

Your success counts

Differential / Sum Flowcomputer with analog and pulse signal outputs



The F-Series is your first and safest choice for field mount indicators in safe and hazardous area applications. Especially in harsh weather conditions like rain, snow, salty atmospheres and temperatures between -40°C up to $+80^{\circ}\text{C}$ (-40°F up to 176°F).

Advantages

- Robust aluminum or stainless steel 316L field enclosure (IP67 / NEMA Type4X). It is so rugged, a truck can even stand on it!
- Intrinsically Safe available - ATEX and IECEx approval for gas and dust applications.
- Programming can be done by your own crew, with the sensible menu-driven structure, saving cost and irritation. Know one, know them all!
- Very diverse mounting possibilities: walls, pipes, panels or directly onto outdoor sensors!

Features

- Calculates differential flow rate (consumption) total and accumulated total of flow A and B or the sum.
- Precautions for pulsating flows and low consumption readings.
- 7 digit resettable total, 11 digit accumulated total.
- Large 17mm (0.67") digits for flow rate or total.
- Ability to process all types of signals: Sine wave (coil), NAMUR, NPN/PNP pulse, Reed-switch, Active pulse signals, (O)4-20mA
- Scaled pulse output according to differential / sum accumulated total.
- Negative total value indication.
- Analog output according to differential / sum flow rate.
- Full Modbus communication RS232/485/TTL.
- Power requirements: Loop or battery powered, 8 - 30V DC, 8 - 24V AC/DC or 115 - 230V AC.
- Sensor supply: 3 / 8.2 / 12 / 24V DC.

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 flow meters can be used instead of one expensive flow meter. 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 flow rate and total. On-screen engineering units are easily configured from a comprehensive menu. 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 password protected. Each setting is clearly indicated with an alphanumeric description, which avoids 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.

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).



Pulse output

The scaleable pulse output, reflects the count on the accumulated display. The pulse width is user defined and the maximum output frequency is 500Hz. 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.

Hazardous areas

This model is ATEX and IECEx certified as Intrinsically Safe for gas and dust applications, with an allowed ambient temperature of -40°C to +70°C (-40°F to +158°F). A flame proof Ex d enclosure with ATEX certification is also available.

Analog output signal

The calculated flow rate is re-transmitted with the (0)4 - 20mA or 0 - 10V DC output signal. The output signal is updated eight 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 flow rate, 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.



All info at a glance



Easy to install



Easy to program



Know one know them all!



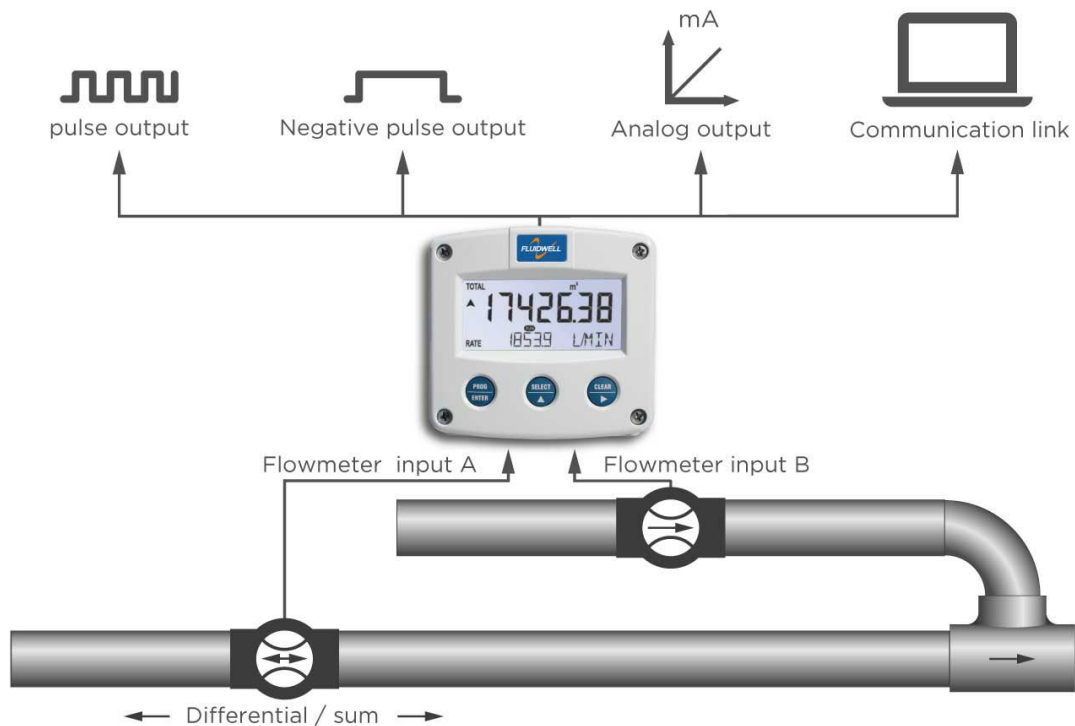
Reliable



User-friendly

Overview application F116

The F-Series is your first and safest choice for field mount indicators in safe and hazardous area applications. Especially in harsh weather conditions like rain, snow, salty atmospheres and temperatures between -40°C up to +80°C (-40°F up to 176°F). 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.



Signal input

The F116 accepts most pulse and analog input signals for volumetric 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.

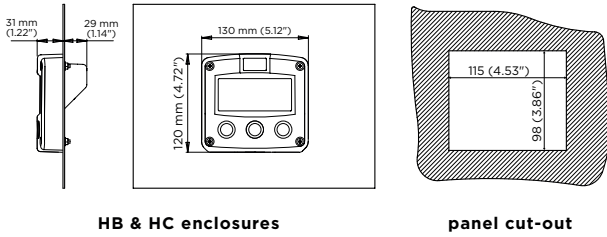
Type of signal	Resistance	Low Pass filter (LP)	Max. frequency	Max. frequency Low Pass filter (LP)	Min. amplitude p-p	Remark
NPN	100kΩ pull-up	100kΩ pull-up	6kHz Threshold 1.2V	1.2kHz		Open collector
REED	1MΩ pull-up	1MΩ pull-up	1.2kHz Threshold 1.2V	120Hz		
PNP	100KΩ pull-down	100KΩ pull-down	6kHz Threshold 1.2V	1.2kHz		
NAMUR	820Ω pull-down	-	4kHz	-		External power required
COIL LO	-	-			80mV _{pp}	Default sensitivity
COIL-HI	-	-			20mV _{pp}	Sensitive for interference!
COIL-HI (Type ZF)	-	-			10mV _{pp}	
ACTIVE 8.2V DC	3K9Ω		10kHz Threshold 4V			External power required
ACTIVE 12V DC	4KΩ		10kHz Threshold 6V			External power required
ACTIVE 24V DC	3KΩ		10kHz Threshold 12V			External power required

Enclosures

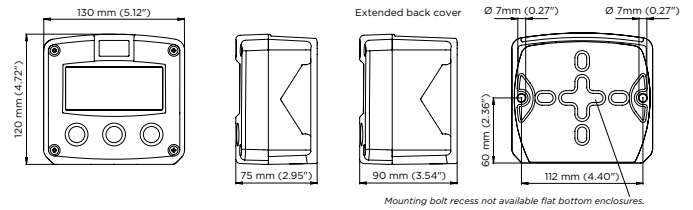
Various types of enclosures can be selected, all ATEX and IECEx approved. The F116 is supplied in an GRP panel mount enclosure as standard, which can be converted to an IP67 / NEMA Type4X GRP field mount enclosure by the addition of a back case. Most popular is our robust aluminum field mount enclosure which is also available with an extended backcover with undrilled preparation for direct meter mounting at the back side. It is so rugged, even a truck can stand on it! For the most challenging environments we have a durable high grade Stainless steel 316L enclosure. All enclosures have a IP67 / NEMA Type4X rating and EU or U.S. cable gland entry threads available.

Dimensions enclosures

Aluminum & GRP panel mount enclosure

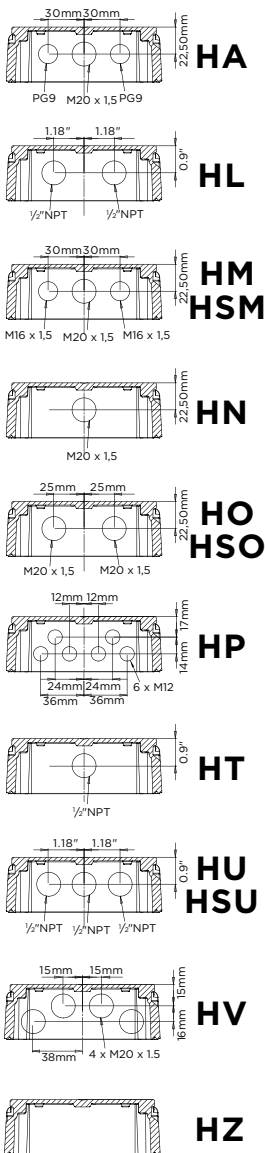


Aluminum, GRP & Stainless steel 316L field mount enclosures

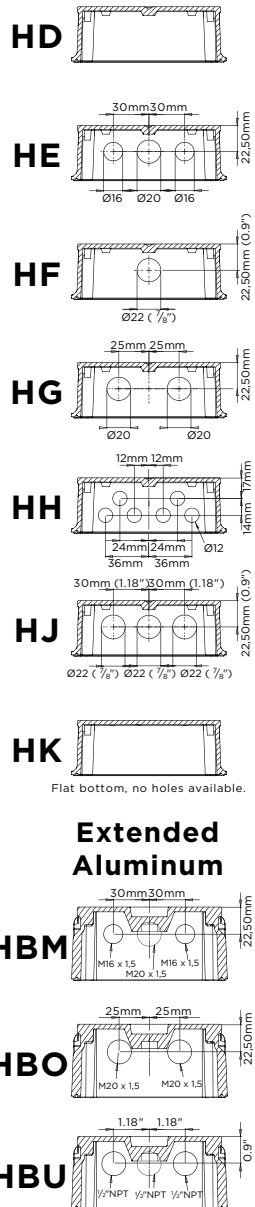


Cable entries

Aluminum / Stainless Steel

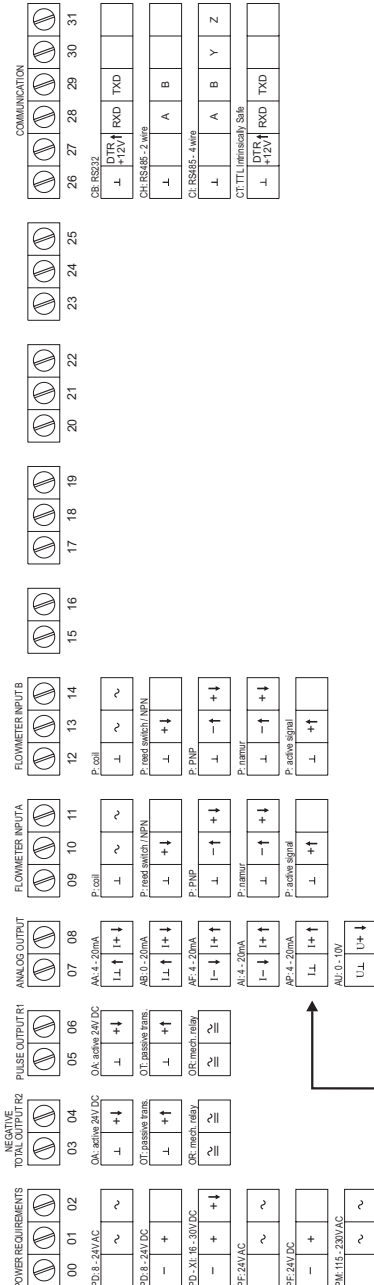


GRP

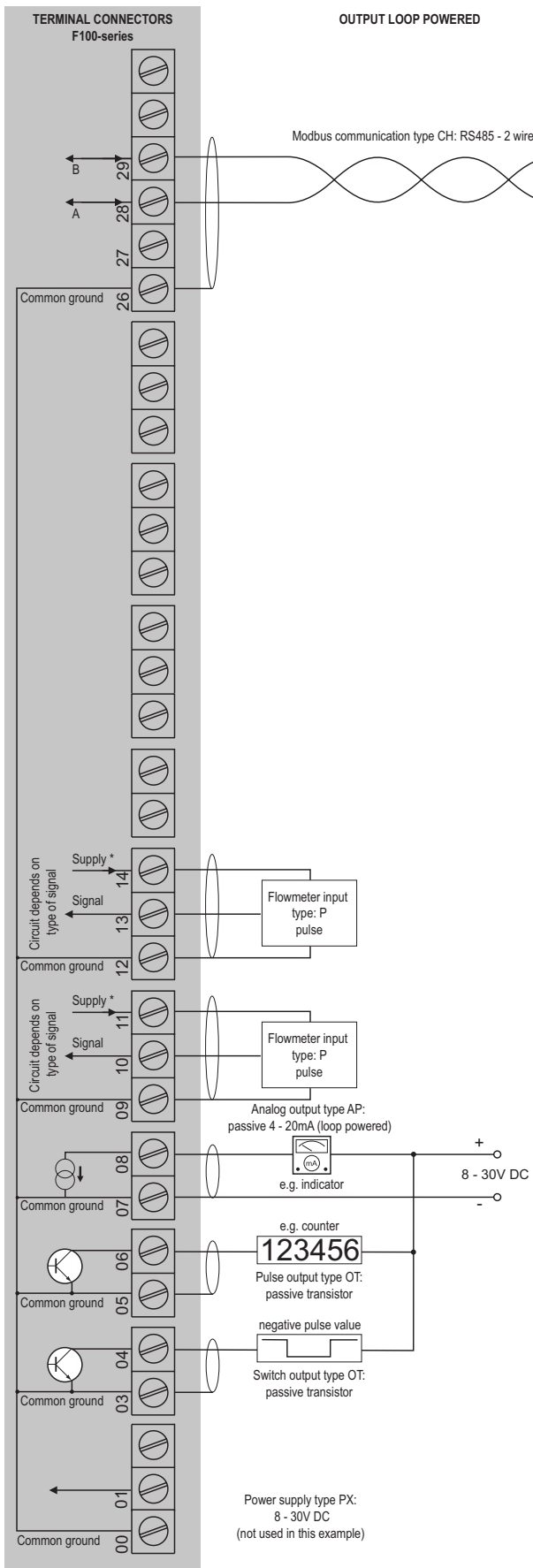


Extended Aluminum

Terminal connections

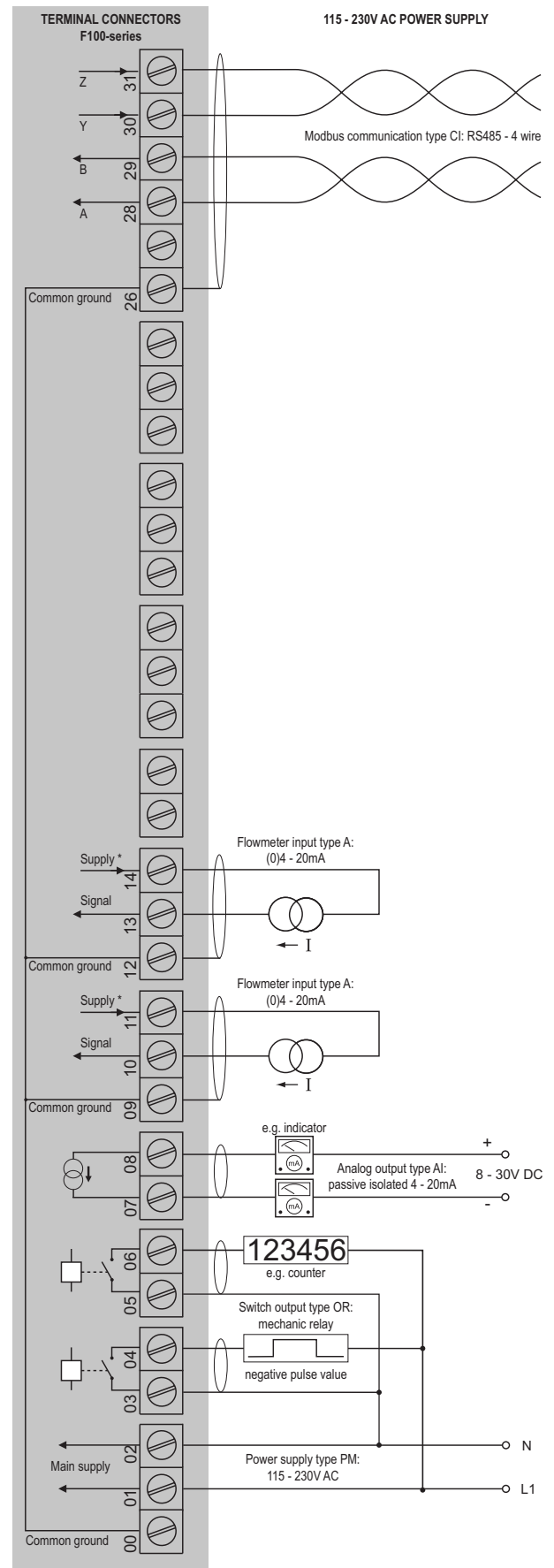


Configuration example F116-P-AP-CH-OT-(PX)-XX-ZX



* For pulse type inputs: V_{ref} : 1.2V/3.0V available.- NO power output, available I_{supply} : <1mA.
Note: using these ref. voltages at max. load, will reduce battery life significantly.

Configuration example F116-A-AI-CI-OR-PM-XX-ZX



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

Hazardous area applications

The F116-XI has been certified according to ATEX and IECEx by DEKRA for use in Intrinsically Safe applications with an ambient temperature of -40°C to +70°C (-40°F to +158°F).

- The ATEX markings for gas and dust applications are:

Gas: **II 1 G Ex ia IIB/IIC T4 Ga**

Dust: **II 1 D Ex ia IIIC T100 °C Da.**

- The IECEx markings for gas and dust applications are:

Gas: **Ex ia IIC/IIB T4 Ga**

Dust: **Ex ia IIIC T100 °C Da.**

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/IIIC applications or one in IIC applications. Consult the certificate for the maximum input and output values of the circuits. 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. An ATEX approved flame proof Ex d enclosure is available as well. Please contact your supplier for further details.

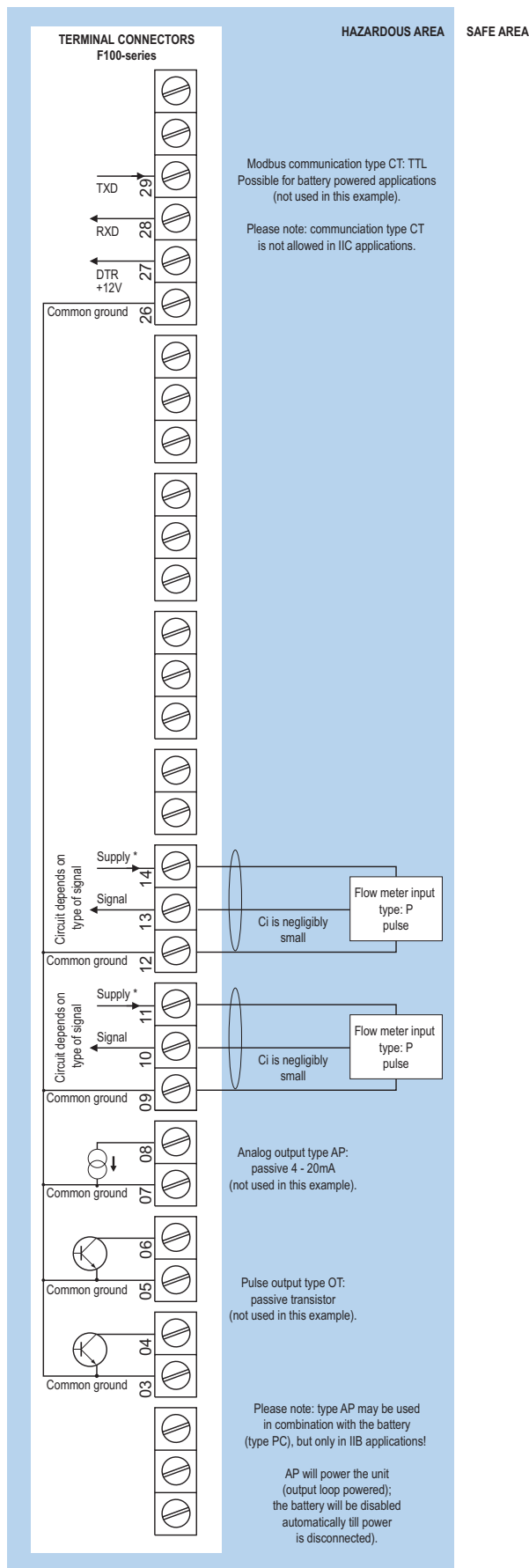
Certificate of conformity KEMA 03ATEX1074 X

- IECEx DEK 11.0042X



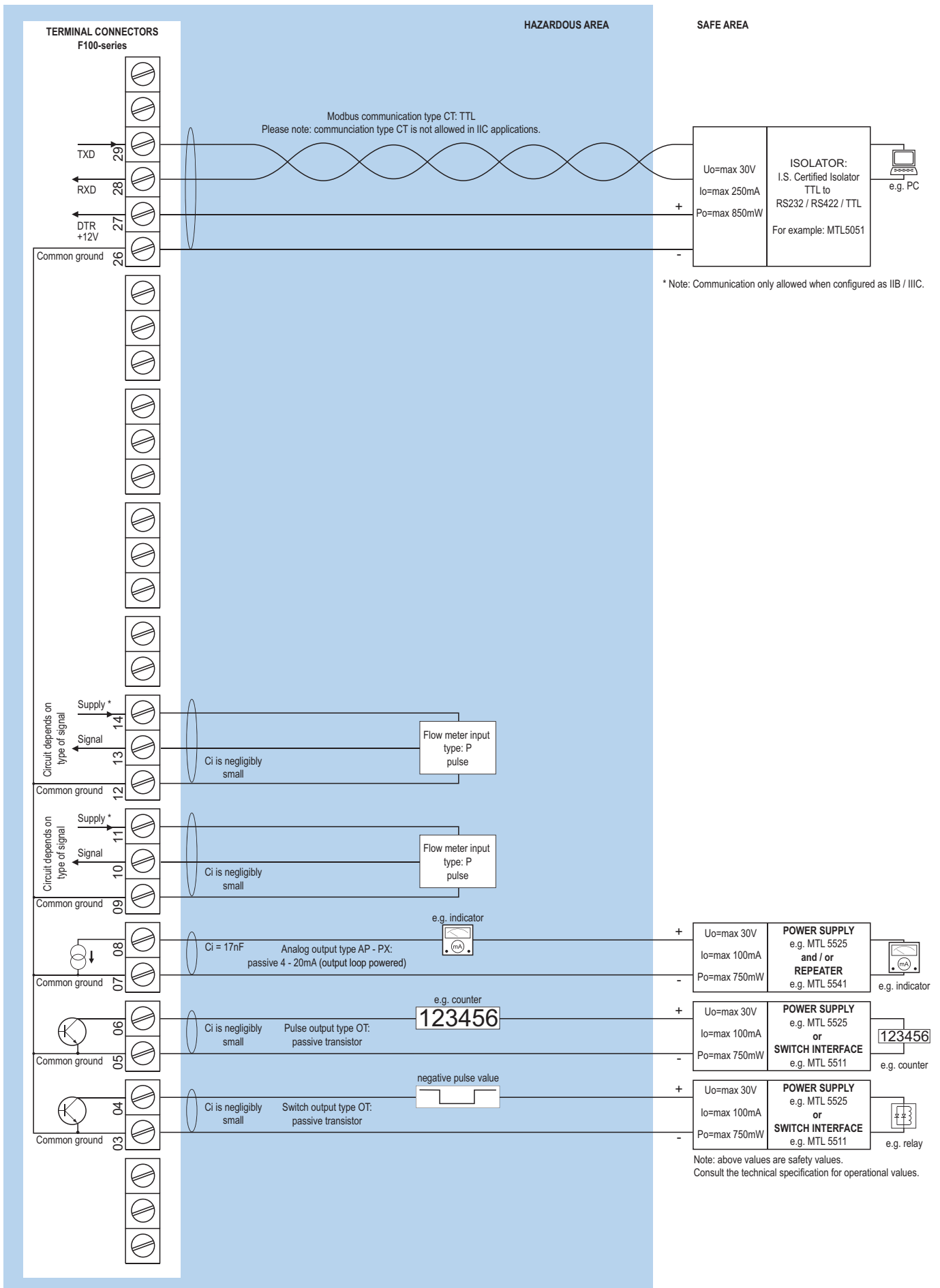
Configuration example IIB / IIIC and IIC

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



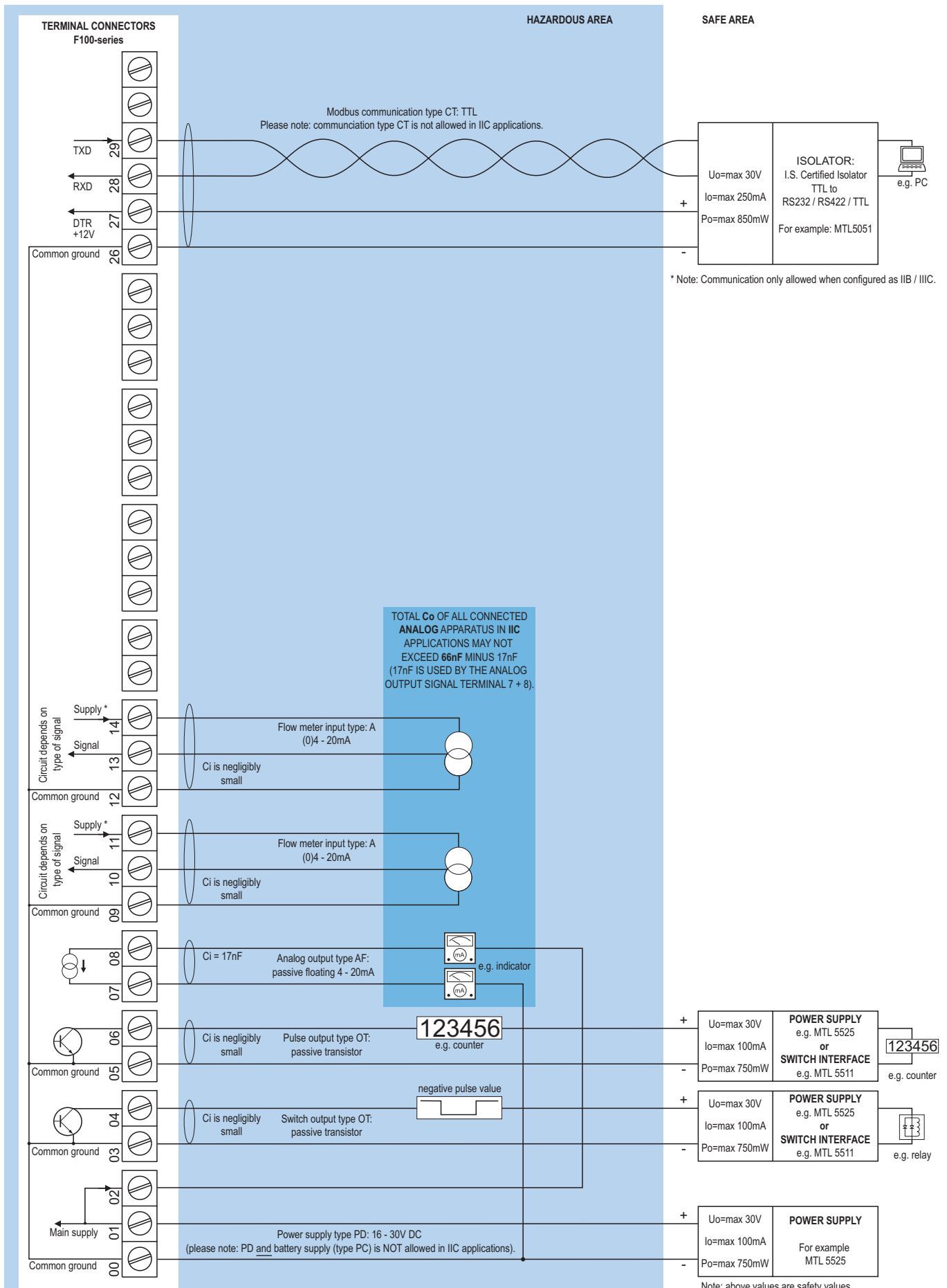
* For pulse type inputs: V_{ref} : 1.2V/3.0V available. - NO power output, available $I_{supply} < 1mA$. Note: using these ref. voltages at max. load, will reduce battery life significantly.

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



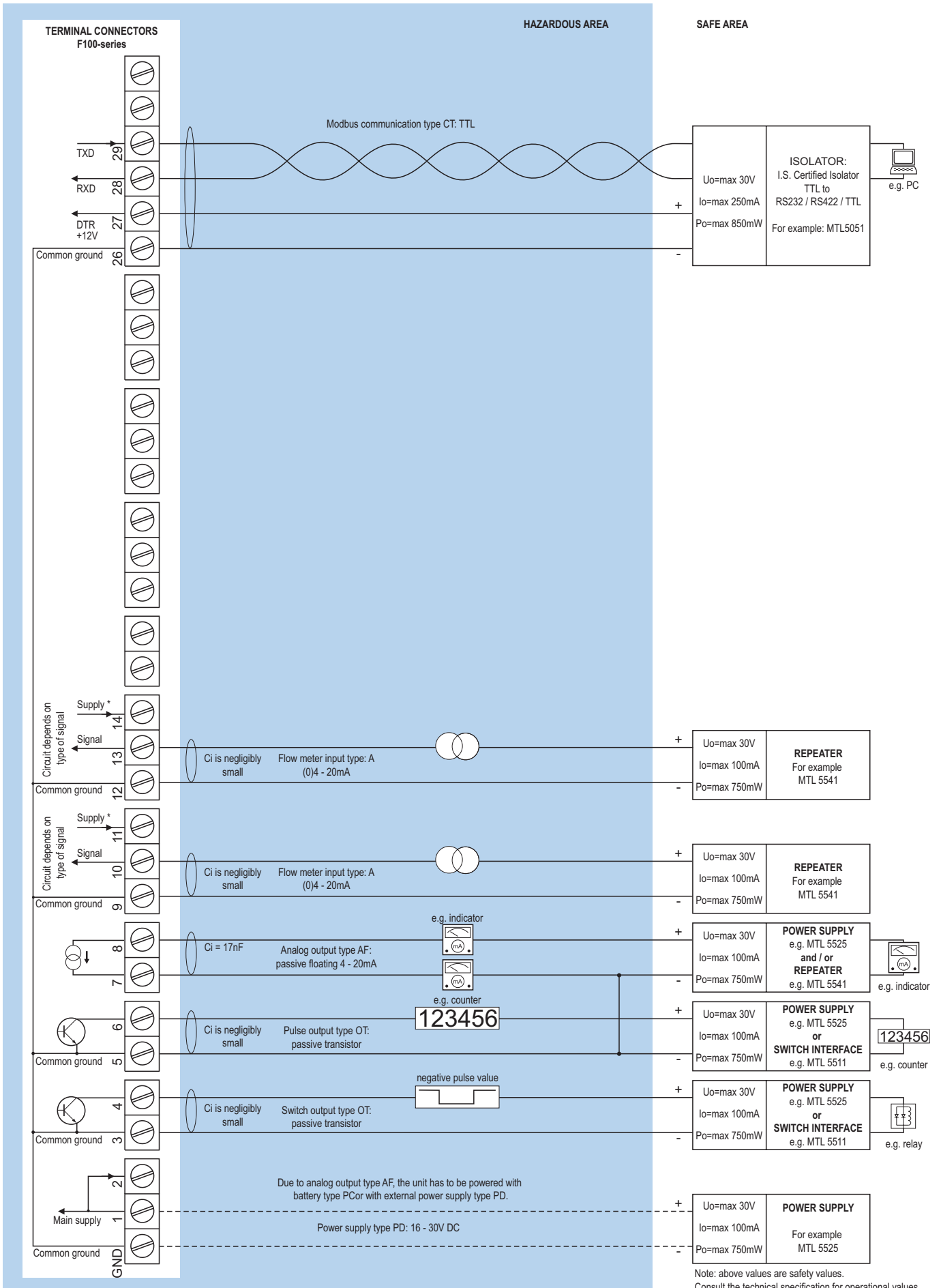
* For pulse type inputs: V_{ref} : 1.2V/3.0V available.- NO power output, available I_{supply}: <1mA.
Note: using these ref. voltages at max. load, will reduce battery life significantly.

Configuration example IIB / IIIC 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 / IIIC - F116-A-AF-CT-OT-(PC)-(PD)-XI - Power supply 16 - 30V DC or battery 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).

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: fast, 1sec, 3sec, 15sec, 30sec, off.
Option ZB	Transflective LCD with white LED-backlight. Intensity can be adjusted in the configuration menu. Good readings in full sunlight and darkness.
Note ZB	Only available for safe area applications.

Ambient temperature

Safe areas	-40°C to +80°C (-40°F to +176°F).
Intrinsically Safe	-40°C to +70°C (-40°F to +158°F).

Terminal connections

Type	Removable plug-in terminal strip. Wire max. 1.5mm ² and 2.5mm ² .
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Data protection

Type	EEPROM backup of all settings. Backup of running totals every minute. Data retention at least 10 years.
Password	Configuration settings can be password protected.

Directives & Standards

EMC	Directive 2014/30/EU, FCC 47 CFR part 15.
Low voltage	Directive 2014/35/EU
RoHS	Directive 2011/65/EU
ATEX / IECEx	Directive 2014/34/EU, IEC 600079-0, IEC 60079-11. IP & NEMA EN 60529 & NEMA 250

Intrinsically Safe (Type XI)

ATEX	Gas: II 1 G Ex ia IIB/IIC T4 Ga. Dust: II 1 D Ex ia IIIC T100 °C Da.
IECEx	Gas: Ex ia IIC/IIB T4 Ga. Dust: Ex ia IIIC T100 °C Da.
Ambient Ta	-40°C to +70°C (-40°F to +158°F).

Explosion proof (Type XF)

ATEX	Gas: II 2 G / Ex d IIB T5 Gb. Dust: II 2 D / Ex t IIB T100 °C Db.
Type XF	Dimensions of enclosure: 300 x 250 x 200mm (11.8" x 9.9" x 7.9") L x H x D.
Weight	Appr. 15kg.
Note XF	IECEx available on request.

Enclosure

Window	Polycarbonate window.
Sealing	Silicone.
Control keys	Three industrial micro-switch keys. UV-resistant silicone keypad.

Panel mount enclosures

Dimensions	130 x 120 x 60mm (5.12" x 4.72" x 2.36") - W x H x D.
Panel cut-out	115 x 98mm (4.53" x 3.86") L x H.
Type HB	Die-cast aluminum panel mount enclosure IP65 / NEMA Type4X.
Weight	600 gr.
Type HC	GRP panel mount enclosure IP65 / NEMA Type4X, UV-resistant and flame retardant.
Weight	450 gr.

GRP wall / field mount enclosures

General	GRP wall/field mount enclosure IP67 / NEMA Type4X, UV-resistant and flame retardant.
Dimensions	130 x 120 x 75mm (5.12" x 4.72" x 2.95") - W x H x D.
Weight	600 gr.
Type HD	Cable entry: no holes.
Type HE	Cable entry: 2 x Ø 16mm and 1 x Ø 20mm.
Type HF	Cable entry: 1 x Ø 22mm (7/8").
Type HG	Cable entry: 2 x Ø 20mm.
Type HH	Cable entry: 6 x Ø 12mm.
Type HJ	Cable entry: 3 x Ø 22mm (7/8").
Type HK	Flat bottom, cable entry: no holes.

Aluminum wall / field mount enclosures

General	Die-cast aluminum wall/field mount enclosure IP67 / NEMA Type4X with 2-component UV-resistant coating. Extended back cover available with undrilled preparation for direct meter mounting.
Dimensions	130 x 120 x 75mm (5.12" x 4.72" x 2.95") - W x H x D. 130 x 120 x 90mm (5.12" x 4.72" x 3.54") - W x H x D.
Weight	1100 gr. / extended enclosure: 1310 gr.
Type HA	Cable entry: 2 x PG9 and 1 x M20.
Type HL	Cable entry: 2 x 1/2" NPT.
Type HM/HBM	Cable entry: 2 x M16 and 1 x M20.
Type HN	Cable entry: 1 x M20.
Type HO/HBO	Cable entry: 2 x M20.
Type HP	Cable entry: 6 x M12.
Type HT	Cable entry: 1 x 1/2" NPT.
Type HB/HBU	Cable entry: 3 x 1/2" NPT.
Type HV	Cable entry: 4 x M20.
Type HZ	Cable entry: no holes.

Stainless steel 316L wall / field mount enclosures

General	Die-cast stainless steel 316L wall / field mount enclosure with flat bottom. IP67 / NEMA Type4X.
Dimensions	130 x 120 x 75mm (5.12" x 4.72" x 2.95") - W x H x D.
Weight	2700 gr.
Type HSM	Cable entry: 2 x M16 + 1 x M20.
Type HSO	Cable entry: 2 x M20.
Type HSU	Cable entry: 3 x 1/2" NPT.

Signal inputs - Flowmeter

Type P	Coil / sine wave (HI: 20mVpp or LO: 80mVpp - sensitivity selectable), NPN/PNP, open collector, reed switch, Namur, active pulse signals 8 - 12 and 24V DC.
Frequency	Minimum 0Hz - maximum 6kHz for total and flow rate. 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: 16 bit. Error < 0.01mA / \pm 0.05% FS. Low level cut-off programmable.
Span	0.000010 - 199,999 with variable decimal position.
Update time	Four times per second.
Voltage drop	Type A: 2.5V DC @ 20mA.
Relationship	Linear and square root calculation.
Note A	For signal type A: external power to sensor is required; e.g. type PD.

Signal outputs - Digital output

Function	Pulse output according to differential or sum accumulated total and indication negative pulse output.
Frequency	Max. 500Hz. Pulse width user definable between 0.001 second up to 9.999 seconds.
Type OA	Two active 24V DC transistor outputs (PNP); max. 50mA per output (requires -PD, PF, PM or PX). Requires min. 24V power supply.
Type OR	Two electro-mechanical relay outputs - isolated; max. switch power 230V AC (N.O.) - 0.5A per relay (requires PF or PM).
Type OT	Two passive transistor outputs (NPN) - not isolated. Max. 50V DC - 300mA per output.

Signal outputs - Analog output

Function	Transmitting differential / sum flow rate.
Accuracy	10 bit. Error < 0.05%. Analog output signal can be scaled to any desired range.
Update time	Eight times per second.
Type AA	Active 4 - 20mA output (requires PD, PF, PM or PX).
Type AB	Active 0 - 20mA output (requires PD, PF, PM or PX).
Type AF	Passive floating 4 - 20mA output for Intrinsically Safe applications (requires XI + PD).
Type AI	Passive galvanically isolated 4 - 20mA output - also available for battery powered models.
Type AP	Passive 4 - 20mA output - not isolated. Unit will be loop powered.
Type AU	Active 0 - 10V DC output (requires PD, PF, PM or PX). Requires min. 12V power supply.

Signal outputs - Communication option

Function	Reading display information, reading / writing all configuration settings.
Protocol	Modbus ASCII / 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.

Power requirements

Type AP	Analog output loop powered, 8 - 30V DC. Power consumption max 0.5 Watt.
Type PB	Long life Lithium battery - life-time depends upon settings and configuration - up to 5 years. (requires PD or PX)
Type PC	Intrinsically Safe long life lithium battery life-time depends upon settings and configuration - up to 5 years. (requires XI and PD or PX)
Type PD	8 - 24V AC / DC \pm 10%. Power consumption max. 5W. Intrinsically Safe: 16 - 30V DC; power consumption max. 1 W.
Type PF	24V AC / DC \pm 10%. Power consumption max. 15W.
Type PM	115 - 230V AC \pm 10%. Power consumption max. 15W.
Type PX	8 - 30V DC. Power consumption max. 0.75W.
Type ZB	12 - 30V DC \pm 10%. Power consumption max. 1.5W.
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 XI	For Intrinsically Safe applications, consult the safety values in the certificate.

Sensor excitation

Type PB/PC/PX	3V DC for pulse signals and 1.2V DC for coil pick-up.
Note PB/PC/PX	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 / 8.2 / 12 / 24V DC - max. 50mA @ 24V DC. U_{max} sensor is 2V below U_{supply}
Type PD-XI	1.2 / 3 / 8.2V DC - max. 7mA @ 8.2V DC and mains power supply voltage (as connected to terminal 1).
Type PF / PM	1.2 / 3 / 8.2 / 12 / 24V DC - max. 400mA @ 24V DC.

Operator functions

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

Flow rate

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

Intrinsically Safe isolators

ACG01	MTL5511 - One channel pulse or switch output transfer from hazardous area to safe area.
ACG02	MTL5525 - One channel power supply from safe area to hazardous area (e.g. to power the unit with PD or to power a switching or analog device in hazardous area).
ACG03	MTL5541 - One channel 4 - 20mA repeater from hazardous area to safe area.
ACG04	MTL 5051 - Bi-direction serial-data-isolator (for Modbus communication).
ACG05	MTL5516C - Two channel pulse or switch output transfer from hazardous area to safe area.
ACG06	MTL5513 - One channel pulse or switch output transfer from hazardous area to safe area.
ACG07	MTL5546Y - One channel isolated driver bringing 4 - 20mA from safe area to hazardous area, HART transparent, OCD.

		Description		
Model	F116	Differential / sum flowcomputer with analog and pulse signal outputs		
Input	A	(0)4 - 20mA input	-A	
	P	Pulse input, e.g., coil, npn, pnp, namur, reed-switch	-P	
Analog output	AA	Active 4 - 20mA output - requires PD, PF, PM or PX - Safe area only	-AA	
	AB	Active 0 - 20mA output - requires PD, PF, PM or PX - Safe area only	-AB	
	AF	I.S. floating 4 - 20mA output - requires XI + PC or PD	-AF	
	AI	Isolated 4 - 20 mA output - Safe area only	-AI	
	AP	Passive 4 - 20mA output, loop powered unit	-AP	
	AU	Active 0 - 10V DC output - requires PD, PF, PM or PX - Safe area only	-AU	
Communication	CB	Communication RS 232 - Modbus ASCII / RTU - requires XX.	-CB	
	CH	Communication RS 485 - 2wire - Modbus ASCII / RTU - requires XX.	-CH	
	CI	Communication RS 485 - 4wire - Modbus ASCII / RTU - requires XX.	-CI	
	CT	Intrinsically Safe TTL - Modbus ASCII / RTU - requires XI.	-CT	
	CX	No communication	-CX	
Enclosures	HB	Aluminum panel mount enclosure	-HB	
	HC	GRP panel mount enclosure	-HC	
	HD	GRP field mount - Cable entry: no holes	-HD	
	HE	GRP field mount - Cable entry: 2 x Ø 16mm & 1 x Ø 20mm	-HE	
	HF	GRP field mount - Cable entry: 1 x Ø 22mm (7/8")	-HF	
	HG	GRP field mount - Cable entry: 2 x Ø 20mm	-HG	
	HH	GRP field mount - Cable entry: 6 x Ø 12mm	-HH	
	HJ	GRP field mount - Cable entry: 3 x Ø 22mm (7/8")	-HJ	
	HK	GRP field mount - Flat bottom, cable entry: no holes	-HK	
	HA	Aluminum field mount - Cable entry: 2 x PG9 + 1 x M20	-HA	
	HL	Aluminum field mount - Cable entry: 2 x 1/2"NPT	-HL	
	HM	Aluminum field mount - Cable entry: 2 x M16 + 1 x M20	-HM	
	HN	Aluminum field mount - Cable entry: 1 x M20	-HN	
	HO	Aluminum field mount - Cable entry: 2 x M20	-HO	
	HP	Aluminum field mount - Cable entry: 6 x M12	-HP	
	HT	Aluminum field mount - Cable entry: 1 x 1/2"NPT	-HT	
	HU	Aluminum field mount - Cable entry: 3 x 1/2"NPT	-HU	
	HV	Aluminum field mount - Cable entry: 4 x M20	-HV	
	HZ	Aluminum field mount - Cable entry: no holes	-HZ	
	HBM	Extended Alu. field/meter mount - Cable entry: 2 x M16 + 1 x M20.	-HBM	
	HBO	Extended Alu. field/meter mount - Cable entry: 2 x M20.	-HBO	
	HBU	Extended Alu. field/meter mount - Cable entry: 3 x 1/2"NPT.	-HBU	
	HSM	Stainless steel 316L field mount - Cable entry: 2 x M16 + 1 x M20.	-HSM	
	HSO	Stainless steel 316L field mount - Cable entry: 2 x M20.	-HSO	
	HSU	Stainless steel 316L field mount - Cable entry: 3 x 1/2"NPT.	-HSU	
	Digital output	OA	Two active transistor outputs- requires and PD, PF, PM or PX - Safe area only	-OA
		OR	Two mechanical relay outputs - requires PF or PM - Safe area only	-OR
		OT	Two passive transistor outputs	-OT
Power	PD	8 - 24V AC/DC + sensor supply - with XI: 16 - 30V DC	-PD	
	PF	24V AC/DC + sensor supply - Safe area only	-PF	
	PM	115 - 230V AC + sensor supply - Safe area only	-PM	
	PX	Basic power supply 8 - 30V DC	-PX	
Battery	PB	Additional lithium battery powered (optional) - requires PD or PX - Safe area only	-PB -P_	
	PC	Additional lithium battery powered (optional) - Intrinsically safe - requires XI, and PD or PX	-PC -P_	
Hazardous	XI	Intrinsically safe, according ATEX and IECEx	-XI	
	XF	Ex d enclosure - 3 keys according ATEX	-XF	
	XX	Safe area only	-XX	
Options	ZB	Backlight - Safe area only	-ZB	
	ZF	Coil input 10mVpp	-ZF	
	ZX	No options	-ZX	

The **bold** marked text contains the standard configuration: F116-P-AP-CX-HC-OT-PX-XX-ZX.