gFlow 1500 E / PTZ / TZ
Gas Energy / Volume Converter

GB **User Manual**

98026-A EN 11-01-2024
Rev. 10

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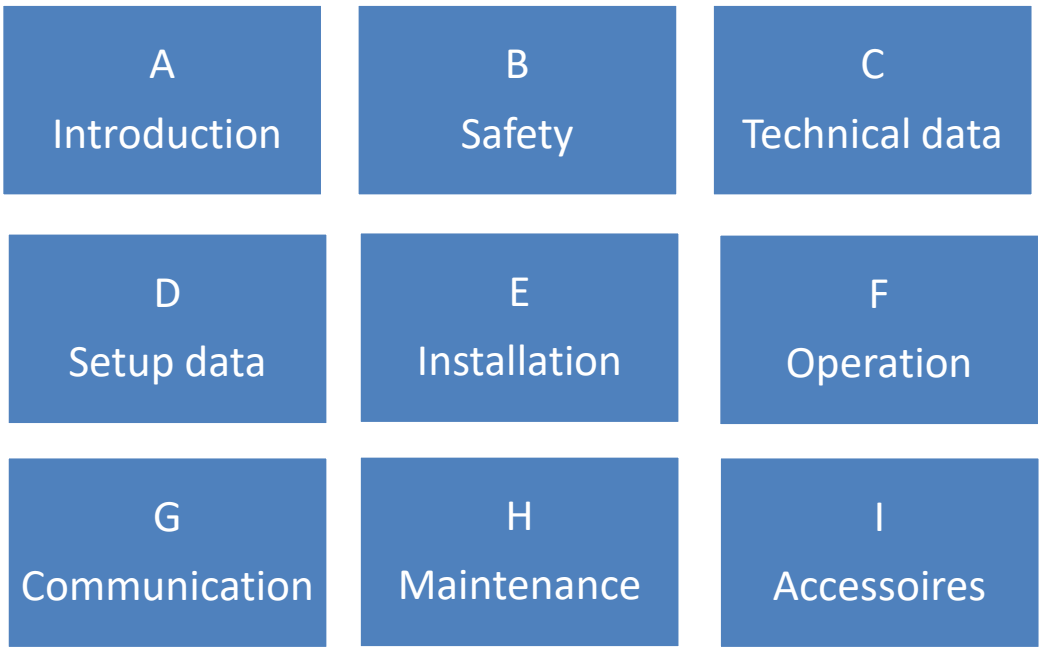
Content:

General

This user manual contains all the information for the installation, operation, maintenance and safety for the gFlow 1500.

The manual is subdivided in 9 sections: Each box is provided with a hyperlink to the first page of the corresponding chapter. At the end of each chapter a button is provided to return to this page.



A. Introduction

1.0 Introduction of the gFlow 1500

The gFlow 1500 by gAvilar is a state-of-the-art Energy / Volume converter using the latest micro controller technology providing excellent features for a fast and accurate measurement of gas volume and energy flows. The gFlow 1500 complies with the latest standards for safety and metrological directives as ATEX (2014/34/EU) and MID (2014/32/EU).

The electronics are housing in an aluminum precision casting consisting of a housing part and a hinged cover. All connections are made in the housing part and a flat cable between the I/O board in the housing is connected to the main board in the cover. The connections are made to spring clamp connectors where wires can be inserted and if required released by pressing the corresponding release button. At the left-hand side, a breathing valve takes care of equalizing the ambient pressure to the inside of the housing. This will avoid any moisture to creep into the housing. At the right-hand side there are 2 lug positions to seal the cover. The cover sealing can be put on by the user.

The power is derived from the internal battery or from an external ATEX certified 5Vdc power source. To extend the battery life time a second battery can be placed inside the gFlow 1500. The battery life time is monitored by a coulomb counter. The used energy from the battery is measured and when the battery has energy left for approximately 6 months the low battery alarm is flagged.

The gFlow 1500 has a digital input for the gasQs gas quality sensor from MEMS to provide input data for heat value, relative density and gas compressibility. The gasQs sensor uses the pressure and temperature measurement values from the gFlow 1500 to compute the corresponding gas quality data to achieve a total energy measurement for a gas line. The Wobbe index is computed from the active input from the gasQs sensor and is monitored within the selected operating range. Alternative the compressibility factor is calculated to AGA NX19 mod; AGA NX19 BRKORR3H; SGERG A, B, C, D, mod H2; AGA 8 GCM1, 2; AGA 8 DC92; CO2 table; H2 table; editable (import) table or fixed number. Using AGA 8 DC92 also the heat value and relative density are calculated using ISO 6976 for base temperature at 0°C, 15°C, 15.5 and 20°C and Hs base temperature of 0°C, 15°C, 20°C and 25°C. At any other base temperature, the heat value and relative density are not calculated.

Using the editable table function allows any gas type to be imported as a matrix of 10 pressures and 20 temperatures. The file format used is .csv. The base compressibility for this gas needs to be entered as a constant.

The gFlow 1500 is equipped with all necessary I/O to work directly with a gas meter pulse sensor for LF or HF and can also be used for NAMUR encoder technology. The Encoder can work on external power in continuous mode and on battery in intermitting mode. Pulse comparing is provided to compare between different inputs to achieve a very high level of reliability for the volume input of the associated gas meter.

An extremely high accuracy internal real time clock insures the correct time of the gFlow 1500 throughout the year. The high accuracy clock facilitates precision logging. The max. deviation of the clock is ± 3.5 ppm between -40°C and 85°C.

An internal temperature sensor measures the device temperature and monitors the operation within the approved ambient temperature range.

The gFlow 1500 can operate with SI or Imperial units for volume, pressure, temperature, Heat value and density.

In addition to the volume and energy conversion function 6 status inputs can be used to monitor the station where gFlow 1500 is installed in. Also 2 Analogue Outputs 4-20 mA are provided for DCS input.

The gFlow 1500 has an internal logging system for interval logging, daily logging, snap shot logging, alarm triggered logging and monthly logging. An automatically updated audit trail monitors any change in accountable data with previous and new value with the time stamp of occurrence.

The interval logger complies with the German MessEV for hourly logging. Any invalid interval is marked on the display with an Asterix upfront the time stamp.

The I/O board has 3 option sockets where option 1 and option 3 are reserved for future expansion. The COMM's option socket 2 can accommodate a 4G/LTE modem board also supporting NB-IoT.

An internal white LED provides light (flash light) on the terminals during installation.

1.1 Front of the gFlow 1500

The front of the gFlow 1500 provides a small key pad, a graphical display and an optical interface for data reading and configuration.

The data is provided on pages where each page has its unique number and the data items on the page their own line number. The top structure is built by page 100 as main page and each scroll to the right increases the page number by 10 or each scroll to the left will decrease the page number. The scroll down step is just one per item.

On the top line of the display the scroll arrows indicate the possible scroll direction available at any point scrolling through the data. All page numbers starting with 1 are related to stream 1 and all page numbers starting with 3 are general for the instrument. The hardware of the gFlow 1500 allows future expansion to 2 streams where stream 2 pages are starting with 2. However, the Firmware does not support this yet. The general pages are starting with 3 and contain common data for up to 2 streams.

The keypad can also be used to select certain items and edit limited data items. To enable the editing function a level 3 password is required and the internal security switches should be in the OFF location.

1.2 Stream 1 pages

100 Main indexes M	110 Index	120 Current values	130 Fixed values	140 Setup	150 Conversion	160 Logger	170 Alarm
	111 Error index	121 Measurement	131 Preset values	141 Login level xx	151 Conversion type	161 Interval log	171 Latest alarm
	112 Interval index	122 Interval of meas.	132 Meter data	142 Data setup	152 Formula	162 Daily log	172 Alarm list
	113 Flow		133 Meter curve	143 Set Limits	153 Base conditions	163 Month log	173 Audit trail
	114 Alarm status			144 Set index	154 Gas type	164 Snapshot log	
	115 Ordinal counters			145 Set Decimals	155 Gas properties	165 Alm triggered log	
				146 Pulse in	156 P-sensor	166 Max logger	
					157 T-sensor		

Display Stream 1 pages

100 Main index Str.1 M ◀▶		
E1	= 3456789012.34	MJ
Vb1	= 12345678.1234	m^3
Vc1	= 00001234.5678	m^3
Vm1	= 00001234.5678	m^3
Ctrl1	= 00001234.5678	m^3

110 Index ▼◀▶
111 Error index
112 Interval index
113 Flow
114 Alarm status
115 Ordinal counters

120 Current values ▼◀▶
121 Measurement
122 Interval of meas.

130 Fixed values ▼◀▶
131 Preset values
132 Meter data
133 Meter curve

140 Setup ▼◀▶
141 Login level xx
142 Data setupm L3
143 Set Limits L3
144 Set Index L3
145 Set decimals
146 Pulse in

150 Conversion ▼◀▶
151 Conversion type
152 Formula
153 Base conditions
154 Gas type
155 Gas properties
156 P-sensor M
157 T-sensor M

160 Logger ▼◀▶
161 Interval log
162 Daily log
163 Month log
164 Snap shot log
155 Alarm trigger log
166 Max log

170 Alarm ▼◀▶
171 Latest alarm
172 Alarm list
173 Audit trail

1.3 General pages

300 General data	310 In/Out data	320 Serial Comm.	330 Options	340 Help	350 GasQs
301 Device data	311 Set HF1	321 MODBUS	331 Communication	341 Help file	351 Gas data
302 Clock set	312 Set HF2	322 Port1 485	332 Option 1	342 Support	352 Gas data limits
303 DST	313 Set Analog 1	323 Port 2 RS485	333 Option 2	343 Diagnostics	355 Calibration
304 DOC	314 Set Analog 2	324 GSM/4G		344 Test Analog O/P	354 Serial number
305 Installation data	315 Set Pulse O/P1			345 Change battery	
306 Units M	316 Set Pulse O/P2			346 MessEV Manual	
307 Air pressure	317 Set Pulse O/P3				
308 Digital inputs	318 Set Pulse O/P4				
309 p2 sensor	319 Set p2 sensor				
30a t2 sensor	31a Set t2 sensor				

Display General pages

300 General data ▼◀▶
301 Device data
302 Clock set
303 DST
304 DOC
305 Installation data
306 Units
307 Air pressure
308 Digital inputs
309 p2 Sensor
30a t2 Sensor

300 In/out data ▼◀▶
311 Set HF1
312 Set HF2
313 Set Analog 1
314 Set Analog 2
315 Set Pulse O/P 1
316 Set Pulse O/P 2
317 Set Pulse O/P 3
318 Set Pulse O/P 4
319 Set p2 Sensor
31a Set t2 Sensor

320 Serial Comm. ▼◀▶
321 MODBUS
322 Port 1 RS485
323 Port 2 RS485
324 GSM/4G

330 Options ▼◀▶
331 Communication
332 Option 1
333 Option 2

340 Help ▼◀▶
341 Help file
342 Support
343 Diagnostics
344 Test Analog O/P
345 Change battery
346 MessEV Manual

350 GasQs gas data ▼◀
351 GasQs gas data
352 GasQs data limits
353 GasQs calibration
354 Serial number

1.4 Display parameters

Page	Header	Line	Sub header	Parameter		Description
100	Main index Str.M			E1		Energy index 1
				Vb1		Converted volume 1
				Vc1		Corrected volume 1
				Vm1		Measured volume 1
				Ctrl1		Control volume 1
110	Index	111	Error Index	Ee1		Energy error index 1
				Vbe1		Converted volume error index 1
				Vce1		Corrected volume error index 1
				Vme1		Measured volume error index 1
				Vctrle1		Control volume error index 1
		112	Interval index M	E1 last month		Energy last month total 1
				Vb1 last month		Converted volume last month total 1
				Vm1 last month		Measured volume last month total 1
				E1 current month		Energy current month total 1
				Vb1 current month		Converted volume current month total 1
				Vm1 current month		Measured volume current month total 1
				E1 last day		Energy last day total 1
				Vb1 last day		Converted volume last day total 1
				Vm1 last day		Measured volume last day total 1
				E1 current day		Energy current day total 1
				Vb1 current day		Converted volume current day total 1
				Vm1 current day		Measured volume current day total 1
				E1 last hour		Energy last hour total 1
				Vb1 last hour		Converted volume last hour total 1
				Vm1 last hour		Measured volume last hour total 1
				E1 current hour		Energy current hour total 1
				Vb1 current hour		Converted volume current hour total 1
				Vm1 current hour		Measured volume current hour total 1
		113	Flow	QE1		Energy flow 1
				Qb1		Converted volume flow 1
				Qc1		Corrected volume flow 1
				Qm1		Measured volume flow 1
		114	Alarm status	01 Tamper input alarm	OFF	Alarm status ON or OFF
				02 EPROM error	OFF	Alarm status ON or OFF
				03 Pressure sensor error	OFF	Alarm status ON or OFF
				04 Temperature sensor error	OFF	Alarm status ON or OFF
				05 Pulse count error	OFF	Alarm status ON or OFF
				06 Pressure sensor EPROM error	OFF	Alarm status ON or OFF
				07 Door open alarm	OFF	Alarm status ON or OFF
				08 External power alarm	OFF	Alarm status ON or OFF
				09 Temperature low limit	OFF	Alarm status ON or OFF
				10 Temperature high limit	OFF	Alarm status ON or OFF
				11 Pressure low limit	OFF	Alarm status ON or OFF
				12 Pressure high limit	OFF	Alarm status ON or OFF
				13 Flow measured low limit	OFF	Alarm status ON or OFF
				14 Flow measured high limit	OFF	Alarm status ON or OFF
				15 Flow corrected low limit	OFF	Alarm status ON or OFF
				16 Flow corrected high limit	OFF	Alarm status ON or OFF
				17 Flow converted low limit	OFF	Alarm status ON or OFF
				18 Flow converted high limit	OFF	Alarm status ON or OFF
				19 Energy low limit	OFF	Alarm status ON or OFF
				20 Energy high limit	OFF	Alarm status ON or OFF
				21 Power low limit	OFF	Alarm status ON or OFF

				22 Power high limit	OFF	Alarm status ON or OFF
				23 Encoder 1 alarm	OFF	Alarm status ON or OFF
				24 Encoder 1 bad crc or no data err.	OFF	Alarm status ON or OFF
				25 Encoder 2 alarm	OFF	Alarm status ON or OFF
				26 Encoder 2 bad crc or no data err.	OFF	Alarm status ON or OFF
				27 Analogue output 1 range error	OFF	Alarm status ON or OFF
				28 Analogue output 2 range error	OFF	Alarm status ON or OFF
				29 Low battery error	OFF	Alarm status ON or OFF
				30 Conversion error	OFF	Alarm status ON or OFF
				31 Program checksum error	OFF	Alarm status ON or OFF
				32 Extern alarm	OFF	Alarm status ON or OFF
				33 HF 1 pulse alarm	OFF	Alarm status ON or OFF
				34 HF 2 pulse alarm	OFF	Alarm status ON or OFF
				35 Wobbe low alarm	OFF	Alarm status ON or OFF
				36 Wobbe high alarm	OFF	Alarm status ON or OFF
				37 Hs low limit	OFF	Alarm status ON or OFF
				38 Hs high limit	OFF	Alarm status ON or OFF
				39 A/D converter error	OFF	Alarm status ON or OFF
				40 Clock set	OFF	Alarm status ON or OFF
				41 Status input 1 on	OFF	Alarm status ON or OFF
				42 Status input 2 on	OFF	Alarm status ON or OFF
				43 Status input 3 on	OFF	Alarm status ON or OFF
				44 Status input 4 on	OFF	Alarm status ON or OFF
				45 Status input 5 on	OFF	Alarm status ON or OFF
				46 Status input 6 on	OFF	Alarm status ON or OFF
				47 Pulse output 1 over run error	OFF	Alarm status ON or OFF
				48 Pulse output 2 over run error	OFF	Alarm status ON or OFF
				49 Pulse output 3 over run error	OFF	Alarm status ON or OFF
				50 Pulse output 4 over run error	OFF	Alarm status ON or OFF
				51 Watchdog alarm	OFF	Alarm status ON or OFF
				52 Gas sensor alarm	OFF	Alarm status ON or OFF
				53 Communication alarm	OFF	Alarm status ON or OFF
				54 No SIM card alarm	OFF	Alarm status ON or OFF
				55 Connection lost alarm	OFF	Alarm status ON or OFF
				56 Option 1 alarm 1	OFF	Alarm status ON or OFF
				57 Option 2 alarm 1	OFF	Alarm status ON or OFF
				58 Option 3 alarm 1	OFF	Alarm status ON or OFF
				59 Option 4 alarm 1	OFF	Alarm status ON or OFF
		115	Ordinal counters	cnt normal		Ordinal counter normal operation
				cnt error		Ordinal counter error operation
120	Current values	121	Measurement M	p1		Gas pressure 1
				t1		Gas temperature 1
				C1		Conversion factor 1
				Zb1		Base compressibility 1
				Z1		Compressibility 1
				K1		Ratio of compressibility Z1/Zb1
				Hs1		Heat value 1 preset or measured
				d1		Relative density 1 or normal density
				CF1		Correction factor 1
				Wobbe index 1		Wobbe index 1 calculated
		121	Interval of meas.	30 sec.		Interval of measurement
130	Fixed values	131	Preset Values M	LF1 Pulse Value 1		LF1 input pulse value 1
				LF2 Pulse Value 1		LF2 input pulse value 1
		132	Meter data	Meter no		Gas meter serial number
				Meter index		Gas meter index on installation
				Meter b-string		Content of Encoder b-telegramn
		133	Meter curve M	Flow 1	Error 1	Gas meter calibration data at Qmax
				Flow 2	Error 2	Gas meter calibration data at Qmax – Qn

				Flow 3	Error 3	Gas meter calibration data at Qmax – Qn
				Flow 4	Error 4	Gas meter calibration data at Qmax – Qn
				Flow 5	Error 5	Gas meter calibration data at Qmax – Qn
				Flow 6	Error 6	Gas meter calibration data at Qmax – Qn
				Flow 7	Error 7	Gas meter calibration data at Qmax – Qn
				Flow 8	Error 8	Gas meter calibration data at Qmax – Qn
				Flow 9	Error 9	Gas meter calibration data at Qmax – Qn
				Flow 10	Error 10	Gas meter calibration data at Qmax – Qn
140	Setup	141	Login level xx M	Enter Password		Enter password through keypad
*	Behind PW-L3	142	Data setup M	Set Pulse Value LF1		Set pulse value for LF1
*	Behind PW-L3			Set Pulse Value LF2		Set pulse value for LF2
*	Behind PW-L3	143	Set limits M	Set p1 hi		Set p1 high limit
*	Behind PW-L3			Set p1 lo		Set p1 low limit
*	Behind PW-L3			Set p1 default		Set p1 default value
*	Behind PW-L3			Set t1 hi		Set t1 high limit
*	Behind PW-L3			Set t1 lo		Set t1 low limit
*	Behind PW-L3			Set t1 default		Set t1 default value
*	Behind PW-L3	144	Set index M	Set E1		Set Energy 1 index value
*	Behind PW-L3			Set Vb1		Set Converted volume 1 index value
*	Behind PW-L3			Set Vc1		Set Corrected volume 1 index value
*	Behind PW-L3			Set Vm1		Set Measured volume 1 index value
*	Behind PW-L3	145	Set decimals M	Set E1 decimals		Set Energy 1 index no. of decimals
*	Behind PW-L3			Set Vb1 decimals		Set Converted volume 1 index no. of dec.
*	Behind PW-L3			Set Vc1 decimals		Set Corrected volume 1 index no. of dec.
*	Behind PW-L3			Set Vm1 decimals		Set Measured volume 1 index no. of dec.
*	Behind PW-L3	146	Pulse in M	Set Vol. to LF, HF, Enc		Set Volume to LF1 or HF1/Encoder1 input
*	Behind PW-L3			Set Flow to LF, HF, Enc		Set Flow to LF1 or HF1/Encoder1 input
*	Behind PW-L3			Set Ctrl. To LF2, HF2, Enc2		Set Control to LF2 or HF2/Encoder2 input
150	Conversion	151	Conversion Type M	E, PTZ, PT or TZ		Selected conversion type
		152	Formula M	Z-equation method		Compressibility equation or method
				p table range min		Pressure min range for Z-table
				p table range max		Pressure max range for Z-table
				t table range min		Temperature min range for Z-table
				t table range max		Temperature max range for Z-table
		153	Base conditions M	p base		Base pressure
				t base		Base temperature
				Hs base temp		Heat value base temperature 0; 15; 25°C
		154	Gas Type	e.g. T1		Entry field for gas type
		155	Gas properties M	Nitrogen		Molar % Nitrogen
				CO2		Molar % Carbon dioxide
				Hydr. Sul.		Molar % Hydrogen sulfide
				Water		Molar % Water
				Helium		Molar % Helium
				Methane		Molar % Methane
				Ethane		Molar % Ethane
				Propane		Molar % Propane
				n-Butane		Molar % n-Butane
				i-Butane		Molar % i-Butane
				n-Pentane		Molar % n-Pentane
				i-Pentane		Molar % i-Pentane
				n-Hexane		Molar % n-Hexane
				n-Heptane		Molar % n-Heptane
				n-Octane		Molar % n-Octane
				n-Nonane		Molar % n-Nonane
				n-Decane		Molar % n-Decane
				Oxygen		Molar % Oxygen
				Carb. Mo		Molar % Carbon monoxide
				Hydrogen		Molar % Hydrogen

				Argon	Molar % Argon
				C6+ value	Molar % Hexane plus
				C6+ On or OFF	Use Hexane plus ON or OFF
				Sum	Sum of all components (100% is required)
		156	P-sensor M	Serial number	Pressure sensor serial number
				Pressure range min	Pressure sensor range min
				Pressure range max	Pressure sensor range max
		157	t-sensor M	Serial number	Temperature sensor serial number
				Temperature range min	Temperature sensor range min
				Temperature range max	Temperature sensor range max
160	Logger	161	Interval log M	Selected interval log data	Display page for interval log data
		162	Daily log	Selected daily log data	Display page for daily log data
		163	Month log M	Selected month log data	Display page for monthly log data
		164	Snap shot log	Selected snap shot log data	Display page for snap shot log data
		165	Alarm trigger log	Selected alarm trigger log data	Display page for alarm triggered log data
		166	Max logger	Max Increm. Time M	Max logger time last month
				Max Increment M	Max logger Vb last month
				Max Increm. Dec M	Max logger Vb decimals last month
				Max Increm. Time M-1	Max logger time 1 month before last
				Max Increment M-1	Max logger Vb 1 month before last
				Max Increm. Dec M-1	Max logger Vb dec. 1 month before last
				Max Increm. Time M-2	Max logger time 2 months before last
				Max Increment M-2	Max logger Vb 2 months before last
				Max Increm. Dec M-2	Max logger Vb dec. 2 months before last
170	Alarm	171	Latest alarm	Last alarm code with time/date	Latest alarm code with time/date /status
		172	Alarm list	List of alarm history	List of alarm history up to 100 entries
		173	Audit trail M	List of logged configurations	List of logged configurations time/date/ID
300	General data	301	Device data	Clock	Internal real time clock time
				Serial number	gFlow serial number
				Type	gFlow type e.g. 1500
				Version	Firmware version with release date
				Battery life time	Remaining battery life time
				Stream select 1 or 2	Stream 2 enable function (future opt)
				Internal temperature	Internal device temperature
		302	Clock set	YYMMDDHHmmss	Set internal real time clock
		303	DST	ON or OFF	Use of Daylight saving ON or OFF
		304	DOC data M	Program checksum	Program checksum
				Metrological checksum	Metrological checksum
				Configuration checksum	Configuration checksum
				Data log checksum Str1	Data log checksum Str1
				Data log checksum Str2	Data log checksum Str2 (future opt)
				Actual security level	Actual security level
					Actual security level S/W : 0
					Actual security level H/W : 3
		305	Installation data	Installation date	Entry field for installation data
				Installation number	Entry field for installation number
				Customer	Entry field for customer name
				Project number	Entry field for project number
				Date of re-calibration	Entry field for re-calibration data
		306	Units M	Volume unit	Unit for Volume
				Pressure unit	Unit for Pressure
				Temperature unit	Unit for Temperature
				Heat value unit	Unit for Heat value
				Energy unit	Unit for Energy
				Density	Unit for Density
		307	Air pressure	Air pressure	Air pressure input (use for gauge sensors)
		308	Digital inputs	Digital input 1 ON/OFF	Digital input 1 status On or OFF

				Digital input 2 ON/OFF	Digital input 2 status On or OFF
				Digital input 3 ON/OFF	Digital input 3 status On or OFF
				Digital input 4 ON/OFF	Digital input 4 status On or OFF
				Digital input 5 ON/OFF	Digital input 5 status On or OFF
				Digital input 6 ON/OFF	Digital input 6 status On or OFF
		309	p2 sensor	p2	Pressure value sensor 2
				p2 hi	Pressure sensor 2 high limit
				p2 lo	Pressure sensor 2 low limit
		30a	t2 sensor	t2	Temperature value sensor 2
				t2 hi	Temperature sensor 2 high limit
				t2 lo	Temperature sensor 2 low limit
310	In/out data	311	Set HF1 M	Set HF1 to Encoder	Set HF1 to Encoder 1 input
*	Behind PW-L3			Set pulse value	Set pulse value for HF1 sensor
*	Behind PW-L3	312	Set HF2	Set HF2 to Encoder	Set HF2 to Encoder 2 input
*	Behind PW-L3			Set pulse value	Set pulse value for HF2 sensor
*	Behind PW-L1	313	Set Analog 1	Select parameter	Select parameter for Analogue O/P1
*	Behind PW-L1			Set 4mA to value	Set value for 4mA
*	Behind PW-L1			Set 20 mA value	Set value for 20mA
*	Behind PW-L1			Set update interval	Set update interval
*	Behind PW-L1			Set update after PF	Set update after power fail
*	Behind PW-L1	314	Set Analog 2	Select parameter	Select parameter for Analogue O/P2
*	Behind PW-L1			Set 4mA to value	Set value for 4mA
*	Behind PW-L1			Set 20 mA value	Set value for 20mA
*	Behind PW-L1			Set update interval	Set update interval
*	Behind PW-L1			Set update after PF	Set update after power fail
*	Behind PW-L2	315	Set Pulse O/P 1	Set to stream 1 or 2	Set pulse output 1 to stream 1 or 2
*	Behind PW-L2			Select parameter	Select output parameter
*	Behind PW-L2			Set pulse value	Set pulse value
*	Behind PW-L2			Set pulse length	Set pulse length
*	Behind PW-L2	316	Set Pulse O/P 2	Set to stream 1 or 2	Set pulse output 2 to stream 1 or 2
*	Behind PW-L2			Select parameter	Select output parameter
*	Behind PW-L2			Set pulse value	Set pulse value
*	Behind PW-L2			Set pulse length	Set pulse length
*	Behind PW-L2	317	Set Pulse O/P 3	Set to stream 1 or 2	Set pulse output 3 to stream 1 or 2
*	Behind PW-L2			Select parameter	Select output parameter
*	Behind PW-L2			Set pulse value	Set pulse value
*	Behind PW-L2			Set pulse length	Set pulse length
*	Behind PW-L2	318	Set Pulse O/P 4	Set to stream 1 or 2	Set pulse output 4 to stream 1 or 2
*	Behind PW-L2			Select parameter	Select output parameter
*	Behind PW-L2			Set pulse value	Set pulse value
*	Behind PW-L2			Set pulse length	Set pulse length
		319	Set p2 sensor	Set pressure sensor ON	Set pressure sensor 2 ON use for str.1
				Set pressure sensor OFF	Set pressure sensor 2 OFF
		31a	Set t2 sensor	Set Temp. sensor ON	Set temperature sensor 2 ON use for str.1
				Set Temp. sensor OFF	Set temperature sensor 2 OFF
320	Serial Comm.	321	MODBUS	Master/Slave	Select gFlow as master or slave
				Slave address	Select slave address
		322	Port1 485	Type: RS485	Port 1 type is RS485
				BAUD Rate:	Set BAUD rate
				Bits:	Set Bits
				Stop bit:	Set Stop bit
				Parity:	Set Parity
		323	Port2 RS485	BAUD Rate:	Set BAUD rate (comm. to GasQs)
				Bits:	Set bits
				Stop bit:	Set Stop bit
				Parity:	Set Parity
		324	GSM/4G	N/A	Settings for internal GSM/4G modem
330	Options	331	Communication	Type	Communication type

				Version	Version number
				Serial number	Serial number
				Test mode	Select test mode 4G/LTE
		332	Option 1	Type	Option 1 type
				Version	Version number
				Serial number	Serial number
		333	Option 2	Type	Option 2 type
				Version	Version number
				Serial number	Serial number
340	Help	341	Help file	User Manual	Link to User Manual QR-code
		342	Support	Connection help	Link to Connection help QR-code
		343	Diagnostics	Enable HF1/Encoder led	Enable HF1/Encoder led
				Enable HF2/Encoder led	Enable HF2/Encoder led
				Read Encoder 1 a teleg	Read Encoder 1 a teleg
				Read Encoder 1 b teleg	Read Encoder 1 b teleg
				Read Encoder 2 a teleg	Read Encoder 2 a teleg
				Read Encoder 2 b teleg	Read Encoder 2 b teleg
**	Behind PW-L1	344	Test Analog O/P	Set Anal. out1 to 4mA	Set Analogue output 1 to 4mA
**	Behind PW-L1			Set Anal. out1 to 12mA	Set Analogue output 1 to 12mA
**	Behind PW-L1			Set Anal. out1 to 20mA	Set Analogue output 1 to 20mA
**	Behind PW-L1			Set Anal. out2 to 4mA	Set Analogue output 2 to 4mA
**	Behind PW-L1			Set Anal. out2 to 12mA	Set Analogue output 2 to 12mA
**	Behind PW-L1			Set Anal. out2 to 20mA	Set Analogue output 2 to 20mA
**	Behind PW-L1	345	Change Battery	Change Battery	One battery change
					Two battery change
		346	MessEV Manual	MessEV Manual	Link to MessEV Manual QR-code
350	GasQs gas data	351	GasQs gas data	Hs	GasQs Heat value
				d	GasQs relative density
				Z	GasQs Z-factor
				Zb	GasQs Zb-factor
				W	GasQs Wobbe index
				Hs default	Heat value default value
				d Default	Relative density default value
				Z Default	Z-factor default value
				Zb Default	Zb-factor default value
				Hs fixed	Heat value fixed value during calibration
				d fixed	Relative density fixed value during calibr.
				Z fixed	Z-factor fixed value during calibration
				Zb fixed	Zb-factor fixed value during calibration
		352	GasQs data limits	Hs hi	GasQs heat value high limit
				Hs lo	GasQs heat value low limit
				W hi	GasQs Wobbe index high limit
				W lo	GasQs Wobbe index low limit
		353	GasQs calibration	Disabled	GasQs calibration mode disabled
				Enabled	GasQs calibration mode enabled
		354	Serial number	Serial number gasQs	Serial number of connected gasQs

* This item can be edited on the gFlow using the Kpad in level 3 or 2

** This item can be edited on the gFlow using the Kpad in level 1

M Identifies Metrological data

In normal operation the display will be in sleep mode, and will be activated only when one of the keys is pressed. When activated the display indicates the following parameters in the status bar above the main indexes:

- Battery status indicator
- External supply indicator
- Tamper switch indicator (on/off)
- Hardware configuration lock (on/off)
- Alarm indicator

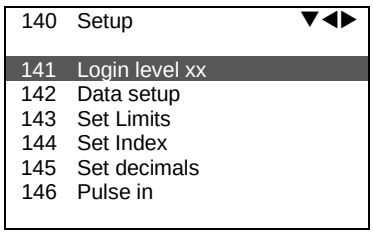
The next table defines the important parameters, and if applicable their notation, unit and pictogram:

Description	Notation	Units	pictogram
Volume converted	xxxx xxxx, xxxx	m^3 or cu ft	Vb
Volume measured	xxxx xxxx, xxxx	m^3 or cu ft	Vm
Volume corrected	xxxx xxxx, xxxx	m^3 or cu ft	Vc
Temperature	xx,xx	°C or °F	T
Pressure	xx,xxxx	bar; kgf/cm^2; PSI; kPa	p
Energy	xxxx xxxx, xxxx	MJ; kWh; BTU	E
Conversion factor	xx,xxxx	n.a.	C
Flow	xxxx,xxxx	m^3/h or cu ft/h	Q
Date	dd:mm:yyyy	n.a.	n.a.
Time	hh:mm:ss	n.a.	n.a.
Battery capacity	n.a.	%	
External power supply	n.a.	n.a.	
Alarm indicator	n.a.	n.a.	
Tamper switch indicator	n.a.	n.a.	
Hardware config lock on/off	n.a.	n.a.	
4G/LTE	n.a.	n.a.	
Optical Interface	n.a.	n.a.	

1.5 Data modifications using the Keypad

The gFlow 1500 offers the possibility to modify certain data items without the use of the configuration program. However, it is still required to enter the level 3 or level 1 password to execute any change on the gFlow 1500. The changes made are recorded in the Audit Trail with the ID: KPAD together with the date and the old and new value. The password is numerical and has at least 4 digits and max. 8 digits. Instead of using the level 3 password also the level 0 password can be entered. This is used for accessing the extended diagnostics on page 344 (Test Analog O/P) and 345 (Change battery). The password is always numerical and has at least 4 characters and a maximum of 8 characters.

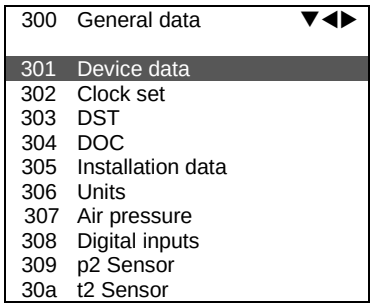
First of all the level 3 password needs to be entered at page 141



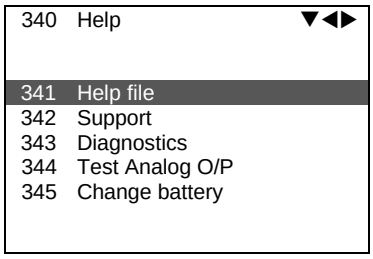
Procedure of entering the level 1 or 3 password:

1. Scroll to page 141.
2. Press Enter.
3. Press Enter.
4. Select the first number of the password: MSD first by using the up/down scroll buttons.
5. Select the second number of the password.
6. Repeat this until at least 4 digits are entered or continue to max 8 digits. After 4 digits Enter is shown.
7. After the complete password is entered just press Enter again.
8. The keylock in the status bar is now open 🔓.

Stream 1 pages 142, 143, 144, 145 and 146 are now accessible for modification.



General pages 311, 312, 313, 314, 315, 316, 317, 318 are now accessible for modification too.



General pages 343, 344 and 345 are now accessible to execute an operation command*.

* These pages are available using password level 1 or password level 3.

Note: The entered level using the keypad is valid for 8 minutes only. After this time the gFlow 1500 is automatically going back into level 0. The temporarily opened pages are closed again. To re-access these pages the password has to be entered again.

Return to General

B. Safety

The gFlow 1500 is ATEX approved for use in the hazard zone and complies with: ATEX 2014/34/EU.

1.0 Ex installation (ATEX SCHEDULED)

Attention:

Warning: Potential electrostatic charging hazard. The installation and use of the gFlow 1500 must be such that the risk of ignition from electrostatic discharge is minimized.

To avoid hazard caused by electrostatic discharge, no installation, maintenance and use of the push buttons at the gFlow front is allowed without ventilation of the room very well so no explosive gas atmospheres are present.

Only clean the gFlow 1500 with a damp cloth.

Following recommendations could be helpful:

- ***Control of environmental humidity to minimize the generation of static electricity***
- ***Protection from direct airflow***
- ***Gas detection monitoring***

For installations in which both the Ci and Li of the connected apparatus exceeds 1% of the Co and Lo parameters (excluding the cable), then 50% of Co and Lo parameters are applicable and shall not be exceeded. The reduced capacitance shall not be greater than 1 µF for Groups IIA and/or IIB.

The pressure and temperature sensors must be installed such that the resistance between the metal sensor housing and earth is < 1GOhm.

Otherwise follow normal procedure for handling risk of electrostatic discharge.

Attention to the demands of tree earth connection for zone 0 equipment. See section 4.3.3 of this manual.

1.1 General considerations

Only technicians who are familiar with the technical terms, warnings, and instructions in the manual and who are able to follow these should connect the device.
Should there be any doubt as to the correct handling of the device, please contact your local distributor or, alternatively,

gAvilar b.v. – Kamerlingh Onnesweg 63 - 3316 GK Dordrecht – The Netherlands
Tel. +31(0)85-489759 - E-mail: info@gavilar.nl

Mounting and connection of the device should comply with national legislation for mounting of electric materials, i.a. wire cross-section, protective fuse, and location. Descriptions of input / output and supply connections will follow in this paper.

1.2 Installation, inspection and maintenance in hazardous environment

For Installation, inspection and maintenance it's recommended to follow the standards:

- EN 60079-14 Electrical apparatus for explosive gas atmospheres
  Part 14. Electrical installations in hazardous area (other than mines).
- EN 60079-17 Electrical apparatus for explosive gas atmospheres
  Part 17. Inspection and maintenance of electrical installations in hazardous area (other than mines).

When mounting an option board and on battery replacements please also observe the common guidelines on "ESD correct handling".

It is also important that the gFlow 1500 is placed in such a way that no direct or indirect heating/cooling is exposed to the device outside the specified ambient temperature range.

Return to General

C. Technical data

Housing	
Dimensions	W195 x H152 x D112 mm
Material	aluminium, with hinged door (left)
Colour	White, powder coated
Markings	undeletable labels, UV-proof
Weight	2.1 kg (including battery)
Cable glands	2 x M16 positioned at the bottom 5 x M12 positioned at the bottom
Pressure relieve valve	Positioned at the side
Metrological access	mechanical and adhesive seals
Door alarm	when opened
Environmental conditions	-30 °C - +70 °C (may be limited due to certifications)
Protection class	IP65 conform IEC 60529
Medium Conditions	-30 °C - +70 °C 0,8 – 30 bar (max. 80 bar)
Mechanical class	M2 according to EN12405-1/A1
Electrical class	E2 according to EN12405-1/A1
Mount	meter- wall- or skid-mount
Compliance	
MID	2014/32/EU
ATEX	2014/34/EU
EN60529-2.1	IP66
Power supply	
Battery	D cell, nominal 3.6 V 19 Ah (space for 2 batteries)
Battery type	Tadiran SL-2780, Lithium Thionyl Chloride
Battery life	minimal 5 years in standard conditions using 2 batteries
Battery condition	Indicated on display
Battery measurement	Coulomb counter for accurate life time calculation
Power supply	5Vdc included
User interface	
Graphical display	LCD display with a white backlight 320 x 240 pixels, non glare
Display “on time”	Selectable up to 240 seconds or permanent on or permanent off
Keypad	6 keys, 4 cursors, enter and esc for display control and entering values and select settings
Pressure sensor	
Type	gAvilar P.N. 94077, 94076, 94075, 94074 or 94073
Version	flying lead version
Pressure ranges	ranges: 0,8 to 2 bar a; 0 to 5 bar abs; 0 to 10 bar abs; 0 to 20 bar; 0 to 30 bar, optional 13 to 80 bar, min. turn down ratio 5 : 1
Dimensions	∅ 27 x 50 mm
Accuracy	± 0,2% R, at ambient temperature -25°C - +55°C, long term drift <0,2%/y
Connection	G ¼” Female (standard)
Standard	EN 12405-1 +A1
Cable (flying lead version)	∅ 6mm, length 3m (fixed)
Temperature sensor	
Type	PT-1000
Version	external with cable

Temperature range	range: -30 °C to 70°C
Dimensions	∅ 5mm x 50 mm
Accuracy	with correction (correction data on label) ±0.1 K (-30°C..+60°C)
Standard	EN 12405-1/A1
Cable	∅ 5 mm, length 3m (fixed) of silicon cable
Inputs	
Connection	Spring clamp terminals
Pulse inputs	4 x LF 2x HF (can be used for NAMUR Encoder)
Digital inputs	6
Tamper input	1
Alarm input	2
Outputs	
Connection	Spring clamp terminals
Pulse outputs	4 optical isolated
Alarm output	1 optical isolated
Analogue output	2 (4 – 20 mA) passive
Option Slots	
Number of slots	3 (2 spares)
Function	4G / LTE communication
Memory	
Size	4 Mbit (max. 8Mbit)
Type	EEPROM
Clock	
RTC	Very high accuracy, max drift 3.5 ppm/year
Processor	
Type	MSP432P4111 32-bit ARM
Conversion methods	
Versions	PTZ, PT, PZ and T
Calculation algorithms	inside the converter with real z computation
Conversion algorithms	Z/Zb (fixed value) AGA NX-19 MOD AGA NX-19 BRKORR-3H AGA 8 DC-92 AGA 8 GCM 1 (Hs, d, CO2) AGA 8 GCM 2 (d, CO2, N2) SGERG A (Hs, d, CO2, H2) SGERG B (Hs, d, N2, H2) SGERG C (d, N2, CO2, H2) SGERG D (Hs, N2, CO2, H2) SGERG mod H2 CO2 (from table, included) H2 (from table, included) Table calculation for special gases (matrix 10 pressure and 20 temperature points.
Features	PZ conversion (fixed pressure) PT conversion (fixed compressibility) PTZ conversion (active compressibility)

	Energy conversion (fixed or with live gas data input from gasQs or gas chromatograph) Encoder input conversion with pulse back up system Pulse input conversion with Encoder comparing Online gas property update for compressibility calculation Heat value and relative density calculation in acc. With ISO 6976
Data logging and measurement interval	
Interval 1	from 1 min to 4 hours up to 120 days on hourly interval
Daily	up to 365 days
Monthly	up to 24 months
Snapshot	manual activated log
Configuration log	Every configuration change is logged
Alarm log	Logging of all System alerts, limit overruns and input alarms
Audit trail	up to 800 events storing the old values, new values access port and user's id
Standard	Complying with the German "Höchstbelastungsanzeige" and "Lastprofilspeicher MESSEV" PTB-A 50.7
Measurement interval	2, 5, 10, 15, 20, 25, 30s, to comply with EN12405 max 30s
Configuration	
gFlow 1500 config	Allows to set the configuration of all operating parameters using 3 password levels with different authority. The optical port on the front and the internal serial port can be used to interface with the config program. conversion configuration, display mode and hardware settings. The program can handle more users with individual passwords. Only numerical passwords are supported.
Firmware updates	memory can be flashed using a JTAG interface
PC configuration software	
Multi language	English; German; Dutch; Portuguese; Turkish
Database type	MS-access
Communication	
Communication port 1	Optical communication port, hardware according IEC62056-21
Communication port 2	485 MODBUS RTU; IEC62056-21; max speed 38400 BAUD
Communication port 3	RS-485 dedicated for gasQs sensor 19200 BAUD
4G/LTE	Modem internal (optional)
Multiple units	
Pressure	bar; kgf/cm^2; PSI; kPa
Temperature	°C, °F
Heat value	MJ/m^3; kWh/m^3, BTU/ft^3
Energy	MJ; kWh; BTU
Volume	m^3 and ft^3
Density	d (relative); ρn in kg/m3; ρn in lbm/ft3
Data security	
Mechanical	data security switches
Software	password protected data with 3 levels of access

Return to General

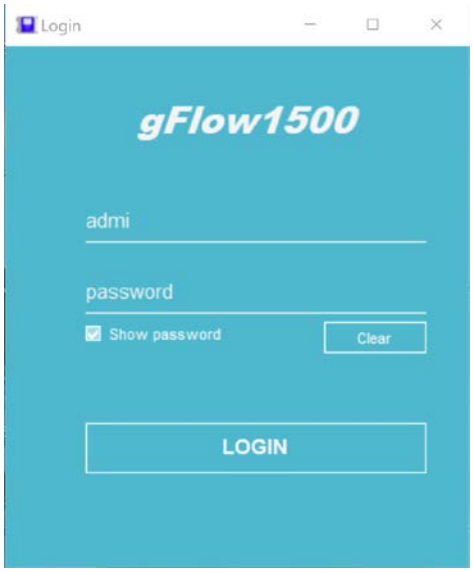
D. Setup data

1.0 Getting started:

The data used in the gFlow can be read and modified using the config program. The config program needs to be installed on a Windows® PC. The program uses Microsoft Framework and this will either be installed or may be updated on your computer.

After the installation the default user is admi with password: password. The password can be made visible by clicking Show password. This allows to access the program and to read all the data from the gFlow 1500.

After installation and by clicking on the gFlow icon on your desktop the following dialog appears:



By using your own name and password you can access the program to the required level.
Access to the main page of the program can be achieved by using admi and password.

Once on the main page of the config program the user can create a connection to the gFlow by entering the access password. The access password may differ from device to device and may be altered every year by gAvilar. Ask your sales contact for support on this.
The administrator in a company is responsible to providing the passwords in conjunction with the required user level.

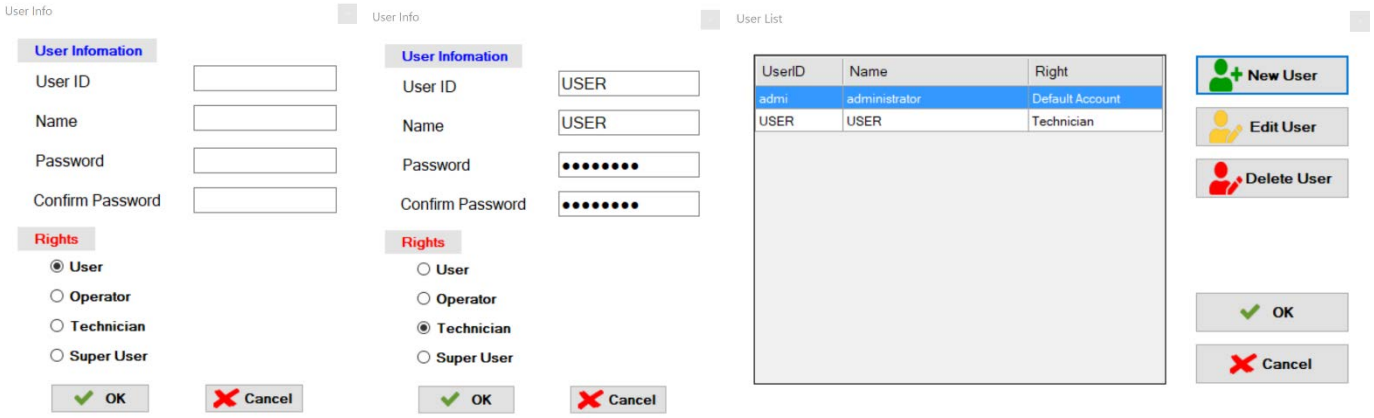
Warning: unauthorized persons are not permitted to modify any metrological data!

1.1 Creating a new user

A new user can only be assigned by the administrator of super user.

Click on the USER button to open the user dialog:

A new user is created by clicking: 



The User ID can contain up to 4 characters and the password up to 8 characters.
After confirming by clicking on OK the user is appended to the user list. In the example the user is a technician.

Modifications to a user are done by clicking on: 

Deleting a user can be done by clicking on: 

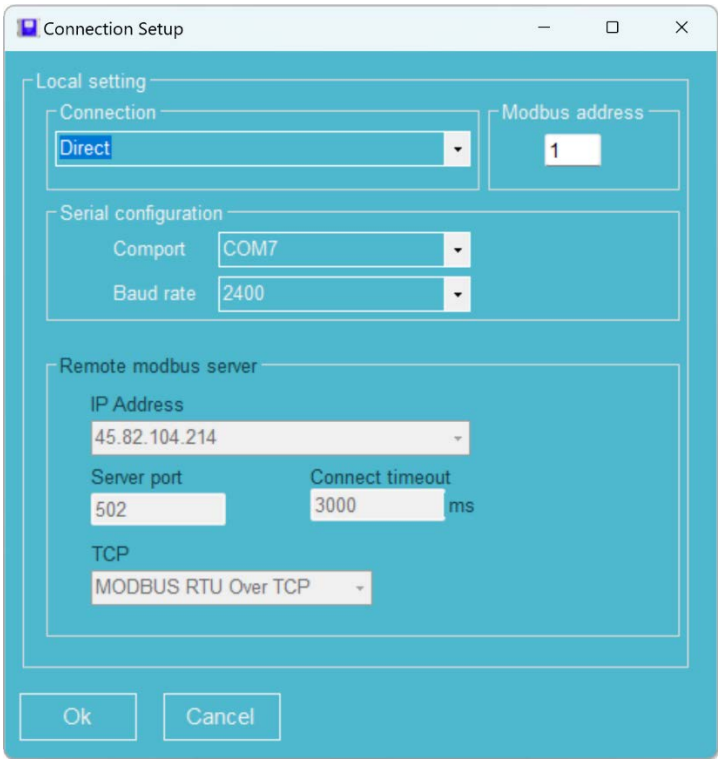
Editing and deleting become effective after clicking:

Rights	Highest Access level	Password level	Read/Write
User	0	1	Read only
Operator	1	1	Read/Write limited
Technician	2	2	Read/Write limited
Super User	3	3	Read/Write all

1.2 Communication setup

The next step is to set the com port at setup:

Select the Setup button to access:
Communication Setup:



The default Baud rate is: 2400

The default Modbus address is: 1

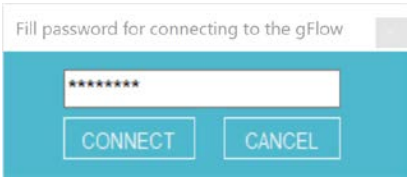
The connection can be Direct or TCP/IP.

TCP communication is either MODBUS TCP or MODBUS RTU over TCP.

The port number is assigned after installing the driver for the optical interface. There are 2 different types of drivers known which are used with the optical sensors supply by gAvilar.
The VCP driver of Silicon labs is CP210x_VCP for Windows 10 or 11 in x86 or x64 and the driver of FTDI is CMD V2.12.28 WHQL certified.
After installation the VCP will be assigned automatically. Once the port is known (please check in the device manager at serial port assignment) this port is set once. The program remembers the port number for future use. Using another USB port on the PC may change the VCP port.

Now the gFlow 1500 is assessable by the user either for reading or configuration. By clicking on CONNECT FOR CONFIGURATION or CONNECT FOR READ a new dialog is popped up.
The required level password has to het entered and thereafter a connection can be made by clicking on CONNECT. The factory default password is for level 3: 22222222.

The gFlow can also be accessed by a network using a defined IP address and port number. The configuration program supports MODBUS TCP and MODBUS RTU over TCP.



By using “Connect for Read” only data can be read and the device stays in level 0. By using “Connect for Configuration” the data is read and by using the password for accessing level 3 all data can be modified.

Remark: Only authorized persons can make modifications to metrological data in level 3. The password for level 3 will only be made available to proven authorized persons. In level 2 and level 1 only limited data can be modified where level 1 only allows to change non-metrological data.

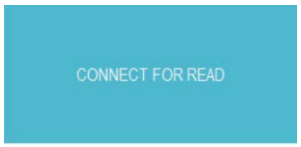
At File a stored file can be searched for and loaded to be used for writing into the gFlow or for editing to create a new setup.

At Password the password can be modified.

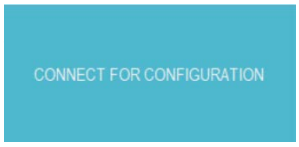
At Help the help file will be opened. The help file shows all relevant information as given in the user manual.

At Logout the program will be closed and returns to the login screen.

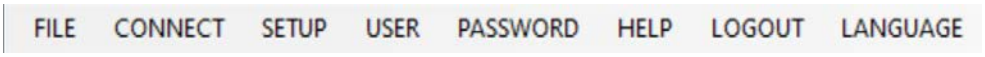
At User a new user can be added to the program. The user is created by the administrator which will also assign the user level. Each time the program is accessed the user password needs to be entered. This is to avoid illegal access by any other user.



Connect for read creates a connection to the gFlow 1500 and allows the user to read all data. No modifications to any setup data can be made.



Connect for configuration creates a connection to the gFlow 1500 and allows user to read all data and to modify data depending on the connect password used. In level 3 all data can be modified and in level 2 and 1 many restrictions are made to modify data.

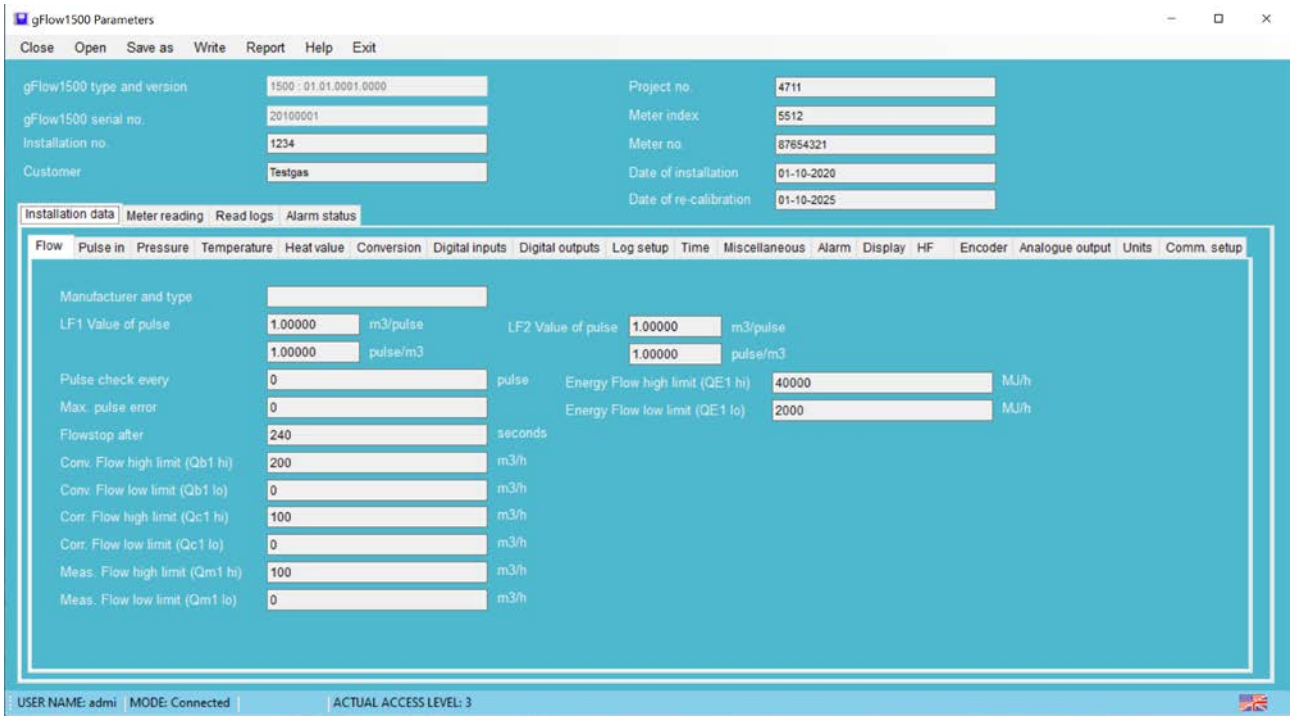


The functions at the top of the main screen are:
FILE which is identical to the box named FILE
CONNECT allows to CONNECT FOR READ or to CONNECT FOR CONFIGURATION
SETUP is the same as the SETUP box
USER is the same as the USER box
PASSWORD is the same as the PASSWORD box
HELP is the same as the HELP box
LOGOUT is the same as the LOGOUT box
LANGUAGE offers a selection of languages which can be chosen for the configuration program
Current languages are: English, German, Dutch, Turkish and Portuguese. Each language is shown with its national flag.

At the bottom of the main page the current user is shown:
In this example administrator.
The current date is shown in the language of the Windows Version.

Also at the bottom of the main page the user name is shown, the current mode of the program and the password level.

After making a connection for configuration the screen below appears:



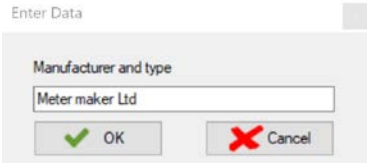
The default passwords from the factory are:
Level 1: 00000000
Level 2: 11111111
Level 3: 22222222

For deliveries complying with MID the passwords are modified with secret passwords.
Only authorized persons have access to the secret passwords. Consult your supplier for more information.

2.0 Setup pages

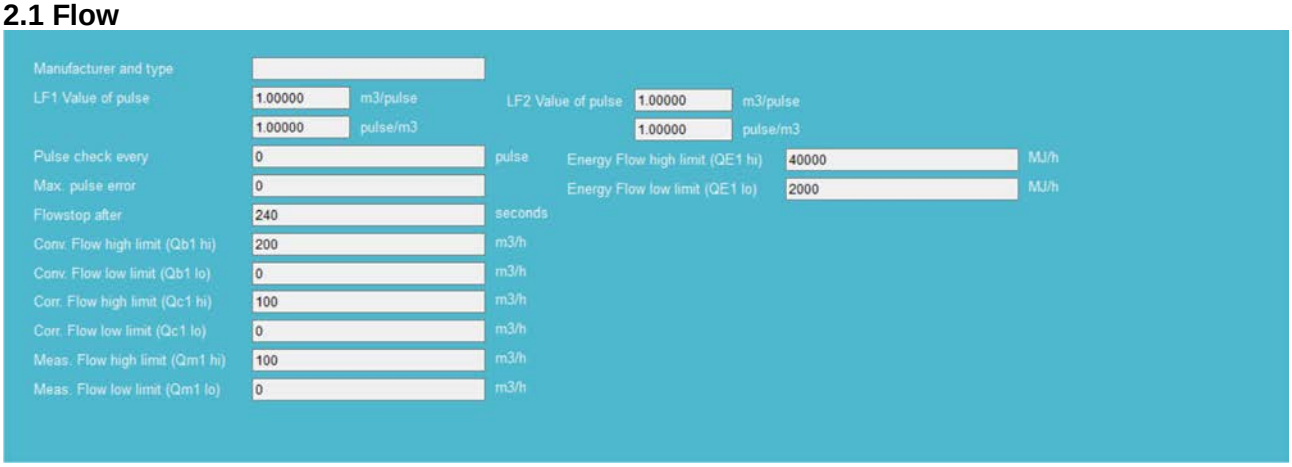
Modifications of parameters can be performed by clicking on a white box on which a new entry dialog is opened automatically. See example below:

Manufacturer and type



Just enter the required text or number and click on OK. After making changes the data needs to be written into the gFlow 1500 memory.

2.1 Flow



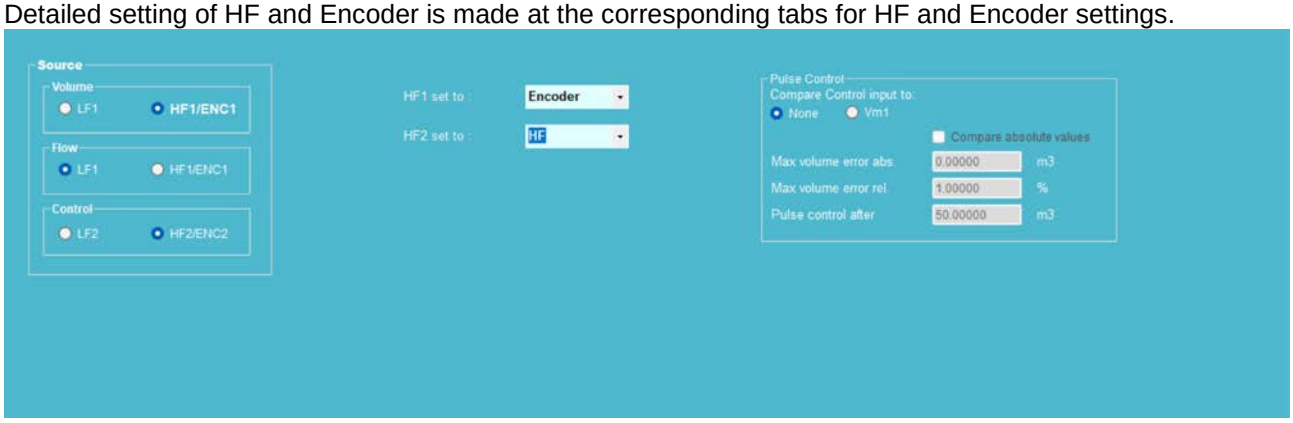
Manufacturer and type is a text field for the connected gas meter. Up to 20 characters can be entered.
LF1 Value of pulse defines the primary LF pulse value of the connected gas meter in m^3/pulse or pulse/m^3.
LF2 Value of pulse defines the secondary LF pulse value of the connected gas meter m^3/pulse or pulse/m^3.
Pulse check every defines the number of pulse used between LF1 and LF2 to detect a deviation in the measured number of pulses.
Max. pulse error defines the max number of pulses difference between LF1 and LF2 before an alarm is flagged.
Flow stop after defines the time after the last LF pulse to force the flow to go to zero.
Conv. Flow high limit (Qb1 hi) defines the high flow alarm for converted flow.
Conv. Flow low limit (Qb1 lo) defines the low flow alarm limit for converted flow.
Corr. Flow high limit (QC1 hi) defines the high flow alarm limit for corrected flow.
Corr. Flow low limit (Qc1 lo) defines the low flow alarm limit for corrected flow.
Meas. Flow high limit (Qm1 hi) defines the high flow alarm limit for measured flow.
Meas. Flow low limit (Qm1 lo) defines the low flow alarm limit for measured flow.

Energy Flow high limit (QE1 hi) defines the high flow alarm limit for Energy flow.
Energy Flow low limit (QE1 lo) defines the low flow alarm limit for Energy flow.

2.2 Pulse in

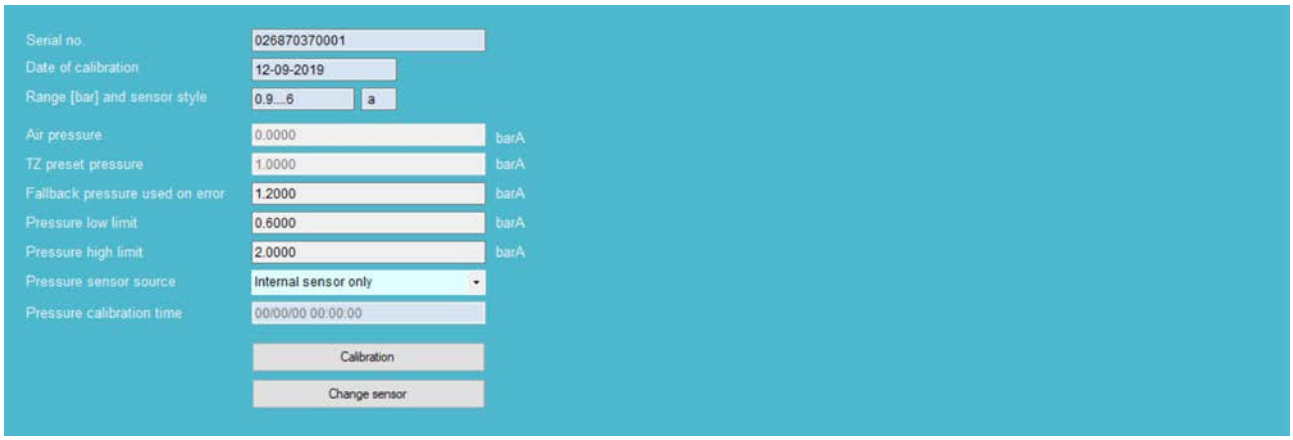
At “Pulse in” the settings for volume input, Flow input and Control input are set. As soon as Volume or Flow is set to HF/ENC1 the box “HF1 set to:” is active and a selection can be made between HF and Encoder input.
Control input is connected to LF2 or HF2/ENC2. Also, the box “HF2 set to:” is becoming active as soon as the control input is set to HF2/ENC2.

Detailed setting of HF and Encoder is made at the corresponding tabs for HF and Encoder settings.



Volume input Vm1 can be compared with Volume Control The compare method can either compare to an absolute difference or a relative difference over a predetermined volume. Also an absolute error can be added to the relative error when a value is applied. When the absolute error is set to “0” only relative is active.

2.3 Pressure



Serial number, date of calibration, the sensor range and style are read from the internal E²PROM. The style can be “a” for absolute or “g” for gauge. For MID approved devices only absolute is used.
Air pressure value can only be entered when a relative or gauge pressure sensor is connected.

TZ preset pressure is the preset pressure when mode TZ has been selected.
Fallback pressure used on error is the value used as constant value during an active alarm. The operation of the fallback value is set in the alarm table.
Pressure low limit is the low value of pressure before a low pressure alarm is flagged.
Pressure high limit is the high value of pressure before a high pressure alarm is flagged.
Pressure sensor source can be Internal sensor only or Fallback only. Under normal conditions always the internal sensor is used. For checking purposes of internal algorithms, the fallback value can be used.
Pressure calibration time is the date and time when the calibration was applied to the sensor and is stored automatically. A 10 points calibration can be applied to the pressure sensor.
Calibration can be applied by the manufacturer or an authorized user. The calibration procedure is described in chapter H maintenance 2.0.
Change sensor can be used to record the change of the pressure to be logged in the audit trail logger.

2.4 Temperature

The gFlow 1500 uses a PT1000 for temperature measurement. The sensor is calibrated including the cable and performs an accurate temperature measurement.

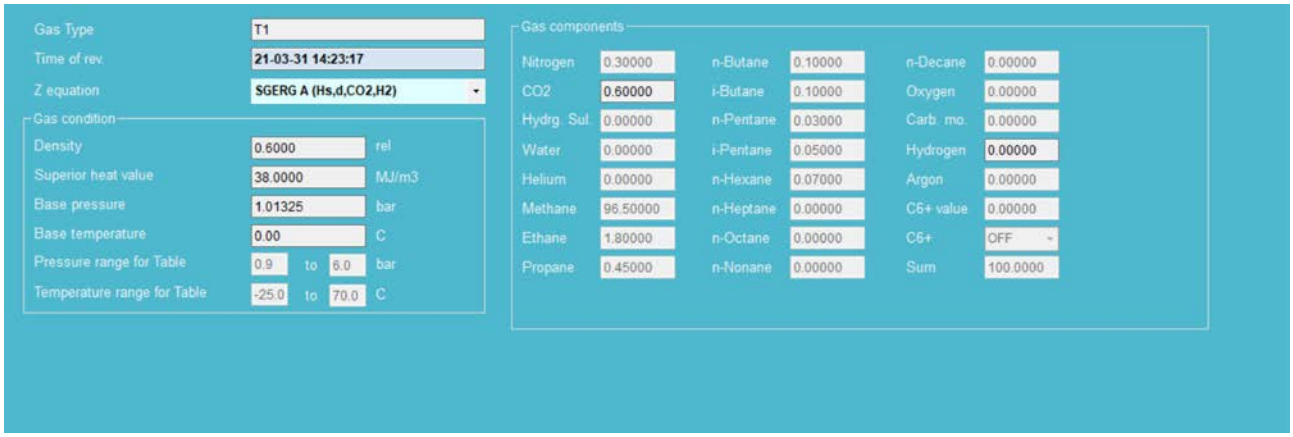
Manufacturer and Type the default is Jumo and PT1000.
Fallback temp. used on error: is the value used as a constant value during an active alarm. The operation of the fallback value is set in the alarm table.
Temperature low limit is the low value of temperature before a low temperature alarm is flagged.
Temperature high limit is the high value of temperature before a high temperature alarm is flagged.
Temperature code is the factory calibration of the sensor at 0°C and 50°C. The deviation is given in mK. The J is the checksum of all data contained for the temperature sensor.
Temperature sensor source can be the Internal sensor only or Fallback only. Under normal conditions always the internal sensor is used. For checking purposes, the fallback value can be used.
Temperature calibration time is the date and time when the calibration was applied to the sensor and is stored automatically. A 10 points calibration can be applied to the temperature sensor.
Calibration can be applied by the manufacturer or an authorized user. The calibration procedure is described in the chapter H maintenance 2.0.
Change sensor can be used to record the change of the pressure to be logged in the audit trail logger.

2.5 Heat value

Hs hi is the upper alarm limit for Hs using the gasQs sensor.
Hs lo is the lower alarm limit for HS using the gasQs sensor.
Wobbe hi is the upper alarm limit for Wobbe index using the gasQs sensor.
Wobbe lo is the lower alarm limit for Wobbe index using the gasQs sensor.
Z default is the value used for Z when no active value is available from the gasQs sensor e.g., at startup
Zb default is the value used for Zb when no active value is available from the gasQs sensor e.g., at startup
d default is the value used for d when no active value is available from the gasQs sensor e.g., at startup
Hs default is the value used for Hs when no active value is available from the gasQs sensor e.g., at startup
Hs t base is the base temperature for which the heat value has been determined. The default value is 25°C and alternatives are 15°C and 0°C.

gasQs calibration is a switch to be used to allow to calibrate the gasQs sensor. The last valid reading is used for conversion during the calibration of the gasQs sensor.

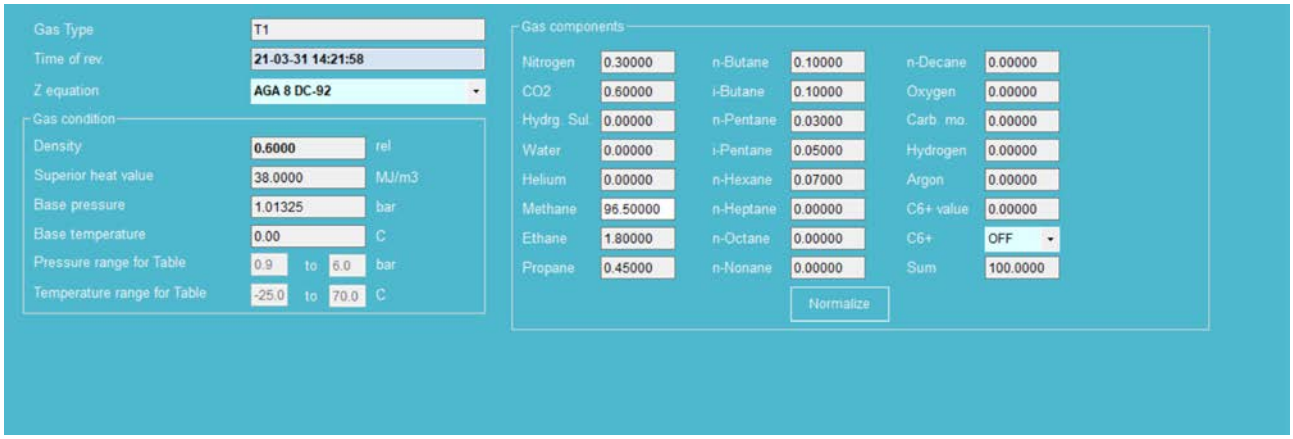
2.6 Conversion



At the conversion TAB all data is entered to determine the compressibility calculation method, the base conditions and the gas properties in case these are required for the selected method.

Gas Type is a text field where the name or type of the gas can be entered. The length is max. 10 characters.
Time of rev. the time where the gas compressibility method is changed is recorded automatically.

Z equation
All listed Z equations are built in to the gFlow 1500. No compromise but only the real equations in its full size are implemented. The required properties for a selected equation are prompted automatically. In case AGA 8 DC92 is used the gas properties can be Normalized to insure a 100% SUM of all used properties.

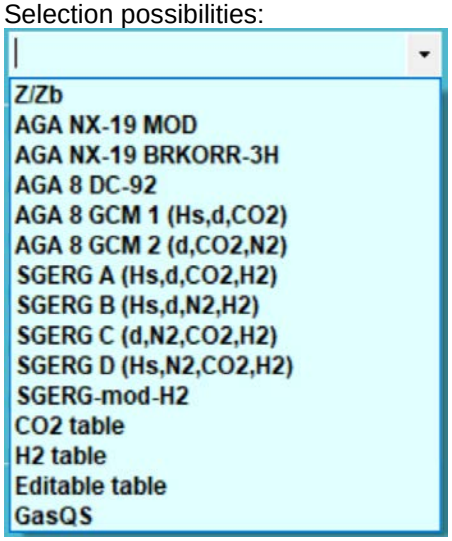


Z = f(p,t,) using gas properties (mol%)

Method	Hs	d	CO2	N2	H2	
Z/Zb						Fixed no: 0.0001 – 2.0000
AGA NX-19 MOD		x	x	x		
AGA NX-19 BRKORR-3H	x	x	x	x		
AGA 8 DC92						Using full gas analysis
AGA 8 GCM1	x	x	x			
AGA 8 CGM2	x		x	x		
SGERG A	x	x	x		x	
SGERG B	x	x		x	x	
SGERG C		x	x	x	x	
SGERG D	x		x	x	x	
SGERG-mod-H2	x	x	x		x	Special German version
CO2 table						Table: 10-p and 20 t-points
H2 table						Table: 10-p and 20 t-points
Table (editable)						Table: 10-p and 20 t-points
gasQs						Reading live data for Z, Zb

The property ranges are given in AGA NX-19, ISO 12213, PTB-TRG9, GERG TM5 and DVGW Technical message PK 1-5-3.

Selection possibilities:



Z/Zb is the fixed factor all pressures and temperatures. This method is chosen for PT conversion.
AGA NX-19 MOD is the modified to SI units from original AGA NX-19 using relative density, nitrogen and CO2 as properties.
AGA NX-19 BRKORR-3H is the modified AGA NX-19 for gases with higher heat value. Any gas above 39.8 MJ/m^3 requires an additional equation for Z2 to correct for the high heat value. This is equation has a limited operating range compared to AGA NX-19. Superior heat value, relative density, nitrogen and CO2 are used as input properties.
AGA 8 DC-92 computes the compressibility factor according AGA 8 DC92 (ISO 12213 part 2) from the full analysis of the gas. Also the superior heat value and the relative density are calculated using ISO 6976. According ISO 6976 only for base temperature of 0, 15, 15,5 and 20°C the superior heat value and relative density are calculated. The combustion base temperature can be set to 0, 15 and 25°C where 25°C is the default.

AGA 8 DC-92 Properties:	Nitrogen Carbon dioxide Hydr. Sul Water Helium Methane Ethane Propane	n-Butane i-Butane n-Pentane i-Pentane n-Hexane n-Heptane n-Octane n-Nonane	n-Decane Oxygen Carb. Mon. Hydrogen Argon C6+*

* When the gas composition contains higher hydro carbons they can be used as a group called C6+. Usually field gas chromatographs go up to hexane and any detected higher hydro carbon can be used switching C6+ on and enter the combined properties at C6+ value.

AGA 8 GCM1 (Hs, d, CO2) is the gross calculation of method of AGA 8 to compute a compressibility factor using Superior heat value, relative density and carbon dioxide as input properties.

AGA 8 GCM2 (d, CO2, N2) is the gross calculation method of AGA 8 to compute a compressibility factor using relative density, carbon dioxide and nitrogen input properties.

SGERG A (Hs, d, CO2, H2) is the gross calculation method of GERG (ISO 12213 part 3) to compute a compressibility factor using Superior heat value, relative density, carbon dioxide and hydrogen as input properties.

SGERG B (Hs, d, N2, H2) is the gross calculation method of GERG (ISO 12213 part 3) to compute a compressibility factor using Superior heat value, relative density, nitrogen and hydrogen.

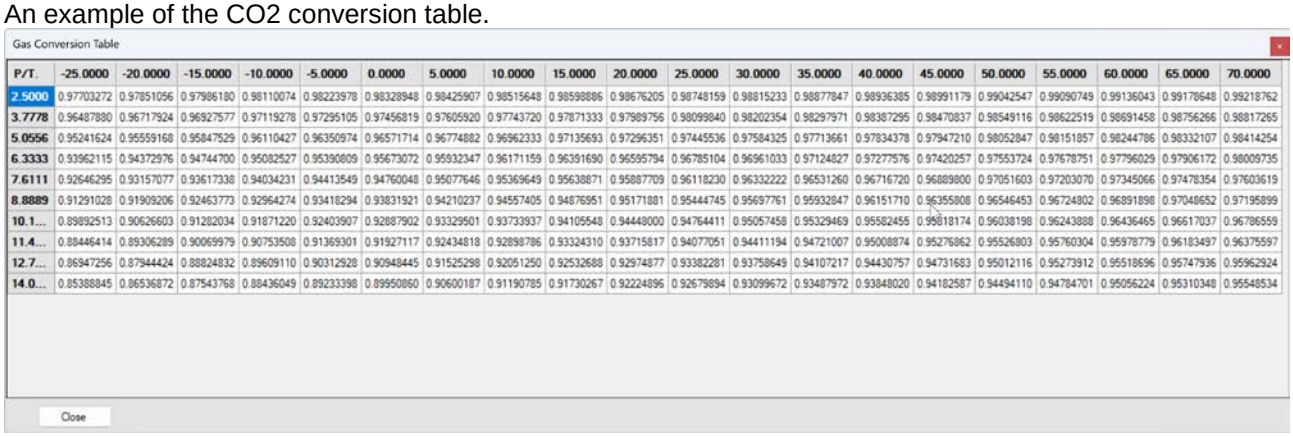
SGERG C (d, N2, CO2, H2) is the gross calculation method of GERG (ISO 12213 part 3) to compute a compressibility factor using relative density, nitrogen, carbon dioxide and hydrogen as input properties.

SGERG D (Hs, N2, CO2, H2) is the gross calculation method of GERG (ISO 12213 part 3) to compute a compressibility factor using Superior heat value, nitrogen, carbon dioxide and hydrogen.

SGERG-mod-H2 (Hs, d, CO2, H2) is the gross calculation method of GERG (ISO 12213 part 3 modified for higher H2 contents for up to 4 bar) to compute a compressibility factor using Superior heat value, relative density, carbon dioxide and hydrogen as input properties.

CO2 table is compressibility factor table for only CO2. The connected pressure sensor range automatically determines the table pressure points. The table size used has 10 pressure points and 20 temperature points. The table is automatically created for the connected pressure sensor range. Zb is a known constant for CO2.

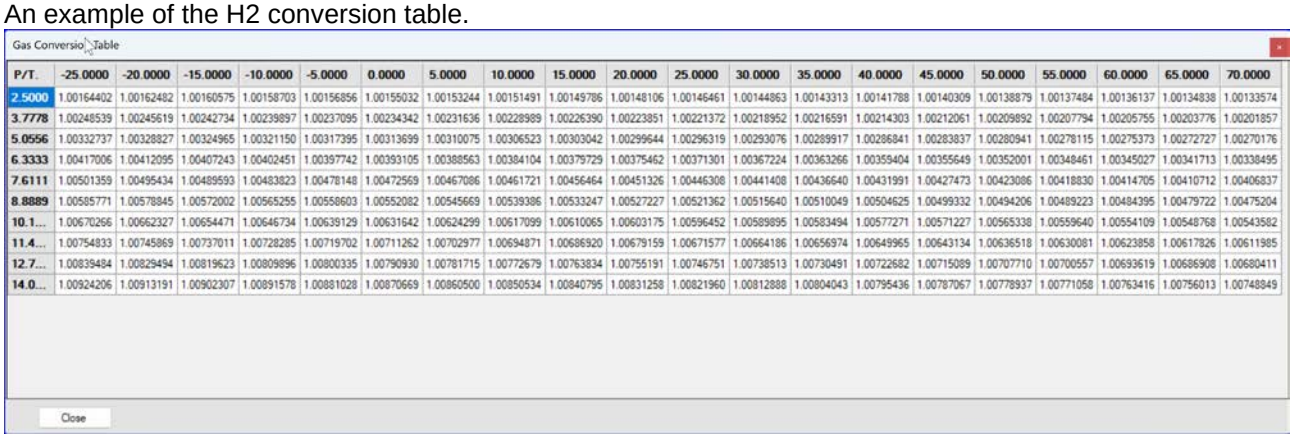
An example of the CO2 conversion table.



P/T.	-25.0000	-20.0000	-15.0000	-10.0000	-5.0000	0.0000	5.0000	10.0000	15.0000	20.0000	25.0000	30.0000	35.0000	40.0000	45.0000	50.0000	55.0000	60.0000	65.0000	70.0000
2.5000	0.97703272	0.97851056	0.97986180	0.98110074	0.98223978	0.98328948	0.98425907	0.98515648	0.98598886	0.98676205	0.98748159	0.98815233	0.98877847	0.98936385	0.98991179	0.99042547	0.99090749	0.99136043	0.99178648	0.99218762
3.7778	0.96487880	0.96717924	0.96927577	0.97119278	0.97295105	0.97456819	0.97605920	0.97743720	0.97871333	0.97989756	0.98099840	0.98202354	0.98297971	0.98387295	0.98470837	0.98549116	0.98622519	0.98691458	0.98756266	0.98817265
5.0556	0.95241624	0.95559168	0.95847529	0.96110427	0.96350974	0.96571714	0.96774882	0.96962333	0.97135693	0.97296351	0.97445536	0.97584325	0.97713661	0.97834378	0.97947210	0.98052847	0.98151857	0.98244786	0.98332107	0.98414254
6.3333	0.93962115	0.94372976	0.94744700	0.95082527	0.95390809	0.95673072	0.95932347	0.96171159	0.96391690	0.96595794	0.96785104	0.96961033	0.97124827	0.97277576	0.97420257	0.97553724	0.97678751	0.97796029	0.97906172	0.98009735
7.6111	0.92646295	0.93157077	0.93617338	0.94034231	0.94413549	0.94760048	0.95077646	0.95369649	0.95638871	0.95887709	0.96118230	0.96332222	0.96531260	0.96716720	0.96889800	0.97051603	0.97203070	0.97345066	0.97478354	0.97603619
8.8889	0.91291028	0.91909206	0.92463773	0.92964274	0.93418294	0.93831921	0.94210237	0.94557405	0.94876951	0.95171881	0.95444745	0.95697761	0.95932847	0.96151710	0.96355808	0.96546453	0.96724802	0.96891898	0.97048652	0.97195899
10.1...	0.89892513	0.90626603	0.91282034	0.91871220	0.92403907	0.92887902	0.93329501	0.93733937	0.94105548	0.94448000	0.94764411	0.95057458	0.95329469	0.95582455	0.95818174	0.96038198	0.96243888	0.96436465	0.96617037	0.96786559
11.4...	0.88446414	0.89306289	0.90069979	0.90753508	0.91369301	0.91927117	0.92434818	0.92898786	0.93324310	0.93715817	0.94077051	0.94411194	0.94721007	0.95008874	0.95276862	0.95526803	0.95760304	0.95978779	0.96183497	0.96375597
12.7...	0.86947256	0.87944424	0.88824832	0.89609110	0.90312928	0.90948445	0.91525298	0.92051250	0.92532688	0.92974877	0.93382281	0.93758649	0.94107217	0.94430757	0.94731683	0.95012116	0.95273912	0.95518696	0.95747936	0.95962924
14.0...	0.85388845	0.86536872	0.87543768	0.88436049	0.89233398	0.89950860	0.90600187	0.91190785	0.91730267	0.92224896	0.92679894	0.93099672	0.93487972	0.93848020	0.94182587	0.94494110	0.94784701	0.95056224	0.95310348	0.95548534

H2 table is compressibility factor table for only H2. The connected pressure sensor range automatically determines the table pressure points. The table size used has 10 pressure points and 20 temperature points. The table is automatically created for the connected pressure sensor range. Zb is a known constant for H2.

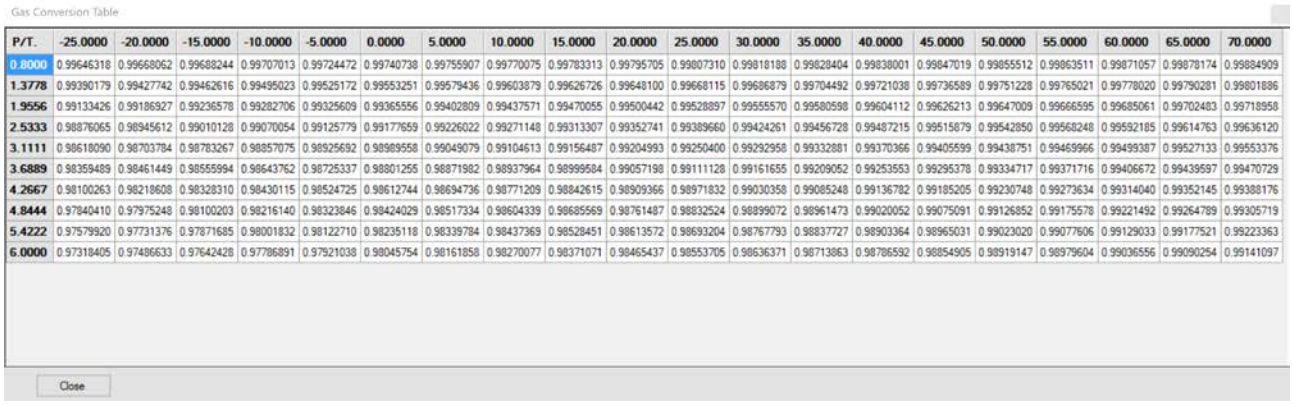
An example of the H2 conversion table.



P/T.	-25.0000	-20.0000	-15.0000	-10.0000	-5.0000	0.0000	5.0000	10.0000	15.0000	20.0000	25.0000	30.0000	35.0000	40.0000	45.0000	50.0000	55.0000	60.0000	65.0000	70.0000
2.5000	1.00164402	1.00162482	1.00160575	1.00158703	1.00156856	1.00155032	1.00153244	1.00151491	1.00149786	1.00148106	1.00146461	1.00144863	1.00143313	1.00141788	1.00140309	1.00138879	1.00137484	1.00136137	1.00134838	1.00133574
3.7778	1.00248539	1.00245619	1.00242734	1.00239897	1.00237095	1.00234342	1.00231636	1.00228989	1.00226390	1.00223851	1.00221372	1.00218952	1.00216591	1.00214303	1.00212061	1.00209892	1.00207794	1.00205755	1.00203776	1.00201857
5.0556	1.00332737	1.00328827	1.00324965	1.00321150	1.00317395	1.00313699	1.00310075	1.00306523	1.00303042	1.00299644	1.00296319	1.00293076	1.00289917	1.00286841	1.00283837	1.00280941	1.00278115	1.00275373	1.00272727	1.00270176
6.3333	1.00417006	1.00412095	1.00407243	1.00402451	1.00397742	1.00393105	1.00388563	1.00384104	1.00379729	1.00375462	1.00371301	1.00367224	1.00363266	1.00359404	1.00355649	1.00352001	1.00348461	1.00345027	1.00341713	1.00338495
7.6111	1.00501359	1.00495434	1.00489593	1.00483823	1.00478148	1.00472569	1.00467086	1.00461721	1.00456464	1.00451326	1.00446308	1.00441408	1.00436640	1.00431991	1.00427473	1.00423086	1.00418830	1.00414705	1.00410712	1.00406837
8.8889	1.00585771	1.00578845	1.00572002	1.00565255	1.00558603	1.00552082	1.00545669	1.00539386	1.00533247	1.00527227	1.00521362	1.00515640	1.00510049	1.00504625	1.00499332	1.00494206	1.00489223	1.00484395	1.00479722	1.00475204
10.1...	1.00670266	1.00662327	1.00654471	1.00646734	1.00639129	1.00631642	1.00624299	1.00617099	1.00610065	1.00603175	1.00596452	1.00589895	1.00583494	1.00577271	1.00571227	1.00565338	1.00559640	1.00554109	1.00548768	1.00543582
11.4...	1.00754833	1.00745869	1.00737011	1.00728285	1.00719702	1.00711262	1.00702977	1.00694871	1.00686920	1.00679159	1.00671577	1.00664186	1.00656974	1.00649965	1.00643134	1.00636518	1.00630081	1.00623858	1.00617826	1.00611985
12.7...	1.00839484	1.00829494	1.00819623	1.00809896	1.00800335	1.00790930	1.00781715	1.00772679	1.00763834	1.00755191	1.00746751	1.00738513	1.00730491	1.00722682	1.00715089	1.00707710	1.00700557	1.00693619	1.00686908	1.00680411
14.0...	1.00924206	1.00913191	1.00902307	1.00891578	1.00881028	1.00870669	1.00860500	1.00850534	1.00840795	1.00831258	1.00821960	1.00812888	1.00804043	1.00795436	1.00787067	1.00778937	1.00771058	1.00763416	1.00756013	1.00748849

Editable table is a feature for importing any type of compressibility table for special gases. The table needs to consists of 10 pressure points and 20 temperature points. The file format is .csv. Zb of the gas used to compute the table needs to be entered. Always check this value to be correct!

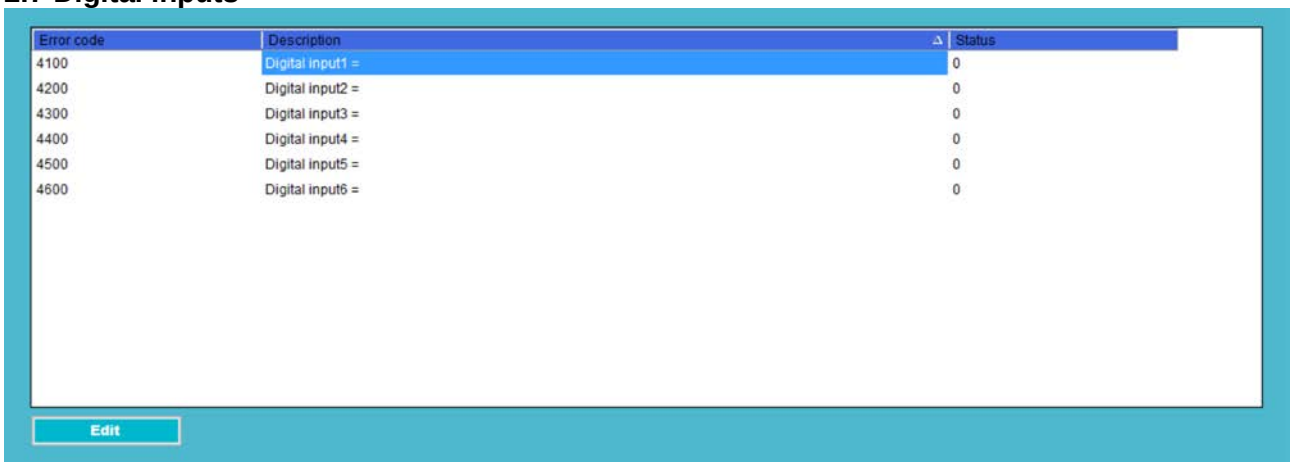
An example of the gas conversion table.



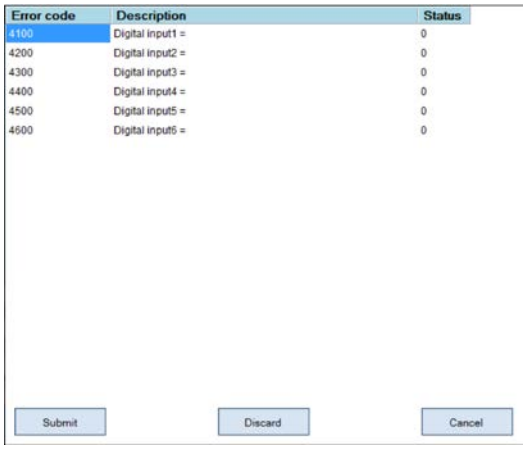
P/T.	-25.0000	-20.0000	-15.0000	-10.0000	-5.0000	0.0000	5.0000	10.0000	15.0000	20.0000	25.0000	30.0000	35.0000	40.0000	45.0000	50.0000	55.0000	60.0000	65.0000	70.0000
0.8000	0.99646318	0.99668062	0.99688244	0.99707013	0.99724472	0.99740738	0.99755907	0.99770075	0.99783313	0.99795705	0.99807310	0.99818188	0.99828404	0.99838001	0.99847019	0.99855512	0.99863511	0.99871057	0.99878174	0.99884909
1.3778	0.99390179	0.99427742	0.99462616	0.99495023	0.99525172	0.99553251	0.99579436	0.99603879	0.99626726	0.99648100	0.99668115	0.99686879	0.99704492	0.99721038	0.99736589	0.99751228	0.99765021	0.99778020	0.99790281	0.99801886
1.9556	0.99133426	0.99186927	0.99236578	0.99282706	0.99325609	0.99365556	0.99402809	0.99437571	0.99470055	0.99500442	0.99528897	0.99555570	0.99580598	0.99604112	0.99626213	0.99647009	0.99666595	0.99685061	0.99702483	0.99718958
2.5333	0.98876065	0.98945612	0.99010128	0.99070054	0.99125779	0.99177659	0.99226022	0.99271148	0.99313307	0.99352741	0.99389660	0.99424261	0.99456728	0.99487215	0.99515879	0.99542850	0.99568248	0.99592185	0.99614763	0.99636120
3.1111	0.98618090	0.98703784	0.98783267	0.98857075	0.98925692	0.98989558	0.99049079	0.99104613	0.99156487	0.99204993	0.99250400	0.99292958	0.99332881	0.99370366	0.99405599	0.99438751	0.99469966	0.99499387	0.99527133	0.99553376
3.6889	0.98359489	0.98461449	0.98555994	0.98643762	0.98725337	0.98801255	0.98871982	0.98937964	0.98999584	0.99057198	0.99111128	0.99161655	0.99209052	0.99253553	0.99295378	0.99334717	0.99371716	0.99406672	0.99439597	0.99470729
4.2667	0.98100263	0.98218608	0.98328310	0.98430115	0.98524725	0.98612744	0.98694736	0.98771209	0.98842615	0.98909366	0.98971832	0.99030358	0.99085248	0.99136782	0.99185205	0.99230748	0.99273634	0.99314040	0.99352145	0.99388176
4.8444	0.97840410	0.97975248	0.98100203	0.98216140	0.98323846	0.98424029	0.98517334	0.98604339	0.98685569	0.98761487	0.98832524	0.98899072	0.98961473	0.99020052	0.99075091	0.99126852	0.99175578	0.99221492	0.99264789	0.99305719
5.4222	0.97579920	0.97731376	0.97871685	0.98001832	0.98122710	0.98235118	0.98339784	0.98437369	0.98528451	0.98613572	0.98693204	0.98767793	0.98837727	0.98903364	0.98965031	0.99023020	0.99077606	0.99129033	0.99177521	0.99223363
6.0000	0.97318405	0.97486633	0.97642428	0.97786891	0.97921038	0.98045754	0.98161858	0.98270077	0.98371071	0.98465437	0.98553705	0.98636371	0.98713863	0.98786592	0.98854905	0.98919147	0.98979604	0.99036556	0.99090254	0.99141097

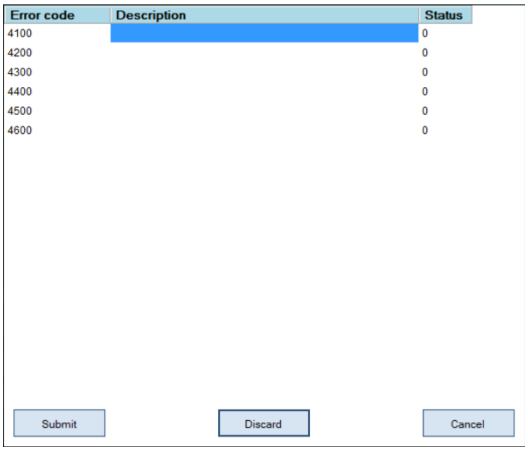
gasQs the values for Hs, d, Z and Zb are provided by the gas quality sensor gasQs. The measurement values for pressure and temperature are send to the gasQs sensor and the Z factor is based on the measured pressure and temperature. Zb is calculated on preset base pressure of 1.01325 and temperature of 0°C.

2.7 Digital inputs

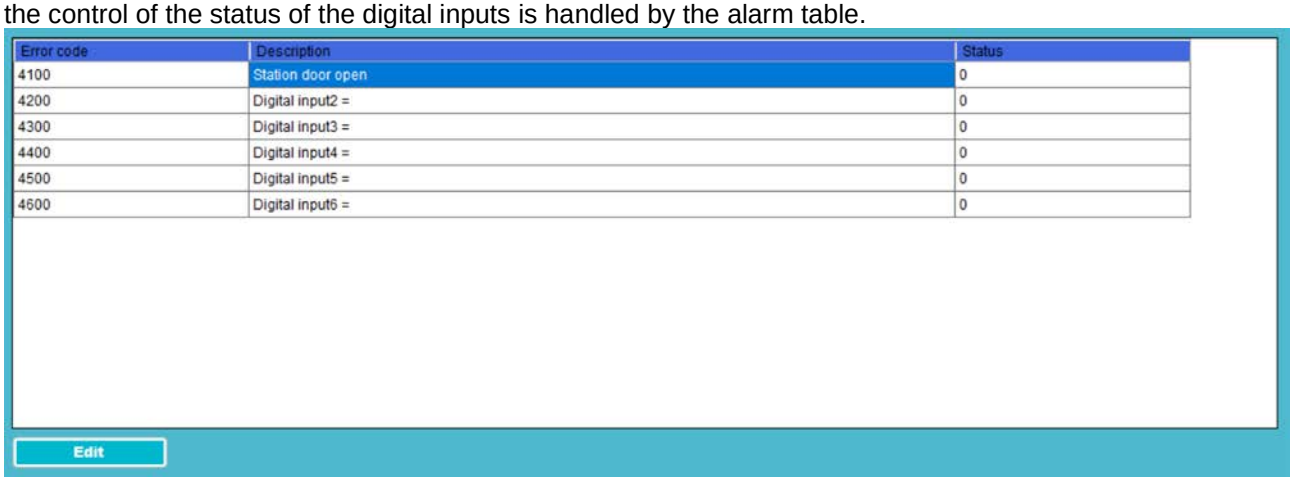


The gFlow 1500 has 6 digital inputs which can be used for station control functions. The text of each input is editable. To edit the text just press the Edit button and the screen left below is opened. By clicking on Discard all text is deleted and can edited as required.

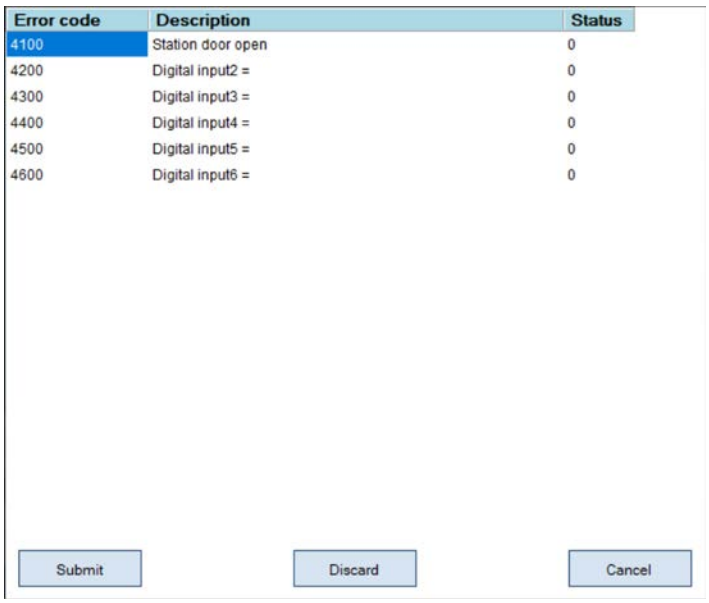




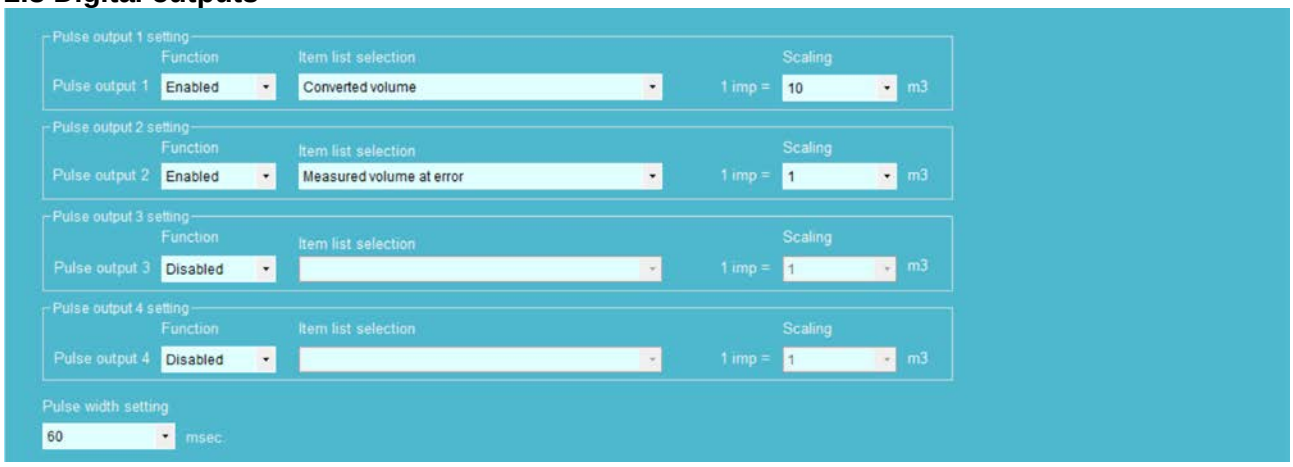
Below an example is shown for the first 3 inputs. The error code is used for MODBUS communication and the control of the status of the digital inputs is handled by the alarm table.



After editing the digital inputs click on the Submit button to save the modifications. To abort the operation just click on Discard. To close the window just click on Cancel.



2.8 Digital outputs

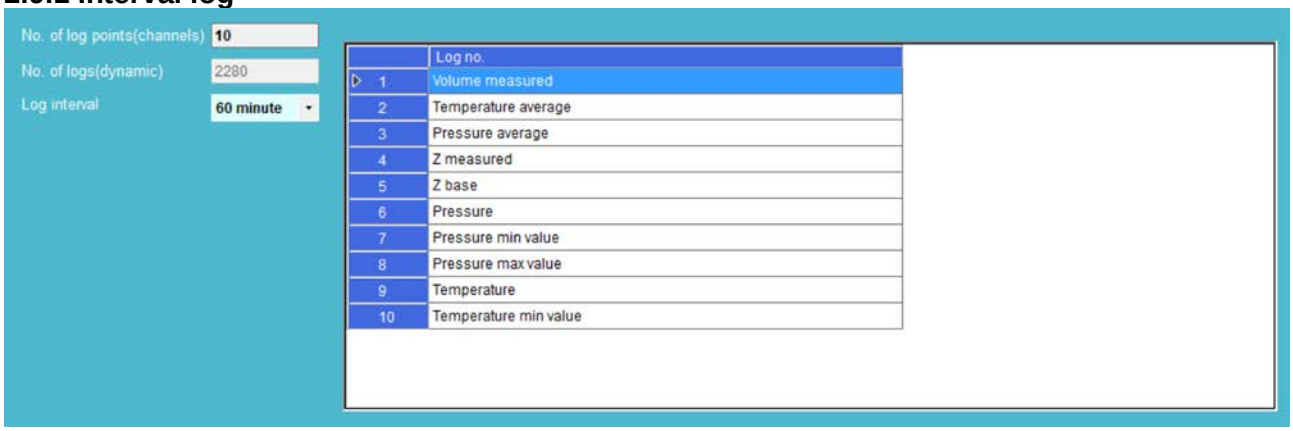


At the TAB digital outputs there are 4 pulse outputs to be set. After setting the output to Enabled the function can be selected. The functions of the outputs are:
Converted volume
Measured volume
Converted volume at error
Measured volume at error
Energy
Energy at error
Volume control

Each output can be scaled with a factor. The scaling factor can be chosen from a drop down list:
0.1
1
10
100
1000

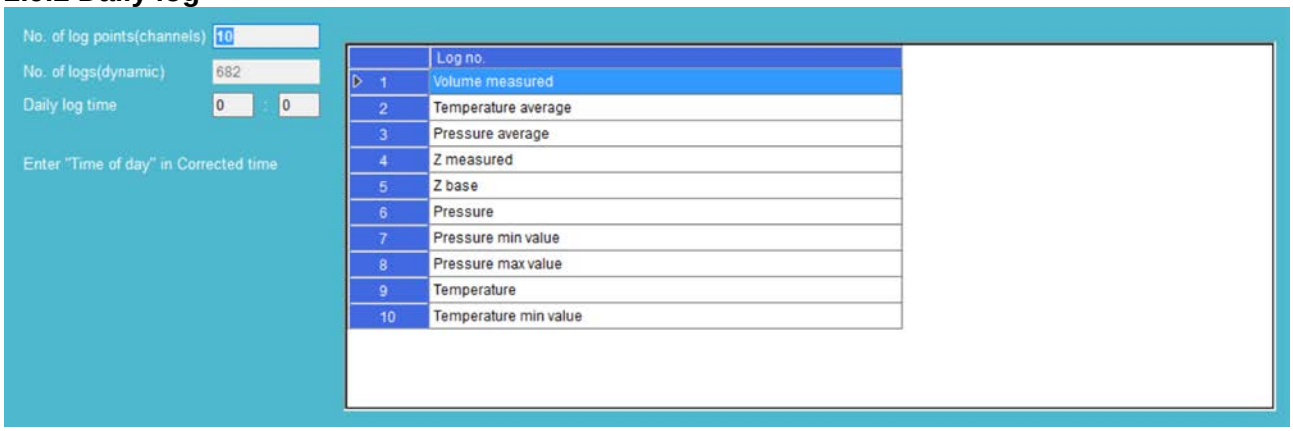
2.9 Log setup

2.9.1 Interval log



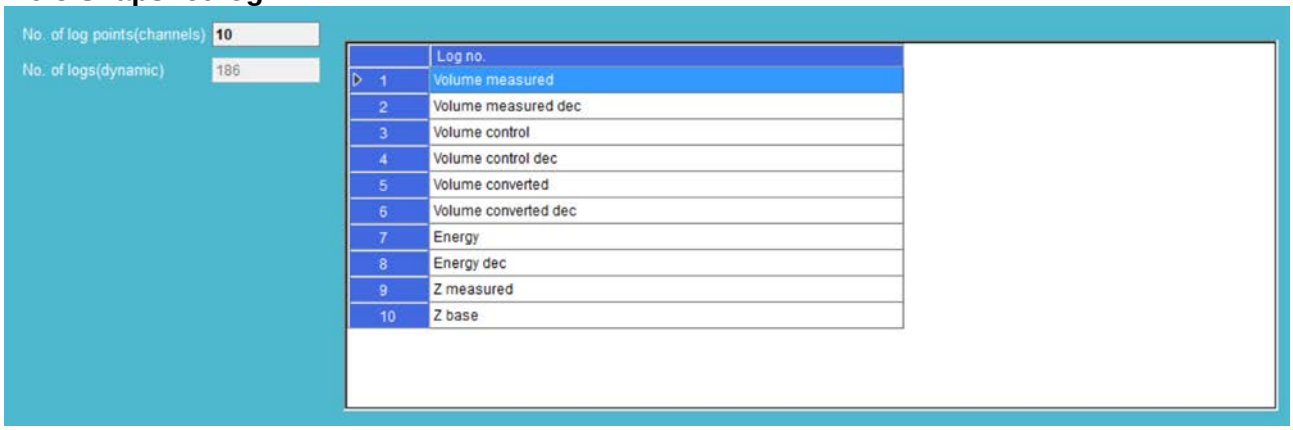
For the interval log up to 20 log points can be selected (see 2.10).
The number of logs is calculated automatically after selecting the no of log points.
The interval can be selected from: 1; 2; 3; 5; 10; 15; 30; 60; 120 up to 240 seconds.
Each log is stored with time and data.

2.9.2 Daily log



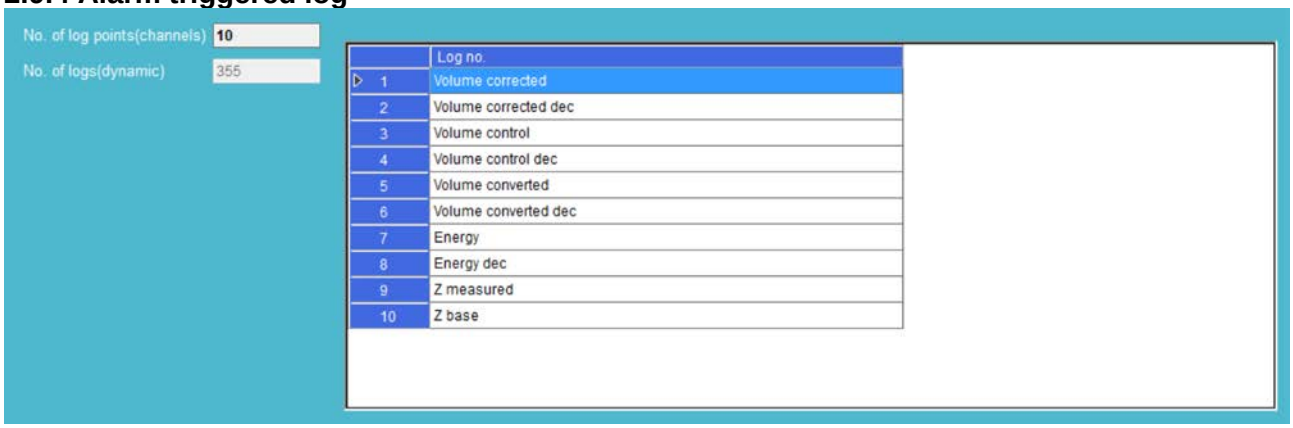
For the daily log up to 20 log points can be selected (see 2.10).
The number of logs is calculated automatically after selecting the no of log points.
The log time of the daily interval is entered at Daily log time in local time.
The logging of the daily log items occurs each 24 hours from Daily log time to Daily log time.
Each log is stored with time and data.

2.9.3 Snapshot log



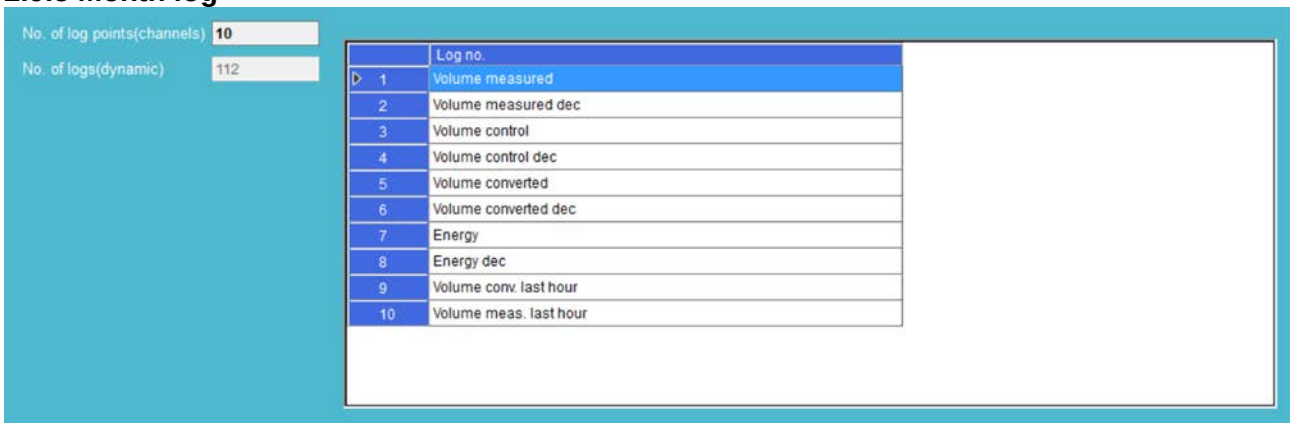
For the Snapshot log up to 20 log points can be selected (see 2.10).
The number of logs is calculated automatically after selecting the no of log points.
Snap shot log is used to instantaneously logging of the selected parameters. This is very suitable during verification or re-calibration. Each log is stored with time and data.

2.9.4 Alarm triggered log



For the Alarm triggered log up to 20 log points can be selected (see 2.10).
Any item selected for alarm triggered log will be logged when an alarm occurs for which in the alarm table logging has been selected. The logging takes place at the occurrence and clearing of an alarm.
Each log is stored with time and data.

2.9.5 Month log



For the Month log up to 20 log points can be selected (see 2.10).
The month log logs each month the selected items at the time set for Daily log time.
Each log is stored with time and data.

2.10 Log items

Log items		
Volume measured	Pressure	Z measured
Volume measured dec	Pressure max value	Z base
Volume measured error	Pressure min value	Wobbe index
Volume measured dec error	Pressure average	Wobbe index average
Volume corrected	Temperature	Relative density
Volume corrected dec	Temperature average	Max increm. Time M
Volume converted	Temperature max value	Max increm.Vb M
Volume converted dec	Temperature min value	Max increm Vb dec. M
Volume converted error	Pressure 2	Max increm. Time M-1
Volume conv. dec. error	Pressure 2 average	Max increm.Vb M-1

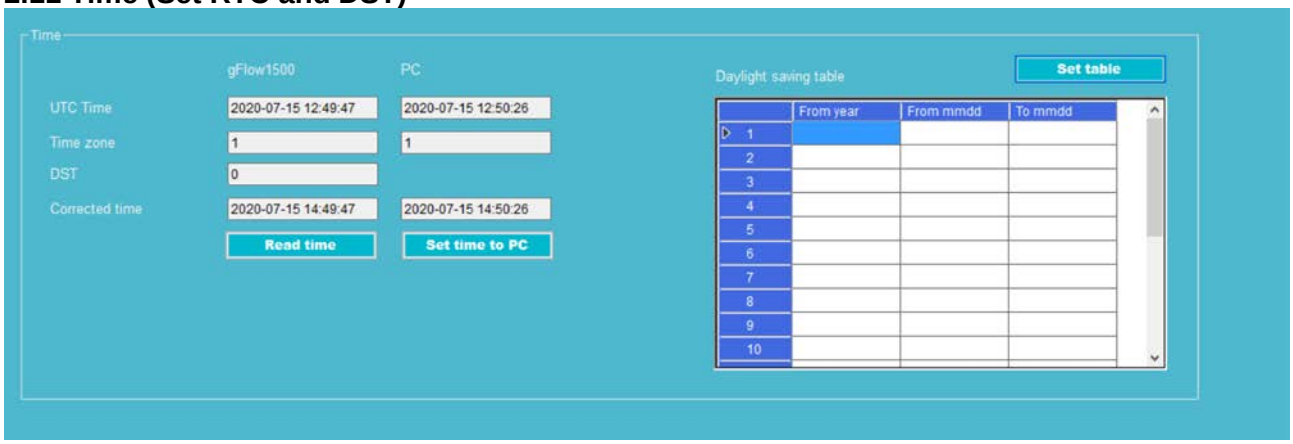
Volume control	Flow measured	Max increm Vb dec. M-1
Volume control dec	Flow measured max value	Max increm. Time M-2
Energy	Flow measure min value	Max increm.Vb M-2
Energy dec	Flow corrected	Max increm Vb dec. M-2
Energy error	Flow corrected average	Ordinal counter normal
Energy dec. error	Flow corrected max value	Ordinal counter error
Volume conv. last hour	Flow corrected min value	Battery remaining in days
Volume meas. last hour	Flow converted	Log line checksum*
Volume conv. current hour	Flow converted average	Alarm 1-32 active
Energy last hour	Flow converted max value	Alarm 33-64 active
Energy current hour	Flow converted min value	Alarm 1-32 registered
Conversion factor	Flow energy	Alarm 33-64 registered
Correction factor	Flow energy average	

*Log line checksum needs to be the last log item.

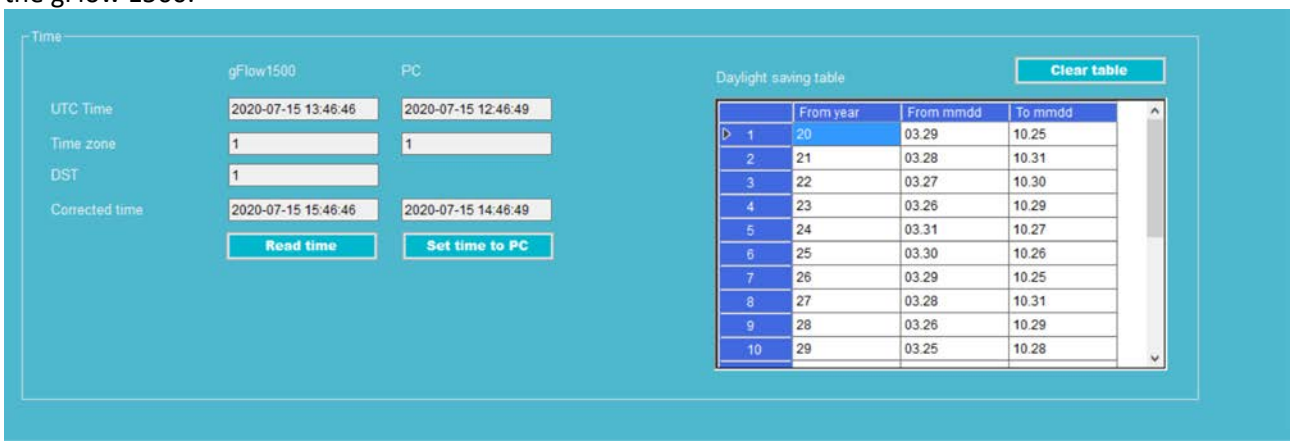
2.10.1 Log dept

Log points	Interval log	Daily log	Snapshot log	Alarm triggered log	Monthly log
1	10488	3139	860	1634	516
2	7491	2242	614	1167	368
3	5826	1743	477	907	286
4	4767	1426	390	742	234
5	4033	1207	330	628	198
6	3496	1046	286	544	172
7	3084	923	252	480	151
8	2760	826	226	430	135
9	2497	747	204	389	122
10	2280	682	186	355	112
11	2097	627	172	326	103
12	1942	581	159	302	95
13	1808	541	148	281	88
14	1691	506	138	263	83
15	1589	475	130	247	78
16	1498	448	122	233	73
17	1417	424	116	220	69
18	1344	402	110	209	66
19	1279	382	104	199	62
20	1219	365	100	190	60

2.11 Time (Set RTC and DST)



The time in the gFlow can be set to PC time by clicking the Set time to PC button. When the Daylight-saving time (DST) is not required the table stays empty. By clicking the Set table button, the table is filled automatically for the northern hemisphere. The table can be edited to fulfil the DST requirements of any country in the southern hemisphere. After activating the table the modification needs to be written into the gFlow 1500.



Note: to notice the effect of filling the table please read the config again to see the actual setting.

2.12 Miscellaneous

At the miscellaneous TAB various settings are made and information is provided for the product conformity.

Interval of measurement determines the cycle time of a conversion routine. A selection can be made between 2, 5, 10, 15, 20, 25 and 30 sec.

Modbus slave address can be set to any slave address between 1 and 247.

Number of slave is the total number of the devices connected in one loop for multi drop data reading.

Password level 1 allows to set the password for level 1 to customer requirements.

Password level 2 allows to set the password for level 2 to customer requirements.

Password level 3 allows to set the password for level 3 to customer requirements.

Set decimals: the decimal setting allows to set the number of decimals and integers of the index. Any index provided should not overrun in 2000 hours. The setting of the number of decimals has be set to comply with the 2000 hour requirement.

E1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.

Vb1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.

Vc1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.

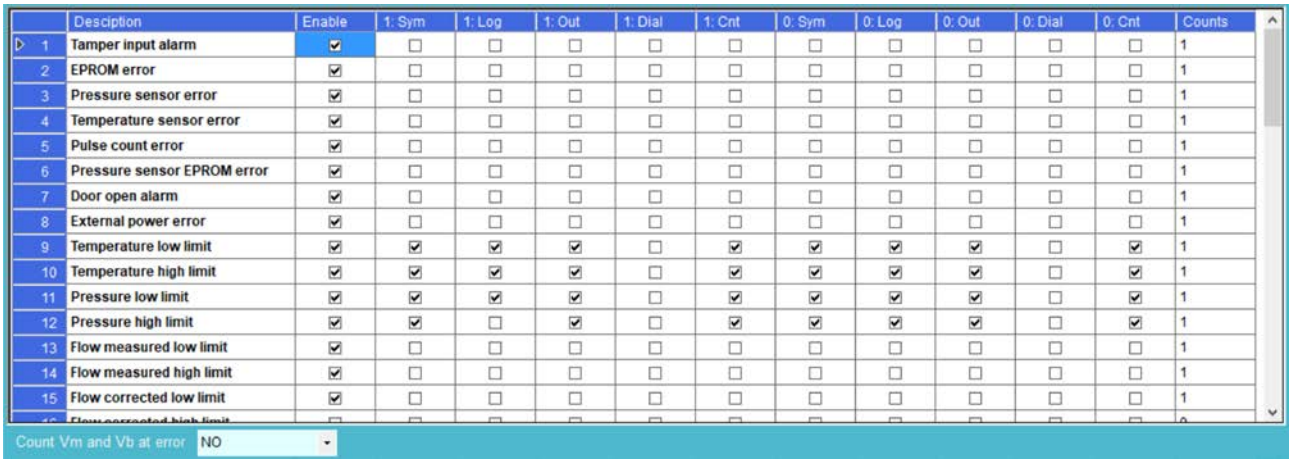
Vm1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.

Ee1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.

Vbe1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.

Vce1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.
Vme1 decimals can be set to 4, 3, 2, 1 or 0 decimals to scale the index on the display.
Conversion type can be set to E for energy conversion and is based of PTZ measurement, PTZ for pressure, temperature and compressibility conversion, PT for pressure and temperature conversion using a fixed number for compressibility or TZ for temperature and compressibility conversion using a fixed pressure.
Battery remaining shows the remaining life time in days of the internal battery(ies).
Battery Alarm remaining shows the remaining number of days before the battery alarm goes on.
Configuration checksum is determined over the setup data.
Program checksum is determined during compiling of the code and represents the conformity of the program inside the gFlow 1500.
Metrology SW checksum is determined during compiling of the program code and represents the conformity of the metrological part of the program.
Data log SW checksum is determined over the log setup.
Pressure sensor 2 is a non-metrological pressure measurement which can be enabled or disabled.
Temperature sensor 2 is a non-metrological temperature sensor which can be enabled or disabled.
LED LIGTH is an internal led light which can be enabled or disabled. The led will be switched on by opening the cover and will be switched off by closing the cover.
Battery setup the gFlow 1500 can operate on one or two internal batteries.
Change battery is a button to reset the battery measurement. An entry in the audit trail will be made automatically on changing.

2.13 Alarm



	Desciption	Enable	1: Sym	1: Log	1: Out	1: Dial	1: Cnt	0: Sym	0: Log	0: Out	0: Dial	0: Cnt	Counts
1	Tamper input alarm	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
2	EPROM error	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
3	Pressure sensor error	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
4	Temperature sensor error	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
5	Pulse count error	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
6	Pressure sensor EPROM error	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
7	Door open alarm	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
8	External power error	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
9	Temperature low limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
10	Temperature high limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
11	Pressure low limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
12	Pressure high limit	☑	☑	☐	☑	☐	☑	☑	☑	☑	☐	☑	1
13	Flow measured low limit	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
14	Flow measured high limit	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
15	Flow corrected low limit	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	1

Count Vm and Vb at error NO

At the alarm page all alarm settings are made. Please read chapter F2.9 (Operation) for detailed explanation of the alarm settings.

2.14 Display

On the display page the display can be controlled for the on-time and for returning to the main page (100) for the main indexes. The times set are independently of each other. The timer starts after the last key pad operation.

If both times are identical the return to page 100 will not be noticed. For normal use it is not recommend to switch off the display completely but to turn it off after the pre-defined time. The range is between: 0 and 240 seconds. If set to 241 seconds the display will never turn off. On external power the display can be kept on always.

The time to return to First display page can be set in the range of 0 to 240 seconds.

The display test button either illuminate all dots of the matrix 320 x 240 and the stop button returns to normal operation of the display.

Warning: never leave the display test on, always switch the test off after use!!

2.15 HF

2.15.1 HF1 SETUP

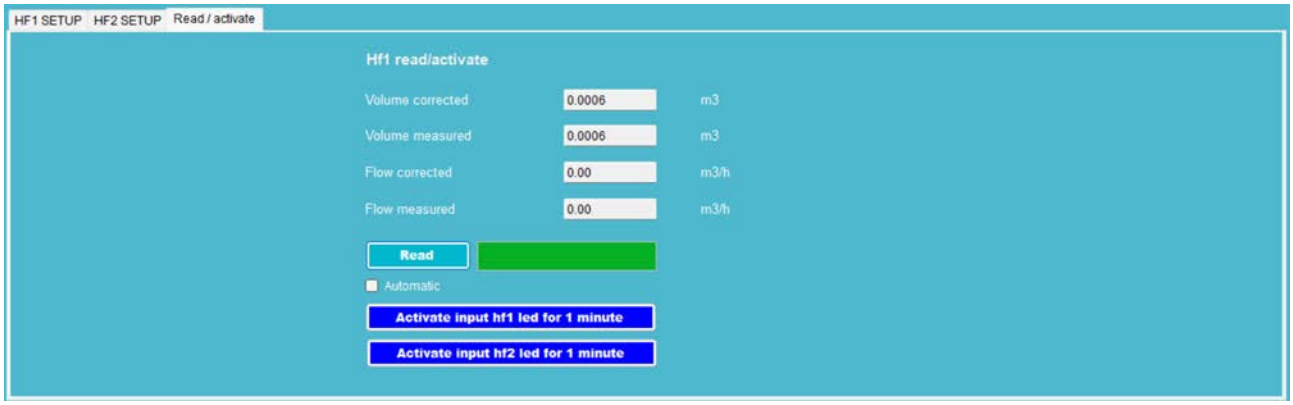
HF1 SETUP (NAMUR input)
HF1 Value of pulse determines the number of pulses per volume unit. The reciprocal value is calculated automatically.
HF Pulse control every determines the number of pulses over which a pulse test can be applied. The HF pulse test is carried out between HF1 and HF2.The max. number is 9999.

HF Max pulse error determines the max amount of pulses difference between HF1 and HF2 before an alarm is flagged. The max. number is 999.
Flow average wma is a damping principle to stabilize the flow. The function can be switched on or off.
HF1 Correction table can be used to correct for an error curve of a gas meter. The curve has to be entered in descending order. Between the test points a linear interpolation takes place. When the number of test points is less than 10 the remaining positions are left open. From the last error point a virtual horizontal line will be drawn to zero flow.

2.15.2 HF2 SETUP

HF2 SETUP (NAMUR input)
HF2 Value of pulse determines the number of pulses per volume unit. The reciprocal value is calculated automatically.

2.15.3 Read/activate



HF1 Read/activate
Volume corrected is the volume index corrected for the gas meter error curve.
Volume uncorrected is the volume index (Vm) represented directly from the gas meter.
Flow corrected is the flow corrected for the gas meter error curve.
Flow uncorrected is the flow represented directly from the gas meter.

Read is a reading button to update the volumes and the flows.
Automatic can be ticked to continuously update the volumes and the flows.

Activate Input HF1 LED for 1 minute is a help function to visualize the input pulses from the HF1 sensor. The LED is marked LD-HF1 left from terminal J301. The color is red.
Activate Input HF2 LED for 1 minute is a help function to visualize the input pulses from the HF2 sensor. The LED is marked LD-HF2 left from terminal J300. The color is red.

2.16 Encoder

2.16.1 ENCODER 1 SETUP

ENCODER 1 SETUP
External power mode is active per default
In external power mode the NAMUR loop is powered continuously and this can only be set when the gFlow is connected to an external power source. The encoder transmits at least one telegram per second.
The time before flow stop is a threshold value where the calculated flow derived from the encoder is set to zero.
Time before "no data" alarm is set to 20 sec per default. The alarm is flagged when no telegram has been received.

Battery mode
Wake-up interval can be selected between 10, 20 and 30 seconds. The NAMUR loop is only powered for a few seconds to real the a-telegram and closes thereafter to save power from the battery.
Timeout identified meter is the time the already known encoder needs to respond after the NAMUR loop is powered.
Timeout unidentified meter is the time an unknown encoder needs to respond after the NAMUR loop is powered.

2.16.2 ENCODER 2 SETUP

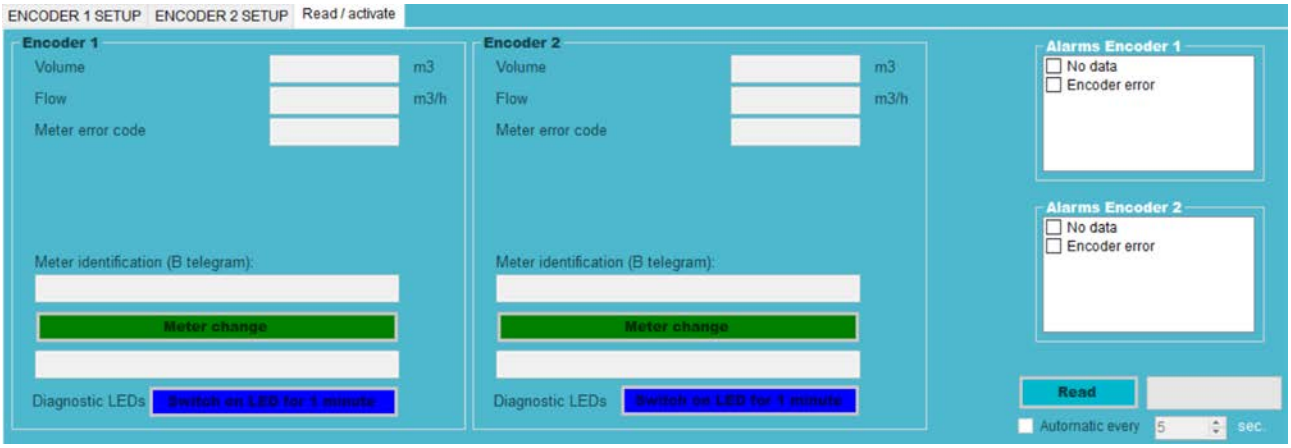
ENCODER 2 SETUP
External power mode is active per default
In external power mode the NAMUR loop is powered continuously and this can only be set when the gFlow is connected to an external power source. The encoder transmits at least one telegram per second.
The time before flow stop is a threshold value where the calculated flow derived from the encoder is set to zero.
Time before "no data" alarm is set to 20 sec per default. The alarm is flagged when no telegram has been received.

Pulse control
Compare encoder input to: allows to compare the encoder reading with any input source for volume e.g. LF1, HF1 or Encoder 1 as used for determining Vm1.

Compare absolute values the max difference between the encoder 2 reading and Vm1 can be set as: Max volume error abs. the absolute value of the allowed difference between encoder 2 and Vm1.

Battery mode
Wake-up interval can be selected between 10, 20, 30, 60 and 120 seconds. The NAMUR loop is only powered for a few seconds to real the a-telegram and closes thereafter to save power from the battery.
Timeout identified meter is the time the already known encoder needs to respond after the NAMUR loop is powered.
Timeout unidentified meter is the time an unknown encoder needs to respond after the NAMUR loop is powered.

2.16.3 Read/activate



Read/activate (for up to 2 Encoders)
Volume is the volume index from the gas meter encoder.
Flow is the flow for the gas meter encoder.
Meter error code is the returned error flag from the gas meter encoder. No error returns 0x30.

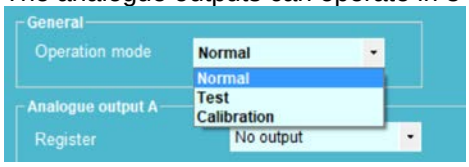
Meter identification (B telegram): shows the content of the b-telegram from the gas meter encoder.
Meter change command for meter change, resets the encoder internal data. This is used for meter exchange.
Diagnostic LED can be used to check the data transmission from the gas meter encoder.
The LED for encoder 1 is marked LD-HF1 on top of terminal J301. The color is red.
The LED for encoder 2 is marked LD-HF2 on top of terminal J361. The color is red.

Alarms Encoder 1/2
No data is marked when no data is received from the gas meter encoder.
Encoder error is marked when the error byte does not contain 0x30.

Read is a reading button to update the volumes, flows and meter error codes.
Automatic can be ticked to continuously update the volumes and the flows.

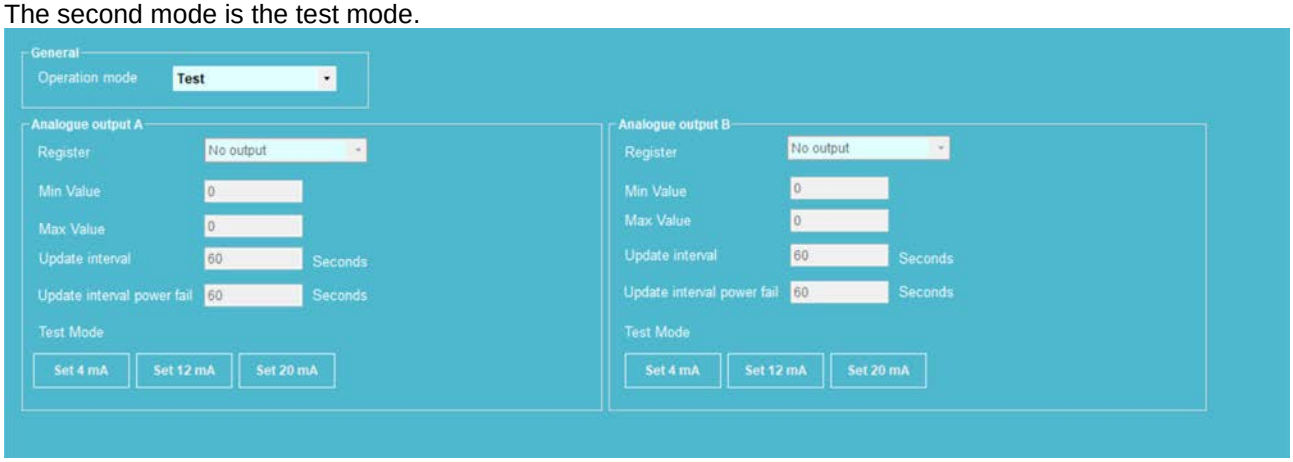
2.17 Analogue output

The analogue outputs can operate in 3 different modes.



The normal mode is for normal operation and is selected during operation.

The second mode is the test mode.

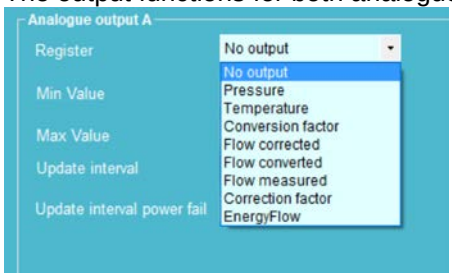


In test mode the outputs can be set to either 4 mA, 12 mA or 20 mA individually.
Clicking on “Set 4 mA” draws a current of 4 mA, clicking on “Set 12 mA” draws a current of 12 mA and clicking on “Set 20 mA” draws a current of 20 mA.

The third mode is Calibration

In calibration mode the analogue outputs can be adjusted for 4 and 20 mA.
Just click on Set 4 mA and measure the output current. The real value measured needs to be entered at Reference low Value (4mA). Thereafter click on Set 20 ma and measure the output current. The real value measured needs to be entered at Reference high Value (20mA).

The output functions for both analogue outputs can be selected from the dropdown list at Register.



2.18 Units

The gFlow 1500 can operate with different units for Volume, Energy, Pressure, Temperature, Density and Heat value. Also, the density of air at reference condition can be entered. A change of unit becomes effective immediately.

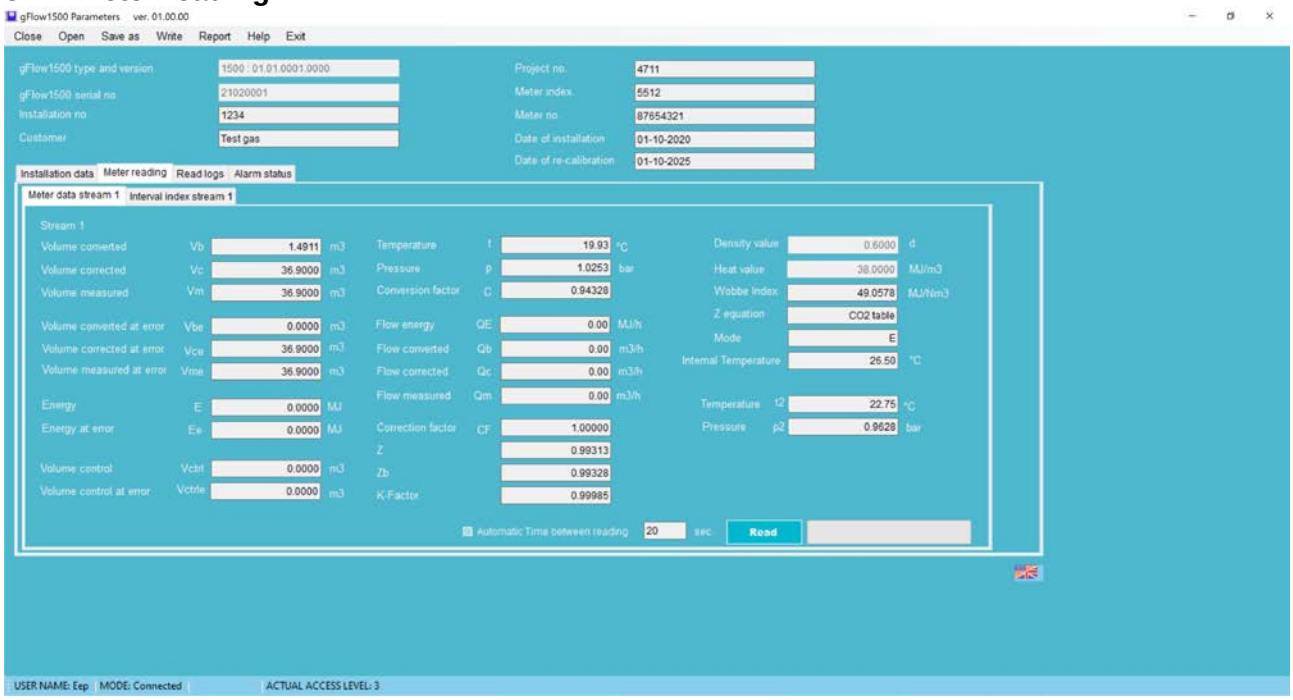
2.19 Comm. Setup

At Comm. Setup the setting for the communication ports can be set. Serial port 1 can be switched on or off and the Baud Rate can be selected from 2400 up to 38400 Baud.
Serial port 2 is dedicated to the gasQs sensor. The default Baud Rate is 19200 but can be set from 2400 up to 38400.

3.0 Data reading

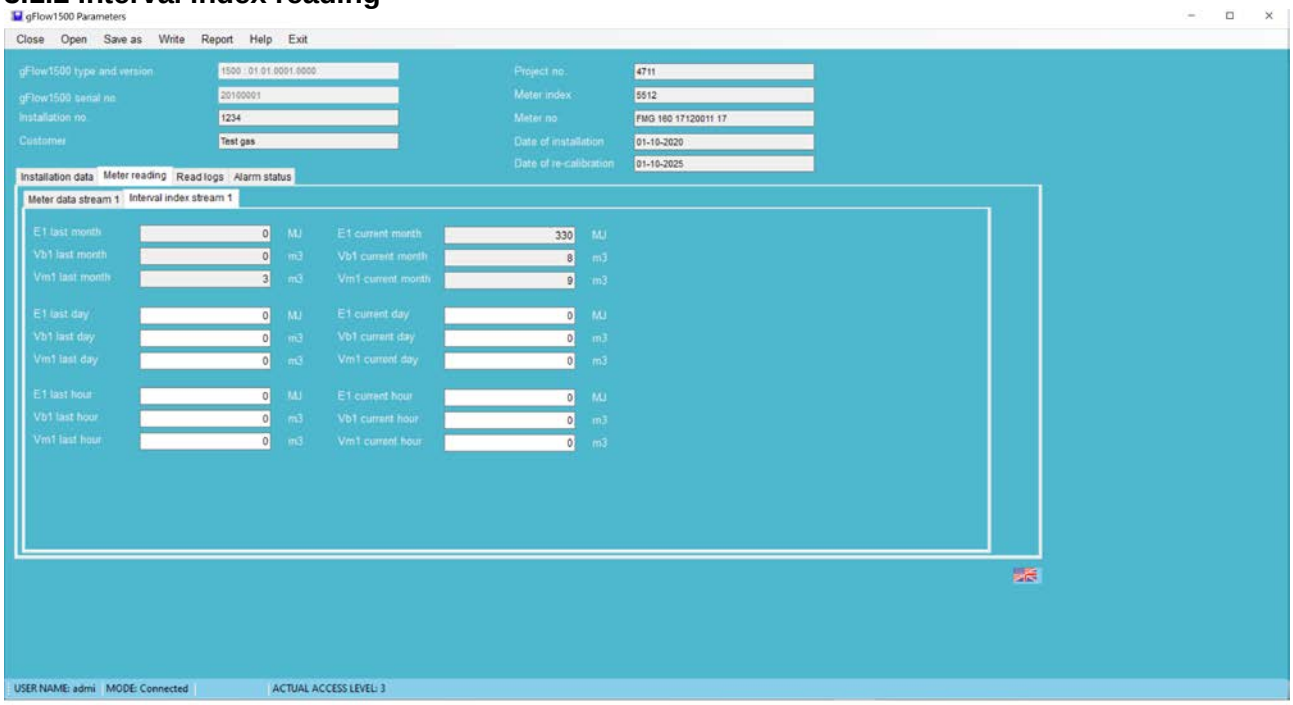
The configuration program can also be used to read data from the gFlow 1500. The program offers a meter reading page and an interval index reading page.

3.1.1 Meter reading



Meter reading is started by clicking on the Read button. The program can also automatically read the data where a time between readings can be set. The default value is 20 sec. The range of the interval can be set between 1 and 500 sec.

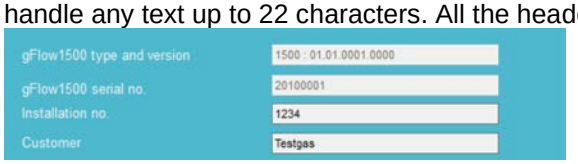
3.1.2 Interval index reading



The interval indexes are read from the gFlow 1500 any time a meter reading is performed. This also applies to automatic meter reading.

3.2 Location information

In the header of the main program page certain location information can be entered. The entry fields can handle any text up to 22 characters. All the header information can be read through MODBUS RTU.



The gFlow 1500 type and version identifies the version of the gFlow.
The gFlow 1500 serial no. is entered in the factory and cannot be modified.
The Installation no. can be entered to locate the installation.
The Customer name can be entered as reference to the owner.

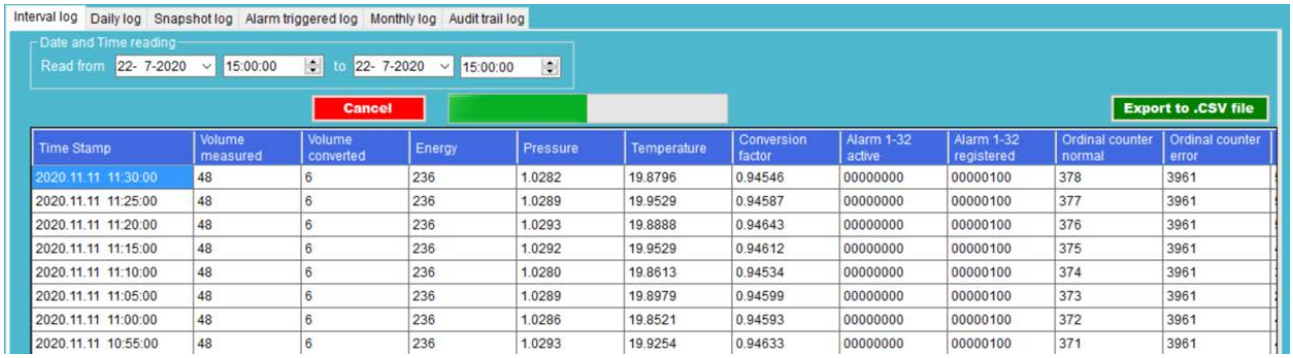
The Project no. can be entered to locate the concerned project.
The Meter index can be entered on installation.
The Meter no. can be entered for logistical purpose. When an Encoder meter is used, it will prompt the information contained in the b-telegram.
Date of installation can be entered to record the installation date.
Date of re-calibration can be entered to indicate the time of re-calibration of the gFlow 1500. This may vary by local legislation.

4.0 Read logs

All loggers can be read by using the configuration program. For more detailed information on the loggers please read F. Operation 3.0.

4.1 Interval log

The interval logs can be read by the configuration program where as default all log are read. During the log reading a Cancel button is popping up to allow a user to stop reading the logs.

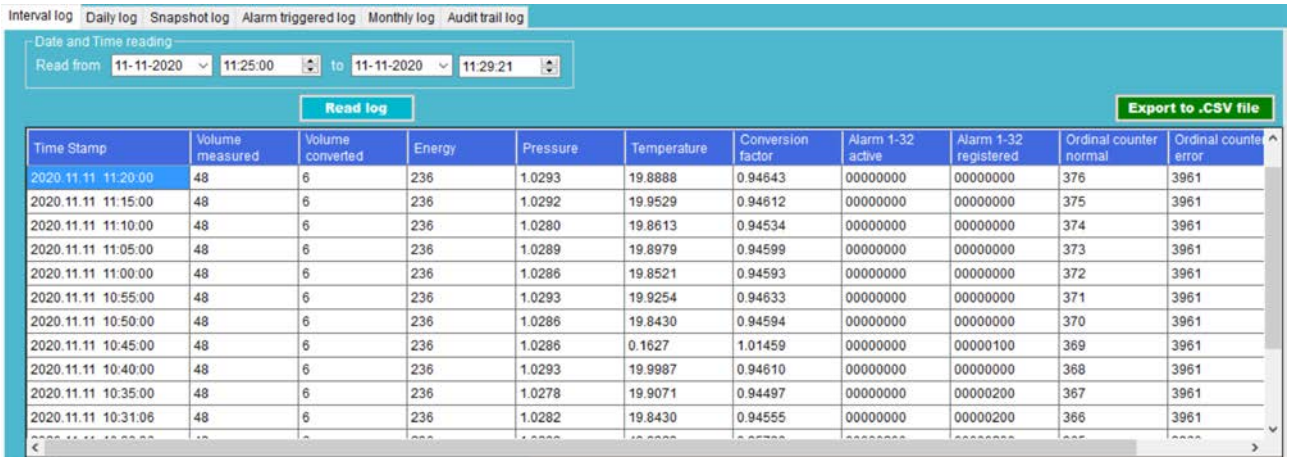


Time Stamp	Volume measured	Volume converted	Energy	Pressure	Temperature	Conversion factor	Alarm 1-32 active	Alarm 1-32 registered	Ordinal counter normal	Ordinal counter error
2020.11.11 11:30:00	48	6	236	1.0282	19.8796	0.94546	00000000	00000100	378	3961
2020.11.11 11:25:00	48	6	236	1.0289	19.9529	0.94587	00000000	00000100	377	3961
2020.11.11 11:20:00	48	6	236	1.0293	19.8888	0.94643	00000000	00000100	376	3961
2020.11.11 11:15:00	48	6	236	1.0292	19.9529	0.94612	00000000	00000100	375	3961
2020.11.11 11:10:00	48	6	236	1.0280	19.8613	0.94534	00000000	00000100	374	3961
2020.11.11 11:05:00	48	6	236	1.0289	19.8979	0.94599	00000000	00000100	373	3961
2020.11.11 11:00:00	48	6	236	1.0286	19.8521	0.94593	00000000	00000100	372	3961
2020.11.11 10:55:00	48	6	236	1.0293	19.9254	0.94633	00000000	00000100	371	3961

After all logs are read the Cancel button disappears again. To read specific logs a time interval can be set as from to date and time. The data of the read log is automatically stored in the install folder of the configuration program. The program will append any new logs to the existing log file automatically. The file name is: Intervallog_serial number.ilg.

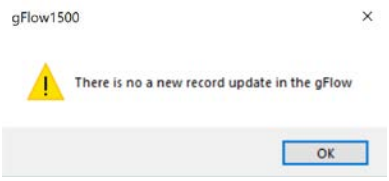
After all logs are read the log file can be exported from the configuration program into a .CSV file. This file can be imported into MS excel® as external data. The separator needs to be selected as comma.

The first time a logger is read, all records are read. From there on only the new records are read and will automatically be appended to the existing log records. A period for log reading can be defined as from - to. A start date and a stop date can be entered or selected.



Time Stamp	Volume measured	Volume converted	Energy	Pressure	Temperature	Conversion factor	Alarm 1-32 active	Alarm 1-32 registered	Ordinal counter normal	Ordinal counter error
2020.11.11 11:20:00	48	6	236	1.0293	19.8888	0.94643	00000000	00000000	376	3961
2020.11.11 11:15:00	48	6	236	1.0292	19.9529	0.94612	00000000	00000000	375	3961
2020.11.11 11:10:00	48	6	236	1.0280	19.8613	0.94534	00000000	00000000	374	3961
2020.11.11 11:05:00	48	6	236	1.0289	19.8979	0.94599	00000000	00000000	373	3961
2020.11.11 11:00:00	48	6	236	1.0286	19.8521	0.94593	00000000	00000000	372	3961
2020.11.11 10:55:00	48	6	236	1.0293	19.9254	0.94633	00000000	00000000	371	3961
2020.11.11 10:50:00	48	6	236	1.0286	19.8430	0.94594	00000000	00000000	370	3961
2020.11.11 10:45:00	48	6	236	1.0286	0.1627	1.01459	00000000	00000100	369	3961
2020.11.11 10:40:00	48	6	236	1.0293	19.9987	0.94610	00000000	00000000	368	3961
2020.11.11 10:35:00	48	6	236	1.0278	19.9071	0.94497	00000000	00000200	367	3961
2020.11.11 10:31:06	48	6	236	1.0282	19.8430	0.94555	00000000	00000200	366	3961

When no new records are available the following message appears.



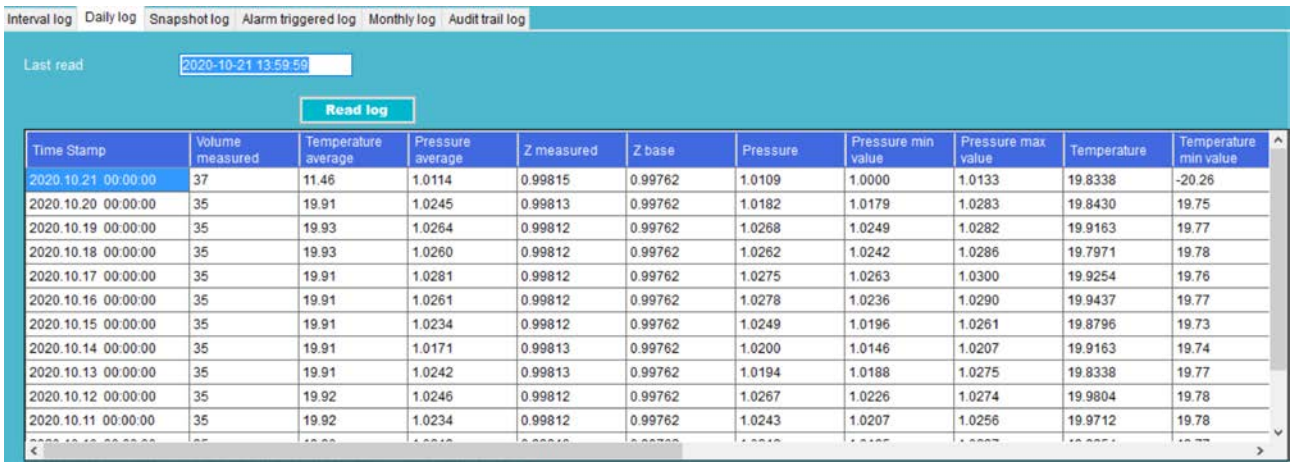
Using the interval logger for hourly data the logger complies with the German MessEV. When the interval is more than 1% off the value is marked with an Asterix upfront the time stamp: See example below for the 12:00 o' clock time stamp.

2021.11.30 14:00:00
2021.11.30 13:00:00
*2021.11.30 12:00:00
2021.11.30 10:00:00
2021.11.30 09:00:00
2021.11.30 08:00:00

This will be shown at all loggers.

4.2 Daily log

The daily log can be read where the (gas) day is defined from daily log time to daily log time 24 hours later. The daily log time needs to be entered as local time. The last reading is shown above the table.

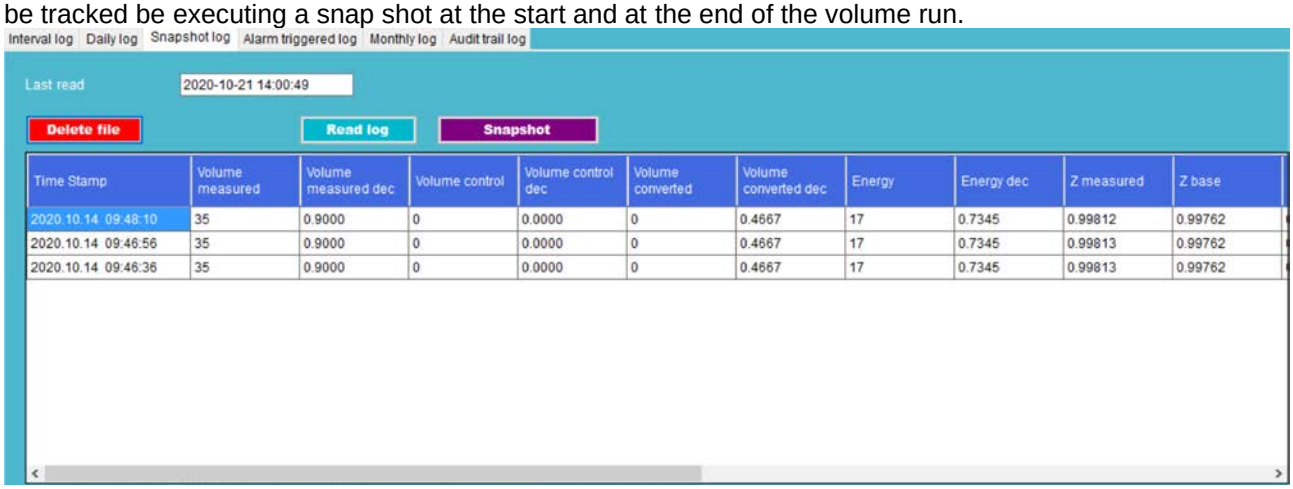


Time Stamp	Volume measured	Temperature average	Pressure average	Z measured	Z base	Pressure	Pressure min value	Pressure max value	Temperature	Temperature min value
2020.10.21 00:00:00	37	11.46	1.0114	0.99815	0.99762	1.0109	1.0000	1.0133	19.8338	-20.26
2020.10.20 00:00:00	35	19.91	1.0245	0.99813	0.99762	1.0182	1.0179	1.0283	19.8430	19.75
2020.10.19 00:00:00	35	19.93	1.0264	0.99812	0.99762	1.0268	1.0249	1.0282	19.9163	19.77
2020.10.18 00:00:00	35	19.93	1.0260	0.99812	0.99762	1.0262	1.0242	1.0286	19.7971	19.78
2020.10.17 00:00:00	35	19.91	1.0281	0.99812	0.99762	1.0275	1.0263	1.0300	19.9254	19.76
2020.10.16 00:00:00	35	19.91	1.0261	0.99812	0.99762	1.0278	1.0236	1.0290	19.9437	19.77
2020.10.15 00:00:00	35	19.91	1.0234	0.99812	0.99762	1.0249	1.0196	1.0261	19.8796	19.73
2020.10.14 00:00:00	35	19.91	1.0171	0.99813	0.99762	1.0200	1.0146	1.0207	19.9163	19.74
2020.10.13 00:00:00	35	19.91	1.0242	0.99813	0.99762	1.0194	1.0188	1.0275	19.8338	19.77
2020.10.12 00:00:00	35	19.92	1.0246	0.99812	0.99762	1.0267	1.0226	1.0274	19.9804	19.78
2020.10.11 00:00:00	35	19.92	1.0234	0.99812	0.99762	1.0243	1.0207	1.0256	19.9712	19.78

The first time a logger is read, all records are read. The data of the read log is automatically stored in the install folder of the configuration program. The program will append any new logs to the existing log file automatically. The file name is: Dailylog_serial number.ilg.

4.3 Snap shot

The snap shot logger is a logger which can be used for on-site calibration. Pre-defined data can be logged at the time the Snapshot button is activated. When e.g., a volume run is checked on site the log parameters can be stored during the volume run as often as required. The start and the beginning of all index can easily be tracked be executing a snap shot at the start and at the end of the volume run.

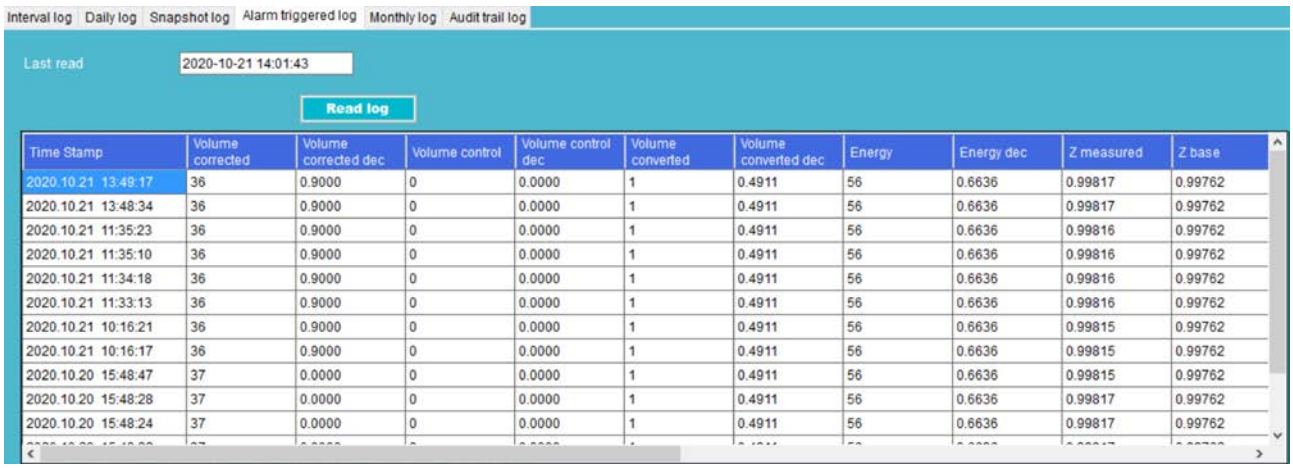


Time Stamp	Volume measured	Volume measured dec	Volume control	Volume control dec	Volume converted	Volume converted dec	Energy	Energy dec	Z measured	Z base
2020.10.14 09:48:10	35	0.9000	0	0.0000	0	0.4667	17	0.7345	0.99812	0.99762
2020.10.14 09:46:56	35	0.9000	0	0.0000	0	0.4667	17	0.7345	0.99813	0.99762
2020.10.14 09:46:36	35	0.9000	0	0.0000	0	0.4667	17	0.7345	0.99813	0.99762

The first time a logger is read, all records are read. The data of the read log is automatically stored in the install folder of the configuration program. The program will append any new logs to the existing log file automatically. The file name is: SnapshotLog_serial number.ilg.

4.4 Alarm triggered log

The alarm triggered log records all pre-defined parameters at the occurrence and disappearing of selected alarms in the alarm table. Each alarm where the box 1. Log and 0. Log is marked will force an entry in the Alarm triggered log.



Time Stamp	Volume corrected	Volume corrected dec	Volume control	Volume control dec	Volume converted	Volume converted dec	Energy	Energy dec	Z measured	Z base
2020.10.21 13:49:17	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99817	0.99762
2020.10.21 13:48:34	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99817	0.99762
2020.10.21 11:35:23	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99816	0.99762
2020.10.21 11:35:10	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99816	0.99762
2020.10.21 11:34:18	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99816	0.99762
2020.10.21 11:33:13	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99816	0.99762
2020.10.21 10:16:21	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99815	0.99762
2020.10.21 10:16:17	36	0.9000	0	0.0000	1	0.4911	56	0.6636	0.99815	0.99762
2020.10.20 15:48:47	37	0.0000	0	0.0000	1	0.4911	56	0.6636	0.99815	0.99762
2020.10.20 15:48:28	37	0.0000	0	0.0000	1	0.4911	56	0.6636	0.99817	0.99762
2020.10.20 15:48:24	37	0.0000	0	0.0000	1	0.4911	56	0.6636	0.99817	0.99762

The first time a logger is read, all records are read. The data of the read log is automatically stored in the install folder of the configuration program. The program will append any new logs to the existing log file automatically. The file name is: AlarmTrigLog_serial number.ilg.

4.5 Monthly log

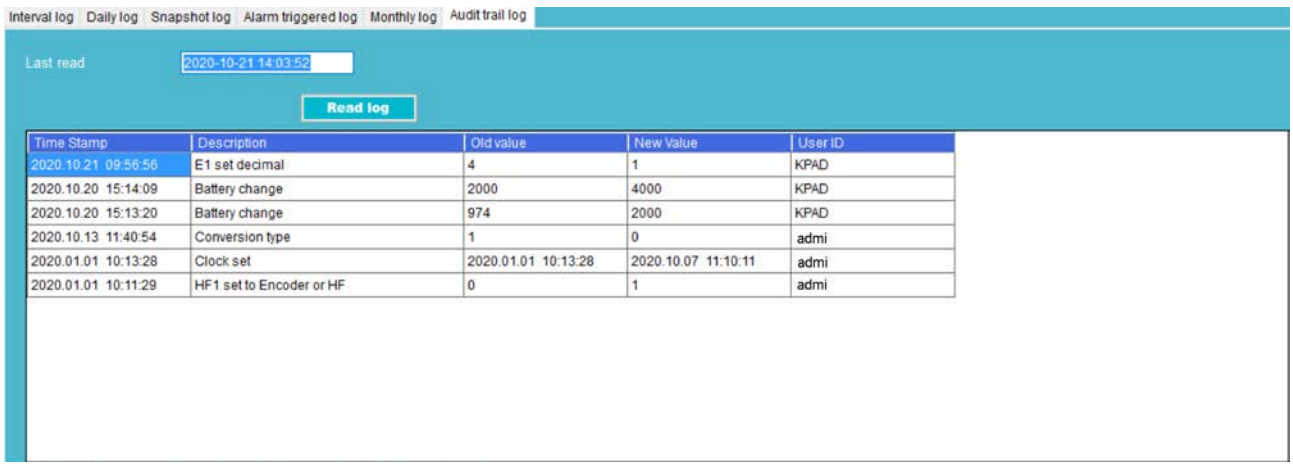
The monthly log records the pre-defined parameters at the end of each month. The month is defined from Daily log time at the 1st of the month up Daily log time the next month.

Time Stamp	Volume measured	Volume measured dec	Volume control	Volume control dec	Volume converted	Volume converted dec	Energy	Energy dec	Volume conv. last hour	Volume meas. last hour
2020.11.01 00:00:00	43	0.6000	0	0.0000	6	0.2122	236	0.0649	0	0

The first time a logger is read, all records are read. The data of the read log is automatically stored in the install folder of the configuration program. The program will append any new logs to the existing log file automatically. The file name is: MonthlyLog_serial number.ilg.

4.6 Audit trail log

The audit trail log records the metrological changes to the gFlow 1500 with a time stamp, a description, the old value, the new value and the User ID. Whenever the modifications are made through the keypad this is recorded as KPAD. Only limited modifications can be made without the use of the configuration program.

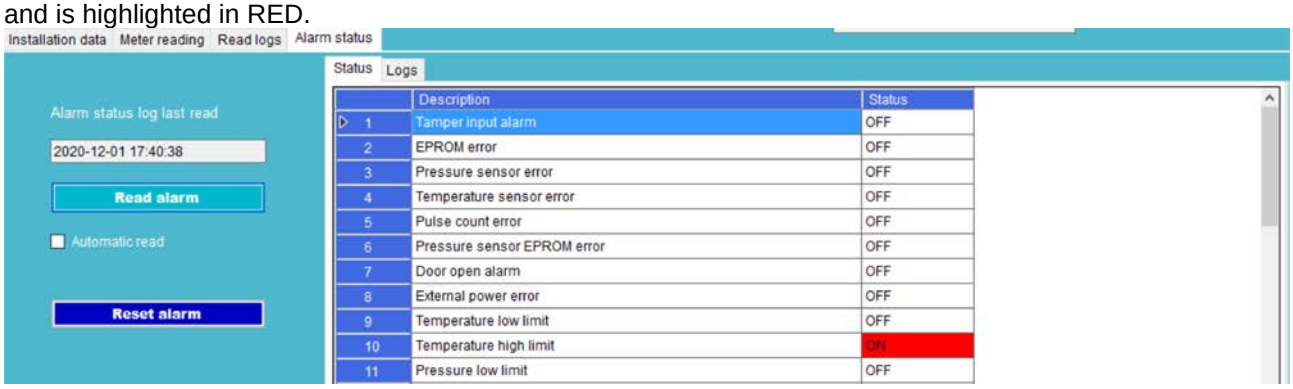


Time Stamp	Description	Old value	New Value	User ID
2020.10.21 09:56:56	E1 set decimal	4	1	KPAD
2020.10.20 15:14:09	Battery change	2000	4000	KPAD
2020.10.20 15:13:20	Battery change	974	2000	KPAD
2020.10.13 11:40:54	Conversion type	1	0	admi
2020.01.01 10:13:28	Clock set	2020.01.01 10:13:28	2020.10.07 11:10:11	admi
2020.01.01 10:11:29	HF1 set to Encoder or HF	0	1	admi

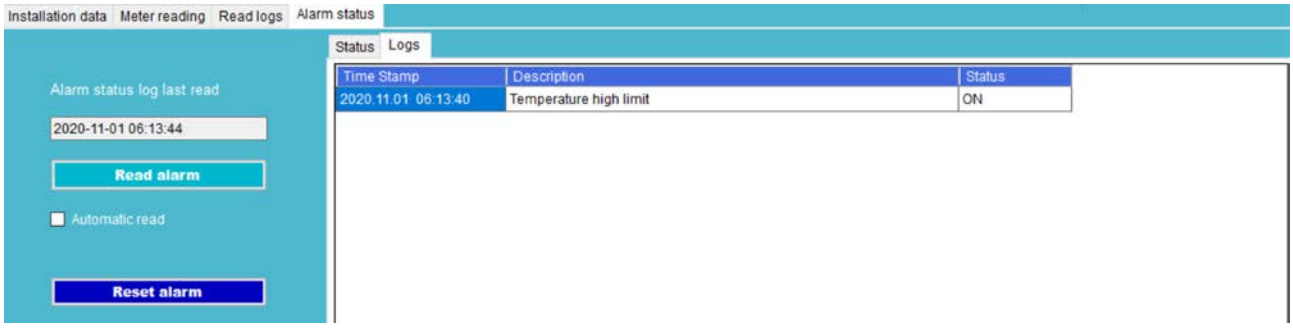
The first time a logger is read, all records are read. The data of the read log is automatically stored in the install folder of the configuration program. The program will append any new logs to the existing log file automatically. The file name is: AuditTraillog_serial number.ilg.

5.0 Alarm status

The current alarm status can be read at the TAB alarm status. Any active alarm will be shown as Status ON and is highlighted in RED.



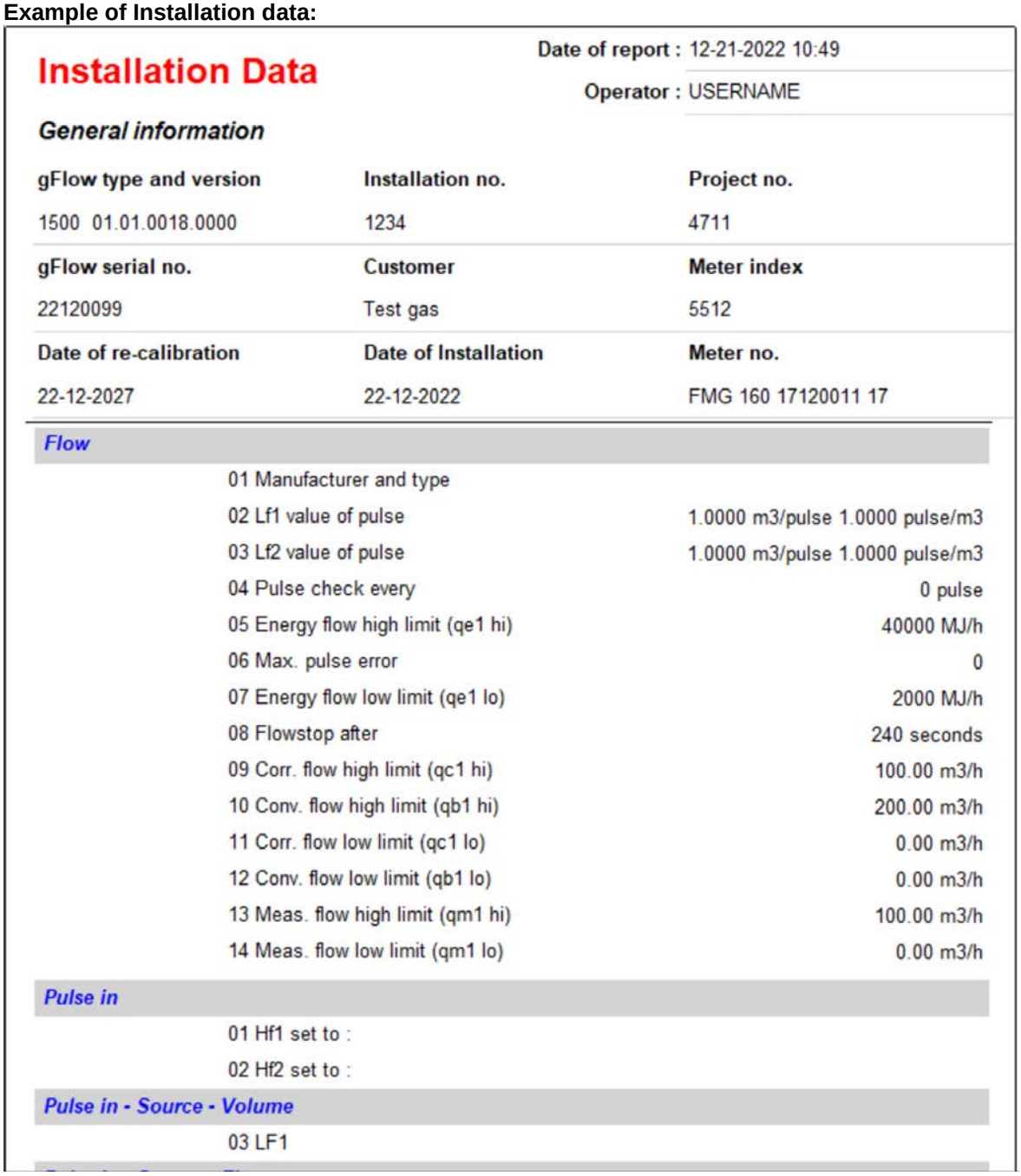
At alarm status Logs the alarm is logged with a time stamp, a description and the status. Every time the status is changing an entry will take place.



6.0 Report

At report a choice can be made to create an installation or meter reading report. The report is automatically created from the data in the gFlow 1500. The installation data represents all current operating data and settings of the gFlow 1500.

Example of Installation data:



Installation Data

Date of report : 12-21-2022 10:49

Operator : USERNAME

General information

gFlow type and version	Installation no.	Project no.
1500 01.01.0018.0000	1234	4711
gFlow serial no.	**Customer**	**Meter index**
22120099	Test gas	5512
Date of re-calibration	**Date of Installation**	**Meter no.**
22-12-2027	22-12-2022	FMG 160 17120011 17

Flow

01 Manufacturer and type	
02 Lf1 value of pulse	1.0000 m3/pulse 1.0000 pulse/m3
03 Lf2 value of pulse	1.0000 m3/pulse 1.0000 pulse/m3
04 Pulse check every	0 pulse
05 Energy flow high limit (qe1 hi)	40000 MJ/h
06 Max. pulse error	0
07 Energy flow low limit (qe1 lo)	2000 MJ/h
08 Flowstop after	240 seconds
09 Corr. flow high limit (qc1 hi)	100.00 m3/h
10 Conv. flow high limit (qb1 hi)	200.00 m3/h
11 Corr. flow low limit (qc1 lo)	0.00 m3/h
12 Conv. flow low limit (qb1 lo)	0.00 m3/h
13 Meas. flow high limit (qm1 hi)	100.00 m3/h
14 Meas. flow low limit (qm1 lo)	0.00 m3/h

Pulse in

01 Hf1 set to :	
02 Hf2 set to :	

Pulse in - Source - Volume

03 LF1	

The report can be printed in portrait and landscape and be saved as: MS Excel; PDF or MS Word format. In the header a search is possible find a specific item in the report.

Example of Meter Reading:

Meter Reading

Date of report : 12-21-2022 10:55

Operator : USERNAME

General information

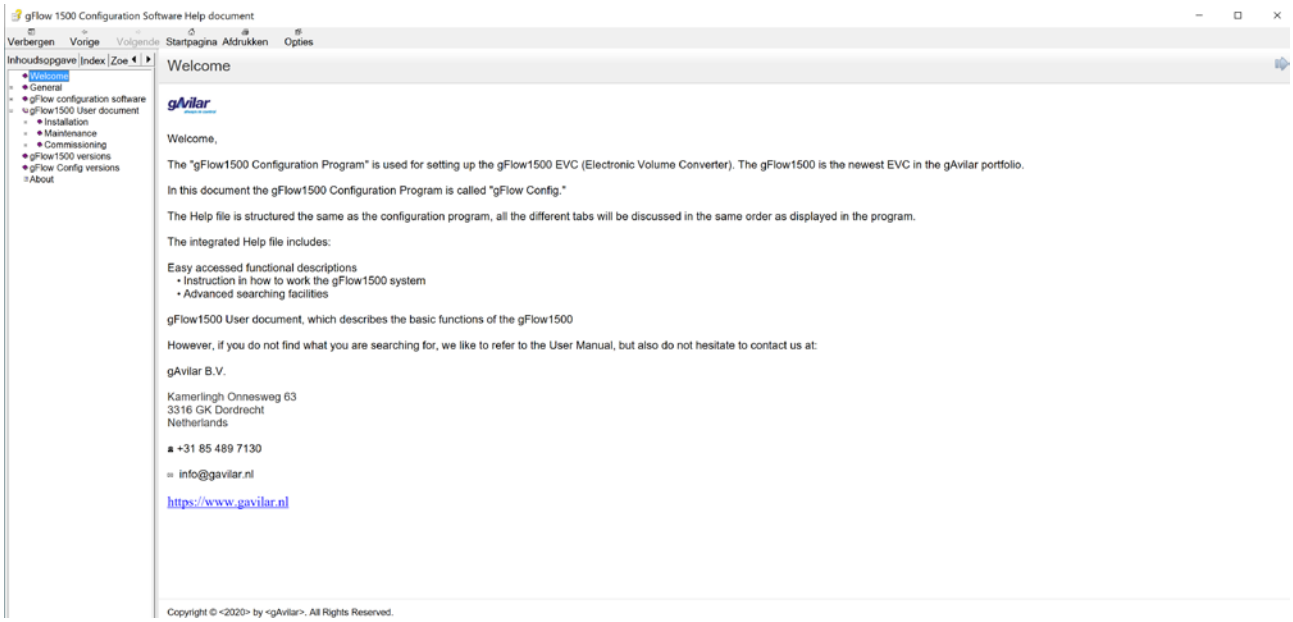
gFlow type and version	Installation no.	Project no.
1500 01.01.0018.0000	1234	4711
gFlow serial no.	**Customer**	**Meter index**
22120099	Test gas	5512
Date of re-calibration	**Date of Installation**	**Meter no.**
22-12-2027	22-12-2022	FMG 160 17120011 17

Meter data stream 1

01 Stream 1	
02 Volume converted	Vb 14.9023 m3
03 Volume corrected	Vc 65.4000 m3
04 Volume measured	Vm 65.4000 m3
05 Volume converted at error	Vbe 3.7921 m3
06 Volume corrected at error	Vce 65.4000 m3
07 Volume measured at error	Vme 65.4000 m3
08 Energy	----------
09 Energy at error	----------
10 Volume control	Vctrl 0.0000 m3
11 Volume control at error	Vctrle 0.0000 m3
12 Temperature	t 20.19 °C
13 Pressure	p 1.0256 bar
14 Conversion factor	C 0.94216
15 Flow energy	----------
16 Flow converted	Qb 0.00 m3/h
17 Flow corrected	Qc 0.00 m3/h
18 Flow measured	Qm 0.00 m3/h
19 Correction factor	CF 1.00000

7.0 Help

At Help a Help file can be opened. The help contains all relevant information to operated and maintain the gFlow 1500 during installation and operation.



Return to General

E. Installation

1.0 Unpacking

1.1 What's included

When unpacking the unit, please check that all components are included in the standard package:

- The gFlow 1500 unit + pressure sensor + temperature sensor
- Test certificate
- Declaration of conformity

If any accessories/options are delivered, it will be shipped in a separate package, with separate documentation.

1.2 At delivery

The gFlow 1500 converter is delivered fully mounted with temperature and pressure sensor, ready to install. Only if the installation requires more features, such as connection of inputs, outputs or serial communication, it is necessary to open the unit. For additional programming of operating parameters is necessary to use the optical head on the front of the gFlow. Writing of metrological data is only possible when the user is authorised for metrological changes.

1.3 gFlow Config.

A special software program is developed for setting up and reading data of the gFlow 1500. This program is called gFlow 1500 Config. The program can be downloaded from the gAvilar website. Once installed, the integrated Help File is a useful tool. The program is explained in section D, Setup data.

Essential features:

- Customized setup of installation parameters
- Remote configuration via fixed cable or modem
- Reports for setup data and meter data
- Advanced data logging
- Audit trail

Certain items can be changed directly on the gFlow 1500 without the need for the configuration program. The procedure for entering data using the keypad is described in section A, Introduction 1.5.

Note: the level 1, 2 or 3 password may have been changed due to metrological requirements. Consult your supplier for more information.

2.0 Description

The gFlow 1500 is contained in a precision aluminium cabinet, enclosure class IP 65. The cabinet is designed for either wall mounting or mounting directly on the gas meter or on the gas pipe using a special installation bracket.

A. Metrological part

The cover contains the main board, the displays, the keypad, the IR-interface and other. Most electronic components are SMD-components (Surface Mounted Device), placed on the main- and the I/O board behind a metrological seal, not accessible to the user.

The hardware security DIP-switches are also included in the cover and accessible through a sealable hole in the cover plate. The input- and output terminals are located on the I/O board and the metrological inputs are mechanically sealed after calibration in the factory. These seals cannot be broken by the user but only by authorised persons or by the local metrological institute.

B. User part

The battery(ies) is (are) contained in a special battery holder on the cover plate of the main board and each battery has its own connector. All additional inputs and outputs including the serial communication ports are located on the I/O board.

C. Optional

- gFlow 1500 Configuration Program (gFlow config.)

2.1 Definitions

Technicians are qualified persons educated or trained to mount, operate, and also troubleshoot technically correct and in accordance with safety- and metrological regulations.

ATEX-scheduled means that the text/drawings cannot be changed without notification of certified body. ATEX relevant data is available at section B, Safety.

Please see Document revision history for further details.

3.0 General recommendations

Environment:

The gFlow 1500 is designed in accordance IEC 60529 to IP 66, for limited outdoor installation. However, if the unit is installed outdoor, or in a high humidity environment, it is recommended to use a special protective housing or at least a shelter, suitable for outdoor weather conditions.

Hazardous areas

The gFlow 1500 contains batteries and is to be considered always powered. Installation in a hazardous area or while an ignitable gas mixture is present is not allowed. Always follow local regulations and at least IEC60079-14 (Explosive atmospheres - Part 14: Electrical installations design, selection and erection) or other local codes of practice to ensure a safe environment while performing maintenance.

- Replacement of batteries inside explosive atmospheres is not allowed.
- Do not open the enclosure while an explosive atmosphere is present.
-

Electrostatic discharge

The gFlow 1500 surface has examined to be safe when there is no risk of electrostatic discharges during the intended use.

Case must be taken not to use the gFlow 1500 in an environment with a prolific charge generating mechanism that can affect the device. Examples where not to use the gFlow 1500:

- Areas where a pneumatic transfer of powders occur.
- Areas where charge spraying in a powder coating process occurs.
- Areas where a direct airflow that could cause a charge transfer is present.

When cleaning, only use a wet cloth to prevent charge transfer by friction.

Pressure sensor

Always use the reference pressure tap (pm or pr) at the gas meter, for connecting the pressure sensor. If this is not available, use a pressure tap upstream or downstream to the meter. Install a valve and a check tap between meter and pressure sensor, to allow a possibility for check and easy replacement.

Temperature sensor

Install the temperature sensor in the meter pocket or in a sensor pocket upstream or downstream to the meter depending on the meter type.

Note:

For positive displacement meters the temperature sensor pocket should be upstream to the meter and for Turbine gas meters and Ultra Sonic gas meters downstream from the meter. Consider 2 to 3 times the diameter of the pipe.

4.0 Installation

4.1 General

The gFlow 1500 must be installed according to local regulations for installation in hazardous area (Ex area).

All installation and service has to be handled by skilled Service Personnel.

Only gAvilar delivered accessories are allowed to be used, battery (batteries) has(have) to be disconnected when connections are made or on inserting/removing parts from the unit. Ignorance of this important instruction may harm the electronics of the gFlow 1500.

All equipment needs to be connected using ATEX approved isolators or safety barriers

Make sure that the installation is properly prepared:

- Pressure tap available, either at the meter or at the inlet pipe.
- Line pressure and pressure range of gFlow 1500 matches (check pressure sensor)
- Pulse valve for the meter pulse output and the gFlow 1500 pulse input matches.
- Cable lengths on pressure sensor and temperature sensor can't be changed.

Tools for mounting/dismounting cables

Hex key wrench	T4 mm	Enclosure screw, Cabinet mounting screw
Screw driver slotted, parallel tip	2,5 mm	terminal button activation
Long nose pliers		Useful when mounting wires

4.2 Mounting gAVC 1200

Wall mounting

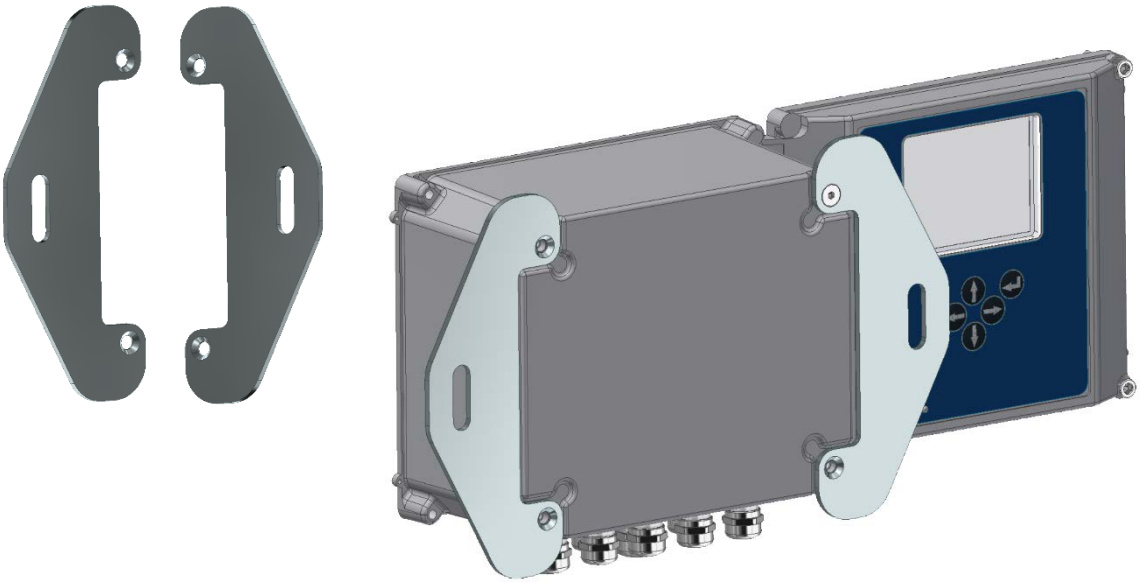
The instrument is for vertical mounting, only (max 40° from vertical). Cable outlet shall be turned downwards.
The gFlow 1500 is mounted on the wall with the optional mounting bracket. To mount the installation bracket there are 4 holes at the back of the gFlow 1500 housing with M5 thread and 15 mm deep.

Optional mounting bracket (gAvilar part no 98019)

The mounting bracket for the gFlow 1500 can be used for meter or skid mounting. It is supplied with 4 mounting screws to fit directly on the gFlow 1500 housing.

Optional mounting bracket (gAvilar part no 98020)

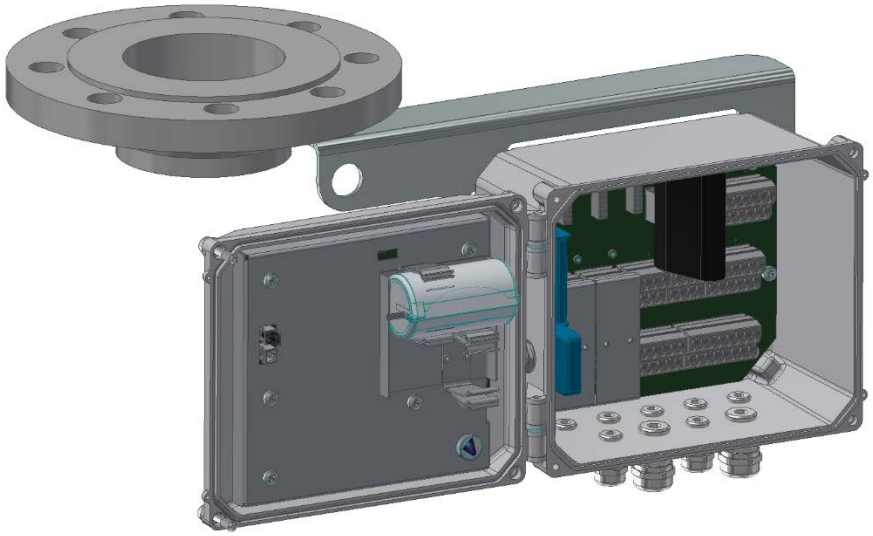
For wall mounting the brackets can be mounted directly on the back of the gFlow 1500 housing.



Meter or skid mounting

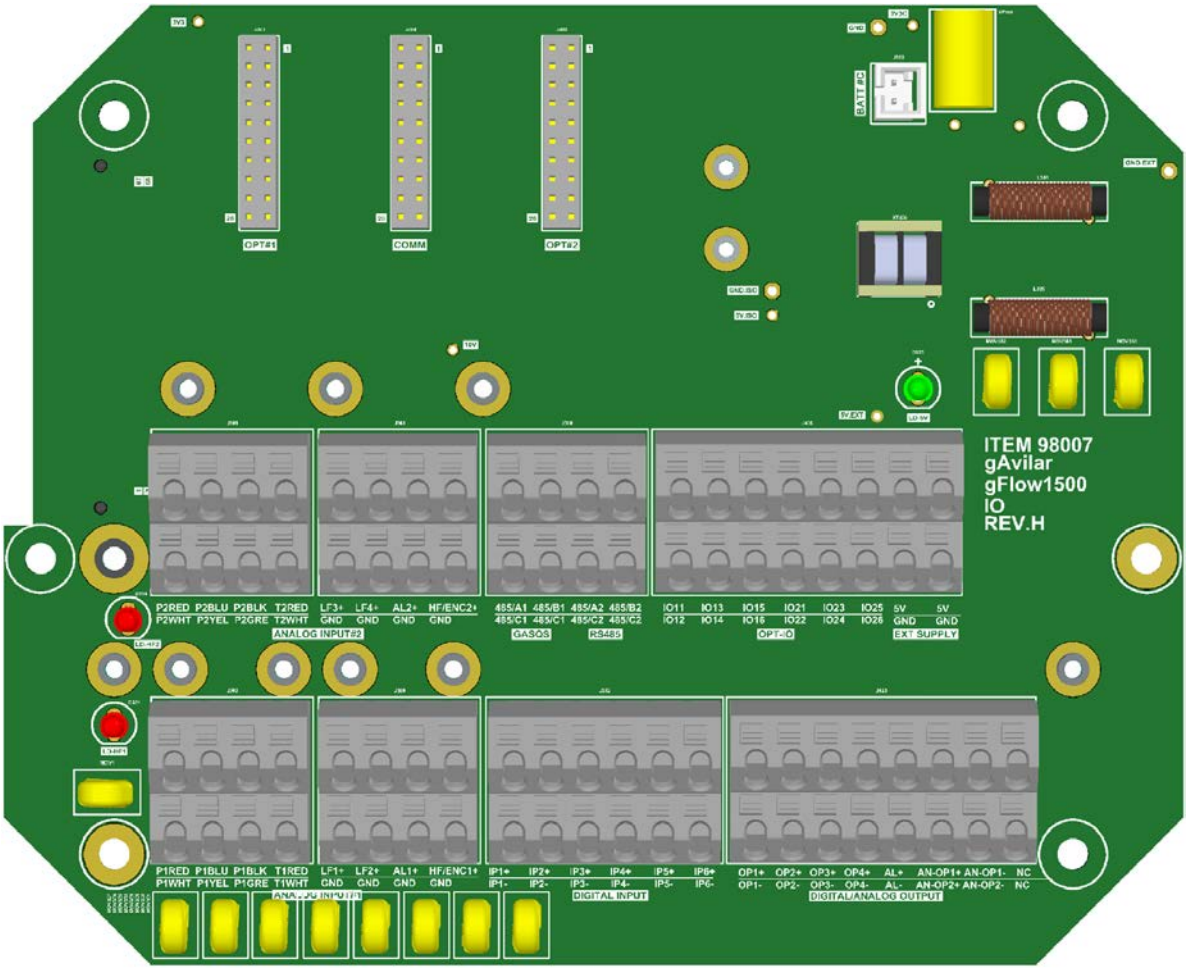
Vertical flange

Horizontal flange



4.3 Wire connections

Terminals



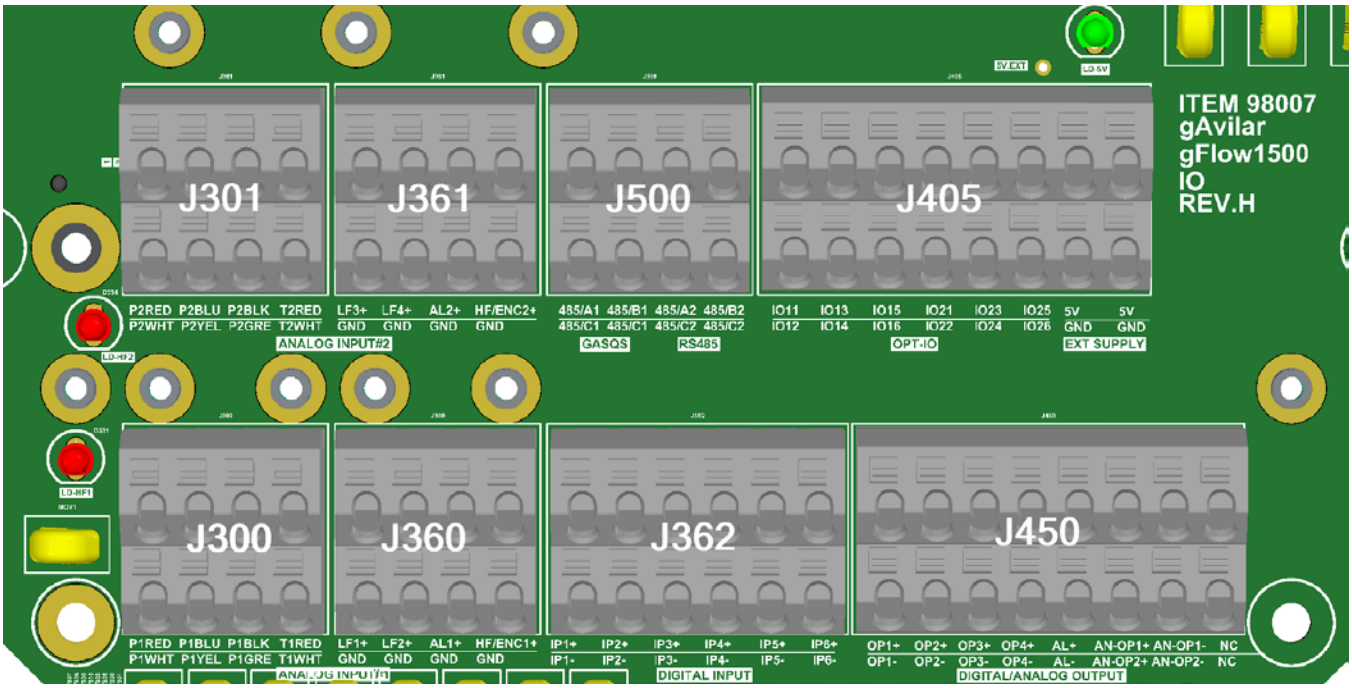
The cables are tightened in the cable glands. It is important to use shielded cable, the shield is connected to the insert in the cable gland. The gFlow is standard equipped with 7 of M12 and 2 of M16 glands.

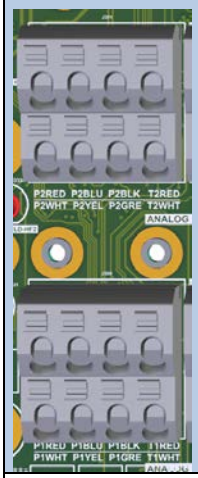
Cable gland

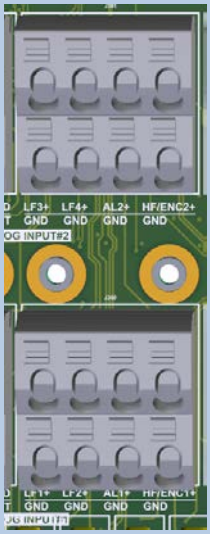
shielding insert

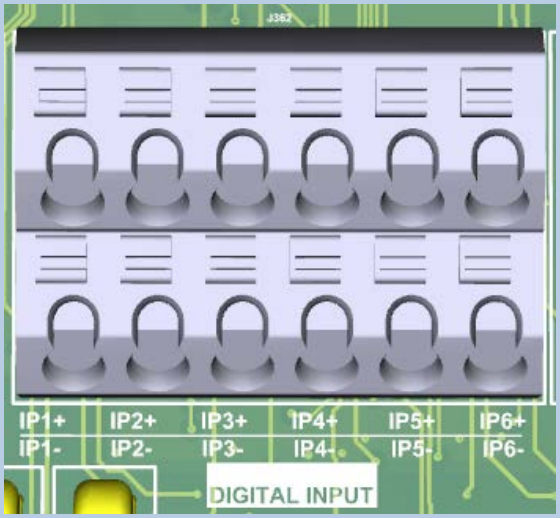
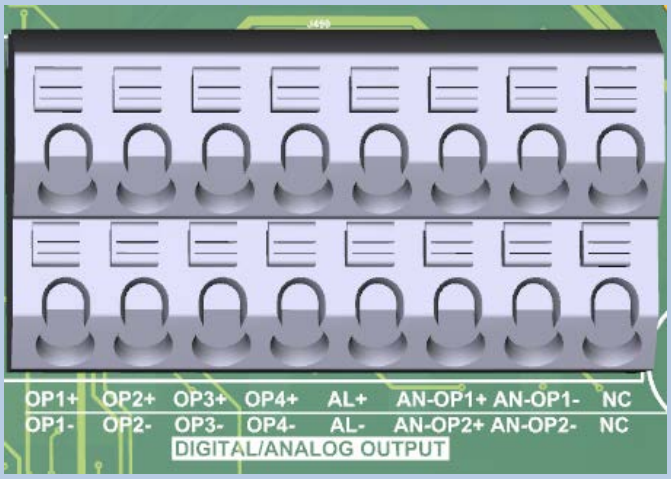
Keep the unshielded wires to the screw terminals as short and direct as possible, to avoid EMC interference.

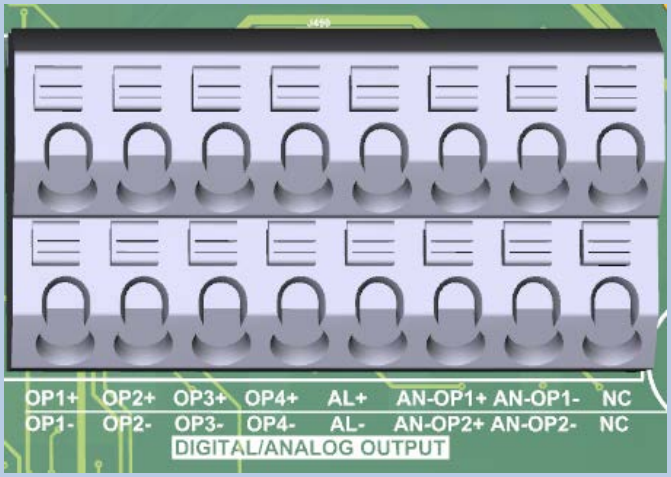
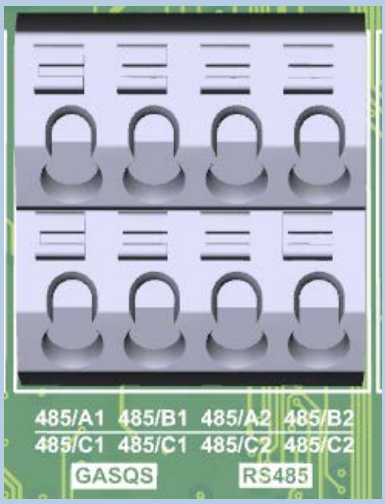
4.3.1Terminal arrangement



ANALOG INPUT #1 Factory sealed (don't remove)  	P2/T2 forms a single circuit that must be kept isolated from earth. Allowed Co/Lo for P2/T2 combined: Co = 1 µF Lo = 32 µH or 32 m cable I.S. parameters: Uo = 5.4 V Io = 477 mA Po = 644 mW Ci = 6.2 µF Li = 3 µH	
Pressure sensor P1	Terminal J300	
P1WHT	Pressure sensor supply -	White
P1YEL	Pressure sensor, pressure signal out	Yellow
P1GRN	Pressure sensor, serial data	Green
P1RED	Pressure sensor supply +	Red
P1BLU	Pressure sensor temperature out	Blue
P1BLK	Pressure sensor, serial clock	Black
Cable screen	Metal part is connected in M12 gland	
Temperature sensor T1	Terminal J300	
T1WHT	Pt 1000 temperature sensor	WHITE
T1RED	Pt 1000 temperature sensor	RED
Pressure sensor P2	Terminal J301	
P2WHT	Pressure sensor supply -	White
P2YEL	Pressure sensor, pressure signal out	Yellow
P2GRN	Pressure sensor, serial data	Green
P2RED	Pressure sensor supply +	Red
P2BLU	Pressure sensor temperature out	Blue
P2BLK	Pressure sensor, serial clock	Black
Cable screen	Metal part is connected in M12 gland	
Temperature sensor T2	Terminal J301	
T2WHT	Pt 1000 temperature sensor	WHITE
T1RED	Pt 1000 temperature sensor	RED

ANALOG INPUT #1 Factory sealed (can be replaced after installation)  	AL1 / AL2 / LF1 / LF2 / LF3 / LF4 form a single circuit that must be kept isolated from earth. Co/Lo or total cable length is allowed to be: Co = 2.5 µF Lo = 3 mH or 1000 m cable of unspecified cable according to IEC60079-14, all AL/LF inputs combined I.S.parameters: Uo = 5.4 V Io = 1 mA Po = 1 mW Ci = negligible Li = 2 mH HF/ENC1 and HF/ENC2 are 2 separate intrinsically safe circuits, that must be kept isolated from earth. Co/Lo or cable length for each circuit is allowed to be: Co = 1 µF Lo = 500 µH or 500 m cable I.S.parameters: Uo = 9.6 V Io = 20 mA Po = 50 mW Ci = 25 nF Li = 306 µH
Pulse- and alarm inputs	Terminal J360
LF1+	LF1 pulse input +
GND	LF1 pulse input -
LF2+	LF2 pulse input +
GND	LF2 pulse input -
AL1+	Alarm 1 input +
GND	Alarm 1 input -
HF/ENC1+	HF1 or Encoder1 input +
GND	HF1 or Encoder1 input -
Pulse- and alarm inputs	Terminal J361
LF3+	LF3 pulse input +
GND	LF3 pulse input -
LF4+	LF4 pulse input +
GND	LF4 pulse input -
AL2+	Alarm 1 input +
GND	Alarm 1 input -
HF/ENC2+	HF1 or Encoder1 input +
GND	HF1 or Encoder1 input -

DIGITAL INPUT 	IP1/IP2/IP3/IP4/IP5/IP6 form a single circuit that must be kept isolated from earth. Co/Lo or total cable length is allowed to be: Co = 3.4 µF Lo = 1 mH or 500 m cable I.S.parameters: Uo = 5.4 V Io = 1 mA Po = 1 mW Ci = negligible Li = negligible
Status inputs	Terminal J362
IP1+	Status input 1 +
IP1-	Status input 1 -
IP2+	Status input 2 +
IP2-	Status input 2 -
IP3+	Status input 3 +
IP3-	Status input 3 -
IP4+	Status input 4 +
IP4-	Status input 4 -
IP5+	Status input 5 +
IP5-	Status input 5 -
IP6+	Status input 6 +
IP6-	Status input 6 -
DIGITAL/ANALOG OUTPUT 	OP1 / OP2 / OP3 / OP4 / AL are 5 separate intrinsically safe circuits, that are isolated from earth and each other. Earthed shunt safety barriers with positive output may be used to prevent the addition of Ui of OP1 / OP2 / OP3 / OP4 / AL to AN-OP1 and AN-OP2 inside the gFlow 1500. Alternatively, isolating barriers (like P+F isolating switch amplifier KFD2SR2-Ex1.W.LB) may be used provided the cables of each circuit are isolated from earth either by: 0.25 mm solid isolation by the use of Type A or Type B cable, fixed and protected against damage (IEC60079-14 §16.2.2.7 and §16.2.2.8). I.S.parameters: Ui = 14.7 V Ii = 147 mA Pi = 540 mW Ci = negligible Li = negligible Co/Lo or cable length for each circuit depends on the connected barrier.
Pulse and Analog output	Terminal J450
OP1+	Pulse output 1 +

OP1-	Pulse output 1 -
OP2+	Pulse output 2 +
OP2-	Pulse output 2 -
OP3+	Pulse output 3 +
OP3-	Pulse output 3 -
OP4+	Pulse output 4 +
OP4-	Pulse output 4 -
AL+	Alarm output +
AL-	Alarm output -
DIGITAL/ANALOG OUTPUT 	AN-OP1 / AN-OP2 are 2 separate intrinsically safe circuits, that are isolated from earth and each other. Only earthed shunt safety barriers with positive output (like MTL Z728) may be used to prevent the addition of Ui of AN-OP1 and AN-OP2 inside the gFlow 1500. I.S.parameters: Ui = 28 V Ii = 95 mA Pi = 650 mW Ci = 63 nF Li = negligible Co/Lo or cable length for each circuit depends on the connected Shunt Safety barrier. In case of a linear barrier with Uo = 28 V and Io = 93 mA, Cc < 20 nF and Lc < 200 µH or 100 m cable.
AN-OP1+	Analogue output 1 +
AN-OP1-	Analogue output 1 -
AN-OP2+	Analogue output 2 +
AN-OP2-	Analogue output 2-
NC	Not connected
NC	Not connected
RS485 	485/1 and 485/2 are 2 separate intrinsically safe circuits, that must be kept isolated from earth. Co/Lo or cable length for each circuit depends on the connected barrier or associated apparatus. See below from recommended options. I.S.parameters: Ui = 5.4 V / Uo = 5.4 V Ii = 225 mA / Io = 128 mA Pi = 304 mW / Po = 172 mW Ci = 1.3 µF Li = 306 µH **RS485 serial communication** A suitable RS485 isolating barrier may be G. M. International D1061S isolating repeater (ATEX certificate Presafe 16ATEX8917) with I.S. parameters: Ui = 30 V / Uo = 3.7 V Ii = 282 mA / Io = 225 mA / Po = 206 mW Ci = 0 µF Li = 0 µH cable capacitance Cc < 1.2 µF and inductance Lc < 94 µH. This allows < 94 m of unspecified cable length.

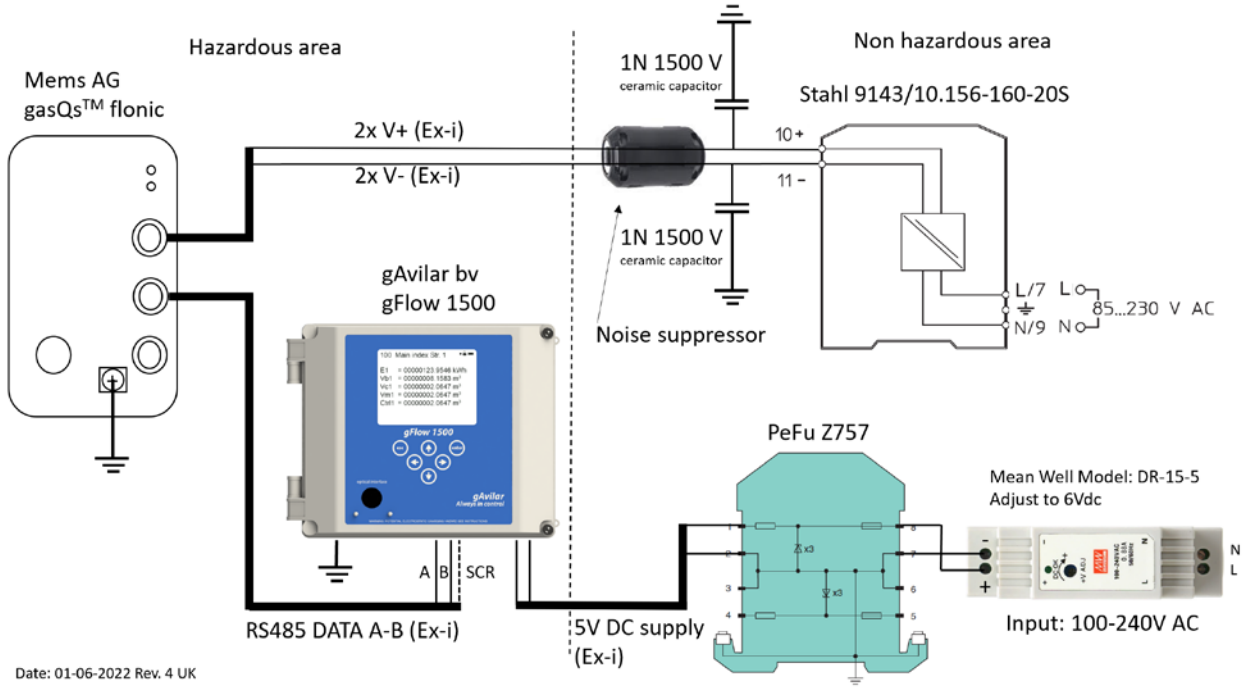
Serial communication	Terminal J500
485/A1	RS485 A + only for gasQs sensor
485/B1	RS485 B – only for gasQs sensor
485/C1	RS485 Common GND
485/C1	RS485 Common GND
485/A2	RS485 A +
485/B2	RS485 B -
485/C2	RS485 Common GND
485/C2	RS485 Common GND

gasQs™

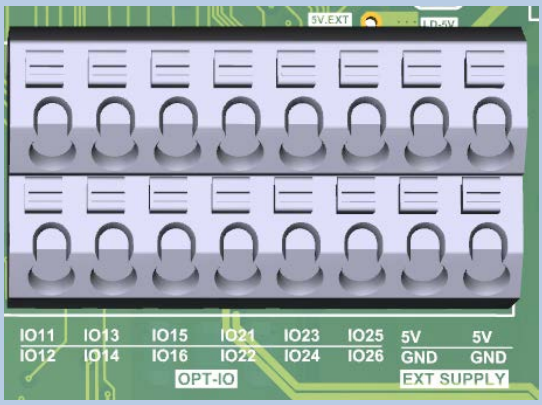
When applying a Mems AG gasQs™ flonic sensor (ATEX certificate SEV18ATEX0111 X) with I.S.parameters:
Ui = 7.5 V / Uo = 4.1 V
Ii = 750 mA / Io = 91 mA
Pi = 1.4 W / Po = 94 mW
Ci = 1.1 µF
Li = 52 µH
cable capacitance Cc < 0.1 µF and inductance Lc < 42 µH. This allows < 42 m of unspecified cable length.

NOTE: GASQS FLONIC SENSOR NEEDS AN INTRINSICALLY SAFE ISOLATING BARRIER TO PROVIDE POWER UNLESS SUFFICIENT POTENTIAL EQUALIZATION EXISTS. A SUITABLE ISOLATING BARRIER MAY BE STAHL 9143/10-156-160-20S. THIS PROVIDES A RECTANGULAR POWER SUPPLY EX IB WITH UO/IO/PO 15.6 V / 160 MA / 2.496 W.

Typical interconnection between gFlow 1500, gasQs™ and (isolating) barriers.



OPTIONAL I/O and EXTERNAL SUPPLY	I/O IO11 – IO26 Not connected EXT SUPPLY is a single intrinsically safe circuit, isolated from earth. Only one of Zener barrier type P+F Z757 in A1 configuration (ATEX certificate BAS01ATEX7005) shall be used with Cc < 200 nF and Lc < 21 uH, or 20 m of unspecified cable according to IEC60079-14.



Option board and power supply	Terminal J405
IO11	Connected to option #1 pin 15
IO12	Connected to option #1 pin 16
IO13	Connected to option #1 pin 17
IO14	Connected to option #1 pin 18
IO15	Connected to option #1 pin 19
IO16	Connected to option #1pin 20
IO21	Connected to option#2 pin 15
IO22	Connected to option#2 pin 16
IO23	Connected to option#2 pin 17
IO24	Connected to option#2 pin 18
IO25	Connected to option#2 pin 19
IO26	Connected to option#2 pin 20
5V	+5V dc supply from ATEX power supply
GND	0V dc supply from ATEX power supply
5V	+5V dc supply from ATEX power supply
GND	0V dc supply from ATEX power supply

4.3.2 Cable connections:

General:

For each circuit Ci and Li have been determined assuming both occur simultaneously. As an alternative the maximum attachable cable length is given assuming unspecified cable according to IEC60079-14 is used (200pF/m, 1uH/m).

The cable glands at the bottom of the gFlow 1500 can handle following cable size:

Gland M12	Cable diameter of min - max:	4mm - 7mm
Gland M16	Cable diameter of min - max:	6mm - 10mm
	Wire cross section min - max:	0.25 mm^2 – 1.5 mm^2
	Wire insulation min:	0.25mm (When installed in hazardous areas)

When installed in hazardous areas the wire insulation of min. 0.25 mm has to be checked.

Recommended types:
Soft cables: LiYCY 0.75 to 1.5mm^2, for measurement etc.
Hard cables: HSPS 0,5 to 1.5mm^2 twisted pairs, shielded.
Shielded cables, suitable for measurement:

Spring clamp terminals:

Manufacturer: Wago
Range: solid wire 0.5 to 1.5 mm^2
fine stranded wire 0.75 – 1.5 mm^2
fine stranded with ferrule 0.5 – 1.0 mm^2

4.3.3 Earthing

Earth is mainly for protection (requirement) and EMC (advantage):

Special requirements in hazardous area: See B. Safety.

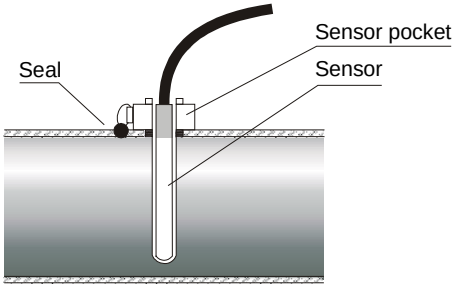
The earth connection can be made to an M4 bolt at the bottom of the gFlow 1500.

4.4 Temperature sensor

If the temperature sensor is mounted by gAvilar (when delivered), the system is already configured according to the temperature sensor specifications.

If the temperature sensor is to be mounted on site, follow the following instructions:

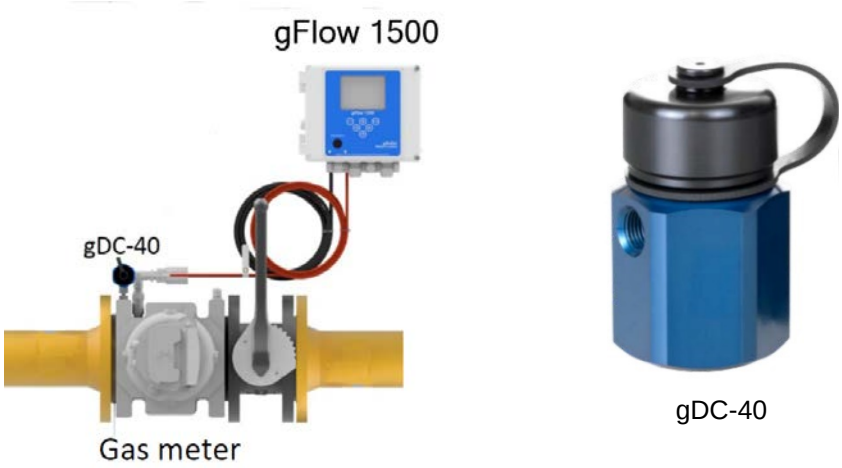
- A label with a bar code is attached to the temperature sensor cable. The code contains the serial number of the sensor and the calibration data. The calibration data insures an accurate measurement of the temperature.
- Enter the bar code number into gAVC Config. (in the "Installation data", "Temperature" tab). Then the system will detect the correct settings.
- After the temperature sensor is installed in the Sensor pocket, it must be sealed with a wire.

Sensor pocket mounting


4.5 Pressure sensor

The pressure sensor is mounted in the gFlow 1500 unit by gAvilar (when delivered).

The pressure sensor is installed to the pressure tap, either at the meter, or at the inlet pipe. It is recommended to install the pressure sensor, using a connection pipe system



gDC-40

gAvilar also offers a wide range of valves suitable for use with the gFlow 1500. The common type used for volume converters is the gDC-40.

4.6 LF Pulse inputs

There are 2 available LF-inputs on the gFlow 1500 unit. These inputs can be used separately or as a LF-LF pulse check. This function is configured in the gFlow Config. program.

The inputs can be connected to a reed-contact, transistor (FET) or Wiegand sensor.

Pulse transmitter requirements

For correct measurement, the pulse transmitter must fulfil the following requirements (worst case):

Pulse inputs	
Pull up supply	Power supply 3..3.6VDC
Pull up resistor	47Kohm (open pulse input) 1 Mohm (closed pulse input)
Pulse on, starting current	Max. 60 μA
Pulse on, current (continuous)	Max. 4 μA

High trigger level	1.3 to 2.5VDC (PS=3.6VDC)
Low trigger level	0.7 to 1.8VDC (PS=3.6VDC)
Hysteresis	0.3 to 1.2VDC (PS=3.6VDC)
Max. Pulse frequency	3 Hz
Fastest "On-time"	33 m sec.
Fastest "Off-time"	300 m sec.

Configuration

The pulse inputs are configured in gFlow Config program.

4.7 HF pulse inputs

The gFlow 1500 has 2 of NAMUR inputs that can be used for HF pulse input or for Encoder input. The actual flow (measured flow) is calculated based on the number of pulses received in the last second. Based on the measured flow (Qm) the corrected (Qc) flow is calculated. Increments on the measured and corrected volume are done, and at last the measured- and corrected flow are checked for high- or low flow alarm.

The gFlow 1500 uses measured flow, measured volume, corrected flow and corrected volume from the HF input instead of from LF inputs. The NAMUR ports can only operated from the external power supply, however when used for Encoder input also battery operation can be selected. The settings are chosen in the Config. Program.

Note: NAMUR is in conformity with IEC 60947-5-6

5.0 Flow meter input

5.1 General

The input from a gas meter to the gFlow can either be an LF pulses device, an HF pulse device (only on permanent power) or an Encoder. The Encoder can operate in external power mode or in battery mode.

Meter input value	Meter power supply	Meter Max. frequency (50% duty cycle)	Able to use tamper functionality
LF	3,6 V	3	Yes
Namur	8.2 V	5000	Yes
Encoder	8.2 V	2400 BAUD	Yes

Default value = LF

5.2 Tamper functionality

For each possible input type the tamper functionality is can be used. The tamper functionality makes it possible to detect fraud/malfunction of the connection to the meter (e.g. putting strong magnets on the gas meter index, either due to damaged wire or damaged transmitter.

Tamper functionality can be activated/deactivated in the alarm table.

5.3 Diode LED's

Each NAMUR input is also equipped with a red LED to indicate the state of the input. The LED will be on if the input is activated (current is running). Flashing of the LED indicates incoming HF pulses or data transmission of the connected Encoder.

The led can be activated using the keypad in page 343 or by using the configuration program in the TAB HF (Read/activate) or the TAB Encoder (Read/activate).

The LED indication is only active for one minute at the time (to save battery consumption. Just activate the function again if longer time is needed for test).

5.4 Alarms

The following alarms may occur:

- HF/HF comparison
- LF/HF comparison
- HF/Encoder comparison
- LF/Encoder comparison

If any of the above alarms is active this is controlling alarm no 5 (Pulse count error) providing alarm no. is enabled.

5.5 Pulse outputs

There are 4 pulse outputs on the gFlow 1500. The outputs can be used to repeat the converted volume, unconverted volume and energy.

Configuration

The pulse outputs are set up in the gFlow Configuration program.

- The parameters below can be selected for all pulse outputs:
  1) Converted volume
  2) Measured volume
  3) Converted volume at error
  4) Measured volume at error
  5) Energy
  6) Energy at error
  7) Volume control

- The pulse output scaling factor
  1) 0.1 The output transmits 10 pulses for each whole increment of the parameter.
  2) 1 The output transmits 1 pulse for each whole increment of the parameter.
  3) 10 The output transmits 1 pulse for each 10 whole increments of the parameter.
  4) 100 The output transmits 1 pulse for each 100 whole increments of the parameter.
  5) 1000 The output transmits 1 pulse for each 1000 whole increments of the parameter.

- The pulse length in msec:
  1) 30
  2) 60
  3) 125
  4) 250
  5) 500

5.6 Alarm inputs

The gFlow 1500 has an alarm input is also called a "Tamper alarm". This input can be used for connecting

an alarm circuit. Modern gas meters are frequently equipped with a tamper output. The tamper output is usually a N.C. contact (reed switch) and can be monitored by the tamper input of the gFlow 1500. The alarm input is set "ON", when the alarm circuit is opened.

When the "Tamper alarm" is activated, the alarm pictogram is displayed on the gFlow 1500 display. The alarm pictogram disappears after the tampering is cleared.

5.7 Alarm output

The alarm output may be connected to an external alarm input. The output is controlled by the settings in the alarm table.

Current alarms:

As long as the origin of the alarm persists, the current alarm is present. When the fault has been corrected, the alarms are cleared again depending on the settings in the alarm table. If the alarm is still present, after clearing, the alarm pictogram will be shown again.

Stored alarm:

All alarms are stored in the alarm log, with time stamp, alarm type and status (if the alarm is "ON " (Active) or "OFF" (not active)). From here the alarm is cleared.

In the gFlow Configurations program the user can categorize the alarms, set up whether to detect both when the alarm occurs and when the alarm disappears.

5.8 IR-interface/Permanent Remote Reading connection

The gFlow 1500 and the Configuration program can be connected in 2 ways:

- Via the IR-interface. The IR-interface is attached to the gFlow 1500 with the built-in magnet.
- Permanently via the serial link on Port 1. Port 1 can operate at higher BAUD rates up to 38400.

5.9 Earthing and connection of conducting cable screens

Earth connection:

gFlow 1500 mounted in zone 1 requires an earth connection.

Outside the gFlow 1500 there is an earth connection on the left-hand side near the lower hinge. A 4 mm^2 green/yellow wire will be used to connect the gflow 1500 to earth. (refer to local regulations).

Precautions must be taken to avoid static electricity. Do not mount gFlow 1500 on an electrically isolated base. At mounting the gFlow 1500: First connect the earth wire and then the rest of wires afterwards.

At dismounting the gFlow 1500: Keep the earth wire connected until all the other wires and sensors are disconnected. Then disconnect the earth wire and the gFlow 1500 can be taken down.

Connection of conducting cable screens leaving hazardous area

Where screening is required, the screen shall be electrically connected to earth at one point, normally at the non-hazardous area end of the circuit. This requirement is to avoid the possibility of the screen carrying a possibly incentive level of circulating current in the event that there are local differences in earth potential between one end of the of the circuit and the other.

5.10 Cable requirements

General cable requirements:

Cable diameter min:	4mm
Cable diameter max:	7mm
Wire insulation thickness (surrounding copper wire) min:	0,25mm

5.11 Battery replacement

When the gFlow 1500 battery(ies) is(are) replaced in the hazardous area always vent the room very well. The operator has to be aware of overloading components in the gFlow 1500. Therefore, it's of outmost importance that the operator follows these instructions:

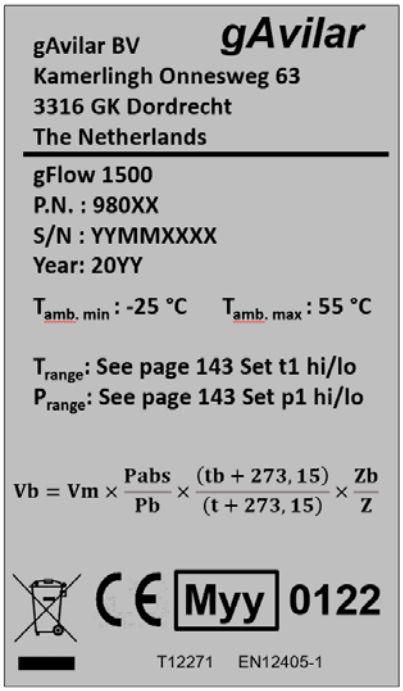
- Remove old battery(ies) (Actual data was stored when the cabinet was opened)
- Insert new battery(ies), please observe ESD correct mounting. (Only batteries approved by gAvilar)

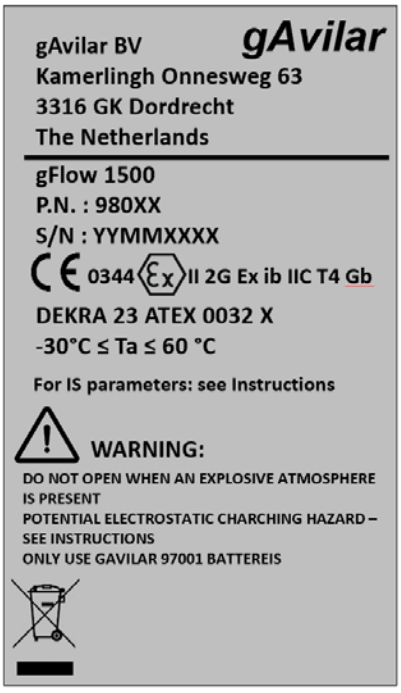
Attention: Use the right battery:
gFlow 1500 for main battery supply, marked: 97001

MSDS (**Material Safety Data Sheet)** see Tadiran home page LTN-065-26-n

5.12 Markings on the gFlow 1500

The MID marking is placed on the left side and the ATEX markings on the right side of the bottom part. The marking for the tariff system is on the left hand side above the metrological label. The markings are as follows:





This label is only present on request!

5.13 Summary of marking for ATEX

yy is the year of production, nnnnn is the serial number.

Designation according to Directive 2014/34/EU (ATEX): CE 0344 Ex II 2G

- Notified body performing the QA surveillance
- Equipment Group II (Surface Industries)
- Equipment Category 2 (Equipment with a high level of protection suitable for in Zone 1 areas)
- For explosive mixtures of gases, mists, or vapors in air

Ex marking: Ex ib IIC T4 Gb

- Electrical apparatus with explosion protection acc. EN-IEC standards
- Type of protection (Intrinsic Safety)
- Gas group
- Temperature class
- IEC equipment protection level

X marking

- POTENTIAL ELECTROSTATIC CHARGING HAZARD
- DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT
- USE ONLY GAVILAR 97001 BATTERIES

EU-Type Examination Certificate Number: DEKRA 23ATEX0032
European Standards applied for explosion protection: EN IEC60079-0:2018
EN 60079-11:2012
Ambient temperature range: -30ºC < Ta < +60ºC

Main product identification is “gFlow 1500” with conversion type: TZ, PTZ or E. (TZ without pressure sensor)
Main product numbers are:

Description	Item no.:
gFlow 1500 pressure range 0 – 2 bar abs	96021
gFlow 1500 pressure range 0 – 6 bar abs	96061
gFlow 1500 pressure range 0 – 14 bar abs	96141
gFlow 1500 pressure range 0 – 30 bar abs	96301
gFlow 1500 pressure range 0 – 80 bar abs	96801

5.13 Option boards

At the time the gFlow 1500 is released in the market there are no option board available yet. Very soon after the market introduction the option board for 4G/LTE communication will be released. This option board has a dedicated position inside the gFlow 1500 and can be powered from an internal pulse battery or from the external 5Vdc power supply.

Atex relevant information for option boards is to be found in their individual user manuals. This includes information about marking, EX data for input and output, conditions for safe use, zone, classes and categories.

Be aware of that some option boards may need creepage distances to other option boards. Please find the actual demands in the individual installation manuals.Be aware of that some option boards have intrinsic safe input or output circuits that are internal related to gFlow 1500 earth connection. Those circuits need isolated barriers if leaving the classified zone. Please find the actual demands in the individual installation manuals.

gFlow 1500 is an ex-group IIC equipment. Product approved for IIC is allowed for use for IIB and IIA but NOT the other way around.

Return to General

F. Operation

1.0 Introduction

The gAvilar gFlow 1500 Gas Volume Converter is designed with special emphasis on simple operation and low maintenance. The gFlow 1500 performs an accurate and secure measurement of the gas consumption, to assure the most accurate customer billing for both volume and energy.
To achieve a high level of performance, it is designed according the latest electronic technologies using:

- Surface mounted components
- High accuracy pressure and temperature sensors
- High resolution graphical display
- Future expansion possibility

The gFlow 1500 can operate in the hazardous zone where the zone is depending on the application. If powered by batteries is fulfils the zone criteria for zone 0 and by using an external power supply it can be installed in zone 1. The gFlow 1500 is certified by DEKRA in the Netherlands: DEKRA 20 ATEX 123456 X.

1.1 Operating principle

The gFlow 1500 records all volume pulses received from the associated gas meter. If any pulses are registered, the temperature and pressure are measured and the gas compressibility is calculated or measured by the gasQs gas quality sensor. Pulses can be derived as LF pulses from the gas meter index or from a HF sensor from the meter internal. Alternative the reading of the gas meter is read digitally from an integral encoder. The passed volume is derived from increments over time. The base volume is determined using the measurements of gas pressure and gas temperature and the gas compressibility, calculated or measured.

Equations:

$$C = \frac{pabs}{pb} \times \frac{(tb + 273.15)}{(t + 273.15)} \times \frac{Zb}{Z}$$

$$Vb = Vc \times C$$

$$Vc = Vm \times cf$$

$$E = Vb \times Hs$$

$$pabs = pgauge + pair$$

$$Vm = \frac{n}{imp.w}$$

$$d = \frac{\rho gas}{\rho air}$$

$$W = \frac{Hs}{\sqrt{d}}$$

Herein is:

C	=	Conversion factor	
p_{abs}	=	Absolute gas pressure	(barA, kg/cm^2, PSI, kPA)
p_{gauge}	=	line pressure	(barA, kg/cm^2, PSI, kPA)
p_{air}	=	atmospheric pressure	(barA, kg/cm^2, PSI, kPA)
p_b	=	Absolute reference pressure	(barA, kg/cm^2, PSI, kPA)
t_b	=	Reference temperature	°C, °F
t	=	Temperature	°C, °F
Z_b	=	Gas compressibility factor at reference conditions	
Z	=	Compressibility at measured conditions	
V_b	=	Converted volume	(m^3, ft^3)
V_c	=	Corrected volume	(m^3, ft^3)
V_m	=	Measured volume	(m^3, ft^3)
n	=	number of impulses	
imp.w	=	pulse value	M^3/pulse or pulses per m^3
cf	=	correction factor of the gas meter curve (only above 10Hz)	
E	=	Energy	(MJ, kWh, BTU)
Hs	=	Superior heat value	(MJ/m^3, kWh/m^3, BTU/ft^3)
d	=	relative density	
ρgas	=	density of gas	kg/m^3, lbm/ft^3
ρair	=	density of air	kg/m^3, lbm/ft^3
W	=	Wobbe index	

Unit conversion:

Pressure

pressure units are: bar, kgf/cm2, PSI, kPa

Unit	Bar	Kgf/cm2	PSI	kPa
value	1	1,019716	14,50377	100

Temperature:

Unit	°C	°F
value	0	32

The conversion from °C into °F:

$$°F = °C \times \frac{9}{5} + 32$$

Energy

Unit	Kwh	MJ	kcal	BTU
Value	1	3,6	859,84524	3412,1416416

Hs

Unit	Kwh/m3	MJ/m3	Kcal/m3	BTU/cu ft
value	1	3,6	859,84524	96,6210912

Volume:

Unit	m3	cu ft
value	1	35,3146667

Wobbe index:

The Wobbe index is calculated from the returned values d and Hs of the GasQs sensor and not read directly from it. The reason for this is the diversity of units which can be applied for expressing the Wobbe index of a gas. The unit for Wobbe index is the same as the unit chosen for heat value per volume unit.

1.2 Measurement

The interval between each measurement, may be set to 2, 5, 10, 15, 20, 25 or 30 seconds.

When AGA 8 DC92 is selected, the measurement time can only being set to 10 sec and longer.

The measurement interval is set in the Config. Program in section “Miscellaneous”.

Every measurement consists of a pressure and a temperature measurement. After this, the system makes a conversion calculation and an energy calculation. When these values are calculated, the index values are updated. Several min. and max. values are recorded automatically for use in the loggers.

Flow stop or decreasing flow is checked continuously.

1.3 Pulse measurement (flow measurement)

The flow is measured as the time between pulses; resolution = 30.5 μs, which corresponds to a max. error = 0.006% at max. flow. The min. measurement flow, that is calculated, is 1 pulse per 16 bit second.

Flow stop:

If the converter does not get any input volume, there is no flow. Under “Flow stop”, you can set up a time that the system must “wait” before flow stop is acknowledged. This feature is used to ensure the flow value becomes zero when the gas meter has come to a stop.

If no volume is detected within the set-up time, there is a flow stop.

Flow stop is set up as a time between 1 and 600 sec. When this time is exceeded, the flow is set to 0 (no flow).

1.4 Master reset

The gFlow 1500 can be completely reset.

- The procedure can only be handled by authorized person.
- The reset command will be executed through the optical port or the serial port.
- All data will be erased including passwords and calibration data stored in the CPU memory.
- The gFlow 1500 will restart with its initial values.
- The gFlow 1500 can no longer being used for metrological purpose and requires re-calibration.

1.5 Firmware update

The gFlow 1500 can be updated to the latest Firmware by using an MSP-FET flash emulation tool. Flashing does not corrupt any operating data nor calibration data. An internal socket on the main PCB provides access to the flash tool. Uniflash of TI can be used to flash the new Firmware file into the converter. Only authorised persons can perform a flash update to the gFlow 1500. The flash connector is located behind a metrological seal. After updating the Firmware, the seal needs to be replaced.

2.0 Inputs

2.1 LF Pulse inputs

There are 2 available LF-inputs per stream on the gFlow 1500 converter. These inputs can be used separately or as a LF-LF pulse check. This function is configured in the Config. program.

The inputs can be connected to a reed-contact, Wiegand sensor, opto a.o. (See "Technical data" for more information).

Pulse generator requirements

For correct measurement, the pulse generator must fulfil the following requirements (worst case):

- Max. pulse frequency 3 Hz
- Fastest "On-time" 33msec
- Fastest "Off-time" 300msec
- Max. "On resistance" 1kΩ (LTL=0.7V; VCC=3.6V; Rpull up=43k; 3Hz)
- Min. "Off resistance" 4MΩ (UTL=2.9V; VCC=3.6V; Rpull up=470k; 3Hz)

Configuration

The pulse inputs are configured in Config. Program.

PULSE INPUTS	
Pull up supply	Power supply 3 to 3.6VDC
Pull up resistor	47kΩ (open pulse input) 1MΩ (closed pulse input)
Pulse on, starting current	Max. 120 μA
Pulse on, current (continuous)	Max. 8μA
High trigger level	1.3 to 2.5VDC (PS=3.6VDC)
Low trigger level	0.7 to 1.8VDC (PS=3.6VDC)
Hysteresis	0.3 to 1.2VDC (PS=3.6VDC)

2.2 LF-LF

2 pulse transmitters can be connected to the 2 pulse inputs on the gFlow 1500. The LF signals of these 2 pulse inputs are compared. That is why the function is called LF-LF comparison. Both inputs operate identical.

In the Configuration program a max. pulse error is entered: The maximum pulse error.

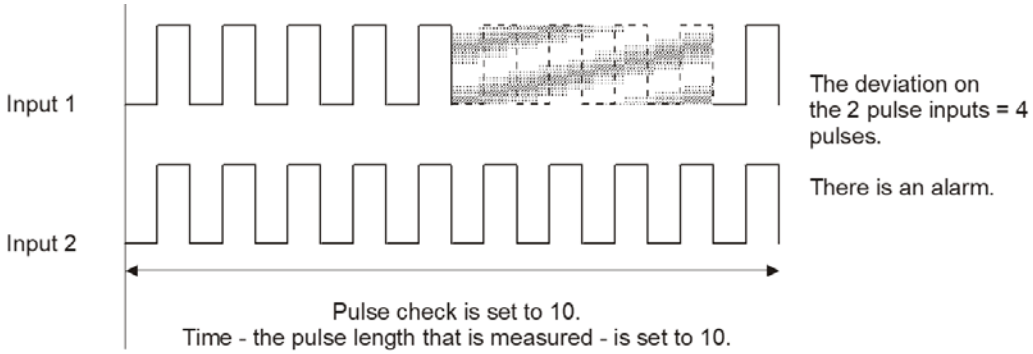
Then the pulse check every is entered: The number of pulses to be measured.

When there is a difference on the 2 pulse inputs more than [Max. pulse error] measured over [Pulse check every] time, an alarm is activated. The alarm is shown after “Max. pulse error” + 1. The order of pulses to arrive does not influence the operation principle.

Example: 10/1: 9 pulses on LF1, 9 pulses on LF 2. The pulses are recorded after pulse no. 10. No matter if the pulses are counted displaced, for/after or on the same time.

[Max. pulse error] can be adjusted between 0-255, where 0 is equal to no LF-LF comparison. [Pulse check every] can be adjusted between 1-65535 pulses.

Max. pulse error is set to 3. If the deviation on the 2 pulse inputs is bigger than 3 pulses, there is an alarm.



Flow stop

If no pulses are received from the flow meter, all flow values are set at a value of "0". The time to pass before all flow values are set at 0 can be adjusted under (flow stop after). The time can be set at 2-255 seconds.

Alarm limits

Alarm limit values can be adjusted for:

- Conv. Flow high limit (Qb1 Hi)
- Conv. Flow low limit (Qb1 Lo)
- Corr. Flow high limit (Qc1 hi)
- Corr. Flow low limit (Qc1 lo)
- Meas. Flow high limit (Qm1 hi)
- Meas. Flow low limit (Qm1 lo)

2.3 HF pulse inputs

The HF input counts are read every second. The actual flow (measured flow) is calculated based on the actual number of pulses received in the last second. Based on the measured flow and the entered error curve, the corrected flow is calculated. Increments on the measured and corrected volume are done, and at last the actual and corrected flow is checked for high flow limit violation.

The gFlow 1500 uses measured flow, measured volume, corrected flow and corrected volume from the HF input instead of the same values collected from the build in LF inputs.

2.4 Error curve correction

According EN12405-1 the error curve correction of the gas meter can be used providing the input frequency is above 10 pulses per second. Using the HF input supports the possibility to linearize the error curve of the gas meter for up to 10 calibration points. The error curve is entered using the configuration program. It consists of an error table showing the allowed error percentage at different flows. The values used are taken from the gas meter calibration certificate.

The flow values have to be entered in descending order.

Example of an error table:

	Flow (m^3/h)	Error (%)
1	1000	0.15
2	800	0.05
3	600	-0.12
4	400	0.11
5	200	0.81
6	100	0.63
7	50	-0.82
8	0	0
9	0	0
10	0	0

The flow meter manufacturer normally specifies a meter flow error. This parameter is called “Real flow error”. It is calculated as follows:

$$\text{Real flow error}[\%] = \frac{(\text{Indiated flow} - \text{Real flow})}{\text{Real flow}} \times 100\%$$

If the measured flow is lower than the lowest table flow value, the error is specified as the error value of lowest table flow (in the example -0.82%). From this point the error remains constant.

If the measured flow is higher than the highest flow in the error table the error is specified as the error value of highest table flow (in the example 0.15%). From this point the error remains constant.

If none of the above-mentioned cases is true, the error table is “searched” to find the correct flow interval and the actual flow error is calculated as a linear interpolation between the error values for the selected flow interval.

Example:

If the measured flow is 300 m^3/h, the flow interval from the table is 200 to 400 m^3/h. The error % is calculated as given below:

$$\text{error} = \frac{EQ_{hi} - EQ_{lo}}{Q_{hi} - Q_{lo}} \times (\text{Measured Flow} - Q_{lo}) + EQ_{lo}$$

EQ_{hi} = the error % of the high error table flow.
EQ_{lo} = the error % of the lowest error table flow.
Q_{hi} = the high error table flow.
Q_{lo} = the low error table flow.

With a measured flow of 300 m^3/h the error is:

$$\text{Error} = \frac{0.11 - (0.81)}{400 - 200} \times (300 - 200) + (0.81) = 0.46\%$$

Notice that the error is a positive number. This means that the meter index shows a too high number. Consequently, the error % must be subtracted from the measured flow.

The corrected flow Qc is then calculated as:

$$\text{Corrected flow} = \text{Measured flow} - \frac{\text{Measured flow} \times \text{error}}{100} = 300 - \frac{300 \times (0.46)}{100} = 298.62\ \text{m}^3/\text{h}$$

2.5 HF/HF comparison

The HF input can detect missing pulses from a meter if the meter can transmit pulses from two independent HF channels with the same number of pulses per m3. One meter channel is connected to HF1 and the other to HF2.

After a fixed number of pulses on HF1 or HF2 (set up in location HF1 "Pulse control every" in the Config Program) the number of pulses received on HF1 and HF2 is compared and if the difference is larger than a given number of pulses (set up in location HF1 "Max pulse error" in the Config Program an alarm is flagged. The comparing system is based on a good working HF sensor generates more impulses than the bad working sensor. When HF1 is working correctly the HF2 pulse alarm will be flagged and if HF2 is working correctly HF1 pulse alarm will be flagged.

The HF/HF comparison is only performed if "Pulse control every" and "Max pulse error" both are different from 0.
If HF/HF comparison is activated do not use "Max pulse error" equal to 1, this will lead to problems with timing on receiving pulses on HF1 and HF2.

It's only pulses received on channel A that are used for calculation of flow and increment of volume values.

2.6 HF/LF comparison

When both the LF1 and HF2 input are connected to the associated gas meter a comparison can be made between the two inputs.

After a fixed number of pulses on LF1 (set up in location "Pulse check every" under the "Flow" tab in Config Program) the number of pulses received on HF2 is compared and if the difference is larger than a given number of pulses (set up in location "Max. pulse error" under the "Flow" tab in Config Program) an alarm is flagged.

The HF/LF comparison is only performed if "Pulse check every" and "Max. pulse error" under the "Flow" tab both are different from 0.

If HF/LF comparison is activated do not use "Max. pulse error" under the "Flow" tab equal to 1, this will lead to problems with timing on receiving pulses on the LF and HF channels.

Using the comparison, only pulses received on the LF input are used for calculation of flow and increment of volume indexes.

2.7 Encoder

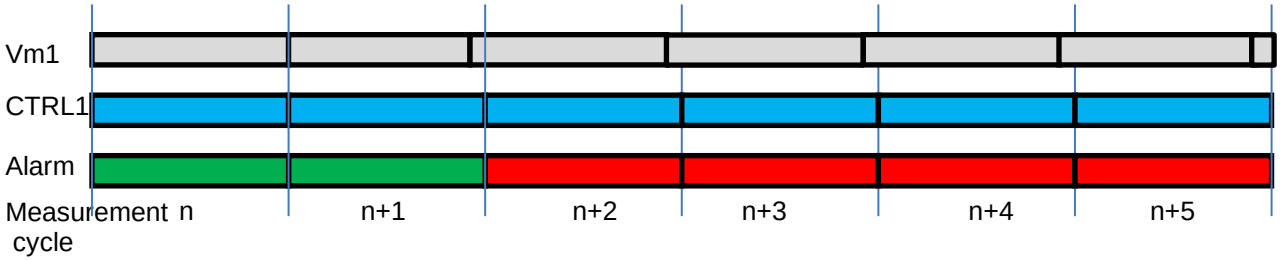
Alternative to using pulse inputs, an encoder (NAMUR) can be used to sequentially read the encoder index of the associated gas meter. The encoder transmits the index value at least once a second and by taking at least 2 reads the passed volume over time can be determined. At each measurement cycle the volume increment is used as an input for volume and energy conversion. The encoder can operate in permanent power mode where the encoder continuously transmits the index value or in battery mode where a preset time activates the encoder reading. The reading interval can be set to 10, 20 or 30 seconds for operation in accordance with EN12405-1 but also to 60 or 120 min for comparison purpose. The NAMUR port is only opened for a few seconds to gather the a-telegram of the encoder. As soon as the telegram has been validated by its sent BCC, the NAMUR port is closed again. The b-telegram is read after the meter has been connected or when the Meter change command is executed. Encoders which can only send the a-telegram can work with the gFlow 1500 without any restriction. The input and Firmware can handle absolute or incremental encoders.

2.8 Compare Control input to Vm1

The Control input can be compared with Voume input Vm1. The Control input can be taken from LF2, HF2 or Encoder 2. Vm1 can be derived from LF

1. **Example (absolute error)**

A choice can be made between None or index Vm1. By selecting “Compare absolute values” continues checking between the index Vm1 with the Control index is made and by exceeding the configured absolute error an alarm is generated. So in this case whenever a deviation between the Vm1 index and the Control index (Ctrl volume) is detected the alarm will remain on.



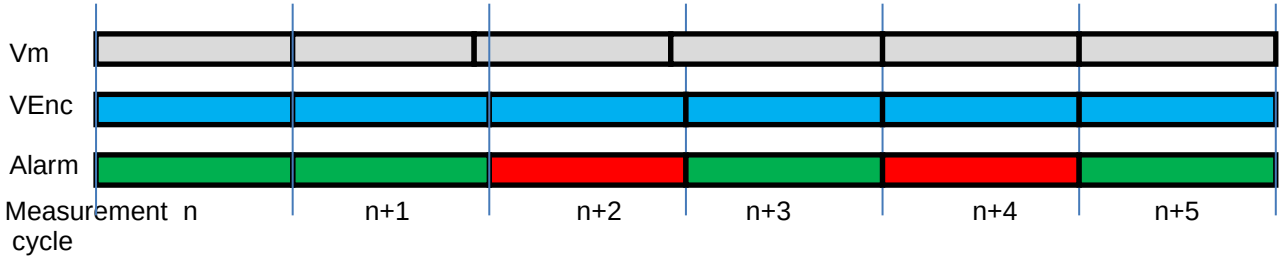
2. **Example (relative error)**

$$\mathrm{Err(abs)} = \mathrm{CTRL1} - \mathrm{Vm1}$$

$$\mathrm{Err(rel)} = \%$$

$$\Sigma\mathrm{Err} = \mathrm{Err(abs)} + \mathrm{Err(rel)}$$

A generated alarm will remain on during the next measurement cycle and at a positive result of the validation it will reset the alarm.



At a positive error as occurring in the measurement period n+1 (too less Vm1 volume counted) the alarm will be on during the following period (n+2). At a negative error as occurring in measurement period n+3 (too much volume Vm counted) the alarm will be on during the following measurement cycle (n+4).
This is just to illustrate how the alarm should be detected. In reality it is unlikely once a volume error has occurred that it will be corrected with the same amount of volume.
When over a running cycle a deviation is detected, the next cycle shows the alarm. After a good cycle (even with a deviation between the 2 indexes) the alarm is turned off again.
The volume used during the comparing is configured at “Pulse control after”. This volume is cyclic and whenever the set absolute or relative error is exceeded an alarm is generated. The error can be set as an absolute and or relative error where the sum of the errors is determining. By setting the relative error to zero only the absolute error is determined or reverse. To achieve the correct alarming, it is mandatory to set the alarm table correctly. For the correct operation of the alarming effecting the counter checking it is required to set the alarms 5, to be active. Of course, other alarms can be set but they don’t affect the comparing between the counters.

The checking volume should be at least the same or bigger thank the value of Qmax of the gas meter (see table hereafter).

G-value	Qmax (m3/h)	G-value	Qmax (m3/h)
16	25	400	650
25	40	650	1000
40	65	1000	1600
65	100	1600	2500
100	160	2500	4000
160	250	4000	6500
250	400	6500	10000

2.7 Flowstop

If the flow is lower than specified in "Min. flow", the error curve correction and HF/HF comparison are no longer performed. The flow will still be calculated, but the volume values will not be updated.All functionality will be performed when the flow again exceeds the "Min. flow".

2.8 Power fail

If the power to the power supply fails the HF inputs will stop counting pulses and the gFlow 1500 automatically uses the LF input for flow calculations and volume updates. On occurance of a power fail the external power alarm is flagged. The operation of the alarm is controlled in the alarm setup. The LF back-up also applies to the operation of the Encoder when used for external power supply.

When the power returns the HF input will resume pulse counting and the gFlow 1500 will again use the flow- and volume values from HF. The external power alarm will disappear on resuming the power. The operation of the alarm is controlled in the alarm setup. The same applies to the operation of the Encoder when used for external power supply.

2.9 Alarm code table

			Action on Alarm appears				Action on Alarm disappears				
No.	Description	Enable	Sym	Log	Out	Cnt	Sym	Log	Out	Cnt	Counts
1	Tamper input alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
2	EPROM error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
3	Pressure sensor error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
4	Temperature sensor error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
5	Pulse count error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
6	Pressure sensor EPROM error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
7	Door open alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
8	External power error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
9	Temperature low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
10	Temperature high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
11	Pressure low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
12	Pressure high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
13	Flow measured low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
14	Flow measured high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
15	Flow corrected low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
16	Flow corrected high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
17	Flow converted low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
18	Flow converted high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
19	Energy low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
20	Energy high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
21	Power low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
22	Power high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1

23	Encoder 1 alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
24	Encoder 1 bad bcc or no data error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
25	Encoder 2 alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
26	Encoder 2 bad bcc or no data error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
27	Analogue output 1 range error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
28	Analogue output 2 range error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
29	Low battery error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
30	Conversion error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
31	Program checksum error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
32	Extern alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
33	HF 1 pulse alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
34	HF 2 pulse alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
35	Wobbe low alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
36	Wobbe high alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
37	Hs low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
38	Hs high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
39	A/D converter error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
40	Clock set	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
41	Status input 1 on	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
42	Status input 2 on	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
43	Status input 3 on	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
44	Status input 4 on	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
45	Status input 5 on	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
46	Status input 6 on	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
47	Pulse output 1 over run error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
48	Pulse output 2 over run error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
49	Pulse output 3 over run error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
50	Pulse output 4 over run error	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
51	Watchdog alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
52	Gas sensor alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
53	Communication alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
54	No Sim card alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
55	Connection lost alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
56	Option 1 alarm 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
57	Option 1 alarm 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
58	Option 2 alarm 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	1
59	Option 2 alarm 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	1

2.9.1 Alarm input

When an alarm occurs, a flag/bit is set in the alarm log (register). The alarm is activated when the input is “opened”. The alarm is set up (1. Alarm code table) in the gFlow 1500 configuration program.

Alarm set up:

When the alarm appears	1	Sym (Symbol)	The ALARM symbol is shown on the display
	1	Log	The specified parameters are logged in the "Alarm Triggered log".
	1	Out (Output)	The alarm output is set to "ON".
	1	Dial	A pre-defined phone no. is dialled via modem.
	1	Cnt (Counters) *	The error counters are activated.
When the alarm disappears	0	Sym (Symbol)	The ALARM symbol om the display is turned off.
	0	Log	The specified parameters are logged in the "Alarm Triggered log".
	0	Out (Output)	The alarm output is set "OFF".
	0	Dial	A pre-defined phone no. is dialled via modem.
	0	Cnt (Counters) **	The error counters are stopped.
	*	If "Cnt (Counters)" is marked, the values of the parameter in question control the operation of the error counters. The operation of the normal- and error counters is depending on the setting of “count at alarm”	
	**	When the alarm disappears, the calculation of the conversion factor returns to normal.	
Counts	1	Counts is the number of times an alarm has to occur before the alarm becomes active. This number can be 1 up to 7.	

2.9.2 Count at alarm

A drop-down box is provided to make following selection:
No, Yes, No and Log and Yes and Log.

Count at alarm	
No	The main index counters are stopped and the error counters are active on alarm.
Yes	The main index counters continue and the error counters are active on alarm too.
No and Log	The main index counters are stopped and the error counters are active on alarm too and the ordinal counters do increment at each log interval. The ordinal counters are starting from 0 (zero on a new instrument after initialisation) and increment at each log interval. When an alarm occurs both normal and error ordinal number increment. Thereafter only the error ordinal counter increments. When the alarm disappears both ordinal counters increment and thereafter the normal ordinal counter continues to increment. The occurrence of the alarm has immediately lead to incrementing ordinal numbers with the time and date of occurrence.
Yes and Log	The main index counters continue and the error counters are active on alarm too and the ordinal counters do increment at each log interval. The ordinal counters are starting from 0 (zero on a new instrument after initialisation) and increment at each log interval. When an alarm occurs both normal and error ordinal number increment. Thereafter only the error ordinal counter increments. When the alarm disappears both ordinal counters increment and thereafter the normal ordinal counter continues to increment. The occurrence of the alarm has immediately lead to incrementing ordinal numbers with the time and date of occurrence.

2.9.3 Tamper alarm

The gFlow 1500 alarm input is also called a "Tamper alarm". This input can be used for connecting an alarm circuit. The alarm input is set "ON", when the alarm circuit is opened. This function may be used to secure the pressure and temperature sensor wire from being cut or damaged a.o..

2.9.4 Functionality

- The alarm is OFF (normal), when the circuit between terminal IN and GND is closed.
- The alarm is ON when the circuit is opened.

Note: Remember to set up the Tamper alarm in the gFlow 1500 Config. section "Installation data", "Alarm". The system can also record when the alarm disappears.

2.9.5 In case of a tamper alarm

- The alarm symbol is ON (when selected in the alarm table). The symbol will disappear when the alarm disappears.
- The alarm is recorded in the "Alarm triggered log". (When selected for Log in the alarm table)
- The alarm is added to the "Volume meas. at error" register.
- The alarm output goes "ON" (Low). The alarm output goes OFF, when the alarm is no longer present.

2.9.6 Door alarm

Inside the gFlow 1500 there is a built-in cable support with an inside magnet. This magnet activates a reed switch on the main board and acts as a door alarm as soon as the door is opened. When the door is closed the reed switch is activated and the contacts are closed.

Note: Remember to set up the alarm in gFlow 1500 Config. "Installation data", "Alarm". The reed switch has multiple functions, e.g., storing of all relevant process data into EEPROM to ensure no data and measured volume and or energy is lost. Also, the internal LED for illumination of the input terminals is controlled by the reed switch.

2.9.7 Alarm types

The gFlow 1500 has 2 different alarm types. The alarm active and the alarm registered.
The alarm active shows any active alarm during the time the alarm is ON. When the alarms are recorded in any of the data loggers the alarm code will be logged. However if the duration of the alarm is shorter then the interval period it will not be noticed. To insure that the alarm is recorded the Alarm registerd is introduced. Any alarm which is ON for a period shorter than the log interval will be recorded during the current log period and be shown at the next log.

gFlow alarms

The gFlow can currently handle up to 59 alarms. These alarms are divided in 2 ranges of 32 alarms. The first range is 1-32 and the second range is 33-64. Alarms 60 up to 64 are spares for future extension.

Alarm active

Alarm active acts immediately on any alarm which is active in the alarm table. The alarm is presented as a hex code for each group of 4 alarms. The content of each nibble can vary from 0 to F. As soon as the alarm disappears the alarm is set to OFF.

Alarm registered

Alarm registered acts immediately on any alarm which is active in the alarm table on occurrence. The alarm is presented as a hex code for each group of 4 alarms for in total up to 32 alarms. The content of each nibble can vary from 0 to F. As soon as the alarm disappears the alarm is set to OFF. As soon as the alarm disappears the alarm remains ON until the next interval time. Any alarm which appears over a period shorter then the interval time in any logger will cause to flag the alarm in alarm registered. This is to indicate that the alarm has appeared but was too short to get noticed in the active alarm. This is valid for alarm condition 1 and 2. In condition 3 and 4 the active alarm will get noticed because it forces an entry within the interval time.

The alarms are presented in the loggers as an 8 digit number. When no alarms are active the result is presented as 00000000.
An active alarm is only ON during the time the alarm is active and OFF when not active.

Logging conditions

For the logging there are 4 conditions for counting at alarm:

1. Count Vm, Vb and E during alarm = NO
2. Count Vm, Vb and E during alarm = YES
3. Count Vm, Vb and E during alarm = No and log
4. Count Vm, Vb and E during alarm = YES and log

For condition 1. the main indexes are stopped and the counting continuous in the error counters.
For condition 2. the main indexes continue and the counting also appears in the error counters.
For condition 3. the main indexes are stopped and the counting continuous in the error counters and a log entry takes place at the time of occurrence of the alarm and also when the alarm disappears.
For condition 4. the main indexes continue and the counting also appears in the error counters and a log entry takes place at the time of occurrence of the alarm and also when the alarm disappears.

Example 1:

Time Stamp	Volume measured	Volume converted	Energy	Pressure	Temperature	Conversion factor	Alarm 1-32 active	Alarm 1-32 registered	Ordinal counter normal	Ordinal counter error
2020.11.11 11:00:00	48	6	236	1.0286	19.8521	0.94593	00000000	00000000	372	3961
2020.11.11 10:55:00	48	6	236	1.0293	19.9254	0.94633	00000000	00000000	371	3961
2020.11.11 10:50:00	48	6	236	1.0286	19.8430	0.94594	00000000	00000000	370	3961
2020.11.11 10:45:00	48	6	236	1.0286	0.1627	1.01459	00000000	00000000	369	3961
2020.11.11 10:40:00	48	6	236	1.0293	19.9987	0.94610	00000000	00000000	368	3961
2020.11.11 10:35:00	48	6	236	1.0278	19.9071	0.94497	00000000	00000200	367	3961
2020.11.11 10:31:06	48	6	236	1.0282	19.8430	0.94555	00000000	00000200	366	3961
2020.11.11 10:30:36	48	6	236	1.0288	49.8323	0.85788	00000200	00000200	365	3960
2020.11.11 10:30:00	48	6	236	1.0277	19.8430	0.94509	00000000	00000000	364	3959
2020.11.11 10:25:00	48	6	236	1.0289	19.8888	0.94606	00000000	00000000	363	3959

In the example 1 there is no alarm at 11:30:00 and an alarm occurs at 11:30:36. Both alarm active and registered show the alarm. The alarm disappears at 10:31:06 and disappears from the active alarm. However the alarm is kept in alarm registered until the next interval time at 10:35:00.

Example 2:

Time Stamp	Volume measured	Volume converted	Energy	Pressure	Temperature	Conversion factor	Alarm 1-32 active	Alarm 1-32 registered	Ordinal counter normal	Ordinal counter error
2020.11.11 11:00:00	48	6	236	1.0286	19.8521	0.94593	00000000	00000000	372	3961
2020.11.11 10:55:00	48	6	236	1.0293	19.9254	0.94633	00000000	00000000	371	3961
2020.11.11 10:50:00	48	6	236	1.0286	19.8430	0.94594	00000000	00000000	370	3961
2020.11.11 10:45:00	48	6	236	1.0286	0.1627	1.01459	00000000	00000100	369	3961
2020.11.11 10:40:00	48	6	236	1.0293	19.9987	0.94610	00000000	00000000	368	3961

In the example 2 a short alarm occurred between 10:40:00 and 10:45:00. The alarm was too short to get noticed as Alarm active but is notified as Alarm registered.

2.10 Power Supply

Standard battery autonomy time

Under reference conditions the battery has a typical autonomy time of 2000 days (5-6 years). The number of days is programmed to 1825 upon delivery or after replacing the battery However when 1 battery is used the time is 913 days. The number of batteries used has to be set in the config program at the tab Miscellaneous. The counter is decremented based on the energy used from the battery and is monitored by an integral coulomb counter and when 90% of the battery energy(equal to 180 days) has been consumed, the "Low battery alarm" is activated.

Warning: always use the gAvilar approved batteries!

Non-standard autonomy time

For batteries (gAvilar devices) that are installed in an environment which deviates from the reference conditions, such as very low or high temperature, interval of measurement shorter than 30 seconds, use of battery powered encoder, short log intervals etc., these parameters may change and have to be taken into consideration.

⚠ Warning: when the battery has been replaced, remember to execute the “Change battery command the config program or on the gFlow 1500 using the keypad in page 345.
To access page 345 at least the level 0 password needs to be entered.

Note: when the low battery status has been reached the backlight will be switched off. After replacing the battery(ies) and executing the Change battery command, the backlight will be switched on again. During the low battery condition the gFlow will continue to measure as under normal circumstances.

2.11 Serial outputs

The gFlow 1500 has two ways of data communication as standard:

1) IR interface (optical interface) placed on the front of the unit.
2) Serial port 485:

Protocol

The data communication protocol = MODBUS RTU.
Data format: 1 start bit, 8 data bits, No parity, 1 stop bit

The baud rate of the optical port is set 2400 BAUD and the Serial port can be set to:
2400; 4800; 9600; 19200 or 38400 BAUD.

Note: Serial port 1 can be switched off when not used.

2.11.1 IR interface/485

IR-INTERFACE		
Protocol		MODBUS RTU
Data spec.: 1 start bit, 8 data bit, 1 stop bit and no parity.		
Transmission speed		2400 Baud
Power consumption (at data transfer)		3.3 mA
SERIAL PORT 1 RS485		
RS485	Protocol	MODBUS RTU
	A (-)	
	B (+)	
	GND	
	Transmission speed	2400; 4800; 9600; 19200; 38400
SERIAL PORT 2		
RS485	Protocol	MODBUS RTU (dedicated for gasQs)
	A (-)	
	B (+)	
	GND	
	Transmission speed	2400; 4800; 9600; 19200 (default); 38400

2.12 Pressure sensor

The pressure is calculated according to a polynomial using 12 calibration coefficients supplied by the pressure sensor manufacturer. The sensor has an integral E^2PROM which contains all calibration data, production data and the serial number. The sensor is based on a silicon diffused strain gauge principle and has a barrier diaphragm between the process medium and the silicon chip. The pressure sensor has a built-in temperature sensor and the measured operating temperature of the sensor is compensated as an active input in the polynomial.

Pressure sensor measuring ranges: A for absolute

Range	Operating range	Calibrated range	Range	Calibrated range
1	0 – 2 bar A	0.6 – 2 bar A	0 – 30 PSI A	9 – 30 PSI A
2	0 – 6 bar A	0.9 – 6 bar A	0 – 90 PSI A	13 – 90 PSI A
3	0 – 14 bar A	2.5 – 14 bar A	0 – 200 PSI A	35 – 200 PSI A
4	0 – 30 bar A	5.0 – 30 bar A	0 – 450 PSI A	70 – 450 PSI A
5	0 – 80 bar A	13 – 80 bar A	0 – 1200 PSI A	200 – 1200 PSI A

PRESSURE SENSOR	
Cable	Ø6 mm, length 3m.
Pressure ranges	2 bar, 6 bar, 14 bar, 30 bar, 80 bar all absolute
Accuracy	± 0,2%R, at ambient temperature –20°C…+55°C Long-time drift: < 0.2%/annum
Process connection	G1/4” Female (standard)

2.12.1 Settings

In the Config Program you can read or set the following pressure sensor parameters:

Read	*Manufacture and type*	Contains pressure sensor data read from the pressure sensor.
Read	*Serial no.*	Contains serial no. read from the pressure sensor.
Read	*Date of calibration*	Contains “date of calibration” data read from the pressure Sensor as carried out by the manufacturer.
Read	*Range [bar] and sensor style*	Contains data read from the pressure sensor. It specifies the pressure range (0.6….2 bar, 0.9….6 bar etc.) and style a for Absolute and g for Gauge
Read + Write	*Air pressure*	The air pressure value is only used on gauge pressure sensors. Zero means no gauge sensor is connected.
Read + Write	*TZ pressure*	Tz pressure is the fixed value used on operating mode TZ using only a temperature sensor and no pressure sensor.
Read + Write	*Fallback pressure used on error*	The fallback value is the value that is shown on the display, in case of an pressure sensor error. Max. range = 0 -99999999 (the number may contain decimal point). Can be Set to a pressure of e.g. 1.01325.
Read + Write	*Pressure low limit*	The alarm limit for the min. pressure. Max. range = 0…99999999 (the number may contain decimal point).
Read + Write	*Pressure high limit*	The alarm limit for the max. pressure. Max. range = 0…99999999 (the number may contain a decimal point).
Select	*Pressure sensor source*	The source for pressure can be selected from a drop down menu. Normally “Internal sensor only” will be selected or Fallback only can be used for algorithm check
Read	*Pressure calibration time*	Records the date and time of the applied calibration.
Calibration	*Read + Write*	The pressure sensor can be calibrated for up to 10 points. The calibration can only be carried out by authorized persons.

2.13 Temperature sensor

The temperature sensor is a highly accurate Pt1000 sensor. Temperature deviations found during calibration in the factory are provided on a tag on the cable. The tag shows the serial number, the offset at 0°C and the offset at 50°C including a checksum.

TEMPERATURE SENSOR			
Accuracy	With correction (correction data available at label)	± 0.1K	(-40°C…+70°C)

2.13.1 Settings

In Config. Program you can set the following temperature sensor parameters:

Read + Write	*Manufacture and type*	Contains temperature sensor data read from the temperature Sensor tag.
Read + Write	*Fallback temp. used on error*	The fallback value. This value is shown in the display in case of a temperature sensor error. Max. range = -99999999…+99999999 (the number may contain a decimal point). Can be set to e.g. 20° C.
Read + Write	*Temperature low limit*	The alarm limit for the min. temperature. Max. range = - 99999999… +99999999 (the number may contain a decimal point).
Read + Write	*Temperature high limit*	The alarm limit for the max. temperature. Max. range = 0...99999999 (the number may contain a decimal point).
Read + Write	*Temperature code*	Error correction data for the temperature sensor element (can be read from the tag placed on the temperature sensor cable).
Select	*Temperature sensor source*	The source for temperature can be selected from a drop down menu. Normally “Internal sensor only” will be selected or Fallback only can be used for algorithm check e.g. compressibility calculation.

3.0 Logging

There are 6 different log functions in the gFlow 1500. The logs can be configured to read a broad range of registers in gFlow 1500. With these it is possible to get a very accurate “picture” of status in the installation.

Logs		Max number of log points	Max number of logs	Example	Number of logs
1)	Interval log	20	1219	10	2280
2)	Daily log	20	365	10	682
3)	Snapshot log	20	100	10	186
4)	Alarm Triggered log	20	190	10	355
5)	Monthly log	20	60	10	112

For all of the log types the number of logs that can be stored depends on the number of registers stored in each log. It's possible to select between 1 and 20 registers for each log. Each time the number of registers stored in the log or a register is changed to another one the log is reset.
Logging operates using the FiFO principle, which means that when the log is full a new log value will overwrite the oldest log value in the log.

3.1 Interval log

The interval log is used to read up to 20 values (registers) with fixed time intervals
The log can be set to log with the following intervals:
1 min., 2 min., 3 min., 5 min., 10 min., 15 min., 30 min., 60 min., 120 min., 240 min..
The log items are given in D setup data 2.10

Max. and min. values can be logged on the following registers:
Pressure 1
Temperature 1
Flow measured
Flow corrected
Flow converted

Average values can be logged on the following registers:
- Pressure 1
- Pressure 2
- Temperature 1
- Temperature 2
- Measured flow
- Converted flow
- Corrected flow

Settings:	A) Select the number of registers to be logged. (The number of logs is automatic calculated).
	B) Set the log interval
	C) Select the registers to log

At the end of the Interval log configuration the log line checksum needs to be selected. This will automatically initiate a checking method based on a CRC-16 polynomial. At reading the interval log at page 161 at each pressing of the scroll button the displayed interval record will be checked again. The CRC as stored in the record is re-calculated and when a failure is found the "!" will be prompted behind the Index/log. The total content of this record is invalid when the record number is marked.

The reading of interval log values can be done at page 161. The data is presented in pages where the scroll buttons can be used to step through the data. By pressing the scroll down button the next record will be displayed and by pressing the scroll right button the next parameter will be displayed. To ease the operation the enter button can be used to step down per day. Daily steps can be made on each logged parameter.

3.2 Daily log

The "Daily log" is used to read up to 20 values (registers) with fixed intervals of 24 hours. The time of the log can be set with hour and minutes in the interval of 00:00 to 23:59. The time is always defined as local time.

Max. and min. values can be logged on the following registers:
Pressure 1
Temperature 1
Flow measured
Flow corrected
Flow converted

Average values can be logged on the following registers:
- Pressure 1
- Pressure 2
- Temperature 1
- Temperature 2
- Measured flow
- Converted flow
- Corrected flow

Settings:	A) Select the number of registers to be logged. (The number of logs is automatic calculated). B) Set the log time C) Select the registers to log

3.3 Snapshot log

The snapshot log expresses a “snapshot picture” of the actual registers in gFlow 1500. A reading with the snapshot log can be activated manually from Config. Program. The snapshot log can be used for testing the unit. In this case it can be useful to read the actual values for pressure, temperature, conversion factor etc.

Max. and min. values can be logged on the following registers:
Pressure 1
Temperature 1
Flow measured
Flow corrected
Flow converted

Average values can be logged on the following registers:
- Pressure 1
- Pressure 2
- Temperature 1
- Temperature 2
- Measured flow
- Converted flow
- Corrected flow

Settings:	A) Select the number of registers to be logged. (The number of logs is automatic calculated). B) Select the registers to log

3.4 Alarm triggered log

Alarm triggered log is used for reading up to 20 values (registers) at the time an alarm changes status.
It could e.g. be a great help when solving an error, if you also know the value for e.g. pressure, temperature, at the moment an alarm arose.
Which alarm that triggers the log is specified under alarms.

Max. and min. values can be logged on the following registers:
Pressure 1
Temperature 1
Flow measured
Flow corrected
Flow converted

Average values can be logged on the following registers:
- Pressure 1
- Pressure 2
- Temperature 1
- Temperature 2
- Measured flow
- Converted flow
- Corrected flow

Settings:	A) Select the number of registers to be logged. (The number of logs is automatic calculated).
	B) Select the registers to log
	C) Set the alarms to trigger the log

3.5 Monthly log

The "Montly log" is used to read up to 20 values (registers) with fixed intervals of 1 month. The month is defined as log time of day 1 up to log time 1 month later. The time of the log can be set with hour and minutes in the interval of 00:00 to 23:59 in the daily log setup. The time is always defined as local time.

Max. and min. values can be logged on the following registers:
Pressure 1
Temperature 1
Flow measured
Flow corrected
Flow converted

Average values can be logged on the following registers:
- Pressure 1
- Pressure 2
- Temperature 1
- Temperature 2
- Measured flow
- Converted flow
- Corrected flow

Settings:	A) Select the number of registers to be logged. (The number of logs is automatic calculated). B) Set the log time C) Select the registers to log

3.6 Alarm log

Up to 100 alarms can be logged.

For alarms are logged:

A) Date + time
B) Alarm type
C) Status:
- "ON" The alarm is active
- "OFF" The alarm is not active

The alarms are divided into 3 groups: System alarms, limit alarms and input alarms.

System alarms:
- Battery
- Conversion error
- Program checksum error
- A/D converter error
- Clock set
- Watchdog

Limit alarms:
- Flow measured max./min.
- Flow corrected max./min.
- Flow converted max./min.
- Energy flow max./min.
- Pressure max./min.
- Temperature max./min.
- Heat value max./min.
- Wobbe index max./min.

Input alarms:
- Tamper input alarm
- Pressure sensor error (outside defined range)
- Temperature sensor error (outside defined range)
- Pulse count error
- Door open alarm
- External power alarm
- HF pulse alarm 1 and 2
- Encoder alarm 1 and 2
- External alarm
- Status input 1, 2, 3, 4, 5 and 6
- Gas sensor alarm

Output alarms:
- Analogue output range error 1 and 2
- Pulse output over run error 1, 2, 3 and 4
- Communication alarm
- No SIM card alarm
- Connection lost alarm

Options:
- Option 1 alarm 1
- Option 2 alarm 2
- Option 3 alarm 3

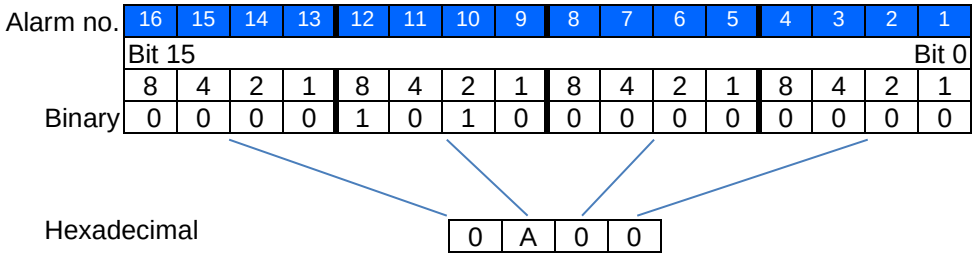
3.7 Alarm code interpretation

In the alarm code example below only the first 16 alarms are given. Alarm active 1-32 and Alarm registered are for the first 32 bits of the alarm table. The second part of the alarms is covered in Alarm active 33-64 and Alarm registered.

Status | Logs

	Description	Status
1	Tamper input alarm	OFF
2	EPROM error	OFF
3	Pressure sensor error	OFF
4	Temperature sensor error	OFF
5	Pulse count error	OFF
6	Pressure sensor EPROM error	OFF
7	Door open alarm	OFF
8	External power error	OFF
9	Temperature low limit	OFF
10	Temperature high limit	ON
11	Pressure low limit	OFF
12	Pressure high limit	ON
13	Flow measured low limit	OFF
14	Flow measured high limit	OFF
15	Flow corrected low limit	OFF
16	Flow corrected high limit	OFF

Current alarms		
	bit	Status
1	bit 0	0
2	bit 1	0
3	bit 2	0
4	bit 3	0
5	bit 4	0
6	bit 5	0
7	bit 6	0
8	bit 7	0
9	bit 8	0
10	bit 9	1
11	bit 10	0
12	bit 11	1
13	bit 12	0
14	bit 13	0
15	bit 14	0
16	bit 15	0



The ALARM reading on the display for the logger: 00000A00

Per nibble the result is determined using the following table:

0x	2^3	2^2	2^1	2^0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1

4.0 Audit trail log

The Audit trail log is used to register the “changes” executed from the Config. Program or by the keypad on the gFlow 1500 that affects the metrological part of the registers. The configuration log can log the last 800 changes. Any modification made through the keypad is logged with User ID KPAD. This is to identify the modification has been made without the use of the configuration program.

For each "event" is registered:

- Time stamp
- Description (parameter name)
- Old value
- New value
- User ID

An example is given below:

Time Stamp	Description	Old value	New Value	User ID
2020.08.19 14:04:28	Clock set	2020.08.19 14:04:28	2020.08.19 14:04:29	MFG
2020.08.19 14:04:19	Clock set	2020.08.19 14:04:19	2020.08.19 14:04:19	MFG
2020.08.19 12:12:10	Density of air	1.29300	1.00000	admi
2020.08.19 12:12:03	P unit	1	0	admi
2020.08.19 12:11:54	Density unit	2	0	admi
2020.08.19 12:11:51	T unit	1	0	admi
2020.08.19 12:11:47	Hs unit	1	0	admi
2020.08.19 12:11:25	T unit	0	1	admi
2020.08.19 12:11:14	P unit	0	1	admi
2020.08.19 12:07:38	Hs unit	2	1	admi
2020.08.19 12:07:30	Hs unit	1	2	admi
2020.08.19 12:07:05	Hs unit	0	1	admi
2020.08.19 12:06:46	Hs unit	2	0	admi

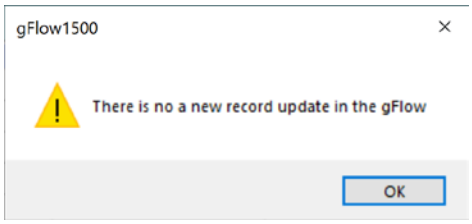
Parameter	Explanation of audit trail events				
Conversion type	Method	0 = E	1 = PTZ	2 = PT	3 = TZ
Volume unit	Volume unit	0 = m^3	1 = cu ft		
Energy unit	E unit	0 = MJ	1 = kWh	2 = kcal	3 = BTU
Pressure unit	P unit	0 = bar	1 = PSI	2 = kgf/cm^2	3 = kPA
Temperature unit	T unit	0 = °C	1 = °F		
Density unit	Density unit	0 = d	1 = ρn kg/m^3	2 = ρn lbm/ft^3	
Heat value unit	Hs unit	0 = MJ/m^3	1 = kWh	2 = kcal	3 = BTU
HF1 set to Encoder	Use HF or Encoder	0 = HF	1 = Encoder		
HF2 set to Encoder	Use HF or Encoder	0 = HF	1 = Encoder		

For the z-equation following numbers are set in the Audit trail logger:

Method	Number
Z/Zb	0
AGA-NX19	1
AGA-NX19 BRKORR3H	2
AGA8 DC92	3
AGA8 GCM1	4
AGA8 GCM2	5
SGERG A	6
SGERG B	7
SGERG C	8
SGERG D	9
SGERG DE	10
CO2	11
H2	12
Editable table	13
GasQs	14

Also the change of index values e.g. at startup of an installation to synchronize the Vm index of the gFlow with the meter index is recorded with the old value, the new value with time stamp and User ID.

When there is no new record, the message below is prompted.



5.0 Security

The gFlow 1500 is “secured” in accordance with EN12405-1 and MID 2014/32/EU. The unit has a “hardware” password which specifies the max. allowed "software" password level.

The hardware password to each single register in gFlow 1500, is decided by two DIP switches placed in the gFlow 1500 on the main board underneath the metal cover. The switches is accessible by breaking the seal near the battery holders. The switches are open on delivery but can be closed on request of the customer, user or local notified body.

The system is secured via 4 software passwords in the Config. Program. Each access level has its own password.

5.1 Hardware security

Switch 1	Switch 2	Acces level	Function	Password required
ON	ON	0	Only reading of the data from the gFlow 1500	YES
ON	OFF	1	Configuration of a few non-metrological parameters	YES
OFF	ON	2	Configuration of non-metrological parameters	YES
OFF	OFF	3	Configuration of all parameters	YES

5.2 Software security

Rights	Highest Access level	Password level	Read/Write
User	0	1	Read only
Operator	1	1	Read/Write limited
Technician	2	2	Read/Write limited
Super User	3	3	Read/Write all

User password

When the gFlow Configuration program is started, you are asked to type in a User ID and a password. This ID and password has been created by the administrator. The first time the Configuration program is started the “administrator user" has to set up the passwords (only the administrator or the super user can set up the initial passwords).

5.3 Getting started

The first time the system is started, the username default = admi (administrator). The default password is password.

User set up

The different users can be set up under “User” in the main menu. Here the administrator can create new users, delete users and set up user rights and user password.

User rights/user password setup

When the <New user> button is clicked, a new window shows.

[User ID]: Abbreviated user name (max. 4 characters)
[Name]: User name (max. 33 characters)
[Password]: User password (max. 8 characters)
[Confirm password]: User password confirmation.

Rights:

[Admi]: The administrator is allowed to make create/change configurations and to create other users, operators, technicians and super users with their own passwords.

[User]: The User is allowed to make create/change limited configurations.

[Operator]: The Operator is allowed to make create/change limited configurations.

[Technician]: The Technician is allowed to make create/change limited configurations.

[Super User]: The Super User is allowed to make create/change configurations and to create other users.

Note: a Super User needs to have official authorisation for modifying metrological data.

Special characters like -, +, /, \ and <space> e.g. are not valid in the passwords.

Next time the Configuration program is started, the “new” user can log on to the system.

5.4 Connection to the gFlow 1500

In addition to the user Id and password, the system also includes a converter access password. This password is requested on making a connection to the gFlow 1500. The converter access password is available in 3 levels.

The default values are:

Level 1: “00000000” (access to read data)

Level 2: “11111111” (access to read and modify limited data)

Level 3: “22222222” (access to read and modify all data)

The Level password are always numerical and have at least 4 digits and max. 8 digits.

The administrator or super user can modify the access passwords.

In the Configuration program 4 different access levels can be set up:

Access level 0: User: access password required

Access level 1: Operator: Configuration of a few parameters.

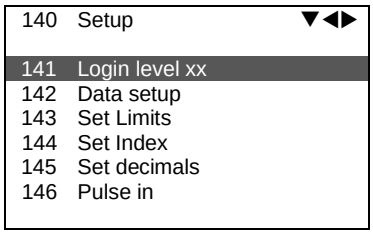
Access level 2: Technician: Configuration of a limited number of parameters.

Access level 3: Super User: Configuration of all parameters.

Only the Super User or administrator is allowed to change the passwords.

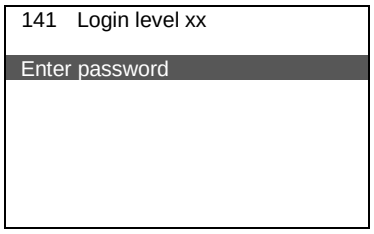
Special characters like -, +, /, \ and <space> e.g. are not valid in the passwords.

5.5 Entering the password (keypad)

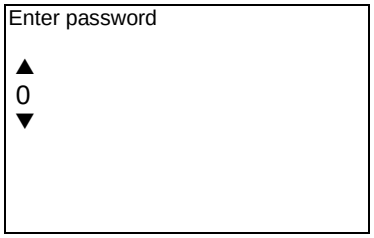


Procedure of entering the level 1 or 3 password: The MSD is entered first.

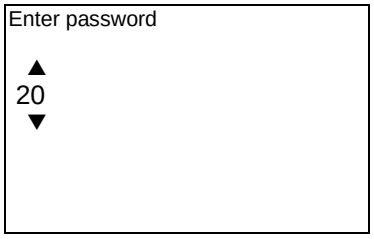
1. Scroll to page 141.
2. Press Enter.



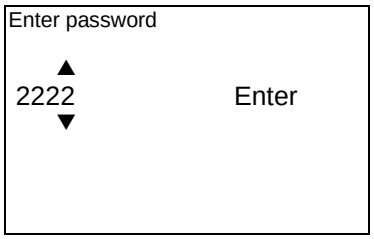
3. Press Enter.



4. Scroll the required number
5. Press the right scroll button



6. Scroll the required number
7. Press the right scroll button
8. Repeat until at least 4 digits are entered



9. After entering the 4th digit Enter is popping up and flashing
10. If the password is only 4 digits press enter or continue to enter more digits
11. After the complete password is entered just press Enter again.
12. The keylock in the status bar is now open 🔓.

Stream 1 pages 142, 143, 144, 145 and 146 are now accessible for modification.

General pages 311, 312, 313, 314, 315, 316, 317, 318 are now accessible for modification too.

340	Help ▼◀▶
341	Help file
342	Support
343	Diagnostics
344	Test Analog O/P
345	Change battery

General pages 343, 344 and 345 are now accessible to execute an operation command*.

* These pages are available using password level 1 or password level 3.

Note: The entered level using the keypad is valid for 8 minutes only. After this time the gFlow 1500 is automatically going back into level 0. The temporarily opened pages are closed again. To re-access these pages the password has to be entered again.

5.6 Set LF1 and LF2 pulse value

142	Data setup L3	▼
Set	Pulse value LF1	
Set	Pulse value LF2	

Set Pulse value LF1
▲
1.00000
▼

By pressing the left button the value can be increased by a factor of 10 or 100.
Using the scroll down button increases the number and using the scroll up button decreases the number.

Set Pulse value LF1
▲
01.00000
▼

Each number can be set individually. The numbers are selected by using the scroll left or scroll right button.
After entering the required number use the scroll right button until Enter is displayed.
Pressing Enter confirms the setting of the number by “Set successful!”

The same procedure is used for LF2.

5.7 Set limits

143	Set limits	▼
Set	p1 hi	
Set	p1 lo	
Set	p1 default	
Set	t1 hi	
Set	t1 lo	
Set	t2 default	

Set p1 hi	
▲	
6.00000	
▼	

By pressing the left button the value can be increased by a factor of 10.
Using the scroll down button increases the number and using the scroll up button decreases the number.

Set p1 hi	
▲	
06.00000	
▼	

Each number can be set individually. The numbers are selected by using the scroll left or scroll right button.
After entering the required number use the scroll right button until Enter is displayed.
Pressing Enter confirms the setting of the number by “Set successful!”

The same procedure is used for all parameters at page 143.

5.8 Set Index L3

On Page 144 the indexes can be preset to synchronize with the gas meter or to continue the index value at replacement of an old converter with the gFlow 1500.

144	Set Index L3	▼
Set	E1	
Set	Vb1	
Set	Vc1	
Set	Vm1	

Set E1	
▲	
00417304.1426	
▼	

Using the scroll down button increases the number and using the scroll up button decreases the number. Each number can be set individually. The numbers are selected by using the scroll left or scroll right button. After entering the required number use the scroll right button until Enter is displayed.
Pressing Enter confirms the setting of the number by “Set successful!”

The same procedure is used for Set Vb1, Set Vc1 and Set Vm1.

5.9 Set decimals

On page 145 the number of decimals for the indexes can be set. The selection can be made from 0 up to 4. The default is 4 decimals.

145	Set decimals	▼
Set	E1 decimals	
Set	Vb1 decimals	
Set	Vc1 decimals	
Set	Vm1 decimals	

After pressing enter the selection of the number of decimals can be made. Just use the scroll up and scroll down button for selection.

Set E1 decimals	
0	
1	*v*
2	
3	
4	

The same procedure is used for Set decimals Vb1, Vc1 and Vm1.

5.10 Pulse in

On page 146 the input selection for volume, flow and control can be selected.

146	Pulse in	▼
Set	Vol. to LF1, HF1, Enc1	
Set	Flow to LF1, HF1, Enc1	
Set	Ctrl. to LF2, HF2, Enc2	

Select the input by using the scroll down and scroll up button and press enter.

Set Vol. to LF1, HF1, Enc1	
LF1	
HF1/	Encoder 1 *v*

After selection just press escape to leave the setting page.

6.0 MessEV Data logging

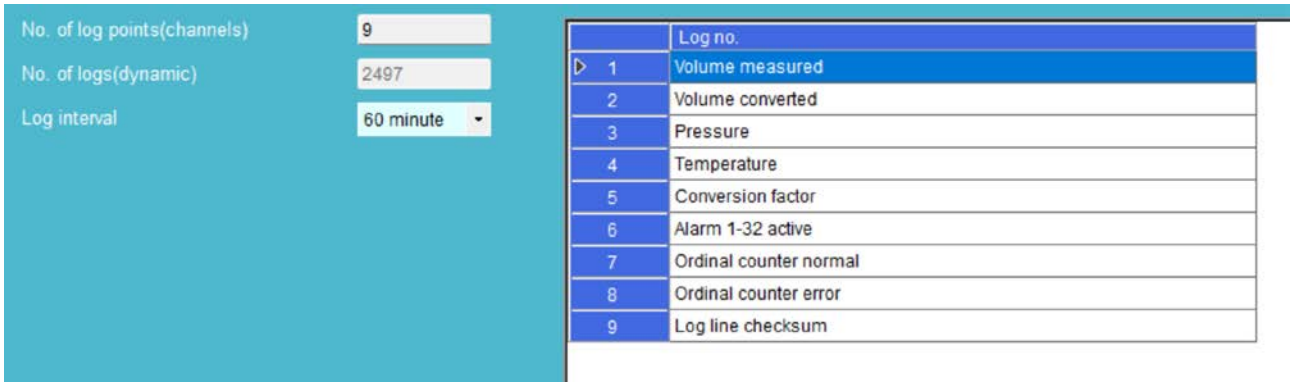
6.1 Introduction

The gFlow 1500 is approved by PTB in accordance with MessEV to national requirements for Germany. The interval logger complies with MessEV for the tarif structure providing the setup is in compliance with the settings as given below:

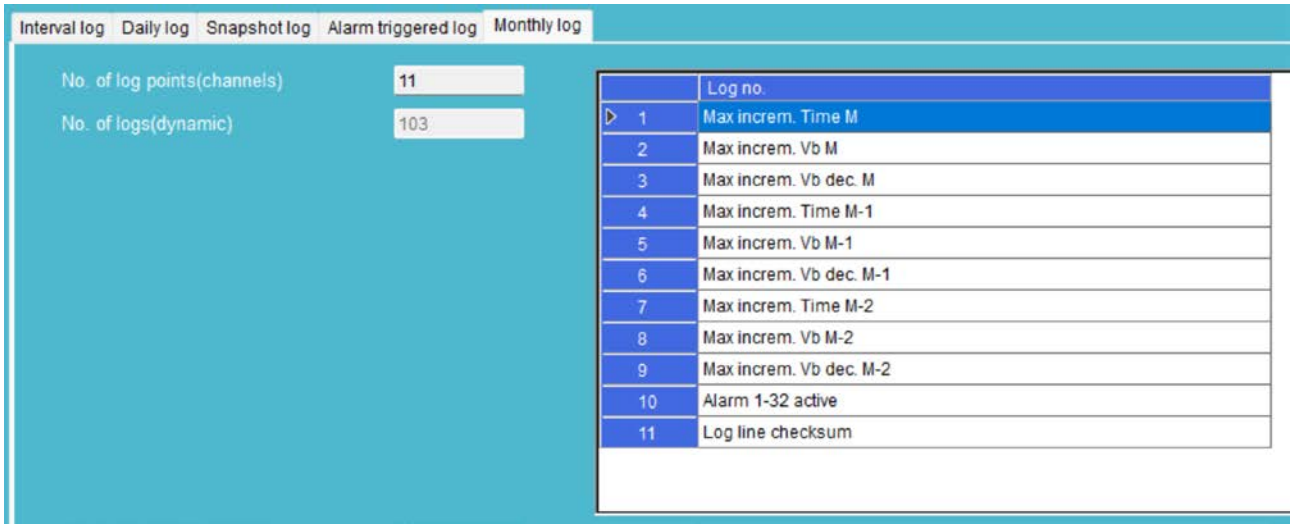
Since the logger in an integral part of the converter the main operation of the converter is adopted to the measurement conditions as given in the measurement application. The input for volume can be derived from LF, HF or Encoder. How the converted volume is determined from which input and which calculation method is used has no effect on the function of the interval logger.

However there are settings required e.g. the data items to be logged and also to stop the main indexes during an alarm condition needs to be set.

The log interval needs to be set to: 60 minute and the parameter list needs at least to be set to volume measured and volume converted followed by alarm active and log line checksum. Other items e.g. pressure, temperature and conversion factor are optional. The ordinal counsters are also mandatory to select.



The monthly logger is used to log the highest hourly value over the last 3 months. Also for this logger a minumum set up is requied to comply with MessEV.

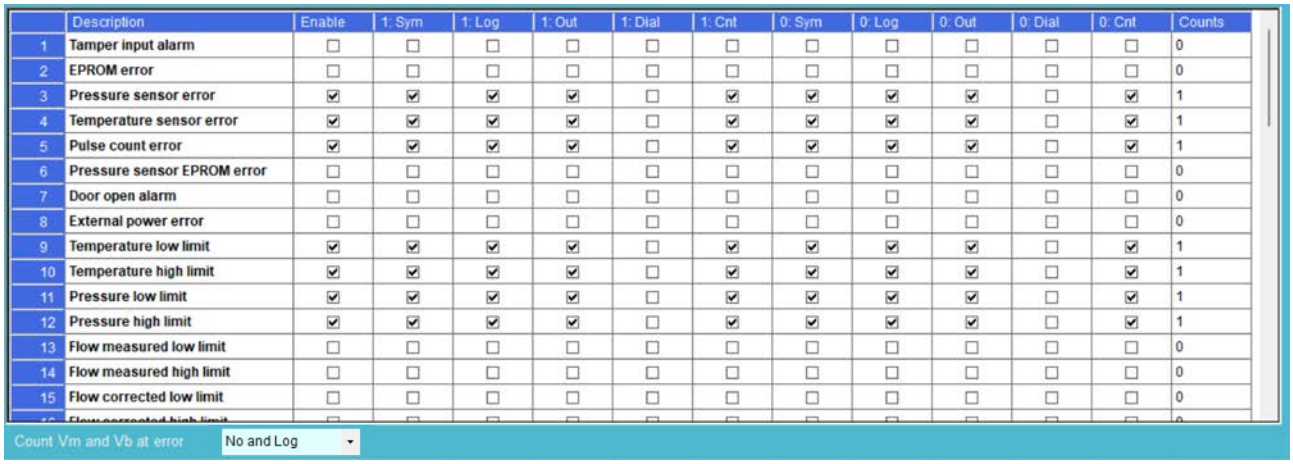


The parameter logged are the time of the highest Vb hourly value over the last month identified with M for Month, M-1 for the previous month and M-2 for pre-previous month.

The value is given as an integer and a decimal for Vb.
The memory is organised to FiFo, First in, First out.

Also here the last item is the log line checksum.

Count Vm and Vb at error should be set to No and log. (use of ordinal numbers)



	Description	Enable	1: Sym	1: Log	1: Out	1: Dial	1: Cnt	0: Sym	0: Log	0: Out	0: Dial	0: Cnt	Counts
1	Tamper input alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
2	EPROM error	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
3	Pressure sensor error	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
4	Temperature sensor error	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
5	Pulse count error	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
6	Pressure sensor EPROM error	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
7	Door open alarm	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
8	External power error	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
9	Temperature low limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
10	Temperature high limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
11	Pressure low limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
12	Pressure high limit	☑	☑	☑	☑	☐	☑	☑	☑	☑	☐	☑	1
13	Flow measured low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
14	Flow measured high limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0
15	Flow corrected low limit	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	0

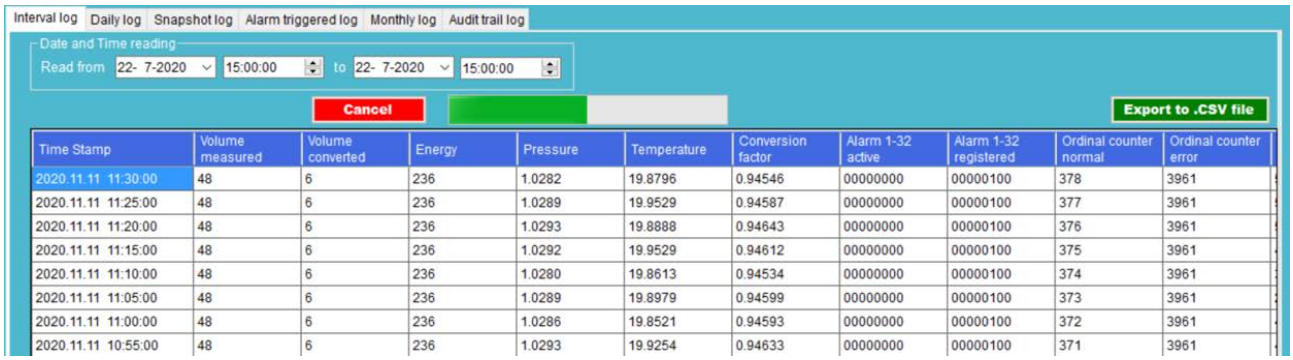
6.2 Reading data from the interval logger

6.2.1 Reading logger data using the gFlow 1500 configuration program

Before data can be read from the gFlow 1500 a connection from a PC to the gFlow needs to be established. This can be either a direct connection using the optical interface on the optical port on the front of the gFlow or by a TCP/IP connection where MODBUS TCP or MODBUS over TCP/IP can be selected. The later depending on the type of connection used.

For a connection always a password is requied even to just read the data. At least the password for level 1 needs to be entered to access the data.

The procedure to create a connection is described in chapter D (Setup data) paragraph 1.2.

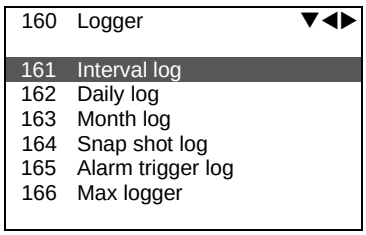


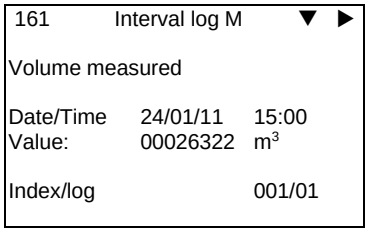
Time Stamp	Volume measured	Volume converted	Energy	Pressure	Temperature	Conversion factor	Alarm 1-32 active	Alarm 1-32 registered	Ordinal counter normal	Ordinal counter error
2020.11.11 11:30:00	48	6	236	1.0282	19.8796	0.94546	00000000	00000100	378	3961
2020.11.11 11:25:00	48	6	236	1.0289	19.9529	0.94587	00000000	00000100	377	3961
2020.11.11 11:20:00	48	6	236	1.0293	19.8888	0.94643	00000000	00000100	376	3961
2020.11.11 11:15:00	48	6	236	1.0292	19.9529	0.94612	00000000	00000100	375	3961
2020.11.11 11:10:00	48	6	236	1.0280	19.8613	0.94534	00000000	00000100	374	3961
2020.11.11 11:05:00	48	6	236	1.0289	19.8979	0.94599	00000000	00000100	373	3961
2020.11.11 11:00:00	48	6	236	1.0286	19.8521	0.94593	00000000	00000100	372	3961
2020.11.11 10:55:00	48	6	236	1.0293	19.9254	0.94633	00000000	00000100	371	3961

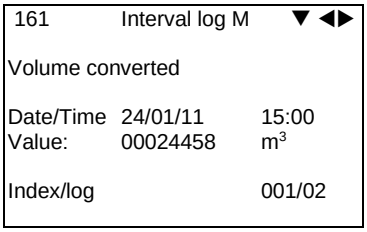
After reading the logger the data can be exported to a .csv file format to be processed in MS Excel.

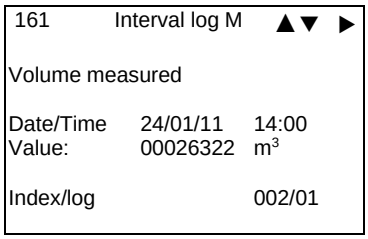
6.2.2 Reading logger data on the gFlow 1500 display

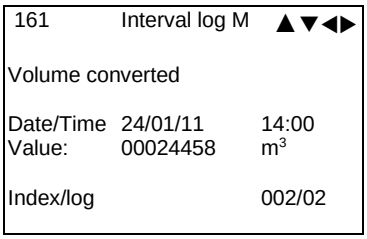
According the requirements of MessEV the logged values also have to be presented on the display of the gFlow.
For the loggers please scroll to page 160.



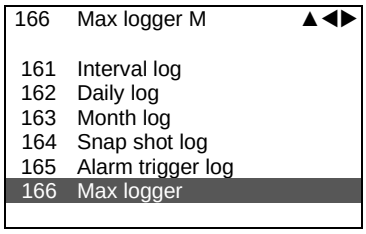


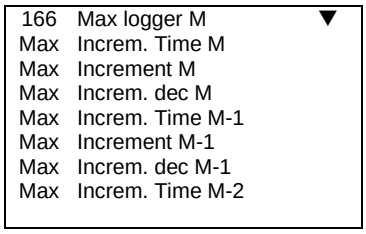


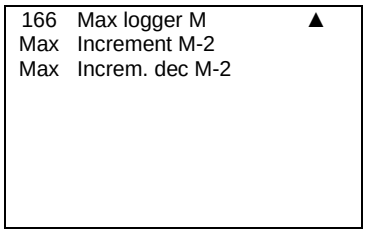




By using the scroll button to right the next parameter will be displayed and by using the scroll button down the previous hourly record will be displayed. By pressing the enter button the cursor steps to the previous day (advances for 24 hours). This makes it easier to step down when data for many days is stored.







For accurate data logging the RTC is an important device to insure the time stamp is determined correctly. However when the time needs to be adjusted this can be done through the serial interfaces e.g. using the configuration program or by entering the correct time in the gFlow using the key pad. When the clock is changed for more than 1% of the logging interval (1 hour) the change of the clock setting is recorded in the

Audit trail and the interval of the change is marked with an asterix * to notify this record is not valid for custody transfer measurement.

Each record is stored with a log line checksum (16 bit CRC) which is determined over all the logs within the line. By reading records back from the memory to be displayed on the gFlow LCD the checksum is recalculated on each line. Whenever a deviation between the stored and recalculated checksum occures the display shows ! for the record to notify this record has become invalid and is not longer subject for custody transfer measurement.

The gFlow has interval indexes for hourly, daily and monthly values.

E1 last month	0	MJ	E1 current month	105598	MJ
Vb1 last month	0	m3	Vb1 current month	1742	m3
Vm1 last month	0	m3	Vm1 current month	3107	m3
E1 last day	0	MJ	E1 current day	105598	MJ
Vb1 last day	0	m3	Vb1 current day	1742	m3
Vm1 last day	0	m3	Vm1 current day	3107	m3
E1 last hour	64842	MJ	E1 current hour	7725	MJ
Vb1 last hour	970	m3	Vb1 current hour	196	m3
Vm1 last hour	2001	m3	Vm1 current hour	208	m3

These indexes are presented at page 112 and are very helpful to use up to the max. allowed gas load during an hour, a day or a month. The indexes of the current hour are copied into the last hour index. The current index starts from zero again after the hour. The same principle is used for day and month.

112	Interval index M ▼
E1	last month
Vb1	last month
Vm1	last month
E1	current month
Vb1	current month
Vm1	current month logger

112	Interval index M ▼
E1	last day
Vb1	last day
Vm1	last day
E1	current day
Vb1	current day
Vm1	current day

112	Interval index M ▼
E1	last hour
Vb1	last hour
Vm1	last hour
E1	current hour
Vb1	current hour
Vm1	current hour

Return to General

G. Communication

The gFlow 1500 uses a non-proprietary protocol: MODBUS RTU.
Specifications are given in: www.modbus.org

The gFlow 1500 is standard equipped with 3 serial communication ports. At the front an optical communication port designed in accordance with IEC 62056-21 is used for reading and writing data. The settings of the optical port are:
2400 baud, 8 data bits, no parity and 1 stop bit. The default slave address is 1.

The slave address of the gFlow 1500 can be set from 1 up to 247. The use of the slave address allows the user to communicate in a multi drop configuration.

Inside the gFlow 1500 there is an RS485 user port.

The baud rate can be set to: 2400; 4800; 9600; 19200 and 38400.
The protocol settings are: 8 data bits, no parity and 1 stop bit.

Both the optical port and serial port 1 can be used to read/write all data. The data can always being read in level 0 but writing data can only occur in the right user level (2 or 3) with the corresponding password.

For the communication with the gasQs sensor a dedicated communication port named Serial port 2 is provided:

The default baud rate is: 19200 for the gasQs sensor.

Return to General

H. Maintenance

1.0 General

The gFlow 1500 is not subjected to a lot of maintenance. At any inspection in the field it is recommended to inspect the internal of the instrument on moisture and dust. When properly installed with a tight cover and cable glands no moisture and dust should creep into the device. The installed breathing valve avoids any pressure difference between the atmospheric- and the internal pressure. The installation of the gFlow 1500 should be such that no water can drop directly on the device. Water may block the breathing valve.

When the housing needs to be cleaned this can only be achieved using a moist cloth to avoid any static electricity building up on the front plate including the window.

Battery replacement can only take place when there is no explosive hazard at the installed location. The person responsible for battery replace needs to check the location before opening the cover of the gFlow 1500.

1.1 Inspection and Maintenance

The requirements as stated in EN-IEC 60079-17 or other codes of practice valid on the place of installation apply.

If the gFlow 1500 enclosure, display or interconnecting cables appears cracked, dented, broken or otherwise no longer in good condition or are very dirty or damaged they must be immediately repaired or cleaned.

As the device internal circuits are always on when battery powered, in case of damage it must be removed from the hazardous area immediately and may only be restored after the repair has been carried out and approved.

When batteries appear empty it is recommended to have them immediately replaced. Only gAvilar 97001 cells may be used.

Cycle of maintenance depends on the specific conditions of use. As a general guide line for light use a 12-month interval is recommended.

1.2 Repair

Repair to the gFlow 1500 may only be done by using original parts. It shall be carried out by qualified skilled workers who have been trained in accordance with EN-IEC 60079-19 or other codes of practice valid on the place of installation.

Applying of non-original parts may lead to injury to persons and damage to equipment.

If non-original parts are used or repair has been carried out in an incompetent manner the warranties concerning explosion safety no longer apply. Therefore, it is advised to return the equipment to the manufacturer in cases repair is demanded.

1.3 Special conditions for Safe Use

- POTENTIAL ELECTROSTATIC CHARGING HAZARD (see 2.3.2 Electrostatic discharge)
- DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT (see 2.3.1 Hazardous areas)
- USE ONLY GAVILAR 97001 BATTERIES (see 3.1 Inspection and Maintenance)

2.0 Calibration

2.1 General

The calibration of the pressure and temperature inputs of the gFlow 1500 can be made by any user in level 3. The modification of the calibration will automatically destroy the current calibration data.

Warning: Please note that gAvilar performs an accurate calibration in the factory as part of the MID accreditation where the highest accuracy possible will be insured. Any modification to the factory calibration will modify the initial calibration and the metrological behaviour will be affected.

Following the procedure described in this manual will help in creating an accurate calibration of the converter.

The calibration can be executed with use of the Configuration Program providing the user has the appropriate user rights.

2.2 Equipment

To be able to apply a calibration to the gFlow 1500 following equipment is required:

1. Pressure reference (error ≤ 0.1 %)
2. Inert gas bottle with pressure controller or air pump
3. Temperature reference (error ≤ 0.1 °C)
4. Temperature controlled bath or at least 2 insulated cans, one with melting ice and one with pre-heated water at approximately 40°C
5. PC with Uniflo 1x00 Config program
6. Optical reading head for gFlow 1500

2.3 Location

The calibration should be done in a temperature controlled room where the reference temperature is approximately 21°C and should not vary more than ± 0.5°C during the calibration procedure.
Alternatively the calibration can be done on site but a higher uncertainty has to be excepted. It is important to verify the operating conditions of the reference equipment.

Warning: Using reference equipment on site may cause safety conflicts since frequently reference equipment cannot be used inside hazardous locations. Please insure the safe use of the reference equipment inside the hazardous location.

2.4 Preparing the calibration

Before the calibration procedure can start, a number of preparations should be handled.

1. Make sure that the gFlow 1500 is temporized for 24 hours in the calibration location.
2. Check the pressure range of the gFlow 1500.
   - **a.** Range 1: 0,8 to 2 bara
   - **b.** Range 2: 0,9 to 6 bara
   - **c.** Range 3: 2.5 to 14 bara
   - **d.** Range 4: 5 to 30 bara
   - **e.** Range 5: 13 to 80 bara

   Use a reference for pressure matching the gFlow 1500 pressure range.
3. Use 1 or 2 temperature controlled bath for setting the required reference temperatures and use a calibrated temperature reference to measure the liquid temperature. For temperatures below 0°C a non-freezing liquid has to be used. Alternatively 2 insulated cans can be used where one is filled with melting ice and the other one with a pre-heated liquid at about 40°C. Please note that the

temperature is falling during the calibration and therefore the reference reading and the measurement has to be done within a short time to avoid unwanted errors.

4. A PC with installed version of the configuration program and an optical infra-red head for reading data from the gFlow 1500 is required.

2.5 Calibration procedure

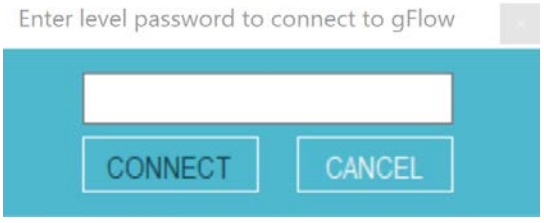
When all equipment is prepared the calibration procedure can start.
The pressure sensor of the gFlow 1500 needs to be connected with the pressure reference and the pressure source. The max pressure of the sensor should not be exceeded. The temperature sensor of the gFlow 1500 should be put into the temperature controlled bath with a temperature of approximately 0°C.

The PC with the configuration program should be started and assuming a new installation of the program where the user is using the default user admi.

1. Start the program (password is password)

2. Click on LOGIN

Click on CONNECT FOR CONFIGURATION



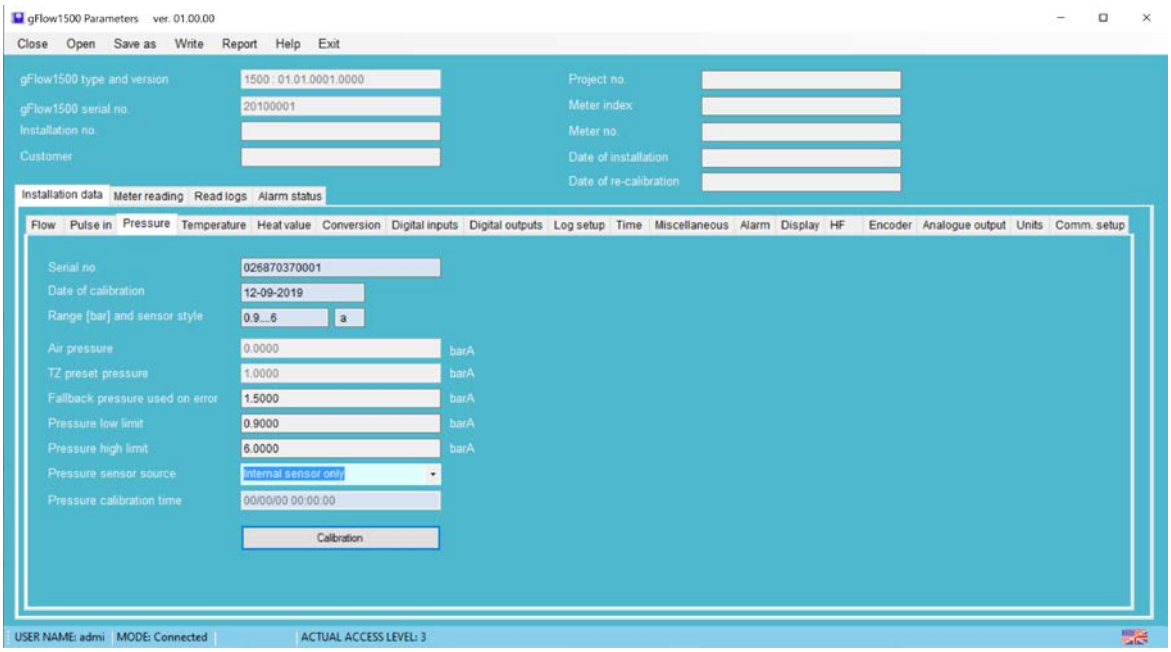
Enter the level 3 password

2.6 Calibration procedure for pressure

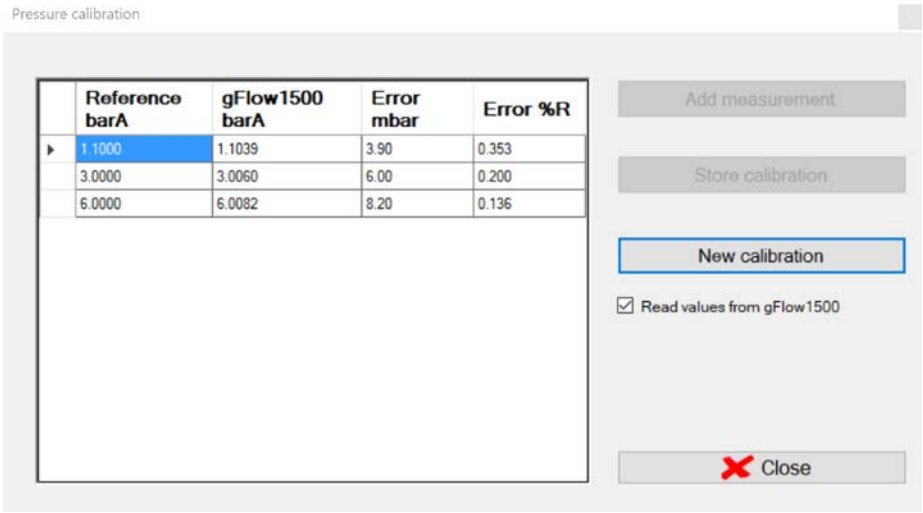
The pressure sensor is pre-cablibrated in the factory and the calibration data is stored inside the sensor. On first boot of the converter the inital data of the pressure sensor is read and will be partly shown in the configuration program. On top of the factory calibration corrections can be made in the gFlow 1500 to influence the characteristics of the sensor.

1. After the connection is made and all data has been read from the gFlow 1500 you can find the button for calibration for the pressure sensor in the folder Pressure. Only with the extended user rights the Calibration can be accessed and modified.

2. Click on Calibration. The MID or factory calibration usually has 3 points. A calibration can contain 0 to 10 points if required. A single point calibration is just an offset calibration where a 2 point calibration also takes influence on the slope of the curve. More than 2 points can correct for the shape of the curve.

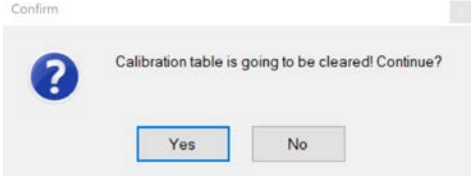


3. At the pressure tab select Calibration.

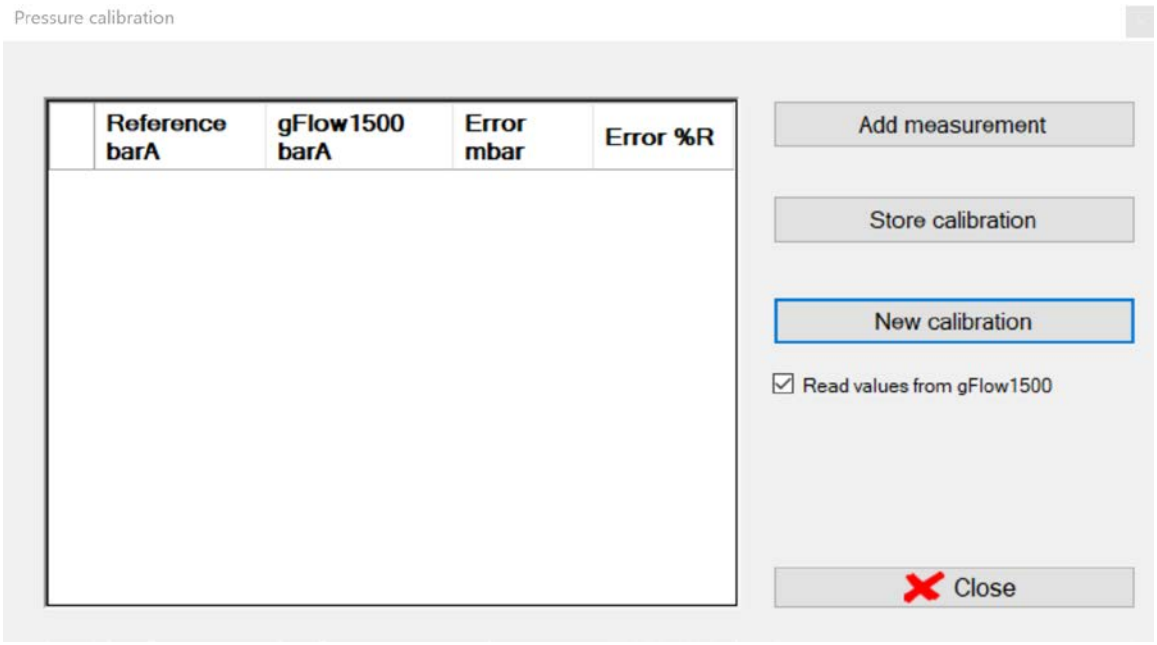


The current calibration is shown.

4. Click on New Calibration.

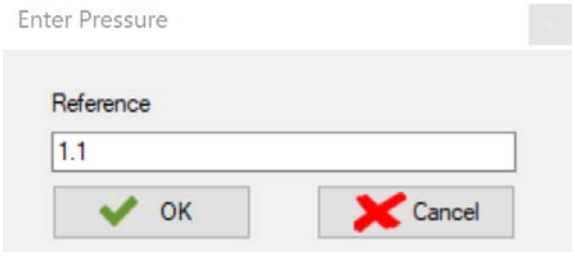


5. Click on Yes.

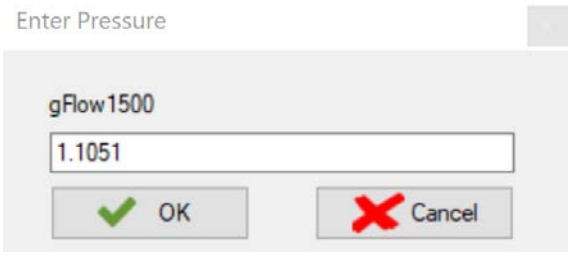


6. Now the button Add measurement and Store measurement are active.

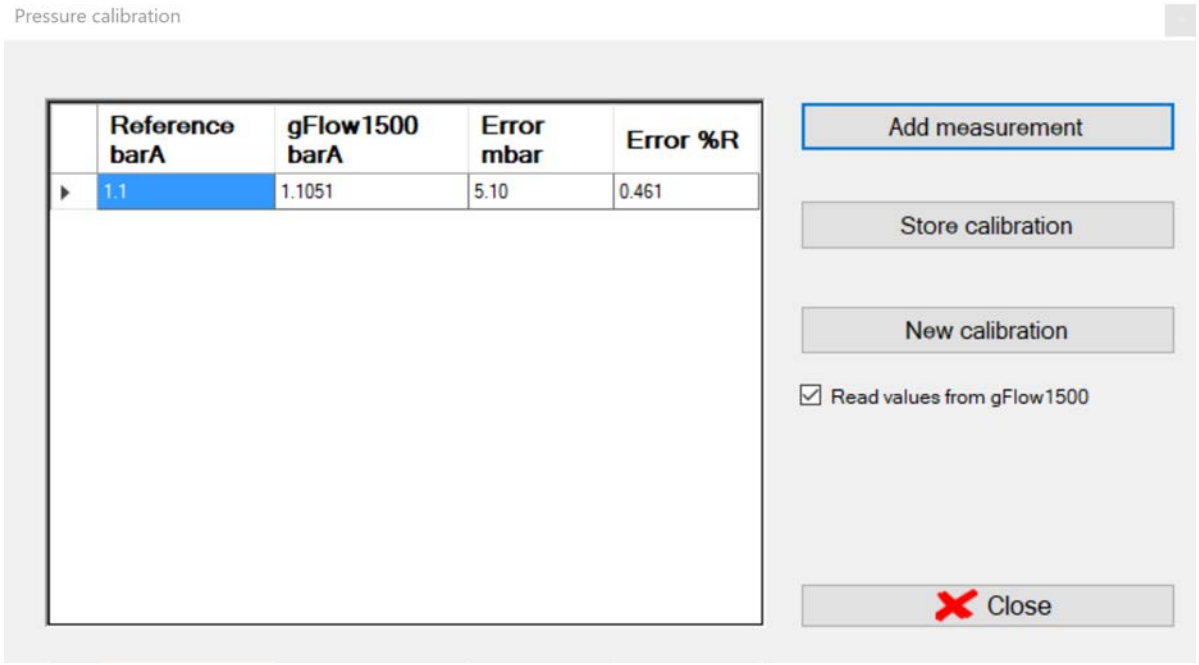
7. Click on Add measurement.



8. Enter the reference pressure in bar absolute (atmospheric pressure + gauge pressure) The value is chosen as 1 + 10% of (pmax – 1) for the 2 bar and 6 bar range. For the higher ranges pmin + 10% (pmax – pmin).

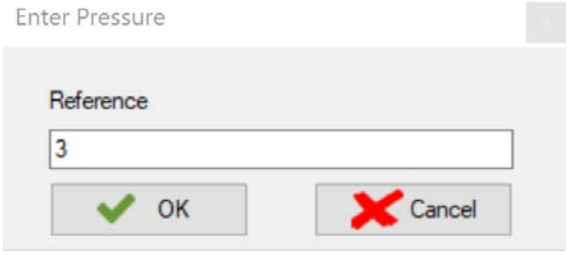


9. Enter the pressure reading from the gFlow 1500 automatically or enter manually.

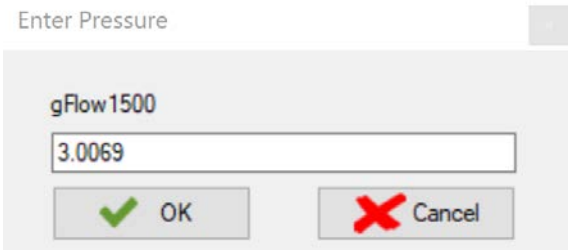


10. The results will be added to the table above. The error is calculated automatically. Whenever the error is too big the sensor needs to be replaced.

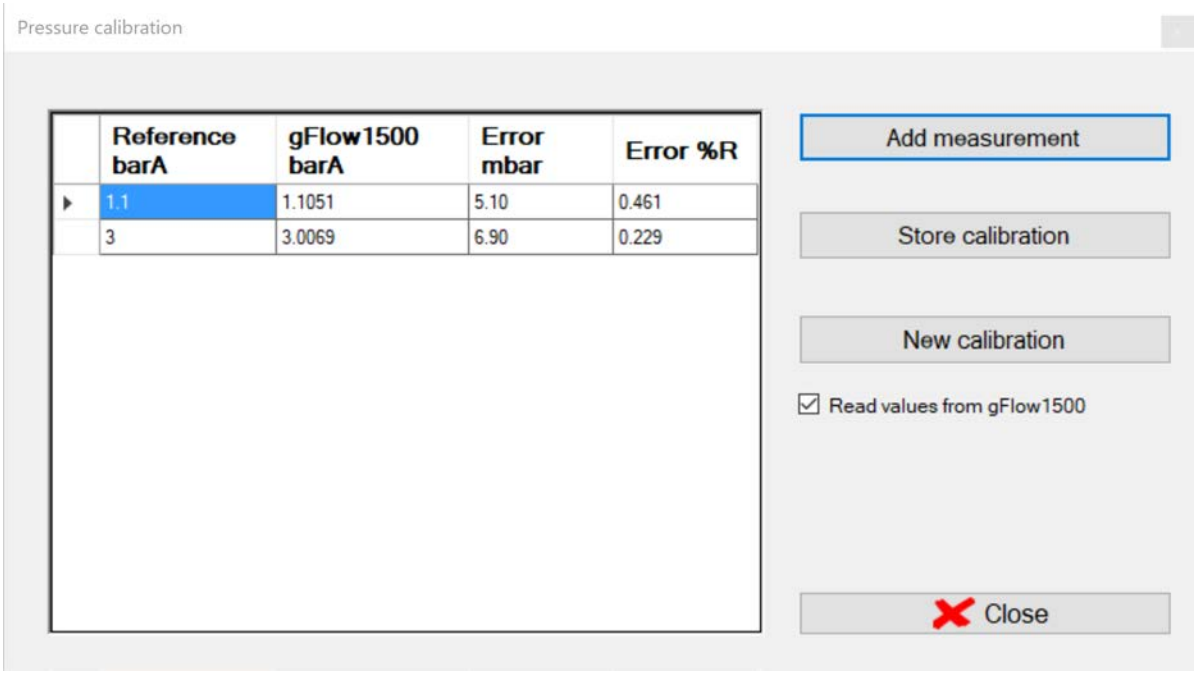
11. Click on Add measurement for the second calibration point.



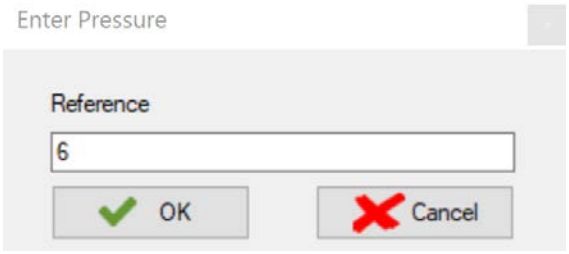
12. Enter the reference pressure in bar absolute (atmospheric pressure + gauge pressure) The value is chosen as 1 + 50% of (pmax – 1) for the 2 bar and 6 bar range. For the higher ranges pmin + 50% (pmax – pmin).



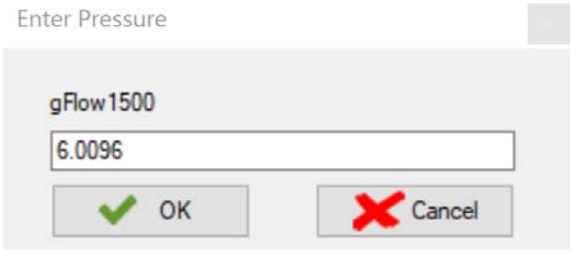
13. Enter the pressure reading from the gFlow 1500 automatically or enter manually.



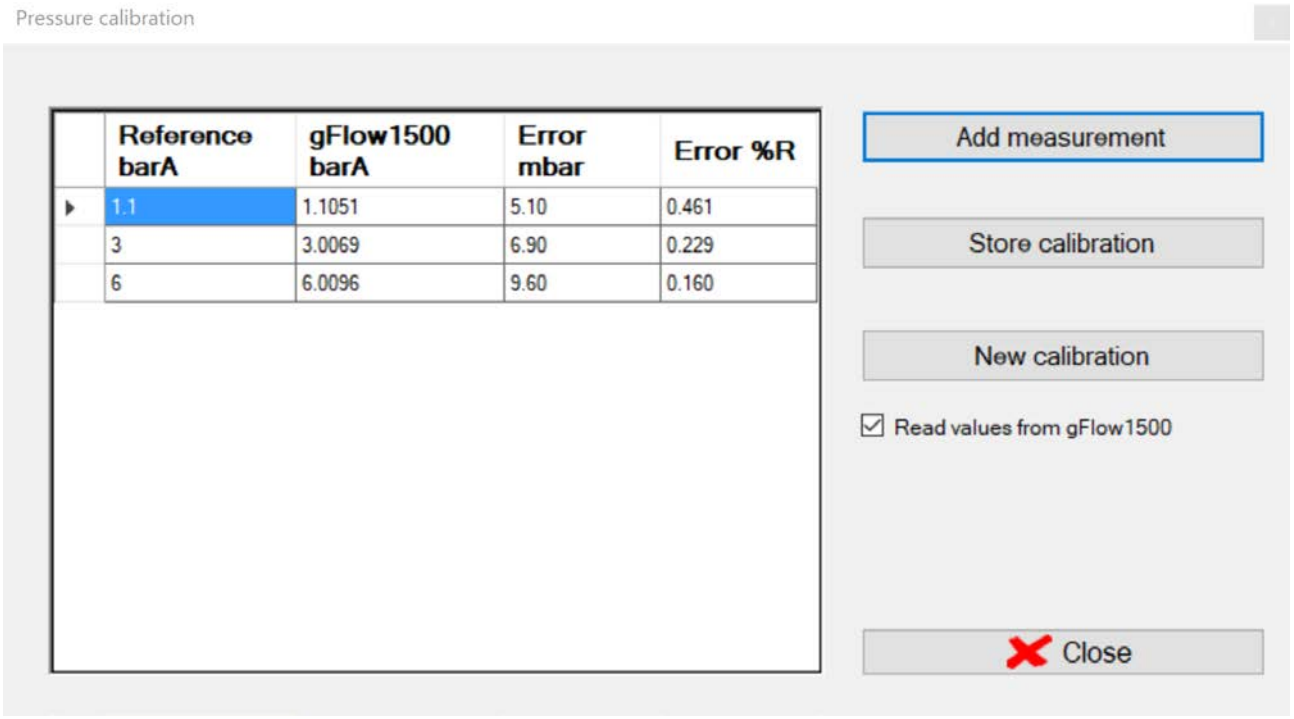
14. The results will be added to the table above.



15. Enter the reference pressure in bar absolute (atmospheric pressure + gauge pressure) The value is chosen as 1 + 100% of (pmax – 1) for the 2 bar and 6 bar range. For the higher ranges pmin + 100% (pmax – pmin). Please do not exceed the value for pmax with more than 5%.



16. Enter the pressure reading from the gFlow 1500 automatically or enter manually.

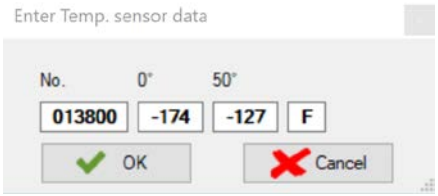


17. The results will be added to the table above.

Whenever the calibration is completed the values must be stored into the gFlow 1500 memory by clicking the Store calibration button. The time of the calibration will stored in the format YYMMDD HHmmss.

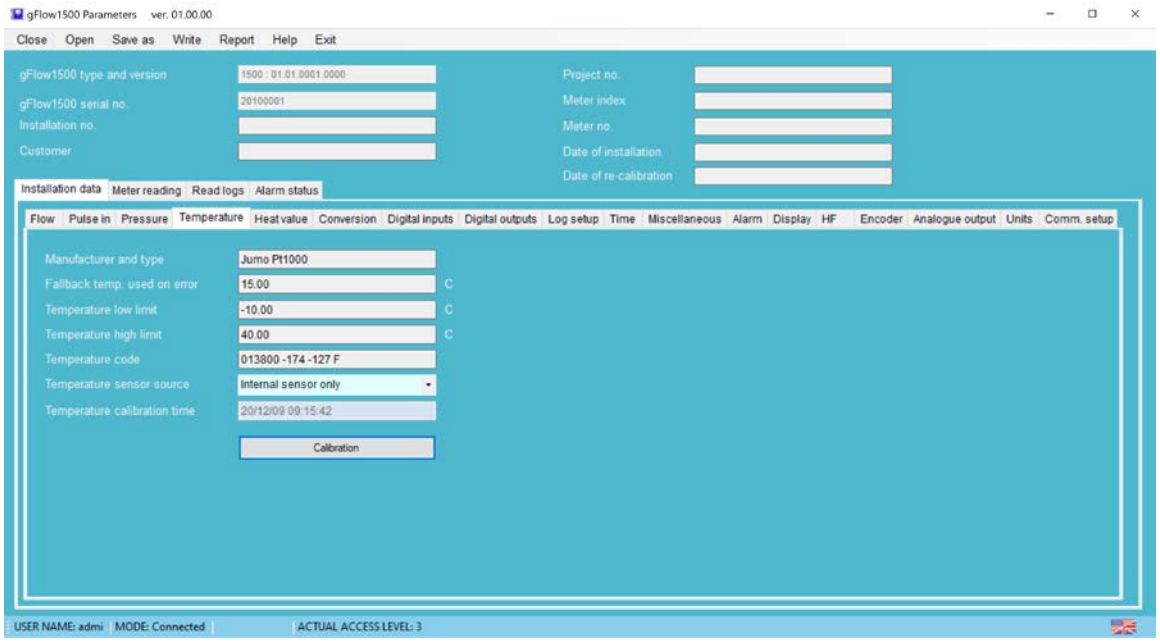
2.7 Calibration procedure for Temperature

To be able to apply the temperature calibration to the gFlow 1500 the connection as described in section 2.5 has to be followed. The temperature sensor is pre-calibrated in the factory and the results of this calibration are tagged to the cable. To insure the calibration is used correctly inside the gFlow 1500 the data from the tag on the cable needs to be entered in the memory of the Uniflo 1x00. An example is given below.

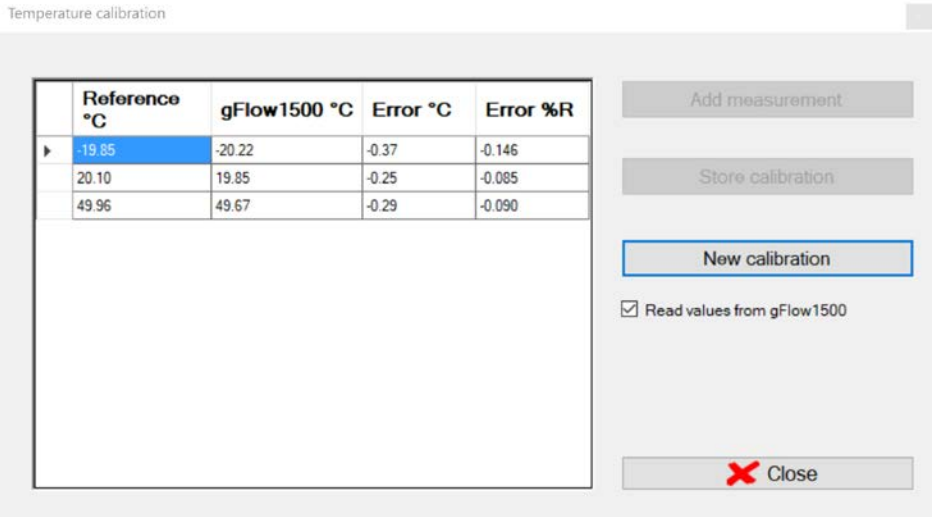


From here the connection is assumed to be made correctly.

1. After the connection is made and all data has been read from the gFlow 1500 you can find the button for calibration for the temperature sensor in the folder Temp.. Only with the extended user rights the Calibration can be accessed and modified.
2. Click on Calibration. The MID or factory calibration usually has 0 points. A calibration can contain 0 to 10 points if required. A single point calibration is just an offset calibration where a 2 point calibration also takes influence on the slope of the curve. More than 2 points can correct for the shape of the curve.

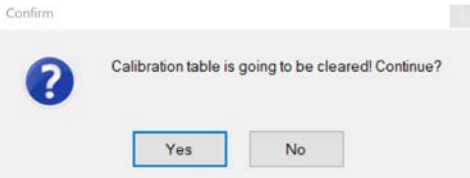


3. At temperature tab select Calibration

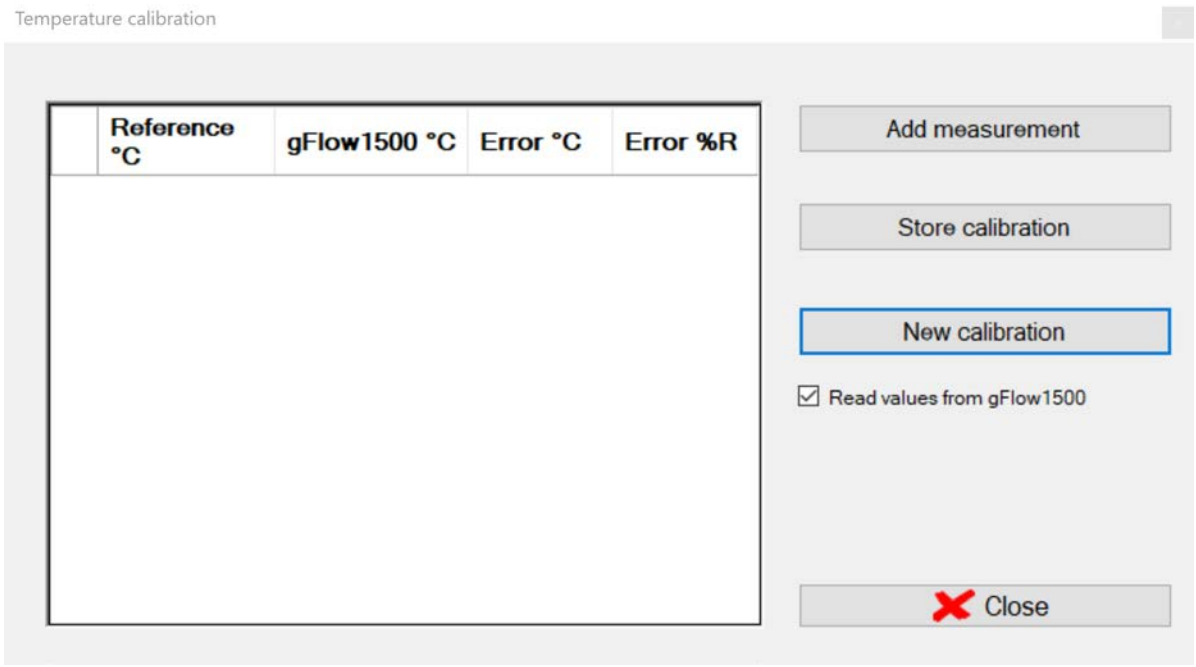


4. The current calibration is shown.

5. Click on New calibration.

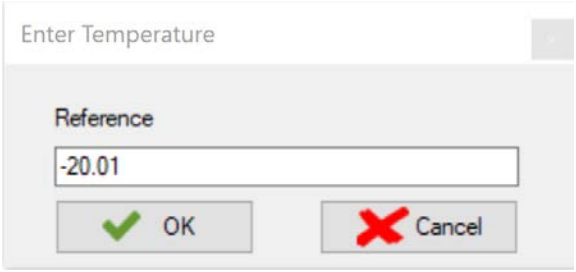


6. Click on Yes.

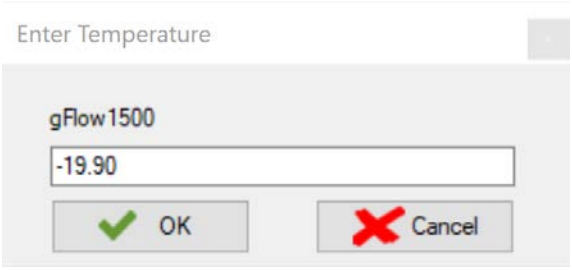


7. Now the button Add measurement and Store calibration are active.

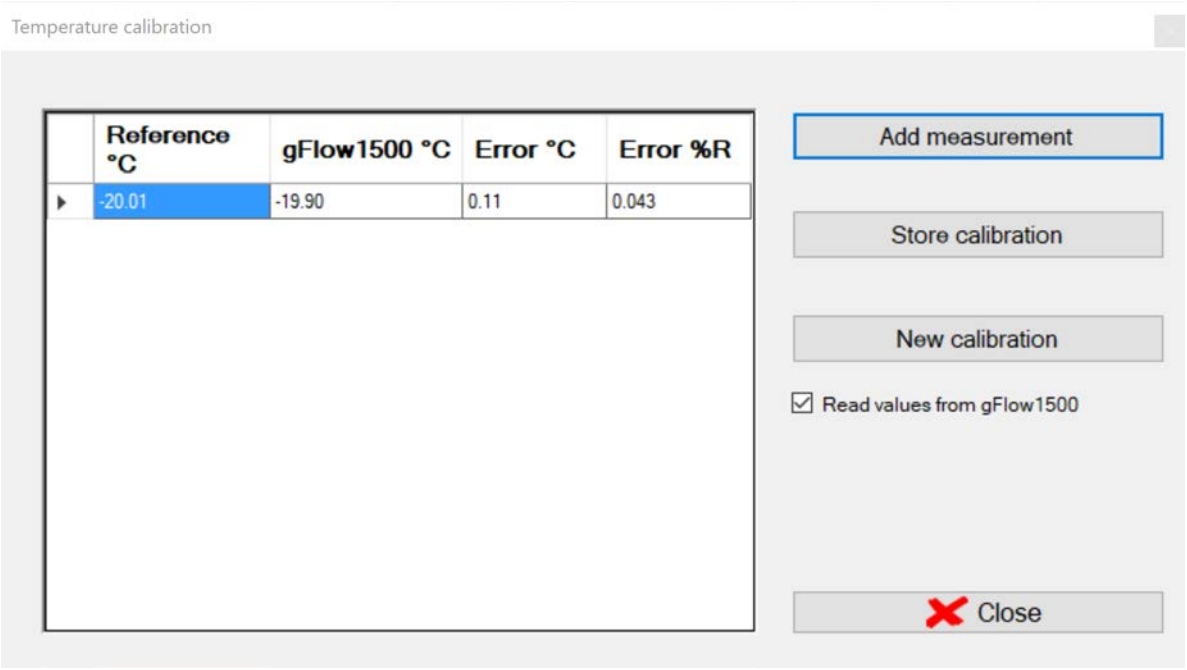
8. Click on Add measurement.



9. Enter the reference temperature in °C. The value is chosen as possible reference temperature depending on the range and equipment used. The values 0 °C and + 40°C are easy to obtain. Using a temperature controlled bath offers more calibration points. In the factory the values of -20°C; +20°C and +50°C are used.

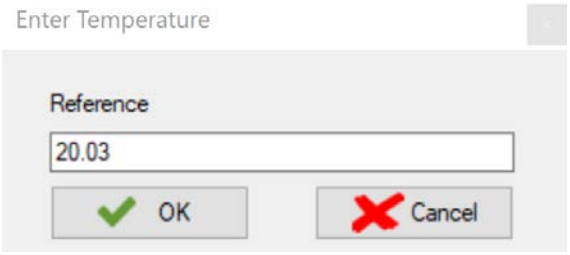


10. Enter the temperature reading from the gFlow 1500 automatically or enter manually.

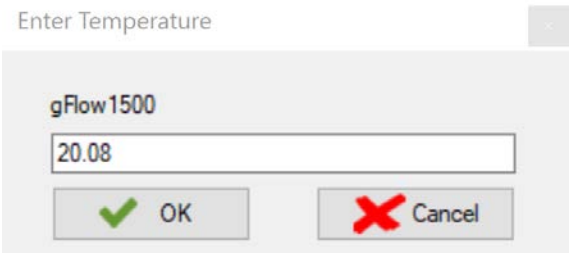


11. The results will be added to the table above. The error is calculated automatically. Whenever the error is too big the sensor needs to be replaced.

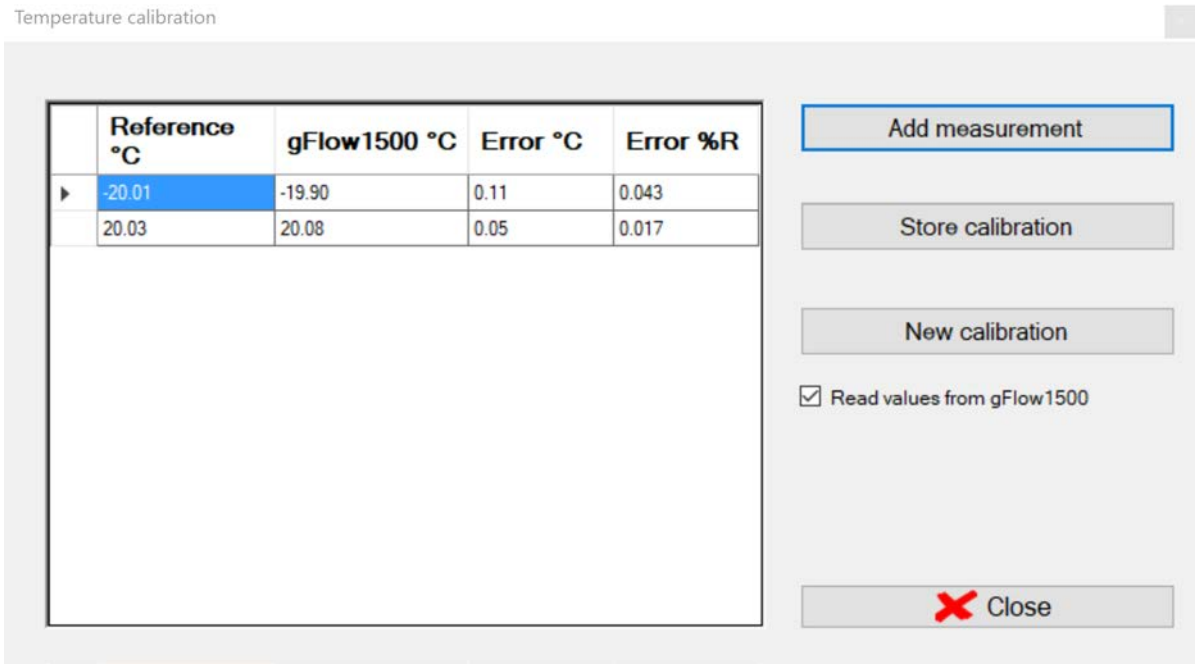
12. Click on Add measurement for the second calibration point.



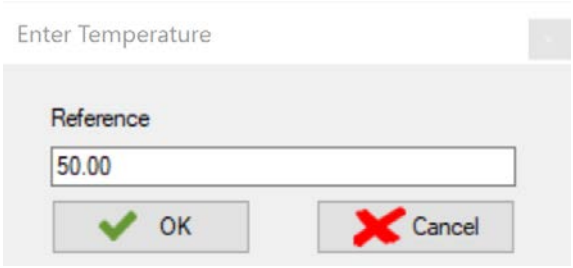
13. Enter the reference temperature in °C. The value is chosen as possible reference temperature depending on the range and equipment used. The values 0 °C and + 40°C are easy to obtain. Using a temperature controlled bath offers more calibration points. In the factory the values of -20°C; +20°C and +50°C are used.



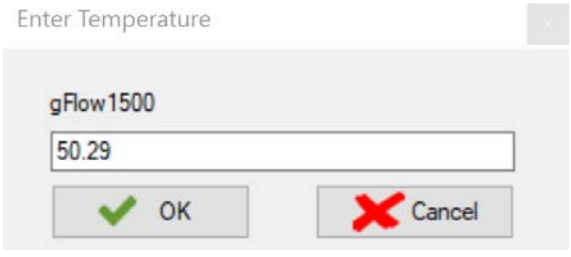
14. Enter the temperature reading from the gFlow 1500 automatically or enter manually.



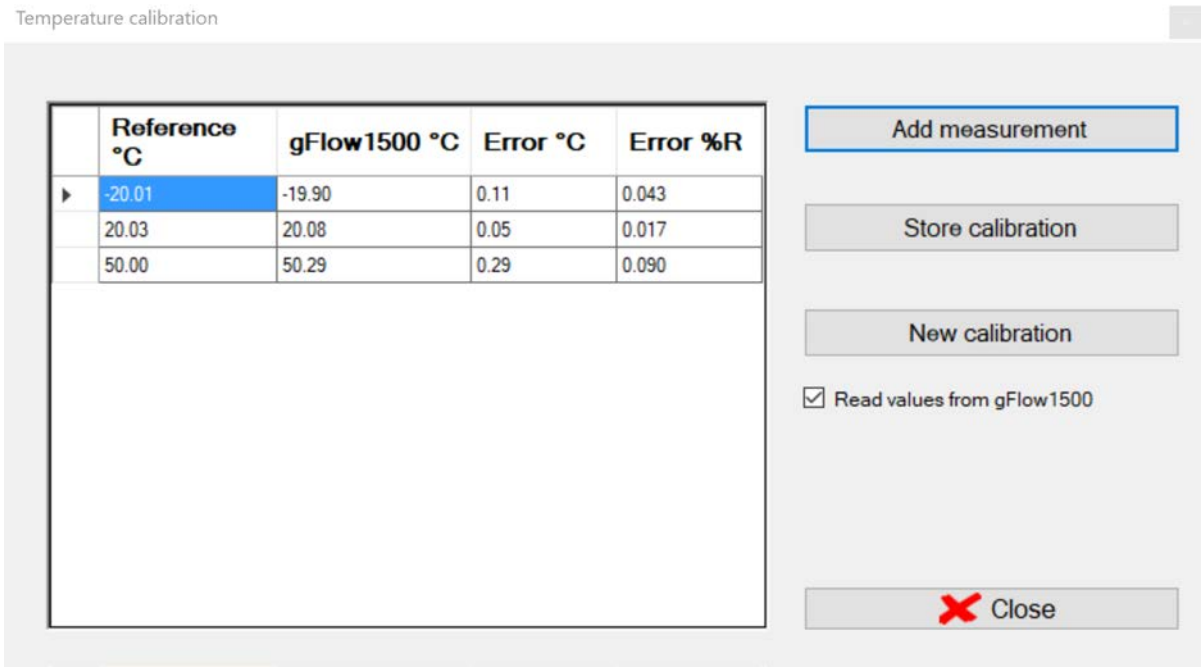
15. The results will be added to the table above



16. Enter the reference temperature in °C. The value is chosen as possible reference temperature depending on the range and equipment used. The values 0 °C and + 40°C are easy to obtain. Using a temperature controlled bath offers more calibration points. In the factory the values of -20°C; +20°C and +50°C are used.



17. Enter the temperature reading from the gFlow 1500 automatically or enter manually.



18. The results will be added to the table above.

Whenever the calibration is completed the values must be stored into the gFlow 1500 memory by clicking the Store calibration button. The time of the calibration will stored in the format YYMMDD HHmmss.

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I. Accessories

For the gFlow 1500 several accessories are available:

No.:	Description	gAvilar part no.
1	Mounting bracket for pipe installation	98019
2	Mounting bracket for wall installation	98019
3	Optical interface USB-A	94081
4	External power supply 230Vac to 5Vdc Meanwell	95282
5	External power supply 24Vdc to 5Vdc PR electronics	94066
6	Safety barrier Z757 (power supply)	95188
7	Safety barrier KHD2-SR2-Ex1.W.LB (pulse + alarm output)	
8	Safety barrier Z788.H (analogue output)	
9	Safety barrier GMI D1061 (serial communication RS485)	
10	Pressure sensor valve gDC-40 PN100	67008

Following spare part are available

No.:	Description	gAvilar part no.
1	Pressure sensor 2 bar abs with 3 meter cable	95006
2	Pressure sensor 6 bar abs with 3 meter cable	95007
3	Pressure sensor 14 bar abs with 3 meter cable	95008
4	Pressure sensor 30 bar abs with 3 meter cable	95009
5	Pressure sensor 80 bar abs with 3 meter cable	95010
6	Temperature sensor 5 mm with 3m cable	94078
7	Temperature sensor 6 mm with 3 m cable	94079
8	Cable gland M12	98109
9	Cable gland M16	98110
10	Breathing valve M12	98111
11	M12 nut	98107

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Document revision

Rev.	Init	Comment
04.05.2020	EvdV	Document created rev0
31.03.2021	EvdV	Modifications due to layout changes in config program rev01
21.09.2021	EvdV	Modifications due to layout changes in config program and Firmware rev02
12.07.2022	EvdV	Modifications due to layout changes in config program and Firmware rev03
21.12.2022	EvdV	Modifications due to layout changes in config program and Firmware rev04
07.02.2023	EvdV	Modifications due to layout changes in config program and Firmware rev05
21.06.2023	EvdV	Modification due to ATEX safety
03.07.2023	EvdV	Modification of page numbers at 350
15.11.2023	EvdV	Modification of Volume comparing and HF comparing
16.11.2024	EvdV	MessEV added in F6.0
25.01.2024	EvdV	Page 346 added, page 111 removed M, M added on pages 112, 161 162, 166

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