

AUTOSTART FIRE PUMP CONTROLLER TYPE EFP/FD3e USER INSTRUCTIONS

1 PREFACE

This operating manual explains the operation of the complete control system and some options, where appropriate. Refer to the product data sheet for a description of the options.

2 CAUTION - HEALTH & SAFETY INFORMATION

In order to avoid risk of personal INJURY or damage to the control equipment, READ THIS MANUAL VERY CAREFULLY, especially section 6 - battery charger . 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 A.C and D.C supplies by use of the AC Isolator and all internal C.B's, and *remove the start solenoid supplies from control circuit terminals 9 and 10 before work commences*. If possible use a temporary label which draws attention to this fact.

Before attempting to start the engine during commissioning, ensure that the 'Fuel Stop Solenoid' is operational, by pressing the engine stop p.b (PB2).

Due to the nature of the 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.

When the equipment is energised and on line, ensure all doors are closed and where applicable locked.

If during commissioning the equipment is energised with the access door to the panel interior open, (not recommended) make sure the terminal cover is fitted to avoid the risk of electric shock.

3 GENERAL

The controller is designed as a fully-automatic engine start system based on the requirements of NFPA No. 20 and UL218 for Engine Driven Fire Pump Controllers.

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

- Visual - Lamp, meter, semaphore or flag.
- Audible - Electronic sounder.
- Volt free - Remote indicating volt free changeover contacts.
- Standby - System awaiting an operational event.
- Normal - Parameters within designed limits

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

THROUGHOUT THE TEXT IN **TWO COLUMN** FORMAT SECTIONS:

The left hand column describes Initiative **events**. The right hand column describes **resultants**.

4 ENERGISING THE CONTROL SYSTEM

Engine, controller and field interconnections are detailed on the engine wiring/interconnection drawing. (DE1861)

Set the following in order:

Mode Switch (SW1).	Manual.
All internal CBs.	On.
AC Isolator (S3).	On.
Visual.	AC On - green Power ON - green Voltsmeters show both battery voltages. Fault on engine or controller. Automatic mode - not selected
Volt free.	
Press the Reset button	
Visual.	Battery A Healthy. Battery B Healthy. Ammeters show current. Voltsmeters show both battery voltages.
Audible.	Silent.
Volt free.	Automatic mode NOT selected.

5 BATTERY DISCONNECTION/OVERVOLTAGE OPERATION / AC FAILURE

If a battery system connection is loose, or a battery is disconnected or CB2 & CB3 trips:

After a short delay:-

Visual.	Battery Healthy off (A or B)
Volt free	Battery failure - Remote (Optional)
after a short delay	
Visual	AC/ Charger failure.
Audible.	Non-Mutable.
Volt free	Fault on engine or controller

Or if the **AC supply is off OR if CB1 trips**

Visual	AC On - goes out
after a short delay,	
Visual	AC/ Charger failure.
Audible	Non-Mutable
Volt-free	Fault on engine or controller (AC/Charger failure - Option R)

When the charging system is ready,
reset the controller.

Battery charger alarms clear.
Battery chargers operate normally.

6 BATTERY CHARGING (12 & 24 volt systems)

6a IMPORTANT SAFETY INSTRUCTIONS (from UL1236)

SAVE THESE INSTRUCTIONS - This manual section contains important safety and operating instructions for the Metron Eledyne battery charger fitted within this controller.

A. Use of the battery charger

This 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 a battery.

4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters the eye, immediately flood the 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 the battery or engine.

6. Be extra cautious to reduce the risk of dropping a metal tool onto the battery. It might spark or short circuit the battery or other electrical part that may cause an 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.

6b TEMPERATURE COMPENSATION (Option V)

Rising temperature reduces the battery gassing point voltage.

The voltage performance of the battery charger is temperature compensated. Battery Voltage is reduced by approximately 0.05 volts/degree Celsius above 20 degrees.(0.004 v/cell/deg C).

NOTE: THE VOLTAGE LEVELS QUOTED WITHIN THIS MANUAL FOR ALL TYPES OF BATTERY ARE FOR AN AMBIENT TEMPERATURE OF 20 DEGREES CELSIUS .

If the temperature compensation unit becomes disconnected or malfunctions	The battery voltages default to the value at 20 degrees Celsius.
Visual.	AC/Charger failure.
Audible.	Non-Mutable.
Volt free.	Fault on engine or controller.

6c BATTERY TYPES

BATTERIES - FLOAT VOLTAGE Figures are for 24v.systems (12v systems in brackets)			
LEAD ACID	27.5v (13.7v) Maximum 31.5v (15.1v)		NI-
CAD 18(9) Cell	26.1v (13v) Maximum 29.7v (14.8v)		
NI-CAD 20(10) Cell	29.0v (14.5) Maximum 33.0v (16.5v)		

Observe the appropriate voltmeter	The battery voltage remains stable at the float level until reduced by loading.
If the battery voltage drops more than 1.5v (0.7v) below the nominal float voltage level.	The ammeter reads Current Limit level of 10Amps.

NOTE:
For recombination batteries the float voltage is 2.3 V/Cell. To achieve full charge in 24 hours they are voltage boosted to 2.33 V/Cell, which is below the safe maximum of 2.346 V/Cell.

7.CONTROL SYSTEM MANUAL OPERATION

Select Manual Mode.

Visual.	Automatic mode - off
Volt free	Automatic mode -not selected

7a STARTING

Press either Crank A (PB3) or Crank (PB4) button	Engine cranks from respective battery
Visual	Ammeters show zero current during

cranking. Used battery ammeter will show current at the current limit after cranking.

If engine does not start, press other crank button

Engine cranks from other battery

If engine does not start due to an individual battery having insufficient charge, press both Crank A and Crank B buttons together

Engine attempts to start from both batteries in parallel.

The following Emergency Start instructions are mounted on the switch cover.

EMERGENCY INSTRUCTIONS

1. UNLOCK COVER OR BREAK GLASS TO OBTAIN KEY
2. USE KEY TO TURN MODE SWITCH TO 'MAN' POSITION
3. PRESS CRANK 'A' OR CRANK 'B' BUTTON UNTIL ENGINE RUNS
4. IF THIS DOES NOT START PRESS OTHER BUTTON
5. SHOULD EITHER BATTERY NOT HAVE SUFFICIENT CHARGE TO START ENGINE, PRESS BOTH BUTTONS TOGETHER

7b ENGINE RUNNING

The engine normally starts after only a few seconds cranking.

Engine runs up to speed.

Visual.

Engine running.

Volt free.

Engine running.

7c ENGINE SHUTDOWN

Push the Engine Shutdown button.(PB2)

Engine fuel solenoid shuts off the fuel.
Engine stops.

Visual.

Engine Running - goes out.

Volt free.

Engine running clears.

8 CONTROL SYSTEM AUTOMATIC OPERATION

CAUTION: The engine may start without warning when in Auto Mode

Four means of initiating automatic start:

1. From main pressure switch detecting loss of pressure in the fire main.(normal)
2. From main pressure switch detecting loss of pressure when drain valve is operated.(TEST START)
3. From remotely wired start switch (remote auto start)
- 4.(option D1) From Deluge Valve start

8a AUTOSTART TYPES

If a DELAY START TIMER is fitted (option D) the above 1,2 & 4 starts are delayed by the period set on the

timer before the system is initiated. (The delay start time is adjustable on the electronic control module)

Once initiated the sequence is the same for starting conditions 1,2,3 or 4:

Set the Mode switch to Auto

Visual.	Auto Mode On.
Volt free.	Automatic mode
Activate remote start	
Start initiated	The engine cranks from one battery. (A or B - indeterminate)
Visual.	Pump on demand (while remote start input is closed) .Ammeters show zero
current while	cranking
Volt free	Pump on Demand - optional

8b CRANK SEQUENCE

Once initiated, crank attempts occur from each battery alternately.

until ENGINE FAILED TO START is reached or Engine runs up to speed

Visual	Crank solenoid energises for 15 secs. Cranking ceases for 15secs.(repeated a total of six times if engine does not start)
Volt free	Cranking is automatically cut off
	Engine running Used battery ammeter shows current at the limit level after cranking.
	Engine running

NOTE: WHILST THE ENGINE ALTERNATOR RECHARGES THE BATTERIES THE CONTROLLER BATTERY CHARGER CURRENT MAY BE ZERO (Option A)

Pressure rises above the start pressure set point.

Engine continues to run until stopped by operator or Autostop module (option B)

8c ENGINE FAILED TO START

Crank sequence ends

Visual	Failed to start
Audible	Non-mutable
Volt free	Failed to start Fault on engine or controller
To restore standby condition Press the Reset Pushbutton	Alarms clear

8d ENGINE SHUTDOWN**NOTE**

If the engine must be shutdown for overriding safety reasons in the presence of a demand, select *Manual* mode first.

Press the Engine Stop pushbutton.	Engine fuel solenoid shuts off the fuel. Engine stops.
Visual	Engine Running - goes out.
Volt free.	Engine running - clears.

8e AUTOSTOP (Option B)

(Note: The auto stop time is factory preset at time of ordering and is NOT adjustable on site)

When the engine runs.

Autostop timer starts to time	Factory Preset time.
Autostop timer times out and start conditions removed.	Engine fuel solenoid shuts off the fuel. Engine stops.
Visual.	Engine Running - goes out.
Volt free.	Engine running - clears.

If the autostop option is specified at the time of ordering then it can be disabled by fitting a link to the link marked, 'fit link to disable autostop' on the electronic control module.

8f BATTERY FAILURE DURING CRANKING

As the starter motor engages, the battery voltage dips briefly to a low value and then recovers to a higher steady value during cranking. With a poor battery, the steady cranking voltage eventually falls below the fault level of half the float voltage.

Engine cranking.	Battery voltage goes below fault level Cranking from the faulty battery ceases battery in circuit.
Visual.	Battery A (or B) Healthy - goes out.
Audible.	Non-mutable.
Volt free.	Fault on engine or controller.
Cranking continues.	All remaining crank attempts occur from the healthy battery.
Press the Reset pushbutton.	Alarms clear.

9 WEEKLY START TIMER and Test start

Set the timer to activate at a convenient day and time or press the test start pb (PB5)	The timer activates.
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With a drain valve fitted.

The drain valve energises to lower the pressure in the start pressure switch pipework.

Visual.

Crank Timer On.

Autostart is initiated as described in Section 8

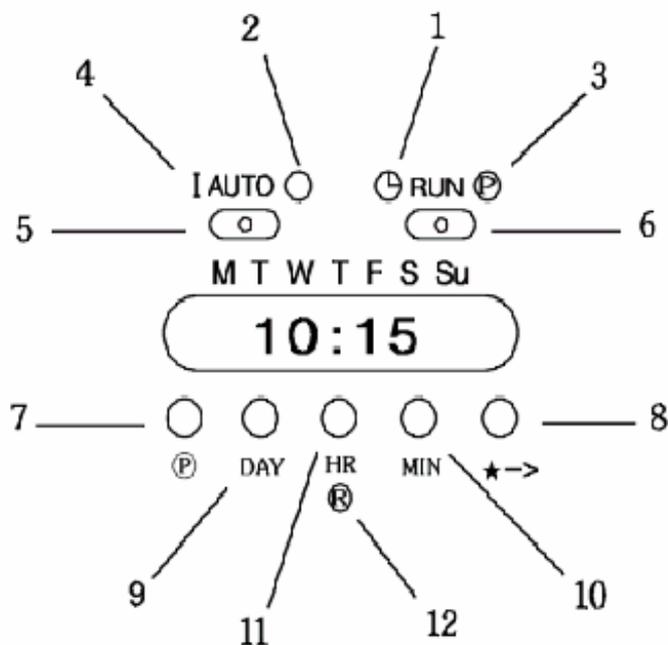
When the weekly start timer de-energises (time period is adjustable on the weekly start timer) then the engine will stop automatically.

The weekly start timer must be set so that the engine runs for at least 30 minutes to comply with NFPA 20 specifications.

10 TIMER

10.a TIMER SETTINGS - DIEHL TYPE 884

CONTROLS



- 1 Allows actual time of day to be set using HR & MIN buttons. Allows actual day to be set using DAY button.
- 2 Timer Off.
- 3 Enables pushbuttons to be used to set programme ON & OFF times.
- 4 Timer ON Constant.
- 5 Timer operating to selected programme.
- 6 Displays time of day & allows set programme to run.
- 7 Selects programme memories. 8 ON 8 OFF.
- 8 Soft override.

9 Individual or group of Days.

10 Minute Units. Hold for Fast Scroll.

11 Units of Hours. Hold for Fast scroll.

12 Clears all settings.

10b REAL TIME SETTING

1 Press the 'R' button to reset all functions.

2 Set the 'RUN' slider switch to its left hand position.

3 Set time of day using the 'HR' and 'MIN' buttons

4 Set current day by repeatedly pressing the 'DAY' button until the Day arrow at the top of the digital display lines up with the current day symbol.

5 Set the 'RUN' slider switch to its centre position. The digital display now shows real time and current day.

10c WEEKLY START TIME SETTING

6 Set the 'RUN' slider switch to its right hand position.

7 Select the required start day by pressing the 'DAY' button repeatedly until the indicator arrow at the digital display top lines up with the required day symbol.

8 'ON' status is indicated by a 'LAMP BULB' graphic symbol on the digital display right hand side.
'OFF' status is indicated by the absence of the 'LAMP BULB' graphic symbol.

9 Press the circled P button (bottom row left hand button) until the digital display shows 1 and the lamp bulb symbol together at the right hand side of the digital display.

10 Set the 'ON TIME' by pressing the 'HR' & 'MIN' buttons until the digital display shows the desired 'ON' time.

11 Press the circled P button once (bottom row left hand button) and see that the digital display lamp bulb symbol is absent and the right hand symbol is now 2. Set the 'OFF' time at least 30 minutes later than the 'ON' time. This is required by the N.F.P.A. rules to give 30 minutes pump test run.

12 Ensure that all other on and off times are set at 00.00.

13 Set the 'RUN' slider switch to its centre position.

14 The timer will start the engine at the set day/time.

15 The 'AUTO' slider switch should remain in the centre position for normal operations. If the 'AUTO' slider switch is set to the left hand position, the timer is permanently ON. If the 'AUTO' slider switch is set to the right hand position, the timer is permanently OFF.

11 ENGINE SYSTEM MONITORING**11a ENGINE OVERSPEED**

If the engine overspeeds.

Engine fuel solenoid shuts off the fuel.
Engine stops.
Autostart is inhibited.

Visual.

Engine Overspeed
Engine Running - goes out

Audible.

Non-mutable

Volt free

Fault on engine or controller
Engine running clears
Engine Overspeed

Volt

free (option R)

The controller remains latched in this condition until reset.

11b RESETTING AFTER OVERSPEED

Select Man mode.

If necessary reset the engine speed switch.

Press the Reset pushbutton. Fault indications clear.

When the engine is ready, reselect Auto mode for operations.

11c OIL PRESSURE MONITOR

NOTE: Between calling for the controller to start the engine in automatic mode and the time when the engine fires it will be observed that the LOW OIL PRESSURE light comes on. This verifies that the oil pressure switch is wired in the correct condition.

Visual.

Low Oil Pressure.

Audible.

None.

Volt free.

None.

Engine runs and after a short delay

Visual.

Low Oil Pressure clears.

11d OIL PRESSURE MONITOR (Engine Running)

With engine running, if oil pressure goes LOW. Timer starts to time (10 secs).

Visual.

Low Oil Pressure.

Timer times out.

Audible.

Non-mutable.

Volt free.

Fault on engine or controller.
Low oil pressure - option R

Alarm remains active whilst the oil pressure is low only until the engine is shutdown.*

Engine stops.

Alarms clear.

11e HIGH WATER TEMPERATURE

With engine running, if water temperature goes HIGH. Timer starts (10 secs).

Timer times out.

Visual.

High Water Temperature.

Audible.

Non-mutable.

Volt free.

Fault on engine or controller.
High water temperature- option R.

Alarm remains active whilst temperature is high only until the engine is shutdown.

Engine stops.

Alarms clear.

Note: see OPTION K - Shutdown in test (if fitted)

11f SPARE CHANNELS (Options H1 & H2)

These channels can monitor a variety of parameters whose sensors provide closing contacts on fault.

When a spare channel sensor activates:

Visual.

Channel lamp

Audible.

Mutable or Non-mutable or lamp only

Volt free.

Fault on engine or controller.

Channel sensor clears.

Alarm indications clear.

11g OPTION H2c

With the engine running

Visual

Engine running

After the engine as been running for 10 seconds

auxiliary H2 channel is now active

channel H2 field contacts close

Visual.

H2 lamp

Volt free.

Fault on engine or controller.

Audible

Non muteable

Channel sensor clears

Alarm indications clear.

12 MAINS FAILURE

If the AC supply fails:

Visual.	AC On - goes out.
Timer times out (factory preset at time of ordering and NOT adjustable on site)	
Audible.	Non-mutable
Volt free.	Fault on engine or controller.

12a MAINS FAILURE START (Option F1)

With the controller in Auto Mode,
if the AC supply or a battery charger fails.

	A factory preset timer starts.
Visual.	AC On - goes out. AC/Charger failure.
Volt free.	Fault on engine or controller. AC/Charger failure - option R
The timer times out. (Factory preset)	Drain valve opens
Visual.	Crank Timer Operating. Test Mode on. Drain valve closes
Delay start timer starts to time	Engine cranks from one battery .
Engine runs up to speed.	Cranking is automatically cut off.
Visual.	Engine Running. Battery ammeters show zero current until the AC supply is restored.
Volt free.	Engine running.
When the AC supply is restored. (Or controller Reset after Charger fail)	. Battery chargers resume operation
Visual.	AC On.
Volt free.	Fault on engine or controller -clears. Engine runs on until manually stopped by the operator or the optional autostop timer.

Note: For option F, the above description is valid but with out test mode. In this situation an internal system activates the crank timer sequence.

13 MUTABLE ALARM

This is an OPTION and, if enabled, provides a muting facility on all fault channels (other than those prohibited under NFPA). This is self-cancelling.

Press Mute Button

Alarms silence

Fault clears

Mute is cancelled

Note: The volt free group fault output is unaffected by the mute function. **14 LAMP TEST**

Press the LAMP TEST button

Visual.

All lamps light.

15 ANTI-CONDENSATION HEATER (Option G)

Thermostat setting. 30? C.

With the cabinet interior temperature below 30? C. Anticondensation heater warms.

With the cabinet interior temperature above 30? C. Anticondensation heater cools.

16 ENGINE HEATERS (Options E1 AND E2)

There can be up to two engine heater supplies covering a range of power up to 3 KW with the standard optional circuit breakers CB6 & CB7, see section 20 for incoming circuit breaker sizing.

17 AUXILIARY DC SUPPLY (For Non-Inductive Loads)

The control system provides a protected auxiliary D.C. supply at control voltage, for non-inductive loads which is available at fused terminal 27 (F4). Replace with a 3.15A fuse only.

18 PRESSURE RECORDER (Dickson) (Fitted with option U3 only)

The recorder is fitted with a 7 day chart. To change a chart slip the old chart off the centre slot. Place the new chart in position and make sure that it lies under the two tags which are at the top and right hand edges. Rotate the chart using a coin or similar tool in the centre boss slot until the current day/time position is under the pen tip. Ensure that the pen tip rubber cover is removed. Take care not to over strain the pen arm. A pen is changed by simply sliding the old pen from the housing and sliding in a new one until it stops.

The rotational speed of the chart is regulated by means of a clock which is powered by a battery. The recorder is shipped switched off. Switch on by using the switch in the bottom right of the chart plate. It is recommended that the battery is renewed every six months, size AA. See the battery record under the chart. Access to the battery is via the turn-to-release cap, use a coin or similar tool, at the bottom left of the chart plate. The battery should be installed + at the top.

19 SHUTDOWN IN TEST (OPTION K)

Press test start.

Visual.

Test mode on.

Drain valve opens

Pressure falls

Delay start timer times out (if enabled)

Cranking is initiated

Drain valve closes

Engine runs.

Should a low oil pressure or high water temperature occur.

Visual.

Low oil pressure **OR**
High water temperature
Test Mode on.

Stop solenoid energises

The fault channel remains latched until reset by the operator. In this condition, the engine will re-start should a remote start, deluge valve start, or pressure drop occur.

20 Mains incoming Circuit Breaker

The incoming AC supply should be protected upstream by a 10A non inductive load type circuit breaker if no engine heaters are fitted. If engine heaters are fitted then the values of CB5 & CB6 should be added together and added to 10A and the nearest value above this should be used. Use the table below to determine CB5 and CB6 value.

CB5 & CB6

OPTION	HEATER SIZE	CIRCUIT BREAKER SIZE FOR 240V	CIRCUIT BREAKER SIZE FOR 120V
E1a OR E2a	500W	2A	4A
E1b OR E2b	500W TO 1kW	6A	10A
E1c OR E2c	1kW TO 2kW	10A	16A
E1d OR E2d	2kW TO 3kW	16A	32A

21 Expansion Module, Options Y1 & Y2.

The expansion module option Y1 displays 12 channels, 8 of which are totally configurable and 4 are preset.

The 8 channels can be configured for:-

Latched	Where the reset push button must be pressed to cancel the alarm.
Muteable	Where the alarm can be silenced, when the channel is activated.
Alarm	The channel when activated sounds the alarm, not muteable.
Polarity	The channel can be normally closed or normally open input contacts.
Inhibit	The channel only operates if the engine has been running for the duration of the oil timer.
Shutdown	If this function is enabled for the particular channel, then if the engine was started by test mode, then the engine will shutdown.
First up	A different flash rate of the indicator which was first to be annunciated out of these 8 auxiliary channels.

All eight channels are totally configurable in any combination of the above parameters.

The four preset indicators are;

Remote Start

This indicator illuminates when the engine is started via the remote start input. It clears when the engine is stopped or if the reset push button is operated.

Controller Unavailable

This indicator illuminates if either, The controller is in manual mode, engine over speed condition exists, engine has failed to start or if the stop timer is operating.

Battery Fault

This indicator is lit if either or batteries have failed.

Manual Mode

This indicator is lit if the controller is in manual mode.

23 CONTROLLER SPECIFICATION

23a REMOTE CONTACTS. (VOLT FREE)

Maximum voltage:	125V
Maximum current rating:	10A
Minimum power	

23b SOLENOID OUTPUTS.

Maximum current rating:	10A
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23c BATTERY CHARGER.

Maximum battery capacity:	224Ah
Charging method:	Constant current and constant voltage control
Charging Topology:	Dual Thyristor based
Battery charging algorithm:	Intelligent boost equalise float cycle (FM APPROVED ONLY)
Temperature Probe:	Optional for battery voltage compensation
Efficiency :	60-80%
Power factor, typically	0.5
Short circuit protection:	Fused output

23d COMPLETE CONTROLLER

Temperature range: -10 to 60? C
Fully EMC compliant: 89/336/EEC

24 TROUBLE SHOOTING

This engine controller has been carefully engineered and built to give years of dependable, trouble - free service. However, for various reasons difficulty may be encountered in the operation. Therefore, the following information is submitted as a guide for locating faults which are easily corrected. If the fault proves to be beyond the scope of this operating manual, then please consult Metron Eledyne for further advice.

Before commencing fault finding:

- A) Check that the engine batteries are to the correct voltage level. Check that all circuit breakers are on and that all connectors and relays are firmly seated into position.
- B) The electronic control module has 2 status lights for annunciating the general condition and operation. The green light labelled, '+5v SUPPLY ON' is illuminated when the local +5v supply is healthy and when the logic is operating within normal limits, this light should therefore be always on. The red indicator marked 'BOARD FAULT' should never be illuminated unless there is a serious problem with the board, if this illuminates then please contact Metron Eledyne immediately.

24a Engine Starting Problems

Engine does not crank.

- A) While the engine is 'supposed' to be cranking, check the status lights on the output of terminals 9 and 10, labelled 'CRANK A' and 'CRANK B' on the electronic control module. If one of the lights are lit, then the problem is in the engine or the engine to controller wiring. If the lights are not lit, then proceed to point B.
- B) Check to see if status light on the input of terminal 2 is lit, labelled 'ENGINE RUNNING' on the electronic control module. If this is lit then the controller believes that the engine is running and will not crank. In this instance check the speed switch wiring.
- C) Check the engine starter batteries to ensure that they are fully charged. Voltage measurement without an actual load is not a sufficient check for the battery condition because the battery plates may be sulphated and not capable of producing cranking power.
- D) Check all battery and ground connections from the battery to the engine box. Also check wiring between the engine solenoids and controller.

Engine Cranks but does not start

- A) Check fuel and throttle solenoid operation on the engine.
- B) Check that CB4 is switched on, and that there is a positive supply available on it at the correct battery voltage.

Engine Starts but does not disengage starter motor

- A) Check status light labelled 'ENGINE RUNNING' located on the electronic control module. This indicator is lit when there is a positive voltage on terminal 2. It should therefore be off while the engine is cranking and then illuminate before the engine reaches ½ normal speed. If this status light does not illuminate at all, then the engine speed switch should be tested for operation and its set points verified also.

24b Weekly start timer does not start the Engine

- A) Make sure that the weekly start timer (PC) is set for the correct day.
- B) When the weekly start timer is energised to start the engine the drain valve should energise to drop the water pressure. Check the drain valve operation by pressing the test start push button. (Weekly start timer output and test start push button operate the same circuit)

24c Low oil Pressure alarm does not operate

- A) Simulate a low oil pressure condition by shorting out the oil pressure switch contacts on the engine. In this condition the status light labelled, 'LOW OIL PRESS.' should illuminate, located on the electronic control module. If this status light does not light in this condition then please check the engine wiring between the oil pressure switch and controller.

24d High Water Temperature alarm does not operate

- A) Simulate a high water condition by shorting out the high water temperature switch contacts on the engine. In this condition the status light labelled, 'HIGH WATER TEMP.' should illuminate, located on the electronic control module. If this status light does not light in this condition then please check the engine wiring between the high water temperature switch and controller.

24e Engine Over speed Alarm does not operate

- A) Simulate an engine over speed condition by shorting out the appropriate engine speed switch contacts. In this condition the status light labelled, 'ENGINE O/SPEED' located on the electronic control module should illuminate. If this status light does not light in this condition then please check the engine wiring between the speed switch and controller. The engine speed switch should be tested for operation and its set points verified also.

24f Battery Charger Problems

- A) Verify that the AC mains supply is present and that the indicator 'AC SUPPLY HEALTHY' is lit. If it is not lit then check CB1 and the AC isolator.
- B) Check that the transformer secondary voltage output is present. It should be +35vac for 24v and 22vac for 12v systems.
- C) Check the output of D1 and D2 bridge rectifiers. Located on the sides of the battery charger chassis.
- D) Check fuses F1A,F1B and F2A,F2B. Located on the front of the battery charger chassis.
- E) Check that all connectors and plugs on the battery charger are fully snapped into place and securely fastened.
- F) Check that the temperature compensation module is securely fastened to the chassis. Plug T on the chassis, left hand side.
- G) Check that the green 'POWER ON' indicator is lit, located on the PC143 battery charger regulator board. If its is not lit, then verify that the system as the correct battery voltage present and that CB4 is switched on.

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