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OPERATING INSTRUCTIONS FOR AUTOSTART DIESEL ENGINE CONTROLLER TYPE MAS/SMB/12

CAUTION

In order to avoid risk of personal INJURY or damage to the control equipment READ THIS MANUAL VERY CAREFULLY. If after reading these instructions doubt exists, do not hesitate to contact Metron Eledyne for further clarification. In the interests of safety pay special attention to the CAUTION notes listed below:

If work has to be carried out on the engine or control equipment, isolate the control equipment from the supply and temporarily remove the start solenoid connection from its control circuit terminal before work commences. If possible use a temporary label which draws attention to this fact. Label suggestion: WARNING ENGINEER WORKING ON EQUIPMENT.

The control system may start the engine at any time when operating in automatic mode. Ensure all concerned are aware of this condition by means of an appropriate label, prominently displayed on the engine skid. Label suggestion: ENGINE MAY START AT ANY TIME.

When the equipment is energised and on line, ensure the front access door is closed and locked. If at any time the equipment is energised with the access door to the panel interior open, make sure the terminal cover is fitted.

COMMISSIONING

Before attempting to start the engine in 'Automatic Mode' during commissioning, start the engine in 'Manual Mode' and ensure that the 'Fuel Solenoid' is operative and the engine can be stopped.

Start the engine in 'Manual Mode' and then disconnect the start solenoid connection. Select 'Automatic Mode' and temporarily close the remote start contacts. Ensure the engine run signal from the speed switch inhibits the automatic cranking signal at the MAS/1E unit terminal 10. Select 'Manual Mode' and stop the engine. Reconnect the crank solenoid and open the remote start contacts.

GENERAL

The Metron Eledyne Autostart TYPE MAS/SMB/12 diesel engine controller is designed to automatically start and manually stop a diesel engine when initiated from remotely sited closing contacts. The system is suitable for operation from a single 12 volt engine start battery, connected negative to common.

The system provides 5 repeat engine cranks during one start cycle. Each crank period is

factory set at approximately 15 seconds, followed by a dwell or rest period of 10 seconds between cranks. The total crank cycle is factory set at approximately 115 seconds.

In these instructions, the following terms used are defined as:-

Visual	- Lamp, metre or other visual device.
Audible	- Alarm bell or klaxon.
Volt free	- Remote indicating volt free contacts.
Clear	- Fault condition cleared, remote signal cancelled.

Generally, for simplicity, only changes in status will be mentioned for the above.

PRELIMINARY

Set the A.C. Isolator to Off.

Set the Mode switch to Off.

Ensure that the panel is connected as shown on the controller wiring diagram.

TIMER SETTINGS

Set the Stop Timer T1.	To a few seconds longer than it takes the engine to come to rest from full speed.
Run timer T2.	Set to 10 seconds.
Fault timers T3 to T5.	Set to 3 seconds.

ENGINE SPEED SWITCH

NOTE
The speed switch is factory set to the correct crank cut off RPM according to the latest information.

The speed switch setting frequency is derived from the formula:-

$$\text{No of Flywheel Teeth} \times \frac{\text{RPM}}{60} \text{ Hz}$$

For this installation the parameters are-

No of flywheel teeth = 110 (Engine type Lister type TS3).

Crank cut-off speed = 400 RPM

Crank cut-off freq' = $\frac{110 \times 400}{60}$ = 733Hz = Speed switch setting.

ENERGISING THE CONTROL SYSTEM

AC SUPPLY ENERGISATION AND MONITOR

Close the A.C. isolator.

Visual.	AC Supply On. Ammeter shows current.

If the AC Supply should fail.

Visual.	AC Supply On - goes out. Ammeter shows no current.

DC ENERGISATION

Set the Mode switch to Man.

Visual.	DC Supply On. Engine On Demand - out.
Volt free.	Clear.
Audible.	Silent.

BATTERY CHARGING

The battery charging circuit maintains the battery at its float voltage level of 13.7V.

Periodically check.	Battery voltage is maintained at 13.7 Volts, measured at the battery terminals.
Battery electrolyte level.	Regularly check and top up with distilled water if necessary.

Battery charger performance will generally be as follows:

Battery discharged.	Ammeter shows current at the 'Current Limit' level of 5 amps. Voltage rises to the 'Float' level of 13.7 Volts in less

	than 24 Hrs.
Battery partially discharged.	Ammeter shows current at the current limit level of 5 Amps. Voltage rises to the float level of 13.7 Volts in a time dependent upon the initial battery charge state.
After an engine start.	Ammeter shows current at the Current Limit level of 5 Amps for a short time. The battery voltage may not go appreciably below 13.7 Volts after a normal engine start. Current at the limit level will occur with a battery volts drop of only a few hundred millivolts.
Float charging.	Ammeter shows current due to the controller load plus about half an Amp or less battery trickle current. Battery voltage maintained at the float level of 13.7 Volts.

NOTES
The Float Voltage and Current Limit levels of the battery charger is factory set and should not be altered or damage to the batteries may result. Maintenance of batteries should be carried out in accordance with the instructions issued by the battery manufacturer.
The need for regular maintenance cannot be overstressed, corrosion of the battery terminals and loose connections will cause erratic operation of the control circuit.

AUDIBLE ALARM

When the audible alarm sounds, it can be silenced by pressing the Mute Alarm button.

The muted condition is cancelled when:-	All faults are cleared and the reset button is pressed. The mode switch is set briefly to Off.

NOTE
In Off Mode all control and monitor functions are interrupted.

OPERATION IN MANUAL MODE

MANUAL START

Set the Mode switch.	Man.
Visual.	AC Supply On.

DC Supply On.

Volt free. Clear.

Audible. Silent.

Controller status. Standby Manual Mode.

Turn the Manual Start keyswitch and hold until the engine runs. The engine cranks and runs.

Visual. Engine On Demand.
Engine Running.
Ammeter zero during cranking.

Volt free. Engine running.

Engine cranking is cut off by the running signal.

Release the Manual Start keyswitch.

Visual. Engine On Demand - goes out.

ENGINE STOP

Press the Manual Stop button. Fuel solenoid de-energises. The engine stops.

Visual. Engine Running - goes out.

Volt free. Engine running - clears.

Controller in Standby.

OPERATION IN AUTOMATIC MODE

Set the Mode switch. Auto.

Visual. AC Supply On.
DC Supply On.

Volt free. Clear.

Audible. Silent.

Controller status. Standby Auto Mode.

The controller remains in this state until the remote start contacts close.

AUTOMATIC START

Remote start contacts close.

Visual.	Engine On Demand. Ammeter zero during cranking.
	The engine cranks and runs.
	Engine cranking is cut off by the running signal.
Visual.	Engine Running.
	Further engine cranking is inhibited.
Volt free.	Engine running.

When the remote start contacts open.

Visual.	Engine On Demand - remains on.
	The engine continues to run until stopped at the controller by the operator.

ENGINE STOP

Press the Manual Stop pushbutton.	The engine fuel solenoid de-energises. The engine stops.
Visual.	Engine On Demand - goes out Engine Running - goes out.
Volt free.	Engine running - clears.
	The controller is in standby condition.

TESTING THE AUTO CRANK CYCLE

Select Auto mode.

Either disconnect the fuel solenoid or inhibit the fuel system in some convenient way.

Close the remote start contacts.

Visual.	Engine On Demand. Ammeter shows zero.
	Engine cranks for 15 secs. Cranking stops for 10 secs. Engine cranks for 15 secs. The cycle repeats until 5 crank attempts have occurred.

At the end of fifth crank.

Visual.	Engine On Demand - remains on. Engine Failed To Start.
Audible.	Sounds.
Volt free.	Failed to start.
	All further cranking is inhibited.
	The start batteries should be capable of sustaining adequate engine cranking throughout the crank cycle.

To restore the system to operation:

Open the Remote start contacts.
Press the Reset button. Reinstate the fuel system.
Set the mode switch to the required operating mode.

Visual.	Engine On Demand - goes out. Failed To Start - goes out. Ammeter shows charging current.
Audible.	Silent.
Volt free.	Failed to start - clears.
	The controller is in standby.

Test start and stop the engine.

ENGINE MONITOR - FAULT SHUTDOWN

The following Fault Channels automatically shut down the engine when activated.

Engine Low Oil Pressure
Engine High Air Temperature
Low Gas Suction Pressure

The fault channels are inhibited until 10 seconds after the engine running signal is displayed. Run timer set to 10 seconds.

In each case when a channel is activated by opening fault contacts:-Individual channel fault timer starts to time, set to 3 seconds.

Fault timer times out.	Engine fuel solenoid de-energises. Stop timer starts to time.

	Engine stops.
Visual.	Channel lamp.
Audible.	Sounds.
Volt free.	Dedicated signal.
Stop timer times out.	Stop circuit remains active and automatic starting is inhibited.
Press the reset button.	Stop circuit de-activated and automatic starting is available.
Visual.	Channel lamp - goes out.
Audible.	Silent.
Volt free.	Clear.

Appendix A

IMPORTANT BATTERY SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS - This manual section contains important safety and operating instructions for the Metron Eledyne battery charger type PFC/SM/BC/10/MP

A. Use of the battery charger
The battery charger is intended for use only in Metron Eledyne control systems. Use of an attachment / connector not recommended or sold by Metron Eledyne may result in a risk of fire, electric shock, or injury to persons.

B. Removing the battery charger
If the battery charger should require removing, then to reduce the risk of damage to the electrical connections, pull by the connector rather than by the cable.

C. Do not disassemble the battery charger
1. Do not in any circumstances disassemble the battery charger, there are no user serviceable parts inside. Incorrect reassembly may result in risk of electric shock or fire.
2. WARNING NOTICE
The performance of the battery chargers is entirely automatic. No operator variables are provided, the chargers are factory preset and **NO ADJUSTMENTS MUST BE ATTEMPTED ON SITE** or damage to the batteries may result. Maintenance of batteries should be carried out in accordance with the instructions issued by the battery manufacturer.

D. WARNING - RISK OF EXPLOSIVE GASES.
1. WORKING IN THE VICINITY OF A LEAD-ACID / ni CAD BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION.
2.To reduce the risk of battery explosion read this manual completely, and the battery manufacturers data. Equipment used in the vicinity of the batteries should also be carefully selected to reduce the risk of a battery explosion.

E. Personal Precautions

1. Someone should be within range of your voice or close enough to come to your aid when you work near a lead acid / niCAD battery.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes.
3. Wear complete eye protection and clothing protection. Avoid touching eyes while working near battery.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cold water for at least 10 minutes and get medical attention immediately.
5. NEVER smoke or allow a spark or flame in the vicinity of battery or engine.
6. Be extra cautious to reduce risk of dropping a metal tool onto battery. It might spark or short circuit battery or other electrical part that may cause explosion.
7.Remove personal metal items such as rings, bracelets, necklaces and watches when working with an engine battery. Such engine batteries can produce a short circuit current high enough to weld a ring or the like to metal, causing a severe burn.
8.NEVER charge a frozen battery.

F. Preparing to charge

1. Clean battery terminals. Be careful to keep corrosion from coming in contact with eyes.
2. Add distilled water in each cell until battery acid level reaches level specified by battery manufacturer. For a battery without cell caps, carefully follow manufacturers recharging instructions.
3. Study all battery manufacturers specific precautions such as removing or not removing cell caps during initial charging and verify that the maximum rate of charge is not exceeded.

G Battery Maintenance

1. The batteries should be maintained in accordance with the specific battery manufacturers data book.
2. Clean terminal post regularly and grease appropriately.