



Manual for connection and operation of

GIR 230 FR

Version 1.1



Index

1. SAFETY REGULATIONS	3
2. INTRODUCTION	4
3. ELECTRICAL CONNECTION.....	4
3.1. Terminal assignment.....	4
3.2. Connection data	4
3.3. Connecting an input signal.....	5
3.3.1. Connecting a frequency signal.....	5
3.3.2. Connecting a counter signal.....	6
3.4. Connecting switching outputs.....	7
3.4.1. Connection of the relay outputs	7
3.4.2. Connection of output 3 (NPN-output, switching to ground).....	7
4. CONFIGURATION OF THE DEVICE	8
4.1. Selecting an input signal type	8
4.2. Measuring frequency (TTL, switching contact).....	9
4.3. Measuring of rotation speed (TTL, switching-contact)	10
4.4. Up-/Downwards counter (TTL, switching-contact).....	10
4.5. Selection of the output function.....	12
5. SWITCHPOINTS AND ALARM-BOUNDARIES.....	13
5.1. 2- point-controller, 3- point-controller.....	13
5.2. 2-point-controller with alarm function, 3-point-controller with alarm function	14
5.3. Minimum/maximum-alarm.....	15
6. MIN-/MAX-ALARM-DISPLAY	15
7. MIN-/MAX-VALUE STORAGE	15
8. OFFSET- AND SLOPE-ADJUSTMENT	16
9. ERROR CODES	17
10. SPECIFICATION.....	18

1. Safety regulations

This device was designed and tested considering the safety regulations for electronic measuring devices.

Faultless operation and reliability in operation of the measuring device can only be assured if the General Safety Measures and the devices specific safety regulations mentioned in this users manual are considered.

1. Faultless operation and reliability in operation of the measuring device can only be assured if the device is used within the climatic conditions specified in the chapter "Specification"
2. Always disconnect the device from its supply before opening it. Take care that nobody can touch any of the unit's contacts after installing the device.
3. Standard regulations for operation and safety for electrical, light and heavy current equipment have to be observed, with particular attention paid to the national safety regulations (e.g. VDE 0100).
4. When connecting the device to other devices (e.g. the PC) the interconnection has to be designed most thoroughly, as internal connections in third-party devices (e.g. connection of ground with protective earth) may lead to undesired voltage potentials.
5. The device must be switched off and must be marked against re starting, in case of obvious malfunctions of the device which are e.g.:
 - visible damage.
 - the device is not working as prescribed.
 - after storage of the device under inappropriate conditions for longer time.

In case of doubt, the device should be sent to the manufacturer for repairing or servicing.



ATTENTION: When running electric devices, parts of them will always be electrically live. Unless the warnings are observed serious personal injuries or damage to property may result. Skilled personnel only should be allowed to work with this device. For trouble-free and safe operation of the device please ensure professional transport, storage, installation and connection as well as proper operation and maintenance.

SKILLED PERSONNEL

Are persons familiar with installation, connection, commissioning and operation of the product and have professional qualification relating to their job.

For example:

- Training or instruction respectively qualifications to switch on or off, isolate, ground and mark electric circuits and devices or systems.
- Training or instruction according to the state.
- First-aid training.



ATTENTION:

Do NOT use this product as safety or emergency stopping device, or in any other application where failure of the product could result in personal injury or material damage.

Failure to comply with these instructions could result in death or serious injury and material damage.

2. Introduction

The GIR 230 FR is a microprocessor controlled displaying, monitoring and controlling device.

The device is supporting one interface for the connection of:

- Frequency (TTL or switching contact)

The device features three switching outputs (2 * Relays, 1 * NPN-Output), which can be configured as 2-point-controller, 3-point-controller, 2-point-controller with min./max. alarm, 3-point-controller with min./max. alarm, or just individual min./max. alarm.

The state of the relay outputs is displayed by two LED's beneath the front 4-digit LED-display. The left LED displays the state of the 1st relay, the right LED displays the state of the 2nd relay.

When having an alert active the display will show AL.Lo or AL.Hi cyclically.

When leaving factory the GIR230FR has been subjected to various inspection tests and is completely calibrated.

Before the GIR230FR can be used, it has to be configured for the customer's application.

Hint: *In order to avoid undefined input states and unwanted or wrong switching processes, we suggest to connect the device's switching outputs after You have configured the device properly.*

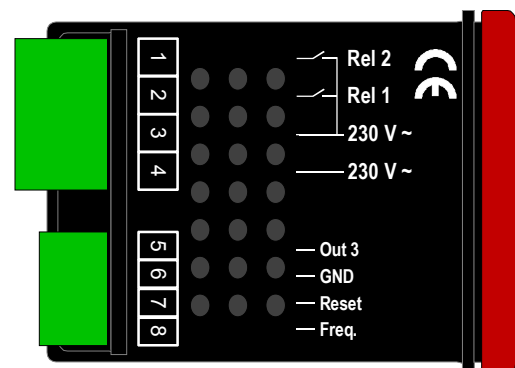
3. Electrical connection

Wiring and commissioning of the device must be carried out by skilled personnel only.

In case of wrong wiring the GIR230FR may be destroyed. We can not assume any warranty in case of wrong wiring of the device.

3.1. Terminal assignment

1	Relay-output 2 (230VAC)
2	Relay-output 1 (230VAC)
3	Supply voltage, 230VAC
4	Supply voltage, 230VAC
5	Output 3
6	GND
7	Reset input for counter
8	Frequency input



3.2. Connection data

	Between terminals	Typical		Limitations		Notes
		min.	max.	min.	max.	
Supply Voltage	3 and 4	207 VAC	244 VAC	0 VAC	253 VAC	
Relay output 1 and 2	1 and 3, 2 and 3				5 A, ohm resistive load	
Output 3 (NPN, open collector)	5 and 6			0 VDC	28 VDC, I < 30mA	
Input reset	7 and 6			0 Ω	∞ Ω	No active signal allowed
Input frequency	8 and 6			-1 VDC	20 VDC, I < 30mA	

These limits must not be exceeded (not even for a short time) !

3.3. Connecting an input signal

Please take care not to exceed the limitations of the inputs when connecting the device as this may lead to destruction of the device..

3.3.1. Connecting a frequency signal

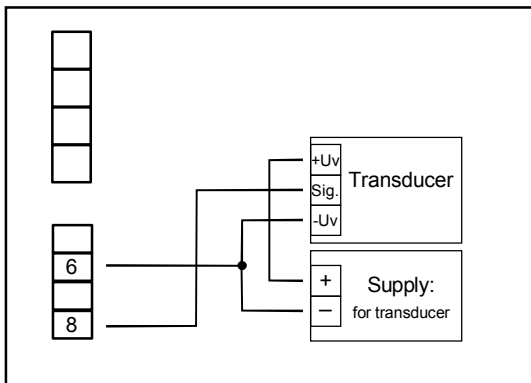
You can select between 3 different input signals when measuring frequency and rotations. You can connect an active signal (TTL, ...), a passive signal, switching to GND (NPN output, push button, relays, ...) or a passive signal switching to +Ub (PNP output switching to +Ub, high-side-switch, ...)

When using the configuration „Switch contact NPN“ the device switches an internal pull-up-resistor (approx. 11kOhm) to +3.3V automatically. Therefore you don't need to connect an external resistor when using devices with NPN output or switch contacts.

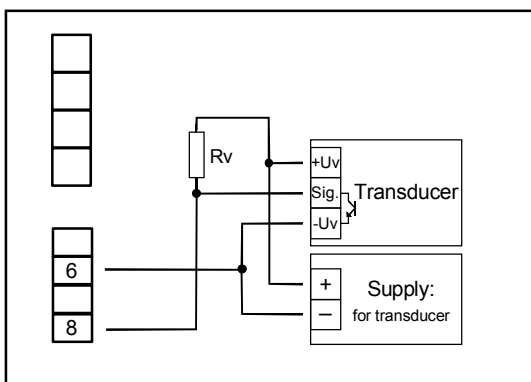
When using the configuration „Switch contact PNP“ the device switches an internal pull-down-resistor (approx. 9kOhm) to GND automatically. Therefore you don't need to connect an external resistor when using devices with PNP output.

It may be that your measuring-signal source needs the connection of an external resistor e.g. the pull-up-voltage of 3.3V is not enough for the signal source, or you want to measure in the top level frequency range. In this case the input signal has to be treated like an active signal and you have to configure the device as „TTL“.

Hint: When connecting the device You have to take care not to exceed the limits of the input voltage and the input current of the frequency-input.

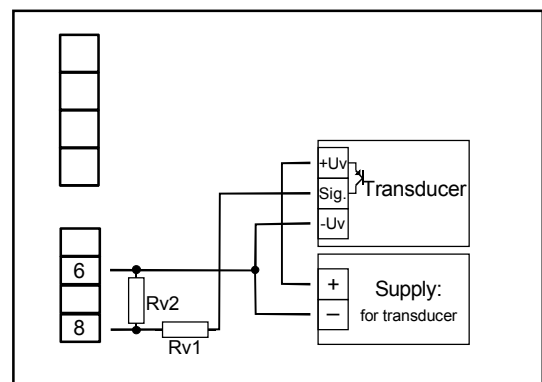


Connecting a transducer with TTL-, NPN- or PNP-output



Connection of a transducer with NPN-Output with needed external resistor

Connection hint: $R_v = 3k$ (transducer supply =12V) or $7k$ (with 24V), device configuration: Sens = TTL



Connection of a transducer with PNP-Output and external resistor circuit

Connection hint: $R_{v2} = 600\Omega$, $R_{v1} = 1k\Omega$ (transducer supply =12V) or $4k\Omega$ (with 24V), device configuration: Sens = TTL
(R_{v1} is for current limiting and may be shorted if necessary. It should never exceed the mentioned value.)

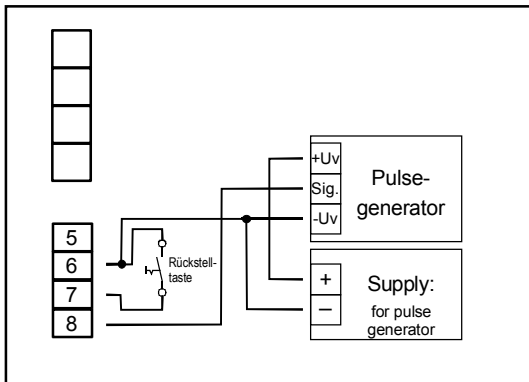
3.3.2. Connecting a counter signal

When configuring the device you can select 3 different input signal modes similar to the connection of frequency- and rotation-signals. The connection of a sensor-signal for a counter-signal is the same used for the frequency- and rotation-signal.

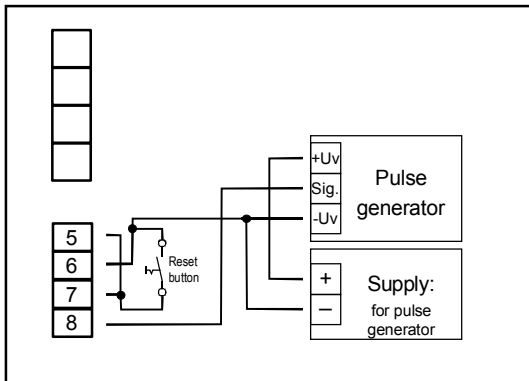
Please use the wiring diagram in this chapter given below.

There is the possibility to reset the counter. When connecting contact 7 with GND (e.g. contact 6) the counter will be reset. You can do this manually (e.g. with the help of a push-button) or automatically (with the switching output out3 of the device).

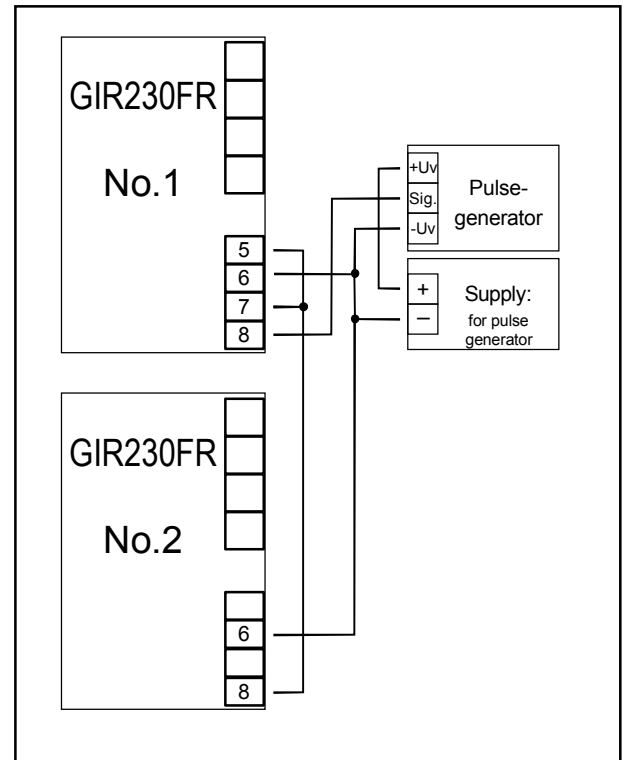
Hint: When connecting the device, take care not to exceed the limits of the input-voltage or the input-current of the frequency input.



Reset manually with an external push button



Reset automatically with output out3 and additional reset with an external push button



GIR230FR cascading

Configuration hints for GIA20EB:

Device 1 – input signal according to pulse generator

Device 2 – Input signal = switching contact

3.4. Connecting switching outputs

The switching outputs are depending on the device's configuration of the selected output functions. (see chapter 4.2)

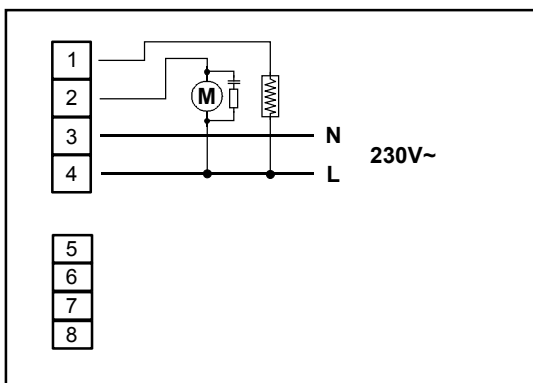
Hint: In order to avoid unwanted or wrong switching processes, we suggest to connect the device's switching outputs after you have configured the device's switching outputs properly.

Please take care that you must not exceed the limits of the voltage and of the maximum current of the switching outputs (not even for a short period of time).

Please take extreme care when switching inductive loads (like coils or relays, etc.) because of their high voltage peaks, protective measures to limit these peaks have to be taken.

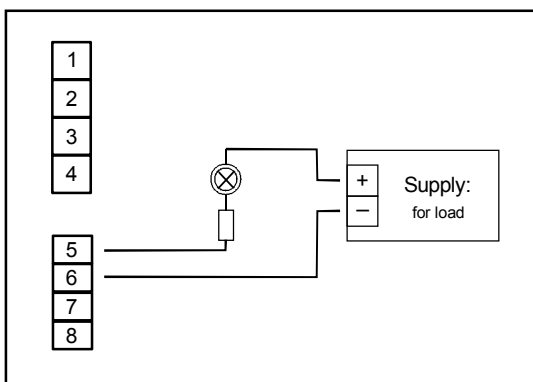
When switching large capacitive loads a series resistor for current limitation is needed, because of the high turn-on-current of high capacitive loads. The same applies to incandescent lamps, whose turn-on-current is also quite high due to their low cold resistance.

3.4.1. Connection of the relay outputs



Connection of consumer loads (motor, heater)

3.4.2. Connection of output 3 (NPN-output, switching to ground)



Connection of consumer loads (lamp)

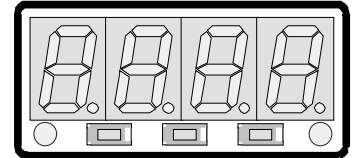
4. Configuration of the device

Please note: When you are configuring the device and don't press any button for more than 60 sec. the configuration of the device will be cancelled. The changes you made will not be saved and will be lost!

Hint: The buttons 2 and 3 are featured with a 'roll-function'. When pressing the button once the value will be raised (button 2) by one or lowered (button 3) by one. When holding the button pressed for longer than 1 sec. the value starts counting up or down, the counting speed will be raised after a short period of time. The device also features a 'overflow-function', when reaching the upper limit of the range, the device switches to the lower limit, vice versa.

4.1. Selecting an input signal type

- Turn the device on and wait until it completed its built-in segment test.
- Press button 2 for >2 sec.
The device displays "InP" ('INPUT').
- Use button 2 or button 3 to select the input signal to be measured.



Button 1 Button 2 Button 3

Display	Input signal to be measured	Notes
FrEq	Frequency	
rPn	Rotation	
Co.uP	Counter upwards	
Co.dn	Counter downwards	

Please Note: When changing to setting rotation (rPn) all settings for measuring and display range will be reset to factory defaults.

- Validate the selection with button 1 (the left button). The display will show "InP".
- Press button 1 again, the display will show "SEnS".
- Use button 2 or button 3 to select the desired input signal.

Display	Input signal	notes
ttL	TTL-signal	
nPn	Switching contact, NPN	For direct connection of a passive switching contact (e.g. push button, relay) or Transmitter with NPN output. A pull-up-resistor is internally connected. <i>Hint: when using push-buttons or relays, they must be bounce-free!</i>
PnP	Switching contact, PNP	For direct connection of a transmitter with PNP output. A pull-down-resistor is internally connected.

Hint: For the connection of a frequency-transmitter, please follow the instructions given in chapter 3.3.6
When connecting a switching-contact-transmitter with increased frequency range (= with external circuitry) you have to select TTL as your desired input signal.

- Validate your selected input signal by pressing button 1. The display shows "SEnS" again.

According to you selected input signal to measure you have to make additional settings. Please use the table given below for finding the next chapter to read on.

Frequency	read on in chapter 4.2
Rotation	read on in chapter 4.3
Counter Upwards	read on in chapter 4.4
Counter Downwards	read on in chapter 4.4

4.2. Measuring frequency (TTL, switching contact)

This chapter describes how to configure the device for measuring frequency.

This instruction demands that you selected “FrEq” as your desired input type like it is explained in chapter 4.1. The device has to display “SEnS”.

- When pressing button 1 again, the display will show “Fr.Lo” (frequency low = lower frequency range limit).
- Use button 2 and button 3 to select the lowest frequency that may occur when measuring.
- Press button 1 to validate your selection. The display shows “Fr.Lo” again.
- When pressing button 1 again, the display will show “Fr.Hi” (frequency high = upper frequency range limit).
- Use button 2 and button 3 to select the highest frequency that may occur when measuring.
- Press button 1 to validate your selection. The display shows “Fr.Hi” again.
- When pressing button 1 again, the display will show “dP” (decimal point).
- Use button 2 and button 3 to select the desired decimal point position.
- Press button 1 to validate your selection. The display shows “dP” again.
- When pressing button 1 again, the display will show “di.Lo” (display low = display at lower frequency range limit).
- Set the value the device shall display at the lower frequency range limit by pressing button 2 or button 3.
- Press button 1 to validate your selection. The display shows “di.Lo” again.
- When pressing button 1 again, the display will show “di.Hi” (display high = display at upper frequency range limit).
- Set the value the device shall display at the upper frequency range limit by pressing button 2 or button 3.
- Press button 1 to validate your selection. The display shows “di.Hi” again
- When pressing button 1 again, the display will show “Li” (limit = measuring range limitation).
- Use button 2 and button 3 to select the desired measuring range limitation.

Display	Measuring range limit	Note
off	inactive	Exceeding of the measuring-frequency is tolerable until you reach the maximum measuring range limit.
on.Er (on error)	active, (error indicator)	The measuring range is exactly bounded by the selected frequency-measuring-range-limit. When exceeding or shortfalling of the limit the device will display an error message.
on.rG (on range)	active, (frequency range limit)	The measuring range is exactly bounded by the selected frequency-measuring-range-limit. When exceeding or shortfalling of the limit the device will display the lower or upper display-range-limit. [e.g. for humidity: when shortfalling or exceeding the device will display 0% or 100%]

Hint: When exceeding the maximum range limit (10kHz) independently from the limit setting an error message will be displayed (“Err.1”).

Press button 1 to validate your selection. The display shows “Li” again.

- When pressing button 1 again, the display will show “FiLt” (Filter = digital filter).
- Use button 2 and button 3 to select the desired filter value [in sec.].
Usable values: 0.01 ... 2.00 sec.

Explanation: this digital filter is a digital replica of a low pass filter.

- Press button 1 to validate your selection. The display shows “FiLt” again.

Now your device is adjusted to your signal source. The only thing you left do is to adjust the outputs of the device.

- When pressing button 1 again, the display will show “outP”. (Output)
For configuring the outputs of the GIA20FR, please follow the instructions shown in chapter 4.5.

4.3. Measuring of rotation speed (TTL, switching-contact)

This chapter describes how to configure the device for measuring rotation speed.

This instruction demands that you selected “rPn” as your desired input type like it is explained in chapter 4.1. The device has to display “SEnS”.

- When pressing button 1 again, the display will show “diu” (divisor).
- Use button 2 and 3 to select your desired divisor.
Set the divisor to the pulses per rotation the transmitter supplies.
- Press button 1 to validate your selection. The display shows “diu” again.
- When pressing button 1 again, the display will show “dP” (decimal point).
- Use button 2 and button 3 to select the desired decimal point position.

Use the decimal point position to change the resolution of your measurement. The more the decimal point position is on the left, the finer the resolution will become. Please note that you lower the maximum value that can be displayed, either

Example: your engine runs with 50 rotations per minute.

With no decimal point the device will display something like 49 – 50 – 51, the maximum value that can be displayed is 9999 rotations per minute.

With the decimal point position on the left e.g. XX.XX the device will display something like 49.99 – 50.00 – 50.01, but the maximum value that can be displayed is 99.99 rotations per minute.

- Press button 1 to validate your selection. The display shows “dP” again.

Now your device is adjusted to your signal source. The only thing left to do is to adjust the outputs of the device.

- When pressing button 1 again, the display will show “outP”. (Output)
For configuring the outputs of the GIA20FR, please follow the instructions shown in chapter 4.5.

4.4. Up-/Downwards counter (TTL, switching-contact)

The upwards counter starts counting upwards from 0 according to its settings.

The downwards counter starts counting downwards from the upper value that had been selected.

Feature: The current value of the counter can be reset anytime by connecting pin 7 to GND (pin 6). The counter starts from its beginning when disconnecting pin 6 and pin 7.

This chapter describes how to configure the device as a counter.

This instruction demands that you selected “Co.up” or “Co.dn” as your desired input type like it is explained in chapter 4.1. The device has to display “SEnS”.

- When pressing button 1 again, the device will be displaying “EdGE” (signal edge).
- Use button 2 or button 3 (middle or right button) to select the desired signal edge.

Display	Signal edge	Note
PoS	positive	The counter is triggered on the positive (rising) edge.
nEG	negative	The counter is triggered on the negative (falling) edge.

- Press button 1 to validate your selection, the display shows “EdGE” again.
- When pressing button 1 again, the display will show “diu” (divisor = pre-scaling factor).
- Use button 2 and button 3 to select the desired pre-scaling factor.

The incoming pulses will be divided with the selected pre-scaling factor, after that they will be transmitted to the device for further processing.

By this factor you can adapt the device to your transmitter or select a pre-scaling factor for large values

Example 1: Your flow rate transmitter supplies 165 pulses per litre. When setting a pre-scaling factor of 165 every 165th pulse (so 1 pulse per litre) will be used for further processing.

Example 2: Your transmitter is supplying about 5 000 000 pulses during the measurement, which exceeds the limit of the device! But when setting a pre-scaling factor of 1000 only every 1000th pulse is used for further processing. So you only got a value 5000 which won't exceed the limit of the device.

- Press button 1 to validate your selection. The display shows "**diu**" again.
- Press button 1 again. The display shows "**Co.Hi**" (counter high = upper counting range limit).
- Use button 2 and button 3 to select the maximum pulse-count (after pre-scaling factor) for the counting process.

Example: Your flow rate transmitter is supplying 1800 pulses per litre, you selected a pre-scaling factor of 100 and you are expecting a maximum flow rate of 300 litres during the measurement. With a pre-scaling factor of 100 selected, you will get 18 pulses per litre. With a maximum flow rate of 300 litres you will be getting a pulse count of $18 * 300 = 5400$.

- Press button 1 to validate your selection. The display shows "**Co.Hi**" again.
- When pressing button 1 again, the device will be displaying "**dP**" (decimal point).
- Use button 2 and button 3 to select the desired decimal point position.
- Press button 1 to validate your selected decimal point position. The display shows "**dP**" again.
- Press button 1 again. The display shows "**di.Hi**" (display high = upper display range limit).
- Use button 2 and button 3 to set the value to be displayed when the maximum pulse (setting of co.Hi) count is reached.

Example: Your flow rate transmitter is supplying 1800 pulses per litre and you are expecting a maximum flow rate of 300 litres. You selected a pre-scaling factor of 100 and a counter range limit of 5400. When wanting a resolution of 0.1 litres shown in the display of the device you would have to set the decimal point position to ---.- and a display range limit of 300.0.

- Press button 1 to validate your selection. The display shows "**di.Hi**" again.
- Press button 1. The display will show "**Li**" (Limit = measuring range limit).
- Use button 2 and button 3 to select the desired measuring range limit (counter range limit).

Display	Measuring range limit	Note
off	inactive	Exceeding of the counter range is tolerable until you reach the maximum measuring range limit.
on.Er	active, (error indicator)	The measuring range is exactly bounded by the selected counter-range-limit. When exceeding or shortfalling of the limit the device will display an error message.
on.rG	active, (measuring range limit)	The measuring range is exactly bounded by the selected counter-range-limit. When exceeding or shortfalling of the limit the device will display the upper counter-range-limit or 0

Hint: The lower counter-range-limit (for configured downwards counter) is fixed to 0.

- Press button 1 to validate your selection. The display shows "**Li**" again.

Now your device is adjusted to your signal source. The only thing left to do is to adjust the outputs of the device.

- When pressing button 1 again, the display will show "**outP**". (Output)
For configuring the outputs of the GIA20FR, please follow the instructions shown in chapter 4.5.

4.5. Selection of the output function

- After configuration of the input (chapter 4.2 – 4.7) you have to select the output function. The display shows “**outP**” (output).
- Use button 2 and button 3 (middle or right button) to select the desired output-function. Please follow the table below to select the desired output function.

Description	To select as output	Output 1 (relay 1)	Output 2 (relay 2)	Output 3 (out 3)	See chapter
No output, device is used as display device	no	off	off	off	--
2-point-controller	2P	switch function 1	Switch function 1, inverted	switch function 1	5.1
3-point-controller	3P	switch function 1	Switch function 2	switch function 1	5.1
2-point-controller with min-/max-alarm	2P.AL	switch function 1	Min-/max-alarm, inverted	min-/max-alarm, inverted	5.2
3- point-controller with min-/max-alarm	3P.AL	switch function 1	Switch function 2	min-/max-alarm, inverted	5.2
min-/max-alarm	AL	max-alarm, inverted	Min-alarm, inverted	min-/max-alarm, inverted	5.3

- Press button 1 to validate the selected output function. The display shows “**outP**” again.

When you selected output function = no the configuration of the device is finished. Press button 1 to switch over to display the measuring value.

When you selected another switching function you have to select the outputs and the switchpoints or alarm-boundaries.

Depending on your output function setting, it may be possible that one or more settings described below won't be available..

- When pressing button 1 again, the device will display “**1.dEL**” (delay of output 1).
- Use button 2 and button 3 to set the desired value [*in sec.*] for the switching-delay of output 1.

Hint: The selected value [0.01 ... 2.00] is in seconds.

- Press button 1 to validate the selection. The display shows “**1.dEL**” again.
- When pressing button 1 again, the device will display “**1.Err**” (preferred state of output 1).
- Use button 2 and button 3 (middle or right button) to set the desired initial state in case of an error.

Display	Initial state of the output	Note
off	inactive in case of an error	
on	active in case of an error	

- Press button 1 to validate the selection. The display shows “**1.Err**” again.
- In case you selected a 3-point-controller you have to make the following settings similar to the settings you already made for output 1:
“**2.dEL**” (delay of output 2), “**2.Err**” (initial state of output 2).

Now you finished configuring the output functions. Depending on the selected output function you have to make the settings for switching and alarm points. See description in chapter „switchpoints and alarm-boundaries“ for further information.

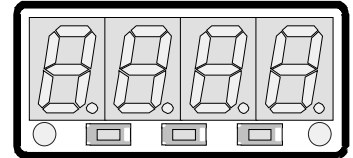
Hint: The settings for the switching and alarm points can be made later in an extra menu (see chapter 5)

5. Switchpoints and alarm-boundaries

Please note: The settings of the switchpoints will be cancelled, when no button was pressed for more than 60 sec. changes you may have made already won't be saved and will be lost!

Hint: The buttons 2 and 3 are featured with a 'roll-function'. When pressing the button once the value will be raised (button 2) by one or lowered (button 3) by one. When holding the button pressed for longer than 1 sec. the value starts counting up or down, the counting speed will be raised after a short period of time. The device also features an 'overflow-function', when reaching the upper limit the device switches to the lower limit, vice versa.

- When pressing button 1 for >2 sec. the menu to select the switchpoints and alarm-boundaries will be called.
- Depending on the configuration you have made in the „output“ menu you will get different display values. Please follow the specific chapter for further information.



Button 1 Button 2 Button 3

Description	To select as output	Go on in chapter	Note
No output, device is used as display device	no	--	
2- point-controller	2P	5.1	
3- point-controller	3P	5.1	
2- point-controller with min-/max-alarm	2P.AL	5.2	
3- point-controller with min-/max-alarm	3P.AL	5.2	
min-/max-alarm	AL	5.3	

5.1. 2- point-controller, 3- point-controller

This chapter describes how to configure the device as a 2-point-controller or 3-point-controller. This instruction demands that you selected "2P" or "3P" as your desired output function.

- Press button 1 (when not already done). The device will be displaying "1.on" (turn-on-point of output 1).
- Use button 2 and button 3 to set the desired value, the device's output 1 should be turning on.
- Press button 1 to validate your selection. The display shows "1.on" again.
- When pressing button 1 again, the device will be displaying "1.off". (turn-off-point of output 1)
- Use button 2 and button 3 to set the desired value, the device's output 1 should be turning off.
- Press button 1 to validate your selection. The display shows "1.off" again.

Example: You want to control the temperature of a heating coil, with a hysteresis of +2°C, to 120°C. Therefore you will have to select the turn-on-point "1.on" to 120°C and the turn-off-point to "122°C". When your heating coil temperature falls below 120°C it will be turned on. When the temperature rises above 122°C the heating coil will be turned off.

Note: Depending on the inertia of your heating coil an overshooting of the temperature may be possible.

When selected '2-point-controller' you finished configuring your device. Press button 1 to switch over to display the measuring value.

When selected '3-point-controller' please follow the instructions given below.

- Press button 1 (when not already done). The device will be displaying "2.on" (turn-on-point of output 2).
- Use button 2 and button 3 to set the desired value, the device's output 2 should be turning on.
- Press button 1 to validate your selection. The display shows "2.on" again.
- When pressing button 1 again, the device will be displaying "2.off". (turn-off-point of output 2)
- Use button 2 and button 3 to set the desired value, the device's output 2 should be turning off.
- Press button 1 to validate your selection. The display shows "2.off" again.

Now you finished configuring the switching points of your device. Press button 1 to switch over to display the measuring value.

5.2. 2-point-controller with alarm function, 3-point-controller with alarm function

This chapter describes how to configure the device as a 2-point-controller with alarm function or 3-point-controller with alarm function. This instruction demands that you selected "2P.AL" or "3P.AL" as your desired output function.

- Press button 1 (*when not already done*). The device will be displaying "1.on" (turn-on-point of output 1).
- Use button 2 and button 3 to set the desired value, the device's output 1 should be turning on.
- Press button 1 to validate your selection. The display shows "1.on" again.
- When pressing button 1 again, the device will be displaying "1.off". (turn-off-point of output 1)
- Use button 2 and button 3 to set the desired value, the device's output 1 should be turning off.
- Press button 1 to validate your selection. The display shows "1.off" again.

Example: *You want to control the temperature of a cooling chamber between -20°C and -22°C . Therefor you will have to select -20°C for the turn-on-point 1 "1.on" and -22°C for the turn-off-point 1 "1.off". When the temperature rises above -20°C the device turns its output 1 on, when falling below -22°C the device will turn its output 1 off.*

Note: Depending on the inertia of your cooling circuit an overshooting of the temperature may be possible.

When selected '3-point-controller with alarm function', you have to select the switching points for the second switching function ("2.on", "2.off"). Configuring these settings like the first switching function.

After that the alarm outputs have to be configured.

- When pressing button 1, the device will be displaying "AL.Hi". (maximum alarm-value)
- Use button 2 and button 3 to set the desired value, the device should turn on its maximum-alarm.
- Press button 1 to validate your selection. The display shows "AL.Hi" again.
- When pressing button 1 again, the device will be displaying "AL.Lo". (minimum alarm-value)
- Use button 2 and button 3 to set the desired value, the device should turn on its minimum-alarm
- Press button 1 to validate your selection. The display shows "AL.Lo" again.
- When pressing button 1 again, the device will be displaying "A.dEL". (delay of the alarm-function)
- Use button 2 and button 3 to set the desired delay of the alarm-function.

Note: *The unit of the value to be set [0 .. 9999] is in seconds. The device will turn on the alarm after the minimum or maximum alarm value was active for the delay-time you have set.*

- Press button 1 to validate the delay time. The display shows "A.dEL" again.

Example: *You want to have an alarm monitoring for the cooling chamber mentioned above. The alarms should start when the temperature will be rising above -15°C or falling below -30°C . Therefore you have to select -15°C for the maximum alarm-value "Al.Hi" and -30°C for the minimum alarm-value "AL.Lo".
The alarm will be starting after the temperature rises above -15°C and stays above -15°C for the entered delay time or after it had been falling below -30°C and stays below -30°C for the entered delay time.*

Please note that the alarm-outputs are inverted! This means, that the output will be active if there is no alarm!

Now you finished configuring your device. Press button 1 to switch over to display the measuring value.

5.3. Minimum/maximum-alarm

This chapter describes how to configure the device's alarm boundaries for min-/max-alarm-monitoring. This instruction demands that you selected "**AL**" as your desired output function.

- Press button 1 (*when not already done*) , the device will be displaying "**AL.Hi**". (maximum alarm-value)
- Use button 2 and button 3 to set the desired value, the device should turn on its maximum-alarm.
- Press button 1 to validate your selection. The display shows "**AL.Hi**" again.
- When pressing button 1 again, the device will be displaying "**AL.Lo**". (minimum alarm-value)
- Use button 2 and button 3 to set the desired value, the device should turn on its minimum-alarm
- Press button 1 to validate your selection. The display shows "**AL.Lo**" again.
- When pressing button 1 again, the device will be displaying "**A.dEL**". (delay of the alarm-function)
- Use button 2 and button 3 to set the desired delay of the alarm-function.

Note: The unit of the value to be set [0 .. 9999] is in seconds. The device will turn on the alarm after minimum or maximum alarm value was active for the delay-time you have set.

- Use button 1 to validate your selection. The display will show "**A.dEL**" again.

Example: You want to have a temperature alarm-monitoring of a greenhouse. The alarm should start when the temperature rises above 50°C or falls below 15°C.

Therefore your settings will be 50°C for the maximum alarm-value "**AL.Hi**" and 15°C for the minimum alarm-value "**AL.Lo**".

The alarm will be starting after the temperature rises above 50°C and stays above 50°C for the entered delay time or after it had been falling below 15°C and stays below 15°C for the entered delay time.

Please note that the alarm-outputs are inverted! This means, that the output will be active when there is no alarm!

Now you finished configuring your device. Press button 1 to switch over to display the measuring value.

6. Min-/max-alarm-display

When a alarm-function was selected (out = 2P.AL, 3P.AL or AL) and the alert status is true this will be shown cyclic in the display

Min.-Alarm: approx. every 2 sec AL.Lo will be displayed

Max.-Alarm: approx. every 2 sec AL.Hi will be displayed

7. Min-/max-value storage

The device features a minimum/maximum-value storage. In this storage the highest and lowest measured value is saved.

Calling of the minimum-value press button 3 shortly

the device will display "**Lo**" briefly, after that the min-value is displayed for about 2 sec.

Calling of the maximum-value press button 2 shortly

the device will display "**Hi**" briefly, after that the max-value is displayed for about 2 sec.

Erasing of the min/max values press button 2 and 3 for 2 sec.

The device will display "**CLr**" briefly, after that the min/max-values are set to the current displayed value.

8. Offset- and slope-adjustment

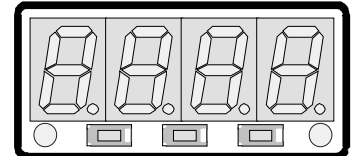
The offset and slope-adjustment function can be used for compensating the tolerance of the used probes.

Please note: The settings of the offset- / slope-adjustment will be cancelled, when no button was pressed for more than 60 sec. Changes you may have made already won't be saved and will be lost!

Please note: The settings of the offset- / slope-adjustment and alarm-boundaries will automatically be reset to factory default when any changes for the settings "InP" or "Unit" had been made!

Hint: The buttons 2 and 3 are featured with a 'roll-function'. When pressing the button once the value will be raised (button 2) by one or lowered (button 3) by one. When holding the button pressed for longer than 1 sec. the value starts counting up or down, the counting speed will be raised after a short period of time. The device also features a 'overflow-function', when reaching the upper limit the device switches to the lower limit, vice versa.

- Turn on the device and wait after it finished its built-in segment test.
- Press button 3 > 2 sec.
The device will be displaying "**OFFS**" (offset).
- Use button 2 and button 3 for setting the desired zero point offset-value.



The input of the offset will be in digits.

The value that had been set will be subtracted from the measured value. (see below for further information)

- Press button 1 to validate your selection. The display shows "**OFFS**" again.
- When pressing button 1 again, the device will be displaying "**SCAL**". (scale = slope)
- Use button 2 and button 3 to select the desired slope-adjustment.

The slope adjustment will be entered in %. The value displayed can be calculated like this:

$$\text{Displayed value} = (\text{measured value} - \text{zero point offset}) * (1 + \text{slope adjustment} [\% / 100]).$$

Example: The setting is 2.00 => the slope has risen 2.00% => slope = 102%.

When measuring a value of 1000 (without slope-adjustment) the device would display 1020 (with slope adjustment of 102%)

- Press button 1 to validate the selection of the slope-adjustment. The display shows "**SCAL**" again.

Example for offset- and slope-adjustment:

Connecting a flow meter

The display without offset- and slope adjustment is at 0 l/min. = 0.00, at 16 l/min. = 16.17

Therefore you calculated: Zero point: 0.00

$$\text{slope: } 16.17 - 0.00 = 16.17$$

$$\text{deviation: } -0.17 \quad (= \text{target-slope} - \text{actual slope} = 16.00 - 16.17)$$

Therefore you select: offset = 0.00

$$\text{scale} = -1.05 \quad (= \text{deviation} / \text{actual-slope} = -0.17 / 16.17 = -0.0105 = -1.05\%)$$

9. Error codes

When detecting an operating state which is not permissible, the device will display an error code

The following error codes are defined:

Err.1: Exceeding of the measuring range

Indicates that the valid measuring range of the device has been exceeded.

Possible causes:

- Input signal too high.
- Counter overflow.

Remedies:

- The error-message will be reset if the input signal is within the limits.
- check device configuration (e.g. input signal)
- reset the counter.

Err.2: Values below the measuring range

Indicates that the value is below the valid measuring range of the device.

Possible causes:

- Input signal is too low
- Counter underflow.

Remedies:

- The error-message will be reset if the input signal is within the limits.
- check device configuration (e.g. input signal)
- Reset the counter.

Err.3: Display range has been exceeded

Indicates that the valid display range (9999 digits) of the device has been exceeded.

Possible causes:

- Incorrect scale.
- Counter overflow.

Remedies:

- The error-message will be reset if the display value is below 9999.
- Reset the counter.

Err.4: Values below display range

Indicates that display value is below the valid display range of the device (-1999 digits).

Possible causes:

- Incorrect scale.
- Counter underflow.

Remedies:

- The error-message will be reset if the display value is above -1999.
- Reset the counter
- Reset the counter.

Note: When Err.3 and Err.4 occur very often maybe the display range was selected too high because of the scale selection. Eventually the display range should be reduced (e.g. 10 times).

Err.7: System-error

The device features an integrated self-diagnostic-function which checks essential parts of the device permanently. When detecting a failure, error-message Err.7 will be displayed.

Possible causes:

- Valid operating temperature range has been exceeded or is below the valid temperature range.
- Device defective.

Remedies:

- Stay within valid temperature range.
- Exchange the defective device.

Er.11: Value could not be calculated

Indicates a measuring value, needed for calculation of the display value, is faulty or out of range.

Possible causes:

- Incorrect scale.

Remedies:

- Check settings and input signal.

10. Specification

Absolute maximum ratings:

	Connection between	Performance data		Limit values		Notes
		Min.	max.	min.	max.	
Supply voltage	3 and 4	207 VAC	244 VAC	0 VAC	253 VAC	
Relay output 1 and 2	1 and 3, 2 and 3				5 A, ohm-resistive Load	
Output 3 (NPN, open collector)	5 and 6			0 VDC	28 VDC, I < 30mA	
Input reset	7 and 6			0 Ω	∞ Ω	<i>no active Signal allowed</i>
Input frequency	8 and 6			-1 VDC	20 VDC, I < 30mA	

Absolute maximum ratings must not be exceeded (not even for a short period of time)!

Measuring inputs: standard inputs for

Input type	Input signal	Range	Resolution	Notes
Frequency	TTL-signal	0 Hz ... 10 kHz	0.001 Hz	$R_i = \sim 50 \text{ k}\Omega$
	Switching contact NPN	0 Hz ... 1 kHz	0.001 Hz	<i>Internal pull-up-resistor ($\sim 11 \text{ k}\Omega$ to +3.3V) is connected automatically.</i>
	Switching contact PNP	0 Hz ... 1 kHz	0.001 Hz	<i>Internal pull-down-resistor ($\sim 9 \text{ k}\Omega$ to GND) is connected automatically.</i>
Rotation speed	TTL-signal, Switching contact NPN, PNP	0 ... 9999 U/min	0.001 U/min	Selectable prescaling (1-1000), pulse-frequency: max. 600000 p./min. *
Up/downwards-Counter	TTL-signal, Switching contact NPN, PNP	0 ... 9999 with prescaling 9 999 000		Selectable prescaling (1-1000) pulse-frequency: max. 10000 p./sec. *

* = with switching contact accordingly to frequency input lower values may occur

Display range: -1999 ... 9999 Digit, *initial value, terminal value and decimal-point-position arbitrary*

Accuracy: < 0.2% FS ± 1 Digit (at nominal temperature)

Measuring frequency: appr. 4 measurements / sec. (at frequency > 4Hz) according to frequency

Output: 2 relay-outputs, switching 230V~
1 NPN-output, switching GND

Relay-output: closing contact,
Breaking capacity: 5A, 230VAC, ohm-resistive load

NPN-output: NPN, open collector
Breaking capacity: 30mA, max. 28VDC

Output functions: 2-point, 3- point, 2-point with alarm, 3-point with alarm, min-/max-alarm.

Switching points: arbitrary
Switching delay: arbitrary: 0.01 ... 2.00 sec.
Alarm delay: arbitrary: 1 ... 9999 sec.

Display: height approx. 10 mm, 4-digit red LED-display

Operation: with help of 3 push-buttons

Supply voltage: 230V, 50/60Hz

Power consumption: approx. 2VA

Nominal temp.: 25°C

Operating ambient: -20 to +50°C

Relative humidity: 0 to 80 % RH (non condensing)

Storing temp.: -30 to +70°C

Enclosure:	main housing: fibre-glass-reinforced noryl front view-panel: polycarbonate
Dimensions:	24 x 48 mm (front-panel cut out).
Installation depth:	approx. 65 mm (incl. screw-in/plug-in clamps)
Panel mounting:	via VA-spring-clip.
Panel thickness:	possible from 1 to approx. 10 mm possible.
Panel cut-out:	21.7+0.5 x 45+0.5 mm (H x W)
Connection:	via screw-in/plug-in clamps: 4-pol. for mains-supply and relay connection, 4-pol. for measuring input and alarm output. Conductor cross-selection: from 0.14 to 1.5 mm ² (input/alarm) or 0.14 to 2.5mm ² (mains/relay).
Protection class:	front IP54
EMC:	EN61326 +A1 +A2 (appendix A, class B), additional errors: < 1% FS When connecting long leads adequate measures against voltage surges have to be taken.

