



ARCONTROL™ Dual Pilot Flare Controller

USER MANUAL



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1 Introduction

Thank you for purchasing the ARControl, our most popular ignition package. This manual will provide you with important information that will help you understand the system, setup the system and how the system operates. Please keep the manual in an accessible location for future reference. At Cimmaron Energy Inc. we are always here to assist you with any service or spare part needs. Contact us at:

Phone: 1-844-746-1676

Website: <https://www.arcontrolbms.com>

1.1 Hardware Installation

The ARControl should be installed according to the directions provided in this manual and **always** be in compliance with local electrical codes and the specifications of the operating company. This section will cover general instructions regarding safety as well as specific wiring and materials required for the safe and successful operation of the ARControl.

WARNING!

Failure to comply with the following safety warning(s) may result in serious personal injury or death.

- Ensure the power is not connected until the final step of installation.
- Failure of the grounding system integrity can result in personal injury, damage, or failure of operation. The equipment must be grounded in accordance with instructions and devices and wiring connected to the controller must be according to the appropriate electrical code
- Ensure that no personnel nor any objects come into contact with the BMS module, terminals, or damaged coil wiring. The ignition coil can generate 38kV and is considered a hazard.
- If using an external power supply, do not power the ARControl with a supply rated for more than 24VDC.

NOTICE

Failure to comply with the following safety warning(s) may result in damage to the product.

- When installation is complete, ensure that the enclosure is properly sealed and the fasteners are tight. The enclosure will ensure that the internal components are not affected by moisture, ice, or debris.
- Disconnect and remove the battery during transportation or when the ARControl will not be operated for a period of time.

Follow these guidelines when installing the ARControl:

- A switch or circuit breaker must be included in the installation; it must be suitably located and easily reached. It must be marked as the disconnecting device for the equipment.
- Proper earth grounding per local electrical codes must be utilized in the installation.
- If the ARControl is used in a manner not specified by Cimarron Energy, Inc., the protection provided by the equipment may be impaired.
- If the BMS Module (1870-511) is used in conjunction with the ARControl it must be mounted externally of the ARControl in order for the ARControl to remain regulatory compliant.
- Use the hardware supplied with the ARControl. The hardware kit supplied with the ARControl contains an aluminum pre-drilled mounting bracket, and (4) 3/4-inch bolts and nuts.
- Locate the unit out of traffic and working areas, away from excessive heat, and above areas where water and liquids may accumulate. Visibility of the display will be enhanced if not facing direct sun.
- Measure the wiring distance. The ignition cable is restricted to a length of 25 feet maximum.

1.2 Ignition Types & Electrical Considerations

The ARControl Dual Pilot Flare Controller is compatible with two different igniter types, these include:

- Spark Igniter
- Hot Surface Igniter

These two igniter types require different hardware and system configurations.

1.2.1 Spark Ignition

Spark ignition utilizes up to two BMS modules to provide both spark ignition and thermocouple temperature input for flame detection (Image 1.2.2). Configuring the ARControl Dual Pilot Flare Controller to use spark ignition requires the following settings under the Igniter Sub-menu (Image 1.2.1) to be configured:

- Set **ENABLE** to **ENABLED**
- Adjust **IGNITION TIME** if necessary
- Adjust **PROVING TIME** if necessary
- Set **IGN SOURCE** to **SPARK**

See Section 3.2.1 Igniter Sub-menu for more detail regarding these settings.

	→	C	O	M	M	I	T		S	E	T	T	I	N	G	S			↵	
ENABLE		E	N	A	B	L	E	:		<			E	N	A	B	L	E	D	>
IGNITION TIME		I	G	N	I	T	I	O	N		T	I	M	E		=	<	1	0	>
PROVING TIME		P	R	O	V	I	N	G		T	I	M	E		=	<	0	5	0	>
IGN SOURCE		I	G	N		S	O	U	R	C	E	=	<	S	P	A	R	K		

Image 1.2.1 • Igniter sub-menu: Spark ignition settings

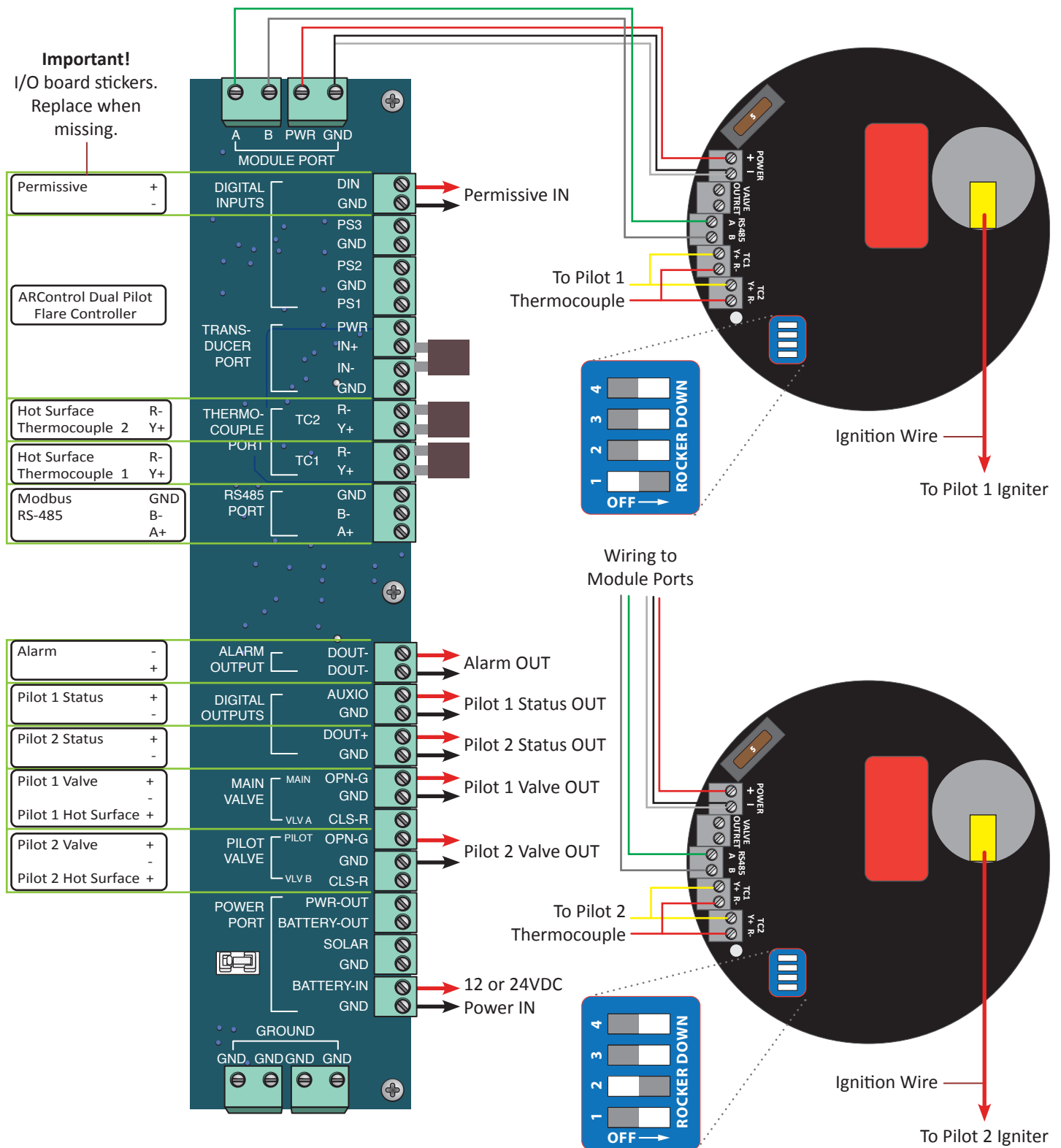


Image 1.2.2 • Dual spark ignition wiring diagram

1.2.2 Hot Surface Ignition

When using the ARControl Dual Pilot Flare Controller with hot surface igniters, the igniters should not be driven directly by the ARControl. The hot surface ignition outputs (Image 1.2.5) on the ARControl should be used to drive normally open high-current relays which in turn drive the hot surface igniters. **Important!** During selection of these relays, special consideration should be given to electrical load requirements and hazardous area classifications of the installation.

Hot surface ignition utilizes up to two 12 or 24VDC hot surface igniters to provide ignition of the pilot gas. The thermocouple inputs on the ARControl main board are used for flame detection in this configuration. Configuring the ARControl Dual Pilot Flare Controller to use hot surface ignition requires the following settings under the Igniter sub-menu to be configured (Image 1.2.3):

- Set **ENABLE** to **ENABLED**
- Adjust **IGNITION TIME** if necessary
- Adjust **PROVING TIME** if necessary
- Set **IGN SOURCE** to **HOT SURFACE**

See Section 3.2.1 Igniter Sub-menu for more detail regarding these settings.

	→	C	O	M	M	I	T		S	E	T	T	I	N	G	S			↵		
ENABLE		E	N	A	B	L	E	:		<			E	N	A	B	L	E	D	>	
IGNITION TIME		I	G	N	I	T	I	O	N		T	I	M	E		=	<	1	0	>	
PROVING TIME		P	R	O	V	I	N	G		T	I	M	E			=	<	0	5	0	>
IGN SOURCE		I	G	N		S	O	U	R	C	E		=	<	H	O	T		S	U	R

Image 1.2.3 • Igniter sub-menu: Hot surface ignition settings

1.2.3 BMS Module DIP Switches

The BMS Module DIP Switches (Image 1.2.4) are used to configure the BMS module’s address to 1 for Igniter 1 and 2 for Igniter 2. The address is set by toggling the BMS Module DIP switches on the BMS module. The white color depicts the portion of the switch that is pushed down. Addresses are entered in binary. For example, the address illustrated in the image below is one or 0001 in binary.

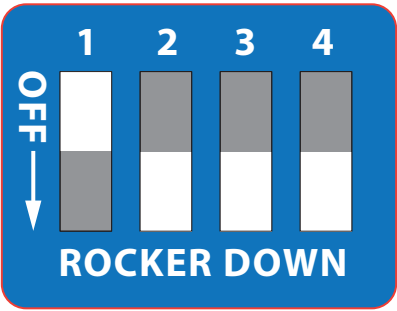


Image 1.2.4 • BMS module DIP switches

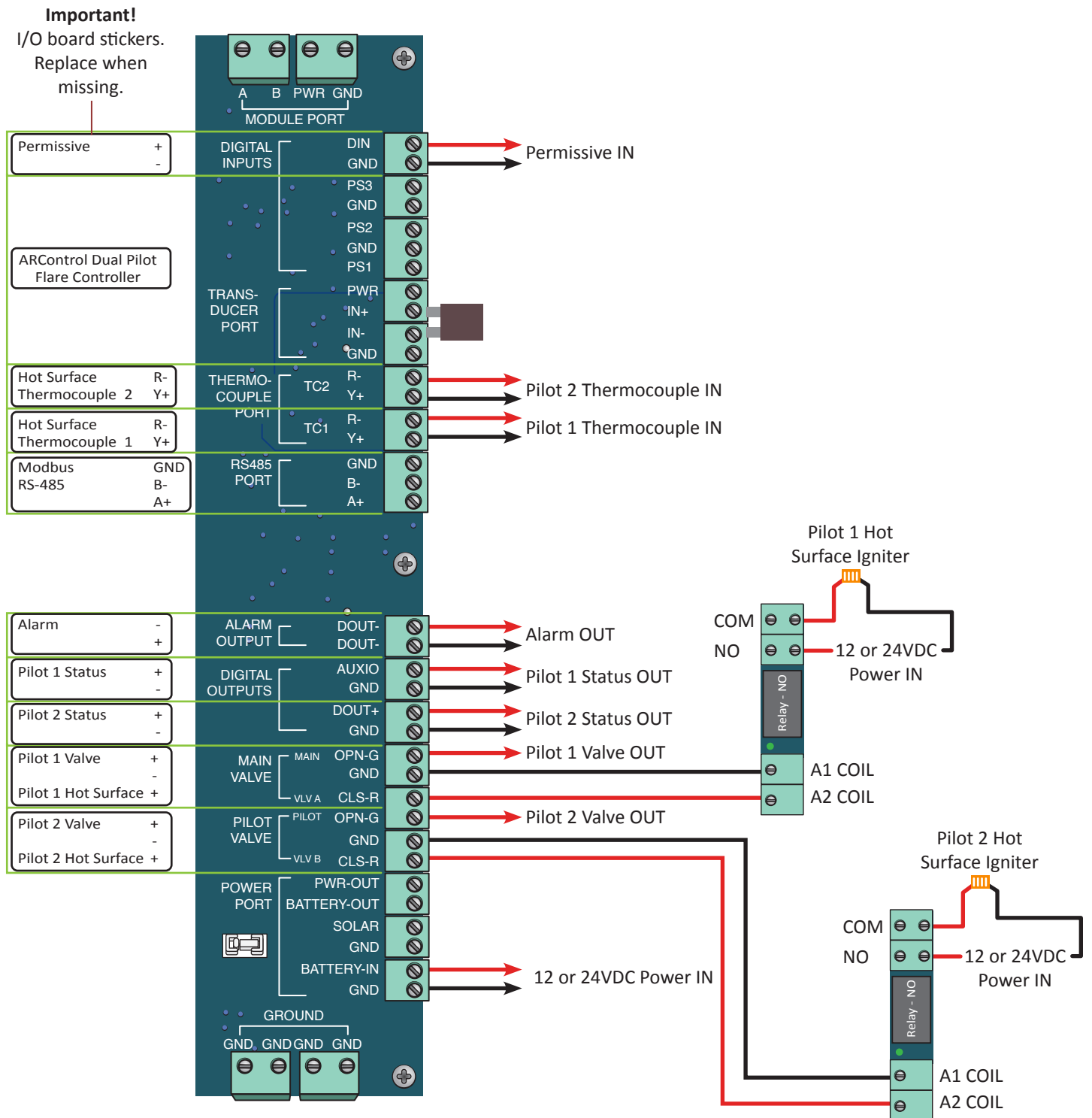


Image 1.2.5 • Dual hot surface ignition wiring diagram

1.3 Wiring for Operation

This section covers general wiring for most common applications. **Important!** All wiring should be done in accordance with local regulations and within the specifications of the site or equipment owner. If necessary, call Cimarron Energy at 1-844-746-1676 for assistance.

1.3.1 Connecting the Power

The ARControl is designed to operate from either 12 or 24 volt power supplies or batteries. Power supplies should be rated Class II and capable of sourcing a minimum of 2 amps. Batteries should be either 12 or 24 volt and have a minimum 12 Ah (amp-hour) capacity.

1.3.2 Connecting a Solar Panel and Battery (if required)

Solar Charing

The ARControl contains an integrated solar charger (Image 1.3.1). The solar charger is capable of charging a 12 volt 12 Ah SLA (sealed lead acid) battery. A solar panel rated for 12 volt systems with a maximum current output of 2 amps is recommended. Installations that require more charging current than provided by the internal solar charger should utilize a properly sized external solar charger and battery.

Battery Pack

The standard ARControl Power Pack (PN: 1960-160) contains a 12 volt 12 Ah SLA battery in a sturdy DIN-mountable bracket and a 5 watt 12 volt solar panel with 9 feet of cable and a mounting bracket (Image 1.3.2). **Note:** The ARControl Power Pack may not be sufficient for Hot Surface ignition installations. These systems will need to be sized properly.

The battery and bracket clips onto the bottom **DIN rail** in the ARControl enclosure. The solar panel can be mounted with a U-bolt to a pole or to any other structure that can accommodate the mounting holes. Be sure to locate the solar panel south facing in an area free from obstruction of the sun throughout the entirety of the day.

Fusing

The ARControl has three user-replaceable fuses. The fuse on the **DIN rail** mounted terminal block that connects to BATTERY IN on the ARControl utilizes a 5 amp ATC or ATO fuse. The ARControl board is fused at both the POWER PORT and MODULE PORT with 2 amp ceramic fuses (PN: 3181-002). The POWER PORT fuse protects all of the valve outputs and the digital outputs. The MODULE PORT fuse protects the power output to the BMS module. There are two spare 2 amp ceramic fuses located in the SPARE FUSES location on the ARControl board.

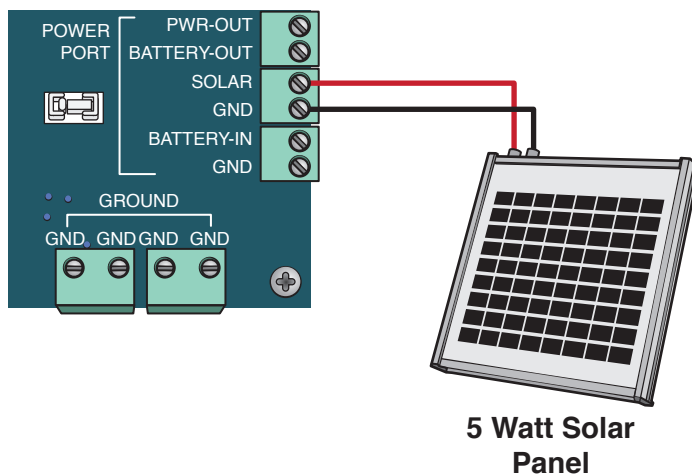


Image 1.3.1 • Solar panel wiring

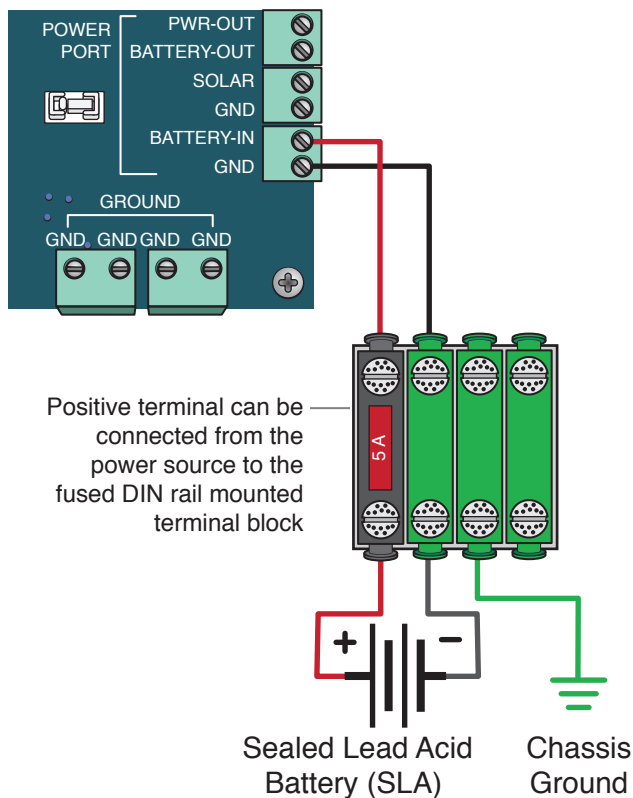


Image 1.3.2 • Battery pack wiring

1.3.3 Communication via Modbus RS-485

To use Modbus communication, use the RS-485 PORT on the board, attaching the A+ and B- wiring as well as the GND to the external PLC or communication device. Notifications of alarms can also be retrieved via Modbus (Image 1.3.4).

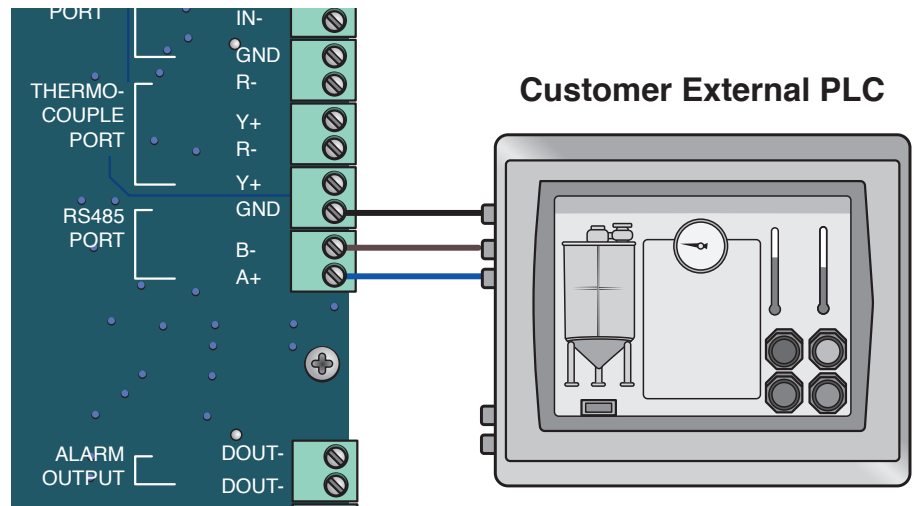


Image 1.3.4 • Modbus RS-485 wiring

1.3.4 Connecting the BMS module

The wiring from the BMS module is connected to the MODULE PORT at the top of the ARControl board. Install the thermocouple in parallel across inputs TC1 & TC2. Both thermocouple inputs must receive the same signal (Image 1.3.5)

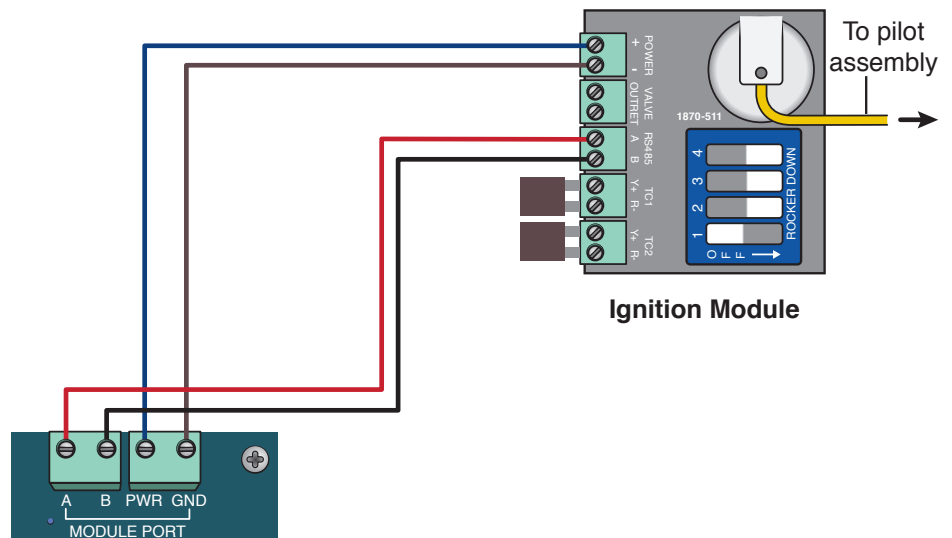


Image 1.3.5 • BMS module wiring

1.3.5 Permissive (DIN) Input

The **Permissive (DIN) Input** comes with a jumper installed from the factory. To use the **Permissive (DIN) Input**, remove the jumper and connect to an external PLC's dry contact switch output or some other external switch. The **Permissive (DIN) Input** is active when the circuit is open (Image 1.3.6).

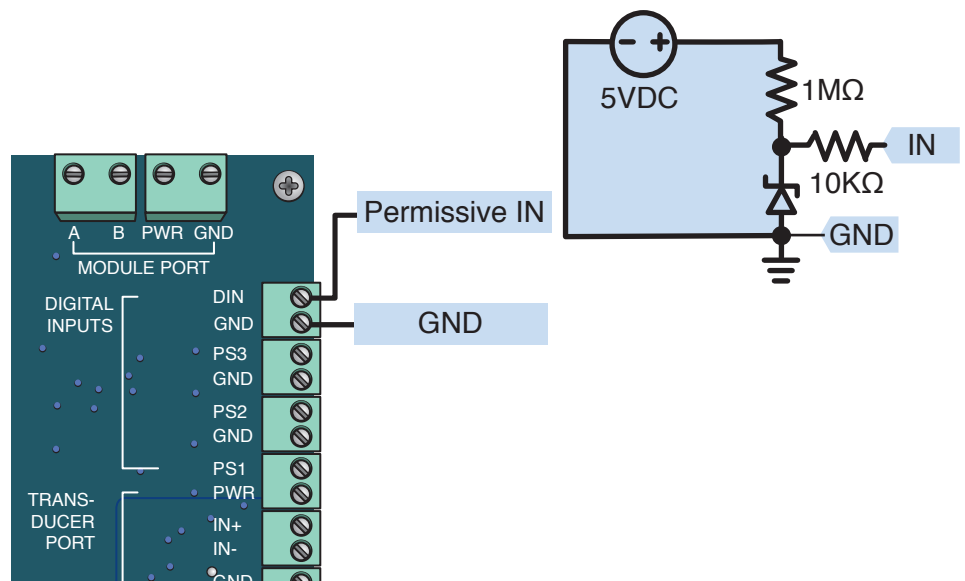


Image 1.3.6 • Permissive (DIN) input wiring

1.3.6 Pilot 1 & 2 Status

The status output indicates if the system is detecting flame at the pilot. This output sources power and can drive an indicator light or interface with an external PLC (Image 1.3.7).

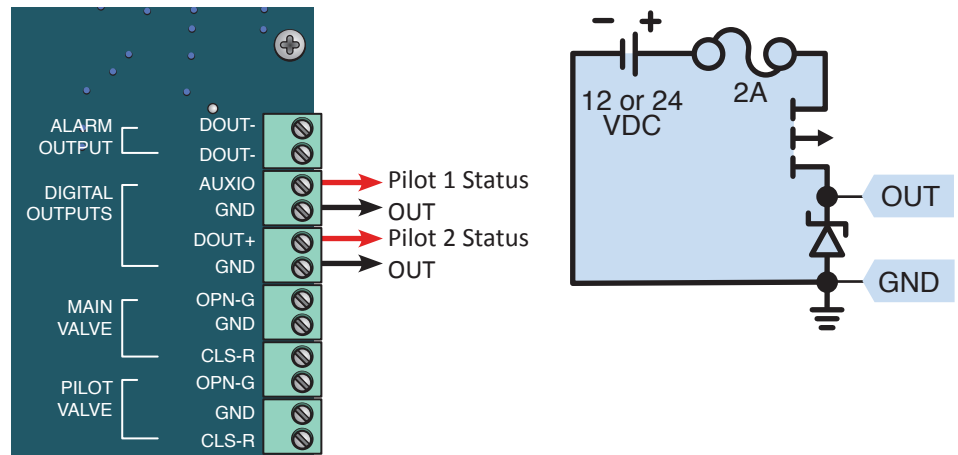


Image 1.3.7 • Pilot 1 & 2 status

1.3.7 Alarm Output

The alarm output is active when the ARControl is in an alarm state. The alarm behaves as a closed switch when it is active. External alarm circuitry should be limited to less than 50mA (Image 1.3.8).

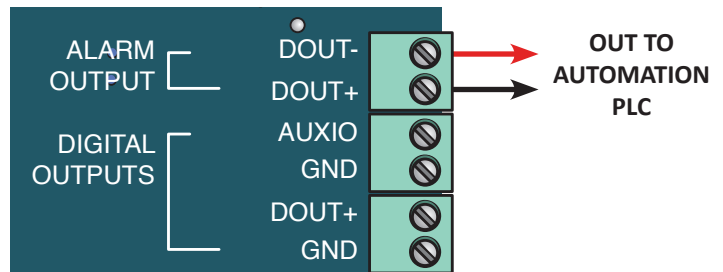
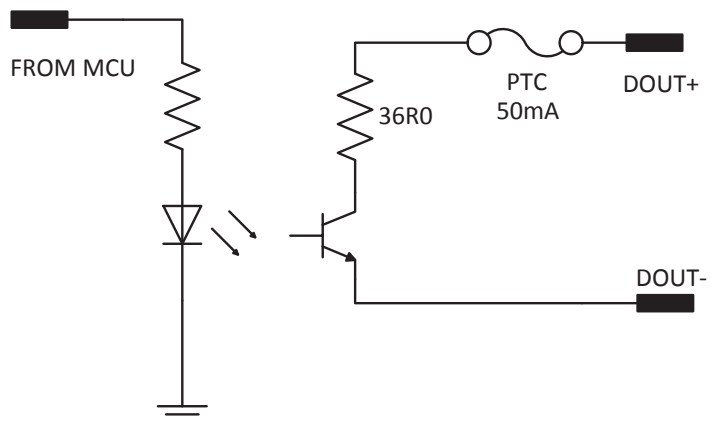


Image 1.3.8 • Alarm output inactive



Alarm output inactive/closed switch circuit diagram

2 System Overview

2.1 User Interface

The system user interface (Image 2.1.1) consists of a text display and seven keys (Table 2.1.1) that are used for menu navigation, selecting options on menu items and entering or exiting menus.

The text display provides information regarding menus, sub-menus, system modes, selectable options, current mode operation states and alarms. The text display features automatic shutoff after 60 seconds without user interaction through the keyboard. The automatic shutoff feature helps save power which is especially important in remote installations that are solar powered.

Pressing any key will wake up the text display and bring it to the top of the Main menu. If the **STOP** key is pressed while the text display is off, it will both send the unit in to the **STOP** state and wake up the text display. Additionally, if the system enters in any of the alarm states (see section 4 System Operation for further information on alarm states) this will also wake up the text display.

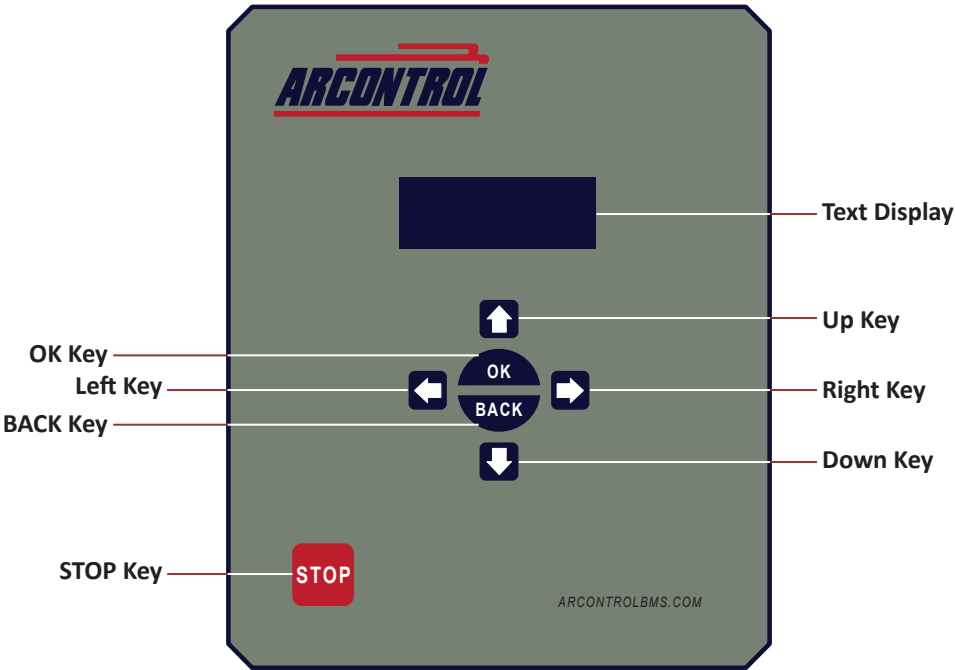


Image 2.1.1 • System user interface

KEY	USE	DESCRIPTION
Up	Use to scroll up menu items	
Down	Use to scroll down menu items	
Left	Use to toggle through selectable options	Selectable options are shown between angle brackets < >
Right	Use to toggle through selectable options	Selectable options are shown between angle brackets < >
OK	Use to enter a sub-menu and select or enter menu item choice	The OK key allows the entering of menu item actions and choices, and to and accept or deny system confirmation screens.
BACK	Use to exit a selected sub-menu or cancel / deny prompts	
STOP	Use to put the system in STOP state	The STOP key interrupts any current operation and sends the system to the STOPPED state.

Table 2.1.1 • User interface keys

2.2 System Splash Window

When the system powers up the System Splash window (Image 2.2.1) will appear for 2 seconds. The splash window contains the company name, system name and finally the system’s firmware identification version number and revision level.

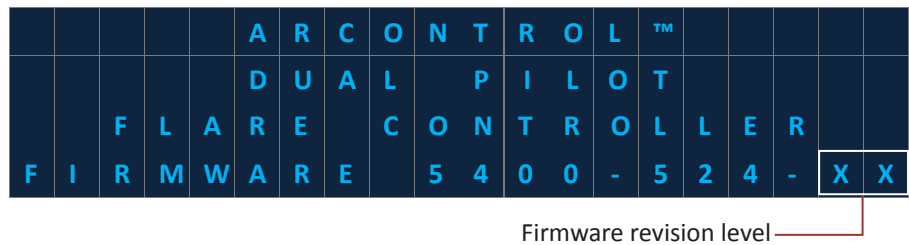


Image 2.2.1 • System splash window

2.3 System Menu

After power up, the **System Menu** is shown in the text display (Image 2.3.1). The menu is composed of two rows reporting the current state of each pilot igniter, two rows displaying additional information for each state for each respective pilot igniter, two rows displaying thermocouple temperature readouts for each respective pilot igniter, one row for battery and solar panel voltages, and finally, two rows for accessing the settings and service information sub menus.

The rows with additional information for each state display information such as countdowns of the **IGNITION** and **PROVING PILOT** states, duration of the **PILOT ON** state, and the command to ‘Start Ignition’ or clear an alarm for each respective pilot.

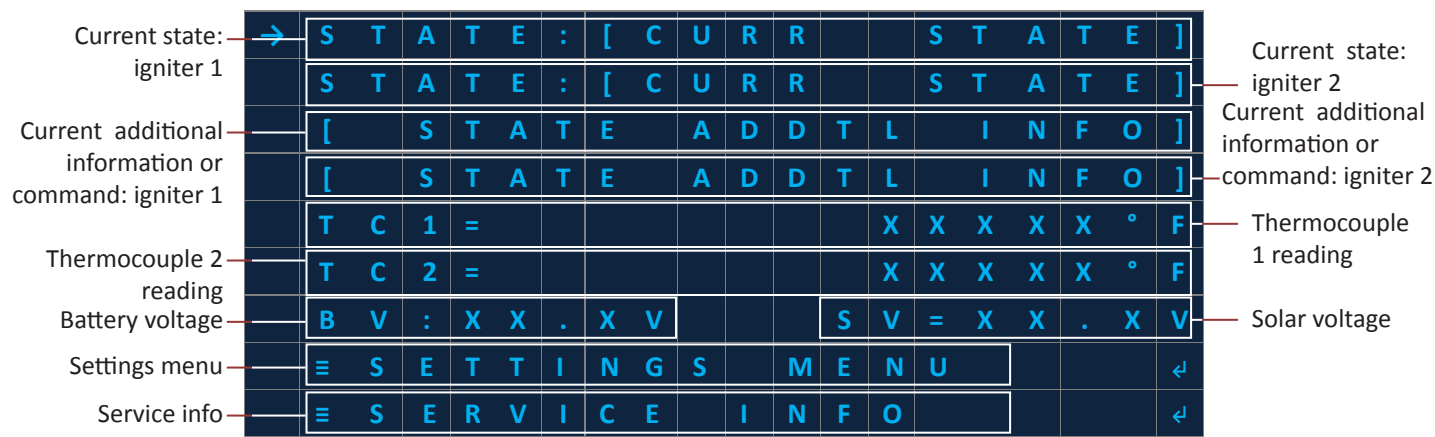


Image 2.3.1 • System menu

The symbols shown in the **System Menu** signify the following:

- Indicates current menu selection
- ≡ Indicates a sub-menu
- ↵ Indicates an actionable menu item
- < > Indicates a user selectable option
- [] Indicates dynamic text related to user selection
- X X X X X X . X Indicates placeholders for numerical values

System sub-menus are used to configure the individual pilot igniters, enable or disable the igniters , set the time and date, clear data logs, set the site name and reset the unit to the factory defaults. Detailed information on system sub-menus is found in Section 3.2 System Sub-menus.

The following is a description of each menu item and the text shown on the text display (Tables 2.3.1 - 2.3.7).

MENU ITEM	FUNCTION	STATE	TEXT DISPLAY
CURRENT STATE	Reports the current operational state of the two pilot igniters	UNKNOWN	UNKNOWN
		STOPPED	STOPPED
		IGNITE	IGNITE
		PILOT ON	PILOT ON
		PROVING PILOT	PROVING PILOT
		IGNITE RETRY	IGNITE RETRY
		PERMISSIVE ON	PERMISSIVE ON
		LOW BATTERY	LOW BATTERY
		TC OPEN	TC OPEN
		LOCKOUT	See BMS Lockout Types table 2.6.3

Table 2.3.1 • CURRENT STATE of pilot igniter's

MENU ITEM	FUNCTION	STATE	TEXT DISPLAY	DESCRIPTION
STATE ADDITIONAL INFORMATION OR COMMAND	Reports countdown or duration information about the current state or allows user interaction with the current state.	STOPPED	START IGNITION	Prompt to start ignition
		PILOT ON	DDDDDDDD:hh:mm:ss	Duration in Pilot On state "Days : hours : minutes : seconds" format
		IGNITE	mm:ss	Ignition countdown "minutes : seconds" format
		PROVING PILOT	mm:ss	Proving Pilot countdown "minutes : seconds" format
		IGNITE RETRY	mm:ss	Ignition Retry countdown "minutes : seconds" format
		IGNITER X DISABLED	"x" is 1 or 2 depending on the igniter	Igniter is disabled. The state that is displayed is State: STOPPED
		FLAME ROD, BMS WARNING, BMS TC, SERVICE BMS	CLEAR ALARM	Prompt to clear alarm

Table 2.3.2 • STATE ADDTL INFO of pilot igniter's

MENU ITEM	FUNCTION	TEXT DISPLAY
THERMOCOUPLE 1 READING	Reports the current thermocouple 1 temperature.	TC1= XXXXX °F

Table 2.3.3 • TC1 reading

MENU ITEM	FUNCTION	TEXT DISPLAY
THERMOCOUPLE 2 READING	Reports the current thermocouple 2 temperature.	TC2= XXXXX °F

Table 2.3.4 • TC2 reading

MENU ITEM	FUNCTION	TEXT DISPLAY
BATTERY and SOLAR VOLTAGE	Reports the current battery and solar input voltages.	BV:XX.XV SV=XX.XV

Table 2.3.5 • BATTERY and SOLAR VOLTAGE reading

MENU ITEM	FUNCTION	TEXT DISPLAY
SETTINGS MENU	Navigates to the settings sub-menus.	SETTINGS MENU

Table 2.3.6 • SETTINGS MENU

MENU ITEM	FUNCTION	TEXT DISPLAY
SERVICE INFO	Navigates service and diagnosis information menu.	SERVICE INFO

Table 2.3.7 • SERVICE MENU

2.4 Thermocouple TC1 & TC2

TC1 is the temperature readout of thermocouple 1 and TC2 is the temperature readout of thermocouple 2. The readout is always in degrees Fahrenheit. If a jumper is connected, the readout will display the ambient temperature. If TC1 and/or TC2 is not connected and the jumper is not in place the display will show the Overflow condition (Table 2.4.1). This helps identify a possible open thermocouple.

CONDITION	TEXT
Overflow	TC1= or TC2= + ∞ °F
Underflow	TC1= or TC2= - ∞ °F
Normal	TC1= or TC2= XXXXX °F

Table 2.4.1 • TC1 & TC2 conditions

2.5 Service Info Menu

The Service Info Menu (Image 2.5.1) displays contact information for the sales and service department, the state of the Permissive Input, battery and solar voltages, the firmware version and revision, and the firmware CRC (cyclic redundancy check). The firmware version, revision, and CRC are necessary to provide to service so that they can best serve you.

	→	F	O	R	S	E	R	V	I	C	E	C	A	L	L		
		1	-	8	4	4	-	7	4	6	-	1	6	7	6		
Firmware ID number		F	W						5	4	0	0	-	5	2	4	- X X
		P	E	R	M	I	S	S	I	V	E	=			C	L	O S E D
Battery voltage		B	A	T	T	E	R	Y	=						X	X	. X V
		S	O	L	A	R			=						X	X	. X V
Firmware CRC value		C	R	C					=			X	X	X	X	-	X X X X

Image 2.5.1 • Service info menu

2.6 State Scopes

The ARControl Dual Pilot Flare Controller ignites and monitors up to two pilots on a single flare. Each pilot that the ARControl Dual Pilot Flare Controller controls is referred to as a pilot igniter instance. Each pilot igniter instance has operation and alarm states. Operation states include **STOPPED**, **IGNITE**, **PILOT ON**, **PROVING PILOT**, **IGNITE RETRY**. Alarm states include **PERMISSIVE ON**, **LOW BATTERY**, **TC OPEN** and **LOCKOUT** (Table 2.6.1).

STATE	STATE NAME	STATE DESCRIPTION	IGNITER	VALVE OUTPUT	PILOT STATUS OUTPUT	ALARM OUTPUT
0	UNKNOWN	Startup state before application initialized.	Inactive	Inactive	Inactive	Inactive
1	STOPPED	Ignition off and valve closed. Waiting for command to start igniting. System function halted.	Inactive	Inactive	Inactive	Inactive
2	IGNITE	Ignition on for set Ignition Time.	Active	Active	Inactive	Inactive
3	PILOT ON	Flame detected.	Inactive	Active	Active	Inactive
4	PROVING PILOT	Waiting for Pilot High Level to be reached to detect flame.	Inactive	Active	Inactive	Inactive
5	IGNITE RETRY	Ignition on for set Ignition Time.	Active	Active	Inactive	Inactive

Table 2.6.1 • Pilot igniter instance state descriptions (note: table continued on next page)

STATE	STATE NAME	STATE DESCRIPTION	IGNITER	VALVE OUTPUT	PILOT STATUS OUTPUT	ALARM OUTPUT
6	PERMISSIVE ON	Permissive Input (DIN) circuit is open. System function halted.	Inactive	Inactive	Inactive	Active
7	LOW BATTERY	Low battery detected. System function halted.	Inactive	Inactive	Inactive	Active
8	TC OPEN	ARControl thermocouple is circuit is open.	Inactive	Inactive	Inactive	Active
9	LOCKOUT	Ignition module error detected. System function halted.	Inactive	Inactive	Inactive	Active

Table 2.6.1 • Pilot igniter instance state descriptions (continued)

Operation and alarm states both have two categories of scopes, **Instance Scope** and **Global Scope** (Table 2.6.2). A state falls into the **Instance Scope** category if the conditions and actions of the state only affect their respective pilot igniter instance. If the conditions and actions of the state affect both Pilot Igniter Instances and the system as a whole, then the state is in the **Global Scope** category.

There is one state, **STOPPED**, that is both an **Instance Scope** and **Global Scope** state. Pilot igniter instances always enter the **STOPPED** state together but can exit independently.

INSTANCE SCOPES	GLOBAL SCOPES
STOPPED	STOPPED
IGNITE	PERMISSIVE ON
PILOT ON	LOW BATTERY
PROVING PILOT	
IGNITE RETRY	
TC OPEN	
LOCKOUT	

Table 2.6.2 • Instance & Global scope states

2.6.1 Instance Scope States

IGNITE state

While a pilot igniter instance is in the (A) **IGNITE** state (Image 2.6.1), its respective igniter is active. If the instance is configured to use spark ignition, then its ignition module will be sparking. If the instance is configured to use hot surface ignition, then its hot surface ignition driver will be energized.

The pilot igniter instance will ignite for the Ignition Time set in its respective **IGNITER** sub-menu. This ignition time will be counted down, which is displayed in the respective State Additional Information row on the System Menu.

If the pilot igniter instance detects flame before the Ignition Time is expired, it will transition to the (B) **PILOT ON** state. If flame is not detected once the Ignition Time is expired, it will transition to the (C) **PROVING PILOT** state.

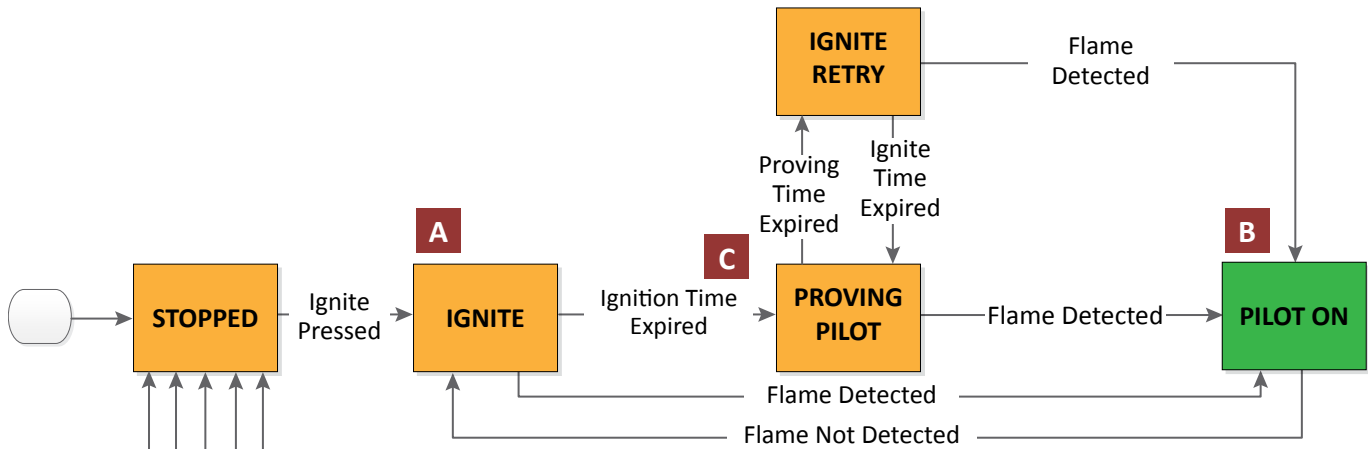


Image 2.6.1 • Pilot igniter instance - **IGNITE** state

PROVING PILOT state

While a pilot igniter instance is in the (A) **PROVING PILOT** state (Image 2.6.2), it is waiting for flame to be detected.

The pilot igniter instance will continue to check if flame is detected for the Proving Time set in its respective **IGNITER** sub-menu. This proving time will be counted down, which is displayed in the respective State Additional Information row on the System Menu.

If flame is detected before the Proving Time is expired, the pilot igniter instance will transition to the (B) **PILOT ON** state. If flame is not detected once the Proving Time has expired, it will transition to the (C) **IGNITE RETRY** state.

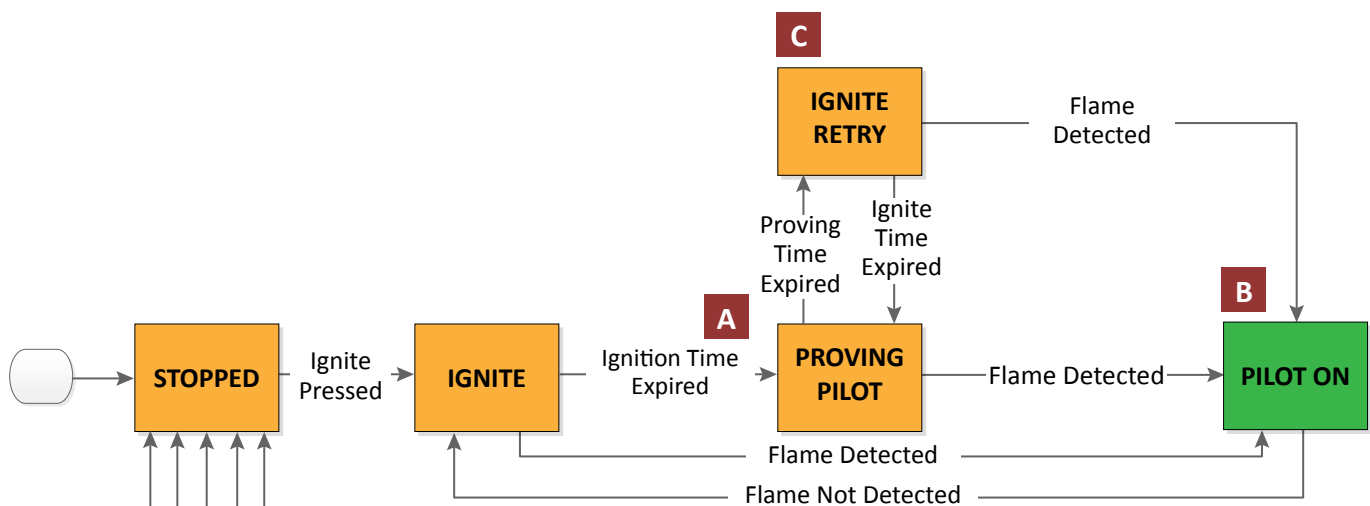


Image 2.6.2 • Pilot igniter instance - **PROVING PILOT** state

PILOT ON state

While a pilot igniter instance is in the (A) **PILOT ON** state (Image 2.6.3), flame is detected. The time that the instance is in the **PILOT ON** state is accumulated and displayed in the respective State Additional Information row on the System Menu.

If flame is not detected, the pilot igniter instance will begin to verify that flame remains undetected for five seconds. If the flame remains undetected for the entire five seconds, the instance will transition to the (B) **IGNITE** state. If flame is detected before the five seconds expires, the instance will remain in the (C) **PILOT ON** state.

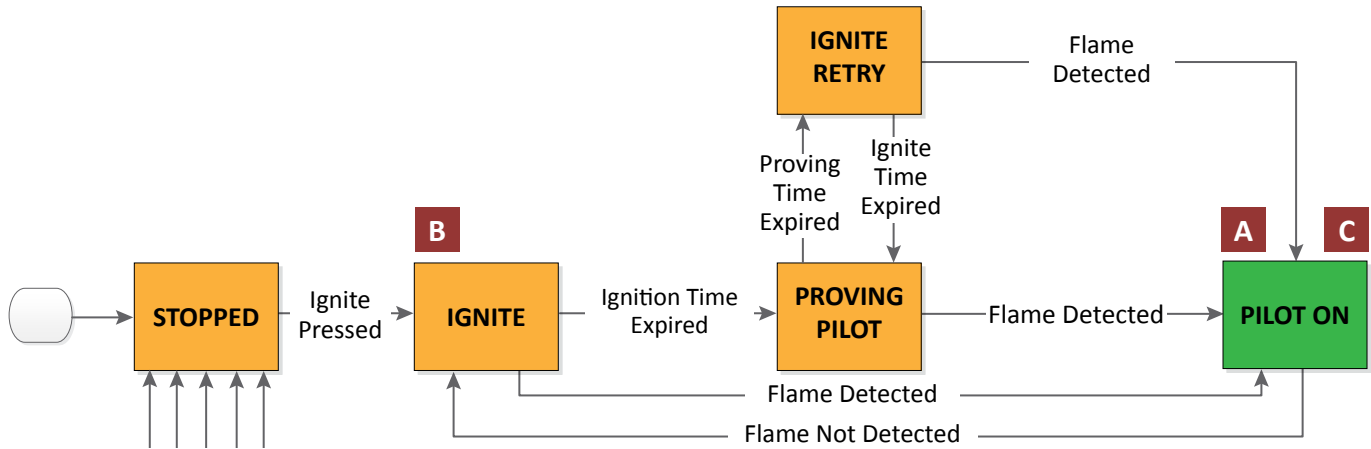


Image 2.6.3 • Pilot igniter instance - **PILOT ON** state

IGNITE RETRY state

While a pilot igniter instance is in the (A) **IGNITE RETRY** state (Image 2.6.4), its respective igniter is active. If the instance is configured to use spark ignition, then its ignition module will be sparking. If the instance is configured to use hot surface ignition, then its hot surface ignition output will be energized.

The pilot igniter instance will ignite for the Ignition Time set in its respective Igniter sub-menu. This ignition time will be counted down, which is displayed in the respective State Additional Information row on the System Menu.

If the pilot igniter instance detects flame before the Ignition Time is expired, it will transition to the (B) **PILOT ON** state. If flame is not detected once the Ignition Time is expired, it will transition to the (C) **PROVING PILOT** state.

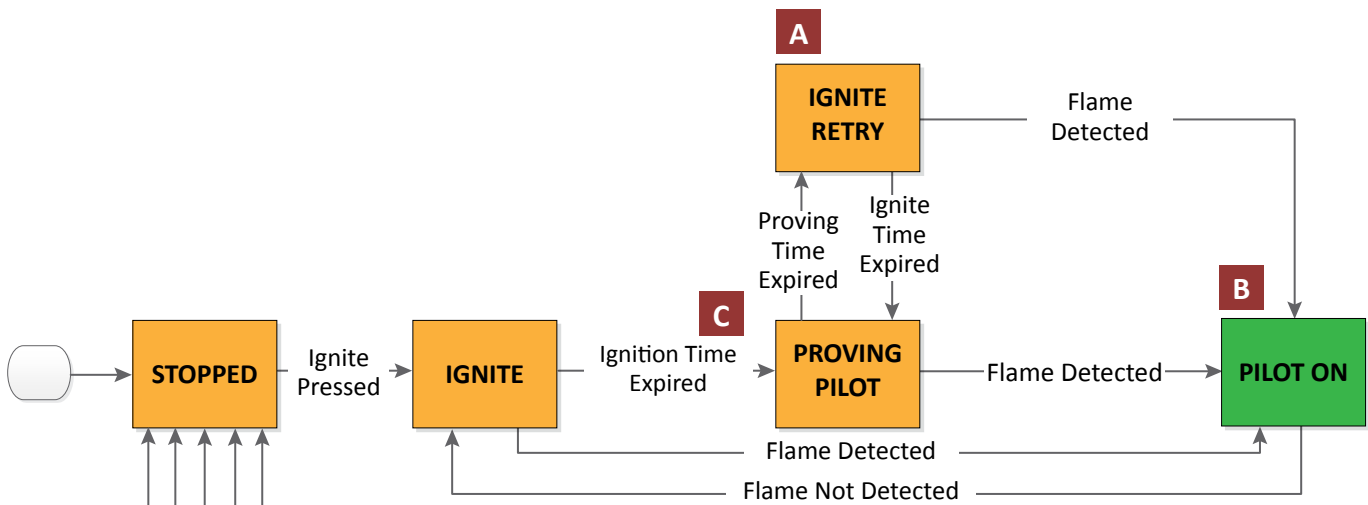


Image 2.6.4 • Pilot igniter instance - **IGNITE RETRY** state

TC OPEN state

A pilot igniter instance is in the (A) **TC OPEN** state if a thermocouple was or is currently open (Image 2.6.5). **TC OPEN** is an alarm state. The instance will remain in the **TC OPEN** state until the thermocouple is repaired and the alarm is cleared. After the thermocouple is repaired and lockout cleared (B) the pilot igniter instance will then transition to the (C) **STOPPED** state.

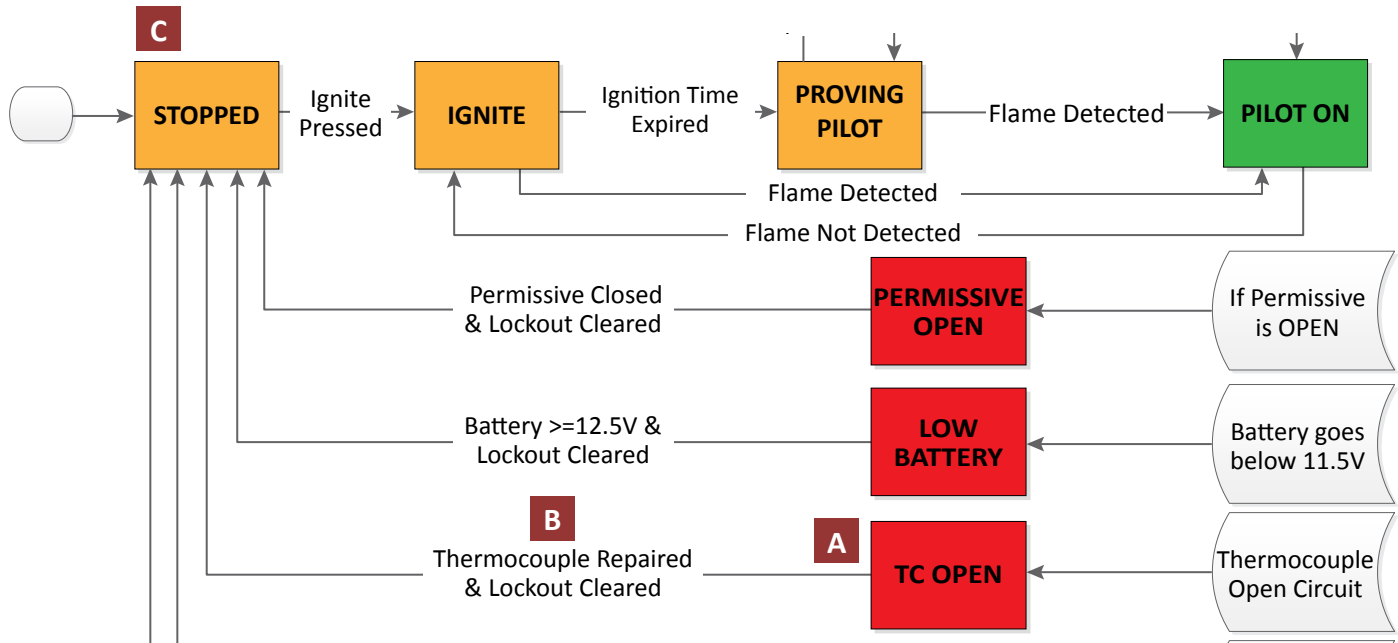


Image 2.6.5 • Pilot igniter instance - TC OPEN state

LOCKOUT state

A pilot igniter instance is in the (A) **FLAME ROD, BMS WIRING, BMS TC, or SERVICE BMS** state if either of these issues was or is currently present (Image 2.6.6). These are all alarm states. The pilot igniter instance will remain in any of these states until the issue is corrected and the alarm state is cleared. After the issue is repaired and lockout cleared (B) the pilot igniter instance will then transition to the (C) **STOPPED** state. See Table 2.6.3 for more information on BMS lockout types.

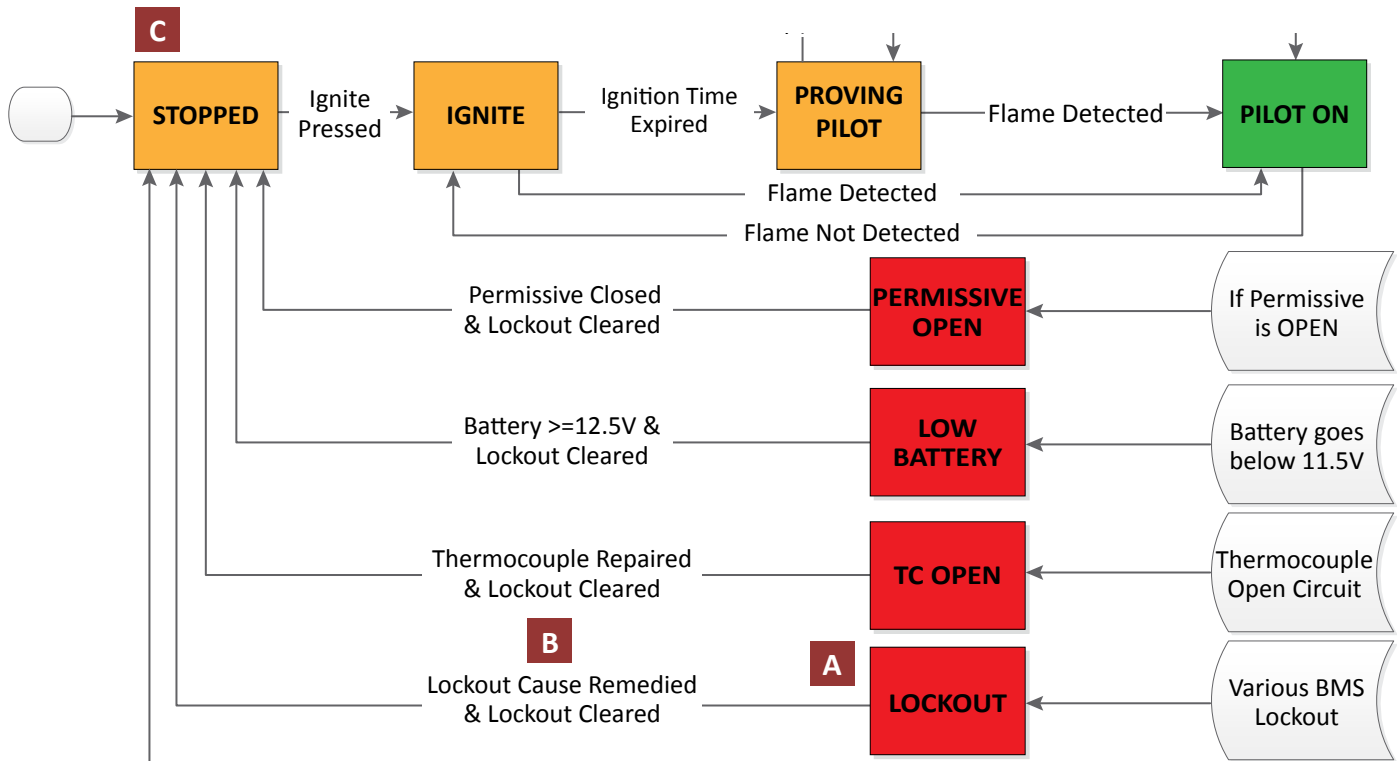


Image 2.6.6 • Pilot igniter instance - LOCKOUT state

LOCKOUT TYPE	EVENT
BMS FLAME ROD	Flame sense error. Check ignition cable, igniter, and grounding.
BMS WIRING	Communication with BMS module lost. Check wiring.
BMS TC	Thermocouple circuit opened, shorted, or reading too high. Check thermocouple.
SERVICE BMS	BMS module fault. Verify installation and reset power.

Table 2.6.3 • BMS lockout types

2.6.2 Global Scope States

PERMISSIVE ON state

The system is in the (A) **PERMISSIVE ON** state if the Permissive Input was or is currently active (Image 2.6.7). The **PERMISSIVE ON** state is an alarm state. The system will remain in the **PERMISSIVE ON** state until the Permissive Input becomes inactive and the alarm is cleared (B). After clearing the alarm, both pilot igniter instances will transition to the (C) **STOPPED** state.

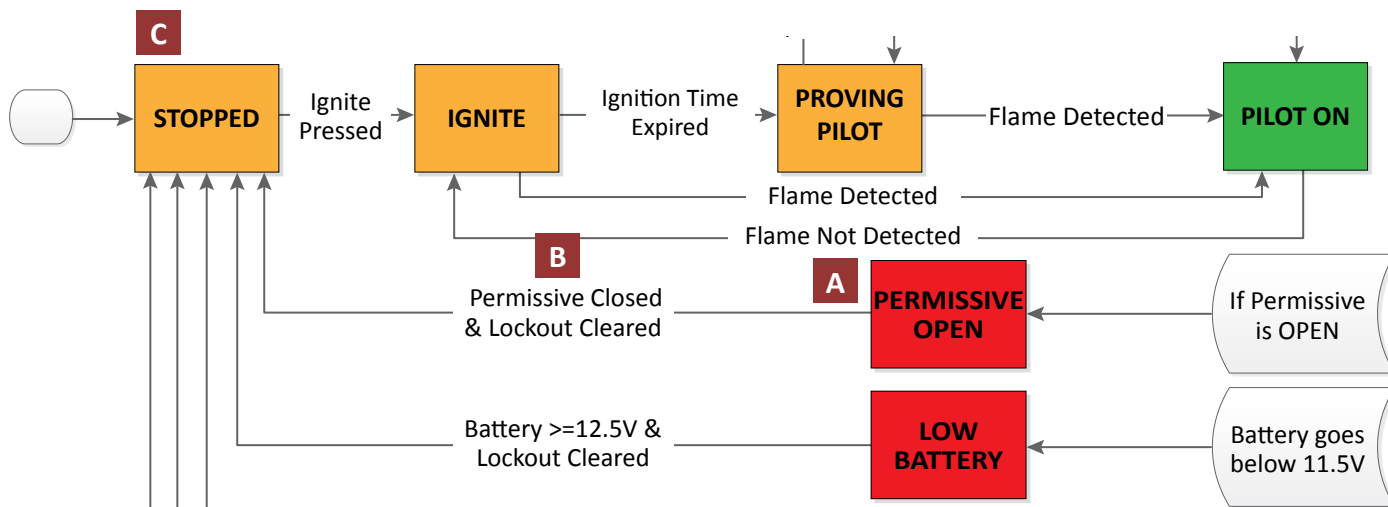


Image 2.6.7 • Pilot igniter instance - **PERMISSIVE ON** state

LOW BATTERY state

The system is in the (A) **LOW BATTERY** state if the battery is below 11.5V (23V for a 24VDC system) (Image 2.6.8). The **LOW BATTERY** state is an alarm state. The system will remain in the **LOW BATTERY** state until the battery voltage is above 12.5V (25V for a 24VDC system) and the alarm is cleared (B). After clearing the alarm, both pilot igniter instances will transition to the (C) **STOPPED** state.

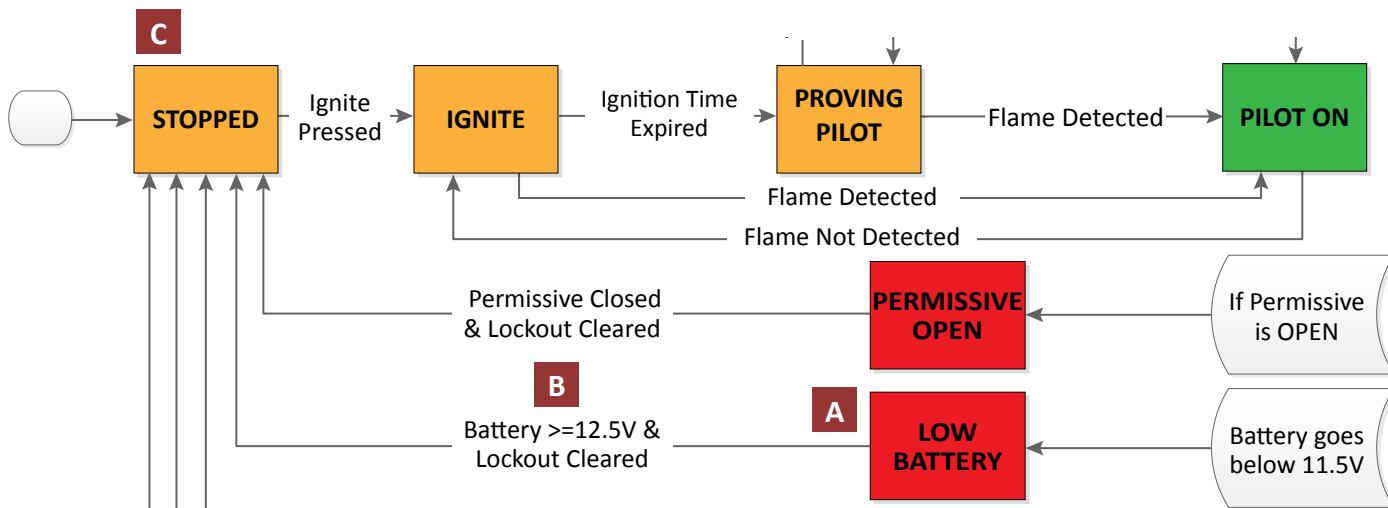


Image 2.6.8 • Pilot igniter instance - **LOW BATTERY** state

STOPPED state

The **STOPPED** state has *both* instance and global scopes (Image 2.6.9). Pilot igniter instances always enter the (A) **STOPPED** state together but can exit independently. The system is in the **STOPPED** state if the unit is reset, power-cycled, or the **STOP** button is pressed (B).

A pilot igniter instance is in the **STOPPED** state if an alarm has been cleared. A pilot igniter instance can exit the **STOPPED** state if it receives the **START IGNITION** command (C). An instance or a global alarm can cause a pilot igniter instance to exit the **STOPPED** state and transition to the respective alarm state.

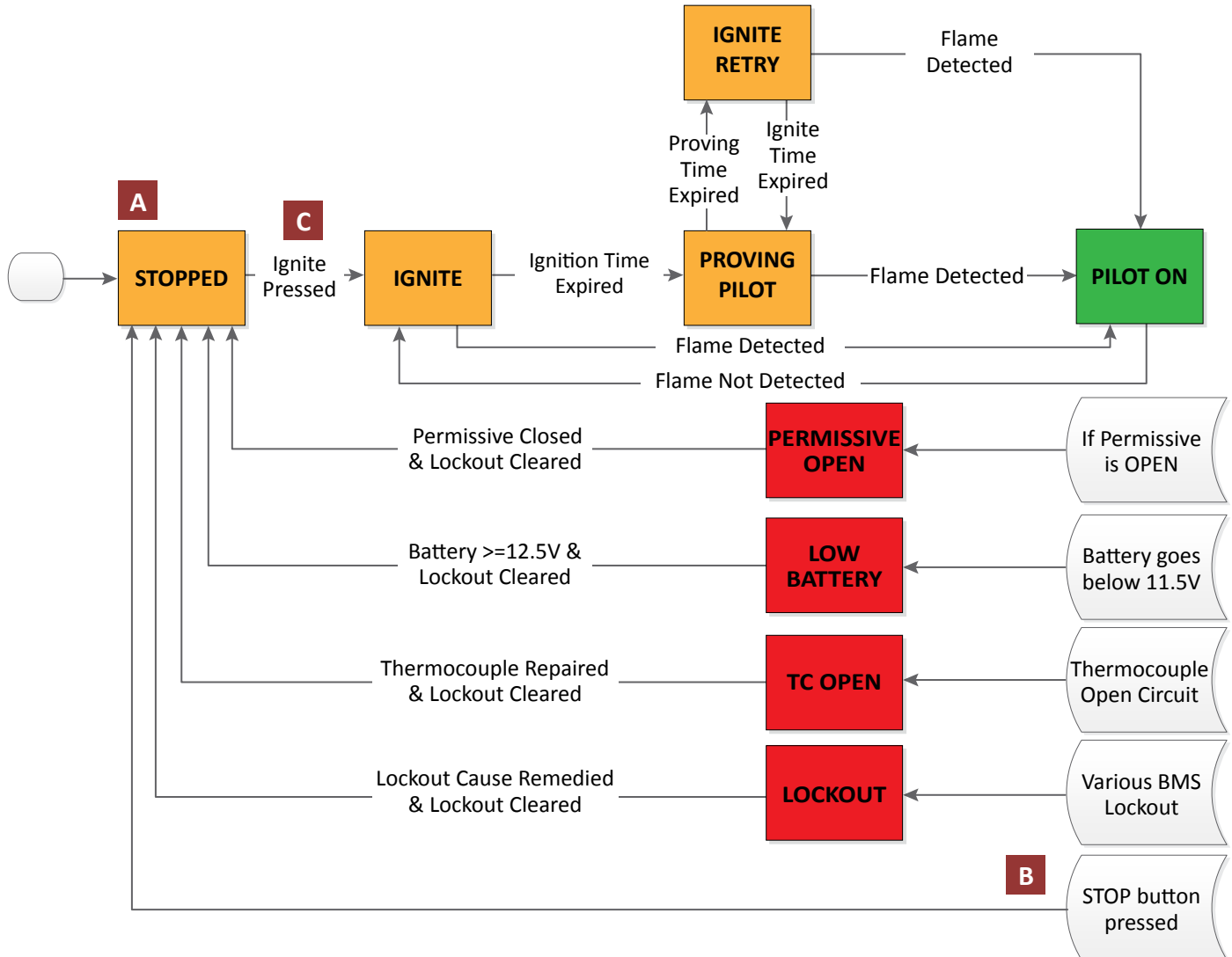


Image 2.6.9 • Pilot igniter instance - **STOPPED** state

2.7 Inputs and Outputs

2.7.1 Valves

The ARControl Dual Pilot Flare Controller drives one valve per pilot igniter instance. When driving a valve, the valve is only active during the **IGNITE**, **PROVING PILOT**, **PILOT ON**, and **IGNITE RETRY** states. In any other state the valve is inactive.

2.7.2 Flame Detection

The ARControl Dual Pilot Flare Controller detects flame using the input temperature reading from each pilot igniter instance's respective thermocouple (Image 2.7.1). The input temperature is compared to the ON °F and OFF °F settings in pilot igniter instance's **Pilot Temperature** sub-menu.

If input temperature is greater than or equal to the ON °F setting, then the pilot flame for that instance is said to be 'detected'. If the pilot flame has been detected it will remain detected until the input temperature transitions to or below the OFF °F setting. Then the pilot flame is said to be 'undetected'.

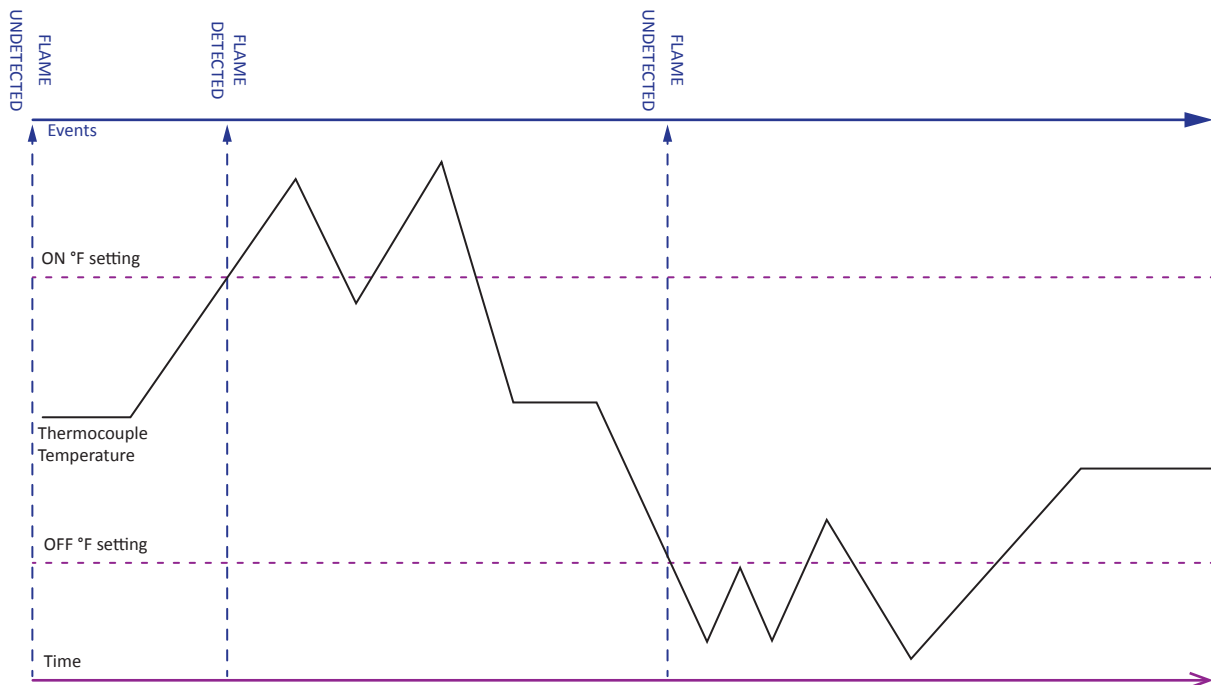


Image 2.7.1 Flame detection hysteresis

If spark ignition is selected for a pilot igniter instance, then the thermocouple input on the ARControl board is used.

If hot surface ignition for a pilot igniter instance, then the thermocouple input on the ignition module is used. The unused thermocouple input on the ignition module is jumped in parallel with the used thermocouple input.

2.7.3 Pilot Status Outputs

The ARControl Dual Pilot Flare Controller drives one pilot status output per pilot igniter instance. When a pilot igniter instance is in the **PILOT ON** state its respective pilot status output is energized.

2.7.4 Alarm Output

The alarm output on the ARControl Dual Pilot Flare Controller is active when any alarm state (**PERMISSIVE ON**, **LOW BATTERY**, **TC OPEN**, or a BMS Module Lockout) is present.

2.7.5 Permissive Input

The permissive input on the ARControl Dual Pilot Flare Controller is active when it detects an open circuit. When the permissive is active, the system enters the **PERMISSIVE ON** alarm state. The permissive input needs to be jumped closed if it is not being used.

2.8 Modbus Protocol

The ARControl Dual Pilot Flare Controller's RS-485 port supports a limited subset of the Modbus protocol for communications. The system supports Modbus RTU mode, functions 3 and 6, giving an external PLC the ability to read settings and system variables as well as stop the system. The communication parameters for the system are fixed as follows (Table 2.8.1):

SETTING	VALUE
ADDRESS	1
BAUD RATE	19200 bps
WORD ORDER	LSW
SERIAL DATA SETUP	8-N-1

Table 2.8.1 • Modbus communication parameters

2.8.1 Modbus Register Map

Modbus registers are as follows (Table 2.8.2):

REGISTER NUMBER	NAME	DESCRIPTION	TYPE	R/W
1	FIRMWARE VERSION	Current version of the firmware	UINT16	R
2	FIRMWARE REVISION	Current revision of the firmware	UINT16	R
5	PILOT 1 ENABLED	0 = Disabled, 1 = Enabled	UINT16	R
6	PILOT 1 IGNITION TIME	1s min, 60s max	UINT16	R
7	PILOT 1 PROVING TIME	10s min, 600s max	UINT16	R
8	PILOT 1 IGNITER TYPE	0 = Spark Igniter, 1 = Hot Surface Igniter	UINT16	R
10	PILOT 2 ENABLED	0 = Disabled, 1 = Enabled	UINT16	R
11	PILOT 2 IGNITION TIME	1s min, 60s max	UINT16	R
12	PILOT 2 PROVING TIME	0s min, 600s max	UINT16	R
13	PILOT 2 IGNITER TYPE	0 = Spark Igniter, 1 = Hot Surface Igniter	UINT16	R
22	PILOT 1 ON °F	Degrees Fahrenheit that Pilot 1 detects flame.	INT16	R
23	PILOT 1 OFF °F	Degrees Fahrenheit that Pilot 1 loses flame.	INT16	R
32	PILOT 2 ON °F	Degrees Fahrenheit that Pilot 2 detects flame.	INT16	R
33	PILOT 2 OFF °F	Degrees Fahrenheit that Pilot 2 loses flame.	INT16	R

Table 2.8.2 • Modbus register map

REGISTER NUMBER	NAME	DESCRIPTION		TYPE	R/W
199 Note: for igniter1 200 Note: for igniter 2	CURRENT SYSTEM STATE	State vs Register Value		UINT16	R
		State	Register Value		
		UNKNOWN	0		
		STOPPED	1		
		IGNITE	2		
		PILOT ON	3		
		PROVING PILOT	4		
		IGNITE RETRY	5		
		PERMISSIVE ON	6		
		LOW BATTERY	7		
		TC OPEN	8		
		LOCKOUT	9		
201	PILOT 1 TEMPERATURE	Thermocouple temperature in degrees Fahrenheit		INT16	R
202	PILOT 2 TEMPERATURE	Thermocouple temperature in degrees Fahrenheit		INT16	R
203	STOP COMMAND	(23917) Stops both pilot igniter instances and sets them to the STOPPED state		UINT16	W

Table 2.8.2 • Modbus register map (continued)

3 System Settings

The **Settings Menu** allows the user to see the current system settings, modify the settings and commit them to the system. This section will explain what each setting is, how to enter the **Settings Menu** and how to change the setting options.

3.1 Settings Menu

The **Settings Menu** is composed of 8 rows, one for each of the igniter settings sub-menus, two for the pilot flame detection temperature setting sub-menus, and the remaining four are commands for setting the date and time, clearing the data logs, setting the site name, and a factory reset of all settings

To change the settings you must enter the **Settings Menu**. Follow these steps to enter the **Settings Menu**:

- 1. Use the **UP** or **DOWN** key and select **SETTINGS MENU** (Image 3.1.1).
- 2. Press the **OK** key.
- 3. Once in the **Settings Menu**, select the system sub-menu to be viewed or changed (Image 3.2.1).

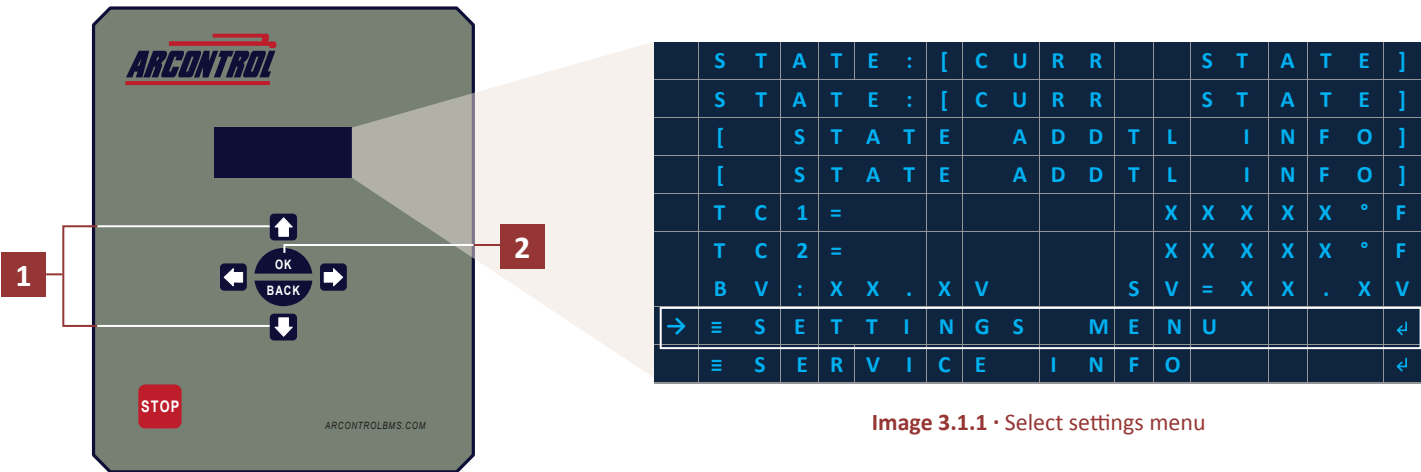


Image 3.1.1 • Select settings menu

3.2 System Sub-menus

The following section will provide an overview of the eight system sub-menus. Follow these steps to select a sub-menu:

- 1. Using the **UP** and **DOWN** key to move the arrow on the left hand side of the menu and navigate to the desired sub-menu.
- 2. Press the **OK** key.

Igniter 1 sub-menu	→	≡	I	G	N	I	T	E	R	1							↵
Igniter 2 sub-menu		≡	I	G	N	I	T	E	R	2							↵
Pilot temperature 1 sub-menu		≡	P	I	L	O	T		T	E	M	P	1				↵
		≡	P	I	L	O	T		T	E	M	P	2				↵
Set date & time sub-menu			S	E	T		D	A	T	E		&	T	I	M	E	↵
			C	L	E	A	R		D	A	T	A		L	O	G	S
Set site name sub-menu			S	E	T		S	I	T	E		N	A	M	E		↵
			F	A	C	T	O	R	Y		R	E	S	E	T		↵

Pilot temperature 2 sub-menu

Clear data logs sub-menu

Factory reset sub-menu

Table 3.2.1 • Settings sub-menu screen

3.2.1 IGNITER sub-menu

The **IGNITER** sub-menu 1 and 2 are used to configure Igniter 1 or 2. The configurable settings are **ENABLE, IGNITION TIME, PROVING TIME AND IGN SOURCE**. The following table shows the options and description for each menu item (Table 3.2.1).

MENU ITEM	OPTIONS	DESCRIPTION
ENABLE	Enable, Disable	Enables or disables the corresponding igniter.
IGNITION TIME	1 - 60	The ignition time in seconds.
PROVING TIME	10 - 600	The pilot proving time in seconds.
IGN SOURCE	Hot Surface, Spark	The type of igniter being used, hot surface or BMS module.

Table 3.2.1 • IGNITER sub-menu configurable settings

Follow these steps to configure a desired pilot igniter setting (Image 3.2.2):

- Use the **UP** or **DOWN** key and select the desired setting.
- Use the **LEFT** or **RIGHT** key to the desired configuration.
- Use the **UP** or **DOWN** key and navigate to **COMMIT SETTINGS**.
- Press the **OK** key.

After configuring the pilot igniter, select **COMMIT SETTINGS**

→	C	O	M	M	I	T		S	E	T	T	I	N	G	S				↩	
	E	N	A	B	L	E	:		<			E	N	A	B	L	E	D	>	
	I	G	N	I	T	I	O	N		T	I	M	E		=	<	1	0	>	
	P	R	O	V	I	N	G		T	I	M	E			=	<	0	5	0	>
	I	G	N		S	O	U	R	C	E	=	<	H	O	T		S	U	R	

Image 3.2.2 • IGNITER sub-menu

3.2.2 PILOT TEMP 1 & 2 sub-menus

The pilot temperature sub-menu (Image 3.2.3) allows you to enter the temperatures, in degrees Fahrenheit, at which the pilot is determined to be burning (ON) or not burning (OFF). After the settings are configured, selecting **COMMIT SETTINGS** will commit all settings to memory.

After configuring the pilot temperature select **COMMIT SETTINGS**

→	C	O	M	M	I	T		S	E	T	T	I	N	G	S			↩	
	O	N			°	F						=	<	+	0	3	0	0	>
	O	F	F		°	F						=	<	+	0	2	0	0	>

Image 3.2.3 • PILOT TEMP sub-menu

MENU ITEM	OPTIONS	DESCRIPTION
ON	0 - 2160	Temperature in degrees Fahrenheit, at or above, which the corresponding pilot is determined to be burning (Flame detected).
OFF	0 - 2160	Temperature in degrees Fahrenheit, at or below, which the corresponding pilot is determined to not be burning (Flame Undetected).

Table 3.2.2 • PILOT TEMP sub-menu configurable settings

3.2.3 SETTING DATE & TIME
sub-menu

Setting the Date

Follow these steps to set the system date.

- 1. Use the **UP** or **DOWN** key to **SETTINGS MENU**.
- 2. Press the **OK** key.
- 3. In the sub-menu, use the **UP** or **DOWN** key and scroll to **DATE**.
- 4. Press the **OK** key.
- 5. Use the **LEFT** or **RIGHT** key and enter the month (Image 3.2.4).
- 6. Press the **OK** key.
- 7. Use the **LEFT** or **RIGHT** key and enter the day (Image 3.2.5).
- 8. Press the **OK** key.
- 9. Use the **LEFT** or **RIGHT** key and enter the year (Image 3.2.6).

Setting the Time

Follow these steps to set the system time.

- 10. Press the **OK** key and return to the sub-menu.
- 11. In the sub-menu, use the **UP** or **DOWN** key and scroll to **TIME**.
- 12. Press the **OK** key.
- 13. Use the **LEFT** or **RIGHT** key and enter the hour (Image 3.2.7).
- 14. Press the **OK** key.
- 15. Use the **LEFT** or **RIGHT** key and enter the minute (Image 3.2.8).
- 16. Press the **OK** key.
- 17. Use the **LEFT** or **RIGHT** key and enter AM or PM (Image 3.2.9).
- 18. Press the **OK** key.

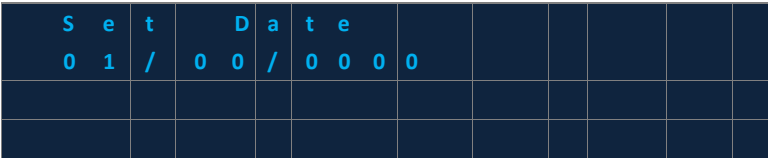


Image 3.2.4 • Enter month

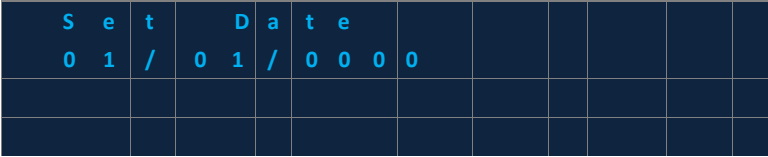


Image 3.2.5 • Enter day

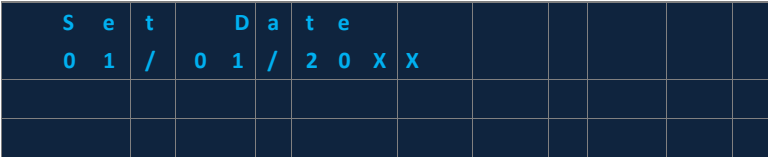


Image 3.2.6 • Enter year

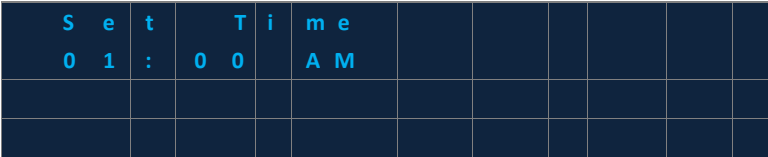


Image 3.2.7 • Enter hour

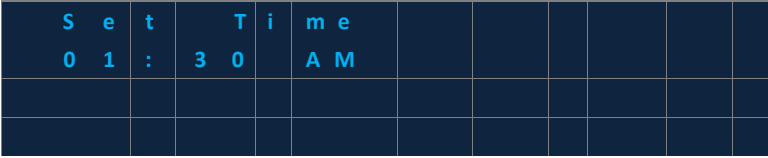


Image 3.2.8 • Enter minute

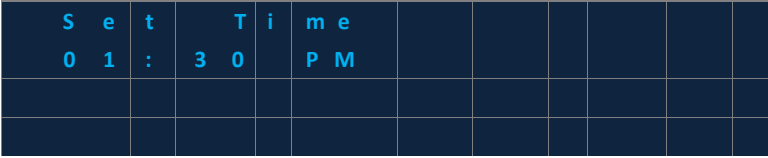


Image 3.2.9 • Select AM or PM

3.2.4 CLEAR DATA LOGS sub-menu

The ARControl Dual Pilot Flare Controller creates and stores timestamped logs of events. The types of events that are logged are periodic time-based logs and event-based logs (Table 3.2.3). The periodic time-based logs are created every fifteen minutes. The event-based logs are created on the occurrence of any event in Table 3.2.3.

LOG TYPE	EVENT
LOGS ERASED	All previously logs erased
POWER ON	Unit has been powered on
POWER OFF	Unit was powered off
INTERVAL	15 minutes interval has occurred
DATA DOWNLOAD	Previous data has been downloaded
SETTINGS CHANGE	System settings have changed
FIRMWARE UPDATE	Firmware has been updated to a new revision
STATE CHANGE	System current state has changed

Table 3.2.3 • Event-based log types

HEADER	DESCRIPTION
TIME STAMP	Time stamp in the format YYYYMMddhhmmss. This time stamp format facilitates data manipulation and plotting.
DATE	Records date of the occurred logged data.
TIME	Records time of the occurred logged data.
LOG TYPE	Records the event that triggered data to be logged.
MODE	Denotes the mode setting at the time when the logged was recorded.
IGNITER TYPE	Indicates if the igniter is spark ignition or hot surface ignition.
STATE	Denotes the mode setting at the time when the logged was recorded.
LOCKOUT	Denotes the current lockout code from the ignition unit at the time when the log was recorded.
TC 1 TEMP or TC 2 TEMP	Temperature of the thermocouple in degrees Fahrenheit if the igniter type is hot surface ignition.
MODULE 1 TC TEMP or MODULE 2 TC TEMP	Temperature of the thermocouple in degrees Fahrenheit if the igniter type is spark ignition.
Permissive (DIN) Input	State of the Permissive input.
ALARM	State of the Alarm output.
AMBIENT TEMPERATURE	Ambient temperature of the ARControl unit in degrees Fahrenheit.
BATTERY VOLTAGE	Battery voltage in millivolts.
SOLAR VOLTAGE	Solar voltage in millivolts.

Table 3.2.4 • Data log headers and description

3.2.5 Downloading Data Logs

The ARControl is easily able to save its data logs to a USB Flash Drive. The data logs will be saved in a folder that is named the same as the Site Name as a *.csv file named with a concatenation of the date and time. The USB Flash Drive must be formatted to FAT formatting. Perform the following sequences to save the ARControl's data logs: Follow these steps to clear the Data Logs:

1. Insert the USB Flash Drive into the USB DRIVE port on the back of the board.
2. 'CIMARRON USB SERVICE' will appear on the display followed by a progress bar and a page count.
3. Wait for the data log save process to complete.
4. Remove the USB Flash Drive when prompted to by the display.

3.2.6 Clearing the Data Logs

The **CLEAR DATA LOGS** command is located in the system sub-menus (Image 3.2.10).



Image 3.2.10 • Select CLEAR DATA LOGS

Follow these steps to clear the Data Logs:

1. Use the **UP** or **DOWN** key and select **CLEAR DATA LOGS**.
2. Press the **OK** key.
3. Use the **LEFT** or **RIGHT** key to select Yes or No (Image 3.2.11).
4. Press the **OK** key to confirm / commit.
5. Press the **OK** key (Note: Pressing the **OK** key will prompt a confirmation screen confirming whether or not to delete all of the previously log data).



Image 3.2.11 • Select Yes or No

3.2.7 Set Site Name

This command sets the site name. The site name will appear as the folder name for the data logs. This is useful if data logs are pulled from multiple units onto the same USB Flash Drive.

3.2.8 Factory Reset

This command resets the system to its default factory settings (Table 3.2.5).

SETTING	DEFAULT VALUE
Igniter 1 Enable	Enabled
Igniter 1 Ignition Time	10
Igniter 1 Proving Time	50
Igniter 1 Source	Spark
Igniter 2 Enable	Disabled
Igniter 2 Ignition Time	10
Igniter 2 Proving Time	50
Igniter 2 Source	Spark
Pilot 1 On Temperature	300
Pilot 1 Off Temperature	200
Pilot 2 On Temperature	300
Pilot 2 Off Temperature	200

Table 3.2.5 • Default factory settings

4 Operation

⚠ WARNING!

Failure to comply with the following safety warning(s) may result in serious personal injury or death.

- Do not open when in operational mode.

Each pilot igniter instance runs continuously, in which once ignition is started, will continually ignite (between pilot proving periods) unless the pilot flame is detected or an alarm condition occurs.

4.1 Starting Ignition

In order to start ignition, the pilot igniter instance must be in the **STOPPED** state. The user will then select the **START IGNITION** command and press the **OK** button. The instance will transition into the **IGNITE** state. These steps must be repeated in order to start ignition of the other pilot igniter instance.

4.2 Stopping the System

In order to stop the system, the **STOP** button must be pressed. Pressing the **STOP** button will return both pilot igniter instances to the **STOPPED** state. The only exception to this is if an instance is in an alarm state. Clearing the alarm will then allow the instance to transition to the **STOPPED** state.

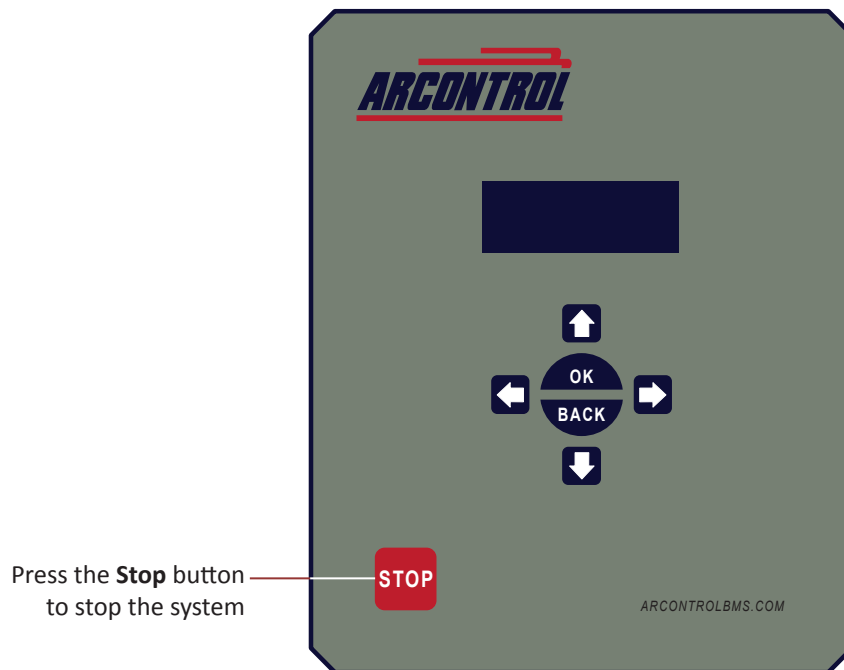


Image 4.2.1 · Stop button

4.3 Clearing Alarms

In order to clear an alarm, the cause of the alarm must first be remedied. Alarms have either instance or global scope. The way in which an alarm is displayed and cleared depends on its scope.

4.3.1 Alarms with Instance Scope

Instance alarms are displayed as states under the Current State area of the System Menu (Image 4.3.1). Instance alarms are cleared by selecting the **CLEAR ALARM** command and pressing the **OK** button.

After pressing the **OK** button the user will then be asked to confirm they want to clear the alarm (Image 4.3.2). The user will then select **YES** and press the **OK** button to clear the alarm. The pilot igniter instance will then transition to the **STOPPED** state.

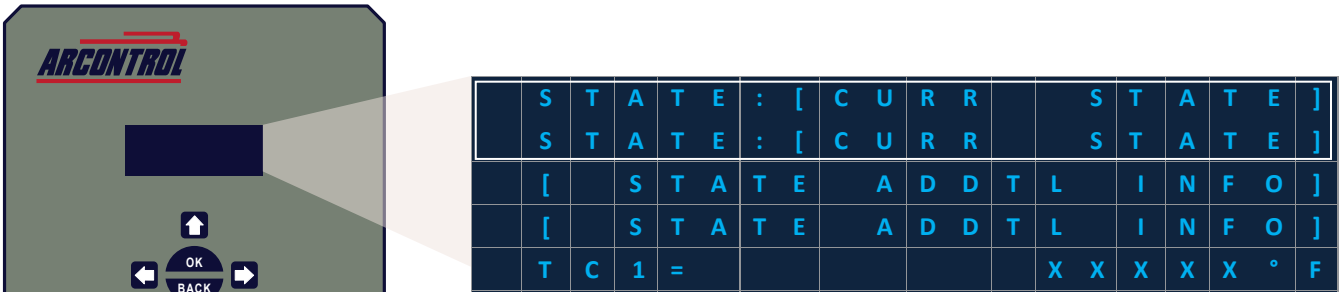


Image 4.3.1 • Alarms will appear in the Current State on the system menu

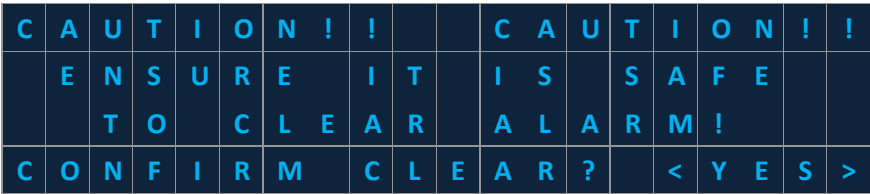


Image 4.3.2 • Select Yes to confirm

4.3.2 Alarms with Global Scope

Global alarms are cleared by pressing the **OK** button in the alarm information window and then selecting **YES** and pressing the **OK** button in the clear alarm popup window. **Both** pilot igniter instances will then transition to the **STOPPED** state.

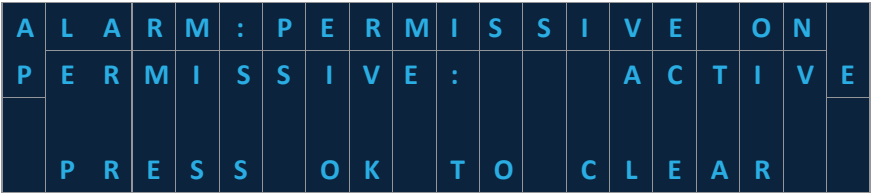


Image 4.3.3 • Press the OK button to clear the alarm

5 Troubleshooting

PROBLEM	SOLUTION
System will not exit Permissive open alarm state	Verify Permissive input is closed circuit or jumped short.
System will not ignite (Spark Ignition)	• Verify sure addresses are set correctly on the ignition modules. Addresses are 1 & 2, respectively or • Verify power and communication to the ignition modules or • Verify proper spark gap and ignition cable and grounding connections or • Inspect MODULE PORT fuse on the ARControl main board. Replace if required.
System will not ignite (Hot Surface Ignition)	• Verify proper wiring of hot surface igniter control relays or • Inspect POWER PORT fuse on the ARControl main board. Replace if required.
System will not detect flame	• Verify proper placement of thermocouples in the pilot flame or • If using spark ignition, verify thermocouple 1 & 2 inputs are wired in parallel on the ignition modules.
System is in low battery mode too often	• Verify the solar panel is positioned facing southward without any obstructions from the Sun or • Verify the battery and solar panel are sized properly to handle the system power requirements or • Verify the gauge of wire used for the battery and solar panel are sized properly to handle the system power requirements.
Pilot 1 Status, Pilot 2 Status, Pilot 1 Valve/Hot Surface Igniter, Pilot 2 Valve/Hot Surface Igniter does not output any power	Inspect the POWER PORT fuse on the ARControl main board. Replace if required.

Table 5.1.1 • Troubleshooting problems and solutions

6 Equipment Ratings

PARAMETER	MINIMUM	TYPICAL	MAXIMUM	UNITS
Ambient Temperature	-40		60	°C
Relative Humidity (Non-Condensing)			100	%
Altitude			2000	m
Enclosure Rating		NEMA 4X		
Operating Voltage		12 or 24		VDC
Operating Current	0.015		2	A
Solar Voltage		12 or 24		VDC
Solar Current			2	A
ALARM Output Voltage In	3		50	VDC
ALARM Output Current			50	mA
Valve, Hot Surface Ignition, Pilot Status Voltage Output		12 or 24		VDC
Valve, Hot Surface Ignition, Pilot Status Current Output (Combined)			2	A
Thermocouple 1 & 2 Type		K		
(DIN) Permissive Input Voltage		5	30	VDC

Table 6.1.1 • Equipment ratings

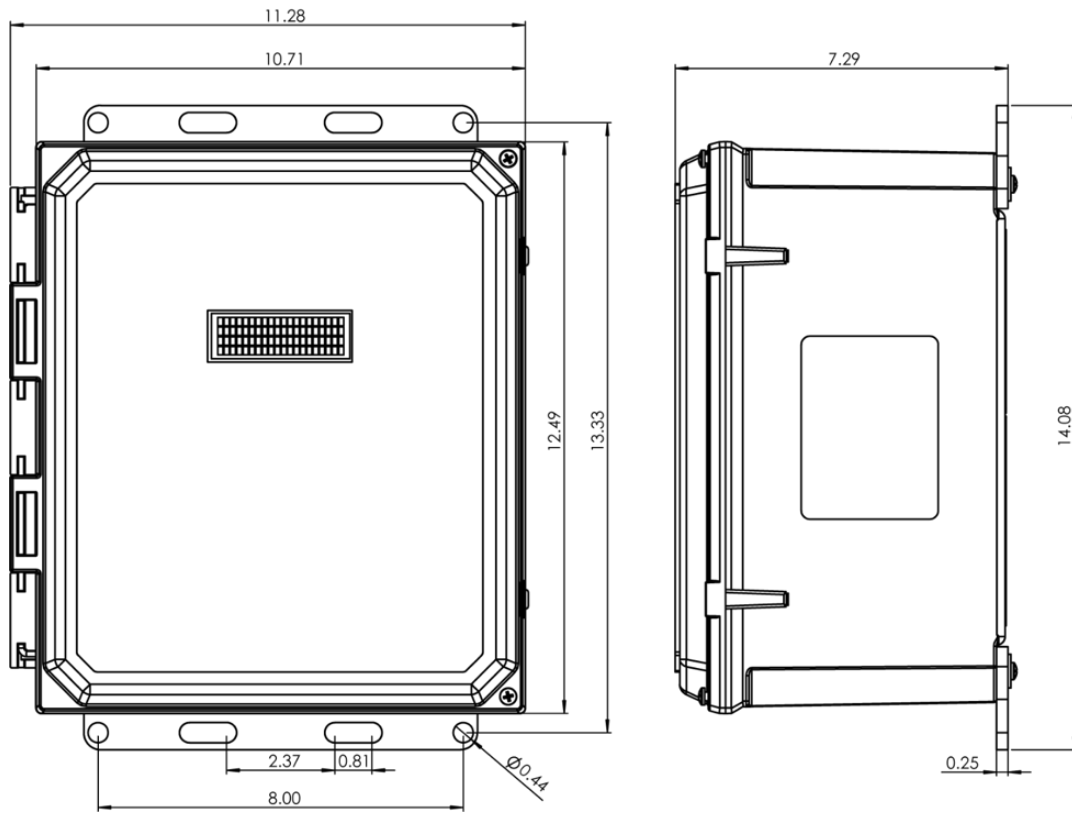


Image 6.1.1 • FLARE controller enclosure dimensions

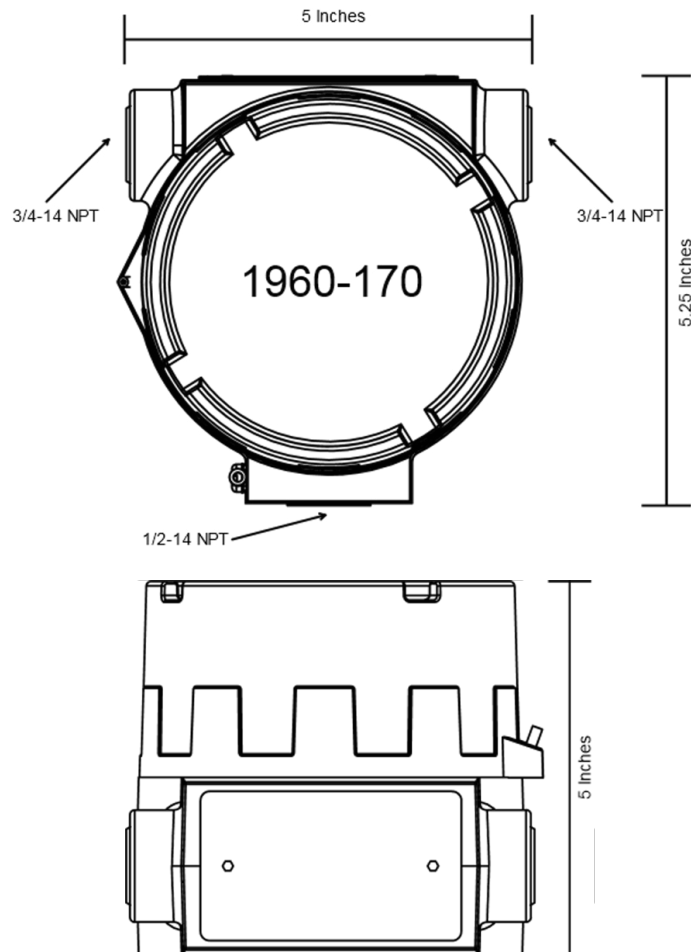


Image 6.1.2 • BMS module enclosure dimensions

7 Maintenance & Service

WARNING!

Failure to comply with the following safety warning(s) may result in serious personal injury or death.

- Do not service in a hazardous area

7.1 Common Replacement Parts

Refer to the following parts list when ordering replacement parts (Table 7.1.1).

PART NUMBER	DESCRIPTION
3181-002	ARControl 2 Amp Spare Fuse
1870-511	BMS Module - Black Ignition Module Puck
1960-170	BMS Module in Class I Division 1 Explosion Proof Enclosure
1960-171	BMS Module on DIN Rail Mounting Bracket
1960-160	5 Watt Solar Panel & 12 Volt 12 Amp Hour SLA Battery with Mounting Brackets
2130-012	12 Volt 12 Amp Hour SLA Battery

Table 7.1.1 • Replacement part numbers

Please contact Cimarron Energy, Inc. for information in regard to maintenance, parts, or service:

1-844-746-1676

11025 Equity Dr., Suite 200, Houston, TX 77041

www.cimarronenergy.com

8 Approvals

- Class I, Division 2, Groups C and D, T4A, Tamb. -40°C to +60°C, Type 4X
- CAN/CSA-C22.2 NO. 61010-1:2012
- CAN/CSA C22.2 NO. 213:2015
- ANSI/ISA 12.12.01: 2015
- UL 61010-1 (3rd Edition)
- ANSI/ISA-61010-1
- CAN/CSA-C22.2
- UL 50E (Ed. 2)

