DIEHL
Metering

HYDRUS 2.0

Ultrasonic Water Meter type 173
FW 2.1.10/3.2.10/5.3.8

User guide

Diese Anleitung ist dem Endkunden auszuhändigen.
This guide must be given to the end consumer.
Ce guide doit être donné au client final.
Esta guía se debe dar al cliente final.

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1 PRODUCT DESCRIPTION

1.1 GENERAL APPLICATION

HYDRUS 2.0 is a static ultrasonic water meter approved in accordance with EN 14154, EN 4064 and OIML R49 standards. It has a MID certification and complies with the sanitary standards applying to material in contact with water. It is a certified precision measuring device for billing that must be handled with care.

1.2 METROLOGICAL FEATURES

HYDRUS 2.0 has been manufactured with care to ensure high precision and reduced standard deviation. It is MID approved up to R=800.

DN15-20 – Brass version

Nominal diameter	DN	mm	15	15	15	15	15[3]	15
Permanent flow rate	Q_3	m³/h	1.6	1.6	1.6	2.5	2.5	2.5
Overall length	L	mm	110	165	170	110	115	165
Dynamic (Q_3/Q_1)	R		400	400	400	800	800	800
Overload flow rate	Q_4	m³/h	2	2	2	3.125	3.125	3.125
Transitional flow rate	Q_2	l/h	6.4	6.4	6.4	5	5	5
Minimum flow rate	Q_1	l/h	4	4	4	3.13	3.13	3.13
Starting flow rate		l/h	1.4	1.4	1.4	1.4	1.4	1.4
Pressure loss at Q_3		bar	0.19	0.19	0.19	0.46	0.46	0.46
Pressure loss at Q_4		bar	0.3	0.3	0.3	0.72	0.72	0.72
Maximum flow rate[2]	Q_{high}	m³/h	2.8	2.8	2.8	4.37	4.37	4.37
Flow rate at ΔP = 1 bar			3.67	3.67	3.67	3.69	3.69	3.69

Nominal diameter	DN	mm	15	20	20	20	20	20
Permanent flow rate	Q_3	m³/h	2.5	2.5	2.5	2.5	4	4
Overall length	L	mm	170	115	130	190	105	115
Dynamic (Q_3/Q_1)	R		800	400	800	800	400	630
Overload flow rate	Q_4	m³/h	3.125	3.125	3.125	3.125	5	5
Transitional flow rate	Q_2	l/h	5	10	5	5	16	10
Minimum flow rate	Q_1	l/h	3.13	6.25	3.13	3.13	10	6.3
Starting flow rate		l/h	1.4	1.4	1.4	1.4	3.0	3.0
Pressure loss at Q_3		bar	0.46	0.4	0.4	0.4	0.55	0.55
Pressure loss at Q_4		bar	0.72	0.63	0.63	0.63	0.86	0.86
Maximum flow rate[2]	Q_{high}	m³/h	4.37	4.37	4.37	4.37	7	7
Flow rate at ΔP = 1 bar			3.69	3.95	3.95	3.95	5.39	5.39

Nominal diameter	DN	mm	20	20	20	20	20
Permanent flow rate	Q_3	m³/h	4	4	4	4	4
Overall length	L	mm	130	165	175	190	220
Dynamic (Q_3/Q_1)	R		800	800	800	800	800
Overload flow rate	Q_4	m³/h	5	5	5	5	5
Transitional flow rate	Q_2	l/h	8	8	8	8	8
Minimum flow rate	Q_1	l/h	5	5	5	5	5
Starting flow rate		l/h	2.5	2.5	2.5	2.5	2.5
Pressure loss at Q_3		bar	0.4	0.4	0.4	0.4	0.4
Pressure loss at Q_4		bar	0.63	0.63	0.63	0.63	0.63
Maximum flow rate[2]	Q_{high}	m³/h	7	7	7	7	7
Flow rate at ΔP = 1 bar			5.39	5.39	5.39	5.39	5.39

[2] Outlet pressure minimum 3 bar, maximum 100 hours per year, closed pipeline network
[3] Please see table DIMENSIONS

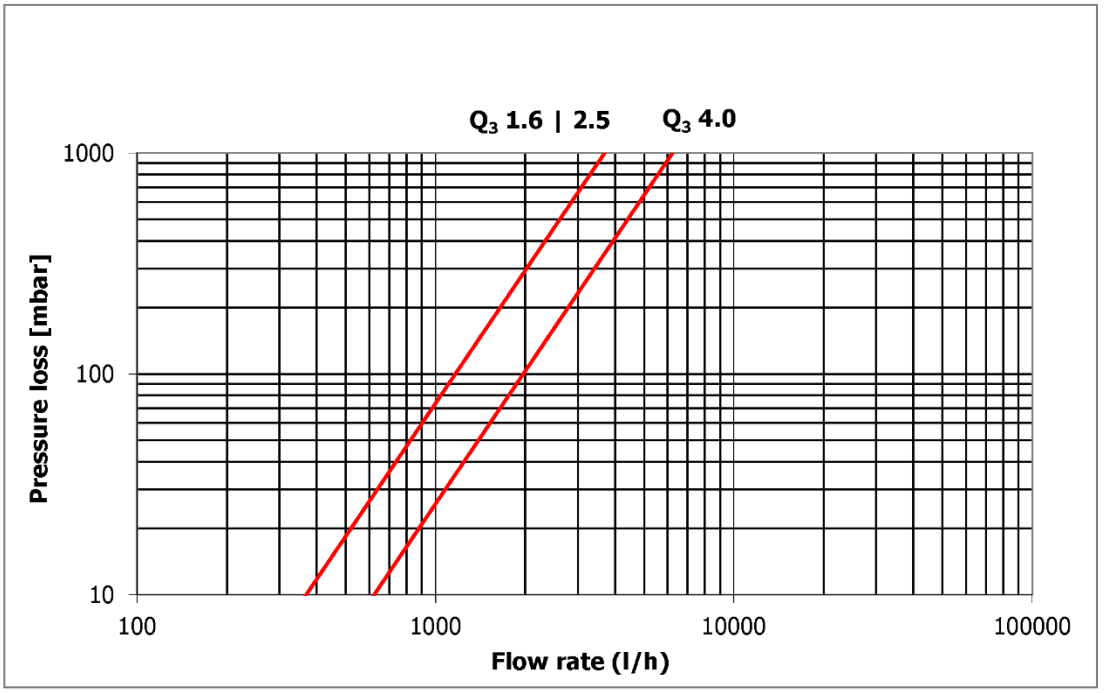
DN15-20 – Composite version

Nominal diameter	DN	mm	15	15	15	15	15[3]
Permanent flow rate	Q_3	m³/h	1.6	1.6	1.6	2.5	2.5
Overall length	L	mm	110	165	170	110	115
Dynamic (Q_3/Q_1)	R		400	400	400	800	800
Overload flow rate	Q_4	m³/h	2	2	2	3.125	3.125
Transitional flow rate	Q_2	l/h	6.4	6.4	6.4	5	5
Minimum flow rate	Q_1	l/h	4	4	4	3.13	3.13
Starting flow rate		l/h	1.4	1.4	1.4	1.4	1.4
Pressure loss at Q_3		bar	0.19	0.19	0.19	0.46	0.46
Pressure loss at Q_4		bar	0.3	0.3	0.3	0.72	0.72
Maximum flow rate[2]	Q_{high}	m³/h	2.8	2.8	2.8	4.37	4.37
Flow rate at ΔP = 1 bar			3.67	3.67	3.67	3.69	3.69

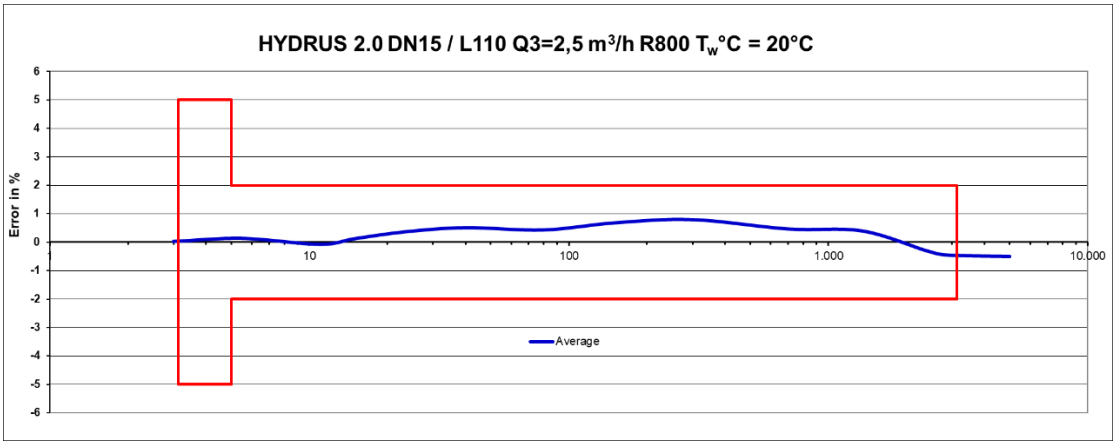
Nominal diameter	DN	mm	15	15	20	20
Permanent flow rate	Q_3	m³/h	2.5	2.5	2.5	4
Overall length	L	mm	165	170	190	190
Dynamic (Q_3/Q_1)	R		800	800	800	800
Overload flow rate	Q_4	m³/h	3.125	3.125	3.125	5
Transitional flow rate	Q_2	l/h	5	5	5	8
Minimum flow rate	Q_1	l/h	3.13	3.13	3.13	5
Starting flow rate		l/h	1.4	1.4	1.4	2.5
Pressure loss at Q_3		bar	0.46	0.46	0.4	0.4
Pressure loss at Q_4		bar	0.72	0.72	0.63	0.63
Maximum flow rate[2]	Q_{high}	m³/h	4.37	4.37	4.37	7
Flow rate at ΔP = 1 bar			3.69	3.69	3.95	5.39

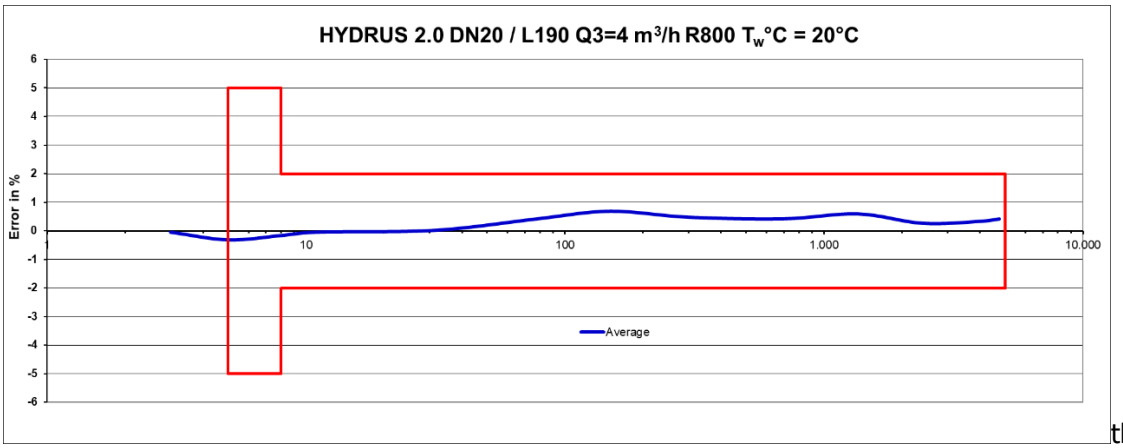
[2] Outlet pressure minimum 3 bar, maximum 100 hours per year, closed pipeline network
[3] Please see table DIMENSIONS

Pressure loss graph DN15/DN20



Metrological curve DN15/DN20





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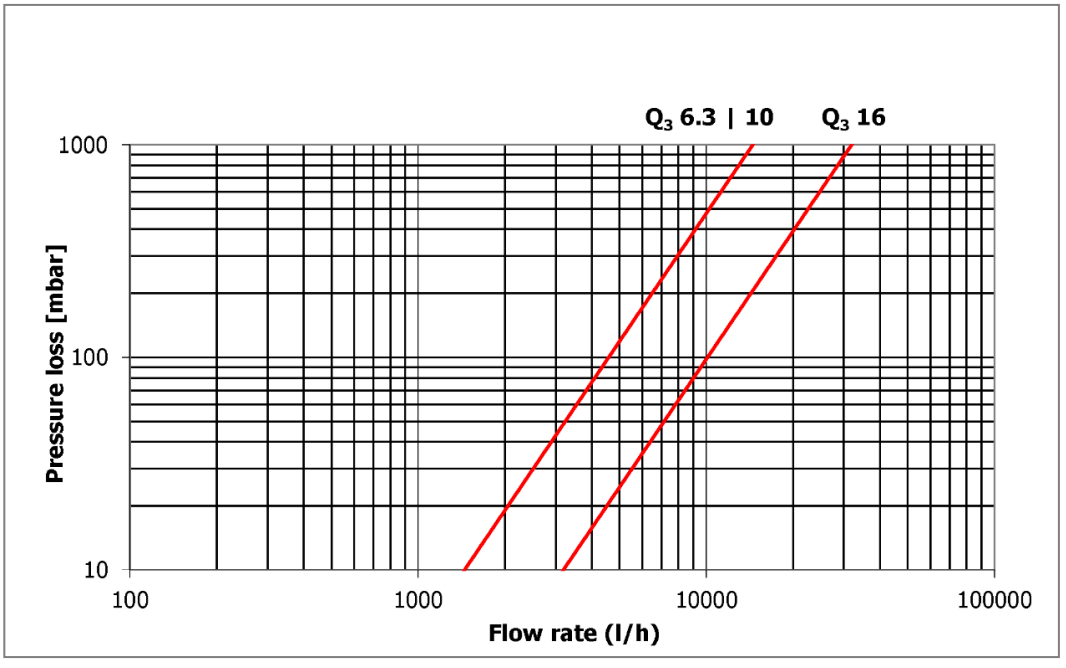
DN25-50 – Brass version

Nominal diameter	DN	mm	25	25	25	25	25	25	25	32
Permanent flow rate	Q_3	m³/h	6.3	6.3	6.3	6.3	10	10	10	10
Overall length	L	mm	135	150	175	260	150	175	260	260
Dynamic (Q_3/Q_1)	R		400	400	400	400	800	800	800	800
Overload flow rate	Q_4	m³/h	7.87	7.87	7.87	7.87	12.5	12.5	12.5	12.5
Transitional flow rate	Q_2	l/h	25.2	25.2	25.2	25.2	20	20	20	20
Minimum flow rate	Q_1	l/h	15.8	15.8	15.8	15.8	12.5	12.5	12.5	12.5
Starting flow rate		l/h	5	5	5	5	5	5	5	5
Pressure loss at Q_3		bar	0.22	0.22	0.22	0.22	0.54	0.54	0.54	0.54
Pressure loss at Q_4		bar	0.34	0.34	0.34	0.34	0.84	0.84	0.84	0.84
Maximum flow rate[2]	Q_{high}	m³/h	11.02	11.02	11.02	11.02	17.5	17.5	17.5	17.5
Flow rate at ΔP = 1 bar			13.43	13.43	13.43	13.43	13.43	13.43	13.43	13.43

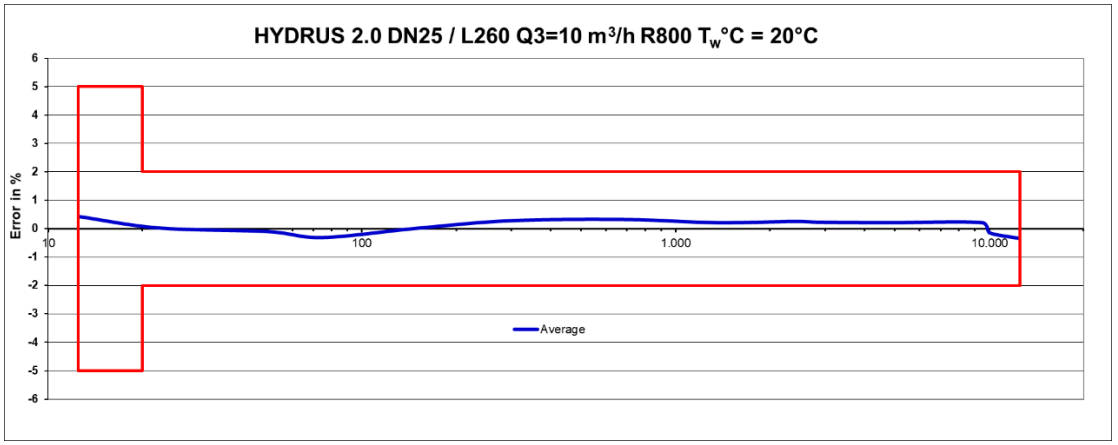
Nominal diameter	DN	mm	40	40	40	40	50	50	50	50
Permanent flow rate	Q_3	m³/h	10	10	16	16	16	16	25	25
Overall length	L	mm	200	300	200	300	270	300	270	300
Dynamic (Q_3/Q_1)	R		400	400	800	800	250	250	400	400
Overload flow rate	Q_4	m³/h	12.5	12.5	20	20	20	20	31.25	31.25
Transitional flow rate	Q_2	l/h	40	40	32	32	102	102	100	100
Minimum flow rate	Q_1	l/h	25	25	20	20	64	64	62.5	62.5
Starting flow rate		l/h	8.7	8.7	8.7	8.7	25	25	25	25
Pressure loss at Q_3		bar	0.22	0.22	0.5	0.5	0.1	0.1	0.25	0.25
Pressure loss at Q_4		bar	0.34	0.34	0.78	0.78	0.19	0.19	0.45	0.45
Maximum flow rate[2]	Q_{high}	m³/h	17.5	17.5	28	28	32.13	32.13	32.13	32.13
Flow rate at ΔP = 1 bar			21.32	21.32	22.63	22.63	46.0	46.0	46.0	46.0

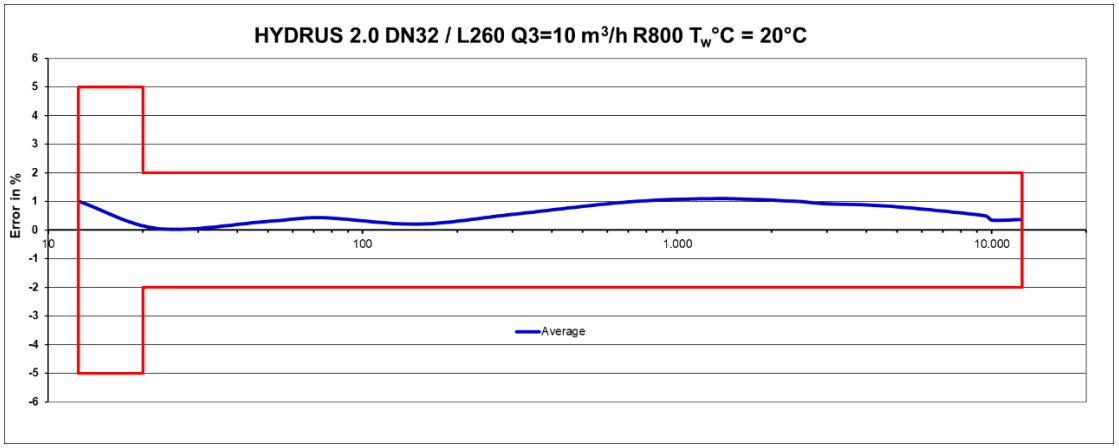
[2] Outlet pressure minimum 3 bar, maximum 100 hours per year, closed pipeline network

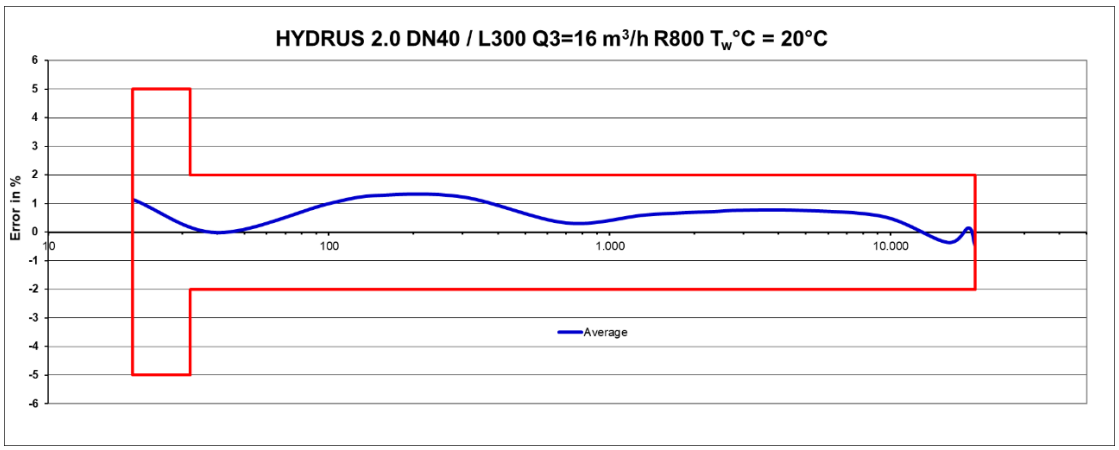
Pressure loss graph DN25/DN32/DN40



Metrological curve DN25/DN32/DN40





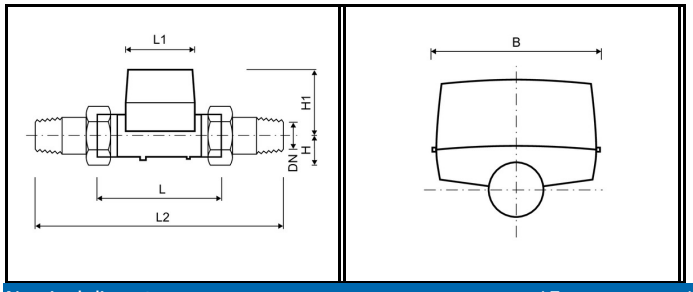


1.3 TECHNICAL DATA

Body	Threaded bodies: Lead free brass – CUPHIN or Composite Flanged bodies: Brass
Temperatures	Water temperature: +0.1 … +90°C Operating ambient temperature: -10 … +55°C Storage temperature: -10 … +70°C (>35°C max. 4 weeks)
Protection class	IP 68
Frost protection	Protect the meter from frost by completely draining all the water it contains. Shut the valve upstream the meter and purge the circuit.
Filtration	A filter must be installed in the inlet pipe, if the water contains particles.
Static pressure	Nominal pressure: 16 bar max.
Sudden influx of water	The meter must be protected against pressure surges in the pipe.
Endurance	Compliant with the MID regulatory tests. Resistance: 1,000 hours at Q_4.
Enhanced flow characteristic	Resistance to a flow rate of 2 x Q_4 for 2 hours without damage to its parts.
Fraud resistance	The meter retains visible traces of fraud attempts: • Broken seals • Cut wires -> which would lead to an immediate notification via the communication interfaces.
Communication	
Communication interfaces	• Optical (standard) • Radio 434/868 MHz • Radio 868 MHz/L-Bus/Pulse • Radio 434 MHz/L-Bus/Pulse • M-Bus • Pulse/Pulse (3- or 4-wire) • M-Bus/Pulse/Pulse • LoRaWAN/wMBus 868 MHz For communication interface descriptions please contact your Sales Representative or visit our Diehl Metering website: https://www.diehl.com/metering/customer-portal/en/login/
Communication protocol	Refer to the "communication interface descriptions" guide.
Frequency	434 / 868 MHz
Frequency modulation	FSK
Standards	EN 300 220, EN 13757-3/-4, RED directive
Battery	2x fixed lithium batteries 3.6 V
Battery lifetime	Up to 16 years (under standard conditions of use and temperature; theoretical lifetime not guaranteed).

1.4 DIMENSIONS

Dimensions DN15/DN20 - Brass version



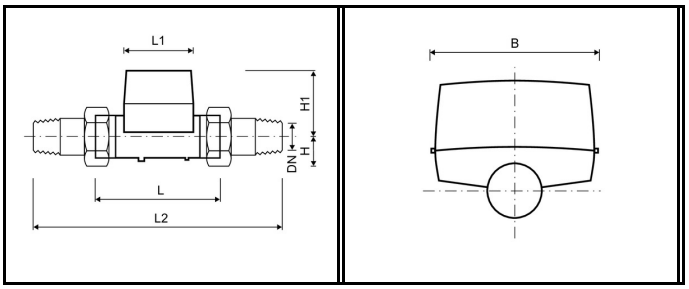
Nominal diameter	DN	mm	15	15	15	15	15[3]	15
Permanent flow rate	Q_3	m³/h	1.6	1.6	1.6	2.5	2.5	2.5
Overall length	L	mm	110	165	170	110	115	165
Counter length	L1	mm	89	89	89	89	89	89
Counter width	B	mm	89	89	89	89	89	89
Overall length with coupling	L2	mm	190	245	250	190	195	245
Connection thread on meter		Inch	G¾B	G¾B	G¾B	G¾B	G¾B	G¾B
Connection thread of coupling		Inch	R½	R½	R½	R½	R½	R½
Height	H1	mm	71	71	71	71	71	71
Weight without coupling (approx.)		kg	0.7	0.8	0.8	0.7	0.7	0.8
Weight with coupling (approx.)		kg	1.1	1.2	1.2	1.1	1.1	1.2
Height	H	mm	18	18	18	18	18	18

Nominal diameter	DN	mm	15	20	20	20	20	20
Permanent flow rate	Q_3	m³/h	2.5	2.5	2.5	2.5	4	4
Overall length	L	mm	170	115	130	190	105	115
Counter length	L1	mm	89	89	89	89	89	89
Counter width	B	mm	89	89	89	89	89	89
Overall length with coupling	L2	mm	250	215	230	290	205	215
Connection thread on meter		Inch	G¾B	G1B	G1B	G1B	G1B	G1B
Connection thread of coupling		Inch	R½	R¾	R¾	R¾	R¾[4]	R¾[4]
Height	H1	mm	71	74	74	74	74	74
Weight without coupling (approx.)		kg	0.8	0.8	0.8	0.9	0.8	0.8
Weight with coupling (approx.)		kg	1.2	1.2	1.2	1.3	1.2	1.2
Height	H	mm	18	21	21	21	21	21

Nominal diameter	DN	mm	20	20	20	20	20	
Permanent flow rate	Q_3	m³/h	4	4	4	4	4	
Overall length	L	mm	130	165	175	190	220	
Counter length	L1	mm	89	89	89	89	89	
Counter width	B	mm	89	89	89	89	89	
Overall length with coupling	L2	mm	230	295	295	290	320	
Connection thread on meter		Inch	G1B	G1¼B	G1¼B	G1B	G1B	
Connection thread of coupling		Inch	R¾	R1	R1	R¾	R¾	
Height	H1	mm	74	74	74	74	74	
Weight without coupling (approx.)		kg	0.8	1.0	1.0	0.9	1.2	
Weight with coupling (approx.)		kg	1.2	1.6	1.6	1.3	1.4	
Height	H	mm	21	27	27	21	21	

[3] Further versions with connection thread on meter inlet G7/8B and meter outlet G¾B on request.
[4] Wrench size should not be bigger than 38 mm

Dimensions DN15/DN20 - composite version

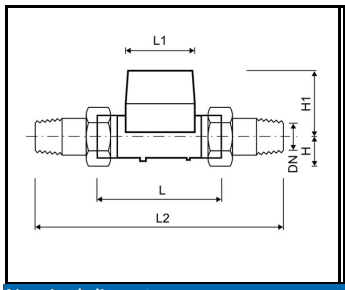


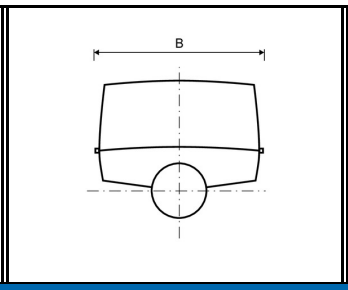
Nominal diameter	DN	mm	15	15	15	15	15[3]
Permanent flow rate	Q_3	m³/h	1.6	1.6	1.6	2.5	2.5
Overall length	L	mm	110	165	170	110	115
Counter length	L1	mm	89	89	89	89	89
Counter width	B	mm	89	89	89	89	89
Overall length with coupling	L2	mm	190	250	250	190	195
Connection thread on meter		Inch	G¾B	G¾B	G¾B	G¾B	G¾B
Connection thread of coupling		Inch	R½	R½	R½	R½	R½
Height	H1	mm	71	71	71	71	71
Weight without coupling (approx.)		kg	0.5	0.6	0.6	0.5	0.5
Weight with coupling (approx.)		kg	0.9	1.0	1.0	0.9	0.9
Height	H	mm	18	18	18	18	18

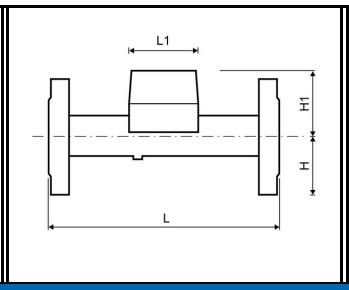
Nominal diameter	DN	mm	15	15	20	20
Permanent flow rate	Q_3	m³/h	2.5	2.5	2.5	4
Overall length	L	mm	165	170	190	190
Counter length	L1	mm	89	89	89	89
Counter width	B	mm	89	89	89	89
Overall length with coupling	L2	mm	245	250	290	290
Connection thread on meter		Inch	G¾B	G¾B	G1B	G1B
Connection thread of coupling		Inch	R½	R½	R¾	R¾
Height	H1	mm	71	71	74	74
Weight without coupling (approx.)		kg	0.6	0.6	0.6	0.6
Weight with coupling (approx.)		kg	1.0	1.0	1.0	1.0
Height	H	mm	18	18	21	21

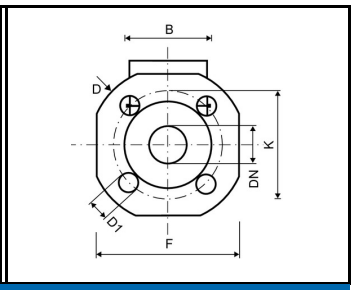
[3] Further version with connection thread on meter inlet G7/8B and meter outlet G3/4B on request.
[4] Wrench size should not be bigger than 38 mm

Dimensions DN25/DN32/DN40/DN50



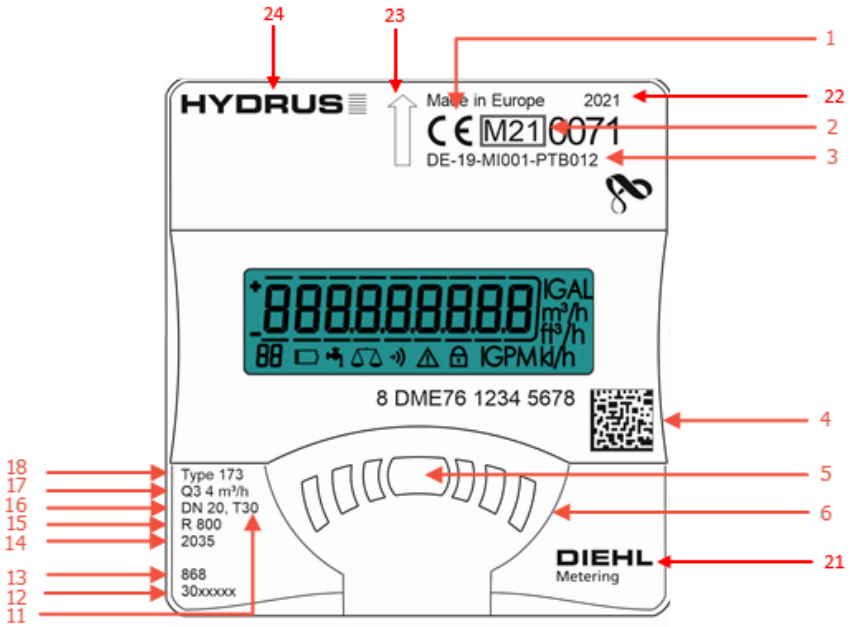


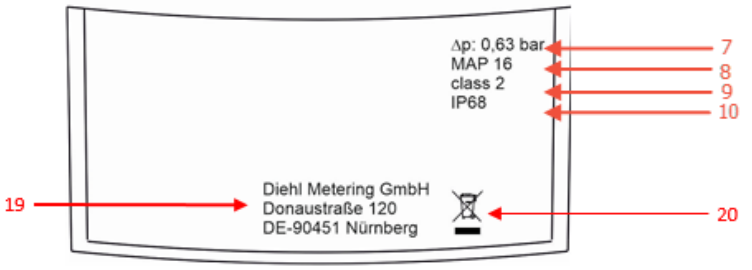




Nominal diameter	DN	mm	25	25	25	25	25	25	25	32
Permanent flow rate	Q_3	m³/h	6.3	6.3	6.3	6.3	10	10	10	10
Overall length	L	mm	135	150	175	260	150	175	260	260
Counter length	L1	mm	89	89	89	89	89	89	89	89
Counter width	B	mm	89	89	89	89	89	89	89	89
DIMENSIONS - THREAD			.	.	.	.	.	.	.	.
Overall length with coupling	L2	mm	255	270	295	380	270	295	380	380
Connection thread on meter		Inch	G1¼B	G1¼B	G1¼B	G1¼B	G1¼B	G1¼B	G1¼B	G1½B
Connection thread of coupling		Inch	R1	R1	R1	R1	R1	R1	R1	R1¼
Height	H1	mm	78	78	78	78	78	78	78	78
Weight without coupling (approx.)		kg	1.0	1.0	1.1	1.4	1.0	1.4	1.4	1.5
Weight with coupling (approx.)		kg	1.6	1.6	1.7	2.0	1.6	2.0	2.0	2.1
Height	H	mm	27	27	27	27	27	27	27	30
DIMENSIONS - FLANGE			.	.	.	.	.	.	.	.
Flange diameter	D	mm	-	-	-	115	-	-	115	140
Hole circle diameter	K	mm	-	-	-	85	-	-	85	100
Number of screw holes		pcs	-	-	-	4	-	-	4	4
Screw hole diameter	D1	mm	-	-	-	14	-	-	14	18
Height	H	mm	-	-	-	50	-	-	50	62.5
Height	H1	mm	-	-	-	84	-	-	84	84
Width	F	mm	-	-	-	100	-	-	100	125
Weight with flanges (approx.)		kg	-	-	-	3.4	-	-	3.4	4.6
Nominal diameter	DN	mm	40	40	40	40	50	50	50	50
Permanent flow rate	Q_3	m³/h	10	10	16	16	16	16	25	25
Overall length	L	mm	200	300	200	300	270	300	270	300
Counter length	L1	mm	96	96	96	96	92	92	92	92
Counter width	B	mm	89	89	89	89	94	94	94	94
DIMENSIONS - THREAD			.	.	.	.	.	.	.	.
Overall length with coupling	L2	mm	340	440	340	440	390	420	390	420
Connection thread on meter		Inch	G2B	G2B	G2B	G2B	G2½B	G2½B	G2½B	G2½B
Connection thread of coupling		Inch	R1½	R1½	R1½	R1½	R2	R2	R2	R2
Height	H1	mm	82	82	82	82	90	90	90	90
Weight without coupling (approx.)		kg	1.8	2.6	1.8	2.6	3.9	4.05	3.9	4.05
Weight with coupling (approx.)		kg	3.0	3.8	3.0	3.8	5.5	5.65	5.5	5.65
Height	H	mm	36	36	36	36	41	41	41	41
DIMENSIONS - FLANGE			.	.	.	.	.	.	.	.
Flange diameter	D	mm	-	148	-	148	-	-	-	-
Hole circle diameter	K	mm	-	110	-	110	-	-	-	-
Number of screw holes		pcs	-	4	-	4	-	-	-	-
Screw hole diameter	D1	mm	-	18	-	18	-	-	-	-
Height	H	mm	-	69	-	69	-	-	-	-
Height	H1	mm	-	87	-	87	-	-	-	-
Width	F	mm	-	138	-	138	-	-	-	-
Weight with flanges (approx.)		kg	-	6.3	-	6.3	-	-	-	-

1.5 LABELLING





1	Conformity label	13	Communication interface
2	Year of the declaration of conformity	14	Battery end-of-life
3	EU Type-examination certificate number	15	Dynamic range
4	Meter serial number & QR code	16	Nominal diameter
5	Optical button	17	Permanent flow rate
6	Optical head positioner	18	Meter family number
7	Pressure loss class	19	Manufacturer address
8	Maximum admissible pressure	20	Separate collection for electrical and electronic equipment
9	Metrological class	21	Manufacturer brand
10	Protection class	22	Manufacture year
11	Temperature class	23	Water flow direction
12	Article number	24	Commercial name of the product

2 CONNECTIVITY

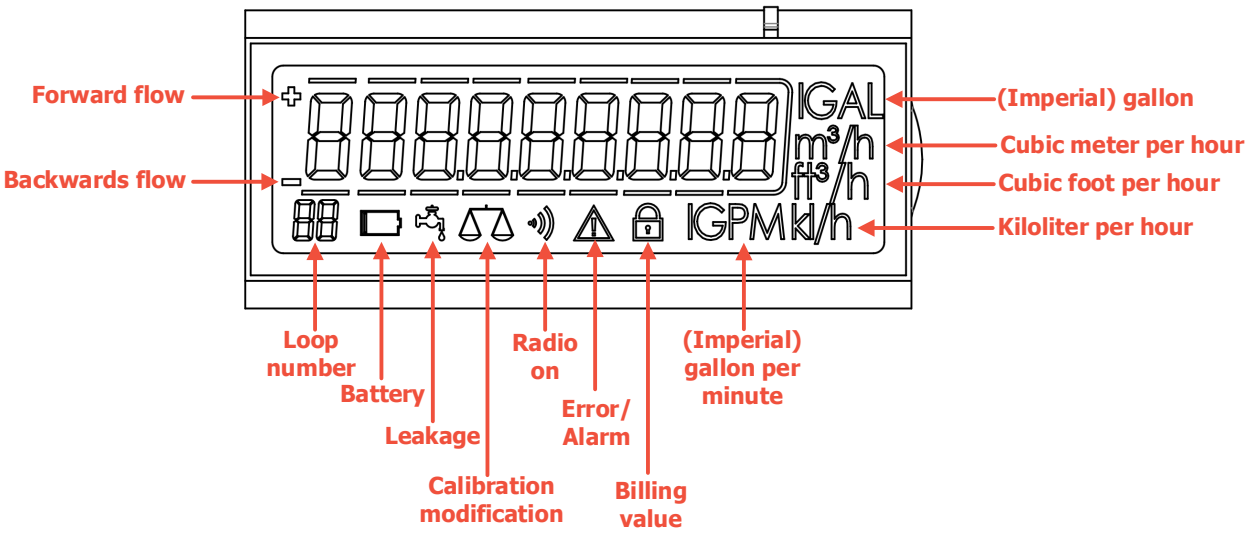
2.1 DISPLAY

The data generated by the meter can be viewed in various display loops with system information (e.g. flow rate, volume, date, due date, medium temperature).

The optical button located on the front panel enables scrolling these individual display loops.

To save battery lifetime, the meter switches automatically to power save mode after 4 minutes of inactivity. The display is awakened again by pressing the optical button.

After awakening, the display shows first a screen check (i.e. all symbols in the display are briefly switched on and off) and then the metrological volume. This remains for at least 10 seconds on the display (also when the optical button is pressed). Afterwards the display loop can be switched with the help of the optical button.



The meter is factory pre-configured with one of the following loops:

Minimum loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum

Medium loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum
Current flow
Errors / Alarms

Maximum loop
Display test
Total volume
Battery lifetime
Firmware version / Checksum
Current flow
Errors / Alarms
High resolution total volume
Due date / Due date volume
Reverse volume

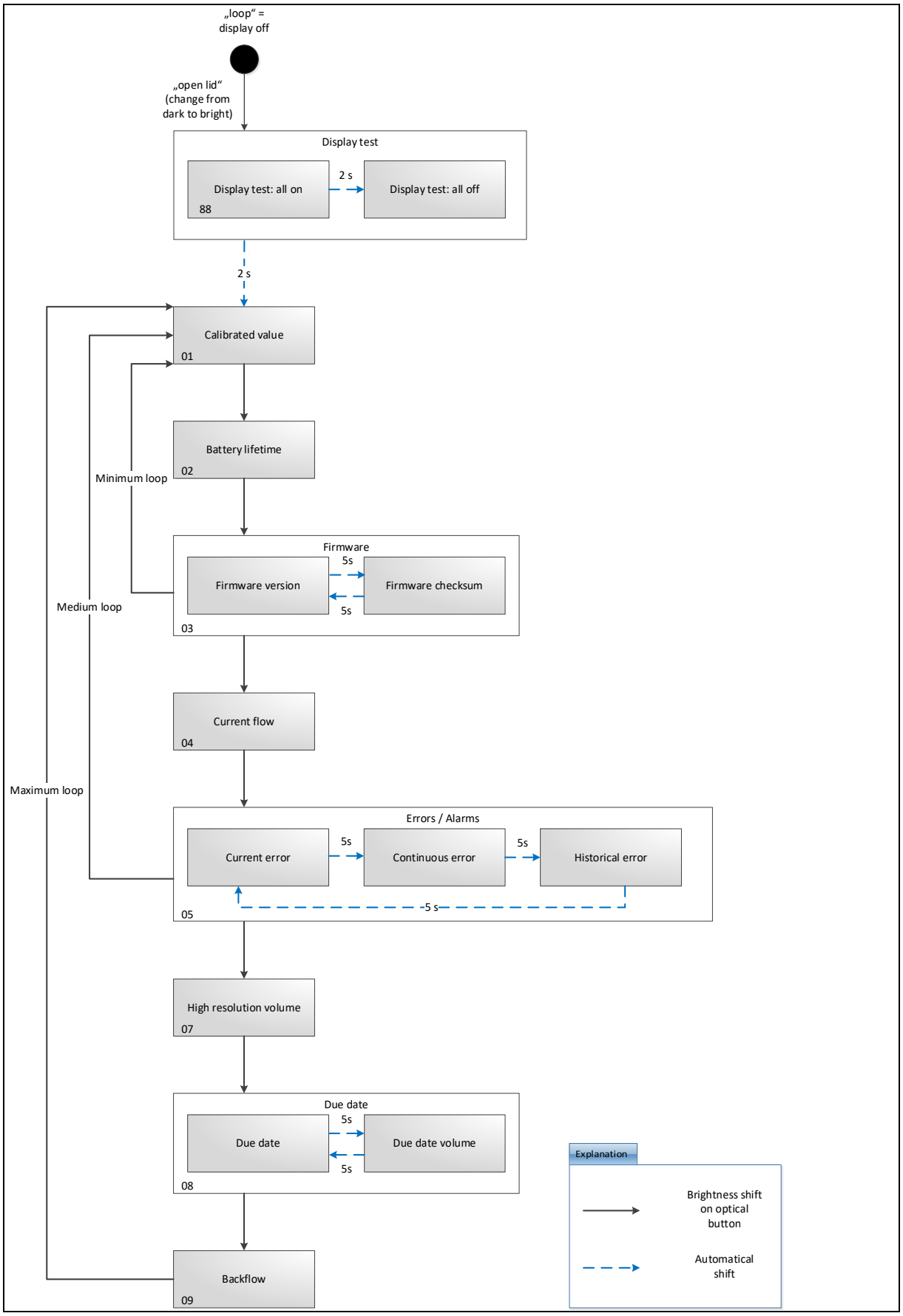
From FW 2.0.2. on, it is possible to configure the display loop in the field and to define a customer specific display loop in the customer variant, this means delivered from factory.

Please note that the configuration of the display is only possible with IZAR@MOBILE 2 version 2.10 onwards and Set Expert license + Bluetooth® opto head.

In the following, you can see the list of available display loop contents with the corresponding display counter number:

- Display test (88)
- Current metrological volume (01)
- Battery lifetime (02)
- Software version alternating with the checked sum of the software (03)
- Current flow rate (m^3/h) (04)
- Error messages (05)
- Total volume high resolution (07)
- Total volume of the due date function alternating with the modification of the due date (08)
- Current reverse volume (09)
- Forward volume (10)
- Water temperature (11)
- Operating time (13)
- Current date alternating with current time (14)
- Secondary address name alternating with Secondary address value (15)
- Primary address name alternating with Primary address value (16)
- Reverse volume of the due date function alternating with the modification of the due date (17)
- Forward volume of the due date function alternating with the modification of the due date (18)
- Error time (19)
- Total volume (20)
- Total volume of the due date function alternating with the modification of the due date (21)

Example Maximum Loop:



2.2 COMMUNICATION VIA RADIO

2.2.1 R3, R4, R4+, L1C

The HYDRUS 2.0 has an integrated radio, which is an interface for unidirectional communication in order to read out the meter. The communication always transmits the currently measured data.

Data generated by the meter are typically sent every:

Transmission scheme		
	Fixed Network ready transmission scheme	Fixed Network light transmission scheme
T1 / OMS (mobile reading)	14 sec	64 sec
Long-range fixed network R4 mode	15 min	5 min

Beginning from FW 2.0.3. the R4+ and L1C radio mode are also available in HYDRUS 2.0 Domestic.

Planned transmission schemes - version FW 2.0.3		
	Fixed Network ER* light	Fixed Network EER** light
T1	64 sec	64 sec
R4	5 min	-
R4+	15 min	-
L1C	-	60 min

*Extended Range
**Extreme Extended Range

Mobile reading in Walk-by / Drive-by / Passive Drive-by:
The data sent by the HYDRUS 2.0 can be collected using:

- Walk-by / Drive-by - Diehl Metering portable receiver IZAR RECEIVER BT with a handheld device and IZAR@MOBILE 2 software.
- Passive Drive-by - Diehl Metering IZAR RDC Vehicle.
- Devices from qualified third parties.

Data is then transferred directly to a centralized monitoring system.

Fixed network:
The stationary receivers IZAR RDC STANDARD/IZAR RDC BATTERY (fixed network R3) or IZAR RDC PREMIUM (long-range fixed network R4) installed in buildings will collect the data and send it fully automatically at predefined intervals, via GPRS or LAN, to a centralized server. Reading through M-Bus application with an IZAR RECEIVER M-BUS associated to an IZAR CENTER and IZAR@NET 2 software is possible as well.

Radio specifications	
Sending intervals	Every 14 … 256 seconds (variable, according to 0.1 duty cycle (min. 14 seconds); depending on protocol length and programming)
434 MHz frequency band	Transmission power (EN 300 220-2): 10 mW e.r.p.
868 MHz frequency band	Transmission power (EN 300 220-2): 25 mW e.r.p

3 different standard telegram packages are available on HYDRUS 2.0. It is possible to modify subsequently the telegram contents and the sequence of values in the meter.

Please note that the configuration of the telegram is only possible with IZAR@MOBILE 2 version 2.10 onwards + Set Expert license + Bluetooth® opto head.

2.2.2 LORAWAN®

The HYDRUS 2.0 has an integrated LoRaWAN® 868 radio option, which is an interface for bidirectional communication to read out data and send commands to the meter.

Data generated by the meter are typically sent every:

Transmission scheme – FW v3.1.8			
	Basic scheme	Advanced scheme	NBTrans3 scheme
C2 wM-Bus OMS (mobile)	64 sec	64 sec	64 sec
LoRaWAN® 868 (fixed network)	6 hours	3 hours	5 hours

Radio specifications	
868 MHz frequency band	Transmission power (EN 300 220-2): 25 mW e.r.p

Please note that the field/remote configuration of the meter is only possible with IZAR@MOBILE 2 and IZAR@NET software

Mobile reading in Walk-by:
Following items are required for mobile reading, alarm reset and configuration:

1. Diehl Metering portable receiver RDC Motion with a handheld device
2. IZAR@MOBILE 2 SA (Standalone) software
   OR
3. IZAR@NET/IZAR@MOBILE 2 Regular combo.
   OR
4. Devices from qualified third parties.

Data is then transferred directly to IZAR@NET or other centralized monitoring systems.

Please note that LoRaWAN® meters are only supported from IZAR@MOBILE 2 v2.12 onwards.

IZAR@MOBILE 2 SA is special license to handle OMS key file and configuration without a HES. In addition Set Expert license is required. Bluetooth OH could also be used for local configuration.

IZAR@NET/IZAR@MOBILE 2 regular combo is used when full LoRaWAN solution is supplied by Diehl Metering. This enables keeping digital twin up to date.

LoRaWAN® Fixed network:

a) Diehl Metering Solution

Diehl metering gateways IZAR IoT Gateway Premium/Compact supports LoRaWAN®. NMS from Loriot has been tested for compatibility and shall be supported. IZAR@NET and IZAR Plus Portal software also support LoRaWAN®.

b) Third Party Solution

Third party LoRaWAN® network (Gateways, NMS) and software could also be used.

EDN & DIGITAL TWIN

The meters have 2 sets of security keys included in the EDN file. 1st set is based on OMS Generation 4 Profile B for mobile network, which includes individual key for data read out and role based keys for commands and configuration. 2nd set is LoRaWAN specific for fixed network and includes LoRaWAN security keys and device/application ids.

In addition, the EDN also contains production configuration of the meter that could be visualized on the IZAR@NET software called as digital twin. This is updated when configuration of the meter is changed either using LoRaWAN network or IZAR@Mobile 2 Regular.

The EDN is encrypted and sent over email to a contact at the customer, specified when placing an order. The decryption password is sent separately.

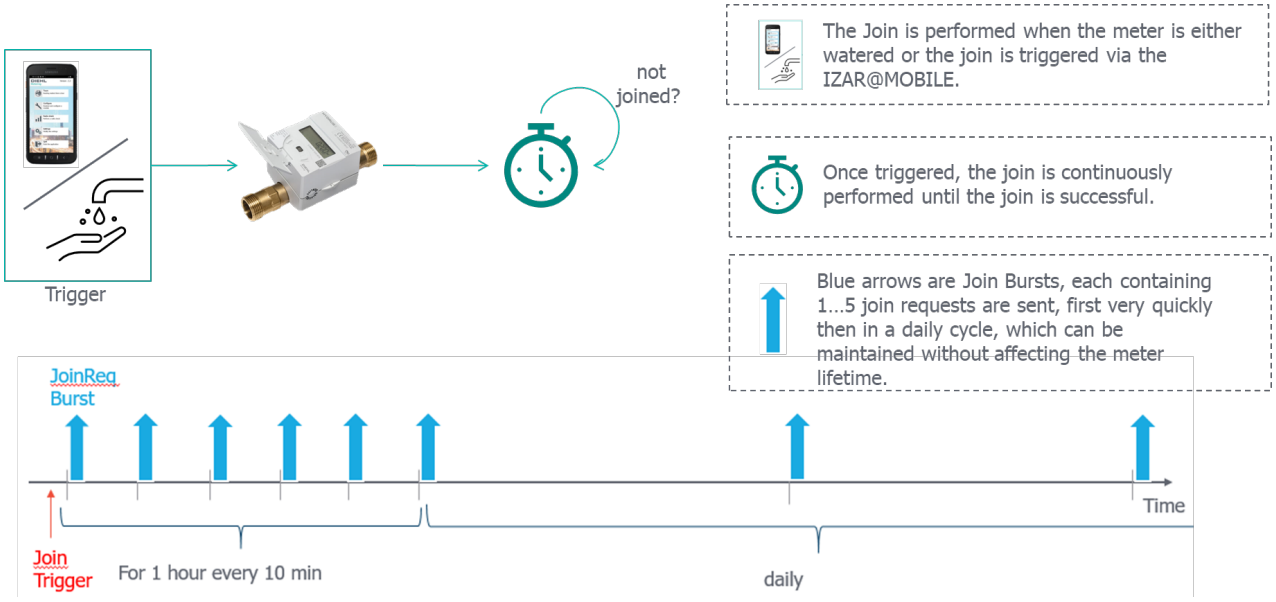
Joining with a JOIN SERVER

Prerequisite: Meter should be ordered with correct Network ID - Depending on the LoRaWAN version, this ID is called **AppEUI** or **JoinEUI**

The Join should be performed in the following sequence:

1. Provisioning of the end-device in the Backend - The device is made known in the Backend. This includes the Device EUI as well as the device individual key(s) using EDN file delivered.

2. Join request - The meter tries to register itself (DevEUI) at a specific network (AppEUI/JoinEUI). This is either triggered by installing the meter on a water line which switches on the radio and exits the meter from storage mode. Or by manually triggering a join command using IZAR @ MOBILE. The picture shown below explains this further.



3. Join accept - The network confirms that the end-device is known and provides session keys for the further communication. After this the end-device is part of the network and the communication is enabled.

2.2.3 MIOTY®4OMS

The HYDRUS 2.0 mioty®4OMS Uni. features unidirectional radio communication and incorporates the latest generation of the OMS protocol. It enables mobile reading and the development of a fixed network for optimal flexibility. The transmitted data consists of real-time measurements, ensuring constant information updates and allowing for proactive and efficient network management.

The latest OMS Generation 5 incorporates advanced telegram splitting technology called mioty®. This allows the OMS telegram to be divided into short data subpackets, which are transmitted at varying times and frequencies for enhanced robustness.

mioty® refers to the wireless transmission method, while mioty®4OMS is the optimized radio technology developed by OMS Group specifically for the metering industry.

The HYDRUS 2.0 mioty®4OMS Uni. is mainly designed for fixed network applications with a back-up mode with mobile reading. The transmission scheme is described below and can be configured (on site or in production depending on the need).

HYDRUS 2.0 mioty®4OMS Uni. transmission scheme		
	Mobile reading	Fixed network
Frequency	868 MHz	868 MHz
Radio protocol	OMS Generation 4	OMS Generation 5
Radio type	C-mode	mioty®4OMS
Directionality	Unidirectional (C1)	Unidirectional
Transmission power	25 mW e.r.p (EN 300 220-2)	25 mW e.r.p (EN 300 220-2)
Key management	Individual key (profile B)	Individual key (profile B)
Telegram sending interval	Every 64 seconds (standard) Configurable from every 14 seconds to 256 seconds (according to 0.1 duty cycle (min. 14 seconds); depending on protocol length and programming)	Every 60 minutes (standard) Configurable depending on protocol length and programming
Applications	Walk-by (standard) Drive-by / Passive drive-by configurable	Fixed network
Network device[1] (Diehl Metering)	IZAR RDC Motion (Walk-by / Drive-by) IZAR RDC Vehicle (Passive drive-by) Devices from qualified third parties.	IZAR IoT Gateway Premium Devices from qualified third parties. IZAR RDC Battery (fixed network with mobile telegram)
Software[1] (Diehl Metering)	IZAR@MOBILE (v2.12.2 or higher)	IZAR PLUS PORTAL (v2.12.2 or higher)

[1]For further information please contact your local Sales Representative or visit our website https://www.diehl.com/metering/en/products-solutions/products-services/software-systemkomponenten-produkt/

The HYDRUS 2.0 mioty®4OMS Uni. is factory pre-configured with one of the following configurations below for the radio telegrams.

The maximum configured telegram size is 6 AES blocks.

Beware that a change of the telegram content and sending interval configuration may result in the violation of the OMS certification.

HYDRUS 2.0 mioty®4OMS Uni. is factory pre-configured with the new standard OMS Generation 5 with mioty® technology.

The meter also integrates recognized Diehl Metering proprietary protocols, such as the long-range telegram (R4), the extended-range (ER) telegram (R4+).

The table below describes the sending intervals and the radio telegram available for each transmission scheme.

	Radio protocol	Fixed network light OMS v5	Fixed network ready	Fixed network light	Fixed network ER ready	Fixed network ER light
Mobile reading	OMS (R3)	64s	14s	64s	14s	64s
Fixed network	Wireless M-Bus (R4)	-	15min	5min	5min	5min
	Wireless M-Bus for hard to read location (R4+)	-	-	-	15min	15min
	mioty®4OMS (OMS Generation 5)	60min	-	-	-	-

The radio is switched off for transportation and will be automatically activated when water is detected in the meter.
The radio remains permanently active after continuous operation (>3 hours) with water.
The radio can be deactivated on site using IZAR@MOBILE 2.12.2 or higher.
Re-activation of the radio is only possible with IZAR@MOBILE 2.12.2 or higher.

The meters are supplied with individual security keys in compliance with current standards. While the end-user has the option to customize these keys according to their requirements, any modification of the default security parameters is carried out at their own discretion and sole responsibility.

Please note that the configuration of the display is only possible with IZAR@MOBILE software, version 2.12.2 or higher, Set Expert license, Bluetooth® optical head and meter keys.

2.2.4 TELEGRAM FOR ALL RADIOS

Telegram for mobile reading (all variants including LoRaWAN)

For mobile reading, the meter is factory pre-configured with one of the following standard telegram packages. The maximum configured telegram size is 6 AES blocks. The telegrams are per OMS specifications.

Mobile minimum
Total volume
Due date
Due date volume
Due date reverse volume
Error bits

Mobile medium
Total volume
Due date
Due date volume
Due date reverse volume
Error bits
Current flow
Battery lifetime
Water temperature in °C

Mobile maximum
Total volume
Due date / due date volume / due date reverse volume
Log entry 1 - Date & Time
Log entry 1 - Volume
Error bits
Current flow
Battery lifetime
Water temperature in °C
Ambient temperature in °C

Telegram for fixed network (R4/R4+/L1C/Mioty4OMS)

For fixed network, the meter is factory pre-configured with one of the following standard telegram packages. The maximum configured telegram size is 6 AES. The telegrams are per OMS specifications.

Fixed Network minimum
Total volume
Reverse volume
Current flow
Water temperature in °C
Error bits

Fixed Network medium
Total volume
Ambient temperature in °C
Current flow
Water temperature in °C
Error bits
Log entry 1 – Max. volume flow
Log entry 1 – Min. volume flow
Log entry 1 – Date & Time

Fixed Network maximum
Total volume
Ambient temperature in °C
Current flow
Water temperature in °C
Error bits
Log entry 1 – Max. volume flow
Log entry 1 – Min. volume flow
Log entry 1 – Date & Time
Log entry 1 - volume
Reverse volume

When the telegram value "Error bits" is selected, all currently active errors/alarms are transmitted. There is no prioritization in the transmission of the errors/alarms as with the M-Bus Status Byte when several error/alarms are currently on the meter.

All possible errors/alarms can also be transmitted. The value can then be displayed via the "Info code" column during a tour in IZAR@MOBILE 2 respectively and in IZAR@NET 2.

Telegram for fixed network (LoRaWAN)

For LoRaWAN fixed network, the meter is factory pre-configured with one of the following standard telegram packages. The maximum telegram size possible is 51 bytes, which is a limitation imposed by LoRaWAN network. The telegrams are per OMS specifications (OMS over LoRaWAN).

Basic	Enhanced	NBTrans 3
Volume (midnight) Reverse volume (midnight) Timestamp (midnight) Error Flag Max flow (40 bytes)	Volume (last hour) Timestamp (last hour) Error Flag Max Flow Compact profile volume Volume – 1:00 h Volume – 2:00 h Volume – 3:00 h Volume – 4:00 h Volume – 5:00 h (49 bytes)	Volume (last hour) Timestamp (last hour) Error Flag Compact profile volume Volume – 1:00 h Volume – 2:00 h Volume – 3:00 h Volume – 4:00 h Volume – 5:00 h (43 bytes)

Telegram content (mobile/fixed - all variants)

In the following, you can see the list of items that could be part of the telegram:

- Volume (metrological)
- Volume (metrological) (high resolution)
- Forward volume
- Reverse volume
- Current flow
- Water temperature
- Ambient temperature
- Remaining battery lifetime
- Battery expiration date
- Error Bits
- Error time
- Ownership number
- Operating time
- Date and time
- Firmware version
- Firmware version metrological
- Log entry 1 – Max. volume flow
- Log entry 1 – Min. volume flow
- Log entry 1 – Date & Time
- Log entry 1 – Total volume
- Compact profile: Five logs of volume increments from log entry 1 – total volume (specific to LoRaWAN variant)
- Log entry 1 – Forward volume
- Log entry 1 – Reverse volume
- Log entry 1 – error flags
- Log entry 1 – current flow
- Log entry 1 – operating time
- Log entry 1 – water temperature
- Log entry 1 – ambient temperature
- Log entry 1 – error time
- Log entry 2 – Max. volume flow
- Log entry 2 – Min. volume flow
- Log entry 2 – Date & Time
- Log entry 2 – Total volume
- Log entry 2 – forward volume
- Log entry 2 – reverse volume
- Log entry 2 – error flags
- Log entry 2 – current flow
- Log entry 2 – operating time
- Log entry 2 – water temperature
- Log entry 2 – ambient temperature
- Log entry 2 – error time
- Log entry 3 – Max. volume flow
- Log entry 3 – Min. volume flow
- Log entry 3 – Date & Time
- Log entry 3 – Total volume
- Log entry 3 – forward volume
- Log entry 3 – reverse volume
- Log entry 3 – error flags
- Log entry 3 – current flow
- Log entry 3 – operating time
- Log entry 3 – water temperature
- Log entry 3 – ambient temperature
- Log entry 3 – error time
- History Log interval
- Due date 1 val. 1 – Total volume
- Due date 1 val. 1 – Forward volume
- Due date 1 val. 1 – Reverse volume
- Due date 1 val. 1 – Date
- Due date 1 val. 2 – Total volume
- Due date 1 val. 2 – Forward volume
- Due date 1 val. 2 – Reverse volume
- Due date 1 val. 2 – Date
- Due date 1 val. 3 – Total volume
- Due date 1 val. 3 – Forward volume
- Due date 1 val. 3 – Reverse volume
- Due date 1 val. 3 - Date
- Due date 2 val. 1 - Total volume
- Due date 2 val. 1 - Forward volume
- Due date 2 val. 1 - Reverse volume
- Due date 2 val. 1 - Date
- Due date 2 val. 2 - Total volume
- Due date 2 val. 2 - Forward volume
- Due date 2 val. 2 - Reverse volume
- Due date 2 val. 2 - Date
- Due date 2 val. 3 – Total volume
- Due date 2 val. 3 – Forward volume
- Due date 2 val. 3 – Reverse volume
- Due date 2 val. 3 – Date
- Date next due date 1
- Date next due date 2
- Production number
- Fabrication number

The radio is switched off for transportation and will be automatically activated when water is detected in the meter.

The radio remains permanently active after continuous operation (>3 hours) with water.

The radio can be deactivated on site using IZAR@MOBILE 2.10 and later versions.

Re-activation of the radio is only possible with IZAR@MOBILE 2.10 and later versions.

Beware that a change of the telegram content and sending interval configuration may result in the violation of the OMS certification.

Please also note that it is not possible to increase data security level. It is only possible to change from radio OMS 3 Profile A to radio OMS 4 Profile B but not vice versa.

2.3 COMMUNICATION VIA M-BUS / L-BUS / PULSE

2.3.1 CONNECTING PROCEDURES

The meter is supplied with Radio/L-Bus/Pulse, Pulse, M-Bus/Pulse variant with a 1.5 m long, 2- / 3- / 3- / 4- / 5-wire connection cable with wire end sleeves.

Available variants

	Variant 1 Radio/ L-Bus/Pulse	**Variant 2** Pulse/Pulse (3 wires)	**Variant 3** M-Bus/ Pulse/Pulse	**Variant 4** M-Bus	**Variant 5** Pulse/Pulse (4 wires)
M-Bus			X	X	
Pulse output 1		X	X		X
Pulse output 2	X	X	X		X
L-Bus	X				
Cables color					
Connection (Network name)					
GND	brown	brown	brown		brown
Pulse 1 or L-Bus	yellow	yellow	yellow		white
Pulse 2	green	green	green		yellow
M-Bus 1			white	white	
M-Bus 2			blue	blue	
Fraud					green
Number of wires	3	3	5	2	4

Telegram for wired M-Bus/ L-Bus

The meter is factory pre-configured with the following telegram package

Please consider that an application reset command is necessary after the modification of the M-Bus telegram in the field.

Please note that the configuration of the telegram is only possible with IZAR@MOBILE 2 version 2.10 onwards + Set Expert license + Bluetooth® opto head.

Wired M-Bus / L-Bus telegram
Total volume
Forward volume
Reverse volume
Current flow
Flow temperature
Ambient temperature in C°
Error bits
Date & Time
Due date 1
Due date 1 volume
Due date 2
Due date 2 volume

The M-Bus is powered by internal battery. An external power supply with an M-Bus master is not possible.

M-Bus communication limitations are not integrated. Continuous Bus communication will drain the battery.

If L-Bus is connected, then the internal radio needs to be switched-off manually. The configuration is possible with IZAR@MOBILE 2 version 2.10 and onwards.

Please note that the cable colors have changed significantly from the first version of HYDRUS (HYDRUS 1.X).

Caution: Never connect the external M-Bus to the pulse output of the meter!
It will destroy the pulse output and lead to the loss of all factory warranty claims.

Caution: The M-Bus communication is designed for 2,400 Baud or 300 Baud. Any other Baud-rate in the M-Bus network will drain the battery.

Caution: Due to possible damage caused by electro-corrosion, a voltage potential between the ground connection of the L-Bus/pulse output and the meter base housing must be avoided.

2.3.2 PULSE OUTPUT (OPEN DRAIN)

The meter has up to 2 interfaces for Pulse. Depending on the device configuration, the set pulse duration, pulse break and pulse frequency can be different.

A detailed description of the pulses can be found in the product specifications:

https://www.diehl.com/metering/customer-portal/en/login/

Maximum input voltage	30 V
Maximum input current	27 mA
Maximum voltage drop at active output	2 V / 27 mA
Maximum current through inactive output	5 µA / 30 V
Maximum reverse current	27 mA
Pulse frequency	Time correct pulses: auto-adaptive, depends on transmitted volume - max. frequency 10 Hz Burst pulses: 4 Hz (configurable to 12 Hz on request)
Pulse width	Time correct pulses: 50 ms Burst pulses: 125 ms

Pulse variants:

Pulse/Pulse

	Pulse 1	Pulse 2
1	Forward volume	Reverse volume, pulse weight as pulse output 1
2	Forward volume	Error flag
3	Forward volume	Forward volume (same or different pulse weight)
4	Total volume (forward + reverse volume)**	Direction flag
5	Net volume (forward – reverse)	Error flag / Direction flag

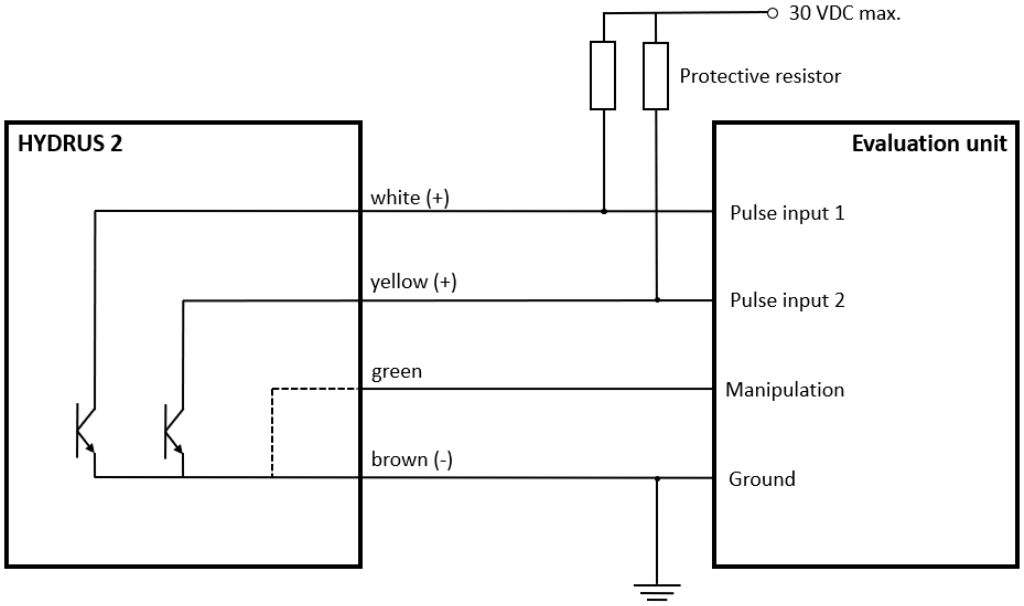
Radio/L-Bus/Pulse types

Pulse 1	Pulse 2
-	Forward volume
-	Net volume (forward – reverse)

All are time correct pulses.

Please note that the configuration of the pulse is only possible with IZAR@MOBILE 2 version 2.10 onwards + Set Expert license + Bluetooth® opto head.

Connection diagram



Example showing 4-wire Pulse/Pulse connected to a evaluation unit (PLC)

The pulse outputs are wired as open drain.

There is a 0-ohm resistor in the drain branch, i.e. there is no current limitation within the meter, this must be provided externally by a protective resistor (if not available on site).

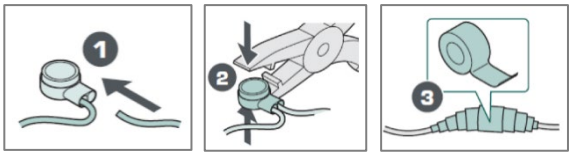
Eg. Calculating the protective resistor of a standard PLC with 24 VDC and input current 24 mA: R= U/I = 24 V / 24 mA = 1 kOhm

The internal resistance value of the switching device should be 5 times the protective resistance.

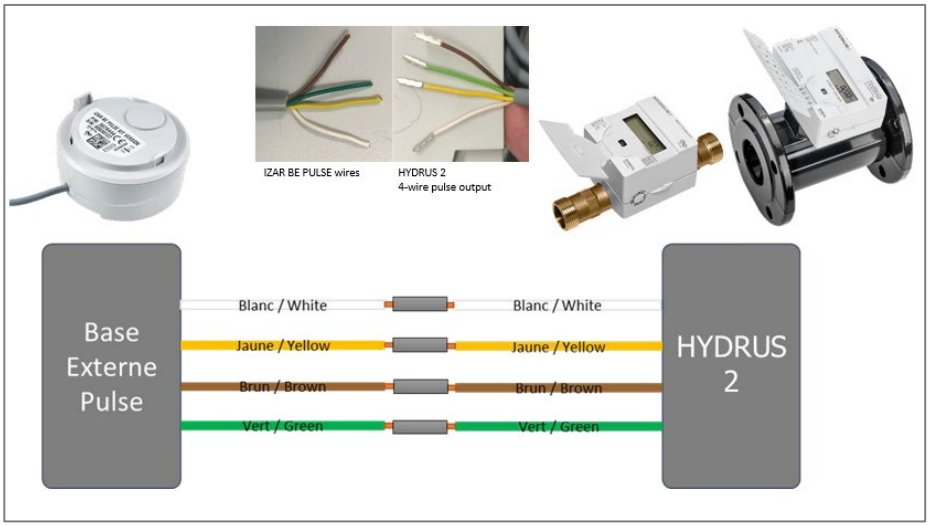
2.3.3 CONNECTING PROCEDURES WITH IZAR BE PULSE

Make sure to cut the terminals of the HYDRUS 2!

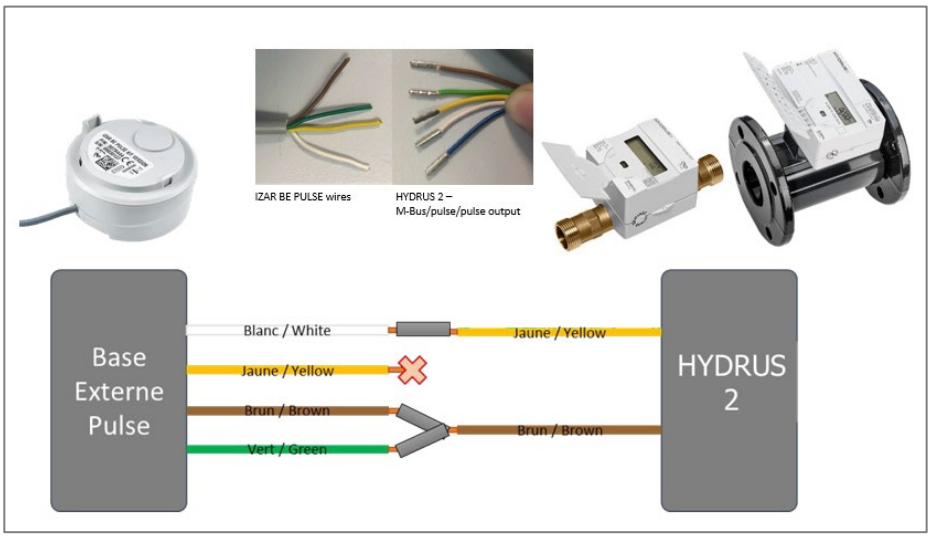
Strip the wires of the HYDRUS as well as those of IZAR BE PULSE for a maximum of 2 mm, to ensure a good electrical contact at the quick connector (Scotchlock).



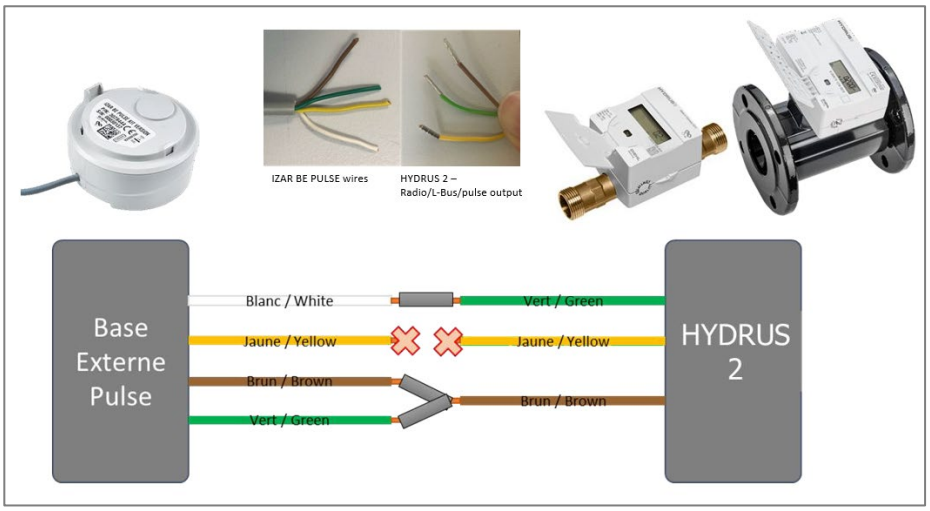
Wiring HYDRUS 2 - 4-wire pulse output + IZAR BE PULSE



Wiring HYDRUS 2 - M-Bus/pulse output + IZAR BE PULSE



Wiring HYDRUS 2 - Radio/L-Bus/pulse output + IZAR BE PULSE



2.4 ERROR MESSAGES DETAILS

Error messages (optical notification on LC-display in case of error).

3 categories of error:

E - Current errors

A - Continuous errors - if the error is, e.g. present for the default value one hour (configurable) – then the hold time of the continuous error is by default 3 days (configurable)

H - Historical errors - if the error is e.g. present for the default value one hour (configurable) – then the hold time of the continuous error is by default 15 months (configurable).

Name of Status	Description	Status Code
Checksum error	Event is triggered if base parameter in Flash or RAM is corrupted	01
Hardware temperature	Event is triggered if temperature sensor cable is cut	02
Hardware flow	Event is triggered if flow measuring error occurs	04
Leakage detection	Event is triggered if the continuous consumption over a period of one day (configurable) is higher than a configurable threshold	05
Back flow volume	Event is triggered if the reverse volume is higher than the configurable threshold	06
Air in pipe	Event is triggered if air is detected in the pipe	07
Low battery	Event is triggered if calculated battery life is less than 1 ½ years	09
Undersized meter	Event is triggered if flow is higher than a configurable threshold	11
No consumption	Event is triggered if volume is lower than a configurable threshold for a configurable period of time	12
High medium temperature	Event is triggered if medium temperature is higher than the threshold	13
Freezing risk	Event is triggered if medium temperature is lower than 3°C	14
Fallback mode	Event is triggered if a significant deviation of the measurement in the two measuring paths occurs	17
Metrological log access	Event is triggered if the metrological log has been accessed	18
Measurement interference	Event is triggered if the measurement is disturbed by influences of cavitation, air water mixture or electromagnetic interference	22
System reset	Event is triggered if the system processor has been reset	98
Any application error	Event is triggered if the bidirectional communication (M-Bus or optical Interface) has been corrupted	99
Too much communication	Event is triggered if the communication through the optical interface exceeds the threshold	00

The simultaneous appearance of the "Hardware temperature" Alarm A2 and the "Hardware flow" Alarm A4 is an indication for tamper activities.

Error and alarm messages can also occur simultaneously:
e.g. E11 - A05 means short-term overload and arising leakage at the same time.

2.5 DATA PRIVACY

The HYDRUS 2.0 saves 1024 consumption values within an interval of 1 hour up to 1 month. This data can be read locally and accessed only by using IZAR@MOBILE 2 version 2.10. As a second logging, a small amount of 32 consumption values can be stored and some selected data can be sent by radio. The meter has a minimal sending interval of about 14 seconds and uses the OMS Generation 3 or 4, Profile B security level. Meters with LoRaWAN have an individual encryption compliant to LoRa alliance recommendation. The device uses keys for the protection of values which are sent out by radio. Both, the radio protocol and the optical interface are encrypted by default.

3 PRECAUTIONS OF USE

3.1 TRANSPORT

Caution: Make sure that the radio is deactivated before air shipment of the meter.

Caution: Protect the meter from frost during transportation

Caution: Meter must be protected against impact and vibration.

Caution: We recommend to use only the original packaging for shipment. If shipped in other than the original packaging the factory warranty expires.

3.2 STORAGE

Meter should be stored in a dry place and protected from frost.

4 INSTALLATION

4.1 LIABILITY

This manual is intended for trained personnel and does not contain any basic working steps.

For the installation, the requirements of EN 14154, ISO 4064 and OIML R49 standards and the EC-type examination certificate must be considered!

⚠	If the installation is not carried out in accordance with good workmanship practices, and if the above-mentioned procedures are not followed, the warranty shall be null and void.
⚠	Protect the meter against any kind of external contamination.
⚠	The set of rules for drinking water installations (e.g. DIN 1988) must be considered! **In case of any treatment or additional substances in the water (additives), the installer or the operator has to make sure that the characteristics of the drinking water and the materials of the installation – meter included – are not altered.**
⚠	The seal on the meter must not be broken! A broken seal will immediately lead to an expiration of the factory warranty and verification/conformity.
⚠	Ensure a sufficient distance between the meter and possible sources of electromagnetic interferences (switches, electric motors, fluorescent lamps, etc.).

4.2 INSTALLATION PRECAUTIONS

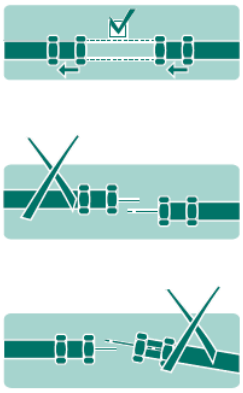
4.2.1 CLEANING THE PIPES

Caution: HYDRUS 2.0 must be installed on a clean pipe free from solid particles on the inside.

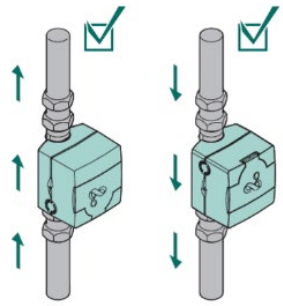
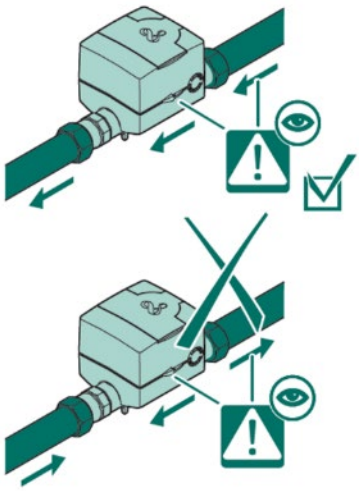
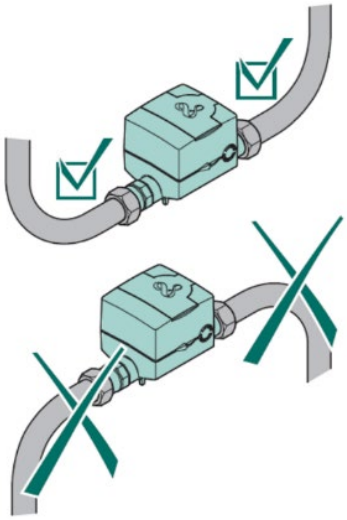
-> Clean the pipes thoroughly before installing the meter.

-> Install a filter in the inlet pipe before the meter if the water contains particles.

4.2.2 PIPES ALIGNMENT

	**Caution:** The pipes must be perfectly aligned in order to minimize the mechanical stresses on the meter' body. Make sure that the pipes support the weight of the meter.

4.2.3 INSTALLATION POSITION

	Installation in horizontal and vertical position.
	**Caution**: Check that the direction of the water flow matches the direction of the arrow located on the casing.
	Install HYDRUS 2.0 at a low point of a pipe to prevent the formation of air bubbles. No straight length required before or after the meter (U0/D0).

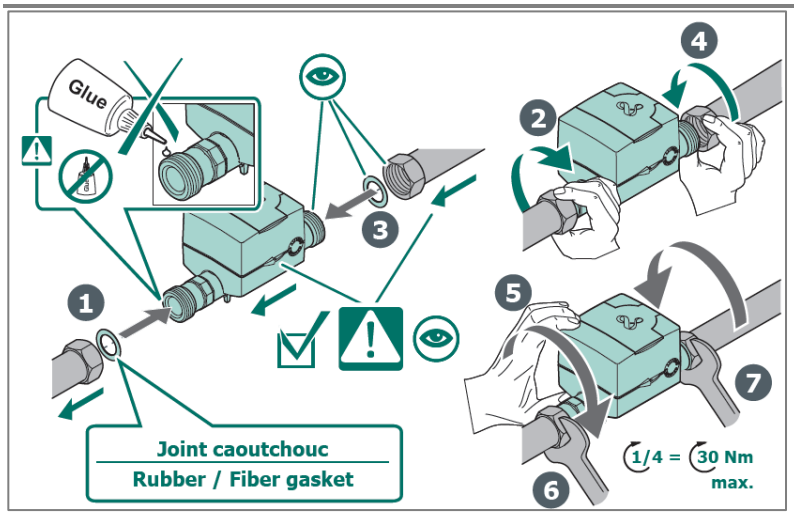
4.2.4 ASSEMBLING/INITIAL OPERATION

-> Remove old seals and clean sealing surfaces.

-> Grease sealing surfaces thinly (use acid-free grease that is approved for drinking water).

Only the newly supplied seals or seals recommended by Diehl Metering are allowed to be used for installation (seals must not be extended into the pipeline).

Used seals on site must be suitable for the intended application and comply with local guidelines and regulations. For the consequential damage caused by the use of different seals, e.g. corrosion on sealing surfaces and threads, no liability is accepted.



-> Screw the meter flange together by hand and then tighten it with suitable tools.

The meter is applicable for water temperatures from 0.1 °C to 90 °C.

-> Fill the pipeline slowly after completing the installation.

The meter must always be completely filled with water.

5 REGULATIONS

5.1 DECLARATION OF CONFORMITY

The meter complies with the European directives as indicated on the EU declaration of conformity delivered with the product and available on the Diehl Metering website:

https://www.diehl.com/metering/en/diehl-metering/support-center/downloads

5.2 SANITARY CONFORMITY

HYDRUS 2.0 meets the food-grade requirements relating to materials in contact with water.

5.3 RECYCLING

The transposed European Directives on waste batteries and waste electrical and electronic equipment supervise the actions necessary to limit the negative impact of the product end of life.

This product is subject to special collection and disposal. It should be deposited at an appropriate facility to enable recovery and recycling. For further details about recycling this product, please contact your Diehl Metering agency.

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