems fit.

The ICP has several terminals (connectors) used for sensor inputs. These sensor inputs can be configured for different types of data input:

- 10K NTC dual temperature safety sensor
- 10K NTC single temperature non-safety sensor
- 12K NTC single temperature non-safety sensor
- 0-150 psi pressure sensor
- 0-50 psi pressure sensor
- 4-20 mA analog input

Each terminal is referenced by an “S*n*” name (where “*n*” is a number in the range of 1-10), and in some cases, may be identified by a functional name that describes it’s purpose (see Table 3). A connector type parameter for each terminal specifies how the data input is interpreted for the terminal.

**Table 3. Sensor input names**

| Name | Terminal | Purpose |
|---|---|---|
| S1 | J8-4 | Inlet temperature or<br>4-20 mA steam pressure (0-15 or 0-150 psi) |
| S2 | J8-6 | 4-20 mA remote control input (setpoint or modulation) or 4-20mA steam pressure (0-15 or 0-150 psi) |
| S3 | J8-8 | Outlet single non-safety temperature |
| S3S4 | J8-8 *and* J8-10 | Outlet dual safety temperature |
| S5 | J8-11 | Outdoor, or Lead Lag Header (Central Heat) |
| S6 | J9-1 | DHW single non-safety temperature |
| S6S7 | J9-1 *and* J9-3 | DHW dual safety temperature |
| S8 | J9-4 | Stack single non-safety temperature |
| S9 | J9-6 | Heat exchanger temperature |
| S8S9 | J9-4 *and* J9-6 | Stack dual safety temperature |
| S10 | J10-7 | Outdoor or Lead Lag Header (Central Heat) temperature |

A pair of status registers exist for each sensor, one register that normally contains the temperature or pressure of the sensor and another register that contains the state of the sensor, e.g., Inlet sensor temperature in register 11 and Inlet sensor state in register 49. If a sensor has a fault, e.g., open or short, then the sensor state register indicates the type of fault (see Table 4), and instead of a temperature/pressure in the sensor status register one of the following values is displayed:

A temperature configuration parameter may have a value of 0x8FFF to indicate that the parameter has not been configured yet, but no temperature status will have this value.

**Table 4. Sensor fault status**

| Sensor Status | Sensor State | Description |
|---|---|---|
| 0x7FFF or 0x8200 | 0=None | No sensor configured for terminal. |
| Temperature in degrees C or Pressure in psi | 1=Normal | Sensor is functioning normally. |
| 0x8000 | 3=Shorted | Sensor short is detected. |
| 0x8100 | 2=Open | Sensor open is detected. |
| 0x8300 | 4=Outside high range | Sensor is reading higher than normal upper limit for sensor. |
| 0x8400 | 5=Outside low range | Sensor is reading lower than normal lower limit for sensor. |
| 0x8500 | 6=Not reliable | Sensor reading is not consistent. |

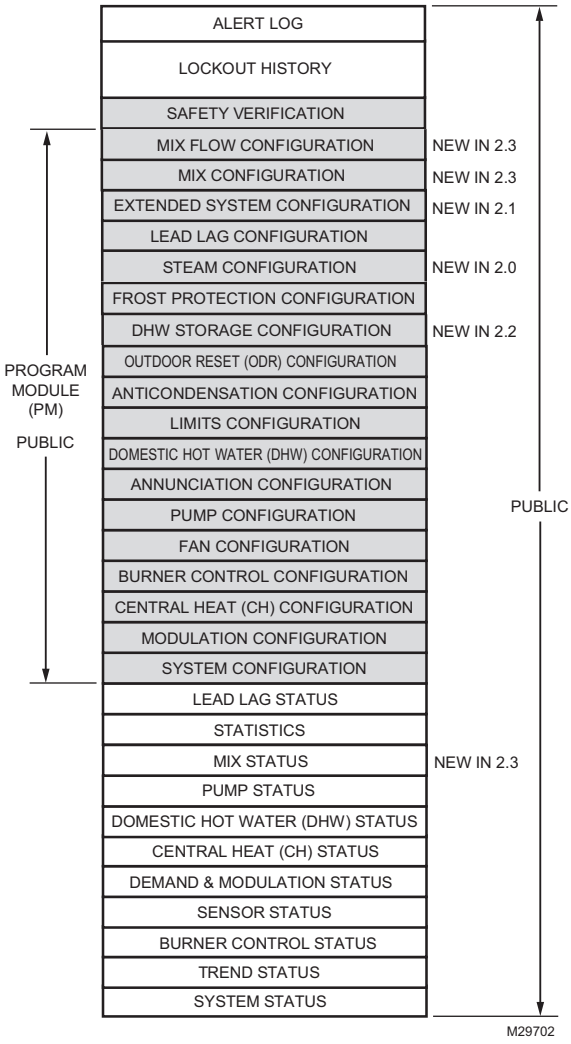


**Fig. 1. Register map.**

**Table 5. SOLA Modbus register map**

| Address (hex) | Register (dec) | Parameter | Read/ Write | Format | Note |
|---|---|---|---|---|---|
| | | **SYSTEM STATUS** | | | |
| 0000 | 0000 | Status Change | R | U16 | Register is cleared (all bits zeroed) after read. Identifies register groups that have new status in them.<br>Bit map:<br>15-11=Reserved (always 1)<br>10=Alert log<br>9=Lockout history<br>8=Lead Lag status<br>7=Statistics<br>6=Pump status<br>5=DHW status<br>4=CH status<br>3=Demand&Modulation status<br>2=Sensor status<br>1=Burner control status<br>0=Active Lockout |
| 0001 | 0001 | Configuration Change | R | U16 | Register is cleared (all bits zeroed) after read. Identifies register groups that have new data in them.<br>Bit map:<br>15=PCB configuration<br>14=PM configuration<br>13=Reserved<br>12=Lead Lag configuration<br>11=Frost protection configuration<br>10=Outdoor reset configuration<br>9=Anti-condensation configuration<br>8=Limits configuration<br>7=DHW configuration<br>6=Annunciation configuration<br>5=Pump configuration<br>4=Fan configuration<br>3=Burner control configuration<br>2=CH configuration<br>1=Modulation configuration<br>0=System configuration |
| 0002 | 0002 | Digital I/O | R | U16 | Bit map:<br>15=Safety relay<br>14=Time of Day<br>13=STAT (Demand)<br>12=High Fire Switch (HFS)<br>11=Low Fire Switch (LFS)<br>10=Load Control Input (LCI)<br>9=Pre-ignition interlock (PII)<br>8=Interlock (ILK)<br>7=Alarm<br>6=Main valve<br>5=Pilot valve<br>4=External ignition<br>3=Blower motor/HSI<br>2=Pump C<br>1=Pump B<br>0=Pump A |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0003 | 0003 | Annunciation I/O | R | U16 | Only applicable when Annunciation is enabled<br>Bit map:<br>15-8=Reserved (always 0)<br>7=Annunciator 8/LFS<br>6=Annunciator 7/HFS<br>5=Annunciator 6<br>4=Annunciator 5<br>3=Annunciator 4<br>2=Annunciator 3<br>1=Annunciator 2<br>0=Annunciator 1/IAS |
| 0004 | 0004 | Limits | R | U16 | Bitmap:<br>15-12=Reserved (always 0)<br>11=Heat exchanger high limit<br>10=Exchanger T-rise limit<br>9=Outlet T-rise limit<br>8=Inversion inlet/exchanger limit<br>7=Inversion exchanger/outlet limit<br>6=Inversion inlet/outlet limit<br>5=Delta T inlet/exchanger limit<br>4=Delta T exchanger/outlet limit<br>3=Delta T inlet/outlet limit<br>2=Stack limit<br>1=DHW high limit<br>0=Outlet high limit |
| 0005 | 0005 | Program Module (PM) status | R | U16 | Bit map:<br>15-11=Reserved<br>10=OEM alert PCB stored in PM<br>9=OEM range PCB stored in PM<br>8=OEM parameter PCB stored in PM<br>7-3=Reserved (always 0)<br>2=Valid copyright<br>1=Lead/Lag enabled<br>0=PM installed |
| | | **TREND STATUS** | | | |
| 0006 | 0006 | Demand source | R | U16 | Current demand source:<br>0=Unknown<br>1=No source demand<br>2=CH<br>3=DHW<br>4=Lead Lag slave<br>5=Lead Lag master<br>6=CH frost protection<br>7=DHW frost protection<br>8=No demand due to burner switch (register 199) turned off<br>9=DHW storage<br>10=Reserved<br>11=Warm weather shutdown |
| 0007 | 0007 | Outlet (S3S4) or Outlet limit (S3) sensor | R | U16 | -40°-130° (0.1°C precision)[a] |
| 0008 | 0008 | Firing rate | R | U16 | Actual firing rate (%[b] or RPM[c]). |
| 0009 | 0009 | Fan speed | R | U16 | RPM |
| 000A | 0010 | Flame signal | R | U16 | 0.01V or 0.01A precision (0.00-50.00V) |
| 000B | 0011 | Inlet (S1) sensor | R | U16 | -40°-130° (0.1°C precision)[a] |
| 000C | 0012 | DHW (S6S7) or DHW limit (S6) sensor | R | U16 | -40°-130° (0.1°C precision)[a] |
| 000D | 0013 | S5 sensor | R | U16 | -40°-130° (0.1°C precision)[a] |
| 000E | 0014 | Stack (S8S9) or Stack limit (S8) sensor | R | U16 | -40°-130° (0.1°C precision)[a] |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 000F | 0015 | 4-20 mA remote control input (S2) terminal | R | U16 | 4-20 mA (0.1 mA precision) or other (see register 609) |
| 0010 | 0016 | Active CH setpoint | R | U16 | -40°-130° (0.1°C precision)[a]<br>Setpoint determined by CH setpoint source (register 65) |
| 0011 | 0017 | Active DHW setpoint | R | U16 | -40°-130° (0.1°C precision)[a] Setpoint determined by DHW setpoint source (register 81) |
| 0012 | 0018 | Active LL setpoint | R | U16 | -40°-130° (0.1°C precision)[a] Setpoint determined by LL setpoint source (register 161). |
| 0013 | 0019 | Register Access Status | R | U16 | Register data write access status:<br>0=No register writes allowed<br>1=Installer register writes allowed<br>2=OEM register writes allowed.<br>3=All register writes allowed. |
| 0014 | 0020 | Steam pressure | R | U16 | 0-150 psi (0.1 psi precision) |
| 0015 | 0021 | Analog modulation input | R | U16 | 0=No signal, otherwise<br>4-20 mA (0.1 mA precision)<br>Duplicate of register 15 when S2 terminal is 4-20 mA. |
| 0016 | 0022 | Active CH pressure setpoint | R | U16 | 0-150psi (0.1psi precision) |
| 0017 | 0023 | Extended Status Change | R | U16 | Register is cleared (all bits zeroed) after read. Identifies register groups that have new status or configuration data in them.<br>Bit map:<br>15-5=Reserved<br>4= DHW plate heat exchanger configuration<br>3=DHW plate heat exchanger status<br>2-0=Reserved |
| 0018 | 0024 | RESERVED | | | |
| 0019 | 0025 | Active CH operating point | R | U16 | -40°-130° (0.1°C precision)[a] |
| 001A | 0026 | Active DHW operating point | R | U16 | -40°-130° (0.1°C precision)[a] |
| 001B | 0027 | Active Lead Lag operating point | R | U16 | -40°-130° (0.1°C precision)[a] |
| 001C | 0028 | Active system operating point | R | U16 | -40°-130° (0.1°C precision)[a] |
| 001D | 0029 | Active system setpoint | R | U16 | -40°-130° (0.1°C precision)[a] |
| 001E | 0030 | Active system on hysteresis | R | U16 | 0°-130° (0.1°C precision)[a] |
| 001F | 0031 | Active system off hysteresis | R | U16 | 0°-130° (0.1°C precision)[a] |
| | | **BURNER CONTROL STATUS** | | | |
| 0020 | 0032 | Burner control status | R | U16 | 0=Disabled<br>1=Locked out<br>2-3=Reserved<br>4=Anti-short cycle,<br>5=Unconfigured safety data<br>6-33=Reserved<br>34=Standby Hold<br>35=Standby Delay<br>36-47=Reserved<br>48=Normal Standby<br>49=Preparing<br>50=Ignition<br>51=Firing<br>52=Postpurge<br>53-65535=Reserved |
| 0021 | 0033 | Burner control state | R | U16 | Burner control sequence (I/O) state (see Table 12). Model type determined by register 176. |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0022 | 0034 | Lockout code | R | U16 | 0=No lockout<br>1-4096 (see Table 9) |
| 0023 | 0035 | Alarm reason | R | U16 | 0=None<br>1=Lockout (see Lockout code, register 34)<br>2=Alert (see Table 11)<br>3=Other |
| 0024 | 0036 | Annunciator first out | R | U16 | Source for annunciator first out:<br>0=None or undetermined<br>1=ILK<br>2=PII<br>11=Annunciator 1<br>12=Annunciator 2<br>13=Annunciator 3<br>14=Annunciator 4<br>15=Annunciator 5<br>16=Annunciator 6<br>17=Annunciator 7<br>18=Annunciator 8 |
| 0025 | 0037 | Annunciator hold | R | U16 | Source for burner control hold condition (see Hold code):<br>0=None or undetermined<br>1=ILK<br>2=PII<br>3=LCI<br>11=Annunciator 1<br>12=Annunciator 2<br>13=Annunciator 3<br>14=Annunciator 4<br>15=Annunciator 5<br>16=Annunciator 6<br>17=Annunciator 7<br>18=Annunciator 8 |
| 0026 | 0038 | Sequence time | R | U16 | Running time for timed burner control operation (seconds) |
| 0027 | 0039 | Delay time | R | U16 | Running delay time (seconds). Applicable when burner control in delayed or hold state. |
| 0028 | 0040 | Hold code | R | U16 | Reason for burner hold (same codes as lockout, see Table 8) |
| 0029 | 0041 | Burner control flags | R | U16 | Bit map:<br>15-2=Reserved (always 0)<br>1=DHW remote STAT demand indicated<br>0=Flame detected |
| 002A | 0042 | CH remote Stat | R/W | U16 | 0=No remote STAT demand<br>1=Remote STAT demand indicated |
| | | **SENSOR STATUS** | | | |
| 002B | 0043 | Outlet operation (S4=J8-10) terminal | R | U16 | -40°-130° (0.1°C precision)[a]<br>or other (see register 610) |
| 002C | 0044 | DHW operation (S7=J9-3) terminal | R | U16 | -40°-130° (0.1°C precision)[a] or other (see register 612) |
| 002D | 0045 | Stack or Heat exchanger operation (S9=J9-6) terminal | R | U16 | -40°-130° (0.1°C precision)[a] or other (see register 613) |
| 002E | 0046 | Outlet operation sensor (S4=J8-10) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 002F | 0047 | DHW operation sensor (S7=J9-3) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range,<br>5=Outside low range,<br>6=Not reliable |
| 0030 | 0048 | Outlet limit sensor (S3=J8-8) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 0031 | 0049 | Inlet sensor (S1=J8-4) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 0032 | 0050 | DHW limit sensor (S7=J9-1) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 00330033 | 00510051 | Stack limit sensor (S8=J9-4) state<br>Stack limit sensor (S8=J9-4) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 0034 | 0052 | S5 (J8-11) sensor state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 0035 | 0053 | 4-20mA remote control input (S2=J8-6) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 0036 | 0054 | Pressure sensor (S1=J8-4) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0037 | 0055 | Stack operation or Heat exchanger sensor (S9=J9-6) state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| | | **DEMAND AND MODULATION STATUS** | | | |
| 0038 | 0056 | Active rate limiter | R | U16 | 0=None<br>1=Outlet high limit<br>2=Delta T limit<br>3=Stack limit<br>4=Slow start limit<br>5=Anti-condensation<br>6=Minimum modulation<br>7=Forced rate<br>8= IAS is open |
| 0039 | 0057 | Limited rate | R | U16 | RPM or %[c] |
| 003A | 0058 | Active rate override | R | U16 | 0=None<br>1=Burner control default<br>2=Burner control<br>3=Manual firing rate<br>4=Manual firing rate off<br>5=Fan on during off cycle |
| 003B | 0059 | Override rate | R | U16 | RPM or %[c] |
| 003C | 0060 | Demand rate | R | U16 | RPM or %[c] |
| 003D | 0061 | Active system sensor | RR | U16 | Modulation sensor for active priority loop:<br>0=No active sensor<br>1=DHW (S6S7) sensor<br>2=Outlet (S3S4) sensor.<br>3=Inlet (S1) sensor<br>4=4-20mA input (S2)<br>5=S5 sensor<br>6=S10 sensor<br>7=Steam (S1) sensor |
| 003E | 0062 | Active Lead Lag sensor | R | U16 | Active modulation sensor for Lead Lag loop:<br>0=No active sensor<br>2=Outlet (S3S4) sensor<br>5=S5 sensor<br>6=S10 sensor |
| 003F | 0063 | RESERVED | | | |
| | | **CENTRAL HEATING (CH) STATUS** | | | |
| 0040 | 0064 | CH status | R | U16 | 0=Unknown<br>1=Disabled<br>2=Normal<br>3=Suspended |
| 0041 | 0065 | CH setpoint source | R | U16 | 0=Unknown<br>1=Normal setpoint<br>2=TOD setpoint<br>3=Outdoor reset<br>4=Remote control<br>7=Outdoor reset time of day<br>8=Reserved<br>9=Outdoor boost |
| 0042 | 0066 | CH heat demand | R | U16 | 0=Off<br>1=On |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0043 | 0067 | CH burner demand | R | U16 | 0=Off<br>1=On |
| 0044 | 0068 | CH requested rate | R | U16 | RPM or %[c] |
| 0045 | 0069 | CH frost heat demand | R | U16 | 0=Off<br>1=On |
| 0046 | 0070 | CH frost burner demand | R | U16 | 0=Off<br>1=On |
| 0047 | 0071 | Active CH on hysteresis | R | U16 | 0°-130° (0.1°C precision)[a] |
| 0048 | 0072 | Active CH off hysteresis | R | U16 | 0°-130° (0.1°C precision)[a] |
| 0049 | 0073 | Active CH pressure on hysteresis | R | U16 | 0-150psi (0.1psi precision) |
| 004A | 0074 | Active CH pressure off hysteresis | R | U16 | 0-150psi (0.1psi precision) |
| 004B | 0075 | Active CH pressure operating point | R | U16 | 0-150psi (0.1psi precision) |
| 004C | 0076 | Active CH sensor | R | U16 | Active modulation sensor for CH loop:<br>0=No active sensor<br>2=Outlet (S3S4) sensor<br>3=Inlet (S1) sensor<br>4=4-20mA input (S2)<br>5=S5 sensor<br>6=S10 sensor<br>7=Steam (S1) sensor |
| 004D-004E | 0077-0078 | RESERVED | | | |
| | | **DOMESTIC HOT WATER (DHW) STATUS** | | | |
| 004F | 0079 | Active DHW sensor | R | U16 | Active modulation sensor for DHW loop:<br>0=No active sensor<br>1=DHW (S6S7) sensor<br>2=Outlet (S3S4) sensor<br>3=Inlet (S1) sensor |
| 0050 | 0080 | DHW status | R | U16 | 0=Unknown<br>1=Disabled<br>2=Normal<br>3=Suspended |
| 0051 | 0081 | DHW setpoint source | R | U16 | 0=Unknown<br>1=Normal setpoint<br>2=TOD setpoint<br>5=DHW tap setpoint<br>6=DHW preheat setpoint |
| 0052 | 0082 | DHW priority count | R | U16 | Countdown of time when DHW has priority over CH (secs). Applicable when DHW priority time is enabled (see register 452). |
| 0053 | 0083 | DHW heat demand | R | U16 | 0=Off<br>1=On |
| 0054 | 0084 | DHW burner demand | R | U16 | 0=Off<br>1=On |
| 0055 | 0085 | DHW requested rate | R | U16 | RPM or %[c] |
| 0056 | 0086 | DHW frost heat demand | R | U16 | 0=Off<br>1=On |
| 0057 | 0087 | DHW frost burner demand | R | U16 | 0=Off<br>1=On |
| 0058 | 0088 | Active DHW on hysteresis | R | U16 | 0°-130° (0.1°C precision)[a] |
| 0059 | 0089 | Active DHW off hysteresis | R | U16 | 0°-130° (0.1°C precision)[a] |
| 005A | 0090 | DHW storage time | R | U16 | Elapsed DHW storage time (secs) |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 005B | 0091 | DHW storage heat demand | R | U16 | 0=Off<br>1=On |
| 005C | 0092 | DHW storage burner demand | R | U16 | 0=Off<br>1=On |
| | | **PUMP STATUS** | | | |
| 005D | 0093 | Pump A status | R | U16 | Bit map:<br>Demand:<br>15-14=Reserved<br>13=Auxiliary 2 pump demand<br>12=Auxiliary 1 pump demand<br>11=System pump demand<br>10=Boiler pump demand<br>9=DHW pump demand<br>8=CH pump demand<br><br>Reason:<br>7=Reserved<br>6=Pump assigned to logical pump<br>5=Pump exercise requested<br>4=On due to exercise<br>3=On due to overrun<br>2=Forced off<br>1=Forced on<br>0=On due to normal demand |
| 005E | 0094 | Pump B status | R | U16 | Bit map:<br>Demand:<br>15-14=Reserved<br>13=Auxiliary 2 pump demand<br>12=Auxiliary 1 pump demand<br>11=System pump demand<br>10=Boiler pump demand<br>9=DHW pump demand<br>8=CH pump demand<br><br>Reason:<br>7=Reserved<br>6=Pump assigned to logical pump<br>5=Pump exercise requested<br>4=On due to exercise<br>3=On due to overrun<br>2=Forced off<br>1=Forced on<br>0=On due to normal demand |
| 005F | 0095 | CH pump start delay time | R | U16 | Running delay time before CH pump will be turned on. |
| 0060 | 0096 | CH pump status | R | U16 | For application build less than 1600 see Table 13. For application build 1600 or higher see Table 14[d]. |
| 0061 | 0097 | CH pump overrun time | R | U16 | Running overrun time for CH pump (seconds) |
| 0062 | 0098 | CH FP overrun time | R | U16 | Running overrun time for CH pump due to frost protection (seconds) |
| 0063 | 0099 | CH pump idle days count | R | U16 | Number of days that CH pump has not run (sat idle). |
| 0064 | 0100 | DHW pump status | R | U16 | For application build less than 1600 see Table 13. For application build 1600 or higher see Table 14[d]. |
| 0065 | 0101 | DHW pump start delay time | R | U16 | Count down (seconds) when DHW pump is delayed from starting. |
| 0066 | 0102 | DHW pump overrun time | R | U16 | Running overrun time for DHW pump (seconds) |
| 0067 | 0103 | DHW FP overrun time | R | U16 | Running overrun time for DHW pump due to frost protection (seconds) |
| 0068 | 0104 | DHW pump idle days count | R | U16 | Number of days that DHW pump has not run (sat idle). |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0069 | 0105 | System pump status | R | U16 | For application build less than 1600 see Table 13. For application build 1600 or higher see Table 14[d]. |
| 006A | 0106 | System pump overrun time | R | U16 | Running overrun time for System pump (seconds) |
| 006B | 0107 | System pump idle days count | R | U16 | Number of days that System pump has not run (sat idle). |
| 006C | 0108 | Boiler pump status | R | U16 | For application build less than 1600 see Table 13. For application build 1600 or higher see Table 14[d]. |
| 006D | 0109 | Boiler pump overrun time | R | U16 | Running overrun time for Boiler pump (seconds) |
| 006E | 0110 | Boiler pump idle days count | R | U16 | Number of days that boiler pump has not run (sat idle). |
| 006F | 0111 | Auxiliary 1 pump status | R | U16 | For application build less than 1600 see Table 13. For application build 1600 or higher see Table 14[d]. |
| 0070 | 0112 | Auxiliary 1 pump idle days count | R | U16 | Number of days that auxiliary 1 pump has not run (sat idle). |
| 0071 | 0113 | Auxiliary 2 pump status | R | U16 | see Table 14. |
| 0072 | 0114 | Auxiliary 2 pump overrun time | R | U16 | Running overrun time for auxiliary 2 pump (seconds) |
| 0073 | 0115 | Auxiliary 2 pump idle days count | R | U16 | Number of days that auxiliary 2 pump has not run (sat idle). |
| 0074-0076 | 0116-0118 | RESERVED | | | |
| 0077 | 0119 | Auxiliary 1 pump overrun time | R | U16 | Running overrun time for auxiliary 1 pump (seconds) |
| 0078-007F | 0120-0127 | RESERVED | | | |
| | | **STATISTICS** | | | |
| 0080-0081 | 0128-0129 | Burner cycle count | R/W | U32 | 0-999,999 |
| 0082-0083 | 0130-0131 | Burner run time | R/W | U32 | Hours |
| 0084-0085 | 0132-0133 | CH pump cycle count | R/W | U32 | 0-999,999 |
| 0086-0087 | 0134-0135 | DHW pump cycle count | R/W | U32 | 0-999,999 |
| 0088-0089 | 0136-0137 | System pump cycle count | R/W | U32 | 0-999,999 |
| 008A-008B | 0138-0139 | Boiler pump cycle count | R/W | U32 | 0-999,999 |
| 008C-008D | 0140-0141 | Auxiliary pump cycle count | R/W | U32 | 0-999,999 |
| 008E-008F | 0142-0143 | Controller cycle count | R | U32 | 0-999,999 |
| 0090-0091 | 0144-0145 | Controller run time | R | U32 | Hours |
| 0092-0093 | 0146-0147 | Auxiliary 2 pump cycle count | R/W | U32 | 0-999,999 |
| | | **EXTENDED PUMP STATUS** | | | |
| 0094 | 0148 | Auxiliary 2 pump start delay time | R | U16 | Running delay time before auxiliary 2 pump will be turned on. |
| 0095 | 0149 | Boiler pump start delay time | R | U16 | Running delay time before boiler pump will be turned on. |
| 0096 | 0150 | System pump start delay time | R | U16 | Running delay time before system pump will be turned on. |
| 0097 | 0151 | Auxiliary 1 pump start delay time | R | U16 | Running delay time before auxiliary 1 pump will be turned on. |
| | | **DHW PLATE HEAT EXCHANGER STATUS** | | | |
| 0098 | 0152 | DHW tap heat demand | R | U16 | 0=Off<br>1=On |
| 0099 | 0153 | DHW preheat demand | R | U16 | 0=Off,<br>1=On |
| 009A | 0154 | DHW change rate | R | U16 | DHW plate heat exchanger temperature change rate (degrees/second, 0.1°C precision) |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 009B | 0155 | DHW tap on recognition time | R | U16 | Persistent time that DHW tap demand has been recognized (seconds) |
| 009C | 0156 | DHW tap on time | R | U16 | Running time of DHW tap heat demand (seconds) |
| 009D | 0157 | DHW preheat delay after tap time | R | U16 | Preheat delay countdown time (seconds) |
| 009E | 0158 | DHW preheat on recognition time | R | U16 | Persistent time that DHW preheat demand has been recognized (seconds) |
| 009F | 0159 | DHW preheat on time | R | U16 | Running time of DHW preheat heat demand (seconds) |
| | | **LEAD LAG STATUS** | | | |
| 00A0 | 0160 | Lead Lag master status | R | U16 | 0=Unknown<br>1=Disabled<br>2=Normal<br>3=Suspended |
| 00A1 | 0161 | Lead Lag slave status | R | U16 | Bit map:<br>15=Slave command received<br>14=Slave mode has priority over CH & DHW<br>13=Slave is modulating<br>12=CH frost protection request<br>11=DHW frost protection request<br>10=Frost protection burner request<br>9=Local frost protection request<br>8=Reserved (always 0)<br>7-0=Burner control status (see register 32) |
| 00A2 | 0162 | Lead Lag master setpoint source | R | U16 | 0=Unknown<br>1=CH setpoint<br>2=CH TOD setpoint<br>3=Outdoor reset<br>4=Remote control<br>(4-20mA or Modbus)<br>7=Outdoor reset time of day<br>8=Reserved<br>9=Outdoor boost |
| 00A3 | 0163 | Lead Lag master heat demand | R | U16 | 0=Off<br>1=On |
| 00A4 | 0164 | Lead Lag slave burner demand | R | U16 | 0=Off<br>1=On |
| 00A5 | 0165 | Lead Lag slave requested rate | R | U16 | RPM or %[c] |
| | | **EXTENDED PUMP STATUS** | | | |
| 00A8–00A8 | 0168–0168 | Pump C status | R–R | U16 | Bit map:<br>Demand:<br>15-14=Reserved<br>13=Auxiliary 2 pump demand<br>12=Auxiliary 1 pump demand<br>11=System pump demand<br>10=Boiler pump demand<br>9=DHW pump demand<br>8=CH pump demand<br><br>Reason:<br>7=Reserved<br>6=Pump assigned to logical pump<br>5=Pump exercise requested<br>4=On due to exercise<br>3=On due to overrun<br>2=Forced off<br>1=Forced on<br>0=On due to normal demand |
| 00A9 | 0169 | RESERVED | | | |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| | | **EXTENDED SENSOR STATUS** | | | |
| 00AA | 0170 | Outdoor temperature | R | U16 | -40°-130° (0.1°C precision)[a] |
| 00AB | 0171 | Outdoor sensor state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| 00AC | 0172 | Outlet T-rise rate | R | U16 | Outlet temperature change rate (degrees/second, 0.1°C precision) |
| 00AD | 0173 | Exchanger T-rise rate | R | U16 | Heat exchanger temperature change rate (degrees/second, 0.1°C precision) |
| 00AE | 0174 | S10 sensor reading | R | U16 | -40°-130° (0.1°C precision)[a] |
| 00AF | 0175 | S10 sensor state | R | U16 | 0=None<br>1=Normal<br>2=Open<br>3=Shorted<br>4=Outside high range<br>5=Outside low range<br>6=Not reliable |
| | | **SYSTEM CONFIGURATION** | | | |
| 00B0 | 0176 | Product type | R | U16 | Product family (MSB):<br>0=Unknown product<br>1=Hydronic boiler control<br>2=Steam boiler control<br>3=Reserved<br>4=Fulton pulse hydronic boiler control<br>5=Fulton pulse steam boiler control<br>6=Cleaver Brooks hydronic boiler control<br>7=Cleaver Brooks steam boiler control<br><br>Product ID (LSB):<br>0=Residential control<br>1=Commercial control |
| 00B1 | 0177 | Password | W | | Variable length password string (up to 20 characters) requesting ICP permission to write registers. |
| 00B2 | 0178 | Temperature units | R/W | U16 | Display format for temperature at user interface:<br>0=°F (Fahrenheit)<br>1=°C (Celsius) |
| 00B3 | 0179 | Antishort cycle time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00B4 | 0180 | Alarm silence time | R/W | U16 | 0-600 minutes |
| 00B5 | 0181 | Power up with lockout | R/W | U16 | **SAFETY** parameter[e]:<br>0=Clear lockout on power-up (reset)<br>1=Do not clear lockout on power-up (preserve) |
| 00B6 | 0182 | Reset and restart | W | U16 | Force soft reset of ICP subsystems:<br>0=None<br>1=Burner control<br>2=Application<br>3=Burner control & application<br>4=Clear alert log<br>5=Clear lockout history<br><br>Successful login required before request is granted. |
| 00B7 | 0183 | Burner name | R/W | | Variable length string (up to 20 characters) |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 00B8 | 0184 | Installation data | R/W | | Variable length string (up to 20 characters) |
| 00B9 | 0185 | OEM ID | R/W | | Variable length string (up to 20 characters) |
| 00BA | 0186 | OS number | R | | Variable length string (up to 16 characters) |
| 00BB | 0187 | Date code | R | | Variable length string (up to 10 characters) |
| 00BC | 0188 | Safety microprocessor build | R | U16 | |
| 00BD | 0189 | Application microprocessor build | R | U16 | |
| 00BE | 0190 | Installer password | W | | To set new installer password (up to 20 characters). Requires register access status (register 177) set to Installer or higher. |
| 00BF | 0191 | OEM password | W | | To set new OEM password (up to 20 characters). Requires register access status (register 177) set to OEM or higher. |
| | | **MODULATION CONFIGURATION** | | | |
| 00C0 | 0192 | Modulation output | R/W | U16 | **SAFETY** parameter[e]<br>0=Fan PWM<br>1=0-10V<br>2=4-20mA |
| 00C1 | 0193 | CH maximum modulation rate | R/W | U16 | RPM or %[c] |
| 00C2 | 0194 | DHW maximum modulation rate | R/W | U16 | RPM or %[c] |
| 00C3 | 0195 | Minimum modulation rate | R/W | U16 | RPM or %[c] |
| 00C4 | 0196 | Prepurge rate | R/W | U16 | **SAFETY** parameter[e]<br>RPM or %[c] |
| 00C5 | 0197 | Lightoff rate | R/W | U16 | **SAFETY** parameter[e]:<br>RPM or %[c] |
| 00C6 | 0198 | Postpurge rate | R/W | U16 | **SAFETY** parameter[e]:<br>RPM or %[c] |
| 00C7 | 0199 | CH forced rate | R/W | U16 | RPM or %[c] |
| 00C8 | 0200 | CH forced rate time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00C9 | 0201 | DHW forced rate | R/W | U16 | RPM or %[c] |
| 00CA | 0202 | DHW forced rate time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00CB | 0203 | Burner switch | R/W | U16 | 0=Off<br>1=On<br>Used to enable/disable burner control. |
| 00CC | 0204 | Firing rate control | R/W | U16 | 0=Auto<br>1=Manual in Run<br>2=Manual in Run&Standby |
| 00CD | 0205 | Manual firing rate | R/W | U16 | Firing rate used when control is set to manual (% or RPM[c]) |
| 00CE | 0206 | Analog output hysteresis | R/W | U16 | 0-10V/4-20mA modulation output hysteresis. Setting of 0-10. |
| 00CF | 0207 | Standby rate | R/W | U16 | **SAFETY** parameter[e]:<br>RPM or %[c] |
| | | **CH CONFIGURATION** | | | |
| 00D0 | 0208 | CH enable | R/W | U16 | 0=Disable Central Heating<br>1=Enable Central Heating |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 00D1 | 0209 | CH demand switch | R/W | U16 | Source for CH demand:<br>0=Modulation sensor only<br>1=STAT terminal<br>2=EnviraCOM remote Stat<br>3=LCI<br>4=Reserved<br>5=Modbus STAT<br>6=Reserved<br>7=STAT terminal or EnviraCOM remote Stat |
| 00D2 | 0210 | CH modulation sensor | R/W | U16 | Sensor used for CH modulation:<br>0=Outlet sensor<br>2=Inlet sensor<br>3=S5 sensor<br>4=S10 sensor<br>5=No sensor |
| 00D3 | 0211 | CH setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 00D4 | 0212 | CH time of day setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a]<br>Setpoint when Time Of Day switch is on. |
| 00D5 | 0213 | CH on hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 00D6 | 0214 | CH off hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 00D7 | 0215 | CH outdoor reset enable | R/W | U16 | 0=Disable outdoor reset,<br>1=Enable outdoor reset |
| 00D8 | 0216 | CH P-gain | R/W | U16 | 0-1000 |
| 00D9 | 0217 | CH I-gain | R/W | U16 | 0-1000 |
| 00DA | 0218 | CH D-gain | R/W | U16 | 0-1000 |
| 00DB | 0219 | CH hysteresis step time | R/W | U16 | 0-64800 seconds (0=Disable hysteresis stepping) |
| 00DC | 0220 | CH pressure setpoint | R/W | U16 | 0-150psi (0.1psi precision) |
| 00DD | 0221 | CH pressure on hysteresis | R/W | U16 | 0-150psi (0.1psi precision) |
| 00DE | 0222 | CH pressure off hysteresis | R/W | U16 | 0-150psi (0.1psi precision) |
| 00DF | 0223 | RESERVED | | | |
| | | **BURNER CONTROL CONFIGURATION** | | | |
| 00E0 | 0224 | Ignition source | R/W | U16 | **SAFETY** parameter[e]:<br>0=Internal ignition, 1=External ignition<br>2=Hot Surface Igniter (HSI) |
| 00E1 | 0225 | BLR/HSI function | R/W | U16 | **SAFETY** parameter[e]:<br>BLR/HSI terminal function:<br>0=blower motor<br>1=Hot Surface Igniter (HSI) |
| 00E2 | 0226 | Igniter on during | R/W | U16 | **SAFETY** parameter[e]:<br>0=All Pilot Flame Establishing Period (PFEP)<br>1=First ½ of PFEP |
| 00E3 | 0227 | Pilot type | R/W | U16 | **SAFETY** parameter[e]:<br>0=Interrupted, 1=Intermittent<br>2=Direct burner ignition (constant ignition)<br>3=Direct burner ignition (pulsed ignition) |
| 00E4 | 0228 | Flame sensor type | R/W | U16 | **SAFETY** parameter[e]:<br>0=None (no sensor)<br>1=Flame rod<br>2=UV power tube<br>3=UV power tube, ignore flame during ignition |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 00E5 | 0229 | Purge rate proving | R/W | U16 | **SAFETY** parameter[e]:<br>0=None<br>1=High Fire Switch (HFS)<br>2=Fan speed |
| 00E6 | 0230 | Lightoff rate proving | R/W | U16 | **SAFETY** parameter[e]:<br>0=None<br>1=(Low Fire Switch) LFS<br>2=Fan speed<br>3=Fan speed, except during ignition |
| 00E7 | 0231 | Prepurge time | R/W | U16 | **SAFETY** parameter[e]:<br>0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00E8 | 0232 | Pre-ignition time | R/W | U16 | **SAFETY** parameter[e]:<br>0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00E9 | 0233 | Pilot flame establishing period (PFEP) | R/W | U16 | **SAFETY** parameter[e]:<br>0=None<br>1=4 seconds<br>2=10 seconds<br>3=15 seconds<br>0xFFFF=Not configured |
| 00EA | 0234 | Main flame establishing period (MFEP) | R/W | U16 | **SAFETY** parameter[e]:<br>0=None<br>1=5 seconds<br>2=10 seconds<br>3=15 seconds<br>0xFFFF=Not configured |
| 00EB | 0235 | Run stabilization time | R/W | U16 | **SAFETY** parameter[e]:<br>0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00EC | 0236 | Postpurge time | R/W | U16 | **SAFETY** parameter[e]:<br>0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00ED | 0237 | Interlock start check enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=No ILK check<br>1=ILK check |
| 00EE | 0238 | Interlock open response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout<br>1=Recycle |
| 00EF | 0239 | Ignite failure response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout<br>1=Continuous recycle<br>2=Retry, recycle & hold<br>3=Retry, recycle & lockout |
| 00F0 | 0240 | Ignite failure retries | R/W | U16 | **SAFETY** parameter[e]:<br>0=None<br>1=3 times<br>2=5 times<br>3=1 time<br>0xFFFF=Not configured |
| 00F1 | 0241 | Ignite failure delay | R/W | U16 | **SAFETY** parameter[e]:<br>0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 00F2 | 0242 | MFEP flame failure response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout<br>1=Recycle |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 00F3 | 0243 | Run flame failure response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout<br>1=Recycle |
| 00F4 | 0244 | Pilot test hold | R/W | U16 | 0=Disable<br>1=Enable |
| 00F5 | 0245 | RESERVED | R/W | U16 | |
| 00F6 | 0246 | Interrupted air switch (IAS) enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable<br>1=Enable during purge<br>2=Enable during purge & ignition<br>3=Enable during all states |
| 00F7 | 0247 | IAS start check enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable<br>1=Enable |
| 00F8 | 0248 | LCI enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable<br>1=Enable |
| 00F9 | 0249 | PII enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable<br>1=Enable |
| 00FA | 0250 | Flame threshold | R/W | U16 | **SAFETY** parameter[e]:<br>Minimum microamps needed to declare flame presence (0.1A precision). Default value is 0.8 A (8). |
| 00FB-00FC | 0251-0252 | RESERVED | | | |
| 00FD | 0253 | ILK/LCI bounce detection | R/W | U16 | **SAFETY** parameter[e]:<br>0=Do not check for ILK or LCI bounce<br>1=Check for ILK and LCI bounce |
| 00FE | 0254 | Forced recycle interval time | R/W | U16 | **SAFETY** parameter[e]:<br>0=No forced recycle<br>1-64800 minutes (1080 hours)<br>0xFFFF=Not configured |
| 00FF | 0255 | Fan speed error response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout<br>1=Recycle |
| | | **FAN CONFIGURATION** | | | |
| 0100 | 0256 | Absolute maximum fan speed | R/W | U16 | RPM |
| 0101 | 0257 | Absolute minimum fan speed | R/W | U16 | RPM |
| 0102 | 0258 | Fan PWM frequency | R/W | U16 | 0=Unknown<br>1=1000 Hz<br>2=2000 Hz<br>3=3000 Hz<br>4=4000 Hz<br>0xFFFF=Not configured |
| 0103 | 0259 | Fan pulses per revolution | R/W | U16 | 1-10 |
| 0104 | 0260 | Fan speed-up ramp | R/W | U16 | 0-7000 RPM/sec |
| 0105 | 0261 | Fan slow-down ramp | R/W | U16 | 0-7000 RPM/sec |
| 0106 | 0262 | Fan gain up | R/W | U16 | 0-65535 |
| 0107 | 0263 | Fan gain down | R/W | U16 | 0-65535 |
| 0108 | 0264 | Fan minimum duty cycle | R/W | U16 | 1-100% (expressed in whole percentage) |
| 0109-010F | 0265-0271 | RESERVED | | | |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| | | **PUMP CONFIGURATION** | | | |
| 0110 | 0272 | CH pump output | R/W | U16 | 0=None<br>1=Pump A<br>2=Pump B<br>3=Pump C |
| 0111 | 0273 | CH pump control | R/W | U16 | 0=Auto<br>1=On |
| 0112 | 0274 | CH pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0113 | 0275 | CH FP pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0114 | 0276 | DHW pump output | R/W | U16 | 0=None<br>1=Pump A<br>2=Pump B<br>3=Pump C |
| 0115 | 0277 | DHW pump control | R/W | U16 | 0=Auto<br>1=On |
| 0116 | 0278 | DHW pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0117 | 0279 | DHW FP pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0118 | 0280 | DHW pump start delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0119 | 0281 | Boiler pump output | R/W | U16 | 0=None<br>1=Pump A<br>2=Pump B<br>3=Pump C |
| 011A | 0282 | Boiler pump control | R/W | U16 | 0=Auto<br>1=On |
| 011B | 0283 | Boiler pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 011C | 0284 | Auxiliary 1 pump output | R/W | U16 | 0=None<br>1=Pump A<br>2=Pump B<br>3=Pump C |
| 011D | 0285 | Auxiliary 1 pump control | R/W | U16 | 0=Auto<br>1=On |
| 011E | 0286 | RESERVED | | | |
| 011F | 0287 | System pump output | R/W | U16 | 0=None<br>1=Pump A<br>2=Pump B<br>3=Pump C |
| 0120 | 0288 | System pump control | R/W | U16 | 0=Auto<br>1=On |
| 0121 | 0289 | System pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0122 | 0290 | Pump exercise interval | R/W | U16 | Days |
| 0123 | 0291 | Pump exercise time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0124 | 0292 | CH pump start delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0125 | 0293 | Boiler pump start delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0126 | 0294 | System pump start delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0127 | 0295 | Auxiliary 1 pump start delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0128 | 0296 | CH pump options 1 | R/W | U16 | Bit map:<br>15=Normal pump demand when auxiliary pump Z is set<br>14=Normal pump demand when auxiliary pump Y is set<br>13=Normal pump demand when auxiliary pump X is set<br>12-10=Reserved (always 0)<br>9=Normal pump demand when local Lead Lag pump demand is requested<br>8=Normal pump demand when local Lead Lag service is active<br>7=Reserved<br>6=Normal pump demand when DHW service is active<br>5=Normal pump demand when CH service is active<br>4=Reserved<br>3=Normal pump demand when DHW demand<br>2=Normal pump demand when CH demand<br>1=Normal pump demand when local burner demand<br>0=Local demand inhibited for faults |
| 0129 | 0297 | CH pump options 2 | R/W | U16 | Bit map:<br>15=Pump used for Lead Lag<br>14=Pump used for local demand<br>13-9=Reserved (always 0)<br>8=Force pump off when DHW high limit<br>7=Force pump off when DHW anti-condensation<br>6=Force pump off when CH anti-condensation<br>5=Force pump off when DHW priority is active<br>4=Force pump on when DHW frost protection<br>3=Force pump on when CH frost protection<br>2=Force pump on when Lead Lag slave demand<br>1=Force pump on when local burner demand<br>0=Force pump on when Outlet high limit |
| 012A | 0298 | DHW pump options 1 | R/W | U16 | Bit map:<br>15=Normal pump demand when auxiliary pump Z is set<br>14=Normal pump demand when auxiliary pump Y is set<br>13=Normal pump demand when auxiliary pump X is set<br>12-10=Reserved (always 0)<br>9=Normal pump demand when local Lead Lag pump demand is requested<br>8=Normal pump demand when local Lead Lag service is active<br>7=Reserved<br>6=Normal pump demand when DHW service is active<br>5=Normal pump demand when CH service is active<br>4=Reserved<br>3=Normal pump demand when DHW demand<br>2=Normal pump demand when CH demand<br>1=Normal pump demand when local burner demand<br>0=Local demand inhibited for faults |
| 012B | 0299 | DHW pump options 2 | R/W | U16 | Bit map:<br>15=Pump used for Lead Lag<br>14=Pump used for local demand<br>13-9=Reserved (always 0)<br>8=Force pump off when DHW high limit<br>7=Force pump off when DHW anti-condensation<br>6=Force pump off when CH anti-condensation<br>5=Force pump off when DHW priority is active<br>4=Force pump on when DHW frost protection<br>3=Force pump on when CH frost protection<br>2=Force pump on when Lead Lag slave demand<br>1=Force pump on when local burner demand<br>0=Force pump on when Outlet high limit |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 012C | 0300 | Boiler pump options 1 | R/W | U16 | Bit map:<br>15=Normal pump demand when auxiliary pump Z is set<br>14=Normal pump demand when auxiliary pump Y is set<br>13=Normal pump demand when auxiliary pump X is set<br>12-10=Reserved (always 0)<br>9=Normal pump demand when local Lead Lag pump demand is requested<br>8=Normal pump demand when local Lead Lag service is active<br>7=Reserved<br>6=Normal pump demand when DHW service is active<br>5=Normal pump demand when CH service is active<br>4=Reserved<br>3=Normal pump demand when DHW demand<br>2=Normal pump demand when CH demand<br>1=Normal pump demand when local burner demand<br>0=Local demand inhibited for faults |
| 012D | 0301 | Boiler pump options 2 | R/W | U16 | Bit map:<br>15=Pump used for Lead Lag<br>14=Pump used for local demand<br>13-9=Reserved (always 0)<br>8=Force pump off when DHW high limit<br>7=Force pump off when DHW anti-condensation<br>6=Force pump off when CH anti-condensation<br>5=Force pump off when DHW priority is active<br>4=Force pump on when DHW frost protection<br>3=Force pump on when CH frost protection<br>2=Force pump on when Lead Lag slave demand<br>1=Force pump on when local burner demand<br>0=Force pump on when Outlet high limit |
| 012E | 0302 | System pump options 1 | R/W | U16 | Bit map:<br>15=Normal pump demand when auxiliary pump Z is set<br>14=Normal pump demand when auxiliary pump Y is set<br>13=Normal pump demand when auxiliary pump X is set<br>12-10=Reserved (always 0)<br>9=Normal pump demand when local Lead Lag pump demand is requested<br>8=Normal pump demand when local Lead Lag service is active<br>7=Reserved<br>6=Normal pump demand when DHW service is active<br>5=Normal pump demand when CH service is active<br>4=Reserved<br>3=Normal pump demand when DHW demand<br>2=Normal pump demand when CH demand<br>1=Normal pump demand when local burner demand<br>0=Local demand inhibited for faults |
| 012F | 0303 | System pump options 2 | R/W | U16 | Bit map:<br>15=Pump used for Lead Lag<br>14=Pump used for local demand<br>13-9=Reserved (always 0)<br>8=Force pump off when DHW high limit<br>7=Force pump off when DHW anti-condensation<br>6=Force pump off when CH anti-condensation<br>5=Force pump off when DHW priority is active<br>4=Force pump on when DHW frost protection<br>3=Force pump on when CH frost protection<br>2=Force pump on when Lead Lag slave demand<br>1=Force pump on when local burner demand<br>0=Force pump on when Outlet high limit |
| | | **ANNUNCIATION CONFIGURATION** | | | |
| 0130 | 0304 | Annunciation enable | R/W | U16 | 0=Annunciation disabled<br>1=Annunciation enabled |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0131 | 0305 | Annunciator mode | R/W | U16 | 0=Fixed<br>1=Programmable |
| 0132-013E | 0306-0318 | Annunciator 1 configuration | R/W | | see Table 7 |
| 013F-014B | 0319-0331 | Annunciator 2 configuration | R/W | | see Table 7 |
| 014C-0158 | 0332-0344 | Annunciator 3 configuration | R/W | | see Table 7 |
| 0159-0165 | 0345-0357 | Annunciator 4 configuration | R/W | | see Table 7 |
| 0166-0172 | 0358-0370 | Annunciator 5 configuration | R/W | | see Table 7 |
| 0173-017F | 0371-0383 | Annunciator 6 configuration | R/W | | see Table 7 |
| 0180-018C | 0384-0396 | Annunciator 7 configuration | R/W | | see Table 7 |
| 018D-0199 | 0397-0409 | Annunciator 8 configuration | R/W | | see Table 7 |
| 019A-01A5 | 0410-0421 | PII configuration | R/W | | see Table 8 |
| 01A6-01B1 | 0422-0433 | LCI configuration | R/W | | see Table 8 |
| 01B2-01BD | 0434-0445 | ILK configuration | R/W | | see Table 8 |
| 01BE-01BF | 0446-0447 | RESERVED | | | |
| | | **DHW CONFIGURATION** | | | |
| 01C0 | 0448 | DHW enable | R/W | U16 | 0=DHW disabled,<br>1=DHW enabled |
| 01C1 | 0449 | DHW demand switch | R/W | U16 | Source of DHW demand:<br>0=Modulation sensor only<br>1=EnviraCOM DHW request<br>2=DHW switch<br>3=Unused<br>4=STAT terminal<br>5=Reserved<br>6=Modbus STAT<br>7=Auto: S6 or EnviraCOM DHW request<br>8=Auto: S6 or sensor only<br>9=Plate heat exchanger<br>10=Reserved<br>11=STAT2 terminal or EnviraCOM DHW request |
| 01C2 | 0450 | DHW priority vs CH | R/W | U16 | 0=CH > DHW<br>1=DHW > CH |
| 01C3 | 0451 | DHW priority vs LL | R/W | U16 | 0=LL > DHW<br>1=DHW > LL |
| 01C4 | 0452 | DHW priority time | R/W | U16 | 0=No DHW priority time<br>>0=DHW priority time (seconds) |
| 01C5 | 0453 | DHW setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 01C6 | 0454 | DHW time of day setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] Setpoint when Time Of Day switch is on. |
| 01C7 | 0455 | DHW on hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 01C8 | 0456 | DHW off hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 01C9 | 0457 | DHW P-gain | R/W | U16 | 0-1000 |
| 01CA | 0458 | DHW I-gain | R/W | U16 | 0-1000 |
| 01CB | 0459 | DHW D-gain | R/W | U16 | 0-1000 |
| 01CC | 0460 | DHW hysteresis step time | R/W | U16 | 0-64800 seconds (0=Disable hysteresis stepping) |
| 01CD | 0461 | DHW modulation sensor | R/W | U16 | Sensor used for DHW modulation:<br>0=DHW sensor<br>1=Outlet sensor<br>2=Inlet sensor<br>3=Modbus<br>4=Auto: DHW or Inlet sensor<br>5=Auto: DHW or Outlet sensor |
| 01CE | 0462 | RESERVED | | | |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 01CF | 0463 | DHW priority source | R/W | U16 | 0=Disable DHW priority<br>1=DHW priority begins when DHW heat demand starts |
| | | **LIMITS CONFIGURATION** | | | |
| 01D0 | 0464 | Outlet high limit setpoint | R/W | U16 | **SAFETY** parameter[e]:<br>-40°-130° (0.1°C precision)[a] |
| 01D1 | 0465 | Outlet high limit response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout, 1=Recycle&hold |
| 01D2 | 0466 | Stack limit enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable stack limit<br>1=Enable dual sensor safety stack limit<br>2=Enable single sensor non-safety stack limit |
| 01D3 | 0467 | Stack limit setpoint | R/W | U16 | **SAFETY** parameter[e]:<br>-40°-130° (0.1°C precision)[a] |
| 01D4 | 0468 | Stack limit response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout, 2=Recycle&delay |
| 01D5 | 0469 | Stack limit delay | R/W | U16 | **SAFETY** parameter[e]:<br>0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 01D6 | 0470 | Delta-T inlet/outlet enable | R/W | U16 | Delta-T limit for inlet to outlet flow:<br>0=Disable Delta-T limit<br>1=Enable Delta-T limit<br>2=Enable Inversion detection<br>3=Enable Delta-T limit and Inversion detection |
| 01D7 | 0471 | Delta-T inlet/outlet degrees | R/W | U16 | Temperature delta between inlet & outlet sensors when Delta-T limit occurs:<br>0°-130° (0.1°C precision)[a] |
| 01D8 | 0472 | Delta-T response | R/W | U16 | 0=Lockout<br>1=Recycle&delay<br>2=Recycle&delay with retry limit |
| 01D9 | 0473 | Delta-T delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 01DA | 0474 | DHW high limit enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable DHW high limit,<br>1=Enable dual sensor safety DHW high limit<br>2=Enable single sensor non-safety DHW high limit |
| 01DB | 0475 | DHW high limit setpoint | R/W | U16 | **SAFETY** parameter[e]:<br>-40°-130° (0.1°C precision)[a] |
| 01DC | 0476 | DHW high limit response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout, 2=Recycle&hold<br>3=Suspend DHW |
| 01DD | 0477 | CH slow start enable | R/W | U16 | 0=Disable CH slow start limit<br>1=Enable CH slow start limit |
| 01DE | 0478 | DHW slow start enable | R/W | U16 | 0=Disable DHW slow start limit<br>1=Enable DHW slow start limit |
| 01DF | 0479 | Slow start ramp | R/W | U16 | RPM/min or %/min[3] |
| 01E0 | 0480 | Slow start setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 01E1 | 0481 | Outlet T-rise enable | R/W | U16 | 0=Disable outlet T-rise limit<br>1=Enable outlet T-rise limit |
| 01E2 | 0482 | Outlet T-rise degrees | R/W | U16 | Degrees/min (0.1°C precision)[a] |
| 01E3 | 0483 | Outlet T-rise delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 01E4 | 0484 | Outlet high limit enable | R/W | U16 | **SAFETY** parameter[e]:<br>0=Disable Outlet high limit, 1=Enable dual sensor safety Outlet high limit<br>2=Enable single sensor non-safety Outlet high limit |
| 01E5 | 0485 | Delta-T retry limit | R/W | U16 | Maximum number of recycles due to Delta-T or inversion limit. |
| 01E6 | 0486 | Delta-T rate limit enable | R/W | U16 | 0=Do not limit modulation rate<br>1=Limit modulation rate when approaching Delta-T threshold |
| 01E7 | 0487 | Delta-T inverse limit time | R/W | U16 | Minimum toleration time for temperature inversion<br>(0-64800 seconds) |
| 01E8 | 0488 | Delta-T inverse limit response | R/W | U16 | 0=Lockout<br>1=Recycle&delay<br>2=Recycle&delay with retry limit |
| 01E9 | 0489 | Delta-T exchanger/outlet enable | R/W | U16 | Delta-T limit for exchanger to outlet flow:<br>0=Disable Delta-T limit<br>1=Enable Delta-T limit<br>2=Enable Inversion detection<br>3=Enable Delta-T limit and Inversion detection |
| 01EA | 0490 | Delta-T exchanger/outlet degrees | R/W | U16 | Temperature delta between exchanger & outlet sensors when Delta-T limit occurs:<br>0°-130° (0.1°C precision)[a] |
| 01EB | 0491 | Exchanger T-rise enable | R/W | U16 | 0=Disable exchanger T-rise limit<br>1=Enable exchanger T-rise limit |
| 01EC | 0492 | T-rise response | R/W | U16 | 0=Lockout<br>1=Recycle&delay<br>2=Recycle&delay with retry limit |
| 01ED | 0493 | T-rise retry limit | R/W | U16 | Maximum number of recycles due to T-rise limit. |
| 01EE | 0494 | Delta-T inlet/exchanger enable | R/W | U16 | Delta-T limit for inlet to exchanger flow:<br>0=Disable Delta-T limit<br>1=Enable Delta-T limit<br>2=Enable Inversion detection<br>3=Enable Delta-T limit and Inversion detection |
| 01EF | 0495 | Delta-T inlet/exchanger degrees | R/W | U16 | Temperature delta between inlet & exchanger sensors when Delta-T limit occurs:<br>0°-130° (0.1°C precision)[a] |
| | | **ANTICONDENSATION CONFIGURATION** | | | |
| 01F0 | 0496 | CH anticondensation enable | R/W | U16 | 0=Disable CH anticondensation<br>1=Enable CH anticondensation |
| 01F1 | 0497 | CH anticondensation setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 01F2 | 0498 | RESERVED | | | |
| 01F3 | 0499 | DHW anticondensation enable | R/W | U16 | 0=Disable DHW anticondensation<br>1=Enable DHW anticondensation |
| 01F4 | 0500 | DHW anticondensation setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 01F5 | 0501 | RESERVED | | | |
| 01F6 | 0502 | Anticondensation priority | R/W | U16 | Is anticondensation more important than (0=No, 1=Yes)?<br>Bit map:<br>15-5=Reserved (always 0)<br>4=Outlet high limit<br>3=Forced rate<br>2=Slow start<br>1=Delta-T limit<br>0=Stack limit |
| 01F7 | 0503 | Frost protection anticondensation enable | R/W | U16 | 0=Disable frost protection anticondensation<br>1=Enable frost protection anticondensation |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| | | **DHW STORAGE CONFIGURATION** | | | |
| 01F8 | 0504 | DHW storage enable | R/W | U16 | 0=DHW storage disabled,<br>1=DHW storage enabled |
| 01F9 | 0505 | DHW storage time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 01FA | 0506 | DHW storage setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 01FB | 0507 | DHW storage on hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 01FC | 0508 | DHW storage off hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 01FD | 0509 | DHW priority method | R/W | U16 | 0=Boost DHW priority ***during*** priority time<br>1=Drop DHW priority ***after*** priority time expires |
| 01FE-01FF | 0510-0511 | RESERVED | | | |
| | | **OUTDOOR RESET (ODR) CONFIGURATION** | | | |
| 0200 | 0512 | CH ODR maximum outdoor temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0201 | 0513 | CH ODR minimum outdoor temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0202 | 0514 | CH ODR low water temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0203 | 0515 | CH ODR boost time | R/W | U16 | 0-64800 seconds(18 hours)<br>0xFFFF=Not configured |
| 0204 | 0516 | CH ODR boost maximum off point | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0205 | 0517 | Lead Lag CH ODR maximum outdoor temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0206 | 0518 | Lead Lag CH ODR minimum outdoor temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0207 | 0519 | Lead Lag CH ODR low water temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0208 | 0520 | Lead Lag CH ODR boost time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0209 | 0521 | Lead Lag CH ODR boost maximum off point | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 020A | 0522 | CH ODR boost step | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 020B | 0523 | RESERVED | | | |
| 020C | 0524 | Lead Lag CH ODR boost step | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 020D | 0525 | RESERVED | | | |
| 020E | 0526 | Minimum boiler water temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 020F | 0527 | Lead Lag CH ODR minimum water temperature | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| | | **FROST PROTECTION CONFIGURATION** | | | |
| 0210 | 0528 | CH frost protection enable | R/W | U16 | 0=Disable CH frost protection<br>1=Enable CH frost protection |
| 0211 | 0529 | DHW frost protection enable | R/W | U16 | 0=Disable DHW frost protection<br>1=Enable DHW frost protection |
| 0212 | 0530 | Outdoor frost protection setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] (applicable for CH only) |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0213 | 0531 | RESERVED | | | |
| 0214 | 0532 | Lead Lag frost protection enable | R/W | U16 | 0=Disable Lead Lag frost protection<br>1=Enable Lead Lag frost protection |
| 0215 | 0533 | Lead Lag frost protection rate | R/W | U16 | 0-100% (in 0.1% units)[b] |
| 0216-0217 | 0534-0535 | RESERVED | | | |
| | | **EXTENDED MODULATION CONFIGURATION** | | | |
| 0218 | 0536 | IAS open modulation enable | R/W | U16 | 0=Disable IAS open modulation<br>1=Enable IAS open modulation |
| 0219 | 0537 | IAS open rate differential | R/W | U16 | RPM or %[c] |
| 021A | 0538 | IAS open modulation step rate | R/W | U16 | RPM or %[c] |
| 021B | 0539 | IAS open modulation step time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 021C | 0540 | IAS closed response | R/W | U16 | **SAFETY** parameter[e]:<br>0=Lockout<br>1=Recycle |
| | | **EXTENDED CENTRAL HEAT CONFIGURATION** | | | |
| 021D | 0541 | CH minimum pressure | R/W | U16 | 0-150psi (0.1psi precision) |
| 021E | 0542 | CH time of day pressure setpoint | R/W | U16 | 0-150psi (0.1psi precision) |
| 021F | 0543 | Analog input hysteresis | R/W | U16 | 0-10.0mA (0.1mA precision) |
| | | **LEAD LAG CONFIGURATION** | | | |
| 0220 | 0544 | Lead Lag slave enable | R/W | U16 | 0=Lead/Lag slave disabled<br>1=Lead/Lag simple slave enabled for EnviraCom master<br>2=Lead/Lag simple slave enabled for SOLA Modbus master (e.g., BAS)<br>3=Lead/Lag full slave enabled for SOLA master |
| 0221 | 0545 | Lead Lag master enable | R/W | U16 | 0=Not a Lead/Lag master<br>1=Lead/Lag master |
| 0222 | 0546 | Lead Lag setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0223 | 0547 | Lead Lag time of day setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] setpoint when Time Of Day switch is on. |
| 0224 | 0548 | Lead Lag outdoor reset enable | R/W | U16 | 0=Disable outdoor reset, 1=Enable outdoor reset |
| 0225 | 0549 | Lead Lag on hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 0226 | 0550 | Lead Lag off hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 0227 | 0551 | Lead Lag hysteresis step time | R/W | U16 | 0-64800 seconds (0=Disable hysteresis stepping) |
| 0228 | 0552 | Lead Lag P-gain | R/W | U16 | 0-100 |
| 0229 | 0553 | Lead Lag I-gain | R/W | U16 | 0-100 |
| 022A | 0554 | Lead Lag D-gain | R/W | U16 | 0-100 |
| 022B | 0555 | Lead Lag operation switch | R/W | U16 | 0=Turn off Lead Lag operation<br>1=Turn on Lead Lag operation |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 022C | 0556 | Lead Lag CH demand switch | R/W | U16 | 0=Disable CH loop<br>1=STAT terminal<br>2=Reserved<br>3=EnviraCOM remote STAT<br>4=Modbus STAT<br>(register 563)<br>5=Reserved<br>6=STAT terminal or EnviraCOM remote STAT |
| 022D | 0557 | Lead Lag CH setpoint source | R/W | U16 | 0=Local setpoint<br>(register 546)<br>1=Modbus setpoint<br>(register 562)<br>2=4-20mA setpoint<br>(register 15) |
| 022E | 0558 | Lead Lag modulation sensor | R/W | U16 | Sensor used for Lead Lag modulation:<br>0=S5 sensor<br>1=S10 sensor |
| 022F | 0559 | Lead Lag modulation backup sensor | R/W | U16 | Backup sensor used for Lead Lag modulation:<br>0=No backup sensor<br>1=Outlet sensor from lead boiler<br>2=Average Outlet sensor from all slave boilers |
| 0230 | 0560 | Lead Lag CH 4 mA water temperature | R/W | U16 | Temperature corresponding to 4mA signal input:<br>-40°-130° (0.1°C precision)[a] |
| 0231 | 0561 | Lead Lag CH 20 mA water temperature | R/W | U16 | Temperature corresponding to 20mA signal input:<br>-40°-130° (0.1°C precision)[a] |
| 0232 | 0562 | Lead Lag CH Modbus setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0233 | 0563 | Lead Lag CH Modbus STAT | R/W | U16 | 0=No call for heat<br>1=Call for heat |
| 0234 | 0564 | Slave mode | R/W | U16 | 0=Use first according to priority<br>1=Equalize run-time<br>2=Use last according to priority |
| 0235 | 0565 | Slave command | R/W | U16 | Bit map:<br>15=Slave demand request<br>14=Slave suspend startup<br>13=Slave run fan request<br>12=Turn on auxiliary pump X<br>11=Turn on auxiliary pump Y<br>10=Turn on auxiliary pump Z<br>9=Slave pump demand<br>8=Commanded rate is binary fraction %[f]<br>7-0=Commanded rate[g] |
| 0236 | 0566 | Base load rate | R/W | U16 | RPM or %[c] |
| 0237 | 0567 | Fan during off cycle rate | R/W | U16 | RPM or %[c] |
| 0238 | 0568 | Slave sequence order | R/W | U16 | 0-255 |
| 0239 | 0569 | Lead Lag Modbus port | R/W | U16 | Modbus port for Lead Lag control:<br>0=No port assigned<br>1=MB1 (Local Modbus) port<br>2=MB2 (Global Modbus) port |
| 023A | 0570 | Slave demand to firing delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 023B | 0571 | Slave capacity | R/W | U16 | MBH (Million BTU / hour) units |
| 023C | 0572 | Base load common rate | R/W | U16 | 0=Disabled<br>1-100% (in 0.1% units)[b] |
| 023D | 0573 | Rate allocation method | R/W | U16 | 0=Parallel common base limited |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 023E | 0574 | Lead allocation method | R/W | U16 | 0=Sequence order rotation<br>1=Lowest measured run time |
| 023F | 0575 | Lag allocation method | R/W | U16 | 0=Sequence order rotation<br>1=Lowest measured run time |
| | | **EXTENDED CH CONFIGURATION** | | | |
| 0241 | 0577 | CH Modbus STAT | R/W | U16 | Modbus call for heat<br>(see register 209):<br>0=No call for heat<br>1=Call for heat |
| 0242 | 0578 | CH setpoint source | R/W | U16 | Source for CH setpoint:<br>0=Local setpoint<br>(registers 211, 212, etc.)<br>1=Modbus setpoint<br>(register 579)<br>2=4-20mA remote control<br>(register 15) |
| 0243 | 0579 | CH Modbus setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0244 | 0580 | CH modulation rate source | R/W | U16 | 0=Local modulation (sensor)<br>1=Modbus binary fraction[g] (FUTURE)<br>2=Modbus modulation step[g] (FUTURE)<br>3=4-20mA modulation (register 15) with sensor on/off[h]<br>4=4-20mA modulation and burner on/off[h] |
| 0245 | 0581 | CH Modbus rate | R/W | U16 | Commanded CH modulation rate[i] when source is Modbus<br>(see register 580). |
| 0246 | 0582 | CH priority vs. Lead Lag | R/W | U16 | 0= Lead Lag > CH<br>1=CH > Lead Lag |
| 0247 | 0583 | CH 4mA water temperature | R/W | U16 | Temperature corresponding to 4mA signal input:<br>-40°-130° (0.1°C precision)[a] |
| 0248 | 0584 | CH 20mA water temperature | R/W | U16 | Temperature corresponding to 4mA signal input:<br>-40°-130° (0.1°C precision)[a] |
| 0249 | 0585 | CH 4mA steam pressure | R/W | U16 | Pressure corresponding to 4mA signal input:<br>0-150psi (0.1psi precision) |
| 024A | 0586 | CH 20mA steam pressure | R/W | U16 | Pressure corresponding to 4mA signal input:<br>0-150psi (0.1psi precision) |
| 024B-024F | 0587-0591 | RESERVED | | | |
| | | **EXTENDED LIMITS CONFIGURATION** | | | |
| 0250 | 0592 | Heat exchanger high limit enable | R/W | U16 | 0=Disable Heat exchanger high limit<br>1= Enable Heat exchanger high limit |
| 0251 | 0593 | Heat exchanger high limit setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0252 | 0594 | Heat exchanger high limit response | R/W | U16 | 0=Lockout<br>1=Recycle&delay<br>2=Recycle&delay with retry limit |
| 0253 | 0595 | Heat exchanger high limit delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 0254 | 0596 | Heat exchanger retry limit | R/W | U16 | Maximum number of recycles due to Heat exchanger high limit. |
| 0255-025F | 0597-0607 | RESERVED | | | |

**Table 5. SOLA Modbus register map (Continued)**

| | | CONNECTOR CONFIGURATION | | | |
|---|---|---|---|---|---|
| 0260 | 0608 | S1 (J8-4) connector type (Inlet sensor) | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |
| 0261 | 0609 | S2 (J8-6) connector type (4-20mA remote control input) | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |
| 0262 | 0610 | S3S4 (J8-8, 10) connector type<br>(Outlet dual sensor)<br>(Outlet limit sensor and Outlet operation sensor) | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |
| 0263 | 0611 | S5 (J8-11) connector type | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |
| 0264 | 0612 | S6S7 (J9-1, 3) connector type<br><br>(DHW dual sensor)<br><br>(DHW limit sensor and DHW operation sensor) | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |
| 0265 | 0613 | S8S9 (J9-4, 6) connector type<br>(Stack dual sensor)<br><br>(Stack limit sensor and Stack operation sensor)<br><br>(Stack limit sensor and Heat exchanger sensor) | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0266 | 0614 | S10 (J10-7) connector type | R/W | U16 | **SAFETY** parameter[e]:<br>0=Unconfigured<br>1=Raw A2D counts<br>2=10K NTC dual temperature<br>3=10K NTC single temperature<br>4=12K NTC single temperature<br>5=0-15 psi pressure<br>6 =0-150 psi pressure<br>7=4-20 mA |
| 0267-026F | 0615-0623 | RESERVED | | | |
| | | **EXTENDED SYSTEM CONFIGURATION** | | | |
| 0270 | 0624 | Installer passcode | W | U16 | To set new installer passcode (000-999). Requires register access status (register 177) set to Installer or higher. |
| 0271 | 0625 | OEM passcode | W | U16 | To set new OEM passcode (000-999). Requires register access status (register 177) set to OEM or higher. |
| 0272 | 0626 | Outdoor temperature source | R/W | U16 | 0=Unconfigured<br>1=Sensor on S5 connector<br>2=Sensor on S10 connector<br>3=Modbus<br>4=EnviraCOM sensor<br>5=C7089 sensor on S10 connector |
| 0273 | 0627 | Warm weather shutdown enable | R/W | U16 | 0=Disable<br>1=Shutdown after demand has ended<br>2=Shutdown immediately |
| 0274 | 0628 | Warm weather shutdown setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 0275 | 0629 | Use STAT with EnviraCOM remote stat | R/W | U16 | 0=Disable<br>1=Enable |
| 0276 | 0630 | Line frequency | R/W | U16 | **SAFETY** parameter[e]:<br>0=60 Hz<br>1=50 Hz<br>2=Auto detect 48-63 Hz |
| 0277 | 0631 | Safety configuration options | R/W | U16 | **SAFETY** parameter[e]:<br>Bit map:<br>15-1=Reserved<br>0=Ignore flame rod faults when UV is configured |
| 0278-027F | 0632-0639 | RESERVED | | | |
| | | **DHW PLATE HEAT EXCHANGER CONFIGURATION** | | | |
| 02B0 | 0688 | Plate preheat delay after tap | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02B1 | 0689 | Plate preheat setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 02B2 | 0690 | Plate preheat on recognition time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02B3 | 0691 | Plate preheat on hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02B4 | 0692 | Plate preheat off hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02B5 | 0693 | Plate preheat minimum on time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02B6 | 0694 | Tap detect degrees | R/W | U16 | Rate of temperature drop in DHW sensor when tap detection is declared:<br>0°-130° / second (0.1°C precision)[a] |
| 02B7 | 0695 | Tap detect on hysteresis | R/W | U16 | 0°-130° (0.1°C precision)[a] |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 02B8 | 0696 | Tap detect on recognition time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02B9 | 0697 | Tap stop DHW-Inlet degrees | R/W | U16 | Temperature delta between DHW & inlet sensors when tap demand is stopped (drops below this limit):<br>0°-130° (0.1°C precision)[a] |
| 02BA | 0698 | Tap stop Outlet-Inlet degrees | R/W | U16 | Temperature delta between outlet & inlet sensors when tap demand is stopped (drops below this limit):<br>0°-130° (0.1°C precision)[a] |
| 02BB | 0699 | Tap minimum on time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02BC | 0700 | Tap detect on threshold | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02BD | 0701 | Preheat detect on threshold | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02BE | 0702 | Preheat detect off threshold | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02BF | 0703 | RESERVED | | | |
| | | **EXTENDED LEAD LAG CONFIGURATION** | | | |
| 02C0 | 0704 | Lead Lag DHW demand switch | R/W | U16 | 0=DHW loop is disabled<br>1=STAT terminal<br>2=Reserved<br>3=EnviraCOM DHW request |
| 02C1 | 0705 | Lead Lag DHW setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 02C2 | 0706 | Lead Lag DHW priority vs. CH | R/W | U16 | 0=CH > DHW<br>1=DHW > CH |
| 02C3-02C8 | 0707-0712 | RESERVED | | | |
| 02C9 | 0713 | Slave dropout/return compensation | R/W | U16 | 0=No slave compensation<br>1=Replace dropout immediately<br>2=Adjust rate for remaining slaves<br>3=Both replace dropout & adjust rate |
| 02CA | 0714 | Add stage method | R/W | U16 | 0=Do not add stage<br>1=Use error threshold<br>2=Use firing rate threshold<br>3=Use error rate change & threshold<br>4=Use firing rate change & threshold |
| 02CB | 0715 | RESERVED | | | |
| 02CC | 0716 | Add stage detection time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02CD | 0717 | RESERVED | | | |
| 02CE | 0718 | Add stage error threshold | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02CF | 0719 | Add stage rate offset | R/W | U16 | -100-100%[b] (0.1% units) |
| 02D0 | 0720 | Add stage error gain | R/W | U16 | 0-100 |
| 02D1 | 0721 | Add stage rate gain | R/W | U16 | 0-100 |
| 02D2 | 0722 | Add stage inter-stage delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02D3 | 0723 | Drop stage method | R/W | U16 | 0=Do not drop stage<br>1=Use error threshold<br>2=Use firing rate threshold<br>3=Use error rate change & threshold<br>4=Use firing rate change & threshold |
| 02D4 | 0724 | RESERVED | | | |
| 02D5 | 0725 | Drop stage detection time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02D6 | 0726 | RESERVED | | | |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 02D7 | 0727 | Drop stage error threshold | R/W | U16 | 0°-130° (0.1°C precision)[a] |
| 02D8 | 0728 | Drop stage rate offset | R/W | U16 | -100-100%[b] (0.1% units) |
| 02D9 | 0729 | Drop stage error gain | R/W | U16 | 0-100 |
| 02DA | 0730 | Drop stage rate gain | R/W | U16 | 0-100 |
| 02DB | 0731 | Drop stage inter-stage delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02DC | 0732 | RESERVED | | | |
| 02DD | 0733 | Lead rotation time | R/W | U16 | 0-64800 minutes<br>(1080 hours)<br>0xFFFF=Not configured |
| 02DE | 0734 | Force lead rotation time | R/W | U16 | 0-64800 minutes<br>(1080 hours)<br>0xFFFF=Not configured |
| 02DF | 0735 | Lead Lag DHW time of day setpoint | R/W | U16 | -40°-130° (0.1°C precision)[a] |
| 02E0 | 0736 | Boiler off options | R/W | U16 | 0=No boiler off options enabled<br>1=All boilers off when threshold (register 737) reached<br>2=Drop lead boiler on error threshold<br>3=All boilers off AND<br>Drop lead boiler on error threshold |
| 02E1 | 0737 | All boilers off threshold | R/W | U16 | Temperature threshold when all slave boilers are immediately turned off<br>-40°-130° (0.1°C precision)[a] |
| 02E2 | 0738 | Lead Lag pressure setpoint | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E3 | 0739 | Lead Lag pressure TOD setpoint | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E4 | 0740 | Lead Lag pressure on hysteresis | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E5 | 0741 | Lead Lag pressure off hysteresis | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E6 | 0742 | Add stage pressure error threshold | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E7 | 0743 | Drop stage pressure error threshold | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E8 | 0744 | Lead Lag minimum pressure | R/W | U16 | 0-150psi (0.1psi precision) |
| 02E9 | 0745 | Lead Lag 4 mA steam pressure | R/W | U16 | 0-150psi (0.1psi precision) |
| 02EA | 0746 | Lead Lag 20 mA steam pressure | R/W | U16 | 0-150psi (0.1psi precision) |
| 02EB | 0747 | Lead Lag Modbus pressure setpoint | R/W | U16 | 0-150psi (0.1psi precision) |
| 02EC-02EF | 0748-0751 | RESERVED | | | |
| | | **EXTENDED PUMP CONFIGURATION** | | | |
| 02F0 | 0752 | Auxiliary 1 pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 02F1 | 0753 | Auxiliary 1 pump options 1 | R/W | U16 | Bit map:<br>15=Normal pump demand when auxiliary pump Z is set<br>14=Normal pump demand when auxiliary pump Y is set<br>13=Normal pump demand when auxiliary pump X is set<br>12-10=Reserved (always 0)<br>9=Normal pump demand when local Lead Lag pump demand is requested<br>8=Normal pump demand when local Lead Lag service is active<br>7=Reserved<br>6=Normal pump demand when DHW service is active<br>5=Normal pump demand when CH service is active<br>4=Reserved<br>3=Normal pump demand when DHW demand<br>2=Normal pump demand when CH demand<br>1=Normal pump demand when local burner demand<br>0=Local demand inhibited for faults |
| 02F2 | 0754 | Auxiliary 1 pump options 2 | R/W | U16 | Bit map:<br>15=Pump used for Lead Lag<br>14=Pump used for local demand<br>13-9=Reserved (always 0)<br>8=Force pump off when DHW high limit<br>7=Force pump off when DHW anti-condensation<br>6=Force pump off when CH anti-condensation<br>5=Force pump off when DHW priority is active<br>4=Force pump on when DHW frost protection<br>3=Force pump on when CH frost protection<br>2=Force pump on when Lead Lag slave demand<br>1=Force pump on when local burner demand<br>0=Force pump on when Outlet high limit |
| 02F3 | 0755 | Auxiliary 2 pump output | R/W | U16 | 0=None<br>1=Pump A<br>2=Pump B<br>3=Pump C |
| 02F4 | 0756 | Auxiliary 2 pump control | R/W | U16 | 0=Auto<br>1=On |
| 02F5 | 0757 | Auxiliary 2 pump start delay | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02F6 | 0758 | Auxiliary 2 pump overrun time | R/W | U16 | 0-64800 seconds (18 hours)<br>0xFFFF=Not configured |
| 02F7 | 0759 | Auxiliary 2 pump options 1 | R/W | U16 | Bit map:<br>15=Normal pump demand when auxiliary pump Z is set<br>14=Normal pump demand when auxiliary pump Y is set<br>13=Normal pump demand when auxiliary pump X is set<br>12-10=Reserved (always 0)<br>9=Normal pump demand when local Lead Lag pump demand is requested<br>8=Normal pump demand when local Lead Lag service is active<br>7=Reserved<br>6=Normal pump demand when DHW service is active<br>5=Normal pump demand when CH service is active<br>4=Reserved<br>3=Normal pump demand when DHW demand<br>2=Normal pump demand when CH demand<br>1=Normal pump demand when local burner demand<br>0=Local demand inhibited for faults |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 02F8 | 0760 | Auxiliary 2 pump options 2 | R/W | U16 | Bit map:<br>15=Pump used for Lead Lag<br>14=Pump used for local demand<br>13-9=Reserved (always 0)<br>8=Force pump off when DHW high limit<br>7=Force pump off when DHW anti-condensation<br>6=Force pump off when CH anti-condensation<br>5=Force pump off when DHW priority is active<br>4=Force pump on when DHW frost protection<br>3=Force pump on when CH frost protection<br>2=Force pump on when Lead Lag slave demand<br>1=Force pump on when local burner demand<br>0=Force pump on when Outlet high limit |
| 02F9-02FF | 0761-0767 | RESERVED | | | |
| | | **EXTENDED LEAD LAG STATUS** | | | |
| 0300 | 0768 | Lead Lag active service | R | U16 | 0=No active service<br>1=Central Heat or Steam<br>2=DHW<br>3=Mix<br>4=Frost protection<br>5-14=Reserved<br>15=Warm weather shutdown |
| 0301 | 0769 | Slave 1 address | R | U16 | Modbus address of 1st slave found on Lead Lag port<br>(0=indicates NO slave found) |
| 0302 | 0770 | Slave 1 state | R | U16 | Slave 1 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 0303 | 0771 | Slave 1 stage order | R | U16 | Relative order that slave 1 has been added to fire<br>(0=Not been staged) |
| 0304 | 0772 | Slave 1 firing rate | R | U16 | Current firing rate (0-100%) of slave 1 |
| 0305 | 0773 | Slave 2 address | R | U16 | Modbus address of 2nd slave found on Lead Lag port<br>(0=indicates NO slave found) |
| 0306 | 0774 | Slave 2 state | R | U16 | Slave 2 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 0307 | 0775 | Slave 2 stage order | R | U16 | Relative order that slave 2 has been added to fire<br>(0=Not been staged) |
| 0308 | 0776 | Slave 2 firing rate | R | U16 | Current firing rate (0-100%) of slave 2 |
| 0309 | 0777 | Slave 3 address | R | U16 | Modbus address of 3rd slave found on Lead Lag port<br>(0=indicates NO slave found) |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 030A | 0778 | Slave 3 state | R | U16 | Slave 3 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 030B | 0779 | Slave 3 stage order | R | U16 | Relative order that slave 3 has been added to fire<br>(0=Not been staged) |
| 030C | 0780 | Slave 3 firing rate | R | U16 | Current firing rate (0-100%) of slave 3 |
| 030D | 0781 | Slave 4 address | R | U16 | Modbus address of 4th slave found on Lead Lag port<br>(0=indicates NO slave found) |
| 030E | 0782 | Slave 4 state | R | U16 | Slave 4 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 030F | 0783 | Slave 4 stage order | R | U16 | Relative order that slave 4 has been added to fire<br>(0=Not been staged) |
| 0310 | 0784 | Slave 4 firing rate | R | U16 | Current firing rate (0-100%) of slave 4 |
| 0311 | 0785 | Slave 5 address | R | U16 | Modbus address of 5th slave found on Lead Lag port<br>(0=indicates NO slave found) |
| 0312 | 0786 | Slave 5 state | R | U16 | Slave 5 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 0313 | 0787 | Slave 5 stage order | R | U16 | Relative order that slave 5 has been added to fire<br>(0=Not been staged) |
| 0314 | 0788 | Slave 5 firing rate | R | U16 | Current firing rate (0-100%) of slave 5 |
| 0315 | 0789 | Slave 6 address | R | U16 | Modbus address of 6th slave found on Lead Lag port<br>(0=indicates NO slave found) |
| 0316 | 0790 | Slave 6 state | R | U16 | Slave 6 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 0317 | 0791 | Slave 6 stage order | R | U16 | Relative order that slave 6 has been added to fire<br>(0=Not been staged) |
| 0318 | 0792 | Slave 6 firing rate | R | U16 | Current firing rate (0-100%) of slave 6 |
| 0319 | 0793 | Slave 7 address | R | U16 | Modbus address of 7th slave found on Lead Lag port<br>(0=indicates NO slave found) |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 031A | 0794 | Slave 7 state | R | U16 | Slave 7 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 031B | 0795 | Slave 7 stage order | R | U16 | Relative order that slave 7 has been added to fire<br>(0=Not been staged) |
| 031C | 0796 | Slave 7 firing rate | R | U16 | Current firing rate (0-100%) of slave 7 |
| 031D | 0797 | Slave 8 address | R | U16 | Modbus address of 8th slave found on Lead Lag port<br>(0=indicates NO slave found) |
| 031E | 0798 | Slave 8 state | R | U16 | Slave 8 state:<br>0=Slave is unknown<br>1=Available<br>2=Add stage<br>3=Suspend stage<br>4=Firing<br>5=On leave<br>6=Disabled<br>7=Recovering |
| 031F | 0799 | Slave 8 stage order | R | U16 | Relative order that slave 8 has been added to fire<br>(0=Not been staged) |
| 0320 | 0800 | Slave 8 firing rate | R | U16 | Current firing rate (0-100%) of slave 8 |
| 0321 | 0801 | Lead boiler address | R | U16 | Modbus address of the first boiler that will be or was added to service Lead Lag demand (slave must be available or firing). |
| 0322 | 0802 | Master firing rate | R | U16 | Current firing rate of the Lead Lag master (0-100%) |
| 0323 | 0803 | Active Lead Lag pressure setpoint | R | U16 | 0-150psi (0.1psi precision) |
| 0324 | 0804 | Active Lead Lag pressure on hysteresis | R | U16 | 0-150psi (0.1psi precision) |
| 0325 | 0805 | Active Lead Lag pressure off hysteresis | R | U16 | 0-150psi (0.1psi precision) |
| 0326 | 0806 | Active Lead Lag pressure operating point | R | U16 | 0-150psi (0.1psi precision) |
| 0327-035F | 0807-0863 | RESERVED | | | |
| | | **LOCKOUT HISTORY** | | | |
| 0360-0370 | 0864-0880 | Lockout history record 1 | R | | Most recent lockout. see Table 6. |
| 0371-0381 | 0881-0897 | Lockout history record 2 | R | | 2nd newest lockout. see Table 6. |
| 0382-0392 | 0898-0914 | Lockout history record 3 | R | | 3rd newest lockout. see Table 6. |
| 0393-03A3 | 0915-0931 | Lockout history record 4 | R | | 4th newest lockout. see Table 6. |
| 03A4-03B4 | 0932-0948 | Lockout history record 5 | R | | 5th newest lockout. see Table 6. |
| 03B5-03C5 | 0949-0965 | Lockout history record 6 | R | | 6th newest lockout. see Table 6. |
| 03C6-03D6 | 0966-0982 | Lockout history record 7 | R | | 7th newest lockout. see Table 6. |
| 03D7-03E7 | 0983-0999 | Lockout history record 8 | R | | 8th newest lockout. see Table 6. |
| 03E8-03F8 | 1000-1016 | Lockout history record 9 | R | | 9th newest lockout. see Table 6. |
| 03F9-0409 | 1017-1033 | Lockout history record 10 | R | | 10th newest lockout. see Table 6. |
| 040A-041A | 1034-1050 | Lockout history record 11 | R | | 11th newest lockout. see Table 6. |
| 041B-042B | 1051-1067 | Lockout history record 12 | R | | 12th newest lockout. see Table 6. |
| 042C-043C | 1068-1084 | Lockout history record 13 | R | | 13th newest lockout. see Table 6. |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 043D-044D | 1085-1101 | Lockout history record 14 | R | | 14th newest lockout. see Table 6. |
| 044E-045E | 1102-1118 | Lockout history record 15 | R | | Oldest lockout |
| 045F | 1119 | Alarm code | R | U16 | Lockout/alert code causing alarm (see register 2). |
| | | **ALERT LOG** | | | |
| 0460-0465 | 1120-1125 | Alert log record 1 | R | U16 | Most recent alert (see Table 10). |
| 0466-046B | 1126-1131 | Alert log record 2 | R | U16 | 2nd newest alert. |
| 046C-0471 | 1132-1137 | Alert log record 3 | R | U16 | 3rd newest alert. |
| 0472-0477 | 1138-1143 | Alert log record 4 | R | U16 | 4th newest alert. |
| 0478-047D | 1144-1149 | Alert log record 5 | R | U16 | 5th newest alert. |
| 047E-0483 | 1150-1155 | Alert log record 6 | R | U16 | 6th newest alert. |
| 0484-0489 | 1156-1161 | Alert log record 7 | R | U16 | 7th newest alert. |
| 048A-048F | 1162-1167 | Alert log record 8 | R | U16 | 8th newest alert. |
| 0490-0495 | 1168-1173 | Alert log record 9 | R | U16 | 9th newest alert. |
| 0496-049B | 1174-1179 | Alert log record 10 | R | U16 | 10th newest alert. |
| 049C-04A1 | 1180-1185 | Alert log record 11 | R | U16 | 11th newest alert. |
| 04A2-04A7 | 11861191 | Alert log record 12 | R | U16 | 12th newest alert. |
| 04A8-04AD | 1192-1197 | Alert log record 13 | R | U16 | 13th newest alert. |
| 04AE-04B3 | 1198-1203 | Alert log record 14 | R | U16 | 14th newest alert. |
| 04B4-04B9 | 1204-1209 | Alert log record 15 | R | U16 | Oldest alert. |
| 04BA | 1210 | Alert data 1 | R | U16 | Optional data for most recent alert. |
| 04BB | 1211 | Alert data 2 | R | U16 | Optional data for 2nd newest alert. |
| 04BC | 1212 | Alert data 3 | R | U16 | Optional data for 3rd newest alert. |
| 04BD | 1213 | Alert data 4 | R | U16 | Optional data for 4th newest alert. |
| 04BE | 1214 | Alert data 5 | R | U16 | Optional data for 5th newest alert. |
| 04BF | 1215 | Alert data 6 | R | U16 | Optional data for 6th newest alert. |
| 04C0 | 1216 | Alert data 7 | R | U16 | Optional data for 7th newest alert. |
| 04C1 | 1217 | Alert data 8 | R | U16 | Optional data for 8th newest alert. |
| 04C2 | 1218 | Alert data 9 | R | U16 | Optional data for 9th newest alert. |
| 04C3 | 1219 | Alert data 10 | R | U16 | Optional data for 10th newest alert. |
| 04C4 | 1220 | Alert data 11 | R | U16 | Optional data for 11th newest alert. |
| 04C5 | 1221 | Alert data 12 | R | U16 | Optional data for 12th newest alert. |
| 04C6 | 1222 | Alert data 13 | R | U16 | Optional data for 13th newest alert. |
| 04C7 | 1223 | Alert data 14 | R | U16 | Optional data for 14th newest alert. |
| 04C8 | 1224 | Alert data 15 | R | U16 | Optional data for oldest alert. |
| 04C9-04FF | 1225-1279 | RESERVED | | | |
| 0500-0509 | 1280-1289 | Password | W | U16 | **Duplicate of register 177.** Password string (up to 20 characters) requesting ICP permission to write registers. |
| 050A-050F | 1290-1295 | RESERVED | | | |
| 0510-0519 | 1296-1305 | Installer password | W | U16 | **Duplicate of register 190.** To set new installer password (up to 20 characters). Requires register access status (register 177) set to Installer or higher. |
| 051A-051F | 1306-1311 | RESERVED | | | |

**Table 5. SOLA Modbus register map (Continued)**

| | | | | | |
|---|---|---|---|---|---|
| 0520-0529 | 1312-1321 | OEM password | W | U16 | **Duplicate of register 191.** To set new OEM password (up to 20 characters). Requires register access status (register 177) set to OEM or higher. |
| 052A-052F | 1322-1327 | RESERVED | | | |
| 0530-0539 | 1328-1337 | Burner name | R/W | U16 | **Duplicate of register 183.** Text string (up to 20 characters) |
| 053A-053F | 1338-1343 | RESERVED | | | |
| 0540-0549 | 1344-1353 | Installation data | R/W | U16 | **Duplicate of register 184.** Text string (up to 20 characters) |
| 054A-054F | 1354-1359 | RESERVED | | | |
| 0550-0559 | 1360-1369 | OEM ID | R/W | U16 | **Duplicate of register 185.** Text string (up to 20 characters) |
| 055A-0FFF | 1370-4095 | RESERVED | | | |

[a] All temperature registers are expressed in °C regardless what temperature units (register 179) is set to. Temperature range is -40°C to 130°C with values given in 0.1°C units (for example, 32.0°C = 320). See Table 4 when the temperature represents a faulty sensor. A temperature parameter that is NOT applicable in this SOLA, i.e., not enabled, has a value of 0x8FFF. This temperature setting is denoted as “UNCONFIGURED” at the user interface.

[b] All percentage values are given in 0.1% granularity, i.e., 0-1000 is the range for 0.0-100.0%.

[c] Most significant bit in value determines which units type the parameter has: 0=RPM, 1=%. If Modulation Output parameter (register 192) doesn’t match with the setting of this bit, then the parameter setting is invalid.

[d] Pump control changed in SOLA starting with application build 1600 (see register 189). Pump status changed as a result. Table 13 contains the status values for SOLA prior to build 1600, and table 14 for SOLA that are build 1600 or later.

[e] This register is a safety configuration parameter that requires successful access login (see register 177) before the setting can be changed. Changing this parameter also requires a safety verification with the SOLA control afterwards to confirm that it’s new setting is consistent with the other safety parameters.

[f] Commanded rate in least significant byte of this register can be expressed in two formats: binary fraction % or multiple of 0.5% steps. Bit 8 of this register indicates which format the commanded rate is expressed in; when bit 8 is set, the commanded rate is in binary fraction % format and when bit 8 is cleared, the commanded rate is in 0.5% steps.

[g] For binary fraction % format commanded rate is a binary fraction between .00000000 (0%=no heat at all) and .11111111 (99.98% heat=maximum fire). For 0.5% step format commanded rate is a value between 0 (minimum fire) and 200 (maximum fire) that is a multiple of 0.5% (200 x 0.5% = 100%).

[h] When CH modulation rate source is “4-20mA modulation with sensor on/off” the burner is turned on or off by the CH modulation sensor’s temperature with respect to CH setpoint and the on/off hysteresis band. When CH modulation rate source is “4-20mA modulation and burner on/off” the burner is turned on when there is CH demand and is turned off when there is no CH demand (immediate turn on/off).

[i] For Modbus binary fraction mode the CH Modbus rate (register 581) is a binary fraction between .00000000 (0%=no heat at all) and .11111111 (99.98% heat=maximum fire). For Modbus modulation step mode the CH Modbus rate is a 0.5% step format with a value between 0 (minimum fire) and 200 (maximum fire) in multiples of 0.5% (200 x 0.5% = 100%).

Each lockout history record has the format described in Table 6.

**Table 6. SOLA lockout history record**

| Byte Offset | Parameter | Read/ Write | Format | Note |
|---|---|---|---|---|
| 0-1 | Lockout code | R | U16 | See register 34 (decimal) |
| 2-3 | Annunciator first out | R | U16 | See register 36 (decimal) |
| 4-5 | Burner control state | R | U16 | See register 33 (decimal) |
| 6-7 | Sequence time | R | U16 | See register 37 (decimal) |
| 8-11 | Cycle | R | U32 | See registers 128-129 (decimal) |
| 12-15 | Hours | R | U32 | See registers 130-131 (decimal) |
| 16-17 | I/O | R | U16 | See register 2 (decimal) |
| 18-19 | Annunciator | R | U16 | See register 3 (decimal) |
| 20-21 | Outlet temperature | R | U16 | See register 7 (decimal) |
| 22-23 | Inlet temperature/Steam pressure | R | U16 | See register 11 or 20 (decimal). Data type is dependent on Product type (register 176) |
| 24-25 | DHW temperature | R | U16 | See register 12 (decimal) |
| 26-27 | Outdoor temperature | R | U16 | See register 13 (decimal) |
| 28-29 | Stack temperature | R | U16 | See register 14 (decimal) |
| 30-31 | 4-20mA input | R | U16 | See register 15 (decimal) |
| 32-33 | Fault data | R | U8 | Fault dependent data (U8 x 2) |

Each annunciator configuration record has the format described in Table 7.

**Table 7. Annunciator configuration**

| Byte Offset | Parameter | Read/ Write | Format | Note |
|---|---|---|---|---|
| 0-1 | Location | R/W | U16 | 0=Unused, 1=PII, 2=LCI, 3=ILK, 4=Other |
| 2-4 | Annunciator short name | R/W | U8 | |
| 5 | Unused | - | U8 | |
| 6-25 | Annunciator name | R/W | U8 | |

The PII, LCI, and ILK terminals are named with configuration records that have a format described in Table 8.

**Table 8. PII, LCI, ILK terminal configuration**

| Byte Offset | Parameter | Read/ Write | Format | Note |
|---|---|---|---|---|
| 0-2 | Interlock short name | R/W | U8 | |
| 3 | Unused | -- | U8 | |
| 4-23 | Interlock name | R/W | U8 | |

SOLA lockout and hold codes are contained in Table 9.

**Table 9. SOLA lockout/hold codes**

| Code | Description | Note |
|---|---|---|
| 0 | None | No lockout/ hold |
| 1 | Unconfigured safety data | Lockout |
| 2 | Waiting for safety data verification | Lockout |
| 3 | Internal fault: Hardware fault | Hold |
| 4 | Internal fault: Safety Relay key feedback error | Hold |
| 5 | Internal fault: Unstable power (DCDC) output | Hold |
| 6 | Internal fault: Invalid processor clock | Hold |
| 7 | Internal fault: Safety relay drive error | Hold |
| 8 | Internal fault: Zero crossing not detected | Hold |
| 9 | Internal fault: Flame bias out of range | Hold |
| 10 | Internal fault: Invalid Burner control state | Lockout |
| 11 | Internal fault: Invalid Burner control state flag | Lockout |
| 12 | Internal fault: Safety relay drive cap short | Hold |
| 13 | Internal fault: PII shorted to ILK | Hold/ Lockout |
| 14 | Internal fault: HFS shorted to LCI | Hold/ Lockout |
| 15 | Internal fault: Safety relay test failed due to feedback ON | Lockout |

**Table 9. SOLA lockout/hold codes (Continued)**

| | | |
|---|---|---|
| 16 | Internal fault: Safety relay test failed due to safety relay OFF | Lockout |
| 17 | Internal fault: Safety relay test failed due to safety relay not OFF | Lockout |
| 18 | Internal fault: Safety relay test failed due to feedback not ON | Lockout |
| 19 | Internal fault: Safety RAM write | Lockout |
| 20 | Internal fault: Flame ripple and overflow | Hold |
| 21 | Internal fault: Flame number of sample mismatch | Hold |
| 22 | Internal fault: Flame bias out of range | Hold |
| 23 | Internal fault: Bias changed since heating cycle starts | Hold |
| 24 | Internal fault: Spark voltage stuck low or high | Hold |
| 25 | Internal fault: Spark voltage changed too much during flame sensing time | Hold |
| 26 | Internal fault: Static flame ripple | Hold |
| 27 | Internal fault: Flame rod shorted to ground detected | Hold |
| 28 | Internal fault: A/D linearity test fails | Hold |
| 29 | Internal fault: Flame bias cannot be set in range | Hold |
| 30 | Internal fault: Flame bias shorted to adjacent pin | Hold |
| 31 | Internal fault: SLO electronics unknown error | Hold |
| 32 | Internal fault: Safety Key 0 | Lockout |
| 33 | Internal fault: Safety Key 1 | Lockout |
| 34 | Internal fault: Safety Key 2 | Lockout |
| 35 | Internal fault: Safety Key 3 | Lockout |
| 36 | Internal fault: Safety Key 4 | Lockout |
| 37 | Internal fault: Safety Key 5 | Lockout |
| 38 | Internal fault: Safety Key 6 | Lockout |
| 39 | Internal fault: Safety Key 7 | Lockout |
| 40 | Internal fault: Safety Key 8 | Lockout |
| 41 | Internal fault: Safety Key 9 | Lockout |
| 42 | Internal fault: Safety Key 10 | Lockout |
| 43 | Internal fault: Safety Key 11 | Lockout |
| 44 | Internal fault: Safety Key 12 | Lockout |
| 45 | Internal fault: Safety Key 13 | Lockout |
| 46 | Internal fault: Safety Key 14 | Lockout |
| 47 | Flame rod to ground leakage | Hold |
| 48 | Static flame (not flickering) | Hold |
| 49 | 24VAC voltage low/high | Hold |
| 50 | Modulation fault | Hold |
| 51 | Pump fault | Hold |
| 52 | Motor tachometer fault | Hold |
| 53 | AC inputs phase reversed | Lockout |

**Table 9. SOLA lockout/hold codes (Continued)**

| | | |
|---|---|---|
| 54 | Safety GVT model ID doesn't match application's model ID | Lockout |
| 55 | Application configuration data block CRC errors | Lockout |
| 56-57 | RESERVED | |
| 58 | Internal fault: HFS shorted to IAS | Lockout |
| 59 | Internal fault: Mux pin shorted | Lockout |
| 60 | Internal fault: HFS shorted to LFS | Lockout |
| 61 | Anti short cycle | Hold |
| 62 | Fan speed not proved | Hold |
| 63 | LCI OFF | Hold |
| 64 | PII OFF | Hold/ Lockout |
| 65 | Interrupted Airflow Switch OFF | Hold/ Lockout |
| 66 | Interrupted Airflow Switch ON | Hold/ Lockout |
| 67 | ILK OFF | Hold/ Lockout |
| 68 | ILK ON | Hold/ Lockout |
| 69 | Pilot test hold | Hold |
| 70 | Wait for leakage test completion | Hold |
| 71 | Input power frequency mismatch | Lockout |
| 72-77 | RESERVED | |
| 78 | Demand lost in run | Hold |
| 79 | Outlet high limit | Hold/ Lockout |
| 80 | DHW high limit | Hold/ Lockout |
| 81 | Delta T inlet/outlet limit | Hold/ Lockout |
| 82 | Stack limit | Hold/ Lockout |
| 83 | Delta T exchanger/outlet limit | Hold/ Lockout |
| 84 | Delta T inlet/exchanger limit | Hold/ Lockout |
| 85 | Inlet/outlet inversion limit | Hold/ Lockout |
| 86 | Exchanger/outlet inversion limit | Hold/ Lockout |
| 87 | Inlet/exchanger inversion limit | Hold/ Lockout |
| 88 | Outlet T-rise limit | Hold/ Lockout |
| 89 | Exchanger T-rise limit | Hold/ Lockout |
| 90 | Heat exchanger high limit | Hold/ Lockout |
| 91 | Inlet sensor fault | Hold |
| 92 | Outlet sensor fault | Hold |

**Table 9. SOLA lockout/hold codes (Continued)**

| | | |
|---|---|---|
| 93 | DHW sensor fault | Hold |
| 94 | S2 (J8-6) sensor fault | Hold |
| 95 | Stack sensor fault | Hold |
| 96 | S5 (J8-11) sensor fault | Hold |
| 97 | Internal fault: A2D mismatch | Lockout |
| 98 | Internal fault: Exceeded VSNSR voltage tolerance | Lockout |
| 99 | Internal fault: Exceeded 28V voltage tolerance | Lockout |
| 100 | Pressure sensor fault | Hold |
| 101-104 | RESERVED | |
| 105 | Flame detected out of sequence | Hold/ Lockout |
| 106 | Flame lost in MFEP | Lockout |
| 107 | Flame lost early in run | Lockout |
| 108 | Flame lost in run | Lockout |
| 109 | Ignition failed | Lockout |
| 110 | Ignition failure occurred | Hold |
| 111 | Flame current lower than WEAK threshold | Hold |
| 112 | Pilot test flame timeout | Lockout |
| 113 | Flame circuit timeout | Lockout |
| 114-121 | RESERVED | |
| 122 | Lightoff rate proving failed | Lockout |
| 123 | Purge rate proving failed | Lockout |
| 124 | High fire switch OFF | Hold |
| 125 | High fire switch stuck ON | Hold |
| 126 | Low fire switch OFF | Hold |
| 127 | Low fire switch stuck ON | Hold |
| 128 | Fan speed failed during prepurge | Hold/ Lockout |
| 129 | Fan speed failed during preignition | Hold/ Lockout |
| 130 | Fan speed failed during ignition | Hold/ Lockout |
| 131 | Fan movement detected during standby | Hold |
| 132 | Fan speed failed during run | Hold |
| 133-135 | RESERVED | |
| 136 | Interrupted Airflow Switch failed to close | Hold |
| 137 | ILK failed to close | Hold |
| 138-142 | RESERVED | |
| 143 | Internal fault: Flame bias out of range 1 | Lockout |
| 144 | Internal fault: Flame bias out of range 2 | Lockout |
| 145 | Internal fault: Flame bias out of range 3 | Lockout |
| 146 | Internal fault: Flame bias out of range 4 | Lockout |
| 147 | Internal fault: Flame bias out of range 5 | Lockout |
| 148 | Internal fault: Flame bias out of range 6 | Lockout |
| 149 | Flame detected | Hold/ Lockout |

**Table 9. SOLA lockout/hold codes (Continued)**

| | | |
|---|---|---|
| 150 | Flame not detected | Hold |
| 151 | High fire switch ON | Hold/ Lockout |
| 152 | Combustion pressure ON | Hold/ Lockout |
| 153 | Combustion pressure OFF | Hold/ Lockout |
| 154 | Purge fan switch ON | Hold/ Lockout |
| 155 | Purge fan switch OFF | Hold/ Lockout |
| 156 | Combustion pressure and Flame ON | Hold/ Lockout |
| 157 | Combustion pressure and Flame OFF | Lockout |
| 158 | Main valve ON | Lockout |
| 159 | Main valve OFF | Lockout |
| 160 | Ignition ON | Lockout |
| 161 | Ignition OFF | Lockout |
| 162 | Pilot valve ON | Lockout |
| 163 | Pilot valve OFF | Lockout |
| 164 | Block intake ON | Lockout |
| 165 | Block intake OFF | Lockout |
| 166-171 | RESERVED | |
| 172 | Main relay feedback incorrect | Lockout |
| 173 | Pilot relay feedback incorrect | Lockout |
| 174 | Safety relay feedback incorrect | Lockout |
| 175 | Safety relay open | Lockout |
| 176 | Main relay ON at safe start check | Lockout |
| 177 | Pilot relay ON at safe start check | Lockout |
| 178 | Safety relay ON at safe start check | Lockout |
| 179-183 | RESERVED | |
| 184 | Invalid BLOWER/HSI output setting | Lockout |
| 185 | Invalid Delta T limit enable setting | Lockout |
| 186 | Invalid Delta T limit response setting | Lockout |
| 187 | Invalid DHW high limit enable setting | Lockout |
| 188 | Invalid DHW high limit response setting | Lockout |
| 189 | Invalid Flame sensor type setting | Lockout |
| 190 | Invalid interrupted air switch enable setting | Lockout |
| 191 | Invalid interrupted air switch start check enable setting | Lockout |
| 192 | Invalid Igniter on during setting | Lockout |
| 193 | Invalid Ignite failure delay setting | Lockout |
| 194 | Invalid Ignite failure response setting | Lockout |
| 195 | Invalid Ignite failure retries setting | Lockout |
| 196 | Invalid Ignition source setting | Lockout |
| 197 | Invalid Interlock open response setting | Lockout |
| 198 | Invalid Interlock start check setting | Lockout |
| 199 | Invalid LCI enable setting | Lockout |

**Table 9. SOLA lockout/hold codes (Continued)**

| | | |
|---|---|---|
| 200 | Invalid lightoff rate setting | Lockout |
| 201 | Invalid Lightoff rate proving setting | Lockout |
| 202 | Invalid Main Flame Establishing Period time setting | Lockout |
| 203 | Invalid MFEP flame failure response setting | Lockout |
| 204 | Invalid NTC sensor type setting | Lockout |
| 205 | Invalid Outlet high limit response setting | Lockout |
| 206 | Invalid Pilot Flame Establishing Period setting | Lockout |
| 207 | Invalid PII enable setting | Lockout |
| 208 | Invalid pilot test hold setting | Lockout |
| 209 | Invalid Pilot type setting | Lockout |
| 210 | Invalid Postpurge time setting | Lockout |
| 211 | Invalid Power up with lockout setting | Lockout |
| 212 | Invalid Preignition time setting | Lockout |
| 213 | Invalid Prepurge rate setting | Lockout |
| 214 | Invalid Prepurge time setting | Lockout |
| 215 | Invalid Purge rate proving setting | Lockout |
| 216 | Invalid Run flame failure response setting | Lockout |
| 217 | Invalid Run stabilization time setting | Lockout |
| 218 | Invalid Stack limit enable setting | Lockout |
| 219 | Invalid Stack limit response setting | Lockout |
| 220 | Unconfigured Delta T limit setpoint setting | Lockout |
| 221 | Unconfigured DHW high limit setpoint setting | Lockout |
| 222 | Unconfigured Outlet high limit setpoint setting | Lockout |
| 223 | Unconfigured Stack limit setpoint setting | Lockout |
| 224 | Invalid DHW demand source setting | Lockout |
| 225 | Invalid Flame threshold setting | Lockout |
| 226 | Invalid Outlet high limit setpoint setting | Lockout |
| 227 | Invalid DHW high limit setpoint setting | Lockout |
| 228 | Invalid Stack limit setpoint setting | Lockout |
| 229 | Invalid Modulation output setting | Lockout |
| 230 | Invalid CH demand source setting | Lockout |
| 231 | Invalid Delta T limit delay setting | Lockout |
| 232 | Invalid Pressure sensor type setting | Lockout |
| 233 | Invalid IAS closed response setting | Lockout |
| 234 | Invalid Outlet high limit enable setting | Lockout |
| 235 | Invalid Outlet connector type setting | Lockout |
| 236 | Invalid Inlet connector type setting | Lockout |
| 237 | Invalid DHW connector type setting | Lockout |
| 238 | Invalid Stack connector type setting | Lockout |
| 239 | Invalid S2 (J8-6) connector type setting | Lockout |
| 240 | Invalid S5 (J8-11) connector type setting | Lockout |
| 241 | Exchanger sensor not allowed with stack connector setting | Lockout |

**Table 9. SOLA lockout/hold codes (Continued)**

| | | |
|---|---|---|
| 242 | Invalid DHW auto detect configuration | Lockout |
| 243 | Invalid UV with spark interference not compatible with Ignitor on throughout PFEP | Lockout |
| 244 | Internal fault: Safety relay test invalid state | Lockout |
| 245 | Invalid Outlet connector type setting for T-rise | Lockout |
| 246 | 4-20mA cannot be used for both modulation and setpoint control | Lockout |
| 247 | Invalid ILK bounce detection enable | Lockout |
| 248 | Invalid forced recycle interval | Lockout |
| 249 | STAT cannot be demand source when Remote Stat is enabled | Lockout |
| 250 | Invalid Fan speed error response | Lockout |
| 251 | Lead drop-stage on error setting does not match drop method configuration | Lockout |
| 252 | Invalid Line frequency setting | Lockout |
| 253-255 | RESERVED | |

Each alert log record has the format described in Table 10.

**Table 10. SOLA alert log record**

| Byte Offset | Parameter | Read/ Write | Format | Note |
|---|---|---|---|---|
| 0-1 | Alert code | R | U16 | see Table 11. |
| 2-5 | Cycle | R | U32 | See registers 128-129 (decimal). |
| 6-9 | Hours | R | U32 | See registers 130-131 (decimal). |
| 10 | - | R | U8 | Unused |
| 11 | Occurrence count | R | U8 | Number of occurrences of most recent alert. |

SOLA alert codes are contained in Table 11.

**Table 11. SOLA alert codes**

| Code | Description |
|---|---|
| 0 | None (No alert) |
| 1 | Alert PCB was restored from factory defaults |
| 2 | Safety configuration parameters were restored from factory defaults |
| 3 | Configuration parameters were restored from factory defaults |
| 4 | Invalid Factory Invisibility PCB was detected |
| 5 | Invalid Factory Range PCB was detected |
| 6 | Invalid range PCB record has been dropped |
| 7 | EEPROM lockout history was initialized |
| 8 | Switched application annunciation data blocks |
| 9 | Switched application configuration data blocks |
| 10 | Configuration was restored from factory defaults |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 11 | Backup configuration settings was restored from active configuration |
| 12 | Annunciation configuration was restored from factory defaults |
| 13 | Annunciation configuration was restored from backup |
| 14 | Safety group verification table was restored from factory defaults |
| 15 | Safety group verification table was updated |
| 16 | Invalid Parameter PCB was detected |
| 17 | Invalid Range PCB was detected |
| 18 | Alarm silence time exceeded maximum |
| 19 | Invalid safety group verification table was detected |
| 20 | Backdoor password could not be determined |
| 21 | Invalid safety group verification table was not accepted |
| 22 | CRC errors were found in application configuration data blocks |
| 23 | Backup Alert PCB was restored from active one |
| 24 | RESERVED |
| 25 | Lead Lag operation switch was turned OFF |
| 26 | Lead Lag operation switch was turned ON |
| 27 | Safety processor was reset |
| 28 | Application processor was reset |
| 29 | Burner switch was turned OFF |
| 30 | Burner switch was turned ON |
| 31 | Program Module (PM) was inserted into socket |
| 32 | Program Module (PM) was removed from socket |
| 33 | Alert PCB was configured |
| 34 | Parameter PCB was configured |
| 35 | Range PCB was configured |
| 36 | Program Module (PM) incompatible with product was inserted into socket |
| 37 | Program Module application parameter revision differs from application processor |
| 38 | Program Module safety parameter revision differs from safety processor |
| 39 | PCB incompatible with product contained in Program Module |
| 40 | Parameter PCB in Program Module is too large for product |
| 41 | Range PCB in Program Module was too large for product |
| 42 | Alert PCB in Program Module was too large for product |
| 43 | IAS start check was forced on due to IAS enabled |
| 44 | Low voltage was detected in safety processor |
| 45 | High line frequency occurred |
| 46 | Low line frequency occurred |
| 47 | Invalid subsystem reset request occurred |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 48 | Write large enumerated Modbus register value was not allowed |
| 49 | Maximum cycle count was reached |
| 50 | Maximum hours count was reached |
| 51 | Illegal Modbus write was attempted |
| 52 | Modbus write attempt was rejected (NOT ALLOWED) |
| 53 | Illegal Modbus read was attempted |
| 54 | Safety processor brown-out reset occurred |
| 55 | Application processor watchdog reset occurred |
| 56 | Application processor brown-out reset occurred |
| 57 | Safety processor watchdog reset occurred |
| 58 | Alarm was reset by the user at the control |
| 59 | Burner control firing rate was > absolute max rate |
| 60 | Burner control firing rate was < absolute min rate |
| 61 | Burner control firing rate was invalid, % vs. RPM |
| 62 | Burner control was firing with no fan request |
| 63 | Burner control rate (nonfiring) was > absolute max rate |
| 64 | Burner control rate (nonfiring) was < absolute min rate |
| 65 | Burner control rate (nonfiring) was absent |
| 66 | Burner control rate (nonfiring) was invalid, % vs. RPM |
| 67 | Fan off cycle rate was invalid, % vs. RPM |
| 68 | Setpoint was overridden due to sensor fault |
| 69 | Modulation was overridden due to sensor fault |
| 70 | No demand source was set due to demand priority conflicts |
| 71 | CH 4-20mA signal was invalid |
| 72-73 | RESERVED |
| 74 | Periodic Forced Recycle |
| 75 | Absolute max fan speed was out of range |
| 76 | Absolute min fan speed was out of range |
| 77 | Fan gain down was invalid |
| 78 | Fan gain up was invalid |
| 79 | Fan minimum duty cycle was invalid |
| 80 | Fan pulses per revolution was invalid |
| 81 | Fan PWM frequency was invalid |
| 82-83 | RESERVED |
| 84 | Lead Lag CH 4-20mA water temperature setting was invalid |
| 85 | No Lead Lag add stage error threshold was configured |
| 86 | No Lead Lag add stage detection time was configured |
| 87 | No Lead Lag drop stage error threshold was configured |
| 88 | No Lead Lag drop stage detection time was configured |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 89 | Lead Lag all boiler off threshold was invalid |
| 90 | Modulation output type was invalid |
| 91 | Firing rate control parameter was invalid |
| 92 | Forced rate was out of range vs. min/max modulation |
| 93 | Forced rate was invalid, % vs. RPM |
| 94 | Slow start ramp value was invalid |
| 95 | Slow start degrees value was invalid |
| 96 | Slow start was ended due to outlet sensor fault |
| 97 | Slow start was end due to reference setpoint fault |
| 98 | CH max modulation rate was invalid, % vs. RPM |
| 99 | CH max modulation rate was > absolute max rate |
| 100 | CH modulation range (max minus min) was too small (< 4% or 40 RPM) |
| 101 | DHW max modulation rate was invalid, % vs. RPM |
| 102 | DHW max modulation rate was > absolute max rate |
| 103 | DHW modulation range (max minus min) was too small (< 4% or 40 RPM) |
| 104 | Min modulation rate was < absolute min rate |
| 105 | Min modulation rate was invalid, % vs. RPM |
| 106 | Manual rate was invalid, % vs. RPM |
| 107 | Slow start enabled, but forced rate was invalid |
| 108 | Analog output hysteresis was invalid |
| 109 | Analog modulation output type was invalid |
| 110 | IAS open rate differential was invalid |
| 111 | IAS open step rate was invalid |
| 112 | Mix max modulation rate was invalid, % vs. RPM |
| 113 | Mix max modulation rate was > absolute max or < absolute min rates |
| 114 | Mix modulation range (max minus min) was too small (< 4% or 40 RPM) |
| 115 | Fan was limited to its minimum duty cycle |
| 116 | Manual rate was > CH max modulation rate |
| 117 | Manual rate was > DHW max modulation rate |
| 118 | Manual rate was < min modulation rate |
| 119 | Manual rate in Standby was > absolute max rate |
| 120 | Modulation commanded rate was > CH max modulation rate |
| 121 | Modulation commanded rate was > DHW max modulation rate |
| 122 | Modulation commanded rate was < min modulation rate |
| 123 | Modulation rate was limited due to Outlet limit |
| 124 | Modulation rate was limited due to Delta-T limit |
| 125 | Modulation rate was limited due to Stack limit |
| 126 | Modulation rate was limited due to anticondensation |
| 127 | Fan speed out of range in RUN |
| 128 | Modulation rate was limited due to IAS was open |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 129 | Slow start ramp setting of zero will result in no modulation rate change |
| 130 | No forced rate was configured for slow start ramp |
| 131 | CH demand source was invalid |
| 132 | CH P-gain was invalid |
| 133 | CH I-gain was invalid |
| 134 | CH D-gain was invalid |
| 135 | CH OFF hysteresis was invalid |
| 136 | CH ON hysteresis was invalid |
| 137 | CH sensor type was invalid |
| 138 | CH hysteresis step time was invalid |
| 139 | CH remote control parameter was invalid |
| 140 | CH ODR not allowed with remote control |
| 141 | Steam P-gain was invalid |
| 142 | Steam I-gain was invalid |
| 143 | Steam D-gain was invalid |
| 144 | Steam OFF hysteresis was invalid |
| 145 | Steam ON hysteresis was invalid |
| 146 | CH control was suspended due to fault |
| 147 | CH header temperature was invalid |
| 148 | CH Outlet temperature was invalid |
| 149 | CH steam pressure was invalid |
| 150 | Steam setpoint source parameter was invalid |
| 151 | Minimum water temperature parameter was greater than setpoint |
| 152 | Minimum water temperature parameter was greater than time of day setpoint |
| 153 | Minimum pressure parameter was greater than setpoint |
| 154 | Minimum pressure parameter was greater than time of day setpoint |
| 155 | CH modulation rate source parameter was invalid |
| 156 | Steam modulation rate source parameter was invalid |
| 157 | DHW demand source was invalid |
| 158 | DHW P-gain was invalid |
| 159 | DHW I-gain was invalid |
| 160 | DHW D-gain was invalid |
| 161 | DHW OFF hysteresis was invalid |
| 162 | DHW ON hysteresis was invalid |
| 163 | DHW hysteresis step time was invalid |
| 164 | DHW sensor type was invalid |
| 165 | Inlet sensor type was invalid for DHW |
| 166 | Outlet sensor type was invalid for DHW |
| 167 | DHW storage OFF hysteresis was invalid |
| 168 | DHW storage ON hysteresis was invalid |
| 169 | DHW modulation sensor type was invalid |
| 170 | DHW modulation sensor was not compatible for Auto mode |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 171 | DHW control was suspended due to fault |
| 172 | DHW temperature was invalid |
| 173 | DHW inlet temperature was invalid |
| 174 | DHW outlet temperature was invalid |
| 175 | DHW high limit must be disabled for Auto mode |
| 176 | DHW sensor type was not compatible for Auto mode |
| 177 | DHW priority source setting was invalid |
| 178 | DHW priority method setting was invalid |
| 179 | CH S5 (J8-11) sensor was invalid |
| 180 | CH Inlet temperature was invalid |
| 181 | CH S10 (J10-7) sensor was invalid |
| 182 | Lead Lag CH setpoint source was invalid |
| 183 | Lead Lag P-gain was invalid |
| 184 | Lead Lag I-gain was invalid |
| 185 | Lead Lag D-gain was invalid |
| 186 | Lead Lag OFF hysteresis was invalid |
| 187 | Lead Lag ON hysteresis was invalid |
| 188 | Lead Lag slave enable was invalid |
| 189 | Lead Lag hysteresis step time was invalid |
| 190 | No Lead Lag Modbus port was assigned |
| 191 | Lead Lag base load common setting was invalid |
| 192 | Lead Lag DHW demand switch setting was invalid |
| 193 | Lead Lag Mix demand switch setting was invalid |
| 194 | Lead Lag modulation sensor setting was invalid |
| 195 | Lead Lag backup modulation sensor setting was invalid |
| 196 | Lead Lag slave mode setting was invalid |
| 197 | Lead Lag rate allocation setting was invalid |
| 198 | Lead selection setting was invalid |
| 199 | Lag selection setting was invalid |
| 200 | Lead Lag slave return setting was invalid |
| 201 | Lead Lag add stage method setting was invalid |
| 202 | STAT may not be a Lead Lag CH demand source when Remote Stat is enabled |
| 203 | Lead Lag base load rate setting was invalid |
| 204 | Lead Lag master was suspended due to fault |
| 205 | Lead Lag slave was suspended due to fault |
| 206 | Lead Lag header temperature was invalid |
| 207 | Lead Lag was suspended due to no enabled Program Module installed |
| 208 | Lead Lag slave session has timed out |
| 209 | Too many Lead Lag slaves were detected |
| 210 | Lead Lag slave was discovered |
| 211 | Incompatible Lead Lag slave was discovered |
| 212 | No base load rate was set for Lead Lag slave |
| 213 | Lead Lag slave unable to fire before demand to fire delay expired |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 214 | Adding Lead Lag slave aborted due to add requirement change |
| 215 | No Lead Lag slaves available to service demand |
| 216 | No Lead Lag active service was set due to demand priority conflicts |
| 217 | No Lead Lag add stage method was specified |
| 218 | No Lead Lag drop stage method was specified |
| 219 | Using backup Lead Lag header sensor due to sensor failure |
| 220 | Lead Lag frost protection rate was invalid |
| 221 | Lead Lag drop stage method setting was invalid |
| 222 | CH frost protection temperature was invalid |
| 223 | CH frost protection inlet temperature was invalid |
| 224 | DHW frost protection temperature was invalid |
| 225-226 | RESERVED |
| 227 | DHW priority override time was not derated due to invalid outdoor temperature |
| 228 | Warm weather shutdown was not checked due to invalid outdoor temperature |
| 229 | Lead Lag slave communication timeout |
| 230 | RESERVED |
| 231 | Lead Lag CH setpoint was invalid |
| 232 | Lead Lag CH time of day setpoint was invalid |
| 233 | Lead Lag outdoor temperature was invalid |
| 234 | Lead Lag ODR time of day setpoint was invalid |
| 235 | Lead Lag ODR time of day setpoint exceeded normal setpoint |
| 236 | Lead Lag ODR max outdoor temperature was invalid |
| 237 | Lead Lag ODR min outdoor temperature was invalid |
| 238 | Lead Lag ODR low water temperature was invalid |
| 239 | Lead Lag ODR outdoor temperature range was too small (minimum 12 C / 22 F) |
| 240 | Lead Lag ODR water temperature range was too small (minimum 12 C / 22 F) |
| 241 | Lead Lag DHW setpoint was invalid |
| 242 | Lead Lag Mix setpoint was invalid |
| 243 | Lead Lag CH demand switch was invalid |
| 244 | Lead Lag ODR min water temperature was invalid |
| 245 | RESERVED |
| 246 | CH setpoint was invalid |
| 247 | CH time of day setpoint was invalid |
| 248 | CH outdoor temperature was invalid |
| 249 | CH ODR time of day setpoint was invalid |
| 250 | CH ODR time of day setpoint exceeds normal setpoint |
| 251 | CH max outdoor setpoint was invalid |
| 252 | CH min outdoor setpoint was invalid |
| 253 | CH ODR low water temperature was invalid |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 254 | CH ODR outdoor temperature range was too small |
| 255 | CH ODR water temperature range was too small |
| 256 | Steam setpoint was invalid |
| 257 | Steam time of day setpoint was invalid |
| 258 | Steam minimum pressure was invalid |
| 259 | CH ODR min water temperature was invalid |
| 260 | RESERVED |
| 261 | DHW setpoint was invalid |
| 262 | DHW time of day setpoint was invalid |
| 263 | DHW storage setpoint was invalid |
| 264 | STAT may not be a DHW demand source when Remote Stat is enabled |
| 265-266 | RESERVED |
| 267 | STAT may not be a CH demand source when Remote Stat is enabled |
| 268 | CH 4mA water temperature setting was invalid |
| 269 | CH 20mA water temperature setting was invalid |
| 270 | Steam 4mA water temperature setting was invalid |
| 271 | Steam 20mA water temperature setting was invalid |
| 272 | Abnormal Recycle: Pressure sensor fault |
| 273 | Abnormal Recycle: Safety relay drive test failed |
| 274 | Abnormal Recycle: Demand off during Pilot Flame Establishing Period |
| 275 | Abnormal Recycle: LCI off during Drive to Purge Rate |
| 276 | Abnormal Recycle: LCI off during Measured Purge Time |
| 277 | Abnormal Recycle: LCI off during Drive to Lightoff Rate |
| 278 | Abnormal Recycle: LCI off during Pre-Ignition test |
| 279 | Abnormal Recycle: LCI off during Pre-Ignition time |
| 280 | Abnormal Recycle: LCI off during Main Flame Establishing Period |
| 281 | Abnormal Recycle: LCI off during Ignition period |
| 282 | Abnormal Recycle: Demand off during Drive to Purge Rate |
| 283 | Abnormal Recycle: Demand off during Measured Purge Time |
| 284 | Abnormal Recycle: Demand off during Drive to Lightoff Rate |
| 285 | Abnormal Recycle: Demand off during Pre-Ignition test |
| 286 | Abnormal Recycle: Demand off during Pre-Ignition time |
| 287 | Abnormal Recycle: Flame was on during Safe Start check |
| 288 | Abnormal Recycle: Flame was on during Drive to Purge Rate |
| 289 | Abnormal Recycle: Flame was on during Measured Purge Time |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 290 | Abnormal Recycle: Flame was on during Drive to Lightoff Rate |
| 291 | Abnormal Recycle: Flame was not on at end of Ignition period |
| 292 | Abnormal Recycle: Flame was lost during Main Flame Establishing Period |
| 293 | Abnormal Recycle: Flame was lost early in Run |
| 294 | Abnormal Recycle: Flame was lost during Run |
| 295 | Abnormal Recycle: Leakage test failed |
| 296 | Abnormal Recycle: Interrupted air flow switch was off during Drive to Purge Rate |
| 297 | Abnormal Recycle: Interrupted air flow switch was off during Measured Purge Time |
| 298 | Abnormal Recycle: Interrupted air flow switch was off during Drive to Lightoff Rate |
| 299 | Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition test |
| 300 | Abnormal Recycle: Interrupted air flow switch was off during Pre-Ignition time |
| 301 | Abnormal Recycle: Interrupted air flow switch was off during Main Flame Establishing Period |
| 302 | Abnormal Recycle: Ignition failed due to interrupted air flow switch was off |
| 303 | Abnormal Recycle: ILK off during Drive to Purge Rate |
| 304 | Abnormal Recycle: ILK off during Measured Purge Time |
| 305 | Abnormal Recycle: ILK off during Drive to Lightoff Rate |
| 306 | Abnormal Recycle: ILK off during Pre-Ignition test |
| 307 | Abnormal Recycle: ILK off during Pre-Ignition time |
| 308 | Abnormal Recycle: ILK off during Main Flame Establishing Period |
| 309 | Abnormal Recycle: ILK off during Ignition period |
| 310 | Run was terminated due to ILK was off |
| 311 | Run was terminated due to interrupted air flow switch was off |
| 312 | Stuck reset switch |
| 313 | Run was terminated due to fan failure |
| 314 | Abnormal Recycle: Fan failed during Drive to Purge Rate |
| 315 | Abnormal Recycle: Fan failed during Measured Purge Time |
| 316 | Abnormal Recycle: Fan failed during Drive to Lightoff Rate |
| 317 | Abnormal Recycle: Fan failed during Pre-Ignition test |
| 318 | Abnormal Recycle: Fan failed during Pre-Ignition time |
| 319 | Abnormal Recycle: Fan failed during Ignition period |
| 320 | Abnormal Recycle: Fan failed during Main Flame Establishing Period |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 321 | Abnormal Recycle: Main Valve off after 10 seconds of RUN |
| 322 | Abnormal Recycle: Pilot Valve off after 10 seconds of RUN |
| 323 | Abnormal Recycle: Safety Relay off after 10 seconds of RUN |
| 324 | Abnormal Recycle: Hardware flame bias |
| 325 | Abnormal Recycle: Hardware static flame |
| 326 | Abnormal Recycle: Hardware flame current invalid |
| 327 | Abnormal Recycle: Hardware flame rod short |
| 328 | Abnormal Recycle: Hardware invalid power |
| 329 | Abnormal Recycle: Hardware invalid AC line |
| 330 | Abnormal Recycle: Hardware SLO flame ripple |
| 331 | Abnormal Recycle: Hardware SLO flame sample |
| 332 | Abnormal Recycle: Hardware SLO flame bias range |
| 333 | Abnormal Recycle: Hardware SLO flame bias heat |
| 334 | Abnormal Recycle: Hardware SLO spark stuck |
| 335 | Abnormal Recycle: Hardware SLO spark changed |
| 336 | Abnormal Recycle: Hardware SLO static flame |
| 337 | Abnormal Recycle: Hardware SLO rod shorted |
| 338 | Abnormal Recycle: Hardware SLO AD linearity |
| 339 | Abnormal Recycle: Hardware SLO bias not set |
| 340 | Abnormal Recycle: Hardware SLO bias shorted |
| 341 | Abnormal Recycle: Hardware SLO electronics |
| 342 | Abnormal Recycle: Hardware processor clock |
| 343 | Abnormal Recycle: Hardware AC phase |
| 344 | Abnormal Recycle: Hardware A2D mismatch |
| 345 | Abnormal Recycle: Hardware VSNSR A2D |
| 346 | Abnormal Recycle: Hardware 28V A2D |
| 347 | Abnormal Recycle: Hardware HFS IAS shorted |
| 348 | Abnormal Recycle: Hardware PII INTLK shorted |
| 349 | Abnormal Recycle: Hardware HFS LCI shorted |
| 350 | Abnormal Recycle: Hardware HFS LFS shorted |
| 351 | Abnormal Recycle: Invalid zero crossing |
| 352 | Abnormal Recycle: fault stack sensor |
| 353 | Abnormal Recycle: stack limit |
| 354 | Abnormal Recycle: delta T limit |
| 355 | Abnormal Recycle: fault outlet sensor |
| 356 | Abnormal Recycle: outlet high limit |
| 357 | Abnormal Recycle: fault DHW sensor |
| 358 | Abnormal Recycle: DHW high limit |
| 359 | Abnormal Recycle: fault inlet sensor |
| 360 | Abnormal Recycle: Check Parameters Failed |
| 361 | Internal error: No factory parameters were detected in control |
| 362 | Internal error: PID iteration frequency was invalid |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 363 | Internal error: Demand-Rate interval time was invalid |
| 364 | Internal error: Factory calibration parameter for modulation was invalid |
| 365 | Internal error: CH PID P-scaler was invalid |
| 366 | Internal error: CH PID I-scaler was invalid |
| 367 | Internal error: CH PID D-scaler was invalid |
| 368 | Internal error: DHW PID P-scaler was invalid |
| 369 | Internal error: DHW PID I-scaler was invalid |
| 370 | Internal error: DHW PID D-scaler was invalid |
| 371 | Internal error: Lead Lag master PID P-scaler was invalid |
| 372 | Internal error: Lead Lag master PID I-scaler was invalid |
| 373 | Internal error: Lead Lag master PID D-scaler was invalid |
| 374 | Abnormal Recycle: Hardware flame bias high |
| 375 | Abnormal Recycle: Hardware flame bias low |
| 376 | Abnormal Recycle: Hardware flame bias delta high |
| 377 | Abnormal Recycle: Hardware flame bias delta low |
| 378 | Abnormal Recycle: Hardware flame bias dynamic high |
| 379 | Abnormal Recycle: Hardware flame bias dynamic low |
| 380 | Abnormal Recycle: Fan Speed Not Proven |
| 381 | Abnormal Recycle: Fan Speed Range Low |
| 382 | Abnormal Recycle: Fan Speed Range High |
| 383-388 | RESERVED |
| 389 | Abnormal Recycle: AC power frequency Mismatch |
| 390-450 | RESERVED |
| 451 | Circulator control was invalid |
| 452 | Circulator P-gain was invalid |
| 453 | Circulator I-gain was invalid |
| 454 | Circulator temperature was invalid |
| 455 | Circulator outlet temperature was invalid |
| 456 | Circulator inlet temperature was invalid |
| 457 | Circulator outdoor temperature was invalid |
| 458 | Circulator sensor choice was invalid |
| 459 | Circulator PID setpoint was invalid |
| 460 | LCI lost in run |
| 461 | Abnormal Recycle: Demand lost in run from application |
| 462 | Abnormal Recycle: Demand lost in run due to high limit |
| 463 | Abnormal Recycle: Demand lost in run due to no flame |
| 464 | LCI lost in Combustion Pressure Establishing Period |
| 465 | LCI lost in Combustion Pressure Stabilization Period |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 466 | RESERVED |
| 467 | Internal error: EEPROM write was attempted before EEPROM was initialized |
| 468 | Internal error: EEPROM cycle count address was invalid |
| 469 | Internal error: EEPROM days count address was invalid |
| 470 | Internal error: EEPROM hours count address was invalid |
| 471 | Internal error: Lockout record EEPROM index was invalid |
| 472 | Internal error: Request to write PM status was invalid |
| 473 | Internal error: PM parameter address was invalid |
| 474 | Internal error: PM safety parameter address was invalid |
| 475 | Internal error: Invalid record in lockout history was removed |
| 476 | Internal error: EEPROM write buffer was full |
| 477 | Internal error: Data too large was not written to EEPROM |
| 478 | Internal error: Safety key bit 0 was incorrect |
| 479 | Internal error: Safety key bit 1 was incorrect |
| 480 | Internal error: Safety key bit 2 was incorrect |
| 481 | Internal error: Safety key bit 3 was incorrect |
| 482 | Internal error: Safety key bit 4 was incorrect |
| 483 | Internal error: Safety key bit 5 was incorrect |
| 484 | Internal error: Safety key bit 6 was incorrect |
| 485 | Internal error: Safety key bit 7 was incorrect |
| 486 | Internal error: Safety key bit 8 was incorrect |
| 487 | Internal error: Safety key bit 9 was incorrect |
| 488 | Internal error: Safety key bit 10 was incorrect |
| 489 | Internal error: Safety key bit 11 was incorrect |
| 490 | Internal error: Safety key bit 12 was incorrect |
| 491 | Internal error: Safety key bit 13 was incorrect |
| 492 | Internal error: Safety key bit 14 was incorrect |
| 493 | Internal error: Safety key bit 15 was incorrect |
| 494 | Internal error: Safety relay timeout |
| 495 | Internal error: Safety relay commanded off |
| 496 | Internal error: Unknown safety error occurred |
| 497 | Internal error: Safety timer was corrupt |
| 498 | Internal error: Safety timer was expired |
| 499 | Internal error: Safety timings |
| 500 | Internal error: Safety shutdown |
| 501 | RESERVED |
| 502 | Mix setpoint was invalid |
| 503 | Mix time of day setpoint was invalid |
| 504 | Mix outdoor temperature was invalid |
| 505 | Mix ODR time of day setpoint was invalid |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 506 | Mix ODR time of day setpoint exceeds normal setpoint |
| 507 | Mix ODR max outdoor temperature was invalid |
| 508 | Mix ODR min outdoor temperature was invalid |
| 509 | Mix ODR low water temperature was invalid |
| 510 | Mix ODR outdoor temperature range was invalid |
| 511 | Mix ODR water temperature range was invalid |
| 512 | Mix demand switch was invalid |
| 513 | Mix ON hysteresis was invalid |
| 514 | Mix OFF hysteresis was invalid |
| 515 | Mix ODR min water temperature was invalid |
| 516 | Mix hysteresis step time was invalid |
| 517 | Mix P-gain was invalid |
| 518 | Mix I-gain was invalid |
| 519 | Mix D-gain was invalid |
| 520 | Mix control was suspended due to fault |
| 521 | Mix S10 (J10-7) temperature was invalid |
| 522 | Mix outlet temperature was invalid |
| 523 | Mix inlet temperature was invalid |
| 524 | Mix S5 (J8-11) temperature was invalid |
| 525 | Mix modulation sensor type was invalid |
| 526 | Mix ODR min water temperature setpoint was invalid |
| 527 | Mix circulator sensor was invalid |
| 528 | Mix flow control was invalid |
| 529 | Mix temperature was invalid |
| 530 | Mix sensor was invalid |
| 531 | Mix PID setpoint was invalid |
| 532 | STAT may not be a Mix demand source when Remote Stat is enabled |
| 533-539 | RESERVED |
| 540 | Delta T inlet/outlet enable was invalid |
| 541 | Delta T exchanger/outlet enable was invalid |
| 542 | Delta T inlet/exchanger enable was invalid |
| 543 | Delta T inlet/outlet degrees was out of range |
| 544 | Delta T exchanger/outlet degrees was out of range |
| 545 | Delta T inlet/exchanger degrees was out of range |
| 546 | Delta T response was invalid |
| 547 | Delta T inversion limit response was invalid |
| 548 | Delta T rate limit enable was invalid |
| 549 | Delta T exchanger/outlet wasn't allowed due to stack limit setting |
| 550 | Delta T inlet/outlet limit was exceeded |
| 551 | Delta T exchanger/outlet limit was exceeded |
| 552 | Delta T inlet/exchanger limit was exceeded |
| 553 | Inlet/outlet inversion occurred |
| 554 | Exchanger/outlet inversion occurred |
| 555 | Inlet/exchanger inversion occurred |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 556 | Delta T exchanger/outlet wasn't allowed due to stack connector setting |
| 557 | Delta T inlet/exchanger wasn't allowed due to stack limit setting |
| 558 | Delta T inlet/exchanger wasn't allowed due to stack connector setting |
| 559 | Delta T delay was not configured for recycle response |
| 560 | Outlet T-rise enable was invalid |
| 561 | Heat exchanger T-rise enable was invalid |
| 562 | T-rise degrees was out of range |
| 563 | T-rise response was invalid |
| 564 | Outlet T-rise limit was exceeded |
| 565 | Heat exchanger T-rise limit was exceeded |
| 566 | Heat exchanger T-rise wasn't allowed due to stack limit setting |
| 567 | Heat exchanger T-rise wasn't allowed due to stack connector setting |
| 568 | Outlet T-rise wasn't allowed due to outlet connector setting |
| 569 | T-rise delay was not configured for recycle response |
| 570 | Heat exchanger high limit setpoint was out of range |
| 571 | Heat exchanger high limit response was invalid |
| 572 | Heat exchanger high limit was exceeded |
| 573 | Heat exchanger high limit wasn't allowed due to stack limit setting |
| 574 | Heat exchanger high limit wasn't allowed due to stack connector setting |
| 575 | Heat exchanger high limit delay was not configured for recycle response |
| 576 | CH pump output was invalid |
| 577 | DHW pump output was invalid |
| 578 | Boiler pump output was invalid |
| 579 | Auxiliary pump output was invalid |
| 580 | System pump output was invalid |
| 581 | Mix pump output was invalid |
| 582-589 | RESERVED |
| 590 | DHW plate preheat setpoint was invalid |
| 591 | DHW plate preheat ON hysteresis was invalid |
| 592 | DHW plate preheat OFF hysteresis was invalid |
| 593 | Tap detect degrees was out of range |
| 594 | Tap detect ON hysteresis was invalid |
| 595 | Inlet - DHW tap stop degrees was out of range |
| 596 | Outlet - Inlet tap stop degrees was out of range |
| 597 | DHW tap detect on threshold was invalid |
| 598 | DHW plate preheat detect on threshold was invalid |
| 599 | DHW plate preheat detect off threshold was invalid |
| 600 | Delta T inlet temperature was invalid |
| 601 | Delta T outlet temperature was invalid |

**Table 11. SOLA alert codes (Continued)**

| | |
|---|---|
| 602 | Delta T exchanger temperature was invalid |
| 603 | CH ODR boost max offpoint temperature was invalid |
| 604 | CH ODR boost max offpoint temperature was too low |
| 605 | Lead Lag ODR boost max offpoint temperature was invalid |
| 606 | Lead Lag ODR boost max offpoint temperature was too low |
| 607 | Mix ODR boost max offpoint temperature was invalid |
| 608 | Mix ODR boost max offpoint temperature was too low |
| 609 | Time to rotate lead boiler to next firing slave |
| 610 | Time to rotate lead boiler to next available slave |
| 611 | Time to rotate lead boiler to first firing slave in order |
| 612 | Time to rotate lead boiler to lowest running slave |
| 613 | Lead boiler was rotated based on new firing sequence order |
| 614 | Lead boiler was rotated based on measured run time |
| 615 | Parameter PCB was switched to backup |
| 616 | Range PCB was switched to backup |

Burner control states are contained in Table 12.

**Table 12. Burner control states**

| State | Name |
|---|---|
| 0 | Initiate |
| 1 | Standby Delay |
| 2 | Standby |
| 3 | Safe Startup |
| 4 | Prepurge - Drive to Purge Rate |
| 5 | Prepurge – Measured Purge Time |
| 6 | Prepurge – Drive to Lightoff Rate |
| 7 | Preignition Test |
| 8 | Preignition Time |
| 9 | Pilot Flame Establishing Period |
| 10 | Main Flame Establishing Period |
| 11 | Direct Burner Ignition |
| 12 | Run |
| 13 | Postpurge |
| 14 | Lockout |
| 15 | Prepurge (Fulton pulse) |
| 16 | Ignition (Fulton pulse) |
| 17 | Combustion Pressure Establish (Fulton pulse) |
| 18 | Combustion Pressure Stabilization (Fulton pulse) |
| 19 | Main Flame Stabilization (Fulton pulse) |
| 255 | Safety Processor Offline |

SOLA pump status codes are contained in Table 13 and 14. The first table is for older SOLA's (application build less than 1600), and the second table is for newer SOLA's (application build 1600 or higher).

**Table 13. Pump Status Codes (Application build less than 1600)**

| Status | Description | Note |
|---|---|---|
| 0 | Unknown | |
| 1 | Not connected | |
| 2 | Not Lead Lag master | |
| 3 | Pump A Off | |
| 4 | Pump B Off | |
| 5 | Pump C Off | |
| 6 | Pump A Off – Anti-condensation (CH demand) | |
| 7 | Pump B Off – Anti-condensation (CH demand) | |
| 8 | Pump C Off – Anti-condensation (CH demand) | |
| 9 | Pump A Off – Anti-condensation (DHW demand) | |
| 10 | Pump B Off – Anti-condensation (DHW demand) | |
| 11 | Pump C Off – Anti-condensation (DHW demand) | |
| 12 | Pump A Off – Anti-condensation (LL demand) | |
| 13 | Pump B Off – Anti-condensation (LL demand) | |
| 14 | Pump C Off – Anti-condensation (LL demand) | |
| 15 | Pump A On – Slave overrun | |
| 16 | Pump B On – Slave overrun | |
| 17 | Pump C On – Slave overrun | |
| 18 | Pump A On – LL master overrun | |
| 19 | Pump B On – LL master overrun | |
| 20 | Pump C On – LL master overrun | |
| 21 | Pump A Off – Start delay (DHW demand) | |
| 22 | Pump B Off – Start delay (DHW demand) | |
| 23 | Pump C Off – Start delay (DHW demand) | |
| 24 | Pump A On – CH demand | |
| 25 | Pump B On – CH demand | |
| 26 | Pump C On – CH demand | |

**Table 13. Pump Status Codes (Application build less than 1600) (Continued)**

| | | |
|---|---|---|
| 27 | Pump A On – CH frost protection | |
| 28 | Pump B On – CH frost protection | |
| 29 | Pump C On – CH frost protection | |
| 30 | Pump A On – DHW demand | |
| 31 | Pump B On – DHW demand | |
| 32 | Pump C On – DHW demand | |
| 33 | Pump A On – DHW frost protection | |
| 34 | Pump B On – DHW frost protection | |
| 35 | Pump C On – DHW frost protection | |
| 36 | Pump A Off – DHW high limit | |
| 37 | Pump B Off – DHW high limit | |
| 38 | Pump C Off – DHW high limit | |
| 39 | Pump A On – Exercise | |
| 40 | Pump B On – Exercise | |
| 41 | Pump C On – Exercise | |
| 42 | Pump A On – Frost protection | |
| 43 | Pump B On – Frost protection | |
| 44 | Pump C On – Frost protection | |
| 45 | Pump A On – Lead Lag master demand | |
| 46 | Pump B On – Lead Lag master demand | |
| 47 | Pump C On – Lead Lag master demand | |
| 48 | Pump A On – Slave demand | |
| 49 | Pump B On – Slave demand | |
| 50 | Pump C On – Slave demand | |
| 51 | Pump A On – Manual | |
| 52 | Pump B On – Manual | |
| 53 | Pump C On – Manual | |
| 54 | Pump A On – Outlet high limit | |
| 55 | Pump B On – Outlet high limit | |
| 56 | Pump C On – Outlet high limit | |
| 57 | Pump A On – Overrun | |
| 58 | Pump B On – Overrun | |
| 59 | Pump C On – Overrun | |
| 60 | Pump A On – Frost protection overrun | |
| 61 | Pump B On – Frost protection overrun | |
| 62 | Pump C On – Frost protection overrun | |
| 63 | Pump A On – Mix demand | |
| 64 | Pump B On – Mix demand | |
| 65 | Pump C On – Mix demand | |

**Table 14. Pump Status Codes (Application build 1600 or higher)**

| Status | Description | Note |
|---|---|---|
| 92 | Forced On from manual pump control | |
| 93 | Forced On due to Outlet high limit is active | |
| 94 | Forced On from burner demand | |
| 95 | Forced On due to Lead Lag slave has demand | |
| 96 | Forced Off from local DHW priority service | |
| 97 | Forced Off from Lead Lag DHW priority service | |
| 98 | Forced Off from Central Heat anti-condensation | |
| 99 | Forced Off from DHW anti-condensation | |
| 100 | Forced Off due to DHW high limit is active | |
| 101 | Forced Off from EnviraCOM DHW priority service | |
| 102 | On due to local CH frost protection is active | |
| 103 | On due to Lead Lag CH frost protection is active | |
| 104 | On due to local DHW frost protection is active | |
| 105 | On due to Lead Lag DHW frost protection is active | |
| 106 | On from local Central Heat demand | |
| 107 | On from Lead Lag Central Heat demand | |
| 108 | On from local DHW demand | |
| 109 | On from Lead Lag DHW demand | |
| 110 | On from local Mix demand | |
| 111 | On from Lead Lag Mix demand | |
| 112 | On from local Central Heat service | |
| 113 | On from Lead Lag Central Heat service | |
| 114 | On from local DHW service | |
| 115 | On from Lead Lag DHW service | |
| 116 | On from local Mix service | |
| 117 | On from Lead Lag Mix service | |
| 118 | On from Lead Lag auxiliary pump X | |
| 119 | On from Lead Lag auxiliary pump Y | |
| 120 | On from Lead Lag auxiliary pump Z | |
| 121 | On, but inhibited by pump start delay | |
| 122 | On from pump override | |
| 123 | Off, not needed | |
| 124 | On from burner demand | |
| 125 | On from exercise | |
| 126 | On from local Lead Lag service | |
| 127 | On from local Lead Lag pump demand | |

## Functional Codes

Some holding registers contain variable length data in them, e.g., register 186 (OS number) that extend common Modbus access for holding registers. Only a single register address is assigned to these parameters even though they may contain more than two bytes (16-bits) of data. These registers MUST be accessed individually ONLY in order that no confusion exists about parameter boundaries[j].

## Register Writes

Writing to any data register may require an access level password before it can be changed (written) by the Modbus master. For those data registers requiring access security a password matching the one contained in the SOLA must be provided before the SOLA allows the data to be changed. A valid password login remains in effect for 10 minutes before another login is required (SOLA timeout for password login). See User Interface Data Attribute Table section for more information regarding how access security is determined.

Two Modbus registers are defined to manage the register data access login:

- (0x00B1) Password
- (0x0013) Register Access Status

The Modbus master writes a password into the Password register to request write access privileges to the data registers. Even though this register is a holding register, and therefore, should normally only accept a 16-bit value, it accepts alphanumeric text up to 20 characters in length. Due to this length change this register must be written individually and not as part of a group register write.

Results of the login are reported by the SOLA in the Register Access Status register. If the Modbus master writes the correct installer password, the status register indicates this result and all data with installer access level and below can be changed. If the Modbus master writes the correct OEM password, the status register indicates this result and all data with OEM access level and below can be changed.

## 03 (0x03) Read Holding Registers

This function is used to read one or more consecutive data registers in the SOLA. The register address of the first register (see Modbus register map in Fig. 1) in the range is included in the request along with the number of registers to read. SOLA returns a response with the starting register address, the number of bytes returned, followed by the register data contents in register address order (lowest register address first, etc.).

Normally, the number of bytes returned is 2 times the number of registers requested since each register usually contains a 16-bit value. An exception to this rule is that registers representing variable length text data return the length of the text data which can exceed 2 bytes.

[j] Standard Modbus protocol doesn't support the concept of variable length data. The SOLA Modbus interface varies from the protocol in that it supports a single register definition for text data. These special registers must be accessed exclusively by themselves in order for them to be supported.

## 06 (0x06) Write Single Register

This function is used to write data to a single register in the SOLA. The SOLA register address and 16-bit data value to write into the register are sent to the SOLA, and the SOLA returns an acknowledged response.

NOTE: This function (command) cannot be used for variable length text data registers.

## 16 (0x10) Write Multiple Registers

This function is used to write data into multiple SOLA registers with a single request. The SOLA registers must be located consecutively in the register map since only a base address is provided. The Modbus master provides the starting register address, the number of registers to write, the total number of bytes, followed by the actual data itself. The SOLA writes the data into each register and acknowledges the completion with a response echoing the number of registers written.

When writing text data to a register representing variable length text, the number of registers should be specified as one and the byte count be the number of bytes in the text data.

## 17 (0x11) Report Slave ID

This function is used to locate and identify the SOLAs connected on the Modbus network. The Modbus master issues a Report Slave ID request for a specific Modbus address onto the Modbus network, and if an SOLA exists with the requested Modbus address, it responds to the request. If no SOLA exists, the Modbus master times out and concludes that no SOLA is present with that Modbus address.

Included in the SOLA response is the following data to further identify it:
- OS number
- Burner name

Format of the SOLA response message is depicted in Table 15.

**Table 15. Report slave ID response**

| Byte: 0 | 1 | 2 | 3 | 4 | 5-20 | 21-40 | 41-42 |
|---|---|---|---|---|---|---|---|
| Slave Address | Function Code | Byte Count | Slave ID | Run Indicator | OS Number | Burner Name | CRC |
| 0x01-0xF0 | 0x11 | 0x30 | 0x79 | 0x00=OFF<br>0xFF=ON | | | |

The OS number (up to 16 characters) and burner name (up to 20 characters) fields are NULL filled text strings. They have a fixed field length so that the boundaries of each field are known. These same SOLA parameters can be obtained with the Read Holding Register function.

The Run Indicator status contains an OFF status when the ICP is in a lockout or unconfigured state. In any other case the status indicates an ON condition.

NOTE: A slave ID of 0x79 is reserved for all SOLA hydronic boiler control models.

## Exception Codes

The Modbus exception codes in Table 16 may be given by the SOLA in response to function code requests.

**Table 16. Modbus exception codes**

| Code | Name | Comment |
|---|---|---|
| 0x01 | ILLEGAL_FUNCTION | Illegal function code or action requested |
| 0x02 | ILLEGAL_DATA_ADDRESS | Register address out of bounds |
| 0x03 | ILLEGAL_DATA_VALUE | Data in register write is invalid for register |
| 0x10 | READ_MULTIPLE_NOT_OK | Exceeded maximum registers allowed in read |
| 0x11 | ACCESS_FAILURE | Invalid password access level for register |
| 0x12 | LOGIN_FAILURE | Unrecognized password given for login |

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