FP-3021, FP-3021N

Flow computer for calculating compensated flow and thermal energy of steam, water and other liquid media, HART and RS-485/Modbus RTU communication

- Up to 2 independent installations (A, B)
- 2 PULS type inputs
- Port HART – Master 0/1 type
- RS-485 (1) port – Master (Modbus RTU protocol); RS-485 (2) port – Slave (Modbus RTU, ASCII protocols)
- Math channels & functions (+, -, /, *, √)
- User configurable data presentation, the colour TFT display
- USB port on the front panel
- Advanced data logging, recording data to the text files, 2 GB internal data memory
- Alarm & control functions, 4 solid state relays (SSR)
- Ethernet port (Modbus TCP protocol, serwer WWW)
- 4-20mA analogue output (option)
- GSM module (option)
- Dedicated PC software for commissioning and archive data visualization
- Available languages: EN, DE, FR, PL

FP-3021 and FP-3021N are versatile and precise flow totalizers used for measurement of steam and water in various industrial installations, measurements of industrial gases and typical or special liquids (like glycol, supercooled water, oils) in heat exchange systems. There is possibility of local alarming or simple control implementation. Data are recorded and can be read locally or periodically using a USB mass storage device.

Device can communicate with master system via Ethernet port (Modbus TCP protocol, www server) or via RS-485 port (Modbus RTU and ASCII protocols) and can work in distributed control systems.

Device may be configured by the user from the front panel or using commissioning software on PC.

APPLICATIONS FOR STEAM, LIQUIDS AND TECHNICAL GASES

- For A and B main application setup one of possible applications using a configuration wizard:
- the flow and heat of a liquid medium
- the flow and delta heat of a liquid medium in a closed supply-return installation
- the flow and delta heat of a liquid medium in an installation with different supply and return flow rates
- the flow and heat of a steam
- the flow and heat of steam for steam-condensate conditions
- the flow and delta heat in a closed steam-condensate installation
- the flow and delta heat in a steam-condensate installation with different steam and condensate flow rates
- the flow and delta heat in a steam-generating installation with the supplied water flow rate measured
- the flow of a technical gas

FLOW RATE MEASUREMENT

- The flow computer can work with:
- mass flowmeters
- volume flowmeters
- differential pressure devices with approximation by square root curve or differential pressure devices (orifices and nozzles) according to iteration algorithm according to PN-EN ISO 5167 standard (only for water and steam)

INPUTS AND CHANNELS TYPES

FP-3021/FP-3021N has: HART port, RS-485 (1) port – Master (5 channels for reading data), 2 PULS type inputs, RS-485 (2) port – Slave and Ethernet port. In addition, 8 auxiliary channels are available, which can be used as measuring channels or as a math channels. Up to 16 User's characteristics can be defined.

Input or Channel type	No.	Description
Measurement channel (HART/Modbus RTU)	5	reading data from transducers with the **HART** protocol: possible configuration as Primary or Secondary Master; read variables: PV – primary variable, SV – secondary variable, TV – third variable, FV – fourth variable; digital values read from transducers/devices connected in parallel to the current loop (Multidrop)
		reading data from instruments and transducers with the **Modbus RTU** protocol: sensors or instruments connected parallel to one twisted pair of wires (RS-485 (1) port); baud rate in range 1200 .. 115200 bps; available functions: 03 (Read Holding Register) and 04 (Read Input Register); registers in the range 0 ... 65535
PULS	2	frequency measurement mode in range 0.001 Hz .. 10 kHz, on/off state tracking
Auxiliary channel	8	measurement of additional quantities or calculation of the formula entered by the user (available mathematical operations: addition, subtraction, multiplication, division, extract the root)

THE SCOPE OF MEASUREMENT OF STEAM, WATER PARAMETERS AND OTHER MEDIA

- The flow and heat measurement of superheated or saturated steam or water are according to IAPWS-IF97 recommendations in the operating range of temperature 0 .. 800 °C and absolute pressure 0.05 .. 16.52 MPa
- Flow and energy measurements of liquids other than water are performed in the range of tabular values entered by the user – density and enthalpy as function of temperature
- Measurement of technical gas flow according to the ideal gas equation

TOTALIZERS

- Totalizers for energy and flow measurements (2 for each channel)
- Up to 12 totalizers: underflow or overflow
- Totalizers can be reset manually or automatically every day, week or month

ALARMS AND CONTROL

- 4 alarm thresholds for each result
- Alarm or control mode, signaling failure of sensors connected to analogue inputs
- 4 solid state relays rated at 0.1 A/60 V
- Option of informing about the alarm via SMS (optional GSM module connected to the RS485 (2) port)

RECORDING MEASUREMENT RESULTS

- Archive files: process values (recording rate from 3 s up to 24 h), totalizers and min/average/max values (record every 1 h and every 24 h)
- Event files: authorization log file, event log file, settings log file (recording after the occurrence of the event)
- 2 recording rates, toggled by alarm state for shorting/opening time of selected binary inputs
- Access to recorded data through USB port on the front panel or through Ethernet port
- Checksum secured files – protection against data manipulation

SCREEN EXAMPLES
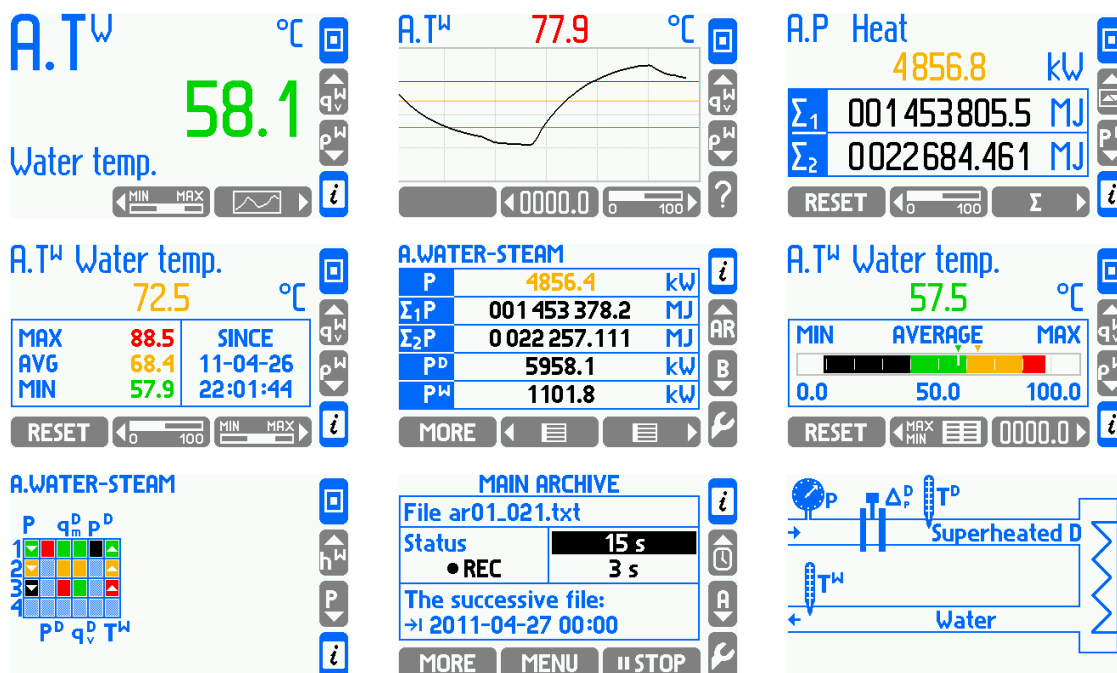
APPLICATION EXAMPLE
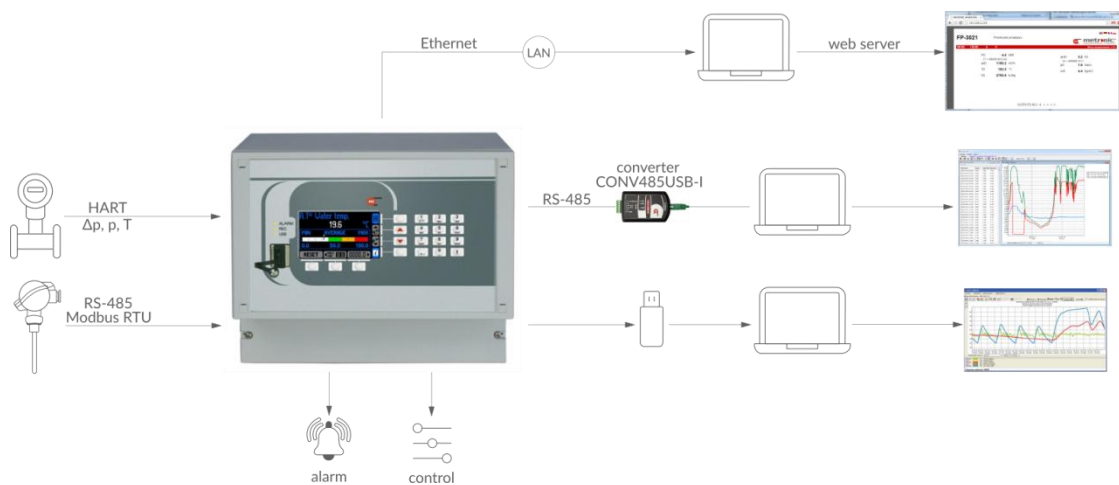
AVAILABLE OPTIONS AND ORDERING INFORMATION

FP-3021	(N)	- x	- y	
				panel mount version
	N			wall mount version
		- 0		basic option with one main application A
		- 1		extended option with A and B applications
			- 0	option without analogue 4-20mA output
			- 1	option with analogue 4-20mA output

For example device in wall mount version, in extended option with A and B applications, without analogue 4-20mA output has code: **FP-3021N-1-0**.

TECHNICAL SPECIFICATIONS

COMPENSATED FLOW AND HEAT ENERGY MEASUREMENT

Accuracy of compensated steam, water, other liquid or technical gas flow	<2% (typically <0.5%)
Frequency of measurement and calculation results	1 s

FRONT PANEL

Display type	LCD TFT colour 272x480 px
Display size	43.8 mm x 77.4 mm
Keyboard	• FP-3021: 7 membrane buttons • FP-3021N: 19 membrane buttons
LED indication	3 LEDs 3-colour, red-orange-green

INPUTS ORGANIZATION

FP-3021, FP-3021N	HART port: RS-485 (1) port: 2 x PULS:	IN1, IN2, IN3, IN4, IN5 IN6, IN7

HART port

Transmission protocol	Master type 0 or 1, rev. 4, rev. 5, rev. 6; FSK
Implemented features	Reading variables PV, SV, TV, FV Retrieve long address (rev. 5, rev. 6) Change of short address
Multidrop mode	Yes, up to 12 devices
Loop power	24 VDC (max 50 mA)
Analog line 4-20mA reading	No
Galvanic isolation from supply voltage	400 VAC (functional isolation)

RS-485 (1) serial port – Master

Transmission protocol	Modbus RTU
Data format	Uns. Integer, Integer, Uns. Long, Uns. Long (sw), Long, Long (sw), Float, Float (sw)
Frequency of reading	3 s, 4 s, 5 s, 6 s, 10 s, 12 s, 15 s, 30 s, 1 min
Baud rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbps
Address space of transducers	1 .. 247
Maximum load	32 receivers/transmitters
Maximum line length	1200 m
Maximum differential voltage A(+) – B(-)	-7 .. +12 V
Maximum total voltage A(+) – 'ground' or B(-) – 'ground'	-7 .. +12 V
Minimal output signal from transmitter	1.5 V (for R_0 = 54 Ω)
Minimum receiver sensitivity	200 mV / R_{IN} = 12 kΩ
Minimum impedance of data transmission line	54 Ω
Internal terminating resistor	Yes, activated by short-circuit pins on terminal block
Short-circuit/thermal protection	Yes/Yes
Galvanic isolation from supply voltage	400 VAC (functional isolation)

PULS type inputs (binary/pulse/frequency)

Maximum input voltage	±28 VDC
Galvanic isolation from supply voltage	400 VAC (functional isolation)
Functions	State detection Pulse counting Frequency measurement

Measuring range	0.001 Hz .. 10 kHz (0.001 Hz .. 1 kHz with filtrating capacitor)
Minimum impulse width	20 μs 0.5 ms with filtrating capacitor
Accuracy (at T_a = +20 °C)	0.02%

<div align="center">Configuration: OC/contact[1]</div>

Open circuit voltage	12 V
Short circuit current	12 mA
On/off threshold	2.7 V / 2.4 V

[1]The default setting.

<div align="center">Configuration: voltage input</div>

Input resistance	>10 kΩ
On/off threshold	2.7 V / 2.4 V
Open circuit voltage	12 V

<div align="center">Configuration: Namur</div>

High impedance state	0.4 .. 1 mA
Low impedance state	2.2 .. 6.5 mA

<div align="center">4-20mA analogue output (optional)</div>

Output signal	4-20mA (3.6–22 mA)
Maximum voltage between I+ and I-	28 VDC
Loop resistance (at U_{cc} = 24 V)	0 .. 500 Ω
Converter resolution D/A	16 bits
Accuracy	0.5%
Current loop supply	External or internal power supply 24 VDC /22 mA
Galvanic isolation from supply voltage	400 VAC (functional isolation)

<div align="center">Binary outputs (Solid State Relays)</div>

Number of outputs	4
Type of outputs	Solid State Relays
Maximum load current	100 mA DC/AC
Maximum voltage	60 V DC/AC
Galvanic isolation between outputs	400 VAC (functional isolation)
Galvanic isolation from supply voltage	400 VAC (functional isolation)

<div align="center">RS-485 (2) serial port – Slave</div>

Maximum load	32 receivers/transmitters
Maximum line length	1200 m
Maximum differential voltage A(+) – B(-)	-7 .. +12 V
Maximum total voltage A(+) – 'ground' or B(-) – 'ground'	-7 .. +12 V
Minimal output signal from transmitter	1.5 V (for R_0 = 54 Ω)
Minimum receiver sensitivity	200 mV / R_{IN} = 12 kΩ
Minimum impedance of data transmission line	54 Ω
Internal terminating resistor	Yes, activated by short-circuit pins on terminal block
Short-circuit/thermal protection	Yes/Yes
Transmission protocol	ASCII Modbus RTU
Baud rate	2.4, 4.8, 9.6 ,19.2, 38.4, 57.6, 115.2 kbps
Parity control	Even, Odd, None

Frame	1 start bit, 8 data bits, 1 stop bit
Galvanic isolation	No

Ethernet port	
Transmission protocol	Modbus TCP, ICMP (ping), DHCP server, http server
Interface	10BaseT Ethernet
Data buffer	300 B
Number of opened connections (simultaneously)	4
Connector type	RJ-45
LED signaling	2, build in RJ-45 socked

USB port	
Socket type	A type, according to USB standard
Version	USB 1.1
Socket protection class	IP54
Recording format	FAT16 (within a limited scope)
Recording indication	red-orange-green LED on the front panel

FP-3021 power supply	
Supply voltage	24 VAC (+5%/-10%) or 24 VDC (15 .. 30 VDC)
Maximum power consumption	5 VA / 5 W

FP-3021N power supply	
Supply voltage	100 .. 240 VAC 50/60 Hz or 24 VAC (+5%/-10%) or 24 VDC (15 .. 30 VDC)
Maximum power consumption	14 VA / 14 W (for 100 .. 240 VAC power supply) 5 VA / 5 W (for 24 VAC/VDC power supply)

Wire terminals	
Type	• FP-3021: screw type terminal blocks • FP-3021N: spring type terminal block
Conductor cross section	• FP-3021: solid max. 1.5 mm^2 • FP-3021N: stranded 0.2 .. 1.5 mm^2

FP-3021 enclosure – dimensions	
Enclosure type	Panel mount, nonflammable plastic material 'Noryl'
Dimensions (width x height x depth)	144 mm x 72 mm x 130 mm
Enclosure depth with terminals	ca. 140 mm
Panel cut-out dimensions (width x height)	$138^{+1.0}$ mm X $68^{+0.7}$ mm
Panel maximum thickness	5 mm
Weight	ca. 0.5 kg
Protection class from the front panel	IP54
Protection class from the rear panel	IP30

FP-3021N enclosure – dimensions	
Enclosure type	Wall mount, PC material
Dimensions (width x height x depth)	257 mm X 217 mm X 125 mm (without cable glands) 257 mm X 247 mm X 125 mm (with cable glands)
Weight	ok. 2.1 kg
Protection class	IP54

Environmental conditions

Ambient temperature	• FP-3021: 0 .. +50 °C • FP-3021N: -20 .. +50 °C
Relative humidity	0 .. 75% (without steam condensation)
Storage temperature	-20 .. +80 °C
Overvoltage category	OV II
Pollution degree	PD 2
LVD (safety)	EN 61010-1
EMC	Directive 2014/30/EU: • immunity for industrial environments according to EN 61326-1:2013 (Table 2) • conductive and radiated emissions Class A equipment according to EN 61326-1:2013
RoHS	Directive 2011/65/EU
Installation location	• FP-3021: Indoor only • FP-3021N: Indoor or outdoor[2]

[2]If additional protection against atmospheric precipitation is provided (roofing), the device can be installed outdoor.

Data sheet version: 181203EN Device version: 1.31