VERSAFLOW Handbook

- 100 Series Twin Straight Tube Coriolis Mass Flowmeter
- 200 Series Twin Straight Tube Coriolis Mass Flowmeter
- 1000 Series Single Straight Tube Coriolis Mass Flowmeter

Honeywell

6. VERSAFLOW 1000 (Single Straight Tube Meter)

7. TWC 9000 Converter

8. Start Up

9. Service and Troubleshooting

10. Additional Information

Congratulations on purchasing this high quality product. To get the best out of your mass flowmeter, please take some time to read through this handbook which describes the many features and options available. Please refer to the index for a list of detailed topics.

If applicable, a separate document is supplied that describes hazardous area information.

1.1 Intended Use

The VERSAFLOW mass flowmeter family is designed for the direct measurement of mass flow rate, product density and product temperature. Indirectly, it also enables measurement of parameters such as: total mass; concentration of dissolved substances and the volume flow.

For use in hazardous areas, special codes and regulations are applicable which are specified in a separate handbook.

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

Improper installation and operation of the flow meters may lead to loss of warranty. Warranty is also null and void if the instrument is damaged or interfered with in any way.

In addition, the "general conditions of sale" which forms the basis of the purchase agreement are applicable.

If you need to return your VERSAFLOW flow meters to HONEYWELL, please complete the form on the last page of this handbook and return it with the meter to be repaired. HONEYWELL regrets that it cannot repair or check your flow meter unless accompanied by a completed form.

1.2 CE/EMC Standards/Approvals

The VERSAFLOW family with the TWC 9000/010 signal converter meets all the requirements of the EU-EMC and PED Directives and bears the CE Symbol.

The VERSAFLOW system is approved for hazardous duty installations to the harmonised European Standards (ATEX) to Factory Mutual (FM) and CSA (Canadian Standards).

Technical data subject to change without notice

It should be noted that this handbook MUST be read in conjunction with the following additional documentation:

- Hazardous Areas Handbook.
- Communications Handbook.
- Concentration Handbook.
- Corrosion Guidelines.

1.3 PED Integrity

To ensure the PED integrity of the meter, you MUST ensure that the serial numbers on both the conveter (or remote terminal box) data label and the sensor match.

1.4 Secondary Containment & Burst Discs

Where the meter is being used to measure:

- high pressure gases
- gases kept as liquids by high pressure

and/or where there is a risk of tube failure because of:

- the use of corrosive and/or errosive process fluids
- frequent pressure and/or temperature cycling
- seismic or other shock loading

a secondary containment option MUST be purchased. Where the above situation applies and secondary pressure containment is not available, the burst disc option MUST be purchased. For more information, please contact Honeywell Ltd

1.5 Explanation of Symbols Used

The following is a guide to the meaning of the symbols used in this handbook.The symbols fall into two types. The rectangular symbols with blue background draws the reader's attention to general points of information. The triangular symbols with yellow background draw the reader's attention to hazards or hazardous situations.

	**General Information**	Information is important to the installation/operation of the meter.
	**General Warning**	Risk of damage to the meter or installation.
	**EX - Hazardous Area Warning**	Instruction MUST be observed in order to comply with Hazardous Areas Certification.
	**High Voltage**	Risk of electric shock.
	**General Hazard**	Non specific hazard that could result in injury.
	**Hot Surface or High Temperature**	Risk of burning.
	**Heavy Item**	Risk of injury.

2.1 Scope of Delivery

When unpacking your meter, please ensure that no visible damage has occurred during transportation. If damage has occurred, please contact the carrier for claims.

Your high quality instrument has been fully tested and checked before shipping. The following items should be included with your instrument unless otherwise requested:

1. VERSAFLOW Mass Flow Meter
2. Separate Converter with remote converter wall mount (not for compact version)
3. CD-ROM & Quick Start Guides
4. Screw driver for terminal connections
5. Calibration certificate
6. Factory and Material certification, if ordered.

If any of these items are missing, please contact your nearest HONEYWELL Office or representative (see back page).

2.1.1 Flange Versions

If your meter has been ordered with a flange connection, this will be supplied as per your order and the flange specification is stamped on the outer edge of the flange.

Please check this specification against your original order and refer to the appropriate section in this handbook.

2.1.2 Hygienic Versions

If your meter was ordered with a hygienic connector, it should be noted that the 'O' ring seals between the meter and process pipework are NOT normally supplied.

If the hygienic connection is via an adaptor, then 'O' rings (material EPDM) are supplied in order to make the connection between the meter and the adaptor. Please note that other materials are available on request.

'O' rings are not normally supplied for the seal between the adaptor connection and process pipework.

Adaptor connections may also be supplied loose, dependng upon type supplied.

For DIN11864-2 connections, 'O' rings and counter flanges are not supplied as standard but are available on request.

2.1.3 Remote Field/Wall/Rack Conveter

The VERSAFLOW range of massflow meters are normally supplied with the converter integrally fitted. If you have specified a remote converter, the meter will be supplied with the converter as a separate unit, together with a wall/pipe mounting bracket and a connection box mounted to the meter.

In order to comply with 3A approval, all unused holes MUST be plugged and unused threads MUST be covered or removed!

If ordered with the meter, cabling is supplied loose and IS NOT pre-prepared!

Wall Converter

If specified at the time of ordering, the meter will be supplied with a plastic wall mounted converter that can be mounted on a wall or a pipe The housing material is Polyamide - polycarbonate.

Please note that the wall converter has not been 3A approved for hygienic applications.

19" Rack Mount Converter

If specified at the time of ordering, the meter will be supplied with a 19" rack mounted converter

3.1 General Installation Information

The VERSAFLOW mass flow meters provide high accuracy and excellent repeatability. Narrow band pass digital filtering, and the mathematically modelled internal primary head design with AST (Adaptive Sensor Technology) for the VERSAFLOW sensor family provide exceptional immunity to external disturbances caused by vibrations from nearby process equipment.

The accuracy of the flow meter is not affected by velocity profile.

The following installation guidelines are practical to implement, particularly if planned before the VERSAFLOW meter is first installed. For further dimensions or connections, please refer to the relevant section.

For the VERSAFLOW, in general, no special mounting requirements are necessary. However, good general engineering practice for the installation of flow meters should still be observed.

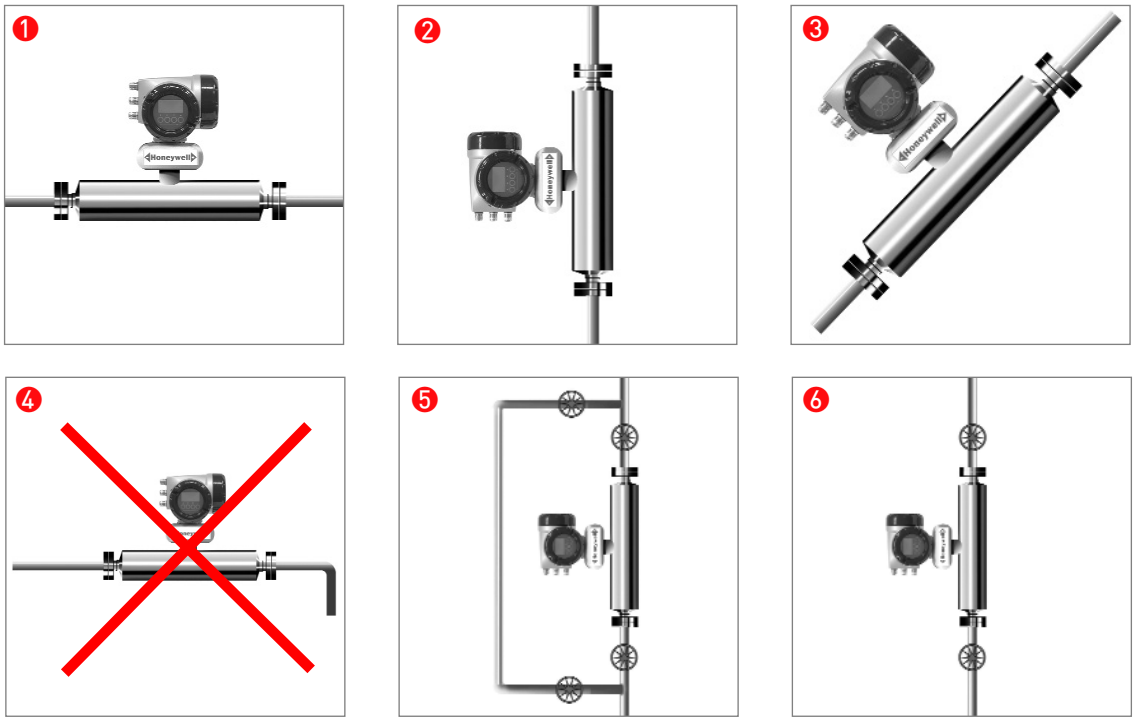
The general guidelines described in this section are valid for the complete VERSAFLOW family of mass flow meters

- The mass flow meters do not require any straight inlet or outlet runs.
- Due to the weight of the meters we recommend the use of supports.
- It is permissible to support the body of the meter.
- The meter can be installed horizontally, in an upward sloping pipeline or vertically. For best results, a vertical installation with flow in an upward direction is recommended.

This label on the meter shows the flow direction programmed into the converter in function C.1.3.1

As default this is always in the direction of the '+' arrow, i.e. left-to right as the label is viewed.

3.2 General Installation Principles



❶ Horizontal intalation with flow from left to right

❷ Vertcial installation with flow uphill

❸ Angled installation with flow uphill

❹ Horizontal installation with long vertical drops after the meter ARE NOT recommended

❺ ❻ Vertical installations with isolation valves fitted for setting the zero calibration. It is recommended that a valve is fitted below the meter to prevent a reverse flow when the pump is switched off.

Notes:

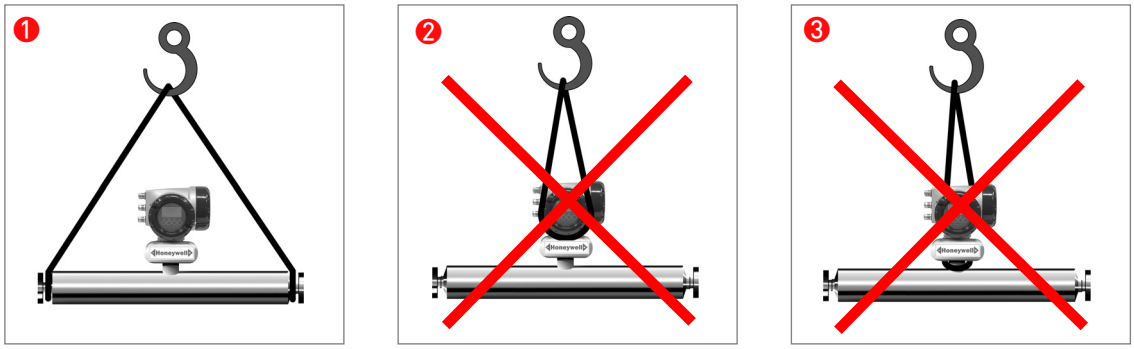
Avoid long vertical runs after the meter (❹). They can cause siphoning and therefore measurement errors. If long vertical runs are unavoidable, then you should use a valve or orifice plate downstream of the mter in order to the restrict flow.

Avoid mounting the meter at the highest point in the pipeline. Air or gas can accumulate here and cause faulty measurements.

3.3 Storage

If the meter is to be stored prior to installation, it is recomended that the meter is stored in its original packaging and that the ambient temperature range does not exceed -50°C or 85°C

3.4 Lifting



❶ Use a well maintained sling to lift the meter by the spigots

❷ DO NOT lift the meter by the electronics housing.

❸ DO NOT lift the meter by the electronics stem.

NOTE:

The 100 and 200 meters have 4 eye holes on the outer tube, 2 each end. These can be used to lift the meter into place on vertical installations, where the meter is supplied with hygienic connections. Please be aware, that they ARE NOT suitable for lifting the meter where is has been supplied with [heavier] flange connections. It is the user's responsibility to use suitable lifting equipment.

3.5 CSA Dual Seal (pending)

To cover the requirements of ANSI/ISA -12.27.01-2003 "Requirements for Process Sealing Between Electrical Systems and Flammable or Combustible Process Fluids" a secondary seal is incorporated into all VERSAFLOW coriolis products. If the primary seal fails, the secondary seal will prevent escaping fluid reaching the electronic compartment.

VERSAFLOW 100, 200, 1000

Liquids (Example model code: VERSAFLOW 1000C S25 – LIQUID)

Pressure/Temperature data:

VERSAFLOW 100 / 100C / 100M -40°C...130°C and 100...10,000 kPa

VERSAFLOW 200 / 200C / 200M -45°C...130°C and 100...14,000 kPa

VERSAFLOW 1000 / 1000C / 1000M -40°C...150°C and 100...10,000 kPa

If the primary seal fails, the casing of the meter will fill with liquid and the meter will stop working. The meter will notify the operator by going into <start up> mode and a diagnostic error will be shown on the TWC 9000 or PLC display. This is an indication that the primary seal (tube/s) has failed and the status of the meter should be checked.

Meter Status:

The meter will also go into <Start up> mode if the primary seal (tube/s) fail, or are not completely filled with fluid. For example, if the meter is drained or re/filled. To check the status of the meter, drain and re/fill with fluid and note the TWC 9000 or PLC display. See section11.5 for a list of status messages and diagnistics information.

If the meter remains in <Start Up> mode you MUST assume that the primary seal (tube/s) has failed and the appropriate action MUST be taken.

Gases (Example model code: VERSAFLOW 1000C S25 – GAS)

Pressure/Temperature data:

VERSAFLOW 100 / 100C / 100M -40°C...130°C and +500 to +10,000 kPa

VERSAFLOW 200 / 200C / 200M -45°C...130°C and +500 to +15,000 kPa

VERSAFLOW 1000 / 1000C / 1000M -40°C...150°C and +500 to +10,000 kPa

Pressures and/or temperatures may be further limited by tube, temperature, connection and Ex limits. Consult the meter data plates and relevant documentation for full details.

On all meters operating on gas measurement the casing of the meter is fitted with a burst disc. If the the primary seal (tube/s) fails leakage will occur from the burst disc.

Install the meter so that the burst disc is pointing away from personnel.

Regular Maintenance of Burst Disc:

Carry out regular maintenance checks on burst discs for leakage and/or blockages.

On all VERSAFLOW meters, the primary seal is considered to be the measuring tube of the meter. The materials of construction of the measuring tube/s are described within the relevant sections of this handbook and the customer's product and any other fluid flowing through the tube must be compatible with the material of construction.

If failure of the primary seal is suspected then the process line should be de-pressurised and the meter removed as soon as it is safe to do so. Please then contact Honeywell customer service for servicing or replacement of the meter.

4.1 Specific Installation Guidelines

- Tighten flange bolts evenly.
- Observe the pipe end loads as shown in s. 4.6
- It is permissible to support the weight of the meter on the body.
- Use of standard pipework reducers at the flange is allowed. Avoid extreme changes in pipe size (step changes).
- The use of flexible hoses directly at the meter is permitted.
- The meter can be installed so that the converter is on the side of the meter, resulting in the measuring tubes on top of each other, unless gases or solids are being measured.
- The 100 series has exceptional immunity to cross-talk, therefore allowing meters to be used in series.

4.2 Ambient / Process temperatures

The specified and approved ambient and process temperatures must be observed.

		SS318L	
		°C	°F
Process	All meters	-45...+130	-49...266
Ambient	Compact Al.	-40...+60	40...+140
	Compact Al. with certain I/O options (consult Honeywell)	-40...+65	-40...+149
	Compact SS	-40...+55	-40...+131
	Remote	-40...+65	-40...+149

Note:

For additional temperature limits in hazardous area applications, reference should be made to the publication *"Guidelines for the use of Coriolis Meters in Hazardous Areas"*.

Where meters are mounted in direct sunlight, it is recommended to install a sunshade. This is particularly important in countries with high ambient temperatures.

The maximum differential temperature between the process and ambient temperature without insulation is 110°C or 200°F.

To avoid thermal shock, the meter MUST not be subject to rapid changes in process tempratures and reference should be made to the following table

Meter	Max. Temperature Shift
S15 & S25	80°C
S40 & S50	110°C

Operation outside these limits may result in shifts in density and mass flow calibration. Repeated shocking may also lead to premature failure of the meter!

4.3 Pressure Equipment Directive (PED) requirements

To comply with the requirements of the PED in Europe, the following information is provided to assist the plant engineer in installing the meter:

Measuring tube:	Sealing Faces:
Stainless Steel UNS 31803	Stainless Steel 316L

The outer cylinder 304 / 304L is dual certified (Optional outer cylinder of 316/316L). This also applies to PED certified housings.

Wiring feedthrough is made of Epoxy (or PEEK) with 2 'O' ring seals in FPM / FKM & Hydrogenated Nitrile.

Flanges all 316 / 316 L dual certified.

Hygienic Connections are 316L

Optional heating jacket 316 / 316L

Note: Outer cylinder is in contact with heating medium

4.4 Secondary Pressure containment

The VERSAFLOW 100 meters are supplied (as standard) without secondary pressure containment. The outer casing has a typical burst pressure >100 barg.

Options are available with PED certified secondary pressure containment, with the following pressure ratings:

304/304L and 316/316L: 63 bar @20°C 580 psi @ 68°F

316/316L: 100 bar @20°C 1450 psi @ 68°F

If the user suspects that the primary tube has failed, the unit must be depressurised and removed from service as soon as it is safe to do so.

Note:

In the 100 series there is a high pressure wire feed through with 'O' rings that might not be compatible with the process fluid for an extended period if a primary tube fails.

It is the user's responsibility to ensure that the materials used are compatible with this product.

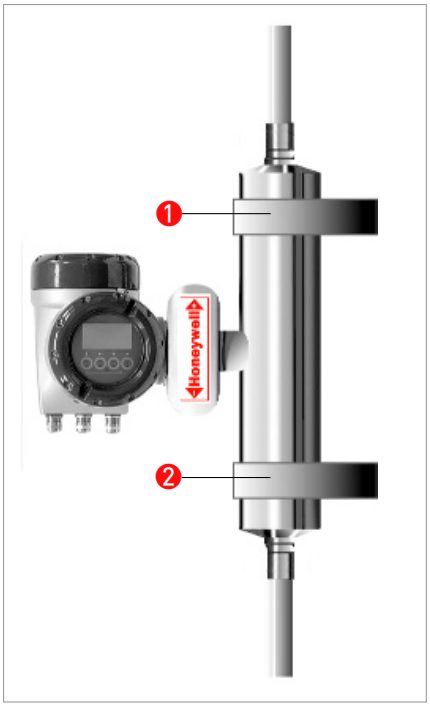
Other 'O' ring materials are available on request.

4.5 Hygienic Applications

The VERSAFLOW 100 series is available with a variety of hygienic process connectors.

When installing / using meters with hygienic process connectors, support /clamp the meter properly. The meters are heavy and could injure when disconnected from the adjacent pipe work.

The recommended method of installation is to mount the meter against a support / wall with the body of the meter supported / clamped. The process pipe work can then be supported off the meter. The meter is too heavy to be supported from the thin walled piping usually associated with the hygienic industry



❶ ❷ Meter Supports

The 3A approval for the 100 series requires that it is “self draining”. Install the meter vertically with the flow running uphill.

Installation lengths

For installation lengths, please see section 4.9

Please check with HONEYWELL if you are unsure of the installation length. Many meters are built to customer requirements / specifications especially where special hygienic process nectors have been adapted to the meter. As these are normally non-standard, the installation length will not be given in the technical data

It is also recommended that the seals be replaced regularly to maintain the hygienic integrity of the connection.

Unless specifically requested, internal surfaces are not polished and no warranty is made as to the surface finish.

If polishing option and /or EHEDG, ASME Bio-Processing or 3A approvals was selected at time of order, all product contact surfaces are polished 0.5 micrometer Ra (20CLa) finish or better.

4.6 Pressure ratings

Tubes and secondary pressure containment 100 barg	100 bar at 20°C (1450 psi at 68°F)
De-rated to	80 bar at 130°C (1160 psi at 266°F)
Heating Jacket	10 bar at 130°C (145 psi at 266°F)
Secondary pressure containment 63 barg	63 bar at 20°C (914 psi at 68°F)
De-rated to	50 bar at 130°C (725 psi at 266°F)

Meter data plates are stamped with maximum pressure rating at both 20°C (68°F) and max. operating temperature of connection, primary tube or secondary pressure containment **whichever is the lower.**

Maximum pipe work forces

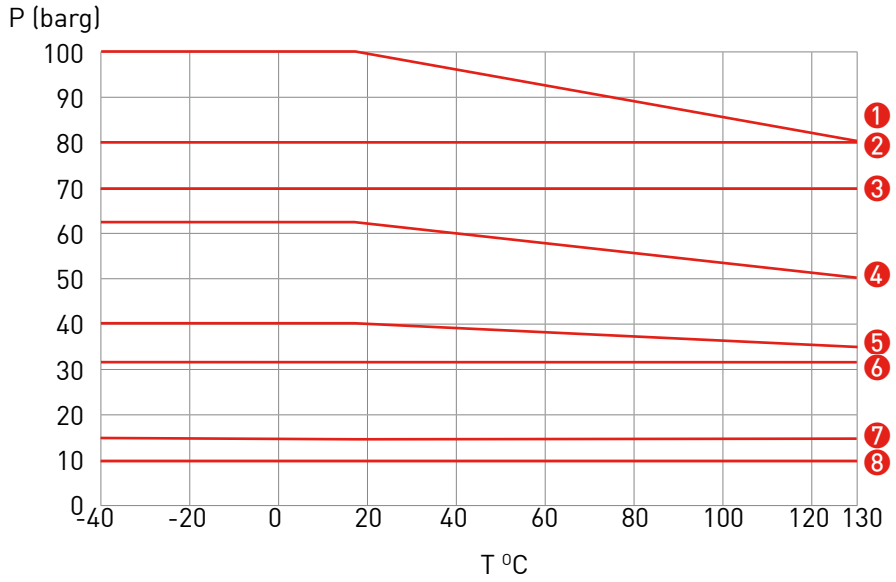
	20°C		130°C	
	40 bar	100 bar	32 bar	80 bar
Size	Max Load	Max Load	Max Load	Max Load
15	25 kN	17 kN	18 kN	12 kN
25	38 kN	19 kN	28 kN	12 kN
40	48 kN	15 kN	35 kN	7 kN
50	99 kN	20 kN	72 kN	8 kN
	Flange Connections			

These loads are roughly equivalent to the max axial loading allowed in an un-radiographed butt weld in a 316L schedule 40 pipe.

Loads given are maximum static loads. If loads are cycling, particularly between tension and compression, these loads should be reduced.

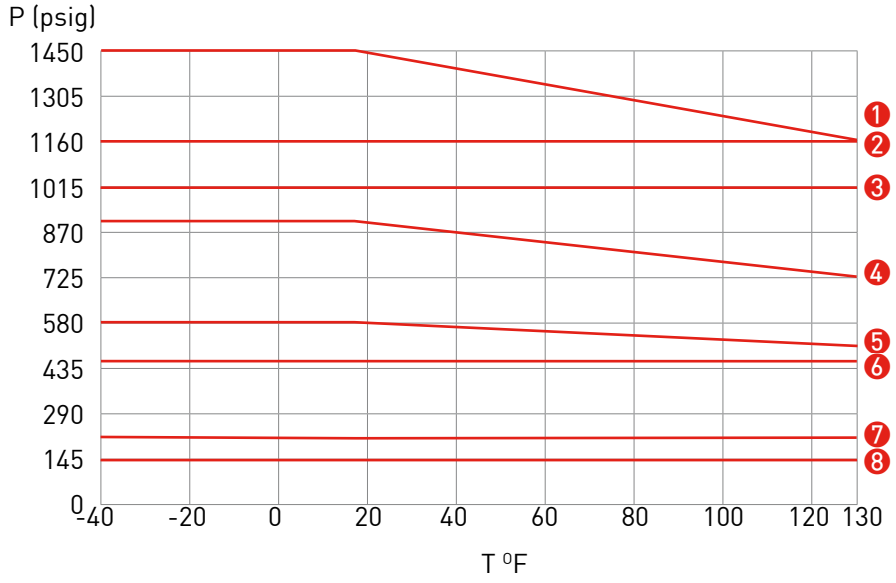
Please consult HONEYWELL for more information.

Pressure de-rating (barg)



1. Measuring tubes (PED & CRN 15/25) and outer cyclinder 316 (100 barg PED option) PN100, DIN2637, PN100
2. CRN S40 measuring tube
3. CRN S30 measuring tube
4. Outer cylinder 304 & 316 (63 barg PED option), DIN 2636, PN 63
5. DIN 2635 PN 40
6. JIS 20K
7. JIS 10K
8. Hygienic connection

Pressure de-rating (psig)



1. Measuring tubes (PED & CRN 15/25) and outer cyclinder 316 (1450 psig PED option)
2. CRN S40 measuring tube
3. CRN S30 measuring tube
4. ASME 600 lbs
5. Outer cyclinder 304 & 316 (914 psig PED option)
6. ASME 300 lbs
7. ASME 150 lbs
8. Hygienic connection

DIN flange ratings based on EN 1092-1: 2001 table 18, 1% proof stress material group 14EO
ASME flange ratings based on ASME B16.5: 2003 table 2 material group 2.2
JIS flange rating based on JIS 2220: 2001 table 1 division 1 material group 022a

4.7 Heating and insulation

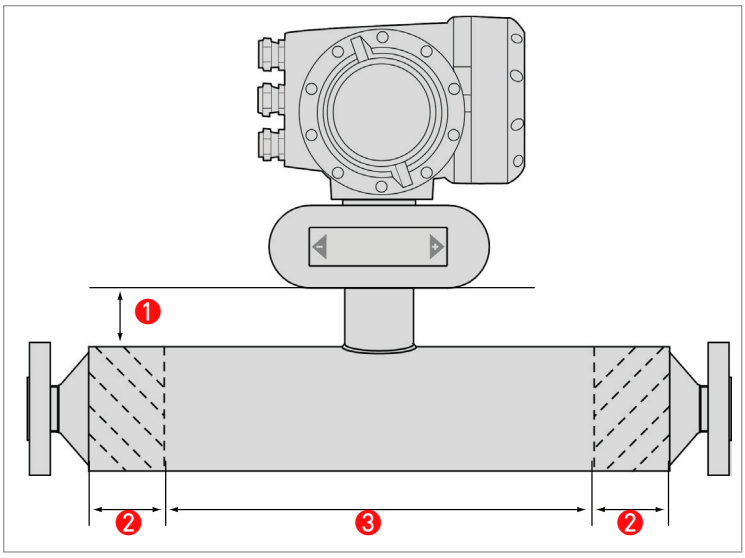
There are several ways to heat the meter. In most cases heating is unnecessary as the meter is designed as such that very little heat is lost or gained through the outer cylinder.

Insulation

Where insulation is required a variety of materials may be used to insulate the meter. Care must be taken not to insulate the meter above the halfway mark of the electronics support post as shown.

Electrical Heating

Electrical tape heating may be used. Care should be taken to only heat the sections where the best effect will be achieved. Do not heat above the converter mount centre line See illustration.



1. Max insulation depth
2. Heated Areas
3. Do NOT heat this area

When insulating please observe guidelines as per insulation section.

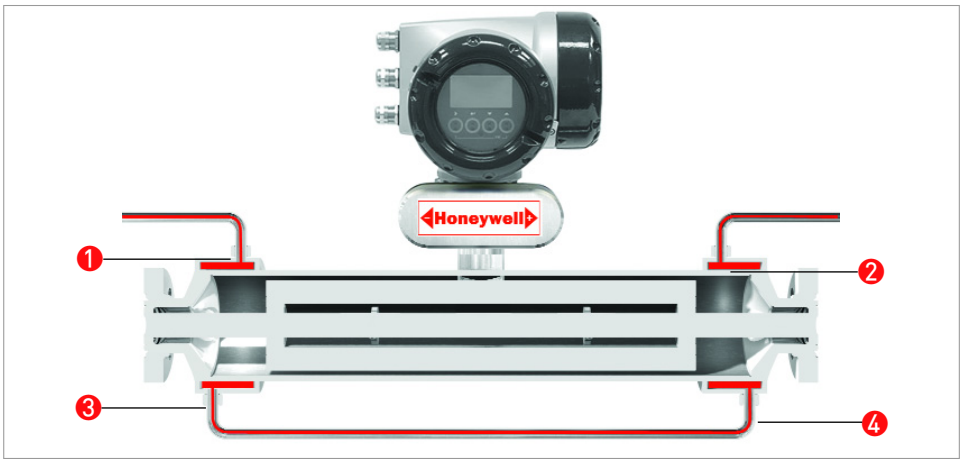
Size	DIM 2
15	65 mm
25	75 mm
40	110 mm
50	125 mm

Liquid / Steam heating jacket

The meter can be supplied with a heating jacket. This jacket is designed to minimise the differential stress across the meter where differences in temperature between outer cylinder and measuring tube exist.

The connections to the heating jacket are NPT or Ermeto sockets.

It is recommended that reinforced flexible hoses be used to connect the heating jacket to the heat source.



❶ ❷ ❸ ❹ Connection Points

Important:

Always heat the jacket to working temperature before flowing product in measuring tube.

Avoid the use of fluids that can cause crevice corrosion.

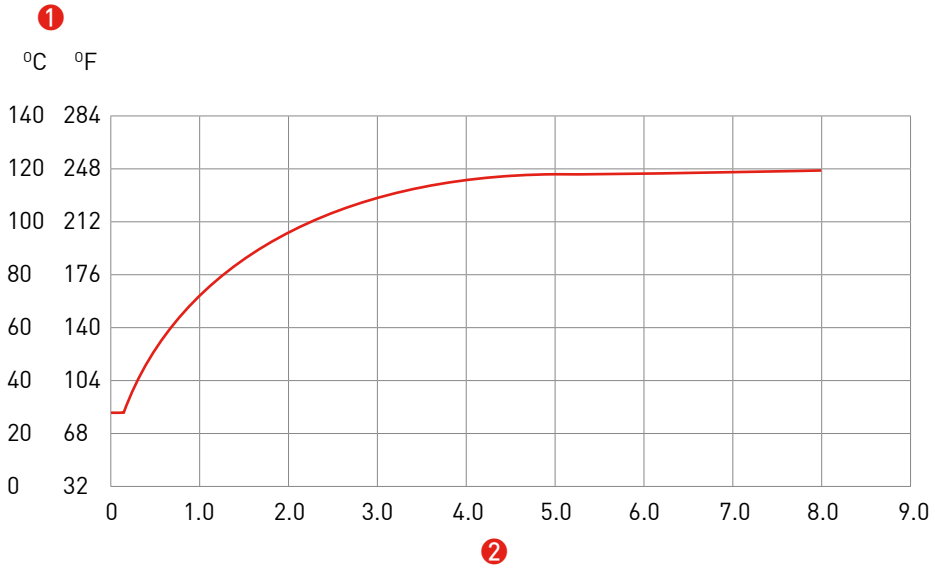
Although all the jacket materials are 316L, the outer cylinders are 304L (Optional 316L).

Connections should be made to ensure all air can be vented on liquid systems and all condensate can be drained on steam systems.

Note :

The maximum heating medium pressure and temperature for heating jackets is 10 bar at 130°C or 145 psig at 266°F.

Heating Times (based on heating jacket operating at maximum temperature)



❶ Temperature at centre of measuring tube

❷ Time (hours)

Cooling: please consult HONEYWELL if cooling medium is to be used in the heating jacket.

4.8 Purge Port Meters

Purge Port Options

If the purge port option was selected at time of order, then your meter will be fitted with ½" NPT female connections – these will be clearly identified. These connections are sealed with NPT plugs and PTFE tape.

Important:

Do not remove these plugs.

The meter is factory sealed with a dry nitrogen gas fill and any ingress of moisture will damage the meter. The plugs should only be removed to purge the inside of the meter case of any product if it is suspected that the primary measuring tube has failed. If it is suspected that the primary tube has failed, depressurise and remove the meter from service, as soon as it is safe to do so.

4.9 Technical Data

Maximum Flow Rates:

	15	25	40	50
Kg/h	6,500	27,000	80,000	170,000
Lbs/min	239	992	2,940	6,247

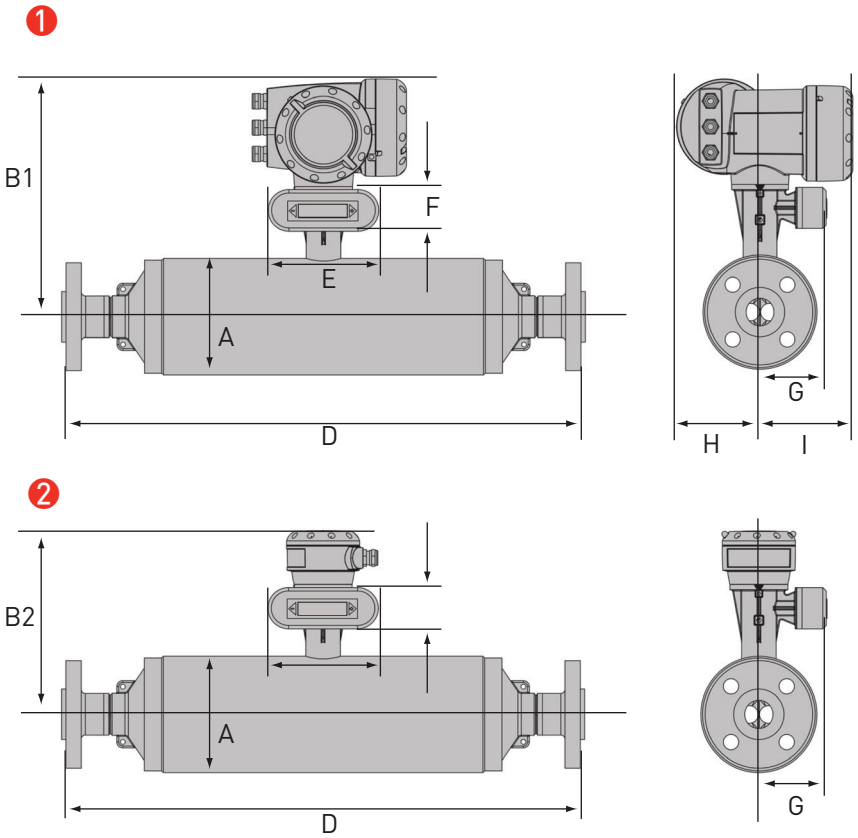
Minimum flow rate

Depending on measuring error required.

Weights (PN40 flanges)								
	15		**25**		**40**		**50**	
	kg	**lbs**	**kg**	**lbs**	**kg**	**lbs**	**kg**	**lbs**
Compact with aluminium TWC 9000	13.5	30	16.5	36	29.5	65	57.5	127
Compact with SS TWC 9000	18.8	41	21.8	48	34.8	77	62.8	138
Remote with aluminium J box	11.5	25	14.5	32	25.5	56	51.5	113
Remote with SS J box	12.4	27	15.4	34	26.4	58	52.4	115

Dimensions

Flanged versions



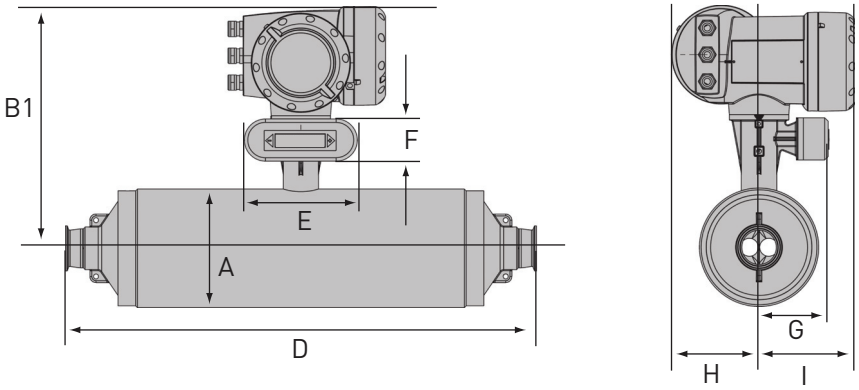
1 Compact version
2 Remote Version

Metric (mm)																
DN15																
	DN 15 PN40	DN 25 PN40	DN 15 PN100	DN 25 PN100	½" ASME 150	½" ASME 300	½" ASME 600	¾" ASME 150	¾" ASME 300	¾" ASME 600	1" ASME 150	1" ASME 300	1" ASME 600	15A JIS 20K	25A JIS 20K	
A	101.6															
B1 / B2	311 / 231															
D	498	503	513	538	518	528	541	528	538	550	534	546	558	498	503	
DN25																
	DN 25 PN40	DN 40 P N40	DN 25 PN100	DN 40 PN100	1" ASME 150	1" ASME 300	1" ASME 600	1½" ASME 150	1½" ASME 300	1½" ASME 600	25A JIS 20K	40A JIS 20K				
A	114.3															
B1 / B2	317 / 237															
D	531	541	567	575	563	575	589	575	589	603	531	541				
DN40																
	DN 40 PN40	DN 40 PN100	DN 50 PN40	DN 50 PN63	DN 50 PN100	1½" ASME 150	1½" ASME 300	1½" ASME 600	2" ASME 150	2" ASME 300	2" ASME 600	40A JIS 20K	50A JIS 20K	50A JIS 10K		
A	168.3															
B1 / B2	344 / 264															
D	706	740	712	740	752	740	754	770	744	756	774	706	712			
DN50																
	DN 50 PN40	DN 50 PN63	DN 50 PN100	DN 80 PN40	DN 80 PN63	DN 80 PN100	2" ASME 150	2" ASME 300	2" ASME 600	3" ASME 150	3" ASME 300	3" ASME 600	50A JIS 10K	50A JIS 20K	80A JIS 10K	80A JIS 20K
A	219.1															
B1 / B2	370 / 290															
D	862	890	902	882	910	922	894	906	926	906	926	944	862		882	
All sizes																
E	160															
F	60															
G	98.5															
H	123.5															
I	137															

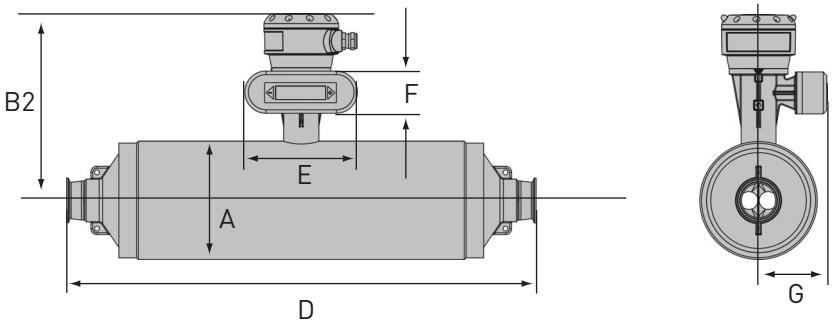
Imperial (Inches)																
DN15																
	DN 15 PN40	DN 25 PN40	DN 15 PN100	DN 25 PN100	½" ASME 150	½" ASME 300	½" ASME 600	¾" ASME 150	¾" ASME 300	¾" ASME 600	1" ASME 150	1" ASME 300	1" ASME 600	15A JIS 20K	25A JIS 20K	
A	4															
B1 / B2	12.2 / 9.09															
D	19	19.8	20.2	21.2	20.4	20.8	21.3	20.8	21.2	21.6	21	21.5	22	19.6	19.8	
DN25																
	DN 25 PN40	DN 40 P N40	DN 25 PN100	DN 40 PN100	1" ASME 150	1" ASME 300	1" ASME 600	1½" ASME 150	1½" ASME 300	1½" ASME 600	25A JIS 20K	40A JIS 20K				
A	4.5															
B1 / B2	12.5 / 9.3															
D	20.9	21.3	22.3	22.6	22.2	22.6	23.8	22.6	23.2	23.7	20.9	22.8				
DN40																
	DN 40 PN40	DN 40 PN100	DN 50 PN40	DN 50 PN63	DN 50 PN100	1½" ASME 150	1½" ASME 300	1½" ASME 600	2" ASME 150	2" ASME 300	2" ASME 600	40A JIS 20K	50A JIS 20K	50A JIS 10K		
A	6.6															
B1 / B2	14.6 / 11.4															
D	27.8	29.1	28	29.1	29.6	29.1	29.7	30.3	29.3	29.8	30.5	27.8	28			
DN50																
	DN 50 PN40	DN 50 PN63	DN 50 PN100	DN 80 PN40	DN 80 PN63	DN 80 PN100	2" ASME 150	2" ASME 300	2" ASME 600	3" ASME 150	3" ASME 300	3" ASME 600	50A JIS 10K	50A JIS 20K	80A JIS 10K	80A JIS 20K
A	8.6															
B1 / B2	14.6 / 11.4															
D	33.9	35	35.5	34.7	35.8	36.3	35.2	35.7	36.4	35.7	36.5	37.2	39.9		34.7	
All sizes																
E	6.3															
F	2.4															
G	3.9															
H	4.9															
I	5.4															

Hygienic versions

1



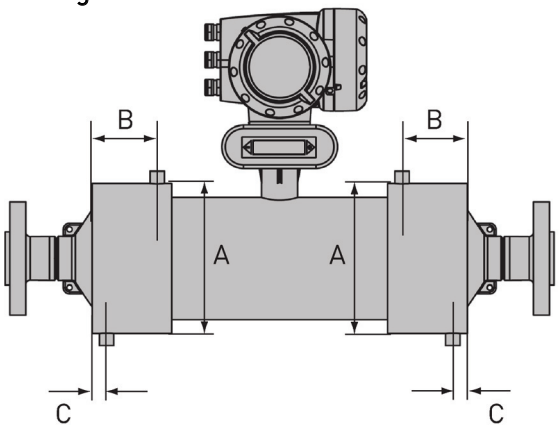
2



Metric (mm)																	
Meter	15								25								
Conn	DN25			1"					DN40			1½"					
	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT
A	101.6								114.3								
B1 / B2	311 / 231								317 / 237								
D	483	468	505	473	487	474	487	498	538	515	562	502	534	537	534	545	
	40								50								
	DN50			2"					DN80			3"					
	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT	
A	168.3								219.1								
B1 / B2	344 / 264								370 / 290								
D	704	677	724	667	691	694	691	702	870	836	896	817	832	837	832	843	
All sizes																	
E	160																
F	60																
G	98.5																
H	123.5																
I	137																

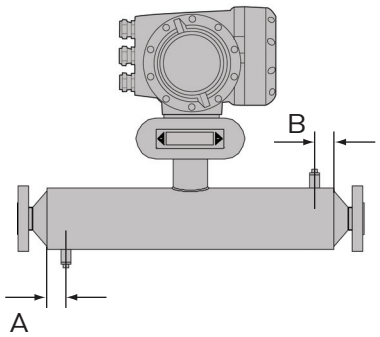
Imperial (inches)																
Meter	15								25							
Conn	DN25			1"					DN40			1½"				
	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT
A	4								4.5							
B1 / B2	12.2 / 9.0								12.5 / 9.3							
D	19	18.4	19.9	18.6	19.2	18.7	19.2	19.6	21.2	20.3	22.1	19.8	21	21.1	21	21.4
	40								50							
	DN50			2"					DN80			3"				
	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT	DIN 11851	DIN 32676	DIN 11864-2	Tr-Clamp (ISO)	Tri-Clover	SMS	IDF	RJT
A	6.6								8.6							
B1 / B2	13.5 / 10.4								14.6 / 11.4							
D	27.7	26.6	28.5	26.2	27.2	27.3	27.2	27.6	34.2	32.9	35.3	32.2	32.7	32.9	32.7	33.2
All sizes																
E	6.3															
F	2.4															
G	3.9															
H	4.9															
I	5.4															

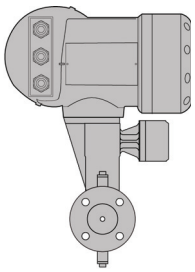
Heating Jacket



Meter size	DN15	DN25	DN40	DN50
Connection size	½" (12mm)			1" (25mm)
Metric (mm)				
A	115 ±1.0	142 ±1.0	206 ±1.0	254 ±1.0
B	51	55	90	105
C	20			26
Imperial (inches)				
A	4.5 ±0.04	5.6 ±0.04	8.1 ±0.04	10.0 ±0.04
B	2.0	2.2	3.5	4.1
C	0.8			1.0

Purge Port





Meter size	DN15	DN25	DN40	DN50
Metric (mm)				
A	30 ±1.0		65 ±1.0	
B	30 ±1.0		65 ±1.0	
Imperial (inches)				
A	1.2 ±0.04		2.5 ±0.04	
B	1.2 ±0.04		2.5 ±0.04	

5.1 Specific Installation Guidelines

- Tighten flange bolts evenly.
- Observe the pipe end loads as shown in S.5.6
- It is permissible to support the weight of the meter on the body.
- Use of standard pipework reducers at the flange is allowed. Avoid extreme changes in pipe size (step changes).
- The use of flexible hoses for connection to the process pipework is NOT recommended.
- The meter can be installed so that the converter is on the side of the meter, resulting in the measuring tubes on top of each other, unless gases or solids are being measured.
- The 200 series has exceptional immunity to cross-talk, therefore allowing meters to be used in series or parallel

5.2 Ambient / Process temperatures

The specified and approved ambient and process temperatures must be observed.

		SS318L	
		°C	°F
Process	All meters	-45...+130	-49...266
Ambient	Compact Al.	-40...+60	40...+140
	Compact Al. with certain I/O options (consult Honeywell)	-40...+65	-40...+149
	Compact SS	-40...+55	-40...+131
	Remote	-40...+65	-40...+149

Note:

For additional temperature limits in hazardous area applications, reference should be made to the publication *"Guidelines for the use of Coriolis Meters in Hazardous Areas".*

Where meters are mounted in direct sunlight, it is recommended to install a sunshade that covers the converter and front end. This is particularly important in countries with high ambient temperatures.

The maximum differential temperature between the process and ambient temperature without insulation is 110°C or 200°F.

To avoid thermal shock, the meter MUST NOT be subject to rapid changes in process tempratures and reference should be made to the following table

Meter	Max. Temperature Shift
S100	90°C (110°C with a max operating pressure of 40 barg)
S150	80°C
S250	50°C

Operation outside these limits may result in shifts in density and mass flow calibration. Repeated shocking may also lead to premature failure of the meter! However, higher thermal shocks are possible at lower working presures. Please consult Honeywell for more information.

5.3 Pressure Equipment Directive (PED) requirements

To comply with the requirements of the PED in Europe, the following information is provided to assist the plant engineer in installing the meter:

Measuring tube:	Spigots
Stainless Steel UNS 531803	Stainless Steel UNS J902205

The outer cylinder 304 / 304L is dual certified (Optional outer cylinder of 316 / 316L).

Wiring feedthrough is made of Epoxy (or PEEK) with 2 'O' ring seals in Fpm / fkm & Hydrogenated Nitrile.

Flanges:

PN160/250 and ASME 900/1500 are duplex stainless steel (UNS 531803). All other flanges are 316 / 316 L dual certified (optional UNS 531803).

NOTE: if the NACE option has been selected at the time of order, the flanges will be duplex stainless steel (UNS 31803).

Hygienic Connections are 316L (S100 only)

Optional heating jacket 316 / 316L

Note: Outer cylinder is in contact with heating medium

5.4 Secondary Pressure containment

The VERSAFLOW 200 meters are supplied (as standard) without secondary pressure containment. The outer casing has a typical burst pressure >100 barg..

If the user suspects that the primary tube has failed, the unit must be depressurised and removed from service as soon as it is safe to do so.

Note:

In the 200 Series there is a high pressure wire feed through with 'O' rings that might not be compatible with the process fluid for an extended period if a primary tube fails.

It is the user's responsibility to ensure that the materials used are compatible with this product.

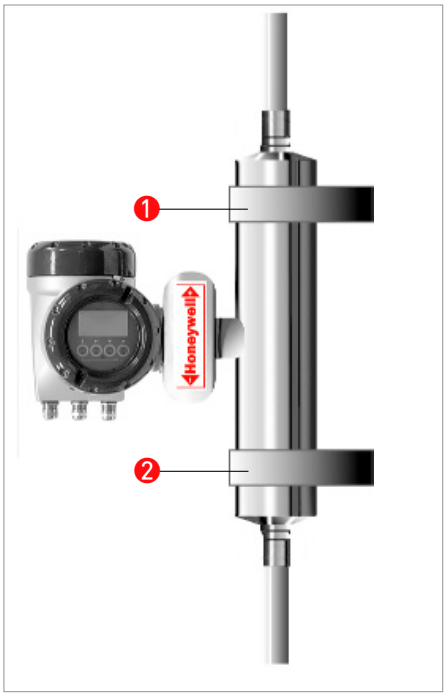
Other 'O' ring materials are available on request.

5.5 Hygienic Applications

The VERSAFLOW 200 (S100) is available with a variety of hygienic process connectors.

When installing / using meters with hygienic process connectors, support /clamp the meter properly. The meters are heavy and could injure when disconnected from the adjacent pipe work.

The recommended method of installation is to mount the meter against a support / wall with the body of the meter supported / clamped. The process pipe work can then be supported off the meter. The meter is too heavy to be supported from the thin walled piping usually associated with the hygienic industry. For information regarding lifting the meter, please refer to section 3.4.



❶ ❷ Meter Supports

The 3A approval for the 200 series requires that it is “self draining”. Therefore, the meter MUST be installed vertically with the flow running uphill.

Installation lengths

For installation lengths, please see section 5.9

Please check with HONEYWELL if you are unsure of the installation length. Many meters are built to customer requirements / specifications especially where special hygienic process nectors have been adapted to the meter. As these are normally non-standard, the installation length will not be given in the technical data.

5.6 Pressure Ratings

Measuring Tube PED certification	See pressure de-rating graphs
Measuring Tube FM certification	
Measuring Tube CRN & CSA certification	

Meter data plates are stamped with maximum pressure rating at both 20°C (68°F) and maximum operating temperature of connection or primary tube, **whichever is the lower**.

Maximum pipe work forces

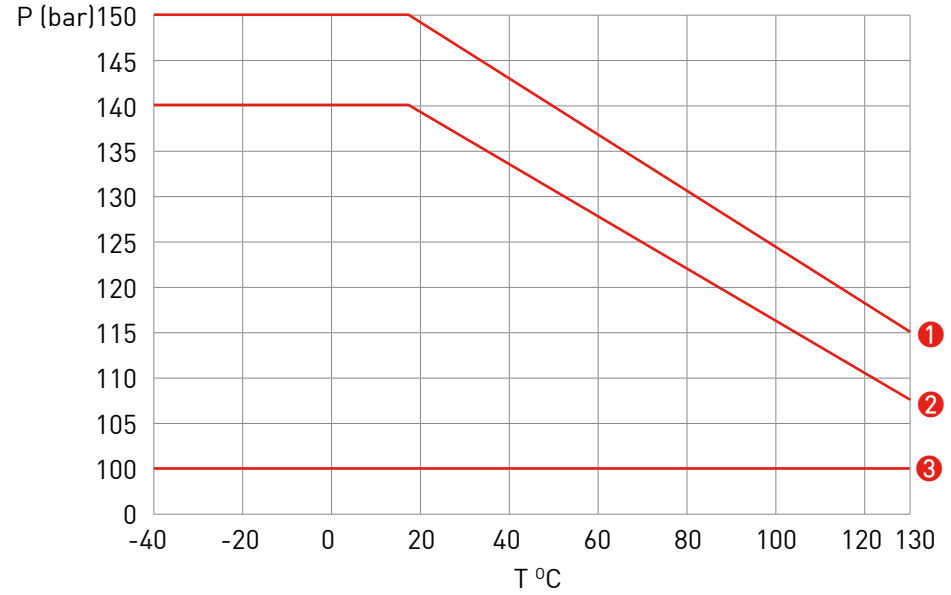
size	20°C			130°C		
	40 barg	100 barg	150 barg	32 bar	80 barg	115 barg
100	150 kN	100 kN		150 kN	60 kN	
150	650 kN	120 kN		280 kN	50 kN	
250	550 kN	60 kN		400 kN	50 kN	
Flange Connections						

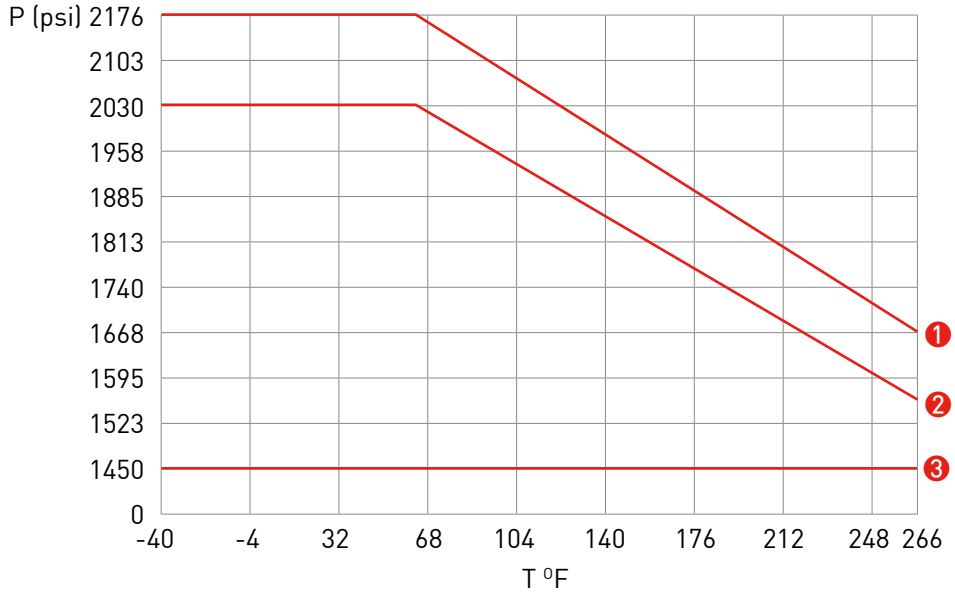
These loads are roughly equivalent to the max axial loading allowed in an un-radiographed butt weld in a 316L schedule 80 pipe.

Loads given maximum static loads. If loads are cycling, particularly between tension and compression then these loads should be reduced.

Please consult HONEYWELL for more information.

Pressure de-rating





❶ Measuring Tube PED certification
❷ Measuring Tube FM certification
❸ Measuring Tube CRN & CSA certification

Flanges

DIN flange ratings based on EN 1092-1 2007 table G.4.1 material group 14E0

ASME flange ratings based on ASME B16.5 2003 table 2 material group 2.2

JIS flange ratings based on JIS 2220: 2001 table 1 division 1 material group 022a

Note:

The maximum operating pressure will be either the flange rating or measuring tube rating **WHICHEVER IS THE LOWER!**

It is recommended that the seals be replaced regularly to maintain the hygienic integrity of the connection.

Unless specifically requested, internal surfaces are not polished and no warranty is made as to the surface finish.

If polishing option and /or EHEDG, ASME Bio-Processing or 3A approvals was selected at time of order, all product contact surfaces are polished 0.5 micrometer Ra (20CLa) finish or better.

5.7 Heating and insulation

There are several ways to heat the meter. In most cases heating is unnecessary as the meter is designed so that very little heat is lost or gained through the outer cylinder.

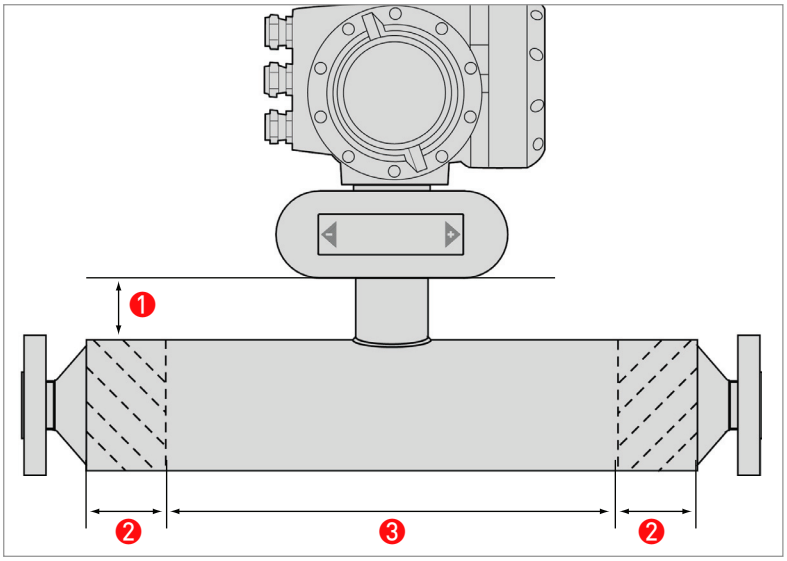
Insulation

Where insulation is required, a variety of materials may be used to insulate the meter. Care must be taken not to insulate the meter above the halfway mark of the electronics support post as shown.

Electrical Heating

Electrical tape heating may be used. Care should be taken to only heat the sections where the best effect will be achieved. Do not heat above the converter mount centre line as shown above.

The following guidelines must be observed.



1. Max insulation depth
2. Heated Areas
3. Do NOT heat this area

When insulating please observe guidelines as per insulation section.

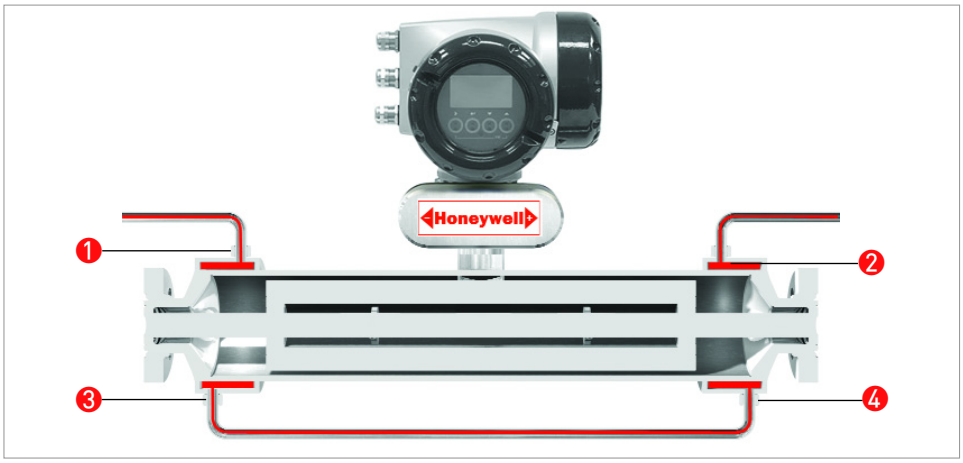
Size	DIM 1
100	200 mm
150	250 mm
250	250 mm

Liquid / Steam heating jacket

The meter can be supplied with a heating jacket. This jacket is designed to minimise the differential stress across the meter where differences in temperature between outer cylinder and measuring tube exist.

The connections to the heating jacket are NPT or Ermeto sockets.

It is recommended that reinforced flexible hoses be used to connect the heating jacket to the heat source.



❶ ❷ ❸ ❹ Connection Points

Important:

Always heat the jacket to working temperature before flowing product in measuring tube.

Avoid the use of fluids that can cause crevice corrosion.

Although all the jacket materials are 316L, the outer cylinders are 304L (Optional 316L).

Connections should be made to ensure all air can be vented on liquid systems and all condensate can be drained on steam systems.

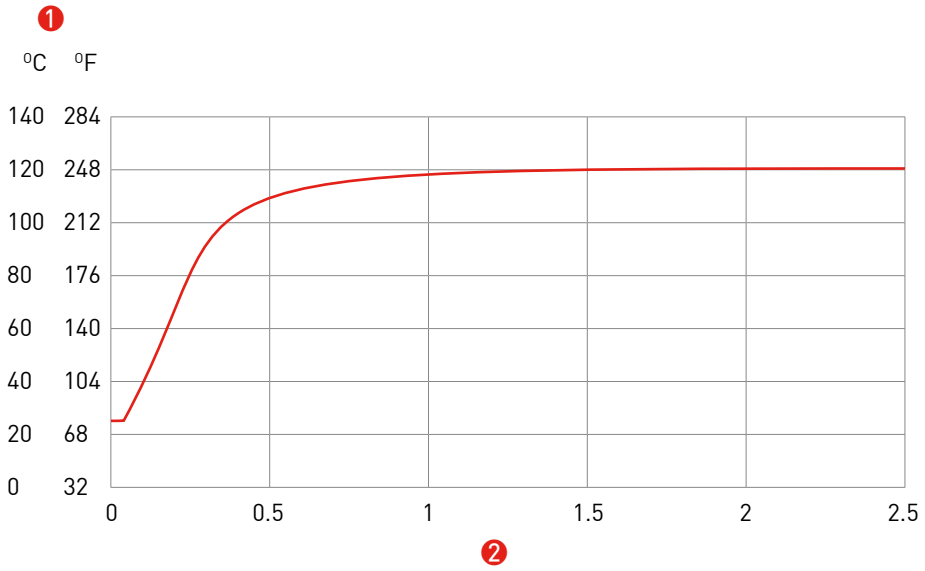
Note :

Max heating medium pressure and temperature for heating jackets is 10 bar at 130°C or 145 psig at 266°F.

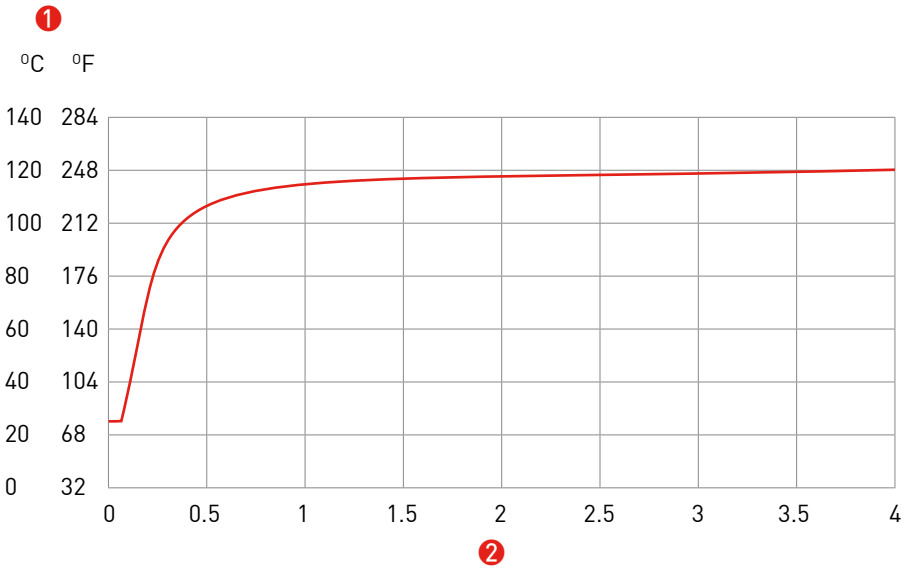
Heating Times

The heating times shown in the following illustrations are based on the heating jacket operating at maximum temperature and show the measured temperatures at the spigot end of the measuring tubes. If a desired temperature is required in the centre of the measuring tubes, then the heating times MUST be extended.

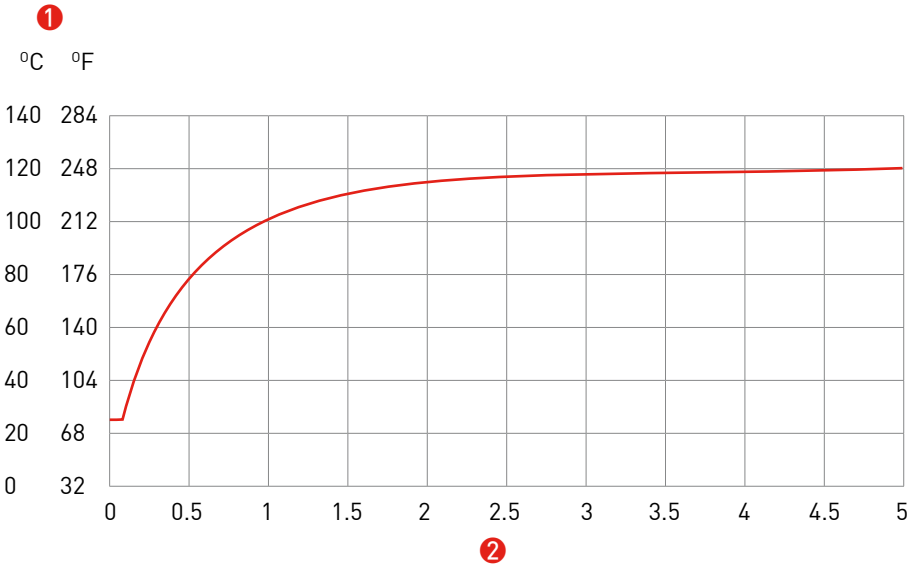
VERSAFLOW 200 S100



VERSAFLOW 200 S150



VERSAFLOW 200 S250



1 Temperature at spigot end of measuring tubes

2 Time (hours)

Cooling

Please consult HONEYWELL if cooling medium is to be used in the heating jacket.

5.8 Purge Port Meters and Burst Disc Meters

Purge Port Options

If the purge port option was selected at time of order, then your meter will be fitted with ½" NPT female connections – these will be clearly identified. These connections are sealed with NPT plugs and PTFE tape.

Important:

Do not remove these plugs.

The meter is factory sealed with a dry nitrogen gas fill and any ingress of moisture will damage the meter. The plugs should only be removed to purge the inside of the meter case of any product if it is suspected that the primary measuring tube has failed. If it is suspected that the primary tube has failed, depressurise and remove the meter from service, as soon as it is safe to do so.

Burst Disc meters

VERSAFLOW 200 meters that have been ordered with a burst (rupture) disc will be suppled with the disc fitted. The disc failure pressure is 20barg @ 20°C.

Meters fitted with connection ratings in excess of 100 barg,(1450 psig) will be supplied with a burst disc fitted as an added safety feature.

Important:

The burst disc is suitable for the designed application according to the process conditions and flow rates as per original order. If conditions alter, consult HONEYWELL for further advice regarding suitability of disc fitted.

If the product is in any way hazardous, it is strongly recommended that an exhaust tube is connected to the NPT male thread of the burst disc so that the discharge can be piped to a safe area. This tube MUST be large enough AND the pipe route designed in such a way, so that pressure cannot build up in the meter case.

Ensure arrow on burst disc is pointing away from meter

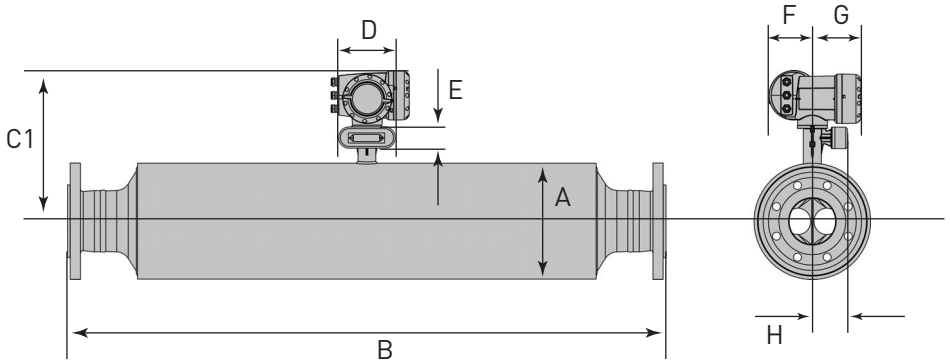
5.9 Technical Data

Maximum Flow Rates			
	100	150	250
Kg/h	420,000	900,000	2,300,000
Lbs/min	14,698	33,804	84,510
Minimum Flow Rates			
Kg/h	Dependant on measuring error required		
Lbs/min	Dependant on measuring error required		

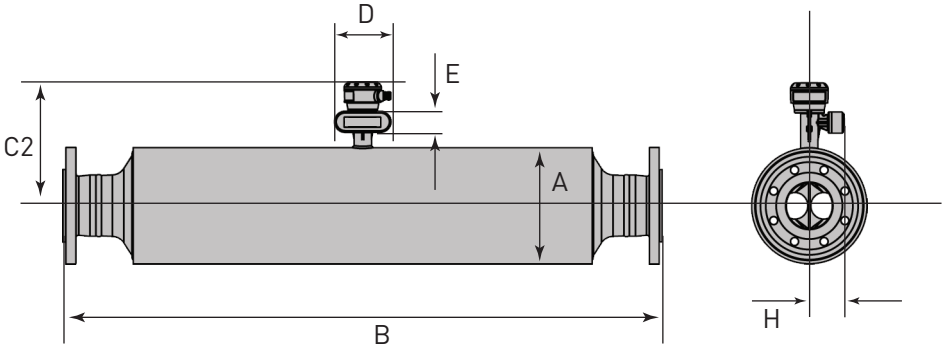
Weights (PN40 Flanges)						
	100		**150**		**250**	
	kg	**lbs**	**kg**	**lbs**	**kg**	**lbs**
Compact with aluminium TWC 9000	84.8	187	211.5	466	444.5	980
Compact with SS TWC 9000	90.1	198	216.8	478	449.8	991
Remote with aluminium J box	80.8	178	207.8	457	440.5	971
Remote with SS J box	81.7	180	208.4	459	441.4	973

Dimensions (Flanged versions)

❶



❷



❶ Compact version
❷ Remote Version

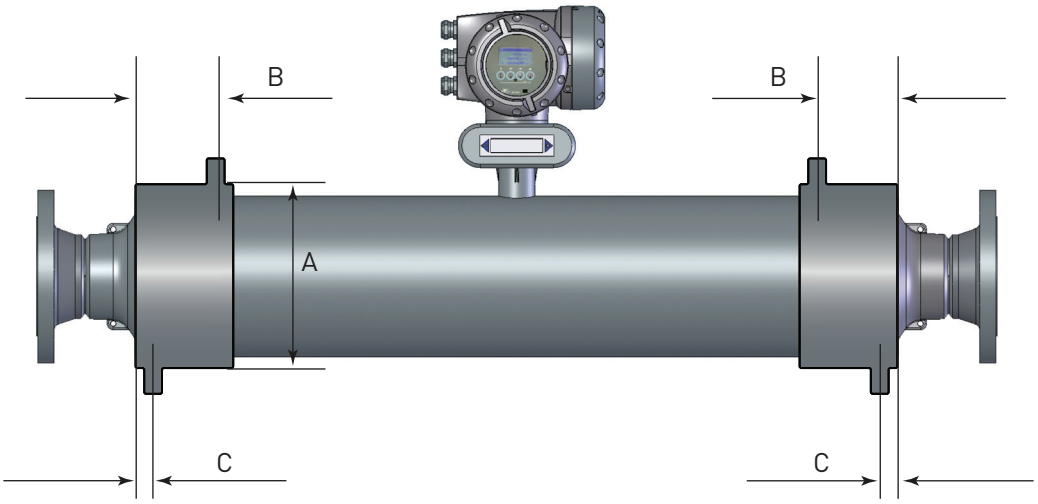
Metric (mm)															
DN100															
	DN 100 PN40	DN 150 PN40	DN 100 PN63	DN 150 PN63	DN 100 PN100	DN 150 PN100	4" ASME 150	4" ASME 300	4" ASME 600	4" ASME 900	6" ASME 150	6" ASME 300	6" ASME 600	6" ASME 900	JIS 10K	JIS 20K
A	219															
B	1310	1330	1336	1370	1360	1410	1334	1352	1398	1422	1358	1378	1428	1474	1332	
C1 / C2	370 ±5 / 293±5															
DN150															
	DN 150 PN40	DN 200 PN40	DN 150 PN63	DN 200 PN63	DN 150 PN100	DN 200 PN100	6" ASME 150	6" ASME 300	6" ASME 600	6" ASME 900	8" ASME 150	8" ASME 300	8" ASME 600	8" ASME 900	JIS 10K	JIS 20K
A	323															
B	1621	1647	1661	1691	1701	1731	1649	1669	1719	1765	1675	1695	1751	1809	N/A	
C1 / C2	422 ±5 / 345 ±5															
DN250															
	DN 250 PN40	DN 300 PN40	DN 250 PN63	DN 300 PN63	DN 250 PN100	DN 300 PN100	10" ASME 150	10" ASME 300	10" ASME 600	10" ASME 900	12" ASME 150	12" ASME 300	12" ASME 600	12" ASME 900	JIS 10K	JIS 20K
A	406															
B	2030	2050	2070	2100	1977	2160	2024	2056	2138	2202	2050	2082	2146	2234	N/A	
C1 / C2	463 ±5 / 386 ±5															
All sizes																
D	160															
E	60															
F	123.5															
G	137															
H	98.5															

Imperial (inches)															
DN100															
	DN 100 PN40	DN 150 PN40	DN 100 PN63	DN 150 PN63	DN 100 PN100	DN 150 PN100	4" ASME 150	4" ASME 300	4" ASME 600	4" ASME 900	6" ASME 150	6" ASME 300	6" ASME 600	6" ASME 900	JIS 10K	JIS 20K
A	8.6															
B	51.6	52.4	52.6	53.9	53.5	55.5	52.5	53.2	55	56	53.5	54.2	56.2	58	52.4	
C1 / C2	14.6 ±0.2 / 11.5 ±0.2															
DN150																
	DN 150 PN40	DN 200 PN40	DN 150 PN63	DN 200 PN63	DN 150 PN100	DN 200 PN100	6" ASME 150	6" ASME 300	6" ASME 600	6" ASME 900	8" ASME 150	8" ASME 300	8" ASME 600	8" ASME 900	JIS 10K	JIS 20K
A	12.7															
B	63.8	64.8	65.4	66.6	67	68.1	65	65.7	67.7	69.5	65.5	66.7	69	71.2	N/A	
C1 / C2	16.6 ±0.2 / 13.6 ±0.2															
DN250																
	DN 250 PN40	DN 300 PN40	DN 250 PN63	DN 300 PN63	DN 250 PN100	DN 300 PN100	10" ASME 150	10" ASME 300	10" ASME 600	10" ASME 900	12" ASME 150	12" ASME 300	12" ASME 600	12" ASME 900	JIS 10K	JIS 20K
A	16															
B	80	80.7	81.5	82.7	77.8	85	79.7	81	84.2	86.7	80.7	82	84.5	88	N/A	
C1 / C2	18.2 ±0.2 / 15.2 ±0.2															
All sizes																
D	6.3															
E	2.4															
F	4.9															
G	5.4															
H	3.9															

Hygienic connections (S100 only)

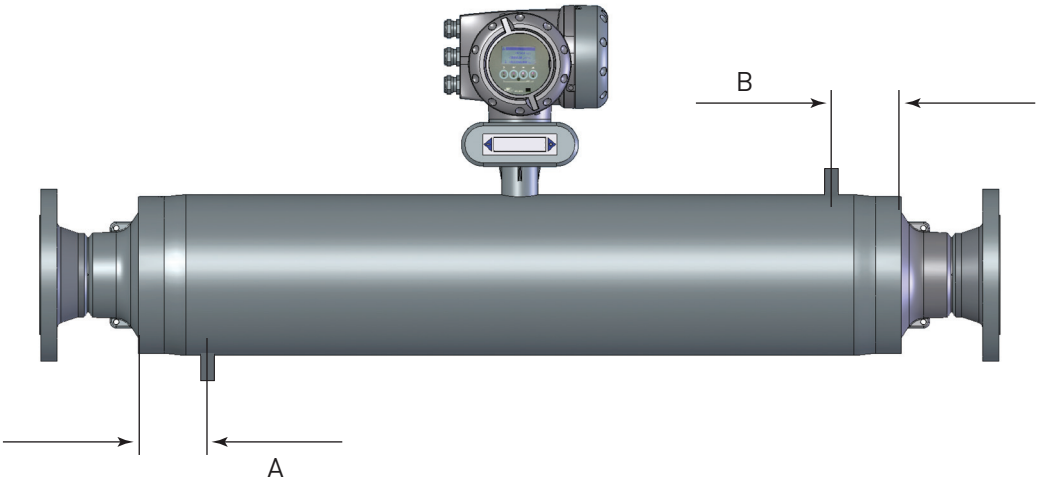
	DN100			4"				
	DIN 11864-2	DIN 11851	DIN 32676	Tri-Clover	Tri-clamp (ISO)	SMS	IDF	RJT
Metric (mm)								
B	1296	1288	1236	1223	1223	1236	1223	1234
Imperial (inches)								
B	51	50.1	48.7	48	48	48.7	48	48.6

Heating Jacket



	S100	S150	S250
	All flanges	All flanges	All flanges
mm			
A	254 ±2.5	355 ±2.5	444 ±2.5
B	178 ±2.0	228 ±2.0	208 ±2.0
C	28 ±2.0	28 ±2.0	6.5 ±2.0
inches			
A	10 ±0.1	14 ±0.1	17.5 ±0.06
B	7 ±0.08	9 ±0.08	8.2 ±0.08
C	1.1 ±0.08	1.1 ±0.08	0.25 ±0.08

Purge Port



	S100	S150	S250
	All flanges	All flanges	All flanges
mm			
A	70 ±1.0	100 ±1.0	
B	70 ±1.0	100 ±1.0	
inches			
A	2.75 ±0.04	4.0 ±0.04	
B	2.75 0.04±	4.0 ±0.04	

6.1 Specific Installation Guidelines

- Tighten flange bolts evenly.
- Observe min and max pipe end loads at the end of this section.

The use of reducers at the flanges is allowed but extreme pipe size reductions should be avoided. This is to prevent the possibility of cavitation and degassing.

There are no additional installation requirements for the VERSAFLOW 1000 sensors. Fixing of flexible hoses directly on the meter is allowed.

6.2 Ambient/Process Temperatures

The specified and approved ambient and process temperatures MUST be observed.

		Process			Ambient			
			Hygienic/aseptic connections	❶	Compact Al		Compact S.S	Remote
Titanium	°C	-40...+150	-20...+150		-40...+60	❸	-40...+55	-40...+60
	°F	-40...+300	4...+300		-40...+140		-40...+130	-40...+140
HC22 / Tantalum	°C	0...+100			-40...+60	❸	-40...+55	-40...+60
	°F	0...212			-40...+140		-40...+130	-40...+140
SS318L	°C	0...+100	0...+130	❷	-40...+60	❸	-40...+55	-40...+60
	°F	0...212	0...266		-40...+140		-40...+130	-40...+140
	❶ Available across the whole range (½"ASME on the T15) ❷ Option available on 25, 40, 50 & 80 meters ❸ Temp range: -40...+65°C (-40...+149°F) on certain I/O options. Call HONEYWELL for details							

Note:

For additional temperature limits in hazardous area applications, reference should be made to the publication *"Guidelines for the use of Coriolis Meters in Hazardous Areas".*

Where meters are mounted in direct sunlight, it is recommended that a sunshade is installed. This is particularly important in countries with high ambient temperatures!

The maximum differential temperature between the process and ambient temperature without insulation is 130°C or 266°F for Titanium and 80°C or 1 76°F for Hastelloy, Stainless Steel and Tantalum meters.

6.3 Pressure Equipment Directive (PED) Requirements.

To comply with the requirements of the PED in Europe, the following information is provided to assist the plant engineer in installing the meter.

Measuring tube:	Sealing Faces:
Titanium Grade 9	Titanium Grade 2
Hastelloy C22	Hastelloy C22
Stainless UNS 31803	Stainless UNS 31803
Tantalum grade RO5255	Tantalum grade RO5200

The outer cylinder 304 / 304L is dual certified (Optional outer cylinder of 316 / 316L). This also applies to PED certified housings.

Wiring feedthrough is made of Epoxy.(or PEEK) with 2 'O' ring seals of FPM / FKM & Hydrogenated Nitrile

Flanges all 316 / 316 L dual certified.

Optional heating jacket 316 / 316L.

Note: The outer cylinder is in contact with heating medium

6.4 Secondary Pressure Containment

The VERSAFLOW 1000 meters are supplied (as standard) without secondary pressure containment. The outer casing has a typical burst pressure >100 barg .

Options are available with PED certified housings, with the following pressure ratings:

304 / 304L or 316 / 316L: 63 barg @20°C (580 psig @ 68°F)

316/316L: 100 barg @20°C (1450 psig @ 68°F)

If the user suspects that the primary tube has failed, the unit must be depressurised and removed from service as soon as it is safe to do so.

Note:

In the 1000 Series there are high pressure feed through seals and 'O' rings that might not be compatible with the process fluid for an extended period if a primary tube fails. Therefore it is important to remove the meter at the earliest possible time.

It is the user's responsibility to ensure that the materials used are compatible with this product.

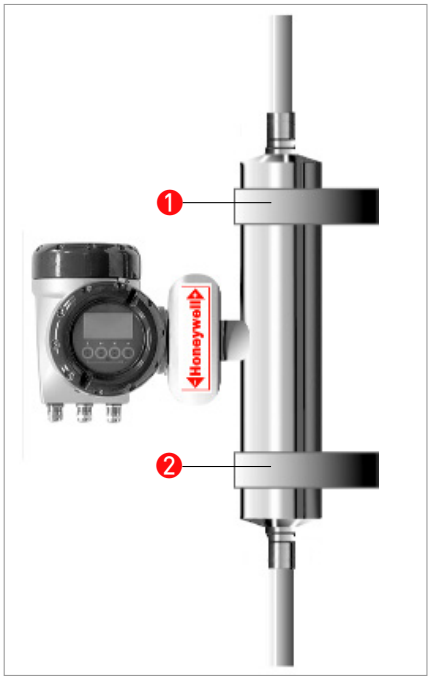
Other 'O' ring materials are available on request.

6.5 Hygienic Applications

The VERSAFLOW 1000 series is available with a variety of hygienic process connectors.

When installing / using meters with hygienic process connectors, support /clamp the meter properly. The meters are heavy and could injure when disconnected from the adjacent pipe work

The recommended method of installation is to mount the meter against a support/wall with the body of the meter supported/clamped. The process pipe work can then be supported off the meter. The meter is too heavy to be supported from the thin walled piping usually associated with the hygienic industry For information regarding lifting the meter, please refer to section 3.4



1 2 Meter Supports

Installation lengths: please see section 6.9

Please check with HONEYWELL if you are unsure of the installation length. Many meters are built to customer requirements / specifications especially where special hygienic process connectors have been adapted to the meter. As these are normally non-standard, the installation length will not be given in the technical data.

It is also recommended that the seals be replaced regularly to maintain the hygienic integrity of the connection.

Version	Titanium Meter	SS 318 Meter
All welded DIN 11864-2 All welded Tri-Clamps	Titanium Grade 2	UNS 31803
Adaptor versions	316L Stainless Steel	316L Stainless Steel
	EPDM seals	EPDM seals
Hygienic Connection Materials		

Unless specifically requested, internal surfaces are not polished and no warranty is made as to the surface finish. If polishing option and /or EHEDG, ASME Bio-Processing or 3A approvals was selected at time of order, all product contact surfaces are polished 0.5 micrometer Ra (20 CLA) finish or better.

Use of VERSAFLOW 1000 SS sensors above 100°C (Hygienic Connections only)

Sizes 25S, 40S, 50S and 80S sensors with hygienic connections may be exposed to temperatures above 100°C (212°F) up to a maximum of 130°C (266°F) for a maximum of 2 hours (e.g. for steam cleaning purposes). The maximum temperature shock permitted either from cold to hot or from hot to cold is 110°C (230°F).

For example, a meter measuring a product at 20°C (68°F) can be steam cleaned at 130°C (266°F), but a meter measuring a product at 5°C (41°F) can only be steam cleaned at 115°C. (239°F) After steam cleaning at 130°C (266°F) the minimum allowed temperature of the product introduced immediately afterwards is 20°C (68°F).

Operation outside these guidelines may cause shifts in the mass flow and density calibration. Repeated shocking may also cause premature failure of the meter.

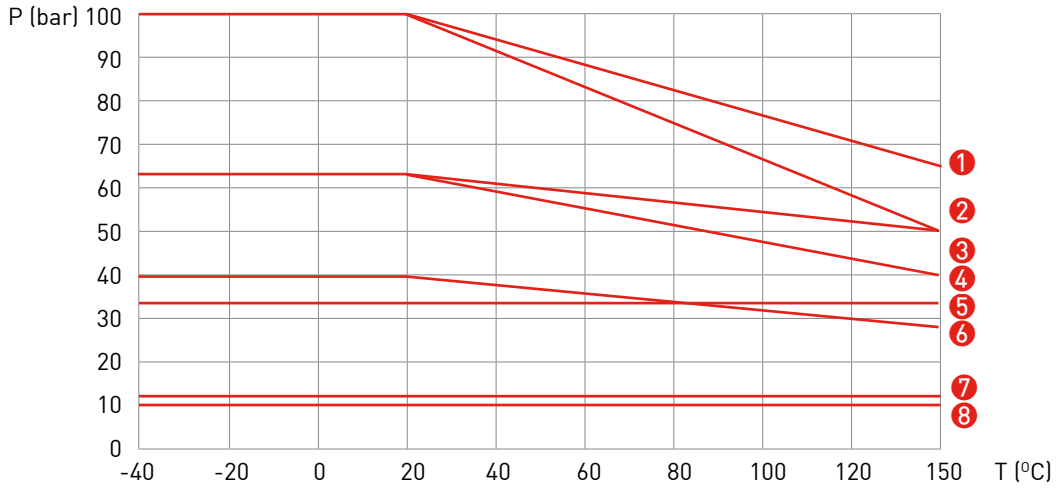
6.6 Pressure Ratings

Meter data plates are stamped with maximum pressure rating (at 20°C and max. operating temperature) of connection, primary tube or secondary pressure containment (whichever is the lower).

Titanium Tubes and optional 100 barg secondary pressure containment	100 bar at 20°C or 1450 psi at 68°F
De-rated to	63 bar at 150°C or 580 psi at 300°F (06...25) 50 bar at 150°C or 725 psi at 300°F (40...80)
63 barg secondary pressure containment	63 bar at 20°C or 910 psi at 68°F
De-rated to	40 bar at 150°C or 580 psi at 300°F

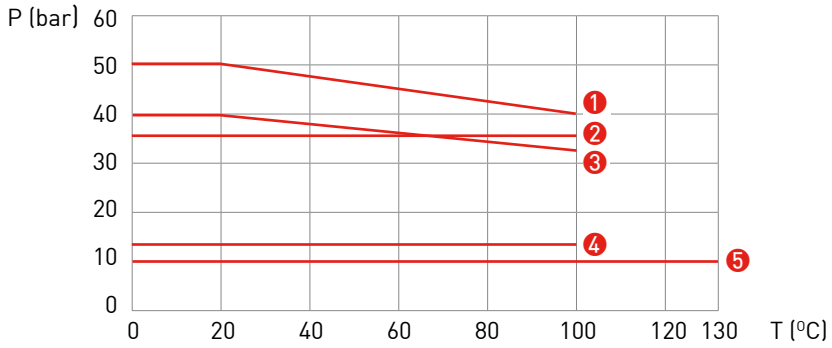
Hastelloy and SS & Tantalum measuring tubes rating	50 bar at 20°C or 725 psi at 68°F
De-rated to	40 bar at 100°C or 580 psi at 210°F
Heating Jacket (Titanium)	10 bar at 150°C or 145 psi at 300°F
Heating Jacket (SS/Hastelloy/Tantalum)	10 bar at 100°C or 145 psi at 210°F
130°C option on measuring tube	10 bar at 130°C or 145 psi at 266°F

Pressure/temperature de-rating for Titanium Gr 9 (deg C)



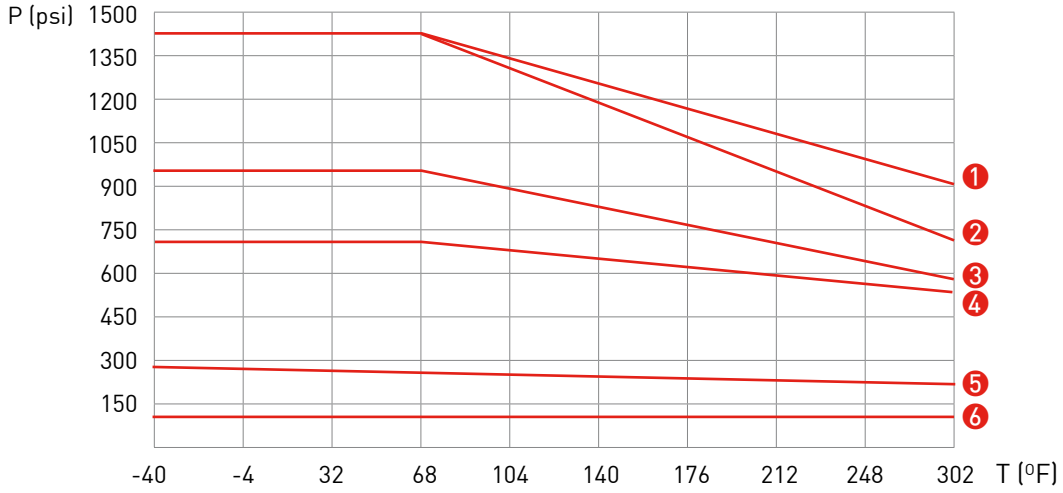
1. Standard tube and outer cyclinder 316(100 barg PED option) with PN100 flanges (sizes T06...T25)
2. Standard tube and outer cyclinder 316(100 barg PED option) with PN100 flanges (sizes T40...T80)
3. DIN 2637 PN63 flanges
4. Outer cylinder 304
5. JIS 20K flanges
6. DIN 2635 PN40 flanges
7. JIS 10K flanges
8. Hygienic connections

Pressure/temperature de-rating for SS, Hastelloy C22 and Tantalum (deg C)



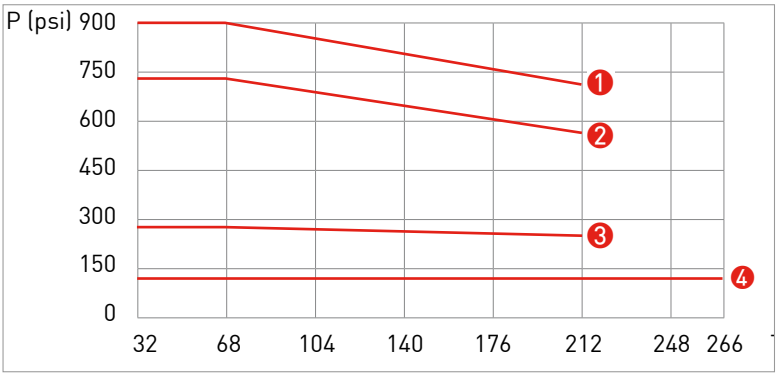
1. Standard tube and outer cyclinder 304 (all sizes)
2. JIS 20K flanges
3. DIN 2635 PN40 flanges
4. JIS 10K flanges
5. Hygienic connections (extended temperature option, stainless steel only)

Pressure/temperature de-rating for Titanium Gr 9 (deg F)



1. Standard tube and outer cyclinder 316 (100 barg PED option) with ASME 600 lbs flanges (sizes T06...T25)
2. Standard tube and outer cyclinder 316(100 barg PED option) with ASME 600 lbs flanges (sizes T40...T80)
3. Outer cylinder 304
4. ASME 300 lbsflanges
5. ASME 150 lbs flanges
6. Hygienic connections

Pressure/temperature de-rating for SS, hastelloy and Tantalum (deg F)



1. Outer cylinder (all sizes)
2. ASME 300 lbs flanges
3. ASME 150 lbs flanges

DIN flange ratings based on EN 1092-1: 2001 table 18, 1% proof stress material group 14EO
ASME flange ratings based on ASME B16.5: 2003 table 2 material group 2.2
JIS flange rating based on JIS 2220: 2001 table 1 division 1 material group 022a

Maximum Pipework Forces

The maximum forces exerted on the meter from the pipe work, compressive or tensile has been calculated for the 7000 Series (Straight tube meter) with Titanium, Hastelloy and SS measuring tubes as follows:

Size	Max Force: Flanges	Max Force: Hygienic Connectors
06 T	19 kN	1.5 kN
10 T	25 kN	2 kN
15 T*	38 kN	5 kN
25 T	60 kN	9 kN
40 T	80 kN	12 kN
50 T	170 kN	12 kN
80 T	230 kN	30 kN
* On VERSAFLOW 15T with ½" ASME flanges only, the max. end load is 19kN		
Titanium		

Size	Max Force: Flanges	Max Force: Hygienic Connectors
06 S	19 kN	1.5 kN
10 H/S	25 kN	2 kN
15 H/S/A*	38 kN	5 kN
25 H/S/A	60 kN	9 kN
40 H/S/A	80 kN	12 kN
50 H/S/A	80 kN	12 kN
80 H/S	170 kN	18 kN
* On OPTIMASS 15H, S OR A with ½" ASME flanges only, the max. end load is 19kN		
Hastelloy, Stainless Steel and Tantalum		

Loads given in both tables are maximum static loads. If loads are cycling, particularly between tension and compression then these loads should be reduced.

For information regarding Tantalum (or any material) please consult HONEYWELL.

6.7 Heating and insulation

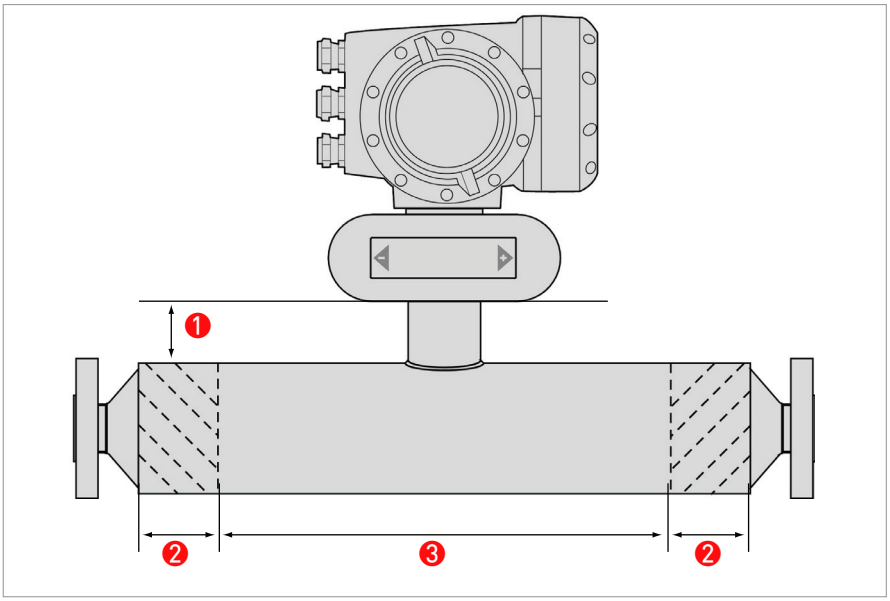
There are several ways of heating the meter. In most cases heating is unnecessary as the meter is designed as such that very little heat is lost or gained through the outer cylinder.

Insulation

Where insulation is required a variety of materials may be used to insulate the meter. Care must be taken not to insulate the meter above the halfway mark of the electronics support post as shown in the illustration.

Electrical Heating

Electrical tape heating may be used. Care should be taken to only heat the sections where the best effect will be achieved. Do not heat above the converter mount centre line as shown.



❶ Max insulation depth
❷ Heated Areas
❸ Do NOT heat this area

Size	Dimension ❷ (mm)	
	Titanium	Hastelloy, SS 318 & Tantalum
10	50	-
15	65	65
25	120	75
40	150	150
50	200	125
80	410	225

Liquid / Steam heating jacket

The meter can be supplied with a heating jacket. This jacket is designed to minimise the differential stress across the meter where differences in temperature between outer cylinder and measuring tube exist.

The connections to the heating jacket are NPT or Ermeto sockets.

It is recommended that reinforced flexible hoses be used to connect the heating jacket to the heat source

❶ ❷ ❸ ❹ Connection Points

Important:

Always heat the jacket to working temperature before flowing product through the measuring tube.

Avoid the use of fluids that can cause crevice corrosion.

Although all the jacket materials are 316L, the outer cylinders are 304L (Optional 316L).

Connections should be made to ensure all air can be vented on liquid systems and all condensate can be drained on steam systems.

Note :

The maximum heating medium pressure and temperature for heating jackets is 10 barg at 150°C (145 psig at 300°F) for titanium measuring tubes and 10 barg at 100°C (145 psig at 210 °F) for Hastelloy, Stainless Steel and Tantalum measuring tubes.

Heating Times:

The following graphs are provided as a guide only. Heating times were calculated and tested using the following conditions:

- Ambient temperature 25°C (80°F)
- Meter insulated.

The Titanium meters were heated using a steam temperature of 150°C (302°F) and the Hastelloy and Stainless Steel meters using a temperature of 100°C (212°F).

Heating times may vary depending on the quality of insulation (if any), ambient temperature and temperature of the heating medium. Once the meter has been heated to a temperature where the product will not solidify, the product may be introduced if required. This will bring the meter to operating temperature sooner.

Note:

The maximum heating temperature for a Titanium meter is 150°C (300°F).

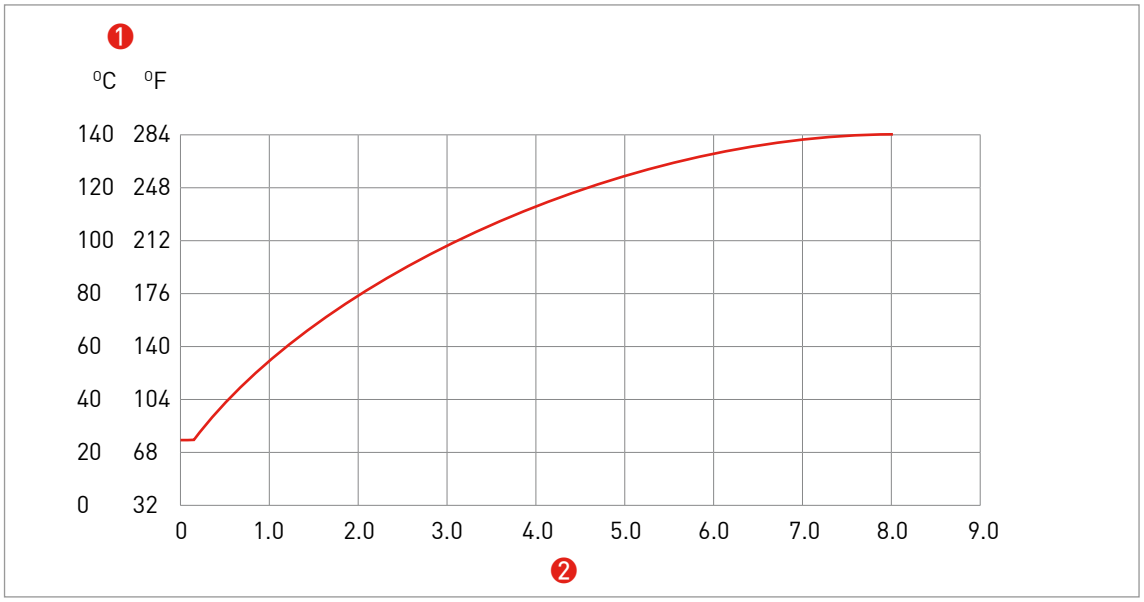
The maximum heating temperature for Hastelloy, SS or Tantalum meters is 100°C (212°F).

If these temperatures are exceeded, the meter will be damaged.

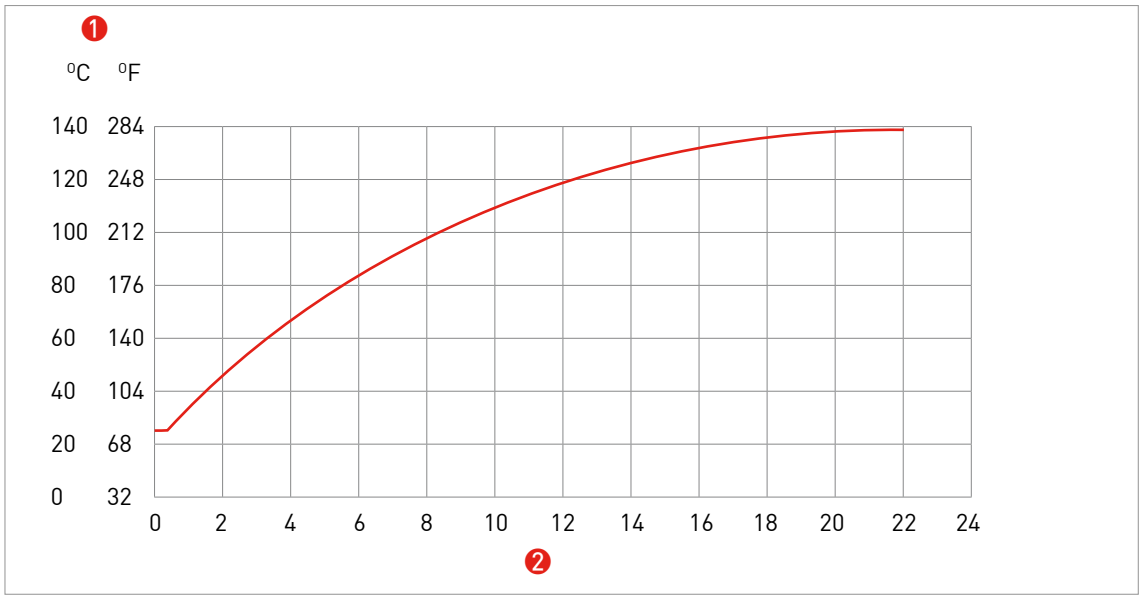
HONEYWELL accepts no responsibility if this happens.

Heating Times (based on heating jacket operating at maximum temperature

VERSAFLOW 1000 T10...T25

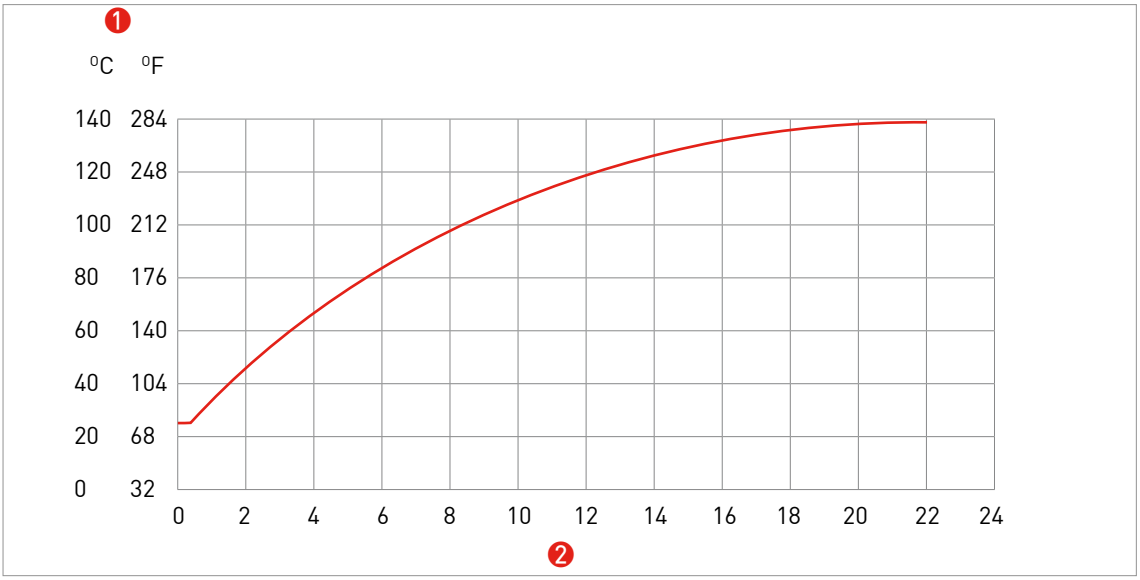


VERSAFLOW 1000 T40...T80

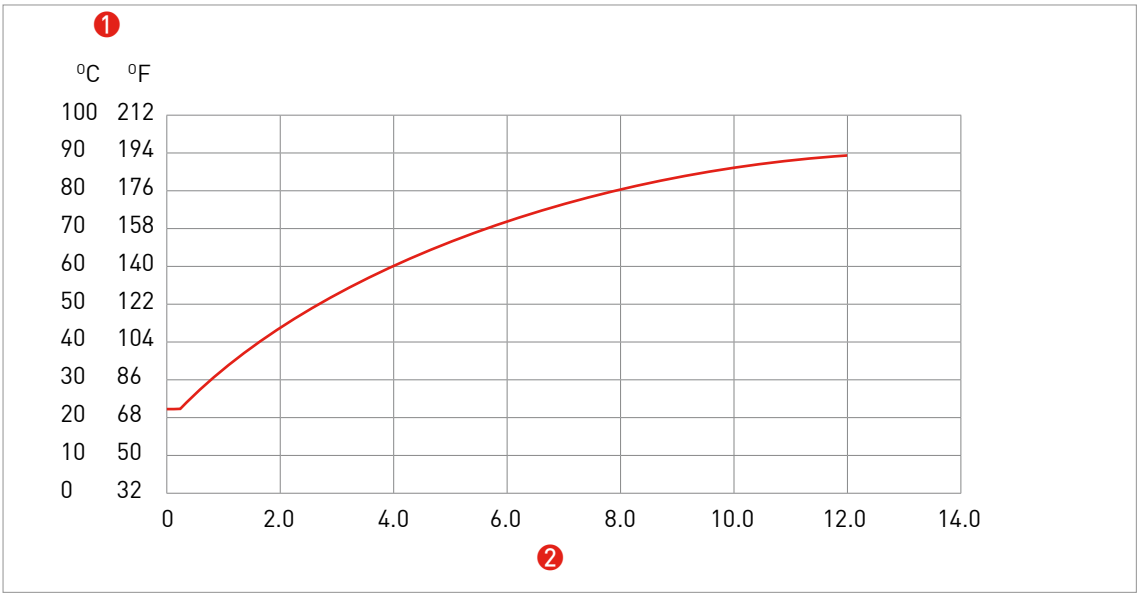


1 Temperature at centre of measuring tube
2 Time (hours)

VERSAFLOW 1000 H & S15 to 25



VERSAFLOW 1000 H & S 40...80



1 Temperature at centre of measuring tube

2 Time (hours)

6.8 Purge Port Meters

Purge Port Options:

If the purge port option was selected at time of order, then your meter will be fitted with ½" NPT female connections and they will be clearly identified. The connections are sealed with NPT plugs and PTFE tape.

Important:

Do not remove these plugs.

The meter is factory sealed with a dry nitrogen gas fill and any ingress of moisture will damage the meter. The plugs should only be removed to purge the inside of the meter case of any product if it is suspected that the primary measuring tube has failed. This must only be done after the meter has been depressurised and removed from service. This should be done as soon as it is safe to do so.

6.9 Technical Data

Maximum Flow Rates

Size	06	10	15	25	40	50	80
Kg/h	1,230	3,500	14,600	44,800	120,000	234,000	560,000
Lbs/min	45	129	536	1,646	4,409	8,598	20,577

Minimum flow rate

Depending on measuring error required.

Tube materials:

- Titanium Gr. 9
- Hastelloy C22
- UNS 31803.
- Tantalum alloy RO5255.

The meter size has a prefix T, H, or S indicating the tube material.

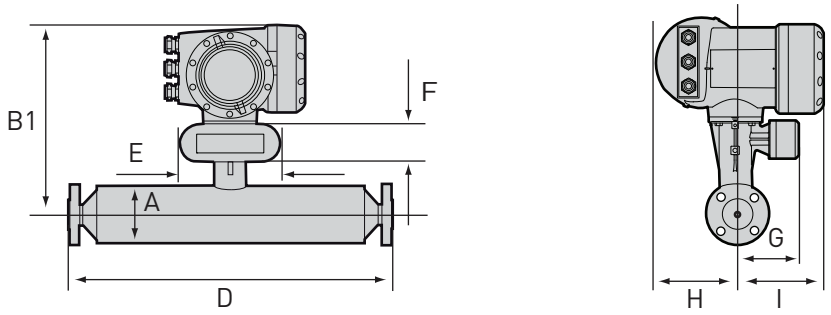
Materials of construction:

- Flanges: SS 316 / 316L dual certified
- Spigots and outer cylinder: SS 304 / SS 304L optional SS 316 / SS 316 L dual certified
- Optional 100 bar secondary containment SS 316/L
- Front end housing and post: SS 316L
- Converter housing/junction box: Epoxy coated aluminium or stainless steel.

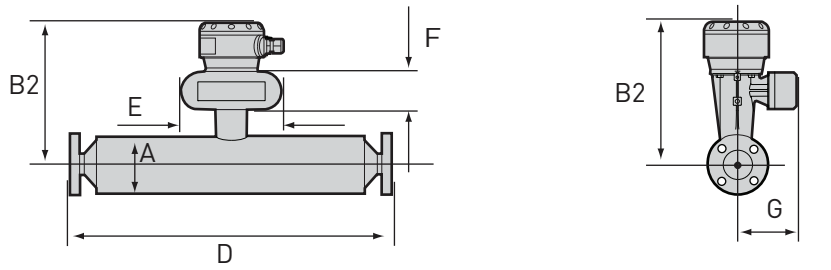
Weights (PN40 Flanges)		06	10	15	25	40	50	80
Compact with aluminium TWC 9000	Kg	18	22	25	37	82	147	262
	lbs	40	49	56	82	181	324	577
Compact with SS TWC 9000	Kg	23	27	30	42	87	152	267
	lbs	51	60	67	93	192	335	588
Remote with aluminium junction box	Kg	16	20	23	35	80	145	260
	lbs	35	44	51	77	176	319	572
Remote with SS junction box	Kg	17	21	24	36	81	146	261
	lbs	37	46	53	79	178	321	574
For Tantalum add	Kg			2.7	4.5	9.2	15.1	
	lbs			5.9	9.9	20.2	33.2	

Dimensions (Flanged versions)

❶



❷



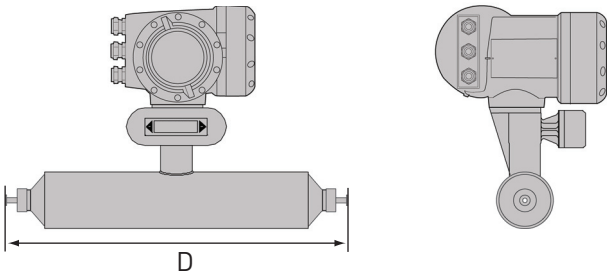
❶ Compact version

❷ Remote version

Metric (mm)	S/T 06	S/T/H 10	S/T/H 15	S/T/H 25	S/T/H 40	S/T/H 50	S/T/H 80
A	102			115	170	220	274
B1	311			318	345	370	397
B2	231 ±2			237 ±2	265 ±2	290 ±2	317 ±2
D (std flange)	420 ±2	510 ±2	548 ±2	700 ±2	925 ±2	1101 ±2	1460 ±2
D (ASME flange 600 lbs)	428 ±2	518 ±2	556 ±2	708 ±2	933 ±2	1109 ±2	1468 ±2
E	160						
F	60						
G	98.5						
H	123.5						
I	137						
Tantalum			A15	A25	A40	A50	
D (std flange)			623 ±2	790 ±2	1065 ±2	1271 ±2	

Imperial (inches)	S/T 06	S/T/H 10	S/T/H 15	S/T/H 25	S/T/H 40	S/T/H 50	S/T/H 80
A	4			4.5	6.7	8.7	10.8
B1	12.2			12.5	13.6	14.6	15.6
B2	9.1 ±0.08			9.3 ±0.08	10.4 ±0.08	11.4 ±0.08	12.5 ±0.16
D (std flange)	16.5 ±0.08	20.1 ±0.08	21.6 ±0.08	27.6 ±0.08	36.4 ±0.08	43.3 ±0.08	57.5 ±0.16
D (ASME flange 600 lbs)	16.9 ±0.08	20.4 ±0.08	21.9 ±0.08	27.9 ±0.08	36.7 ±0.08	43.7 ±0.08	57.8 ±0.08
E	6.3						
F	2.4						
G	3.9						
H	4.9						
I	5.4						
Tantalum			A15	A25	A40	A50	
D (std flange)			24.5 ±0.08	31.1 ±0.08	41.9 ±0.08	50.1 ±0.08	

Hygienic versions

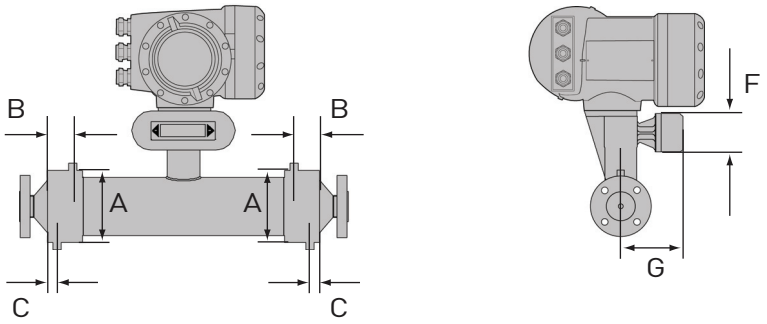


Hygienic connections: all welded versions												
	Tri-Clover	D		Tri-Clamp DIN 32676	D		Tri-Clamp ISO 2852	D		Tongue & groove DIN 11864	D	
		mm	inches		mm	inches		mm	inches		mm	inches
06	½"	480 ±2	18.9 ±0.08	DN10	484 ±2	19 ±0.08	-	-	-	-	-	-
10	½"	558 ±2	22 ±0.08	DN10	564 ±2	22.2 ±0.08	-	-	-	DN10	528 ±2	20.8 ±0.08
15	¾"	596 ±2	23.5 ±0.08	DN15	602 ±2	23.7 ±0.08	-	-	-	DN15	566 ±2	22.3 ±0.08
25	1½"	816 ±2	32.1 ±0.08	DN25	761 ±2	30 ±0.08	1½"	816 ±2	32.2 ±0.08	DN25	718 ±2	28.3 ±0.08
40	2"	1043 ±2	41 ±0.08	DN40	986 ±2	38.8 ±0.08	2"	1043 ±2	41.1 ±0.08	DN40	948 ±2	37.3 ±0.08
50	3"	1305 ±2	51.4 ±0.08	DN50	1168 ±2	46 ±0.08	3"	1305 ±2	51.4 ±0.08	DN50	1124 ±2	44.3 ±0.08
80	4"	1527 ±2	49.5 ±0.08	DN80	1584 ±2	62.4 ±0.08	4"	1527 ±2	60.1 ±0.08	DN80	1538 ±2	60.5 ±0.08

Hygienic connections: adapter versions (Tri-Clover & Tri-Clamp)									
	Tri-Clover	D		Tri-Clamp DIN 32676	D		Tri-Clamp ISO 2852	D	
		mm	inches		mm	inches		mm	inches
06	-	-	-	-	-	-	-	-	-
10	½"	597 ±2	23.5 ±0.08	DN10	590 ±2	23.2 ±0.08	-	-	-
15	¾"	635 ±2	25 ±0.08	DN15	628 ±2	24.7 ±0.08	-	-	-
15	1"	665 ±2	26.2 ±0.08	-	-	-	1"	665 ±2	26.2 ±0.08
25	1½"	855 ±2	33.7 ±0.08	DN25	787 ±2	31 ±0.08	1½"	855 ±2	33.7 ±0.08
40	2"	1077 ±2	42.4 ±0.08	DN40	1017 ±2	40 ±0.08	2"	1077 ±2	42.4 ±0.08
50	3"	1355 ±2	53.3 ±0.08	DN50	1193 ±2	47 ±0.08	3"	1355 ±2	53.3 ±0.08
80	-	-	-	-	-	-	-	-	-

Hygienic connections: adapter versions (Male thread)												
	Male thread DIN 11851	D		Male thread SMS	D		Male thread IDF/ISS	D		Male thread RJT	D	
		mm	inches		mm	inches		mm	inches		mm	inches
06	-	-	-	-	-	-	-	-	-	-	-	-
10	DN10	596 ±2	23.5 ±0.08	-	-	-	-	-	-	-	-	-
15	DN15	634 ±2	25 ±0.08	-	-	-	-	-	-	-	-	-
15	-	-	-	1"	665 ±2	26.2 ±0.08	1"	664 ±2	26.1 ±0.08	1"	676 ±2	26.6 ±0.08
25	DN25	802 ±2	31.6 ±0.08	1½"	852 ±2	33.5 ±0.08	1½"	854 ±2	33.6 ±0.08	1½"	866 ±2	34.1 ±0.08
40	DN40	1040 ±2	41 ±0.08	2"	1074 ±2	42.3 ±0.08	2"	1076 ±2	42.4 ±0.08	2"	1088 ±2	42.8 ±0.08
50	DN50	1220 ±2	48 ±0.08	3"	1360 ±2	53.5 ±0.08	3"	1354 ±2	53.3 ±0.08	3"	1366 ±2	53.8 ±0.08
80	DN80	1658 ±2	65.3 ±0.08	-	-	-	-	-	-	-	-	-

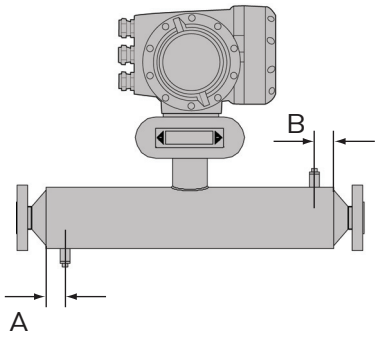
Heating Jacket

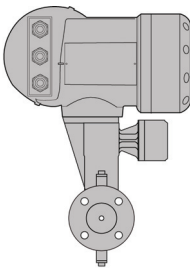


Metric (mm)						
	10	15	25	40	50	80
Connection size	12				25	
A	115 ±1		142 ±1	206 ±1	254 ±1	305 ±1
F	60					
G	98.5					
Titanium						
B	36 ±1	51 ±1	100 ±1	90 ±1	175 ±1	385 ±1
C	25			26 ±1		
SS, Hast & Ta						
B	-	51 ±1	55 ±1	90 ±1	100 ±2	200 ±2
C	-	20		26 ±1		

Imperial (inches)						
	10	15	25	40	50	80
Connection size	½				1	
A	4.5 ±0.04		5.6 ±0.04	8.1 ±0.04	10 ±0.04	12 ±0.04
F	2.4					
G	3.4					
Titanium						
B	1.4 ±0.04	2 ±0.04	3.9 ±0.04	3.5 ±0.04	6.9 ±0.04	15.2 ±0.04
C	0.8			1.0 ±0.04		
SS, Hast & Ta						
B	-	2.0 ±0.04	2.2 ±0.04	3.5 ±0.04	3.9 ±0.04	7.9 ±0.08
C	-	0.8		1.0 ±0.04		

Purge Port (optional)





Metric (mm)							
	S/T 06	S/T/H 10	S/T/H/A 15	S/T/H/A 5	S/T/H/A 40	S/T/H/A 50	S/T/H 80
A	65	30			65		
B	30				65		
Imperial (inches)							
A	2.6	1.2			2.6		
B	1.2				2.6		

Your measuring device is delivered ready to operate. Operating data have been factory set to your order. The signal converter is equipped as standard with a local display, operator control elements and with a HART® interface

The dataplate lists the CG32 number for the TWC 9000 converter supplied with your flowmeter and it describes the converter options. Please refer to section 7.7

TWC 9000 C Compact flowmeter
signal converter mounted directly on the flow sensor

TWC 9000 F Signal converter in field housing, remote version
electrical connection to the flow sensor via four core cable.

TWC 9000 W Signal converter in wall-mounted housing, remote version
electrical connection to the flow sensor via four core cable.

TWC 9000 R Signal converter in 19" rack, remote version
electrical connection to the flow sensor via four core cable.

C and F Optional
These versions available for use in hazardous areas.

Please check against the device nameplates that the device supplied is in the correct version, see following examples. The nameplate for inputs/outputs is illustrated in section 9.7

7.1 Electrical Connection: Power Supply

Note the following points:

- Electrical connection MUST conform with VDE 0100 "*Regulations for electrical power installations with line voltages up to 1000 V*" or equivalent national regulations.
- Use separate entry fittings (PG screwed cable entries) for power supply, field current and signal cables and for outputs and inputs.
- Protect the signal converter against direct solar radiation, install a sunshade if necessary.
- Signal converters installed in switchgear cabinets require adequate cooling, e.g. by fan or heat exchanger.
- Do not expose signal converters to intense vibration.
- Dimensions: see section 7.10.

For separate systems /remote signal converters only (F and W versions)

7.2 Mounting the TWC 9000 W

1. Remove mounting plate from rear of signal converter and attach to wall or standpipe.
2. Fit the signal converter to the mounting bracket.
3. Position lock washers and nuts on the housing bolts and tighten nuts slightly.
4. Align the housing and tighten nuts firmly.

Dimensions: for further information (minimum distances between signal converters) see section 7.10.

7.3 Mounting the TWC 9000 F

Standpipe:

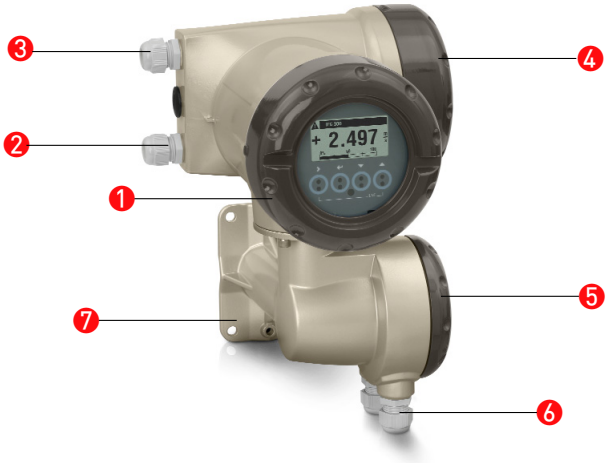
1 . Locate the TWC 9000 F on the standpipe.

2. Use standard U bolts and lock washers to secure the TWC 9000

3. Align converter and tighten the bolts

Wall:

1. Using the Dimensions in section 7.10, drill the wall and prepare with rawplugs
2. Secure with fixing screws and lock washers.



❶ Cover, electronics compartment

❷ Cable entry for inputs/outputs

❸ Cable entry for power

❹ Cover for terminal compartment for power supply and inputs/outputs

F Version only (remote)

❺ Sensor terminal compartment cover

❻ Cable entry for sensor cable

❼ Attachment plate for wall or pipe mounting

7.4 Changing Display Orientation

The orientation of the meter, the display of the TWC 9000 C and TWC 9000 F can be rotated in 90° steps.

1. Unscrew the electronics compartment front cover.

2 Pinch the two plastic locking clips either side of the display to release it.

3. Rotate the display to the required position and push back onto the clips until they lock.

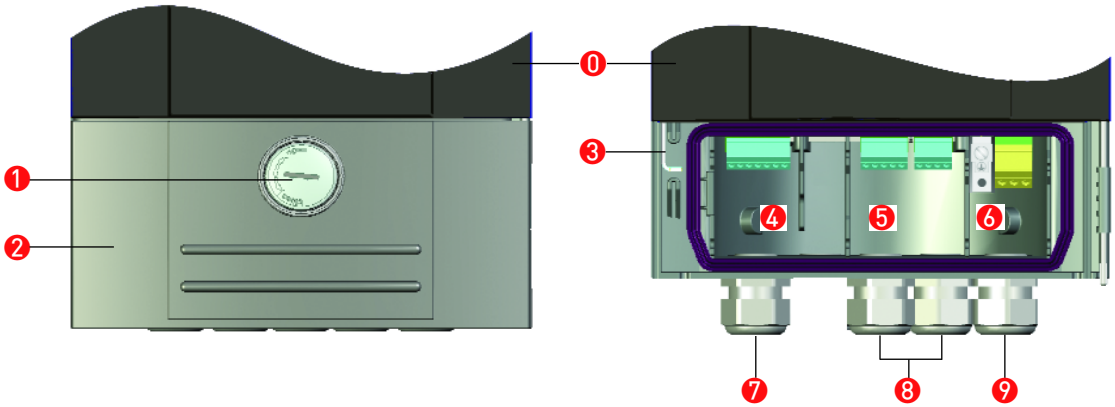
Note Make sure not to damage the flat ribbon cable!

4. Replace the cover and tighten by hand.

Important:

Before replacing the electronics compartment cover, ensure that the threads on the converter housing are clean of debris and apply grease to the cover threads prior to re-fitting.

This is particularly important with hazardous-duty (Ex) versions.



0 Cover, electronics compartment

1 Locking screw, 1/2 turn left/right to open/close cover (2)

2 Cover for the three separate terminal compartments for power, sensor connection and inputs/outputs

3 Safety lever to open cover (1)

4 Sensor terminal compartment, open separate cover

5 Terminal compartment, outputs/inputs

6 Power terminal compartment, open separate shock-hazard protection cover

7 Entry fitting for sensor cable

8 Two cable entries for outputs/inputs

9 Cable entry for power supply

7.5 Mains Power Connection versions C, F and W

PLEASE NOTE!

- The degree of protection in relation to IP 65 and 67 to IEC 529 / EN 60529, (NEMA 4 / 4X) is dependent on the version.
- The housings of the flowmeters, which are designed to protect the electronic equipment from dust and moisture, should be kept closed at all times. Creepage distances and clearances are dimensioned to VDE 0110 and IEC 664 for pollution severity 2. Supply circuits are designed for overvoltage category III and the output circuits for overvoltage category II
- Fuse protection for the infeed power circuit, and also a disconnecting device (switch, circuit breaker) to isolate the signal converter must be provided.

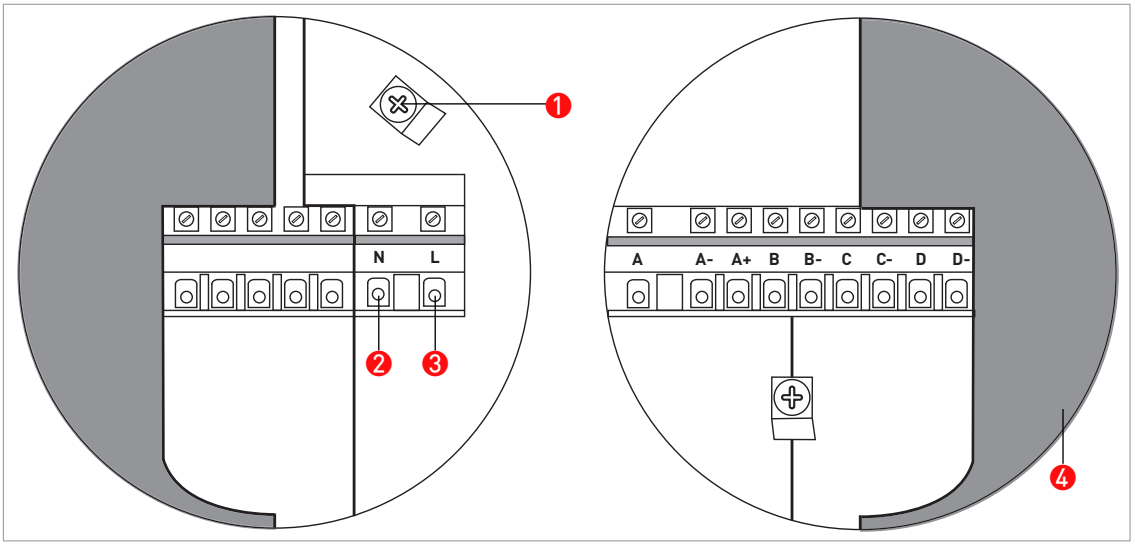
100...230 Volt AC (tolerance range: -15%...+10%)

- Note the data on the nameplate, power supply voltage and frequency range (50...60 Hz).
- The protective ground conductor PE of the power supply must be connected to the separate terminal in the terminal compartment of the signal converter.
- Connection diagrams I - II for the power supply and the electrical connection between flow sensor (primary head) and signal converter are provided in this section.

12...24 Volt DC (tolerance range: -25%...+30%)

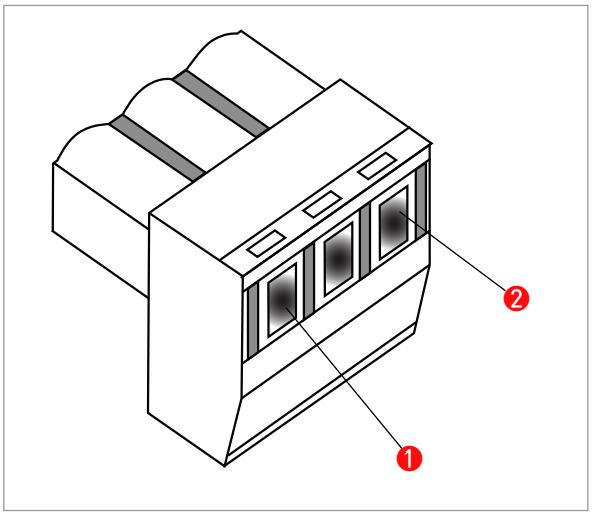
- Note the data on the instrument nameplate!
- For reasons to do with the measurement process, connect a functional ground FE to the separate U-clamp terminal in the terminal compartment of the signal converter.
- When connecting to functional extra-low voltages, provide a facility for protective separation (PELV) (VDE 0100 / VDE 0106 and/or IEC 364 / IEC 536 or relevant national regulations).
- Connection diagrams I - II for the power supply and the electrical connection between flow sensor and signal converter converter are provided in this section.

Power Connection (Compact & Field versions)



1. Earth Terminal (PE)
2. Neutral Connection
3. Live Connection
4. Cover in closed position after electrical connections have been made.

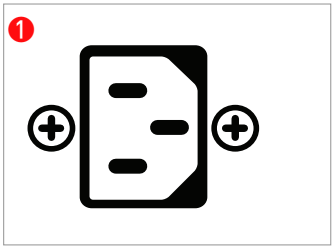
Power Connection (Wall Version)



1. N (L-)
2. L (L+)

Earth connection MUST be parked on the earth tab inside the power compartment.

Power Connection (19" Rack Version)



1. Connection via standard IEC socket

Warning:

The signal converter MUST be properly grounded to avoid shock hazard.

After connecting the power supply, close the plastic cover MUST as shown.

For installations in hazardous areas, reference MUST also be made to the guidlines for the use of coriolis meters in hazardous areas

7.6 Connection of Remote Sensors

The VERSAFLOW meter can be supplied as a remote meter with up to 300m (1000ft) distance between sensor and converter.

Sensor end (All Housings)

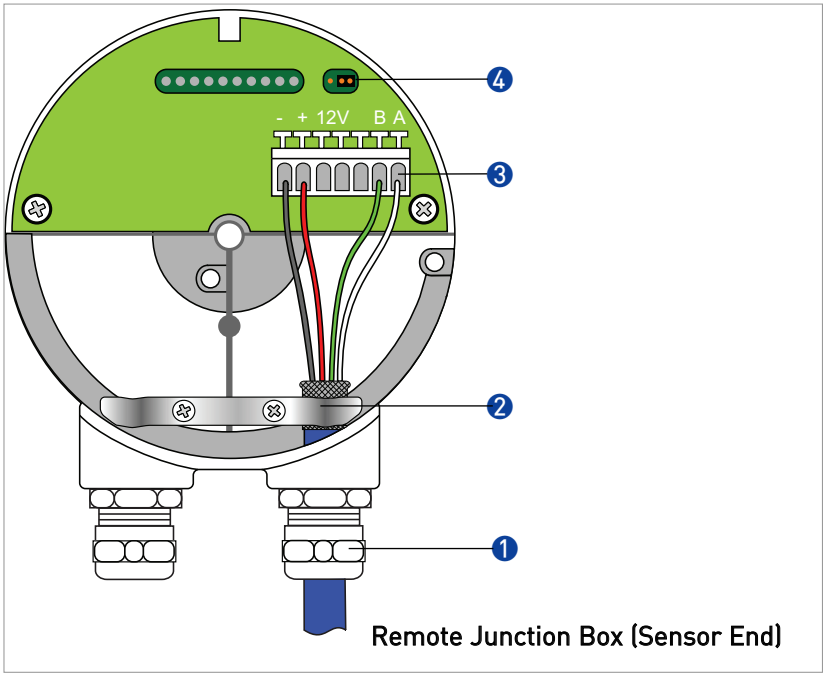
1. Uscrew the fixing screw on the junction box cover.
2. Release the two fixing screws holding the cable grip in place and remove the grip.
3. Strip approx. 50mm of the outer casing of the signal cable.

4 Split the screen away from the cores and fold it back on the outer cable

5 Fit the cable grip and secure, making sure that the screen is gripped under the grip.

6. Connect the four cores to the terminals marked A, B, +, - as shown

NOTE: The spring loaded connections are released by depressing the white lever above each connection



Remote Junction Box (Sensor End)

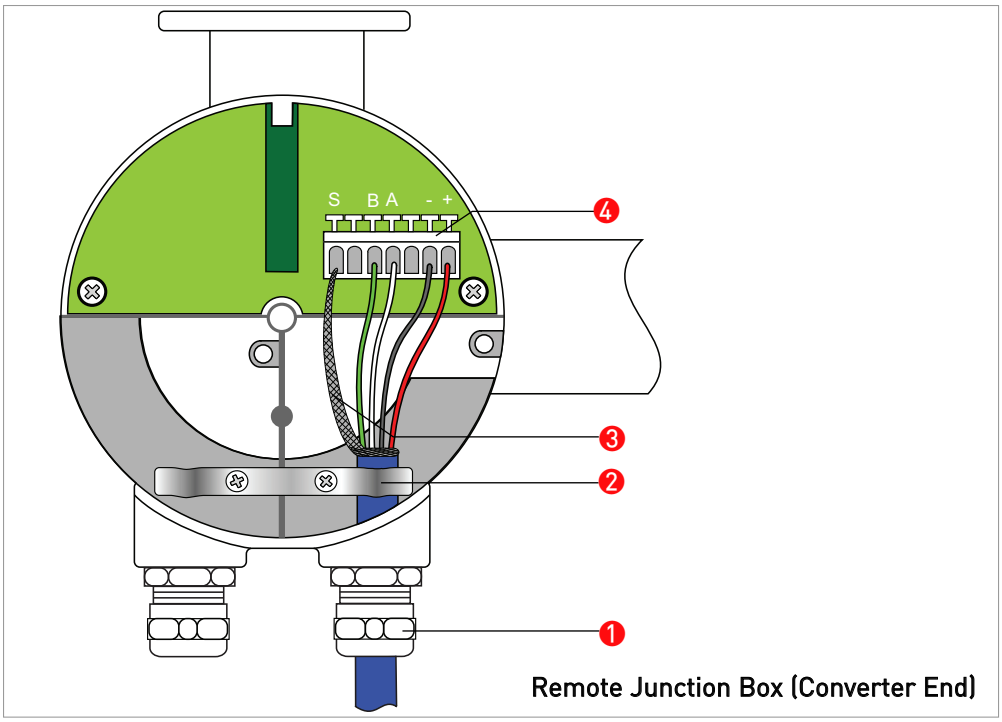
1. Cable Gland
2. Cable Grip/Earth
3. Terminal Connections
4. Jumper Connections

Converter end (Dependant on Housing)

7.6.1 TWC 9000 F

1. Uscrew the fixing screw on the junction box cover.
2. Release the two fixing screws holding the cable grip in place and remove the grip.
3. Strip approx. 50mm of the outer casing of the signal cable.
4 Split the screen away from the cores and twist it to form a "pig-tail"
5 Fit the cable grip and secure, making sure that the cable grip and screen are isolated
6. Connect the four cores and the pig tail, to the terminals marked A, B, +, - as shown

NOTE: The spring loaded connections are released by pressing the white lever above each connection.

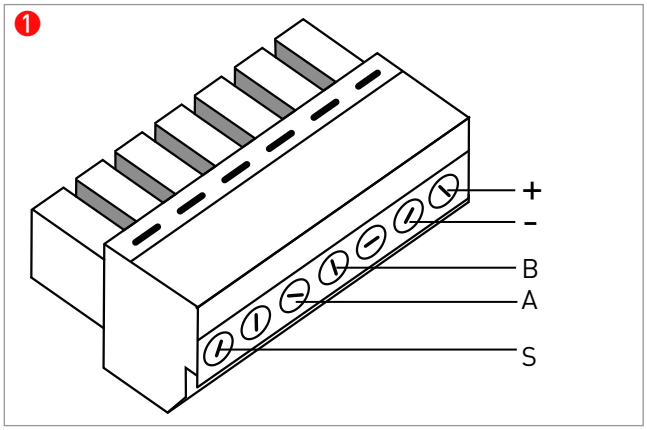


Remote Junction Box (Converter End)

1. Cable Gland
2. Cable Grip
3. Foil Screen formed into a "Pig-Tail"
4. Terminal Connections

7.6.2 TWC 9000 W

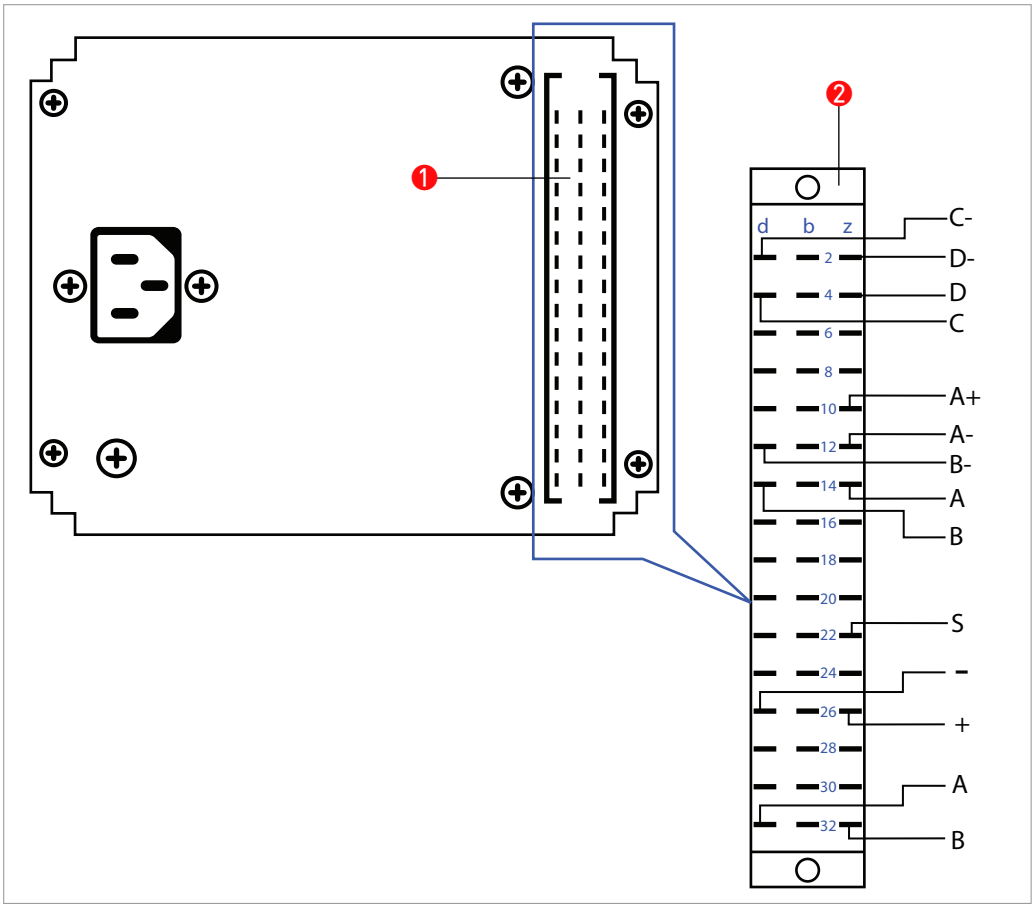
1. Turn the locking screw clockwise on the bottom panel to gain access to the connection compartments.
2. Open the flap marked "Sensor"
3. Unscrew locking ring on the respective cable gland and remove the blanking plug.
4 Feed the signal cable through the locking ring and cable gland.
5 Strip approx. 50mm of the outer casing of the signal cable
6. Connect the cores and the pig tail, to the terminal plug (marked A, B, +, -, S) as shown
7 Push plug onto the connector.



1 7 Way Sensor Plug

7.6.3 TWC 9000 R

The 19" rack mount version of the TWC 9000 uses a multi pin connector that plugs into the rear of the unit. The designated connections on the plug are as follows:



1 Socket

2 Multi-Pin Plug

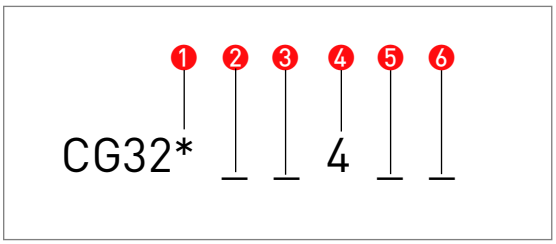
7.7 I/ O Assemblies for the Inputs and Outputs

Important information for outputs and inputs

PLEASE NOTE

- The output / input groups are galvanically separated from each other and from all other input and output circuits.
- **Active mode:** the signal converter supplies the power for operation (activation) of receiver instruments; observe max. operating data.
- **Passive mode:** operation (activation) of receiver instruments requires an external power supply (Uext); observe max. operating data.
- Connection diagrams of outputs and inputs are shown in section 7.9.
- For operating data of outputs and inputs, refer to section 7.8
- The TWC 9000 is available with a choice of output/input assemblies:
- Basic I/O has one mA, one pulse and 2 status outputs. The pulse output can be set as a status output, and one of the status outputs as a control input (see Basic I/O table).
- Modular I/O can be equipped with different output modules, depending on the task (see Modular I/O table).
- For hazardous areas, all I/O variants are available for the TWC 9000 C (compact) and TWC 9000 F (remote) with terminal compartment in EEx - d (flameproof enclosure) or EEx - e (increased safety) protection.
- The Bus - System I/O allows intrinsically safe and non-intrinsically safe bus interfaces in combination with further modules (see Bus - System I/O table).
- The last 3 places of the CG No. indicate the assigned terminals, see examples below.
- Abbreviations used are explained in the table on page 82.

Examples of CG No. to identify the electronic module and the I/O variants:



1. Converter type designation
2. Power
3. Display Version
4. I/O Version
5. First option module for terminal A
6. Second option module for terminal B

CG No. examples	
CG 320 11 100	100...230 V AC & Standard Display / Basic I/O: I_a or I_p & S_p/C_p & S_p & P_p/S_p (see table on page 81)
CG 320 11 7FK	100...230 V AC & Standard Display / Modular I/O: I_a & P_n/S_n and option module P_N/S_N & C_N (see table on page 81)
CG 320 81 4EB	24 V DC & Standard Display / Modular I/O: I_a & P_a/S_a and option module P_p/Sp & I_p (see tables on page 81)

7.7.1 Basic I/Os (input/output versions) – not changeable

				Terminals								
I/Os	CG-No			D-	D	C-	C	B-	B	A-	A	A+
Basic Standard	1	0	0	P_p / S_p (changeable)		S_p		S_p / C_p (changeable)		I_p + HART®		
										or (reverse term.)		
											I_a + HART®	

7.7.2 Fixed I/Os (input/output versions) not changeable

EEx - i Option	2	0	0	P_N / S_N NAMUR (changeable)		I_a + HART® active						
	3	0	0	P_N / S_N NAMUR (changeable)		I_p + HART® passive						
	2	1	0	P_N / S_N NAMUR (changeable)		I_a + HART® active		P_N / S_N / C_N NAMUR (changeable)		I_a		
	3	1	0	P_N / S_N NAMUR (changeable)		I_p + HART® active		P_N/S_N/C_N NAMUR (changeable)				
	2	2	0	P_N / S_N NAMUR (changeable)		I_a + HART® active		P_N/S_N/C_N NAMUR (changeable)		I_p		
	3	2	0	P_N / S_N NAMUR (changeable)		I_p + HART® passive		P_N / S_N / C_N NAMUR (changeable)		I_p		
PA - Bus PROFIBUS (EEx-i) option	D	0	0	Term PA-	Term PA+	Term PA-	Term PA+					
				FISCO Device		FISCO Device						
	D	1	0	Term PA-	Term PA+	Term PA-	Term PA+	P_N / S_N / C_N NAMUR (changeable)		I_a		
				FISCO Device		FISCO Device						
	D	2	0	Term PA-	Term PA+	Term PA-	Term PA+	P_N / S_N / C_N NAMUR (changeable)		I_p		
				FISCO Device		FISCO Device						
FF - Bus Foundation Field-Bus (EEx-i) Option	E	0	0	Term V/D-	Term V/D+	Term V/D-	Term V/D+					
				FISCO Device		FISCO Device						
	E	1	0	Term V/D-	Term V/D+	Term V/D-	Term V/D+	P_N / S_N / C_N NAMUR (changeable)		I_a		
				FISCO Device		FISCO Device						
	E	2	0	Term V/D-	Term V/D+	Term V/D-	Term V/D+	P_N / S_N / C_N NAMUR (changeable)		I_p		
				FISCO Device		FISCO Device						

7.7.3 Modular I/Os (input/output versions)

- The grey boxes denote freely selectable option modules for terminals A and B.
- Terminal A+ functions only for the Basic I/O.
- For hazardous areas, all I/O variants for TWC 9000 C and TWC 9000 F are available with terminal compartment in EEx - d (flameproof enclosure) or EEx - e (increased safety) protection.

				Terminals								
I/Os	CG-No			D-	D	C-	C	B-	B	A-	A	A+
Modular Option	4	–	–	P_a / S_a (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: I_a or P_a / S_a or C_a				
	8	–	–	P_a / S_a (changeable)		I_p + HART® passive		max. 2 option modules for term. B + A: I_a or P_a / S_a or C_a				
	6	–	–	P_P / S_p (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: I_a or P_p / S_p or C_p				
	B	–	–	P_N / S_N (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: I_p or P_p / S_p or C_p				
	7	–	–	P_N / S_N NAMUR (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: Ia or P_N / S_N or C_N				
	C	–	–	P_N / S_N NAMUR (changeable)		I_p + HART® passive		max. 2 option modules for term. B + A: I_p or P_N / S_N or C_N				
PA - Bus PROFIBUS option	D	–	–	Term PA-	Term PA+	Term PA-	Term PA+	max. 2 option modules for term. B + A: I_a or P_a / S_a or C_p				
FF - Bus Foundation Field-Bus Option	E	–	–	Term V/D-	Term V/D+	Term V/D-	Term V/D+	max. 2 option modules for term. B + A: I_a or P_a / S_a or C_p				
DP - Bus PROFIBUS Option	F	–	0	RxD/TxD N	RxD/TxD P	Termin. N	RxD/TxD N	RxD/TxD P	Termin. P	max. 1 option module for term. A: see table below for selection		
RS485 MODBUS ❶	G	-	-	RS485				Many combinations possible				
RS485 MODBUS ❷	H	-	-	RS485				Many combinations possible				

❶ Without termination resistor

❷ With termination resistor

Option Modules		
Abbreviation	**Description**	**Ident for CG No.**
I_a	Active current output	A
I_p	Passive current output	B
P_a / S_a	Active pulse, frequency, status output or limit switch	C
P_p / S_p	Passive pulse, frequency, status output or limit switch	E
P_N / S_N	Pulse, frequency, status output or limit switch to NAMUR	F
C_a	Active control input	G
C_p	Passive control input	K
CN	Control input to NAMUR	H
-	No module installed	8
-	No further module possible	0

7.8 Operating Data I/O

7.8.1 Current Output

Depending on the version, the outputs and inputs to be connected passively or actively and / or to NAMUR EN 60947-5-6! The tables in section 7.7 show which I/O version and which inputs and outputs are installed in your signal converter.See the sticker inside the cover of the terminal compartment.

All current outputs are galvanically separated from each other and from all other circuits.

Depending on the version, up to 3 current outputs in parallel can be built in, one always with HART® communication (except for Foundation Fieldbus and PROFIBUS).

Passive mode: external power supply $U_{ext} \leq 32$ V DC @ $I \leq 22$ mA

Active mode: load impedance $R_L \leq 1$ kΩ at $1 \leq 22$ mA (not applicable to EEx-i, see separate Ex – operating instructions)

Self-monitoring interruption of mA loop or
load impedance too high in mA loop

Factory-set data and functions are given in the enclosed report on settings.

All operating data and functions are settable, see section 8.4.

Error message via status output (see Fct. C 3.x.1).

Current value for error identification adjustable, see Fct. C 3.x.3 (current output).

Range change, automatically by status output or manually by control input, see Sect. 8.4, Fct. C 3.x.11 and C 3.x.12 (for current output) and Fct. C 3.x.01 (for status output or control input).

Setting range threshold: 5...80% of Q100%, ± 0...5% hysteresis (appropriate ratio from low to high range of 1:20 to 1:1.25).

The active range is signalled via a status output.

Forward / reverse flow measurement (F/R mode) is possible, see Fct. C 3.x.7 (current output) and Fct. C 3.x.1 (status output).

Connection diagrams, see s.7.9

Warning:

For installations in hazardous areas, reference MUST also be made to the guidelines for the use of coriolis meters in hazardous areas!

7.8.2 Pulse and Frequency Output

Depending on the version, outputs and inputs to be connected passively or actively and/or to NAMUR EN 60947-5-6. The tables in section 7.7 show which I/O version and which inputs and outputs are installed in your signal converter.

See the sticker inside the cover of the terminal compartment.

The pulse or frequency output can be set under Fct. C 3.1 Hardware.

All pulse / frequency outputs are galvanically separated from all other circuits and from each other.

Depending on the version, several pulse / frequency outputs can be installed in parallel.

Factory-set data and functions will be found in the enclosed report on factory settings.

All operating data and functions are adjustable, see Sect. 8.4.

Passive Mode:	requires external power source: U_{ext} ≤ 32V DC U_0 1.5V @ 10 mA: I ≤ 20 mA at f ≤ 10 kHz (overflow up to fmax ≤ 12 kHz) I ≤ 100 mA at f ≤100 Hz
Active Mode:	uses internal power source: U_{nom} 24 V DC Uo 1.5V @ 10 mA I ≤ 20 mA at f ≤ 10 kHz (overflow up to fmax ≤ 12 kHz) I ≤ 100 mA at f ≤ 100 Hz
NAMUR Mode:	passive to EN 60947-5-6, f ≤ 10 kHz, f_{max} ≤ 12 kHz
Scaling:	Frequency output: in pulses per unit time (e.g. 1000 pulses/s at $Q_{100\%}$ Pulse output: in pulses per unit volume (e.g. 100 pulses/m³).
Pulse output:	in pulses per unit volume (e.g. 100 pulses/m³).
Pulse width	symmetrical, pulse duty factor 1:1, independent of output frequency, automatic, with fixed pulse width, duty factor approx. 1:1 at $Q_{100\%}$, or pulse width of 0.01-2 s adjustable as required for correspondingly low output frequency

If pulse output up to 10 kHz is used on the TWC 9000W, cables MUST be screened and the screens terminated on the special receptacles provided.

Forward / reverse flow measurement (F/R mode) is possible, see Fct. C 3.x.6 or 7 Polarity (frequency/pulse output) and Fct. C 3.x.1 Mode (status output).

Connection diagrams see section 7.9

Warning:

For installations in hazardous areas, reference MUST also be made to the guidelines for the use of coriolis meters in hazardous areas

7.8.3 Status Output and Limit Switches

Depending on the version, the outputs and inputs to be connected passively or actively and/or to NAMUR EN 60947-5-6! The tables in Section 9.7 show which I/O version and which inputs and outputs are installed in your signal converter.

See also the sticker inside the cover of the terminal compartment.

Passive Mode: requires external power source:
U_{ext} ≤ 32V DC: U_0 1.5V @ 10 mA I ≤ 100 mA

Active Mode: uses the internal power supply:
U_{nom} 24 V DC U_0 1.5V @ 10 mA:I ≤ 100 mA

NAMUR Mode: passive in conformity with EN 60947-5-6

Status Output (adjustable to following operating states, see, Fct. C 3.x.1)

error in device	output W
application error	output Y
out of specification.	output Z
polarity, flow	off
overrange, flow	
counter 1 preset	
counter 2 preset	
counter 3 preset	

Limit Swtches (adjustable to following operating states, see Fct. C 3.x.1):
Flow Velocity
Volume Flow
Mass Flow

Setting of limit value and hysteresis
Polarity of measured value
Time constant

Connection diagrams, see section 7.9

Warning:

For installations in hazardous areas, reference MUST also be made to the guidelines for the use of coriolis meters in hazardous areas

7.8.4 Control Input

Depending on the version, the outputs and inputs to be connected passively, actively and/or to NAMUR EN 60947-5-6. Refer to the tables in section 7.7 to see which I/O version and which inputs and outputs are installed in your signal converter.

See also the sticker inside the cover of the terminal compartment.

All control inputs are galvanically separated from all other circuits and from each other.

Depending on the version, two control inputs can be installed in parallel.

If two are installed, these have to be set to different functions.

In the passive mode, the control inputs can be operated with any polarity.

Factory-set data and functions are given in the enclosed report on settings.

All operating data and functions are adjustable, see section. 8.4.

Status output (adjustable to following operating states, see Fct. C 3.x.1):

Passive Mode: requires external power source: U_{ext} ≤ 32V DC:
U_{on} 19 V DC
U_{off} 2.5 V DC

Active Mode: uses the internal power supply:
U_{nom} 24 V DC
I_{nom} 16 mA

NAMUR Mode: to EN 60947-5-6
(Control input active in accordance with NAMUR EN 60947-5-6: open-circuit and short-circuit monitoring to EN 60947-5-6 (NAMUR) can only be done from the infeeding device. Due to the principle involved, only monitoring of control input CN takes place in the signal converter.)

Control Input (adjustable to the following operating states, see Fct. C 2.x.1):

off	zero output + stop Cnt. (not display)
stop all counters	all outputs zero (not display, not counters)
stop counter 1 or 2	output A, B, C or D zero
reset all counters	hold all outputs (not display, not counters)
reset counter 1 or 2	hold output A, B, C or D
error reset	range change
Zero calibration	

Connection diagrams: see section 7.9

Warning:

For installations in hazardous areas, reference MUST also be made to the publication *"Guidelines for the use of Coriolis Meters in Hazardous Areas"*

7.9 Connection Diagrams of Outputs and Inputs

Please note: Depending on the version, connect the outputs and inputs passively, actively and/or to NAMUR EN 60947-5-6

The tables in section 9.7 show which I/O version and which outputs and inputs are installed in your signal converter. Please note the operating data!

The following connection diagrams and operating data do not apply to hazardous-duty equipment (EEx); refer to separate operating instructions for such equipment.

Active mode: The TWC 9000 supplies the power for operating (driving) the receiver instruments; note max. operating data.

Passive mode: An external power source (Uext) is required to operate (drive) the receiver instruments.

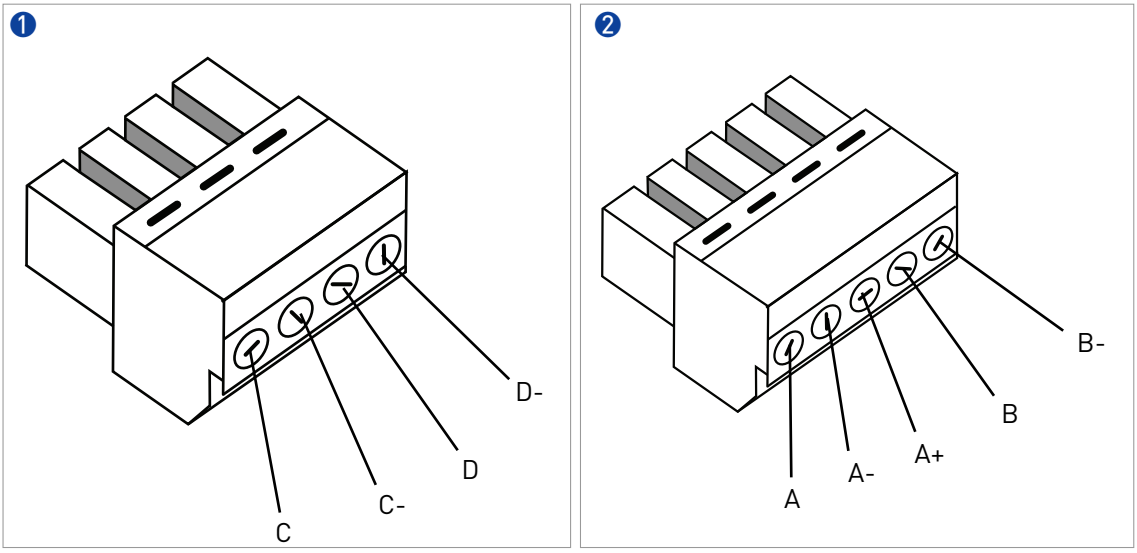
All groups are galvanically separated from each other and from all other input and output circuits.

Terminals that are not used should not have any conductive connection to other electrically conductive parts.

I_a	Ip	Current output active or passive
P_a	P_p	Pulse / frequency output active or passive
P_N		Pulse / frequency output passive to NAMUR EN 60947-5-6
S_a	S_p	Status output / limit switch active or passive
S_N		Status output / limit switch passive to NAMUR EN 60947-5-6
C_a	C_p	Control input active or passive
C_N		Control input active to NAMUR EN 60947-5-6:

Open-circuit and short-circuit monitoring in accordance with EN 60947-5-6 (NAMUR) can only be done from the infeeding device. Due to the principle involved, only monitoring of control input CN takes place in the signal converter.

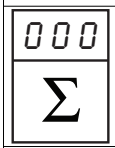
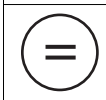
7.9.1 TWC 9000W connection block



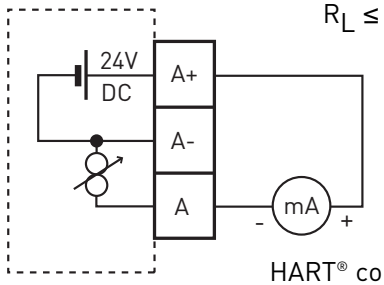
1 4 way I/O plug

2 5 way I/O plug

7.9.2 Basic I/O Connection Diagrams

	Milliammeter 0...20 mA or 4...20 mA and others
	Counter: Electronic (EC) or Electromechanical (EMC)
	Button, N/O contact or similar
	DC voltage source (U_{ext})external power supply, any connection polarity
	DC voltage source (U_{ext}) Connection polarity as shown in the diagrams

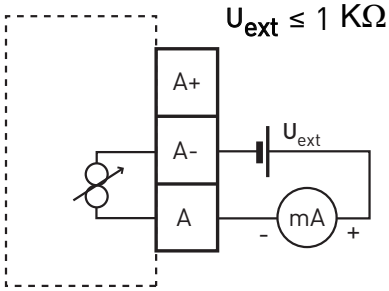
❶



I ≤ 22mA
R_L ≤ 1 KΩ

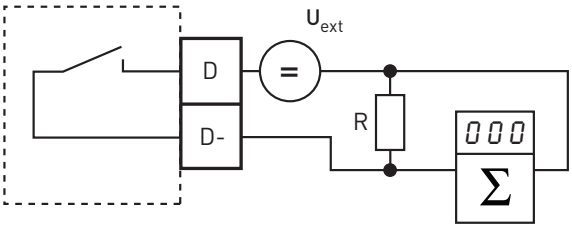
HART® connection
See P.61

❷



I ≤ 22mA
U_{ext} ≤ 1 KΩ

❸



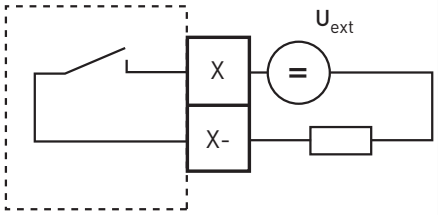
f ≤ 10 KHz: I ≤ 20 mA
f ≤ 100 Hz: I ≤ 100 mA

U_o 1.5V @ 10 mA
U_{ext} ≤ 32 V Dc

R = 1.2 KΩ / 0.5 W
Only necessary when using an electronic totalizer with an impedance >5 KΩ

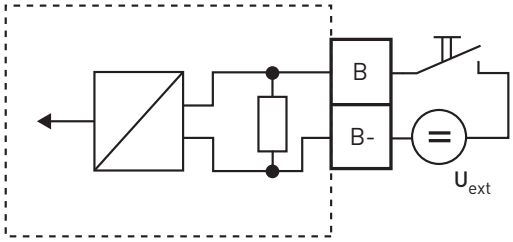
Can also be set as status output. In this case, connection is as shown in fig. 4

❹



U_o 1.5V @ 10 mA
U_{ext} ≤ 32 V Dc
I ≤ 100 mA
X = terminals B or D

❺



U_{on} 19 V DC
U_{off} 2.5 V DC

U_{ext} ≤ 32 V Dc
I_0 ≤ 100 mA

Can also be set as status output , in which case electrical connections are as per fig. 4.

❶ Current Output Active I_a HART®
❷ Current Output Passive I_p HART®
❸ Pulse / Frequency Output Passive P_p
❹ Status Output / Limit Switch Passive S_p
❺ Control Input Passive C_p

7.9.3 Modular I/O and Fixed I/O Connection Diagrams

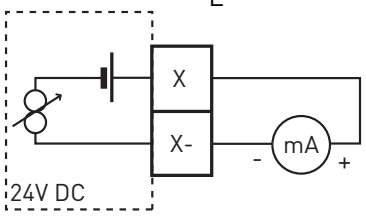
Terminals A, B, C or D are marked with X, depending on the TWC version. Please refer to the tables in section 7.7

For electrical connections of the Bus System, please refer to the separate communications handbook in relation to Foundation Fieldbus, PROFIBUS PA or DP.

0

I ≤ 22mA

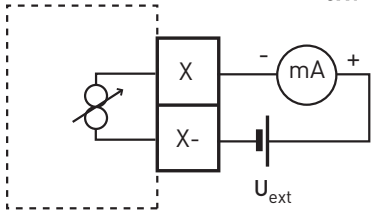
R_L ≤ 1 KΩ



1

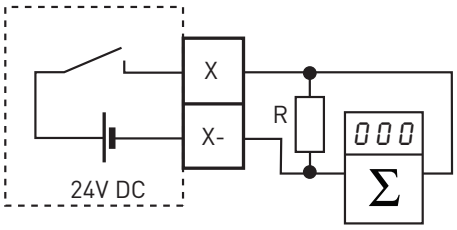
I ≤ 22mA

U_{ext} ≤ 32 V DC



Note: Only the current output module for terminals C / C- has HART capability. See the relevant diagrams in section 7.9.4.

2



f ≤ 10 KHz: I ≤ 20 mA

f ≤ 100 Hz: I ≤ 100 mA

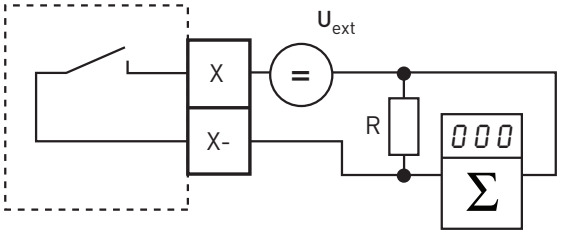
U_o 1.5V @ 10 mA

U_{nom} 24 V DC

R = 1.2 KΩ / 0.5 W

Only necessary when using an electronic totalizer with an impedance >5 KΩ

3



f ≤ 10 KHz: I ≤ 20 mA

f ≤ 100 Hz: I ≤ 100 mA

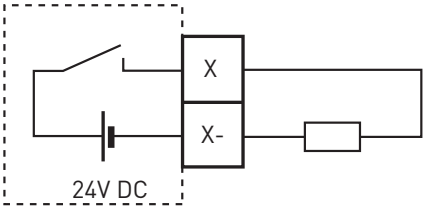
U_o 1.5V @ 10 mA

U_{ext} ≤ 32 V DC

R = 1.2 KΩ / 0.5 W

Only necessary when using an electronic totalizer with an impedance >5 KΩ

4

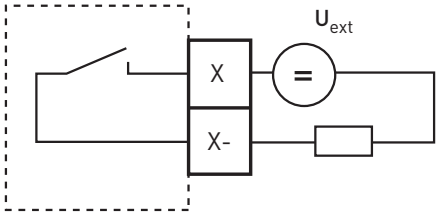


U_o 1.5V @ 10 mA

I ≤100mA

U_{nom} 24 V DC

5

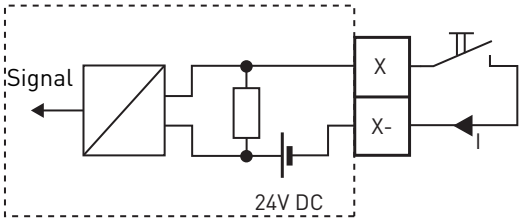


U_o 1.5V @ 10 mA

U_{ext} ≤ 32 V DC

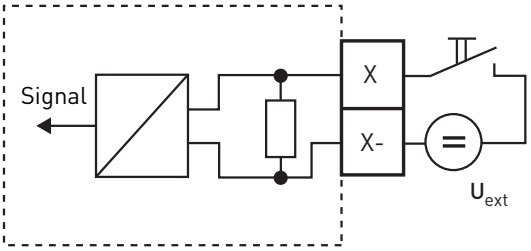
I ≤100mA

6



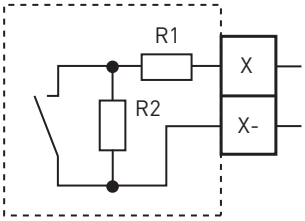
I_{nom} 16 mA
U_{nom} 24V DC

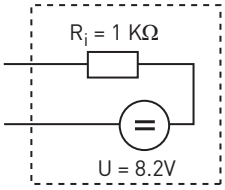
7



I_{on} > 19V DC
U_{off} 2.5V DC
U_{ext} ≤ 32 V DC
I_{nom} 16 mA

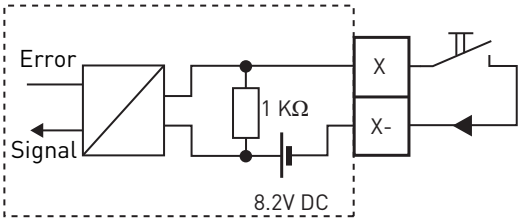
8





Switching amplifier to NAMUR with internal voltage source

9



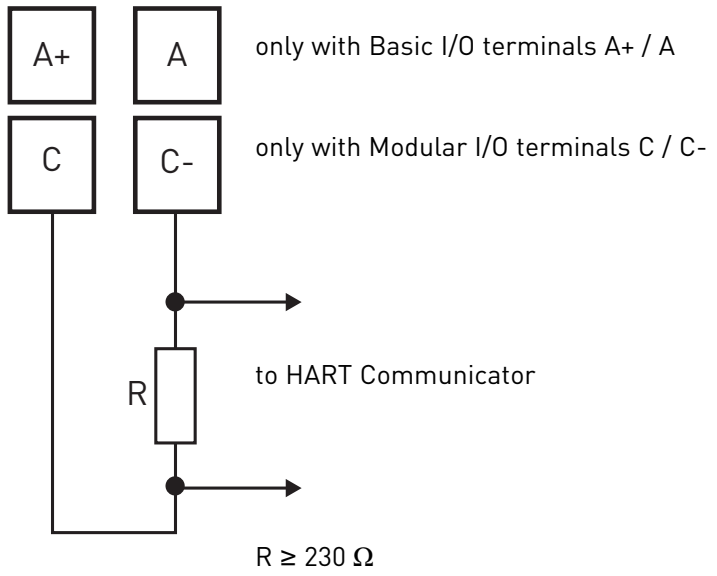
0 Current Output Active I_a HART®
1 Current Output Passive I_p HART®
2 Pulse / Frequency Output Active P_a
3 Pulse / Frequency Output Passive P_p
4 Status Output / Limit Switch Active S_a
5 Status Output / Limit Switch Passive S_p
6 Control Input Active C_a
7 Control Input Passive C_p
8 Pulse, Frequency & Status Outpu / Limit Switch Passive P_n/S_n to NAMUR EN 60947-5-6
9 Control Input Active C_n to NAMUR EN 60947-5-6

7.9.4 HART®

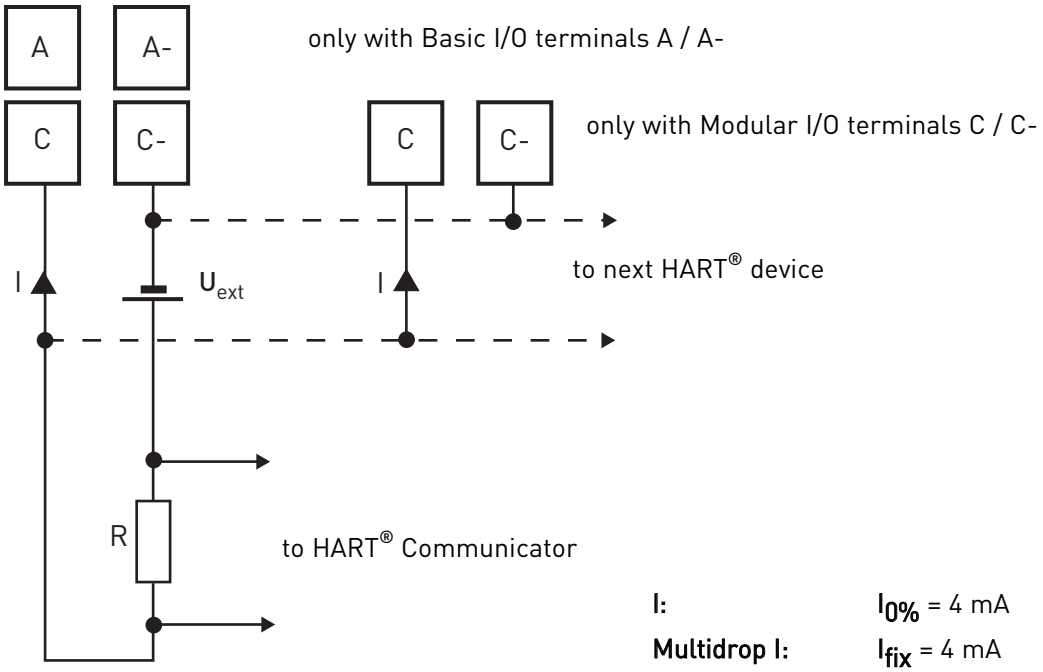
In the Basic I/O, the current output at terminals A+ / A- / A is always HART capable!

In the Modular I/O, only the current output module for terminals C / C - is HART-capable!

❶



❷

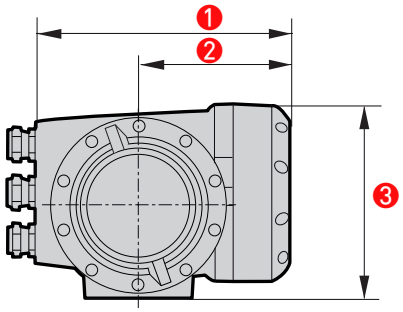


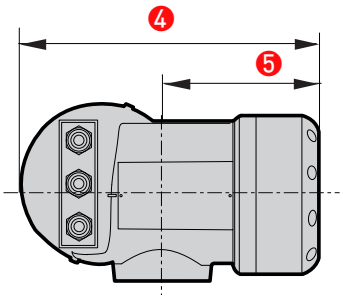
❶ I_a HART® Connection Active

❷ I_p HART® Connection Passive

7.10 Dimensions and Weights

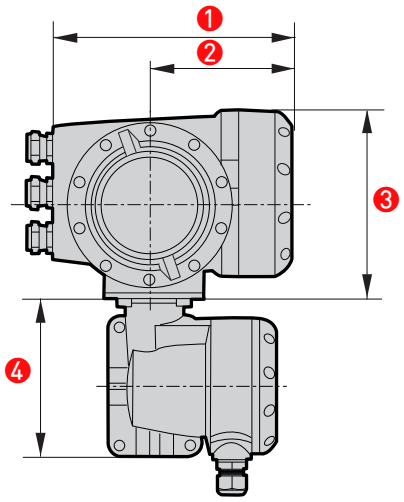
TWC 9000 C

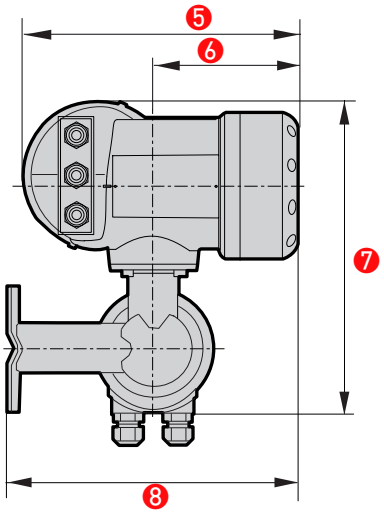




Dimensions				Weights	
Item	mm	inches		mm	inches
1	202	8.0	Al	4.2 kg	9.3 lb
2	120	4.7	SS	9.5 kg	20.3 lb
3	155.3	6.1			
4	260.2	10.2			
5	136.9	5.4			

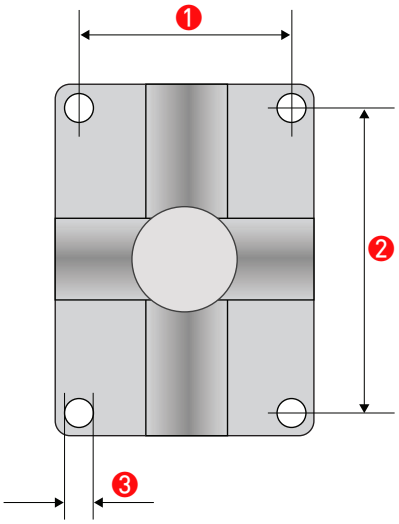
TWC 9000 F





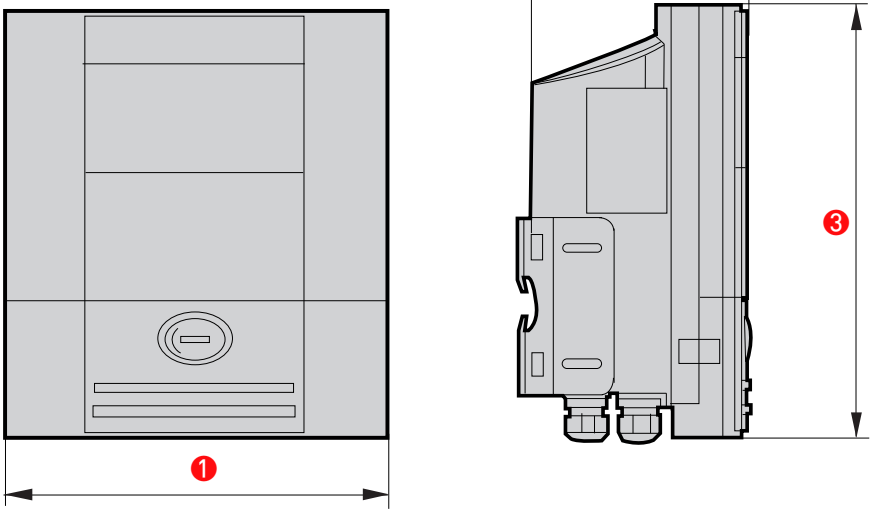
Dimensions				Weights	
Item	mm	inches		Metric	Imperial
1	202	8.0	Al	5.7 kg	12.6 lb
2	120	4.7	SS	14 kg	31 lb
3	155.3	6.1			
4	140.5	5.5			
5	260.2	10.2			
6	136.9	5.4			
7	295.8	11.6			
8	276.9	10.9			

TWC 9000 F Wall & Pipe Mount



Dimensions		
Item	mm	inches
1	60	2.4
2	100	3.9
3	ϕ 9	0.4

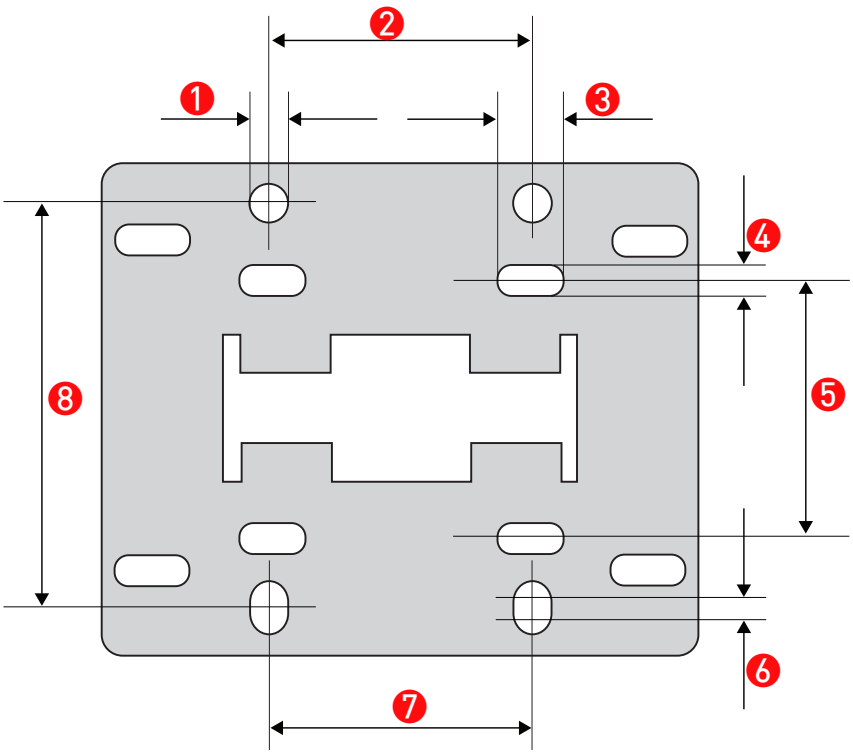
TWC 9000 W



Dimensions		
Item	mm	inches
1	198.3	7.8
2	138.1	5.4
3	298.7	11.8

Weights		
	mm	inches
	2.4 kg	5.3 lb

TWC 9000 W Wall & Pipe Mount



Dimensions					
Item	mm	inches		mm	inches
1	ϕ 9	ϕ 0.4	5	6.3	2.5
2	64	2.5	6	4	0.2
3	16	0.6	7	64	2.5
4	6	0.2	8	98	3.85

7.11 Technical Data

Versions

Standard	TWC 9000 **C**	Compact Version	All versions with HART Display and operator control elements.
	TWC 9000 **F**	Field Housing Version	
	TWC 9000 **W**	Wall Mount Version	
	TWC 9000 **R**	19" Rack Version	

Option	Interface (for all versions)		Fieldbus Foundation and PROFIBUS PA and DP
	EEx Versions	ATEX	EEx Zone 1 d + e + i
		FM	Class I DIV 1 + 2
		CSA	Class I DIV 1 + 2
		TIIS	Zone 1 + 2(pending)
		IECEX	Ex Zone 1 + 2 (pending)
		Nepsi	Ex Zone 1 + 2
	Approvals	Custody transfer	OIML R 117 (pending)

Measurements / Measured variables	Units	Metric, British or US units
	Variables	Mass Flow rate
		Mass Total
		Temperature
		Density
		Volume Flow rate
		Volume Total
		Velocity
		Direction (this is not a display variable – though it can be on an output)
		Brix
		Baume
		NaOH
		Plato
		API General Purpose.
		Concentration by Mass
		Concentration by Volume
Diagnostic functions	Standards	meets and exceeds VDI / NAMUR / WIB 2650 (pending)
	Messages	Output of messages optionally via display, current and/or status output, and also HART® or bus interface
	Sensor Diagnostics	Sensor values
		Drive level
		Tube Frequency
		MT Strain
		IC Strain
		SE/BE temperature

Display and operator control	Type	Graphic display (backlit – white) 128 × 64 pixels / 59 × 31 mm
	Display functions	4 pages (page through with ▲ ▼) • pages 1-2: optionally with one to three lines. Each line can be set to show required measurement value. In a 2-line setting, the measured variable in the 1st line can be shown in the form of a bar graph in the 2nd line. Display ranges and number of places freely selectable. • Page 3: List of diagnostic and status messages Page 4: Trend display
	Counter places	Max. 8
	Language of display texts	English, German, French, Spanish. Danish, Polish, Portuguese, Dutch and others pending.
	Operating elements	4 optical keys (> ↵ ▲ ▼) for operator control of the signal converter without opening the housing Infrared interface for reading and writing all parameters with HONEYWELL IR-Interface without opening the housing
Output / input assemblies		For number and possible combinations of the various outputs and inputs, refer to section. 9.7
Current outputs	Function	• Mass and volume flow rate, flow velocity, temperature, concentration, concentration flow, density, diagnosis values • HART® interface is standard (but not for all option modules), see section. 9.8 • active or passive operation, dependent on the output / input assemblies, see section 9.8
	Op. values and load rating	Active $I \leq 22$ mA / $R_L \leq 1$ kΩ Passive $I \leq 22$ mA / $U \leq 32$ V DC
	Current	Measuring range I_{min} - I_{max} between 0...20 mA settable as required
	Overrange	Setting: 0.00 mA ≤ value ≤ 21.5 mA
	Error identification	0 mA ≤ $I_{Err} < I_{min}$ or $I_{max} < I_{Err} \leq 22$ mA
	Forward / reverse measurement	Direction identified via status output, see below
	Automatic range or external range	via status output or control input, see below
	Time constant	0 - 100.0 s, settable as required
	Low-flow cutoff	Value: 0.0...20.0 % Hysteresis: ± 0.0...20.0 %. } of $Q_{100\%}$ settable as required

Pulse / frequency output	Function	• When set as frequency output: Mass and volume flow rate, flow velocity, temperature, concentration, concentration flow, density, diagnosis values • When set as pulse output: volume, mass, concentration (e.g. 1 pulse / m3 or / kg) • active or passive mode, dependent on the output / input assemblies, see section 7 .8
	Op. values and load rating	Active f ≤10 kHz: I ≤ 20 mA / f ≤100 Hz: I ≤100 mA U_{nom} 24 V DC / U_0 1.5 V @ 10 mA
		NAMUR to EN 60947-5-6 (operating data as for "passive")
	Pulse rate	0...10 kHz, scaleable (overflow up to fmax ≤ 12 kHz)
	Pulse width	0.05 ...2000 ms (autom., symm. or settable)
	Forward / reverse measurement	Direction identified via status output, see below
	Time constant	0...100.0 s, settable as required
	Low-flow cutoff	Value: 0.0...20.0 % Hysteresis: ± 0.0...19.9 % } of $Q_{100\%}$ settable as required
Status output	Function	• Error in device, application error, out of specification error, polarity, overrange, counter preset • active or passive operation, dependent on output / input assemblies, see section 9.8
	Op. values and load rating	Active U ≤24 V DC/ I ≤100 mA / U0 ≤ 1.5 V @ 10 mA
		Passive U ≤32 V DC/ I ≤100 mA / U0 ≤ 1.5 V @ 10 mA
		NAMUR to EN 60947-5-6 (operating data as for "passive")
	Time constant	0...100.0 s, settable as required
Control input	Function	• hold outputs, set outputs to zero, stop cpunters, counter reset, error reset, range change, • active or passive operation, dependent on output / input assemblies, see section 9.8.
	Op. values and load rating	Active Inom = 16 mA / Unom = 24 V DC
		Passive U ≤32 V DC/ / Uon >19 V DC / Uoff < 2.5 V DC
		NAMUR to EN 60947-5-6 (operating data as for "passive")
Internal electronic counters	Number	3, settable independent of one another
	Measured variable	Total mass, volume or concentration
	Function	Sum + or – counter and preset counter
	Time constant	0 - 100.0 s, settable as required
	Low-flow cutoff	Value: 0.0 - 20.0 % Hysteresis:± 0.0 - 19.9 %. } of Q100%, settable as required

Power supply		**AC Version**	**DC Version**	**AC/DC version**	
Voltage range (without changeover)		100...230 V AC	12...24 V DC	24V AC	24V DC
Tolerance band		-15% / +10 %	-25 % / +30 %	-15% / +10%	-25% / +30%
Frequency		48...63 Hz	N/A	48...63 Hz	N/A
Max. power consumption (incl. sensor)		23 VA	14 W	25 VA	14 W
When connected to functional extra-low voltage (12 - 24 V DC), protective separation (PELV) must be ensured (to VDE 0106 and IEC 364 / 536 or equivalent national regulations).					
Housing					
Materials	**C** Compact:	die-cast aluminium (optionally stainl. steel 1.4404)			
	F Field housing	die-cast aluminium (optionally stainl. steel 1.4404)			
	W Wall-mounted housing	polyamide			
	R 19" rack	aluminium section, stainless steel and aluminium sheet, in part with polyester coating			
Ambient temperature	in operation	-40...+60 °C / -40...149 °F (-40...+55 °C / -40...131 °F for SS)			
	In storage	-50...+70 °C / -58...+158 °F			
Degree of protection					
(IEC 529 / EN 60 529)	**C** Compact:	IP 67 / NEMA 4X			
	F Field housing	IP 67 / NEMA 4X			
	W Wall-mounted hsg	IP 65 / NEMA 4 and 4X			
	R 19" rack	IP 20 / NEMA 1			
Cable entry	for Versions C, F and W	M 20 × 1.5, ½" NPT or PF ½"			

Before connecting to the power supply, check that the system has been correctly installed in accordance with the relevant sections

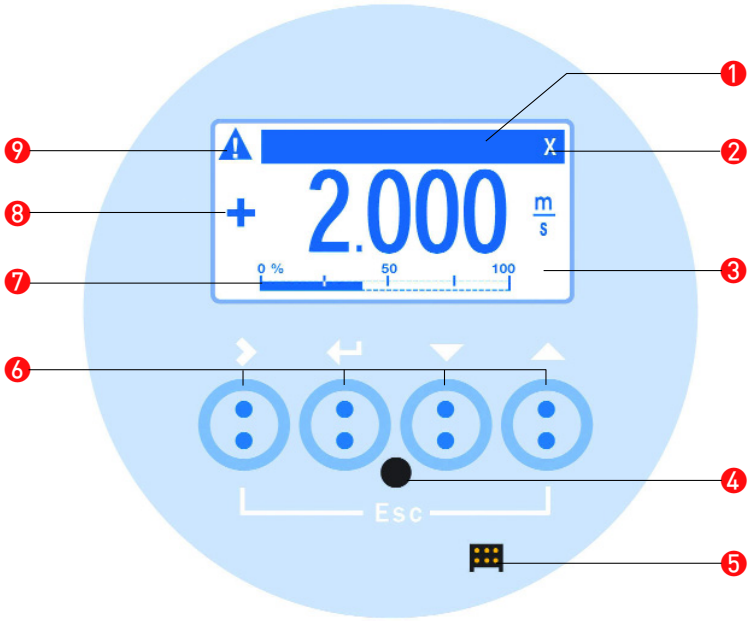
The flowmeter, comprising sensor and signal converter, is delivered in a ready-to-operate condition. All operating data have been factory-set according to your order specifications and reference should be made to the report on settings which is supplied.

After switching on the power, a self-test is carried out, after which the flowmeter immediately starts flow measurements and displays the current measured values.

Alternating between the 1st and 2nd measured value window and, if provided, the list of status messages is carried out by actuating key ▲or▼ Possible status messages, their meaning and possible cause are listed in the Status Table in section 10.5

8.1 Operator Control of the Signal Converter

Display, operating and control elements



1 Blue bar indicates:
- The tag number.in the measuring mode
- The menu/ function name in the setting mode

2 'X' indicates actuation of a key
indicates IR transmission in operation; the 4 optical keys then have no function

3 Graphics display, backlit (white)

4 Optical interface for wireless transfer of data (input / output)

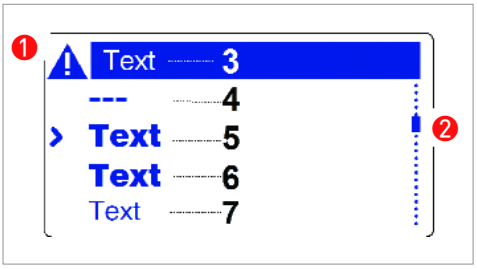
5 Socket for connection to the HONEYWELL GDC bus

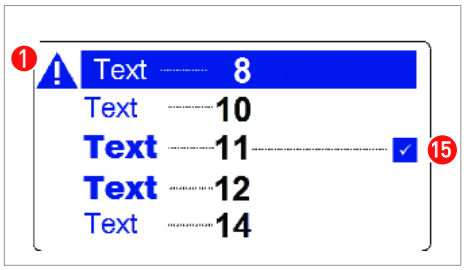
6 Optical keys for operating the signal converter without opening the housing

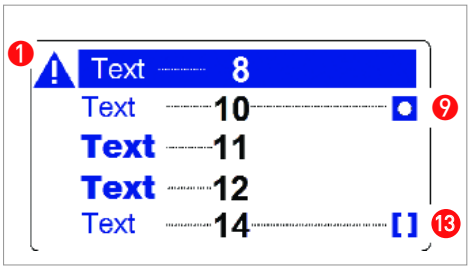
7 3rd display line, shown here as bar graph

8 1st and 2nd display line to indicate different measured variables
Shown here in large format for only one measured variable

9 signals a status message in the status list







1. indicates status messages, if any
2. Marker indicates position in the menu/function lists
3. Higher-level menu (with No. in Setup Menu only)
4. Indicate beginning and end of menu/function lists
5. Current menu
6. Not indicated in Menu Mode
7. Next selectable menu
8. Current menu/function (with No. only in Setup Menu)
9. Indicator for factory settings

   Factory setting (for info only, unalterable) of current (sub-) function to be changed

   Current (sub-) function

   Currently set value, unit or function (when selected,shown as white characters on blue background)

   Indicator for allowable range of values

   Allowable range of values, only in case of numerical values or next function

   Indicator for changing a (sub-) function; allows simple check of changed data when scrolling through the (sub-) function lists.

Key	Meass Mode	Menu Mode	Function Mode	Data Mode
▲ ▼	Alternate between display measured value pages 1 + 2 and status list(s), if provided	Select menu	Select function or (sub) function	Blue cursor: • change number • change unit • change property • change decimal point
>	Switch from measuring mode to menu mode. Press key for 2.5 s to display the "Quick-Start" menu.	Entry into selected menu displayed, then 1st function of menu displayed	Entry into displayed, selected function or subfunction	For numerical values, move cursor (blue) one place to the right
↵		Return to measuring mode, preceded by query whether changed data to be accepted	Press 1 - 3 times, to accept data and return to menu mode.	Accept data and return to function or subfunction.
Esc (>▲)			Discard data and return to menu	Discard data and Return to function or subfunction.

8.2 Time-Out Function

Operator Control Mode

After 5 minutes without key op., return to meas. mode, without acceptance of prev. changed data.

Test Menu Mode

After 60 minutes without key op., return to meas. mode without acceptance of prev. changed data.

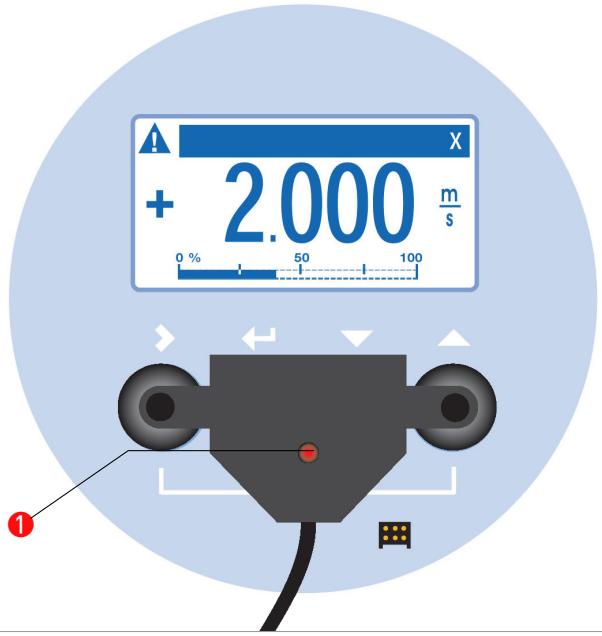
GDC IR-Interface Mode

After the IR-Interface has been activated in Fct. 6.6.6, the interface must be correctly positioned and affixed with the suction cups on the pane of the housing within 60 seconds.

Mounting: GDC IR - Interface

Optical IR-Interface for PC-supported communication with the signal converter; adapter for the optical interface option:

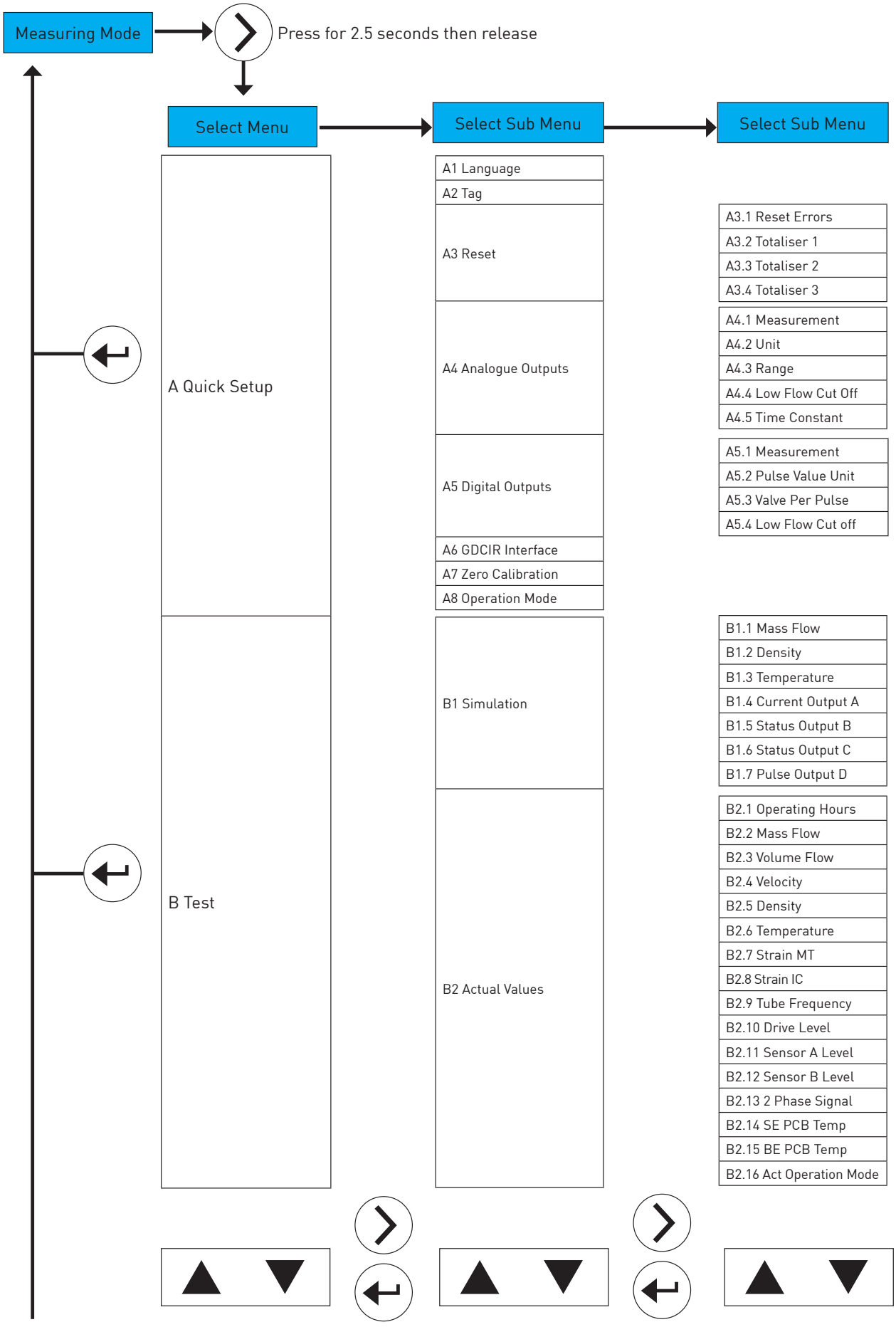
See Section 10.4, Fct. 6.6.6.



1 LED

Please note: The operating point of the 4 optical keys is located directly behind the glass pane. The most reliable way is to actuate the keys from the front. Actuation from the side of the display can lead to incorrect operation.

8.4 Menu Structure



B Ctd...

C Setup

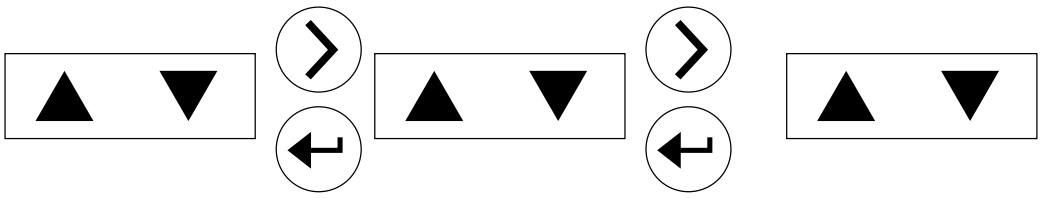
- B3 Information
  - B3.1 C Number
  - B3.2 Sensor Electronics
  - B3.3 SW. REV. MS
  - B3.4 SW. REV. UIS
  - B3.6 Electronic Revision ER
- C1 Process Input
  - C1.1 Calibration
  - C1.2 Density
  - C1.3 Filter
  - C1.4 System Control
  - C1.5 Self Test
  - C1.6 Information
  - C1.7 Factory Calibration
  - C1.8 Simulation
- C2 Concentration
  - Refer to Concentration h/book
- C3 I/O
  - C3.1 Hardware
  - C3.x Current Output
  - C3.x Frequency Output
  - C3.x Pulse Output
  - C3.x Status Output
  - C3.x Limit Switch
  - C3.x Control Input
- C4 I/O Counter

	HART Devices	PROFIBUS Devices
C4.1	Totaliser 1	FB2 Totaliser 1
C4.2	Totaliser 2	FB3 Totaliser 2
C4.3	Totaliser 3	FB4 Totaliser 3

- C5 I/O Hart

	HART Devices	PROFIBUS Devices
C5.1	PV IS	FB1 Analog INP
C5.2	SV IS	FB5 Analog INP
C5.3	TV IS	FB6 Analog INP
C5.4	4V IS	FB7 Analog INP
C5.5	HART Units	FB8 Analog INP

- C6 Device
  - C6.1 Device Info
  - C6.2 Display
  - C6.3 1 Meas Page
  - C6.4 2 Meas Page
  - C6.5 Graphic Page
  - C6.6 Special Functions
  - C6.7 Units
  - C6.8 HART
  - C6.9 Quick Set-up



8.4 Table of Settable Functions

For your guidance, all menus and functions in the following tables are marked with letters and numbers.

A Quick Setup			
Ref	**Display**	**Description & Settings**	
A1	Language	Description as for C 6.2.1	
A2	Tag	Description as for C 6.1.1	
A3	Reset	A3.1 Reset Errors	Description as for C 6.6.1
		A3.2 Totaliser 1	Description as for C 4.1.6
		A3.3 Totaliser 2	Description as for C 4.2.6
		A3.4 Totaliser 3 (where fitted)	Description as for C 4.3.6
A4	Analogue Outputs	A4.1 Measurement	Measurement Value used for driving HART current outputs
		A4.2 Unit	Units for measurement value defined in A4.1
		A4.3 Range	Range of the output used for A4.1
		A4.4 Low Flow Cut-Off	Low Flow Cutoff used for main current output
		A4.5 Time Constant	Time constant used for main current output
A4	Station Address	If Profibus/FF Device – Address of the device at the DP/PA/FF interface	
A5	Digital Outputs	A5.1 Measurement	Measurement Value used for driving pulse output D
		A5.2 Pulse Value Unit	Unit for the Pulse Output D
		A5.3 Value per Pulse	Value of unit per pulse
		A5.4 Low Flow Cut-Off	Low Flow Cutoff used for Pulse Output D
A6	GDC IR Interface	GDC IR InterfaceDescription as for C 6.6.6,	
A7	Zero Calibration	Zero Calibration, description as for C.1.1.1	
A8	Operation Mode	Input of the instrument state. Choose from:	Measure
			Stop
			Stanby

B Test level		
Ref	**Display**	**Description & Settings**
B1	**Simulation**	
B1.1	Mass Flow	**Set Value:** Confirm with ↵ key and set/edit value. Confirm with ↵ At prompt "Start simulation?", select No or Yes and press ↵ to start simulation **Break:** Extras Menu without simulation
B1.2	Density	As B1.1
B1.3	Temperature	
B1.4	Current Output A	
B1.5	Status Output B	
B1.6	Status Output C	
B1.7	Pulse Output D	
B2	**Actual Values**	
B2.1	Operating Hours	Displays the actual operating hours of the device. Exit using the ↵ key
B2.2	Act. Mass Flow	Displays the actual unfiltered mass flow. Exit using the ↵ key
B2.3	Volume Flow	Displays the actual unfiltered volume flow. Exit using the ↵ key
B2.4	Velocity	Displays the actual unfiltered velocity. Exit using the ↵ key
B2.5	Density	Displays the actual unfiltered density. Exit using the ↵ key
B2.6	Temperature	Displays the actual unfiltered temperature. Exit using the ↵ key
B2.7	Strain MT	Displays the actual value for the measuring tube strain gauge. Exit using the ↵ key
B2.8	Strain IC	Displays the actual value for the inner cylinder strain gauge. Exit using the ↵ key
B2.9	Tube Frequency	Displays the actual tube oscillation frequency. Exit using the ↵ key
B2.10	Drive Level	Displays the actual drive level for the tube. Exit using the ↵ key
B2.11	Sensor A Level	Displays the actual amplitude of vibration of Sensor A or B. Exit using the ↵ key
B2.12	Sensor B Level	
B2.13	2 Phase Signal	Displays the actual flow noise. Exit using the ↵ key
B2.14	SE PCB Temp	Displays the actual temperature of the Sensor Electronics. Exit using the ↵ key
B2.15	BE PCB Temp	Displays the actual temperature of the Converter (Back End) Electronics. Exit using the ↵ key
B2.16	Act. Operation Mode	Displays the actual operation mode of the system. Exit using the ↵ key
B3	**Information**	
B3.1	C Number	Displays the CG (identifying) number of the electronics.
B3.2	Sensor Electronics	Displays information about the sensor electronics
B3.3	SW.REV. MS	Displays information about the device incliding HART software
B3.4	SW.REV. UIS	Displays information about the user interface of the device
B3.6	Electronic Revision ER	Displays information about the electronics revision of the sensor

C Setup level		
Ref	**Display**	**Description & Settings**
C1	**Process Input**	
C1.1	**Calibration**	
C1.1.1	Zero Calibration	Display of current zero value, continue with Query: calibrate zero? Select with▲or▼: **Break:** return with ↵, **Automatic:** continue with ↵, time counts down, displays actual value when complete **Default:** press ↵ to set to factory-set zero value **Manual:** continue with ↵ display of last set value, use ▲ ▼to set new value (range -10... +10%) (preferably use "Automatic",Before calibration, set "zero" flow in the pipeline!)
C1.1.2	Zero Add Offset	Direct input of a zero flow offset
C1.1.3	Pipe Diameter	Set the pipe diameter in mm for the velocity calculation
C1.1.4	Flow Correction	Defines additional correction for the mass flow range (-100...100%)
C1.2	**Density**	
C1.2.1	Density	Perform density calibration see section 10.5
C1.2.2	Density Mode Sel	Select From: **Actual:** return with ↵ **Fixed:** Use a fixed value for the density **Referred:** Calculates the process density to a reference temperature
C1.2.3	Fixed Density Value	Set the fixed density value
C1.2.3	Density Reference Temperature	Set the reference temperature for the referred density option
C1.2.4	Referred Density Slope	Set the density slope for the referred density option
C1.3	**Filter**	
C1.3.1	Flow Direction	Define normal direction of flow. Set either POSITIVE or NEGATIVE according to flow arrow
C1.3.2	Pressure Suppression Time	Define pressure suppression time limit. Range 0.0...20.0 Seconds
C1.3.3	Pressure Suppression Cutoff	Define pressure suppression cutoff value. Range 0.0...10.0%
C1.3.4	Density Averaging	Define time constant for density measurement. Range 1.0...20.0 Seconds
C1.3.5	Low Flow Cut-Off	Define low flow cut-off value Range 00.0...10.0%
C1.4	**System Control**	
C1.4.1	Sys Ctrl Function	Defines action of the process control. Select • NO ACTION: OFF • Flow and Total = 0: Force flow and all totalisers to zero • Flow = 0: Force flow to zero
C1.4.2	Sys Ctrl Condition	Defines the condition for the process control function. Select either DENSITY or TEMPERATURE

Ref	Display	Description & Settings
C1.4	**System Control Ctd...**	
C1.4.3	Sys Ctrl Max Limit	Defines the maximum value for the process control condition
C1.4.4	Sys Ctrl Min Limit	Defines the minimum value for the process control condition
C1.5	**Self Test**	
C1.5..1	Maximum Temp.	Displays the maximum recorded sensor temperature
C1.5.2	Minimum Temp.	Displays the minimum recorded sensor temperature
C1.5.3	2 Phase Threshold	Defines acceptable level of 2 phase signal. Set to zero to disable function.
C1.5.4	Diagnosis Value 1	Defines the parameter for the first diagnosis value. Select from: • Off (forced to zero) • Sensor Ave (Sensor amplitude) • Sensor Stdev • Energy level • Tube Frequency • Strain MT • Strain IC • 2 phase signal
C1.5.5	Diagnosis Value 2	
C1.5.6	Diagnosis Value 3	
C1.6	**Information**	
C1.6.2	V No Sensor	Displays the V-code (identification) of the sensor
C1.6.3	SE Serial No	Displays information of the SE
C1.6.4	SE Version	
C1.6.5	SE Interface	
C1.7	**Factory Calibration**	
C1.7.1	Sensor Type	Displays the Sensor Type
C1.7.2	Transducer Size	Displays the nominal sensor size
C1.7.3	Transducer Material	Displays the sensor material type
C1.7.4	Sensor Maximum Temp	Displays the maximum allowable temperature for the sensor
C1.7.5	Sensor Minimum Temp	Displays the minimum allowable temperature for the sensor
C1.7.6	CF1	Displays the sensor calibration coefficients (not Cf9 or Cf10)
C1.7.7	CF2	
C1.7.8	CF3	
C1.7.9	CF4	
C1.7.10	CF5	
C1.7.11	CF6	
C1.7.12	CF7	
C1.7.13	CF8	
C1.7.14	CF11	
C1.7.15	CF12	
C1.7.16	CF13	
C1.7.17	CF14	
C1.7.18	CF15	

Ref	Display	Description & Settings
C1.7	**Factory Calibration ctd...**	
C1.7.19	CF16	Displays the sensor calibration coefficients (not Cf9 or Cf10)
C1.7.20	CF17	
C1.7.21	CF18	
C1.7.22	CF19	
C1.7.23	CF20	
C1.7.24	CF21	
C1.7.25	CF22	
C1.7.26	CF23	
C1.7.27	CF24	
C1.7.28	CF25	
C1.7.29	CF26	
C1.7.30	CF27	
C1.8	**Simulation**	
C1.8.1	Mass Flow	As B1.1
C1.8.2	Density	As B1.2
C1.8.3	Temperature	As B1.3
C2	**Concentration**	Refer to Concentration Handbook
C3 I/O		
C3.1	**Hardware**	
C3.1.1	Terminals A	Assignment of terminals A - D dependent on TWC 9000 version: **Outputs:** • current • frequency • pulse • status • limit value **Input:** • control • off (input and/or output switched off)
C3.1.2	Terminals B	
C3.1.3	Terminals C	
C3.1.4	Terminals D	
In the following descriptions of the current output, "**x**" denotes the terminals: C 3.**2** = A C 3.**3** = B C 3.**4** = C		
C 3.x	**Current output X**	
C 3.x.1	Range 0% ... 100%	xx.x ... xx.x mA (setting range 0.00 mA ≤ value ≤ 20.0 mA) 0 mA ≤ 1st value ≤ 2nd value ≤ 20 mA
C 3.x.2	Extended range	xx.x ... xx.x mA (setting range 3.5 mA ≤ value ≤ 21.5 mA) 0 mA ≤ 1st value ≤ 2nd value ≤ 21.5 mA
C 3.x.3	Error current	xx.x mA (setting range 0.00 mA ≤ value ≤ 22.0 mA) 0 mA ≤ value ≤ 25 mA (outside the overrange)
C 3.x.4	Error condition	• Application error • Error in device • Out of specification Condition for fault current: fault in the selected and in higher fault categories, see Sect. 10.5
C 3.x.5	Measurement	• Volume flow rate • Mass flow rate • Temperature • Density • Diagnosis1 • Diagnosis 2 • Flow Speed • Concentration 1 • Concentration 2 • Concentration Flow1 • Concentration Flow 2 • Diagnosis 3

Ref	Display	Description & Settings	
C 3.x	**Current output X ctd...**		
C3 x.6	Range	0 ... xx.xx (format and unit depends on measured variable, see C3 .x.05)	
C3 .x.7	Polarity	Both polarities Positive polarity Negative polarity Absolute Choice of meas. value polarity, note flow direction, see C 1.5.1	Plus and minus values are used Negative values are set to 0% Positive values are set to 0% Absolute value is used
C.3.z.8	Limitation	± xxx ... ± xxx % (setting range -150 % ≤ value ≤ +150 %)	
C 3.x.9	Low flow cutoff	xx.x ± xx.x %	(setting range: 0.0 %...20 %) 1st value = operating point 2nd value = hysteresis (condition: 2nd value ≤ 1st value)
C 3.x.10	Time constant	xxx.x s	(setting range 000.1 s...100.0 s) Time constant for Current Output X
C 3.x.11	Special function	**OFF:** switched off **Automatic range:** switched on - for indication status output accordingly **External range:** switched on- for external range change Activate control input accordingly	
C 3.x.12	Threshold	Appears only when Fct. C 3.x.11 activated, see above. Set switching point for automatic range or external range; defines the rangeability	
		xx.x ± xx.x %	(setting range: 5.0 %...80 %) 1st value = operating point 2nd value = hysteresis (condition: 2nd value ≤ 1st value)
C 3.x.13	Information	Displays the Serial No, Software No and calibration date of the circuit board	
C 3.x.14	Simulation	Sequence, see Test Level Menu, Fct. B 1	
C 3.x.15	4mA trimming	Set actual value for 4mA.	
C 3.x.16	20mA trimming	Set actual value for 20mA.	
In the following descriptions for the frequency output, "x" denotes the terminals: C 3.**2** = A C 3.**3** = B C 3.**5** = D			
C 3.x	**Frequency output X**		
C 3.x.1	Pulse shape	**Automatic** approx. pulse width in [ms] = 500 / (max. pulse rate in [1/s]) **Symmetrical:** pulse duty factor approx. 1:1 **Fixed** set in Fct. C 3.x.2	
C 3.x.2	Pulse width	Appears only when "fixed" activated in Fct. C 3.x.01 Pulse Shape, see above	
		xxx.xx ms	(setting range: 0.05...2000 ms) (Note: max. setting value Tp [ms] ≤ 500.00 / (max. pulse rate [1/s])
C 3.x.3	100 % Puls rate	xxxxx.x Hz	(setting range 00000.00...10000.0 Hz) limitation at 100% pulse rate ≤ 100 Hz: I_{max} ≤ 100 mA limitation ati 100% pulse rate > 100 Hz:I_{max} ≤ 20 mA

Ref	Display	Description & Settings
C 3.x	**Frequency output X ctd...**	
C 3.x.4	Measurement	• Volume flow rate • Mass flow rate • Temperature • Density • Diagnosis1 • Diagnosis 2 • Flow Speed • Concentration 1 • Concentration 2 • Concentration Flow1 • Concentration Flow 2 • Diagnosis 3
C 3.x.5	Range	0...100% (= unit dependent on measured variable selected)
C 3.x.6	Polarity	**Both polarities** Plus and minus values are used **Positive polarity** Negative values are set to 0% **Negative polarity** Positive values are set to 0% **Absolute** Absolute value is used Choice of meas. value polarity, note flow direction, see C 1.5.1
C 3.x.7	Limitation	**-xxx...+xxx** % (setting range -150%...+150%)
C 3.x.8	Low flow cutoff	**xxxx.x...±xxxx.x** unit dependent on measured variable selected 1st value ≥ 2nd value (hysteresis), values around "0" are set to "0"
C 3.x.9	Time constant	**xxx.x s** (setting range 000.0...100.0 s)
C 3 x.10	Invert signal	**Select:** **Off** switch closes on every pulse, normally open **On** switch opens on every pulse, normally closed
C 3.x.11	Special function	This function is only at output B in devices with 2 frequency outputs connected to terminals B + D or B + A See Fct. 3.x.11 below **Select:** **Off** no special function **Phase shift to D** setting of all functions for output B via output D **Phase shift to A** setting of all functions for output B via output A
C 3.x.11	Phase shift in relation to output B	This function is only available at output A or D, in devices with 2 frequency outputs connected to terminals B + D or B + A See Fct. 3.3.11 above! **Select:** **Off** no phase shift **0° shift** signal inversion possible **90° shift** signal inversion possible **180° shift** signal inversion possible When Fct. C 3.5.6 Polarity is set to "both polarities", the flow direction is indicated (e.g. +90° or -90°)
C 3.x.12	Information	Displays the Serial No, Software No, and calibration date of the circuit board
C 3.x.13	Simulation	For sequence, see Test Level Menu, Fct. B 1
In the following descriptions for the pulse output, "x" denotes the terminals: C 3.2 = A C 3.3 = B C 3.5 = D		
C 3.x	**Pulse output X**	
C 3.x.1	Pulse shape	**Automatic** approx. pulse width in [ms] =500 / (max. pulse rate in [1/s]) **Symmetrical:** pulse duty factor approx. 1:1 **Fixed** set in Fct. C 2.x.2

Ref	Display	Description & Settings	
C 3.x.2	Pulse width	Appears only when "fixed" activated in Fct. C 2.x.1 Pulse Shape, see above	
		xxx.xx ms	setting range: 0.05...2000 ms) (Note: max. setting value Tp [ms] ≤ 500.00 / (max. pulse rate [1/s]
C 3.x.3	Max pulse rate	**xxxxx.x Hz**	(setting range 00000.0...10000.0 Hz, max. 120%)
		when limited to 100% pulse rate ≤ 100 Hz: I_{max} ≤ 100 mA when limited to 100% pulse rate >100 Hz: I_{max} ≤ 20 mA	
C 3.x.4	Measurement	• Volume total • Mass total • Concentration total 1 • Concentration total 2	
C 3.x.5	Pulse value unit	Selection of unit from one of the lists, Dependent on measured variable	
C 3.x.6	Pulse p.value	**xxx.xxx** - set for volume or mass per pulse The lowest settable pulse value is calculated using the formula: $\frac{\text{measuring range (in l/s or kg/s)}\ ❶}{\text{100\% pulse rate (in 1/s)}\ ❷}$ ❶ vol. or mass, see Fct. C 2.x.06 for current output ❷ see Fct. C 2.x.3 for pulse output	
C 3.x.7	Polarity	• both polarities Plus and minus values are used • positive polarity Negative values are set to 0% • negative polarity Positive values are set to 0% • absolute Absolute value is used Choice of meas. value polarity, note flow direction, see C 1.5. 1	
C 3.x.8	Low flow cutoff	xxxx.x ... ±xxxx.x unit dependent on meas. variable selected1st value ≥ 2nd value (hysteresis), values around "0" are set to "0"	
C 3.x.9	Time constant	xxx.x s (setting range 000.0...100.0 s)	
C 3.x.10	Invert signal	**Select:** **Off** switch closes on every pulse, normally open **On** switch opens on every pulse, normally closed	
C 3.x.11	Special function	This function is only at output B in devices with 2 frequency outputs connected to terminals B + D or B + A See Fct. 3.x.11 below	
		Select: **OFF:** switched off **Automatic range:** switched on - for indication Activate status output accordingly **External range:** switched on- for external range change Activate control input accordingly	
C 3.x.11	Phase shift	This function is only at output B in devices with 2 frequency outputs connected to terminals B + D or B + A See Fct. 3.x.11 below **Select:** **Off** no phase shift **0° shift** signal inversion possible **90° shift** signal inversion possible **180° shift** signal inversion possible When Fct. C 3.5.6 Polarity is set to "both polarities", the flow direction is indicated (e.g. +90° or -90°)	
C 3.x.12	Information	Displays: Serial No, Software No, & calibration date of the circuit board	

Ref	Display	Description & Settings	
C 3.x.13	Simulation	For sequence, see Test Level Menu, Fct. B 1	
In the following descriptions of the outputs/inputs, "x" denotes the terminals: C 3.**2** = A / C 3.**3** = B / C 3.**4** = C / C 3.**5** = D (control input connected only to terminals A and B)			
C 3.x	**Status output X**		
C 3.x.1	Mode	• error in device • application error • out of specification. • polarity, flow • overrange, flow • counter 1 preset	• counter 2 preset • counter 3 preset • output W • output Y • output Z • off
C 3.x.2	"Output or input" Dependent on selection under Fct. 3.x.1, see above	Appears only when "output W, Y or Z" activated in Fct. C 2.x.1 Mode, see above	
		• **same signal** (only when there are 2 status outputs)	Selection dependent on input or output combination
		• **polarity**	
		• **over range**	
		• **Range change** (appears only if set to current output X in Fct. C 3.x.1, see status output above)	
		• **off**	
C 3.x.3	Invert signal	**Off** Active output generates high current at output, switch closed **On** Active output generates low current at output, switch open	
C 3.x.4	Information	Displays: Serial No, Software No & calibration date of the circuit board	
C 3.x.5	Simulation	For sequence, see Test Level Menu, Fct. B 1	
C 3.x	**Limit switch X**		
C 3.x.1	Measurement	• Volume flow rate • Density • Flow Speed • Concentration Flow1	• Mass flow rate • Diagnosis1 • Concentration 1 • Concentration Flow 2	• Temperature • Diagnosis 2 • Concentration 2 • Diagnosis 3
C 3.x.2	Threshold	xxx.x ± x.xxx (set limit value, hysteresis) format, unit acc. to meas. range selected and its upper range value. 2nd value (= hysteresis) ❮ 1st value	
C 3.x.3	Polarity	• both polarities — Plus and minus values are used • positive polarity — Negative values are set to 0% • negative polarity — Positive values are set to 0% • absolute — Absolute value is used Choice of meas. value polarity, note flow direction, see C 1.5.1	
C 3.x.4	Time constant	xx.x s (setting range 000.0...100.0 s)	
C 3.x.5	Invert signal	• **off** Active output generates high current at output, switch closed • **on** Active output generates low current at output, switch open	
C 3.x.6	Information	Displays: Serial No, Software No & calibration date of the circuit board	
C 3.x.7	Simulation	For sequence, see Test Level Menu, Fct. B 1	

Ref	Display	Description & Settings	
C 3.x	Control input X		
C 3.x.1	Mode	• off • zero output + stop cnt. (not display) • stop all counters • stop counter 1, 2 or 3 • reset all counters • reset counter 1, 2 or 3 • error reset	• hold all outputs (not display, not counters) • hold output W, Y or Z • all outputs zero (not display, not counters) • output W, Y or Z zero • range change W, Y or Z • zero calibration
		Note! If two control inputs are provided, they should not be set to the same operating mode; if they are, only the control input connected to Term. A is in function!	
C 3.x.2	Invert signal	• off High current at input, switch closed activates function • on Low current at output, switch open activates function	
C 3.x.3	Information	Displays the Serial No, Software No, and calibration date of the circuit board	
C 3.x.4	Simulation	For sequence, see Test Level Menu, Fct. B 1	
C4 I/O Totaliser			
C 4.y	Totaliser 1, 2 or 3	All functions and settings for both counters are the same! In the following descriptions the "y" indicates the counter: Totaliser 1 = C 3.1 Totaliser 2 = C 3.2 Totaliser 3 = C 3.3	
C 4.y.1	Function of Totaliser	**Incremental Total**	counts only positive values
		Decremental Total	counts only negative values
		Absolute Total	counts positive and negative values
		off	counter is disabled
C 4.y.2	Measurement	• volume flow • mass flow • concentration total1 • concentration total2	
C 4.y.3	Low flow cutoff	xxxx.x ... ±xxxx.x unit dependent on measured variable selected 1st value ≥ 2nd value (hysteresis), values around "0" are set to "0"	
C 4.y.4	Time constant	xx.x s (setting range 000.0...100.0 s)	
C 4.y.5	Preset value	x.xxxxx in the unit selected, max. 8 places (see Fct. C 4.7.10 or 13), Status output X becomes active when value is reached. Status output X mode (see Fct. C 3.x.1) must be set to Counter 1/2/3 Preset	
C 4.y.6	Reset Total	• **yes** • **no**	
C 4.y.7	Set Total	Set initial counter value (overwrites current reading) **Cancel** ↵ > return without simulation **Set Value** ↵ > set value ↵ > query "set counter?" No - Yes > execute with ↵	
C 4.y.8	Stop Totaliser	Select: • **yes** • **no**	
C 4.y.9	Start Totaliser	Select: • **yes** • **no**	
C 4.y.10	Information	Displays the Serial No, Software Number and calibration date of the circuit board.	

Ref	Display	Description & Settings
C5 I/O HART		
C5.1	PV is	Displays the HART PV. The PV is always as per the HART current output
C5.2	SV is	Sets the HART variables SV, TV and 4V (QV). List depends on actual configuration. • Volume flow rate • Mass flow rate • Temperature. • Density • Diagnosis1 • Diagnosis2 • Diagnosis3 • Concentration 1 • Concentration2 • Conc Flow1 • Conc Flow2 • Counter 1 • Counter 2 • Counter 3 • Operating hours • Flow Speed
C5.3	TV is	
C5.4	4V is	
C5.5	HART Units	Copies the display units to the HART interface: Continue to copy? **Select:** **Break** - aborts function **Display HART**- copies unit setting from display to those of the HART dynamic variables **Load Defaults** - sets HART dynamic units to defaults
C6 Device		
C 6.1	**Device Info**	
C 6.1.1	Tag	Measuring point identifier (Tag No.), also applies to HART® address & also appears in the display header (up to 8 places)
C 6.1.2	C number	Electronic unit-No. (see signal converter nameplate) / unalterable
C 6.1.3	Device serial no.	Serial No. of the system / unalterable
C 6.1.4	BE serial no.	Serial No. of the complete electronic unit / unalterable
C 6.1.5	SW.REV. MS	Displays the Serial No, Software No and calibration date of the circuit board
C 6.1.6	Electronics Revision ER	
C.6.2	**Display**	
C.6.2.1	Language	**Select:** • English • Deutsch • Français • Dansk • Polski • Portugues • Nederlands • Espanôl
C 6.2.2	Contrast	Setting range: -9...0...+9
C 6.2.3	Default meas. page	**Select:** • 1st meas. page • 2nd meas. page • None • status page • graphic page
C.6.2.5	SW. Rev. MS	Displays the Serial No, Software No, and calibration date of the circuit board display
C 6.3	**1st meas. page 1**	All functions and settings for the two pages are identical! In the following descriptions "z" characterizes the m.v. page: page 1 = C 5.3 page 2 = C 5.4
C.6.4	**2nd meas. page 2**	
C 6.z. 1	Function	• one line • two lines • three lines
C 6.z. 2	Measurement 1st line	• Volume flow rate • Mass flow rate • Temperature • Density • Diagnosis 1 • Diagnosis 2 • Diagnosis 3 • Concentration 1 • Concentration 2 • Conc Flow 1 • Conc Flow 2 • Flow Speed

Ref	Display	Description & Settings
C.6.3	**Display ctd...**	
C 6.z. 3	Range	Unit and format depend on measured quantity selected under C 4.z.2
C 6.z. 4	Limitation	xxx % (100 % ≤ value ≤ 999 %)
C 6.z. 5	Low flow cutoff	xxxx.x...±xxxx.x unit dependent on measured variable selected 1st value ≥ 2nd value (hysteresis), values around "0" are set to "0"
C 6.z.6	Time constant	xxx.x s (setting range 000.0...100.0 s)
C 6.z.7	Format 1st line	Setting of dec. places acc. to list: • X (none) ... X.XXXXXXXX (8 places) Plus automatic
C 6.z.8	Measurement 2nd line	• Volume flow rate • Mass flow rate • Temperature • Density • Diagnosis1 • Diagnosis 2 • Diagnosis 3 • Concentration 1 • Concentration 2 • Conc Flow 1 • Conc Flow 2 • Flow Speed • Counter 1 • Counter 2 • Counter 3 • Operating hours • Bargraph
C 6.z.9	Format 2nd line	Setting of dec. places acc. to list: • X (none) ... X.XXXXXXXX (8 places) Plus automatic
C 6.z.10	Measurement 3rd line	• Volume flow rate • Mass flow rate • Temperature • Density • Diagnosis1 • Diagnosis 2 • Diagnosis 3 • Concentration 1 • Concentration2 • Conc Flow 1 • Conc Flow 2 • Flow Speed • Counter 1 • Counter 2 • Counter 3 • Operating hours • Bargraph
C 6.z.11	Format 3 rd line	Setting of dec. places acc. to list: • X (none) ... X.XXXXXXXX (8 places) Plus automatic
C 6.5	**Graphic Page**	**Shows the trend of the first measured value on the first measuring page**
C 6.5.1	Select range	• manual • automatic
C 6.5.2	Range	Sets scaling of the Y-axis of the trend
C 6.5.3	Time Scale	Total time span of the trend
C 6.6	**Special Functions**	
C 6.6.1	Reset Errors	Select: • No • Yes (reset errors that are not automatically deleted, such as "line failure", "counter overflow", etc.)
C 6.6.2	Save settings	• Backup 1 • Backup 2 • Break select, then press ↵ • No • Yes confirm with ↵ or start Backup With this function, complete device data records can be written into the Backup 1, 2 memories and from there be reloaded (see below)
C 6.6.3	Load settings	• Backup 1 • Backup 2 • Factory Settings • Break select, then press ↵ • No • Yes confirm with ↵ or start Backup With this function, complete device data records can be loaded from the different storage places

Ref	Display	Description & Settings	
C6.6.4	Password Quick Set	Activates 4-character password for changes in the Quick Setup Menu. 0000 deactivates the password.	
C 6.6.5	Password Setup	Activates 4-character password for changes in the Setup Menu and in the Test Menu. 0000 deactivates the password	
C 6.6.6	GDC IR interface	**Cancel**	Press ↵ key, IR-Interface not activated, andexit this function
		Activate	Press ↵ key, IR-Sensor is activated, and accept all changes made up to now
		Within the next 60 sec. position the IR-Interface with the suction cups on the pane of the housing.The correct position is indicated by the steady bright red LED of the interface, as soon as the red LED and the IR-Sensor (below the keys on the display) are roughly one above the other, see Fig. in Sect. 10.2.	
C 6.7	**Units**	**(units applicable to display and all settings, except for pulse output)**	
C.6.7.1	Volume flow	• l/s • m³/s • ft³/s • gal/s • IG/s • l/min • m³/min • ft³/min • gal/min • IG/min • l/h • m³/h • ft³/h • gal/h • IG/h • barrel/h • barrel/day • user-defined unit (free unit)	
C.6.7.2	Text free unit	appears only when "free unit" selected in Fct. C 4.7.01 to set these two functions, see "free unit" below	
C.6.7.3	[m³ / s] * Factor		
C.6.7.4	Mass flow	• g/s • kg/s • t/min • lb/s • ST/min (= Short Ton) • g/min • kg/min • t/h • lb/min • ST/h • g/h • kg/h • lb/h • LT/h (= Long Ton) • user-defined unit (free unit)	
C.6.7.5	Text free unit	appear only when "free unit" selected in Fct. C 6.7.4 to set these two functions, see "free unit" below	
C.6.7.6	[kg / s] * Factor		
C.6.7.7	Flow Speed	• m/s or • ft/s	
C.6.7.8	No Function		
C.6.7.9	Temperature	• K • °C • °F	
C.6.7.10	Volume	• ml • l • hl • m³ • in³ • ft³ • yd³ • gal • IG • barrel • user-defined unit (free unit)	
C.6.7.11	Text free unit	• appear only when "free unit" selected in Fct. C 6.7.10 • to set these two functions, see "free unit" below	
C.6.7.12	[m³] * Factor		
C.6.7.13	Mass	• mg • g • kg • t • oz • lb • ST (Short Ton) • LT (Long Ton) • user-defined unit (free unit)	
C.6.7.14	Text free unit	• appear only when "free unit" selected in Fct. C 6.7.13 • to set these two functions, see "free unit" below	
C.6.7.15	[kg] * Factor		

Ref	Display	Description & Settings
C 6.7.16	Density	• kg/m³ • kg/l • lb/ft³ • lb/gal • SG • API • user-defined unit (free unit)
C 6.7.17	Text free unit	• appear only when "free unit" selected in Fct. C 6.7.16 • To set these two functions, see "free unit" below
C 6.7.18	[kg / m³] * Factor	
Free (user-defined) unit		
	Set required texts:	For volume rate of flow, mass rate of flow and density: max. 3 characters before and max. 3 characters after the slash
		For volume and mass: max.3 characters
		Permissible characters a...z / A...Z / 0...9 / . , " + - ? / # @ $ % ~ ( ) [ ]
	Set conversion factor:	Wanted unit = [unit, see above] × conversion factor
		Conversion factor: max. 9 digits
		Shift decimal point with ▲ (to left) and with ▼ (to right)
C 6.8	HART	
C 6.8.1	HART	• HART on • HART off
C 6.8.2	Address	If 0, HART current output has normal function Otherwise, set address for multi-drop usage. Current set to 0% value.
C 6.8.3	Message	Hart message – free text
C 6.8.4	Description	Hart description – free text
C 6.9	Quick Setup	
C 6.9.1	Reset Totaliser 1	• yes • no Selects whether counter can be reset in the Quick Setup Menu
C 6.9.2	Reset Totaliser 2	
C 6.9.3	Reset Totaliser 3	

To reset counters			
Key	**Text Displayed**		**Description**
>	A	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
>▲▼	A3	Reset	
>	A 3.1	Reset errors	
▼	A 3.2	Totaliser 1	Select totaliser that is to be reset
▼	A 3.3	Totaliser 2	
▼	A 3.4	Totaliser 3	
>	A 3.x	Reset Totaliser? No	
▲ (▼)	A 3.x	Reset Totaliser? Yes	
4x ↵		Measuring mode	Totaliser has been reset
To delete error messages (for list of possible error messages, see Sect. x.x)			
>	A 3.x	Reset? No	
▲ (▼)	A 3.x	Reset? Yes	
4x ↵		Measuring mode	Errors have been reset

8.5 Description of Functions

Operation Mode (Menu A8)

The meter may be put in a STANDBY In this state all outputs go to their off state and the mass totaliser is frozen. The main display will have the STANDBY indicator set and will display either the frozen totaliser or just STANDBY.

Whilst in this state the measuring tube still vibrates and the measurements can come back on line as soon as required.

In addition, there is a 'STOP' condition, in which the drive to the primary head is disabled and vibrations cease. It MUST be noted that when leaving STOP, the converter has to return to STARTUP before measurements can resume.

The instrument can be switched to STANDBY either by the sensors on the display or by the control input signal. STOP can only be set by the optical sensors.

To set STANDBY or STOP:
Begin from measuring mode

Key	Text Displayed		Description
>	A	Quick Setup	Countdown from 2.5 s to 0.0 s,then release key
>▲	A8	Operation Mode Measuring	
>		Operation Mode Measuring	
▲		Operation Mode Standby	
▲		Operation Mode Stop	
↵ x 3		Save Configuration? Yes	
↵		Measuring Page	

If STANDBY or STOP was selected the instrument goes immediately into that state.

To return to measurement, go back to menu A8 and select MEASURE.

Note:

When changing from STOP into STANDBY the meter will run through the STARTUP mode.

In addition to these 'standby' modes the PROCESS CONTROL function provides a fully automated way of switching to similar modes using either the density or temperature of the process fluid as a control.

In addition to these 'standby' modes the PROCESS CONTROL function provides a fully automated way of switching to similar modes using either the density or temperature of the process fluid as a control.

Zero Calibration (Menu C1.1.1)

Following checks on the installation for soundness, it is necessary to set the zero point on the meter prior to use.

All modifications/adjustments to the installation MUST be completed before the zero point is set. Any modifications or changes (to piping or calibration factor) carried out after the zero point has been set will render the performance of the meter unreliable and therefore will require the zero point to be reset.

To achieve a successful zero calibration the following points MUST be noted:

- The primary head should be completely full of process fluid at normal operating pressures and temperatures.
- All air MUST be exluded from the fluid, particularly for horizontal installations. It is recommended that the primary head be flushed with the process fluid at a high flow rate (>50%), for 2 minutes, prior to starting the adjustment.
- After flushing, flow in the primary head MUST be brought back to zero by tightly closing appropriate valves.

The zero off-set can either be measured automatically or entered manually using the display keys. If an automatic adjustment is to be made then the operator should trigger this, with the front cover still in place.

A) Automatic Adjustment:

Key	Text Displayed		Description
>	A	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
▼ ▼	C	Setup	
>>>	C1.1.1	Zero Calibration	
>		Calibrate Zero? Break	
▼		Calibrate Zero? Automatic	
↵		Please Wait Countdown from 32s	
		Zero Calibration +XX.XXX%	Displays zero value in % Note: Care MUST be taken as the value can be edited!
↵ x 5		Save Configuration? Yes	Accept Zero
↵		Measuring Page	

B) Manual Adjustment

Key	Text Displayed		Description
>	A	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
▼ ▼	C	Setup	
>>>	C1.1.1	Zero Calibration	
>		Calibrate Zero? Break	
▼ ▼		Calibrate Zero? Manual	
		Zero Calibration +XX.XXX%	Displays zero value in % Note: Care MUST be taken as the value can be edited!
↵ x 5		Save Configuration? Yes	Accept Zero
↵		Measuring Page	

Under certain conditions, it may not be possible to adjust the zero point. These can include situations where:

- The medium is in motion because the shut-off valves etc. are not functioning properly.
- There are still gaseous inclusions in the primary head because it was flushed insufficiently.

In such cases the zero point adjustment will not be accepted!

Certain media might make it difficult to set the zero point. In such cases, certain solutions will resolve the problem and allow zero point adjustment:

It may also be necessary to make a manual zero calibration.

Media	Possible Solution
Media which tends to vaporise or degas.	Keep the media under higher pressure.
Two-phase media (slurry) consisting of solid components that can be separated.	Fill the primary head with the carrier medium only.
Two-phase media where the solid or gaseous components cannot be separated.	Fill the measuring system with a substitute liquid (e.g. water)

Density Calibration

Menu C1.2.1

A density calibration can be made on-site to improve density accuracy. The original factory calibration can also be re-loaded in the event of a data loss or error in density calibration procedure.

Options available:

Option	Result
1 Point Calibration:	The converter uses the existing calibration, and decides which point to adjust when the calibration is made
2 Point Calibration:	The user enters the two points to be used in the calibration.
Default	Converter restores the factory density calibration
Manual	User can read the existing density calibration values and edit if required

Key	Text Displayed		Description and Settings
>	A	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
▼ x 2	C	Setup	
> x 2		Calibration	
▼		Density	
> x2		Density Calibration? Break	Press ↵ to exit from density calibration
▼		Density Calibration? Default	Press ↵ to load factory density calibration
▼		Density Calibration? Manual	Press ↵ to read and edit existing calibration
▼		Density Calibration? 2 Point Calibration	Press ↵ to start 2 point calibration
▼		Density Calibration? 1 Point Calibration	Press ↵ to start 1 point calibration

1 Point Calibration

The options are: Empty, Pure water, Town water and Other. Select with ▼ or ▲ and press ↵ If you select "Other" you will need to enter the product density and this can be in any of the normal density units. If you select: 'pure water', 'air' or 'town water' the density does not need to be entered.

Once selected

Single Pt Density Calib
Break

is displayed.

Press ▼ or ▲ to select OK. Density calibration should take about 10 seconds. After this time the result of the calibration will be displayed. CALIB OK - the point has been entered correctly.

CALIB FAIL - the density calibration has failed. There are several reasons for this condition:

- Not in measuring mode
- The 2 points are too close
- The 2 points fail a plausibility check

Normally a 1 point calibration is adequate for most density calibrations e.g. tailoring the density to the new installation.

The 1 point calibration can be done twice, with two different products to achieve a 2 point calibration. However, this is not recommended as there is no guarantee that the first point entered will not be moved when the second point is entered.

2 Point Calibration

This is when the user wants to enter 2 set points.

The 2 point calibration makes sure that the 2 points entered by the user are used.

Warning - 2 point calibration will restore the factory calibration data before calibrating the 1st point.

If first point has not been done, options will be as per "1 point calibration"

If first point has been calibrated, you must first select whether to proceed with 2nd point, make the 1st point again, or break. Options are then as before.

Manual

If a manual calibration is selected, Point 1 density type DCF1 is dislayed. Press ↵ to step to the next DCF option or ▲ and ▼ to edit. After the last DCF, you will be asked to save data or break.

Temperature		Density	
°C	°F	kg/m3	lb/ft3
0	32	999.8396	62.41999
0.5	32.9	999.8712	62.42197
1	33.8	999.8986	62.42367
1.5	34.7	999.9213	62.42509
2	35.6	999.9399	62.42625
2.5	36.5	999.9542	62.42714
3	37.4	999.9642	62.42777
3.5	38.3	999.9701	62.42814
4	39.2	999.9720	62.42825
4.5	40.1	999.9699	62.42812
5	41	999.9638	62.42774
5.5	41.9	999.9540	62.42713
6	42.8	999.9402	62.42627
6.5	43.7	999.9227	62.42517
7	44.6	999.9016	62.42386
7.5	45.5	999.8766	62.42230
8	46.4	999.8482	62.42053
8.5	47.3	999.8162	62.4185
9	48.2	999.7808	62.41632
9.5	49.1	999.7419	62.41389
10	50	999.6997	62.41125
10.5	50.9	999.6541	62.40840
11	51.8	999.6051	62.40535
11.5	52.7	999.5529	62.40209
12	53.6	999.4975	62.39863
12.5	54.5	999.4389	62.39497
13	55.4	999.3772	62.39112
13.5	56.3	999.3124	62.38708
14	57.2	999.2446	62.38284
14.5	58.1	999.1736	62.37841
15	59	999.0998	62.37380
15.5	59.9	999.0229	62.36901
16	60.8	998.9432	62.36403
16.5	61.7	998.8607	62.35887
17	62.6	998.7752	62.35354
17.5	63.5	998.6870	62.34803
18	64.4	998.5960	62.34235
18.5	65.3	998.5022	62.33650
19	66.2	998.4058	62.33047
19.5	67.1	998.3066	62.32428
20	68	998.2048	62.31793
20.5	68.9	998.1004	62.31141
21	69.8	997.9934	62.30473
21.5	70.7	997.8838	62.29788
22	71.6	997.7716	62.29088

Temperature		Density	
°C	°F	kg/m3	lb/ft3
22.5	72.5	997.6569	62.28372
23	73.4	997.5398	62.27641
23.5	74.3	997.4201	62.26894
24	75.2	997.2981	62.26132
24.5	76.1	997.1736	62.25355
25	77	997.0468	62.24563
25.5	77.9	996.9176	62.23757
26	78.8	996.7861	62.22936
26.5	79.7	996.6521	62.22099
27	80.6	996.5159	62.21249
27.5	81.5	996.3774	62.20384
28	82.4	996.2368	62.19507
28.5	83.3	996.0939	62.18614
29	84.2	995.9487	62.17708
29.5	85.1	995.8013	62.16788
30	86	995.6518	62.15855
30.5	86.9	995.5001	62.14907
31	87.8	995.3462	62.13947
31.5	88.7	995.1903	62.12973
32	89.6	995.0322	62.11986
32.5	90.5	994.8721	62.10987
33	91.4	994.7100	62.09975
33.5	92.3	994.5458	62.08950
34	93.2	994.3796	62.07912
34.5	94.1	994.2113	62.06861
35	95	994.0411	62.05799
35.5	95.9	993.8689	62.04724
36	98.6	993.6948	62.03637
36.5	97.7	993.5187	62.02537
37	98.6	993.3406	62.01426
37.5	99.5	993.1606	62.00302
38	100.4	992.9789	61.99168
38.5	101.3	992.7951	61.98020
39	102.2	992.6096	61.96862
39.5	103.1	992.4221	61.95692
40	104	992.2329	61.94510
40.5	104.9	992.0418	61.93317
41	105.8	991.8489	61.92113
41.5	106.7	991.6543	61.90898
42	107.6	991.4578	61.89672
42.5	108.5	991.2597	61.88434
43	109.4	991.0597	61.87186
43.5	110.3	990.8581	61.85927
44	111.2	990.6546	61.84657
44.5	112.1	990.4494	61.83376

Temperature		Density	
°C	°F	kg/m3	lb/ft3
45	113	990.2427	61.82085
45.5	113.9	990.0341	61.80783
46	114.8	989.8239	61.79471
46.5	115.7	989.6121	61.78149
47	116.6	989.3986	61.76816
47.5	117.5	989.1835	61.75473
48	118.4	988.9668	61.74120
48.5	119.3	988.7484	61.72756
49	120.2	988.5285	61.71384
49.5	121.1	988.3069	61.70000
50	122	988.0839	61.68608
50.5	122.9	987.8592	61.67205
51	123.8	987.6329	61.65793
51.5	124.7	987.4051	61.64371
52	125.6	987.1758	61.62939
52.5	126.5	986.9450	61.61498
53	127.4	986.7127	61.60048
53.5	128.3	986.4788	61.58588
54	129.2	986.2435	61.57118
54.5	130.1	986.0066	61.55640
55	131	985.7684	61.54153
55.5	131.9	985.5287	61.52656
56	132.8	985.2876	61.51150
56.5	133.7	985.0450	61.49636
57	134.6	984.8009	61.48112
57.5	135.5	984.5555	61.46580
58	136.4	984.3086	61.45039
58.5	137.3	984.0604	61.43489
59	138.2	983.8108	61.41931
59.5	139.1	983.5597	61.40364
60	140	983.3072	61.38787
60.5	140.9	983.0535	61.37203
61	141.8	982.7984	61.35611
61.5	142.7	982.5419	61.34009
62	143.6	982.2841	61.32400
62.5	144.5	982.0250	61.30783

Temperature		Density	
°C	°F	kg/m3	lb/ft3
63	145.4	981.7646	61.29157
63.5	146.3	981.5029	61.27523
64	147.2	981.2399	61.25881
64.5	148.1	980.9756	61.24231
65	149	980.7099	61.22573
65.5	149.9	980.4432	61.20907
66	150.8	980.1751	61.19233
66.5	151.7	979.9057	61.17552
67	152.6	979.6351	61.15862
67.5	153.5	979.3632	61.14165
68	154.4	979.0901	61.12460
68.5	155.3	978.8159	61.10748
69	156.2	978.5404	61.09028
69.5	157.1	978.2636	61.07300
70	158	977.9858	61.05566
70.5	158.9	977.7068	61.03823
71	159.8	977.4264	61.02074
71.5	160.7	977.1450	61.00316
72	161.6	976.8624	60.98552
72.5	162.5	976.5786	60.96781
73	163.4	976.2937	60.95002
73.5	164.3	976.0076	60.93216
74	165.2	975.7204	60.91423
74.5	166.1	975.4321	60.89623
75	167	975.1428	60.87816
75.5	167.9	974.8522	60.86003
76	168.8	974.5606	60.84182
76.5	169.7	974.2679	60.82355
77	170.6	973.9741	60.80520
77.5	171.5	973.6792	60.78680
78	172.4	973.3832	60.76832
78.5	173.3	973.0862	60.74977
79	174.2	972.7881	60.73116
79.5	175.1	972.4890	60.71249
80	176	972.1880	60.69375

Density Mode (Menu C1.2.02)

There are 3 density modes available, which can be selected here.

Actual: The meter measures and then displays the actual density of the process fluid

Fixed: The meter displays a fixed density value. This is entered in menu C1.2.03

Referred: The meter calculates the process density to a reference temperature.

The equation used is

$p_r=p_a+a(t_a-t_r)$

p_r = Density at reference temperature

p_a = Actual measured density at actual temperature

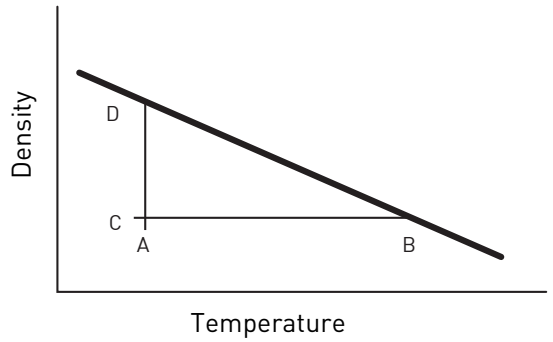
a = Temperature coefficient/Density Slope

t_a = Actual temperature

t_r = Reference temperature

Reference temperature is set in menu C1.2.03

Density Slope is set in menu C1.2.04



To calculate the density slope use the equation:

$$a = \frac{(p_D-p_C)}{(T_B-T_A)}$$

Value for the density slope should normally be positive, based on the normal assumption that increasing the temperature decreases the measured density.

Pipe Diameter (Menu C1.1.3)

This function provides the user with an additional measurement of velocity. To provide this measurement, the pipe diameter of the measurement tube is required for the calculation. This value can be either the sensor tube internal diameter (default), or the internal diameter of the process pipe.

Concentration Measurement (Menu C2)

This menu is used to enter the password to activate concentration measurement, in case the concentration option is purchased after the meter is delivered.

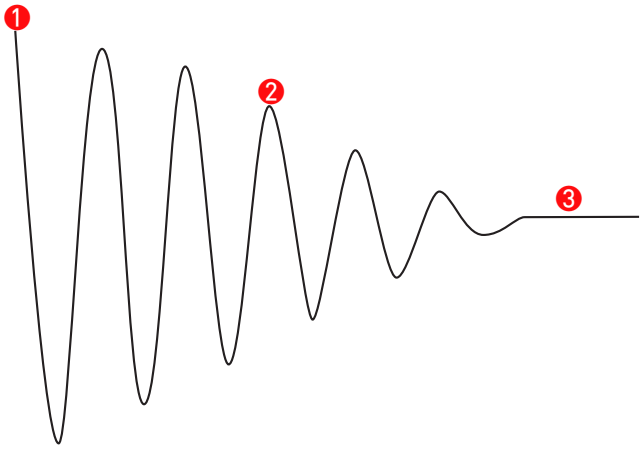
Please refer to the separate concentration manual for further details of concentration measurement.

Flow Direction (Menu C1.3.1)

This function allows the user to select the direction of the flow measurement in relation to the arrows on the Front End housing. (see section 1.1 General Principles). 'Positive' is selected if the flow is in the same direction as the + arrow and 'Negative' if the flow is in the reverse or negative direction, i.e. same direction as the – arrow.

Pressure Suppression

The Pressure Suppression feature eliminates any influences on the measurement result of sudden termination of flow, for example when a valve is shut. When this occurs the propagation of pressure waves along the pipe work and through the meter may produce an "Over-shoot" or "ringing" effect, where the flow rate will oscillate backwards and forwards until it settles to a stable zero flow condition, as is indicated in the diagram below. Typically this will only be noticeable on high pressure applications.

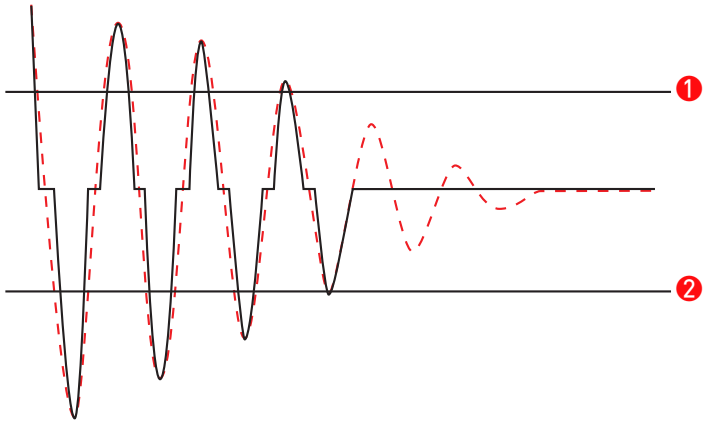


1 Flow Switch off

2 Sinudoidal Ringing

3 Stable Zero Flow

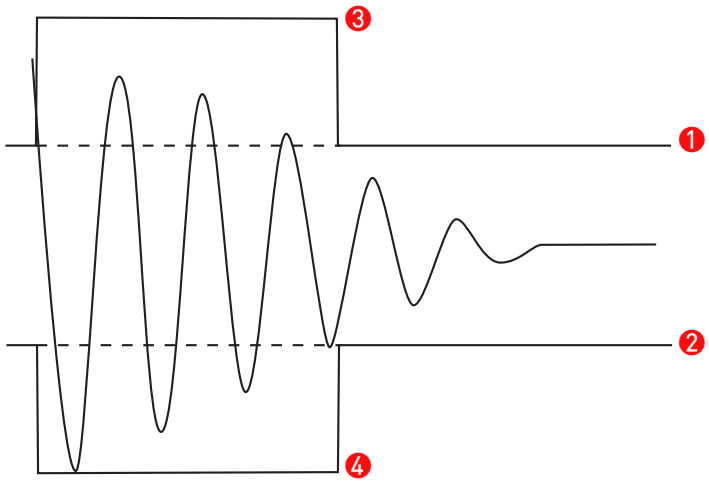
In most cases the amplitude of the ringing will be below the "Low Flow Threshold" and will therefore not influence the result. However, in some cases the amplitude of the ringing is above the Low Flow Threshold and could cause an error in the totaliser values.



1 2 Low Flow Threshold

The pressure suppression function eliminates this effect, by increasing the Low Flow Cutoff for a short period of time, triggered when the flow first drops below the Low Flow Threshold.

For a set time period (set in menu C1.3.2) the pressure suppression threshold (set in menu C1.3.3) is added to the standard Low Flow Threshold.



1 2 Low Flow Threshold

3 4 Pressure Supression

Settings of these parameters depend on actual process conditions and characteristics of the pipework and so can only be determined by experimentation in-situ.

Process Control (Menu C1.4.1 - Function)

This menu allows the setting up of certain instrument functions depending on the selected process condition. If a pre-determined condition arises (as selected in Fct. 4.8.2) then one of the following options can be selected. Options are:

NO ACTION : Process control is OFF

Flow and Total = 0 : Forces flow and counters to zero

Flow = 0 : Force flow to zero

Menu C1.4.2 - Condition

Selects the process condition that activates the process control function. Select either Density or Temperature.

Menu C1.4.3 – Max Limit

Menu C1.4.4 – Min Limit

Sets the limits that activate the process control function.

Values outside of these limits activate the function.

Diagnosis Values (Menu C1.5.4 to C1.5.6)

Selects the values for the diagnosis values. These can be then attributed to the display or outputs.

Graphic Page (Menu C6.5)

With the MFC300, it is possible to show a graphical trend of the prime measured value which is defined by the first measured value on the first measuring page.

Menu C6.5.1 defines the range of the trend value (manual or automatic)

Menu C6.5.2 defines the manual range

Menu C6.5.3 defines the time span of the trend

Save Settings (Menu C6.6.2)

With this function it is possible to save a copy of the complete device data into a storage area.

Backup 1: Saves settings to backup 1 storage place

Backup 2: Saves settings to backup 2 storage place

Load Settings (Menu C6.6.3)

With this function it is possible to load the complete device data from the different storage areas.

Backup 1: Loads from Backup1 area

Backup 2: Loads from Backup 2 area

Factory: Reloads the original factory settings

Passwords (Menu 6.6.4 Quick Set Menu 6.6.5 Setup)

To enable a password for either the quick set menu or the setup menu, enter a 4 digit code into the menu.

This will then be required to allow access to change the relevant menus.

The passwords are hierarchic – therefore the setup password can be used when the quick setup is required.

To deactivate the password, set 0000 into each menu.

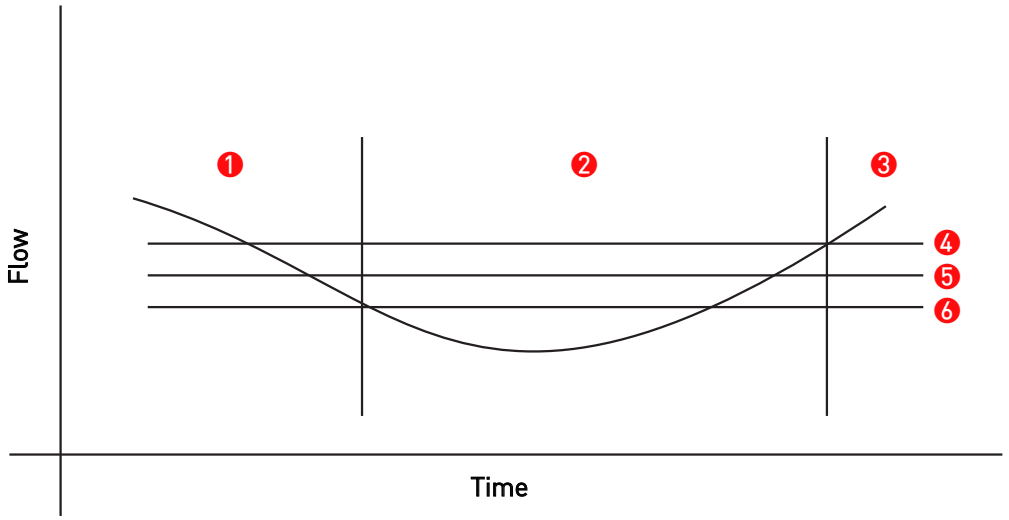
Low Flow Cut Off

Low flow cut offs can be set individually to all outputs and display lines. When active, the low flow cut off sets the output or display to its zero value.

The value is entered as either a percentage of the nominal rated flow of the sensor, or in the case of a pulse output and counters, as a discreet flow value.

Two values are set. The first value is the operating point, and the second point is the hysterisis.

Condition: 1st Value > 2nd Value



1. Actual Flow Displayed
2. Display Set to Zero
3. Actual Flow Displayed
4. Positive Hyserisis
5. Operating Point
6. Negative Hysterisis

Time Constant

In order to deal with fluctuating flows through the meter, measurements taken from the sensor are digitally filtered in order to stabilise readings. Time constants can be set individually for each output, display page and density measurement.However, it should be noted that the degree of filtering affects the response time of the reading due to rapid changes in the flow.

Short time constant	Fast response
	Fluctuating reading
Long time constant	Slow response
	Stable reading

The time constant represents the sample time for each value. The value displayed or output is an average value of the preceding sample time.

Dual-Phase Pulse Output

For Custody Transfer applications, it can be necessary to use a dual phase pulse or frequency output. With this option, a pulse output will be available on terminals B + D or A + B

In this case the following needs to be set:

C3.3.11: Phase shift to D

All functions for output B are set via output A / D

C3.2.11: Sets the phase shift of output B relative to output A. Options are 0, 90 or 180 deg.

C3.5.11: Sets the phase shift of output B relative to output D. Options are 0, 90 or 180 deg.

Timeouts in Edit Mode:

Normal Menu Function: If no key is pressed in a normal menu function for 5 mintes, the display returns automatically into the measuring mode. All changes made are lost.

Test function: During test mode, the test function is terminated after 60 minutes.

GDC IR interface: If a search for a GDC-IR connection is started, this function will be terminated after 60 seconds if no connection is found. If the connection is interrupted, after 60 seconds, the display will work again with the optical keys.

Output Hardware:

Depending on the hardware fitted (see CG No), it may be possible to change the output options at terminals A, B, C or D in menus C3.1.x

E.G. Pulse output into a frequency output, or a status output into a control input.

Options depend upon hardware fitted. Refer to Section 8.8 for output options.

It is not possible to change output type e.g. from active to passive or Namur.

9.1 Diagnostic functions

The following diagnostic functions are available in the TEST level Menu B2.

Temperature (menu B2.6):

- Displays temperature in either ^{O}C or ^{O}F. The value should be stable.

Strain (menu B2.7 Strain measuring tube / B2.8 Strain inner cylinder):

- Value of strain in Ohms. The values should be in the range stated in section 10.3. Wildly unstable value even after temperature stabilisation: the strain gauge has possibly become delaminated due to the meter being operated over maximum temperature for prolonged periods of time (please contact HONEYWELL UK service department).

Frequency (menu B2.9):

- Variations in the first digit after the decimal point indicate gas or air in the fluid.
- Worn or eroded flow tube: frequency will increase by around 2...4 Hz meter requires re-calibration
- Coatings can also alter the frequency
- Large fluctuations are seen if the meter is in 'Start Up'

Drive Energy (menu B2.10):

Typical values for the drive energy level with water as process fluid (with no air or gas) are:

VERSAFLOW 100:	All sizes	0...6
VERSAFLOW 200:	All sizes	0...5
VERSAFLOW 1000:	06...40 50...80	0...6 4...10

Higher drive energy levels can occur due to gas or air in the fluid or at the measurement of high viscous fluids or fluids with high densities.

Sensor A and B (menu B2.11, B2.12):

The displayed value should be around:

- 80% for VERSAFLOW 1000 – sizes 06 ... 40
- 60% for VERSAFLOW 1000 – sizes 50 and 80
- 60% for VERSAFLOW 200 - size 100
- 50% for VERSAFLOW 200 - size 150 & 250
- 80% for VERSAFLOW 100

NOTE: Sensor values should be within 2% of each other.

2-Phase Flow (menu B2.13):

This function gives an indication of the 2-phase signal level of the unit. This is application and process dependent and it can be used to determine the set point for the 2-phase flow alarm function. This can only be done on-site under actual flowing conditions.

SE Board Temperature (menu B2.14):

Displays the temperature of the sensor electronics

BE Board Temperature (menu B2.15):

Displays the temperature of the converter electronics

9.2 Functional Tests and Troubleshooting

Min. and Max. recorded temperature (menu C1.9.1 & C1.9.2):

Records the maximum values of temperature and strain as experienced by the transducer.

		Minimum	Maximum
Operating Temperature Range	VERSAFLOW 1000 (Titanium)	-40 °C or –40°F	150°C or 302°F
	VERSAFLOW 1000 (Hastelloy)	0°C or 32°F	100°C or 212°F
	VERSAFLOW 1000 SS Optional	0°C or 32°F	100°C or 212°F 130°C or 266°F
	VERSAFLOW 100	-40 °C or –40°F	130°C or 266°F
	VERSAFLOW 200	–44 °C or –99°F	130°C or 266°F

Application problems that appear to be Transducer Faults

- Leaky Valves will cause high zeros
- Entrained Air/gas will cause high energy levels and high zero
- Product coating on the inside of the tube will cause high/low density and high zero

The following faults have occurred (listed below with their symptoms):

Beware:

Application problems can cause similar symptoms, check this first!

Tube bore slightly eroded or corroded

- Density Low
- Frequency High
- Small Mass Flow Errors

Tube eroded or corroded through (fluid in housing)

- Tube will not start
- If fluid conductive - low resistance to ground

Open Circuit Drivers, Sensors, RTD's and Strain Gauges

- Detectable with Ohm meter

Typical Frequency values (at 20°C / 68°F)						
Model Size	Titanium		Stainless Steel		Hastelloy	
	Empty	Water	Empty	Water	Empty	Water
1000 - 06	316 ± 10	301 ± 10	374 ± 6	361 ± 7		
1000 - 10	402 ± 10	367 ± 10	419 ± 15	394 ± 15	439 ± 7	415 ± 6
1000 - 15	507 ± 7	436 ± 6	573 ± 15	514 ± 15	574 ± 27	517 ± 27
1000 - 25	619 ± 6	488 ± 6	701 ±10	589 ± 10	693 ± 10	586 ± 10
1000 - 40	571 ± 6	415 ± 6	642 ± 10	509 ± 10	633 ± 6	506 ± 6
1000 - 50	539 ± 5	375 ± 5	550 ± 14	435 ± 14	582 ± 11	453 ± 11
1000 - 80	497 ± 5	349 ± 5	502 ± 10	378 ± 12	492 ± 12	369 ± 12
100-15			443 ± 3	451 ± 3		
100-25			598 ± 3	518 ± 3		
100-40			485 ± 3	406 ± 3		
100-50			577 ± 3	448 ± 3		
200-100			350 ± 10	270 ± 10		
200-150			325 ± 10	255 ± 10		
200-200			300 ± 10	230 ± 10		

Zero Problems

- Perform auto zero, observe the displayed value, it should be stable and lower than +/- 0.5%
- If the result is bad carry out the following procedure:

  1. Stop flow
  2. Set totaliser function (C4.y.1) to Absolute Total
  3. Set totaliser low flow cut off (C4.y.3) to 0
  4 Set Low Flow cut off (C1.3.5) to 0
  5. Perform auto zero
  6. Reset total and totalise over 2 minutes.
  7. Compare totalised flow to specified zero stability.

For best process results, zero setting should be performed on process fluid at process temperature.

High zeros can be caused by:

- Leaking valves
- Air/Gas inclusions
- Coating on tube.

9.3 Driver or Sensor Coil Fault

Typical inductance and resistance values:

VERSAFLOW 1000	Inductance (mH)		Resistance (Ohm)	
	Driver	Sensor A/B	Driver	Sensor A/B
06/10	5.30 (4.32)	17.32 (10.36)	37...42	147...152
15/25	11.7 (8.9)	17.32 (10.36)	40...51	147...152
40	13.1 (11.3)	17.32 (10.36)	80...82	147...152
50/80	23.5 (12.9)	17.32 (10.36)	98...102	147...152

- The above data are provided as a rough guide only.
- Damaged magnet coil assembly: Inductance values in brackets.
- Driver = Black and Grey.
- Sensor A = White and Yellow. Sensor B = Green and Purple.
- RTD = Red and Blue (530...550 Ω) at ambient temperature

Tube strain = Red and Brown:	VERSAFLOW 1000 – 06	600 - 800Ω at ambient
	VERSAFLOW 1000 – 10...80	420 - 560Ω at ambient
IC strain= Brown and Orange	VERSAFLOW 1000 – 06...10	225 - 275 Ω at ambient
	VERSAFLOW 1000 – 15...80	Not fitted

- Resistance values outside these values could indicate a circuit failuire. Meter may be in start-up or have measuring errors.
- All circuit should be isolated from ground (meter case) and each other: >20MΩ. If circuits are shorting to ground, meter may be in start-up.

Caution:

If the measuring tube/s fail, process fluid can leak into the outer casing. If this happens, depressurise the meter and remove it from the process line as soon as it safe to do so.

VERSAFLOW 100	Resistance (Ohm)	
	Driver	Sensor A/B
Size 15	240	78
Size 25	240	64
Size 40	168	78
Size 50	168	64
Size 15 – Ex	240	78
Size 25 – Ex	240	64
Size 40 – Ex	91	78
Size 50 – Ex	91	64

- The above data are provided as a rough guide only.
- Driver = Black and Grey.
- Sensor A = White and Yellow. Sensor B = Green and Purple.
- RTD = Red and Blue (530...550 Ω) at ambient temperature
- Measuring Tube Strain Gauge = 420...560 Ω
- Resistance values outside these values could indicate a circuit failure. Meter may be in start-up or have measuring errors.
- All circuit should be isolated from ground (meter case) and each other: >20MΩ. If circuits are shorting to ground, meter may be in start-up.

Caution:

If the measuring tube/s fail, process fluid can leak into the outer casing. If this happens, depressurise the meter and remove it from the process line as soon as it safe to do so.

VERSAFLOW 200	Resistance (Ohm)	
	Driver	Sensor A/B
Size 100	240	78
Size 150	240	64
Size 250	168	78

- The above data are provided as a rough guide only.
- Driver = Black and Grey.
- Sensor A = White and Yellow. Sensor B = Green and Purple.
- RTD = Red and Blue (530...550 Ω) at ambient temperature
- Strain Gauge = 420...560 Ω
- Resistance values outside these values could indicate a circuit failure. Meter may be in start-up or have measuring errors.
- All circuit should be isolated from ground (meter case) and each other: >20MΩ. If circuits are shorting to ground, meter may be in start-up.

Caution:

If the measuring tube/s fail, process fluid can leak into the outer casing. If this happens, depressurise the meter and remove it from the process line as soon as it safe to do so.

9.4 Replacing the Sensor or Converter Electronics

If a failure occurs in one of the above electronics, these can be easily replaced with the minimum downtime.

You MUST disconnect or switch off the power supply to the meter when performing these tasks and observe the waiting time for Hazardous area approved meters.

To make exchanging the components easy, a copy of the Sensor calibration coefficients are stored in the converter as well. This means that you can make the changes without re-calibrating the meter.

Note:

The following functions must only be performed by qualified personnel.

Replacing the Sensor Electronics

- Unscrew the four small screws holding the Sensor Electronics in place (screws at the rear).
- Take care when removing to ensure that the connections are not damaged.
- Retain the the gasket.
- Replace with new sensor electronics, ensuring that the gasket is well positioned and the connections have mated correctly.
- Do not force the connectors.
- Tighten securely.
- It is recommended that some Loctite or similar compound is used for the screws.

Replacing the Back End

Turn off the power. Unscrew the front lid and use a small screwdriver to prise the retaining clips that hold the display and remove the two retaining screws. The converter can then be removed simply by pulling the plastic chassis at the sides. The converter will slide out easily after disengaging from the backplane PCB.

To insert the new electronics, simply slide the chassis back into the housing, secure with the screws previously removed and refix the display over the retaining clips.

When the power supply is re-estalished, the measuring system will recognize a hardware change.

If the Back End is replaced with a compatible version, the display will show Load from backpl.?

Select:	
Load all data	• If the converter was replaced with an identical version and it is compatible
Load sensor data	• If the converter was replaced & data is not compatible. • Sensor calibration data is loaded from the backplane • Customer settings are not loaded
Load no data	• Data in converter is used. • Backplane data is overwritten next time a change is made and saved.

In the case that the sensor electronic (SE), or primary with SE, or back end (BE) is changed, the device will notify it during start-up and will go into fatal error state. In such a case the menu will have different selections, depending on detected situation. The device can detect 3 different situations:

Note: in some rare cases 2 confirmations are required (e.g.: “SE data invalid” and than “Copy BE data”) . This should prevent from choosing the wrong selection in the usual situation.

Select the correct option required in menu C.1.6.3

Situation	Cause	Possible Action
SE data invalid:	The calibration parameters stored in the SE are invalid. Most likely causes: • It's a virgin SE that is not programmed and therefore only contains default data of the production • Corrupted data set written by any accident.	**No action:** After restart the same situation **Copy BE data**: Copy calibration data stored in the BE into SE. If the calibration data in the BE is not valid for the connected primary, the proper data has to be entered before copying!
BE data invalid:	The calibration parameter of the BE are invalid. A new BE electronic was inserted.	**No action:** After restart the same situation **Copy SE data:** copy calibration data stored in the SE into BE. If the calibration data in the SE is not valid for the connected primary, do not use "Copy SE data", you MUST enter the correct data into the BE. Restart is then required and the resulting status will be "SE data different"
SE data different:	The calibration data of the SE differs from the calibration data of the BE. Most probably a new primary with SE is installed, but it is also possible that the SE is replaced, which was already set for another primary.	**No action:** After restart the same situation **Copy SE data:** The calibration data stored in the SE will be copied to the device. This should be the standard procedure, when a primary is exchanged (together with belonging SE). After confirmation the system will restart, and use the calibration data of the new primary. **Delete SE data:** Set SE as virgin. After confirmation the system will restart, and detect the "SE data invalid" situation.

9.5 Status Messages and Diagnostics Information

These messages are shown on page 3 of the display. mA- and status outputs can be set so that error messages are signalled, see Section 8.4, Fct. C 3.x.4 (current) and Fct. C 3.x.1 (status).

Please note: for settings with mA and/or status outputs:
- out of specification (S) = all errors of Categories S, F and **F**
- application error (F) = all errors of Categories F and **F**
- fault in device (**F**) = all errors of Category **F**

Display Messages	Description	Possible causes, remedial action
Status: F _ _ _ _ See texts below)	**Operational fault in device** **• mA output ≥ 3.5 mA** **• Status outputs open** **• Pulse / frequency output: no pulses**	**Repair necessary!**
Error in device	Operational fault in device. No measurement possible.	Group message, when one of the following or some other severe error occurs
IO 1	Error, operational fault in IO 1. No measurement possible	Load settings (Fct. C 6.6.3) (Backup 1 or Backup 2 or factory settings). If status message continues, replace electronic unit.
IO 2	Error, operational fault in IO 2, No measurement possible	
Parameter	Error, operational fault in device, Parameters no longer useable No measurement possible	
Configuration (also when module changed)	Identified configuration differs from the one stored. No measurement possible	After change of module, confirm query for changed configuration. If device configuration is unchanged the device is likely to be defective. Replace electronic unit.
Display	Error, operational fault in display	Defective, replace electronic unit
SE defective	Error, operational fault in sensor electronics, No measurement possible	Defective, replace electronic unit
sensor global	Data error in the global data of the sensor electronic equipment No measurement possible	Load settings (Fct. C 6.6.3) (Backup 1 or 2 or factory settings). If status message continues, replace electronic unit.
sensor local	Data error in the local data of the sensor electronics. No measurement possible	Defective, replace electronic unit
SE Data Error	Data error in the Sensor Electronics	Load settings (Fct. C 6.6.3) (Backup 1 or 2 or factory settings). If status message continues, replace electronic unit.
current output A/B/C	Operational fault in current output at the pair of terminals indicated. Measured value at this pair of terminals no longer available	Defective Replace electronic unit or I/O module.
Fieldbus	Operational fault in Fieldbus Connections ???	Defective Replace electronic unit or I/O module
SE Drive Failure	Fault in Sensor Electronics, unable to control drive amplitude	Replace sensor electronics

Display Messages	Description	Possible causes, remedial action
Fatal Error	Fault in Electronics	Replace Electronics
Wiring Error	Fault in wiring (in remote sensors)	Check wiring and rectify
Interface Board defective	Ex-fuse burnt out in electronics	Replace electronics
Hardware settings	Set hardware parameters do not match the identified hardware. Dialogue appears in the display.	Answer queries in dialogue mode and follow directions.
Hardware identification	Existing hardware cannot be identified. There are either defects or unknown modules.	Replace electronic unit
RAM/ROM error IO1	A RAM or ROM error is detected during the CRC check.	Defective, replace electronic unit or I/O module
RAM/ROM error IO2		
Status: F _ _ _ _ See texts below)	**Application-sensitive fault, device is OK, but measured values are affected**	**Application test or operator action necessary !**
Application error	Application fault, device OK. Use measured values with caution	Group message, when errors as below or other application errors occur.
Overflow	Mass flow is greater than max flow rate. Accuracy is not guaranteed!	Reduce flow rate. Increase meter size
Underflow	Mass flow is less than min flow rate. Accuracy is not guaranteed!	Increase flow rate Decrease meter size
Open circuit A	Load of current output A too high	Current not correct, mA output cable has open circuit or load too high. Check cable, reduce load (should be < 1000 Ohm)!
Open circuit B	Load of current output B too high	
Open circuit C	Load of current output C too high	
Over range A	Measured value at terminals A limited by filter setting	Check with Fct. C 3.1 Hardware or sticker in terminal compartment, which output is connected to the terminal. If **current output**: - Extend Fct. C 3.x.6 Measuring Range and Fct. C 3.x.8 Limitation If **frequency output**:- Extend values under Fct. C 3.x.5 and Fct. C 3.x.7.
Over range B	Measured value at terminals B limited by filter setting	
Over range C	Measured value at terminals C limited by filter setting	
Over range D	Measured value at terminals D limited by filter setting	
Wiring A/B	Wiring Error	Check Connections at terminals A/B
Stop Mode	Meter is in Stop Mode	Check Fct A7.
Tube not oscillating	Meter may be in Start-Up phase	Check process conditions (air) Check meter settings C1.7.1 to C1.7.3 Check sensor resistances
System Control	System Control is Active. Mass flow is not measured	Check Process Control settings C1.4.1 to C1.4.4 Check Control Input C3.x.y

Display Messages	Description	Possible causes, remedial action
SE Data Different	Sensor electronics configuration does not match MFC300	Sensor or converter has been changed. See section 9.4.
COMM FAIL	Communications failure with the sensor electronics. Measurement data not available	Check wiring. Check grounding. Replace electronics
Active settings	Fault detected during CRC check of active settings	Upload Backup 1 or Backup 2 settings, check and adjust if necessary.
Factory settings	Fault detected during CRC check of factory settings	
Backup 1 / 2 settings	Fault detected during CRC check of Backup 1 / 2 settings	Store active settings in Backusp 1 / 2.
Status: S _ _ _ _	**Out of specification, Measurement continues but measured values are uncertain**	**Maintenance necessary!**
Out of specification	Out of specification: measurement continues with less accuracy	Group message, when faults as below or other influences occur.
Overflow, counter 1/2/3	Counter has overrun and started again at zero.	Check counter format
Backplane invalid	The data record on the backplane is invalid. The CRC check has revealed a fault.	Save data again to backplane (Service)
SE PCB Temperature	Temperature on SE PCB is exceeding maximum limit	Check process & ambient temperature. Check wiring. Replace sensor electronics
Start Up	Sensor is in start up phase	Check process conditions (air) Check meter settings C1.7.1 to C1.7.3 Check sensor resistances
Power Fail	For custody transfer application. Indicates a failure of power supply. No measurement is possible during power failure	
Tube Temperature	Process temperature is outside limits of sensor.Failure of sensor may occur if prolonged.	Check settings C1.7.04 & C1.7.05 Reduce process temperature
Density	Process density over range	Check process conditions
Temperature Drift	Operating temperature has drifted by >30 deg C from temperature at zero calibration.	Perform new zero calibration to maintain accuracy.
Sensor Signal Error	DC component of sensor signal too high	Check sensor resistances Replace sensor
Resistance Sensor Defective	PT500 sensor defective. Temperature measurement & compensation unreliable	Check sensor resistances. Replace sensor

Display Messages	Description	Possible causes, remedial action
Status: C _ _ _ _ see texts below	**Output values in part simulated or fixed**	
Checks in progress	Testing mode by invoking test or simulation functions, All or some outputs not available, Measured values might be simulated	Message via HART or FDT, as the case may be. Indic. via the display when outputs held by control input or have been set to zero
Test XXXXX see texts below	Test of relevant unit activated	
Standby Mode	Meter is in standby mode	Check Control input settings. Check A7
Status: I _ _ _ _ see texts below	**Information (current measurement OK)**	
Counter 1/2/3 stopped	Counter 1/2/3 has stopped counting	If counter to continue counting, activate "yes" in Fct. C 2.y.09 Start Counter
Power Fail	Indicates that the device was out of service for an unknown period due to a power failure	Cause: temporary line failure, during which counters stopped counting.
Control input A active	Message appears when the control input at terminals A or terminals B is active.	This message is for information only
Control input B active		
Over range Display 1	1st line on page ? and/or ? of display limited by filter setting, indication not correct	Menu Display Fct. C 6.3 and/or C 6.4, select Meas. Page 1 or 2, and increase values in Functions C 6.z.03 Meas. Range and/or C 6.z.04 Limitation
Over range Display 2		
Backplane, sensor	The sensor data on the backplane are no use because they have been generated with an incompatible version.	Check for software upgrades
Backplane settings	The global settings on the backplane are no use because they have been generated with an incompatible version.	
Backplane difference	The data on the backplane differ from the data in the display. If the data can be used, a dialogue is indicated in the display.	
Optical interface	The optical interface is in use. The keys on the local display are inoperative.	Keys are ready to operate again 60s after end of data transfer / removal of the opto-coupler

10.1 External Standards and Codes

The VERSAFLOW range of mass flowmeters comply with some, or all, of the following standards

Mechanical

Pressure Equipment Directive PED (acc. to AD2000 Regelwerk)	97/23/EC
Hygienic	ASME Bioprocessing ASME BPEa-2000 Addenda to BPE-1997 3A Dairy Products Standard (23-03) Authorization No 1246 EHEDG TNO report No. V5247/02
Protection Category IP67 (euiv. Nema 4x)	EN 60529
Custody Transfer	OIML R117 PTB

Electrical

Electromagnetic Compatibility (EMC)	EN 50081-1 1992 EN 50082-2 1994 NAMUR NE21/5-93 89/336/EEC (EMC) 72/23/EEC (low Voltage Directive)
European Hazardous Areas Approval	ATEX - 94/9/EC
US Hazardous Area Approval	FM (Project J.I.3028356) / CSA

10.2 Certificates

All relevant certificates currently held in relation to the VERSAFLOW range of meters can be viewed and dowloaded from the HONEYWELL website. Please visit: www.honeywell.com/ps

10.3 Honeywell Publications:

"Guidelines for the use of Coriolis Meters in Hazardous Areas"

"Corrosion & Abrasion Guidelines for Coriolis Meters"

"Communication Options Handbook"

"Concentration Measurement Handbook"

10.4 Declaration of Cleanliness Certificate

Returning a device for testing or repair to HONEYWELL

This device has been carefully manufactured and tested. If installed and operated in accordance with this handbook, it should provide many years of trouble free service Should you need to return a device for inspection or repair, please pay strict attention to the following points:

Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, HONEYWELL may only handle, test and repair returned devices that do not present a risk to personnel and/or the environment.

This means that HONEYWELL can only service this device if it is accompanied by the following certificate, confirming that it is safe to handle and does not pose any threat to personnel or the environment.

If the device has been operated with toxic, caustic, flammable or water-endangering products, please:

- check and ensure, if necessary by rinsing or neutralizing, that all cavities are free from any harmul/dangerous substances,
- enclose a certificate with the device, confirming that is safe to handle and stating the product used.

Please note that we cannot service this device unless accompanied by the certificate.

10.5 Specimen Certificate

Company: . . . . . .Address: . . . . . .

. . . . . .

Department: . . . . . .Name . . . . . .

Tel. No. . . . . .Fax No.: . . . . . .

The enclosed device

Type: . . . . . .

HONEYWELL Order No. or Series No.: . . . . . .

has been operated with the following liquid: . . . . . .

Because this liquid is ☐ water-hazardous ☐ toxic ☐ caustic ☐ flammable

we have ☐ checked that all cavities in the instrument are free from such substances /

☐ flushed out and neutralized all cavities in the device

We confirm that there is no risk to humans or environment through any residual liquid contained in this device.

Date: . . . . . .Signature: . . . . . .

Company stamp:

Honeywell Field Solutions
512 Virginia Drive
Fort Washington, PA 19034
www.honeywell.com/ps