Frequency- and voltage monitoring

G4PF21-1

Monitoring relays - GAMMA series

Frequency and voltage monitoring in 3-phase mains

in accordance with CEI 0-21

Quick net error recognition

Connection of neutral wire optional

2 change over contacts:

- 1 for net error indication
- 1 for main contactor error indication

Width 45mm

Industrial design

Read and understand these instructions before installing, operating or maintaining the equipment.

Danger!
Never carry out work on live parts! Danger of fatal injury! The product must not be used in case of obvious damage. To be installed by an authorized person.

Technical data

1. Functions
Frequency monitoring in Phase L1
Voltage monitoring in 3-phase mains
Selection between 2-line, 3-line and 4-line mode
10-minutes average
non volatile error message memory including datestamp
Password protected
selectable between „Transitory Mode“ (default) and „Definitive Mode“
switchover between parameter sets via digital inputs

2. Time ranges

ON-Delay:	300s
OFF-Delay:	see table - parameter

3. Thresholds
see table - parameter.

4. Indicators
see display specification.

5. Mechanical design
Self-extinguishing plastic housing, IP rating IP40
Mounted on DIN rail TS 35 according to EN 60715
Mounting position: any
Shockproof terminal connection according to VBG 4 (PZ1 required), IP rating IP20
Tightening torque: max. 1Nm
Terminals capacity:
- 1 x 0.5 to 2.5mm² with/without multicore cable end
- 1 x 4mm² without multicore cable end
- 2 x 0.5 to 1.5mm² with/without multicore cable end
- 2 x 2.5mm² flexible without multicore cable end

6. Input circuit
Supply voltage:

G4PF21-1 230V AC:	230V a.c.
G4PF21-1 400V AC:	400V a.c.
G4PF21-1 24V DC:	24V d.c.
	terminals A1-A2 (galvanically separated)
Tolerance:	-20% to +15%
Rated frequency:	50Hz
Rated consumption:	6VA (4W)
Duty cycle:	100%
Reset time:	500ms + 300s power-up delay
Voltage drop:	the device must be supplied via an UPS (>5s).
Drop-out voltage:	30% of nominal supply voltage
Overvoltage category:	III (in accordance with IEC 60664-1)
Rated surge voltage:	4kV

7. Output circuit
2 potential free change over contacts

Rated voltage:	250V a.c.
Switching capacity:	750VA (3A / 250V a.c.) If the distance between the devices is less than 5mm.
Switching capacity:	1250VA (5A / 250V a.c.) If the distance between the devices is greater than 5mm.
Fusing:	5A fast acting
Mechanical life:	20 x 10^6 operations
Electrical life:	2 x 10^5 operations at 1000VA resistive load
Overvoltage category:	III (in accordance with IEC 60664-1)
Rated surge voltage:	4kV

8. Load for external feedback contacts Y1a, Y1b, Y1c, Y2c

Voltage:	12V d.c.
Switched current:	10mA d.c.
Continuous current:	1mA d.c.

9. Measuring circuit
Frequency monitoring

Measured variable:	frequency of phase L1
Measurement input:	230V a.c.
Terminals:	N-L1
Switching threshold:	see table - parameter

Voltage monitoring $U_{\triangle}$

Measured variable:	voltage, a.c. sinus
Measuring input:	3x 400V a.c.
Terminals:	(N)-L1-L2-L3
Overload capacity:	
3(N)~ 400/230V	3(N)~ 600/346V
Input resistance:	
3(N)~ 400/230V	1MΩ
Switching threshold U_S:	see table - parameter

Voltage monitoring $U_{\curlywedge}$

Measured variable:	voltage, a.c. sinus
Measuring Input:	3x 230V a.c.
Terminals:	N-L1-L2-L3
Overload capacity:	
3N~ 400/230V	3N~ 600/346V
Input resistance:	
3N~ 400/230V	1MΩ
Switching threshold U_S:	see table - parameter

10-minutes-average Ūmax

Threshold range:	see table - parameter

Technical data

Overvoltage category: III (in accordance with IEC 60664-1)
Rated surge voltage: 4kV

10. Accuracy

Accuracy voltage measurement[1)]:	5% of U_{nom}
Repeat accuracy of voltage measurement[1)]:	2% of U_{nom}
Timing accuracy:	±3% / ±20ms
Accuracy of frequency measurement:	±20mHz
Repeat accuracy of frequency measurement:	±20mHz
Timing accuracy:	±3% / ±20ms
Temperature influence voltage measurement:	0.05% / °C

[1)] for clockwise turning 3-phase systems and the three phases connected correctly to L1, L2 and L3.

11. Ambient conditions

Ambient temperature:	-25 to +55°C (in accordance with IEC 60068-1)
Storage temperature:	-25 to +70°C
Transport temperature:	-25 to +70°C
Relative humidity:	15% to 85% (in accordance with IEC 60721-3-3 class 3K3)
Pollution degree:	3 (in accordance with IEC 60664-1)
Vibration resistance:	10 bis 55Hz 0.35mm (in accordance with IEC 60068-2-6)
Shock resistance:	15g 11ms (in accordance with IEC 60068-2-27)

Functions

Measurement and supervision
The device measures and supervises the three line to neutral voltages in 4-wire mode. When 3-wire mode is selected, the 3 line to line voltages are supervised.

An additional 2-wire mode is available for single phase measurement (L1-N). In this case the terminals L2 and L3 need not to be connected.

Selection between 2-wire, 3-wire and 4-wire modes has to be done manually via the user menu. Default setting is 4-wire mode.

The thresholds for line to line voltages and line to neutral voltages are identical (in terms of % of U_{nom}).

U_{nom} is 230V for line to neutral voltages and 398,4V for line to line voltages. For better readability the voltages displayed are normalized to 100% = 400V.

Also depending if 2-wire, 3-wire or 4-wire mode is selected, the 10 minutes averages of the three line to neutral voltages (in 4-wire mode) or of the three line to line voltages (in 3-wire mode) or the voltage between L1 and N (in 2-wire mode) are measured and supervised.

Frequency is measured between L1 and N (in 3-wire mode a virtual neutral is used). If the voltage between L1–N is <20% of U_{nom}, all frequency functions are disabled (i.e. frequency is “good” in every case).

Disconnection
If at least one of the threshold limits (voltage or frequency) is exceeded Relay A is switched off within a defined time window (see parameter table). This time window is depending on the type of error. For more than one error at the same time, the fastest time window is executed.

When the 10min average of one of the three supervised voltages exceeds the defined limit, Relay A is switched off within 3 seconds from the time the exceeding is detected.

When the Teledistacco input is active (Y1a, Y2a shortened), Relay A switches off immediately (within 50ms).

On the error display window as well as in the error memory the reason of the disconnection is displayed:

f ... frequency error
U ... voltage error
Ū ... average voltage error
T ... Teledistacco

While changing parameters via the display unit (program mode) Relay A and Relay B are switched off, independent from the applied voltages frequencies and digital inputs.

Reconnection
When there is no error, the Teledistacco signal is inactive, the device is not in programming mode and Relay A is switched off, a fixed reconnection time of 300s is started.

This mechanism also causes, that after powering up the device the connection delay is started (indicated by a letter „T“ in the bottom left corner of the voltage / frequency displays).

If within this reconnection time there appears no error, the Teledistacco signal stays inactive and the device is not set in programming mode, the Relay A is switched on.

Communication Modes and Parameter switchover
Via the display unit 2 modes can be selected:

- Transitory Mode (default)
- Definitive Mode

Transitory mode is the currently used and is implemented according to the standard. Definitive Mode is reserved for future use.

Transitory Mode
Y1c has to be always shortened to Y3c (but is not supervised by the device).

With the input signal Y2c the device can be switched over between two parameter sets:

Y2c-Y3c connected: Narrow frequency window, intervention time = 0.1s

Y2c open: Wide frequency window, intervention time = 0.1s

Reaction time to the digital inputs (until new settings are valid) is < 1s.

Definitive Mode
Y1c has to be always open (but is not supervised by the device).

Y2c-Y3c connected: Wide frequency window, intervention time = 1s (for overfrequency) resp. intervention time = 4s (for underfrequency)

The state Y2c open is not supervised and therefore undefined.

Supervision of the main contactor
Input Y1b/Y2b checks the actual position of the main contactor via an auxiliary contact and compares it to the target position of the main contactor which is derived from the target state of Relay A.

Functions

As soon as the state of Relay A is off, the state of the main contactor is checked continuously. If the main contactor stays closed the Relay B is switched on and hence reports a system error.

Relay A is not affected by this function.

As soon as the deviation between Relay A and the main contactors exists no longer, Relay B is switched off again. This state is neither stored nor a minimum time is guaranteed.

The polarity of the auxilliary contact of the main contactor can be selected via the display unit (normally opened, normally closed, not supervised).

Display
Via the display unit the measured and supervised voltages, the frequency and all types of active errors can be read off.

Error memory
The voltage frequency relay supports an error memory, which stores the last 5 error events (even after voltage loss) with error code and relative time stamp (time difference to now). The error memory can be read out using the display and the pushbuttons and needs no additional device at all.

Parameter setting
Parameter setting can be done when entering the “program mode”. Voltage thresholds are set in % of U_{nom}, Frequency thresholds are set in Hz and Timers are set in s. While changing parameters via the display unit (program mode) Relay A and Relay B are switched off.

Starting from the standard mode, where the display shows the measured values.

► Press repeatedly „+“ or „-“ until the display shows “ProgMode ENT”

► Press “Ent”

Now you are in the Password screen.

► Select the first character of the password by using “+” or “-“ then Press “Ent”

► Repeat the same for the 2nd, 3rd and 4th character (The default password is “0000”)

► If the Password is OK the display shows “Password OK”

► Press “Ent” to Enter the programming mode

► Press repeatedly „+“ or „-“ until the display shows the desired parameter

► Press “Ent” to step into parameter change mode.

The display shows “*” in the top right corner

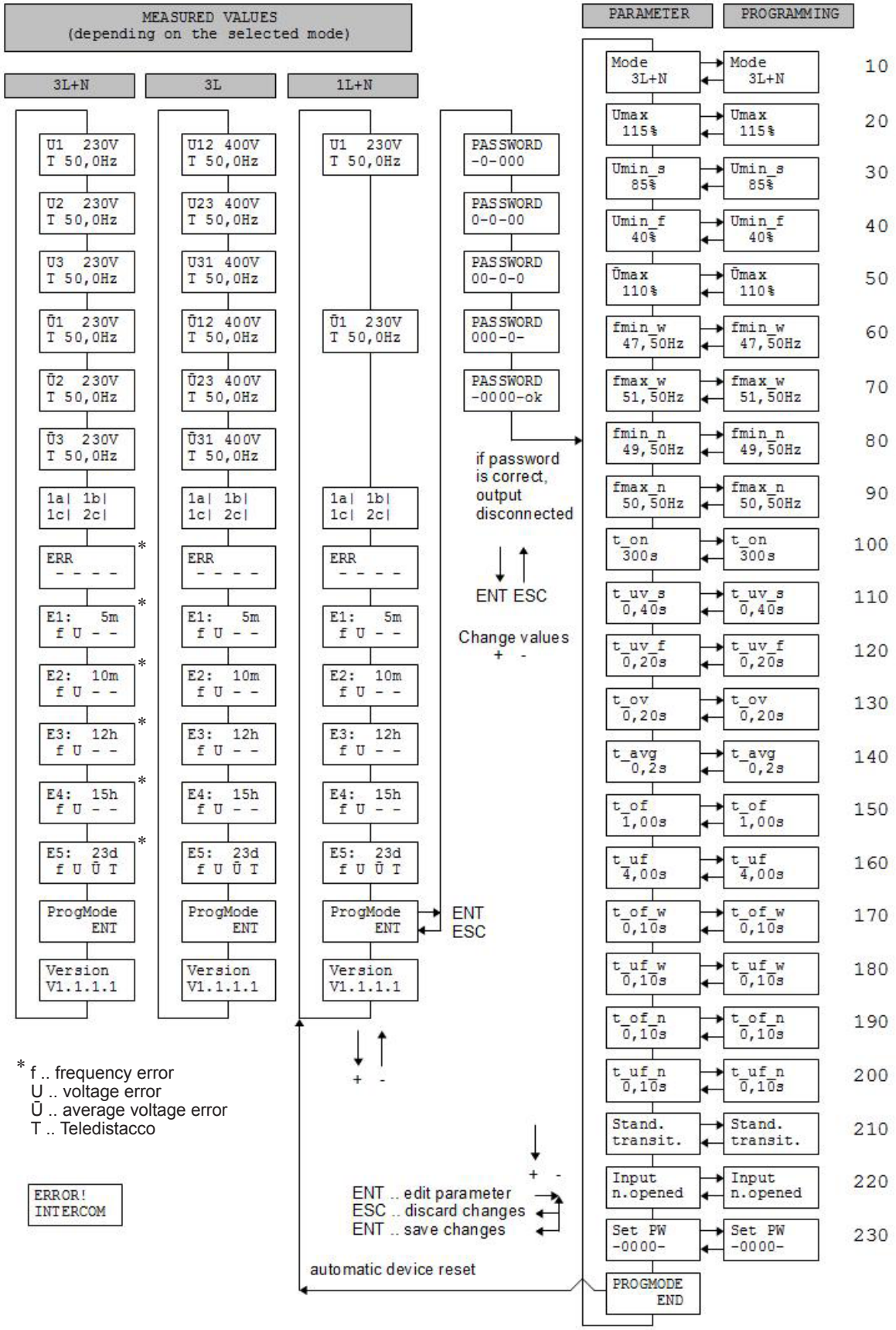
► Change the parameter value by using “+” or “-“

► Press “Ent” to store the new value and leave the parameter change mode or press “Esc” to leave the parameter change mode without storing the changed value.

► By using “+” or “-“ you can select the next parameter you want to change or, if you are ready, select “PROGMODE END” and press “Ent”.

The device is back in standard mode, where the displays shows the measured values.

Display specification



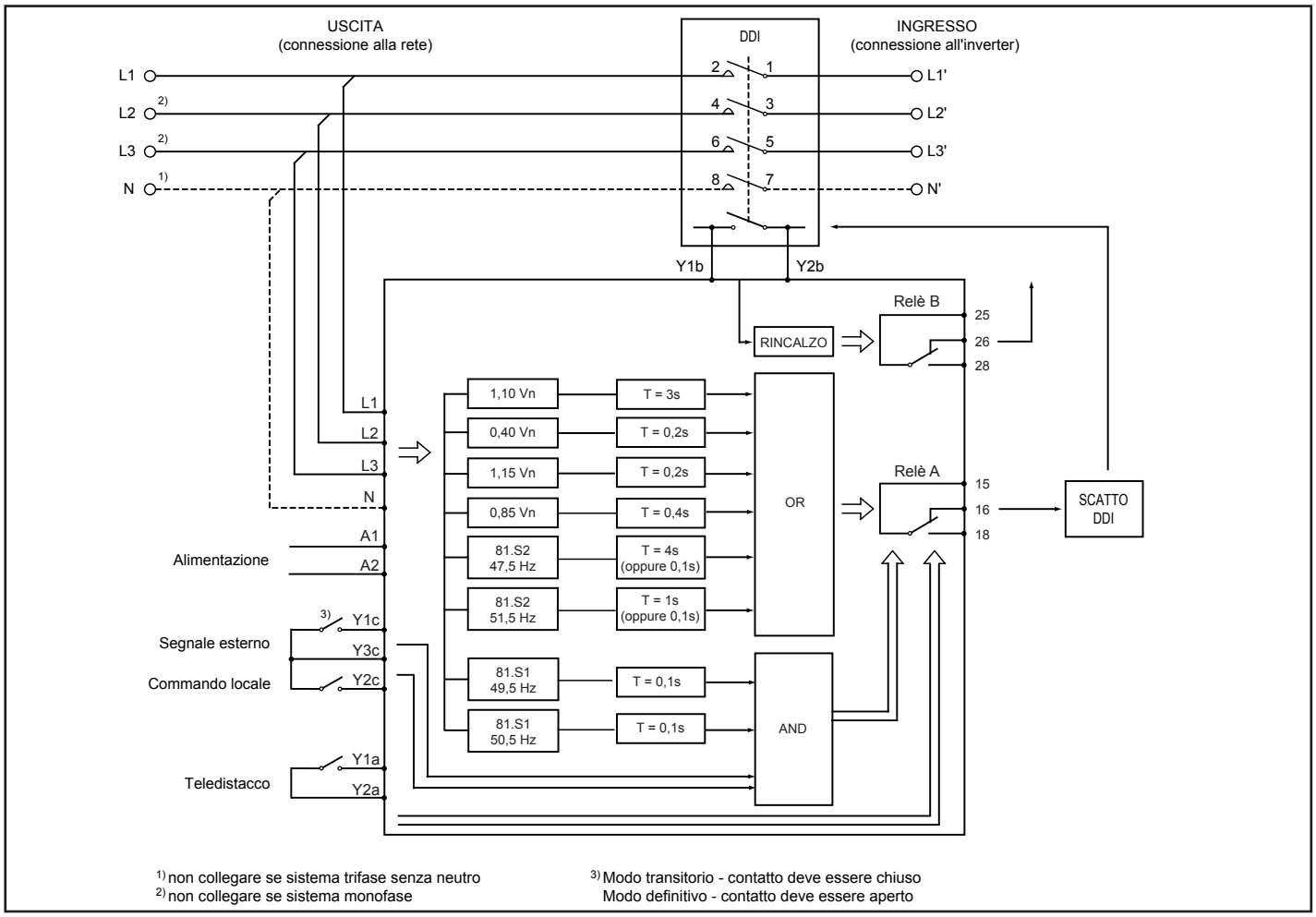
Parameter table

Parameter[2)]	Threshold Default	Threshold Range	Intervention time default	Intervention time Range	Hysteresis	Reconnection time
10min Average 59.S1 Ūmax tavg	110%U_{nom}	100 - 120%U_{nom} Step 1%	<3s	0,2 - 10s Step 0,1s	4%$U_{Threshold}$	300s[3)]
Overvoltage 59.S2 Umax t_ov	115%U_{nom}	100 - 130%U_{nom} Step 1%	0,2s	0,05 - 1s Step 0,05s	4%$U_{Threshold}$	300s[3)]
Undervoltage slow 27.S1 Umin_s t_uv_s	85%U_{nom}	20 - 100%U_{nom} Step 5%	0,4s	0,05 - 5s Step 0,05s	4%$U_{Threshold}$	300s[3)]
Undervoltage fast 27.S2 Umin_f t_uv_f	40%U_{nom}	5 - 100%U_{nom} Step 5%	0,2s	0,05 - 5s Step 0,05s	4%$U_{Threshold}$	300s[3)]
Overfrequency Narrow window 81>S1 fmax_n t_of_n	50,5Hz	50 - 52Hz Step 0,1Hz	0,1s	0,05 - 5s Step 0,05	100mHz	300s[3)]
Overfrequency Wide window 81>S2 fmax_w t_of_w t_of[1)]	51,5Hz	50 - 52Hz Step 0,1Hz	0,1s or 1s[1)]	0,05 - 5s Step 0,05s 0,5 - 5s Step 0,1s	100mHz	300s[3)]
Underfrequency Narrow window 81<S1 fmin_n t_uf_n	49,5Hz	47 - 50Hz Step 0,1Hz	0,1s	0,05 - 5s Step 0,05s	100mHz	300s[3)]
Underfrequency Wide window 81<S2 fmin_w t_uf_w t_uf[1)]	47,5Hz	47 - 50Hz Step 0,1Hz	0,1s or 4s[1)]	0,05 - 5s Step 0,05s 0,5 - 5s Step 0,1s	100mHz	300s[3)]
Mode selection Stand.	transit.	“transit.“ or “de-finit.“	-	-	-	-
Auxiliary contact of main contactor Input	n.opened	“n. opened“, “n. closed“ or “deact.“	-	-	-	-
Password[4)] Set PW	0000	0000 - 9999	-	-	-	-
Measurement Mode	3L + N	3L, 1L, 3L+N	-	-	-	-

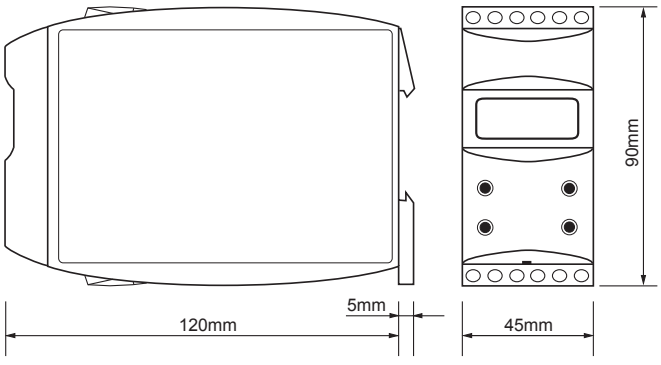
[1)] ... only for Definitive Mode.
[2)] the parameter names in grey are the names used by the display unit
[3)] adjustable from 5s...300s (parameter t_on, default 300s, step width 5s)
[4)] Warning: no master password available

Connection

G4PF21-1



Dimensions



Terminal configuration

A1	N	15	A1	Y3c	25
L1	L2	L3	Y1c	Y2c	-
Y1a	Y2a	-	Y1b	Y2b	-
16	18	A2	26	28	A2

Remark, the terminals A1-A1 and A2-A2 are internally connected. The maximum permissible load of this connection is 100mA.

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Subject to alterations and errors

Technik Braucht Kontrolle