HydroMet



User Manual

Red Back

KISTERS
Empowering decisions of tomorrow

06-2026 – 01-09-004

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I Disclaimer

The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred.

This manual does not include all of the details of design, production, or variation of the equipment nor does it cover every possible situation which may arise during installation, operation or maintenance. KISTERS shall not be liable for any incidental, indirect, special or consequential damages whatsoever arising out of or related to this documentation and the information contained in it, even if KISTERS has been advised of the possibility of such damages.

Any errors found in any KISTERS product should be reported to KISTERS where every effort will be made to quickly resolve the problem.

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This document is public.

II Scope of Delivery

Basic Kit:

- Bucket Meter
- Screwdriver
- 2.5 m Connecting Lead
- Calibration Certificate and Table
- 30 ml of Current Meter Oil

III Safety Instructions

- Read the user manual including all operating instructions prior to installing, connecting and powering up the KISTERS RedBack. The manual provides information on how to operate the product. The manual is intended to be used by qualified personnel, i.e. personnel that have been adequately trained, are sufficiently familiar with installation, mounting, wiring, powering up and operation of the product.
- Keep the user manual on hand for later reference!
- If you encounter problems understanding the information in the manual (or part thereof), please consult the manufacturer or its appointed reseller for further support.
- KISTERS RedBack is intended to be used in hydrometeorological or environmental monitoring applications.
- Before starting to work, you have to check the functioning and integrity of the system.
  - Check for visible defects on the RedBack, this may or may not include any or all of the following: mounting facilities, connectors and connections, mechanical parts, internal or external communication devices, power supplies or power supply lines, etc.
  - If defects are identified that could compromise operational safety, work must be stopped immediately. This applies to defects detected both before work begins and during operation.
- Do not use the KISTERS RedBack in areas where there is a danger of explosion.
- The present user manual specifies environmental/climatic operating conditions as well as mechanical and electrical conditions. Installation, wiring, powering up and operating the KISTERS RedBack must strictly comply with these specifications.
- Perform maintenance only when tools or machinery are not in operation.
- If guards are removed to perform maintenance, replace them immediately after servicing.
- Never make any electrical or mechanical diagnostics, inspections or repairs under any circumstances. Return the product to the manufacturer's named repair centre. You can find information on how to return items for repair in the relevant section of the KISTERS website.



Disposal instructions: After taking the KISTERS RedBack out of service, it must be disposed of in compliance with local waste and environmental regulations. The KISTERS RedBack is never to be disposed of in household waste!



Inputs and outputs of the device are protected against electric discharges and surges (so-called ESD). Do not touch any part of the electronic components! If you need to touch any part, please discharge yourself, i.e. by touching grounded metal parts.

1 Introduction

Thank you for choosing our product. We hope you will enjoy using the device.

KISTERS manufactures, sells, installs and operates quality instrumentation, data loggers and communication technology. Products are designed with passion for environmental monitoring and with a deep understanding of the quality, accuracy and robustness needed to fulfil the requirements of measurement practitioners in the field.

The present User Manual will help you understand, install and deploy the device. If, however, you feel that a particular information is missing, incomplete or confusing, please do not hesitate to contact us for further support!

KISTERS' RedBack is a cup-type current meter for the measurement of water flow in open and closed waters to a fine degree of accuracy and repeatability. This is due to its advanced contact switching system and interchangeable bucket system that provides trouble free operation.

2 Installation

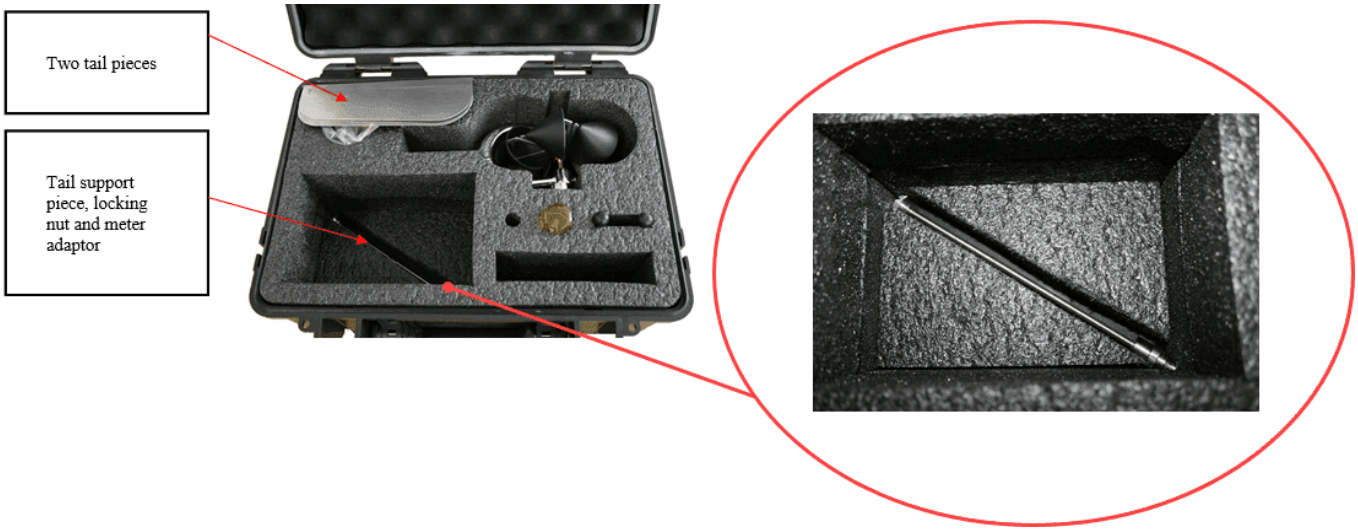
This chapter contains the following subsections:

- Assembling the Tail Fin 7

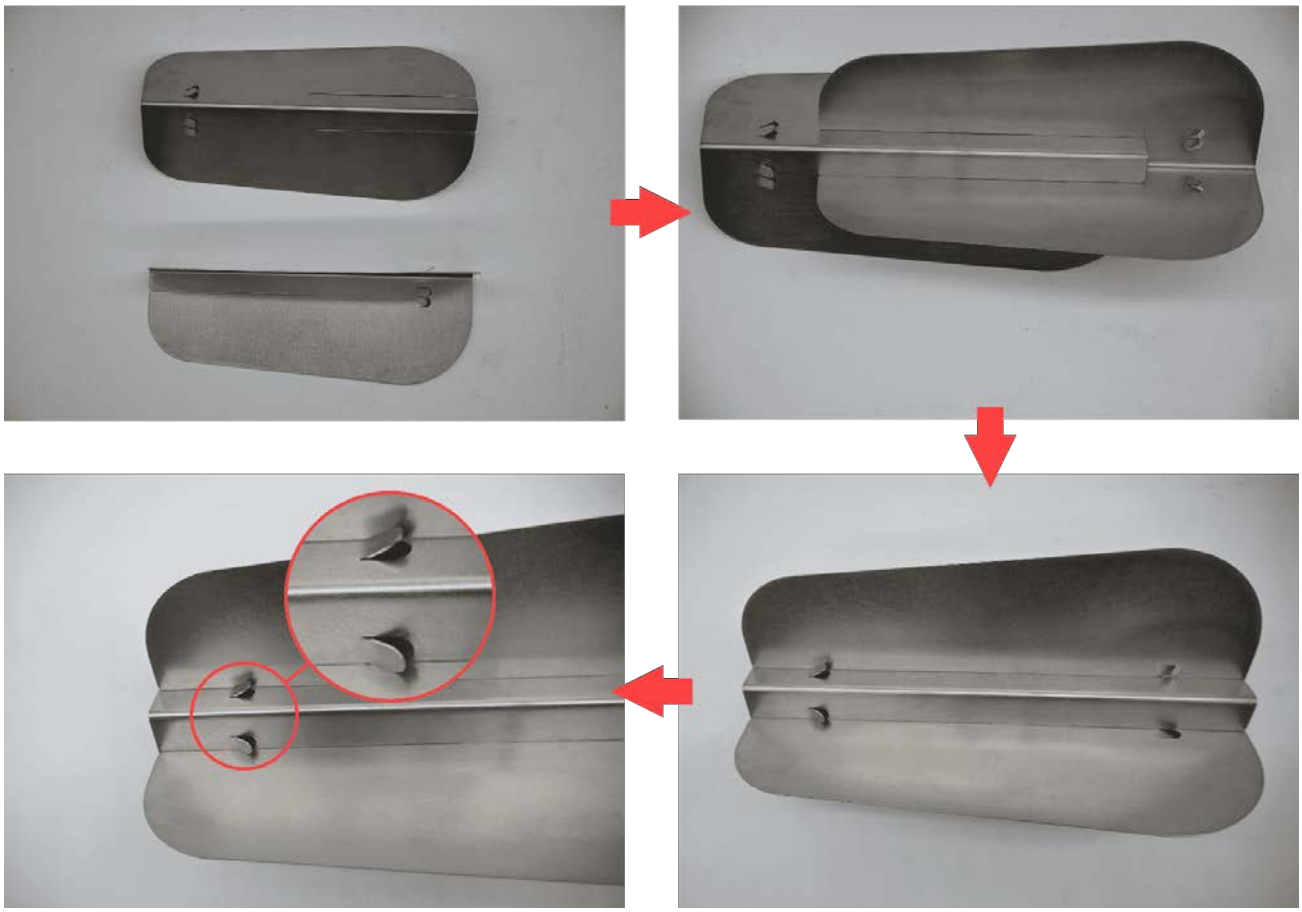
2.1 Assembling the Tail Fin

This user manual provides graphical instructions on how to assemble the tail fin.

Step 1: Open the case and locate the tail pieces.



Step 2: Assemble the tail pieces together as shown below.



Step 3: Assemble the tail pieces to the tail support as shown below.



Step 4: Tighten the locking nut as shown using the supplied screwdriver.



Step 5: Assemble the Tail assembly to the RedBack Current Meter.



Step 6: Tighten the tail screw using the supplied screwdriver.



3 Configuration

RedBack is a purely mechanical instrument. No specific configuration is required.

Please follow installation instructions 7.

4 Operation

The standard operation of the current meter is used in conjunction with a wading rod and a current meter counter. This method requires you to stand in the stream and observe the flow velocities at various depths across the stream.

The current meter can be fitted with a stabiliser tail fin which is attached to a hanger bar and Colombus gauging weight in sizes of 7, 15, 23, 34, 45, 68, 90 or 135 kg (135 kg model not available from KISTERS). This assembly is suspended from a gauging winch with armoured signal cable.

KISTERS offers a counter option for the RedBack. The PVD200 (see website for details).

The RedBack Current Meter is fitted with a raising nut to protect the tungsten carbide tip on the pivot and the mating bearing surface during transport. Before calibrating, turn the raising nut anti-clockwise so that the pivot engages in the bearing. This allows the RedBack bucket wheel to rotate freely (see Figure 1).



Figure 1 – Detail Raising Nut

A small amount of the oil supplied should also be applied to both the pivot and contact shaft cavities to lubricate the rotating surfaces (see Figures 2 and 3 for details).

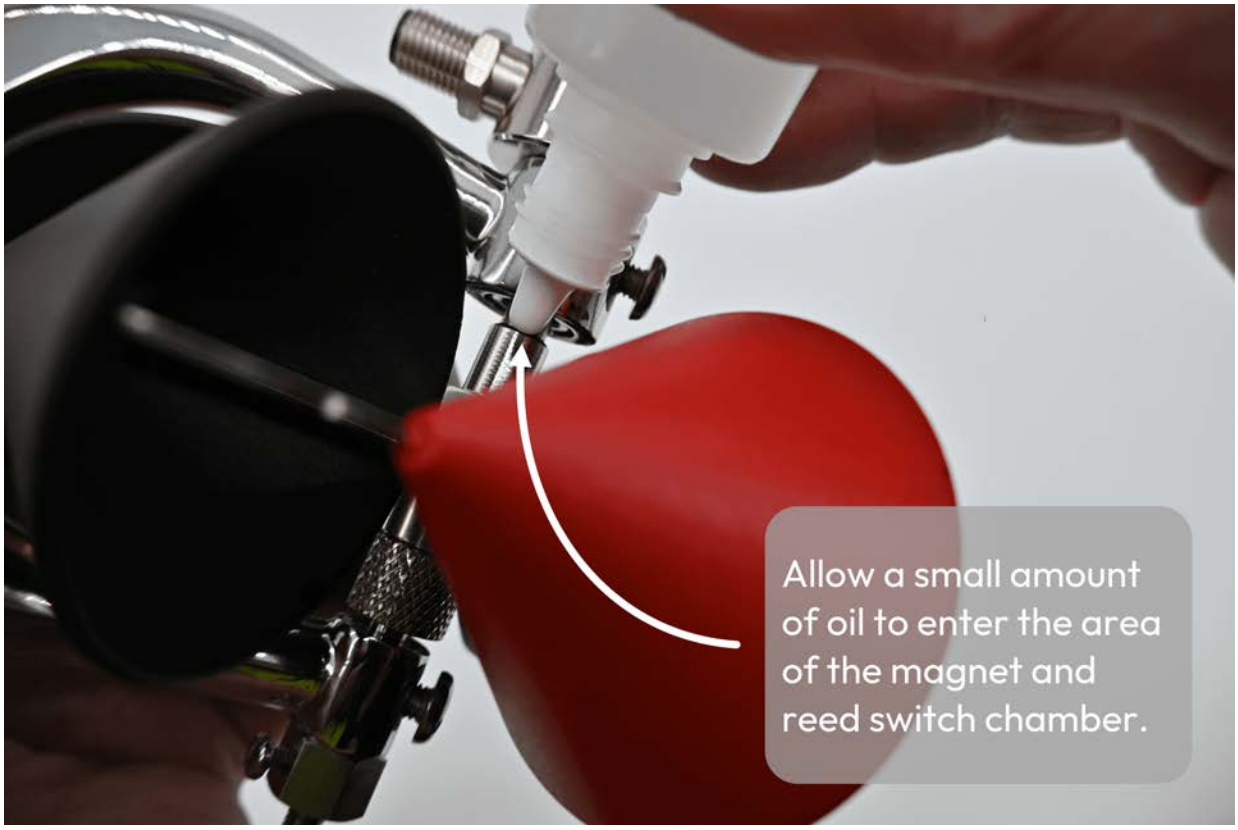


Figure 2 – Oiling Magnet and Reed Switch Area



Figure 3 – Oiling Pivot Cavity

5 Maintenance

A key concept in maintaining the accuracy of a current meter is to keep it in the same good condition as when it was obtained from the manufacturer or when it was last calibrated. It order to do so, cleaning the meter after use is essential.

After a day of use in the field

1. The pivot, magnet and reed switch chamber should be removed and cleaned using the supplied current meter oil, apply a small droplet to the upper and lower bearing surfaces. (Do not use “3-in-1” type oil; this type of oil will solidify when exposed to water.)
2. Using a magnifying glass a visual inspection should be carried out to ensure the bearing surface is not wearing or damaged. The pivot tip should feel sharp as opposed to dull or rounded. It should not a burr detectable visually or by fingernail.
3. The pivot should be always adjusted to the right position by setting the locknut and then securely tightening the lock screw.
4. After oiling and replacing the pivot and the magnet/reed switch housing, ensure the meter is turning freely and comes to a smooth and gradual stop. The meter should not have any undue vibration when rotating. Apply oil to the bearing and pivot if vibration occurs as described in step1.

Before use in the field

1. Inspect the meter carefully and perform a spin test visually observing the rotation. If the meter is turning freely and comes to a smooth and gradual stop, then the meter is ready for use. However, if the meter fails to spin freely cleaning and adjustment is required to ensure proper operation.

Inactive meter

1. Prior to the meter being stored, it should have been disassembled, inspected and cleaned as described. In case the period of storage is less then 5 weeks, the meter can be used without any additional maintenance other then a spin test.
2. If the meter was stored for a longer period of time, it is advisable to first clean the meter and then spin test before use.

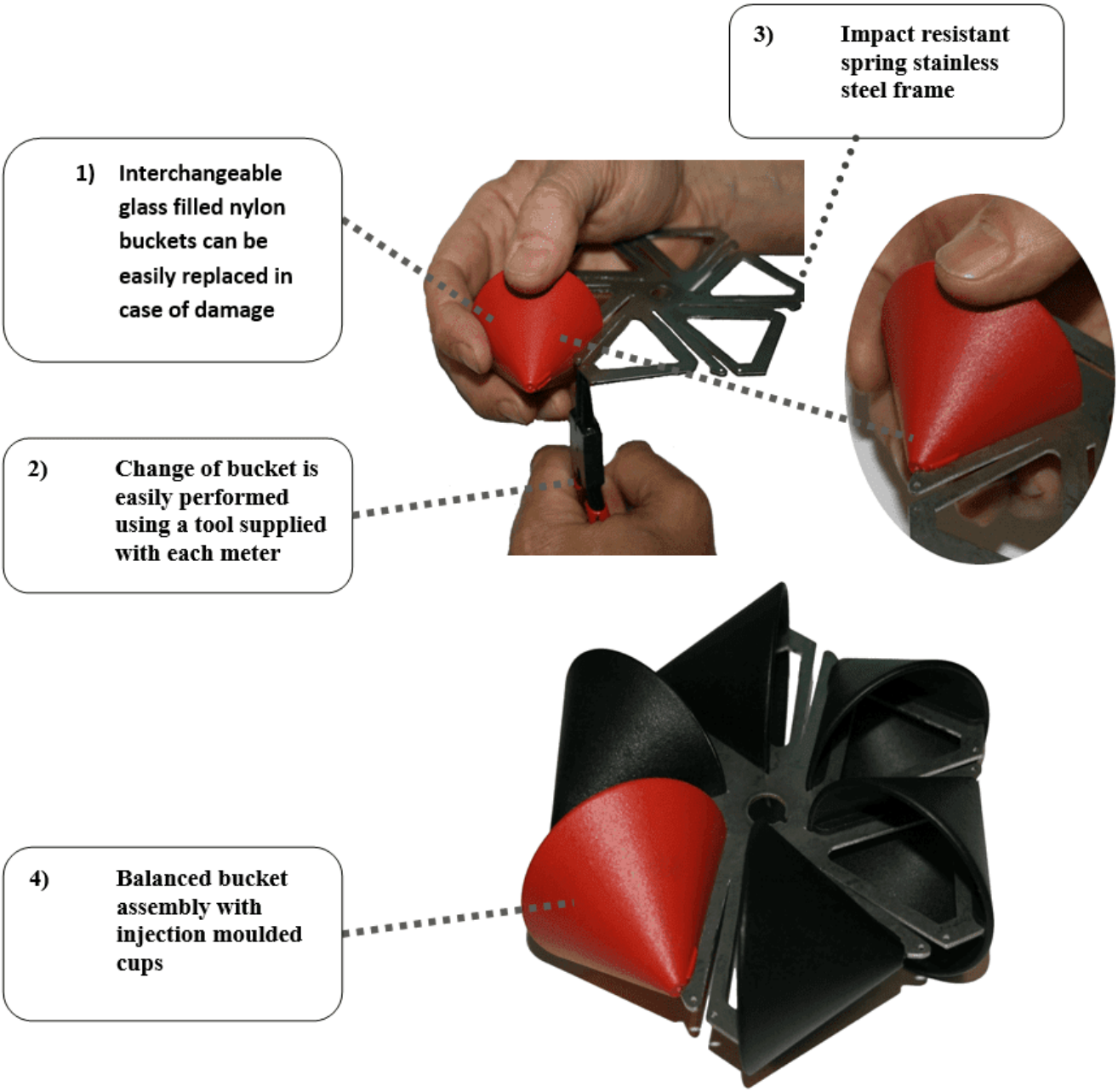
For more information, see the following subsections:

- RedBack Meter Maintenance 13
- Service and Recalibration 15

5.1 RedBack Meter Maintenance

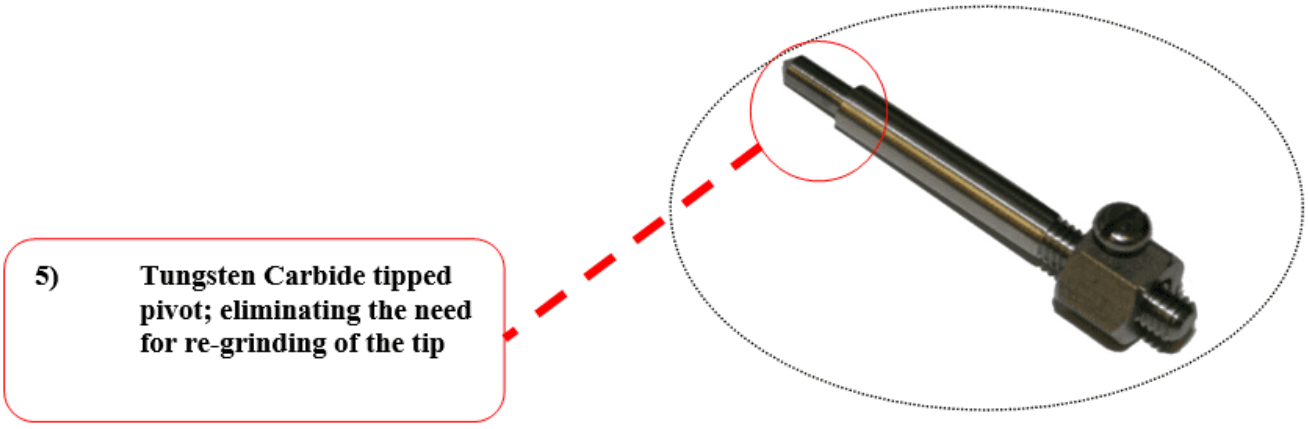
The advantages of the RedBack over the traditional bucket meter can be summarised as follows:

a) Flexible stainless spring steel frame which can resist force; where traditional stainless steel frame will bend slightly causing frame assembly to be out of balance, hence drift in calibration results.
b) Glass filled nylon interchangeable buckets are used instead of the traditional nickel plated brass bucket which if dented, will cause bad performance and inaccurate measurement. Moulded glass filled nylon buckets are identical in size, weight , hence calibration is maintained even if one or more damaged cups are replaced.



c) Advanced magnet/reed switch assembly provides superior performance and reliability; unlike traditional bucket meter cats whisker switch assemblies the RedBack reed switch is maintenance free.

d) The pivot assembly is made from 316G stainless steel and has a tungsten carbide tip. The bearing plate is also made up of a similar metal. Hence, the turning motion is not affected by friction ensuring a low starting velocity and accuracy.



e) Low maintenance and cost effective; The RedBack cost is incomparable to its accuracy ±1 %.

5.2 Service and Recalibration

KISTERS recommends that the RedBack current meter should be recalibrated every 300 hours of use or once a year, whichever comes first (see KISTERS calibration certificate for details).

6 Repair

KISTERS precision instruments and data loggers are produced in quality-controlled processes. All KISTERS production and assembly sites in Australia, New Zealand and Europe are ISO 9001 certified. All equipment is factory tested and/or factory calibrated before it is shipped to the client. This ensures that KISTERS products perform to their fullest capacity when delivered.

Despite KISTERS most rigorous quality assurance (QA), malfunction may occur within or outside of the warranty period. In rare cases, a product may not be delivered in accordance with your order.

In such cases KISTERS' return and repair policy applies. For you as a customer, this means the following:

- Contact KISTERS using the Repair Request Form and the Declaration of Contamination made available online:

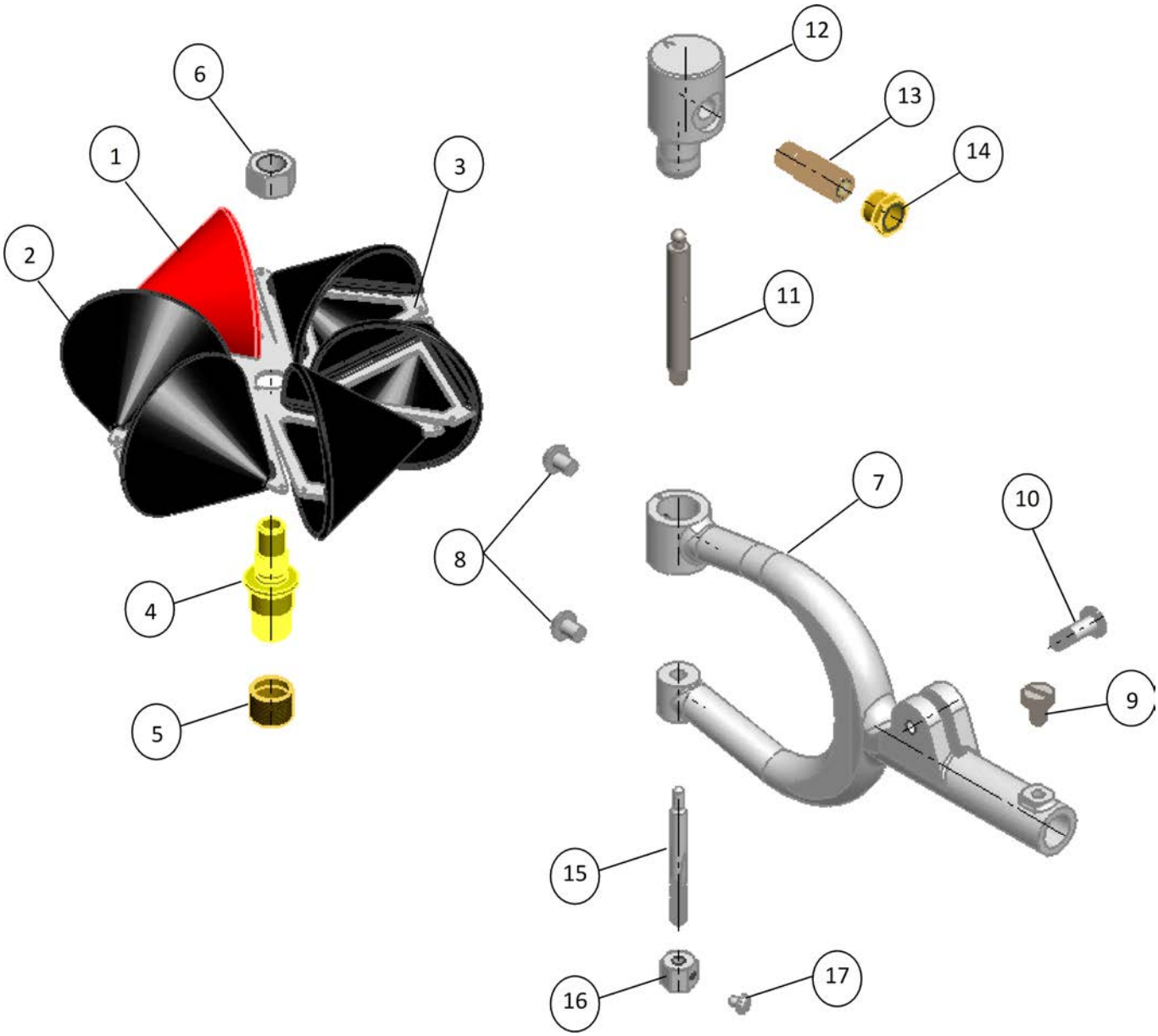
Region (Language)	Download Link
Asia-Pacific (English)	Repair Request Form (APAC) Declaration of Contamination (APAC)
Europe, the Middle East and Africa (English)	Repair Request Form (EMEA) Declaration of Contamination (EMEA)
Germany (German)	Repair Request Form (DE) Declaration of Contamination (DE)

  In response you will receive a reference number that must be referenced on all further correspondence and on the freight documents accompanying your return shipment.
- Please provide as much information and/or clear instructions within the return paperwork. This will assist our test engineers with their diagnosis.
- Please do not ship the goods prior to obtaining the reference number. KISTERS will not reject any equipment that arrives without reference number; however, it may take us longer to process.

Custom requirements for items sent to KISTERS for warranty or non-warranty repairs: Check with your national customs/tax authorities for details, processes and paperwork regarding tax exempt return of products. Typically, special custom tariff codes are available (such as HS Code = 9802.00) that verify the item is being returned for repair and has no commercial value. Please note that the customs invoice / dispatch documents should also clearly state: "Goods being returned to manufacturer for repair – No Commercial value". It is mandatory to have any returned goods accompanied by a commercial invoice on headed paper. KISTERS reserves the right to charge the customer for time spent rectifying incorrect customs documents.

Note: Please ensure that your goods are packed carefully and securely. Damage that occurs during transit is not covered by our warranty and may be chargeable.

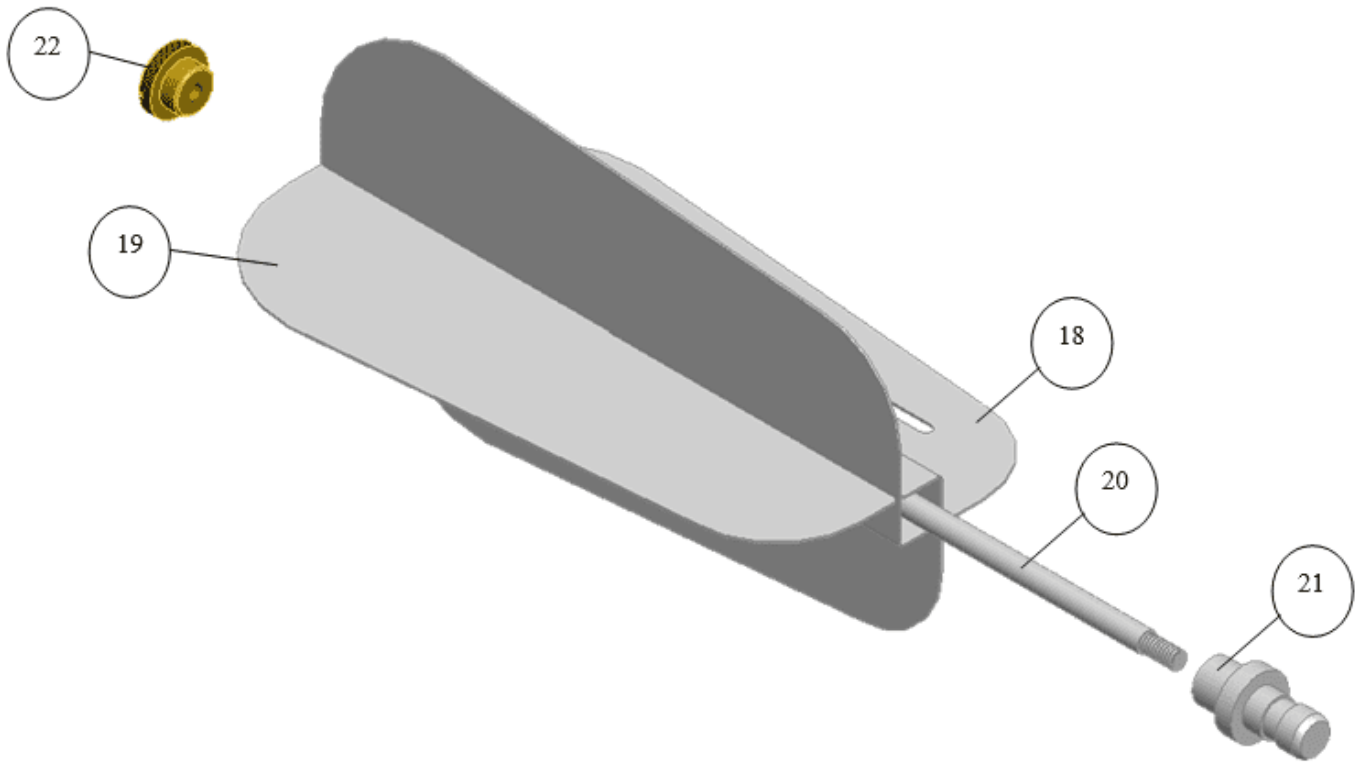
6.1 Meter Part List



No.	PART NAME	DESCRIPTION	QUANTITY
1	BUK01-01R	RED BUCKET	1
2	BUK01-01B	BLACK BUCKET	5
3	BUK01-02	BUCKET WHEEL	1
4	BUK05-01/02/03/06	BEARING CARRIER WITH BEARING INCLUDED	1
5	BUK05-04	RAISING NUT	1
6	BUK05-05	HUB NUT	1
7	BUK03-01POL	MAIN BODY	1

No.	PART NAME	DESCRIPTION	QUANTITY
8	SC022-74	SLOT HD SCREW	2
9	BUK03-03	TAIL SCREW	1
10	BUK03-02	HANGER BAR SCREW	1
11	BUK06-01/02	CONTACT SHAFT WITH MAGNET	1
12	BUK07-01	MAGNET & REED SWITCH CHAMBER	1
13	BUK07	REED SWITCH ASSEMBLY	1
14	PYG10-06	REED SWITCH HEX NUT	1
15	BUK04-01	PIVOT	1
16	BUK04-02	PIVOT ADJUSTING NUT	1
17	SC022-73	PIVOT SCREW	1

6.2 Tail Part List



No.	PART NAME	DESCRIPTION	QUANTITY
18	BUK08-01	TAIL PIECE - LEFT-HAND SIDE	1
19	BUK08-02	TAIL PIECE - RIGHT-HAND SIDE	1
20	BUK08-03	BODY SUPPORT ROD	1
21	BUK08-04	TAIL ADAPTOR	1
22	BUK08-05	TAIL LOCKING NUT	1

7 Technical Data

Construction	▪ Cast brass body, chrome-plated ▪ 6 durable glass-filled nylon buckets ▪ Stainless spring steel bucket wheel frame ▪ Stainless steel pivot with tungsten carbide tip
Operating Velocity Range	0.025 m/s to 8 m/s
Reed Switch	Encapsulated reed switch
Output Signal	▪ Voltage free digital signal ▪ 1 full revolution of bucket assembly produces one pulse ▪ Converted to direct velocity reading when used in conjunction with KISTERS' counters PVD200 or CMCbt when connected to HydroTab - Stream Gauging Computer.
Overall Accuracy	±1 %

Calibration and Calibration Method	▪ Meter supplied with batch calibration certificate (metric 23 / imperial 27)
	▪ Individual meter calibration available on request (additional costs):
	  ▪ Calibration in accordance with AS3778.6.1-2022/ISO 2537:2007 standard
	  ▪ Up to 3 line fit
	  ▪ Supplied with calibration and a rating table
	  ▪ Calibrated over full velocity range

Carry Case	Heavy-duty case with durable moulded foam
Dimensions and Mass	500 × 390 × 190 mm; 5 kg

8 Obligations of the Operator and Disposal

This chapter contains the following subsections:

- Obligations of the Operator 21
- Dismantling / Disposal 21

8.1 Obligations of the Operator

European Union

In the Single European Market it is the responsibility of the operator to ensure that the following legal regulations are observed and complied with: national implementation of the framework directive (89/391/EEC) and the associated individual directives, in particular 2009/104/EC, on minimum safety and health requirements for the use of work equipment by employees at work.

Worldwide

Regulations: If and where required, operating licences must be obtained by the operator. In addition, national or regional environmental protection requirements must be complied with, regardless of local legal provisions regarding the following topics:

- Occupational safety
- Product disposal

Connections: Local regulations for electrical installation and connections must be observed.

8.2 Dismantling / Disposal

When disposing of the units and their accessories, the applicable local regulations regarding environment, disposal and occupational safety must be observed.

Before dismantling

- Electrical Devices:
  - Switch off the units.
  - Disconnect electrical appliances from the power supply, regardless of whether the appliances are connected to the mains or to another power source.
- Mechanical devices:
  - Fix all loose components. Prevent the device from moving independently or unintentionally.
  - Loosen mechanical fastenings: Please note that appliances can be heavy and that loosening the fastenings may cause them to become mechanically unstable.

Disposal

Operators of old appliances must recycle them separately from unsorted municipal waste. This applies in particular to electrical waste and old electronic equipment.

Electrical waste and electronic equipment must not be disposed of as household waste!

Instead, these old appliances must be collected separately and disposed of via the local collection and return systems.

Integrated or provided batteries and accumulators must be separated from the appliances and disposed of at the designated

collection point. At the end of its service life, the lithium-ion battery must be disposed of according to legal provisions.

EU WEEE Directive

As players in the environmental market, KISTERS AG is committed to supporting efforts to avoid and recycle waste. Please consider:

- Avoidance before recycling!
- Recycling before disposal!

This symbol  indicates that the scrapping of the unit must be carried out in accordance with Directive 2012/19/EU. Please observe the local implementation of the directive and any accompanying or supplementary laws and regulations.

9 Appendices

This chapter contains the following subsections:

- Calibration Certificate and Lookup Tables - Metric 23
- Calibration Certificate and Lookup Tables - Imperial 27

9.1 Calibration Certificate and Lookup Tables - Metric

KISTERS INSTRUMENTS PTY. LTD., AUSTRALIA

CERTIFICATE OF CALIBRATION Date: 11/5/12

Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Diameter: Pitch:
Type of Support:
Method of Calibration: Average Value Equation

n <	0.14	V =	0.6564 n	+0.0094	m/s
0.14 < n <	2.69	V =	0.6981 n	+0.0035	m/s
n >	2.69	V =	0.7157 n	-0.0438	m/s

Starting Velocity = 0.025 m/s
Maximum Velocity = 8.000 m/s

Note: 'n' denotes the number of revolutions of the propeller per second
'V' is the water velocity in meters per second.

Date: 11/5/12 INSPECTED:_____

The above meter calibration certificate is based on a batch calibration in accordance with ISO 3455:2021.
The clause below has been printed with the permission of Standards Australia from AS 3778.6.1-2022. This standard is identical with and has been reproduced from ISO 2537:2007.
Clause 9.5.3 Group (standard) calibration : Group calibration shall be based on the calibration of a group of current-meters of uniform manufacture.The sample of current-meters calibrated shall be adequate in number and shall comprise, if possible, both new current-meters and well-maintained used current-meters. The manufacturer shall make available a description of the original calibration and of the current - meters used in the calibration. In addition, they shall check the validity of the standard calibration on a sample comprising at least 10% of newly manufactured meters selected at random, and again shall give similar details of the check calibration.The cost saving in adopting a group calibration is significant but the confidence levels are lower than for an individual calibration.Strict control of manufacture's tolerances is an essential requirement for the the implementation of a group calibration and careful vigilance by the user is necessary.

D127.08.23

KISTERS INSTRUMENTS PTY. LTD., AUSTRALIA

CALIBRATION TABLE Date: 11/5/12

Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Type of Table: Revs/sec vs m/s
Velocity in meters/second at increments of 0.01 Revolutions per second

n	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	n
0.0	*****	*****	*****	0.029	0.036	0.042	0.049	0.055	0.062	0.068	0.0
0.1	0.075	0.082	0.088	0.095	0.101	0.108	0.115	0.122	0.129	0.136	0.1
0.2	0.143	0.150	0.157	0.164	0.171	0.178	0.185	0.192	0.199	0.206	0.2
0.3	0.213	0.220	0.227	0.234	0.241	0.248	0.255	0.262	0.269	0.276	0.3
0.4	0.283	0.290	0.297	0.304	0.311	0.318	0.325	0.332	0.339	0.346	0.4
0.5	0.353	0.360	0.367	0.373	0.380	0.387	0.394	0.401	0.408	0.415	0.5
0.6	0.422	0.429	0.436	0.443	0.450	0.457	0.464	0.471	0.478	0.485	0.6
0.7	0.492	0.499	0.506	0.513	0.520	0.527	0.534	0.541	0.548	0.555	0.7
0.8	0.562	0.569	0.576	0.583	0.590	0.597	0.604	0.611	0.618	0.625	0.8
0.9	0.632	0.639	0.646	0.653	0.660	0.667	0.674	0.681	0.688	0.695	0.9
1.0	0.702	0.709	0.716	0.723	0.730	0.737	0.743	0.750	0.757	0.764	1.0
1.1	0.771	0.778	0.785	0.792	0.799	0.806	0.813	0.820	0.827	0.834	1.1
1.2	0.841	0.848	0.855	0.862	0.869	0.876	0.883	0.890	0.897	0.904	1.2
1.3	0.911	0.918	0.925	0.932	0.939	0.946	0.953	0.960	0.967	0.974	1.3
1.4	0.981	0.988	0.995	1.002	1.009	1.016	1.023	1.030	1.037	1.044	1.4
1.5	1.051	1.058	1.065	1.072	1.079	1.086	1.093	1.100	1.106	1.113	1.5
1.6	1.120	1.127	1.134	1.141	1.148	1.155	1.162	1.169	1.176	1.183	1.6
1.7	1.190	1.197	1.204	1.211	1.218	1.225	1.232	1.239	1.246	1.253	1.7
1.8	1.260	1.267	1.274	1.281	1.288	1.295	1.302	1.309	1.316	1.323	1.8
1.9	1.330	1.337	1.344	1.351	1.358	1.365	1.372	1.379	1.386	1.393	1.9
2.0	1.400	1.407	1.414	1.421	1.428	1.435	1.442	1.449	1.456	1.463	2.0
2.1	1.470	1.476	1.483	1.490	1.497	1.504	1.511	1.518	1.525	1.532	2.1
2.2	1.539	1.546	1.553	1.560	1.567	1.574	1.581	1.588	1.595	1.602	2.2
2.3	1.609	1.616	1.623	1.630	1.637	1.644	1.651	1.658	1.665	1.672	2.3
2.4	1.679	1.686	1.693	1.700	1.707	1.714	1.721	1.728	1.735	1.742	2.4
2.5	1.749	1.756	1.763	1.770	1.777	1.784	1.791	1.798	1.805	1.812	2.5
2.6	1.819	1.826	1.833	1.840	1.846	1.853	1.860	1.867	1.874	1.881	2.6
2.7	1.889	1.896	1.903	1.910	1.917	1.924	1.932	1.939	1.946	1.953	2.7
2.8	1.960	1.967	1.974	1.982	1.989	1.996	2.003	2.010	2.017	2.025	2.8
2.9	2.032	2.039	2.046	2.053	2.060	2.068	2.075	2.082	2.089	2.096	2.9
3.0	2.103	2.110	2.118	2.125	2.132	2.139	2.146	2.153	2.161	2.168	3.0
3.1	2.175	2.182	2.189	2.196	2.203	2.211	2.218	2.225	2.232	2.239	3.1
3.2	2.246	2.254	2.261	2.268	2.275	2.282	2.289	2.297	2.304	2.311	3.2
3.3	2.318	2.325	2.332	2.339	2.347	2.354	2.361	2.368	2.375	2.382	3.3
3.4	2.390	2.397	2.404	2.411	2.418	2.425	2.433	2.440	2.447	2.454	3.4
3.5	2.461	2.468	2.475	2.483	2.490	2.497	2.504	2.511	2.518	2.526	3.5
3.6	2.533	2.540	2.547	2.554	2.561	2.569	2.576	2.583	2.590	2.597	3.6
3.7	2.604	2.611	2.619	2.626	2.633	2.640	2.647	2.654	2.662	2.669	3.7
3.8	2.676	2.683	2.690	2.697	2.704	2.712	2.719	2.726	2.733	2.740	3.8
3.9	2.747	2.755	2.762	2.769	2.776	2.783	2.790	2.798	2.805	2.812	3.9
4.0	2.819	2.826	2.833	2.840	2.848	2.855	2.862	2.869	2.876	2.883	4.0
4.1	2.891	2.898	2.905	2.912	2.919	2.926	2.934	2.941	2.948	2.955	4.1
4.2	2.962	2.969	2.976	2.984	2.991	2.998	3.005	3.012	3.019	3.027	4.2
4.3	3.034	3.041	3.048	3.055	3.062	3.069	3.077	3.084	3.091	3.098	4.3
4.4	3.105	3.112	3.120	3.127	3.134	3.141	3.148	3.155	3.163	3.170	4.4

Page 2

Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Type of Table: Revs/sec vs m/s
Velocity in meters/second at increments of 0.01 Revolutions per second

n	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	n
4.5	3.177	3.184	3.191	3.198	3.205	3.213	3.220	3.227	3.234	3.241	4.5
4.6	3.248	3.256	3.263	3.270	3.277	3.284	3.291	3.299	3.306	3.313	4.6
4.7	3.320	3.327	3.334	3.341	3.349	3.356	3.363	3.370	3.377	3.384	4.7
4.8	3.392	3.399	3.406	3.413	3.420	3.427	3.435	3.442	3.449	3.456	4.8
4.9	3.463	3.470	3.477	3.485	3.492	3.499	3.506	3.513	3.520	3.528	4.9
5.0	3.535	3.542	3.549	3.556	3.563	3.570	3.578	3.585	3.592	3.599	5.0
5.1	3.606	3.613	3.621	3.628	3.635	3.642	3.649	3.656	3.664	3.671	5.1
5.2	3.678	3.685	3.692	3.699	3.706	3.714	3.721	3.728	3.735	3.742	5.2
5.3	3.749	3.757	3.764	3.771	3.778	3.785	3.792	3.800	3.807	3.814	5.3
5.4	3.821	3.828	3.835	3.842	3.850	3.857	3.864	3.871	3.878	3.885	5.4
5.5	3.893	3.900	3.907	3.914	3.921	3.928	3.935	3.943	3.950	3.957	5.5
5.6	3.964	3.971	3.978	3.986	3.993	4.000	4.007	4.014	4.021	4.029	5.6
5.7	4.036	4.043	4.050	4.057	4.064	4.071	4.079	4.086	4.093	4.100	5.7
5.8	4.107	4.114	4.122	4.129	4.136	4.143	4.150	4.157	4.165	4.172	5.8
5.9	4.179	4.186	4.193	4.200	4.207	4.215	4.222	4.229	4.236	4.243	5.9
6.0	4.250	4.258	4.265	4.272	4.279	4.286	4.293	4.300	4.308	4.315	6.0
6.1	4.322	4.329	4.336	4.343	4.351	4.358	4.365	4.372	4.379	4.386	6.1
6.2	4.394	4.401	4.408	4.415	4.422	4.429	4.436	4.444	4.451	4.458	6.2
6.3	4.465	4.472	4.479	4.487	4.494	4.501	4.508	4.515	4.522	4.530	6.3
6.4	4.537	4.544	4.551	4.558	4.565	4.572	4.580	4.587	4.594	4.601	6.4
6.5	4.608	4.615	4.623	4.630	4.637	4.644	4.651	4.658	4.666	4.673	6.5
6.6	4.680	4.687	4.694	4.701	4.708	4.716	4.723	4.730	4.737	4.744	6.6
6.7	4.751	4.759	4.766	4.773	4.780	4.787	4.794	4.801	4.809	4.816	6.7
6.8	4.823	4.830	4.837	4.844	4.852	4.859	4.866	4.873	4.880	4.887	6.8
6.9	4.895	4.902	4.909	4.916	4.923	4.930	4.937	4.945	4.952	4.959	6.9
7.0	4.966	4.973	4.980	4.988	4.995	5.002	5.009	5.016	5.023	5.031	7.0
7.1	5.038	5.045	5.052	5.059	5.066	5.073	5.081	5.088	5.095	5.102	7.1
7.2	5.109	5.116	5.124	5.131	5.138	5.145	5.152	5.159	5.166	5.174	7.2
7.3	5.181	5.188	5.195	5.202	5.209	5.217	5.224	5.231	5.238	5.245	7.3
7.4	5.252	5.260	5.267	5.274	5.281	5.288	5.295	5.302	5.310	5.317	7.4
7.5	5.324	5.331	5.338	5.345	5.353	5.360	5.367	5.374	5.381	5.388	7.5
7.6	5.396	5.403	5.410	5.417	5.424	5.431	5.438	5.446	5.453	5.460	7.6
7.7	5.467	5.474	5.481	5.489	5.496	5.503	5.510	5.517	5.524	5.532	7.7
7.8	5.539	5.546	5.553	5.560	5.567	5.574	5.582	5.589	5.596	5.603	7.8
7.9	5.610	5.617	5.625	5.632	5.639	5.646	5.653	5.660	5.667	5.675	7.9
8.0	5.682	5.689	5.696	5.703	5.710	5.718	5.725	5.732	5.739	5.746	8.0
8.1	5.753	5.761	5.768	5.775	5.782	5.789	5.796	5.803	5.811	5.818	8.1
8.2	5.825	5.832	5.839	5.846	5.854	5.861	5.868	5.875	5.882	5.889	8.2
8.3	5.897	5.904	5.911	5.918	5.925	5.932	5.939	5.947	5.954	5.961	8.3
8.4	5.968	5.975	5.982	5.990	5.997	6.004	6.011	6.018	6.025	6.032	8.4
8.5	6.040	6.047	6.054	6.061	6.068	6.075	6.083	6.090	6.097	6.104	8.5
8.6	6.111	6.118	6.126	6.133	6.140	6.147	6.154	6.161	6.168	6.176	8.6
8.7	6.183	6.190	6.197	6.204	6.211	6.219	6.226	6.233	6.240	6.247	8.7
8.8	6.254	6.262	6.269	6.276	6.283	6.290	6.297	6.304	6.312	6.319	8.8
8.9	6.326	6.333	6.340	6.347	6.355	6.362	6.369	6.376	6.383	6.390	8.9
9.0	6.397	6.405	6.412	6.419	6.426	6.433	6.440	6.448	6.455	6.462	9.0
9.1	6.469	6.476	6.483	6.491	6.498	6.505	6.512	6.519	6.526	6.533	9.1
9.2	6.541	6.548	6.555	6.562	6.569	6.576	6.584	6.591	6.598	6.605	9.2
9.3	6.612	6.619	6.627	6.634	6.641	6.648	6.655	6.662	6.669	6.677	9.3
9.4	6.684	6.691	6.698	6.705	6.712	6.720	6.727	6.734	6.741	6.748	9.4
9.5	6.755	6.763	6.770	6.777	6.784	6.791	6.798	6.805	6.813	6.820	9.5
9.6	6.827	6.834	6.841	6.848	6.856	6.863	6.870	6.877	6.884	6.891	9.6

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Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Type of Table: Revs/sec vs m/s
Velocity in meters/second at increments of 0.01 Revolutions per second

n	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	n
9.7	6.898	6.906	6.913	6.920	6.927	6.934	6.941	6.949	6.956	6.963	9.7
9.8	6.970	6.977	6.984	6.992	6.999	7.006	7.013	7.020	7.027	7.034	9.8
9.9	7.042	7.049	7.056	7.063	7.070	7.077	7.085	7.092	7.099	7.106	9.9
10.0	7.113	7.120	7.128	7.135	7.142	7.149	7.156	7.163	7.170	7.178	10.0
10.1	7.185	7.192	7.199	7.206	7.213	7.221	7.228	7.235	7.242	7.249	10.1
10.2	7.256	7.263	7.271	7.278	7.285	7.292	7.299	7.306	7.314	7.321	10.2
10.3	7.328	7.335	7.342	7.349	7.357	7.364	7.371	7.378	7.385	7.392	10.3
10.4	7.399	7.407	7.414	7.421	7.428	7.435	7.442	7.450	7.457	7.464	10.4
10.5	7.471	7.478	7.485	7.493	7.500	7.507	7.514	7.521	7.528	7.535	10.5
10.6	7.543	7.550	7.557	7.564	7.571	7.578	7.586	7.593	7.600	7.607	10.6
10.7	7.614	7.621	7.629	7.636	7.643	7.650	7.657	7.664	7.671	7.679	10.7
10.8	7.686	7.693	7.700	7.707	7.714	7.722	7.729	7.736	7.743	7.750	10.8
10.9	7.757	7.764	7.772	7.779	7.786	7.793	7.800	7.807	7.815	7.822	10.9
11.0	7.829	7.836	7.843	7.850	7.858	7.865	7.872	7.879	7.886	7.893	11.0
11.1	7.900	7.908	7.915	7.922	7.929	7.936	7.943	7.951	7.958	7.965	11.1
11.2	7.972	7.979	7.986	7.994	8.001	*****	*****	*****	*****	*****	11.2

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9.2 Calibration Certificate and Lookup Tables - Imperial

KISTERS INSTRUMENTS PTY. LTD., AUSTRALIA

CERTIFICATE OF CALIBRATION Date: 11/5/12

Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Diameter: Pitch:
Type of Support:
Method of Calibration: Average Value Equation

n <	0.14	V =	2.1535 n	+0.0308	ft/s
0.14 < n <	2.69	V =	2.2904 n	+0.0115	ft/s
n >	2.69	V =	2.3481 n	-0.1437	ft/s

Starting Velocity = 0.082 ft/s
Maximum Velocity = 26.200 ft/s

Note: 'n' denotes the number of revolutions of the propeller per second
'V' is the water velocity in feet per second.

Date: 11/5/12 INSPECTED:_____

The above meter calibration certificate is based on a batch calibration in accordance with ISO 3455:2021.
The clause below has been printed with the permission of Standards Australia from AS 3778.6.1-2022. This standard is identical with and has been reproduced from ISO 2537:2007.
Clause 9.5.3 Group (standard) calibration : Group calibration shall be based on the calibration of a group of current-meters of uniform manufacture.The sample of current-meters calibrated shall be adequate in number and shall comprise, if possible, both new current-meters and well-maintained used current-meters. The manufacturer shall make available a description of the original calibration and of the current - meters used in the calibration. In addition, they shall check the validity of the standard calibration on a sample comprising at least 10% of newly manufactured meters selected at random, and again shall give similar details of the check calibration.The cost saving in adopting a group calibration is significant but the confidence levels are lower than for an individual calibration.Strict control of manufacture's tolerances is an essential requirement for the the implementation of a group calibration and careful vigilance by the user is necessary.

D127.08.23

KISTERS INSTRUMENTS PTY. LTD., AUSTRALIA

CALIBRATION TABLE

Date: 11/5/12

Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Type of Table: Revs/sec vs ft/s
Velocity in feet/second at increments of 0.01 Revolutions per second

n	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	n
0.0	*****	*****	*****	0.095	0.117	0.139	0.160	0.182	0.203	0.225	0.0
0.1	0.246	0.268	0.289	0.311	0.332	0.355	0.378	0.401	0.424	0.447	0.1
0.2	0.470	0.492	0.515	0.538	0.561	0.584	0.607	0.630	0.653	0.676	0.2
0.3	0.699	0.721	0.744	0.767	0.790	0.813	0.836	0.859	0.882	0.905	0.3
0.4	0.928	0.951	0.973	0.996	1.019	1.042	1.065	1.088	1.111	1.134	0.4
0.5	1.157	1.180	1.202	1.225	1.248	1.271	1.294	1.317	1.340	1.363	0.5
0.6	1.386	1.409	1.432	1.454	1.477	1.500	1.523	1.546	1.569	1.592	0.6
0.7	1.615	1.638	1.661	1.683	1.706	1.729	1.752	1.775	1.798	1.821	0.7
0.8	1.844	1.867	1.890	1.912	1.935	1.958	1.981	2.004	2.027	2.050	0.8
0.9	2.073	2.096	2.119	2.142	2.164	2.187	2.210	2.233	2.256	2.279	0.9
1.0	2.302	2.325	2.348	2.371	2.393	2.416	2.439	2.462	2.485	2.508	1.0
1.1	2.531	2.554	2.577	2.600	2.622	2.645	2.668	2.691	2.714	2.737	1.1
1.2	2.760	2.783	2.806	2.829	2.852	2.874	2.897	2.920	2.943	2.966	1.2
1.3	2.989	3.012	3.035	3.058	3.081	3.103	3.126	3.149	3.172	3.195	1.3
1.4	3.218	3.241	3.264	3.287	3.310	3.332	3.355	3.378	3.401	3.424	1.4
1.5	3.447	3.470	3.493	3.516	3.539	3.562	3.584	3.607	3.630	3.653	1.5
1.6	3.676	3.699	3.722	3.745	3.768	3.791	3.813	3.836	3.859	3.882	1.6
1.7	3.905	3.928	3.951	3.974	3.997	4.020	4.043	4.065	4.088	4.111	1.7
1.8	4.134	4.157	4.180	4.203	4.226	4.249	4.272	4.294	4.317	4.340	1.8
1.9	4.363	4.386	4.409	4.432	4.455	4.478	4.501	4.523	4.546	4.569	1.9
2.0	4.592	4.615	4.638	4.661	4.684	4.707	4.730	4.753	4.775	4.798	2.0
2.1	4.821	4.844	4.867	4.890	4.913	4.936	4.959	4.982	5.004	5.027	2.1
2.2	5.050	5.073	5.096	5.119	5.142	5.165	5.188	5.211	5.233	5.256	2.2
2.3	5.279	5.302	5.325	5.348	5.371	5.394	5.417	5.440	5.463	5.485	2.3
2.4	5.508	5.531	5.554	5.577	5.600	5.623	5.646	5.669	5.692	5.714	2.4
2.5	5.737	5.760	5.783	5.806	5.829	5.852	5.875	5.898	5.921	5.944	2.5
2.6	5.966	5.989	6.012	6.035	6.058	6.081	6.104	6.127	6.150	6.173	2.6
2.7	6.196	6.220	6.243	6.267	6.290	6.314	6.337	6.361	6.384	6.407	2.7
2.8	6.431	6.454	6.478	6.501	6.525	6.548	6.572	6.595	6.619	6.642	2.8
2.9	6.666	6.689	6.713	6.736	6.760	6.783	6.807	6.830	6.854	6.877	2.9
3.0	6.901	6.924	6.948	6.971	6.995	7.018	7.041	7.065	7.088	7.112	3.0
3.1	7.135	7.159	7.182	7.206	7.229	7.253	7.276	7.300	7.323	7.347	3.1
3.2	7.370	7.394	7.417	7.441	7.464	7.488	7.511	7.535	7.558	7.582	3.2
3.3	7.605	7.629	7.652	7.675	7.699	7.722	7.746	7.769	7.793	7.816	3.3
3.4	7.840	7.863	7.887	7.910	7.934	7.957	7.981	8.004	8.028	8.051	3.4
3.5	8.075	8.098	8.122	8.145	8.169	8.192	8.216	8.239	8.262	8.286	3.5
3.6	8.309	8.333	8.356	8.380	8.403	8.427	8.450	8.474	8.497	8.521	3.6
3.7	8.544	8.568	8.591	8.615	8.638	8.662	8.685	8.709	8.732	8.756	3.7
3.8	8.779	8.803	8.826	8.850	8.873	8.896	8.920	8.943	8.967	8.990	3.8
3.9	9.014	9.037	9.061	9.084	9.108	9.131	9.155	9.178	9.202	9.225	3.9
4.0	9.249	9.272	9.296	9.319	9.343	9.366	9.390	9.413	9.437	9.460	4.0
4.1	9.483	9.507	9.530	9.554	9.577	9.601	9.624	9.648	9.671	9.695	4.1
4.2	9.718	9.742	9.765	9.789	9.812	9.836	9.859	9.883	9.906	9.930	4.2
4.3	9.953	9.977	10.000	10.024	10.047	10.071	10.094	10.117	10.141	10.164	4.3
4.4	10.188	10.211	10.235	10.258	10.282	10.305	10.329	10.352	10.376	10.399	4.4

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Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Type of Table: Revs/sec vs ft/s
Velocity in feet/second at increments of 0.01 Revolutions per second

n	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	n
4.5	10.423	10.446	10.470	10.493	10.517	10.540	10.564	10.587	10.611	10.634	4.5
4.6	10.658	10.681	10.705	10.728	10.751	10.775	10.798	10.822	10.845	10.869	4.6
4.7	10.892	10.916	10.939	10.963	10.986	11.010	11.033	11.057	11.080	11.104	4.7
4.8	11.127	11.151	11.174	11.198	11.221	11.245	11.268	11.292	11.315	11.338	4.8
4.9	11.362	11.385	11.409	11.432	11.456	11.479	11.503	11.526	11.550	11.573	4.9
5.0	11.597	11.620	11.644	11.667	11.691	11.714	11.738	11.761	11.785	11.808	5.0
5.1	11.832	11.855	11.879	11.902	11.926	11.949	11.972	11.996	12.019	12.043	5.1
5.2	12.066	12.090	12.113	12.137	12.160	12.184	12.207	12.231	12.254	12.278	5.2
5.3	12.301	12.325	12.348	12.372	12.395	12.419	12.442	12.466	12.489	12.513	5.3
5.4	12.536	12.560	12.583	12.606	12.630	12.653	12.677	12.700	12.724	12.747	5.4
5.5	12.771	12.794	12.818	12.841	12.865	12.888	12.912	12.935	12.959	12.982	5.5
5.6	13.006	13.029	13.053	13.076	13.100	13.123	13.147	13.170	13.193	13.217	5.6
5.7	13.240	13.264	13.287	13.311	13.334	13.358	13.381	13.405	13.428	13.452	5.7
5.8	13.475	13.499	13.522	13.546	13.569	13.593	13.616	13.640	13.663	13.687	5.8
5.9	13.710	13.734	13.757	13.781	13.804	13.827	13.851	13.874	13.898	13.921	5.9
6.0	13.945	13.968	13.992	14.015	14.039	14.062	14.086	14.109	14.133	14.156	6.0
6.1	14.180	14.203	14.227	14.250	14.274	14.297	14.321	14.344	14.368	14.391	6.1
6.2	14.415	14.438	14.461	14.485	14.508	14.532	14.555	14.579	14.602	14.626	6.2
6.3	14.649	14.673	14.696	14.720	14.743	14.767	14.790	14.814	14.837	14.861	6.3
6.4	14.884	14.908	14.931	14.955	14.978	15.002	15.025	15.048	15.072	15.095	6.4
6.5	15.119	15.142	15.166	15.189	15.213	15.236	15.260	15.283	15.307	15.330	6.5
6.6	15.354	15.377	15.401	15.424	15.448	15.471	15.495	15.518	15.542	15.565	6.6
6.7	15.589	15.612	15.636	15.659	15.682	15.706	15.729	15.753	15.776	15.800	6.7
6.8	15.823	15.847	15.870	15.894	15.917	15.941	15.964	15.988	16.011	16.035	6.8
6.9	16.058	16.082	16.105	16.129	16.152	16.176	16.199	16.223	16.246	16.269	6.9
7.0	16.293	16.316	16.340	16.363	16.387	16.410	16.434	16.457	16.481	16.504	7.0
7.1	16.528	16.551	16.575	16.598	16.622	16.645	16.669	16.692	16.716	16.739	7.1
7.2	16.763	16.786	16.810	16.833	16.857	16.880	16.903	16.927	16.950	16.974	7.2
7.3	16.997	17.021	17.044	17.068	17.091	17.115	17.138	17.162	17.185	17.209	7.3
7.4	17.232	17.256	17.279	17.303	17.326	17.350	17.373	17.397	17.420	17.444	7.4
7.5	17.467	17.491	17.514	17.537	17.561	17.584	17.608	17.631	17.655	17.678	7.5
7.6	17.702	17.725	17.749	17.772	17.796	17.819	17.843	17.866	17.890	17.913	7.6
7.7	17.937	17.960	17.984	18.007	18.031	18.054	18.078	18.101	18.124	18.148	7.7
7.8	18.171	18.195	18.218	18.242	18.265	18.289	18.312	18.336	18.359	18.383	7.8
7.9	18.406	18.430	18.453	18.477	18.500	18.524	18.547	18.571	18.594	18.618	7.9
8.0	18.641	18.665	18.688	18.712	18.735	18.758	18.782	18.805	18.829	18.852	8.0
8.1	18.876	18.899	18.923	18.946	18.970	18.993	19.017	19.040	19.064	19.087	8.1
8.2	19.111	19.134	19.158	19.181	19.205	19.228	19.252	19.275	19.299	19.322	8.2
8.3	19.346	19.369	19.392	19.416	19.439	19.463	19.486	19.510	19.533	19.557	8.3
8.4	19.580	19.604	19.627	19.651	19.674	19.698	19.721	19.745	19.768	19.792	8.4
8.5	19.815	19.839	19.862	19.886	19.909	19.933	19.956	19.979	20.003	20.026	8.5
8.6	20.050	20.073	20.097	20.120	20.144	20.167	20.191	20.214	20.238	20.261	8.6
8.7	20.285	20.308	20.332	20.355	20.379	20.402	20.426	20.449	20.473	20.496	8.7
8.8	20.520	20.543	20.567	20.590	20.613	20.637	20.660	20.684	20.707	20.731	8.8
8.9	20.754	20.778	20.801	20.825	20.848	20.872	20.895	20.919	20.942	20.966	8.9
9.0	20.989	21.013	21.036	21.060	21.083	21.107	21.130	21.154	21.177	21.201	9.0
9.1	21.224	21.247	21.271	21.294	21.318	21.341	21.365	21.388	21.412	21.435	9.1
9.2	21.459	21.482	21.506	21.529	21.553	21.576	21.600	21.623	21.647	21.670	9.2
9.3	21.694	21.717	21.741	21.764	21.788	21.811	21.834	21.858	21.881	21.905	9.3
9.4	21.928	21.952	21.975	21.999	22.022	22.046	22.069	22.093	22.116	22.140	9.4
9.5	22.163	22.187	22.210	22.234	22.257	22.281	22.304	22.328	22.351	22.375	9.5
9.6	22.398	22.422	22.445	22.468	22.492	22.515	22.539	22.562	22.586	22.609	9.6

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Current Meter Model: RedBack Serial No.
Fan No. Serial No.
Type of Table: Revs/sec vs ft/s
Velocity in feet/second at increments of 0.01 Revolutions per second

n	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09	n
9.7	22.633	22.656	22.680	22.703	22.727	22.750	22.774	22.797	22.821	22.844	9.7
9.8	22.868	22.891	22.915	22.938	22.962	22.985	23.009	23.032	23.055	23.079	9.8
9.9	23.102	23.126	23.149	23.173	23.196	23.220	23.243	23.267	23.290	23.314	9.9
10.0	23.337	23.361	23.384	23.408	23.431	23.455	23.478	23.502	23.525	23.549	10.0
10.1	23.572	23.596	23.619	23.643	23.666	23.689	23.713	23.736	23.760	23.783	10.1
10.2	23.807	23.830	23.854	23.877	23.901	23.924	23.948	23.971	23.995	24.018	10.2
10.3	24.042	24.065	24.089	24.112	24.136	24.159	24.183	24.206	24.230	24.253	10.3
10.4	24.277	24.300	24.323	24.347	24.370	24.394	24.417	24.441	24.464	24.488	10.4
10.5	24.511	24.535	24.558	24.582	24.605	24.629	24.652	24.676	24.699	24.723	10.5
10.6	24.746	24.770	24.793	24.817	24.840	24.864	24.887	24.910	24.934	24.957	10.6
10.7	24.981	25.004	25.028	25.051	25.075	25.098	25.122	25.145	25.169	25.192	10.7
10.8	25.216	25.239	25.263	25.286	25.310	25.333	25.357	25.380	25.404	25.427	10.8
10.9	25.451	25.474	25.498	25.521	25.544	25.568	25.591	25.615	25.638	25.662	10.9
11.0	25.685	25.709	25.732	25.756	25.779	25.803	25.826	25.850	25.873	25.897	11.0
11.1	25.920	25.944	25.967	25.991	26.014	26.038	26.061	26.085	26.108	26.132	11.1
11.2	26.155	26.178	26.202	*****	*****	*****	*****	*****	*****	*****	11.2

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