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# **NOVAR 305**

## **12 Stage Capacitor Controller for Power Factor Correction**

### **Commissioning Instructions** Novar305

Issue: March 2005

## 1. INTRODUCTION

There is a warning symbol on the equipment, an exclamation mark within a triangle. This alerts the user to refer to these Commissioning Instructions or the Operation and Maintenance Manual before installing, commissioning or operating the equipment.

### WARNINGS

1. Installation, commissioning and maintenance should only be carried out by suitably qualified personnel.
2. Terminations exposed during installation, commissioning and maintenance may present a hazard unless the equipment is electrically isolated.
3. The equipment should only be operated as intended e.g. with the covers in place, and within the specified electrical and environmental limits.
4. Susceptibility to Electrostatic Discharge : 8 kV air discharge / 4 kV contact.  
This specification applies for direct contact with the terminals and via air discharge when the front cover is fitted. When setting the DIL switches, using the front buttons or making adjustments, appropriate ESD protection must be taken.

## 2. COMMISSIONING

The NOVAR 305 should be connected to the system as per the wiring diagram on the side of the case. Ensure that the current and voltage connections are made up to the correct terminals and have the required phase relationship. Capacitors must be connected on the load side of the CT. Fuses (0.5A rated) should be connected as shown on the wiring diagram. Full details are given in the publication.

### The following settings need to be made:

Sequence, Time and Limit DIL selector switches plus c/k and  $\cos\phi$  potentiometer settings.

### DANGER

**OPEN CIRCUIT CURRENT TRANSFORMERS ARE DANGEROUS.**

**THE CURRENT TRANSFORMER SECONDARY SHOULD BE SHORT-CIRCUITED BEFORE THE CONTROLLER INPUTS ARE DISCONNECTED.**

Care must be taken to earth oneself effectively before removing the NOVAR 305 from its housing. Use of a wrist strap connected to earth through a  $1M\Omega$  resistor is recommended.

### Settings

All the necessary adjustments are accessible on the controller fascia (see Figure 1).

#### 1. Selector switch settings

Use a small tool to set the DIL selector switches **BEFORE** power is applied.

Set switch numbers 1 to 10 inclusive according to the desired sequence, time delay and stage limit required. Table 1 provides all the details. Further details and explanations of the switch functions are provided in the publication.

#### 2. Setting c/k potentiometer

Setting range = 0.03 to 1.0

$$c/k = \frac{\text{smallest capacitor step size in vars}}{\sqrt{3} V I} \times 5$$

where  $V$  = nominal primary system voltage.

$I$  = primary rating of the current transformer

Adjust using a small screwdriver.

Example

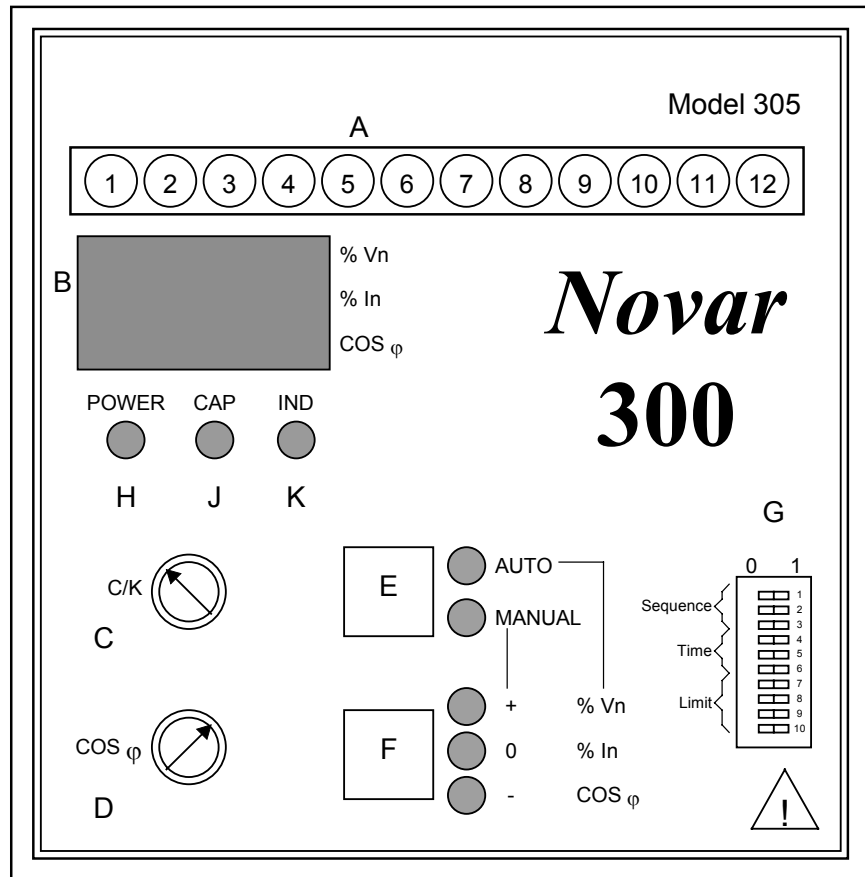
Smallest capacitor step size	= 50 kvar
CT primary rating	= 600 A
Primary system voltage	= 415 V

$$c/k = \frac{50000}{\sqrt{3} \times 415 \times 600} \times 5 = 0.58$$

### 3. Setting target power factor ( $\cos\phi$ ) potentiometer

Setting range 0.80 lagging to 0.95 leading.

Adjust using a small screwdriver.

**Fascia Key**

- A** - Secret-until-lit display of energised stages
- B** - High definition liquid crystal display
- C** - C/K setting
- D** - COS  $\phi$  setting
- E** - Dual mode button: auto/manual
- F** - Dual mode button: capacitor switching (man) and display selection (auto)
- G** - DIL switch (sequence, time and limit setting)
- H** - Power on indication LED
- J** - Switching in progress, circuit is capacitive
- K** - Switching in progress, circuit is inductive

**Figure 1. NOVAR 305 indication and user adjustments**

Sequence					Time				Limit				
Switch Nos.		1	2	3		4	5	6		7	8	9	10
Sequence Number	Sequence				Time Delay (Seconds)				Stage Limit (No. of contactors)				
00	1:1:1:1:1	0	0	0	10	0	0	0	1	1	0	0	0
01	1:1:2:2:2	1	0	0	20	1	0	0	2	0	1	0	0
02	1:2:2:2:2	0	1	0	30	0	1	0	3	1	1	0	0
03	1:2:3:3:3	1	1	0	60	1	1	0	4	0	0	1	0
04	1:2:3:4:4	0	0	1	180	0	0	1	5	1	0	1	0
05	1:2:4:4:4	1	0	1	300	1	0	1	6	0	1	1	0
06	1:2:3:6:6	0	1	1	480	0	1	1	7	1	1	1	0
07	1:2:4:8:8	1	1	1	600	1	1	1	8	0	0	0	1
									9	1	0	0	1
									10	0	1	0	1
									11	1	1	0	1
									12	x	x	1	1

x = switch position not important

Note: During operation, capacitors are switched in and out at a rate of one fifth of the safety lockout time if, and only if, the relevant capacitors have been discharged for at least one safety lockout time.

**Table 1 NOVAR 305 selector switch settings**

#### **4. Power may now be applied to the NOVAR**

Note: If a sequence or limit selector switch is adjusted whilst the NOVAR 305 is energised, all capacitor stages will be switched out automatically.

A safety lockout time will be imposed to allow for capacitor discharge before any further switching.

#### **5. Self-test**

At switch-on the NOVAR 305 will automatically undertake a self-test procedure. The model type is indicated for a few seconds on units equipped with a display and is repeated every 10 minutes. Any malfunction detected will result in a display of the model type number and the CAP and IND leds on the front fascia flashing alternately. Under normal operation, models with display will show the system power factor.

#### **6. Connection error**

If the voltage or current connections have been made to the wrong phase, the NOVAR 305 will indicate this by flashing the CAP and IND leds on the front fascia. NOVAR 305 will also display the phase angle by which the current leads the voltage to assist with connection fault diagnosis.

For example: At unity power factor with a reversed CT, the display will indicate 270 °.

#### **7. Current beyond operational limits**

If the current is below 10% of nominal rating, NOVAR 305 will display ' - - - - ' ; the NOVAR 305 will, however, be functioning correctly. If the current is higher than 120 % of nominal rating 'A - HI' will be displayed and relay switching will stop. Switching will recommence once the current has fallen below 120% of nominal rating.

## 8. Expanded display mode


On display models, a more accurate setting of c/k and  $\cos\phi$  can be made as well as showing selected sequence, time and limit settings:

Press the lower push button for approximately five seconds to enter expanded display mode.

Repeatedly press and release lower button to loop through functions:

- Sequence displayed as : \* \* 
- Time displayed as : \* \* \*  (seconds)
- Limit displayed as : \* \* 
- c/k setting displayed as : \* \* 

Then adjust c/k potentiometer to desired setting.

- Target  $\cos\phi$  setting displayed as : \* \* 

Then adjust  $\cos\phi$  potentiometer to desired setting.

- System power factor indication (followed by % Vn and % In for model 305 only).

Press lower button for approximately five seconds to exit expanded display mode. Power Factor Indication will be shown. The NOVAR 305 will exit expanded display mode after 15 minutes if left unattended.

## 9. Manual capacitor switching

Pressing the upper button will enter the manual mode as indicated by the led on the NOVAR 305 fascia. The '0' led will also light.

A depression of the lower button will instruct the NOVAR 305 to switch in all capacitors at intervals of one-fifth of the safety lockout time as indicated by the '+' led and the Stage leds (providing that the safety lockout time has elapsed).

Once all stages have been switched in, a further two depressions of the lower button will instruct the NOVAR 305 to switch out all stages at intervals of one-fifth of the safety lockout time as indicated by the '-' led and the Stage leds.

Pressing the upper button returns the NOVAR 305 to automatic mode. If the NOVAR 305 is left in manual mode it will return to automatic mode after the safety lockout time plus five minutes.

Any setting changes or keypad activity within this time will inhibit the return to auto.

## WARNING

**THE MANUAL FACILITY SHOULD NOT BE USED TO DISABLE CAPACITORS FOR MAINTENANCE PURPOSES.**

## 10. Measurement display

With the NOVAR 305 in AUTO mode, repeatedly pressing the lower button allows the display to read % Vn and then % In before returning to  $\cos\phi$ . The nominal Vn and In values are printed on the rating label.

## Electromagnetic Compatibility Directive 89/336/EEC

Emissions standard EN50081-2 1994 Industrial environment

Immunity standard	EN50082-2 1995 Industrial environment (IEC801 parts 2,3,and 4)
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Susceptibility to Electrostatic Discharge 8kV air discharge / 4kV contact.

**WARNING:** This specification applies for direct contact with the terminals and via air discharge when the front cover is fitted. When setting the DIL switches, using the front buttons and making adjustments, appropriate ESD protection must be taken.

## Low Voltage Directive 72/23/EEC

Designed to EN61010-1 1993 safety requirements.