kamstrup

Data Sheet

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MULTICAL® 21

- Pinpoint accuracy
- Drive-by' or network
- Temperature measurement
- Low leakage limit
- Long range
- Long life
- Simple installation
- Environment-friendly

Contents

Smart water meter – ultrasonic compact meter for measurement of cold and hot water consumption in households, apartment buildings and small commercial properties

Pinpoint accuracy

Ultrasonic flow measurement guarantees pinpoint measuring accuracy. The electronic meter has no moving parts, meaning that there is no wear and that MULTICAL® 21 is resistant to any impurities in the water.

'Drive-by' or network

MULTICAL® 21 comes with the newest radio technology to meet increasing market demands for smart metering, both for 'drive-by' and network installations. Radio packages are available with transmission intervals of 16 or 96 seconds. Consumption data can be read manually directly from the display or using an optical eye. Furthermore, consumption data can be remotely read by means of Wireless M-Bus, which is built into the meter.

Temperature

The meter measures both water and ambient temperatures - combinations of these can be defined in the optional radio packages.

Low leakage limits

MULTICAL® 21 has built-in sensitive leak monitoring, as low as 0.1% of Q3, which means that even the smallest water losses are detected very quickly. The unique combination of pinpoint measuring accuracy, longevity and built-in wireless radio communication – Wireless M-Bus – reduces the operating costs for the water company continuously and contingencies, caused by any leakage, are minimized, as waste of water is discovered immediately.

Long range

MULTICAL® 21 is equipped with a long range antenna that transmits strog radio signals with intelligent coding to the network. The meter can also be read from a long distance with 'drive-by'.

Installation

MULTICAL® 21 is easy to install in all operating environments, horizontally as well as vertically, independent of piping and installation conditions.

The meter is **waterproof, IP68** type tested, so also suitable for installation in meter pits.

User-friendly

MULTICAL® 21 comes with a large and easy to read display and the meter is constructed as a hermetically vacuumsealed unit, which prevents humidity from reaching the electronics. Therefore condensation water between the glass and the large display is avoided.

Environment-friendly meter

The compact water meter has been approved for drinking water in several countries. Meter housing and flow parts are made of the synthetic material PPS, which means that the meter does not contain lead or other heavy metals.
The environmental report ,for MULTICAL® 21, documents that the meter has low environmental impact, and high recyclability of materials when the meter is taken out of service.

General description

MULTICAL® 21 is a hermetically closed compact static water meter intended for the registration of cold and hot water consumption. The water meter uses the ultrasonic principle and has been constructed on the basis of Kamstrup's experience since 1991 with the development and production of static ultrasonic meters.

MULTICAL® 21 has been subjected to a very comprehensive OIML R49 type test with a view to securing a long-term stable, accurate and reliable meter. One of the water meter's many advantages is the fact that it has no wearing parts, which entails high immunity towards particles and thereby longevity.
Furthermore, the meter has a low-flow cut-off (start flow) of only 2 l/h for $Q3 = 1.6$ m³/h and 2.5 m³/h and 3.2 l/h for $Q3 = 4.0$ m³/h, which provides accurate measurement also at low water flows.

MULTICAL® 21 is constructed as a vacuum chamber of moulded composite material. Thus, the electronics are fully protected against penetration of water. This means that the meter can without problems be placed in e.g. bathrooms where it is sprayed with water daily, and it is also suitable for mounting in meter pits, which are frequently filled with water.

The meter can and must only be opened by Kamstrup A/S. If the meter has been opened and the seals have thus been broken, the meter is no longer valid for billing purposes.

Furthermore, the factory guarantee no longer applies.

The volume is measured using ultrasonic technique which is proven as a long-term stable and accurate measuring principle. Two ultrasonic transducers are used to send sound signals both against and with the flow. The ultrasonic signal travelling with the flow reaches the opposite transducer first. The time difference between the two signals can be converted into flow velocity and subsequently volume.

The accumulated water consumption is displayed by MULTICAL® 21 in cubic metres (m³) with five digits and up to three decimals, i.e. the resolution has been extended to 1 litre only. The large and clear display has been specially designed to obtain long life and sharp contrast in a wide temperature range.

In addition to volume reading, a graphic indication of current flow and a number of information codes are displayed.

The meter measures continuously both water and ambient temperature, and stores minimum, mean and maximum temperatures daily. All registers are saved daily in the meter's memory for 460 days. Furthermore, monthly data for the latest 36 months are saved.

MULTICAL® 21 is fitted with an optical eye which makes it possible to read saved consumption data and info codes, stored in the meter's data logger. Using a serial PC connection, the optical eye furthermore gives access to configure the water meter.

The water meter is powered by an internal lithium battery with up to 16 years' lifetime.

MULTICAL® 21 comes with the newest radio technology to meet increasing market demands for smart metering. It has built-in data communication for Wireless M-Bus and the built-in radio can be configured for both 'drive-by' reading and reading in 'Fixed network' – e.g. Kamstrup Radio Link network

Characteristics in short:	• accurate and reliable
	• ultrasonic metering
	• low start flow
	• measuring water and ambient temperatures
	• remote reading
	• no moving parts – no wear
	• long-term stable – long life
	• powered by a lithium battery
	• multiple info codes
	• large clear display
	• hermetically sealed
	• fully waterproof
	• suitable for mounting in pits.

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MULTICAL® 21

Approved meter data

MID classifications

Approval	DK-0200-MI001-015
Mechanical environment	Class M1
Electromagnetic environment	Class E1 and E2
Climatic environment	5...55 °C, condensing humidity (indoors mounted in utility rooms and outdoors in meter pits – mounting in direct prolonged sunligt must be avoided)

OIML R49 designations

Accuracy class	2
Ambient class	Fulfils OIML R49 class B and C (indoors/outdoors)
Medium temperature, cold water	0.1...30 °C (T30) or 0.1...50 °C (T50)
Medium temperature, hot water	0.1...70 °C (T70) or T30/70
Meter types	$Q3 =$ 1.6 m³/h 2.5 m³/h and 4.0 m³/h

Material

Wetted parts

Meter housing and meter pipe	Polyphenylene sulfide PPS with 40 % fibre glass
Reflectors	Stainless steel, W.no. 1,4306

Technical data

Electrical data

16-year battery	3.65 VDC, C-cell lithium
EMC data	Fulfils MID class E1 and E2

Mechanical data

Metrological class	2
Ambient class	Fulfils OIML R49 class B and C (indoors/outdoors)
Ambient temperature	2...55 °C
Protection class	IP68
Medium temperature	0.1...30 °C (T30); 0.1...50 °C (T50); 0.1...70 °C (T70) or T30/70.
Storage temp. empty sensor	-25...60 °C
Pressure stage	PN16

Technical data

Accuracy

MPE (maximum permissible error)
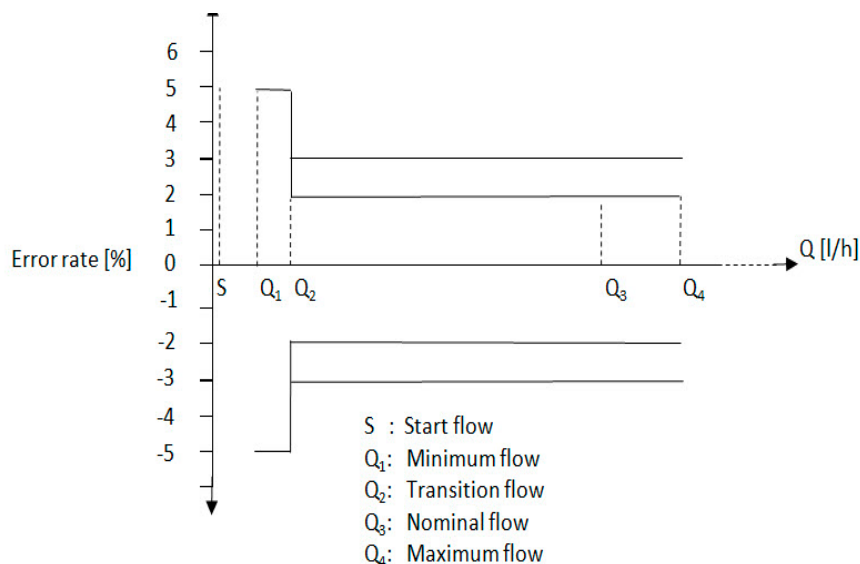
MPE according to OIML R49

Meter approved 0.1...70 °C

± 5 % in range Q1 ≤ Q < Q2

± 2 % in range Q2 ≤ Q ≤ Q4

At 30 °C < t < 70 °C

3 % in range Q2 ≤ Q ≤ Q4

S : Start flow
Q_1: Minimum flow
Q_2: Transition flow
Q_3: Nominal flow
Q_4: Maximum flow

Meter sizes

MULTICAL® 21 is available in different combinations of overall length and nominal flow Q3.

Type number	Nom. flow Q3 [m³/h]	Min. flow Q1 [l/h]	Max. flow Q4 [m³/h]	Dynamic range Q3/Q1	Min. cutoff [l/h]	Max. cutoff [m³/h]	Pressure loss Δp at Q3 [bar]	Connection on meter	Length [mm]
021-46-C0A8XX	1.6	10	2.0	160	2	4.6	0.25	G3/4B	110
021-46-C0D8XX	2.5	10	3.1	250	2	4.6	0.55	G3/4B	110
021-46-C0G8XX	2.5	10	3.1	250	2	4.6	0.55	G1B	105
021-46-C0H8XX	2.5	10	3.1	250	2	4.6	0.55	G1B	130
021-46-C0E8XX	2.5	10	3.1	250	2	4.6	0.55	G1B	190
021-46-C0L8XX	4.0	16	5	250	3.2	8.5	0.38	G1B	130
021-46-C0N8XX	4.0	16	5	250	3.2	8.5	0.38	G1B	190

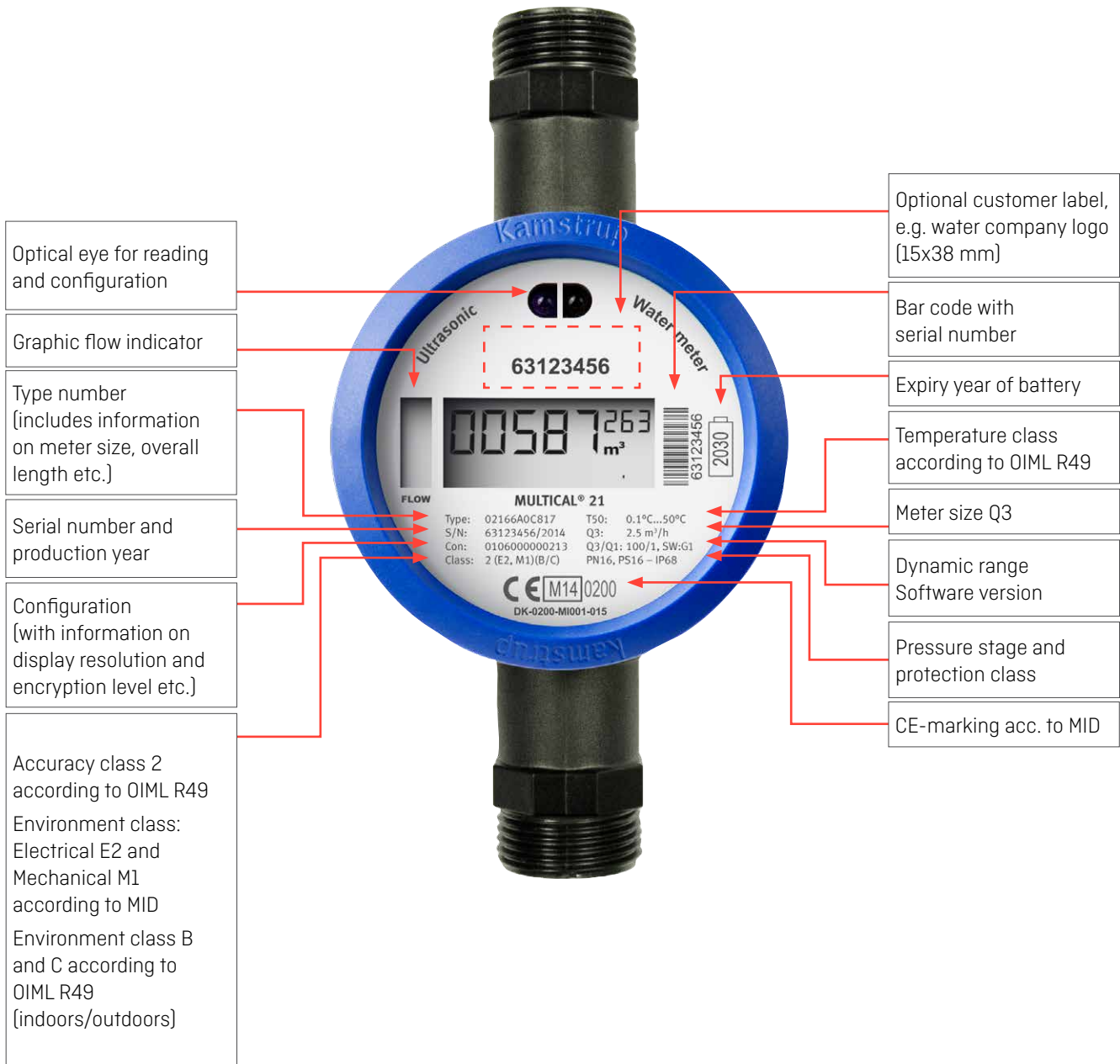The meter is available in versions for cold and hot water. The choice is controlled by the type number's country code, which is 8XX for cold water and 7XX for hot water.

Different extension pipes can be enclosed as accessories. These extension pipes make it possible to adjust the meter to most existing current overall lengths. (See Accessories for Water Meters: 5810-1270)

MULTICAL® 21

Meter details

Meter information in permanent laser engraved text.

Optical eye for reading and configuration

Graphic flow indicator

Type number (includes information on meter size, overall length etc.)

Serial number and production year

Configuration (with information on display resolution and encryption level etc.)

Accuracy class 2 according to OIML R49

Environment class: Electrical E2 and Mechanical M1 according to MID

Environment class B and C according to OIML R49 (indoors/outdoors)

Optional customer label, e.g. water company logo (15x38 mm)

Bar code with serial number

Expiry year of battery

Temperature class according to OIML R49

Meter size Q3

Dynamic range Software version

Pressure stage and protection class

CE-marking acc. to MID

63123456

00587²⁶³ m³

FLOW

MULTICAL® 21

Type:	02166A0C817	T50:	0.1°C...50°C
S/N:	63123456/2014	Q3:	2.5 m³/h
Con:	0106000000213	Q3/Q1: 100/1, SW:G1
Class:	2 (E2, M1)(B/C)	PN16, PS16 – IP68

CE M14 0200
DK-0200-MI001-015

Display and info codes

MULTICAL® 21 can be read from the large, easily readable, specially designed display. The five large figures indicate number of cubic meters. The three small figures are decimals. The sign L (to the right of m³) will always be off when the meter is in operation as it is solely used during factory control and verification of the meter. The flow arrows in the left side of the display indicate water flow through the meter. If there is no flow, all arrows will be off.

The info codes in the display have the following meaning and function:

Info code flashes in the display	Meaning
LEAK	The water in the meter has not been stagnant for one continuous hour during the latest 24 hours.
	This can be a sign of a leaky faucet or toilet cistern.
BURST	The water consumption has been consistently high for half an hour, which indicates a pipe burst.
TAMPER	Attempt of fraud. The meter is no longer valid for billing.
DRY	The meter is not water-filled. In this case nothing will be measured.
REVERSE	The water flows through the meter in the wrong direction.
RADIO OFF	The meter is still in transport mode with the built-in radio transmitter turned off. The transmitter turns on automatically when the first litre of water has run through the meter.
■■ (two squared 'dots')	Two small squares flashing alternately indicate that the meter is active.
'A' followed by a number	IIndicates the number of metrologic changes the meter has gone through after factory verification. If no adjustments have been made both the 'A' symbol and the digit are inactive.

Info codes 'LEAK', 'BURST', 'DRY' and 'REVERSE' switch off automatically, when the conditions that activated them no longer exist. In other words, LEAK disappears when the water has been stagnant for an hour, BURST disappears when the consumption falls to normal level, REVERSE disappears when the water no longer flows in the wrong direction, and DRY disappears when the meter is filled with water.

Measurement of temperatures

Temperature monitoring

MULTICAL® 21 measures water and ambient temperatures respectively.

The measurements can be used to monitor the installation and to give an indication of the quality of the water.

Both temperatures are logged in the daily and monthly records.

Minimum, mean and maximum values are being registered daily. The register contains the last 460 days.

The first day of each month minimum, maximum and mean temperatures are stored in the register. The register contains the last 36 months.

Temperature values are referred to in °C and can be read via the optical eye and sent by the Wireless M-Bus radio signal. Optional temperature combinations in the radio package are described in the section *'Optional registers in data logger'.*

Ambient temperatures

Monitoring the ambient temperature of the installation can be used as a warning of freezing temperatures or unintended high temperatures. The measurement in the meter housing corresponds to the ambient temperature where the meter is installed. The temperature is measured every minute. The calculation of maximum and minimum values is based on a two-minute averaging value. The mean temperature is a time-weighted average value.

Water temperatures

Water temperature is measured as an indirect measurement of the water using the ultrasound signal. The water temperature is measured every 32 seconds.

The maximum and minimum values are calculated every 2 minutes based on an average since the latest calculation. Measurement of water temperature requires that the meter is filled with water. If there is no water in the meter a code will be saved, saying that the meter is not water filled.

During periods of very low water consumption the water temperature approaches the ambient temperature. To give a correct indication of average water temperature this value is a volume weigthed average. During periods without water flow the weighted average cannot be calculated and then a code is stored.

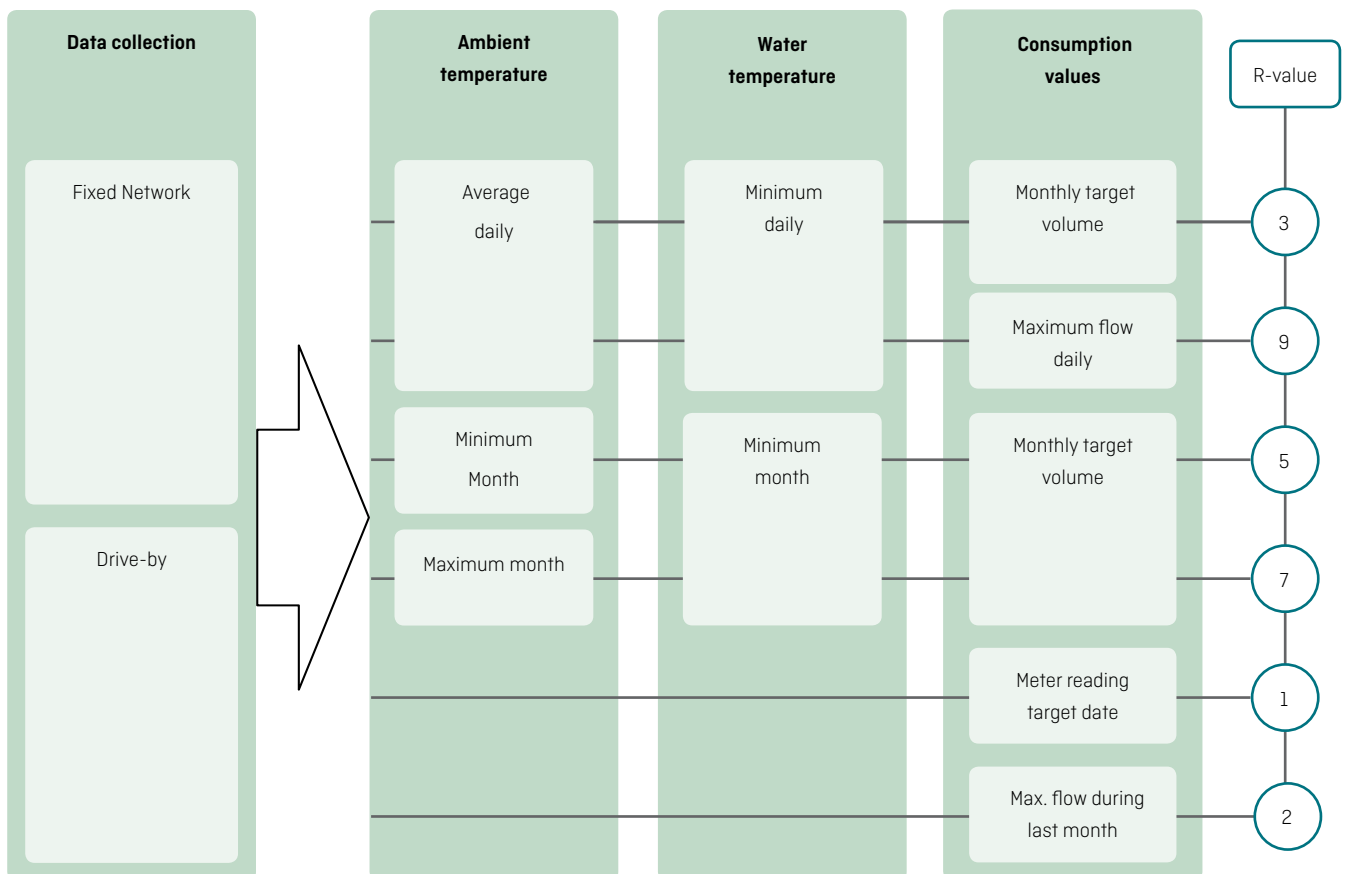## Measurement of temperatures

Consumption values
Besides readout of the current totally registered water use the meter saves a number of other consumption data.

Following values are stored:

- Target Volume - i.e. meter reading the first day of the month
- Maximum flow - daily
- Maximum flow - monthly
- Selected values of water temperatures and ambient temperatures.

Optional registers in data logger
Some of the data sent via the Wireless M-Bus radio is optional. It is possible to select one data package; content is illustrated below. The choices are determined by means of the selected R-value when ordering a water meter – as shown to the right in the figure.

Data collection	Ambient temperature	Water temperature	Consumption values	R-value
Fixed Network	Average daily	Minimum daily	Monthly target volume	3
			Maximum flow daily	9
	Minimum Month	Minimum month	Monthly target volume	5
Drive-by	Maximum month			7
			Meter reading target date	1
			Max. flow during last month	2

MULTICAL® 21

Wireless M-Bus
– wireless radio communication

MULTICAL® 21 communicates via built-in Wireless M-Bus. which gives access to quick and easy wireless reading of the meter.

The meter has a long range antenna. Via Wireless M-Bus a data package is transmitted every 16 or 96 seconds – according to the selected radio package.

The options are 'Drive-by' or 'Fixed network'.

When sending a data package every 16 seconds the package is kept short and compressed to achieve a long battery life. At 96 second intervals, a longer and intelligent radio package with built-in 'repair coding' is sent – the long battery life is still guaranteed since the transmission interval is increased.

The following details are transmitted:

• Current meter reading

• Optional register combination of:
  Target volume – monthly / max. flow / water and ambient temperatures

• List of active info codes

• List of info codes which have been active within the latest 30 days.

The list of info codes which have been active also includes information on how long they have been active.

Wireless M-Bus is an open standard, which means that MULTICAL® 21 can be configurered with or without encryption of the Wireless M-Bus signal.

Encryption protects personal data against unauthorised monitoring. Furthermore, the encryption file provides easy access to import of meter data into reading programs.

Kamstrup A/S recommends encryption.

MULTICAL® 21 can be read by using for example the 'READy' – Kamstrup's mobile Android app – which is ideal for 'walk-by' and 'drive-by' reading.

To the right are previews of how a reading may appear on the user's smart phone.
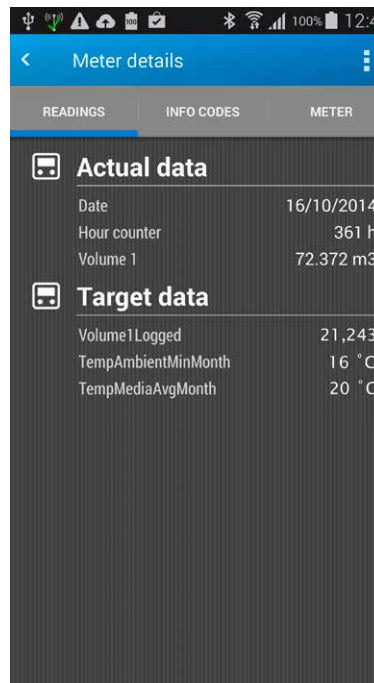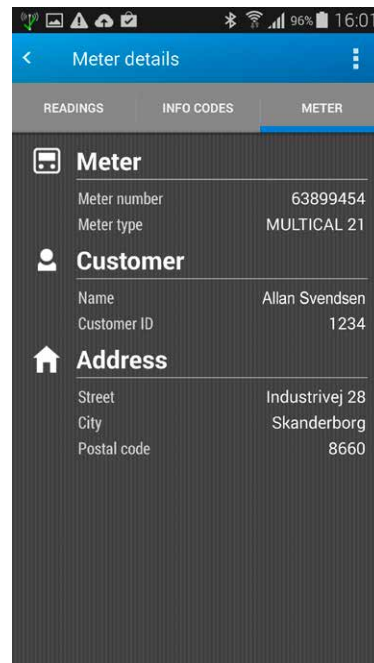
Wireless M-Bus
– wireless radio communication

Below an example of the graphics from the READy Manager program on the PC.

Data registers

MULTICAL® 21 has a permanent memory (EEPROM), in which
the values of various data loggers are saved.

The meter includes the following registers:

Data logging interval	Data logging depth	Logged value
Monthly logger	36 months	See table below
Daily logger	460 days	See table below
Info logger	50 events	Info code, meter reading and date

It is always possible to read target volume and info codes for
each of the latest 36 months as well as corresponding meter
reading and possible info codes for each of the latest 460
days. The loggers can only be read via the meter's optical eye.

The following registers are logged:

The monthly logger is written on the first day of the month,
the daily logger is written at midnight.

Register type	Description	Monthly logger. 36 months	Daily logger. 460 days
Date (YY.MM.DD)	Logging time, year, month and day	•	•
Volume	Current meter reading (legal)	•	•
Operating hour counter	Accumulated number of operating hours	•	•
Info	Information code	•	•
Vol Reverse	Volume during reverse flow	•	–
Date of max. flow	Date stamp of max. flow during period	•	–
Max flow	Value of max. flow during period	•	•
Date of min. flow	Date stamp of min. flow during period	•	–
Min. flow	Value of min. flow during period	•	•
Min. temp water	Water temperature – minimum	•	•
Max. temp. water	Water temperature – maximum	•	•
Mean temp. water	Volume weighted mean water temp.	•	•
Min. temp.	Meter temperature – minimum	•	•
Max. temp.	Meter temperature – maximum	•	•
Mean temp.	Meter temp. – time weighted average	•	•

Every time the information code changes, date and info
codes are logged. Thus, it is possible to data read the latest
50 changes of the information code as well as the date the
change was made. Reading is only possible via the optical
eye.

Pressure loss

According to OIML R49 the maximum pressure loss must not exceed 0.63 bar (0.063 MPa) in the range Q1 to Q3.
The pressure loss in a meter increases with the square of the flow and can be stated as:
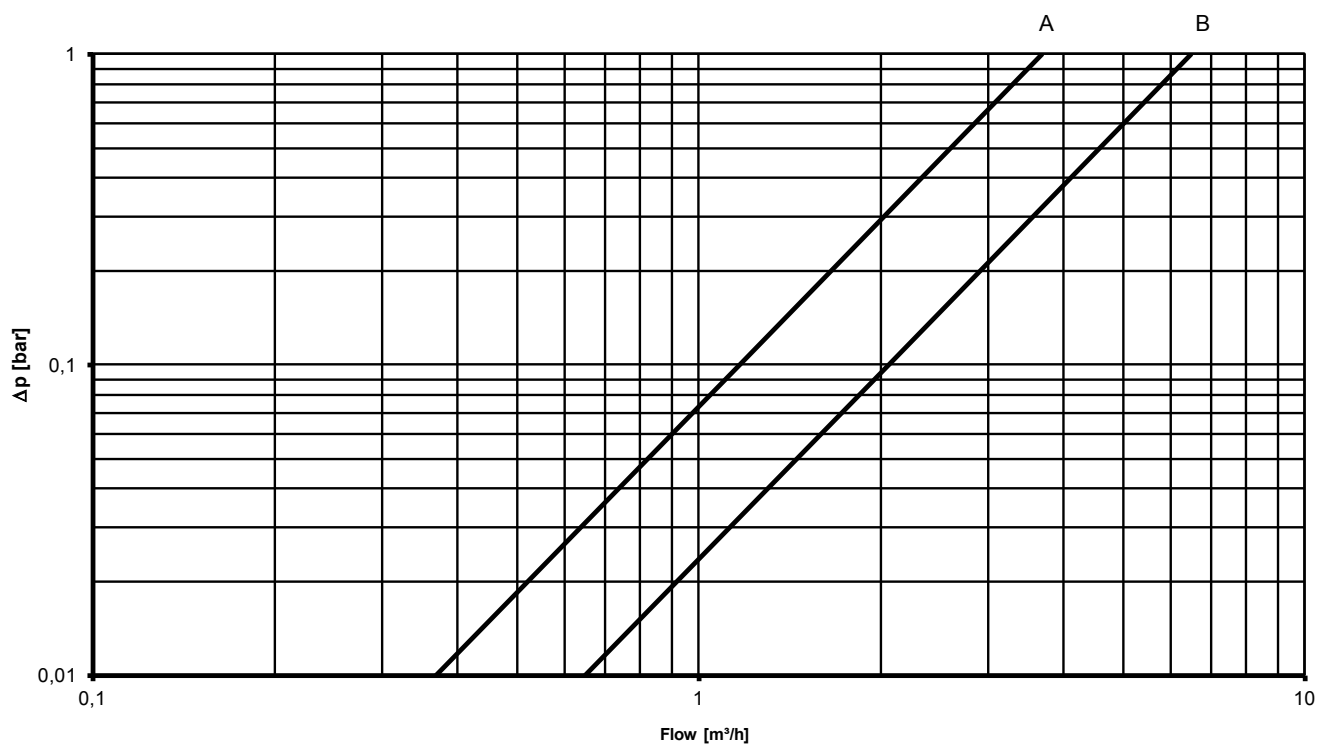
$$Q = k_v \times \sqrt{\Delta p}$$

where:

Q = volume flow rate [m³/h]

k_v = volume flow rate at 1 bar pressure loss

Δp = pressure loss [bar]

Graph	Q3 [m³/h]	Nom. diameter [mm]	k_v	Q at 0.63 bar [m³/h]
A	1.6 & 2.5	DN15 & DN20	3.4	2.7
B	4.0	DN20	6.5	5.1

Δp MULTICAL® 21

Ordering details

An order is initiated by stating the type number of the selected model of MULTICAL® 21.
The type number includes information on meter type - cold or hot water, meter size, overall length, battery life, country code etc.

Some of the features included in the type number cannot be changed.

Subsequently, the meter configuration, which determines customer specific requirements such as number of digits in display etc., is selected. The configuration is completed during programming of the finished meter.

Finally, required accessories, if any, in the form of gaskets, different extension pipes, non-return valve, strainer and standard couplings are selected.

Accessories are enclosed separately to be mounted by the installer.

MULTICAL® 21			Type 021	□ □	□	□	□	□ □
Communication								
Wireless M-Bus. 868 MHz. mode C1, ver. 2				46				
Wireless M-Bus. 868 MHz. mode T1 - OMS, ver. 2 *)				47				
*) *only for selected markets*								
Supply								
16 years' battery life					C			
Meter size								
Q3 [m³/h]	Connection	Length [mm]						
1.6	G¾B (R½)	110				A		
2.5	G¾B (R½)	110				D		
2.5	G1B (R¾)	105				G		
2.5	G1B (R¾)	130				H		
2.5	G1B (R¾)	190				E		
4.0	G1B (R¾)	130				L		
4.0	G1B(R¾)	190				N		
Meter type								
Hot water meter							7	
Cold water meter							8	
Country code (language on label etc.)								XX

The country code is used for:

• Language and approval on type label

• Temperature class of water meter. cold water (T30 and T50) or hot water (T70 and T30/70)

Configuration

	KK	LLL	MMM	N	P	R	S	T
Target date (fixed)	01							
Average time of max. values								
2 minutes		002						
Customer label 2005-MMM			MMM					
Leakage message limit								
OFF				0				
Flow continuously > 0.5 % of Q3				1				
Flow continuously > 1.0 % of Q3				2				
Flow continuously > 2.0 % of Q3				3				
Flow continuously > 0.25 % of Q3				4				
Flow continuously > 0.1 % of Q3				5				
Pipe burst limit								
OFF					0			
Flow > 5 % of Q3 for 30 minutes					1			
Flow > 10 % of Q3 for 30 minutes					2			
Flow > 20 % of Q3 for 30 minutes					3			
Optional register in data logger * Recommended for 'Drive-by' ** Recommended for 'Fixed Network'								
Meter reading target date						1		
Max. flow during last month						2		
Monthly target volume / Min.temp.water - daily / Time weighted average temp. meter - daily **						3		
Monthly max. flow / Average temp.water - daily / Time weighted average temp. meter-daily **						4		
Monthly target volume / Min. water Temperature - Monthly / Min. temp. meter - latest month *						5		
Monthly target volume / Min. water Temperature - Monthly / Max. temp. meter - latest month *						7		
Daily max. flow / Min.temp.water-daily / Time weighted average temp. meter- daily **						9		
Display resolution								
00001 m³							0	
00000.1 m³							1	
00000.01 m³							2	
00000.001 m³							3	
Encryption level								
No encryption								0
Utility encryption (only available for selected markets)								2
Encryption with separately forwarded key								3

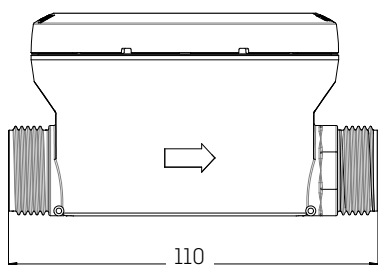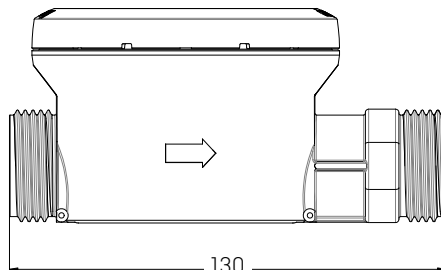| *Unless otherwise stated in the order.* *Kamstrup supplies the following:*	01	002	000	1	3	5	3	3

MULTICAL® 21

Dimensioned sketches

Type A and D – G3/4B x 110 mm

110
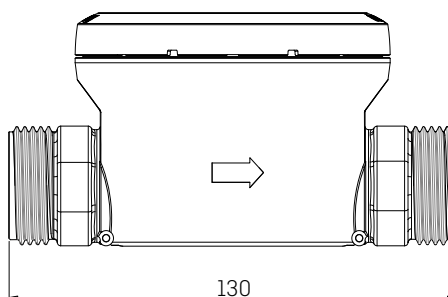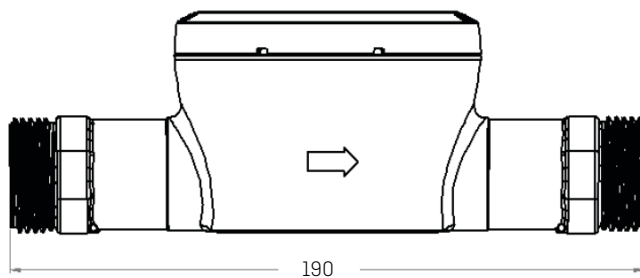
Type H – G1B x 130 mm

130

Type G – G1B x 105 mm

105

Type L – G1B x 130 mm

130
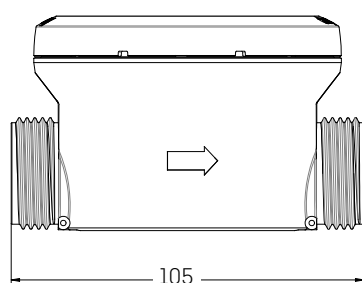
Type E and N – G1B x 190 mm

190

Accessories

See Accessories for Water Meters: 5810-1270-GB

Think forward