INSTALLATION GUIDE

DI 002 EN N

CMA TRONIQUE TC50 and TC80 types

Described in EU-type examination certificate N°: LNE-14983

Issue	Date	Nature of modifications	Written by	Approved by
N	2018/10/15	New FORM DOC for connectivity *[PJA074]*, Drawings update	DSM	MV
M	2018/02/08	Modification of the assignment of the extension board ‘sonde AD’ 2 wires *[PJV128]*, Drawings update	DSM	XS
L	2017/09/11	2 wires-‘sonde AD’ IS electronic board *[PJV129]*, Drawings update, New FORM DOC	DSM	XS
F	2015/04/16	Creation	DSM	XS

CONTENTS

1. GENERAL RECOMMENDATIONS

IN ORDER TO AVOID ALL THE PROBLEMS CONCERNING THE INSTALLATION, THE OPERATION AND THE MAINTENANCE OF THE EQUIPMENTS, BEING ABLE TO CREATE INOPPORTUNE FAILURE, PLEASE RESPECT THE FOLLOWING RECOMMENDATIONS.

BEFORE ANY WORK, MAKE SURE THAT THE EQUIPMENTS ARE NOT POWERED.

1.1. MECANICAL RECOMMENDATIONS

⇨ Respect the recommendations of the instruction manual specifying the installation, operation and maintenance conditions of the ATEX equipment (instruction manual supplied with the equipment).

⇨ Take care to place the equipment in order to facilitate their installation, operation and maintenance by the technicians (working ergonomics).

⇨ Take care to position properly the equipment; the display must be readable without any difficulty.

⇨ Apply a tightening torque suitable with size and material of the fixation element except particular specifications mentioned on the presentation drawing or in the installation guides.

⇨ Mechanically protect the cables with the corrugated conduit if the cables are not ADR (corrugated conduit adapted to vehicles used for "carriage of dangerous goods of road" - hydrocarbons, LPG … - and meet the requirements of French standard NF R13-903. Refer to the regulations in force).

⇨ Ensure there are a good mechanical strength and a good sealing between cable glands and cables, and between cable glands and corrugated conduit.

⇨ Respect cables and corrugated conduit radii of curvature.

⇨ Leave enough flexibility to wires in order to avoid any risk of stripping.

⇨ Allow the drainage of the water in the lower loop (siphon) of the corrugated conduit (not water retention inside the corrugated conduit).

⇨  See § INSTALLATION AND SEALING RECOMMENDATIONS ADRIANE TURBINE METER.

1.2. ELECTRICAL RECOMMENDATIONS

⇨ According to the ATEX directive or any other regulations in force in the country of destination, the safety protection level of the equipment must agree with the installation area (potentially explosive atmospheres).

⇨ Respect the recommendations of the instruction manual specifying the installation, operation and maintenance conditions of the ATEX equipment (instruction manual supplied with the equipment).

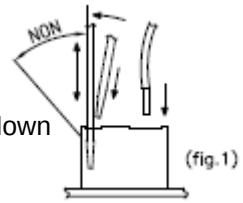
⇨ Connect the supply of the equipment downstream cut-out, on the power supply reserved to the measured distribution.

⇨ Put a delayed protection of 5A upstream the 24VDC supply to protect equipment in case of reverse polarity or overcurrent.

⇨ Use ADR specific cable, if it is not the case, use at minimum a cable resisting to hydrocarbons. Mechanically protect this cable with a corrugated conduit (corrugated conduit adapted to vehicles used for "carriage of dangerous goods by road" - hydrocarbons, LPG … - and meet the requirements of French standard NF R13-903. Refer to the regulations in force).

⇨ Take care not to damage the terminals of the different electronic boards while wiring.

- Screw terminals: do not damage the screw heads of the terminals.
  - Use insulated lugs and insulated wire ferrules adapted to the section of wires.
- Spring terminals: do not block the springs (if a spring is blocked, the electronic board must be replaced).
  - Use flat screwdriver 0.4x2.5 (see fig.1).
  - Insert the screwdriver slightly tilted, then push it perpendicularly to the terminal.
  - Do not exceed the upright position when the screwdriver is down in order not to block the spring.
  - Insert or remove the wire and remove the screwdriver.



(fig.1)

⇨ Pass the power supply cores (24VDC truck) through the ferrites by carrying out a loop (ALMA supply).

⇨ Do not use wires of section higher than 1.5mm².

⇨ Do not insert more than two wires in a terminal, if necessary use an insulated twin wire ferrule (unless otherwise indicated).

⇨ Strictly respect the polarities of the input/output when wiring, in accordance with serigraphy on the cards and/or with the installation guide indications.

⇨ Whenever possible, perform a wired test, after wiring and before powering.

⇨ Whenever possible, respect the locations of the cables specified in the installation guide.

⇨ Equipment must be connected to the frame ground (external ground connection).

⇨ Whenever possible, use shielded cables with a 360° connection through the metal cable glands (see the documentation delivered with the equipment).

Otherwise, connect the shields to devices inside the equipment (ground terminal, earth bar, earth boss…).

⇨ Whenever possible, label the cables and cores according to the installation guide to facilitate the later maintenance operations.

⇨ Respect a homogeneous wire color code.

⇨ Printer TMU295: before positioning the printer on its support, check that configuration switches of the data link protocol, located under the printer, are well positioned: No3 on 'ON' and the 7 others on 'OFF'.

⇨ Current of the electrical devices:

Electrical devices	Supply voltage	Minimum current	Maximum current
MICROCOMPT+	24VDC +/-10%	0.7 A	1.5 A
PRINTER	24VDC +/-10%	0.1 A	5.5 A (switch-on)

⇨ Color code according to DIN 47100.

⇨ Code for designation of colours according to IEC 60757 (except FR codes):

FR				EN	IT	ES	DE
Couleurs	Codes		Standard codes CEI 60757	Colours	Colori	Colores	Farbe
Blanc	**Bc**		**WH**	White	Bianco	Blanco	Weiβ
Marron	**Mr**		**BN**	Brown	Marrone	Marrón	Braun
Vert	**Vt**		**GN**	Green	Verde	Verde	Grün
Jaune	**Jn**		**YE**	Yellow	Giallo	Amarillo	Gelb
Gris	**Gr**		**GY**	Grey	Grigio	Gris	Grau
Rose	**Rs**		**PK**	Pink	Rosa	Rosa	Lila
Bleu	**Bl**		**BU**	Blue	Blu	Azul	Blau
Rouge	**Rg**		**RD**	Red	Rosso	Rojo	Rot
Noir	**Nr**		**BK**	Black	Nero	Negro	Schwarz
Violet	**Vi**		**VL**	Violet	Viola	Violeta	Violett
Orange	**Or**		**OG**	Orange	Arancio	Naranja	Orange
Vert/Jaune	**V/J**		**GNYE**	Green/Yellow	Verde/Giallo	Verde/Amarillo	Grün/Gelb

1.3. PNEUMATIC RECOMMENDATIONS

⇨ Air must be filtered – from 40 to 20µm. Specific recommendations may be added in the installation guides or on the presentation drawings.

⇨ The air lubrication must be permanent and correct to avoid any damage on the pneumatic components.

⇨ The air supply pressure to the inlet of the equipment must be at least 6 bar and max 8 bar. Specific recommendations may be added in the installation guides or on the presentation drawings.

⇨ The pneumatic supply pipes (6/4) must be cut straight (no slanting cut) and should not be crushed after cutting to prevent leakage on fittings.

⇨ Respect the radii of curvature of the pneumatic pipes indicated by the manufacturer.

⇨ Use colored pneumatic pipes to ease maintenance operation.

⇨ In no case the exhaust holes of the pneumatic organs should be plugged, obstructed, unless if that is clearly specified in the installation guides or on presentation drawings.

⇨ The use of muffler is not allowed under any circumstances (fouling, frost…). Put a pneumatic pipe of sufficient length, pointed downwards, so that its end is placed in a protected area (L = 100 mm min.).

⇨ Pressure unit conversion:

PRESSURE UNIT CONVERSION				
Unités	**Bar**	**PSI**	**Pascal**	**kg/cm²**
1 Bar =	1	14,5	100 000 ($1x10^5$)	1,0197
1 PSI =	0.069	1	6894,5	0,07031
1 Pascal =	$1x10^{-5}$	$14,5x10^{-5}$	1	$1,0197x10^{-5}$
1 kg/cm² =	0,98	14,22	98066,5	1

PSI = Pound per Square Inch (livre par pouce carré)
1 bar = 100 kPa = 0.1 MPa (1 MPa = 10 bar)

2. GENERAL PRESENTATION

2.1. USE ACCORDING TO MID CERTIFICATE

The measuring system CMA TRONIQUE type TC50 or TC80 is covered by the EU type examination certificate N° LNE-14983. Refer to this certificate for any precision about its installation.
For the sealing plan, see Annex to EU type examination certificate N° LNE-14983.

2.2. SPECIAL CONDITIONS FOR INSTALLATION

ALMA CPR3000 pressure sensor is to be installed:

- ⇨ If possible by an equal distance between filter and pump entry, and in all cases with a minimal distance 200mm upstream from the pump entry
- ⇨ At the most vertical position regardless of the nipple on the pipe.

Any disruptive system (filter, valve, etc.) cannot be situated between the pressure entry and the pump entry.

Connection pipework between the compartments and the pump must have a minimum gradient of 3%. In case of a manifold configuration, this requirement is limited to the following conditions:

- ⇨ 3% minimum gradient of the pipe between bottom flap and manifold
- ⇨ No reverse slope between manifold and pump entry.

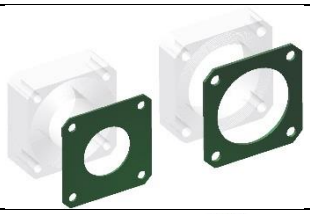
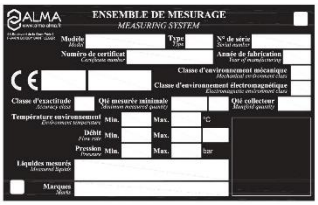
If the measuring system is fitted with two delivery points, it needs to be equipped with a device allowing a liquid delivery by only one point at once.

3. PART LIST

EQUIPMENTS INCLUDED IN THE MEASURING SYSTEM DELIVERED BY ALMA				
Item	**Equipment**	**Designation**	**Qty**	**Option***
1		**CALCULATOR INDICATOR MICROCOMPT+ CMA TRONIQUE WITH Bluetooth CONNECTION** NON ATEX or ATEX version	1	
		Wi-Fi CONNECTION (As an alternative to Bluetooth)		•
		**RFID SUPERVISOR KEY**		
2	2a 	**ADRIANE TURBINE METER DN50-50 or DN80-80** (Depending on configuration)	1	
	2b 	**ADRIANE TURBINE METER DN80-80 373 PN16 Ad blue®** (Only for CMA TRONIQUE Ad blue®)		
3		**RELATIVE PRESSURE SENSOR – CPR3000** NON ATEX or ATEX (Supplied with hydraulic shock absorber)	1	
4		**PRINTER TMU-295** (Printer – power supply cable – serial link cable 10m)	1	
5		**CONVERTER 24VDC/24VDC 2.1A 50W** (Printer power supply 24VDC)	1	

Non-contractual pictures

EQUIPMENTS INCLUDED IN THE MEASURING SYSTEM DELIVERED BY ALMA

Item	Equipment	Designation	Qty	Option*
6		**NON-RETURN VALVE KIT DN50 or DN80** (Depending on configuration)	1	
7		**SIGHTGLASS KIT DN50 or DN80 FOR ADRIANE TURBINE METER** (Depending on configuration) (Supplied with pre-drilled screws for sealing)	1	
8		**CONNECTION KIT DN50 or DN80** (Depending on configuration) (Supplied with pre-drilled screws for sealing)	1	●
9		**NC/NO SOLENOID VALVES KIT** NON ATEX or ATEX version	1	●
10		**Pt100 TEMPERATURE PROBE – CT1001-Pe ATEX** (Supplied with thermowell)	1	●
11		**2-ANTENNA BOX GSM AND GPS**	1	●
12		**KIT FOR MEASURING SYSTEM IDENTIFICATION PLATE** (Plate and sealing device)	1	●

Option*: equipment sold as an option by ALMA, it must be installed on the measuring system if required by the certificate.

Non-contractual pictures

4. MICROCOMPT+ CMA TRONIQUE NON ATEX OR ATEX

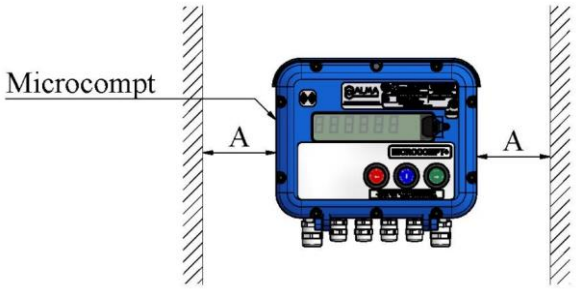
4.1. CALCULATOR-INDICATOR MICROCOMPT+ NON ATEX

4.2. CALCULATOR-INDICATOR MICROCOMPT+ ATEX

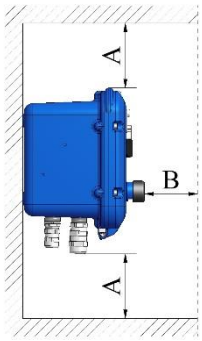
Document available on website alma-alma.fr

4.3. INSTALLATION RECOMMENDATIONS CALCULATOR-INDICATOR MICROCOMPT+

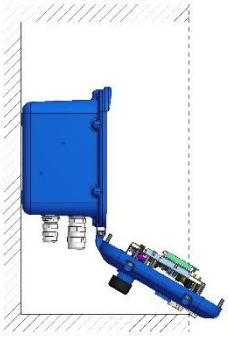
- Fasten the box with 4 M6 screws (holder suitable for vibrations and designed to support the MICROCOMPT). On the box: 4 M6 blind holes tapped length=12 over 185x132).
- Leave an open space around the box in order:
  - To facilitate maintenance operation.
  - To prevent any pressing on pushbuttons and on the glass.
- The space between the front face of the box and the cabinet door shall be sufficient.
- Dimensions: A > 100mm and B > 60mm



- SOLUTION 1: straight box if it's a breast height.

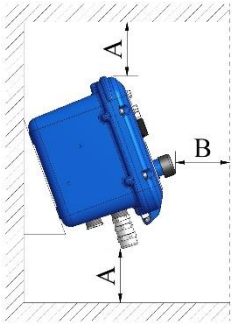


Left hand view
Closed box



Left hand view
open box

- SOLUTION 2: 20° angle if it's not at breast height.

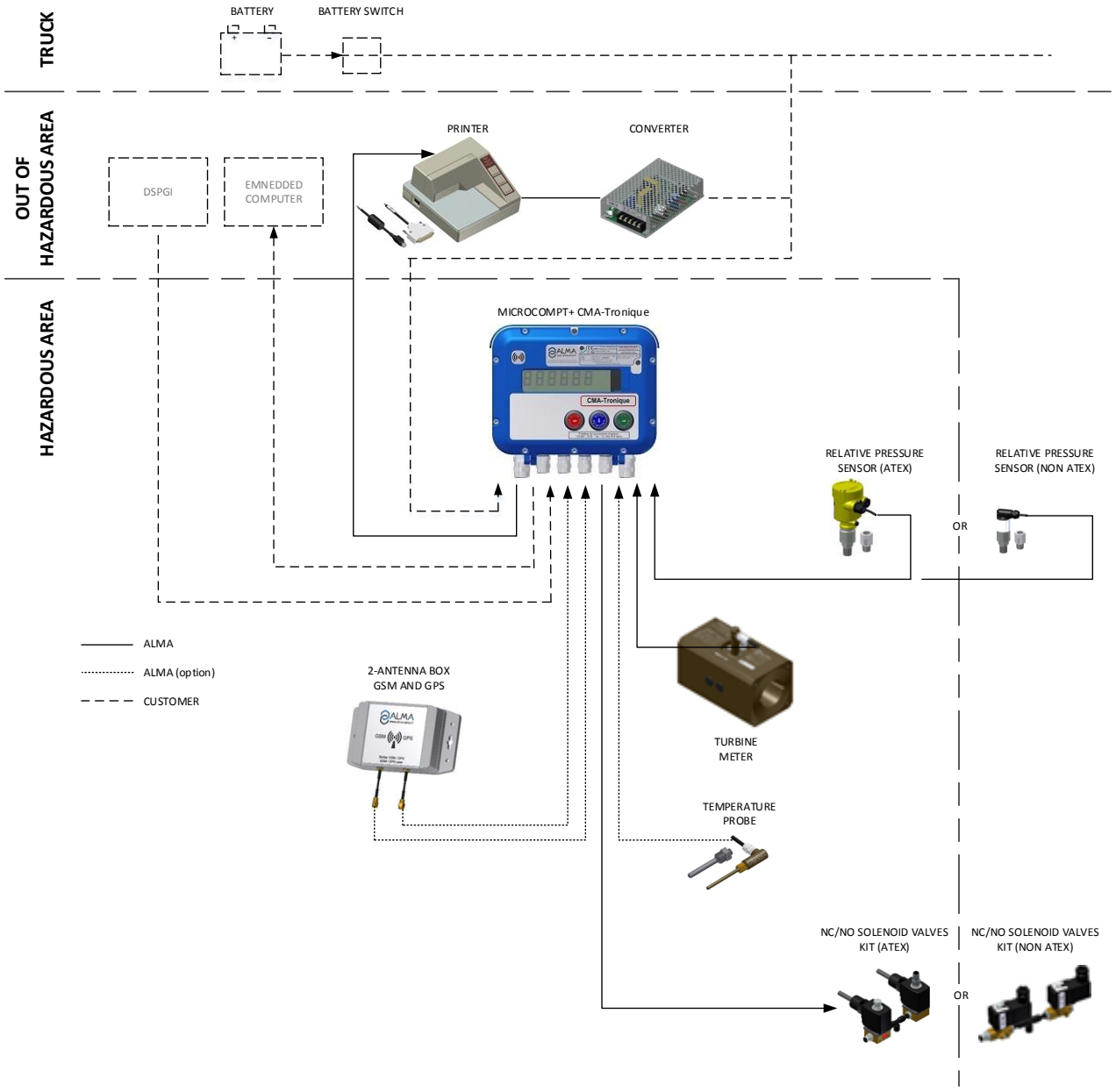


Left hand view
Closed box

Left hand view
open box

REFER TO THE INSTRUCTION MANUAL
(DELIVERED WITH THE EQUIPMENT OR AVAILABLE ON ALMA WEBSITE)

4.4. ELECTRICAL WIRING CALCULATOR-INDICATOR MICROCOMPT+

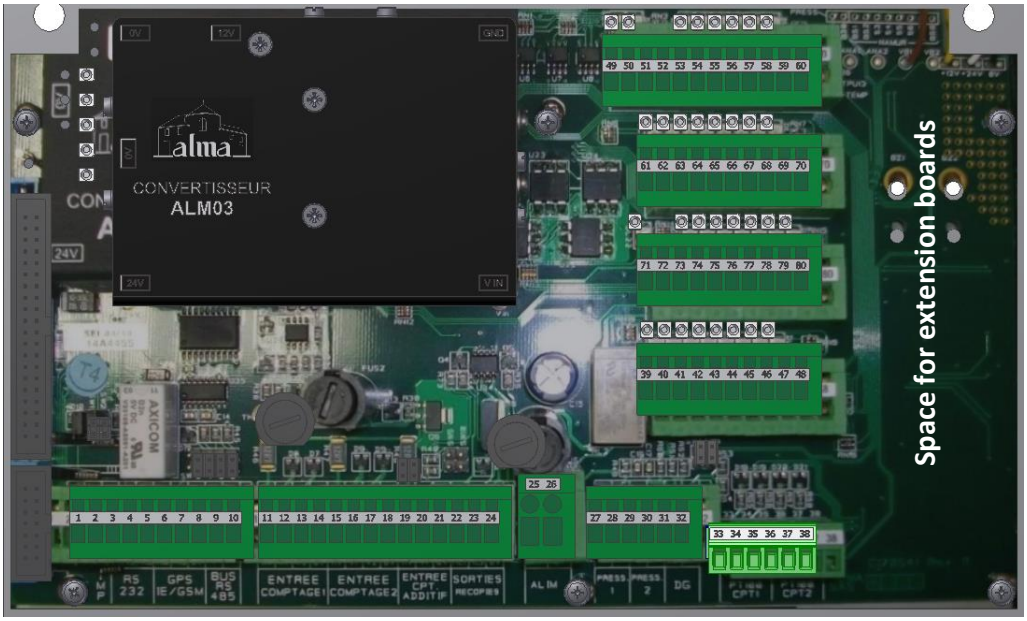


Terminal assignment of the power supply board

Any mass braids and shielding must be connected to the MICROCOMPT+ ground bar

TERMINAL ASSIGNEMENT OF MICROCOMPT+ BOARDS

POWER SUPPLY BOARD



EQUIPMENTS CONNECTED TO THE MICROCOMPT+								POWER SUPPLY BOARD			
Option	Equipment	Cable (for information) No.	CG*	Alma	Type	Function	Colour or No.	Terminal	Function		Observation
	PRINTER	C1	1/2"NPT	●	ADR 4x0.34 sh.	Rx Printer	Bc	1	Tx	PRINTER	Connect the shielding
						Tx Printer	Mr	2	Rx		
						0V	Vt	3	0V		
•	EMBEDDED COMPUTING	C8	1/2"NPT		3x0.34 sh.	0V		3	0V	RS232	Connect the shielding. ALMA or FTL Light Protocol
						Rx E.C.		4	Tx		
						Tx E.C.		5	Rx		
•	DSPGI DEVICE					Rx	Vt	6	Tx	DSPGI	Gauging system for product identification
						Tx	Bc	7	Rx		
						Ground	Nr	8	Ground		
•	REMOTE DISPLAY					Tx		9	+	RS485	Remote display type SREI TC5-10-24 Ext Use an RS485/RS232 converter
						Rx		10	-		
	TURBINE TRANSMITTER	C2	1/2"NPT	●	ADR 4x0.34 sh.	12V	Jn	11	12V	INPUT TURBINE EMA	Connect the shielding
						V1	Mr	12	V1		
						V2	Vt	13	V2		
						0V	Bc	14	0V		
•	ADDITIVE INJECTOR METERING							19	PO EMA	INPUT ADDITIVE METERING	
								20	PO EMB		
								21	0V		
•	PULSES OUTPUT		1/2"NPT			PO EMA		22	12V	PULSES OUTPUT	Control system / Display Put SW9 and SW10 to have a 0-24V signal
						PO EMB		23	V1		
						0V		24	0V		
	SUPPLY 24VDC	A1	1/2"NPT		2x1	Bat. (+)	1	25	24VDC	POWER SUPPLY	24VDC truck battery (after battery switch and protected by a fuse)
						Bat. (-)	2	26	0V		

EQUIPMENTS CONNECTED TO THE MICROCOMPT+								POWER SUPPLY BOARD			
Option	Equipement	Cable (for information)				Function	Colour or No.	Terminal	Function		Observation
		No.	CG*	Alma	Type						
	RELATIVE PRESSURE SENSOR CPR3000 (NON ATEX)	C3	1/2"NPT	●	2x0.34 sh.	+	Mr	27	+	PRESSURE	Connect the shielding
						-	Bl	28	-		
●	Pt100 TEMPERAURE PROBE	C4	1/2"NPT	●	ADR 3x0.6 sh.	+	Jn	33	+	Pt100	Connect the shielding
						-	Bc	34	-		
						-	Vt	35	-		
	MANIFOLD FLAP CONTROL OR PRODUCT RETURN AUTHORISATION AND/OR ADDITIVATION 2 CONTROL				4 to 7x1	Flap 1	1	39	24VDC = opened flap (outputs FET 24V 5W max.) FET:Field Effect Transistor	EV Flaps or Product return and/or Additivation 2	Depending on configuration: direct connection or via plexmi electronic board. Refer to the assignment table and the connection table of the relevant plexmi board
						Flap 2	2	40			
						Flap 3	3	41			
						Flap 4	4	42			
						Flap 5	5	43			
						Flap 6	6	44			
						Flap 7	7	45			
								46			
					1x1	0V		47	0V		
								48			
	RC-HEATING OIL RECEIVER				2x1	Start/Stop	1	49	Start/Stop	RC-Oil_1	
						LF/HF	2	50	LF/HF	RC-Oil_2	
	COUNTED / PUMPED DISTRIBUTION WAY (with additional commands)				3x1	Gravi/Pmp	1	51	0V	Gravity / Pumped	Closed circuit=product pumped (end position)
						Pct/Pnc	2	52	0V	Pumped counted/ no counted	Closed circuit=product counted
						0V	3	59	0V	0V (GND)	51, 52 and 59 are shunted if manual valves are not instrumented
	PTO CONTROL				1x1	PTO Ctrl		58		PTO control	Power-take-off engaged
	FOOTVALVE CONTROL				1x1	Footvalve		64	24VDC= cde	FOOTVALVE	24VDC=opening (Outputs FET 24V 5W max.) *FET=Field Effect Transistor*
	PRODUCT RETURN CONTROL				3 to 6X1	PR1	1	65	24VDC= author.	Return_1	Depending on configuration: direct connection (Outputs FET Field Effect Transistor 24V 5W max.) or via plexmi electronic board. Refer to the assignment table and connection table of the relevant plexmi board
						PR2	2	66		Return_2	
						PR3	3	67		Return_3	
						Chasse		68		Cde chasse	
	HOSES 1 AND 2 AUTHORISATION CONTROL	C6			3x1	0V	1	70	0V	0V (GND)	Hoses 1and 2 authorisation control (Outputs FET 24V 5W max.) *FET=Field Effect Transistor*
						Hose 1	2	75	24VDC= distrib.	Hose_1ctrl	
						Hose 2	3	63		Hose_2 ctrl	
	ADDITIONAL COMMANDS				5X1	PTO	1	61	24VDC= pto	PTO	(Outputs FET 24V 5W max.) *FET=Field Effect Transistor*
						Stop Mot.	2	62	24VDC= stop	Stop motor	
						Acc. Mot.	3	73	24VDC= acc.	Motor acceleration	
						Clutching	4	76	24VDC= clutchin	Clutching	
						Start Mot.	5	77	24VDC= start	Start motor	
	ADDITIVATION 1 CONTROL				2x1	Power	1	71	NO free contact	Additivation 1	Closed contact=additivation (Output: NO free potential relay)
						Control	72	72			
●	KIT SOLENOID VALVES NC/NO (NON ATEX or ATEX)	C5		●	*[3xG0.75]*	NC valve Pump bypass	1 / [Mr]	74	24VDC	NC control	24VDC= opening NC solenoid valve 24VDC= closing NO solenoid valve *[cable supplied by ALMA for ATEX version]*
							2 / [Nl]	80	0V		
						NO valve Exhaust	1 / [Mr]	79	24VDC	NO control	
							2 / [Nl]	80	0V		
	MANIFOLD VENT VALVE CONTROL				1x1	Vent valve		78	24VDC	Vent valve control	24VDC=opening (Outputs FET 24V 5W max.) *FET=Field Effect Transistor*

SOME EXTENSION BOARDS MAY BE SET ON TO THE POWER SUPPLY BOARD

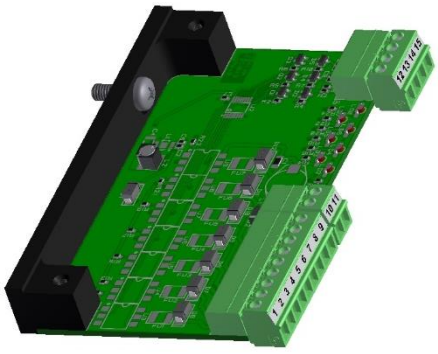
**Refer to the Cable Glands Installation Instructions*

Assignments table according to number of flaps, product returns and depending on the presence or not of a second additive injector:

				MICROCOMPT+ power supply board V1 REV11									
Nb of Flaps	**Nb of Returns**	**Addit #1**	**Addit #2**	**45**	**44**	**43**	**42**	**41**	**40**	**39**	**67**	**66**	**65**
5	0-4	yes	yes	addit#2	ret#4	flap#5	flap#4	flap#3	flap#2	flap#1	ret#3	ret#2	ret#1
5	5	yes	no	ret#5	ret#4	flap#5	flap#4	flap#3	flap#2	flap#1	ret#3	ret#2	ret#1
6	0-3	yes	yes	addit#2	flap#6	flap#5	flap#4	flap#3	flap#2	flap#1	ret#3	ret#2	ret#1
6	4	yes	no	ret#4	flap#6	flap#5	flap#4	flap#3	flap#2	flap#1	ret#3	ret#2	ret#1
6	5-7	yes	yes	addit#2	flap#6	flap#5	flap#4	flap#3	flap#2	flap#1	PLEXMI 1 (ret#1-ret#7)		
7	0-3	yes	no	flap#7	flap#6	flap#5	flap#4	flap#3	flap#2	flap#1	ret#3	ret#2	ret#1
7	4-7	yes	no	flap#7	flap#6	flap#5	flap#4	flap#3	flap#2	flap#1	PLEXMI 1 (ret#1-ret#7)		
8	0-6	yes	no	ret#6	ret#5	ret#4	flap#8	PLEXMI 1 (flap #1- flap#7)			ret#3	ret#2	ret#1
9	0-5	yes	no	ret#5	ret#4	flap#9	flap#8	PLEXMI 1 (flap#1- flap#7)			ret#3	ret#2	ret#1
9	6-9	yes	no	ret#9	ret#8	flap#9	flap#8	PLEXMI 1 (flap#1- flap#7)			PLEXMI 2 (ret#1-ret#7)		

If both PLEXMI electronic boards are useful, PLEXMI 1 is fixed to the MICROCOMPT+ frame and PLEXMI 2 (ret#1-ret#7) has to be installed in a 24VDC-supplied independent box.

Connection of plexmi electronic boards for manifold flaps and product returns



Multiplexing table:

MULTIPLEXING TABLE									
Input 1 (12)	Input 2 (13)	Input 3 (14)	Output 1 (1)	Output 2 (2)	Output 3 (3)	Output 4 (4)	Output 5 (5)	Output 6 (6)	Output 7 (7)
0	0	0	0	0	0	0	0	0	0
24V	0	0	**24V**	0	0	0	0	0	0
0	**24V**	0	0	**24V**	0	0	0	0	0
24V	**24V**	0	0	0	**24V**	0	0	0	0
0	0	**24V**	0	0	0	**24V**	0	0	0
24V	0	**24V**	0	0	0	0	**24V**	0	0
0	**24V**	**24V**	0	0	0	0	0	**24V**	0
24V	**24V**	**24V**	0	0	0	0	0	0	**24V**

PLEXMI board connection table for manifold flaps:

CONNECTED EQUIPMENT								PLEXMI ELECTRONIC BOARD							MICROCOMPT+			
								OUTPUTS				INPUTS			POWER SUPPLY BOARD			
Option	Equipment	Cable (for information)				Function	Colour or No	Terminal	Function		Observation	Observation	Function	Terminal	Terminal	Function		Observation
		No	CG*	Alma	Type													
●	MANIFOLD FLAP CONTROL				4 to 7x1	Flap#1	1	1	Outputs 24VDC (24VDC = opened flap)	Flap#1	500 mA max	Multiplexing** for flap#1 to flap#7	Input 1	12	39	Outputs 24VDC (24VDC = opened flap) outputs FET 24V 5W max	Flap#1 to Flap#7	
						Flap#2	2	2		Flap#2			Input 2	13	40			
						Flap#3	3	3		Flap#3			Input 3	14	41			
						Flap#4	4	4		Flap#4								
						Flap#5	5	5		Flap#5								
						Flap#6	6	6		Flap#6								
						Flap#7	7	7		Flap#7								
								8	0V	GND			SUPPLY	24VDC 10	S2	24VDC (white)	Supply via Microcompt+	
														0V 11	S4	0V (black)		
					1x1	0V		9	0V	GND			GND	0V 15	47	0V		

**Refer to the Cable Glands installation instructions*
***Refer to the multiplexing table*

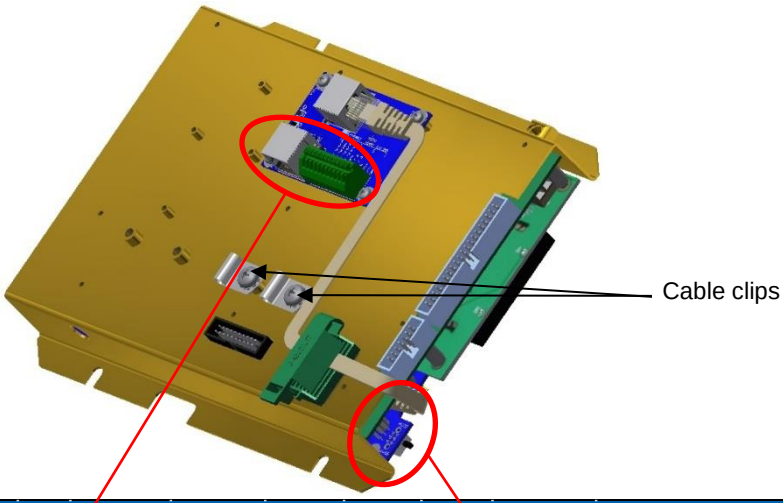
PLEXMI board connection table for product returns:

CONNECTED EQUIPMENT								PLEXMIELECTRONIC BOARD							MICROCOMPT+			
								OUTPUTS				INPUTS			POWER SUPPLY BOARD			
Option	Equipment	Cable (for information)				Function	Colour or No	Terminal	Function		Observation	Observation	Function	Terminal	Terminal	Function		Observation
		No	CG*	Alma	Type													
●	PRODUCT RETURN CONTROL				4 to 7x1	Return#1	1	1	Outputs 24VDC (24VDC = opened return)	Return#1	500 mA max	Multiplexing** from return#1 to return#7	Input 1	12	65	24VDC = authorisation	Product return compartment 1 to 7	Output FET 24V 5W max
						Return#2	2	2		Return#2			Input 2	13	66			
						Return#3	3	3		Return#3			Input 3	14	67			
						Return#4	4	4		Return#4								
						Return#5	5	5		Return#5								
						Return#6	6	6		Return#6								
						Return#7	7	7		Return#7								
								8	0V	GND			SUPPLY	24VDC 10	S2	24VDC (white)	Supply via Microcompt+	
														0V 11	S4	0V (black)		
					1x1	0V		9	0V	GND			GND	0V 15	47	0V		

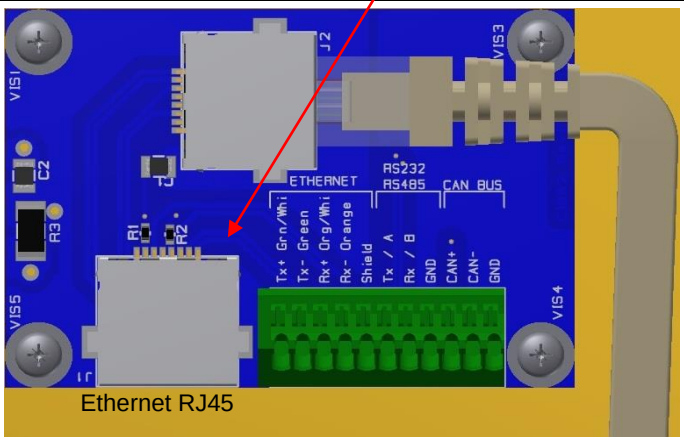
**Refer to the Cable Glands installation instructions*
***Refer to the multiplexing table*

Connection of the network board – Ethernet, RS232/485, CANBus

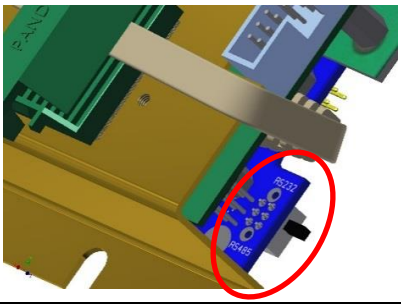
Connection to the Ethernet network:
- With the RJ45 connector according to the EIA/TIA-568 standard
- Or with the screw-terminal: see details in the table below.



NETWORK BOARD



RS232 or RS485 Switch

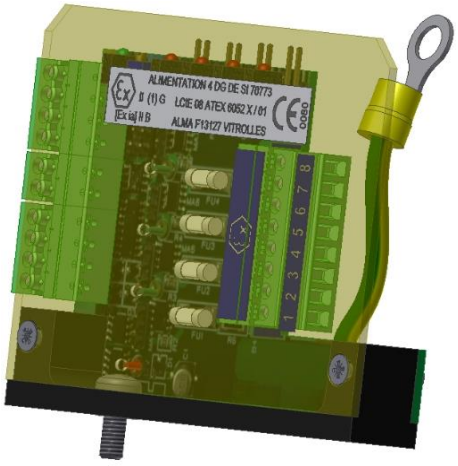


NETWORK CONNECTION TYPE								NETWORK BOARD			
Option	Connection	Cable (for information) No.	CG*	Alma	Type	Function	Coulor or No.	Coulor	Function		Observation
	ETHERNET NETWORK							Vt/Bc	Tx+	Ethernet	Or connection with RJ45 according to EIA/TIA-568
								Vt	Tx-		
								Or/Bc	Rx+		
								Or	Rx-		
									Sh		
	RS232 or RS485								Tx / A	RS232 or RS485	Depending on the switch configuration See above
									Rx / B		
									GND		
	CANBus NETWORK								CAN+	CANBus	
									CAN-		
									GND		

**Refer to the Cable Glands Installation Instructions*

Terminal assignment of the extension board 4DG (IS)

EXTENSION BOARD 4DG (IS)



NT IN ATEX 506 C

EQUIPMENTS CONNECTED TO THE MICROCOMPT+								EXTENSION BOARD 4DG (IS)			
Option	Equipment	Cable (for information) No.	CG*	Alma	Type	Function	Colour or No.	Terminal	Function		Observation
	RELATIVE PRESSURE SENSOR CPR3000 (ATEX)	C3			ADR 4x0.34 sh.	PRESSURE	Bc	5	+	PRESSURE	
							Mr	6	-		

**Refer to the Cable Glands Installation Instructions*

Terminal assignment of the extension board “sonde AD” 5 wires (IS)

EXTENSION BOARD SONDE AD 5 wires (IS)

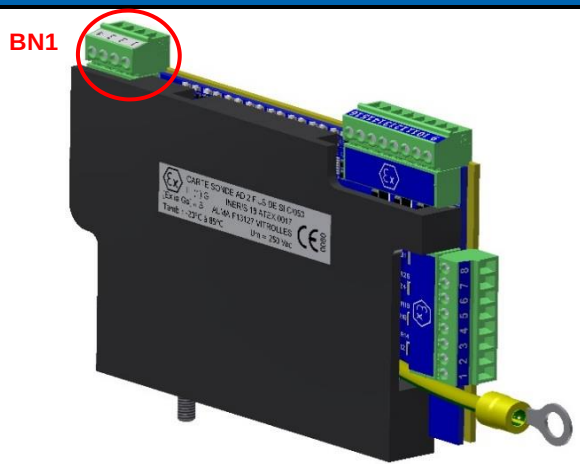
NT IN ATEX 510 C

EQUIPMENTS CONNECTED TO THE MICROCOMPT+								EXTENSION BOARD SONDE AD (IS)			
Option	Equipement	Cable (for information) No.	CG*	Alma	Type	Function	Colour or No.	Terminal	Function		Observation
•	OVERFILL PREVENTION PROBE	C7			*[6x1]*	Common	*[Nr]*	1	-	OVERFILL PREVENTION PROBES	*[If cable are supplied by ALMA]*
						Supply	*[Rg]*	2	+		
						From probe	*[Or]*	3	From probe		
						To probe	*[Jn]*	4	To probe		

**Refer to the Cable Glands Installation Instructions*

Terminal assignment of the extension board “sonde AD” 2 wires (IS)

EXTENSION BOARD SONDE AD 2 wires (IS)

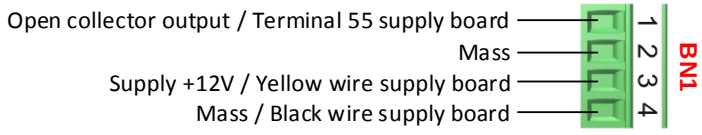


EQUIPMENT CONNECTED TO THE MICROCOMPT+							EXTENSION BOARD SONDE AD (IS)				
Option	Equipment	Cable (for information) No.	CG*	Alma	Type	Function	Terminal	Function		Colour	Observation
•	OVERFILL PREVENTION PROBE 1					Supply	1	Supply +	SIGNAL PROBE 1	Mr	
						Common	2	Common		Bc	
•	OVERFILL PREVENTION PROBE 2					Supply	3	Supply +	SIGNAL PROBE 2	Rg	
						Common	4	Common		Bc	
•	OVERFILL PREVENTION PROBE 3					Supply	5	Supply +	SIGNAL PROBE 3	Or	
						Common	6	Common		Bc	
•	OVERFILL PREVENTION PROBE 4					Supply	7	Supply +	SIGNAL PROBE 4	Jn	
						Common	8	Common		Bc	
•	OVERFILL PREVENTION PROBE 5					Supply	9	Supply +	SIGNAL PROBE 5	Vt	
						Common	10	Common		Bc	
•	OVERFILL PREVENTION PROBE 6					Supply	11	Supply +	SIGNAL PROBE 6	Bl	
						Common	12	Common		Bc	
•	OVERFILL PREVENTION PROBE 7					Supply	13	Supply +	SIGNAL PROBE 7	Vi	
						Common	14	Common		Bc	
•	OVERFILL PREVENTION PROBE 8					Supply	15	Supply +	SIGNAL PROBE 8	Gr	
						Common	16	Common		Bc	

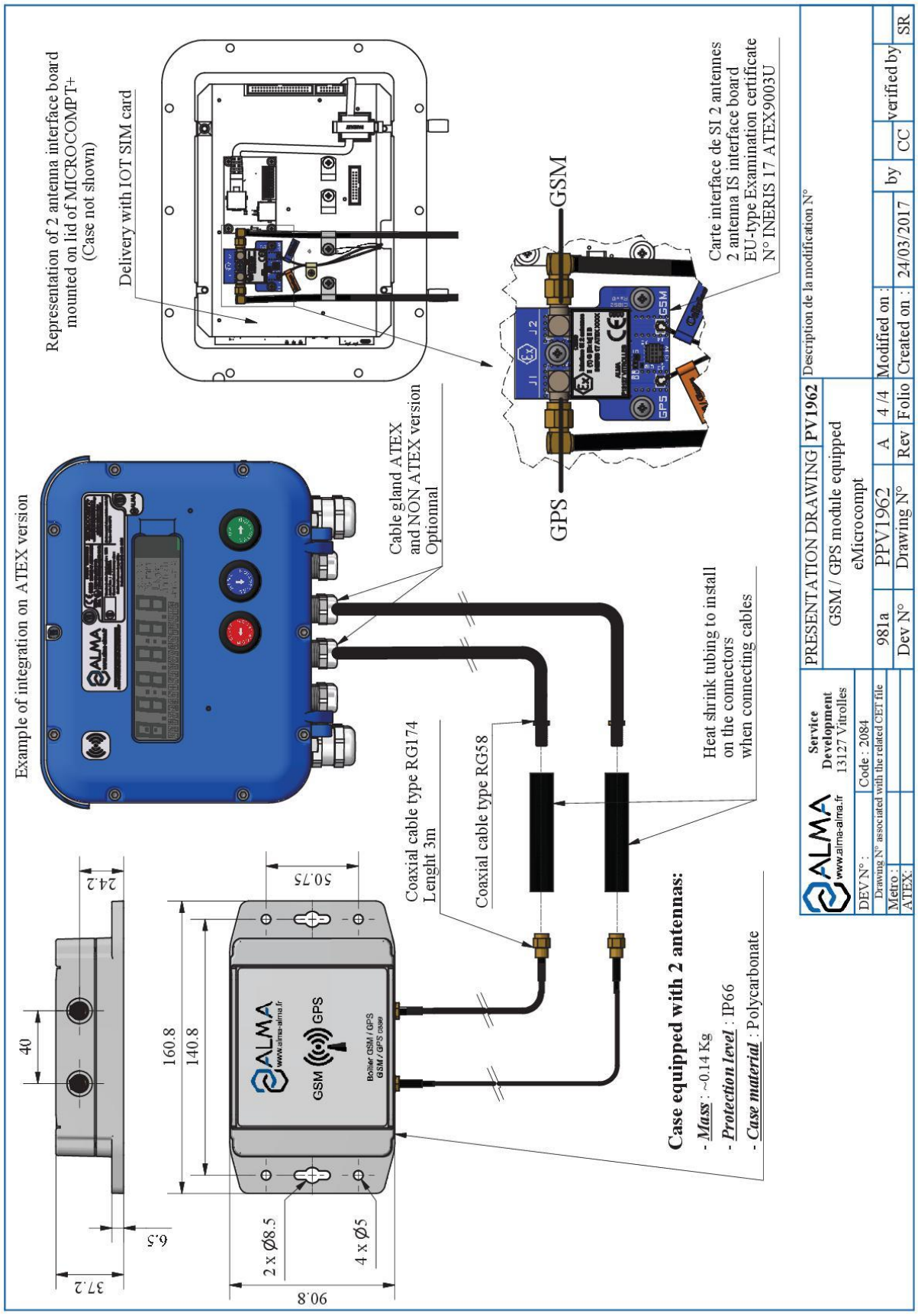
**Refer to the Cable Glands Installation Instructions*

- This extension board only works with two-wire optic overfill prevention probes.
- A Dummy device is a two-wire dry probe simulator. Channels that are not connected to overfill prevention probes must be connected to a Dummy device. None of the 8 channels must be open.
- Do not install the Dummy into the MICROCOMPT housing.
- If the MICROCOMPT is off, the probes and the Dummy device shall be electrically isolated.

Connection of the BN1-terminal to the MICROCOMPT+ power supply board (non-IS area):

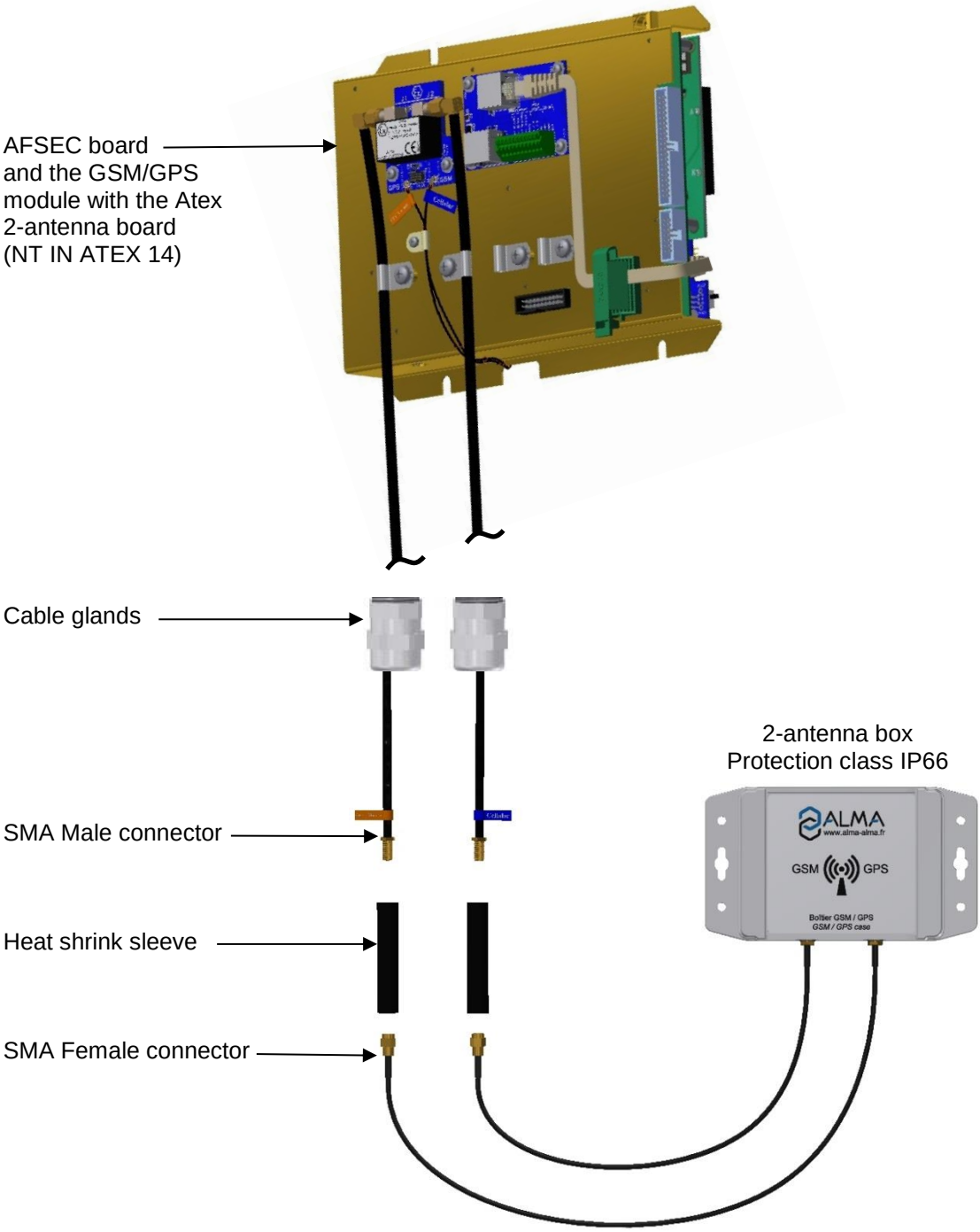


4.5. GSM/GPS MODULE EQUIPPED – 2-ANTENNA BOX



Document available on website alma-alma.fr

Mounting and wiring of the GSM and GPS antennas



The 2-antenna board is supplied with a micro-SD card mounted as follows:

Mounting of the GSM/GPS cables into the cable glands

ALMA connects the GSM and GPS antenna to the MICROCOMPT+ (2-antenna board).

At the outlet of the MICROCOMPT+ box, you must pass both cables through cable glands. In case of an ATEX MICROCOMPT+, cable glands must be ATEX.

Into the MICROCOMPT+, adjust the cable length to easily open and close the cover. Make sure to prevent damage to the cable.

Tighten both cable glands.

Wiring of the 2-antenna box to the MICROCOMPT+

Fasten the box. You must install it in an area free of metallic cover to have a good reception and broadcasting of signal. You can install the box in a horizontal or vertical position.

Put each coaxial cable through the heat shrink sleeve.

Plug the RG58(1) cable from the MICROCOMPT+ with the RG174(2) cable from the antenna box and tighten them. Isolate the male/female SMA connectors with the supplied heat shrink sleeve (both antennas in the box are the same, cables don't have to be labelled).

Position and heat up the sleeve on the connectors to prevent corrosion and humidity.

WARNING: The cables of this box can be **neither shortened nor extended**

(1) RG58: Semi-rigid coaxial cable, 5mm diameter

(2) RG174: Flexible coaxial cable, 2.7mm diameter

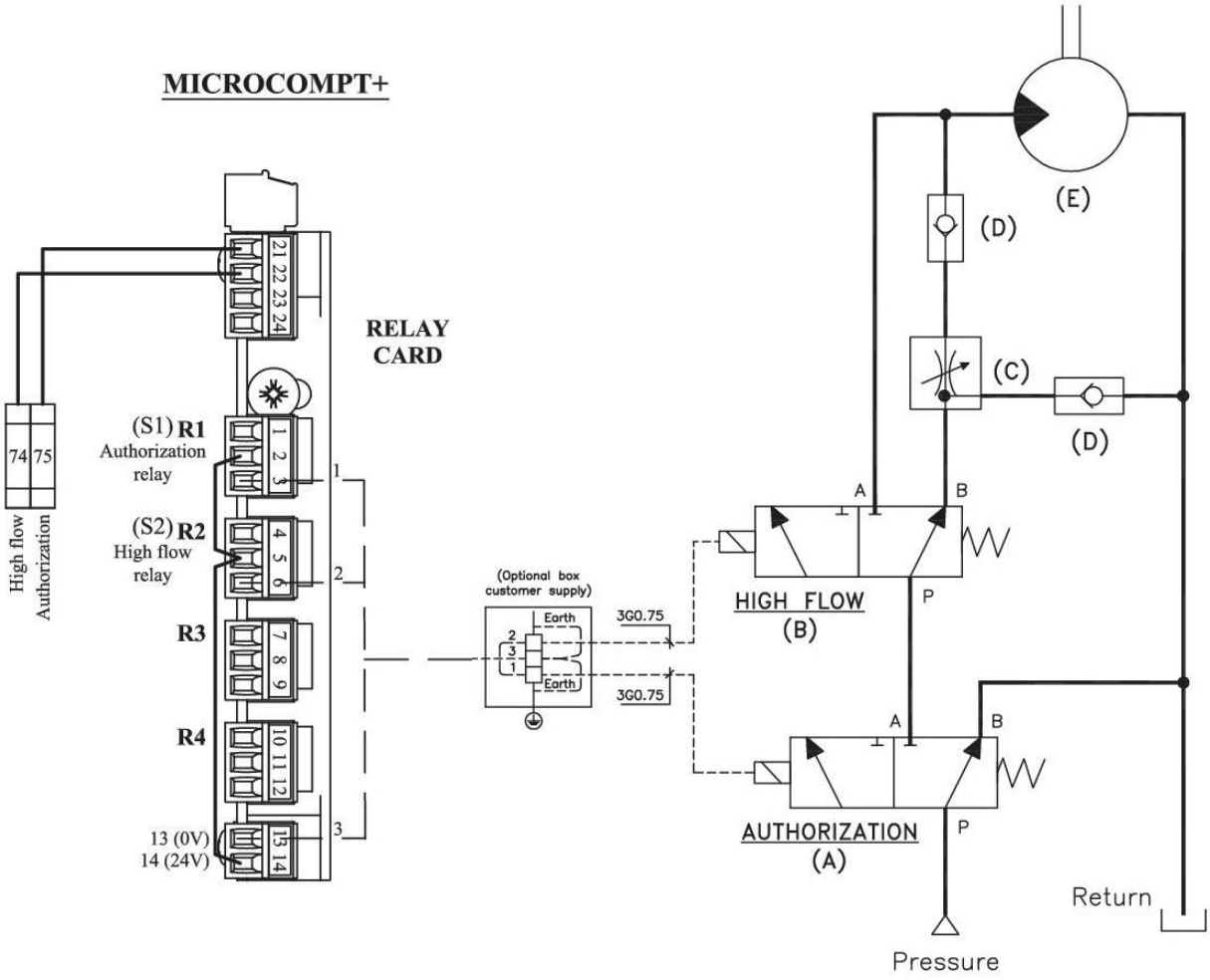
4.6. SPOOL VALVE CONTROL: ELECTRICAL AND HYDRAULIC WIRING

EQUIPMENTS CONNECTED TO THE MICROCOMPT+								POWER SUPPLY BOARD			
Option	Equipement	Cable (for information) No.	CG*	Alma	Type	Function	Colour or No.	Terminal	Function		Observation
	MANIFOLD FLAP CONTROL OR PRODUCT RETURN AUTHORISATION AND/OR ADDITIVATION 2 CONTROL				4 to 7x1	Flap 1	1	39	24VDC = opened flap (outputs FET 24V 5W max.) FET: Field Effect Transistor	EV Flaps or Product return autorisation and/or Additivation 2	Depending on configuration: direct connection or via plexmi electronic board. Refer to the assignment table and to the connection table of the relevant plexmi board
						Flap 2	2	40			
						Flap 3	3	41			
						Flap 4	4	42			
						Flap 5	5	43			
						Flap 6	6	44			
						Flap 7	7	45			
								46			
					1x1	0V		47	0V		
								48			
	RC-HEATING OIL RECEIVER				2x1	Start/Stop	1	49	Start/Stop	RC-Oil_1	
						LF/HF	2	50	LF/HF	RC-Oil_2	
	COUNTED / PUMPED DISTRIBUTION WAY (with additional commands)				3x1	Gravi/Pmp	1	51	0V	Gravity / Pumped	Closed circuit=product pumped (end position)
						Pct/Pnc	2	52	0V	Pumped counted/ no counted	Closed circuit=product counted
						0V	3	59	0V	0V (GND)	51, 52 and 59 are shunted if manual valves are not instrumented
	PTO CONTROL				1x1	PTO Ctrl		58		PTO control	Power-take-off engaged
	FOOTVALVE CONTROL				1x1	Footvalve		64	24VDC= cde	FOOTVALVE	24VDC=opening (Outputs FET 24V 5W max.) *FET=Field Effect Transistor*
	PRODUCT RETURN CONTROL				3 to 6X1	PR1	1	65	24VDC= author.	Return_1	Depending on configuration: direct connection (Outputs FET Field Effect Transistor 24V 5W max.) or via plexmi electronic board. Refer to the assignment table and to the connection table of the relevant plexmi board
						PR2	2	66		Return_2	
						PR3	3	67		Return_3	
						Chasse		68		Cde chasse	
	ADDITIONAL COMMANDS				5X1	PTO	1	61	24VDC= pto	PTO	(Outputs FET 24V 5W max.) *FET=Field Effect Transistor*
						Stop Mot.	2	62	24VDC= stop	Stop motor	
						Acc. Mot.	3	73	24VDC= acc.	Motor acceleration	
						Clutching	4	76	24VDC= clutchin	Clutching	
						Start Mot.	5	77	24VDC= start	Start motor	
	ADDITIVATION 1 CONTROL				2x1	Power	1	71	NO free contact	Additivation 1 control	Closed contact=additivation
						Control	2	72			(Output: NO free potential relay)
	SPOOL VALVE CONTROL				2x1	HF		74	HF solenoid valve	Spool valve (hydraulic motor)	
						Author.		75	Author. Solenoid valve		
	MANIFOLD VENT VALVE CONTROL				1x1	Vent valve		78	24VDC	Vent valve control	24VDC=opening (Outputs FET 24V 5W max.) *FET=Field Effect Transistor*

SOME EXTENSION BOARDS MAY BE SET ON TO THE POWER SUPPLY BOARD

**Refer to the Cable Glands installation instructions*

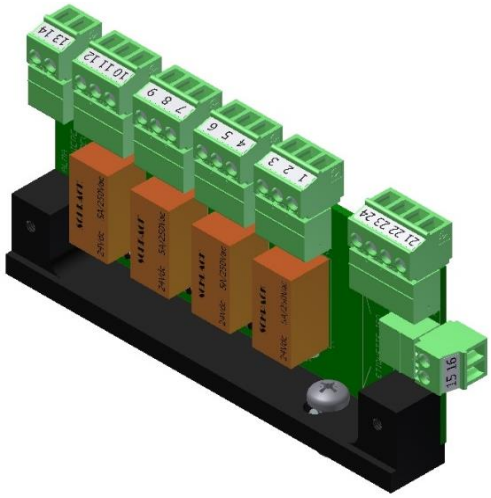
HYDRAULIC DIAGRAM



(A) : AUTHORISATION solenoid valve (not supplied by ALMA)
(B) : HIGH FLOW solenoid valve (not supplied by ALMA)
(C) : Flow regulator (not supplied by ALMA)
(D) : Non return valve (not supplied by ALMA)
(E) : Hydraulic motor (not supplied by ALMA)

Terminal assignment of the relay extension board

RELAY EXTENSION BOARD (used to control a minimum 5W spool valve)

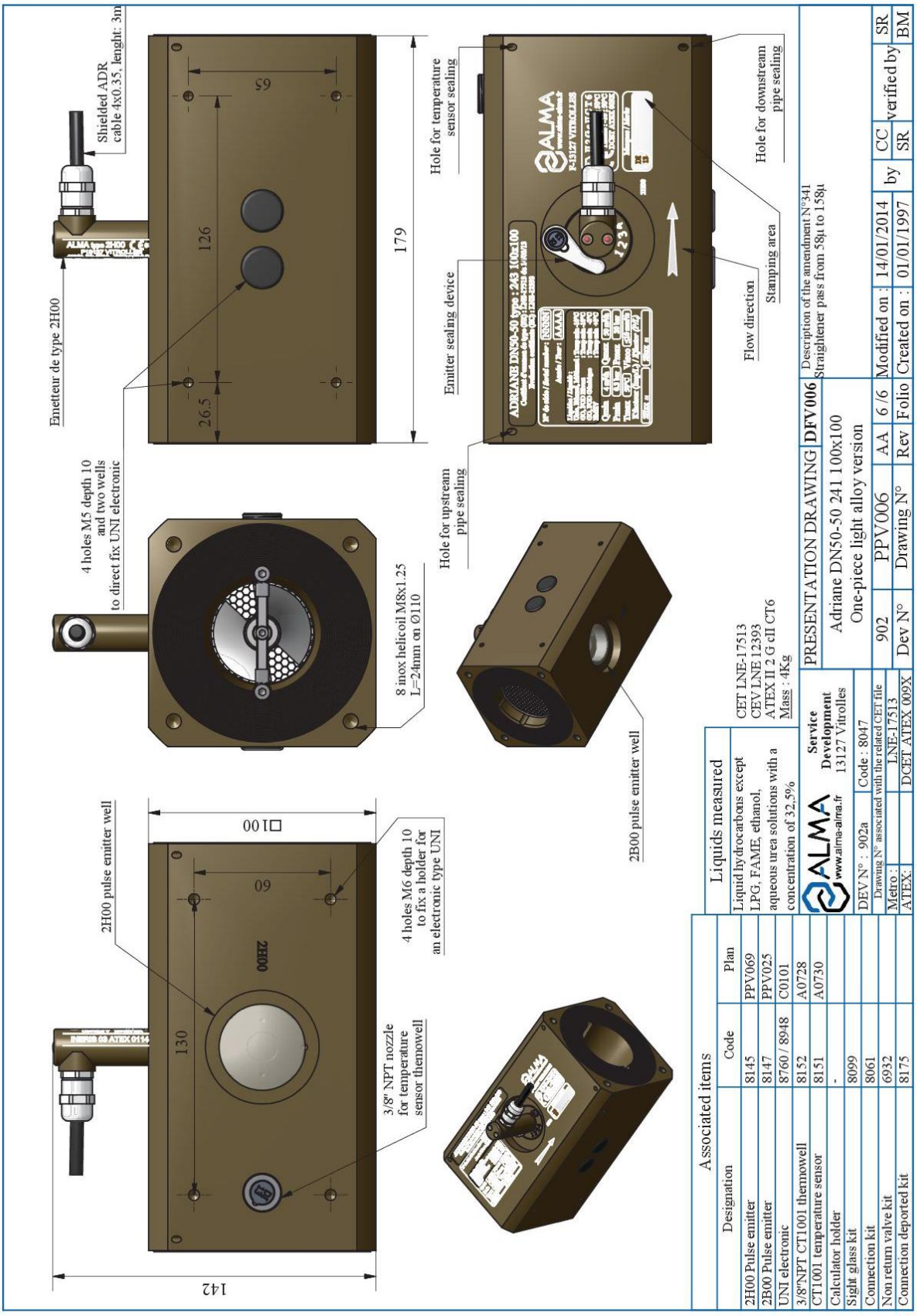


EQUIPEMENT CONNECTED TO THE MICROCOMPT+								RELAY EXTENSION BOARD			
Option	Equipement	Cable (for information) No.	CG*	Alma	Type	Function	Colour or No.	Terminal	Function		Observation
	AUTHORISATION SOLENOID VALVE					Author.		1	NC free contact	RELAY 1	Hydraulic control of hydraulic pump
								2	0V/24VDC		
								3	NO free contact		
	HIGH FLOW SOLENOID VALVE					High flow		4	NC free contact	RELAY 2	High flow control of hydraulic pump
								5	0V/24VDC		
								6	NO free contact		

**Refer to the Cable Glands Installation Instructions*

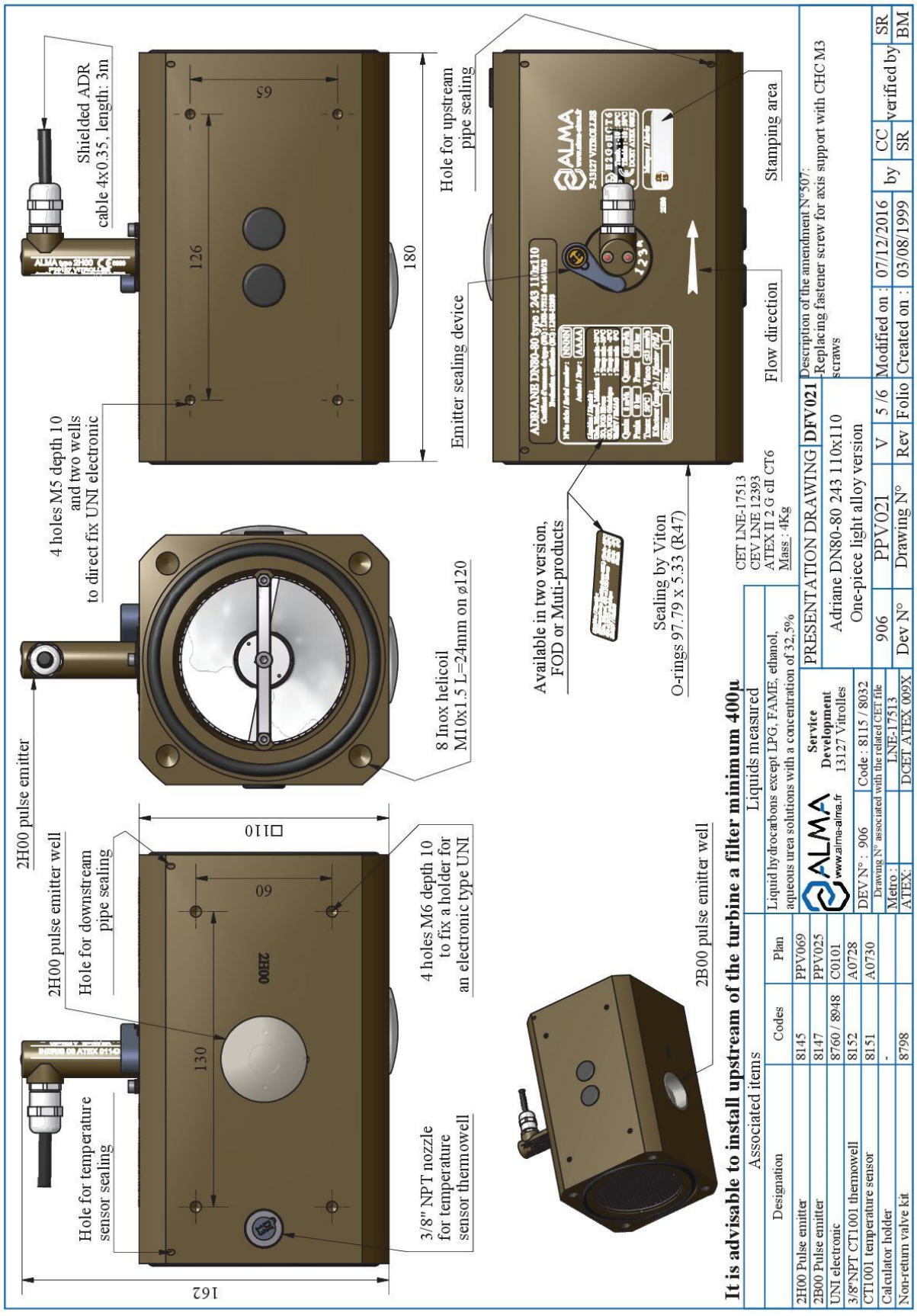
5. ADRIANE TURBINE METER

5.1. ADRIANE TURBINE METER DN50-50 243 100x100



Document available on website alma-alma.fr

5.2. ADRIANE TURBINE METER DN80-80 243 110x110



It is advisable to install upstream of the turbine a filter minimum 400µ

Associated items

Designation	Codes	Plan
2H00 Pulse emitter	8145	PPV069
2B00 Pulse emitter	8147	PPV025
UNI electronic	8760 / 8948	C0101
3/8"NPT CT1001 thermowell	8152	A0728
CT1001 temperature sensor	8151	A0730
Calculator holder	-	
Non-return valve kit	8798	

Liquids measured

Liquid hydrocarbons except LPG, FAME, ethanol, aqueous urea solutions with a concentration of 32,5%

CET LNE-17513
CEV LNE 12393
ATEX II 2 G cIl CT6
Mass : 4Kg

ALMA
www.alma-alma.fr

Service Development
13127 Vitrolles

DEV N° : 906 Code : 8115 / 8032
Drawing N° associated with the related CET file
Metro : LNE-17513
ATEX : DCET ATEX 009X

PRESENTATION DRAWING | DFV021 | V | 5 /6

Adriane DN80-80 243 110x110
One-piece light alloy version

906	PPV021
Dev N°	Drawing N°

Description of the amendment N°07:
Replacing fastener screw for axis support with CHC M3 screws

Rev	Folio	Modified on :	07/12/2016	by	CC	verified by	SR
		Created on :	03/08/1999		SR		BM

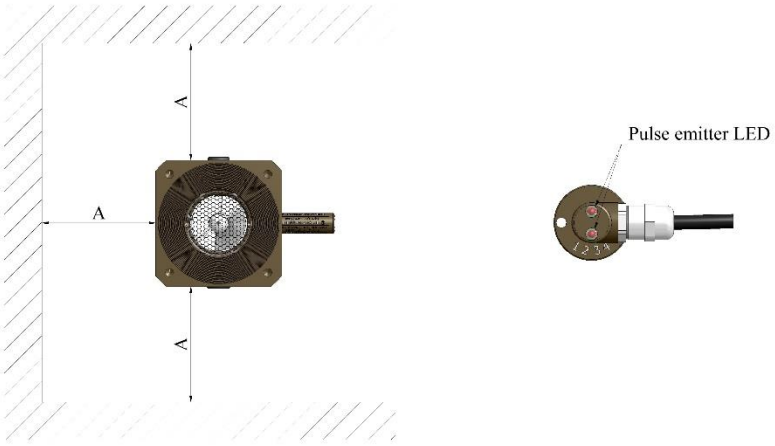
Document available on website alma-alma.fr

5.3. ADRIANE TURBINE METER DN80-80 373 PN16 Adblue®

Document available on website alma-alma.fr

5.4. INSTALLATION AND SEALING RECOMMENDATIONS ADRIANE TURBINE METER

- The identification plate and the led of the pulse emitter(s) shall be visible and accessible.
- The turbine must be installed with respect to the flow direction.
- Put sealing rings each other sides between the turbine and the backflanges.
- Leave an open space all around the turbine in order to ease maintenance.
- Install a 400µ filter (mini) on the pipe upstream from the turbine meter.
- After installation or during the commissioning period, if the new or modified pipes have not been perfectly cleaned or pickled and passivated, the turbine should be protected by a honeycomb sieve – max. 1mm mesh. It must be placed between two flanges upstream from the turbine.
- Dimensions: A > 100mm.



- Refer to the certificate written on the identification plate of the measuring system to suit the sealing requirements
- No loose lead wire on the sealing devices

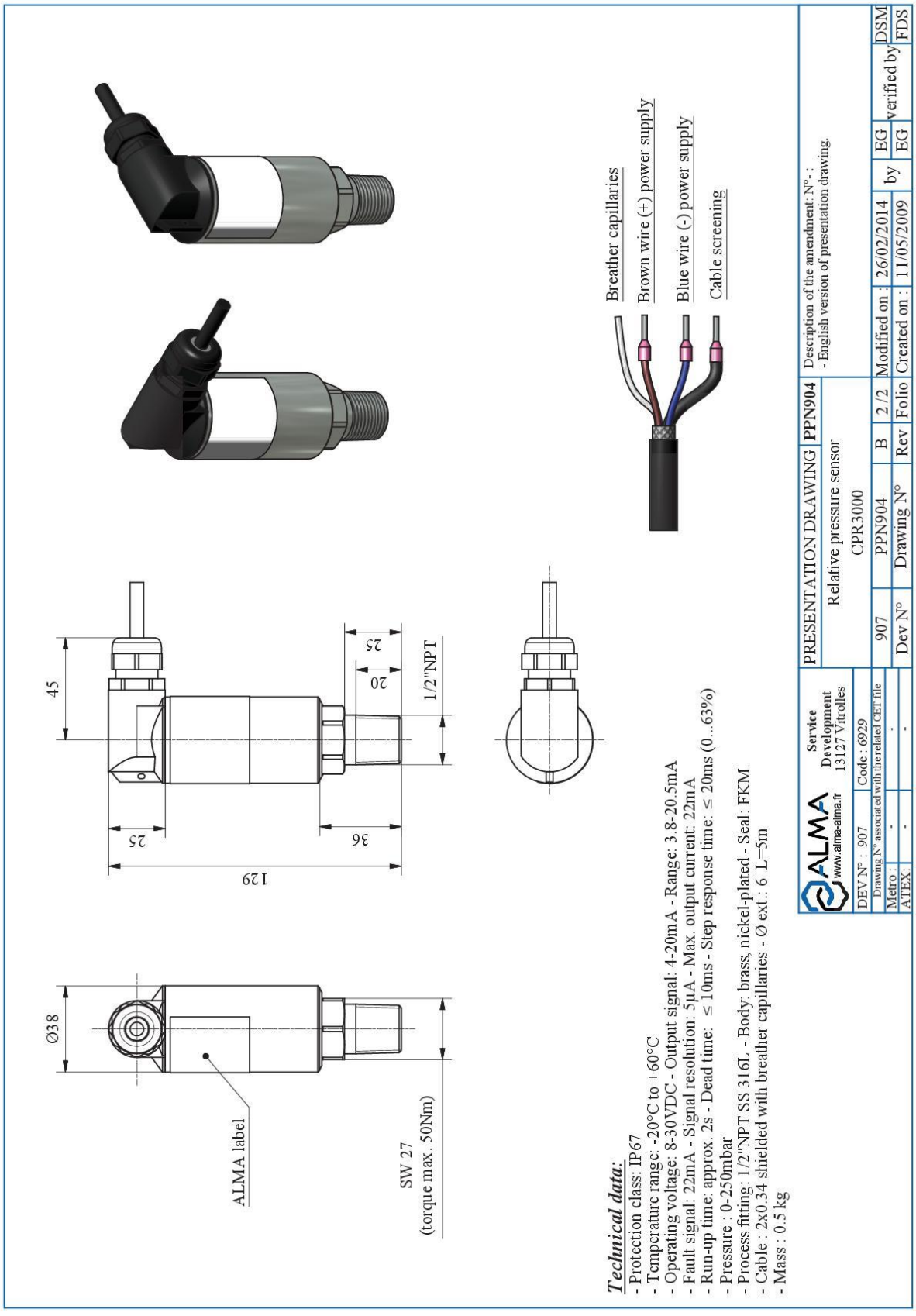
For accuracy class 0.5 and 1.0 measuring systems, the pipes and equipment upstream or downstream the turbine meter must have the same nominal diameter as the meter on a length at least equal to 10 times this diameter upstream and 5 times this diameter downstream.

These lengths can be straight or bent.

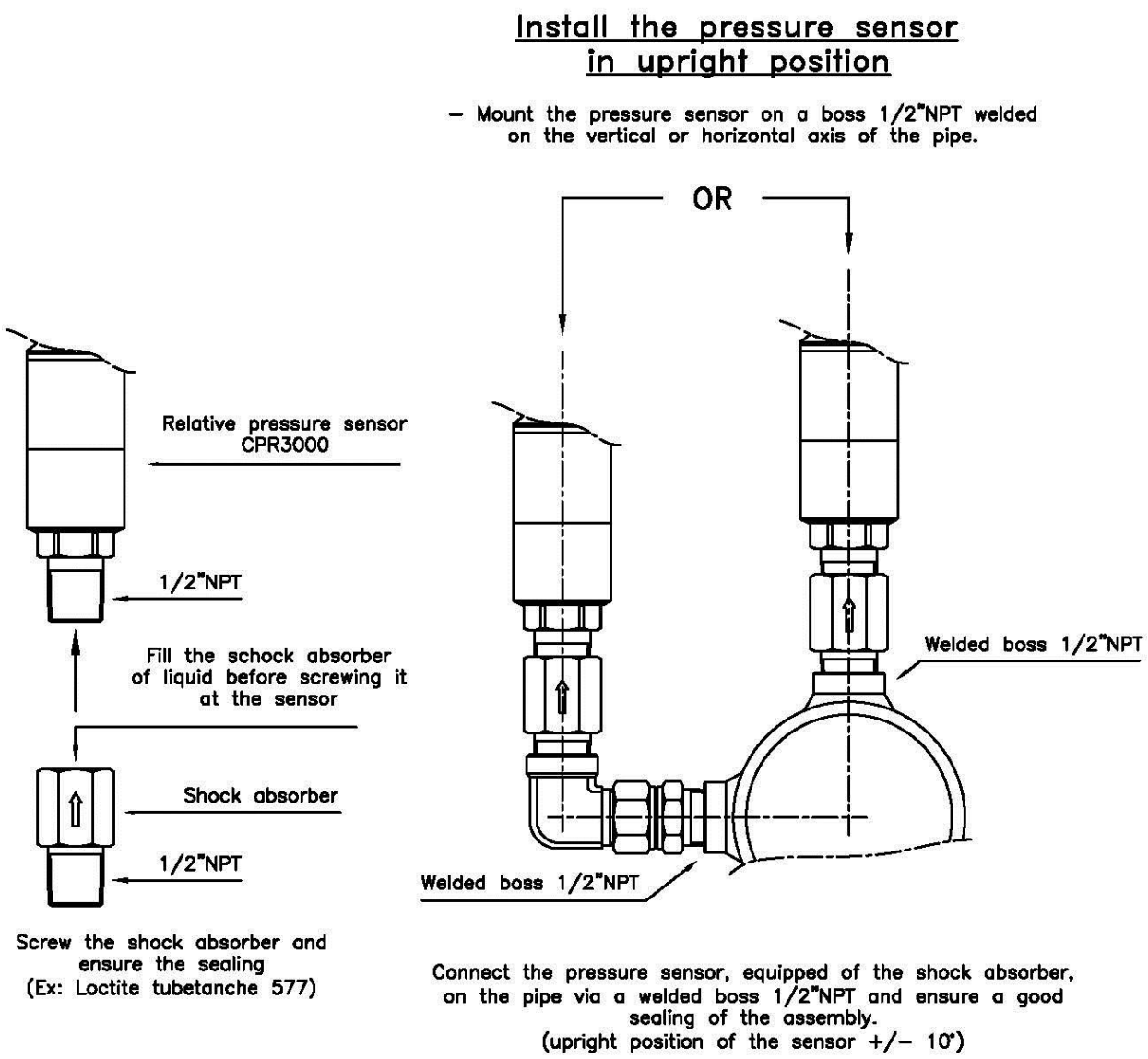
It is mandatory that no flowrate adjustment device (e.g. a variable-opening valve) is located upstream at a distance less than 10 times the nominal diameter of the meter. Do not create derivation circuits with sample or bypass, specially make sure that no nozzle is present on this pipe.

6. RELATIVE PRESSURE TRANSMITTER CPR3000 NON ATEX OR ATEX

6.1. RELATIVE PRESSURE TRANSMITTER CPR3000 NON ATEX

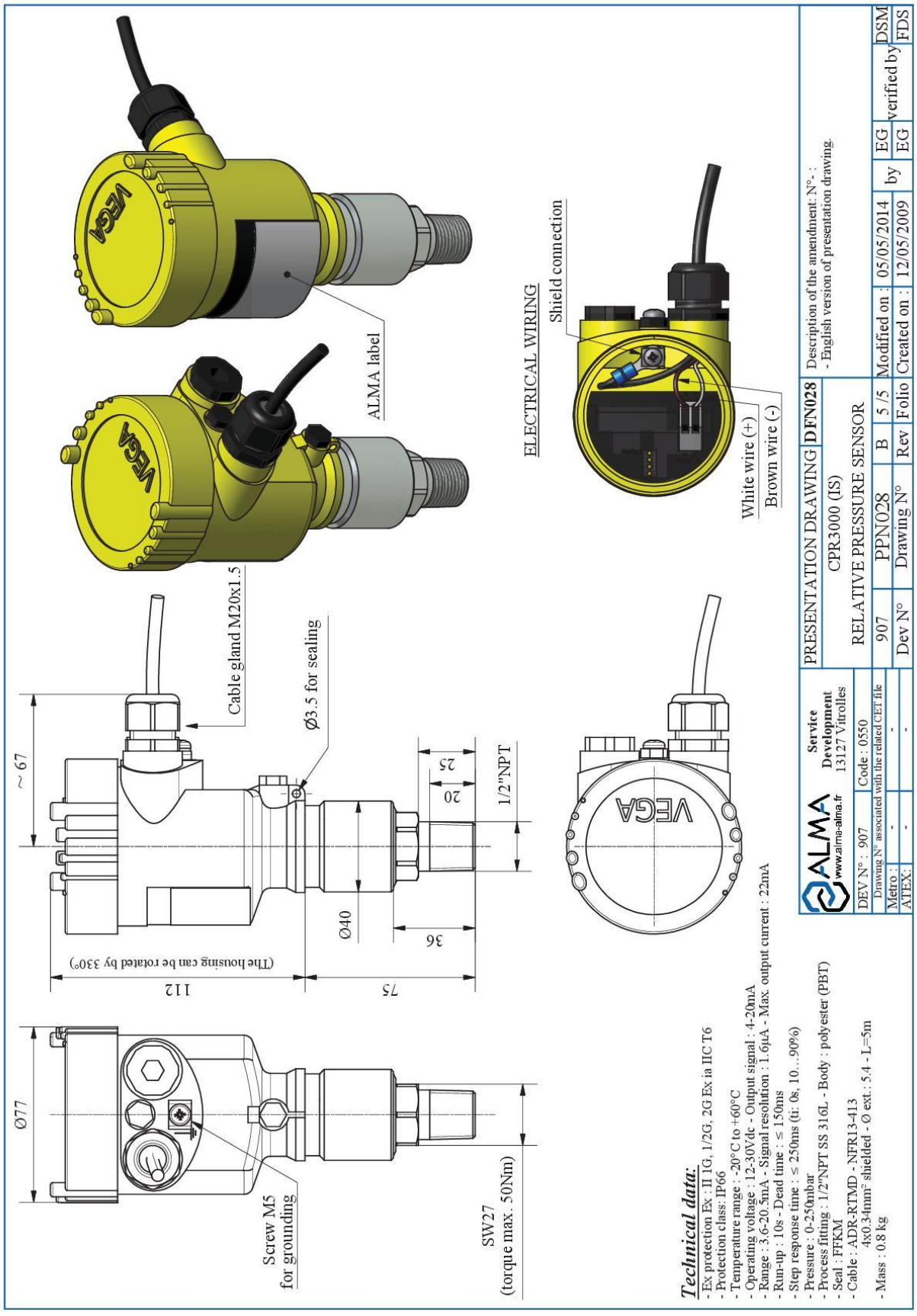


6.2. INSTALLATION RECOMMENDATIONS CPR3000 NON ATEX



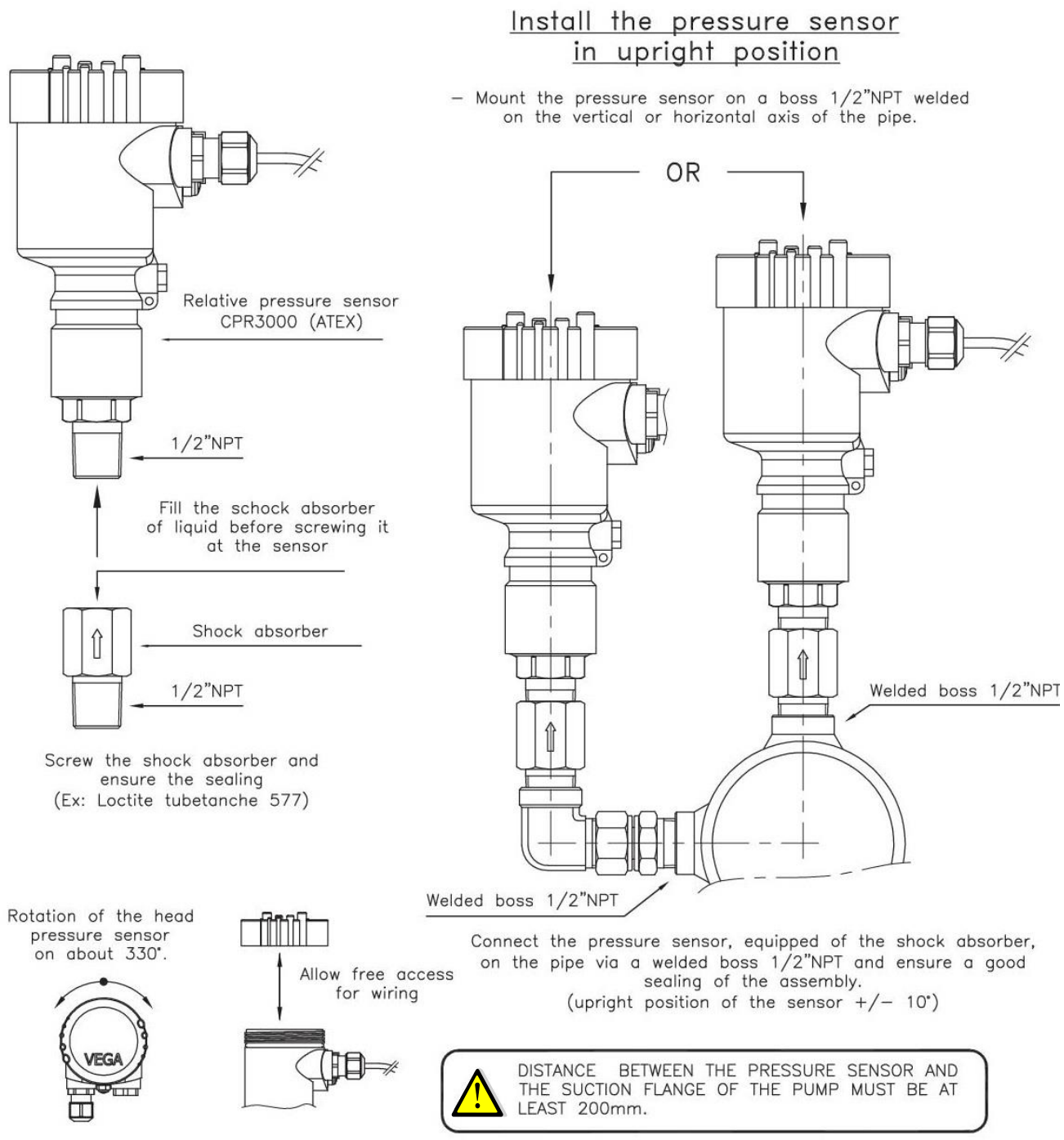
DISTANCE BETWEEN THE PRESSURE SENSOR AND THE SUCTION FLANGE OF THE PUMP MUST BE AT LEAST 200mm.

6.3. RELATIVE PRESSURE TRANSMITTER CPR3000 ATEX



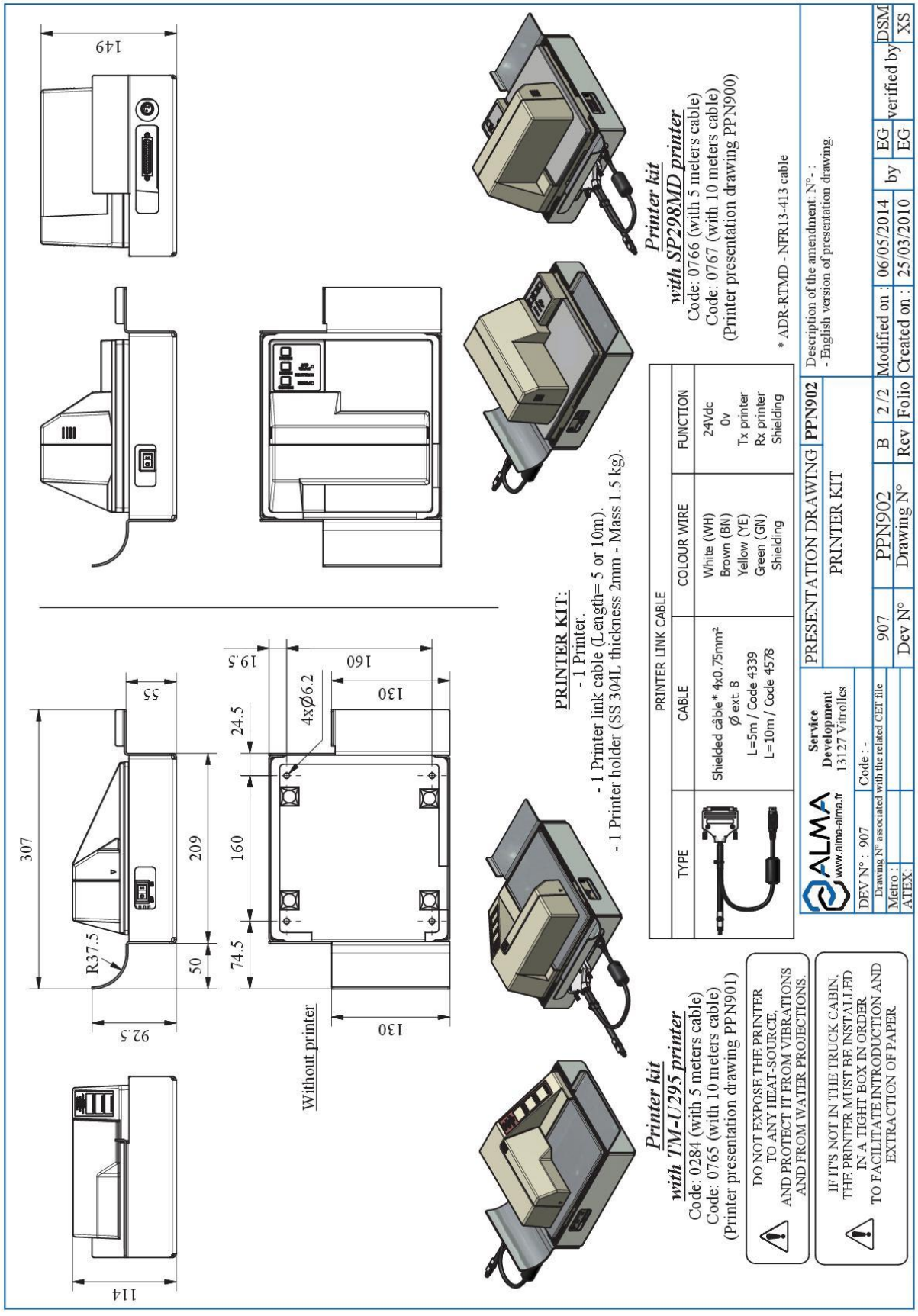
Document available on website alma-alma.fr

6.4. INSTALLATION RECOMMENDATIONS CPR3000 ATEX



REFER TO INSTRUCTION MANUAL
(DELIVERED WITH THE EQUIPMENT AND AVAILABLE ON ALMA WEBSITE)

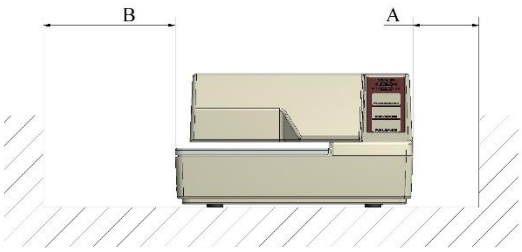
7. PRINTER

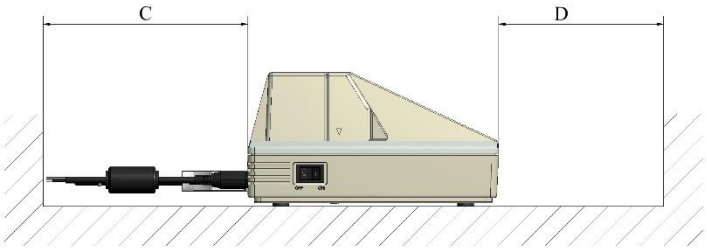


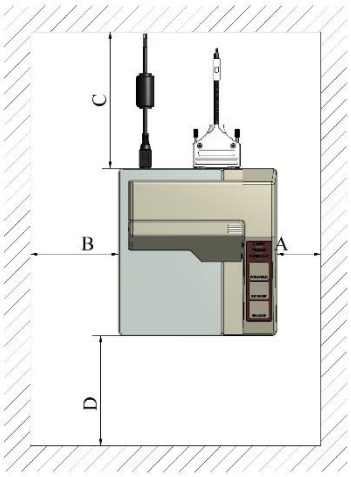
Document available on website alma-alma.fr

7.1. INSTALLATION RECOMMENDATIONS PRINTER

- The printer must be installed in a tight box and be laid out so as not to obstruct the introduction/extraction of sheet of paper (Dimension D).
- Do not store anything above the printer.
- Leave an open space all around the printer to ease maintenance.
- Dimensions: A ≥ 50mm, B ≥ 100mm, C ≥ 120mm.

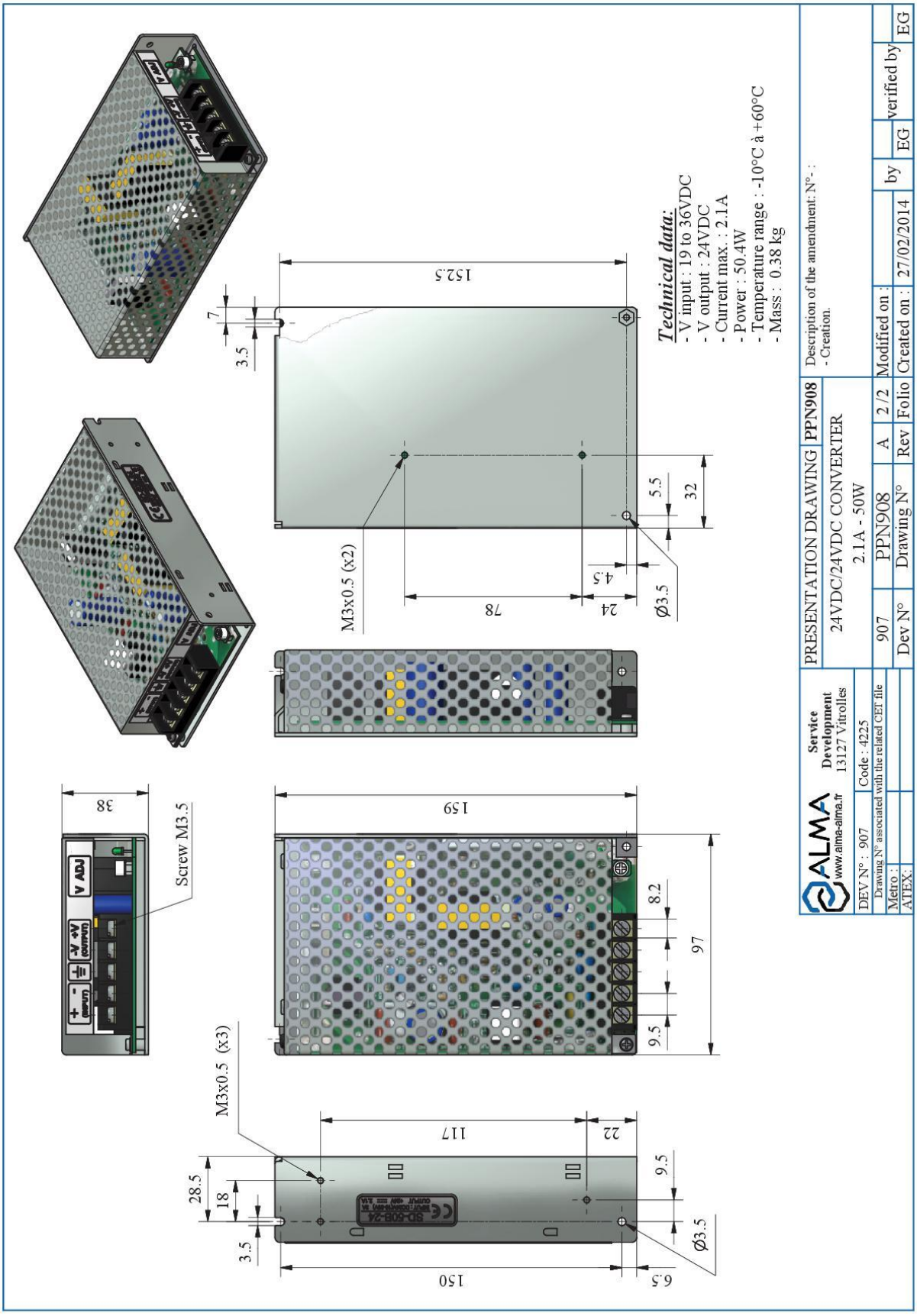






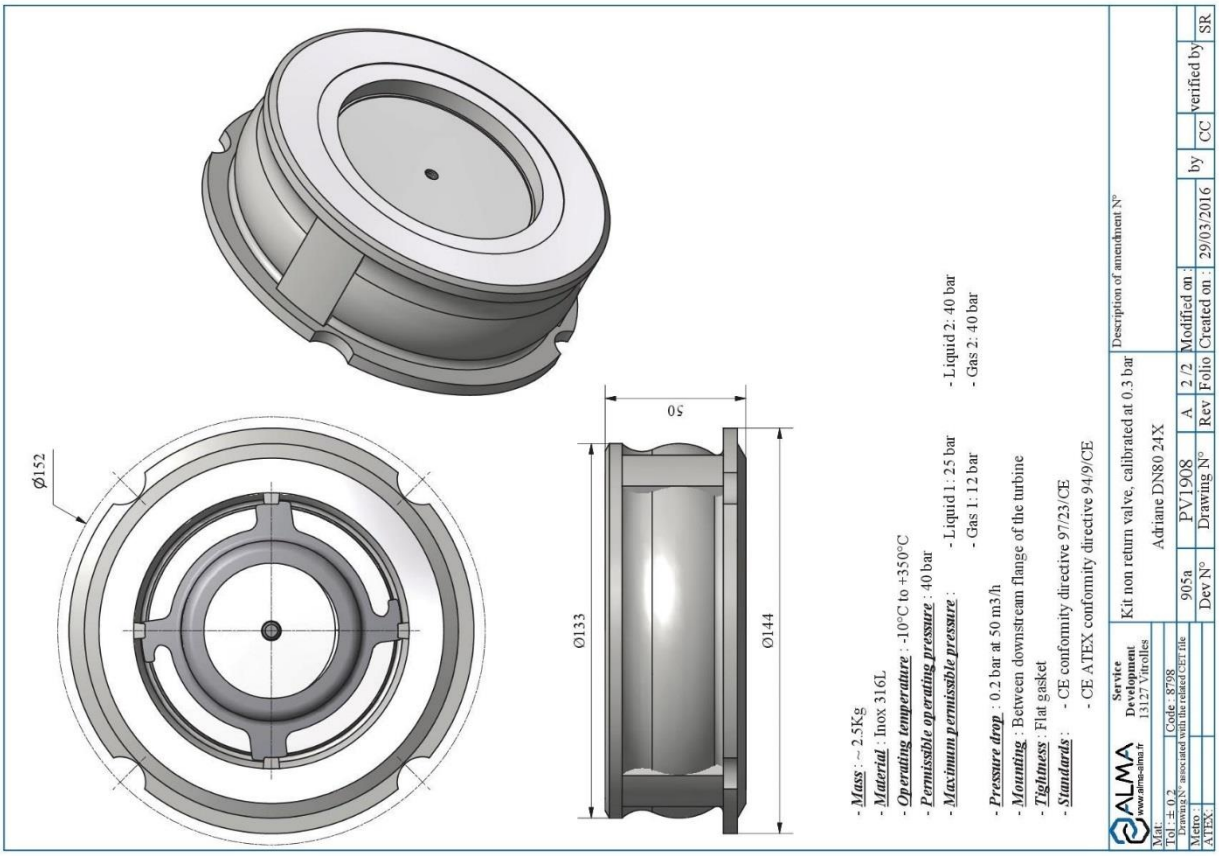
DO NOT EXPOSE THE PRINTER TO ANY HEAT-SOURCE.
PROTECT IT FROM VIBRATIONS AND WATER PROJECTIONS.

8. CONVERTER 24VDC/24VDC 2.1A 50W



Document available on website alma-alma.fr

9. NON-RETURN VALVE KIT DN50 OR DN80



- **Mass** : ~ 2.5Kg
- **Material** : Inox 316L
- **Operating temperature** : -10°C to +350°C
- **Permissible operating pressure** : 40 bar
- **Maximum permissible pressure** : - Liquid 1: 25 bar - Liquid 2: 40 bar - Gas 1: 12 bar - Gas 2: 40 bar
- **Pressure drop** : 0.2 bar at 50 m3/h
- **Mounting** : Between downstream flange of the turbine
- **Tightness** : Flat gasket
- **Standards** : - CE conformity directive 97/23/CE - CE ATEX conformity directive 94/9/CE

ALMA www.alma-alma.fr	Service Development 13127 Vitrolles	Kit non return valve, calibrated at 0.3 bar								Description of amendment N°	
Mat:		Adriane DN80 24X									
Tol ± 0.2	Code : 8798	905a	PV1908	A	2/2	Modified on :		by	verified by		
Drawing N° associated with the related CET file		Dev N°	Drawing N°	Rev	Folio	Created on :	29/03/2016	CC	SR		
Metro :											
ATEX :											

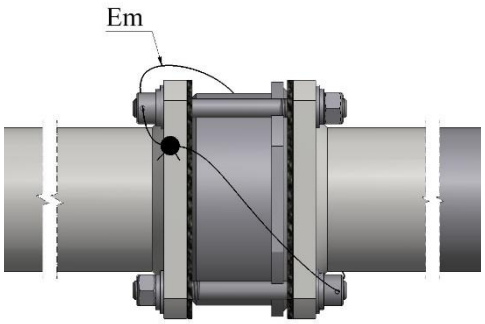
- **Mass** : ~ 1Kg
- **Material** : - Valve: Inox 316L - Screws: Inox A4-70 - Flat gasket: KINGLERSIL
- **Operating temperature** : -10°C to +350°C
- **Permissible operating pressure** : 40 bar
- **Maximum permissible pressure** : - Liquid 1: 40 bar - Liquid 2: 40 bar - Gas 1: 20 bar - Gas 2: 40 bar
- **Pressure drop** : 0.4 bar at 25 m3/h
- **Mounting** : Between downstream flange of the turbine
- **Tightness** : Flat gasket
- **Standards** : - CE conformity directive 97/23/CE - CE ATEX conformity directive 94/9/CE

ALMA www.alma-alma.fr	Service Development 13127 Vitrolles	Kit non return valve								Description of amendment N°	
Mat:		Adriane DN50 24X									
Tol ± 0.2	Code : 6932	902	PV1909	A	2/2	Modified on :		by	verified by		
Drawing N° associated with the related CET file		Dev N°	Drawing N°	Rev	Folio	Created on :	29/03/2016	CC	SR		
Metro :											
ATEX :											

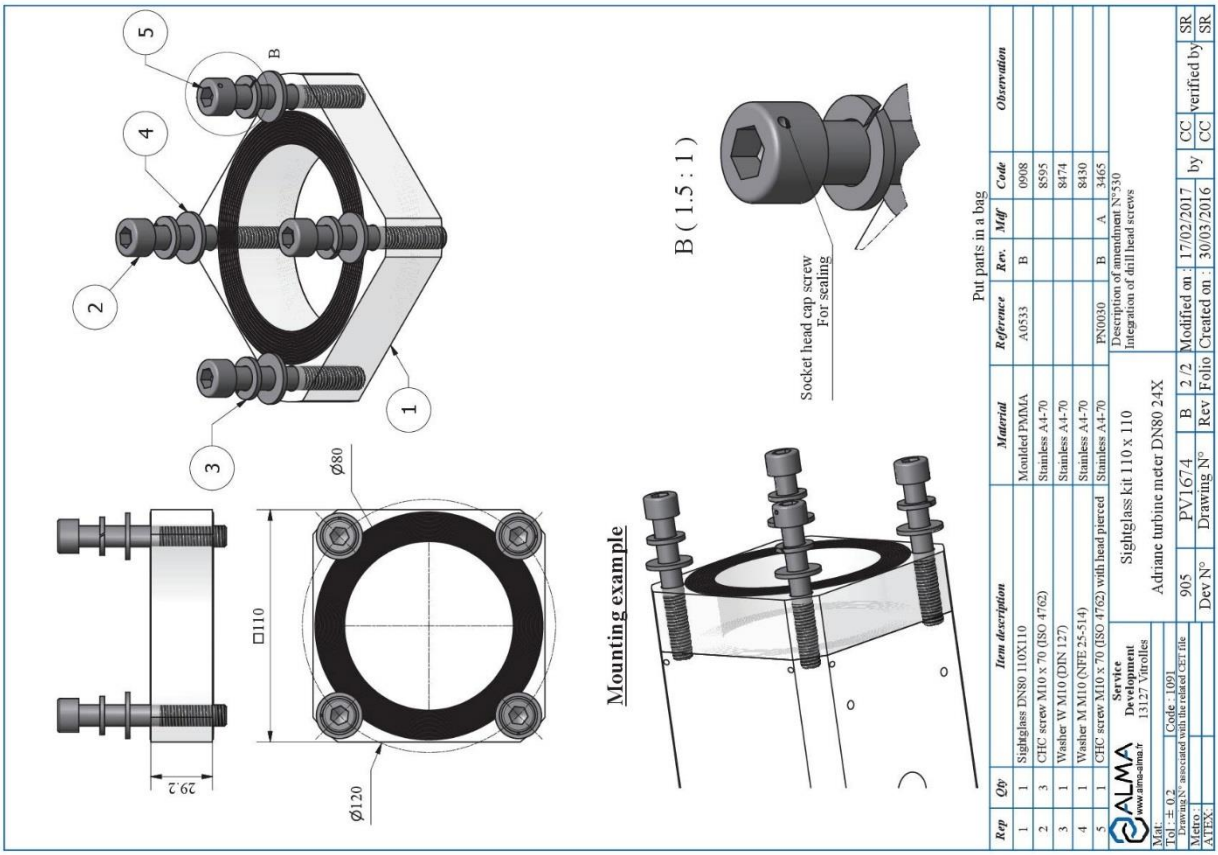
Document available on website alma-alma.fr

9.1. INSTALLATION RECOMMENDATIONS NON-RETURN VALVE KIT DN50 OR DN80

- Refer to the certificate written on the identification plate of the measuring system to suit the sealing requirements
- No loose lead wire on the sealing devices



10. SIGHTGLASS KIT DN50 OR DN80



Rep	Qty	Item description	Material	Reference	Rev.	Mfg	Code	Observation
1	1	Sightglass DN80 110X110	Moulded PMMA	A0533	B		0908	
2	3	CHC screw M10 x 70 (ISO 4762)	Stainless A4-70				8595	
3	1	Washer W M10 (DIN 127)	Stainless A4-70				8474	
4	1	Washer M M10 (NFE 25-514)	Stainless A4-70				8430	
5	1	CHC screw M10 x 70 (ISO 4762) with head pierced	Stainless A4-70	PN0030	B	A	3465	

Put parts in a bag

ALMA Service Development 13127 Vitrolles www.alma-alma.fr

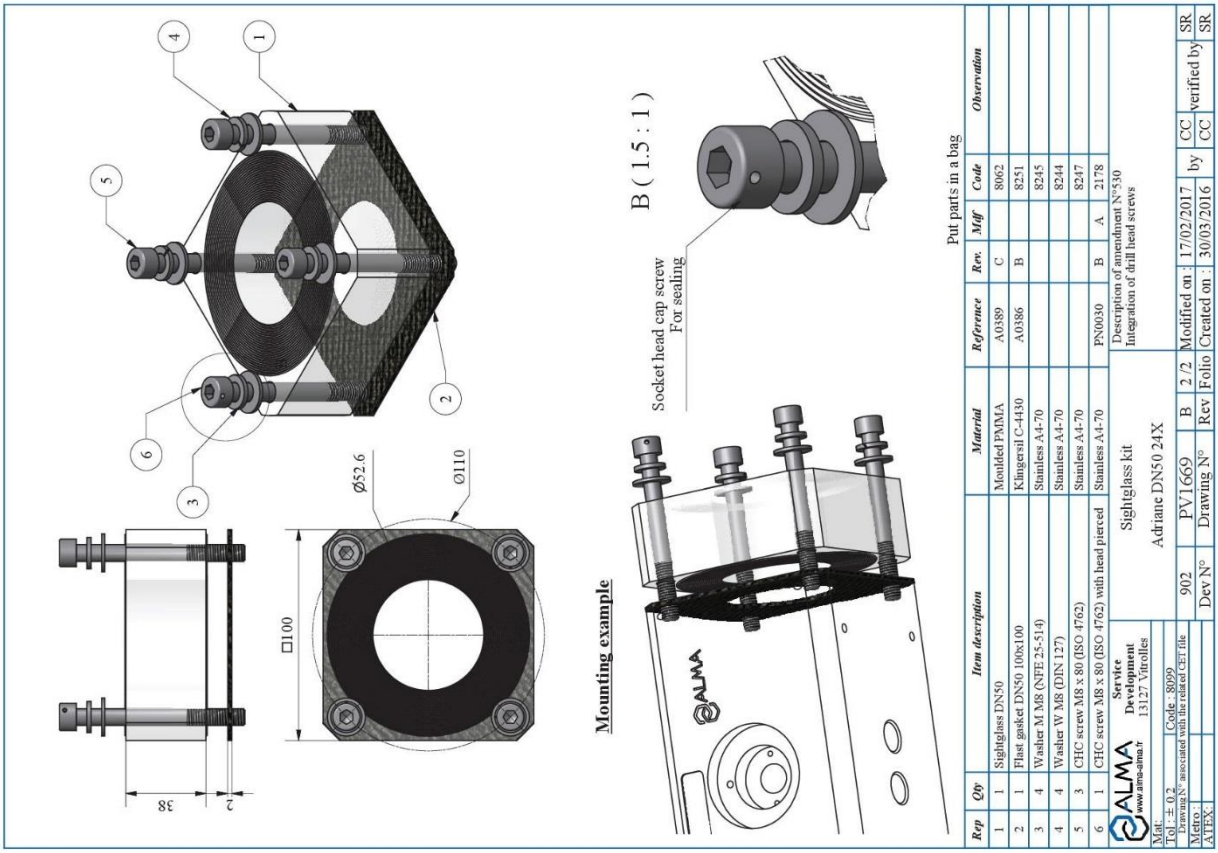
Sightglass kit 110 x 110
Adriane turbine meter DN80 24X

Description of amendment N°530
Integration of drill head screws

Mat:
Tol.: ± 0.2
Drawing N° associated with the related CET file : Code - 109]

Metro:
ATEX:

905 | PV1674 | B | 2/2 | Modified on : 17/02/2017 | by | CC | verified by | SR
Dev N° | Drawing N° | Rev | Folio | Created on : 30/03/2016 | by | CC | verified by | SR



Rep	Qty	Item description	Material	Reference	Rev.	Mfg	Code	Observation
1	1	Sightglass DN50	Moulded PMMA	A0389	C		8062	
2	1	Flat gasket DN50 100x100	Klingersil C-4430	A0386	B		8251	
3	4	Washer M M8 (NFE 25-514)	Stainless A4-70				8245	
4	4	Washer W M8 (DIN 127)	Stainless A4-70				8244	
5	3	CHC screw M8 x 80 (ISO 4762)	Stainless A4-70				8247	
6	1	CHC screw M8 x 80 (ISO 4762) with head pierced	Stainless A4-70	PN0030	B	A	2178	

Put parts in a bag

ALMA Service Development 13127 Vitrolles www.alma-alma.fr

Sightglass kit
Adriane DN50 24X

Description of amendment N°530
Integration of drill head screws

Mat:
Tol.: ± 0.2
Drawing N° associated with the related CET file : Code - 8099

Metro:
ATEX:

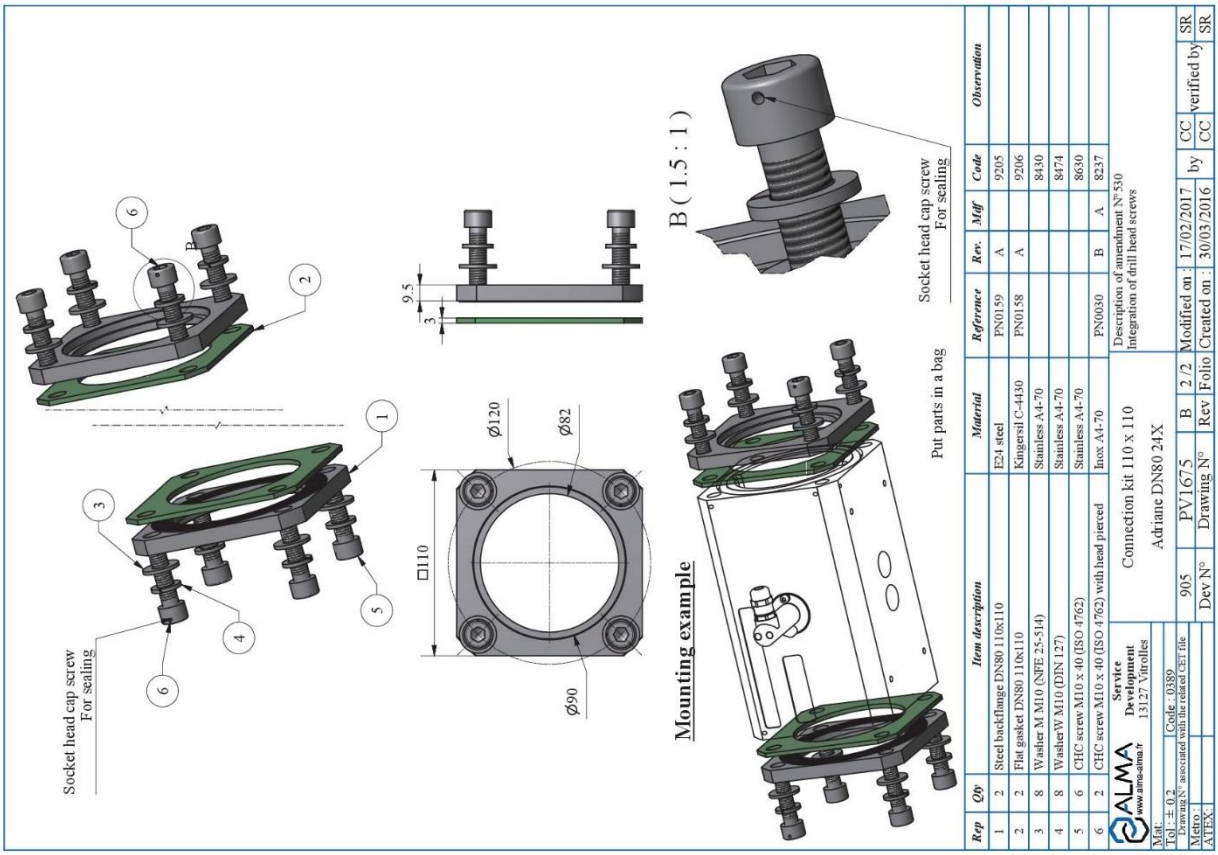
902 | PV1669 | B | 2/2 | Modified on : 17/02/2017 | by | CC | verified by | SR
Dev N° | Drawing N° | Rev | Folio | Created on : 30/03/2016 | by | CC | verified by | SR

Document available on website alma-alma.fr

10.1. INSTALLATION RECOMMENDATIONS SIGHTGLASS KIT DN50 OR DN80

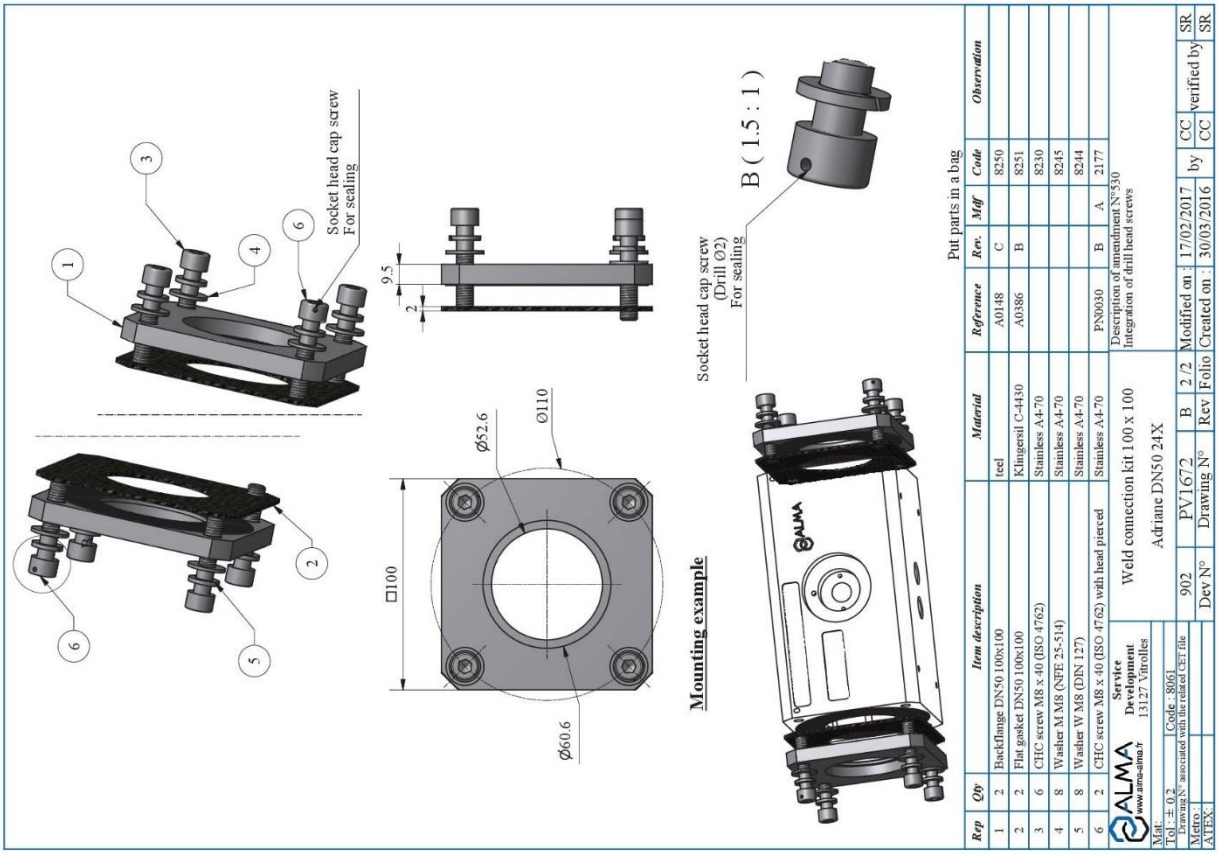
- Refer to the certificate written on the identification plate of the measuring system to suit the sealing requirements
- No loose lead wire on the sealing devices

11. CONNECTION KIT 100x100 DN50 OR DN80



Rep	Qty	Item description	Material	Reference	Rev.	Mgf	Code	Observation
1	2	Steel backflange DN80 110x110	E24 steel	PN0159	A		9205	
2	2	Flat gasket DN80 110x110	Klingersil C-4430	PN0158	A		9206	
3	8	Washer M M10 (NFE 25-514)	Stainless A4-70				8430	
4	8	Washer W M10 (DIN 127)	Stainless A4-70				8474	
5	6	CHC screw M10 x 40 (ISO 4762)	Stainless A4-70				8630	
6	2	CHC screw M10 x 40 (ISO 4762) with head pierced	Inox A4-70	PN0030	B	A	8237	

ALMA Service Development 13127 Vitrolles www.alma-alma.fr
Connection kit 110 x 110
Adriane DN80 24X
Description of amendment N°530
Integration of drill head screws
Mat: | Tol : ± 0.2 | Drawing N° associated with the related CET file | Code - 0389
Metric | ATEX
905 | PV1675 | B | 2/2 | Modified on : 17/02/2017 | by | CC | verified by | SR
Dev N° | Drawing N° | Rev | Folio | Created on : 30/03/2016 | by | CC | verified by | SR



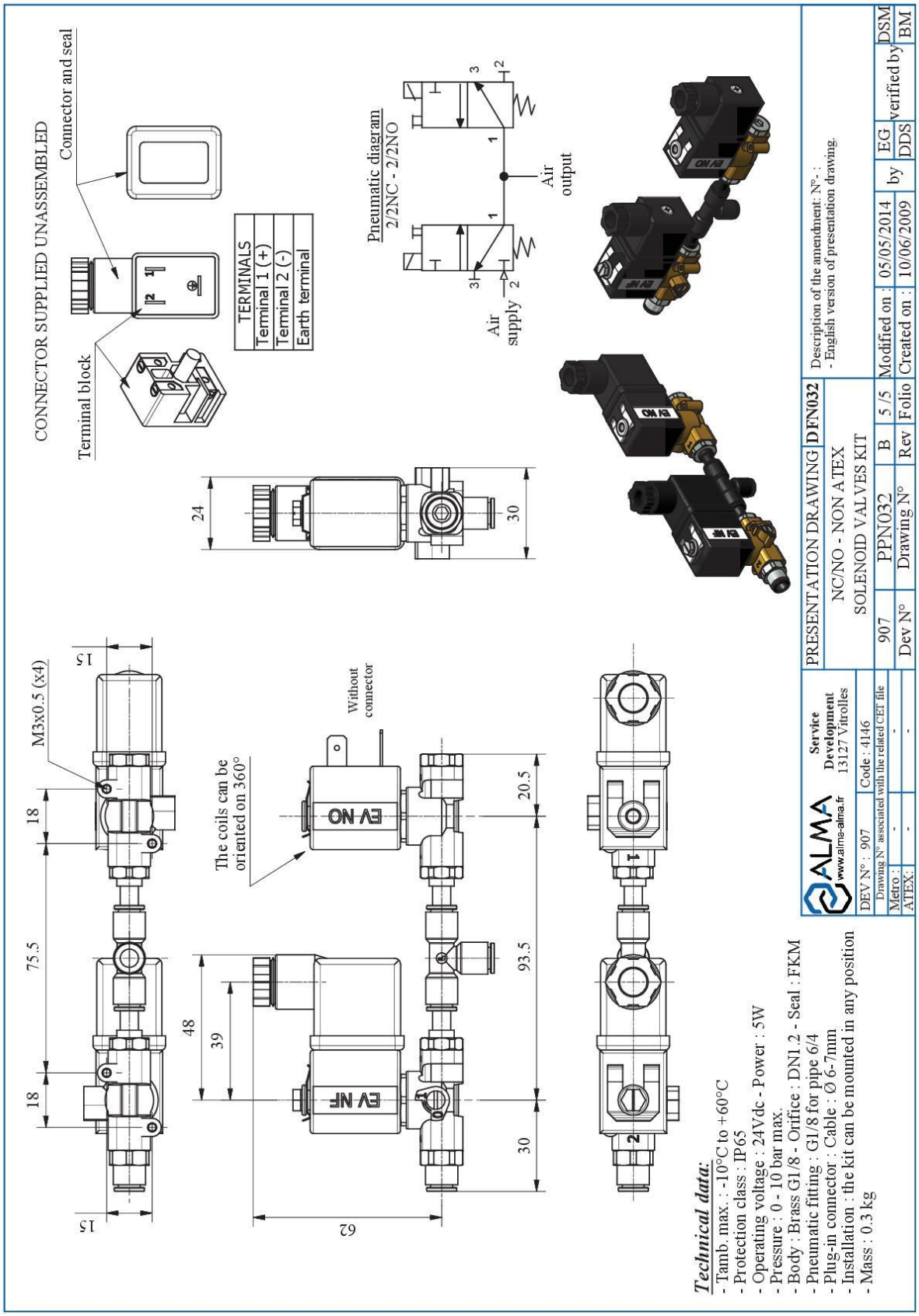
Rep	Qty	Item description	Material	Reference	Rev.	Mgf	Code	Observation
1	2	BackFlange DN50 100x100	teel	A0148	C		8250	
2	2	Flat gasket DN50 100x100	Klingersil C-4430	A0386	B		8251	
3	6	CHC screw M8 x 40 (ISO 4762)	Stainless A4-70				8230	
4	8	Washer M M8 (NFE 25-514)	Stainless A4-70				8245	
5	8	Washer W M8 (DIN 127)	Stainless A4-70				8244	
6	2	CHC screw M8 x 40 (ISO 4762) with head pierced	Stainless A4-70	PN0030	B	A	2177	

ALMA Service Development 13127 Vitrolles www.alma-alma.fr
Weld connection kit 100 x 100
Adriane DN50 24X
Description of amendment N°530
Integration of drill head screws
Mat: | Tol : ± 0.2 | Drawing N° associated with the related CET file | Code - 8061
Metric | ATEX
902 | PV1672 | B | 2/2 | Modified on : 17/02/2017 | by | CC | verified by | SR
Dev N° | Drawing N° | Rev | Folio | Created on : 30/03/2016 | by | CC | verified by | SR

Document available on website alma-alma.fr

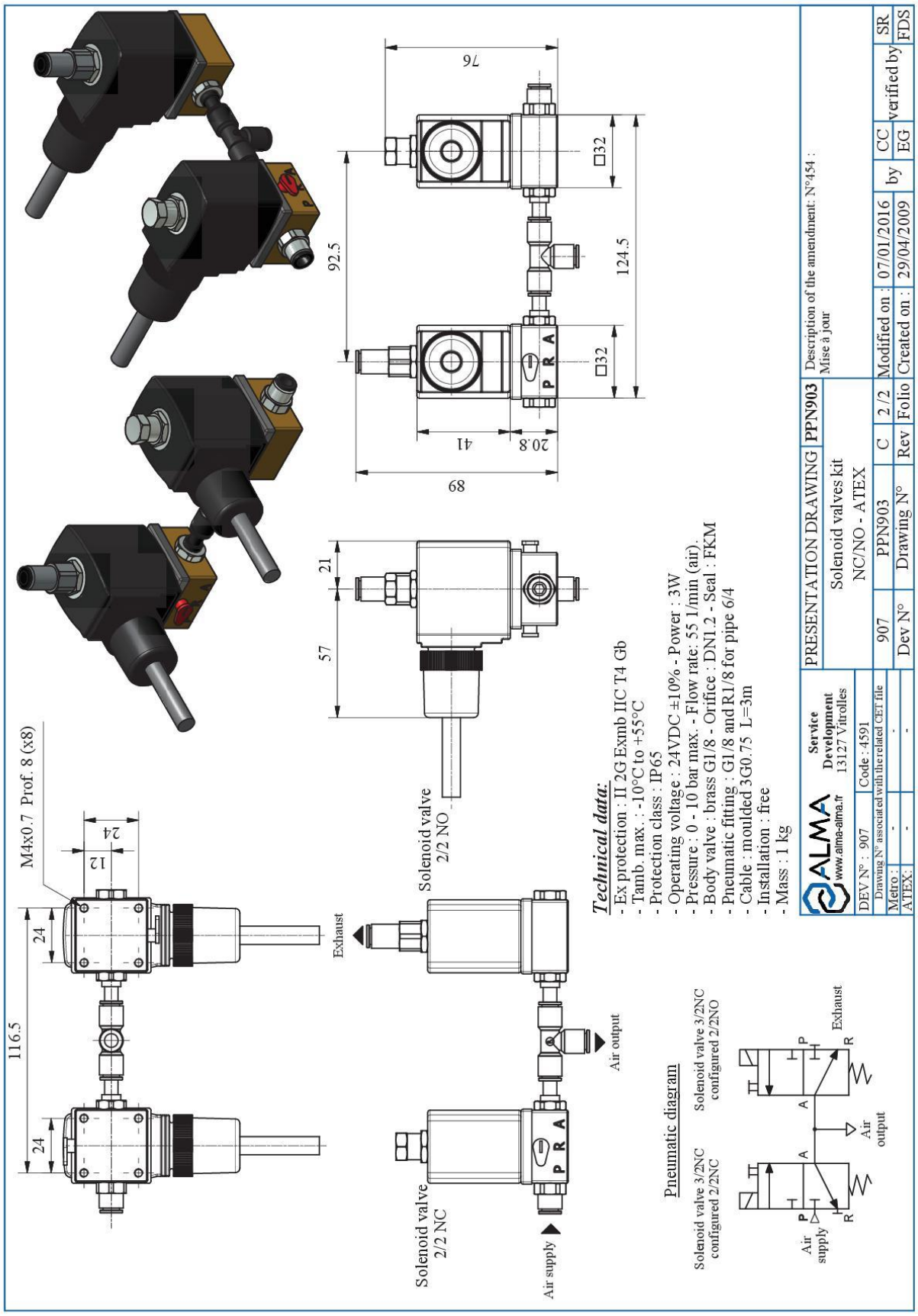
12. NC/NO SOLENOID VALVES KIT NON ATEX OR ATEX

12.1. NC/NO SOLENOID VALVES KIT NON ATEX



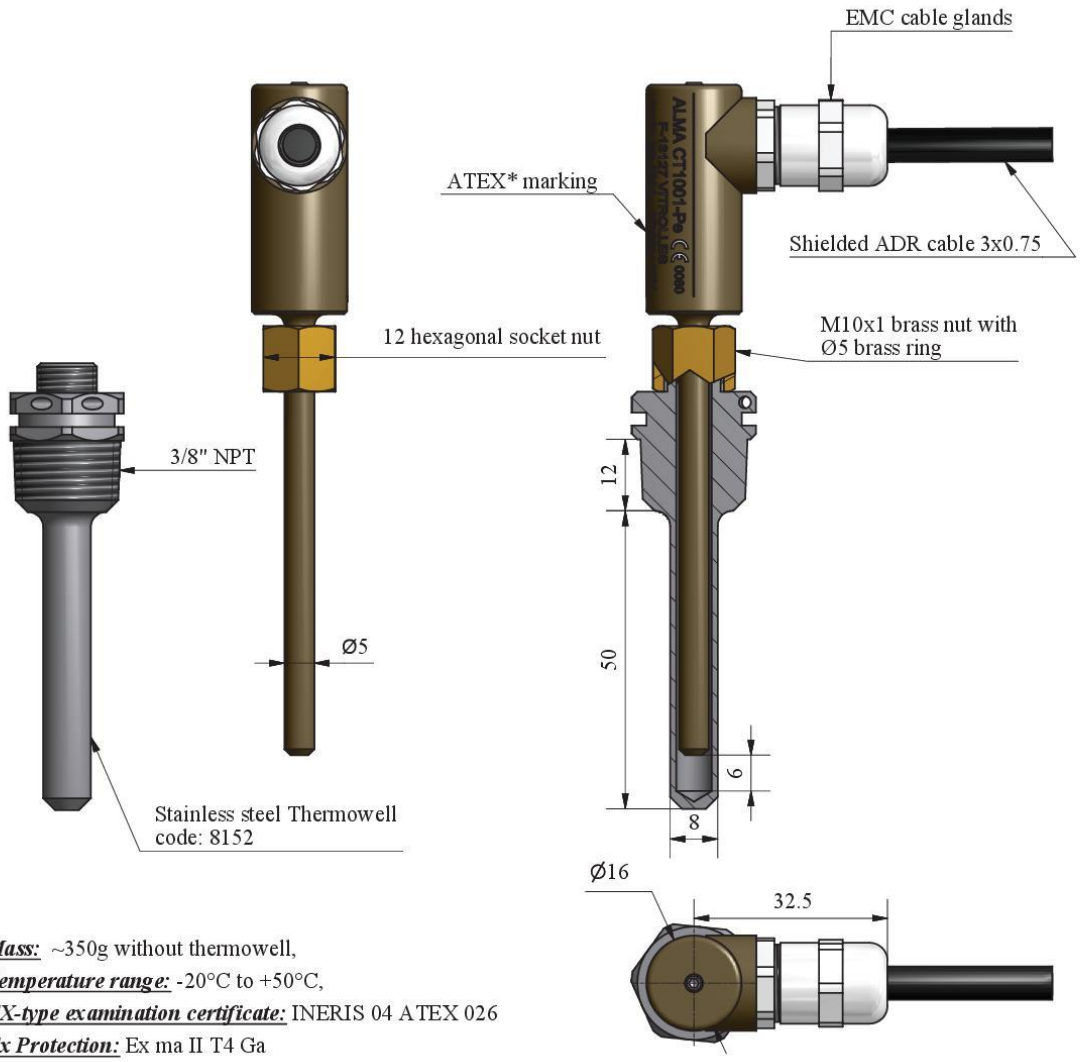
Document available on website alma-alma.fr

12.2. NC/NO SOLENOID VALVES KIT ATEX



Document available on website alma-alma.fr

13. TEMPERATURE PROBE Pt100 – CT1001 ATEX



- ***Mass:*** ~350g without thermowell,
- ***Temperature range:*** -20°C to +50°C,
- ***EX-type examination certificate:*** INERIS 04 ATEX 026
- ***Ex Protection:*** Ex ma II T4 Ga

The sensor body is made of bronze color anodized aluminum alloy;
The ring and the nut are made of brass.
The probe can be be mounted either on a ALMA thermowell or on a thimble connection 1/4 "BSP (M10x1 n5).
Before installation, lubricate the parts in contact with the thermowell or the boss, to prevent corrosion

PT100 features:

- 3 wires
- 1/3 DIN

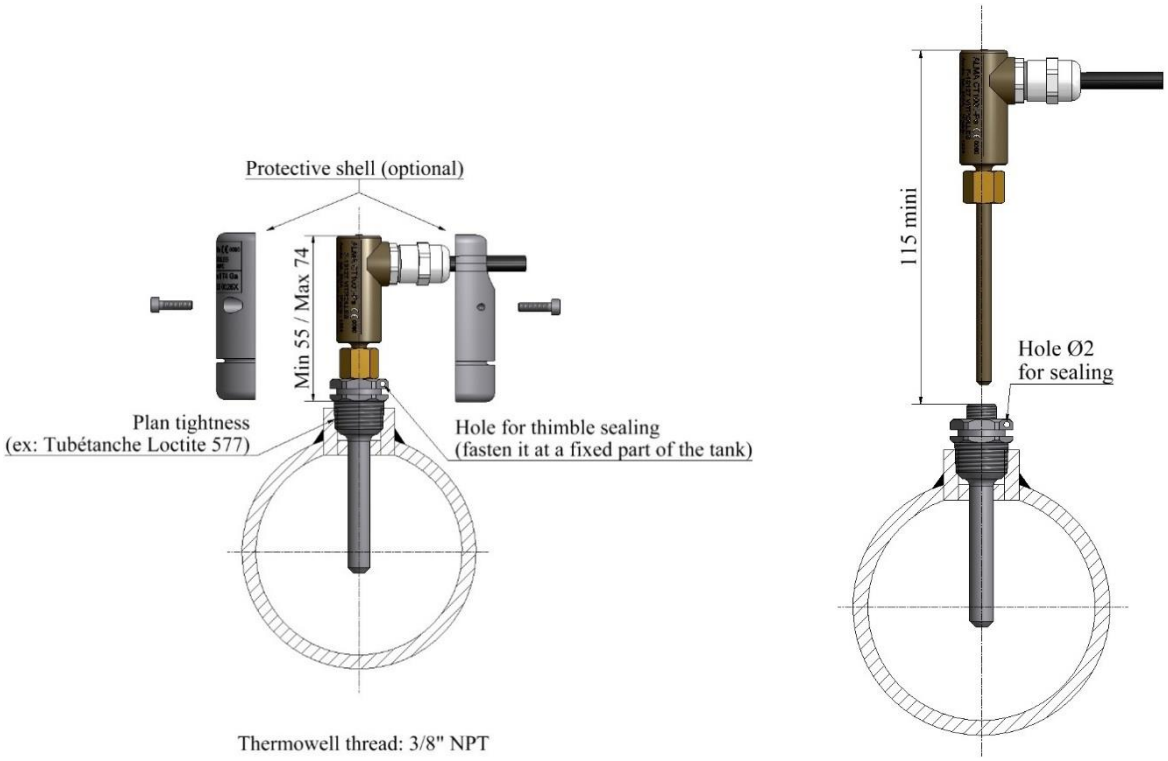
*ATEX "ma" certification.
For installation and use in hazardous areas see Instruction manual

Also available with output connector according to IEC 60947-5-2

Connecting the cable		
Function	***Marking on the wire***	***Color wire***
PT100/1	1	Yellow
PT100/2	2	White
PT100/3	3	Green

ALMA www.alma-alma.fr Service Development 13127 Vitrolles		PRESENTATION DRAWING	**DFV042**			Description of the amendment N° 596 - Compliance with ATEX marking - Replacement of the ADR cable - Modification of CI051						
DEV N° : 949d	Code : 8151	Temperature probe CT1001-Pe										
Drawing N° associated with the related CET file		949d	PPV042	K	5 /7	Modified on :	21/02/2018	by	ROC	verified by	CC
Metro :		Dev N°	Drawing N°	Rev	Folio	Created on :	13/09/2003		BM		BM
ATEX:	INERIS 04 ATEX 0026											

13.1. INSTALLATION RECOMMENDATIONS TEMPERATURE PROBE



REFER TO INSTRUCTION MANUAL

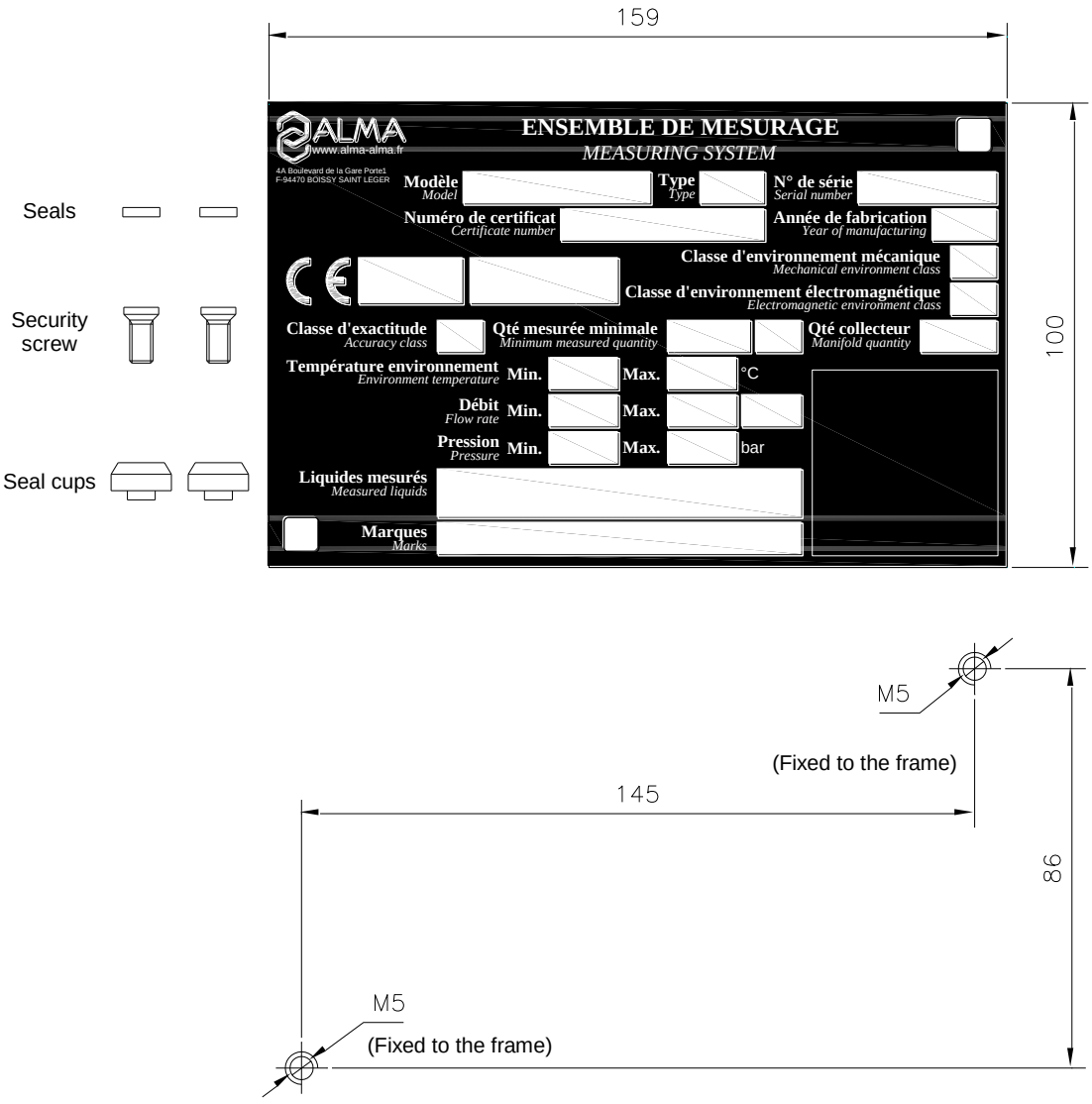
(DELIVERED WITH THE EQUIPMENT AND AVAILABLE ON ALMA WEBSITE)

INSTALLATION OF THE TEMPERATURE SENSOR

ON THE ALMA TURBINE METER:

14. KIT FOR MEASURING SYSTEM IDENTIFICATION PLATE

The identification plate shall be clearly installed, near the associated indicator device, and of easy access in order to be able to read features and to stamp the regulatory marks.



The security screws of the cups (provided by ALMA) must be screwed in the tap of the frame (do not use removable nuts).