CB Falcon Modbus Communication

INTRODUCTION

This document describes the interface to the CB Falcon boiler controller on either the MB1 or MB2 Modbus port. These ports are RS-485 connectors that use the Modbus communication protocol to allow configuration and status data to be read from and written to the Falcon.

The CB Falcon 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 CB Falcon. PCBs reside in the non-volatile storage in the Falcon and are uploaded from the controller into the user interface.
PIM	Plug-In Module. Plug that can be inserted into the Falcon to enable Lead Lag and to backup & restore parameter settings in the Falcon.
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.

Reference

The following is used as a reference in this document:

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

INTERFACE

Physical Layer

The Falcon Modbus port is a 3-pin connector that interfaces to RS-485 signals as indicated in 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 the RTU mode. 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 = 1 start bit 8 data bits No parity bit 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 Falcon 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 the configuration and status data are accessed as 16-bit holding registers in this interface. Since all Falcon 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 Fig. 1 and Table 4. 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 Falcon 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 Falcon has several terminals (connectors) 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
- 0-15 psi pressure sensor
- 0-50 psi pressure sensor
- 4-20 mA analog input
- Raw 0-4096 digital 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 its 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 4-20 mA steam pressure (0-15 or 0-50 psi)
S2	J8-6	4-20 mA remote control input (setpoint or modulation)
S3	J8-8	Outlet single non-safety temperature
S4	J8-10	Undefined temperature (called Outlet operation channel)
S3S4	J8-8 *and* J8-10	Outlet dual safety temperature
S5	J8-11	Outdoor, Header (Central Heat), or Mix temperature
S6	J9-1	DHW single non-safety temperature
S7	J9-3	Undefined temperature (called DHW operation channel)
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

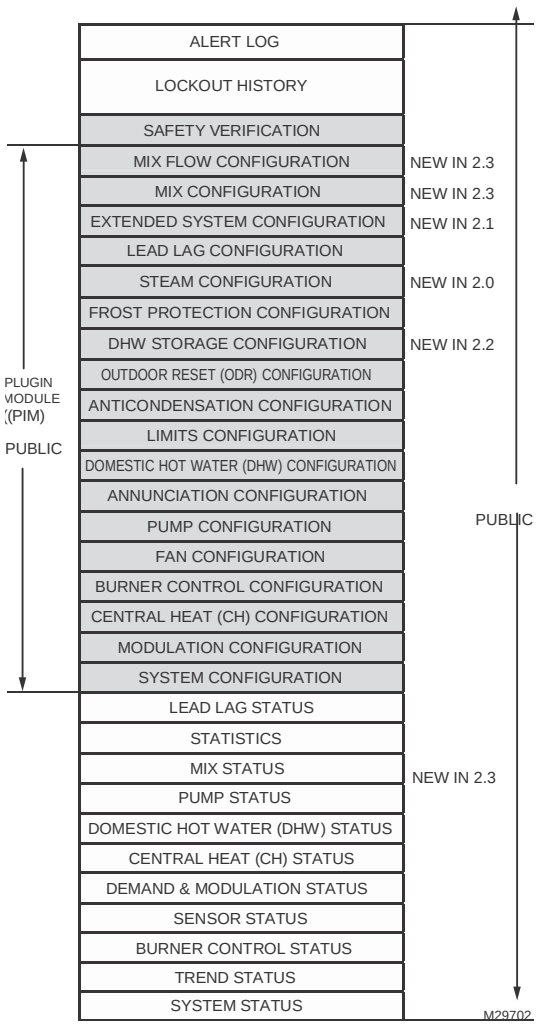

Fig. 1. Register map

Table 4. CB Falcon 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. Bit map: 15-11=Reserved (always 1) 10=Alert log 9=Lockout history 8=Lead Lag status 7=Statistics 6=Pump status 5=DHW status 4=CH status 3=Demand&Modulation status 2=Sensor status 1=Burner control status 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. Bit map: 15=PCB configuration 14=PIM configuration 13=Reserved 12=Lead Lag configuration 11=Frost protection configuration 10=Outdoor reset configuration 9=Anti-condensation configuration 8=Limits configuration 7=DHW configuration 6=Annunciation configuration 5=Pump configuration 4=Fan configuration 3=Burner control configuration 2=CH configuration 1=Modulation configuration 0=System configuration
0002	0002	Digital I/O	RR	U16	Bit map: 15=Safety relay 14=Time of Day 13=STAT (Demand) 12=High Fire Switch (HFS) 11=Low Fire Switch (LFS) 10=Load Control Input(LCI) 9=Pre-ignition interlock (PII) 8=Interlock (ILK) 7=Alarm 6=Main valve 5=Pilot valve 4=External ignition 3=Blower motor/HSI 2=Pump C 1=Pump B 0=Pump A

Table 4. CB Falcon Modbus register map

0003	0003	Annunciation I/O	R	U16	Only applicable when Annunciation is enabled Bit map: 15-8=Reserved (always 0) 7=Annunciator 8/LFS 6=Annunciator 7/HFS 5=Annunciator 6 4=Annunciator 5 3=Annunciator 4 2=Annunciator 3 1=Annunciator 2 0=Annunciator 1/IAS
0004	0004	Limits	R	U16	Bitmap: 15-12=Reserved (always 0) 11=Heat exchanger high limit 10=Exchanger T-rise limit 9=Outlet T-rise limit 8=Inversion inlet/exchanger limit 7=Inversion exchanger/outlet limit 6=Inversion inlet/outlet limit 5=Delta T inlet/exchanger limit 4=Delta T exchanger/outlet limit 3=Delta T inlet/outlet limit 2=Stack limit 1=DHW high limit 0=Outlet high limit
0005	0005	Plug-In Module (PIM) status	R	U16	Bit map: 15-11=Reserved, 10=OEM alert PCB stored in PIM, 9=OEM range PCB stored in PIM, 8=OEM parameter PCB stored in PIM, 7-3=Reserved (always 0), 2=Valid copyright, 1=Lead/Lag enabled, 0= PIM installed
		TREND STATUS			
0006	0006	Demand source	R	U16	Current demand source: 0=Unknown, 1=No source demand, 2=CH, 3=DHW, 4=Lead Lag slave, 5=Lead Lag master, 6=CH frost protection, 7=DHW frost protection, 8=No demand due to burner switch (register 199) turned off, 9=DHW storage, 10=Reserved, 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 4. CB Falcon Modbus register map

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] 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	RR	U16U16	Register data write access status: 0=No register writes allowed, 1=Installer register writes allowed, 2=OEM register writes allowed. 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 4-20 mA (0.1 mA precision) 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. Bit map: 15-5=Reserved 4= DHW plate heat exchanger configuration 3=DHW plate heat exchanger status 2-0=Reserved
0018-001F	0024-0031	RESERVED			
		BURNER CONTROL STATUS			
0020	0032	Burner control status	R	U16	0=Disabled, 1=Locked out, 2-3=Reserved, 4=Anti-short cycle, 5=Unconfigured safety data, 6-33=Reserved, 34=Standby Hold, 35=Standby Delay, 36-47=Reserved, 48=Normal Standby, 49=Preparing, 50=Ignition, 51=Firing, 52=Postpurge, 53-65535=Reserved
0021	0033	Burner control state	R	U16	Burner control sequence (I/O) state (see table 11). Model type determined by register 176.
0022	0034	Lockout code	R	U16	0=No lockout, 1-4096 (see Table 8)
0023	0035	Alarm reason	R	U16	0=None, 1=Lockout (see Lockout code, register 34), 2=Alert (see Table 10), 3=Other

Table 4. CB Falcon Modbus register map

0024	0036	Annunciator first out	R	U16	Source for annunciator first out: 0=None or undetermined, 1=ILK, 2=PII, 11=Annunciator 1, 12=Annunciator 2, 13=Annunciator 3, 14=Annunciator 4, 15=Annunciator 5, 16=Annunciator 6, 17=Annunciator 7, 18=Annunciator 8
0025	0037	Annunciator hold	R	U16	Source for burner control hold condition (see Hold code): 0=None or undetermined, 1=ILK, 2=PII, 3=LCI 11=Annunciator 1, 12=Annunciator 2, 13=Annunciator 3, 14=Annunciator 4, 15=Annunciator 5, 16=Annunciator 6, 17=Annunciator 7, 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 7)
0029	0041	Burner control flags	R	U16	Bit map: 15-1=Reserved (always 0) 0= Flame detected
002A	0042	Remote Stat	R/W	U16	0=No remote STAT demand, 1=remote STAT demand indicated
		SENSOR STATUS			
002B	0043	Outlet operation (S4=J8-10) terminal	R	U16	-40°-130° (0.1°C precision)[d] or other (see register 610)
002C	0044	DHW operation (S7=J9-3) terminal	R	U16	-40°-130° (0.1°C precision)[e] or other (see register 612)
002D	0045	Stack or Heat exchanger operation (S9=J9-6) terminal	R	U16	-40°-130° (0.1°C precision)[e] or other (see register 613)
002E	0046	Outlet operation sensor (S4=J8-10) state	R	U16	0=None, 1=Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
002F	0047	DHW operation sensor (S7=J9-3) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0030	0048	Outlet limit sensor (S3=J8-8) state	R	U16	0=None, 1=Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0031	0049	Inlet sensor (S1=J8-4) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0032	0050	DHW limit sensor (S7=J9-1) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0033	0051	Stack limit sensor (S8=J9-4) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0034	0052	S5 (J8-11) sensor state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable

Table 4. CB Falcon Modbus register map

0035	0053	4-20mA remote control input(S2=J8-6) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0036	0054	Pressure sensor (S1=J8-4) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
0037	0055	Stack operation or Heat exchanger sensor (S9=J9-6) state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
		DEMAND AND MODULATION STATUS			
0038	0056	Active rate limiter	R	U16	0=None, 1=Outlet high limit, 2=Delta T limit, 3=Stack limit, 4=Slow start limit, 5=Anti-condensation, 6=Minimum modulation, 7=Forced rate, 8= IAS is open
0039	0057	Limited rate	R	U16	RPM or %[c]
003A	0058	Active rate override	R	U16	0=None, 1=Burner control default, 2=Burner control, 3=Manual firing rate, 4=Manual firing rate off, 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-003F	0061-0063	RESERVED			
		CENTRAL HEATING (CH) STATUS			
0040	0064	CH status	R	U16	0=Unknown, 1=Disabled, 2=Normal, 3=Suspended
0041	0065	CH setpoint source	R	U16	0=Unknown, 1=Normal setpoint, 2=TOD setpoint, 3=Outdoor reset, 4=Remote control
0042	0066	CH heat demand	R	U16	0=Off, 1=On
0043	0067	CH burner demand	R	U16	0=Off, 1=On
0044	0068	CH requested rate	R	U16	RPM or %[c]
0045	0069	CH frost heat demand	R	U16	0=Off, 1=On
0046	0070	CH frost burner demand	R	U16	0=Off, 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-004F	0075-0079	RESERVED			

Table 4. CB Falcon Modbus register map

		DOMESTIC HOT WATER (DHW) STATUS			
0050	0080	DHW status	R	U16	0=Unknown, 1=Disabled, 2=Normal, 3=Suspended
0051	0081	DHW setpoint source	R	U16	0=Unknown, 1=Normal setpoint, 2=TOD setpoint, 5=DHW tap setpoint, 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, 1=On
0054	0084	DHW burner demand	R	U16	0=Off, 1=On
0055	0085	DHW requested rate	R	U16	RPM or %[c]
0056	0086	DHW frost heat demand	R	U16	0=Off, 1=On
0057	0087	DHW frost burner demand	R	U16	0=Off, 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)
005B	0091	DHW storage heat demand	R	U16	0=Off, 1=On
005C	0092	DHW storage burner demand	R	U16	0=Off, 1=On
		PUMP STATUS			
005D	0093	Pump A status	R	U16	Bit map: Demand: 15-14=Reserved, 13=Auxiliary 2 pump demand, 12=Auxiliary 1 pump demand, 11=System pump demand, 10=Boiler pump demand, 9=DHW pump demand, 8=CH pump demand Reason: 7=Reserved, 6=Pump assigned to logical pump, 5=Pump exercise requested, 4=On due to exercise, 3=On due to overrun, 2=Forced off, 1=Forced on, 0=On due to normal demand

Table 4. CB Falcon Modbus register map

005E	0094	Pump B status	R	U16	Bit map: Demand: 15-14=Reserved, 13=Auxiliary 2 pump demand, 12=Auxiliary 1 pump demand, 11=System pump demand, 10=Boiler pump demand, 9=DHW pump demand, 8=CH pump demand Reason: 7=Reserved, 6=Pump assigned to logical pump, 5=Pump exercise requested, 4=On due to exercise, 3=On due to overrun, 2=Forced off, 1=Forced on, 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 12. For application build 1600 or higher see table 13[e]
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 12. For application build 1600 or higher see table 13[e].
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).
0069	0105	System pump status	R	U16	For application build less than 1600 see table 12. For application build 1600 or higher see table 13[e].
006A	0106	System pump overrun time	R	U16	Running overrun time for Lead Lag pump (seconds)
006B	0107	System pump idle days count	R	U16	Number of days that LL pump has not run (sat idle).
006C	0108	Boiler pump status	R	U16	For application build less than 1600 see table 12. For application build 1600 or higher see table 13[e].
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 12. For application build 1600 or higher see table 13[e].
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 13.
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			

Table 4. CB Falcon Modbus register map

		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, 1=On
0099	0153	DHW preheat demand	R	U16	0=Off, 1=On
009A	0154	DHW change rate	R	U16	DHW plate heat exchanger temperature change rate (degrees/second, 0.1°C precision)
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, 1=Disabled, 2=Normal, 3=Suspended
00A1	0161	Lead Lag slave status	R	U16	Bit map: 15=Slave command received, 14=Slave mode has priority over CH & DHW, 13=Slave is modulating, 12=CH frost protection request, 11=DHW frost protection request, 10=Frost protection burner request, 9=Local frost protection request, 8=Reserved (always 0), 7-0=Burner control status (see register 32)
00A2	0162	Lead Lag master setpoint source	R	U16	0=Unknown, 1=Normal setpoint, 2=TOD setpoint, 3=Outdoor reset

Table 4. CB Falcon Modbus register map

00A3	0163	Lead Lag master heat demand	R	U16	0=Off, 1=On
00A4	0164	Lead Lag slave burner demand	R	U16	0=Off, 1=On
00A5	0165	Lead Lag slave requested rate	R	U16	RPM or %[c]
		EXTENDED PUMP STATUS			
00A8	0168	Pump C status	R	U16	Bit map: Demand: 15-14=Reserved, 13=Auxiliary 2 pump demand, 12=Auxiliary 1 pump demand, 11=System pump demand, 10=Boiler pump demand, 9=DHW pump demand, 8=CH pump demand Reason: 7=Reserved, 6=Pump assigned to logical pump, 5=Pump exercise requested, 4=On due to exercise, 3=On due to overrun, 2=Forced off, 1=Forced on, 0=On due to normal demand
00A9	0169	RESERVED			
		EXTENDED SENSOR STATUS			
00AA	0170	Outdoor temperature	R	U16	-40°-130° (0.1°C precision)[b]
00AB	0171	Outdoor sensor state	R	U16	0=None, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 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, 1= Normal, 2=Open, 3=Shorted, 4=Outside high range, 5=Outside low range, 6=Not reliable
		SYSTEM CONFIGURATION			
00B0	0176	Product type	R	U16	Product family (MSB): 0=Unknown product, 1=Hydronic boiler control, 2=Steam boiler control, 3=Reserved, 4=Fulton pulse hydronic boiler control, 5=Fulton pulse steam boiler control, 6=Cleaver Brooks hydronic boiler control, 7=Cleaver Brooks steam boiler control Product ID (LSB): 0=Residential control, 1=Commercial control
00B1	0177	Password	W		Variable length password string (up to 20 characters) requesting Falcon permission to write registers.
00B2	0178	Temperature units	R/W	U16	Display format for temperature at user interface: 0=°F (Fahrenheit), 1=°C (Celsius)
00B3	0179	Antishort cycle time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured

Table 4. CB Falcon Modbus register map

00B4	0180	Alarm silence time	R/W	U16	0-600 minutes
00B5	0181	Power up with lockout	R/W	U16	**SAFETY** parameter[f]: 0=Clear lockout on power-up (reset), 1=Do not clear lockout on power-up (preserve)
00B6	01820182	Reset and restart	W	U16	Force soft reset of Falcon subsystems: 0=None, 1=Burner control, 2=Application, 3=Burner control & application, 4=Clear alert log Successful login required before request is granted.
00B7	0183	Burner name	R/W		Variable length string (up to 20 characters)
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 Processor build	R	U16	
00BD	0189	Application Processor 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[f]: 0=Fan PWM, 1=0-10V, 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[f]: RPM or %[c]
00C5	0197	Lightoff rate	R/W	U16	**SAFETY** parameter[f]: RPM or %[c]
00C6	0198	Postpurge rate	R/W	U16	**SAFETY** parameter[f]: 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), 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), 0xFFFF=Not configured
00CB	0203	Burner switch	R/W	U16	0=Off, 1=On. Used to enable/disable burner control.
00CC	0204	Firing rate control	R/W	U16	0=Auto, 1=Manual in Run, 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.

Table 4. CB Falcon Modbus register map

00CF	0207	Standby rate	R/W	U16	**SAFETY** parameter[f]: RPM or %[c]
		CH CONFIGURATION			
00D0	0208	CH enable	R/W	U16	0=Disable Central Heating, 1=Enable Central Heating
00D1	0209	CH demand switch	R/W	U16	Source for CH demand: 0=Modulation sensor only, 1=STAT terminal, 2=EnviraCOM remote Stat, 3=LCI, 4=Reserved, 5=Modbus STAT
00D2	0210	CH modulation sensor	R/W	U16	Sensor used for CH modulation: 0=Outlet sensor, 2=Inlet sensor, 3=S5 sensor, 4=S10 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] 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, 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[f]: 0=Internal ignition, 1=External ignition, 2=Hot Surface Igniter (HSI)
00E1	0225	BLR/HSI function	R/W	U16	**SAFETY** parameter[f]: BLR/HSI terminal function: 0=blower motor, 1=Hot Surface Igniter (HSI)
00E2	0226	Igniter on during	R/W	U16	**SAFETY** parameter[f]: 0=All Pilot Flame Establishing Period (PFEP), 1=First ½ of PFEP
00E3	0227	Pilot type	R/W	U16	**SAFETY** parameter[f] 0=Interrupted, 1=Intermittent, 2=Direct burner ignition (constant ignition), 3=Direct burner ignition (pulsed ignition)
00E4	0228	Flame sensor type	R/W	U16	**SAFETY** parameter[f]: 0=None (no sensor) 1=Flame rod, 2=UV power tube, 3=UV power tube, ignore flame during ignition

Table 4. CB Falcon Modbus register map

00E5	0229	Purge rate proving	R/W	U16	**SAFETY** parameter[f]: 0=None, 1=High Fire Switch (HFS), 2=Fan speed
00E6	0230	Lightoff rate proving	R/W	U16	**SAFETY** parameter[f]: 0=None, 1=(Low Fire Switch) LFS, 2=Fan speed, 3=Fan speed, except during ignition
00E7	0231	Prepurge time	R/W	U16	**SAFETY** parameter[f]: 0-64800 seconds (18 hours), 0xFFFF=Not configured
00E8	0232	Pre-ignition time	R/W	U16	**SAFETY** parameter[f]: 0-64800 seconds (18 hours), 0xFFFF=Not configured
00E9	0233	Pilot flame establishing period (PFEP)	R/W	U16	**SAFETY** parameter[f]: 0=None, 1=4 seconds, 2=10 seconds, 3=15 seconds, 0xFFFF=Not configured
00EA	0234	Main flame establishing period (MFEP)	R/W	U16	**SAFETY** parameter[f]: 0=None, 1=5 seconds, 2=10 seconds, 3=15 seconds, 0xFFFF=Not configured
00EB	0235	Run stabilization time	R/W	U16	**SAFETY** parameter[f]: 0-64800 seconds (18 hours), 0xFFFF=Not configured
00EC	0236	Postpurge time	R/W	U16	**SAFETY** parameter[f]: 0-64800 seconds (18 hours), 0xFFFF=Not configured
00ED	0237	Interlock start check enable	R/W	U16	**SAFETY** parameter[f]: 0=No ILK check, 1=ILK check
00EE	0238	Interlock open response	R/W	U16	**SAFETY** parameter[f] 0=Lockout, 1=Recycle
00EF	0239	Ignite failure response	R/W	U16	**SAFETY** parameter[e]: 0=Lockout, 1=Continuous recycle, 2=Retry, recycle & hold, 3=Retry, recycle & lockout
00F0	0240	Ignite failure retries	R/W	U16	**SAFETY** parameter[f]: 0=None, 1=3 times, 2=5 times, 3=1 time, 0xFFFF=Not configured
00F1	0241	Ignite failure delay	R/W	U16	**SAFETY** parameter[f]: 0-64800 seconds (18 hours), 0xFFFF=Not configured
00F2	0242	MFEP flame failure response	R/W	U16	**SAFETY** parameter[f]: 0=Lockout, 1=Recycle
00F3	0243	Run flame failure response	R/W	U16	**SAFETY** parameter[f]: 0=Lockout, 1=Recycle
00F4	0244	Pilot test hold	R/W	U16	0=Disable, 1=Enable
00F5	0245	RESERVED	R/W	U16	

Table 4. CB Falcon Modbus register map

00F6	0246	Interrupted air switch (IAS) enable	R/W	U16	**SAFETY** parameter[f]: 0=Disable, 1=Enable during purge, 2=Enable during purge & ignition, 3=Enable during all states
00F7	0247	IAS start check enable	R/W	U16	**SAFETY** parameter[f]: 0=Disable, 1=Enable
00F8	0248	LCI enable	R/W	U16	**SAFETY** parameter[f]:: 0=Disable, 1=Enable
00F9	0249	PII enable	R/W	U16	**SAFETY** parameter[f]: 0=Disable, 1=Enable
00FA	0250	Flame threshold	R/W	U16	**SAFETY** parameter[f]: 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 bounce detection	R/W	U16	**SAFETY** parameter[f]: 0=Do not check for ILK bounce, 1=Check for ILK bounce
00FE	0254	Forced recycle interval time	R/W	U16	**SAFETY** parameter[f]: 0=No forced recycle, 1-64800 minutes (1080 hours), 0xFFFF=Not configured
00FF	0255	RESERVED			
		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, 1=1000 Hz, 2=2000 Hz, 3=3000 Hz, 4=4000 Hz, 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%[b]
0109-010F	0265-0271	RESERVED			
		PUMP CONFIGURATION			
0110	0272	CH pump output	R/W	U16	0=None, 1=Pump A, 2=Pump B, 3=Pump C
0111	0273	CH pump control	R/W	U16	0=Auto, 1=On
0112	0274	CH pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0113	0275	CH FP pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0114	0276	DHW pump output	R/W	U16	0=None, 1=Pump A, 2=Pump B, 3=Pump C
0115	0277	DHW pump control	R/W	U16	0=Auto, 1=On
0116	0278	DHW pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0117	0279	DHW FP pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0118	0280	DHW pump start delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0119	0281	Boiler pump output	R/W	U16	0=None, 1=Pump A, 2=Pump B, 3=Pump C
011A	0282	Boiler pump control	R/W	U16	0=Auto, 1=On

Table 4. CB Falcon Modbus register map

011B	0283	Boiler pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
011C	0284	Auxiliary 1 pump output	R/W	U16	0=None, 1=Pump A, 2=Pump B, 3=Pump C
011D	0285	Auxiliary 1 pump control	R/W	U16	0=Auto, 1=On
011E	0286	RESERVED			
011F	0287	System pump output	R/W	U16	0=None, 1=Pump A, 2=Pump B, 3=Pump C
0120	0288	System pump control	R/W	U16	0=Auto, 1=On
0121	0289	System pump overrun time	R/W	U16	0-64800 seconds (18 hours), 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), 0xFFFF=Not configured
0124	0292	CH pump start delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0125	0293	Boiler pump start delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0126	0294	System pump start delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0127	0295	Auxiliary 1 pump start delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
0128	0296	CH pump options 1	R/W	U16	Bit map: 15=Normal pump demand when auxiliary pump Z is set, 14=Normal pump demand when auxiliary pump Y is set, 13=Normal pump demand when auxiliary pump X is set, 12-7=Reserved (always 0), 6=Normal pump demand when DHW service is active, 5=Normal pump demand when CH service is active, 4=Reserved, 3=Normal pump demand when DHW demand, 2=Normal pump demand when CH demand, 1=Normal pump demand when local burner demand, 0=Local demand inhibited for faults
0129	0297	CH pump options 2	R/W	U16	Bit map: 15=Pump used for Lead Lag, 14=Pump used for local demand, 13-9=Reserved (always 0), 8=Force pump off when DHW high limit, 7=Force pump off when DHW anti-condensation, 6=Force pump off when CH anti-condensation, 5=Force pump off when DHW priority is active, 4=Force pump on when DHW frost protection, 3=Force pump on when CH frost protection, 2=Force pump on when Lead Lag slave demand, 1=Force pump on when local burner demand, 0=Force pump on when Outlet high limit
012A	0298	DHW pump options 1	R/W	U16	Bit map: 15=Normal pump demand when auxiliary pump Z is set, 14=Normal pump demand when auxiliary pump Y is set, 13=Normal pump demand when auxiliary pump X is set, 12-7=Reserved (always 0), 6=Normal pump demand when DHW service is active, 5=Normal pump demand when CH service is active, 4=Reserved, 3=Normal pump demand when DHW demand, 2=Normal pump demand when CH demand, 1=Normal pump demand when local burner demand, 0=Local demand inhibited for faults

Table 4. CB Falcon Modbus register map

012B	0299	DHW pump options 2	R/W	U16	Bit map: 15=Pump used for Lead Lag, 14=Pump used for local demand, 13-9=Reserved (always 0), 8=Force pump off when DHW high limit, 7=Force pump off when DHW anti-condensation, 6=Force pump off when CH anti-condensation, 5=Force pump off when DHW priority is active, 4=Force pump on when DHW frost protection, 3=Force pump on when CH frost protection, 2=Force pump on when Lead Lag slave demand, 1=Force pump on when local burner demand, 0=Force pump on when Outlet high limit
012C	0300	Boiler pump options 1	R/W	U16	Bit map: 15=Normal pump demand when auxiliary pump Z is set, 14=Normal pump demand when auxiliary pump Y is set, 13=Normal pump demand when auxiliary pump X is set, 12-7=Reserved (always 0), 6=Normal pump demand when DHW service is active, 5=Normal pump demand when CH service is active, 4=Reserved, 3=Normal pump demand when DHW demand, 2=Normal pump demand when CH demand, 1=Normal pump demand when local burner demand, 0=Local demand inhibited for faults
012D	0301	Boiler pump options 2	R/W	U16	Bit map: 15=Pump used for Lead Lag, 14=Pump used for local demand, 13-9=Reserved (always 0), 8=Force pump off when DHW high limit, 7=Force pump off when DHW anti-condensation, 6=Force pump off when CH anti-condensation, 5=Force pump off when DHW priority is active, 4=Force pump on when DHW frost protection, 3=Force pump on when CH frost protection, 2=Force pump on when Lead Lag slave demand, 1=Force pump on when local burner demand, 0=Force pump on when Outlet high limit
012E	0302	System pump options 1	R/W	U16	Bit map: 15=Normal pump demand when auxiliary pump Z is set, 14=Normal pump demand when auxiliary pump Y is set, 13=Normal pump demand when auxiliary pump X is set, 12-7=Reserved (always 0), 6=Normal pump demand when DHW service is active, 5=Normal pump demand when CH service is active, 4=Reserved, 3=Normal pump demand when DHW demand, 2=Normal pump demand when CH demand, 1=Normal pump demand when local burner demand, 0=Local demand inhibited for faults
012F	0303	System pump options 2	R/W	U16	Bit map: 15=Pump used for Lead Lag, 14=Pump used for local demand, 13-9=Reserved (always 0), 8=Force pump off when DHW high limit, 7=Force pump off when DHW anti-condensation, 6=Force pump off when CH anti-condensation, 5=Force pump off when DHW priority is active, 4=Force pump on when DHW frost protection, 3=Force pump on when CH frost protection, 2=Force pump on when Lead Lag slave demand, 1=Force pump on when local burner demand, 0=Force pump on when Outlet high limit

Table 4. CB Falcon Modbus register map

		ANNUNCIATION CONFIGURATION			
0130	0304	Annunciation enable	R/W	U16	0=Annunciation disabled, 1=Annunciation enabled
0131	0305	Annunciator mode	R/W	U16	0=Fixed, 1=Programmable
0132-013E	0306-0318	Annunciator 1 configuration	R/W		See table 6.
013F-014B	0319-0331	Annunciator 2 configuration	R/W		See table 6.
014C-0158	0332-0344	Annunciator 3 configuration	R/W		See table 6.
0159-0165	0345-0357	Annunciator 4 configuration	R/W		See table 6.
0166-0172	0358-0370	Annunciator 5 configuration	R/W		See table 6.
0173-017F	0371-0383	Annunciator 6 configuration	R/W		See table 6.
0180-018C	0384-0396	Annunciator 7 configuration	R/W		See table 6.
018D-0199	0397-0409	Annunciator 8 configuration	R/W		See table 6.
019A-01A5	0410-0421	PII configuration	R/W		See table 7.
01A6-01B1	0422-0433	LCI configuration	R/W		See table 7.
01B2-01BD	0434-0445	ILK configuration	R/W		See table 7.
01BE-01BF	0446-0447	RESERVED			
		DHW CONFIGURATION			
01C0	0448	DHW enable	R/W	U16	0=DHW disabled, 1=DHW enabled
01C1	0449	DHW demand switch	R/W	U16	Source of DHW demand: 0= Modulation sensor only, 1=EnviraCOM DHW request, 2=DHW switch, 3=Unused, 4=STAT terminal, 5=Reserved, 6=Modbus STAT, 7=Auto: S6 or EnviraCOM DHW request, 8=Auto: S6 or sensor only, 9=Plate heat exchanger
01C2	0450	DHW priority vs CH	R/W	U16	0=CH > DHW, 1=DHW > CH
01C3	0451	DHW priority vs LL	R/W	U16	0=LL > DHW, 1=DHW > LL
01C4	0452	DHW priority time	R/W	U16	0=No DHW priority time, >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: 0=DHW sensor, 1=Outlet sensor, 2=Inlet sensor, 3=Modbus, 4=Auto: DHW or Inlet sensor, 5=Auto: DHW or Outlet sensor

Table 4. CB Falcon Modbus register map

01CE	0462	RESERVED			
01CF	0463	DHW priority source	R/W	U16	0=Disable DHW priority, 1=DHW priority begins when DHW heat demand starts
		LIMITS CONFIGURATION			
01D0	0464	Outlet high limit setpoint	R/W	U16	**SAFETY** parameter[f]: -40°-130° (0.1°C precision)[a]
01D1	0465	Outlet high limit response	R/W	U16	**SAFETY** parameter[f]: 0=Lockout, 1=Recycle&hold
01D2	0466	Stack limit enable	R/W	U16	**SAFETY** parameter[f]: 0=Disable stack limit, 1=Enable dual sensor safety stack limit, 2=Enable single sensor non-safety stack limit
01D3	0467	Stack limit setpoint	R/W	U16	**SAFETY** parameter[f]: -40°-130° (0.1°C precision)[a]
01D4	0468	Stack limit response	R/W	U16	**SAFETY** parameter[f]: 0=Lockout, 2=Recycle&delay
01D5	0469	Stack limit delay	R/W	U16	**SAFETY** parameter[f]: 0-64800 seconds (18 hours), 0xFFFF=Not configured
01D6	0470	Delta-T inlet/outlet enable	R/W	U16	Delta-T limit for inlet to outlet flow: 0=Disable Delta-T limit, 1=Enable Delta-T limit, 2=Enable Inversion detection, 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: 0°-130° (0.1°C precision)[a]
01D8	0472	Delta-T response	R/W	U16	0=Lockout, 1=Recycle&delay, 2=Recycle&delay with retry limit
01D9	0473	Delta-T delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
01DA	0474	DHW high limit enable	R/W	U16	**SAFETY** parameter[f]: 0=Disable DHW high limit, 1=Enable dual sensor safety DHW high limit, 2=Enable single sensor non-safety DHW high limit
01DB	0475	DHW high limit setpoint	R/W	U16	**SAFETY** parameter[f]: -40°-130° (0.1°C precision)[a]
01DC	0476	DHW high limit response	R/W	U16	**SAFETY** parameter[f]: 0=Lockout, 2=Recycle&hold, 3=Suspend DHW
01DD	0477	CH slow start enable	R/W	U16	0=Disable CH slow start limit, 1=Enable CH slow start limit
01DE	0478	DHW slow start enable	R/W	U16	0=Disable DHW slow start limit, 1=Enable DHW slow start limit
01DF	0479	Slow start ramp	R/W	U16	RPM/min or %/min[c]
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, 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), 0xFFFF=Not configured
01E4	0484	Outlet high limit enable	R/W	U16	0=Disable Outlet high limit, 1=Enable dual sensor safety Outlet high limit, 2=Enable single sensor non-safety Outlet high limit

Table 4. CB Falcon Modbus register map

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, 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 (0-64800 seconds)
01E8	0488	Delta-T inverse limit response	R/W	U16	0=Lockout, 1=Recycle&delay, 2=Recycle&delay with retry limit
01E9	0489	Delta-T exchanger/outlet enable	R/W	U16	Delta-T limit for exchanger to outlet flow: 0=Disable Delta-T limit, 1=Enable Delta-T limit, 2=Enable Inversion detection, 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: 0°-130° (0.1°C precision)[a]
01EB	0491	Exchanger T-rise enable	R/W	U16	0=Disable exchanger T-rise limit, 1=Enable exchanger T-rise limit
01EC	0492	T-rise response	R/W	U16	0=Lockout, 1=Recycle&delay, 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: 0=Disable Delta-T limit, 1=Enable Delta-T limit, 2=Enable Inversion detection, 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: 0°-130° (0.1°C precision)[a]
		ANTICONDENSATION CONFIGURATION			
01F0	0496	CH anticondensation enable	R/W	U16	0=Disable CH anticondensation, 1=Enable CH anticondensation
01F1	0497	CH anticondensation setpoint	R/W	U16	-40°-130° (0.1°C precision)[a]
01F2	0498	CH anticondensation pump force off	R/W	U16	0=Normal (no change to CH pump) 1=CH pump forced off
01F3	0499	DHW anticondensation enable	R/W	U16	0=Disable DHW anticondensation, 1=Enable DHW anticondensation
01F4	0500	DHW anticondensation setpoint	R/W	U16	-40°-130° (0.1°C precision)[a]
01F5	0501	DHW anticondensation pump force off	R/W	U16	0=Normal (no change to DHW pump) 1=DHW pump forced off
01F6	0502	Anticondensation priority	R/W	U16	Is anticondensation more important than (0=No, 1=Yes)? Bit map: 15-5=Reserved (always 0) 4=Outlet high limit 3=Forced rate 2=Slow start 1=Delta-T limit 0=Stack limit
01F7	0503	Frost protection anticondensation enable	R/W	U16	0=Disable frost protection anticondensation, 1=Enable frost protection anticondensation

Table 4. CB Falcon Modbus register map

		DHW STORAGE CONFIGURATION			
01F8	0504	DHW storage enable	R/W	U16	0=DHW storage disabled, 1=DHW storage enabled
01F9	0505	DHW storage time	R/W	U16	0-64800 seconds (18 hours), 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, 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), 0xFFFF=Not configured
0204	0516	CH ODR 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), 0xFFFF=Not configured
0209	0521	Lead Lag CH ODR 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	CH ODR boost recovery step time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
020C	0524	Lead Lag CH ODR boost step	R/W	U16	0°-130° (0.1°C precision)[a]
020D	0525	Lead Lag CH ODR boost recovery step time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
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, 1=Enable CH frost protection
0211	0529	DHW frost protection enable	R/W	U16	0=Disable DHW frost protection, 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)
0213	0531	RESERVED			

Table 4. CB Falcon Modbus register map

0214	0532	Lead Lag frost protection enable	R/W	U16	0=Disable Lead Lag frost protection, 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, 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), 0xFFFF=Not configured
021C	0540	IAS closed response	R/W	U16	**SAFETY** parameter[f]: 0=Lockout, 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, 1=Lead/Lag simple slave enabled for EnviraCom master, 2=Lead/Lag simple slave enabled for Global Modbus master, 3=Lead/Lag full slave enabled for Global Modbus master
0221	0545	Lead Lag master enable	R/W	U16	0=Not a Lead/Lag master 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, 1=Turn on Lead Lag operation
022C	0556	Lead Lag CH demand switch	R/W	U16	0=Disable CH loop, 1=STAT terminal, 2=Reserved, 3=EnviraCOM remote STAT, 4=Modbus STAT (register 563)

Table 4. CB Falcon Modbus register map

022D	0557	Lead Lag CH setpoint source	R/W	U16	0=Local setpoint (register 546), 1=Modbus setpoint (register 562), 2=4-20mA setpoint (register 15)
022E	0558	Lead Lag modulation sensor	R/W	U16	Sensor used for Lead Lag modulation: 0=S5 sensor, 1=S10 sensor
022F	0559	Lead Lag modulation backup sensor	R/W	U16	Backup sensor used for Lead Lag modulation: 0=No backup sensor, 1=Outlet sensor from lead boiler, 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: -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: -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, 1=Call for heat
0234	0564	Slave mode	R/W	U16	0=Use first according to priority, 1=Equalize run-time, 2=Use last according to priority
0235	0565	Slave command	R/W	U16	Bit map: 15=Slave demand request, 14=Slave suspend startup, 13=Slave run fan request, 12=Turn on auxiliary pump X, 11=Turn on auxiliary pump Y, 10=Turn on auxiliary pump Z, 9=Reserved (always 0), 8=Commanded rate is binary fraction %[g], 7-0=Commanded rate[h]
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: 0=No port assigned, 1=MB1 (Local Modbus) port, 2=MB2 (Global Modbus) port
023A	0570	Slave demand to firing delay	R/W	U16	0-64800 seconds (18 hours), 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, 1-100% (in 0.1% units)[b]
023D	0573	Rate allocation method	R/W	U16	0=Parallel common base limited
023E	0574	Lead allocation method	R/W	U16	0=Sequence order rotation, 1=Lowest measured run time
023F	0575	Lag allocation method	R/W	U16	0=Sequence order rotation, 1=Lowest measured run time
		EXTENDED CH CONFIGURATION			
0241	0577	CH Modbus STAT	R/W	U16	Modbus call for heat (see register 209): 0=No call for heat, 1=Call for heat

Table 4. CB Falcon Modbus register map

0242	0578	CH setpoint source	R/W	U16	Source for CH setpoint: 0=Local setpoint (registers 211, 212, etc.), 1=Modbus setpoint (register 579), 2=4-20mA remote control (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), 1=Modbus binary fraction[i], 2=Modbus modulation step[h] 3=4-20mA modulation (register 15)
0245	0581	CH Modbus rate	R/W	U16	Commanded CH modulation rate[h] when source is Modbus (see register 580).
0246	0582	CH priority vs. Lead Lag	R/W	U16	0= Lead Lag > CH, 1=CH > Lead Lag
0247	0583	CH 4mA water temperature	R/W	U16	Temperature corresponding to 4mA signal input: -40°-130° (0.1°C precision)[a]
0248	0584	CH 20mA water temperature	R/W	U16	Temperature corresponding to 4mA signal input: -40°-130° (0.1°C precision)[a]
0249	0585	CH 4mA steam pressure	R/W	U16	Pressure corresponding to 4mA signal input: 0-150psi (0.1psi precision)
024A	0586	CH 20mA steam pressure	R/W	U16	Pressure corresponding to 4mA signal input: 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, 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, 1=Recycle&delay, 2=Recycle&delay with retry limit
0253	0595	Heat exchanger high limit delay	R/W	U16	0-64800 seconds (18 hours), 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			
		CONNECTOR CONFIGURATION			
0260	0608	S1 (J8-4) connector type (Inlet sensor)	R/W	U16	**SAFETY** parameter[f]: 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 7=4-20 mA

Table 4. CB Falcon Modbus register map

0261	0609	S2 (J8-6) connector type(4-20mA remote control input)	R/W	U16	**SAFETY** parameter[f]: 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 7=4-20 mA
0262	0610	S3S4 (J8-8, 10) connector type (Outlet dual sensor) (Outlet limit sensor and Outlet operation sensor)	R/W	U16	**SAFETY** parameter[f]: 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 7=4-20 mA
0263	0611	S5 (J8-11) connector type	R/W	U16	**SAFETY** parameter[f]: 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 7=4-20 mA
0264	0612	S6S7 (J9-1, 3) connector type (DHW dual sensor) (DHW limit sensor and DHW operation sensor)	R/W	U16	**SAFETY** parameter[f] 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 7=4-20 mA
0265	0613	S8S9 (J9-4, 6) connector type (Stack dual sensor) (Stack limit sensor and Stack operation sensor) (Stack limit sensor and Heat exchanger sensor)	R/W	U16	**SAFETY** parameter[f]: 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 7=4-20 mA
0266	0614	S10 (J10-7) connector type	R/W	U16	**SAFETY** parameter[f]: 0=Unconfigured, 1=Raw A2D counts, 2=10K NTC dual temperature, 3=10K NTC single temperature, 4=12K NTC single temperature, 5=0-15 psi pressure, 6 =0-150 psi pressure, 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.

Table 4. CB Falcon Modbus register map

0272	0626	Outdoor temperature source	R/W	U16	0=Unconfigured, 1=S5 connector, 2=S10 connector, 3=Modbus, 4=EnviraCOM sensor
0273	0627	Warm weather shutdown enable	R/W	U16	0=Disable, 1=Enable
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, 1=Enable
0276-02AF	0630-0687	RESERVED			
		DHW PLATE HEAT EXCHANGER CONFIGURATION			
02B0	0688	Plate preheat delay after tap	R/W	U16	0-64800 seconds (18 hours), 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), 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), 0xFFFF=Not configured
02B6	0694	Tap detect degrees	R/W	U16	Rate of temperature drop in DHW sensor when tap detection is declared: 0°-130° / second (0.1°C precision)[a]
02B7	0695	Tap detect on hysteresis	R/W	U16	0°-130° (0.1°C precision)[a]
02B8	0696	Tap detect on recognition time	R/W	U16	0-64800 seconds (18 hours), 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): 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): 0°-130° (0.1°C precision)[a]
02BB	0699	Tap detect minimum on time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
02BC-02BF	0700-0703	RESERVED			
		EXTENDED LEAD LAG CONFIGURATION			
02C0	0704	Lead Lag DHW demand switch	R/W	U16	0=DHW loop is disabled, 1=STAT terminal, 2=Reserved, 3=EnviraCOM DHW request, 4=Unused
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, 1=DHW > CH
02C3-02C6	0707-0710	RESERVED			
02C7	0711	Warm weather shutdown enable	R/W	U16	0=Disable, 1=Enable
02C8	0712	Warm weather shutdown setpoint	R/W	U16	-40°-130° (0.1°C precision)[a]

Table 4. CB Falcon Modbus register map

02C9	0713	Slave dropout/return compensation	R/W	U16	0=No slave compensation, 1=Replace dropout immediately, 2=Adjust rate for remaining slaves, 3=Both replace dropout & adjust rate
02CA	0714	Add stage method	R/W	U16	0=Do not add stage, 1=Use error threshold, 2=Use firing rate threshold, 3=Use error rate change & threshold, 4=Use firing rate change & threshold
02CB	0715	RESERVED			
02CC	0716	Add stage detection time	R/W	U16	0-64800 seconds (18 hours), 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%[2] (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), 0xFFFF=Not configured
02D3	0723	Drop stage method	R/W	U16	0=Do not drop stage, 1=Use error threshold, 2=Use firing rate threshold, 3=Use error rate change & threshold, 4=Use firing rate change & threshold
02D4	0724	RESERVED			
02D5	0725	Drop stage detection time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
02D6	0726	RESERVED			
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%[2] (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), 0xFFFF=Not configured
02DC	0732	RESERVED			
02DD	0733	Lead rotation time	R/W	U16	0-64800 minutes (1080 hours), 0xFFFF=Not configured
02DE	0734	Force lead rotation time	R/W	U16	0-64800 minutes (1080 hours), 0xFFFF=Not configured
02DF-02EF	0735-0751	RESERVED			
		EXTENDED PUMP CONFIGURATION			
02F0	0752	Auxiliary 1 pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
02F1	0753	Auxiliary 1 pump options 1	R/W	U16	Bit map: 15=Normal pump demand when auxiliary pump Z is set, 14=Normal pump demand when auxiliary pump Y is set, 13=Normal pump demand when auxiliary pump X is set, 12-7=Reserved (always 0), 6=Normal pump demand when DHW service is active, 5=Normal pump demand when CH service is active, 4=Reserved, 3=Normal pump demand when DHW demand, 2=Normal pump demand when CH demand, 1=Normal pump demand when local burner demand, 0=Local demand inhibited for faults

Table 4. CB Falcon Modbus register map

02F2	0754	Auxiliary 1 pump options 2	R/W	U16	Bit map: 15=Pump used for Lead Lag, 14=Pump used for local demand, 13-9=Reserved (always 0), 8=Force pump off when DHW high limit, 7=Force pump off when DHW anti-condensation, 6=Force pump off when CH anti-condensation, 5=Force pump off when DHW priority is active, 4=Force pump on when DHW frost protection, 3=Force pump on when CH frost protection, 2=Force pump on when Lead Lag slave demand, 1=Force pump on when local burner demand, 0=Force pump on when Outlet high limit
02F3	0755	Auxiliary 2 pump output	R/W	U16	0=None, 1=Pump A, 2=Pump B, 3=Pump C
02F4	0756	Auxiliary 2 pump control	R/W	U16	0=Auto, 1=On
02F5	0757	Auxiliary 2 pump start delay	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
02F6	0758	Auxiliary 2 pump overrun time	R/W	U16	0-64800 seconds (18 hours), 0xFFFF=Not configured
02F7	0759	Auxiliary 2 pump options 1	R/W	U16	Bit map: 15=Normal pump demand when auxiliary pump Z is set, 14=Normal pump demand when auxiliary pump Y is set, 13=Normal pump demand when auxiliary pump X is set, 12-7=Reserved (always 0), 6=Normal pump demand when DHW service is active, 5=Normal pump demand when CH service is active, 4=Reserved, 3=Normal pump demand when DHW demand, 2=Normal pump demand when CH demand, 1=Normal pump demand when local burner demand, 0=Local demand inhibited for faults
02F8	07600760	Auxiliary 2 pump options 2	R/W	U16	Bit map: 15=Pump used for Lead Lag, 14=Pump used for local demand, 13-9=Reserved (always 0), 8=Force pump off when DHW high limit, 7=Force pump off when DHW anti-condensation, 6=Force pump off when CH anti-condensation, 5=Force pump off when DHW priority is active, 4=Force pump on when DHW frost protection, 3=Force pump on when CH frost protection, 2=Force pump on when Lead Lag slave demand, 1=Force pump on when local burner demand, 0=Force pump on when Outlet high limit
02F9-033F	0761-0831	RESERVED			
		SAFETY CONFIGURATION			
0340-035F	0832-0863	RESERVED			
		LOCKOUT HISTORY			
0360-0370	0864-0880	Lockout history record 1	R		Most recent lockout. See Table 5.
0371-0381	0881-0897	Lockout history record 2	R		2nd newest lockout. See Table 5.
0382-0392	0898-0914	Lockout history record 3	R		3rd newest lockout. See Table 5.
0393-03A3	0915-0931	Lockout history record 4	R		4th newest lockout. See Table 5.
03A4-03B4	0932-0948	Lockout history record 5	R		5th newest lockout. See Table 5.
03B5-03C5	0949-0965	Lockout history record 6	R		6th newest lockout. See Table 5.
03C6-03D6	0966-0982	Lockout history record 7	R		7th newest lockout. See Table 5.
03D7-03E7	0983-0999	Lockout history record 8	R		8th newest lockout. See Table 5.
03E8-03F8	1000-1016	Lockout history record 9	R		9th newest lockout. See Table 5.
03F9-0409	1017-1033	Lockout history record 10	R		10th newest lockout. See Table 5.

Table 4. CB Falcon Modbus register map

040A-041A	1034-1050	Lockout history record 11	R		11th newest lockout. See Table 5.
041B-042B	1051-1067	Lockout history record 12	R		12th newest lockout. See Table 5.
042C-043C	1068-1084	Lockout history record 13	R		13th newest lockout. See Table 5.
043D-044D	1085-1101	Lockout history record 14	R		14th newest lockout. See Table 5.
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 9).
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-0FFF	0954-4095	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). A temperature that is NOT applicable in this Falcon, 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] 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). A temperature that is NOT applicable in this Falcon, i.e., not enabled, has a value of 0x8FFF. This temperature setting is denoted as “UNCONFIGURED” at the user interface. When
configured for raw a2d counts a range of 0-4095 counts is outputted with no error detection provided in the corresponding status register. When configured for 0-15 psi or 0-150 psi the value is expressed in 0.1 psi precision.

[e] Pump control changed in Falcon starting with application build 1600 (see register 189). Pump status changed as a result. Table 12 contains the status values for units prior to build 1600, and table 13 for build 1600 or later.

[f] 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 Falcon control afterwards to confirm that its new setting is consistent with the other safety parameters.

[g] 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.

[h] 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%).

[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 5.

Table 5. CB Falcon 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 Table 6.

Table 6. 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	

PII, LCI, and ILK terminals are named with configuration records that have a format described in Table 7.

Table 7. 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	

The Falcon lockout and hold codes are listed in Table 8.

Table 8. Falcon lockout and 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
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

Table 8. Falcon lockout and hold codes

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
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
71-77	RESERVED	
78	Demand lost in run	Hold
79	Outlet high limit	Hold/ Lockout
80	DHW high limit	Hold/ Lockout

Table 8. Falcon lockout and hold codes

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
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

Table 8. Falcon lockout and hold codes

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
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	

Table 8. Falcon lockout and hold codes

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
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	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

Table 8. Falcon lockout and hold codes

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
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	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
250-255	RESERVED	

Each alert log record has the format described in Table 9.

Table 9. Falcon alert log record

Byte Offset	Parameter	Read/ Write	Format	Note
0-1	Alert code	R	U16	See table 10.
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.

The Falcon alert codes are listed in Table 10.

Table 10. Falcon 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
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	Plug-In Module (PIM) was inserted into socket
32	Plug-In Module (PIM) was removed from socket
33	Alert PCB was configured
34	Parameter PCB was configured
35	Range PCB was configured
36	Plug-In Module (PIM) incompatible with product was inserted into socket
37	Program Module application parameter revision differs from application processor

Table 10. Falcon alert codes

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
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
71-73	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

Table 10. Falcon alert codes

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
89	RESERVED
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

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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
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	RESERVED
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
225-230	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
254	CH ODR outdoor temperature range was too small
255	CH ODR water temperature range was too small
256	Steam setpoint was invalid

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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 1
375	Abnormal Recycle: Hardware flame bias 2
376	Abnormal Recycle: Hardware flame bias 3
377	Abnormal Recycle: Hardware flame bias 4
378	Abnormal Recycle: Hardware flame bias 5
379	Abnormal Recycle: Hardware flame bias 6
380-450	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
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

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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
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

Table 10. Falcon alert codes

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

Burner control states are provided in Table 11.

Table 11. 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

The Falcon pump status codes are contained in the following two tables. Table 12 is for older units (application build less than 1600) and Table 13 is for newer units (application build 1600 or higher).

Table 12. 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	
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	

Table 12. Pump status codes (application build less than 1600)

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 13. 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	

Some holding registers contain variable length data, e.g., register 186 (OS number), that bend the normal 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 ONLY individually so that no confusion will exist about parameter boundaries*.

Register Writes

Data registers may require an access-level password before they can be changed (written) by the Modbus master. For data registers requiring access security, a password matching the one contained in the Falcon must be provided before the Falcon can allow the data to be changed. A valid password login remains in effect for 10 minutes before another login is required (Falcon 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. Owing to this text-length limitation, change to this register must be written individually and not as part of a group register write.

Results of the login are reported by the Falcon Modbus 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 Falcon Modbus. The register address of the first register (see Modbus register map in Figure 1) in the range is included in the request along with the number of registers to read. The Falcon Modbus 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.

06 (0x06) Write Single Register

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

*The standard Modbus protocol does not support the concept of variable length data. The Falcon 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.

16 (0x10) Write Multiple Registers

This function is used to write data into multiple Falcon registers with a single request. The Falcon 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, and the total number of bytes, followed by the actual data itself. The Falcon 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 as the number of bytes in the text data.

17 (0x11) Report Slave ID

This function is used to locate and identify the Falcons 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 a Falcon with the requested Modbus address exists, it responds to the request. If none exists, the Modbus master times out and concludes that no Falcon is present with that Modbus address.

Included in the Falcon response is the following data to further identify it:

- OS number
- Burner name

The format of the Falcon response message is depicted in Table 14.

Table 14. 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 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 Falcon parameters can be obtained with the Read Holding Register function.

The Run Indicator status contains an OFF status when the Falcon 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 Falcon hydronic boiler control models at this time. Future design may expand this list to include more IDs for different models.

Exception Codes

The Modbus exception codes in Table 15 may be given by the Falcon in response to function code requests.

Table 15. 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