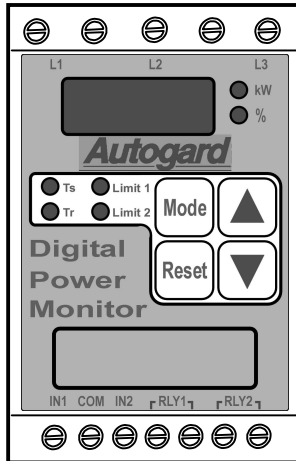


DIGITAL POWER MONITOR

Model E-220 Installation & Operating Instructions

A Digital Power Monitor with programmable trips, analogue and digital outputs.
For use with 3 phase electric motors.



- Can be used with variable frequency drives.
- Accurate and sensitive load monitoring not possible by current measurement alone.
- Measures and displays Power (kW/HP), % Load, RMS voltage, RMS current and Power Factor.
- Programmable limits have delay timers to avoid nuisance trips. (Types 1-4)
- Latching trips can be re-set remotely.
- Standard analogue outputs 0-10V and 4-20mA. (Type 5) plus digital outputs (Type 6).

Overview

The E-220 Power Monitor measures voltage and current to give the true 3-phase power in an electric circuit. This provides an accurate measure of motor load. Types 1-4 have programmable trips which activate internal relays at set power levels. These can be used to control process changes, alarms and motor shutdown circuits. Transducer models (types 5 and 6) provide output signals proportional to motor load for use with customers controllers, data-loggers, etc. Other non-standard types are also available. Please refer to separate datasheet.

Key Features

- Fully digital design, easy to program via interactive front panel.
- High frequency sampling for accurate real time power measurement.
- Self powered – no separate power supply required.
- Internal current transformer with single wire feed through hole in casing.

CONTENTS

page

General

Voltage Ranges	2
Current Ranges	2
Model Types	2
Function Summary	2
Technical Specifications	2

Installation

External Current Transformers	3
Basic Wiring	3
Wiring: Relays and Control Signal	4
Wiring: Transducer types 5,6	5

Operating Instructions

Prepower-up checklist	6
Set-up mode	6
Basic Settings	6
Setting Trip Levels and Delays	7
Run Mode	7

Voltage Ranges

The E-220 is suitable for use with motor voltages between 380 and 460V AC 3-phase. Units are factory set for either 50Hz or 60Hz supplies.

Current Ranges

The E-220 measures current using an internal current transformer (CT). There are 6 current range settings for optimum performance as shown in Table 2. For normal running currents over 25A (motor power 18.5kW/25HP), an external CT is also required. See page 3.

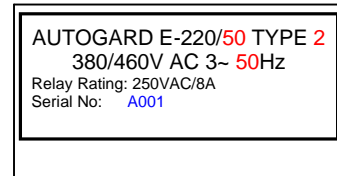
Table 1 - Function Summary

TYPE	FUNCTION
Type 1 Single Relay One overload trip	Relay is normally held closed and latches open on trip.
Type 2 2 relays One overload trip One underload trip	The overload trip operates relay 1. The underload trip operates relay 2. Both are normally held closed and latch open on trip.
Type 3 2 relays One overload warning One overload trip	Trip 1 (warning) operates relay 1 which is normally open and closes (non-latching) on trip. Trip 2 (overload) operates relay 2, which is normally held closed and latches open on trip.
Type 4 2 relays 2 overload trips Only one active at a time	0V to IN2 - trip 1 active on relay 1. 12-24 V DC to IN2 - trip 2 active on relay 2. Both relays normally held closed and latch open on trip.
Type 5 No trips or relays 0-10V and 4-20mA outputs	0-10V and 4-20 mA output signals proportional to Power, are available using the terminal block on the front panel.
Type 6 No trips or relays Digital Output in ASCII	The power value is output in ASCII characters as a digital signal using RS485.
Type 'n' Alternative configurations	Other type numbers have alternative configurations of relays, trips and outputs. See specific datasheet for the type concerned.

Model Types

The type designation indicates the function of the unit supplied. This is printed on the product label together with rating information as shown opposite. In this example, the unit is a Type 2, set for 50Hz operation.

Label Information (example)



Technical Specification

Voltage Range	380 – 460 V AC 3Ø
Current Range	Internal max 25 A With ext. CT: 300A
Supply Frequency	50/60Hz (Factory set)
Power consumption	2 VA
Display	3-digit, 7 segment LED
Units of power	kW (50Hz models) HP (60Hz models)
Relays	SPST
Contact rating	250V AC/ 8 A
Housing Enclosure	Noryl
Housing Base	Lexan
Mounting	35mm DIN rail
Protection Class	IP40 enclosure (excl. terminals)
Max wire L1,L2,L3.	12 AWG (4mm ²)
Max wire dia small term.	14 AWG (2.5mm ²)
CT wire hole	8 AWG (10mm ²)
Temperature range	-15° C - +50° C
Weight	260g
Dimensions (WxHxL)	45 x 78 x 108mm 1.77" x 3.07" x 4.25"

Table 2 - Current Range Settings

Motor Rating (380/460V)		Current Range
kW	HP	
up to 0.75	up to 1.0	1
0.76 – 2.9	1.1 – 3.9	2
3.0 – 10.9	4.0 – 14.9	3
11 – 18.5	15 – 25	4
18.6 - 45	26 - 60	5(ext. CT)
46 - 220	61 - 300	6(ext. CT)

INSTALLATION

WARNING !

This equipment must only be installed by qualified personnel. These instructions should be followed with reference to all other relevant instructions, wiring diagrams etc. relating to the specific application. The user must ensure that the overall installation is safe and conforms to all local and statutory regulations. Ensure that all mains electrical supplies are isolated and locked out before commencing installation or maintenance.

External Current Transformers

For normal running currents over 25A, an external current transformer (CT) is used as well as the internal CT. For these higher current ranges, the E-220 is designed to operate with a 300A/5A CT, Accuracy Class 1, rated at 2.5VA (minimum). Suitable CT's are available from Autogard and will be supplied with the unit when specified by the customer. If in doubt, please consult Autogard.

Basic Wiring

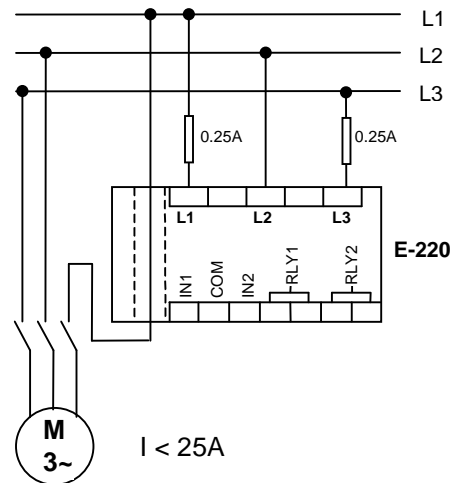
Fix the unit as required to the 35mm DIN rail. If an external current transformer (CT) is to be used, install according to the manufacturer's instructions, adjacent to the E-220 for convenience of wiring. Make the necessary connections according to the appropriate wiring diagram below.

Wiring Diagram Types 1-4 No External CT (I < 25A)

Wire as shown for normal motor currents up to 25A. One phase of the motor supply must be fed through the hole in the casing for the purpose of current measurement. This must be from the same phase as the connection to L1. Either of the other phases may be connected to L2 and L3.

Line fuses (0.25A) are required in the connections to L1 and L3. L2 is a high impedance input, which does not require a fuse.

Fig 1

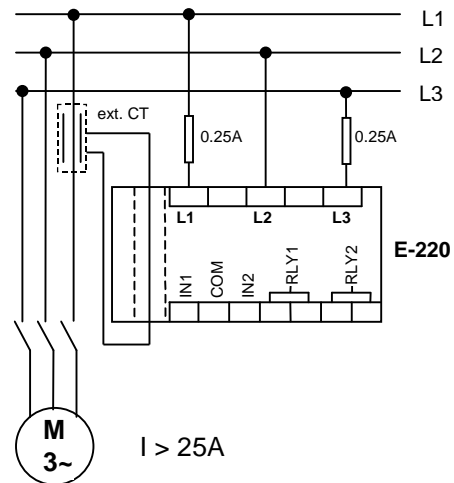


Wiring Diagram Types 1-4 With External CT (I > 25A)

Wire as shown for normal motor currents over 25A. One phase of the motor supply must be fed through the external CT. This must be from the same phase as the connection to L1. Either of the other phases may be connected to L2 and L3. Connect a wire to one secondary terminal on the CT, loop through the hole in the casing of the E-220 and connect to the other secondary terminal on the CT.

Line fuses (0.25A) are required in the connections to L1 and L3. L2 is a high impedance input, which does not require a fuse.

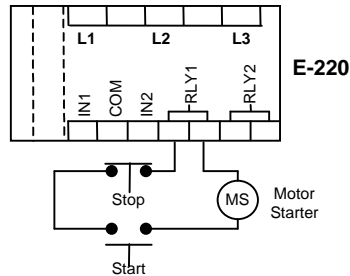
Fig 2



Wiring: Relays and Control Signals (Types 1-4)

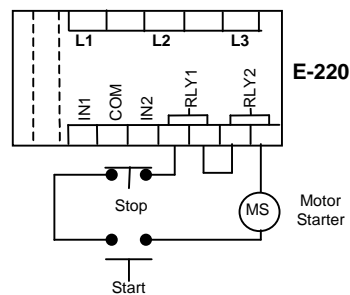
Refer to the the overall system installation manuals for full details and wiring instructions for relays and control signals. This information should be provided by the customer. Typical arrangements are shown in figures 2 – 4, but wiring may vary according to specific circumstances.

Fig. 3 Motor shut-off on trip (Type 1, 1 trip)



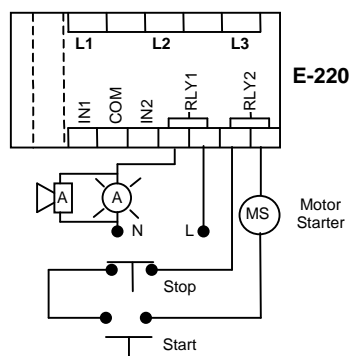
Relay 1 is normally held closed and opens when trip 1 is activated.

Fig. 4 Motor shut off on trip (Type 2, 2 trips)



Both relays are normally held closed and open when the corresponding trip is activated. In either case, the motor will be shut down.

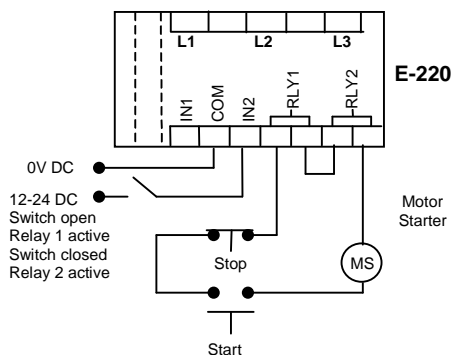
Fig. 5 Warning plus motor shut off. (Type 3)



Relay 1 is normally open. When the trip is activated, it closes the alarm circuit.

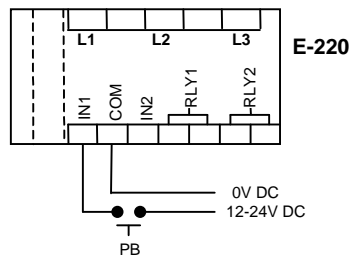
Relay 2 is normally held closed and opens when the trip is activated and shuts down the motor.

Fig. 6 Motor shut off on trip (Type 4, 2 independent trips)



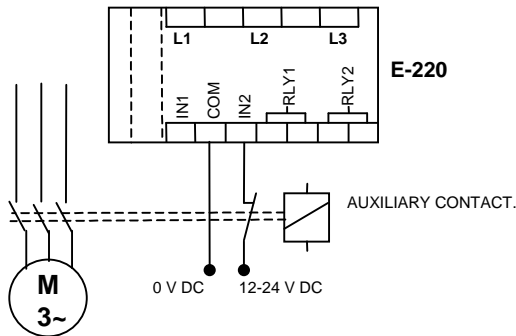
Both relays are normally held closed and open when the corresponding trip is activated. In either case, the motor will be shut down. Only one trip is active at a time, according to the signal to IN2.

Fig. 7 Remote Push Button to Reset (Types 1,2,3,4)



When 12-24V is detected on IN1, latched relays will be reset.

Fig. 8 Trip Inhibit on motor shutdown (Type 2)

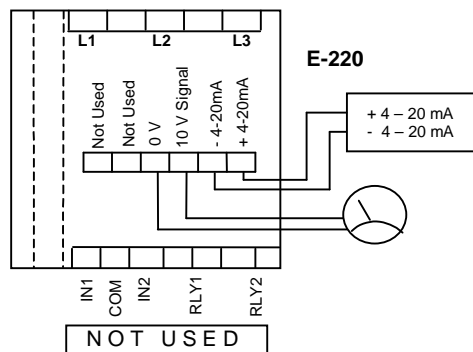


Trips are inhibited if 12-24V DC is applied to IN2. In the case of type 2, an auxiliary contact may be provided which inhibits the trips automatically on motor shut down, to prevent unwanted "underload" trips.

Wiring: Transducer Types 5 and 6

Types 5 and 6 have terminal blocks on the front panel. Make the necessary connections to external equipment according to the customer's instructions. Typical arrangements are shown below for reference.

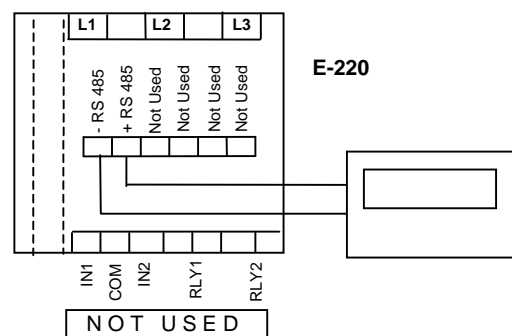
Fig. 9 Analogue output 0-10V, 4-20mA (Type 5)



4 – 20 mA analogue output

0 – 10 V signal to analogue meter.

Fig. 11 Digital output (Type 6)



Type 6 outputs Power as serial data expressed as an ASCII character string. Please consult Autogard for data format and refer to the customer's instructions for interfacing details.

OPERATING INSTRUCTIONS



Prepower-up Checklist

Before first operating the unit, please verify the following items:


- Is the motor voltage in the range 380-460 V AC (3 phase)? If not, please consult Autogard for a unit with alternative voltage rating.
- Does the frequency specification match your supply? (50 or 60Hz).
- Is the normal motor current < 25A? If not, you require an external current transformer.
- Does the feed from one phase pass through the body of the E-220? (Or the core of the external CT)
- Does the connection to L1 come from the same phase as the wire through the E-220 or CT?
- If any inputs or outputs have been connected to IN1 and IN 2, verify that they have been wired back to 0V to avoid creating ground loops.
- The primary disconnection device must comply with IEC947-1 or IEC947-3 and should be located near the E-220.

If the E-220 is used in a manner not specified by the manufacturer, the protection provided by the E-220 may be impaired.

Set-up Mode

The E-220 must first be configured to suit your installation. The E-220 has a user **set-up** mode for this purpose. When power is applied to the system, the E-220 starts automatically in **run** mode. To enter **set-up** mode, hold the *Mode* button for > 2 seconds.  will appear briefly and then  is displayed and one of the LED's next to the display flashes. The required parameters may now be set.

WARNING ! All trips are inhibited whilst in **set-up** mode. If no key is pressed for 30 seconds, the E-220 automatically reverts to **run** mode.

The first parameter displayed is  which determines if the readings are to be in Power (kW or HP) or percentage of normal power. Press the up arrow to change to Power (top LED flashes) or the down arrow for % (lower LED flashes). Initially, this should be set to read Power.

Press *Mode* to move on to the next parameter. This also confirms the previous setting. The full parameter list for each type is shown below. For parameters which have value settings, the symbol for the selected parameter alternates with the set value. When trip values are being set (Types 1-4 only), the corresponding LED on the front panel illuminates. The set value can be changed by pressing the up and down arrow buttons. If a button is held down, the change in value accelerates. To revert to the previous value for each setting, press *Reset*. This is useful if you make an error and have forgotten the previous setting. Using the *Mode* button, select each parameter in turn and adjust the setting as required.

Basic Settings – All Types

kW/HP, %Load “dSP”

The power can be displayed in kW/HP or as a percentage of the normal power. (% load). On initial set-up, select kW or HP. Note: 50Hz models have the kW option, HP is on 60Hz models. % load is set later.

Current Range “cur”

Select the required current range according to Table 2 (page 2). This is a guide to ensure that the optimum sensitivity is achieved. Use the up and down arrow keys to vary the setting. The unit will not be damaged if too low a range is selected, but measurements errors could occur. If in doubt, select a higher range.

Normal Power “nP”

It is necessary to set the power level which equates to 100%.

Types 1-4

For setting trips on type 1-4, it is convenient to set the normal running power to be 100% load. To do this, ensure any trips are set to *OFF* and exit **set-up** by holding down the *Mode* button for > 2 seconds. Run the motor under normal load conditions and note the E-220 Power reading. Now go back into **set-up** and set “nP” equal to the power level measured above.

Types 5,6

For types 5 and 6, the 100 % level corresponds to full scale output. Determine the normal power level as for types 1-4, and set “nP” accordingly.

Return to “dSP” by pressing *Mode* and set the display to % if required. Set up is now complete for types 5 and 6. To enter *run* mode, press hold down *Mode* for > 2 seconds.

For Types 1-4, proceed now to the instructions for setting trip levels.

Setting Trip Levels and Delays

Types 1 – 4

Start Delay "tS"

The start delay inhibits trips during motor start-up and thereby prevents tripping due to current surges. To give optimum protection, it should therefore be set to the minimum level which avoids nuisance trips. Set the required value (in seconds) by scrolling to "tS" and adjusting the value using the up and down arrow keys. If start delay is not required set to OFF by setting below 0.01s.

Type 1

Limit "L1" Overload

Select parameter "L1". Adjust to the desired Power or % level. For optimum protection, set to a low level and increase later if necessary. L1 can be set to OFF by setting below 0.01.

Delay "td1" Overload

Select parameter "td" with L1 LED also lit. Set the required trip delay in seconds. The trip will be activated when the load has continuously exceeded L1 for the duration of "td". Set to the minimum duration whilst being long enough to avoid nuisance trips.

Type 2

Limit "L1" Overload

Select parameter "L1". Adjust to the desired Power or % level. For optimum protection, set to a low level and increase later if necessary. L1 can be set to OFF by setting below 0.01.

Delay "td1" Overload

Select parameter "td" with L1 LED also lit. Set the required trip delay in seconds. The trip will be activated when the load has continuously exceeded L1 for the duration of "td". Set to the minimum duration whilst being long enough to avoid nuisance trips.

Limit "L2" Underload

Select parameter L2. Adjust to the desired Power or % level. For optimum protection, set to a high level and decrease later if necessary. L2 can be set to OFF by setting below 0.01.

Delay "td2" Underload

Select parameter "td" with L2 LED also lit. Set the required trip delay in seconds. The trip will be activated when the load has been continuously below L1 for the duration of "td". Set to the minimum duration whilst being long enough to avoid nuisance trips.

Types 3 and 4

Limit "L1" Overload

Select parameter "L1". Adjust to the desired Power or % level. For optimum protection, set to a low level and increase later if necessary. L1 can be set to OFF by setting below 0.01.

Delay "td1" Overload

Select parameter "td" with L1 LED also lit. Set the required trip delay in seconds. The trip will be activated when the load has continuously exceeded L1 for the duration of "td". Set to the minimum duration whilst being long enough to avoid nuisance trips.


Limit "L2" Overload

Select parameter L2. Adjust to the desired Power or % level. For optimum protection, set to a low level and increase later if necessary. L2 can be set to OFF by setting below 0.01.

Delay "td2" Overload

Select parameter "td" with L2 LED also lit. Set the required trip delay in seconds. The trip will be activated when the load has continuously exceeded L1 for the duration of "td". Set to the minimum duration whilst being long enough to avoid nuisance trips.

Run Mode

When you enter **run** mode,  will appear in the display and the LED's next to the display stop flashing, leaving the selected display option LED lit continuously. During **run** mode, the Power or % load value is normally displayed. Power Factor, Voltage and Current values can also be displayed by pressing *Mode* repeatedly. This scrolls through these values in turn and then returns to the Power or % reading.

Types 1-4

When a trip level is reached, the trip delay timer starts and the Td LED will light. If the limit is exceeded for a continuous period $>T_d$, the trip is activated and the corresponding relay changes state. Latching relays remain latched until the E-220 receives a reset signal. This may be done manually via the front panel (press the *Reset* button) or by applying a 12-24V DC signal to terminal IN1. The user must ensure that on re-set, the drive system restarts safely. Note, all trips have latching relays except for the warning level on Type 3.