

# Introducing the **POWER Plus**

By **e-CON**

## Innovative New Accessory For 3 Phase Induction Motors

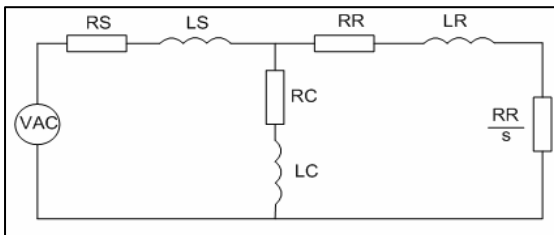
### Designed To Conserve Energy & Reduce Operating Costs

#### PRODUCT THEORY & METHOD

The **POWER Plus** from E-CON Industries, LLC has been designed for energy conservation in real power (kWatts) in applications using three phase induction motors at <600 VAC (Delta or Wye). This proprietary method for energy conservation yields dollar savings in the form of reduced motor operating cost.

Energy conservation is achieved by minimizing the electrical losses of the individual motor, which are generally categorized as:

- Losses in the Stator
- Losses in the Rotor
- Losses in the Magnetic Core

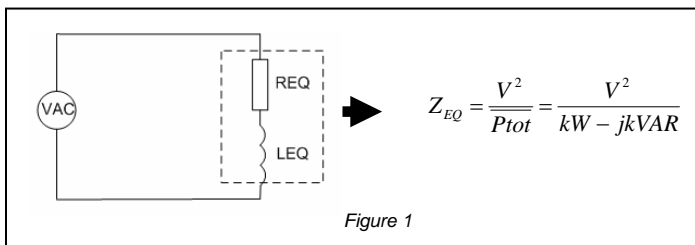


EQUIVALENT CIRCUIT FOR 1PHASE OF A 3 PHASE A/C MOTOR

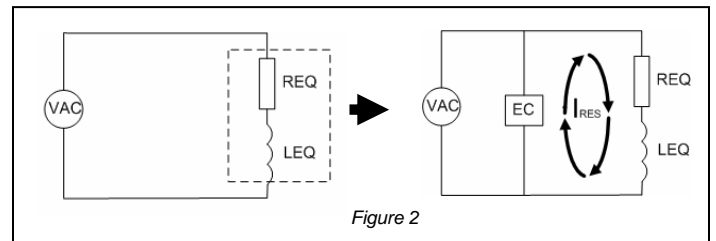
Under-loaded, or oversized, motors have more electrical losses and therefore more potential for energy conservation and dollar savings than fully loaded motors.

In order to determine the amount of electrical losses and potential for conservation and savings, an electrical motor energy audit of the motor load must first be conducted under normal operating and load conditions – which entails collecting basic electrical values of the motor load (voltage, current, real power, total power, power factor, and reactive power).

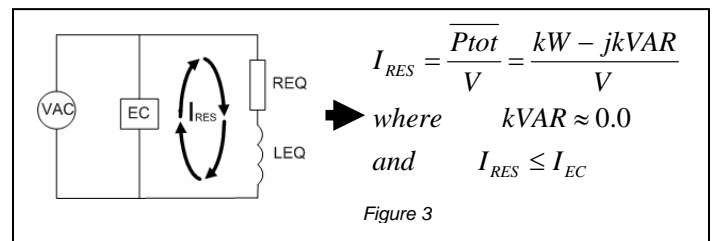
These values are then used to accurately calculate and determine the complex impedance (i.e. resistance and inductance) of the motor (Figure 1).



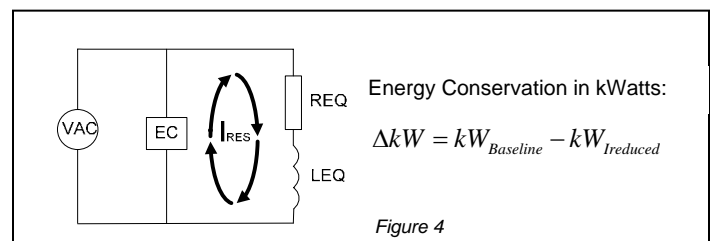
Based on these mathematical parameters the **POWER Plus** can then be customized to create a resonant current and produce a recycling effect of the unused reactive current (Figure 2).



This unique recycling and balancing process flows between the **POWER Plus** and the motor, which diminishes the electrical losses across the motor and therefore lowers the consumption of line side current and real power (kW) of the main source, without affecting the output, or load (Figure 3).



This difference between the original line side power and reduced line side power becomes the energy conservation (Figure 4). Average kW savings range from 10 -35% kW depending on motor load conditions, and will always be dependent upon the load.



## PROJECT PROCEDURE

The general project procedure is as follows:

- Facility Assessment
- Proposal
- Receipt of Customer PO and 50% Production Deposit
- Production
  - Procurement
  - Manufacturing
  - QA
  - Shipment
- Delivery and 50% Balance Due
- Installation (by Customer or recommended electrician)
- Follow Up and Support

The Facility Assessment is the most critical step in the Project Procedure and entails a visit to the facility by E-CON representatives in order to perform an electrical motor energy audit. Usually, a motor list is provided prior to the Assessment that contains basic motor name plate information (e.g. HP), motor location, ID number, annual hours of operation, and if the motor incorporates any Soft Starts, VFD's or other peripherals. Utility billing information is also generally collected during the Assessment in order to determine the historical average annual utility rate.



TYPICAL ASSESSMENT WITH FLUKE 434 AND LAPTOP

**Generally, motors greater than 5HP, with at least 50% annual operation time, and without Soft Starts and/or VFD's are the best candidates for Assessment and application.**

Normally, a facility representative who is very familiar with the location of the motors and their operation is required to assist with locating the identified motors from the list. Moreover, it is very important that the motor be under normal load and operating conditions during the electrical motor energy audit, which usually takes 15 minutes per motor.

Once the Assessment is completed, E-CON can generate a Proposal document outlining the projected investment, required equipment, payback period, and ongoing cost savings.

After the Proposal is accepted by the Customer, a Purchase Order is submitted to E-CON with a production deposit of 50% of the total investment. This deposit secures the order and initiates the manufacturing process. Each **POWER Plus** unit is individually tested for quality assurance throughout the Production process and again before shipping. E-CON follows UL-508A guidelines. Delivery is generally made within 6 – 8 weeks, when final payment is also due.

## INSTALLATION

Installation should be handled by a licensed electrician designated by the customer, or recommended by E-CON. Though the installation of each unit is as simple as installing a panel box or service disconnect, installation time varies depending on the electrician and mounting requirements, but generally ranges between 15 minutes and 2 hours.

E-CON products are suitable for indoor or outdoor environments, and complete instructions regarding Installation are detailed in the User's Manual that is included with each order (also listed are recommended bill of materials and wiring diagrams).

Because the **POWER Plus** is a passive device it is always connected in parallel, ideally at the motor connection (@ motor junction box), or on the load side of the service disconnect near the motor, per local codes and NEC requirements.



TYPICAL INSTALLATION AT MOTOR CONNECTION



TYPICAL INSTALLATION AT MOTOR CONNECTION



TYPICAL INSTALLATION AT SERVICE DISCONNECT

Loads utilizing soft start, delta/bye start, or part-wind starting methods are compatible with the **POWER Plus**. Such applications follow specific connection guidelines which are addressed and detailed in the User's Manual.



TYPICAL PANEL MOUNT INSTALLATION



TYPICAL PANEL INSTALLATION FOR SOFT START APPLICATIONS

Loads utilizing variable frequency drives (VFD's) are not good candidates for the **POWER Plus** due to the functionality, high harmonic content, and circuitry design involved with the VFD. Moreover studies have not consistently verified any significant energy savings when combining a VFD and the **POWER Plus**.

E-CON recommends and currently uses the Fluke 430 Series Power Quality Analyzer for the electrical motor energy audit process. This is a very accurate, reliable, and user friendly meter.



FLUKE 430 SERIES POWER QUALITY ANALYZER

An additional electrical motor energy audit can be conducted following Installation and the motor returns to normal operating conditions to verify energy conservation and dollar savings. The simplest way to verify savings is to collect a baseline sample of motor load data (without **POWER Plus**):

Power & Energy				
FULL 0:00:06				
	A	B	C	Total
kW	3.859	4.069	4.242	12.17
kVA	4.925	5.335	5.232	15.50
kVAR	3.061	3.451	3.062	9.600
PF	0.78	0.76	0.81	0.79
DPF	0.78	0.76	0.81	0.78
A rms	17.44	18.85	18.53	
<hr/>				
	A	B	C	
V rms	282.4	283.1	282.3	
11/16/06 19:21:03 277V 60Hz 3Ø WYE DEFAULT				
VOLTAGE	ENERGY		TREND	HOLD RUN

SAMPLE DATA: BASELINE

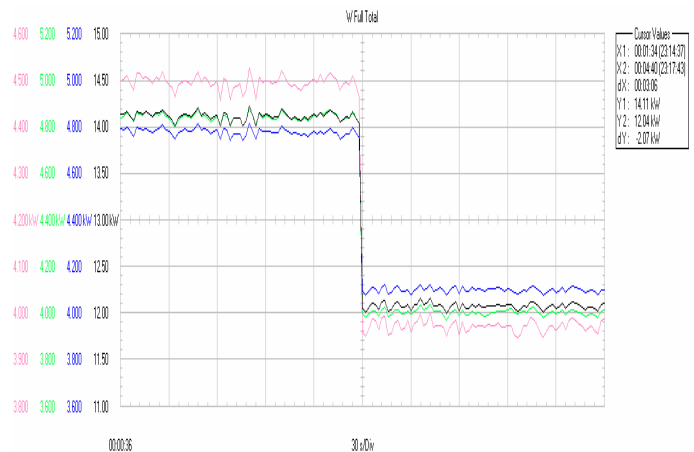
Then take another comparable load sample with **POWER Plus** engaged and evaluate the difference:

Power & Energy				
FULL 0:00:03				
	A	B	C	Total
kW	3.402	3.653	3.813	10.87
kVA	3.457	3.683	3.869	11.02
kVAR	±0.614	0.471	±0.651	±1.824
PF	0.98	0.99	0.99	0.99
DPF	1.00	1.00	1.00	1.00
A rms	12.22	12.99	13.67	
<hr/>				
	A	B	C	
V rms	282.9	283.6	282.9	
11/16/06 19:13:50 277V 60Hz 3Ø WYE DEFAULT				
VOLTAGE	ENERGY		TREND	HOLD RUN

SAMPLE DATA: WITH POWER PLUS  
(20HP MOTOR LOAD)

Real Power (energy) is recorded and listed as kW, Total Power as kVA, Reactive Power as kVAR, Power Factor as PF, Displacement Power Factor as DPF, Current as A rms, and Voltage as V rms.

Energy conservation can also be presented graphically or downloaded into spreadsheet format.



GRAPHICAL REPRESENTATION OF SAVINGS

### SAVINGS ESTIMATIONS/PROJECTIONS

E-CON applies a proprietary Model to conservatively project real power (kW) savings, or energy conservation for each motor application. The average values of the data collected during the electrical motor energy audit are used to calculate the impedance of the motor and necessary equivalent resonance current to match the equivalent circuit of the 3 phase motor.

divided by the application cost to yield a projected payback period (in years).

These projections are itemized for each recommended application and submitted with the Proposal for Customer review.

ASSESSMENT DATA							
AVG. VOLT	AVG. AMP	AVG. kW	AVG. kVA	AVG. PF	AVG. kVAR	AWG	LENGTH (m)
297.03	13.89	1.23	3.93	0.31	3.73	8	20
282.47	46.58	4.90	13.17	0.36	12.07	8	20
283.97	57.27	8.13	16.26	0.47	13.66	8	20
281.56	70.05	9.48	19.72	0.50	17.27	8	20
283.23	50.23	9.89	14.24	0.69	10.44	8	20
284.20	172.84	38.60	49.13	0.79	30.38	1	20
283.09	73.80	7.06	20.90	0.31	19.06	2	20
282.75	73.82	5.70	20.87	0.26	19.87	8	20
282.78	117.21	8.95	33.16	0.26	31.71	1	20
283.97	57.27	8.13	16.26	0.47	13.66	8	20

SAMPLE ASSESSMENT DATA

This proprietary Model can also calculate projected annual dollar savings and payback periods for each application when the hours of operation and utility rate are known.

FINANCIAL INFORMATION					
PROPOSED UNIT	EQUIPMENT COST	ASSESSMENT SUPPORT	VERIFICATION SUPPORT	APPLICATION COST	PAYBACK (YEAR)
EC480V04K80	\$764.00	\$110.00	\$100.00	\$974.00	3.80
EC480V14K40	\$804.00	\$110.00	\$100.00	\$1,014.00	1.19
EC480V16K00	\$810.00	\$110.00	\$100.00	\$1,020.00	0.87
ECS480V20K80	\$2,064.00	\$150.00	\$100.00	\$2,314.00	1.69
EC480V12K80	\$800.00	\$110.00	\$100.00	\$1,010.00	2.14
ECS480V35K20	\$2,970.00	\$150.00	\$100.00	\$3,220.00	3.03
ECS480V20K80	\$2,064.00	\$150.00	\$100.00	\$2,314.00	1.85
ECS480V24K00	\$2,230.00	\$150.00	\$100.00	\$2,480.00	1.32
ECS480V35K20	\$2,970.00	\$150.00	\$100.00	\$3,220.00	4.64
EC480V16K00	\$810.00	\$110.00	\$100.00	\$1,020.00	1.04

FINANCIAL INFORMATION					
TOTAL UNITS	EQUIPMENT COST	ASSESSMENT SUPPORT	VERIFICATION SUPPORT	APPLICATION COST	PAYBACK (YEAR)
10	\$17,906.00	\$1,520.00	\$1,200.00	\$20,626.00	1.76

SAMPLE PROJECTIONS: PAYBACK PERIOD

### Important Notes:

- (1) Projections are based on the electrical load data collected during the Assessment, and the hours of operation and utility rate provided by the Customer. Changes in the basis can significantly effect the actual payback period.
- (2) Energy conservation and dollar savings cannot be extrapolated from treated applications to untreated applications.
- (3) The payback period is based on the prior year's average annual utility rate provided by the Customer. Utility rates have consistently risen over the past 10 years.
- (4) Additional savings may be possible if the Utility Company billing structure includes charges for kVAh and/or kVARh.
- (5) All E-CON products carry a full 1 year warranty. Extended warranties are available for an additional charge.
- (6) The expected application life is 10 – 25 years depending on the environment and operating conditions.

E-CON is a privately held Texas based limited liability corporation (LLC) providing high quality customized energy conservation products and services. The E-CON process and product line is patent pending.

ENERGY SAVINGS						
Original kW	New kW	REDUCED kW	REDUCED kW %	AVG \$/kWh	Hours/Year	\$ savings/year
1.23	0.55	0.68	55.22%	0.11340	3328	\$256.31
4.90	2.89	2.01	41.00%	0.11340	3744	\$852.92
8.13	6.05	2.07	25.52%	0.11340	4992	\$1,174.11
9.48	6.58	2.89	30.53%	0.11340	4160	\$1,365.32
9.89	8.89	1.00	10.13%	0.11340	4160	\$472.44
38.60	36.10	2.50	6.49%	0.11340	3744	\$1,063.40
7.06	4.12	2.94	41.66%	0.11340	3744	\$1,248.32
5.70	2.37	3.33	58.43%	0.11340	4992	\$1,884.92
8.95	7.72	1.23	13.69%	0.11340	4992	\$693.77
8.13	6.05	2.07	25.52%	0.11340	4160	\$978.42

ENERGY SAVINGS						
Original kW	New kW	REDUCED kW	REDUCED kW %			\$ savings/year
118.31	93.43	24.88	21.03%			\$11,751.11

SAMPLE PROJECTIONS: ANNUAL DOLLAR SAVINGS

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