DATASHEET F116 – FLOWCOMPUTER

# 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 Ex II 1GD EEx ia IIB/IIC T4 T100°C.
- Explosion/flame proof Ex II 2G 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.
- Coil (sine wave).
- 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.

# 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 alphanumerical 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).

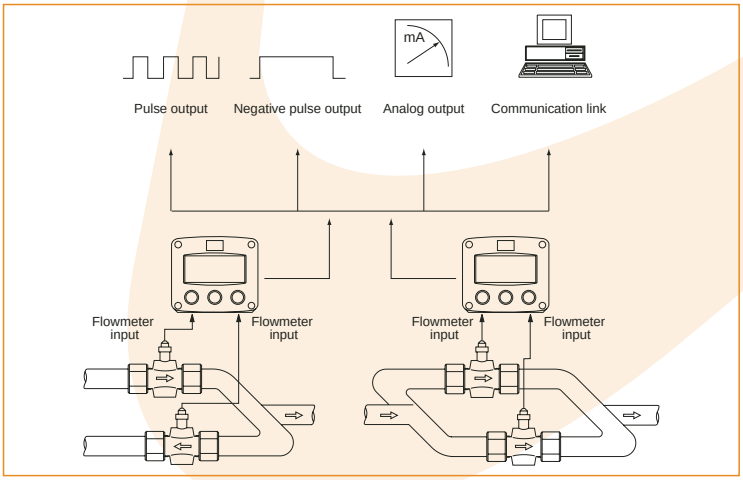
## Hazardous areas

For hazardous area applications, this model has been ATEX certified intrinsically safe Ex II 1GD EEx ia IIB / IIC T4 T100°C with an allowed operational temperature of -30°C to +70°C (-22°F to +158°F). A flame proof enclosure is also available with the rating Ex II 2G 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

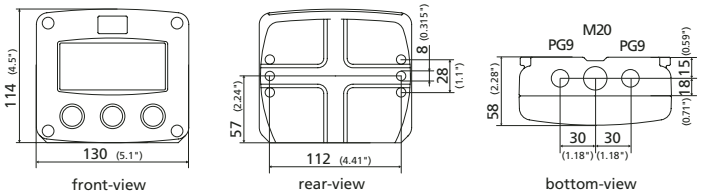


# Dimensions enclosures

## Enclosure HA

## Aluminum field mount enclosure

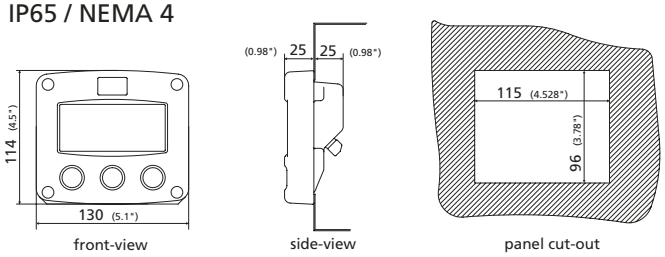
IP67 / NEMA 4X
Tapped holes: European thread




## Enclosure HB

## Aluminum panel mount enclosure

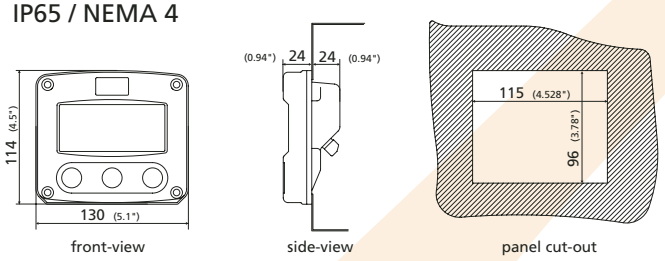
IP65 / NEMA 4




## Enclosure HC (standard)

## ABS panel mount enclosure

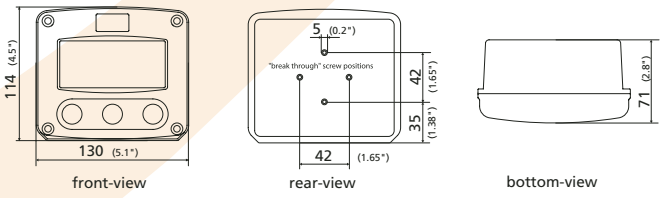
IP65 / NEMA 4




## Enclosure HD

## ABS wall mount enclosure

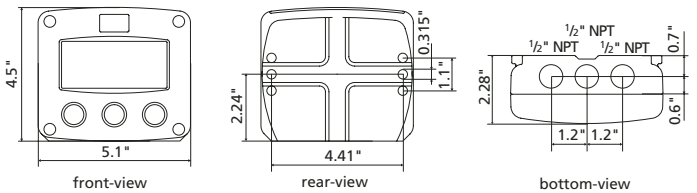
IP67 / NEMA 4X
Holes user defined



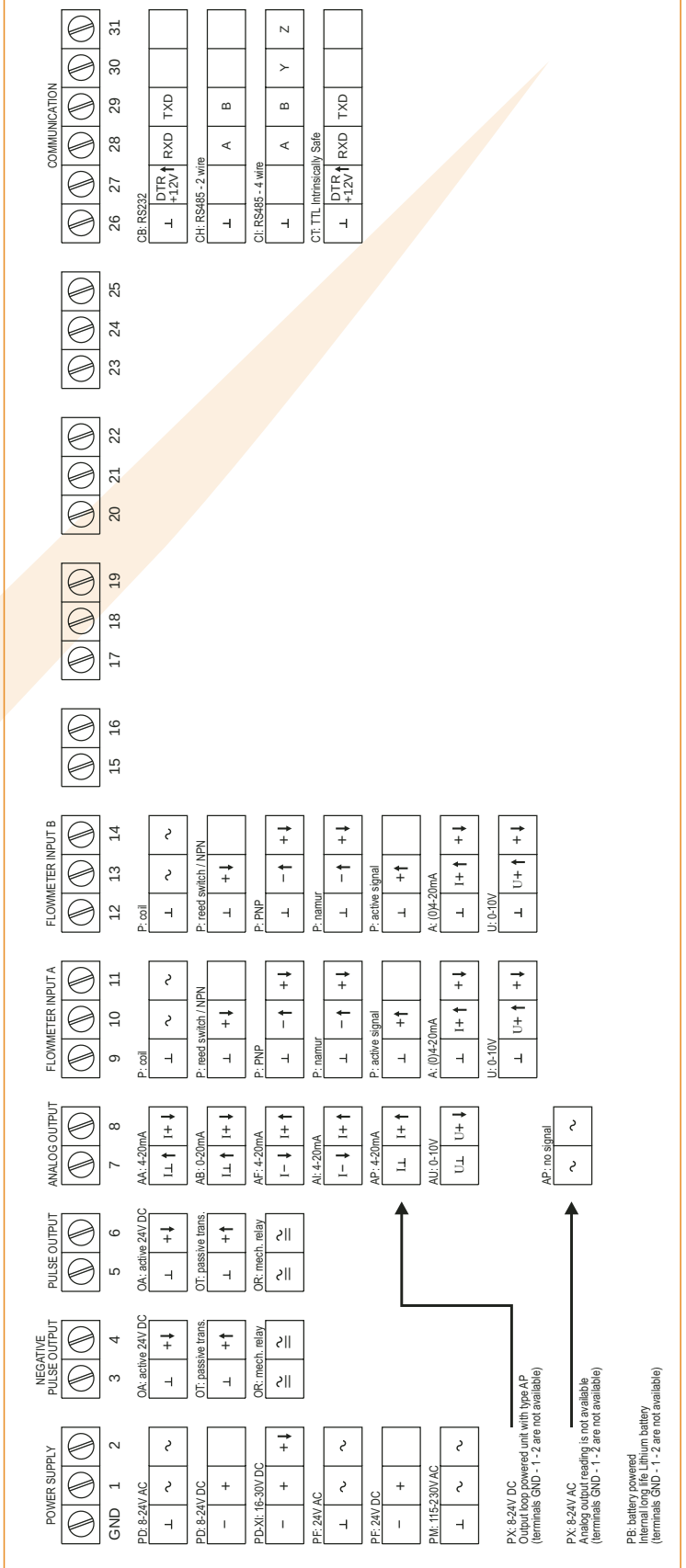

## Enclosure HU

## Aluminum field mount enclosure

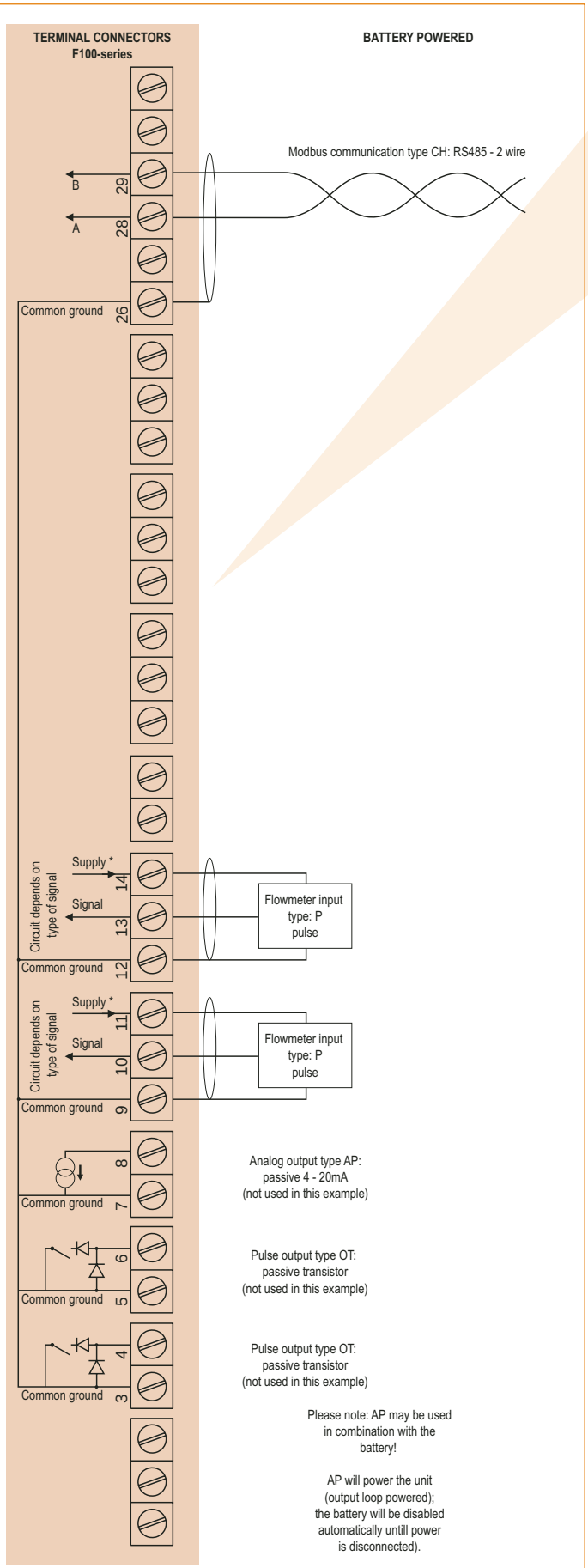
IP67 / NEMA 4X
Tapped holes: U.S. thread




# Terminal connections

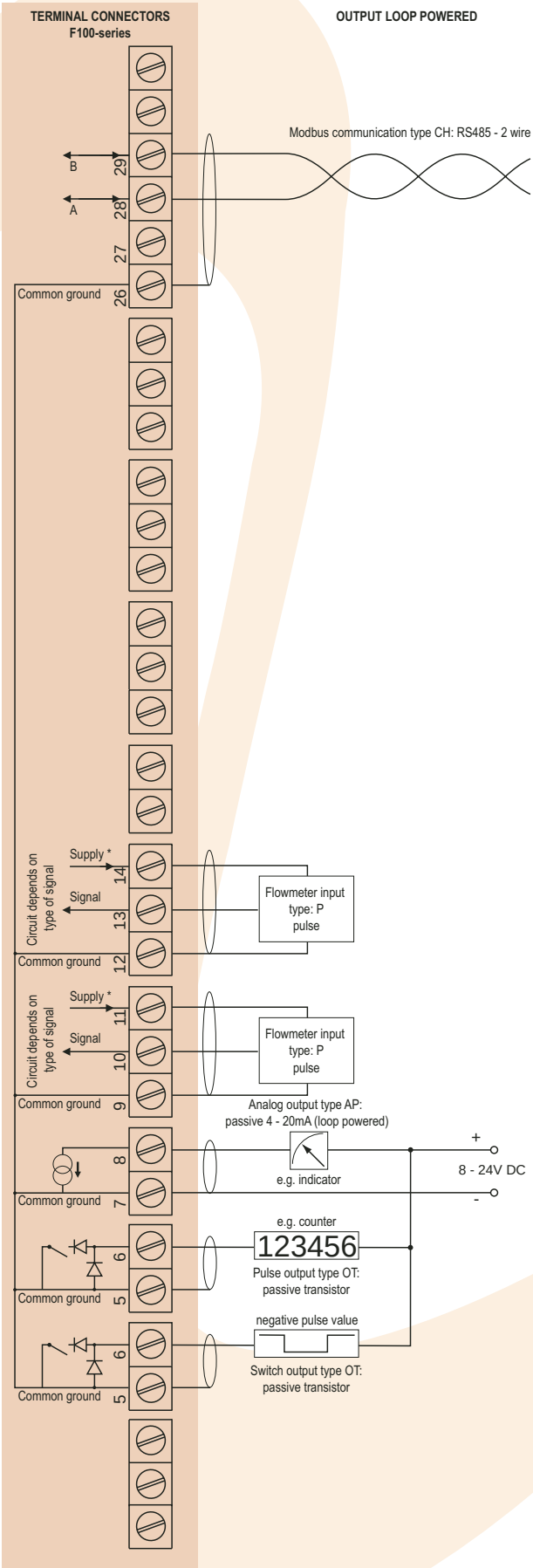


## Typical wiring diagram F116-P-(AP)-CH-PB-(OT)



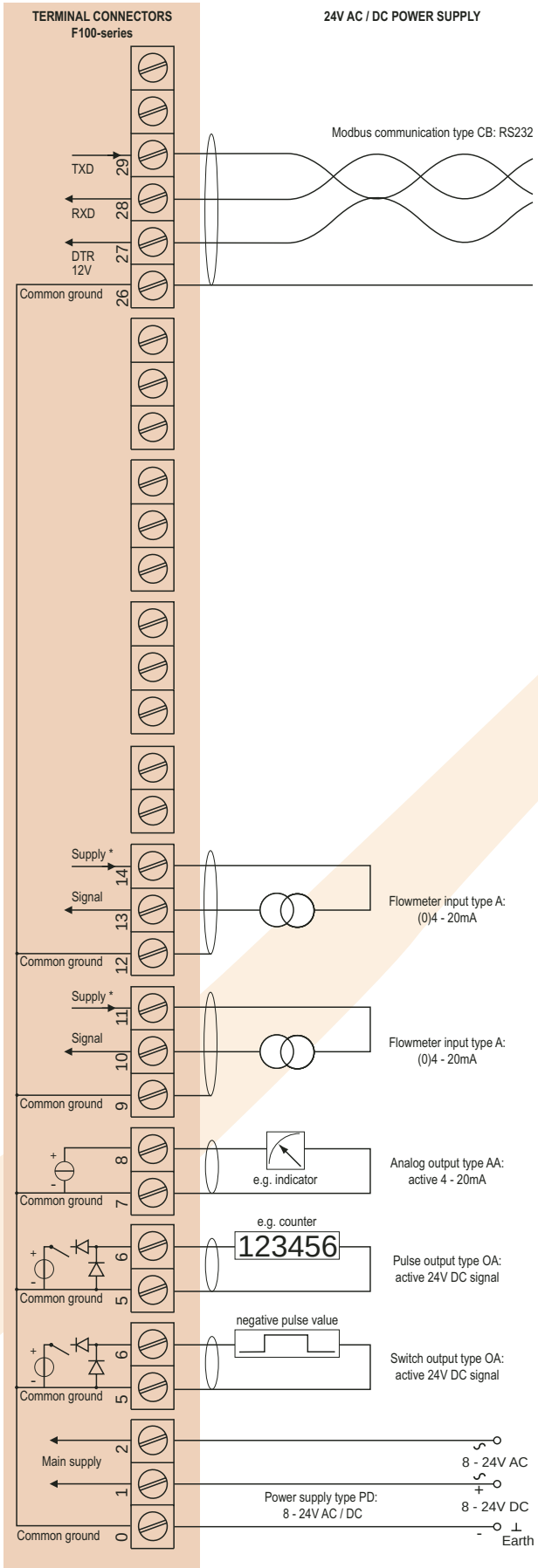

* Supply voltage: 1.2 - 3.2V DC to sensor

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



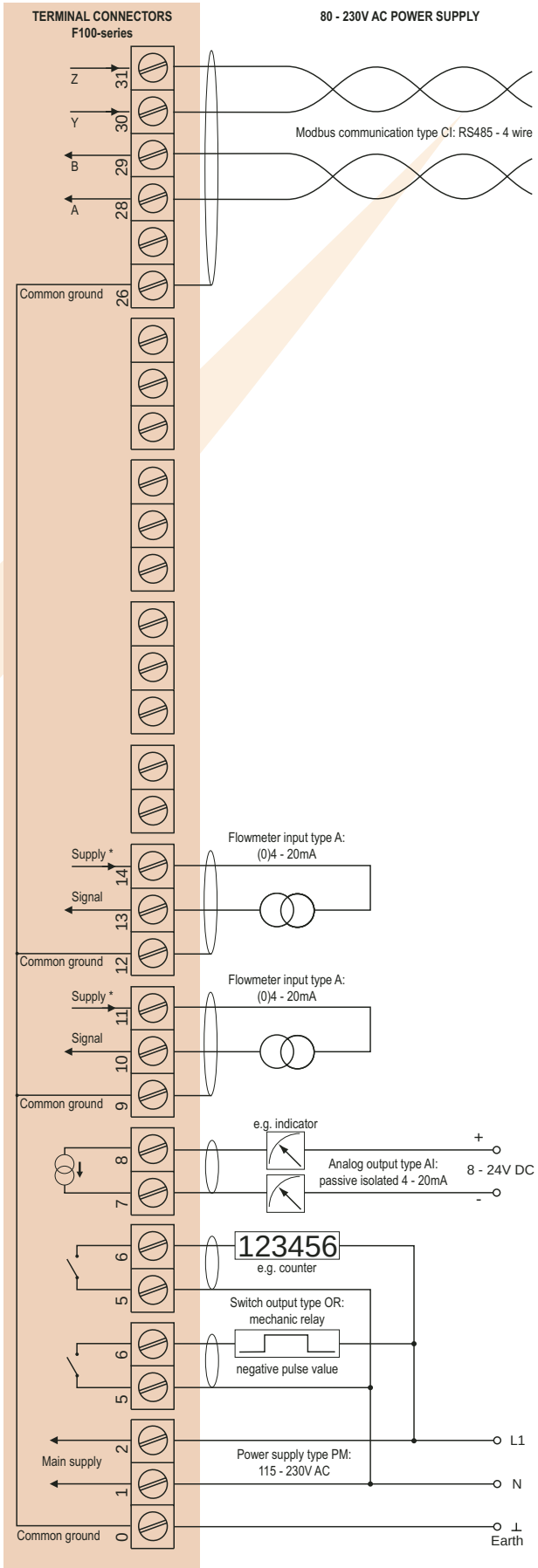

* Supply voltage: 1.2 - 3.2V DC to sensor

## 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

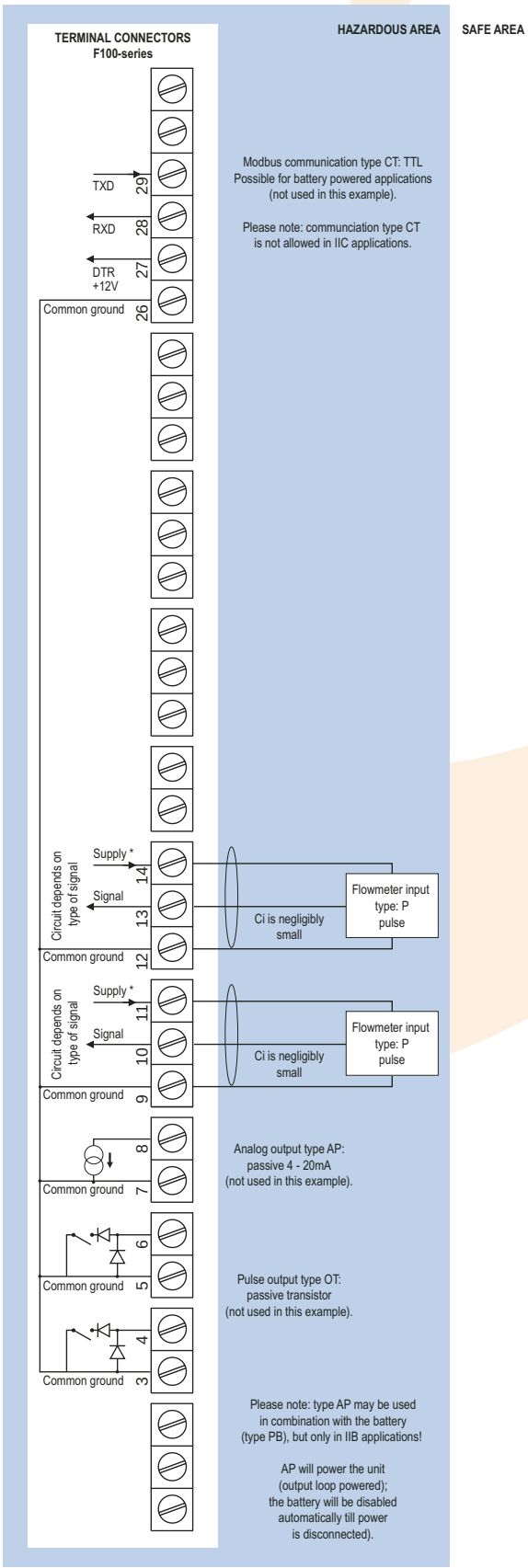
The F116-XI has been ATEX approved by KEMA for use in intrinsically safe applications. It is approved according to Ex II 1GD EEx ia IIB/IIC T4 T100°C for gas and dust applications with an operational temperature range of -30°C to +70°C (-22°F to +158°F). Besides the two I.S. power supplies for the pulse 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 Ex II 2G EEx d IIB T5 is available as well.
Please contact your supplier for further details.

### *Certificate of conformity KEMA 03ATEX1074 X*


KEMA

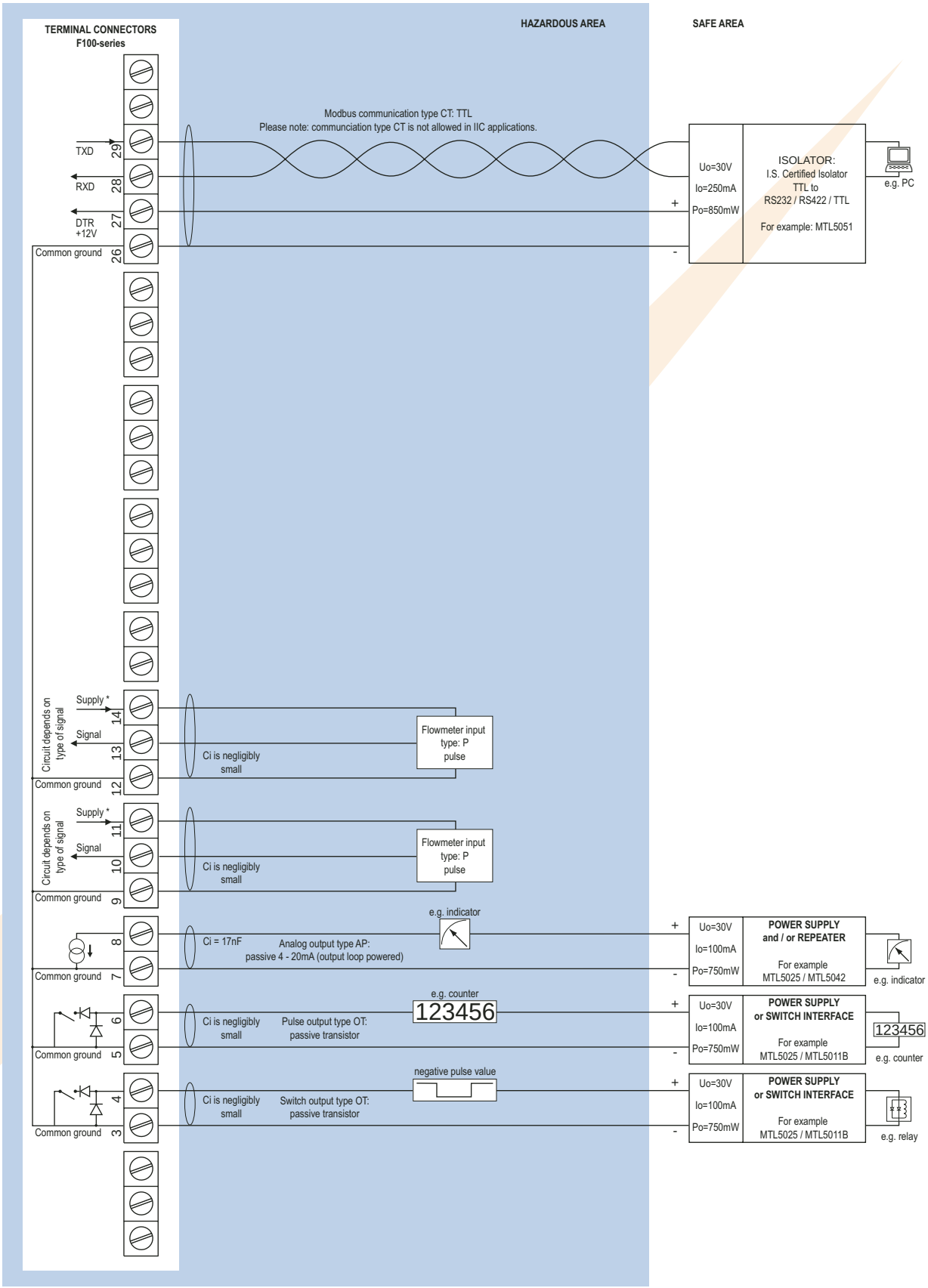
EC-TYPE EXAMINATION CERTIFICATE

### *Configuration example IIB and IIC*
### *F116-P-(AP)-(CT)-(OT)-PB-XI - battery powered unit*



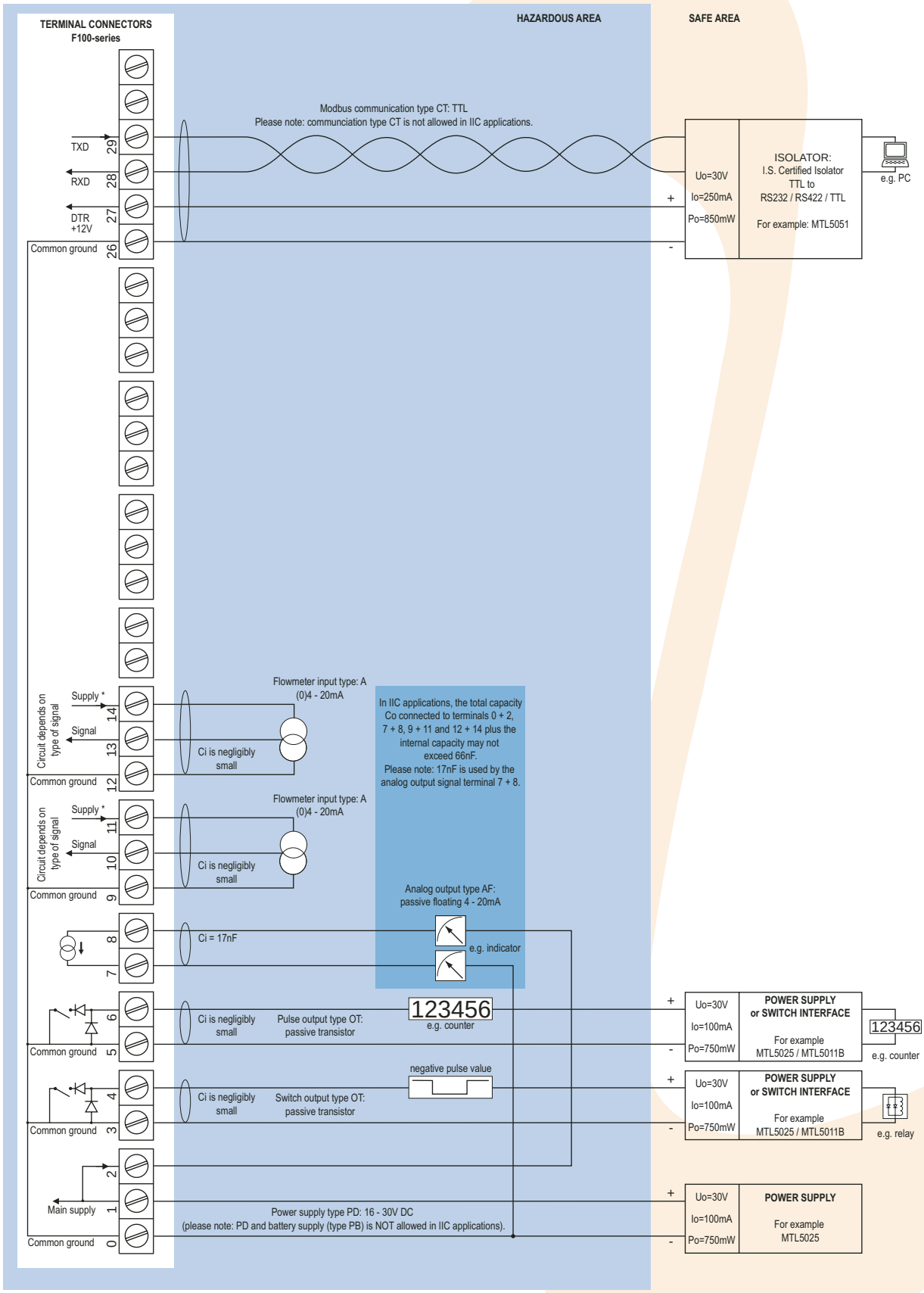

* Note sensor supply voltage: 1.2V DC for coil sensors or 3.2V DC for other pulse sensors.

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



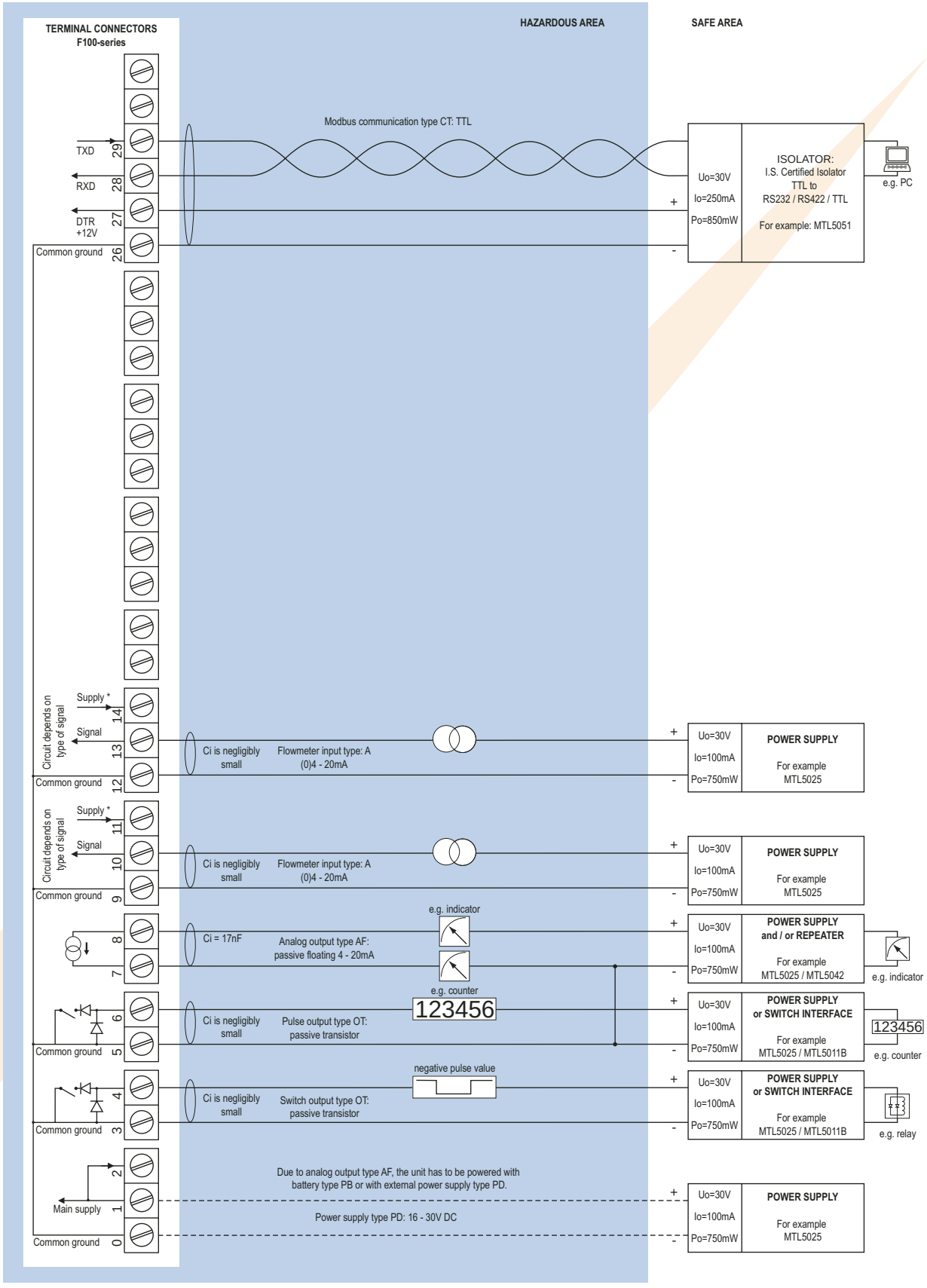

* Note sensor supply voltage: 1.2V DC for coil sensors or 3.2V DC for other pulse sensors.

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




* Note power supply type PD: internally linked to terminal 1.

## *Configuration example IIB - F116-A-AF-CT-OT-(PB)-(PD)-XI - Power supply 16 - 30V DC or battery*




* Note power supply type PD: internally linked to terminal 1.

# 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 | LED-backlight - available appr. Nov. 2004. |

| 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 retardent. |
| 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 retardent. |
| 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). |

| Power requirements | |
|---|---|
| Type PB | Long life Lithium battery - life-time depends upon settings and configuration - up to 5 years. |
| Type PD | 8 - 24V AC/DC ± 10%. |
| Type PD-XI | 16 - 30V DC (Intrinsically Safe). |
| Type PF | 24V AC/DC ± 10%. |
| Type PL | Input loop powered from sensor signal 4 - 20mA (type "A") - requires types AI or AF and OT. |
| Type PM | 115 - 230V AC ± 10%. |
| Type PX | 8 - 28V DC output loop powered unit with analog output signal type AP (or 8 - 24 V AC/DC if type AP will not be used). |

| Sensor excitation | |
|---|---|
| Type PB / PX | 3.2V DC for pulse signals and 1.2V DC for coil pick-up. |
| 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 input type A or U, the sensor supply volage will be according to power supply as connected to terminal 1. |
| Type PF / PM | 1.2 - 3.2 - 8.2 - 12 and 24V DC - max. 200mA@24V DC. |

| Terminal connections | |
|---|---|
| Type | Removable plug-in terminal strip. Wire max. 1.5mm² and 2.5mm². |

| 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: ⟨Ex⟩ II 1GD EEx ia IIB/IIC T4 T100°C. |
| Type XI | CSA/FM pending. Maximum ambient +70°C (158°F). |
| Explosion proof | ATEX approval ref: ⟨Ex⟩ II 2G EEx d IIB T5. |
| Type XD/XF | Dimensions of enclosure: 218 x 418 x 210mm (8.58" x 16.45" x 8.38") L x H x D. |
| Weight | 16 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 | 14 bit. Error < 0.05%. 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: 3kΩ. |
| 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 PB, 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. |
| 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. |
| Pulse output | Max. frequency 64Hz. Pulse length user definable between 7.8msec up to 2 seconds. |

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

## Operational

| Operator functions | |
|---|---|
| Displayed functions | • Differential flowrate (consumption) or the sum of both flowrates.<br>• Differential / sum total and accumulated total.<br>• Total can be reset to zero by pressing the CLEAR-key twice. |

| Total | |
|---|---|
| Digits | 7 digits. |
| Units | L, m3, 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, m3, Gallons, KG, Ton, lb, bl, cf, RND, ft3, scf, Nm3, Nl, igal - 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**: the unit is powered by the analog output loop, type AP: 8 - 28V DC (or AC); **XX**: Safe area; **ZX**: no options.

| Ordering information: | FXXX -_ | -A _ | -C _ | -H _ | -O _ | -P _ | -X _ | -Z _ |
|---|---|---|---|---|---|---|---|---|
| **Flowmeter input signal** | | | | | | | | |
| A Ⓔx | (0)4 - 20mA input. | | | | | | | |
| **P** Ⓔx | **Pulse input: coil, npn, pnp, namur, reed-switch.** | | | | | | | |
| U Ⓔx | 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 Ⓔx | I.S. floating 4 - 20mA output - requires PB, PL or PD. | | | | | | | |
| AI | Isolated 4 - 20mA output - requires PB, PD, PF, PL or PM. | | | | | | | |
| **AP** Ⓔx | **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 Ⓔx | Intrinsically Safe TTL - Modbus RTU. | | | | | | | |
| **CX** Ⓔx | **No communication.** | | | | | | | |
| **Enclosure** | | | | | | | | |
| HA Ⓔx | Aluminum field mount enclosure IP67 / NEMA 4X. | | | | | | | |
| HB Ⓔx | Aluminum panel mount enclosure IP65 / NEMA 4. | | | | | | | |
| **HC** Ⓔx | **ABS panel mount enclosure IP65 / NEMA 4.** | | | | | | | |
| HD Ⓔx | ABS wall mount enclosure IP67 / NEMA 4X. | | | | | | | |
| HU Ⓔx | 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** Ⓔx | **Two passive transistor outputs - standard configuration.** | | | | | | | |
| **Power supply** | | | | | | | | |
| PB Ⓔx | Lithium battery powered. | | | | | | | |
| PD Ⓔx | 8 - 24V AC/DC + sensor supply - with XI: 16 - 30V DC. | | | | | | | |
| PF | 24V AC/DC + sensor supply. | | | | | | | |
| PL Ⓔx | Input loop powered from sensor signal type “A” - requires AI or AF and OT. | | | | | | | |
| PM | 115 - 230V AC + sensor supply. | | | | | | | |
| **PX** Ⓔx | **No power supply option. Unit requires external loop AP.** | | | | | | | |
| **Hazardous area** | | | | | | | | |
| XI Ⓔx | Intrinsically safe. | | | | | | | |
| XD Ⓔx | EExd enclosure - 1 key. | | | | | | | |
| XF Ⓔx | EExd enclosure - 3 keys. | | | | | | | |
| **XX** | **Safe area only.** | | | | | | | |
| **Other options** | | | | | | | | |
| ZB Ⓔx | Backlight (available appr. Nov. 2004). | | | | | | | |
| ZF Ⓔx | Coil input 10mVpp. | | | | | | | |
| **ZX** Ⓔx | **No options.** | | | | | | | |

The bold marked text contains the standard configuration.

Ⓔx Available Intrinsically Safe.

Specifications are subject to change without notice.

FLUIDWELL bv
P.O. Box 6
5460 AA - Veghel - The Netherlands
Tel.: +31 (0)413 343786
Fax.: +31 (0)413 363443
sales@fluidwell.com
Internet: www.fluidwell.com

ISO 9001:2000 KEMA
DUTCH COUNCIL FOR ACCREDITATION