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Power Factor Controllers Novar 1106 / 1114 / 1206 / 1214

Shortform Manual

(1.4 / 2012)

This *Shortform Manual* contains Novar 1106, 1114, 1206, 1214 controllers typical installation basic information only. Full-scale *Operating Manual* containing detailed description of all Novar controllers can be free downloaded form manufacturer's website www.kmbsystems.eu .

Maintenance, Service

Novar line power factor controllers do not require any maintenance. For reliable operation you only have to comply with the operating conditions specified and prevent mechanical damage to the instrument.

The controller's power supply is one-pole protected with a mains fuse rated as T0.5A . The fuse is only accessible after back disassembly and only the controller supplier's qualified personnel may thus replace it.

In the event of the product's breakdown, you have to return it to the supplier at their address.

The product must be packed properly to prevent damage in transit. Description of the problem or its symptoms must be sent along with the product. If warranty repair is claimed, the warranty certificate must be sent in too. If after-warranty repair is requested, a written order must be included.

Warranty Certificate

Warranty period of 24 months from the date of purchase, however no later than within 30 months from the dispatch date from manufacturer's warehouse, is provided for the instrument. Problems in the warranty period, evidently caused by poor workmanship, design or inconvenient material, will be repaired free of charge by the manufacturer or an authorized servicing organization.

The warranty becomes void even within the warranty period if the user makes unauthorized modifications or changes to the instrument, connects it to out-of-range quantities if the instrument is damaged in out-of-specs impacts or from improper handling or if it has been operated in conflict with the technical specifications.

type of product: **NOVAR**..... serial number .....

date of dispatch: ..... final quality inspection: .....

manufacturer's seal:

date of purchase: ..... supplier's seal:

1. Installation

1.1 Physical

The instrument is built in a plastic box to be installed in a distribution board panel. The instrument's position must be fixed with locks.

Natural air circulation should be provided inside the distribution board cabinet, and in the instrument's neighbourhood, especially underneath the instrument, no other instrumentation that is source of heat should be installed or the temperature value measured may be false.

1.2 Connection

To connect the controller there are connectors with screw-on terminals in the back wall. For typical wiring see examples in a separate chapter at the end of this manual. Maximum cross section area of connection wires is 2.5 square millimetres.

1.2.1 Power Supply

1.2.1.1 Standard Version Controllers

The controller requires supply voltage in the range as declared in technical specifications table for its operation.

The supply voltage connects to terminals 3 (***L***) and 4 (***N***). Power supply voltage needs to be externally protected.

Power supply terminal 3 (***L***) is internally connected to the common pole of output relays. It is necessary to dimension the power supply protection in consideration of output contactors' power as well.

1.2.1.2 "/S400" Version Controllers

Controllers of the "/S400" version can be supplied with higher voltage – up to 500 V, either AC or DC. The power demand is the same as those of standard version.

The supply voltage connects to terminals 3 (***L1***) and 5 (***L2/N***). In case of DC supply voltage the polarity of connection is generally free, but for maximum electromagnetic compatibility grounded pole should be connected to the terminal 5 (***L2/N***).

Power supply voltage needs to be externally protected (see following chapter).

Despite of standard version, power supply terminal 3 (***L***) **is not** internally connected to the common pole of output relays. Terminals 4 and 6 are not used.

1.2.1.3 Protection

Article 6.12.2.1 in the EN 61010-1 standard requires that instrument must have a disconnecting device in the power supply circuit (a switch). It must be located at the instrument's immediate proximity and easily accessible by the operator. The disconnecting device must be marked as such. A circuit breaker for nominal current of 10 amp makes a suitable disconnecting device, its function and working positions, however, must be clearly marked.

Since the controller's inbuilt power supply is of pulse design, it draws momentary peak current on powerup which is in order of magnitude of amperes. This fact needs to be kept in mind when selecting the primary protection devices.

1.2.2 Measurement Voltage

1.2..2..1 1106 and 1114 Controllers

The power supply voltage is used as measurement voltage in 11xx line controllers and it is not thus necessary (or possible) to connect measurement voltage independently.

1.2..2.1 12xx Line Controllers

The 12xx Line Controllers feature a general-purpose, galvanic-isolated voltage measurement input. In basic connection phase L1 goes to terminal ***L*** (7) and neutral wire to terminal ***N/L*** (9).

The measurement voltage must be protected externally. If the measurement voltage is identical with power supply voltage, they can share a circuit breaker. Otherwise each voltage branch must be protected with fuses or circuit breakers of nominal value 1 to 6 A.

1.2.3 Measurement Current

Metering current transformer (CT) outputs connect to terminals 1 (***k***) and 2 (***l***).

A metering current transformer of nominal output current 5 or 1 A can be used – the metering current transformer's ratio must be entered when setting up the instrument for proper measured values display (parameters 12, 13 – see further below).

The connector features a screw lock to prevent accidental pull-out.

1.2.4 Error Indication

The instrument has an auxiliary Alarm relay to indicate nonstandard conditions. This relay's contact goes to terminals 17 and 18.

1.2.5 Output Relays

The instrument has 6 or 14 output relays (depending on controller model). The relays' contacts go to terminals 19 through 32.

1.2.5.1 Standard Version Controllers

The relays' common contacts are internally connected to power supply terminal ***L*** (No. 3). When an output relay contact closes, power supply voltage appears at the corresponding output terminal.

1.2.5.2 "/S400" Version Controllers

Despite of standard version, the relays' common contacts are connected to additional terminals 33, 34.

In case of DC voltage for supplying of contactors, installation of suppression 2A/600V diodes directly at contactors's coils is strongly recommended. Furthermore, note lower maximum current load of the controller outputs at such case (see technical parameters table).

2. Putting in Operation

2.1 First Use

The instrument's installation is fully automatic. At most of cases there is sufficient to switch a power supply on; the controller automatically detects both the connection configuration and the value of each compensation section connected and it starts to control. Then it is necessary to check the setting and to modify some of parametres, if required.

On powerup, display test runs first. The display momentarily shows

- type of controller (e.g. `n 1 14`)
- firmware version (e.g. `1.4`)
- type of measurement voltage set(`ULn` or `ULL`)
- metering current transformer secondary side nominal value set (`I =5A` or `I = 1A`)

Then automatic connection configuration detection process starts.

2.2 Automatic Connection Configuration Detection Process

The controller's default measurement voltage and current connection parameters are set as follows:

- type of measurement voltage set to phase voltage (`Ln`, parameter 15)
- method of connection of U and I not defined (parameter 16)
- compensation system nominal voltage **UNOM** set to 230 V (parameter 18)

As the method of connection is not defined, the controller carries out automatic connection detection process. For the controller to be able to start this process, the following conditions must be met:

- controller operation is not disabled (i.e. the ***Manual*** LED is dark)
- controller is in the control mode, i.e. the numeric display mode is ***Measurement***

If meeting the conditions, the controller starts the automatic connection detection process.

The process may have up to seven steps. The controller makes four measuring attempts in each step in which it consecutively connects and disconnects sections 1 through 4. It, at the same time, assumes that power factor capacitors are connected to at least two of the sections (if any choke connected to sections 1 through 4, detection process fails). The two following messages are shown, one after another, in each measurement attempt on the numerical display:

1. step number in format `APnn` (**A**utomatic **P**hase detection, nn... attempt number)
2. attempt result, e.g. `L 1-0`

If the controller measures identical values repeatedly in each attempt, it considers the connection detected and quits carrying out further steps. If the measurement results are different from each other in a particular step, the controller carries out another measurement step.

The following conditions must be met for successful automatic connection configuration detection process:

- type of measurement voltage is set correctly (phase, "LN" or line, "LL" – parameter 15)
- at least two power factor capacitors are connected to sections 1 through 4 and no power factor choke is connected to these sections

The controller measures the measurement voltage value for the whole of the automatic connection configuration detection process. It evaluates this voltage's average value at the end of the process and selects the compensation system nominal voltage **UNOM** (parameter 18) as the nearest value of the following choice of nominal voltages.

Tab. 2.1 : Choice of nominal voltages

58 V	100 V	230 V	400 V	500 V	690 V

Type of connection detected is shown on the numeric display for a moment after successful completion of the automatic connection configuration detection process, the selected **UNOM** nominal voltage, the true power factor value in the power system, and thereafter the instrument starts the control process or it starts the automatic section power recognition process.

If the automatic connection configuration detection process is not completed successfully, the numeric display shows flashing `P=0`. It is, in such a case, necessary to enter the type of connection manually or to re-enter `----`(= not defined) in editing parameter 16 and thus restart the automatic connection configuration detection process. Otherwise the controller changes over to a waiting mode and it repeats the automatic connection configuration detection process in 15 minutes automatically.

If the actual nominal voltage in the compensation system differs from the value entered in parameter 18 in the automatic connection configuration detection process, the parameter can be corrected to its actual value when the process has finished.

The automatic connection configuration detection process can be interrupted at any time by switching the numeric display mode to ***Parameters***. The automatic connection configuration detection process will start again from scratch on return to instantaneous value display mode.

2.3 Automatic Section Power Recognition Process

The controllers come with enabled function of automatic section power recognition process (parameter 20 set to A) as default setting. The controller starts the automatic section recognition power process on powerup (connection of power supply voltage) with this setting, provided none of the outputs (in parameter 25) has a valid power value; this happens if a new controller is installed for the first time or after its initialization). The process can also be started without interrupting the power supply voltage connection, by editing parameter 20 to value 1 or by controller initialization (see further below).

For the controller to be able to start the automatic section power recognition process, the following conditions must be met:

- controller automatic operation is not disabled (i.e. the ***Manual*** LED is dark)
- controller is in control mode, i.e. the numeric display mode is ***Measurement***
- connection mode of measurement U and I is defined (parameter 16)

If these conditions are met, the controller starts the automatic section power recognition process.

The process may have three or six steps. The controller consecutively connects and disconnects each output in each step. While doing that, it measures the effect of connection and disconnection on total reactive power in the power system. From the values measured the power of each section is determined.

The following messages are shown one after another in each measurement attempt on the numeric display:

1. Step number in format `AC-n` (n... step number).
2. Sectional power measured in kvars; the **nominal** power value of the section under measurement is displayed, that is the value that corresponds to nominal voltage **UNOM** of the compensation system as specified in parameter 18. If the metering current transformer turns ratio has been entered (parameters 12 and 13), or, if measuring voltage via a metering voltage transformer, the voltage transformer's turns ratio as well (in parameter 17), sectional power in the power system is shown (that is at the metering current transformer primary side, or metering voltage transformer primary side). If the metering current transformer primary side (parameter 12), or metering voltage transformer primary side (parameter 17) is not defined, sectional power in the metering current transformer's, or the metering voltage transformer's, secondary side is shown.

If the controller does not succeed in determining a section's value, it does not show it. This condition occurs if reactive power value in the power system fluctuates considerably due to changes in load.

After carrying out three steps, evaluation is carried out. If each measurement carried out provides sufficiently stable results, the automatic section power recognition process is completed. Otherwise the controller carries out three more steps.

A requirement for successful automatic section power recognition process is sufficiently stable condition of the power system – while connecting or disconnecting a section, the reactive load power must not change by a value which is comparable with, or even greater than, the reactive power value of the section under test. Otherwise the measurement result is unsuccessful. As a rule of thumb, the section values are recognized the more precisely, the lower the load is in the power system.

On successful completion of automatic section power recognition process, the controller checks whether at least one capacitive section has been detected and, if so, it starts control. Otherwise the controller goes to the waiting mode and after 15 minutes it starts the automatic section power recognition process again.

At this phase it is recommended to preset a CT ratio (parameters 12, 13) and to check recognized section values in the side branch of parameter 25. A positive power value means a capacitive section, negative value means inductive section. If the value could not be recognized, "`----`" is shown. Each value recognized can be edited manually.

If the automatic section power recognition process can not be completed successfully or none of the sections recognized is capacitive, flashing `C=0` is shown on the numeric display and the ***Alarm*** signal is activated at the same time. In such an event, it is necessary to enter each section's value manually (see description further below) or by editing parameter 20 enter value `A` (= carry out the automatic section recognition power process) and thus force another start of the automatic section power recognition process.

The automatic section power recognition process can be stopped any time by switching the display mode to ***Parameters***. On return to the instantaneous value display mode the automatic section power recognition process will be started over again.

3. Description

3.1 Novar – 1106 / 1114 Controllers

3.1.1 Measurement Values

The mode of displaying instantaneous values is the basic display mode which the controller enters on power-up. If you switch to parameter display mode, you can get back to instantaneous value display mode by pressing the ***M*** (Measurement) button.

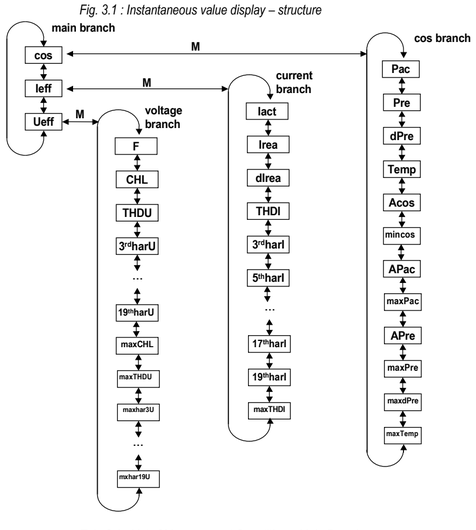
The controller enters the instantaneous display mode automatically in about 30 seconds from the moment you stop pressing control keys (or in five minutes if control time is displayed – see description of parameter 46).

3.1.2 Main Branch

One LED, ***COS*** or ***A*** or ***V***, is always lit in the instantaneous display mode. These LEDs identify the value group displayed. Instantaneous values displayed are organized in branches – see Figure 3.1. The main branch contains the following main instantaneous values: **cos**, **Ieff** and **Ueff**. You can switch between the values displayed using the ▲ , ▼ buttons.

Pressing the ***M*** button switches to the relevant subbranch: to the branch of power factors, power, and temperature while displaying ***COS*** (further as COS Branch), to the current branch while displaying **Ieff** (further as A Branch) or to the voltage branch while displaying **Ueff** (further as V Branch). Again, you can move up and down the branch using the ▲ , ▼ buttons. Displaying values of the subbranches' quantities is indicated with periodic flashes of the quantity symbol. To get back to the main branch of instantaneous values press button ***M***.

Fig. 3.1 : Instantaneous value display – structure



Tab. 3.1 : List of Measurement Quantities – Main Branch

abbrev.	quantity	unit
cos	Instantaneous power factor. The value corresponds to the ratio of instantaneous active component to instantaneous total power fundamental harmonic value in the power system. A positive value means inductive power factor, negative means capacitive power factor.	-
Ieff	Instantaneous current effective value in the power systems (including higher harmonic components).	A / kA *
Ueff	Instantaneous voltage effective value in the power system (including higher harmonic components). By default shown in volts. If the measurement voltage is connected via a metering transformer, in kilovolts.	V (kV)

* … in A as default; flashing decimal point indicates value in kA

3.1.2.1 COS Branch

Instantaneous power values as well as recorded average, maximum and minimum values of selected quantities are shown in the COS Branch. Power is displayed as three-phase values (single-phase power values multiplied by three). Reactive power values are prefixed with L for positive values and C for negative values.

Tab. 3.2 : List of Measurement Quantities – COS Branch

Abbrev.	symbol	quantity	unit
Pac	`PAC`	Instantaneous fundamental harmonic active power (**Power ac**tive).	kW / MW *
Pre	`PrE`	OInstantaneous fundamental harmonic reactive power (**Power re**active).	kvar / Mvar *
dPre	`dPrE`	Instantaneous fundamental harmonic reactive power difference to achieve target power factor (**D**elta **P**ower **re**active).	kvar / Mvar *
Temp	`°C /°F`	Instantaneous temperature (in the distribution board cabinet, at the controller). In degrees Celsius or Fahrenheit, as specified in par. 58.	°C nebo °F
Acos	`ACOS`	Average power factor over the time specified in par. 56 (**Average cos**).	-
mincos	`nCOS`	Minimum power factor in the power system achieved since last clear. The evaluation window is specified in parameter 57.	-
APac	`APAC`	Average fundamental harmonic active power in the power system over the time specified in parameter 56 (**A**verage **P**ower **ac**tive).	kW / MW *
maxPac	`↑PAC`	Maximum fundamental harmonic active power achieved since last clear. The evaluation window is specified in par. 57 (**M**aximum **P**ower **ac**tive).	kW / MW *
APre	`APrE`	Average fundamental harmonic reactive power in the power system over the time specified in parameter 56 (**A**verage **P**ower **ac**tive).	kvar / Mvar *
maxPre	`↑PrE`	Maximum fundamental harmonic reactive power achieved since last clear.The eval. window is specified in par. 57 (**M**aximum **P**ower **re**active).	kvar / Mvar *
maxdPre	`↑dPr`	Maximum fundamental harmonic reactive power difference to achieve target power factor in the power system achieved since last clear. The eval. window is specified in par. 57 (**M**aximum **D**elta **P**ower **re**active).	kvar / Mvar *
maxTemp	`°C /°F`	Maximum temperature recorded since last clear. The evaluation is based on temperature one-minute moving averages (**M**aximum **Temp**erature).	°C or °F

* … in kW-, kvar- units as default; flashing decimal point indicates value in MW, Mvar

The values recorded can be divided by their nature into three groups:

1. Average values **Acos**, **APac**, **APre**

   These are average values of power factor, active and reactive power. The depth of average can be set in parameter 56 from 1 minute to 7 days.

2. Maximum and minimum values **mincos**, **maxPac**, **maxPre**, **maxdPre**

   - **mincos** – evaluated as a ratio of fundamental harmonic active and reactive power moving averages. The moving average window size can be specified in parameter 57 from 1 minute to 7 days. The minimum value is recorded and displayed. Evaluation is conditioned by the corresponding average current being at least 5% of the nominal load as determined from the CT turns ratio primary value (parameter12) else the value is ignored (the value is not recorder for minimum loads).
   - **maxPac**, **maxPre** – the maximum values of fundamental harmonic active and reactive power moving averages. The average window size can be specified in parameter 57 from 1 minute to 7 days.
   - **maxdPre** – the maximum value of fundamental harmonic absent reactive power moving average. As opposed to the absent reactive power instantaneous value, **dPre**, which is the difference between the actual and required reactive power, irrespective of the instantaneous condition of the controller's closed outputs, **maxdPre** is only evaluated if the required reactive power exceeds the system's control capacity (that is the total power of all compensation banks, or sections), and its value is determined as a difference between this control capacity and required power (if the control capacity is sufficient, the **maxdPre** value is zero). The moving average window size can be specified in parameter 57 from 1 minute to 7 days.

3. Maximum temperature **maxTemp**

   The temperature moving average maximum value. The moving window depth is fixed at 1 minute.

The above described recorded values can be cleared, each group separately – when clearing a value, all other values in the same groups are cleared too. Clearing values is explained in the Editing chapter further down.

3.1.2.2 A Branch

All quantities related to current are shown in this branch. The **maxTHDI** value can be cleared manually.

Tab. 3.3 : List of Measurement Quantities – A Branch

abbrev.	symbol	quantity	unit
Iact	`ACt`	Instantaneous active current fundamental harmonic component (**act**ive).	A / kA *
Irea	`rEA`	Instantaneous reactive current fundamental harmonic component (**rea**ctive); ***L*** indicates inductive, ***C*** indicates capacitive polarity.	A / kA *
dIrea	`drEA`	Instantaneous reactive current fundamental harmonic component difference to achieve the target power factor in the power system (**Delta rea**ctive).	A / kA *
THDI	`tHd`	Instantaneous level of power system current's total harmonic distortion (**T**otal **H**armonic **D**istortion) – shows the ratio of current higher harmonic components content, up to the 19th harmonic, to the level of fundamental harmonic.	%
3.÷19.har	`H3÷ 19`	Instantaneous current harmonic component level in the power system.	%
maxTHDI	`↑tHd`	Maximum THDI value achieved since last clear. The evaluation is based on THDI one-minute moving averages.	%

* … in A as default; flashing decimal point indicates value in kA

3.1.2.3 V Branch

This branch shows all the quantities related to voltage. They are commonly used quantities. The maximum values can be cleared manually. Clearing any of these values clears all the other maximum values within this branch.

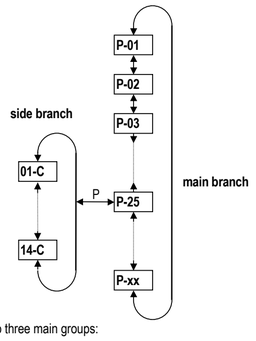
Tab. 3.4 : List of Measurement Quantities – V Branch

abbrev.	symbol	quantity	unit
F	`F`	Instantaneous voltage fundamental harmonic component frequency.	Hz
CHL	`CHL`	Instantaneous value of Capacitor Harmonic Load factor.	%
THDU	`tHd`	Instantaneous level of power system voltage's total harmonic distortion (**T**otal **H**armonic **D**istortion) – shows the ratio of current higher harmonic components content, up to the 19th harmonic, to the level of fundamental harmonic.	%
3.÷19.har	`H3÷ 9`	Instantaneous level of harmonic component voltage in the power system.	%
maxCHL	`↑CHL`	Maximum CHL value achieved since last clear. The evaluation is based on CHL one-minute moving averages.	%
maxTHDU	`↑tHd`	Maximum THDU value achieved since last clear. The evaluation is based on THDU one-minute moving averages.	%
3. ÷ 19. maxharI	`↑H- 3 ÷ 19`	Maximum value of voltage harmonic component achieved since last clear. The evaluation is based on harmonic component one-minute moving averages.	%

3.1.3 Controller Parameters

You can view controller parameters by pressing the ***P*** button (parameters). First the parameter number shows momentarily and then its value does. The parameter number flashes momentarily every five seconds for better orientation.

Fig. 3.2 : Parameter Display – Structure



The parameters can be divided into three main groups:

- Parameters determining controller functions. These parameters can be set to direct the control process. There are target power factor, control period, reconnection delay time, etc.
- Parameters indicating controller's current condition. This is the alarm (parameter 40), error condition (parameter 45), and control time (parameter 46). These parameters' values are set by the controller and they identify nonstandard or error conditions and monitor progress of the control process in detail.
- Total connected times recorded and numbers of connections of each compensation banks, or sections (parameters 43 and 44, respectively). These values are set by the controller and the operator can only clear them.

The parameters are organized by ordinal number in the main branch. Some of the parameters (parameter 25 – sectional power, 26 – fixed sections, 30 – alarm setting, 40 – state of alarm, 43 – total connected times, 44 – number of sections connected) are located on side branches for easier navigation. You can switch to a side branch with selected parameters by pressing button ***P*** (parameters) and switch back to the main branch in the same way. Side branch parameter displayed are identified by a dash between the parameter number and value. For example: in the main branch, while showing parameter 26 (fixed sections), you will see `01 C` (section 1 is a capacitive compensation one); if you want to display conditions of the other sections, you need to switch display to the side branch by pressing button ***P***; the display will change to `01-C` and now you can move up and down the branch, through all sections' values. Pressing button ***P*** again returns display to the main branch (the dash disappears).

Pressing button ***M*** (measurement) returns to the instantaneous value display mode. The controller gets back to this mode automatically in about 30 seconds from the last press of button.

Exception: In the ***Manual*** mode the parameter values cannot be viewed. Instantaneous output values are displayed on pressing button ***P*** (parameters) — see description further below.

3.3 Test and Error Messages

In the instantaneous value display mode a test or error message pops up in place of a power factor value in some situations. In these situations, if the value shown does not represent power factor, the ***COS*** LED flashes.

3.4 Indication LEDs

Besides the numeric display and adjacent LEDs, ***COS*** , ***A*** , ***V***, the front panel has some more indication LEDs.

3.4.1 Output State Indication

The array of LEDs at the top right of the front panel show the current state of output relays. Each LED is assigned a number from 1 to 14, and if lit, they indicate closed contacts of the corresponding output relay.

If a LED is flashing, it means the controller wants to connect the output, but it has to wait for the delay time to elapse. The output relay contacts are open and they will be closed as soon as the reconnection delay time has elapsed.

An exception is the power-up display test to check correct operation of all display elements. In this test the display shows `tESt` and all indication LEDs come on. All output relays stay open while the test is running.

3.4.2 Trend Indication

These LEDs show the magnitude of deviation of the true instantaneous reactive power in the power system from optimum reactive power value which would correspond to the specified value of required power factor.

If the deviation is smaller than a half of the reactive power value of the smallest capacitor, both LEDs are dark. If the deviation is greater than a half of, but smaller than, the reactive power value of the smallest capacitor, the corresponding LED flashes — if lagging (undercompensation), the ***IND*** LED flashes; if leading (overcompensation), the ***CAP*** LED flashes. If the deviation exceeds the value of the smallest capacitor, the corresponding LED is permanently lit.

Exceptions to these LEDs' meanings are the following situations:

- measurement U and I method of connection is not defined (parameter 16)
- automatic connection configuration detection process is in progress
- automatic section power recognition process is in progress

If the method of connection is not defined, both LEDs flash; they are dark in the other two situations.

3.4.3 Indication of Manual Mode

Flashing ***Manual*** LED indicates that the controller is in the manual mode. The controller's control function is disabled.

If this LED is dark and display is in the ***Measurement*** mode, the controller is in its standard control mode or it is carrying out automatic connection configuration detection process or automatic section power recognition process.

3.4.4 Indication od Backfeed (Power Export)

The ***Export*** LED indicates the power transmission direction. If it is dark, the power is flowing from the assumed power supply to the appliance. If the LED is lit, the power is flowing in the opposite direction.

3.4.5 Alarm Indication

An ***Alarm*** relay can be used for non-standard events signalling. This relay's operation can be set up as described further below (parameter 30).

The ***Alarm*** LED indicates this relay's condition, that is if the ***Alarm*** relay's output contact is closed, the LED flashes.

4. 4. Controller Setup

To achieve optimum compensation in accordance with character of the load controlled, the controller has a number of parameters that govern its operation. Table on chapter 6 shows a list of the parameters. Detailed description of all parameters can be found at *Operating Manual* (www.kmbsystems.eu).

4.1 Parameter Editing

The controller's parameters are set to default values, which are shown in table in chapter 5, when shipped. To achieve optimum compensation results, it is sometime necessary to change some of the values in correspondence with particular requirements; in the other situations it is at least necessary to enter the measurement voltage type (phase or line) and current transformer turns ratio, within installation of the instrument.

If parameter edit is enabled (see next chapter), you should proceed as follows:

1. Switch controller to parameter display mode by pressing button ***P***.
2. Find parameter you want to edit by pressing the ▲ , ▼ buttons repeatedly.
3. Press button ***P*** and hold it down until the display starts flashing.
4. Release button ***P*** and set the value desired with the ▲ , ▼ buttons. Some values can be incremented or decremented continuously by holding down the ▲ or ▼ button.
5. When the value desired is displayed, press button ***P***. The value will be saved in the controller's memory, the display stops flashing and editing is thus complete.

4.2 Clearing Recorded Measurement Values

Recorded measurement values can be cleared in an analogous way:

1. Switch the controller to the measurement value display mode and scroll to the value you want to clear using the ▲ , ▼ and ***M*** buttons.
2. Press the ***M*** button and hold it pressed until the displayed value starts flashing.
3. Release the ***M*** button and by pressing the ▲ or ▼ button change display to show `CLr` (= clear). The following press of the ***M*** button will clear the value.

Clearing a value clears all the other values in its group and starts over their evaluation.

4.3 Enable / Disable Parameter Edit

When shipped, the controller has the Parameter Edit feature enabled, that means the parameters can be edited freely on power supply voltage connection as desired. After being put in operation, Parameter Edit can be disabled to protect the controller against unauthorized changes to its mode of operation.

To see if Parameter Edit is disabled or enabled, check parameter 00. It can contain the following:

`Ed=0` ..... edit disabled

`Ed= 1` ..... edit enabled – parameters can be edited, recorded measurement values can be cleared

If Parameter Edit is locked, you can unlock it using the following procedure, which is similar to editing the controller's parameters:

1. Switch controller to parameter display mode by pressing button ***P*** to display parameter 00 - `Ed=0` is displayed (controller must not be in the ***Manual*** mode).
2. Press button ***P*** and hold it down until the last character on the display starts flashing. A digit between 0 and 9 will be shown on the last digit position. As an example you can imagine 5 is displayed so the display shows `Ed=5` with the `5` flashing.
3. Press the following sequence: ▼, ▲, ▲, ▼. If `5` was shown as the last display digit, it would change to `4 - 5 - 6 - 5`, so the same value is shown at the end as at he beginning.
4. Press button ***P***. The display will show `Ed= 1`, indicating correct password and enabled Parameter Edit while clearing recorded measurement values.

The digit shown while entering the unlocking keypress sequence is random generated by the controller and it is not important for its correctness (it is there only to confuse). Only the sequence of buttons pressed is important.

Parameter Edit mode is enabled until it gets disabled by the operator. Parameter Edit enabled or disabled conditioned is retained in the instrument even on power off.

Parameter Edit can be disabled in a way analogous to enabling it but you press buttons different from the correct unlocking keypress sequence.

4.4 Manual Mode

When installing or testing the controller it may sometimes be required to check the function of each compensation section or it is necessary to put the automatic control process out of operation for a rather long time.

In such situations, you can switch the controller to a mode in which it only carries out measurements and displays the values. You can switch to this mode by pressing buttons ***M*** and ***P*** and holding them down simultaneously for about 6 seconds (until the ***Manual*** LED starts flashing). You can switch back to the automatic control mode analogously.

You **can not** view or edit the controller's parameters in the ***Manual*** mode – you can only close or open each of the controller's outputs.

On switching the regulator to the ***Manual*** mode, the outputs stay in the state they were in during the control process before switching over the modes. You can then change the states of the outputs manually – after pressing button ***P*** the state of a corresponding output is shown (for example `01-0`, which means output 1 is off – contacts open) and you can scroll through them all using buttons ▲ , ▼ and edit them very much like the instruments' parameters. The outputs' states change while being edited, respecting the reconnection delay time specified.

If the controller is in the ***Manual*** mode and there is a supply voltage failure, the ***Manual*** mode is resumed on power recovery. At this, all outputs that were on before the failure get switched on one by one again (the states of outputs are remembered).

Warning ! Alarm actuation (parameter 30) is disabled in ***Manual*** mode !

4.5 Controller Initialization

In some situations it may be necessary to put the controller back to its default settings with which it is shipped. You can do this using controller *initialization*. After initialization has been run, the initial test starts too, that means the controller carries out all the operations as if the power supply voltage is introduced.

The controller's parameters are set to the values shown as default in chapter 6 on initialization, except the following parameters:

- metering current transformer nominal secondary value (13)
- type of measurement voltage (phase or line, 15)
- instrument address, communication rate and protocol in instruments with communication interface (50, 51, 52)

These parameters remain unchanged, at the values specified before initialization.

The counters of connection time and switching operations (parameters 43, 44) are not affected by initialization either.

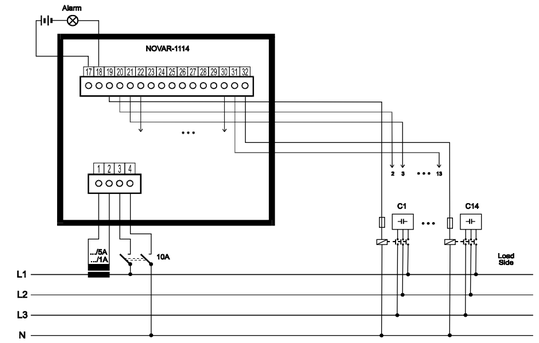
You can start the controller initialization by pressing buttons ***M***, ***P***, and ▼ simultaneously and holding them down for about 6 seconds. The controller will first disconnect all sections connected and run the initial test – this is when you can release the buttons. Then it will carry out the initialization routine proper and since parameter 16 value is not defined, it will start the automatic connection configuration detection process.

5. Novar-11xx / 12xx Controller Parameters

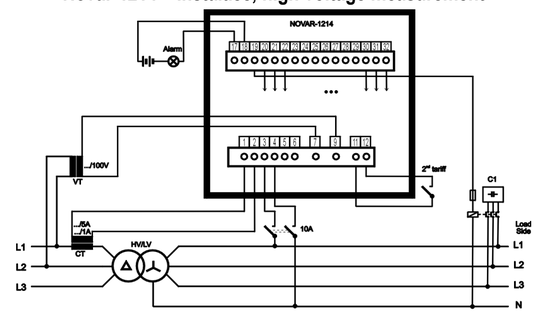
No	Name	Range	Default	Comment
0	parameter edit enable/disable	0 / 1	1	see Enable / Disable Par. Editing
1	target power factor (tariff 1)	0.80 L ÷ 0.80 C	0.98 L	
2	control time when undercompensated (tariff 1)	5 sec ÷ 20 min	3 min	No "L": control time reduction by squared proportion "L": linear control time reduction.
3	control time when overcompensated (tariff 1)	5 sec ÷ 20 min	30 sec	No "L": squared control time red. "L": linear control time reduction
4	control bandwidth	0.000 ÷ 0.040	0.010	
5	offset power	(0.001 ÷ 5.5 kvar) x CT ratio x VT ratio	0	Value corresponds to U_{NOM} specified (parameter 18) ; positive for capacitive, negative for inductive values. Displayed when parameter 63 is active only.
6	tariff 2 enable/disable	0 – 1 – E	0	
7 ÷ 11	like param. 1 ÷ 5, but for tariff 2	same as par. No. 1 ÷ 4	-	not shown unless tariff 2 enabled
12	metering current transformer primary side nominal value	5 - 9950 A	undefined	
13	metering current transformer secondary side nominal value	1 A - 5 A	5	
14	reconnection delay time	5 sec ÷ 20 min	20 sec	
15	measurement voltage type – phase-neutral or phase-phase	LN (phase) – LL (line)	LN	correct setting essential for automatic connection detection process
16	method of U and I connection	6 combinations	undefined	see parameter description
17	VT turns ratio	no VT or 10 ÷ 5000	--- (no VT)	
18	system nominal voltage U_{NOM}	50 ÷ 750 V x VT ratio	230 / 400 V	established by controller in automatic connection detection process
20	automatic section power recognition process	A(auto) – 0 (no) - 1(yes)	A	
21	switching program, linear switching mode	12 combinations or „L"	undefined	not shown if automatic section recognition process enabled
22	smallest capacitor nominal power (C/K_{MIN})	(0.007 ÷ 1.3 kvar) x CT ratio x VT ratio	undefined	not shown if automatic section recognition process enabled
23	number of capacitors	1 – 14	6 / 8 / 14	not shown if automatic section recognition process enabled
25	sectional nominal power	(0.001 ÷ 5.5 kvar) x CT ratio x VT ratio	undefined	Corresponds to U_{NOM}. Positive for caps (lead), negative for chokes (lag)
26	fixed sections	regulated / 0 / 1	all regulated	„F" / „H" / „A" for 2 highest sect. only „A" for Novar 1005 / 1007 only
27	power factor limit for compensation by choke	0.80 L ÷ 0.80 C	undefined	No compensation by chokes unless this parameter specified.
30	alarm setting	0 / indication only / actuation only / indication and actuation	undercurrent, voltage loss and section error indication & actuation	1...undercurrent 9... comp. error 2...overcurrent 10… export 3... voltage loss 11… no. of 4...undervoltage connections > 5...overvoltage 12… section 6... THDI > error 7... THDU > 13...overheated 8… CHL > 14… ext. alarm
31 ÷ 37	alarm thresholds: undervoltage, overvoltage, THDI, THDU, CHL, number of connections and temperature	-	-	not displayed if the alarm not set up
40	alarm instantaneous condition			Indicates current state of alarm.
43	section connection time			in thousands of hours
44	number of section connections			in thousands
45	instrument failure condition			
46	Instant. condition of control time			time until next control intervention[sec]
50	instrument address	1 ÷ 254	1	
51	communication rate	4800–9600–19200 Bd	9600 Bd	
52	communication protocol	KMB / Modbus-RTU	KMB(P0)	
55	power system frequency	A (auto) – 50 Hz – 60 Hz	A (auto)	
56	average value eval. window size	1 min ÷ 7 days	7 days	applies to Acos, APac, APre
57	min/max value eval. window size	1 min ÷ 7 days	15 min	for mincos,maxPac, maxPre, maxdPre
58	Celsius/Fahrenheit temp. mode	°C – °F	°C	
59	cooling enable threshold	+10 ÷ +60 °C	+40 °C	not displayed if cooling not set
60	heating enable threshold	-30 ÷ +10 °C	-5 °C	not displayed if cooling not set
63	offset control	0 (no) - 1 (yes)	-	0

6. Wiring Examples

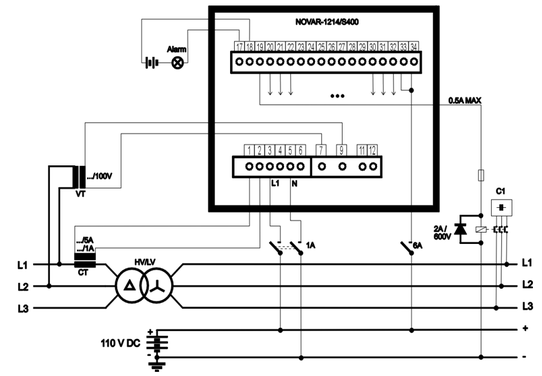
Novar-1114 – Installation



Novar-1214 – instalace, high voltage measurement



Novar-1214/S400 – installation, supllied from DC



7. Technical Specifications

CE

Adjustable Parameters

parameter	Novar	
	1106 / 1114	1206 / 1214
power factor desired	0.80 ind. ÷ 0.80 cap.	
connection time	5 ÷ 1200 seconds	
reconnection delay time	5 ÷ 1200 seconds	
smallest capacitor current	(0.002 ÷ 2 A) x CT ratio	
connection & section power setting	automatic or manual	

Ranges, Accuracy

power supply : standard version	90÷275 V AC, 43÷67Hz,7VA	90 ÷ 275 V AC (43÷67 Hz) or 100÷300 V DC, 7VA
"/S400" version	75÷500 V AC 43 ÷ 67 Hz	75÷500 VAC 43 ÷ 67 Hz or 90÷600 V DC, 7VA
measurement voltage	the same as pow.s. voltage	57.7÷690 V AC, +10/-20%, 43÷67 Hz
voltage measurement accuracy	+/-1% of range +/- 1 digit	
measuring voltage loss response time	<= 20 ms	
measurement current (galv. isolated)	0.002 ÷ 7 A	
current input serial impedance	< 10 mOhm	
current measurement accuracy • range 0.5 ÷ 7A • range 0.02 ÷ 0.5 A • range 0.002 ÷ 0.02A	+/- 0.02A +/- 1 digit +/- 0.002A +/- 1 digit +/- 0.0005A +/- 1 digit	
max. phase angle error (PF & powers measurement)	+/-1° at I > 3 % of range, otherwise +/-3°	
current harm. & THDI meas. accuracy	±5 % ± 1 digit (for U, I > 10 % of range)	
temperature meas. range / accuracy	-30 ÷ 60 °C, ± 5 °C	
number of output relays	6 / 14	
output relay load rating : • standard version • "/S400" version	250 V AC / 4 A 110 V DC / 0.3 A 250 V AC / 4 A ; 110 V DC / 0.5 A ; 220 V DC / 0.2 A (400 V AC for overvoltage cathegory II)	
installation cathegory / level of pollution • for voltage up to 300 V AC • for voltage over 300 V AC	III-2 in compliance with EN 61010-1 II-2 in compliance with EN 61010-1	

Operating Conditions

working environment	class C1 in compliance with IEC 654-1
operating temperature	40° ÷ +60°C
relative humidity	5 to 100 %

EMC

noise suppression level	in compliace with EN 50081-2, EN 55011/class A, EN 55022/class A
immunity	in compliance with EN 61000-6-2

Physical

enclosure • front panel • back panel	IP40 (IP54option) IP 20
dimensions • front panel • built-in depth • instalation cutout	144 x 144 mm 80 mm 138^{+1} x 138^{+1} mm
mass	max. 0.7 kg