

## DOCUMENT ISSUE

	<b>Name</b>	<b>Dep</b>	<b>Date</b>	<b>Signature</b>
Written to:	Costabloz Stefania	Prod	11 July 2005	
Verified to:	Beco Alberto	R&D	11 July 2005	
Approved to:	Re Francesco	R&D	11 July 2005	
Approved to:	Gardini Bruno	SQ	11 July 2005	

# INDEX

DOCUMENT ISSUE .....	1
INDEX.....	2
GENERAL DESCRIPTION .....	3
INTRODUCTION .....	3
The GPS Plus System .....	3
Technical Characteristics .....	3
Operating Characteristics of the GPS Plus System .....	4
Structure of the GPS Plus System .....	4
INSTALLATION .....	6
TRENCH PREPARATION .....	6
NORMAL SOIL, GRASSED AREAS .....	7
GRAVEL.....	7
ASPHALT .....	8
BLOCK PAVING/PAVING SLABS .....	8
CONCRETE .....	8
VARIABLE SURFACES .....	8
TYPICAL INSPECTION PIT CONSTRUCTION.....	9
TUBE PRESSURISATION.....	10
Back-filling .....	12
SENSOR INSTALLATION .....	13
SENSOR CABLING .....	14
GPS "Communication 115" (COM115) Serial Line .....	15
GPS Plus System (art. PGPS2002).....	16
COMMUNICATION "COM115" LINE TERMINATION .....	18
Dip-Switch Sensor Address Selection .....	19
GPS Plus system for underground use (art. PGPS2002/I) .....	20
System Connections (PGPS2002).....	22
System Connections (PGPS2002/12).....	23
System Connections (PGPS2002/SA).....	24
System Connections PGPS2002 .....	26
PGPS2002/I.....	27
GPS SENSOR (Art. PGPS2001/2) .....	28
INSTALLATION OF THE CONCENTRATOR .....	29
SYSTEM COMMISSIONING.....	29
INITIALISATION OF THE SYSTEM.....	29
IN CASE OF INCORRECT OPERATION .....	30
PARAMETER SETTING .....	30
Used channel qualification. ....	30
Pressure tube measurement. ....	30
Tube Sensitivity.....	30
Signal analysis selection. ....	31
Start Analysis Threshold Levels .....	32
Auto setup .....	32
FINAL CONSIDERATIONS .....	33
Summary Of The Principal Installation Steps.....	33
Commissioning the GPS Plus System .....	33
SYSTEM CHARACTERISTICS .....	34

# GENERAL DESCRIPTION

## INTRODUCTION

Twenty five years experience in the electronic security industry, coupled with the production of around 5,000 “**GPS**” systems, is the base which has allowed **GPS Standard spa** to develop the next generation of GPS system: the **GPS Plus**.

It constitutes the most advanced answer to the requirements of an external perimeter system. The equipment is based on solid field experience in the application of electronic security systems and a profound technical understanding of the most advanced electronic components and systems.

The fundamental characteristic is the complete invisibility of the system: most of today's external protection systems are easily avoided and damaged.

The GPS Plus will detect human intrusions, silently and invisibly, ignoring small animals, birds and other weather related disturbances, which can cause alarms on other systems.

The GPS system, using the buried tubes, detects differences in pressure generated by a target crossing the sensitive zone (**it is completely insensitive to electromagnetic fields and interference**).

The tubes, buried along the length of the perimeter, are filled with a low freezing point fluid (antifreeze) and then pressurized.

Something crossing the sensitive area generates a change in pressure between these two tubes, which is recorded and amplified by an appropriate transducer. The signal obtained is sent to the **Concentrator Analyzer** where it is analyzed and then an appropriate signal is sent to the **Universal Communications Processor** (Prealarm, Alarm, etc.).

## The GPS Plus System

### Technical Characteristics

The **GPS Plus** system, thanks to the use of the most up to date **DSP** (Digital Signal Processing) technology, allows a high number of signals received by the GPS System to be processed in a very short time:

- Evaluation of the signal in the time domain;
- Evaluation of the signal in the frequency domain;
- Combined time/frequency evaluation;
- Use of characteristic masks to recognize signals detected by the sensors;
- Detection of signal energy levels (spectral analysis);
- Energy matrix categorization for signal energy levels;

The **GPS Plus** system creates a sensitive zone of about 3 - 4m wide and up to 200m long.

To cover longer perimeters it is possible to have a system with up to 64 sensors connected to a single **Universal Communications Processor** (UCP).

## Operating Characteristics of the GPS Plus System

The operation of the **GPS Plus** system is based on the detection of the pressure variations that an intruder, crossing the sensitive area, creates on the ground above the GPS tubes. The pressure variations produce signals that are sent to a **Control Unit**, which, after time and frequency analysis, generates management and alarm monitoring signals.

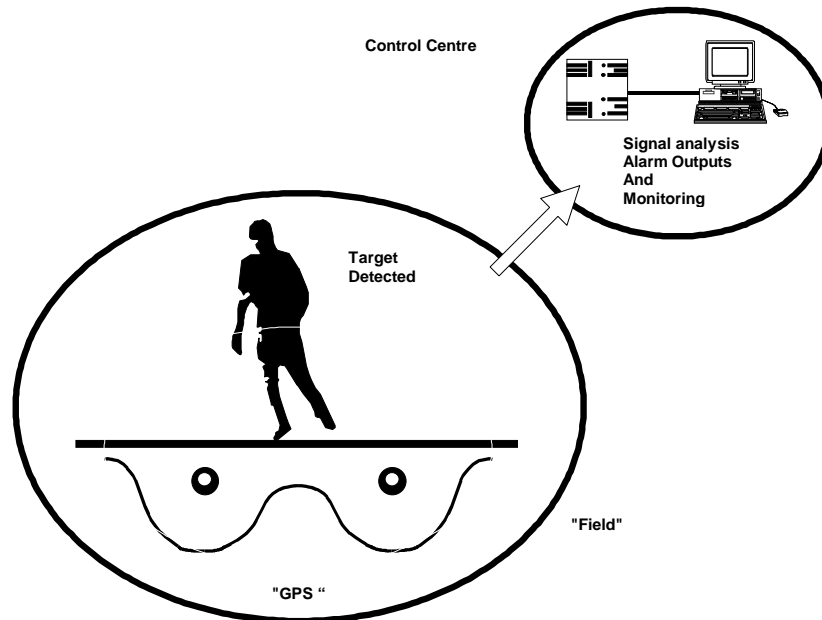


Figure 1

### Structure of the GPS Plus System

**GPS Plus** is subdivided into two principal parts:

- a) The **Analysis Concentrator** in the **Field**;
- b) The **Universal Communications Processor (UCP)**.

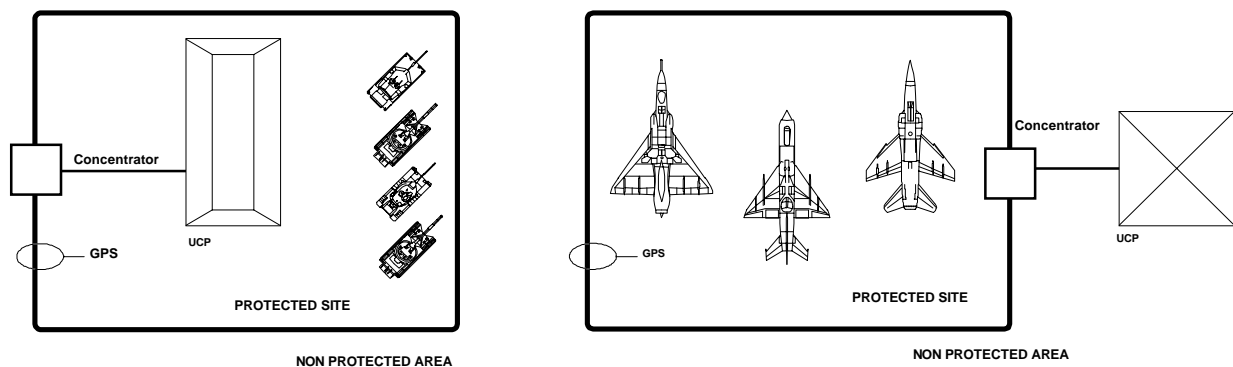


Figure 2

**a) The Field**

This comprises the "**sensor**" part of the system, with the capacity to detect the events generated by a violation of the protected perimeter.

The parts are: the **Analysis Concentrator**, the **GPS Sensor**, the **GPS Tubes**.

This represents the intelligence of the system, with the capability to analyze, discriminate and signal all the events detected along the perimeter.

There is a board containing a Digital Signal Processor, which permits the analysis of all the system events.

It defines the sensitive zone, delimiting the area to be protected.

**b) Universal Communications Processor (UCP)**

Comprises: the **Power Supply**, **Analyzer Unit**, the **Relay Cards**.

Allows the collection of the alarm signals and is usually installed within the area to be protected, but it is also possible to install it remotely.

The **GPS Plus** system can manage up to 64 peripherals (**Analysis Concentrators**) all connected to a single cable. Each concentrator can control two GPS sensors (PGPS2001/2) which can create, using the GPS Tubes, a sensitive zone **3 - 4 m** wide and up to **200m** long (2 x 100m zones).

## INSTALLATION

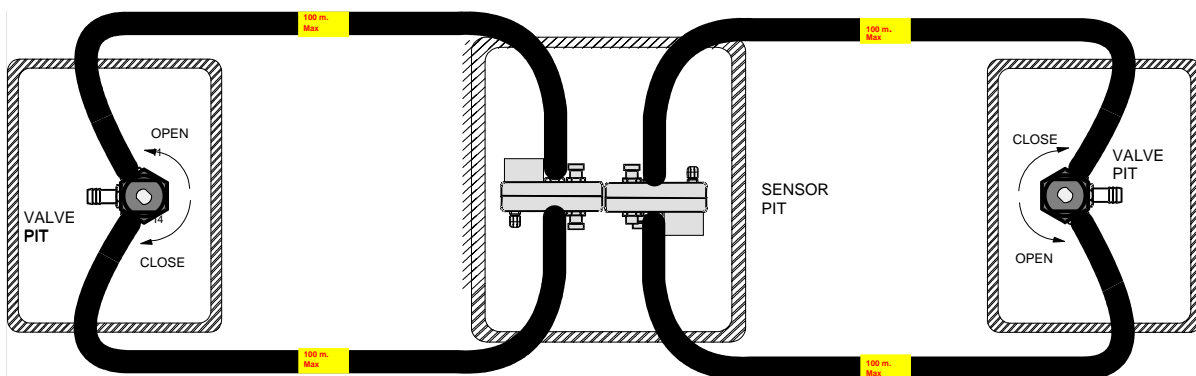
There are four basic stages to the installation of any GPS System.

- a. Trench and sensor/valve pit preparation.
- b. Tube/sensor installation.
- c. Back-filling the trenches.
- d. UCP installation.

The most time consuming and also the most critical is the correct preparation of the trenches for the application. Poor preparation work is the most difficult to overcome at a later date.

**The key to a successful installation is careful preparation.**

All systems will require inspection pits, one at each end of the system for the valves and a third one for the sensors.



Once the trenches are opened and the inspection pits prepared the tubes and cables should be laid in. The tube can then be filled with the appropriate water/antifreeze mixture, using a temporary connection in place of the sensor, and pressurised.

The trenches should not be back-filled until the tubes have been pressurised to prevent undue compression of the tubes during back-filling.

## TRENCH PREPARATION

When installing the tubes it is necessary to vary the installation process dependant on the type of ground that they are buried under.

The primary consideration no matter what the ground type is that there is good contact between the full length of the tube and the surrounding ground.

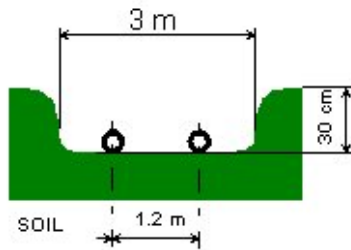
Air gaps between the tube and the surrounding material will cause insensitivity.

## NORMAL SOIL, GRASSED AREAS

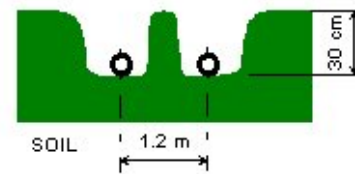
The tubes should be laid in trenches approximately 25 - 30 cm deep and 1.2 - 1.5 metres apart. The tubes can be laid either in individual trenches or a single large trench.

Experience has shown that a single large trench will give quicker settlement time and more even sensitivity in the short term.

NORMAL SOIL / GRASS - SINGLE TRENCH



NORMAL SOIL / GRASS - FOUR TRENCHES



Unless there are noticeable sharp and flinty stones or glass liable to damage the tube, it is only necessary to place the old material back in the trench once the tubes have been pressurised.

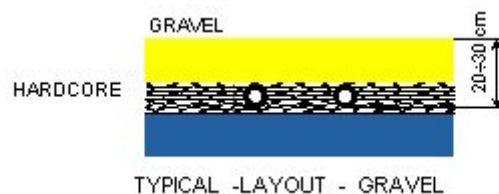
The replaced soil must be compacted as much as possible to ensure good contact with the tube.

Where sharp stones exist the tube should be covered with a 5cm layer of light grade 'pea shingle' to prevent any damage to the tube during back-filling.

**Ensure that the tube spacing is maintained but making any necessary adjustments for local sources of interference.**

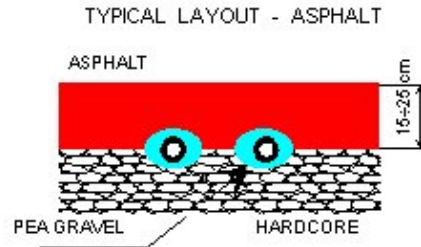
## GRAVEL

Under gravel the standard spacing and depth should be maintained wherever possible. It is always desirable to have the tube resting on a hard surface such as hardcore or concrete base with the primary ground material above.



## ASPHALT

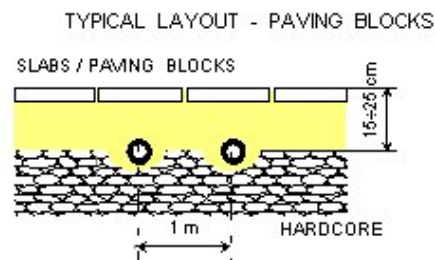
The optimum depth under asphalt is 15 - 25 cm, ideally located directly on the hardcore or concrete base. A thin layer of pea gravel should be placed on the tube before back-filling to prevent damage.



This also ensures a good contact between the asphalt and the tube.

## BLOCK PAVING/PAVING SLABS

The tubes would normally be buried in the binding/supporting material directly below the blocks. If this material is laid as a wet mortar, the tubes should be covered with the light pea gravel to ensure good contact when the mortar dries.



The distance between the tubes will normally be reduced to around 1 metre to ensure a continuous detection band.

## CONCRETE

The tubes should not be used in concrete areas without prior consultation with GPS as the sensitivity is significantly reduced.

## VARIABLE SURFACES

When the surface changes throughout the detection zone due to roads or pathways crossing the system, this will not cause any variation in sensitivity providing the spacing and depth criteria are followed for each different ground type.

Once the trenches have been opened, the tubes can be laid in. At each end of the zone an inspection pit will be required into which the tubes must be dressed.

The construction of the pits is not critical but they are commonly made of prefabricated plastic or concrete rainwater drain liners with metal lids.

For the GPS system a minimum internal dimension of 60 cm x 60 cm x 60 cm depth is recommended.

Ensure that the incoming tubes are dressed around the pit and enter the pit from the opposite side to ensure protection of the area around the pit.

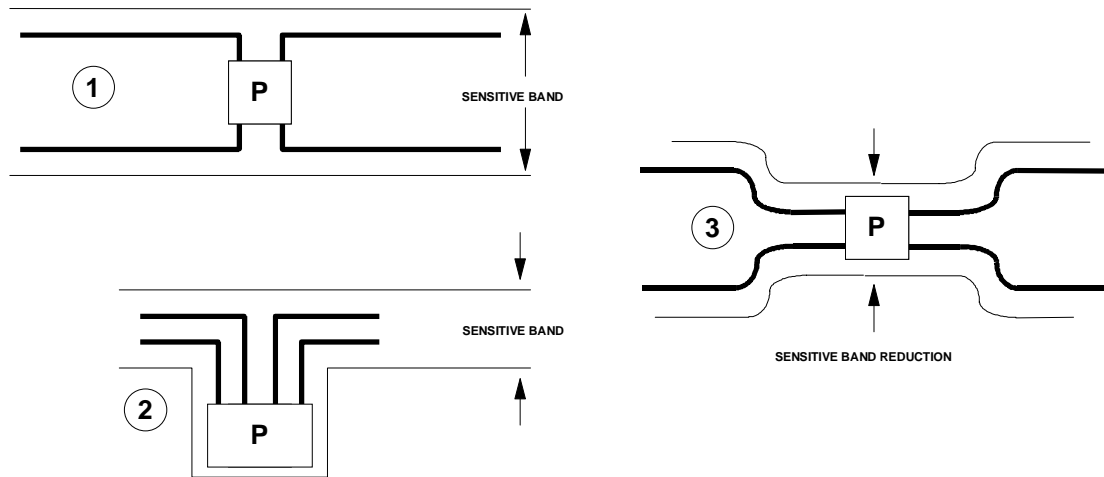
The tubes may now be filled with the appropriate water antifreeze mixture and pressurised prior to back-filling.

## TYPICAL INSPECTION PIT CONSTRUCTION

Ensure that the pits are adequately drained and that the lids will support any proposed traffic requirements.

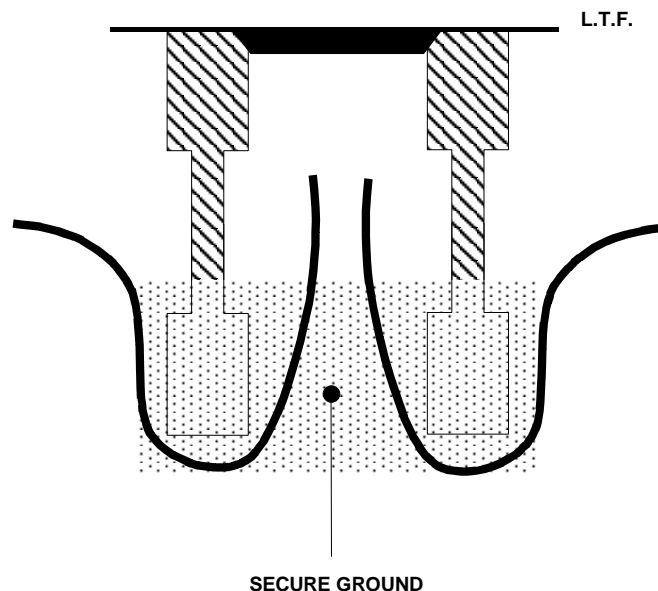
It is important that the pits are correctly positioned to ensure correct zone lengths. Note that tube is supplied in 100m lengths and so the zones must be slightly less than this to allow for looping of the tube around the pits.

The pits, without bottoms must be positioned on good drainage material.



How to enter the pits with the GPS tubes.

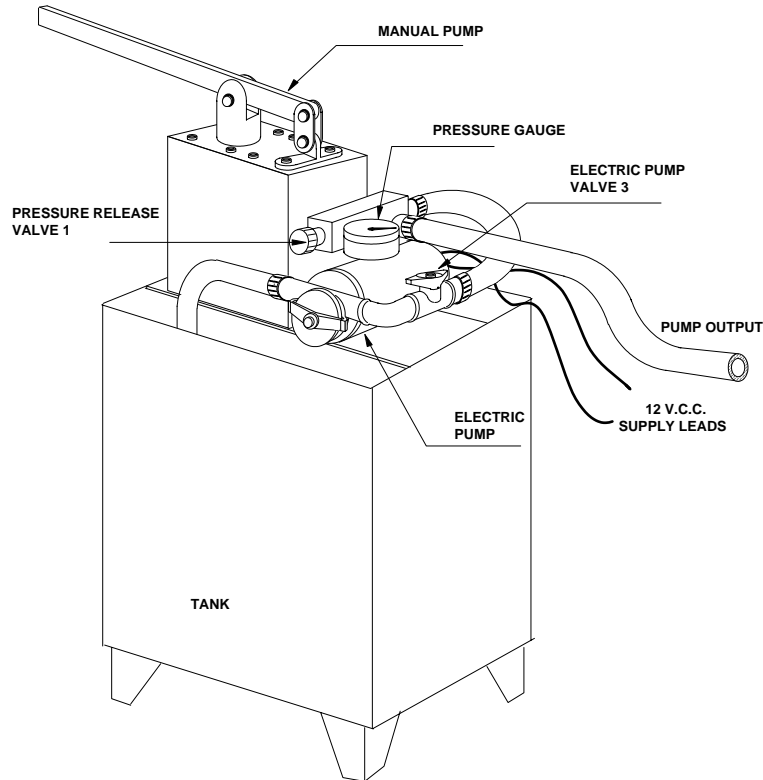
- 1) Normal conditions;
- 2) To increase the protection area to more than 3 metres.
- 3) **Poor layout**; close to the pit the sensitive band is reduced.



If the installation area is infested with animals (such as moles, mice, etc.) it is necessary to de-infest the area. GPS Standard recommends the use of "calcium cyanamide" to fertilize the ground.

## TUBE PRESSURISATION

Tube pressurisation requires the use of the pump:

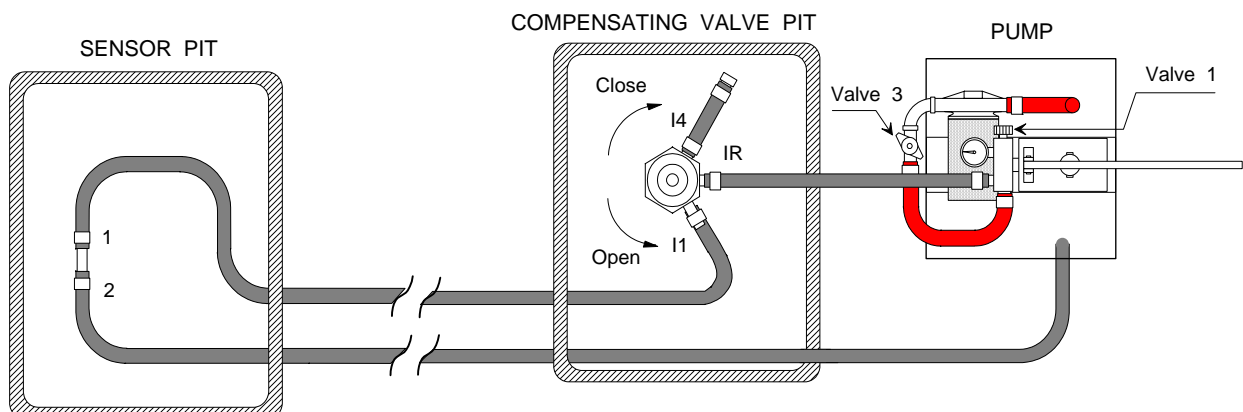


Once all the tubes are placed in the trenches ensure that all the lengths for any one zone are the same. The tubes can be crossed if necessary to provide length compensation.

If required, lay the sensor cable alongside the tubes.

Ensure that the tube has no sharp bends or kinks, which would prevent liquid flow and also ensure that no stones or earth enter the ends of the tube.

Within the pit where the sensor is to be fitted join Tubes 1 - 2 GPS600 tube joints (see Fig). Use the clips provided.



In the pit at the opposite end, connect tube 1 to inlet I1 of the compensating valve. Block inlet I4 with a blind-end tube stop. The tube stop can be made of 15mm copper tube, blocked and fitted into a short length of GPS tube. Always use the tube clips provided.

Fill the pump tank to the top with water and Glycol in the appropriate mixture. This will be enough liquid to completely fill a 100 metre, two tube zone (both tubes).

Before connecting the pump to the system, it is always necessary to purge both the electric and manual pumps of air.

1. Close the electric pump valve (3) and the pressure release valve (1).
2. Operate manual pump until liquid flows evenly from the pump outlet.  
(To conserve liquid, this flow can be re-directed into the pump tank).
3. Open the electric pump valve (3).
4. Operate the electric pump briefly until liquid flows evenly from the pump outlet.
5. Switch off the electric pump and close the valve (3).
6. The pumps are now purged of air.

Connect the pump outlet to the Inlet IR on the valve.

Place the ends of tube 2 into the pump tank ensuring that the ends are below the level of the liquid. In this a complete loop has been created, formed by Tubes 1 and 2. The loop starts, via the valve from the pump tank and returns to the pump tank.

Open the electric pump valve (3) and then also open the GPS valve by turning the top spindle fully anti-clockwise. Activate the electric pump (12v DC). After a few seconds, air will start to bubble out of the ends of the tubes 2.

Maintain the flow until fluid starts to come out of the ends of tube 2. This can take some 10 - 15 minutes for a full-length zone and will be signalled by a significant reduction in the bubbles rising to the surface of the pump tank.

Ensure that at no time does the level of liquid in the tank fall below the pump inlets, as this would suck air into the system.

Continue the circulation until no more bubbles are evident in the flow from Tube 2. This can take as long as 30 - 45 minutes and it is desirable to shake and tap the tubes and valves to release any trapped air.

Loosen and remove the tube stop connected to the valve inlet I1 and block this temporarily by hand. Remove Tube 2 from the pump tank and connect to valve inlet I1. Keep the electric pump operating throughout.

Shut electric pump valve (3) and switch off the electric pump. Manually pump the system to approximately 5 ATM, indicated on the pump pressure meter.

Check all the tubes and joints for leaks.

Open the pressure reduction valve 1 and allow the pressure to reduce to 3÷3.2 ATM. Close valve 1.

Close the GPS compensating valve but do not over tighten.

Open pressure reduction valve (1) and allow the pressure in the pump/valve connections to reduce to 0. Remove the tube from the valve inlet IR and cover the inlet to prevent ingress of stones, soil etc.

The tubes are now pressurised and the preceding steps should be repeated for the tubes associated with the second zone.

Back filling can now take place.

## **Back-filling**

Before back filling the trenches ensure that any pea gravel required is used to cover the tube. Also ensure that the tube spacing is maintained as the backfill material covers the tube and that no damage occurs to the tube.

It is essential that there is good contact between the tube and the surrounding ground and so, particularly under soil, the ground should be compacted as much as possible during back filling. The more compact the fill, the better the system sensitivity will be.

Once filled, there will be a period during which natural settlement of the trenches will occur. The length of time this takes will depend upon the type of material in which the tube is buried. This will cause a small variation in the system sensitivity but the dynamic threshold adjustment of the system will ensure that this is not noticeable in operational terms.

To maintain the covert nature of the system, it is essential that the trenches be brought as close as possible to their original condition after back filling.

Once the tubes are covered, normal site activity of vehicles, machinery and personnel can continue.

After a period of settlement, which can be around 6 to 8 months, the ground will have returned to the original level of compression and the system will be at the optimum level of sensitivity. It is usual to visit the site at this time to verify the system operation, check the pressure and to make any adjustments to the system sensitivity.

## SENSOR INSTALLATION

Place the pump adjacent to the previously installed compensating valve and fill the pump tank to at least 10 cm above the inlet tubes with appropriate water glycol mixture.

Purge the pump of air by following the steps described previously.

Connect the pump output to the input on the compensating valve. Operate the manual pump continually throughout the connection process to prevent the formation of air bubbles in the hydraulic system.

Secure the connection with a tube clip and continue pumping until the pressure meter reads approx. 1 ATM.

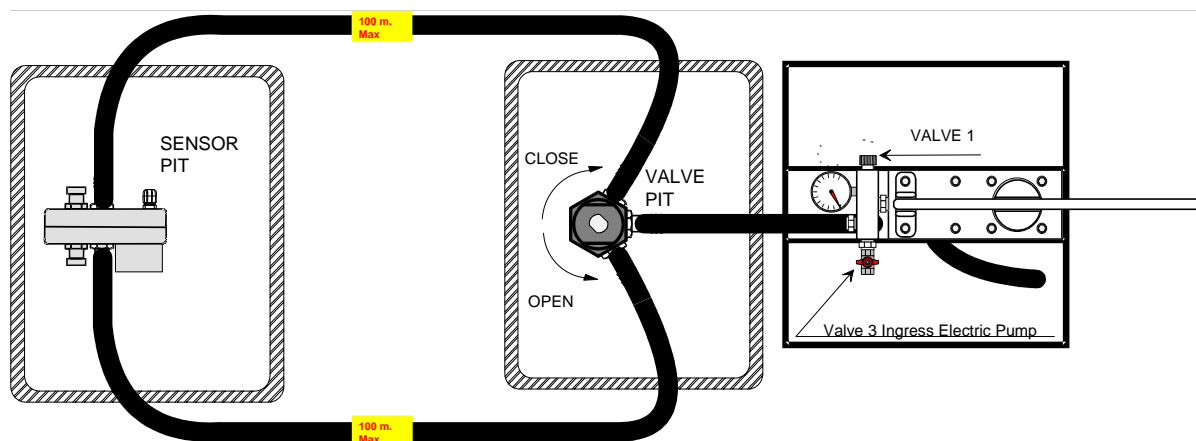
Slowly open the compensating valve. It is now possible to read the system pressure on the pressure meter.

Open pressure release valve (1) and allow the pressure to drop to 0. Close the pressure release valve (1) and the compensating valve.

**Open the bleed valves of the Sensors by unscrewing the two bleed nuts, do not remove them.**

Protect the cable inlets to prevent water ingress.

Disconnect the temporary tube connections at the sensor ends of the tubes and connect the tubes to the sensor inputs. Tighten the tube clips. Try to prevent too much liquid loss from the tubes and arrange the tubes at the sensor to prevent any undue kinks or sharp bends (that can obstruct the liquid flow).



The fluid will normally rise to the top of the pressure chambers on the sensor once the tubes are connected.

Open the compensating valve.

Operate the manual pump gently and after a few seconds any air in the pressure chambers of the sensor will be expelled and the fluid will rise to the top of the chamber. Continue pumping until all the chambers are full and liquid is running from the chambers in a steady flow with no obvious air bubbles escaping.

Gently squeeze the tube adjacent to the sensor and shake the sensor to dislodge any residual trapped air.

Screw the bleed nuts at the same time and tighten finger-tight. Fully tighten all the bleed taps.

Operate the manual pump to increase the system pressure to 5ATM. Check for leakage around the sensor and the compensating valve.

Slowly open the pressure release valve (1). Reduce the system pressure to 3.0-3.2ATM and then shut the release valve (1).

Close the compensating valve and open the pump pressure release valve (1) to release the pump pressure. Disconnect the pump outlet tube from the compensating valve and block the compensating valve input to prevent dirt ingress.  
Make a final check for leakage.

**Repeat the previous instructions for the second sensor.**

## SENSOR CABLING

Each sensor is connected to a common 4-core screened cable, which is designed to withstand direct burial alongside the tubes as necessary.

The cable provides the power for the sensor and carries the analogue signals and the pressure measurements from the sensors to the signal concentrator.

Prevent water, sand or soil from entering the space for the connections.

After making the connections tighten the sensor cable glands and smear with silicone to improve the waterproofing of the connection space.

Smear the upper part of the space with silicone and fit the cover, ensuring that the O ring is positioned correctly.

**Installation of the sensor is now complete. The procedure may be summarised as follows:**

1. Prepare trenches and inspection pits.
2. Lay the tubes (and cable) in the trenches and pits.
3. Fill tubes with fluid and pressurise.
4. Backfill the trenches.
5. De-pressurise system and install sensor.
6. Re-pressurise the system.
7. Connect cable into sensor and seal it.

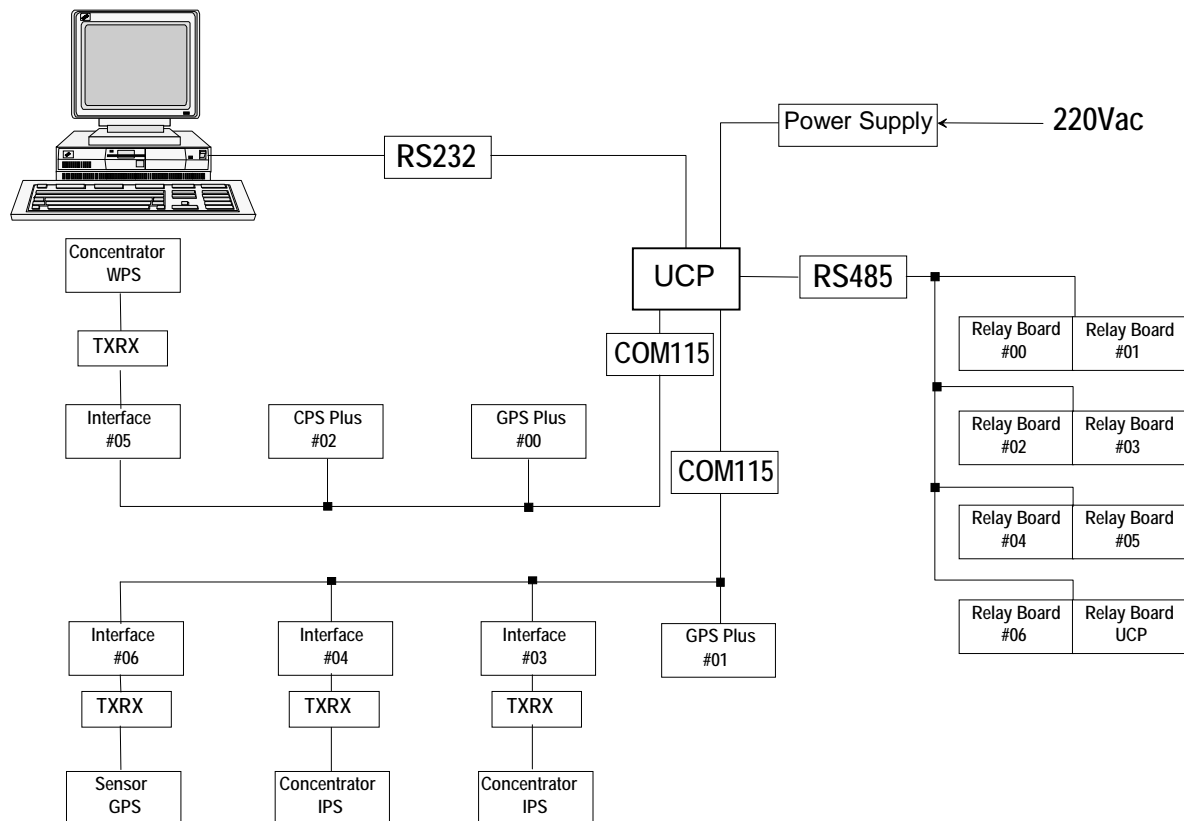
After completing all the above procedures it is possible to install the analysis concentrator and the UCP and to initiate the system operation.

When final commissioning is finished it is important to carefully fill the sensor and valve pits with a small grade 'pea shingle'. This will prevent unwanted movement of tubes within the pits but provide relatively easy access for subsequent service, if required.

## GPS “Communication 115” (COM115) Serial Line

The high speed communication line, called “Communication 115”, between the peripherals and the UCP has allowed an increase in the number of sensors that can be managed and gives a very quick system response in the event of an Alarm or Pre-alarm.

The presence of two separate communication ports means that the maximum distance covered by the system can be increased to 10 Km (5Km + 5Km)



**Figure 3**

Example of a **Multiplex 2000** system with one UCP, Relay Boards, two COM115 connected to CPS Plus sensors GPS Plus Sensors and, using an interface, to IPS, WPS and GPS sensors.

## GPS Plus System (art. PGPS2002)

The **GPS Plus** is designed to be integrated into a **Multiplex 2000** system, an interconnection system which, using a single Data Cable (art. **PUCP2115**), can connect up to 64 Sensors to a single **Universal Communications Processor (UCP)** which can manage and output the signals provided by the sensors using the Relay Cards (art. **PUCP2005** e **PUCP2006**). In this system the management of the sensors, up to 5km from the **UCP**, is by a software package running in the **Windows® 9X/2000/NT/XP** environment (art. **PUCP2000SW**). It is possible to control all of the sensor parameters as well as monitoring and recording the signals generated by the sensor and updating sensor firmware.

The board is designed to accommodate an optional board which can provide local inputs and outputs (art. **PCPS2002**).

The **Multiplex 2000** System, because of the distance from the UCP to the sensors, uses a power supply of **48 Vdc** (minimum). The **GPS Plus** sensor has an internal circuit that generates the 12vdc required for normal operation.

The Dip-Switch **DSW1** (1- 6) assigns the unique address used to communicate with the UCP to which it is connected (see Table 2).

The Leds **1, 2, 3, 4, 6** and **7** provide indications as described below and dependent on the setting of switches 7 and 8 of Dip-Switch **DSW1**, as shown in Table 2, Leds **1, 2, 3, 4** **DO NOT** give alternative indications, whereas leds **6** and **7** can give indications of the communications traffic to and from the PC.

All of the operating parameters can be varied using the management software and, by short circuiting link P1 for at least 1 second it is possible to reset all the parameters back to the factory defaults.

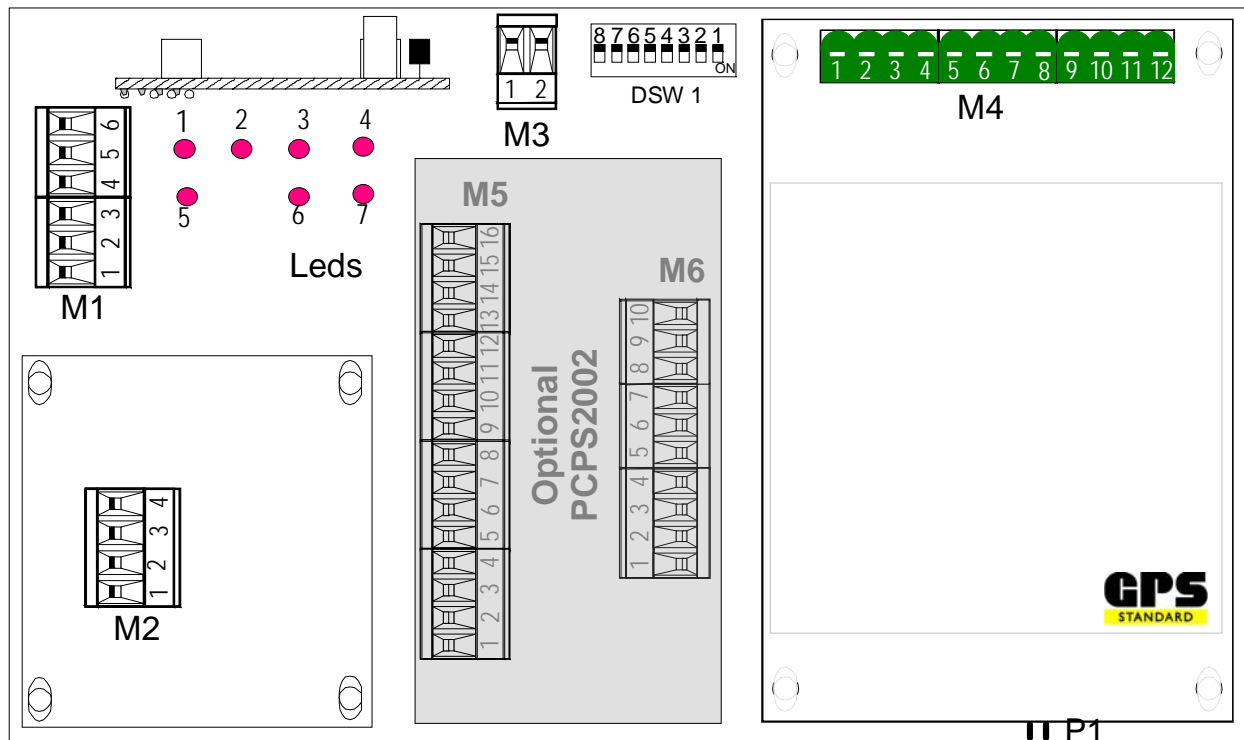


Figure 4

**Terminals M1 (Serial Communication Line)**

- 6 = [ **COM\_A** ] Serial Communications (COM115) to UCP
- 5 = [ **COM\_B** ] Serial Communications (COM115) to UCP
- 4 = [ **COM\_A** ] Serial Communications (COM115) to Next Sensor
- 3 = [ **COM\_B** ] Serial Communications (COM115) to Next Sensor
- 2 = [ **GND** ] Screen
- 1 = [ **+12 VDC** ] Auxiliary power supply 12 VDC

**Terminals M2 (Power Supply)**

- 4 = [ **+55V** ] Positive Power Supply Input (nominal 48Vdc)
- 3 = [ **GND** ] Negative Power Supply Input (nominal 48Vdc)
- 2 = [ **GND** ] Negative Power Supply Input (nominal 48Vdc)
- 1 = [ **+55V** ] Positive Power Supply Input (nominal 48Vdc)

**Terminals M3 (Tamper Input)**

- 1 = [ **GND** ] Negative
- 2 = [ **TAMPER** ] Tamper Input N.C.

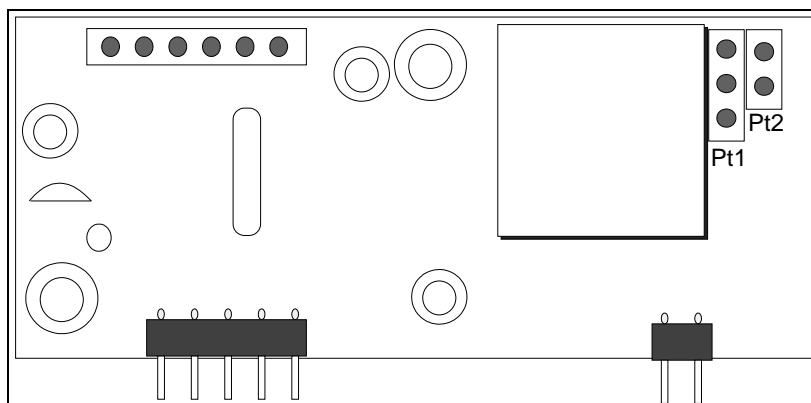
**Terminals M4 (Signal Input and power supply for GPS sensor)**

- 1 = [ **Ch1** ] Signal Input GPS Ch1
- 2 = [ **P-Ch1** ] Pressure ch1
- 3 = [ **GND** ] Negative Power Supply to GPS sensor
- 4 = [ **+12** ] Positive Power Supply to GPS sensor
- 5 = [ **P-Ch2** ] Pressure ch2
- 6 = [ **Ch2** ] Signal Input GPS Ch2
- 7 = [ ] N.U.
- 8 = [ ] N.U.
- 9 = [ **GND** ] Negative Power Supply
- 10 = [ **+12** ] Positive Power Supply
- 11 = [ ] N.U.
- 12 = [ ] N.U.

**Link P1 (Set to default)****Leds (Indicators)**

- 1 = Pre-alarm channel **A**
- 2 = Alarm channel **A**
- 3 = Alarm channel **B**
- 4 = Pre-alarm channel **B**
- 5 = Power supply
- 6 = Pressure low channel **A** / transmitted data line COM115
- 7 = Pressure low channel **B** / received data line COM115

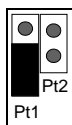
## COMMUNICATION “COM115” LINE TERMINATION



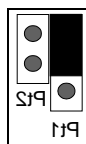
To ensure reliable operation of the COM115 communications it is necessary to terminate the line using links PT1 and PT2 on the small communications board located close to M1.

There are two possible scenarios:

1. the sensor is located between 0 and 3 Km from the UCP and it is the last one in the line: terminate PT1 and PT2 as shown in the following figure:



2. the sensor is located between 3 and 5 Km from the UCP and it is the last one in the line: terminate PT1 and PT2 as shown in the following figure:



for more details see the *UCP Installation Manual*

## Dip-Switch Sensor Address Selection




















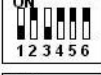
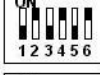
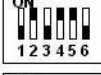



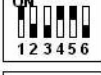
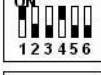



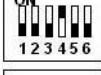


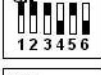





























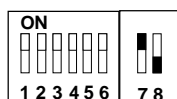
 #00	 #16	 #32	 #48
 #01	 #17	 #33	 #49
 #02	 #18	 #34	 #50
 #03	 #19	 #35	 #51
 #04	 #20	 #36	 #52
 #05	 #21	 #37	 #53
 #06	 #22	 #38	 #54
 #07	 #23	 #39	 #55
 #08	 #24	 #40	 #56
 #09	 #25	 #41	 #57
 #10	 #26	 #42	 #58
 #11	 #27	 #43	 #59
 #12	 #28	 #44	 #60
 #13	 #29	 #45	 #61
 #14	 #30	 #46	 #62
 #15	 #31	 #47	 #63

Table 1



Selecting the switches 7 & 8 on the Dip – Switch as shown in the figure make it possible to view the data traffic on the COM115 line connected to the sensor:

**Led n°6 = Transmit Data**

**Led n° 7 = Receive Data**

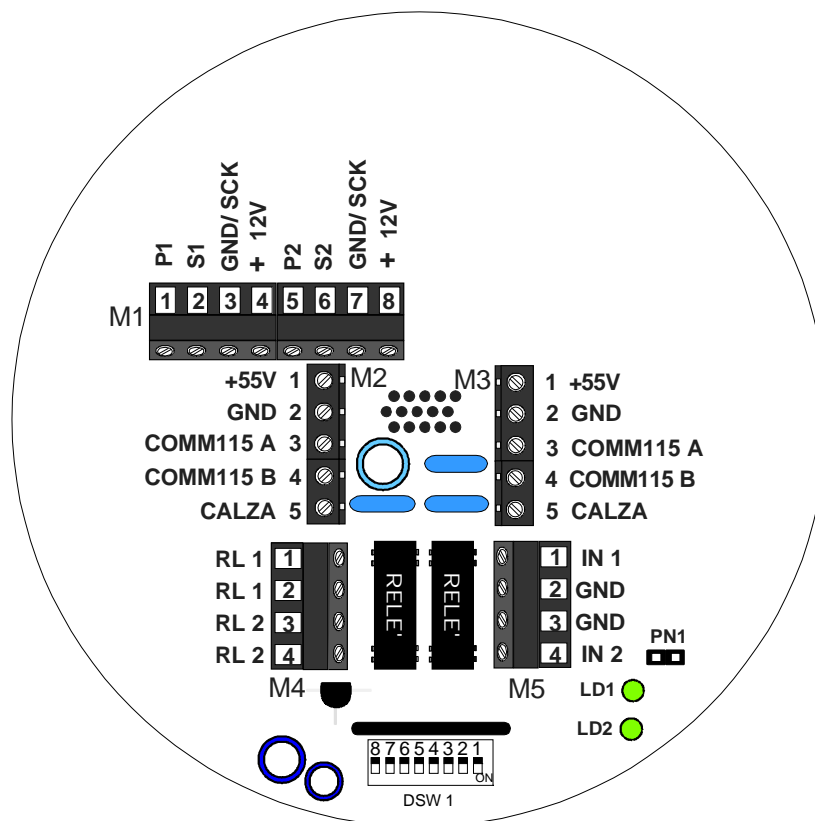
## GPS Plus system for underground use (art. PGPS2002/I)

The **GPS Plus** for underground use (art. **PGPS2002/I**) is designed to be integrated into a **Multiplex 2000** system, the difference relative to the PGPS2002 analyser is that the case is made from stainless steel material and it can be installed underground or in the pit near the PGPS2001/2 sensors.

The Dip-Switch **DSW1** (1- 6) assigns the unique address used to communicate with the UCP to which it is connected (see Table 2). The dip-switch 7 and 8 position are not used.

The Leds **1**, and **2** provide indications as described below.

All of the operating parameters can be adjusted using the management software and, by short circuiting link P1 for at least 1 second it is possible to reset all the parameters back to the factory defaults.



### Terminals M1 (Signals input)

- |                |  |
|----------------|--|
| 1 = [ P1]      | Pressure Input Ch1                     |
| 2 = [ S1]      | Signal Input GPS Ch1 (*)               |
| 3 = [ GND]     | Negative power supply and cable shield |
| 4 = [ +12 VDC] | Positive power supply                  |
| 5 = [ P2]      | Pressure input Ch2                     |
| 6 = [ S2]      | Signal input GPS Ch2 (*)               |
| 7 = [ GND]     | Negative power supply and cable shield |
| 8 = [ +12 VDC] | Positive power supply                  |

(\*) **N.B.** insert a 10K resistor between signal input and GND for each sensor connected.

### Terminals M2 (Communication serial line input)

1 = [+55V]	Positive power supply input (55Vdc)
2 = [GND]	Negative power supply input (55Vdc)
3 = [COM115_A]	Serial communication (COM115)
4 = [COM115_B]	Serial communication (COM115)
5 = [CALZA]	Cable shield connection

#### Terminals M3 (Communication serial line output)

1 = [+55V]	Positive power supply output (55Vdc)
2 = [GND]	Negative power supply output (55Vdc)
3 = [COM115_A]	Serial communication (COM115)
4 = [COM115_B]	Serial communication (COM115)
5 = [CALZA]	Cable shield connection

#### Terminals M4(Relay contact outputs)

1 – 2 = [RL1]	NC Contact with 22 Ohm series resistance;
3 – 4 = [RL2]	NC Contact with 22 Ohm series resistance;

#### Terminals M6 (Local input)

1 = [ IN1]	Logic input 1 (NC)
2 = [GND]	Negative
3 = [GND]	Negative
4 = [ IN2]	Logic input 2 (NC)

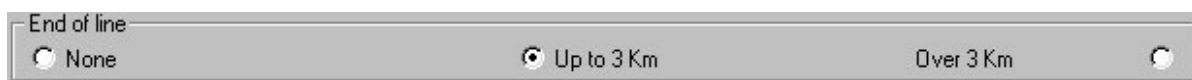
#### Link P1 (Set to default)

#### Leds (Indicators)

LD1 = Power supply  
LD2 = Amplification fault/Pressure.

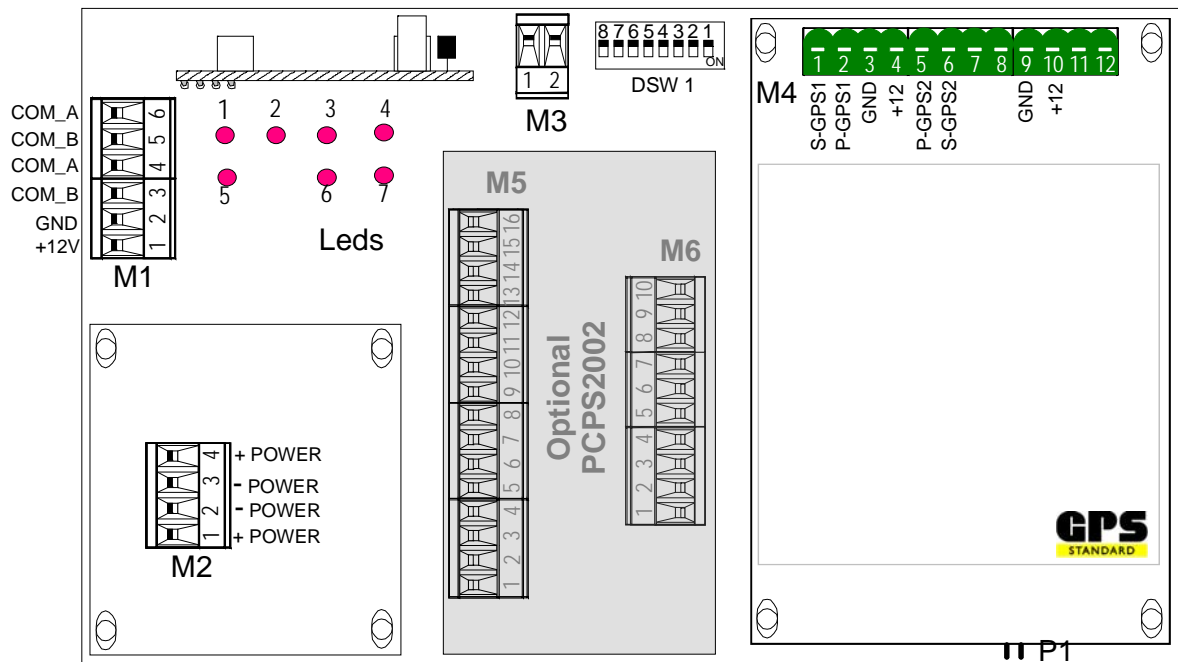
**N.B.** the termination at the end of communication line must be selected by the management software, Multiplex 2000. In the default situation all the sensors have the end of line inserted as if it was at the last sensor on the communication line and for a line of 3 km length.

To modify the end of line go to the parameter setup in the Multiplex 2000 management software and select the correct end of line:



- **None:** for intermediate sensors.
- **Up to 3 km:** for last sensor in line at distances up to 3 Km from UCP.
- **Over 3 km:** for last sensor in line sensors at distances more than 3 Km from UCP

## System Connections (PGPS2002)



### Terminals M1 (Serial Communication Line)

- 6 = [ COM\_A ] Serial Communications (COM115) to UCP
- 5 = [ COM\_B ] Serial Communications (COM115) to UCP
- 4 = [ COM\_A ] Serial Communications (COM115) to Next Sensor
- 3 = [ COM\_B ] Serial Communications (COM115) to Next Sensor
- 2 = [ GND ] Screen
- 1 = [ +12 VDC ] Auxiliary power supply 12 VDC

### Terminals M2 (Power Supply)

- 4 = [ +55V ] Positive Power Supply Input (nominal 48Vdc)
- 3 = [ GND ] Negative Power Supply Input (nominal 48Vdc)
- 2 = [ GND ] Negative Power Supply Input (nominal 48Vdc)
- 1 = [ +55V ] Positive Power Supply Input (nominal 48Vdc)

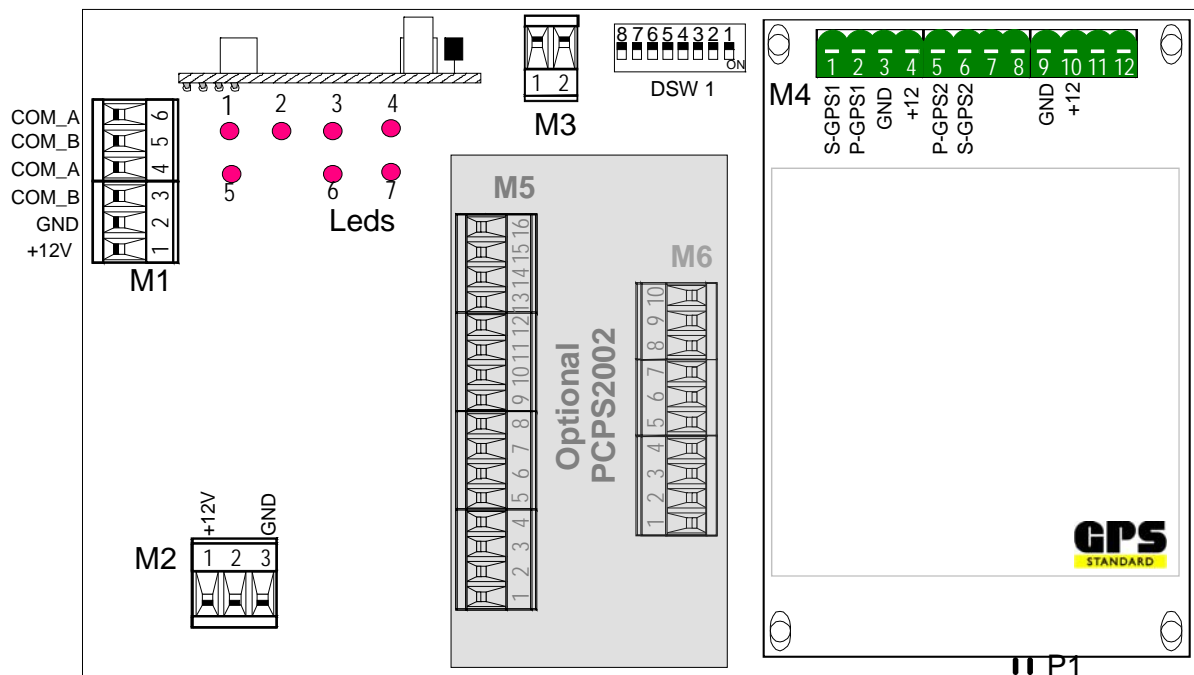
### Terminals M3 (Tamper Input)

- 1 = [ GND ] Negative
- 2 = [ TAMPER ] Tamper Input N.C.

### Terminals M4 (Signal Input and power supply for GPS sensor)

- 1 = [ Ch1 ] Signal Input GPS Ch1
- 2 = [ P-Ch1 ] Pressure ch1
- 3 = [ GND ] Negative Power Supply to GPS sensor
- 4 = [ +12 ] Positive Power Supply to GPS sensor
- 5 = [ P-Ch2 ] Pressure ch2
- 6 = [ Ch2 ] Signal Input GPS Ch2
- 7 = [ ] N.U.
- 8 = [ ] N.U.
- 9 = [ GND ] Negative Power Supply
- 10 = [ +12 ] Positive Power Supply
- 11 = [ ] N.U.
- 12 = [ ] N.U.

## System Connections (PGPS2002/12)



### Terminals M1 (Serial Communication Line)

- 6 = [ **COM\_A** ] Serial Communications (COM115) to UCP
- 5 = [ **COM\_B** ] Serial Communications (COM115) to UCP
- 4 = [ **COM\_A** ] Serial Communications (COM115) to Next Sensor
- 3 = [ **COM\_B** ] Serial Communications (COM115) to Next Sensor
- 2 = [ **GND** ] Screen
- 1 = [ **+12 VDC** ] Auxiliary power supply 12 VDC

### Terminals M2 (Power Supply)

- 3 = [ **GND** ] Negative Power Supply Input (nominal 12Vdc)
- 2 = [ **N.U.** ] Not Used
- 1 = [ **+12V** ] Positive Power Supply Input (nominal 12Vdc)

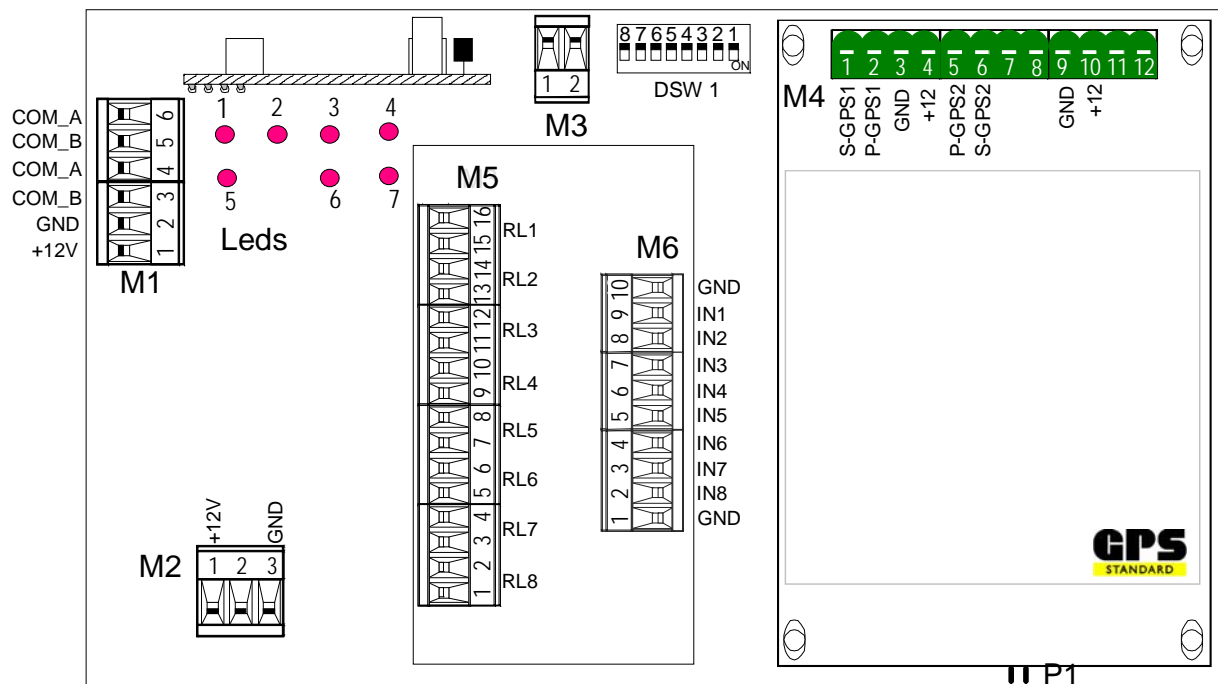
### Terminals M3 (Tamper Input)

- 1 = [ **GND** ] Negative
- 2 = [ **TAMPER** ] Tamper Input N.C.

### Terminals M4 (Signal Input and power supply for GPS sensor)

- 1 = [ **Ch1** ] Signal Input GPS Ch1
- 2 = [ **P-Ch1** ] Pressure ch1
- 3 = [ **GND** ] Negative Power Supply to GPS sensor
- 4 = [ **+12** ] Positive Power Supply to GPS sensor
- 5 = [ **P-Ch2** ] Pressure ch2
- 6 = [ **Ch2** ] Signal Input GPS Ch2
- 7 = [ ] N.U.
- 8 = [ ] N.U.
- 9 = [ **GND** ] Negative Power Supply
- 10 = [ **+12** ] Positive Power Supply
- 11 = [ ] N.U.
- 12 = [ ] N.U.

## System Connections (PGPS2002/SA)



### Terminals M1 (Serial Communication Line)

- 6 = [ **COM\_A** ] Serial Communications (COM115) to UCP
- 5 = [ **COM\_B** ] Serial Communications (COM115) to UCP
- 4 = [ **COM\_A** ] Serial Communications (COM115) to Next Sensor
- 3 = [ **COM\_B** ] Serial Communications (COM115) to Next Sensor
- 2 = [ **GND** ] Screen
- 1 = [ **+12 VDC** ] Auxiliary power supply 12 VDC

### Terminals M2 (Power Supply)

- 1 = [ **+12V** ] Positive Power Supply Input (nominal 12Vdc)
- 2 = [ **N.U.** ] Not Used
- 3 = [ **GND** ] Negative Power Supply Input (nominal 12Vdc)

### Terminals M4 (Signal Input and power supply for GPS sensor)

- 1 = [ **Ch1** ] Signal Input GPS Ch1
- 2 = [ **P-Ch1** ] Pressure ch1
- 3 = [ **GND** ] Negative Power Supply to GPS sensor
- 4 = [ **+12** ] Positive Power Supply to GPS sensor
- 5 = [ **P-Ch2** ] Pressure ch2
- 6 = [ **Ch2** ] Signal Input GPS Ch2
- 7 = [ **N.U.** ] Not Used
- 8 = [ **N.U.** ] Not Used
- 9 = [ **GND** ] Negative Power Supply
- 10 = [ **+12** ] Positive Power Supply
- 11 = [ **N.U.** ] Not Used
- 12 = [ **N.U.** ] Not Used

**Terminals M3 (Tamper Input)**

- 1 = [GND] Negative
- 2 = [TAMPER] Tamper Input N.C.

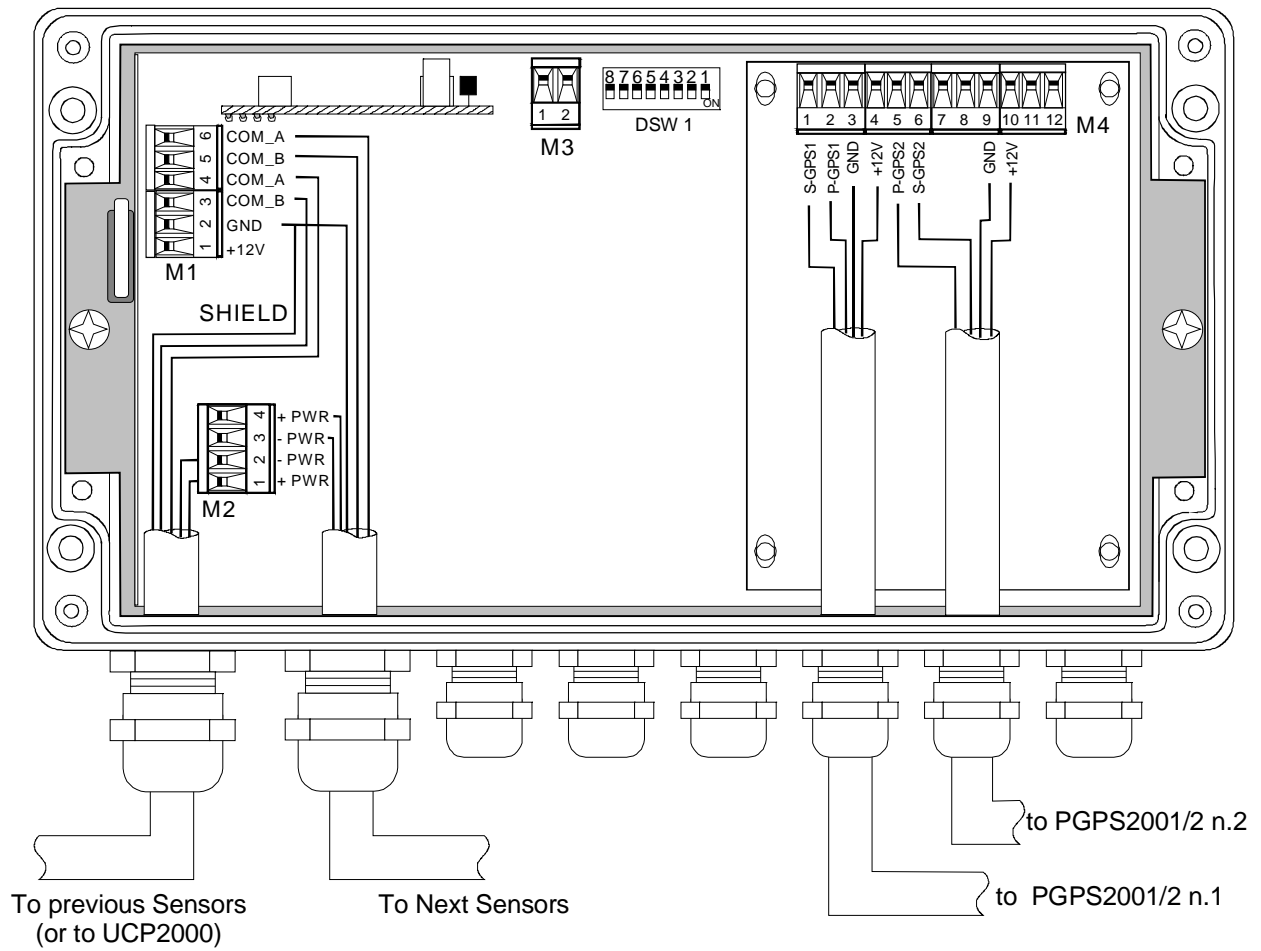
**Terminals M5 (Local Relay Output)**

- 15 – 16 = [RL1] NC Contact with 22 Ohm series resistance;
- 13 – 14 = [RL2] NC Contact with 22 Ohm series resistance;
- 11 – 12 = [RL3] NC Contact with 22 Ohm series resistance;
- 9 – 10 = [RL4] NC Contact with 22 Ohm series resistance;
- 7 – 8 = [RL5] NC Contact with 22 Ohm series resistance;
- 5 – 6 = [RL6] NC Contact with 22 Ohm series resistance;
- 3 – 4 = [RL7] NC Contact with 22 Ohm series resistance;
- 1 – 2 = [RL8] NC Contact with 22 Ohm series resistance;

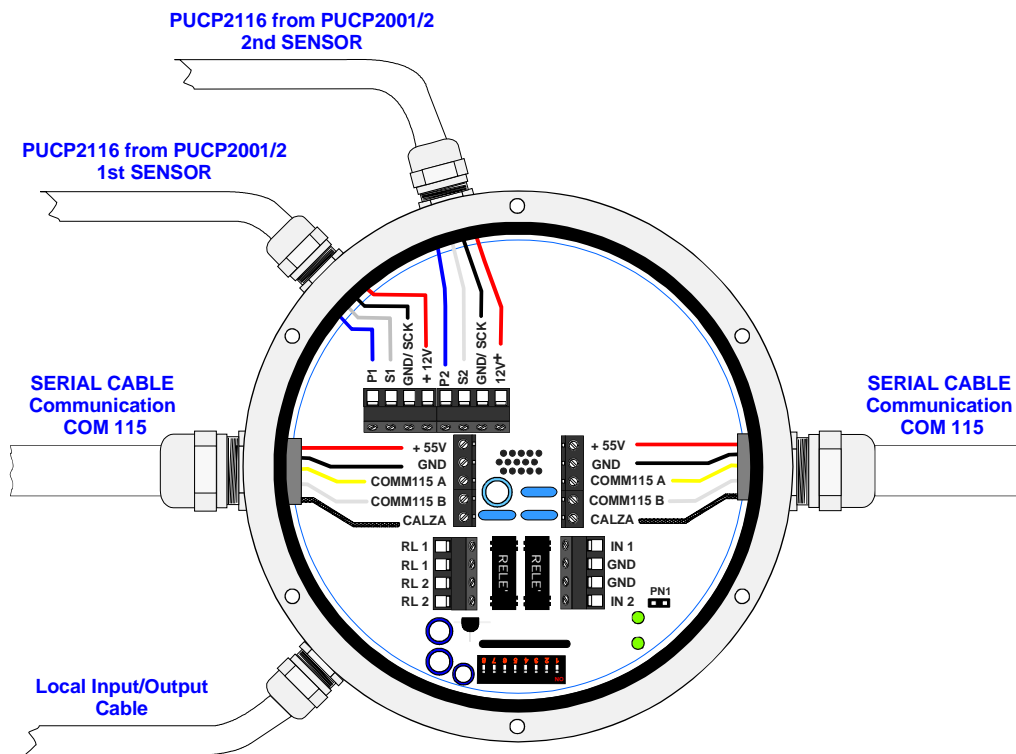
**Terminals M6 (Logical Local Input)**

- 10 = [GND] Negative
- 9 = [IN1] Logical Input 1 (NC)
- 8 = [IN2] Logical Input 2 (NC)
- 7 = [IN3] Logical Input 3 (NC)
- 6 = [IN4] Logical Input 4 (NC)
- 5 = [IN5] Logical Input 5 (NC)
- 4 = [IN6] Logical Input 6 (NC)
- 3 = [IN7] Logical Input 7 (NC)
- 2 = [IN8] Logical Input 8 (NC)
- 1 = [GND] Negative

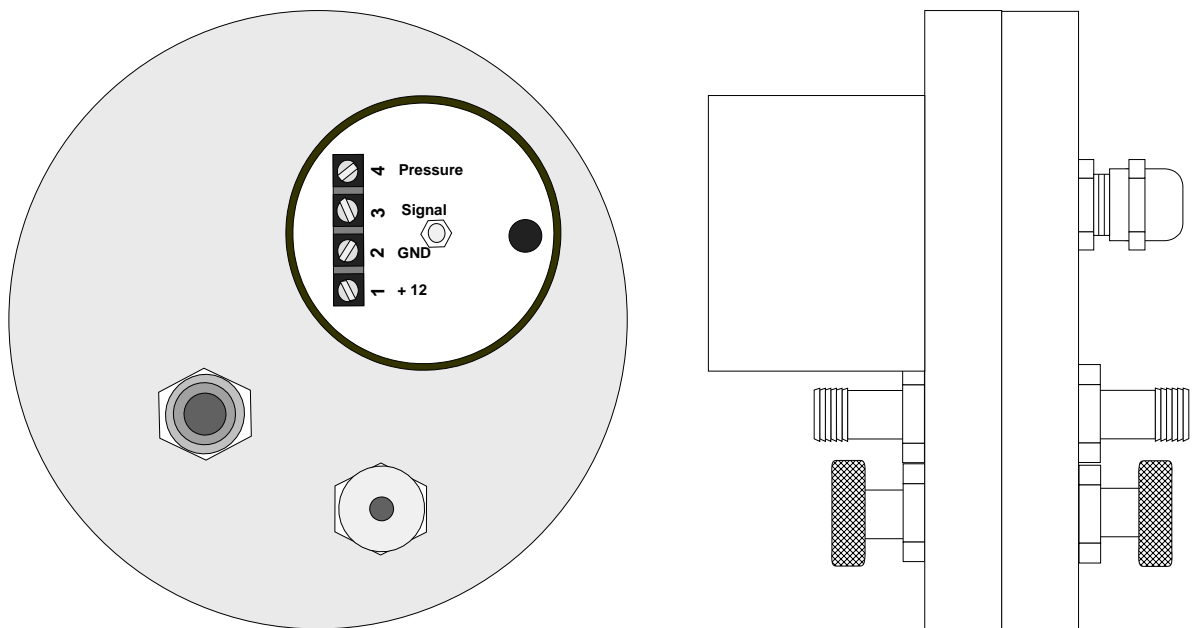
### System Connections PGPS2002



# PGPS2002/I



## GPS SENSOR (Art. PGPS2001/2)



To connect the GPS Sensors PGPS2001/2 to the Concentrator use the special cable PGPS2116. Ensure that the screen is continuous throughout the length of the cable and that it is connected to negative at the concentrator and left free at the sensor.

## **INSTALLATION OF THE CONCENTRATOR**

After installing the tubes and sensors it is possible to make both the connections between the sensors and the concentrator and the final installation of the UCP.

More details on the installation of the UCP are contained in the detailed Technical Manual.

## **SYSTEM COMMISSIONING**

Once all the system has been installed and connected, the initial system commissioning can commence.

After powering up the UCP the system carries out an automatic configuration of the sensors connected and initiates the monitoring of the signals provided by the sensors.

For correct operation it is necessary to set all of the system parameters using the Multiplex 2000 management software.

To do this it is necessary to make a temporary connection between the UCP and a computer, as described in the Multiplex 2000 Software Manual, to evaluate the signals provided by each sensor and to adjust the parameters following the guidelines shown in the manual. This phase is best conducted with the support of the GPS Technical Support Network.

## **INITIALISATION OF THE SYSTEM**

Connect the output of the power supply (Art. PUCP2004) to the UCP and then connect the AC mains supply to the power supply. The UCP initiates an automatic acquisition of all the sensors connected to the communication line(s). This activity is indicated by the "General Fault" and "Communication Fault" led flashing. When this is finished the "Power" indicator on the front panel comes on.

Check that the "Fault" indicator is off and not flashing.

Press and release the system "Test" switch.

All the control unit indicators will flash, once for each sensor detected by the system.

Set the Sensitivity switch to mid position.

Confirm that, when the system detects a crossing alarm from a zone, the alarm led reports this condition correctly.

Connect the service computer as per the UCP manual and load the Multiplex 2000 software as described.

After the system acquisition check that the table displayed on the PC monitor corresponds to the number and type of sensors actually installed.

Select "Monitoring" e check that the signals provided by the sensors are displayed on the screen.

Check that there are no low pressure signals from any of the sensors.

Disconnect the main power supply and ensure that the system functions correctly using only the batteries.

Proceed to set the parameters.

## IN CASE OF INCORRECT OPERATION

Check the power supply connections and confirm the power supply output voltage.

Check the protection fuse for the UCP, the sensor cable connections and the correct setting of the sensor addresses.

Check the connection between the computer and the UCP.

Check for correct end of line terminations.

Check the pressure on the appropriate sensors using the installation pump.

Check the battery voltage.

## PARAMETER SETTING

The operating parameters for each sensor are initially set by a simple walk test and analyzing the resultant signal.

This process is repeated for each sensor on the system.

### Used channel qualification.

The GPS Plus system can work with 1 sensor PGPS2001/2 (for 1 zone protection length up to 100 meters) or with 2 sensors PGPS2001/2 (for 2 zones protections). Using the Multiplex 2000 management software it is possible to enable only the channels connected to a GPS sensor to avoid incorrect indications (amplification fault or low pressure). To do this, enable only the channels present by checking the flag  Enable channel in the sensor parameters window.

### Pressure tube measurement.

Enter Parameters and read, with the appropriate key, the tube pressure value from the pressure sensor.

### Tube Sensitivity

The quiescent signals from the sensor in quiet, low wind conditions should be below 100 millivolts and one person should then walk at normal walking pace across the system at approximately 10 meters intervals, while a second person monitors the 'Monitoring' screen. The peak signals generated by this should be between  $\pm 2$  -  $\pm 2.5$  volts. It is important that the signal does not reach the saturation level.

Using the parameter setting screen the sensitivity of each sensor can be adjusted to ensure the correct level of signal.

It may be necessary to repeat this process a few times to obtain the optimum settings.

### Signal analysis selection.

For each enabled channel, the GPS Plus sensor can have 3 different signal analysis procedures enabled to determine an alarm condition. It is possible to enable one or more of these algorithms.

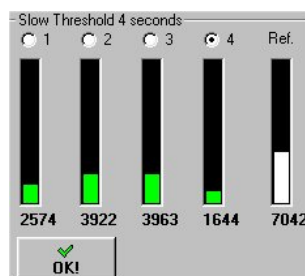
- **Fast analysis:** used to detect people walking normally or running across the sensitivity area. To enable the fast analysis check the flag  Enable Fast Analysis.
- **Slow analysis:** used to detect people that move slowly across the sensitive area. It contains one analysis 4 seconds long, one 8 seconds long and one 16 seconds long. To enable the slow analysis check the flag  Enable Slow Analysis, then select the required analysis:  Slow Threshold 4 seconds for the 4 second analysis,  Slow Threshold 8 seconds for the 8 second analysis,  Slow Threshold 16 seconds for the 16 second analysis.
- **Jump analysis:** used to detect people that try to jump the sensitive area.

For fast and slow analysis the start threshold must be set.

For the fast analysis it is possible to acquire 4 different crossing attempts. To do this enable the required,  Mask 1  2  3  4  for each enabled mask it is necessary to acquire an auto-setup signal.

For the slow analysis, after the slow crossing auto-setup, it will be necessary to select a threshold value for each analysis enabled:

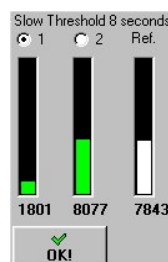
#### 1. Slow analysis 4 seconds:



The **Ref.** value is the value currently stored in the sensor. The values 1, 2, 3 and 4 are the threshold values generated in the 4 acquisitions of 4 seconds in the acquired auto-setup signal. Select the required value and press the Ok button to store the selected value in the sensor.

**N.B.** It is necessary select a threshold value that relates to a time interval where the signal shows some variations. Avoid selecting a threshold that relates to a signal with no variations.

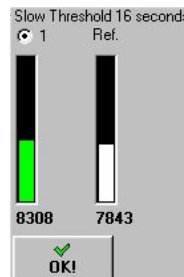
#### 2. Slow analysis 8 seconds:



The **Ref.** value is the value currently stored in the sensor. The values 1 and 2 are the threshold values generated in the 2 acquisitions of 8 seconds in the acquired auto-setup signal. Select the required value and press the Ok button to store the selected value in the sensor.

**N.B.** It is necessary select a threshold value that relates to a time interval where the signal shows some variations. Avoid selecting a threshold that relates to a signal with no variations.

### 3. **Slow analysis 16 seconds:**



The **Ref.** value is the value currently stored in the sensor. The value 1 is the threshold value generated during the 16 seconds of the acquired auto-setup signal. Please press the Ok button to store the selected value in the sensor.

**N.B.** Enable the 16 second slow analysis only if the auto-setup signal has variations throughout the 16 seconds.

For the jump analysis, after the auto-setup, it is possible to manually modify the threshold that determines the jump signal.

### **Start Analysis Threshold Levels**


**The default settings for the start analysis thresholds are suitable for initial set up.**

These can be set so that they are above the fundamental noise level of the system such that the frequency domain analysis of the signals only starts when the signal generated by a zone is different from the normal noise of the system.

The **Fast Analysis Threshold** levels must be set so that they are above the fundamental noise level of the system, shown with 1 Hz high pass filter, and below the crossing signal, shown in the same mode.

The **Slow Analysis Threshold** levels must be set so that they are above the fundamental noise level of the system, shown with 1 Hz low pass filter, and below the crossing signal, shown in the same mode.

### **Auto setup**

After setting the sensitivity and the start threshold level (for the fast analysis it will be necessary also select the number of masks), selecting auto setup will start the auto acquisition of the crossing signals. After selecting the channel and the type of crossing to be acquired the system waits for the selected type of crossing to be attempted. Clicking the  button will cause the program to wait while the selected number of attempts are carried out. As soon as the number of attempts have been completed the program calculates the resultant average of the attempts.

After the attempt is completed clicking the  button will send the average to the sensor being programmed.

After acquiring the different attempts to be detected, make a series of tests at crossing the sensitive zone at different points and confirm that each attempt generates an alarm.

## FINAL CONSIDERATIONS

### Summary Of The Principal Installation Steps.

- ❖ Make the system connections:
  - as per all of the instructions in the **SYSTEM CONNECTIONS** section;
  - ensure they are all correct to prevent system malfunction.
- ❖ Commission the system:
  - The definition of the parameters is possible by connecting to the serial line and using a personal computer running the management software (**PUCP2000SW**) in a **Windows® 95/98/2000/NT** environment. The **GPS Plus** Multiplex system (Art. **PGPS2001**) has a COM115 type serial interface and it is necessary to use the optional **RS232 - COM115** converter (with the PUCP2000SW software) to interconnect between the sensor and the Personal Computer.
- ❖ Conclusions.
  - The notes in this manual are designed to support the installation of the **GPS Plus** system in its most common applications.
  - It is true that poor installation of the system (poorly selected tube routes, etc...) can compromise and limit the performance of the system.
  - For difficult situations, or for specific advice contact GPS Technical Support.

### Commissioning the GPS Plus System

For more information on setting up and commissioning the GPS Plus systems refer to the **On-Line Help** in the MX2000 Management Software (art. **PUCP2000SW**).

## SYSTEM CHARACTERISTICS

### GENERAL DATA

<b>General Data</b>		
➤ Versions Available	<b>art. PGPS2002 PGPS2002/12 PGPS2002/SA</b>	GPS Plus Multiplex System GPS Plus Multiplex System(12 Volt) GPS Plus Stand Alone
➤ Options	<b>Art. PCPS2002</b>	Local relay Board and Logic Inputs for GPS Plus Multiplex System ( <b>art. PGPS2002</b> )
➤ System ➤ Applications	External	
➤ Maximum System Coverage	<b>200 m</b> approx (two 100 meter zones)	
➤ System Parameter Setting	Via serial port <b>COM115</b> , using Personal Computer	
➤ Parameter ➤ Memory	On <b>EEPROM</b> (non volatile RAM)	
➤ Firmware	Resident on Flash upgradeable via Serial line	

<b>Mechanical Data</b>	
➤ Cabinet	<p>Metallic Container (tamper protected) completely weatherproof to <b>IP65</b></p> <p>Dimensions: [L] <b>260x</b> [H] <b>160x</b> [D] <b>90mm</b>            Weight: <b>2 Kg</b>            Color: <b>gray</b></p>

<b><i>Environmental</i></b>
-----------------------------

➤ Operating Temperature	- 30°C - + 70°C Relative Humidity 90%
-------------------------	--

<b><i>Electrical Data</i></b>
-------------------------------

➤ Power Supply	art. PGPS2002 PGPS2002/12 PGPS2002/SA	24 - 55 Vdc (48 Volt nominal) 10.5-16 Vdc (12 Volt nominal) 10.5-16 Vdc (12 Volt nominal)
➤ Current	Art. PGPS2002	60 mA (max) at 48 Vdc 240 mA (max) at 12 Vdc
➤ Outputs	Art. PCPS2002	8 relay contacts NC (optional)
➤ Relay rating	12 V (max), 100 mA (contact NC, 22 Ohm in series)	
➤ Inputs	Art. PCPS2002	8 NC / NO (optional)
➤ Input/Output Circuit Protection	Using Varistors	
➤ Auto protection in case of atmospheric interference	Using Watch – Dog (External/ Internal)	