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TECHNICAL GUIDANCE

SONICMAX[®]

UL3400C

3-BEAM Compact Ultrasonic Flowmeter

OUTLINE

The **SONICMAX[®] UL3400C** is a converter-integrated ultrasonic flowmeter for inline liquid measurement with 3 pairs of ultrasonic sensors. The 3-beam measuring method and digital signal processor (DSP) offer highly accurate, stable measurement in a broad range of applications.

The **UL3400C** can be used independently of changes in physical or chemical properties of liquids such as density, viscosity or electric conductivity. A wide range of sizes spanning 25 to 2000 mm are available.

FEATURES

- High accuracy: $\pm 0.5\%$ of reading. 3-ultrasound beam technology enables highly accurate measurement ranging from laminar to turbulent flow.
- The digital signal processor ensures stable measurement and minimizes the influence of bubbles and particles.
- No moving parts and maintenance-free. Suitable for measuring a variety of liquids including oil and solvent, as well as for replacing turbines or PD flowmeters
- Easy installation with compact design
- 4 to 20 mA current output, pulse output, and status output
- Explosionproof types are available; TIIS approved, and ATEX and IEC Ex are pending
- Complying with:

EMC	EN61326-1:2013
Safety requirements	EN61010-1:2010
RoHS	Decision No. 768/2008/EC

STANDARD SPECIFICATIONS

- Measuring method : Time – flight ultrasound, 3 beams
- Nominal size : 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400, 500, 600, 700, 800, 900, 1000, 1200, 1400, 1600, 1800, 2000 mm
*Note: Contact Tokyo Keiso for the size over 2000 mm
- Measuring range Flow velocity : Min. 0 to 0.3 m/s
: Max. 0 to 20 m/s
*Note: See “FLOW RANGE” table for details.
- Protection class : IP66 / 67
- Ambient temperature : -40 to 65°C
*Note: See “Requirements for explosionproof” for the allowable ambient temperature of the explosionproof types.



Fluids

- Measuring fluid : Liquids with solid particle content $\leq 5\%$ in volume, bubbles $\leq 2\%$ in volume
- Temperature : -45 to 140°C
- Pressure : Max. 10 MPa as per flange rating
- Kinetic viscosity : Max. 100 cSt

Sensors

- Wetted part materials
 - Measuring tube : Size 25 to 65 mm : SS316
Size 80 to 2000 mm : Carbon steel (Option : SS316)
 - Sensor housing/sensor window : SS316
 - Flange : Size 25 to 65 mm : SS316
Size 80 to 2000 mm : Carbon steel (Option : SS316)
- Body materials
 - Transducer cover : Applied to 300 mm or less in size
Size 25 to 65 mm : SS316
Size 80 to 300 mm : Carbon steel
 - Sensor housing cover : Applied to 350 mm or more in size SS316L
- Process connection : Flanges
- Type of flanges : Equivalent to JIS10K, JIS20K
ASME class 150, 300, 600
EN1092-1 PN6, 10, 16, 25, 40, 63, 100
- Painting : Polysiloxane epoxy resin paint
- Color : Gray

Converter

- Housing material : Aluminum alloy (Option : SS316)
- Painting : Polysiloxane epoxy resin paint
- Color : Gray (Converter body), Jade green (Converter cover, Terminal box cover)
- Power supply : 100 to 230 V AC (85 to 253 V)
24 V DC (11 to 31 V)
Figures in parenthesis are the acceptable range of voltage.
- Frequency : 50 / 60 Hz in AC
- Power consumption : Approx. 22 VA (AC), 12 W (DC)
- Grounding : Grounding resistance $\leq 100 \Omega$ for non Ex. Type
Grounding resistance $\leq 10 \Omega$ for Ex. Type
- Cable entry : 2 \times G $\frac{1}{2}$ female with adapter or 2 \times $\frac{1}{2}$ NPT female with adapter or 2 \times M20 \times 1.5 female.
Max.3 entries are available.

Display and output

- Display : Blue dot matrix LCD with back light
128 \times 64 pixels (59 \times 31 mm)
Switchable 4 screens, each has 1 to 3 lines for presentation of followings:
Flow rate in bar graph, total flow, flow rate in trend graph in % and others including setting parameters and diagnosis data
- Current output : 4 to 20 mA DC (Max. 22 mA)
Load resistance Max. 1 k Ω
- Pulse output : Open collector output
Rating : 32 VDC, 100 mA or less
20 mA or less (100 Hz < f \leq 10 kHz)
Residual voltage at close
< 1.5 V when load current is ≤ 1 mA
< 2.5 V when load current is ≤ 10 mA
< 5 V when load current is ≤ 20 mA
100 mA or less (f \leq 100 Hz)
Residual voltage at close
< 0.2 V when load current is ≤ 10 mA
< 2 V when load current is ≤ 100 mA
Output frequency : Max. 10 kHz
Pulse rate : 36 to 36,000,000 pulse/h (0.01 Hz to 10 kHz)
Pulse width: One of the following selectable
1. Automatic : Pulse width by which duty factor becomes 50% at full scale
2. Duty factor : Always 1 : 1
3. Free setting : 0.05 to 2000 ms
- Status output : Open collector output
Rating : 32 VDC, 100 mA or less
Residual voltage at close
< 0.2 V when load current is ≤ 10 mA
< 2 V when load current is ≤ 100 mA
Contents of output : One of the following selectable:
1. No status output (Standard setting)
2. Identification of flow direction
3. Over range
4. Flow alarm
5. Presetting total flow
6. Selecting a range when double range is used
7. Error

●Control input

- Voltage input : 8 to 32 V DC at "ON", 2.5 V DC at "OFF"
Max. current 6.5 mA when ≤ 24 V DC
Max. current 8.2 mA when ≤ 32 V DC
8V DC or more at "ON": 2.8 mA (normal)
2.5V DC or more at "OFF": 0.4 mA (normal)

Contents of control input : One of the following selectable:

1. No control input (Standard setting)
2. Hold output
3. Lock output at 0%
4. Reset total flow
5. Reset error
6. Identify a range when double range is used
7. Others

●Assignment of input and output terminal

Terminal	Standard setup	Switchover by reprogramming
A (A, A+ / A-)	Current output	—
B (B+, B-)	Status output	Control input
C (C+, C-)	Status output	—
D (D, D-)	Pulse output	Status output

●Low cutoff

- Current output, Pulse output, Indication (Separate setting is possible)
Setting value : 0 to 20% F.S. at 0.1% step
Hysteresis : 0 to 5% F.S. at 0.1% step

●Damping time constant

- Current output, Pulse output, Indication (Separate setting is possible)
Setting value : 0.0 to 100.0 s at 0.1 s step

Standard functions

●Free measuring unit setting function

- : Volume and time unit can be created in Max. 7 characters and displayed as flow rate unit.

●Bi-directional flow measurement function

- Flow measurement is possible in both directions.
: A flow-direction distinction signal is output in state output.

●Self-diagnosis function

- The following conditions are indicated by error message;
Functional diagnosis : CPU, Memory, Software, Hardware, and Output connection
Status diagnosis : Sensor signal lost, Over range, Counter over flow, and Power fail detection.

●Memory save function for power fail

- Operation parameters and totalized data can be stored in EEPROM (non-volatile memory) for more than 10 years.
(With up to 100,000 times of rewriting, data can be stored for about ten years.)

●Testing function

- Simulating output function for current and pulse output, loop check without calibrator

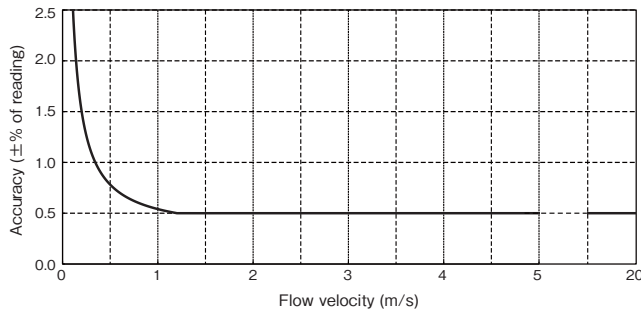
●Setting by touch sensor (Optical key)

- Four touch sensors allow you to alter the settings without removing the cover of conversion section. These sensors work as push buttons when the cover is opened.

Accuracy *1

● Indication and pulse output

- For flow velocity ≥ 1 m/s : $\pm 0.5\%$ of reading
- For flow velocity < 1 m/s : $\pm 0.3\%$ of reading + velocity error ± 0.002 m/s



*1 Conditions

- Fluid : Water
- Fluid temperature : 20°C
- Ambient temperature: 20°C
- Supply voltage : Rated voltage $\pm 2\%$
- Upstream / Downstream straight pipe length : 10D / 5D (D: Diameter)
- Measuring time : 100 s

● Current output accuracy

± 0.01 mA is added to the accuracy of indication or pulse output.

Requirements for explosionproof

● TIIS Technology Institute of Industrial Safety in Japan

Compact type (Converter housing: Aluminium alloy)

Model, Nominal size	UL3400C-JEx (DN25-65)	UL3400C-JEx (DN80-150)	UL3400C-JEx (DN200-3000)
Ex class	Sensor Converter Terminal box	Ex ia IIC T4 Gb Ex d [ia] IIC T4 Gb Ex d IIC T4 Gb	
Fluid temp.		-45°C to +130°C	
Ambient temp.		-20°C to +50°C	
Certificate No.	TC22293X	TC22294X	TC22295X

● ATEX pending

● IEC Ex pending

FLOW RANGE

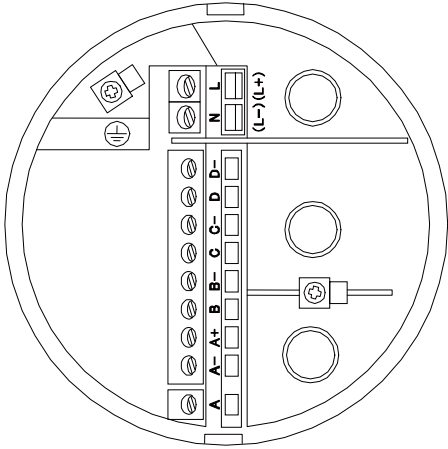
Nominal size mm	Allowable setting range m ³ /h		Nominal size mm	Allowable setting range m ³ /h	
	Min.	Max.		Min.	Max.
25	0 to 0.531	0 to 35.3	400	0 to 136	0 to 9047
32	0 to 0.87	0 to 57.9	500	0 to 213	0 to 14137
40	0 to 1.36	0 to 90.4	600	0 to 306	0 to 20357
50	0 to 2.13	0 to 141	700	0 to 416	0 to 27708
65	0 to 3.59	0 to 238	800	0 to 543	0 to 36191
80	0 to 5.43	0 to 361	900	0 to 688	0 to 45804
100	0 to 8.49	0 to 565	1000	0 to 849	0 to 56548
125	0 to 13.3	0 to 883	1200	0 to 1222	0 to 81430
150	0 to 19.1	0 to 1272	1400	0 to 1663	0 to 110835
200	0 to 34.0	0 to 2261	1600	0 to 2172	0 to 144764
250	0 to 53.1	0 to 3534	1800	0 to 2749	0 to 183217
300	0 to 76.4	0 to 5089	2000	0 to 3393	0 to 226194
350	0 to 104	0 to 6927			

Allowable flow velocity : 0.3 to 20 m/s

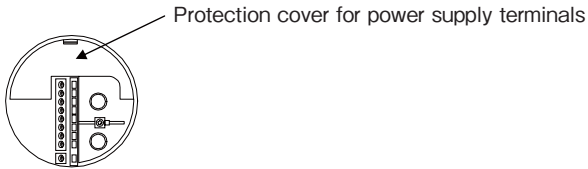
ELECTRICAL CONNECTION

[Input and output terminals of converter] ULC400

- One current output, one pulse output, one status output, one control input (as standard)



The power supply terminals have a protection cover.

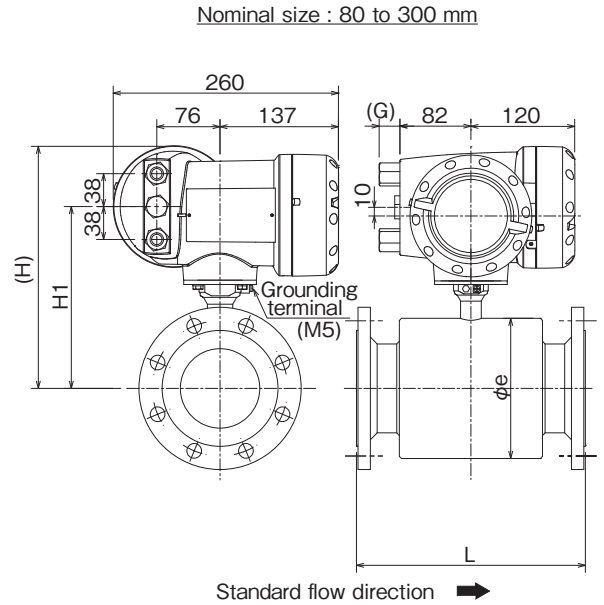
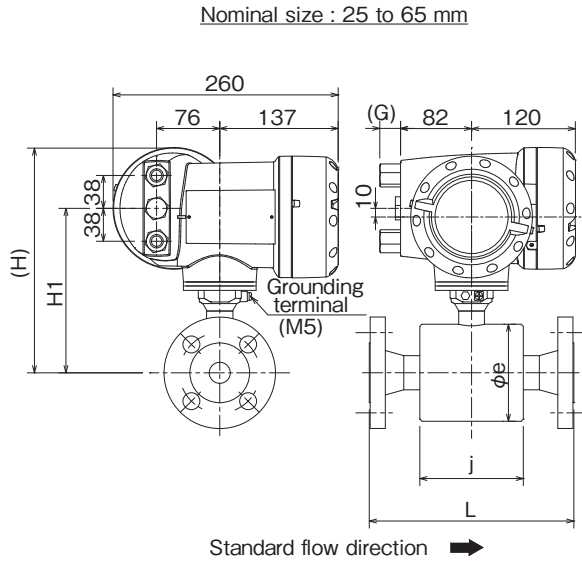


Terminal	Description
L / L+	AC power, DC power is connected to "L+" and "L-" for "+" and "-" respectively
N / L-	
⊕	Grounding terminal

Terminal	Polarity	Description (As standard)
D-	-	Pulse or status output
D	+	
C-	-	Status output
C	+	
B-	-	Control input or status output
B	+	
A+	+	Current output 4 to 20 mA by internal power
A-	-	
A	-	

- Terminal type : Spring clamp terminal
- Applicable core size : 0.5 to 2.5 mm²
- Applicable cable diameter : 7 to 12 mm

DIMENSIONS



Nominal size mm	Dimensions mm					Approx. Mass* ² kg
	L* ¹	H	H1	j	e	
25	250	253	183	120	106	13
32	260	253	183	120	106	15
40	270	252	182	120	106	19
50	300	268	198	152	133	22
65	300	268	198	152	133	24
80	300	299	229	170	190	23
100	350	312	242	190	215	24
125	350	322	252	210	237	25
150	350	338	268	236	266	34
200	400	405	335	225	359	53
250	400	432	362	260	407	60
300	500	457	387	290	457	76

- * 1 Face to face dimensions L of flowmeters is that of JIS10K.
- * 2 Mass of flowmeters is that of JIS10K.
- * 3 JIS20K flanges of 25 to 40 mm in size are used in common to JIS10K as standard. All the dimensions of JIS10K and JIS20K are identical except for the thickness of flanges.
- * 4 Length "G" : 26 mm for G½ female adapter, ½NPTfemale adapter.
85 mm for TIS explosionproof construction.

Consult us for the dimensions of the flowmeters larger than 300 mm.

MODEL CODE

●Nominal size : 25 to 65 mm

Model : UL3400C (General purpose), UL3400C-EEx (ATEX Explosionproof (Pending), IEC Ex (Pending)), UL3400C-JEx (TIIS Explosionproof)

[Sensor spec code]

Sensor spec code	VN61	4					B	0	2	2	1	0	0	0	0	3	0	0	0	0	Description	Std.
Sensor code	VN61																				ULS3000 sensor (Nominal size: 25 to 65 mm)	○
(Fixed code)		4																			Always 4	○
Nominal size		4																			25 mm (1")	○
		5																			32 mm (1 ¼")	○
		6																			40 mm (1 ½")	○
		7																			50 mm (2")	○
		8																			65 mm (2 ½")	○
		5																				EN1092-1 PN40
		6																			EN1092-1 PN63	
		7																			EN1092-1 PN100	
		A																			ASME class 150	
		B																			ASME class 300	
		D																			ASME class 600	
		M																			Equivalent to JIS20K *1	
		N																			Equivalent to JIS10K (only for sizes 50 mm and 65 mm) *1	○
	Explosionproof		0																			Without (Non Ex type)
		1																			ATEX Ex (Pending)	
		F																			IEC Ex (Pending)	
		9																			TIIS Ex	
Cable entry for sensor		1																			Without (Compact type with converter)	○
Model																					Compact type with converter	○
Materials of sensor tube/flange							B														SS316/SS316	○
Sensor cable								0													Without (Compact type with converter)	○
Calibration								0													Standard calibration	○
(Fixed code)																					2 2 1 0 0 0 0 0 3 0 0 0	○
Special feature																					(Blank) None	○
																					/Z Specified	

*1 JIS20K flanges of 25 to 40 mm in size are used in common to JIS10K as standard.

Select code "M" for JIS20K flange for 25 to 40 mm in size.

All the dimensions of JIS10K and JIS20K are identical except for the thickness of flanges.

[Converter spec code]

Converter spec. code	VN35	4					6	0	0		2	1	0	0	0	3					Description	Std.	
Converter code	VN35																				ULC400 converter	○	
(Fixed code)		4																			Always 4	○	
Type		5																			Compact type	○	
Power supply		A																			100 to 230 V AC	○	
		1																			24 V DC		
Explosionproof		0																			Without (Non Ex type)	○	
		1																			ATEX Ex (Pending)		
		F																			IEC Ex (Pending)		
		9																			TIIS Ex		
Cable entry for power supply and input/output		4																			½" NPT		
		5																			G½ female	○	
		6																			M20 × 1.5		
		9																			G½ flameproof gasket adapter for TIIS explosionproof		
(Fixed code)																					6 0 0	○	
Converter housing																						1 Aluminum alloy	○
																						2 SS316	
Orientation of display																						A Version A	○
																						B Version B	
																						C Version C	
(Fixed code)																					2 1 0 0 0 0 3	○	
Special feature																						(Blank) None	○
																						/Z Specified	

●Nominal size : 80 to 300 mm

Model : UL3400C (General purpose), UL3400C-EEx (ATEX Explosionproof (Pending), IEC Ex (Pending)), UL3400C-JEx (TIIS Explosionproof)

[Sensor spec code]

Sensor spec code	VN62	4								0 0 2 1 0 0 0 0 0 3 0 0 0	Description	Std.
Sensor code	VN62										ULS3000 sensor (Nominal size: 80 to 300 mm)	○
(Fixed code)		4									Always 4	○
Nominal size	A										80 mm (3")	○
	B										100 mm (4")	○
	C										125 mm (5")	○
	D										150 mm (6")	○
	E										200 mm (8")	○
	F										250 mm (10")	○
	G										300 mm (12")	○
Flange	2										EN1092-1 PN10 (only for 200 to 300 mm)	
	3										EN1092-1 PN16 (only for 100 to 300 mm)	
	4										EN1092-1 PN25 (only for 100 to 300 mm)	
	5										EN1092-1 PN40 (only for 80 to 300 mm)	
	A										ASME class 150	
	B										ASME class 300	
	D										ASME class 600	
	M										Equivalent to JIS20K	
Explosionproof	N										Equivalent to JIS10K	○
	0										Without (Non Ex type)	○
	1										ATEX Ex (Pending)	
	F										IEC Ex (Pending)	
Cable entry for sensor	9										TIIS Ex	
	1										Without (Compact type with converter)	○
Model		1									Compact type with converter	○
Materials of sensor tube/flange/type of flange	2										SS316/SS316/slip-on welding	
	3										Carbon steel/carbon steel/butt welding *1	○
	B										SS316/SS316/butt welding	
Sensor cable	C										Carbon steel/carbon steel/butt welding *2	
	0										Without (Compact type with converter)	○
Calibration									0		Standard calibration	○
(Fixed code)										0 2 1 0 0 0 0 0 3 0 0 0	Always 021000003000	○
Special feature											(Blank) None	○
											/Z Specified	

*1 JIS flanges and EN1092-1 flanges: as standard. Note that butt welding is used for the EN1092-1 PN40 flange with the size of 200 to 300 mm.

*2 ASME flange: as standard

[Converter spec code]

Converter spec. code	VN35	4				6 0 0				2 1 0 0 0 0 3	Description	Std.
Converter code	VN35										ULC400 converter	○
(Fixed code)		4									Always 4	○
Type		5									Compact type	○
Power supply	A										100 to 230 V AC	○
	1										24 V DC	
Explosionproof	0										Without (Non Ex type)	○
	1										ATEX Ex (Pending)	
	F										IEC Ex (Pending)	
	9										TIIS Ex	
Cable entry for power supply and input/output	4										½" NPT	
	5										G½ female	○
	6										M20 × 1.5	
	9										G½ flameproof gasket adapter for TIIS explosionproof	
(Fixed code)					6 0 0						(Fixed code)	○
Converter housing	1										Aluminum alloy	○
	2										SS316	
Orientation of display	A										Version A	○
	B										Version B	
	C										Version C	
(Fixed code)									2 1 0 0 0 0 3		Always 2100003	○
Special feature											(Blank) None	○
											/Z Specified	

●Nominal size : 350 to 2000 mm

Model : UL3400C (General purpose), UL3400C-EEx (ATEX Explosionproof (Pending), IEC Ex (Pending)), UL3400C-JEx (TIIS Explosionproof)

[Sensor spec code]

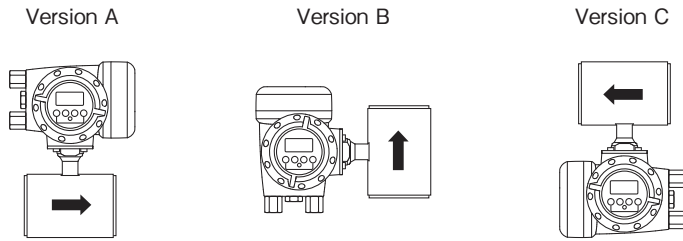
Sensor spec. code	VN63	4						0	0 2 1 0 0 0 0 3 0 0 0	Description	Std.
Sensor code	VN63									ULS3000 sensor (Nominal size: 350 to 2000 mm)	○
(Fixed code)		4								Always 4	○
Nominal size		H								350 mm (14")	○
		K								400 mm (16")	○
		L								450 mm (18")	○
		M								500 mm (20")	○
		N								600 mm (24")	○
		P								700 mm (28")	○
		R								800 mm (32")	○
		S								900 mm (36")	○
		T								1000 mm (40")	○
		U								1200 mm (48")	
		V								1400 mm (56")	
	W								1600 mm (64")		
	X								1800 mm (72")		
	Y								2000 mm (80")		
Flange		1								EN1092-1 PN6 (only for 1200 to 2000 mm)	
		2								EN1092-1 PN10 (only for 350 to 1000 mm)	
		3								EN1092-1 PN16	
		4								EN1092-1 PN25	
		5								EN1092-1 PN40	
		A								ASME class 150 (only for 350 to 600 mm)	
		B								ASME class 300 (only for 350 to 600 mm)	
		D								ASME class 600 (only for 350 to 600 mm)	
Explosionproof		0								Without (Non Ex type)	○
		1								ATEX Ex (Pending)	
		F								IEC Ex (Pending)	
		9								TIIS Ex	
Cable entry for sensor		1							Without (Compact type with converter)	○	
Model		1								Compact type with converter	○
Materials of sensor tube/flange/type of flange		2								SS316/SS316/slip-on welding	
		3								Carbon steel/carbon steel/butt welding *1	○
		B								SS316/SS316/butt welding	
		C								Carbon steel/carbon steel/butt welding *2	
Sensor cable		0							Without (Compact type with converter)	○	
Calibration		0							Standard calibration	○	
(Fixed code)								0 2 1 0 0 0 0 3 0 0 0	Always 02100003000	○	
Special feature									(Blank)	None	○
									/Z	Specified	

*1 JIS flanges and EN1092-1 flanges: as standard. Note that butt welding is used for the EN1092-1 PN40 flange with the size of 350 to 600 mm and EN1092-1 PN25 flange with the size of 450 to 600 mm.

*2 ASME flange: as standard

[Converter spec code]

Converter spec. code	VN35	4				6 0 0			2 1 0 0 0 3	Description	Std.
Converter code	VN35									ULC400 converter	○
(Fixed code)		4								Always 4	○
Type		5								Compact type	○
Power supply		A								100 to 230 V AC	○
		1								24 V DC	
Explosionproof		0								Without (Non Ex type)	○
		1								ATEX Ex (Pending)	
		F								IEC Ex (Pending)	
		9								TIIS Ex	
Cable entry for power supply and input/output		4								½" NPT	
		5								G½ female	○
		6								M20 × 1.5	
		9								G½ flameproof gasket adapter for TIIS explosionproof	
(Fixed code)					6 0 0				(Fixed code)	○	
Converter housing		1								Aluminum alloy	○
		2								SS316	
Orientation of display		A								Version A	○
		B								Version B	
		C								Version C	
(Fixed code)								2 1 0 0 0 3	Always 2100003	○	
Special feature									(Blank)	None	○
									/Z	Specified	

Orientation of display

The arrow indicates flow direction as standard.
The opposite direction can be set by changing the setting.

STANDARD ACCESSORIES

- Parameter sheet : 1
- Instruction manual : 1

OPTION

- G1/2 watertight cable glands for cable entry [Code : WG]
- Number of cable entries: 3 [Code : 3G]

ORDERING INSTRUCTIONS

Specify the following when ordering :

1. Model and specification codes

Example : model UL3400C

Sensor spec code : VN6144M011B00221000003000

Converter spec. code : VN3545A056001A2100003

2. Full scale flow range (no need for NS option)
3. Orientation of display on converter: Either A, B or C See above figures.
4. Optional requirements marked with above codes, if required.
5. Fluid name

* Specification is subject to change without notice.

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