

AUTOSTART FIRE PUMP CONTROLLER FD2E USER INSTRUCTIONS

1 PREFACE

This operating manual explains the operation of the complete control system and some options, where appropriate. Refer to the 'Description of Options' appendix section of this manual for the full list of options available.

2 CAUTION - HEALTH & SAFETY INFORMATION

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 A.C and D.C supplies, 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.

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, 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 for Engine Driven Fire Pump Controllers.

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

Visual - Lamp or meter.

Audible - Electronic sounder.

Volt free - Remote indicating volt free changeover contacts.

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. As detailed on the engine wiring/interconnection drawing.

Set the following in order:

Mode Switch (S1).	Man.
All internal CBs.	On.
DC Isolator/CBs (CB2 & CB3).	On.
AC Isolator (S3).	On.
Visual.	AC On.
Volt free.	Voltmeter shows selected battery volts. Fault on engine or controller. Controller off or in manual.
Press the Reset button	
Visual.	Battery A Healthy. Battery B Healthy. Ammeters show current. Voltmeter shows selected battery volts.
Audible.	Silent.
Volt free.	Controller off or in manual.

5 **BATTERY DISCONNECTION/OVERVOLTAGE OPERATION / AC FAILURE**

If a battery system connection is loose, or a battery is disconnected.

After a short delay:-

Visual.

Battery Healthy off (A or B)

Volt free (option R6)

Battery failure - Remote

after approx 2 seconds

Visual

AC/ Charger fail.

Audible.

Non-Mutable.

Volt free

Fault on engine or controller

Volt free (option R5)

AC/Charger fail - Remote

Or if the AC supply is off.

Visual

AC On - goes out

after approx 2 seconds

Visual

AC/ Chargers fail

Audible

Non-Mutable

Volt-free

Fault on engine or controller

When the charging system is ready,
reset the controller.

Battery charger alarms clear.
Battery chargers operate normally.

6 BATTERY CHARGING (12 & 24 volt systems)

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 FOR ALL TYPES OF BATTERY ARE FOR AN AMBIENT TEMPERATURE OF 20 DEGREES CELCIUS

WARNING NOTICE
The performance of the battery chargers is entirely automatic. No operator variables are provided, the chargers are factory preset and <u>NO ADJUSTMENTS MUST BE ATTEMPTED ON SITE</u> or damage to the batteries may result. Maintenance of batteries should be carried out in accordance with the instructions issued by the battery manufacturer.

If the temperature compensation unit becomes disconnected or malfunctions.

Battery voltages default to the value at 20 degrees Celcius.

Visual.

AC Charger Failed.

Audible.

Mutable.

Volt free.

Fault on engine or controller.

LEAD ACID BATTERIES

NOTE
Figures in brackets refer to 12 volt systems.

Set the voltmeter switch to the desired battery position.

The battery voltage remains stable at the float level of 27.5 (13.7) volts until reduced by loading.

If the battery voltage goes more than 100mV below the nominal float voltage level.

The ammeter reads Current Limit level of 10 Amps.

If loading reduces the battery voltage to below 26 (13) volts.

A period of boost/equalisation is initiated.

Battery voltage rises and may reach the maximum of 31.5 (15.1) volts.

Regular voltage sampling takes place.

The voltage plateau of the battery is determined.

A period of cell voltage equalisation occurs.

The battery voltage floats at 27.5 (13.7) volts, each cell ideally being at 2.29 volts.

The battery voltage remains stable at the float level of 27.5 (13.7) volts until again reduced by loading.

The battery charger achieves the stable battery float voltage in less than 24 Hrs.

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.

18 (9) CELL NI/CAD BATTERIES

NOTE
Figures in bracket refer to 12 volt systems.

Set the voltmeter switch to the desired battery position.

The battery voltage remains stable at the float level of 26.1 (13) volts until reduced by loading.

If the battery voltage goes more than 100mV below the nominal float voltage level.

The ammeter reads Current Limit level of 10 Amps.

If loading reduces the battery voltage to below 24.6 (12.4) volts.

A period of boost/equalisation is initiated.

The ammeter reads the Current Limit level of 10 Amps.

Battery voltage rises and may reach the maximum of 29.7 (14.8) volts.

Regular voltage sampling takes place.

The voltage plateau of the battery is determined.

A period of cell voltage equalisation occurs.

The battery voltage floats at 26.1 (13) volts, each cell ideally being at 1.45 volts.

The battery voltage remains stable at the float level of 26.1 (13) volts until again reduced by loading.

The battery is recharged in less than 24 Hrs.

20 (10) CELL NI/CAD BATTERIES

NOTE
Figures in brackets refer to 12 volt systems.

Set the voltmeter switch to the desired battery position.

The battery voltage remains stable at the float level of 29 (14.5) volts until reduced by loading.

If the battery voltage goes more than 100mV below the nominal float voltage level.

The ammeter reads Current Limit level of 10 Amps.

If loading reduces the battery voltage to below 27.5 (13.8) volts.

A period of boost/equalisation is initiated.

The ammeter reads the Current Limit level of 10 Amps.

Battery voltage starts to rise.

On passing 30.3 (15.1) volts the current limit value is reduced to 5 Amps.

Battery voltage rises and may reach the maximum of 33.0 (16.5) volts.

Regular voltage sampling takes place.

Battery voltage approaches 31.5 (17) volts.

Regular voltage sampling takes place.

The voltage plateau of the battery is determined.

A period of cell voltage equalisation occurs.

The battery voltage floats at 29 volts, each cell ideally being at 1.45 volts.

The battery voltage remains stable at the float level of 29 volts until again reduced by loading.

The battery is recharged in less than 24 Hrs.

7.CONTROL SYSTEM MANUAL OPERATION

Unlock and lift the hinged switch cover.

Select Manual Mode.

Visual.

Auto Mode off

Volt free

Controller off or in manual

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
2. 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

ENGINE RUNNING

The engine normally starts after only a few seconds cranking.

Engine runs up to speed.

Visual.	Engine running.
Volt free.	Engine running.

ENGINE SHUTDOWN

Push the Engine Shutdown button.	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

Three 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 (AUXILIARY AUTOSTART)
- 4.(option D1) From Deluge Valve start

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.

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

Set the Mode switch to Auto

Visual.	Auto Mode On.
Volt free.	Controller off or in manual clears.

AUTOSTART

Start initiated	The engine cranks from one battery. (A or B - indeterminate)
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Visual. Crank Timer On
 cranking Ammeters show zero current while

Volt free(Option R1) Pump on Demand - Remote

CRANK SEQUENCE

Once initiated,crank attempts occur from each battery alternately.

Crank solenoid energises for 15 secs. Cranking ceases for 15 secs.(repeated a total of six times if engine does not start)

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

Cranking is automatically cut off

Visual

Engine running
 Crank Timer on- goes out. Used battery ammeter shows current at the limit level after cranking.
 Engine running

Volt free

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

Pressure rises above the start pressure set point.

Engine continues to run until stopped by operator or Autostop module.

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

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.
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Visual	Engine Running - goes out.
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Volt free.	Engine running - clears.
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AUTOSTOP (Option B)

When the engine runs.

Autostop timer starts to time	Adjustable 20 to 80 mins.
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Autostop timer times out and start conditions removed.	Engine fuel solenoid shuts off the fuel. Engine stops.
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Visual.	Engine Running - goes out.
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Volt free.	Engine running - clears.
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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 Cranking resumes with the healthy battery In circuit
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Visual.	Battery A (or B) Healthy - goes out.
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Audible.	Non-mutable.
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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

Set the timer.

To activate at a convenient day and time.

The timer activates.

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

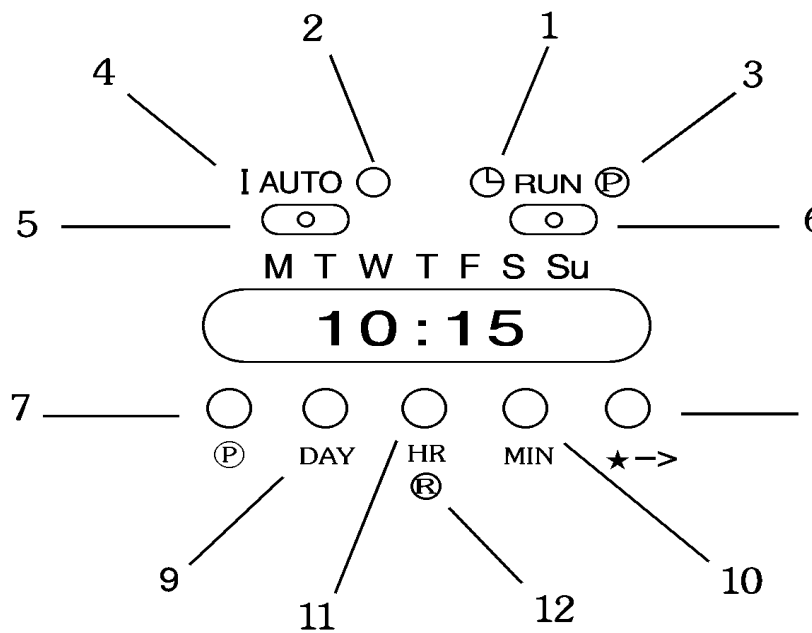
The engine starts and runs until shut down by the operator or the Autostop module.

The Weekly start timer must be allowed approximately 30 minutes to reset before the engine is stopped. This is automatic when using the Autostop module.

10 TIMER

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.

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.

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

ENGINE OVERSPEED (Without air flaps fitted)

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 R4)

The controller remains latched in this condition until reset.

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.

ENGINE AIR FLAPS (Option C)

If the engine overspeed activates.

Air Flap Solenoid is energised.
Air flaps close.
Engine fuel solenoid shuts off the fuel.
Engine stops.
Autostart is inhibited.

Visual.

Engine Overspeed.
Air Flaps Closed.
Engine Running - goes out.

Audible.

Non-mutable

Volt free.

Fault on engine or controller.
Engine running - clears.

Air flap solenoid de-energises
when the air flaps close.
The controller remains latched in this
condition until reset.

RESETTING THE AIR FLAPS

Select Man mode.

If necessary reset the engine speed switch.

Press the Reset pushbutton.

Overspeed indications clear.

Air flap alarms persist.

Audible.

Non-mutable.

Reset the air flaps.

Air flap alarms persist.

Press the Reset pushbutton.

Air flap alarms clear.

When the engine is ready, reselect to operational mode.

OIL PRESSURE MONITOR

NOTE:

Between calling for the controller to start the engine 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 in the correct condition. (See Option S)

Visual.

Low Oil Pressure.

Audible.

None.

Volt free.

None.

Engine runs

Visual.

Low Oil Pressure clears.

OIL PRESSURE MONITOR (Engine Running)

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

Visual.

Low Oil Pressure.

Timer times out.

Audible.

Non-mutable.

Volt free.

Fault on engine or controller.

Volt free (Option R2)

Low Oil pressure - Remote

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

Engine stops.*

Alarms clear.*

HIGH WATER TEMPERATURE

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

Visual.	High Water Temperature.
Timer times out.	
Audible.	Non-mutable.
Volt free.	Fault on engine or controller.
Volt free(Option R3)	High Water Temp. - Remote
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)

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.
Volt free.	Fault on engine or controller.
Channel sensor clears.	Alarm indications clear.

12 MAINS FAILURE

If the AC supply fails:

Visual.

AC On - goes out.

Timer times out

Audible.

Non-mutable

Volt free.

Fault on engine or controller.

MAINS FAILURE START (Option F)

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

A adjustable timer starts. (TR4)

Visual.

AC On - goes out.
AC/Charger fail

Volt free.

Fault on engine or controller.

The timer times out.

Drain valve opens

Visual.

Crank Timer Operating.
Shutdown / test mode

Delay start timer TR1 starts to time

Engine cranks from one battery .

Engine runs up to speed.

Cranking is automatically cut off.
Drain valve closes

Visual.

Engine Running.
Crank Timer Operating - goes out.
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 autostop module.

13 **MUTABLE ALARM** (OPTION L)

This is an OPTION and, if fitted, 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

14 **LAMP TEST**

Press the LAMP TEST button

Visual.

All lamps light.

15 **ANTI-CONDENSATION HEATER (Option G)**

Thermostat setting. 30EC.

With the cabinet interior temperature below 30EC. Anticondensation heater warms.

With the cabinet interior temperature above 30EC. 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

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).

18 PRESSURE RECORDER (Dickson)

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. Shutdown / Test mode on.

Drain valve opens Pressure falls

TR1 times out Cranking is initiated

Engine runs.

After TR6 as timed.

(TR6 should be set so that there is time for the pressure to rise again. After TR6 as timed, then any 'real' start signal will cancel the test mode.)

Should a low oil pressure or high water temperature occur.

Visual. Low oil pressure - briefly **OR**

High water temperature briefly
Shutdown / test - on.

Stop solenoid energises for TR2.

In this condition, the engine will re-start should a remote start, deluge valve start, or pressure drop occur.

20 ENGINE LOCKOUT (OPTION M)

A special +24v input supply must be provided to power RL30 for this feature to function. When RL30 is energised all future automatic starts will be inhibited, if the engine is already running then it will continue to run.

21 MAINS INCOMING CIRCUIT BREAKER

The incoming AC supply should be protected upstream by a 10A (for 120-240v operation) 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 tables below to determine CB5 and CB6

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

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