



The SaveAir Electronic Air Start System is designed to be retrofit to almost any engine utilizing the air-in-head starting method. A description of the function of the major components and their integrated operation appears below:

- The SaveAir Distributor may be installed in place of the existing pneumatic or mechanical distributor, or to another shaft turning at camshaft speed. This innovative device provides a highly accurate source of crankshaft position data, both while the engine is at a stop and while running.
- The SaveAir Output Module accepts the angular position data derived by the Logic/Distribution Module and electronically actuates the start air solenoid valves to admit high pressure starting air into the appropriate cylinder(s).
- Monitoring and system troubleshooting is made simpler and more convenient by the operator Display Module. This interface device gives the user access to all of the setup, monitoring, and diagnostic capabilities of the system. An included SaveAir Terminal Program offers the same functionality for remote access and control.

In operation the starting sequence is begun in the normal way by manually or remotely actuating a valve which pressurizes the engine's air supply piping. The SaveAir system automatically senses the rising pressure (via a pressure transducer input) or else reacts to a contact closure from a pressure switch in the air piping. The SaveAir system knows the precise crank position of the engine at all times and automatically applies air to the cylinder(s) in optimum position to deliver the maximum torque to the engine. User configurable "maps" of air admission angle and duration of the air event versus engine speed allow the user to regulate the cranking speed to the optimum value without wasting air. Turning off the air before the intake and exhaust ports (valves) open eliminates both wasted air and starting air back pressure in the intake and exhaust manifolds. The user can also configure a purge cycle to purge the engine thoroughly without wasting starting air.

The system outputs a "purge confirm" signal which can be utilized by the starting control system to energize ignition if so desired. When the user specified "running" rpm is reached and maintained for a user specified number of revolutions the starting air is automatically turned off and locked out until the system is reset.

Start Sequence

The sequence described below outlines the SaveAir system startup and associated screens that would appear through the process on the system Display Module and in the Terminal Program:

<pre> TRYING 220° 0 ON 110° RPM </pre>	TRYING – A system start has been initiated, but the engine has not yet begun to rotate.
<pre> ROLLING 220° 15 ON 110° RPM </pre>	ROLLING – The engine is rolling on starting air, but has not yet exceeded the user-defined purge RPM.
<pre> PURGING 40 ON 90° RPM </pre>	PURGING – The engine starting speed has exceeded the user-defined purge RPM, but has not yet completed the user-defined number of engine cycles.
<pre> STARTING 60 ON 80° RPM </pre>	STARTING – Purging has been completed and the purge confirm output has been activated.
<pre> FIRING 90 ON 0° RPM </pre>	FIRING – Indicates that the unit has reached a pre-configured RPM known to be associated with "light-off" or engine operation based upon in-cylinder combustion.
<pre> RUNNING 300 RPM </pre>	RUNNING – Final stage of the start cycle. The engine is now running and starting air is shutoff and locked out until system reset.

Typical System Configurations



Pneumatic air distributor with pilot-actuated air-in-head valve

Installation of the SaveAir system on engines with an existing pneumatic air distributor (OEM or aftermarket) and pilot actuated in-head starting valve represents the least complex installation requirements to the user.

Retrofit requires the removal of the mechanical/pneumatic air-start distributor, and all of the associated air tubing to the existing air-start valves. The SaveAir Distributor is mounted on the air distributor drive or other camshaft speed accessory drive, with the SaveAir Output and Display Modules mounted on the engine (the Display Module can also be mounted in the engine control panel). The electrically-actuated SaveAir solenoids are mounted near each engine air-starting valve, with their pilot air drawn from the high volume starting air pipe local to each cylinder or via a small diameter starting air manifold running the length of the engine. Each solenoid admits the high pressure air charge into the associated cylinder to begin and maintain engine rotation.

Terminal Program

- Provides for simple system monitoring and configuration
- Graphical user interface (GUI)
- Remote operator interface (ROI) duplicates the system display for convenient remote access
- Built-in data logging and screen capture capability for system troubleshooting

The SaveAir system includes a comprehensive ModBus-RTU-based Terminal Program for monitoring and configuration. As an alternative to the system Display Module, all system setup, including the angles between cylinders, air initiation and air duration maps, and engine-specific RPM settings for purge and engine run indication can be configured using this software. To assist in system installation and troubleshooting, the Terminal Program also enables the user to create a Microsoft Excel™ spreadsheet of all operating data associated with the SaveAir system from data logs taken and recorded three times per second. A unique screen capture option embedded into the system software also allows the user to acquire and save the monitored display and values for future reference or troubleshooting.



Cam actuated start valves with pressure-actuated in-head check valves

Some Clark engines (BA, HBA and TLA) utilize camshaft-actuated air starter valves for each cylinder, which in turn direct high volume starting air directly to in-head starting air check valves.

Mounting of the SaveAir Distributor to engine camshaft speed may be to a SAE ignition drive directly or by use of an engine-specific mounting adaptor. The OEM cam-actuated air start valves are no longer used (permanently eliminating camshaft lobe repairs), and are disabled during SaveAir installation. The SaveAir electrical solenoid pilot valve is supplemented with a pilot-actuated high volume "relay" valve. A high-capacity stainless steel flex-hose completes the installation by connecting to the in-head check valve on each cylinder. Thus, for these applications, the SaveAir air solenoid pilot valve trips the associated air handling relay valve which directly admits the high pressure air into the cylinder for starting. Refer to the SaveAir technical documentation for further installation details.



SPECIFICATIONS

INPUTS

- (1) Integrated Angular Position Sensor
- (1) Discrete Start Signal (Digital)
- (1) Pressure Start Signal (4–20mA)

OUTPUTS

- (10) or (20) Control Solenoid Outputs
- (1) Purge Confirm Output (Digital)

DISPLAY

Alphanumeric 2x16 character backlit

POWER REQUIREMENT

No power supply upgrade is required for existing CPU-95 or CPU-2000 applications
 24VDC, 5–10 Amps for applications operating without upgraded digital ignition systems:

TEMPERATURE

-40°F. to +158°F./-40°C. to +70°C.

COMMUNICATIONS

ModBus RTU Protocol (RS-485)
 (Supports Display or PC communications)

ORDERING INFORMATION

SaveAir Distributor (A flange).....	291310-A
SaveAir Distributor (GV flange).....	291310-GV
Mounting Adapter.....	See below*
Output Module, 10 outputs.....	291301-1
Output Module, 20 outputs.....	291301-2
Display Module.....	291302-1
Harness, Output, 48" Conduit, 90° with 72" Leads	293023-16
Harness, Output, 84" Conduit, 90° with 120" Leads	293026-16
Harness, Output, 96" Conduit, 90° with 180" Leads	293028-16
Harness, Output, 144" Conduit, 90° with 180" Leads	293027-16
Harness, Logic to Output, 24" with 180° Connector	293031-24
Harness, Logic to Output, 48" with 180° Connector.....	293031-48
Harness, Logic to Output, 72" with 180° Connector.....	293031-72
Harness, Logic to Output, 24" w/90° & 180° Connectors.....	293036-24
Harness, Logic to Output, 48" w/90° & 180° Connectors....	293036-48
Harness, Logic to Output, 72" w/90° & 180° Connectors.....	293036-72
Harness, Logic to Output, 96" w/90° & 180° Connectors.....	293036-96
Harness, Display & I/O, 48"	293034-48
Solenoid Valve, standard	690017-1
Solenoid Valve, Quick Exhaust	690017-2
Solenoid Valve Ass'y., Clark engine, 1.5" NPT	690018-1
In-line Filter (690017-1)	615007
Hose Assembly, Clark engine, 24"	580035-24
Hose Assembly, Clark engine, 48"	580035-48

(*) If a camshaft speed SAE flange drive is not available, a mounting adapter is required; contact one of the following:

Advanced Gas Engine Solutions
 616-B Beatty Road Monroeville, PA 15146
 Exline Ignition and Automation
 3256 Country Club Road, Salina, KS 67401

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DIMENSIONS

