

DIFFERENTIAL / SUM FLOWCOMPUTER

WITH ANALOG AND PULSE SIGNAL OUTPUTS



Features

- Calculates differential flowrate (consumption) total and accumulated total of flow A and B or the sum .
- Precautions for pulsating flows and very low consumption readings.
- 7 digit resettable total.
- 11 digit accumulated total.
- Large 17mm (0.67") digit selection for flowrate or total.
- Analog and pulse signal outputs.
- Very compact design for panel mount, wall mount or field mount applications.
- Operational temperature -30°C up to +80°C (-22°F up to 178°F).
- Rugged aluminum field mount enclosure IP67/NEMA4X.
- Intrinsically Safe
 Ⓢ II 1 GD EEx ia IIB/IIC T4 T100°C.
- Explosion/flame proof Ⓢ II 2 GD EEx d IIB T5.
- Full Modbus communication RS232/485/TTL.
- Loop or battery powered, 8 - 24V AC/DC or 115 - 230V AC power supply.
- Sensor supply 3.2 - 8.2 - 12 - 24V DC.

Signal output

- (0)4 - 20mA / 0 - 10V DC according to differential / sum flowrate.
- Scaled pulse output according to differential / sum accumulated total.
- Negative pulse value indication.

Signal input

Flow

- Reed-switch.
- NAMUR.
- NPN/PNP pulse.
- Sine wave (coil).
- Active pulse signals.
- (0)4 - 20mA.
- 0 - 10V DC.

Applications

- fuel consumption calculation for diesel engines on board of ships or locomotives. Sum function: where flows are split-up in two pipe-lines and total flow has to be calculated. More advanced model: F127.

General information

Introduction

The flowcomputer Model F116 has been developed to calculate differential or total volume. Typical applications are the measurement of fuel consumption or the calculation of total flow (sum) if - for costs reasons - two low cost flowmeters can be used instead of one expensive flowmeter. The usual difficulties encountered in such applications include: pulsating flows, very low consumption readings, vibration and high ambient temperatures. These are all well catered for in the design and operation of the F116.

Display

The display has large 17mm (0.67") and 8mm (0.31") digits which can be set to show flowrate and total. On-screen engineering units are easily configured from a comprehensive selection. The accumulated total can register up to 11 digits and is backed-up in EEPROM memory every minute.

Configuration

All configuration settings are accessed via a simple operator menu which can be pass-code protected. Each setting is clearly indicated with an alphanumeric description, therefore avoiding confusing abbreviations. Once familiar with one F-series product, you will be able to program all models in the series without a manual. All settings are safely stored in EEPROM memory in the event of sudden power loss.

Analog output signal

The calculated flowrate is re-transmitted with the (0)4 - 20mA or 0 - 10V DC output signal. The output signal is updated ten times per second with a filter function being available to smoothen out the signal if desired.

The output value is user defined in relation to the flowrate, e.g. 4mA equals to 15L/Hr and 20mA equals to 2000L/Hr. The output signal can be passive, active or isolated where the passive output type will loop power the F116 as well.

Pulse output

The scaleable pulse output, reflects the count on the accumulated display. The pulse length is user defined and the maximum output frequency is 64Hz. The second output will be

switched in case the total is counting down (negative consumption). The output signal can be a passive NPN, active PNP or an isolated electro-mechanical relay.

Signal input

The F116 will accept most pulse and analog input signals for flow or mass flow measurement. The input signal type can be selected by the user in the configuration menu without having to adjust any sensitive mechanical dip-switches or jumpers.

Communication

All process data and settings can be read and modified manually or through the Modbus communication link (RS232 / RS485).

Full Modbus functionality remains available for the Intrinsically Safe version (TTL).

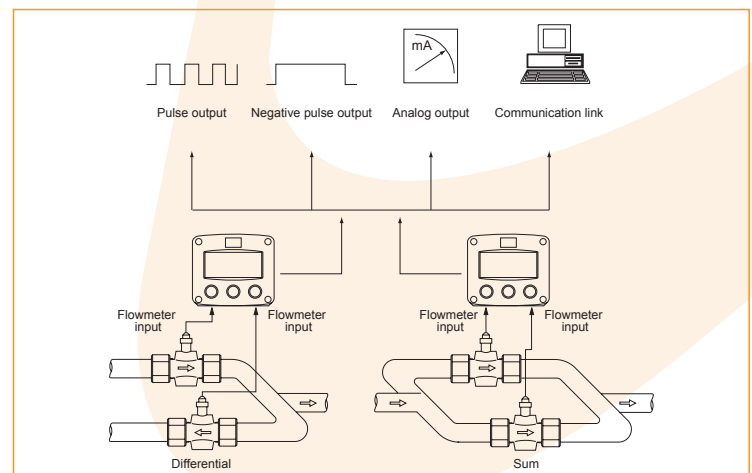
Hazardous areas

For hazardous area applications, this model has been ATEX certified Intrinsically Safe $\text{Ex II 1 GD EEx ia IIB / IIC T4 T100}^\circ\text{C}$ with an allowed operational temperature of -30°C to $+70^\circ\text{C}$ (-22°F to $+158^\circ\text{F}$). A flame proof enclosure is also available with the rating $\text{Ex II 2 GD EEx d IIB T5}$.

Enclosures

Various types of enclosures can be selected, all ATEX approved. As standard the F116 is supplied in an ABS panel mount enclosure. Most popular is our rugged aluminum field mount enclosure with IP67 / NEMA 4X rating. Both European or U.S. cable gland entry threads are available.

Overview application F116



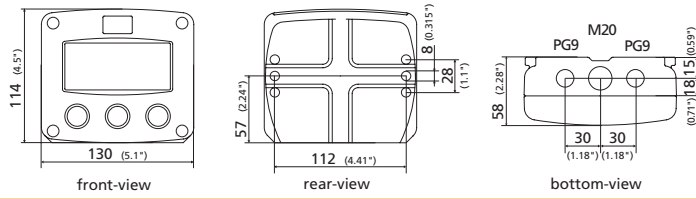
Dimensions enclosures

Enclosure HA

Aluminum field mount enclosure

IP67 / NEMA 4X

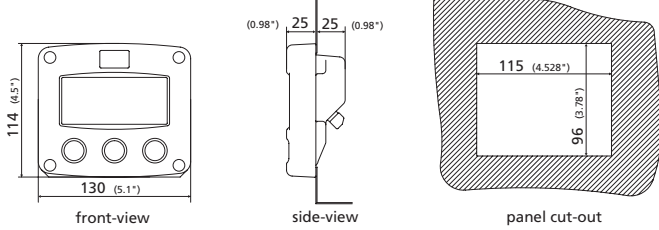
Tapped holes: European thread



Enclosure HB

Aluminum panel mount enclosure

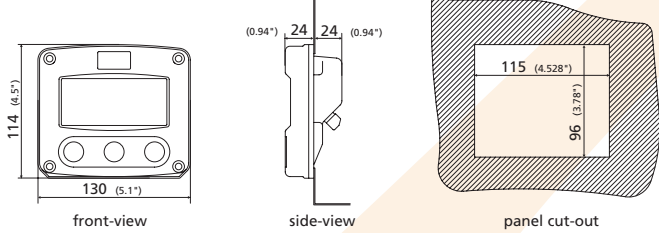
IP65 / NEMA 4



Enclosure HC (standard)

ABS panel mount enclosure

IP65 / NEMA 4

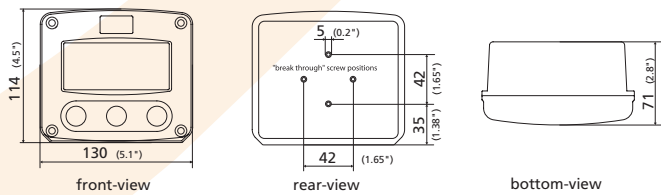


Enclosure HD

ABS wall mount enclosure

IP67 / NEMA 4X

Holes user defined

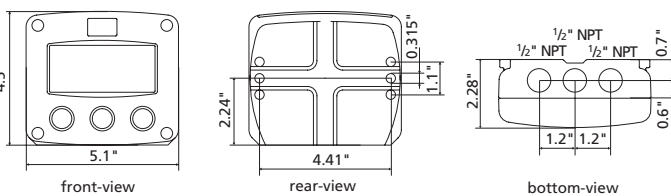


Enclosure HU

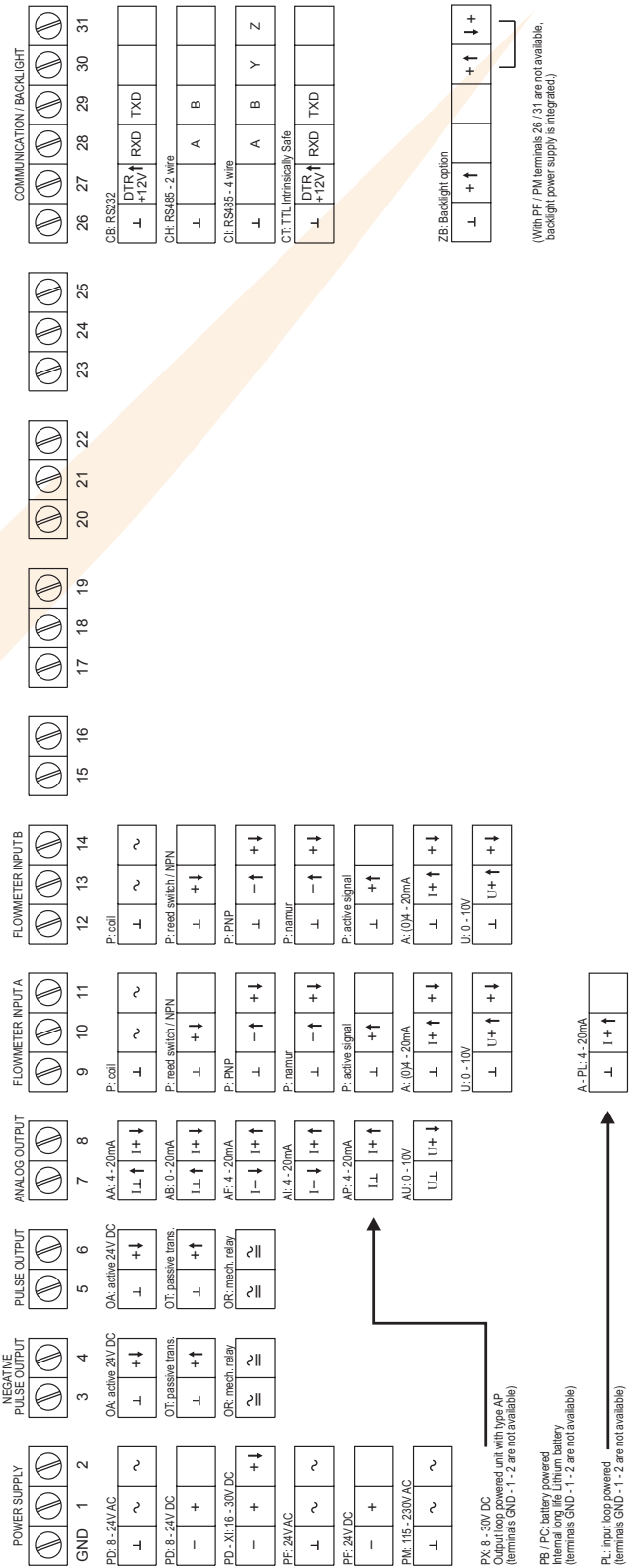
Aluminum field mount enclosure

IP67 / NEMA 4X

Tapped holes: U.S. thread

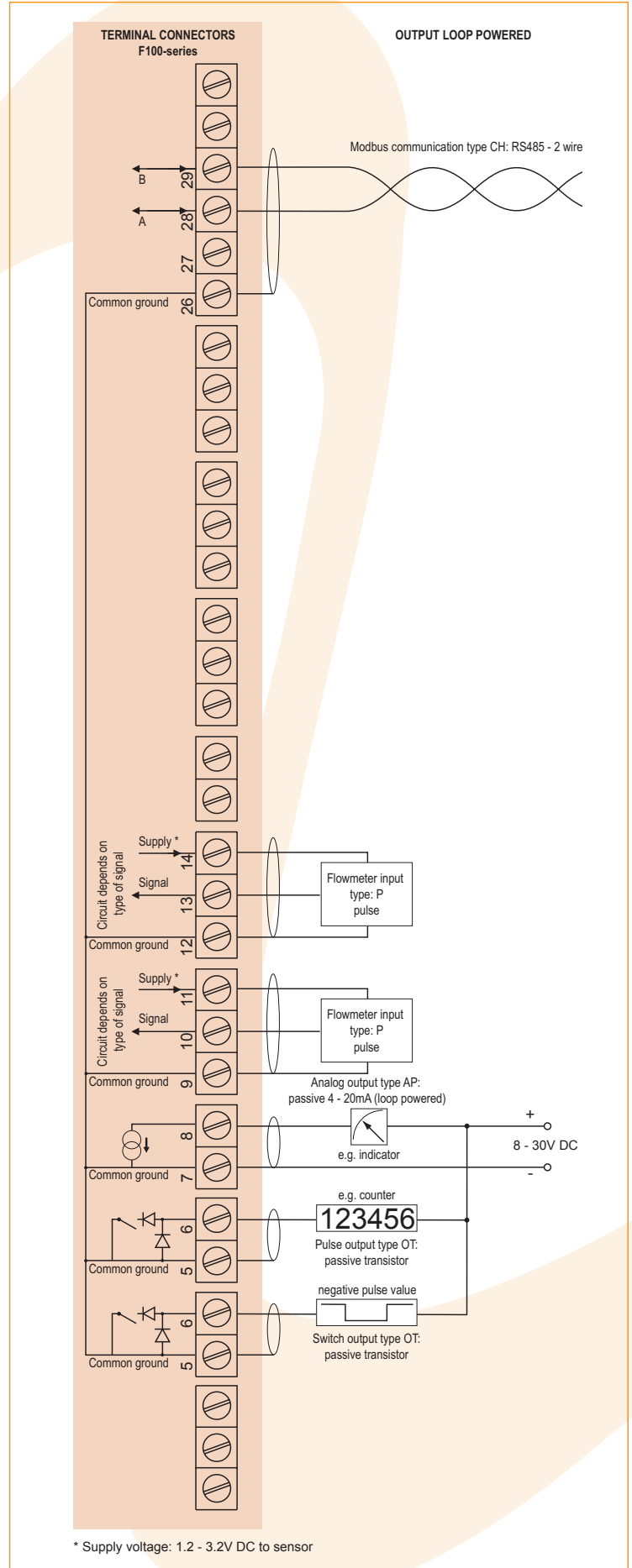
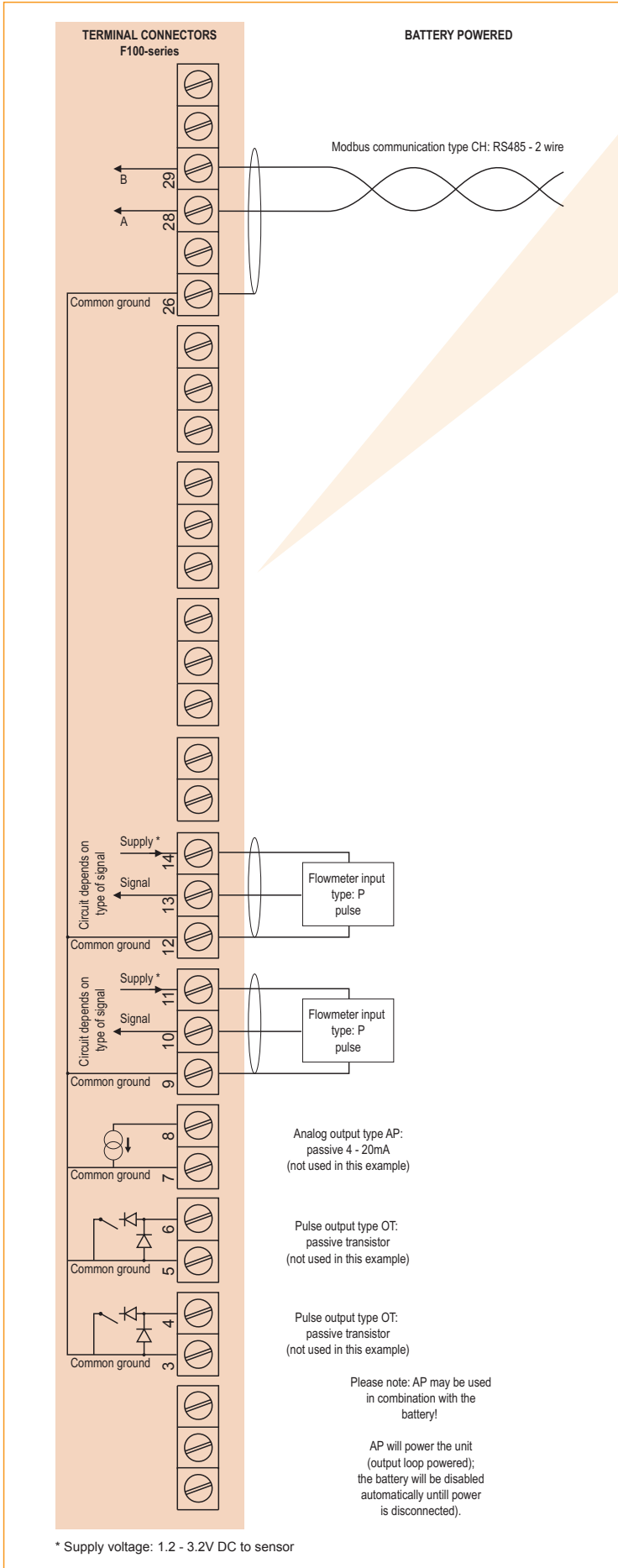


Terminal connections

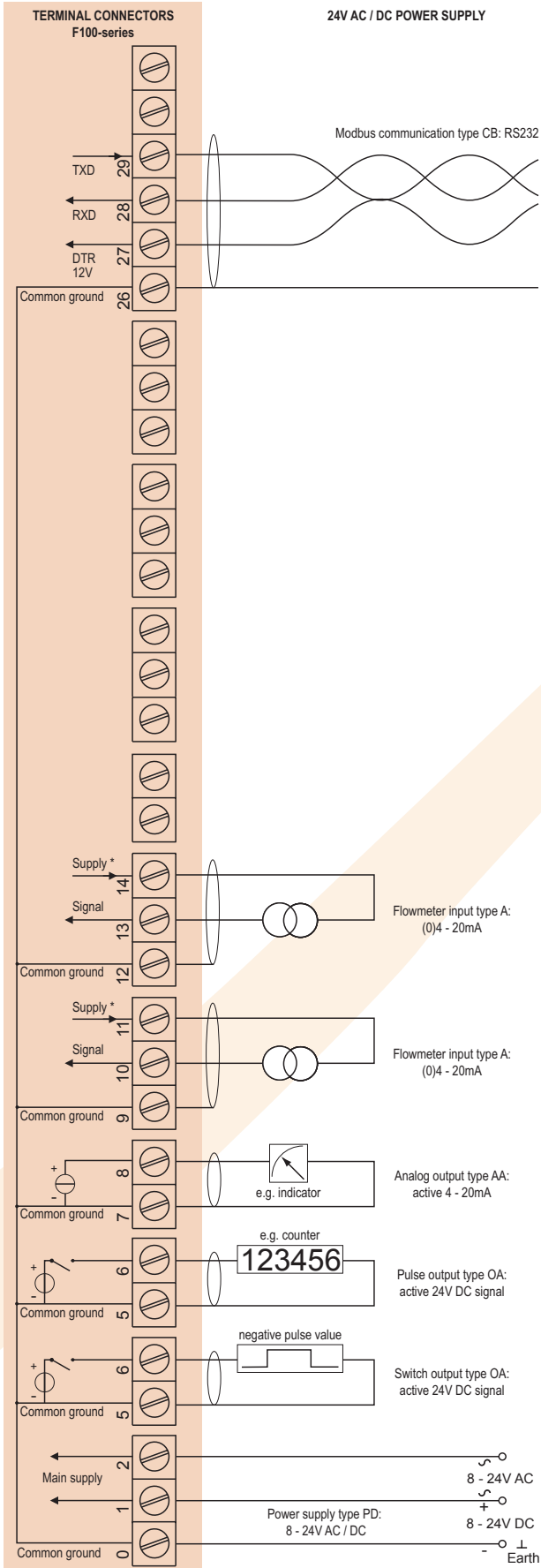


Typical wiring diagram F116-P-(AP)-CH-(OT)-PB

Typical wiring diagram F116-P-AP-CH-OT-PX

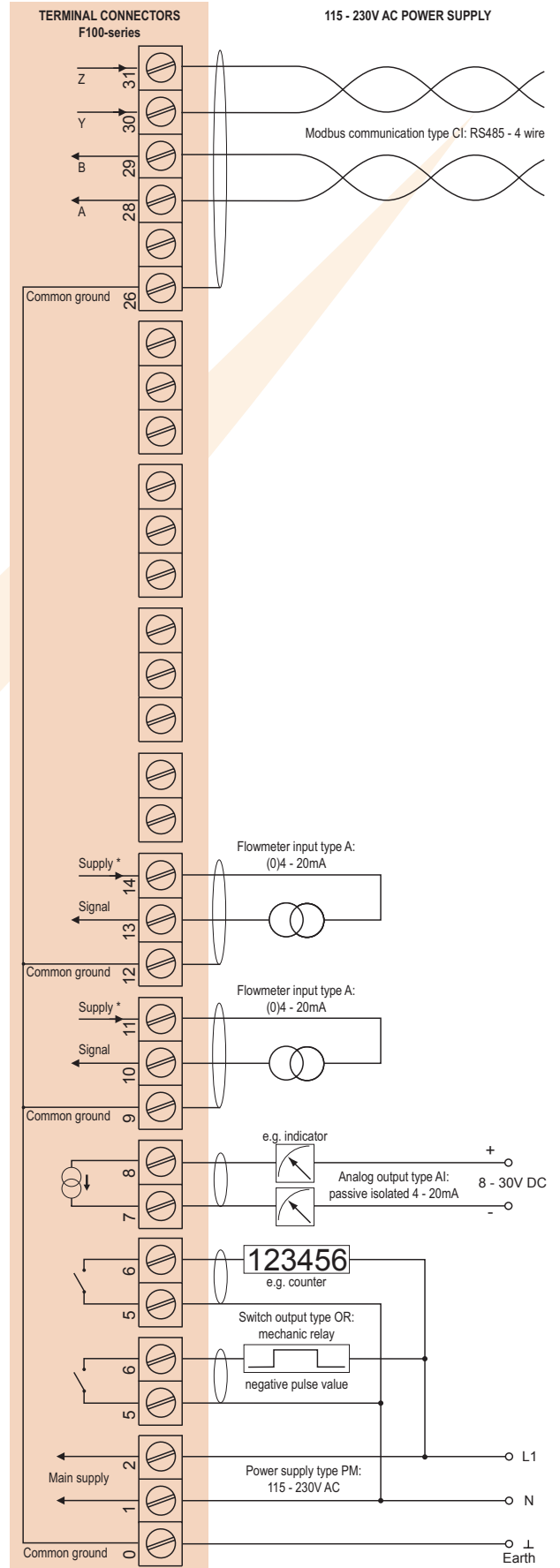


Typical wiring diagram F116-A-AA-CB-OA-PD





* Supply voltage: 3.2 - 8.2 - 12 - 24V DC to sensor

Typical wiring diagram F116-A-AI-CI-OR-PM





* Supply voltage: 3.2 - 8.2 - 12 - 24V DC to sensor

Hazardous area applications

The F116-XI has been ATEX approved by KEMA for use in Intrinsically Safe applications. It is approved according to  II 1 GD EEx ia IIB/IIC T4 T100°C for gas and dust applications with an operational temperature range of -30°C to +70°C (-22°F to +158°F). Besides the two I.S. power supplies for the pulse outputs, it is allowed to connect up to four I.S. power supplies in IIB applications or one in IIC applications. Full functionality of the F116 remains available, including 4 - 20mA output, pulse output and Modbus communication (type CT). Power supply type PD-XI offers a 8.2V sensor supply e.g. for two Namur sensors. A flame proof enclosure with rating  II 2 GD EEx d IIB T5 is available as well. Please contact your supplier for further details.

Certificate of conformity KEMA 03ATEX1074 X

(1) **EC-TYPE EXAMINATION CERTIFICATE**

(2) Equipment or protective system intended for use in potentially explosive atmospheres – Directive 94/9/EC

(3) EC-Type Examination Certificate Number: KEMA 03ATEX1074 X

(4) Equipment or protective system: Indicator Model F100 Series

(5) Manufacturer: Fluidwell B.V.

(6) Address: Eisenhowerweg 1, 5466 AB Veghel, The Netherlands

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V., notified body number 0344 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report no. 2028528.

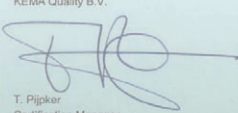
(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014 : 1997 EN 50020 : 2002 EN 50281-1-1 : 1998 EN 50284 : 1999

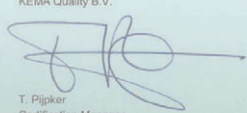
(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-Type Examination Certificate relates only to the design, examination and tests of the specified equipment or protective system according to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.

(12) The marking of the equipment or protective system shall include the following:

 II 1 GD EEx ia IIB/IIC T4 T 100 °C


Amham, 2 July 2003
KEMA Quality B.V.


T. Pijker
Certification Manager

* This Certificate may only be reproduced in its entirety and without any change

KEMA Quality B.V.
Ulrechtsweg 310, 6812 AR Amham, The Netherlands
P.O. Box 5165, 6602 ED Amham, The Netherlands
Telephone +31 26 3 56 20 08, Telefax +31 26 3 52 58 00

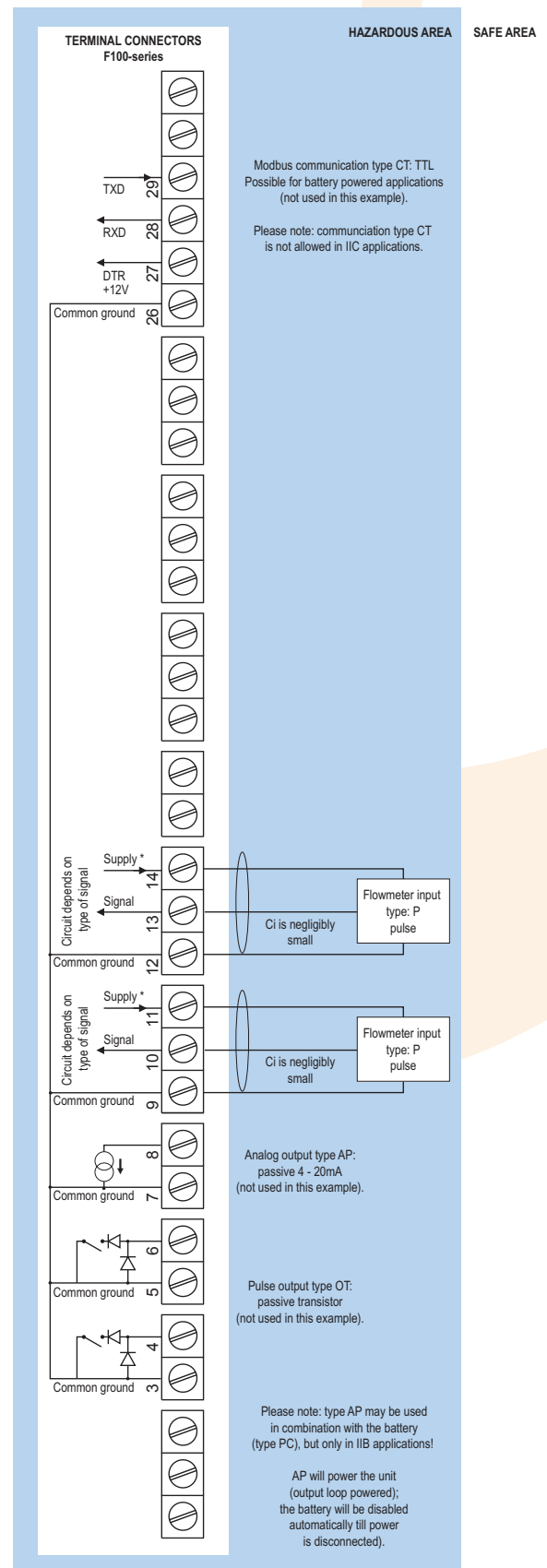
ACCREDITED BY THE
DUTCH ACCREDITATION
COUNCIL



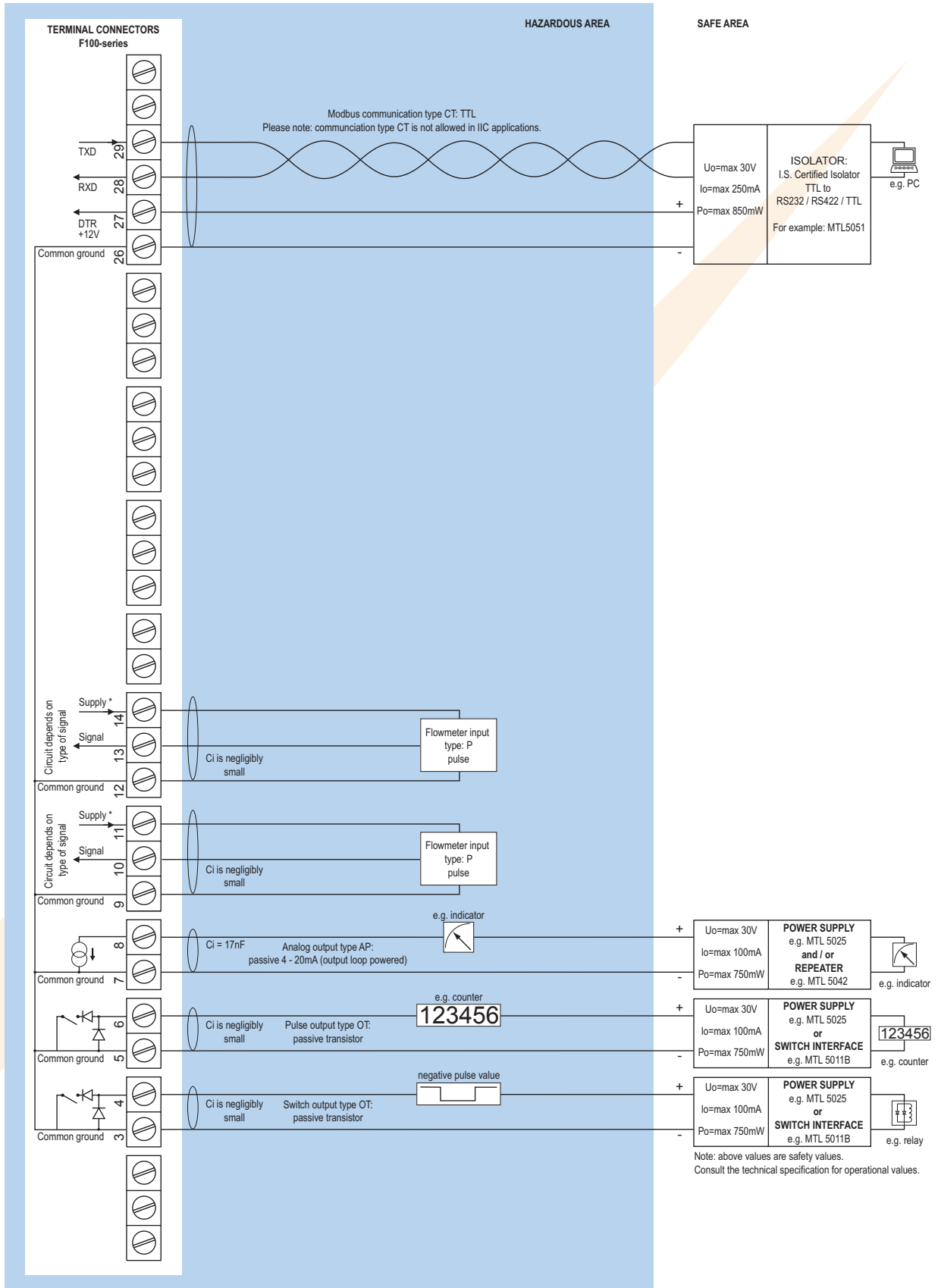
Page 1/8

Configuration example IIB and IIC

F116-P-(AP)-(CT)-(OT)-PC-XI - Battery powered unit

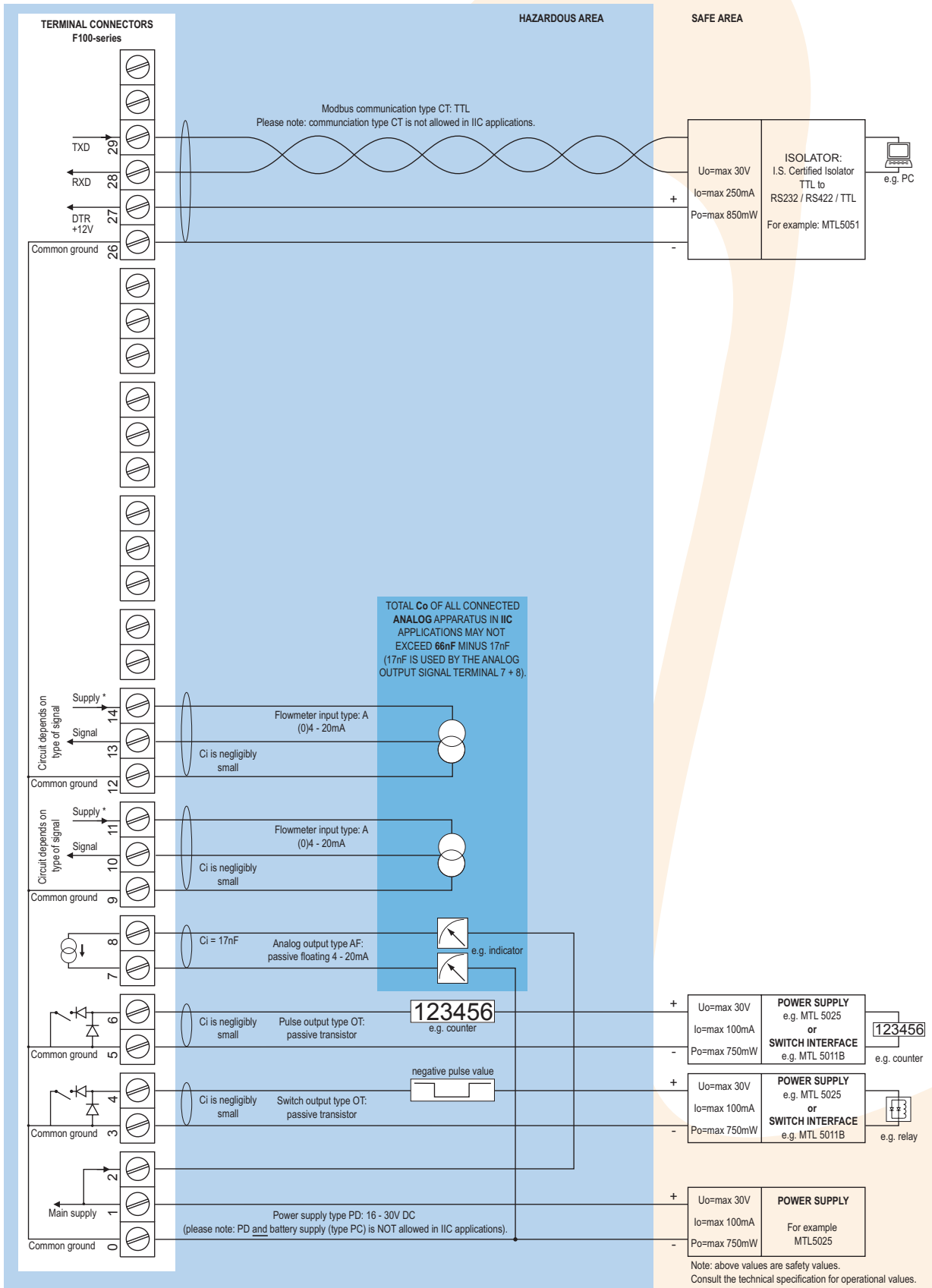


Configuration example IIB and IIC - F116-P-AP-(CT)-OT-PX-XI - Output loop powered



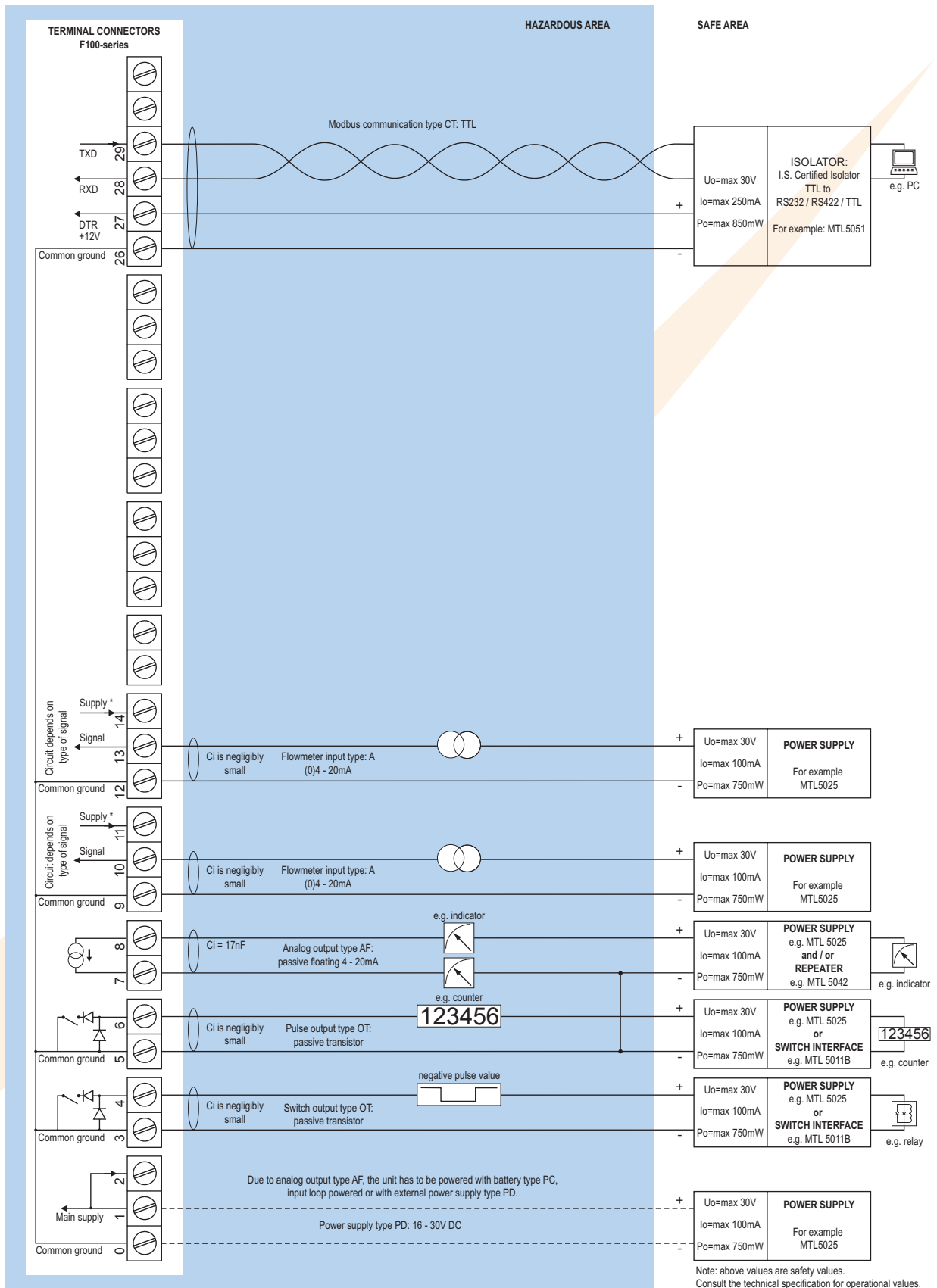
* Note sensor supply voltage: 1.2V DC for coil sensors or 3.2V DC for other pulse sensors.

Configuration example IIB and IIC - F116-A-AF-(CT)-OT-PD-XI - Power supply 16 - 30V DC



* Note power supply type PD: the supply voltage to pulse sensors is maximum 8.7V (U_o=max 8.7V I_o=max 25mA P_o=max 150mW) and to analog sensors as connected to terminal 1 (internally linked).

Configuration example IIB - F116-A-AF-CT-OT-(PC)-(PD)-(PL)-XI - Power supply 16 - 30V DC, battery or loop powered



* Note power supply type PD: the supply voltage to pulse sensors is maximum 8.7V (Uo=max 8.7V Io=max 25mA Po=max 150mW) and to analog sensors as connected to terminal 1 (internally linked).

Technical specification

General

Display	
Type	High intensity reflective numeric and alphanumeric LCD, UV-resistant.
Dimensions	90 x 40mm (3.5" x 1.6").
Digits	Seven 17mm (0.67") and eleven 8mm (0.31") digits. Various symbols and measuring units.
Refresh rate	User definable: 8 times/sec. - 30 secs.
Option ZB	Transflective LCD with green LED backlight. Good readings in full sunlight and darkness.
Note	Only available for safe area applications.

Casing	
Window	Polycarbonate window.
Sealing	EPDM and PE.
Control keys	Three industrial micro-switch keys. UV-resistant polyester keypad.
Type HA	Die-cast aluminum field mount enclosure IP67 / NEMA 4X with 2-component UV-resistant coating.
Dimensions	130 x 114 x 58mm (5.1" x 4.5" x 2.28") - W x H x D.
Cable Entry	2 x PG9 and 1 x M20 tapped hole in the centre.
Weight	950 gr.
Type HB	Die-cast aluminum panel mount enclosure IP65 / NEMA 4 with 2-component UV-resistant coating.
Dimensions	130 x 114 x 50mm (5.1" x 4.5" x 1.97") - W x H x D.
Panel cut-out	115 x 96mm (4.53" x 3.78") LxH.
Weight	525 gr.
Type HC	ABS panel mount enclosure IP65 / NEMA 4, UV-resistant and flame retardant.
Dimensions	130 x 114 x 48mm (5.1" x 4.5" x 1.89") - W x H x D.
Panel cut-out	115 x 96mm (4.53" x 3.78") LxH.
Weight	300 gr.
Type HD	ABS wall mount enclosure IP67 / NEMA 4X, UV-resistant and flame retardant.
Dimensions	130 x 114 x 71mm (5.1" x 4.5" x 2.8") - W x H x D.
Cable Entry	None, user defined.
Weight	400 gr.
Type HU	Die-cast aluminum field mount enclosure IP67 / NEMA 4X with 2-component UV-resistant coating.
Dimensions	5.1" x 4.5" x 2.28" - W x H x D.
Cable Entry	3 x 1/2" NPT tapped hole.
Weight	950 gr.



Operating temperature	
Operational	-30°C to +80°C (-22°F to +178°F).
Intrinsically Safe	-30°C to +70°C (-22°F to +158°F).

Power requirements	
Type PB	Long life Lithium battery - life-time depends upon settings and configuration - up to 5 years.
Type PC	Intrinsically Safe long life lithium battery - life-time depends upon settings and configuration - up to 5 years.
Type PD	8 - 24V AC / DC \pm 10%. Power consumption max. 10 Watt. Intrinsically Safe: 16 - 30V DC; power consumption max. 0.75 Watt.
Type PF	24V AC / DC \pm 10%. Power consumption max. 15 Watt.
Type PL	Input loop powered from sensor signal 4 - 20mA (type "A") - requires types AI or AF and OT.
Type PM	115 - 230V AC \pm 10%. Power consumption max. 15 Watt.
Type PX	8 - 30V DC. Power consumption max. 0.5 Watt.
Type ZB	12 - 24V DC \pm 10% or type PD / PF / PM. Power consumption max. 1 Watt.
Note PB/PF/PM	Not available Intrinsically Safe.
Note PF/PM	The total consumption of the sensors and outputs may not exceed 400mA @ 24V.
Note	For Intrinsically Safe applications, consult the safety values in the certificate.

Sensor excitation	
Type PB/PC/PX	3.2V DC for pulse signals and 1.2V DC for coil pick-up.
Note	This is not a real sensor supply. Only suitable for sensors with a very low power consumption like coils (sine wave) and reed-switches.
Type PD	1.2 - 3.2 - 8.2 - 12 and 24V DC - max. 50mA @ 24V DC.
Type PD-XI	1.2 - 3.2 - 8.2V DC - max. 7mA @ 8.2V DC and mains power supply voltage (as connected to terminal 1).
Note	In case PD-XI and signal A or U: the sensor supply voltage is according to the power supply voltage connected to terminal 1. Also terminal 2 offers the same voltage.
Type PF / PM	1.2 - 3.2 - 8.2 - 12 and 24V DC - max. 400mA @ 24V DC.

Terminal connections	
Type	Removable plug-in terminal strip. Wire max. 1.5mm ² and 2.5mm ² .

Data protection	
Type	EEPROM backup of all settings. Backup of running totals every minute. Data retention at least 10 years.
Pass-code	Configuration settings can be pass-code protected.

Hazardous area	
Intrinsically Safe	ATEX approval ref.:  II 1 GD EEx ia IIB/IIC T4 T100°C.
Type XI	Maximum ambient +70°C (158°F).
Explosion proof	ATEX approval ref.:  II 2 GD EEx d IIB T5.
Type XF	Dimensions of enclosure: 350 x 250 x 200mm (13.7" x 9.9" x 7.9") L x H x D.
Weight	appr. 15 Kg.

Environment	
Electromagnetic compatibility	Compliant ref: EN 61326 (1997), EN 61010-1 (1993).

Signal inputs

Flowmeter

Type P	Coil / sine wave (minimum 20mVpp or 80mVpp - sensitivity selectable), NPN/PNP, open collector, reed-switch, Namur, active pulse signals 8 - 12 and 24V DC.
Frequency	Minimum 0Hz - maximum 7kHz for total and flowrate. Maximum frequency depends on signal type and internal low-pass filter. E.g. reed switch with low-pass filter: max. frequency 120Hz.
K-Factor	0.000010 - 9,999,999 with variable decimal position.
Low-pass filter	Available for all pulse signals.
Option ZF	coil sensitivity 10mVpp.
Type A	(0)4 - 20mA. Analog input signal can be scaled to any desired range within 0 - 20mA.
Type U	0 - 10V DC. Analog input signal can be scaled to any desired range within 0 - 10V DC.
Accuracy	Resolution: 14 bit. Error < 0.025mA / \pm 0.125% FS. Low level cut-off programmable.
Span	0.000010 - 9,999,999 with variable decimal position.
Update time	Four times per second.
Voltage drop	Type A: 2.5V @ 20mA.
Load impedance	Type U: 3k Ω .
Relationship	Linear and square root calculation.
Note	For signal type A and U: external power to sensor is required; e.g. type PD.

Signal outputs

Analog output

Function	Transmitting differential / sum flowrate.
Accuracy	10 bit. Error < 0.05%. Analog output signal can be scaled to any desired range.
Update time	Ten times per second.
Type AA	Active 4 - 20mA output (requires OA + PD, PF or PM).
Type AB	Active 0 - 20mA output (requires OA + PD, PF or PM).
Type AF	Passive floating 4 - 20mA output for Intrinsically Safe applications (requires PC, PL or PD).
Type AI	Passive galvanically isolated 4 - 20mA output - also available for battery powered models (requires PB, PD, PF, PL or PM).
Type AP	passive 4 - 20mA output - not isolated. Unit will be loop powered.
Type AU	Active 0 - 10V DC output (requires OA + PD, PF or PM).

Pulse output

Function	Pulse output according to differential or sum accumulated total and indication negative pulse output.
Frequency	Max. 64Hz. Pulse length user definable between 7.8 msec up to 2 seconds.
Type OA	Two active 24V DC transistor outputs (PNP); max. 50mA per output (requires AA + PD, PF or PM).
Type OR	Two electro-mechanical relay outputs (N.O.) - isolated; max. switch power 230V AC - 0.5A per relay (requires PF or PM).
Type OT	Two passive transistor outputs (NPN) - not isolated.
Load	Max. 50V DC - 300mA per output.

Communication option

Function	Reading display information, reading / writing all configuration settings.
Protocol	Modbus RTU.
Speed	1200 - 2400 - 4800 - 9600 baud.
Addressing	Maximum 255 addresses.
Type CB	RS232
Type CH	RS485 2-wire
Type CI	RS485 4-wire
Type CT	TTL Intrinsically Safe.

Operational

Operator functions

Displayed functions	<ul style="list-style-type: none"> Differential flowrate (consumption) or the sum of both flowrates. Differential / sum total and accumulated total. Total can be reset to zero by pressing the CLEAR-key twice.
---------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Total

Digits	7 digits.
Units	L, m ³ , GAL, USGAL, KG, lb, bbl, no unit.
Decimals	0 - 1 - 2 or 3.
Note	Total can be reset to zero.

Accumulated total

Digits	11 digits.
Units / decimals	According to selection for total.
Note	Can not be reset to zero.

Flowrate

Digits	7 digits.
Units	mL, L, m ³ , Gallons, KG, Ton, lb, bl, cf, RND, ft ³ , scf, Nm ³ , NL, igital - no units.
Decimals	0 - 1 - 2 or 3.
Time units	/sec - /min - /hr - /day.

Display example - 90 x 40mm (3.5" x 1.6")



Ordering information

Example (standard configuration)

F116-P-AP-CX-HC-OT-PX-XX-ZX.

Explanation standard configuration:

P: flowmeter signal: pulse; AP: passive 4 - 20mA analog output; CX: no communication; HC: ABS panel mount enclosure; OT: passive transistor output; PX: basic power supply 8 - 30V DC (requires AP); XX: safe area; ZX: no options.

Ordering information:	FXXX	-	-A	-C	-H	-O	-P	-X	-Z
Flowmeter input signal									
A	⊗								
(0)4 - 20mA input.									
P	⊗								
Pulse input: coil, npn, pnp, namur, reed-switch.									
U	⊗								
0 - 10V DC input.									
Analog output signal									
AA									
Active 4 - 20mA output - requires OA + PD, PF or PM.									
AB									
Active 0 - 20mA output - requires OA + PD, PF or PM.									
AF	⊗								
I.S. floating 4 - 20mA output - requires PC, PL or PD.									
AI									
Isolated 4 - 20mA output - requires PB, PD, PF, PL or PM.									
AP	⊗								
Passive 4 - 20mA output, loop powered unit.									
AU									
Active 0 - 10V DC output - requires OA + PD, PF or PM.									
Communication									
CB									
Communication RS232 - Modbus RTU.									
CH									
Communication RS485 - 2wire - Modbus RTU.									
CI									
Communication RS485 - 4 wire - Modbus RTU.									
CT	⊗								
Intrinsically Safe TTL - Modbus RTU.									
CX	⊗								
No communication.									
Enclosure									
HA	⊗								
Aluminum field mount enclosure IP67 / NEMA 4X.									
HB	⊗								
Aluminum panel mount enclosure IP65 / NEMA 4.									
HC	⊗								
ABS panel mount enclosure IP65 / NEMA 4.									
HD	⊗								
ABS wall mount enclosure IP67 / NEMA 4X.									
HU	⊗								
Aluminum field mount enclosure IP67 / NEMA 4X.									
Outputs									
OA									
Two active transistor outputs - requires AA, AB or AU and PD, PF or PM.									
OR									
Two mechanic relay outputs - requires PF or PM.									
OT	⊗								
Two passive transistor outputs - standard configuration.									
Power supply									
PB									
Lithium battery powered.									
PC	⊗								
Lithium battery powered - Intrinsically Safe.									
PD	⊗								
8 - 24V AC/DC + sensor supply - with XI: 16 - 30V DC.									
PF									
24V AC/DC + sensor supply.									
PL	⊗								
Input loop powered from sensor signal type "A" - requires AI or AF and OT.									
PM									
115 - 230V AC + sensor supply.									
PX	⊗								
Basic power supply 8 - 30V DC (no real sensor supply). Unit requires external loop AP.									
Hazardous area									
XI	⊗								
Intrinsically Safe.									
XF	⊗								
EExd enclosure - 3 keys.									
XX									
Safe area only.									
Other options									
ZB									
Backlight.									
ZF	⊗								
Coil input 10mVpp.									
ZX	⊗								
No options.									

The bold marked text contains the standard configuration.

⊗ Available Intrinsically Safe.

Specifications are subject to change without notice.